EDITORIAL INDEX—PAGE 20 BUYERS' DIRECTORY—PAGE 58 ADVERTISING INDEX—PAGE 64

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, JANUARY, 1919 No. 1

The Publisher's Page

TORONTO JANUARY 9, 1919

NO one knows better than an advertiser that all the investment he has made in the years of building his business through advertising can be knocked into a cocked hat by a few pieces of unsatisfactory product.

No one knows better than he that ONE proved instance of departure from square dealing will instantly bar him from the pages of every reputable publication—his marketing medium.

There is no secret diplomacy in advertising in legitimate publications. There never can be.

There is no commercial bribery in orders placed through the open claims of consistent advertisers.

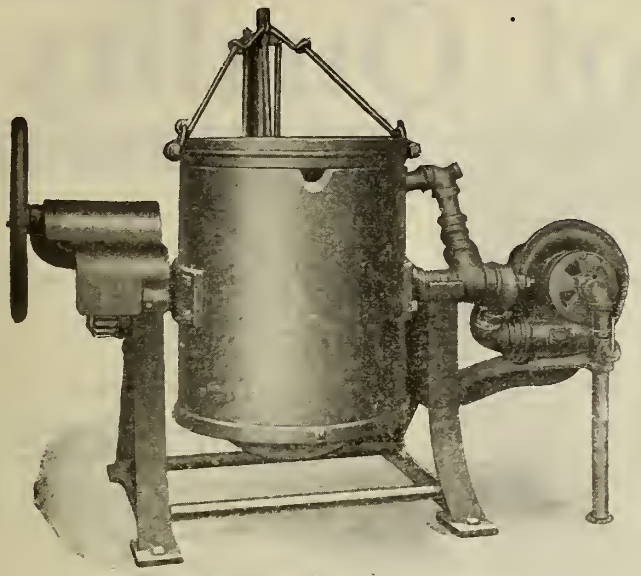
The advertiser cannot afford to profiteer or to cut quality. Only the firm that has discontinued advertising and is planning to go out of business can do so.

Remember the odium that is bound to attach to the man who has recommended the purchase of goods which fall down—whether their failure is through intentional scrimping or blundering lack of knowledge.

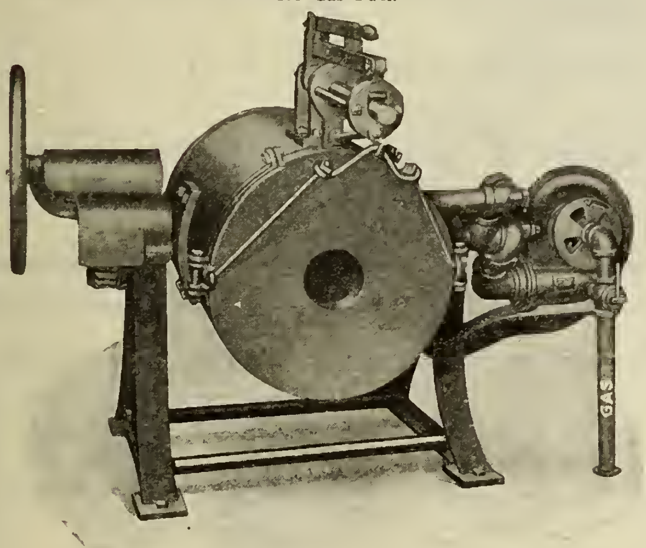
Remember the loss in time and production, as well as the cost of replacing, when equipment fails to fulfill the claims made for it by some irresponsible salesman. Whether his firm authorized such claims or not, the loss is on you, if that firm is not a business builder —an advertiser backing his claims with a "make-good" policy.

Think these facts over, Mr. Superintendent, when you are making out your next requisition for supplies, or when you make that recommendation for equipment.

Think them over, Mr. Owner, when you are about to put your O.K. on your superintendent's requirements.



Front view of furnace equipped with Premix Motor Blower for Gas Fuel.



Front view, furnace tilted for pouring. The worm gear tilting mechanism holds furnace safely at any angle.

NEW

Monarch

VERTICAL MELTING FURNACE

Best-Paying Furnaces for Small, Quick Melts

BY no other means can you produce small melts as quickly, economically and as efficiently as with the **New Monarch Vertical Non-Crucible Tilting Furnaces.** They represent a big improvement in Melting furnace, and are designed to save time and cut costs.

Melts Brass, Copper, Monel-Metal, Nickel, Aluminum, Bronze, Gold, Silver and any ordinary foundry mixture. Equipped with Premix Motor Blower for oil or gas fuel. Good for any line of air or oil system.

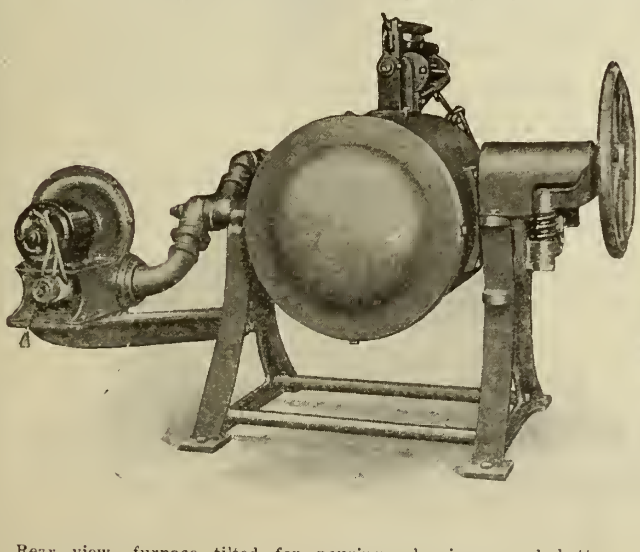
These are the furnaces you need for the big production period of the near future. Investigate them without delay.

SEND FOR OUR NEW CATALOGUE

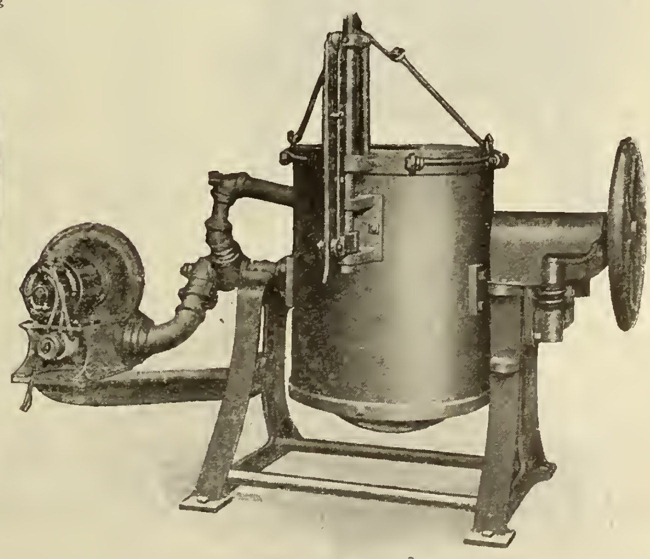
The Monarch Engineering & Mfg. Company

Shops: Curtis Bay, Md.

1206 American Bldg., Baltimore, Md., U.S.A.



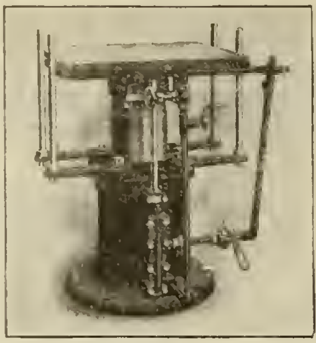
Rear view. furnace tilted for pouring, showing round bottom. Inside bottom corners are rounded, which eliminates loss from metal adhering to lining in corners and preventing the pouring of full contents. Adopted to any existing "air or oil and gas" line.



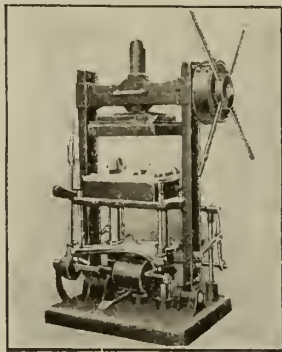
Rear view showing Permix Motor Blower and cover-lifting and swinging device. The gas or oil burns and melting proceeds continuously whether furnace is upright or tilted.

British Moulding Machines

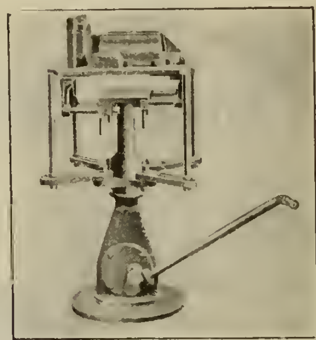
AND FOUNDRY EQUIPMENT



The JARR RAM (Pneumatic).
The Machine with a Perfect Lift.



The HEAD RAM.
Most powerful Hand Machine made.



The HAND RAM.
Adjustable to any size box.

The most efficient Machines, built to stand rough usage

Write for Catalogue to

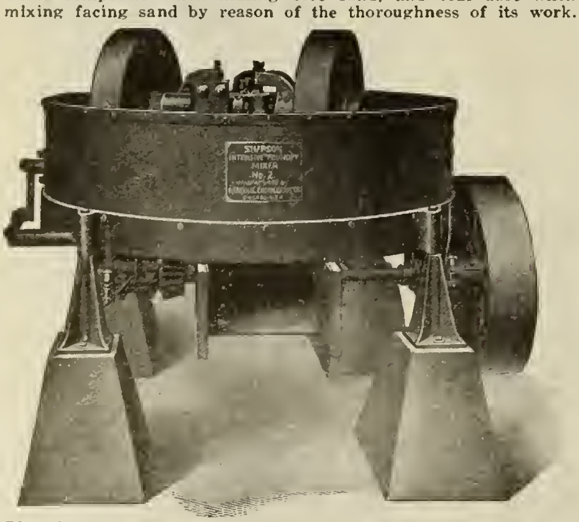
BRITANNIA FOUNDRY COMPANY

COVENTRY, ENGLAND

A Message to Canadian Foundries
INTENSIVE FOUNDRY MIXER
THE SIMPSON

Saves Both Sand and Labor

Improves the quality of the castings.
Correct "scabbing" due to imperfect mixing of facing sand.
Saves compound when mixing core sand, and coal dust when mixing facing sand by reason of the thoroughness of its work.



The Simpson Intensive Foundry Mixer is in successful operation in some of the best known foundries in Canada.
Write for details and prices to

National Engineering Co.

Machinery Hall Building
549 W. WASHINGTON BLVD., CHICAGO, ILL.

Let us assist you in "Grinding Down Costs"

To do this simply give us an outline of your grinding operation and we will furnish the **best possible wheel** for the purpose.

Gresolite
for Grey and Chilled Iron.

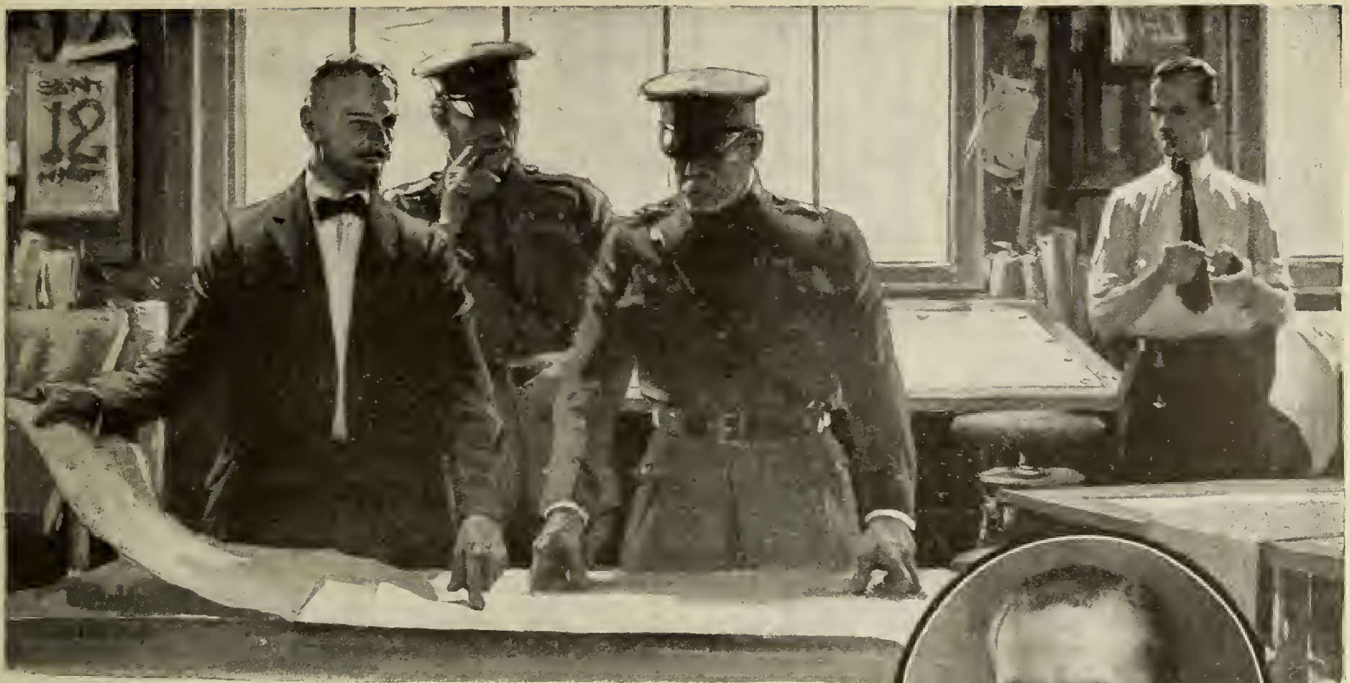
Emery
for Steel Foundry and General Purpose.

Corundum and Rexite
for Precision and Fine Tool Grinding.

Write for booklet "Safety as Applied to Grinding Wheels."

Canadian Hart Wheels

LIMITED
Manufacturers of Grinding Wheels and Machinery
456 Barton Street East
HAMILTON, CANADA



Planning for War —and Peace

In the field of manufacture, as on the field of battle, American strategy has been a big factor in the winning of the war.

Our fighting men at the front, and our fighting men back of the front, down to the humblest of the workers in shop and shipyard, have given heroic demonstrations of their courage, initiative, resourcefulness and spirit of self-sacrifice.

Our war plans have made good. But what about our Peace plans?

Now that the Unconditional Surrender of the Hun looms as an imminent possibility, with its accompanying cessation of war orders and the resumption of intense competition, what does it mean to us industrially? Is it a threat or a promise?

We believe it is a promise—but only to those who continue to seek diligently *now* for better methods of management and production.

Looking over our own record of the war plans in the making and carrying out of which the Keller organization has been privileged to co-operate, it is gratifying to realize that while we have been working for the success of the Allied cause, we have also been working for the post-war success of ourselves and our customers.

By striving steadily to increase our production of Keller-Made Master-Built Pneumatic Tools, and to improve the tools themselves so that they can be depended upon to increase the production of the Shipyards, Shops and Foundries using them, we have not only "done our bit" to render certain the outcome of the great Battle for Democracy, but have at the same time and to the same extent helped to pave the way for the winning of the great Battle for World Trade that is to follow.

Preventable inefficiency is Treason during the war. After the war it will be Business Suicide.

KELLER-MADE PNEUMATIC TOOLS MASTER-BUILT

William H. Keller, President

KELLER PNEUMATIC TOOL COMPANY, Grand Haven, Mich., U. S. A.

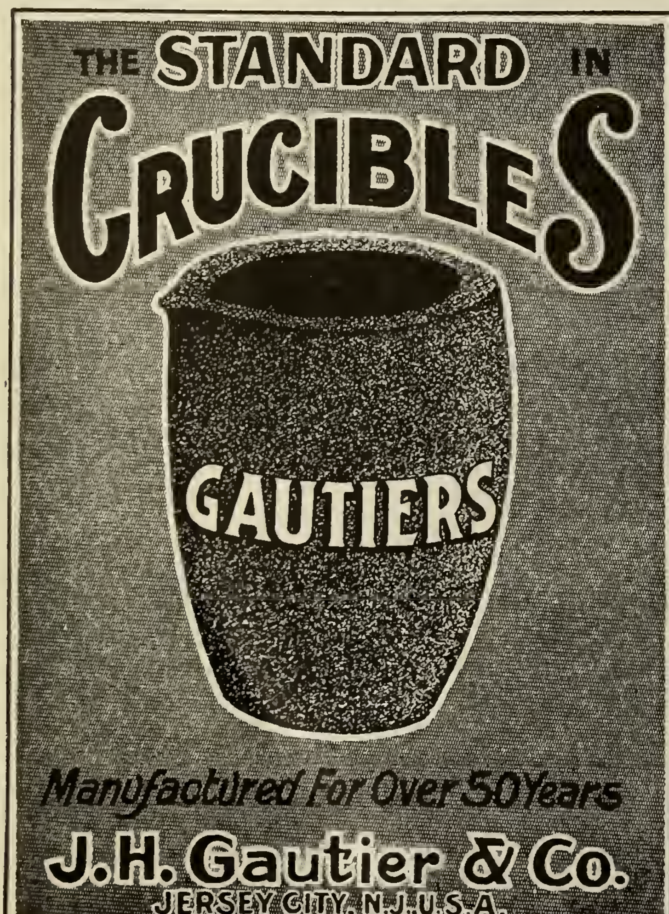
If any advertisement interests you, tear it out now and place with letters to be answered.

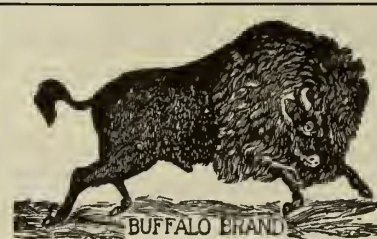
How One Plant Uses The "LITTLE DAVID" GRINDER

CANADIAN INGERSOLL-RAND CO., LTD.

With Offices at

SYDNEY, SHERBROOKE, MONTREAL, TORONTO, COBALT, WINNIPEG, NELSON, VANCOUVER





Look for the **Buffalo** on the octagon Cardboard Spools

VENT WAX

Our customers are our best advertisers. A few of their remarks at the Milwaukee Exhibition were:

"The easiest and best way to vent any core."

"Have used BUFFALO BRAND for years and it never failed yet."

"No other Vent Wax for me: I know what BUFFALO BRAND will do."

Etc., Etc.

Let us add your name to our list of advertisers.

Write for trial spool and prices.

Be SURE it's "BUFFALO BRAND."

UNITED COMPOUND CO.

228 Elk St., Buffalo, N.Y.

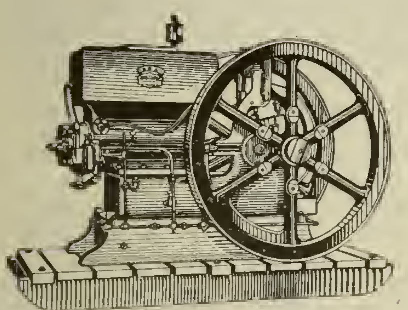
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Moulding and Pouring a Gasoline Engine Bed

Showing Method of Casting a Sheet Steel Bottom Into a Grey Iron Casting, Making the Entire Bed Into a Tank—Also Small Chamber Cored Off From the Large One

By F. H. BELL Associate Editor



THE "Ideal" gas, gasoline and kerosene engine, one style of which is shown in the accompanying illustration, and also shown in part in the succeeding engravings, is, and has for many years been manufactured by the Gould, Shapley & Muir Co., of Brantford, Limited, and viewing it from the exterior it is of similar appearance to the original engine built by this company, but on examination of its interior mechanism it will be found to be vastly different.

With the increased knowledge born of experience and the progress made in gasoline engineering generally, came the necessary alterations and improvements. This, coupled with the shortage of gasoline owing to exigencies of the war situation making a substitute for gasoline imperative, has made at least the foundryman's part of the work an entirely different proposition.

It is not our intention in this article to describe in detail everything which the foundryman has to do in the construction of the engine, but simply to confine ourselves to the molding and casting of the bed, it having probably undergone as many changes as any part of the engine. In order to properly understand these beds it is perhaps as well to explain what is required of them. The gasoline which formerly constituted the fuel was held in a container enclosed within the bed. The container consisted of a galvanized can of the proper dimensions to fill all the available space, but this galvanized receptacle would frequently be punctured in transit from the works to its destination or otherwise, and at best it was not any too long-lived. It was therefore deemed practicable and advisable to cast a bottom to the bed, thus utilizing it for the purpose spoken of. This was achieved with a fair degree of success but entailed a considerable amount of extra trouble and expense, besides additional risk of loss in the foundry as well as making a clumsy casting. The shortage of the gasoline supply as we have said made a substitute necessary, and coal oil has been found to do equally as well once the engine is under headway, but for starting purposes a small amount of gasoline is necessary.

The Steel Bottom

It therefore remained for the foundry superintendent, Mr. Robert Rutledge, to use his ingenuity in devising the means of "casting in" the steel bottom, which is now so successfully accomplished, as well as providing a small chamber for gasoline, while giving over the main space for the "new explosive" coal oil.

Making the Mold

By permission of Mr. George McCrea, the general superintendent of the works, we will endeavor to demonstrate how the molds are made.

In Fig. 1 are seen four beds, the appearance of which might indicate a very simple design, and on taking into consideration the number of improvements and new ideas involved in their make-up, they may be truthfully termed simple. These four are but a few of the many sizes built by this company and ranging from one horsepower to fifty horsepower, being slightly different in design, but all having the same fundamental principles.

Originally when these beds were cast with the wide open bottom and the bridge wall shown at X, Fig. 1, was lacking, the molding was a much simpler operation. To mold a bed of this type requires a 4 part flask, viz., the drag or nowel A, the cheek B, the cope C, and the small cope D, which covers the bearings.

The first move to be made is to level the bottom board E, on the floor and ram up the drag A, right side up, and strike it off and sift it on a little facing sand, after which the pattern is centred and rapped down to a solid bearing, care being taken to always keep it level. The pattern, it might be explained, is solid and all in one piece, with the exception of the bearings Y, Fig. 1, and the small

pipe connections on the side, Z, Fig. 1. The parting is next made by ramming in extra sand to insure a good solid joint and striking off even with the flask. It is now troweled smooth and parting sand put on, after which it is ready for the cheek B to be put in place and rammed. The top of the cheek, as will be seen in Fig. 3, comes even with the straight part of the pattern. This cheek is chucked to fit the shape of the pattern so that very little trouble is ever experienced in holding the sand in shape. After ramming the cheek and making the parting the cope is put in place, and as shown in the different illustrations has the shaft bearings protruding through it, and level with the top of it, also bars fitted down into the crank pit between the bearings. So complete are these flasks constructed that very little gaggering is required.

After the cope is rammed up to the shaft bearings they are bedded in and another parting made for the small cope D which covers this portion. After ramming up the small cope the remainder of the work as regards the molding of the outside of the casting will require very little detailed explanation. The small cope is lifted off and put to one side, the bearings are swabbed and vented and drawn out, after which the horns which hold the shaft bearings are rapped and the main cope carefully lifted off and rolled over. The cheek is now swabbed and vented all around and scored off as shown at F, Fig. 2 and 3.

In lifting the cheek the pattern is secured and lifted with it and rolled over on horses, thus giving the workman an opportunity to see that his joint is all right before drawing the pattern. After drawing the pattern the mold is finished and plumbagoed in the usual way.

Building the Core

After the removal of the cheek and pattern the drag will show the imprint of the bottom of the pattern which is practically flat, all but the bearing strips on each side and which project a short distance into the sand. On top of this impression the core boxes are placed and the core built in its place (and it is right here that the real mechanical ability of the molder is put to the test). The steel bottom G, Fig. 2, consists of a sheet of steel plate somewhat larger than the core. This plate is ground all around the outer edge so as to give a clean surface as well as an easily fused body for the melted metal to burn onto. The manner of "casting in" the steel bottom is to have it built into the core with the ground edge projecting out from the core as shown at G, Fig. 2, into the space allowed for the casting and about an inch above the bottom. This gives abundance of strength of metal below and also provides air space between the bottom and the foundation of the engine when in use.

In starting to build the core a frame of the size required for the core and of the depth required between the steel plate and the bottom is placed on the imprint left by the pattern on the drag. This frame is rammed full of sand and struck off level. The frame is now removed and the steel bottom put in place on top of this thickness of sand, after which the core box is placed where the frame was removed from, and the balance of the core H made up. The core I, Fig. 2, which is separated by the bridge wall X, Fig. 1, from the main core H, forms the small chamber in which is held the gasoline. This core I is a dry oil-sand core, so also is the portion of the core J under it, as well as the cores K and L. The balance of the core H is green molding sand. The core box for the green sand core is open-topped excepting the portion where the square opening is shown with the vent hole M and the iron post marked N. The balance is swept to shape with a strickle. The fact that the core rests on a steel plate makes it more difficult to hold down than if it were rammed into the sand forming the drag, and the fact that the vent has no means of escape excepting through the vent hole M makes it imperative that careful provision be made for securing the core as well as venting it.

Before putting in the sand to form the core a sectional grid is placed on top of the steel plate and over this a stout bar is laid running lengthwise, and on top of this is stood the upright bar which reaches to the surface at N, Fig.

FIG. 2—TO THE RIGHT DRAG, WITH CORES COMPLETE. TO THE LEFT, CHEEK BEING LOWERED INTO PLACE.

FIG. 3—SHOWING CHEEK IN POSITION AND COPE BEING LOWERED INTO PLACE.

2. This bar N, as will be explained later, is held down from the top and in turn holds the entire system of rods which keep the plate in place.

The green sand portion of the core is now rammed up, the interior of which is filled with fine coke. The top is put on the level part and the sand tucked under and also the cores K and L are tucked into place, the core box being a guide to go by. The curved part is now strickled into shape and the core vented down into the coke. The core box being lifted off the core is slicked and finished. The core J, which forms part of the main coal oil chamber fits tight against the plate and also against the core H. The core I rests on chaplets on top of the core J and is separate from the core H, thus forming the wall shown at X, Fig. 1. The vent from both of these cores is taken out through the top of the cope at the point also marked M. In gating this mold two gate sticks are stood at the points OO, Figs. 2 and 4, and the gates are cut from these to the bed at point, just missing the core and traveling close under the steel plate so as to heat it, but not close enough to cut it away. Two overflow risers are taken off at P P, shown in all the different views in Fig. 4.

In closing this mold there is little to take note of. The cheek has to be closed so as to give even thickness on both sides and in case it is not properly centred, the cheek may be moved so as to rectify it by withdrawing the long guide pins which are not fastened. The top of the cheek is best to be floured and the cope tried on and off, thus giving the workman an opportunity of seeing that it has not been crushed and also to see that iron cannot get into the vents. In ramming the cope an iron was rammed into it in such a manner as to rest on the iron N in the core and reach up through the cope, and when clamping the mold this iron is strapped down and clamped, holding that end of the core secure. Before closing on the small cope, stud chaplets of the proper length are placed on top of the cores K and L and the half round cores which form the shaft bearing are put in place in the prints and also resting on the chaplets. When the small cope is closed on top of these and clamped the entire combination of cores and chaplets are held as in a vise.

As shown in Fig. 4, the risers P P are headed up; these may have a basin of sufficient capacity to hold what is flowed through or they may be on a slant so as to flow the iron over into a sand bed. The runner basin is also raised to the level of the risers and the two gates are connected by this basin. This style of bed has been a decided success as not a complaint has been recorded against it. The steel plate instead of putting a strain on the casting actually strengthens it. The iron passing in from the gate heats the plate almost to the melting point and the casting being heavy and the plate light gives the plate time to become heated throughout before the casting sets. Thus, when the casting contracts the plate also contracts with it, with the exception of the central part, which might not be as hot as the rest, and this can easily buckle up or down without in any way doing harm either to itself or to the casting. The molding of this bed, like that of any other casting, depends for success on the care and good judgment of the workman. The gas or vent must have some means of escape else it will cause a blow. If the inside is properly vented to the coke, and if the outlet from the coke is well guarded so that nothing obstructs the way, and all joints around it are floured so that no metal gets in there should be no fear of trouble from that source. The gates should be of sufficient size to allow the iron (which should be in a good fluid condition) to flow in without hindrance, otherwise cold shots may give trouble. The workmen shown in the illustrations require no pointers on this score.

Another point worthy of note in connection with this work is the oil sand cores spoken of. These cores are made from silica sand similar to what is used in the manufacture of glass, and while it perhaps costs a little more than river sand there is a real economy in its use. One part of linseed oil or any good prepared core oil is sufficient for 65 parts of this sand. The advantages from this are apparent. The sand being pure silica generates practically no gas and the small percentage of oil required would create so little gas that it would be hardly perceptible. The grain being fairly coarse and ragged gives the core a chance to bake hard and at the same

FIG. 4—TO LEFT, BUILDING, POURING BASIN AND RISORS. TO RIGHT, WORKMEN CLOSING ON SMALL COPE.

time have a good open structure, through which the vent can pass with ease, thereby obviating the necessity of venting to a great extent. This sand is used for jacketed cylinders, etc., with the best of success. Superintendent Rutledge showed us some very complicated cores which required no venting whatever. Cores which formerly had to have vent holes connected to the vent holes in other cores are now successfully handled without vent holes at all. From a monetary standpoint a cheaper sand with a higher percentage of binder, and more labor required would in all probability be the most expensive in the long run, particularly when the greater risk of bad castings is taken into consideration.

Moulding an Eighth Turn Elbow Without Pattern

Sweeping Core First, After Which Core May be Used as Pattern

WE are frequently called upon to make a special casting similar to the one shown in our illustration. To make pattern and core-box for just one would be a big expense and is not required. I have in mind an eighth turn elbow for water works pump shown at Fig. 1. One end was required to be of larger caliber than the other and in

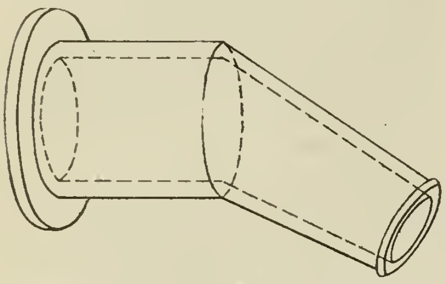


FIG. 1

addition the larger end was flanged to bolt against a flange coupling while the smaller end was beaded so as to be leaded and caulked into the standard water pipe. It will be seen that it had a number of peculiarities, being curved, tapered, flanged and beaded. To make this with as small an outlay as possible, I made the core first and used it as a pattern. The first move was to strike up a level place on the foundry floor and make two core plates in the open (one would have done had it not been that I wanted a smooth face on each one, and they had to be right and left, or rather top and bottom). After making the plates, I made two arbors in a similar manner by cutting them out in the floor with a gate cutter and pouring them open. When the metal was beginning to set I stood a few rods up near the outside, which I afterwards bent over

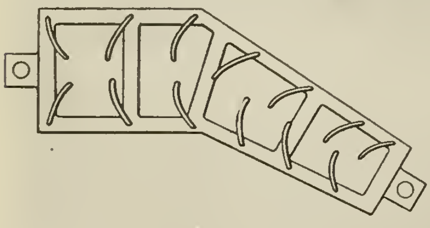


FIG. 2

making it appear as in Fig. 2. At each end of the arbor will be seen a square lug with a round hole in it. These holes were formed by placing pipe sockets in the mold and letting the melted iron burn them in, thus making a cheap, threaded hole. The next move was to make a frame, Fig. 3, of inch strips, the inside of which forms the outside design of the core. On each end of this frame was fastened half circle pieces A and B Fig. 3 in the usual manner, and at the junction of the two sizes was another half circle piece C of the same outside dimensions as the one A at the large end. This piece C is cut away on the inside leaving just enough material to give it sufficient strength. It is put in a position parellel with A, giving it the apearance of Fig. 3. In Fig. 4 will be seen the core plate with arbor Fig. 2 and skeleton core box from Fig. 3 in position, preparatory to sweeping the core. In making this half core the plate should be well oiled and about a half an inch of core sand spread upon it and the claywashed arbor Fig. 2 bedded into this thin layer of sand. The frame Fig. 3 is now put in place, and filled with coke up to within a couple of inches of the outside. The core sand is now rammed around this coke and struck off with a straight strike stick. That it to say. the portion between A and C is struck up straight and the portion between C. and B is struck off to a straight taper. The core may now be vented with a needle wire down from the surface to the coke if the nature of the mixture is such that it requires it. The skeleton core box Fig. 3 is now removed and the space left by the half circle C is filled in by hand and the core finished and blackwashed. The other half core is made by placing the half circles on the reverse side of the frame Fig. 3. All that remains to make a pattern from these cores is to have flanged pattern made with the inside cut away to fit the circle of the core. The thickness of the castwill be made by placing strips of wood of the proper thickness around the core. These do not require to fit closely. They may fit close at the small end and spread apart at the bend. The straight part may as well be close and if the flange is fastened to them it helps to keep it in place. These strips may be stuck to the core with paste and the spaces filled with molding sand and slicked up smooth. We now have a pattern and core and may proceed to mold it in what ever way we are best equipped for. The method which I adopted is, I think, about as safe and at the same time as economical as any method. I had screws made of gas pipe to fit the arbor. The bottom half was bedded in the floor and for the cope I just made a square frame of proper height, but made no attempt to fit the pattern. I barred it across the top part with bars about 6 inches deep and at the bottom I made a plate in similar fashion to the core plates, but with outside dimensions to fit inside of cope, and through the plate I had an opening of similar shape to the pattern, but abundantly loose. This plate had four pipe sockets cast into it, staples would have done. In starting on the cope the top half of the pattern is put in place by means of the gas pipe screws, the screws being left in place. The plate is now put in its place and the screws also left in it. The sand is now put in and where required, gaggers or nails may be placed between the plate and the pattern. No other supports of any kind were used. Before lifting the cope the bolts holding the plate as well as those holding the pattern are securely fastened by using staunch bars of iron. The cope being lifted and rolled over the T which formed the eye of the bolt is unscrewed, but the balance of the pipe is left, and other pipes are inserted

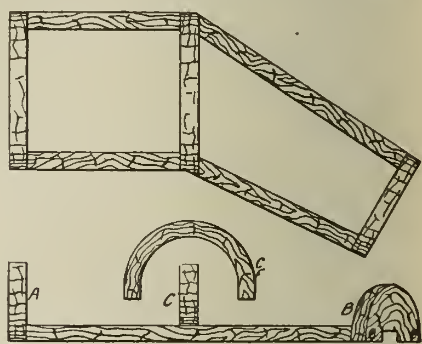


FIG. 3

in the opposite side of the arbor with which the pattern is drawn. The pipes which were used as lifters acting as guides in drawing the pattern. The thickness strips are now removed and the core cleaned up and if necessary reblackwashed and dried. The cope will require a little slicking, but the core prints will remain untouched. When the cope is ready the core is dropped back into its place, the pipes guiding it so that any possible unevenness in the core will fit into the corresponding unevenness formed by it. It is now fastened to the back the same as when lifting off the cope. The bottom half is done in the same way. The vent is taken from the end of the core by breaking through to the coke, and each half is finished as a separate mold. If reasonable care is taken in molding by this process, a very superior quality of casting is produced with even less labor and less risk than by the ordinary way of molding. If the job is very heavy, auxiliary bolts would be required, but it is surprising how heavy a load can be lifted with a piece of gas pipe when properly threaded. As regards supporting the cope, the cross bars prevent it from coping and also from dropping when rolled back. The iron plate which constitutes the bottom of the cope does all of the lifting of sand, but if so desired boards may be nailed at one end to the bars and the other end rest on the bottom plate. If the bars are of iron, clamps may be placed with one toe over the top and the other end on the plate. Gaggers may connect from these down to the pattern. These last points are only precautions which may be taken for safety. A pipe seldom drops out, because its shape supports it. A bent pipe is even less liable to drop in rolling over if rolled with the long side up, thus arching itself. The method of setting cores here described, is my idea of setting any pipe core. If the cores are properly rubbed to a joint before starting the mold, they should fit down perfectly when closing, but I prefer not to take a chance on venting from the joint. The bead for holding the caulking lead is formed by a little hand sweep which is guided by the small core print, thus making it the exact thickness required, and if the core print is right, the bead will be right. If not the bead can be cut with spoon slick or gate cutter.

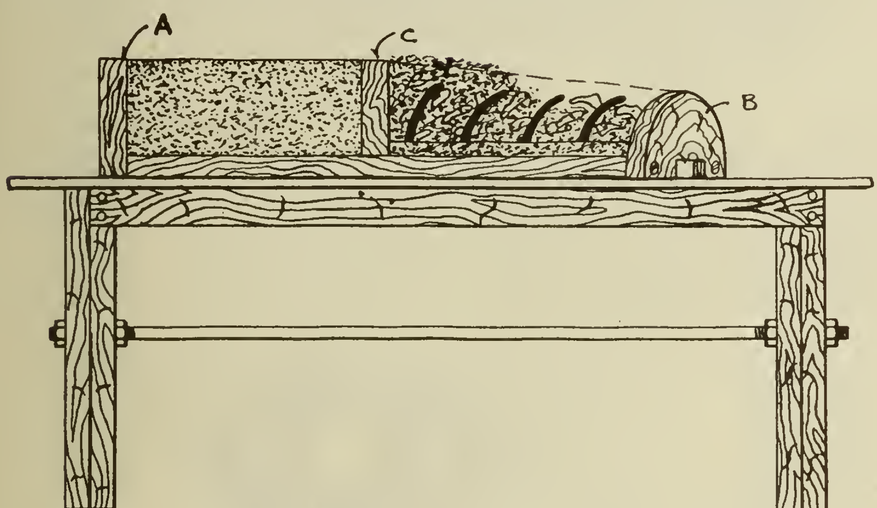


FIG. 1—SHOWING MANNER OF MAKING CORE.

CANADIAN FOUNDRYMAN is in receipt of a "portrait gallery" in the shape of a wall placque from the E. J. Woodison Co., of Detroit, manufacturers of fire brick, foundry requisites, platers' and polishers' supplies.

The manager of the Toronto branch and vice-president of the firm is C. H. Woodison whose picture appears on the folder with that of thirty-eight others, including the president, secretary and treasurer, all of whom look as if they ably upheld "Woodison's Methods," and their admonition: "Buy the Best—it is the Cheapest in the Long Run." Eight of the men pictured are now in their country's service.

This interesting group of Woodison Co.'s staff is captioned: "They represent the house that Woodison built—and wish you the compliments of the season."

CANADIAN FOUNDRYMAN wishes Woodison and Co. the same, and congratulates them on having a fine, energetic-looking force.

THE MOLDER AND HIS TRADE

By One of Them.

Why does the molder complain about his trade? This is a question which I have often asked myself, and which I have often asked other molders and it is amusing the answers which are handed out. Some will say that it is the hardest work which any man ever worked at. Others will say that it is the dirtiest, while still others think that the employer is making too big a percentage of profit off the workingman's labor, and so on, but none of them seem to strike the right key from my point of view. As a molder who has followed the trade for a good many years and raised among molders, I, like the rest of them, complained and thought that molders as a class were imposed upon, and that a man was foolish to waste his life in such a manner, and I quit, but like the rest I came back, only to quit again and to again return. This I did several times but never stumbled onto any thing which was any better, so I finally decided that there was nothing any better to go at and have concluded that the whole thing in a nutshell is that on the one hand not any too much encouragement is given to the molder to take an interest in his work, and on the other hand the molder himself gives no one any encouragement to take an interest in his welfare, and so here the matter seems to rest.

The tendency of late seems to be to build a better class of foundry, with more thought of ventilation and the general good and welfare of the workmen, and it is to be hoped that the employees will co-operate and try to make themselves better satisfied.

Proper ventilation can never get too much attention. It is the gas and smoke which makes the molder feel tired, not the work. If all the foul air could be removed at night so that the men could work in pure air during the day time they would be in better shape to stand the arduous work of pouring off.

Editor Canadian Foundryman,—In your November issue was an article written by an engineer asking for information regarding the cause of pump casting splitting on a line with the parting of the mold. I have had similar experience although with castings of less thickness, and will endeavor to explain how I have found iron to act in entering a mold and also how it acts in cooling. A sketch might show it to better advantage but I think I can make it clear. In all probability it was gated at the parting and on entering would have to run under the core to fill the opposite side, and after filling it to the level of the parting it would have to be forced uphill, and it would likely find it easier to go over the side next to the gate, and while filling that space the opposite side would be setting, and when the hot iron finally got over the top of the core it would not properly knit onto what had started to set, although it would appear to be.

Another thing to be considered is the uneven shrinkage on account of the valve chamber on one side. If the one side was not too well knit together and the uneven strain was drawing on the weak side it would be an easy matter for the pressure of water and the jarring of the plunger to start a crack, and once started it would continue, as was said to be the case.

A run out at the parting will sometimes cause the same trouble. It may be stopped up all right but there will be a little scum formed on what is below the run out and when the upper half is filled it does not make a strong casting at the parting.

A pasted joint on the core will sometimes make trouble if not properly dried and the trouble will show at the line of the joint, but I think that the trouble in this case has been that the iron in running both ways to get around the core did not knit properly on the opposite side. If this cylinder (which was a small one) was gated along with other pieces, the lower part would probably fill at the beginning and the balance would not be filled until all the other things were filled to the same level, and in this way it would favor cold shot to a still greater extent.—Molder.

A Pouring System for Modern Foundries

Demonstrating How the Largest Day's Work of a Molder May be Poured With Comparative Ease—Eliminating Fatigue Element From the Foundry

By MARK T. OHLSEN

FOR many years progressive foundrymen have been studying the problem of handling molten metal. In many cases the production of molding machines is limited by the ability of men to pour off their floors. Any method therefore, which can be devised for increasing the amount of metal one man can pour will have a direct effect on the production. In the comparatively few shops where complete pouring systems have been installed, the results have been exceedingly gratifying and their investment in pouring apparatus has been rapidly repaid. The fatigue element should not be overlooked in considering the installation of a mechanical pouring system. State laws regarding hours and conditions of labor are rapidly becoming more stringent every year and the foundryman who does everything he reasonably can to ameliorate the working conditions in his shop finds that he not only keeps on the safe side of legislative enactments, but usually also increases his profits owing to the more efficient work obtained from thoroughly satisfied employees.

The labor shortage resulting from the operations of the draft law has a direct bearing on the pouring problem. Pouring is not pleasant work and under existing conditions it is not uncommon for ordinary laborers to refuse to help take off the heat. The value of mechanical pouring systems is therefore more keenly appreciated to-day than during normal times.

The pouring problem also is much more acute in foundries turning out large quantities of light castings than in shops pouring the same tonnage into a few large castings. In the latter case the amount of metal going into each mold is so large that crane ladles must be employed and the actual exertion required is greatly reduced. In some of these foundries 100 tons of iron may be poured into three or four castings, but in foundries specializing in automobile work, agricultural implements castings, sewing machine or typewriter parts, pipe fittings, small parts for marine engines, light artillery castings, etc., the pouring problem is a real one. In one of the large automobile foundries in Detroit, for instance, over 100 tons of iron is poured per day into castings with an average weight of only 28 pounds.

Complete Pouring System

A complete pouring system for a gray-iron foundry handling light work should include apparatus for handling the metal at the cupola, for transferring it to the various floors and for pouring it into the molds. In most foundries at the present time some arrangement is made for transferring the molten metal from the cupola to the floors by mechanical means, even though the actual pouring may be done by hand. Where the average weight of the castings is large, crane ladles of from 1 to 4 tons capacity handled by the regular travelling crane are fairly satisfactory. The crane transfers the metal to the extreme ends of the shop very quickly and most plants are so arranged that the floors are accessible from the crane runway. For lighter work some sort of an overhead system is found more satisfactory and this system should include a device for actually pouring the metal into the molds, as well as

FIG. 1—A POURING DEVICE SUITABLE FOR HANDLING 350 POUNDS OF IRON

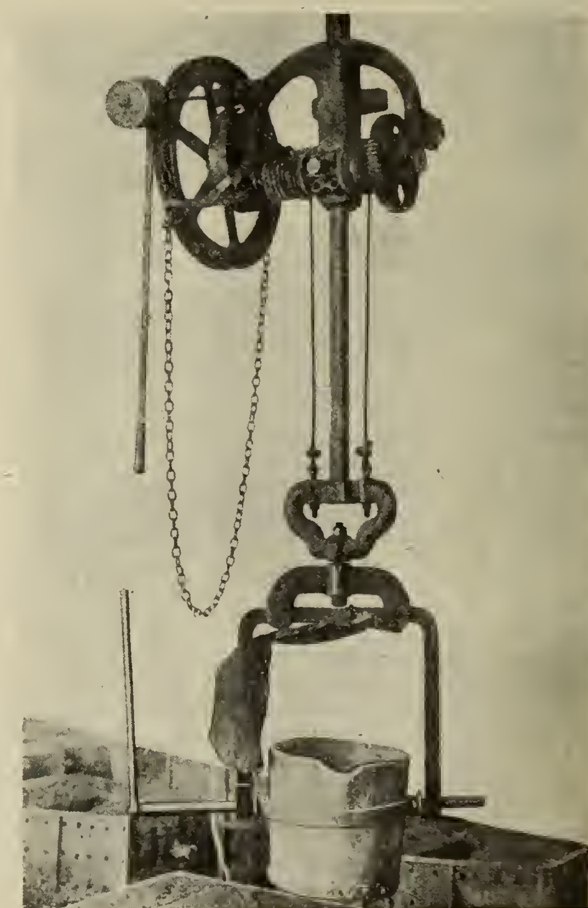


FIG. 2—POURING HOIST DESIGNED FOR LOADS UP TO 2,000 LBS.

means for getting it from the cupola spout to the point where it is finally poured.

The system which it is the purpose of this paper to describe in detail was invented originally for use in the shops of the Brillion Iron Works, where a large number of gray iron castings are made daily. Where a device of this character is used the iron should be distributed to the various floors either by trolley ladle or by some other means. Each floor is equipped with a small, easily-operated hand crane or trolley which usually runs across the shop at right angles to the distributing ladle tracks. This hand crane or trolley carries a small ladle from which the molds are poured. In most shops the cupolas are located near the middle and the distributing ladle makes alternate trips to each end of the molding room. The operator of the distributing ladle controls the filling of the small ladles. The latter are handled entirely by the molders. who not only pour off the floors but in some shops shift their own weights. The general arrangement of the system is clearly shown in Fig. 3. Figs. 1 and 2 give a detailed view of the pouring ladles.

FIG. 3 POURING MOLDS BY MEANS OF OVERHEAD CRANES.

Details of Pouring Device

The pouring ladle yoke is suspended from the lower end of a piece of pipe or steel of convenient length as indicated in Figs. 1 and 2. The ladle itself is carried in a bail to the shaft, to which the tilting lever is attached. For handling up to 350 pounds, the yoke slides over the suspension bar and rests on a large cam which is held in position by a pawl. When the pawl is released the yoke and ladle may be raised or lowered a distance of about 10 inches by operating a lever connected with the cam. Upon receiving metal from the distributing ladle the pouring ladle is brought to its lowest position and is afterwards raised to any height convenient to the operator within the range of the device. The metal shield which is secured to the yoke over the ladle protects the molder's eyes from the intense glare of the hot iron. This, it is said, results in more accurate pouring and fewer spills. The men also appreciate the release from eye strain. For handling up to 1,000 pounds of iron the heavier construction shown in Fig. 2 is employed, in which a geared hoist takes the place of the cam.

The overhead trolley which carries the pouring ladle is made up of brackets to which turned wheels 12 inches in diameter are attached. These wheels are fitted with roller bearings to cut down the friction loss. The tread of the wheels is turned to accommodate the 16-pound rail on which the trolley travels. This arrangement is designed to withstand a load of 1,000 pounds. A somewhat heavier type is also built to handle loads of 2,000 pounds. In the latter case the brackets are heavier and the wheels are 16 inches in diameter. This is known as the 1-ton crane. This crane may run lengthwise of the floor and be equipped with a trolley which runs on the lower flange of the eye beam and travels across the floor so that any point spanned by the crane may be reached by the ladle. The recommended height for a track to accommodate this overhead construction is 12 feet, although a little more or less height is not objectionable.

The pouring device shown in Fig. 1 has a capacity of 350 pounds. It is raised or lowered by means of cams with a range of 10 inches as previously described. This device, of course, is built for the lighter classes of work. The large pouring hoist shown in Fig. 2 is similar in construction to a chain hoist and is equipped with cut gears and rope drums which give it a possible lifting range of 60 inches, although the standard is 36 inches. The pouring device has a molten metal capacity of 1,000 pounds and a general purpose capacity of 2,000 pounds. It can be operated in a minimum headroom of 10 feet, although 12 feet is preferable.

This type of a pouring device is so arranged that the ladle bail can be easily removed by taking out two bolts. This makes it possible to quickly substitute another bail of any desired shape to accommodate other classes of foundry work, as shown in the accompanying illustrations.

The pouring devices developed by the Brillion Iron Works can be used for handling various materials in foundries as well as for pouring. Flasks, for instance, may be shifted from the gangway to the molding machines. Heavy molds also can be handled. With the described, two men can handle molds weighing half a ton with very little effort. The device also is of service in shaking-out flasks.

In the shop of the Brillion Iron Works this device is used for pouring separator stands weighing 48 pounds each. Under the old method of molding, by hand, a man and a helper were able to put up aid of the 1,000-pound hoist previously and handle 14 molds in a day. At present, with the aid of the apparatus described in this paper, one of the molders

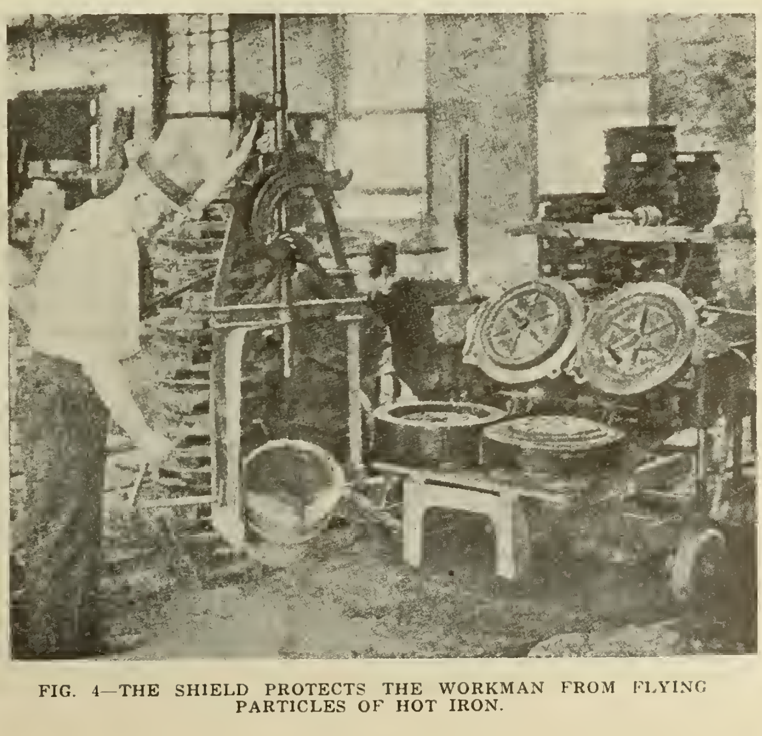


FIG. 4—THE SHIELD PROTECTS THE WORKMAN FROM FLYING PARTICLES OF HOT IRON.

now puts up 22 molds and does his own pouring. This job requires the use of large cores which also must be handled and set.

Tests which have been made show that when the pouring device is loaded with a weight of 200 pounds, the ladle can be started with a push of approximately eight pounds and after it is in motion it proceeds almost entirely by its own momentum. For this reason the device has been installed in some foundries where girls are being tried out for light work in place of men who have been called for military service.

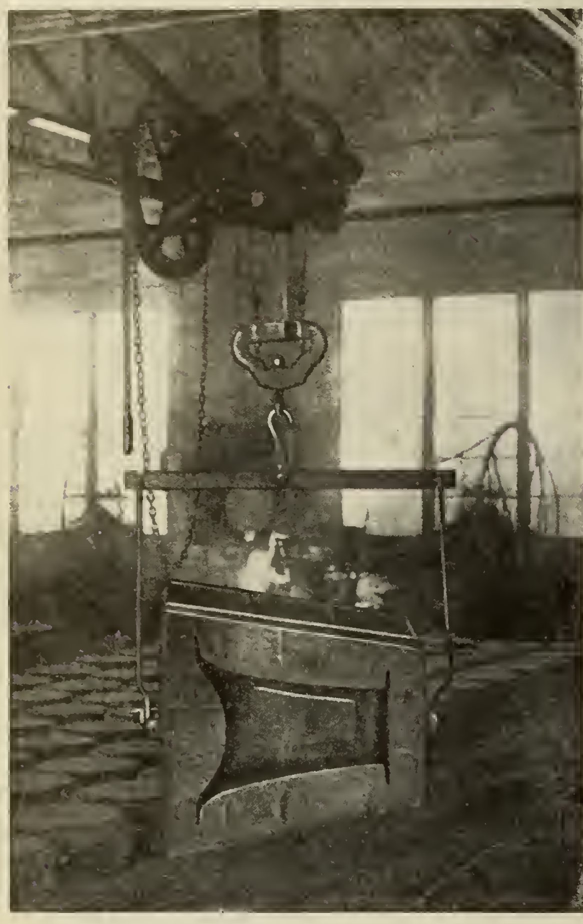


FIG. 5—POURING DEVICE USED AS A TROLLEY HOIST.

GATING AND POURING

SPEAKING and reading about pouring and gating of molds and melting iron hot enough to get good castings brings me back to my youthful days in the foundry.

I served my apprenticeship in a very small foundry where we did not do a very high grade of work, but we had a big variety. After my time was in I worked in different shops, but always in little ones, and finally I accepted a position as foreman in a shop with two sand heaps. I thought I knew everything and made my brags that I was not afraid of anything which might come along. Of course I was safe because there was not much came along excepting such jobs as I was accustomed to. We had a 22-inch cupola and we used 72-hour coke and scrap iron. I used to make three charges of 10 cwt. each for a heat, 30 cwt. being our usual run. I used to charge on the poorest scrap for the first charge and the best scrap for the second, and used all stove plate for the last. For my cores I used sharp sand and flour. If a job came along which was a little out of the ordinary I arranged to pour it about the middle of the heat, and all things considered I had fair success, but as I grew older I began to realize that I was terribly lacking in knowledge and I longed for books or papers from which to get pointers, but nothing of the kind was to be had in those days. If there had been a CANADIAN FOUNDRYMAN to write to I would certainly have written a good many times. However, I got along in a way, and the experiences which I gained in those days have answered me handsomely in later years. Many points which have been brought out as new ideas were in my list of old ones, and many points which are used as arguments nowadays were settled to my satisfaction then. Nothing annoyed me worse than to pour a mold and have it to not run, so I have always melted the iron very hot, and to do this I used one pound of coke to seven pounds of iron in addition to the extra coke on the bed. For the bed I filled the cupola about half full so that when the wood was burned out the coke would be a couple of feet above the tuyeres. The tuyeres were only three inches above the sand bottom, and I still believe in low tuyeres. One thing I learned from the H. C. Frick Coke Co.'s catalogue, and which I always practised but have never seen elsewhere, was to light the fire about twenty minutes before blast time and as soon as the wood was burned out put on the blast. It would not be two minutes until the blaze was going up the stack. Another stunt which I practised was to put on the blast before charging on any iron, and I have put chunks weighing four hundred pounds into that little furnace and never seen them again. My iron always came out white hot and as clean and soft as anyone could wish. It never occurred to me that it was too hot and I used to pour it just as it came out. My castings were none too nice looking but they were always sound. As an example I cite one little job which I did. A set of patterns came in for a small stationary engine, the cylinder of which weighed 200 pounds and our ladles held 150 pounds.

Before saying any more about the ladle I will describe the mold. The pattern was split through the centre with half of the chest and half the cylinder in the cope. I stood a gate pin on the opposite side from the chest about midway between the flanges and I cut gates from this to the two flanges. I rimmed out the top of the gate the same as I would for a plow share or a sash weight, and never cut a basin or had a dirt riser or anything else to keep the dirt back. I placed a riser on top of each flange and left them wide open. When the cupola was working at its best I caught a ladle of iron and stopped up the cupola and then went and poured the cylinder. After I had emptied the ladle I looked down the riser and could still see the core, so I tapped out the furnace and caught a 30-pound hand ladle of iron and poured it in. This covered the core but it did not fill the flanges, so I had to catch again. This time I got it and I suppose that this might be called pouring it on the instalment plan. However, when that casting was machined it was perfect, not a speck as big as the point of a pin was on it. I am not trying to encourage carelessness, but I mention this to show what can be done if the iron is right. That mold was filled above the parting with the first iron, and the next iron instead of having to stick to it, simply had to cut its way through it, but still if the metal was not right it would have simply mixed with the iron on that side and then have gone up the risers, leaving the steam chest short. I never saw dirt coming up a riser like I see in most foundries, and I never saw pulleys thrown away because they had dirt all down the face.

I am an old timer now, and I have seen most of the tricks around the foundry, but I have a few things which I will always adhere to, and one of these is that I want my iron properly melted and then the pouring is not of so great consideration. I also claim that last charge of iron is as hard to melt as one before it and requires as much fuel. As regards pouring it is a common argument that a mold should be poured as fast as it is possible to get the iron into it in order to have it sound. That depends on circumstances. Take as an example the marine cylinder recently described, which weighed eight tons, and then take a small piece weighing a few pounds. If the iron is poured into the big piece as fast as it is possible to get it in, it will not be travelling amongst those cores as fast as it would be in the small piece if poured ordinarily with a hand ladle. While I agree with the idea of pouring fast in big work I have seen small work lost through it. I have in mind a small piece I was called upon to make in an implement shop. It was a piece work shop but this piece had no price on it, for the reason that no one would make it. It weighed 10 or 12 pounds and had three cores all tangled through it, and they generally looked for most of them to be bad but I had no trouble at all.

I just got the hottest iron I could get and poured them as slow as they would run, and got every one of them. The foreman caught me with a ladle of very hot iron, after I had been there several days, and ordered me to not pour it as I would spoil the casting. He had not discovered that this was how I had been saving them. Needless to say I made no more.

Too much stress can not be placed upon the importance of studying one's trade from books or trade papers, although it is not uncommon to hear workmen remarking that there is nothing gained by trying to learn a trade from books or trade papers. Certainly no one would pretend to learn his trade in that manner, and no one should try to advise it; but still after a boy has served his apprenticeship and has begun to travel about as a full-fledged mechanic he may frequently find it to his advantage to be in a position to refer to his store of book knowledge or his past issues of trade papers, and in this way refresh his mind as well as observe how others have been the most successful in accomplishing similar jobs to the one which may be bothering him.

As an example of what study could have done I will cite a few instances in my own experience. I was once engaged with a foundry corporation doing a general line of job work. The foreman was an export stove man, having had some twenty-five years' experience as foreman in one of the largest stove plate shops on the continent, and what he knew he knew thoroughly. He understood the cupola if anybody ever did, and he had a generally good idea of the smaller line of castings, but crane work was out of his reach and it was to attend to this branch that I was engaged. Of course it was not he that engaged me, but it would have been he that disengaged me if he could have worked it without giving himself away. However, we got along fairly well: being of an unassuming nature myself and knowing his position I used to try and humor him. I knew that he was a far superior man to myself with this one exception, that he had never learned to mold anything which could not be poured with a hand ladle, and this was just the point that he was trying to conceal. However we came to words in dead earnest on one occasion over a piece which I was making and which he never noticed how I had it gated until it was finished. It was the frame for some sort of a machine, and weighed probably four or five hundredweight. It covered quite a bit of space and had a lot of light sections so that it was something of a difficult matter to decide where to gate it in order to have it run. So I decided to gate it from both ends and pour it from a basin on the top. This did not suit the foreman. He had never seen anything poured this way and he was not going to stand for it. It was too late to change the gates, but he was determined to dispense with the top runner basin, and use four hand bull-ladles; that is, we would pour two into each end. Two gangs of men would have to empty their ladles, dirt and all, down the gates and then get out of the way as rapidly as possible and make room for the next two gangs to do likewise. In this matter I balked and announced that I would pour it my own way or get out and let him pour it as he pleased, with the result that I won out and got a nice casting. I was actually grieved over this little circumstance. I knew that I was right and I also knew that he thought he was right, but he just lacked the knowledge which he should have possessed in order to fulfill his duties as foreman. I presume that in stove work the metal is poured right down the gate in most cases and that it is not uncommon to pour a mold with four ladles, and this man had seen so much of this way of pouring that he could not see things in any other light, and he really believed that I was trying some experiment which in all probability would be a failure. If he had taken enough trouble to keep himself educated it would have been of great service to him in running the jobbing shop. Reading a trade paper would have been the right thing for him.

It was really amusing some of the things we used to do in that shop. I had a piece weighing a couple of tons bedded in the floor and covered with a shallow flat cipe and I had the gate right in the middle of one end, but the side towards the cupola. We had a small travelling crane and this mold was almost as long as the crane, so I put a basin on the gate and had it arranged so that we would pull the ladle over from the cupola

(Continued on page 11)

THE BUSINESS OF THIS PAPER IS TO BE OF SERVICE TO YOU

CANADIAN FOUNDRYMAN has received the following letters, which are self-explanatory:—

CANADIAN FOUNDRYMAN:—

Dear Sir,—I am one of the many who are always looking for improvements in the foundry, and therefore read any article covering foundry work.

I noticed your article in regard to pouring a pipe in your October number, which explained that by raising one end and pouring at the lower end a better casting was produced.

This style of pouring we have since adopted with good results in numerous cases. I believe twenty-five per cent, of castings scrapped are due to improper gating or pouring. Many molders in making a basin in runner box always make it circular, which causes the iron to form a whirling motion, carrying slag into the mould, instead of a triangular or square basin. This seems a small item, but if a casting must be sound and clean you must keep the slag out.

I am pleased to see your paper has space for foundry news, as the experience which molders have in making different jobs is welcome news to others. I have seen many improvements illustrated in the CANADIAN FOUNDRYMAN, and in some cases work has been lessened; sometimes by a moulder neglecting to do what formerly was considered an important operation, and thereby finding out it was not required.

GEO. GEARY.

Foundry Foreman, Canadian Rumley.

ABOUT THE PLATING DEPT.

The following testimony to the work of CANADIAN FOUNDRYMAN as an educational medium is but one of the many thankfully received at this office, and needs no further comment, being the honest sentiment of a satisfied reader:

Royal Silverplate Co.
207 St. James St.,
Montréal, Dec. 19, 1918.

To The CANADIAN FOUNDRYMAN,
Toronto, Ont.

Mr. Editor,—You have an article in CANADIAN FOUNDRYMAN re "Study and Trade Papers Lead to Success." In reading in haste this morning your paper I am only glad to say that the article is more than right. The ensemble of your literature is not intended altogether for our trade plating, but your education on plating matters is well above all other journals because your editor seems to be a man of efficiency, with lots of knowledge in plating matters, and through his counsels we had two beautiful successes, for which we are content to praise very highly your valuable paper.

A. GIROUX,

Superintendent for Royal Silverplate Co.

Making Mould for Drive Wheel of Large Band Saw

Showing Method of Core Setting to Secure Cross Arms by Reversing Every Alternate Core

By F. H. BELL

IN the accompanying illustrations, Fig. 1 and Fig. 2, is shown in brief the method of molding the bottom or main drive wheel for a large merchant band saw at the foundry of the Waterous Engine Works Co., of Brantford.

Most of us are familiar with the sweeping up of the fly wheel for an engine, in which case the arm cores are fitted together at the centre in such a manner as to form the bulk of the hub. The bandsaw wheel is molded to a considerable extent in the same manner, but different enough to make it interesting. The pit is dug in the floor of the foundry and a level bottom swept. This is done in the ordinary way by plumbing up the spindle and attaching the sweep board, which is swept around, making a true level bottom on which to build the mold. This done, the spindle and sweep are no longer required and are removed. As will be seen in Fig. 1 the arms are zig-zagged; that is to say, one arm extends from the top of the hub to the bottom of the rim, and the next one starts from the bottom of the hub and extends to the top of the rim, and so on all around. This makes a most rigid wheel for heavy duty.

After removing the spindle and sweep, the core A forming the bottom of the hub is put in place. The next move is to place the cores B which form the arms connecting with the bottom of the hub. The other cores C as will be seen lap over the top of these and drop down to the bottom at the rim. These cores do not rest on top of the centre core A but simply fit around the edge of it, using it as a guide, neither do they form the hub. The bottom hub core A, as will be seen, forms a portion of the arms as well as bottom for the hub. The round core D which the workman is holding will also be seen to form part of the arms, and by placing it on top of the core A the bottom course of arms is completed as is also the portion of the hub which connects with these arms. The core E lying on the arms is now put in on top of A and D forming the inside connection for the upper row of arms and also a portion of the hub. After setting the centre core and placing the core F, seen standing at the side, the hub is completed, and both rows of arms connected. In building up the hub the joints are best to be puttied on each one as it is put in place. The putty used is a mixture of plumbago and oil. The joints on the outside of the cores B and C should also be filled in the same manner. Once the cores are set the inside of the wheel is practically done, all that remains is to ram molding sand under the arms and fill in all the intervening spaces and level it up as shown at G, Fig. 2.

Ramming the Outside

In ramming the outside the segment

FIG. 1—SHOWING ARM AND HUB CORES.

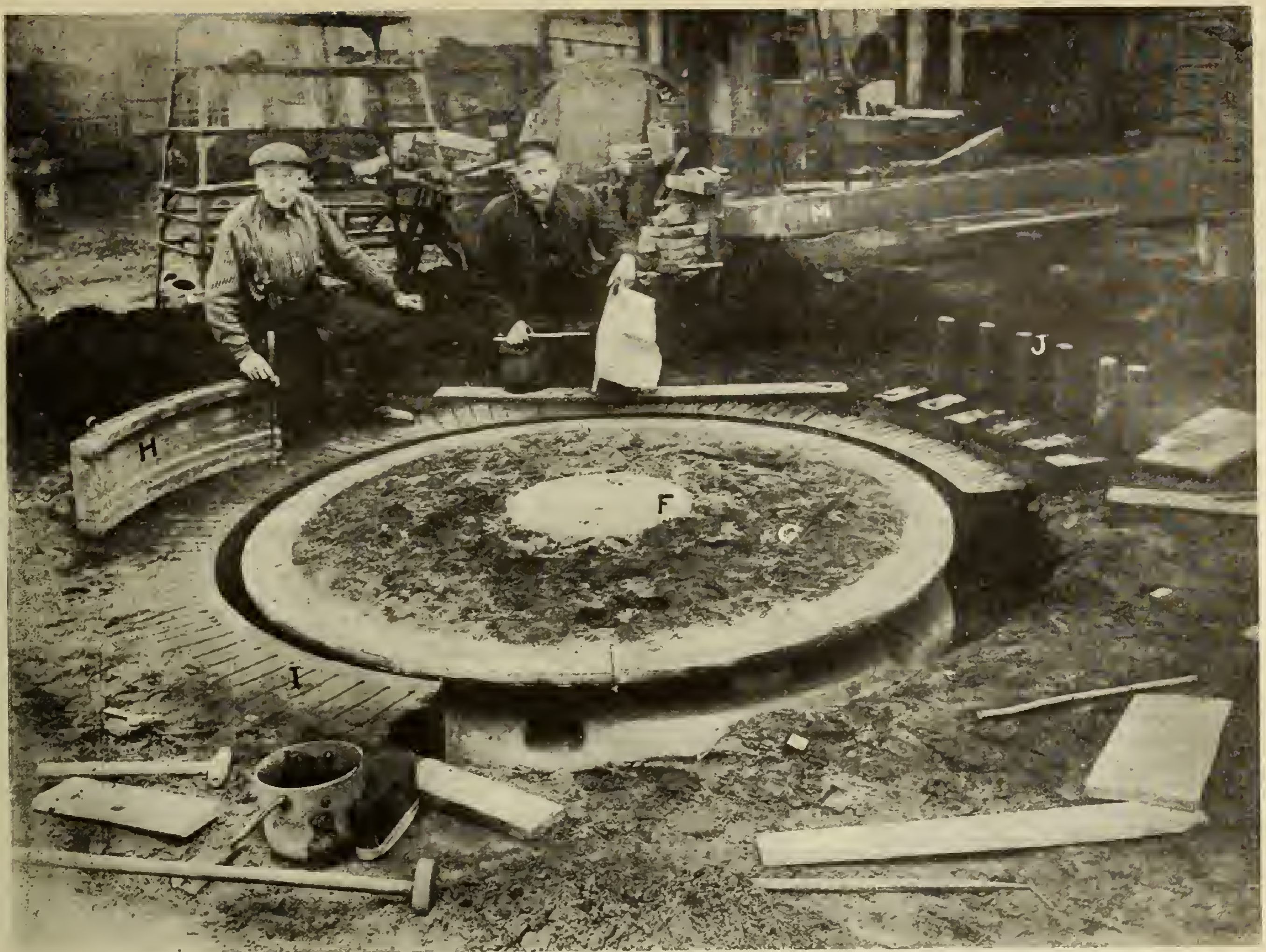


FIG. 2—SHOWING CORES BEDDED IN AND RIM PARTLY RAMMED UP.

of the rim shown at H, Fig. 1 and 2 is placed against the cores and the sand rammed against it as seen in Fig. 2. The part of Fig. 2 which is already done was rammed and struck off level and vented and scored as shown, while the segment pattern was in place, that is to say, each part is completed before the pattern is molded. It is then moved and another part rammed and finished and so on until the circle is completed. When this part is finished and all dust and grains of sand blown out, the rim is covered with flat cores and the entire mold is leveled up with loose molding sand, into which are bedded the covering plates shown in white in the sketch, Fig. 3, which are in turn strapped down by means of the binder irons M which are bolted to the anchor irons in the floor as shown in Fig. 3.

Gating the Mold

The system of gating this wheel will appeal to every lover of clean, sound castings. In Fig. 4 is shown a whirl gate illustrated and described in a former issue of this paper. Six of these gates are required to supply the iron fast enough for a casting of this size, weighing as it does between three and four tons. These six gates are placed in a row to one side of the mold as shown at J, Fig. 2, and are connected together at the top by a pouring basin as shown in Fig. 3.

This wheel, the molding and pouring of which we have endeavored to describe, is but one of the many pieces which go to make up the monstrous saw mill machines built by the Waterous Engine Works Co., and was chosen because of its being a suitable sample of what we wished to demonstrate, but is not to be taken as representative of the capabilities of this establishment.

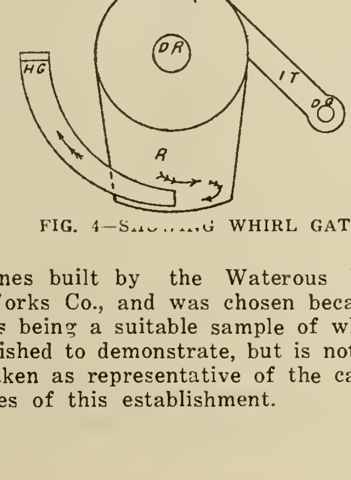


FIG. 4—SHOWING WHIRL GATE.

As will be seen by the interior section of the foundry surrounding this mold, it may be surmised that it is a model foundry in every respect. The walls, as will be seen, are covered with steam radiators. The I beam standing near the mold is one of the supports for the roof as well as for the electric traveling cranes. In one panel of this post is a system of radiators, while in the other is a system of piping, one containing water under pressure, another gas, and still another containing compressed air. Thus the molder has but to reach out his hand for any of these. Water is a common commodity in such places and requires no explanations. Gas is used for skin drying, etc., while compressed air is used for innumerable purposes, even taking the place of the molders' bellows. It is also used for pneumatic rammers, sand sifters, jolters, air hoists, chippers, etc. Electricity also plays a prominent part in the work, being the chief source of supply for the power which is required, not the least important of which is the electric door opener. If it is required that the electric crane be taken to the back yard either to take out a flask or bring one in, or for any purpose whatever, all the crane operator has to do is to touch a button when he is nearing the door, and by the time he arrives at

(Continued on page 16)

Practical Hints for the Brass Founder

Brass Melting in the Electric Furnace

That Electricity Will Ultimately be a Leading Factor in the Brass Foundry is an Assured Fact

The subject of the electric furnace in the foundry has been pretty thoroughly dealt with during the last few years. As a means of melting steel it has proved itself to be of inestimable value, particularly in the matter of melting turnings from the steel shells, in which case it aided materially in the winning of the war.

In the grey-iron foundry it has also been shown to be a decided success; its adaptability to this branch of the foundry business being more particularly along the line of utilizing iron which otherwise would have been more or less of an undesirable class. Burned-iron, iron high in sulphur, cast iron turnings and borings, in fact any kind of undesirable, low-grade scrap could be melted and the injurious elements removed, and the required elements substituted, thereby bringing the resultant metal up to any standard required. It now remains to be seen how far its usefulness can be extended, particularly in the field of the brass foundry. It seems inevitable that the next few years will witness the widespread introduction of electric furnaces in the brass industry. Electric melting in a suitable type of furnace decreases the loss of metal by oxidation and by volatilization, prevents the taking up of sulphur from the fuel, gives better and more healthful working conditions and has many minor advantages over other processes.

However, not every type of electric furnace can be used for brass melting. If brass did not differ materially from steel and iron in its behavior during melting, electric furnaces would long ago have superseded other furnaces in the melting of non-ferrous metals. But brass is made up of copper and zinc, and heat sufficient to melt brass will burn zinc. For this reason reverberatory furnaces fired with coal cannot be used for melting brass without burning out the zinc. Similarly, the direct arc type of electric furnace used for steel melting has the same drawback, because of the high local temperature of the melt under the arc. Indirect arc furnaces of different types are being used with some degree of success, but not what could be considered satisfactory. None seem to be quite fitted to that common set of conditions where a furnace may be called upon to melt successive heats of alloys differing widely in composition, to handle alloys both free from zinc and those high in zinc, and to operate cheaply on a nine or ten-hour day.

In America some marvelous developments of great value have resulted from experiments conducted under the supervision of the Bureau of Mines. A rocking furnace similar in appearance to the rocking tumbling barrels of a few years ago is giving promise of being the leading electric brass furnace of the future.

From a paper by H. W. Gillett and A. E. Rhoads, and published in "Foundry" we take the following: "In its study of electric brass melting during the past five years, the Bureau of Mines has tried out a rocking type of furnace, which may perhaps help to fill this gap. In the ordinary indirect arc type of furnace the heat is applied above the melt and as hot metal is lighter than colder metal, there is little circulation in the bath. If the rate of heat input is at all rapid, it is necessary for thermal efficiency, heat conduction from the top of the melt downward does not keep pace with the heat supply. Before the melt, as a whole, reaches the proper pouring temperature, the surface is much superheated.

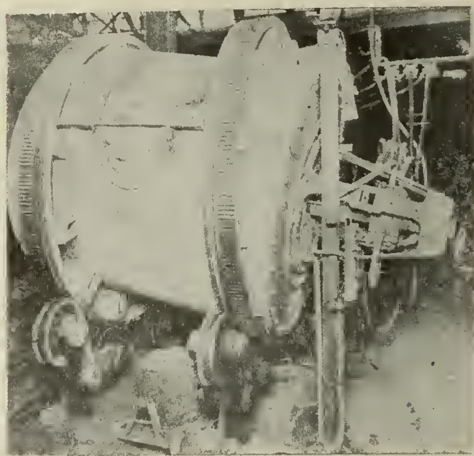


FIG 1 REVOLVING ELECTRIC BRASS FURNACE, INCLINED TOWARD THE RIGHT TO EFFECT THE ROCKING OF THE CHARGE. THIS VIEW SHOWS THE TAPPING SPOUT.

On an alloy high in zinc the surface will reach the boiling point of the zinc in that particular alloy while the bottom is scarcely melted, such heating creates a high pressure of zinc vapor within the furnace, so that if the furnace is not tightly closed zinc is lost continually. If the furnace is sealed tight the pressure may even blow out the roof or door. In case the furnace holds tight and the pressure is not relieved till the spout is opened for pouring, a long hissing stream of zinc vapor then shoots out, burning in the air. This local over-heating is the cause of the failure of the indirect arc furnace to handle alloys high in zinc without large metal losses.

The obvious way to overcome this trouble is to stir the melt so vigorously that the temperature of the melt is practically uniform and the superheating of the surface prevented. The most practical way to stir the melt is by the principle of the cement mixer, by turning the furnace bodily so as to stir the contents thoroughly while being heated. Constant rotation of a cylindrical furnace placed more or less horizontally, but preferably at a slight angle with the horizontal to produce endwise motion of the melt during rotation, with electrodes entering at the ends of the drum and an arc struck between the electrodes, should not only stir the charge thoroughly, avoid surface overheating and thus prevent zinc losses, but should also give a well-mixed alloy. By washing the walls with metal the heat stored in the walls and roof should be largely taken up in the metal instead of passing out. The power consumption, therefore, should be low. As the walls are washed with metal, their temperature can rise little above the temperature of the metal, which should give a good life of lining.

Instead of rotating the furnace through a complete revolution which would involve difficulty in keeping the metal out of the joints between the door and the door opening, as this opening should be on the circumference of the drum rather than on the end, and in making brush contacts to the electrodes, it appears simpler to rock the furnace back and forth so that the molten charge just fails to reach the door at either end of its rocking angle

A small furnace of this type was built and tried out. This was rocked back and forth by hand on tracks. It was cheaply constructed from materials at hand in the laboratory and was not expected to give very good results on power consumption, as the drum was too small to allow a thick refractory linning to be of desirable thickness

The laboratory furnace held 100 pounds of charge and operated on 50 to 75 volts, 500 to 700 amperes at a power factor of 85 to 90. The usual power input was about 30 kilowatts. Graphite electrodes, 2 inches in diameter were used.

Different Alloys Melted

A number of different alloys were melted in the rocking furnace. In melting 1092.1 pounds of yellow brass made up of 45 per cent. ingot, 55 per cent. copper and zinc, the calculated analysis, being 65.6 per cent. copper and 34.4 per cent. zinc, 1080.4 pounds of ingot were obtained.

These analyzed 65.9 per cent. copper and 34.1 per cent. zinc. The metal loss by weight was 1.06 per cent which includes both volatilization and mechanical loss by spatter in pouring. The average pouring temperature was 1080 degrees Cent.

On manganese bronze chips, 40 per cent. zinc, the furnace gave a net metal loss of 3 per cent. Yellow brass chips, 25 per cent. zinc, gave 1.6 per cent. net loss and red brass chips, 10 per cent zinc, 1 per cent.

A fine concentrate, 20 mesh, from brass furnace ashes obtained in the manufacture of an alloy of 80 per cent. copper and 20 per cent, zinc brass, which analyzed 71 per cent. and 14.3 per cent. zinc, the balance being ash, etc., after melting in the furnace, 99 per cent. of the copper and 50 per cent. of the zinc in the concentrate were recovered. This material is usually sent to the smelter and refined in a reverberatory furnace, not all of the copper and none of the zinc being recovered.

Yellow brass ingot, 25 per cent. zinc, was remelted with 0.5 per cent. loss. Red brass, 10 per cent. zinc, made up from red gates, scrap copper, yellow chips, lead and tin, was melted with 0.5 per cent. loss. Heavy German silver scrap, 18 per cent. nickel, 56 per cent. copper and 26 per cent. zinc, was melted with 1.2 per cent. loss. Sound copper castings were made from metal melted in the furnace.

Economy in Time and Power

Red brass containing 81½ per cent. copper, 8½ per cent. zinc, 6 per cent. lead and 4 per cent. tin, made up from red and yellow ingot and scrap copper, was melted in one series of tests with the results given in Table I, the furnace having been cold at the start.

The total elapsed time for the five heats, including charging and pouring, was five hours; 630.9 pounds of ingots were poured and 7.45 pounds metal from spillings, etc., were recovered, giving a gross metal loss of 1.35 per cent. and a net loss of 0.2 per cent.

The power consumption, at the rate of 430 kilowatt-hours per ton on a five-hour run, starting from the cold, and at the rate of 295 kilowatt-hours per ton when the furnace is hot, with the metal heated to 1200 degrees Cent. is surprisingly low for so small a furnace. The results show that the rocking furnace is a type capable of giving low metal loss and low power consumption. When the furnace was not rocked while melting alloys high in zinc, pressure built-up within the furnace and zinc losses were high. The laboratory tests having demonstrated the probable usefulness of the type, a furnace of commercial size was designed.

The Detroit Edison Co. had long been interested in electric brass furnaces as a possible outlet for electric power, and offered to co-operate by constructing a rocking furnace for commercial test without expense to the Bureau of Mines, except for the salaries and expenses of its representatives while supervising the test. Sketches of the furnace design were given the Detroit Edison Co., which refined the design, made the working drawings, constructed and erected the furnace.

The furnace is shown in Figs. 1 and 2. The drum is five feet in diameter hy 5 feet long. The lining is 12 inches thick and consistes of Silocel brick on the outside, special heat-insulating brick in the middle layer and corundite brick (a very refractory fire brick high in Al_2O_3) in the actual hearth lining. The hearth is 3 feet long by 3 feet in diameter, taking charges of 1300 pounds and upwards. The graphite electrodes are 4 inches in diameter, threaded for continuous feed, and are adjusted by screw-operated supports of the lathe-slide type. Single-phase, 60-cycle current, stepped down to 120 or 130 volts is used, 300 kilovolt amperes being available. Electrode adjustment is by hand, and, to stabilize the arc an external reactance is used which brings the power factor of furnace plus reactance measured at the furnace switchboard, to about 85. The open circuit voltage falls to about 106 to 116 volts under load. The current varies, between 1000 and 2000 amperes being about the average. The power input can be varied by alternating the length of the arc and runs from 100 to 200 kilowatts, averaging about 165.

The flexible leads and the water hose for electrode coating are given slack to allow rocking the furnace, as is clearly shown in Fig. 2.

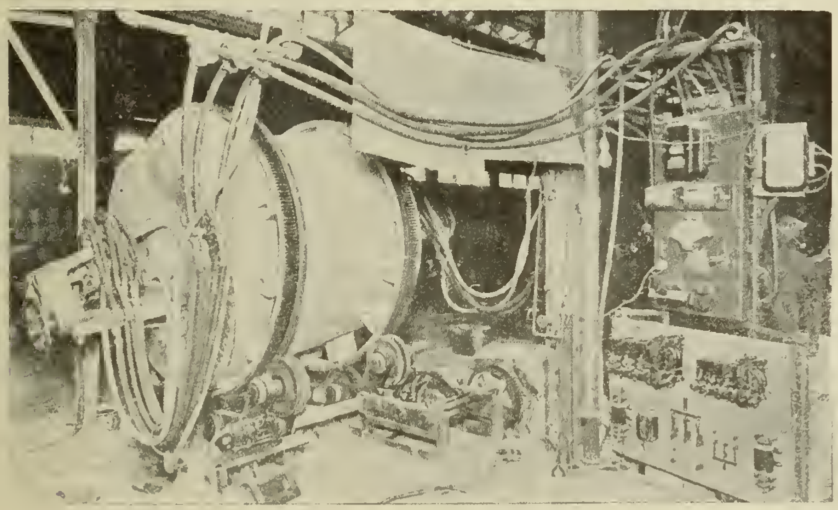


FIG. 2—END VIEW OF REVOLVING ELECTRIC BRASS FURNACE, SHOWING THE SLACK IN THE ELECTRICAL LEADS TO COMPENSATE FOR THE REVOLVING, ROCKING MOTION

Rocking is Automatic

The rocking of the furnace during melting is automatically done by means of the control device shown, with cover removed, in the lower left-hand corner of Fig.2. This can be set to give a safe rock of 80 degrees, the limit of motion being such that the metal just does not run into the spout. After the charge has begun to melt, the safe rock is started. It is called the safe rock because the angle is such that the solid charge will not fall on the electrodes and break them. A complete oscillation on safe rock takes 13½ seconds. During the safe rock the solid metal is washed about in the molten part of the charge and is tumbled over, so that fresh surfaces receive direct radiation from the arc.

As melting goes on, the rocking angle is increased by turning the handle of the control device from time to time, until, when the metal is all melted, the furnace is on the full rock of about 200 degrees. On full rock the metal washes the whole circumference of the hearth except the height of the charging door and a few inches above and below it, so that metal does not splash into the door joint. A complete oscillation takes 33½ seconds.

The reversal of the 5-horse-power motor at either end of the rocking angle is done by contactors, operated by solenoids actuated by the contacts on the control device. When it is desired to depress the spout past the limiting point of the automatic rock for pouring, the control device is switched out and the solenoids are operated by a reversing switch.

The furnace is installed at the plant of the Michigan Smelting & Refining Co., Detroit, which makes brass ingots to customer's specifications from chips, scrap and junk of various kinds, by means of strict chemical control. As the firm makes no sand castings, but ingot only, no observations on the comparative quality of metal melted in the electric furnace and in the coke fires were possible. All the metal melted was poured into ingots which went into the regular output of the plant. As far as could be ascertained by analysis and appearance, the electrically-melted metal was of at least as good a quality as from the coke fires. On alloys high in lead there was somewhat less segregation than in the metal melted in crucibles, and on charges high in zinc, the zinc content of the metal from the electric furnace was higher than that from the same charges melted in the coke fires.

Comparing Metal Losses

As there is generally much oil on the borings and some non-metallic material in the other scrap, the true metallic content of the charge is seldom accurately known. Hence the net metal losses cannot be exactly determined.

The metal losses, therefore, were compared with those of the coke-fired crucible furnaces operating on the same charge. From 102 tons of metal melted in strict comparison with the crucible furnaces, the rocking electric furnace produced 3626 pounds more metal from the same charge than the coke fires, or 1.8 per cent. The alloys melted ran from 90 per cent. to 66 per cent. copper; 1 per cent to 9 per cent. lead and 0 to 30 per cent. zinc. The comparative metal losses on a few alloys in the electric furnace and in the coke fires are given in Table II.

There was no difficulty in drawing the metal completely from the hearth and alloys of different composition can be made one after the other without contamination by metal left in from the previous heat.

The rocking furnace gave alloys analyzing very close to the calculated analysis, especially if the difficulty of calculating the analysis of a scrap charge is considered. Characteristic analyses are given in Table III.

Electrode Consumption

The electrode consumption was 16.3 pounds while melting 21,660 pounds of metal, or 1½ pounds per ton, equivalent to about 40 cents at present electrodes prices. To this must be added the loss due to accidental breakage. There were nine breakages in melting 72 tons, four of which were due to the charge being so bulky that it fell against the electrodes when rocking started, and five to the electrodes being hit while bulky material was being charged. The design of the furnace has now been altered so as to allow the electrode tips to be withdrawn into the walls during the charging of bulky material. When an electrode does break, if nipple joints are used, the breakage is usually of the nipple only.

Free Licenses Granted

The patents taken out by the Bureau of Mines on the rocking furnace have been assigned to the Secretary of the Interior as trustee, and free licenses to operate under them can be obtained by making application through the director of the Bureau of Mines.

TABLE III.

The Analyses of the Mixtures Sought and Obtained by the Electric Furnace Showed Little Difference.

	Copper, per cent.	Tin, per cent.	Lead, per cent.	Zinc, per cent.
Sought	76.0	8.0	13.0	3.0
Electric	75.0	8.3	13.1	2.7
Sought	76.0	8.0	13.0	3.0
Electric	76.2	8.0	12.4	3.2
Sought	85.0	5.0	5.0	5.0
Electric	85.2	4.9	4.8	5.0
Sought	83.0	4.0	6.0	7.0
Electric	82.9	4.4	6.7	6.0
Sought	67.0	1.0	2.0	30.0
Electric	66.6	1.0	2.0	30.4
Coke	68.4	0.5	1.7	29.3
Sought	68.0	1.0	7.0	24.0
Electric	67.9	....	....	....
Coke	69.9	....	....	....

"Honest living means putting back into the world as much as you take out of it. You don't live honestly if, being able-bodied, in good health, and of sound mind, you let somebody else pay your way. You don't live honestly if, when you become a business man, you get something for nothing; from the legislature or the city, or from your customers, or from your wage-earners. Put back in some way, in some service, or improvement, or benefaction, above all in a fair price and a just wage, as much as you take out of the resources of the earth, out of the revenues and common possessions of the community and out of the toil of men. If you don't you are a thief, even if you seem to be respectable, and people are fooled into believing that you are."—"Brass World."

TABLE I.

Results of Melting Red Brass, Furnace Having Been Cold at the Start.

Heat No.	Weight of charge, pounds.	Time arc was on, minutes.	Pouring temp., degrees, Cent.	K.W.H. used.	K.W.H. per 100 pounds.
L34	127.3	57	1140	40	30½
L35	127.75	50	1180	30½	25
L36	128.5	50	1220	26½	20½
L37	126.5	37	1220	22½	17¾
L38	129.5	36	1220	19	14¾
	*639.55	†46	*1200	*138½	†21¾

*Total. †Average.

TABLE II.

Comparative Metal Losses in the Electric Furnace and in Coke Fires

Composition: Copper, per cent.	Tin, per cent.	Lead, per cent.	Zinc, per cent.	Weight charged, pounds.	Per cent. loss, metal, oil and dirt coke fires.	Per cent. loss, metal, oil and dirt, electric.
85	5	5	5	6,576	4.6	3.2
84	7	8	1	11,600	7.0	3.7
84	6	10	0	14,300	2.4	1.8
79	9	10	2	11,790	3.6	2.1
78	2	10	10	15,840	7.1	3.1
76	8	13	3	11,805	4.0	2.4
73	4	20	3	14,392	3.7	2.9
67½	4	26½	2	5,224	3.0	2.4
67	1	2	30	7,200	8.0	5.1

GATING AND PARTING

(Continued from page 9)

and pour into the basin and it would convey the iron to the gate. This also met with disapproval from the foreman. He did not interfere with the basin, but he had the ladle racked over and around to the end so that it would be poured lengthwise of the mold. The iron entered the basin first and then flowed down the gate, but he believed that by entering in this direction it was more likely to run. Supposing we had no basin but poured right down the gate, would it have made any difference where the ladle was, since the iron had to go perfectly straight down through the down gate before it hit the gate leading into the mold?

Barber Brothers, who have been operating a brass foundry at 3 Brookfield and Queen Streets, Toronto, are now doubling their melting capacity and are also installing an electric motor and considerable grinding and polishing machinery, and will specialize in aluminum castings in addition to their regular brass business.

The Hartley Foundry Co., Brantford, Ont., are adding a three-furnace brass foundry to their grey iron foundry, and have considerable volume of work in view.

The 1918 Christmas volume of "Graphite," the Joseph Dixon Crucible Company's attractive trade organ, opens with a terse article on "The Staff and Line of an Industry." Under a picture of a memorial tablet inscribed "Defenders of our Nation" is the Dixon Honor Roll of one hundred and seven employees. A. R. MacDougall & Co., Toronto, are Canadian agents for Dixon's American graphite pencils, and the Canadian Asbestos Company, Montreal, are agents for all other products of the Joseph Dixon Crucible Company.

The Canadian Allis-Chalmers Co. have just completed a one hundred and sixty-foot addition to the Davenport foundry on Gladstone Avenue, Toronto.

The Bawden Machine Co. are building a two-storey addition to their machine shop on Stirling Road and are also building a large brass foundry.

PASSING OF THE SMALL FOUNDRY

WHEN I say "passing," I take into account the fact which confronts me whenever I visit a small town, that somewhere within its boundaries there stands what was once a foundry, but which may now be only a ruin. In years gone by every town or village, no matter how small, had its foundry, and it was no uncommon sight to see two or even more foundries in a town with less than one thousand inhabitants, and I have seen the somewhat amusing spectacle of a village with about three hundred of a population supporting two fairly good foundries, each having a machine shop in connection and each proprietor being a machinist and, of course, managing his own machine shop, and then between the two of them they would engage a molder to work alternate weeks in each foundry. From this it will be understood that the molder would go into one foundry on Monday morning and cut up his sand and begin his week's work by sorting over the jobs laid out for him and making up what cores he would require and dry them in the smoke box of the boiler, or some such an improvised core oven. This would probably consume about all day Monday. On Tuesday he would start molding and continue this until Friday night, and then on Saturday morning he would be in shape to pour off.

Saturday afternoon would be devoted to shaking out and getting his castings in shape to be delivered, and also to wetting down his sand for next time. On the following Monday morning the same procedure would be in order in the other foundry. It was an interesting programme which this molder would have to go through in these little shops. A tin-pail kettle would be in the first mold; after this would be some plow work, such as land sides and mold boards, etc., and also innumerable bits of job work of every conceivable variety. Friday, the last day of molding, would be reserved for the chilled plow shares. These would be left open over night, so that the chills would not draw dampness and become rusty. These foundries always seemed to hold their own, but still, it is quite reasonable to expect, that their "modus operandi" would not stand the test at this late date. However, if managed under modern methods, there is nothing to prevent them from being valuable assets even now. Now, Mr. Reader, I served my time in a foundry which, while not so small, was run on similar lines. All foundries were run the same in those days. Loam molding was more common then than now, and the apprentice learned all branches, including melting, core making, brass molding, etc., and I want to say it required more ability to work in the comparatively small jobbing foundry of those days than perhaps the molders of to-day are apt to imagine.

As regards my own case, I never had any difficulty afterwards in holding my own in the big foundries, but I became ambitious to become a business man myself, and, ultimately, I opened up one of these small shops on my own account. I had an abundance of work, and had exceptional success in collecting my accounts, but I could not see that I was being repaid for my anxiety and worry, so I passed it on.

This was many years ago, but in the years which have passed since then, I have seen many of these little foundries standing idle. Thus the subject of my story, "The Passing of the Small Foundry." I am now more than convinced that if these small foundries were properly managed, they could not only compete with the larger ones, but could surpass them in economical production of castings, and that they could also produce a superior quality of castings. This may be all buncombe, but supposing we argue it out and see wherein I am mistaken. "'Figures will not lie" is an old saying, but unless we understand figures we can't use them. However, we will not jump at conclusions and say that a big furnace will melt more economically than a small one. How do we know that it will? Have we ever figured it out? Or, supposing we have 25 molders working in a row and we take away 24 of them, how does that affect the other one? In what way does it decrease his production? Or, supposing we have one man making a large mold and we put another one on with him, in what way does he cheapen the cost? Can the two make it in any less than half of the time that the one would have required? Now I am not answering any of these questions; I am just asking them, but I will say that I have worked in some very large shops where very large castings were being made, and it was proved by actual figures (according to the superintendent) that molders working in single units will produce more than if working in pairs or in gangs.

Now, to get back to our subject, I can take one thousand dollars and build a foundry which will produce three hundred tons of castings in a year. I am saying this advisedly and can produce the figures and back them up. Will ten thousand dollars build a foundry that will produce 3,000 tons of castings in a year? I could continue enumerate all of the details of a foundry and leave the figuring to my reader and I think he could prove to his own satisfaction that either in building or operating a foundry with a capacity requiring forty molders it will require at least ten times the cash which would be required for the foundry with four molders. Now, as I have already said, I am not answering these questions, I am simply asking them so that the prospective foundryman will have something to study over, and if he corners me up I will be glad of it; I well know that he is interested. I think I know what the first effort will be. As a guess, I will say that it will be to corner me up on that thousand dollar foundry with the three hundred-ton capacity. Of course this will not include a high-priced city lot.

Now, Mr. Editor, what do you think about it? Why cannot these little country shops be put to work?

Small Foundryman

As a lifelong foundryman I can heartily agree with the idea of studying and figuring. That is our object in publishing THE CANADIAN FOUNDRYMAN.

In our boyhood days there were no foundry books to read, no technical schools and no trade papers treating on foundrywork. Now, if all these are at the finger tips, why not avail ourselves? It doesn't cost much to take a course in general foundry practice or cupola management, and it doesn't take many dollars to buy all of the foundry books which are published, and as regards the trade papers treating on foundry work, about one day's wages in a year should pay for all that are published in the English speaking world. Now, prospective foundryman, while all of this is inexpensive, it may be more than you care to expend just at the present time, but the least that we can suggest is that if you are not already doing so, you invest one single dollar per year in the only foundry journal published in Canada, THE CANADIAN FOUNDRYMAN, and if you do not take one dollar's worth of comfort out of it in a year alone with the benefits which you will derive, then we miss our guess. Of course, when you pay your dollar for the paper, insist on getting it, and if it does not come regular, call us down, because we want you to get it, and when you get it read every word in it, and then read it over again. If you read anything with which you do not agree, write and let us know how you would have it; we want to hear from you. Also ask us questions and we will get you the answer, no matter how much trouble it entails. Don't overlook reading the advertisements, that is what they are there for. Don't scorn the molding machine or the pneumatic or electric tools or any of the modern devices which are displayed. You have no doubt heard the story about the first wood planer which was introduced into Great Britain being destroyed by enraged workmen who thought it was bound to be their ruination, but it has not been. Carpenters, printers, farmers, everybody used to do all of their work by hand, but that day is gone, and the carpenter and the printer and the farmer are still on their jobs. Machinery is the salvation of every business, and the foundry must not lag behind.

Now to get back to our story; we want you to study, particularly figures, and when you feel that you have an ambition to be indenendent and be in business for yourselves figure on one of these little shops. They are waiting for you in almost every little town. Of course you will have to figure on getting work. In ordinary normal times work does not come to the shop: it has to be gone after, and you will have to figure the cost of going after it. It is not necessary to be in a city where you can find sale for your castings. The city man who buys your castings usually sells them again and makes a profit which might have been yours. In a small town you have the advantage of buying scrap iron at first cost, and if you have mastered the cupola question and understand the nature of silicon and manganese, etc., you will be able to make first class castings from scrap.

Now I am not advising you to go into business, neither am I advising you not to. My advice is to keep yourself as well posted as you can, and when an opportunity offers you will be in a position to know whether it is a paying proposition or not. If you contemplate going into business remember that three or four men working in one of those little shops could fill it in a day and do as much as one man usually did in a week, thereby producing six times the tonnage with the same initial outlay and the same overhead expenses and a big saving in wages.

This might seem to contradict what we have just been arguing, but it does not. That same man who put in the week filling the shop could have accomplished a much greater amount if he had been pouring off every day. To get the maximum out of any shop it is necessary to use every foot of it every day, and the foundryman who pours off three times a week has the price of his shop invested without interest for the other three. If he gets the maximum out of his men he must supply them with twice the number of flasks and tie up twice the amount of sand, and in fact have twice the amount of everything which would have been required if pouring took place every day. Now we think if you will figure things out you will see that a molding floor thirty feet square will be abundantly large for four good ordinary molders and if supplied with any kind of modern equipment each one can produce an average of 500 pounds of good castings every day, which will figure up to 300 tons in a year. Of course 30 ft. square will not be room enough for one molder if it is used for storage purposes, and this same argument holds good in the case of large shops. The foundry floor should be used for molding entirely, with the exception of the gangways, and all patterns and flasks should be removed as soon as they are done with.

It is not our purpose to dictate, but it is our wish that we may be the means of encouraging both the employer and the employee to take a greater interest in the foundry and try to get it on an equality with the other departments. We have had foundrymen tell us that there was no money in the business and that they were just running it because they had to have the castings. When we looked down through the shop we could readily agree with them. We have worked at molding in shops which were so dirty that we would be forced to stop and clean up a spot big enough to work in and then have had the foreman come and drop a flask which he intended for some other molder right on our cleaned spot because there was nowhere else to put it. The untidy condition of some foundries makes it unpleasant for the workmen and unprofitable for the employer, and a foundry with four floors properly managed could easily undermine the larger one run along these lines.—Editor.

MAKING MOLD FOR DRIVE WHEEL OF LARGE BAND SAW

(Continued from page 11)

the door it is opened and he passes through. Everything about the place is of a similarly up-to-date order, converting the one time slavish work of the foundry to a pleasant and interesting occupation. The molding of grate bars, once the bane of the molder's trade, is now done on the jolt ramming machine, thus changing it to an enjoyable pastime.

Larger work which formerly required hours of hand ramming is now frequently done on the large jolter or rammed with the pneumatic rammer.

Verily foundry work in a modern foundry is keeping pace with other lines of occupation.

Questions and Answers

Question.—In the last issue of the CANADIAN FOUNDRYMAN was an article on mixing iron with copper or brass, by using aluminum. Will you explain this more clearly? It is a well known fact that a speck of iron from the turning lathe will do a lot of harm in a pot of brass.

Answer.—As a brass worker you will not be properly versed in the nature of iron. It is not the iron which injures the brass, but it is the carbon contained in the iron. Iron has a strong affinity for carbon and it is physically impossible to get iron which does not contain carbon. Copper on the other hand will not mix with carbon, and if melted in a pot with iron and carbon it will remain segregated from it, but if aluminum is introduced it acts as a flux and drives the carbon to the surface where it can be skimmed off, leaving the pure iron which readily enters into combination with the copper.

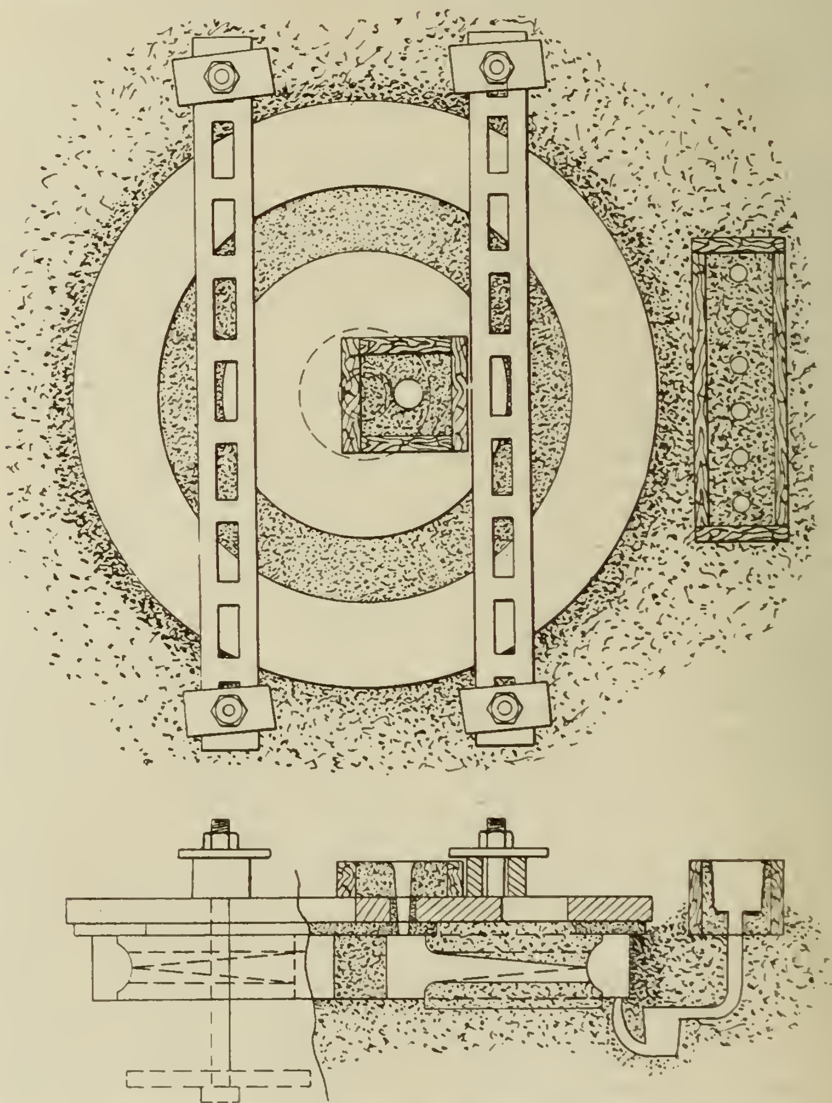


FIG. 3—SHOWING TOP AND SIDE VIEW OF MOLD WHEN COMPLETED.

PLATING AND POLISHING DEPARTMENT

Question.—We are desirous of obtaining a formula for finishing white gold with a coating which will have the appearance of platinum. Would a thin deposit of cobalt answer for this purpose? If not, can you suggest any other coating?

Answer.—Metal finishers throughout the Continent are now using every possible substitute for platinum in finishing certain grades of jewelry and novelties. Some have utilized the tin strike for the production of finishes intended to pass as platinum. The greatest difficulty presented by the cobalt method of imitation is the tendency to obtain cloudy coatings and the inevitable tarnishing which occurs gradually when displayed in store windows. The cobalt deposit soils very easily unless buffed or burnished; these operations, however, defeat the object of its use as a substitute for platinum. A fifteen or thirty second deposit is ample for the purpose, and if a saturated solution containing at least five ounces of boric acid per gallon is used, you may obtain a satisfactory finish. The more practical method would be to prepare a small platinum solution and produce the genuine finish; the cost would be somewhat in excess of the cobalt bath, but the results obtained would be far more satisfactory to you and your customers.

Question.—I am operating a small plating plant in connection with a repair shop and have frequently received aluminum pieces to plate or finish in black or brown color. These jobs cause me endless worry and great loss of time as invariably the attempt proves a failure, yet I have persevered in the hope of succeeding next time. You will oblige me greatly if you can enlighten me regarding the proper method of preparing the aluminum for plating and the process of depositing copper, nickel, silver or brass upon the prepared surface.

Answer.—You are up against the real thing now. "It can't be did." You may polish and clean, scour and wash, dip and rinse until you wear the metal away, and you will not produce a deposit of any commercial value upon an aluminum surface. The deposition of other metals upon the aluminum surface is quite easy. The production of an adherent coating is, however, an entirely different proposition. Aluminum is a very peculiar metal as viewed from the electroplater's standpoint. The metal oxidizes gradually though protected by as non-porous a deposit of copper, nickel, silver or brass as is possible to obtain under practical conditions, and the ultimate result is a complete breaking up of the deposited coating. The writer has repeatedly been compelled to produce deposits of nickel upon aluminum surfaces in response to orders for nickel finish upon aluminum ware, and during recent years has adopted a plan which thus far has excelled all others tried. The method employed permits the preparatory operations to be reduced, simplified, and quickly performed. This is necessary owing to the fact that aluminum oxidizes so readily. A combination cleaning and coppering solution is the only accessory required. The solution should be prepared from either a non-caustic cleaning compound in combination with a weak copper solution or a compound containing a very small percentage of caustics. The solution is employed at a temperature of 210 degrees Fahr. and an E. M. F. of at least 10 volts is required. Suspending wires of ample size to carry full amperage the article will conduct. Immerse the aluminum articles in the solution and immediately connect them to negative bar of the tank; usually a 30 second or 1 minute treatment will suffice to thoroughly clean and copper the surface of the article, rinse in cold water until completely cool, immerse in a cyanide dip to produce a copper surface free from oxides, rinse again in clean, cold water and follow by a final rinse in separate bath of cold water, then transfer direct to the nickel, brass, silver or gold plating solution and plate as is usual for ordinary steel wares. This method will not make possible the production of more satisfactory results than some of the slower methods, but it will facilitate the deposition of any metal upon aluminum surfaces equally as satisfactory as other methods and with much less work and worry. In fact our best specimens have been obtained when the least caution was observed, quick actions on the part of the operator are essential. Metallic deposits upon aluminum surfaces usually prove defective in less than three months. Much depends on the treatment received in use and the atmospheric conditions during the period preceding the final finishing treatment of the deposited metal. Nickel deposits from hot nickel-plating solutions upon the preliminary copper flash appear to give most satisfactory results as they are soft, firm, tough, and may be produced in the least possible time.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1918-1919

President—James Vallier, 701 Crawford St., Toronto.

Vice-President—Charles Kemish, 271 Boston Ave., Toronto.

Sec.-Treas.—E. Coles, P.O. Box 5, Coleman, Ontario.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

Question.—The company I am employed by are making several hundred thousand steel nuts. The nuts are turned from solid bars of hexagon steel, and the manager persists in demanding a smooth finish on the edges without rounding the corners; the finish is to be obtained by tumbling and we have thus far been unable to produce the goods. The nuts are same diameter as the bar from which they are cut and the stock is very porous; it is the eradication of this spongy surface metal which makes the operation difficult by the tumbling process without injury to the corners of the nut. Kindly advise me of some method which we can employ to meet the requirements of the management.

Answer.—If the surface of the steel bars from which the nuts are turned is deeply fitted it will be practically impossible to remove or obliterate them by any known process of tumbling without injuring the hexagonal diameter of the nut. The wet method of tumbling, using steel balls or twin cones, would probably produce the best possible finish obtainable by any method of tumbling. In using this method it is necessary to employ at least twice the bulk of balls as compared to product being treated. The result in your case would be obliteration of the holes rather than their removal; the square corners of the stock would suffer to some extent though not seriously if the speed of tumbler was correct and the load and time of treatment properly regulated. Another method would be to polish the steel bars prior to delivery to machine shop; this method would facilitate prompter routing of the product through the factory and reduce the time required for tumbling, thereby eliminating the danger of rounding the corners of the nuts while obtaining a satisfactory surface on the face. The cost of polishing the steel bars will be very moderate if a rotating fulcrum is located about two feet from the polishing wheel and the bar passed over the fulcrum and beneath the polishing wheel, the surface of the rotating fulcrum should be shaped to accommodate the size and form of bar being polished. Steel bars or large channel shaped pieces of considerable length may be polished in this manner very easily and rapidly after the operator becomes accustomed to the movements necessary to expedite the treatment.

Question.—Through the resignation of the foreman I have recently assumed charge of finishing departments in a large factory engaged in the manufacture of black Japanned steel goods. The steel ware is placed on books formed from spring steel wire and dipped in Japan, then the goods, hooks and carrier are placed in baking ovens and subjected to a temperature of 350 deg. Fahr. for 1½ hours. The hooks are used repeatedly, and as a result they acquire a very thick, hard coating of Japan; in time this coating renders the hooks practically unfit for use. These hooks are quite difficult to form as they are of peculiar shape. If we burn the Japan off we ruin the hook by softening the wire and through distortion by heat. If we hammer the Japan off we ruin the hooks by distortion and embrittlement in spots. We have attempted to dissolve the coating by boiling the hooks in a strong solution of lye, but, after several days' treatment we find that very little of the coating has been affected by the lye. Can you inform us of some practical method of salvaging the hooks? If once clean we intend to try cleaning them at frequent intervals.

Answer.—We can well imagine the condition of hooks after continued use and repeated baking at the temperature you mention and have no hesitancy in stating that your proposition is indeed a difficult one. We would be inclined to try sand-blasting the hooks, and if the result was not satisfactory the treatment with strong lye or caustic would be our second choice. The tank containing the caustic should be equipped with a simple baffle plate to facilitate the maintainence of a constant and rather violent circulation of the boiling solution about the submerged hooks, 2 to 4 ounces of sodium cyanide per gallon of caustic solution will effect a more rapid disintegration of the coating. The process will no doubt require considerable time; the ultimate results, however, will be much more satisfactory than the laborious and tedious mechanical treatment. Your intention to clean the hooks at frequent intervals hereafter is a step in the right direction and the only practical way of dealing with similar problems. The duration of treatment by boiling caustics will be governed by the temperature of the baking oven during the Japanning process rather than those by the time of baking or the number of coats upon the hooks when placed in the cleaning solution. In other words. Japan baked at 200 degrees Fahr. will be more easily removed than Japan baked at a higher temperature.

Question.—We are preparing to instal a new nickel-plating tank in our plating room. The tank proposed is to be six feet long, thirty-three inches wide and eighteen inches deep. Should we use sixteen or eighteen inch nickel anodes for this tank? How many anodes should we order?

Answer.—If your nickel tank is eighteen inches deep it would not be practical to use an anode exceeding sixteen inches in length. Furthermore, if your tank rheostat is such as to furnish you unreliable control of the current or your product as suspended in the plating solution does not reach fully fifteen and one half inches the depth of the tank we would advise a fourteen inch anode. As you are probably aware, nickel deposits usually burn more readily at lower ends of the cathode than elsewhere, and if the cathode equals or exceeds the length of the anode the condition favors burning or oxidation of th deposit on lower ends of cathode. If the anode is slightly shorter than the cathode the tendency to burn the deposit is materially decreased, even during periods when the proper density of the solution is not maintained. Therefore in our opinion the 14-inch anode would be best for your 18-inch tank. The number of anodes required will depend largely upon the square foot area you intend to plate per load; an excess of nickel in the form of anodes in the bath is usually much more economical than the reverse conditions. For ordinary commercial plating we would estimate your anode requirements for the above tank to be approximately 48 anodes of the 2½ inch width type for a single work rod equipment, or 72 anodes of the 2½ inch width type for a double work rod equipment. A method employed by some first-class platers, is to fill the tank rods full of average work and then suspend anodes on the positive rod until an ammeter in the tank circuit ceases to indicate an increase on amperes. This method will permit a finer regulation of the current than the more liberal use of anodes. If your product is irregular in shape or the sizes of pieces processed at different times vary considerably we would advise giving these facts due consideration if the ammeter method of adjustment is employed. Suspend the anodes so that the top of anode is about ½ inch above the surface of the nickel solution. Fill the tank to within one inch of top of tank with solution and tack a strip of ⅞ inch wood along top edge to support the rods. No space is lost and the tank may be kept clean quite easily.

Question.—We have a 250 ampere generator which has been used to operate an electric pickling bath. Recently we installed a small hot copper bath and connected this to the generator mentioned above. The alterations were effected during a week end and when operations were resumed on Monday we could not obtain a current for plating or pickling. A current of electricity was generated, but it was of no value to us, as articles suspended in the copper solution became black and very slight gassing was noticeable, while the forgings hung in the pickling were not materially affected, although a violent liberation of gas resulted. We have not altered the wiring in any way, neither have we changed any parts of the machine. We will be shut down for inventory during the coming week and will appreciate a reply by early mail if you can inform us of method which will restore proper working conditions of generator.

Answer.—Your trouble is evidently reversed residual magnetism. Reversed residual magnetism causes reversed polarity of the generator brushes. The direction of the field current is reversed and agrees with new direction of the residual magnetism. In such cases the field will build up a current, but the polarity of the generator will be reversed. The probable cause of this reversal in your machine was a heavy short circuited current through the armature. This may have resulted from carelessness or ignorance on the part of a workman engaged in fitting the newly installed copper tank or steam coils, as a piece of pipe or other metal object placed directly across the terminals at any point in the circuit would produce a serious short circuit which would have a demagnetizing effect on the field. Compound wound dynamos of the earlier type were very liable to reverse with no apparent cause. More recent types of compound wound plating dynamos are practically free from this defect. Shunt wound plating dynamos will reverse if seriously short circuited, otherwise they are very dependable. The residual magnetism may be again reversed so that the generator will have the same polarity as before, by sending a current from another dynamo or a couple of dry batteries through the field in the proper direction. Disconnect the busbars from the generator so that no current will flow through the external circuit. Disconnect the field terminals from the brush leads and connect the positive terminal of either dynamo or battery to the field terminal on positive side of the affected machine. Connect the negative side up in same manner and allow a current of 3 to 5 volts to flow for a few minutes while the reversal machine is at rest. Connect up busbars, field terminals, etc., and operate machine as usual. With the current reversed your copper anodes were made cathodes and the result was excessive action on extremely small anode surface by current through large cathode surface creating the liberation of gas mentioned and oxidizing the surface of the anode which normally would be the cathode. In the pickling tank the opposite condition resulted. The forgings which usually are anodes were cathodes and the negative current caused excessive liberation of hydrogen with no appreciable loosening of scale in time ordinarily processed. Electro-platers often change the connection from the dynamo in case of a reversal of current and operate the machine with field magnetism reversed. We would advise correcting this condition as mentioned above if possible to obtain current.

Question.—I have several large cast iron panels with figures in relief which I wish to finish in copper. I have tried brushing the coppered surface with a brass wire brush. This produced a dirty dark surface which is not pleasing to the eye. A tampico brush does not leave the surface bright enough, and owing to the uneven condition of the figured portion, it is not practical to attempt polishing with emery. Buffing on cotton wheel does not give desired finish. I want a uniform, clean, bright copper surface similar to bright acid dip finish as produced on small articles.

Answer.—Either pickle or sand blast the panels. Sand blasting is preferable for such work. Polish the borders and prominent high lights. Clean in electro cleaner, swab off with brush and little pumice, rinse, pass through a cyanide dip and copper plate in cyanide copper solution for thirty minutes with moderate current and an E.M.F. of about 5 volts. Remove, rinse and brush by either of the following methods:—use circular brass wire scratch brush, kept wet, while brushing the undried panel:

finish by applying brush in one direction only and full length or width of panel per stroke, or dry the panel by passing through clean hot water and brush in manner previously described, using dry steel wire brush. The finer the wire the more satisfactory the result. Lacquer the face of panel to prevent tarnishing.

Question.—I am in charge of a plating plant of more than average size. We deposit nickel, copper, zinc, brass and bronze. Naturally we require considerable steam to maintain proper temperature of the solutions mentioned as well as the cleaning solutions and water for drying purposes, also coils in sawdust box. The management are continually reminding me of excess use of steam and consequent cost of coal. As a result of this action on the part of my employers I have interested myself in the problem and believe the uncovered condition of steam pipes alone will cause a very considerable loss in steam. All the steam pipes are exposed, and as the room is poorly ventilated we are obliged to open windows during the most severe winter weather. Will you kindly furnish me with some data relative to approximate loss of steam heat from exposed surfaces which would be applicable to plating room conditions, so that I may present the matter in proper form to the management

Answer.—Your attitude respecting the conservation of steam is truly commendable, and with your employer in his present frame of mind you should be able to assist greatly in creating an economic system of heating the solutions in the plating room and aid in saving coal. The fuel administration engineer for the State of Illinois, U.S.A. recently made public some very valuable facts regarding radiation losses from steam heated surfaces, such as steam pipes, etc., He says, a square foot of ordinary bare pipe will radiate approximately 3 B.t.u. per square foot per hour per degree difference between the temperature of the steam and the outside, or room temperature. A properly covered steam pipe, however, radiates only about 0.3 B. t.u. per square foot per hour per degree difference. A one inch iron pipe 2.9 feet long is equivalent to one square foot of exterior surface. With a steam pressure of 100 lbs. and steam temperature 338 degrees Fahr., the room temperature or surrounding air being 70 degrees Fahr. the heat loss per square foot per hour per degree difference would be 820 B.t.u., or a waste of 718 lbs. of coal per sqr. foot per year. With above conditions 2.79 sq. feet of surface means a waste of one ton of coal in 1 year. The cost of covering steam pipe is so quickly made up by the saving which results therefrom that uncovered pipes should not be tolerated for a single day. There are several excellent materials readily available for covering steam pipe. The expense is the initial cost only, because pipe covering will remain in place indefinitely unless it is deliberately destroyed. Here is the means of a direct and inexpensive economy, which your employer will undoubtedly recognize as soon as you present the matter to him.

One of the most perplexing and expensive sources of steam loss in the plating department is the tendency of hot alkaline cleaning solutions to boil over the top of containers and become wasted, Each spill results in a more or less depleted solution, waste of material and steam. As each loss of solution requires the addition of sufficient water to make up loss in volume and a consequent lowering of solution temperature, the loss in steam steadily increases. Calculating an average loss of 12 gallons of cleaning solution per week and the expenditure of 15.000 British thermal units to raise the replenished solution to 212 degrees Fahr., we find it requires approximately one ton of soft coal per annum to restore the effective temperature to a cleaning solution of ordinary volume. Live steam is regarded as a waste of good money when used for heating solutions in plating plants and would refer you to question on page 262 of the October, 1918, issue of the CANADIAN FOUNDRYMAN for further information relative to the utilization of exhaust steam and the thermostatic control of temperatures.

Question.—Kindly oblige me by publishing a simple and reliable formula for a tin plating solution.

Answer.—Dissolve in 2 quarts of water 1 lb. of caustic soda, ½ lb. of hyposulphite of soda and ¼ lb. of tin chloride; then add water to make 1 gallon of solution. The tin salt is precipitated by excess of caustic soda.

Question.—In the manufacture of an electrical device we require a strong magnetic core and have thus far used Swedish and "thermit iron," as we are eager to produce the best apparatus possible to make. We shall appreciate your opinion regarding electrolytic iron for purposes such as we describe.

Answer.—The magnetic susceptibility of electrolytic iron is greatly in excess of that of any other kind of iron owing to its extraordinary purity. It is even purer than "thermit iron" and is usually manufactured in the form of tough plates of considerable brilliancy. The plates may be of any desired shape, according to the conformation of the electrode used as cathode to receive the deposit from the solution. It is claimed that an electric motor of any design develops more than double the original horse power when ordinary armature and magnets are replaced by those constructed of electrolytic iron.

Question.—I operate a rotating platin cylinder in a nickel solution which is composed of double nickel salts, sodium chloride and boric acid and which registers 14 degrees Be. In ordinary fall weather this solution crystalizes during the week-ends and the crystals are always large. Recently during a week-end the crystals formed as usual except in size, they were smaller and very closely formed. Would this fact indicate an abnormal condition in the solution? The hydrometer reading does not indicate a loss in metal.

Answer.—We are at a loss to know why you operate your nickel solution as concentrated as you state. It would be more practical to employ a 50 per cent. single nickel salts and obtain a density equal to that which you now obtain with the double salt, and reduce the tendency to crystalize the salt in the solution during rest periods. The recent finding of smaller crystals than usual probably resulted from more rapid cooling of the solution during a cool week-end. Rapid cooling of liquids produce fine crystals, slow cooling causes large crystal formation. There is no reason why you should not obtain your usual quality of deposits from the solution if you dissolve the crystals. Severe winter temperatures will cause you considerable annoyance unless you resort to some means of keeping the solution warm during the rest periods.

Question.—The tap water used throughout the factory in which I am employed is extremely hard and causes me no little trouble in the various coloring operations on high grade brass, bronze and copper plated goods. We also use this tap water to prepare and refresh our nickel bath. I am informed that rain water, if clean, is the ideal water for nickel plating. Please tell me whether this is correct or not, as we can easily secure unlimited quantities of rain water for plating purposes. Should the rain water be boiled before using?

Answer.—You will make no mistake in using clean filtered rain water from shingle, slate or tile roofs for your nickel, copper, brass or bronze baths. If the tap water is the source of trouble for you in any coloring process, use rain water instead, but do not boil it excessively. There are many platers who soften hard tap water by means of sodium carbonate before using the water in the preparation of or the replenishment of any plating solution. Calcium salts are often very troublesome in tap water used for plating. The sodium carbonate treatment usually improves the condition and the deposits.

Question.—How may I obtain a blue black color on brass? Our line is electrical fixtures.

Answer.—In one gallon of hydochloric acid dissolve one pound of arsenious acid and then add 10 oz. of iron sulphate. Mix well and immerse the brass dry in order to avoid introducing water into the dip. If the cold solution acts too slowly, heat to suitable temperature for your requirements.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries

B. G. NEWTON, Manager.
A. R. KENNEDY, Editor. F. H. BELL, Associate Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1207 Union Trust Bldg., Telephone Main 3449. Eastern Representative: H. V. Tresidder. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: J. N. Robinson.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 900 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 1147. Boston: C. L. Morton, Room 733, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain. Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers, who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. JANUARY, 1919 No. 1

PRINCIPAL CONTENTS

Canada Before and After

CANADIANS before the war were quite contented to take a back seat for almost any race. We actually believed that we were not capable of doing much of anything in competition with other nations. We even told ourselves that we could not build ships. One reason was that we did not know how. Another reason was that if we imported men who did know how we could not finance the building of them without going abroad to borrow the money, and that once built we could not furnish the men with which to man them. How about it now?

At the beginning of hostilities we knew nothing about shell-making, at least we thought so, but a couple of years later scores of Canadian firms were engaged in the work with an average weekly production of some half a million of shells. And not only this, but we went at it right. As Mr. Churchill said after the cessation of hostilities, that "Canada's remarkable output of munitions had played a large part in the munitioning of the British armies, and will remain a testimony to the high value of the work of the Munitions Board in this great struggle." Furthermore, an English engineer of high standing, on a mission to Canada in the interest of one of the greatest British industrial concerns, said, "To me, as an engineering man of some 30 years' experience, the Canadian shell shop was a revelation. Canada could not learn anything from the world in the production of shells. I have been in practically every shell shop of any importance in the Allied countries and from that point am able to appreciate the work that has been going on in this country."

Again, a few years ago when we learned that we had the only "real" nickel mine in the world, what did we do about it? Modesty forbids us dwelling on the subject, but on the quiet we didn't do anything; we let it be done by others. But how about it now since the war woke us up? We have one of the finest nickel refining plants in the world.

Now, Mr. Foundryman, we were not called upon in the early stages of the war to do much foundry work, but when the proper time came we did our bit and we did it right, so let us keep it up now that hostilities are over, and during the reconstruction period don't let us lag behind. Let us be leaders, not laggers. Don't forget that Canada has won a name during the war and that name must be kept. The reputation which we gained as hustlers must be maintained in the days which are before us.

As foundrymen, let us see to it that our foundries are second to none; that we are equipped with the most modern appliances for the economical production of high class castings.

Curious Coincidence

TO those of us who are interested in foundry literature there is no combination of names more outstanding than Simpson Bolland, author of "The Iron Foundry," "The Iron Foundry Supplement" and "The Encyclopedia of Foundry Terms."

Thomas D. West, author of "American Foundry Practice," "The Molders' Text Book" and the "Metallurgy of Cast Iron."

William J. Keep, author of "Cast Iron" and various papers on the subject of shrinkage, etc. Yet through the irony of fate, all three seem to have met untimely deaths of an almost identical nature.

Simpson Bolland, while walking down the street of his home town, Ossining, N.Y., was struck down by a shunting engine on a level crossing and killed.

Thomas D. West, while walking down the street in Cleveland, Ohio, was run down by a street car, and passed away soon after from his injuries.

And in like manner, Wm. J. Keep, while walking down a Detroit street, was knocked to the pavement by a street car and succumbed within a few hours. Thus terminated the careers of three of the most useful figures known to the Foundry World. While all three were well advanced in years, yet all were cut down before their time.

Canada has the largest forest area of any country in the British Empire.

Canada's forests embrace 350,000 square miles of pulp-wood timber, estimated to yield 1,033,370,000 cords of pulp-wood.

Canada has developed water-powers estimated at 1,941,700 h.p., besides undeveloped water-powers incalculable.

In 1890 Canada's exports of pulp and paper products amounted to but $120. In 1910 they were worth $10,000,000. For the fiscal year ending with March 31, 1918, they reached a total of $71,755,325.

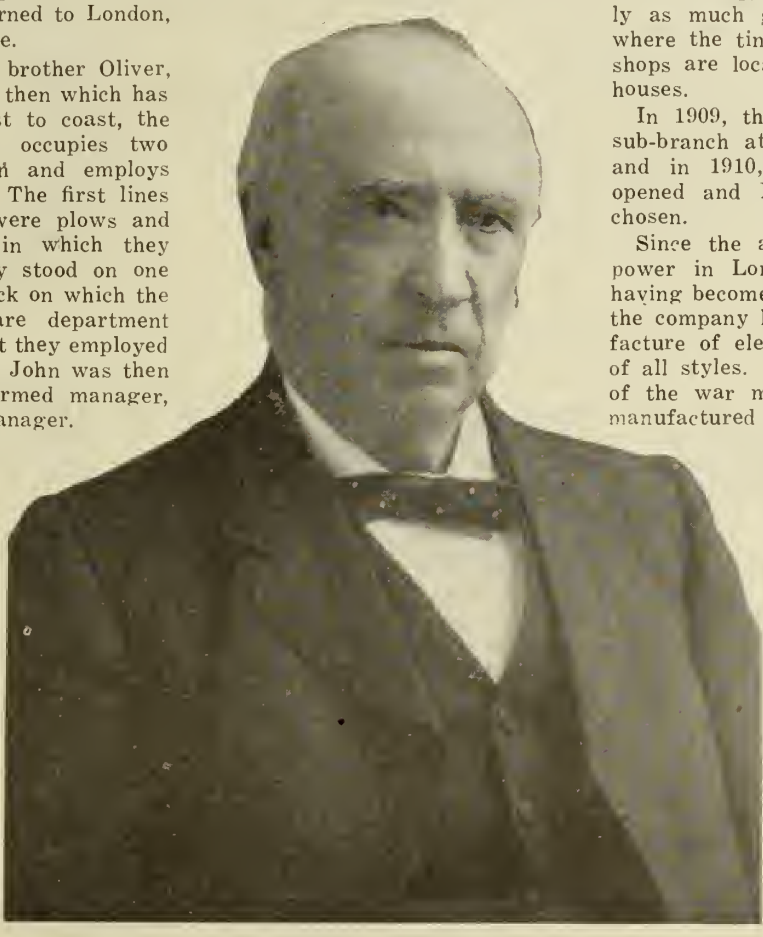
Ninety Years of Age and Still at Business

John McClary, Although He Nears the Century Mark, is Still Hale and Hearty—The Remarkable Growth of One of Canada's Big Industries

LONDON, Jan. 8—Although he celebrated his 90th birthday on Thursday, January 2nd, John McClary, the founder of the McClary Manufacturing Company, is still hale and hearty and spends a great deal of his time at work. Born on a farm near London, in 1829, he came to London in 1847, and started in at the trade of tinsmithing. Seized with the gold fever of 1849, at the age of twenty, he left for California. His was not to be the life of the gold miner, for two years later he returned to London, where he has lived since.

In company with his brother Oliver, he opened up a business then which has since spread from coast to coast, the headquarters of which occupies two large blocks in London and employs more than 1,500 men. The first lines of their manufacture were plows and tinware. The house in which they opened up their factory stood on one small portion of the block on which the tinware and enamelware department is now situated. At first they employed half a dozen workmen. John was then what would now be termed manager, and Oliver was sales manager.

Their customers were the hardy pioneers that were settled between Windsor, Woodstock and Brantford, and Stratford and Lake Erie. Their manufactured goods were delivered by salesmen in wagons driven over the trails that served for roads at that time. All of their raw material had to be teamed from Port Stanley or from Hamilton over roads that for many months in the year were practically impossible.



JOHN McCLARY

With the opening of the Great Western Railroad in 1853-4, began the expansion of the business which has grown so rapidly and which is still dropping its branches to take root in other places in the Dominion. Shortly after the entrance of the railroad, the firm decided that the rush of settlers to this part of the Province would provide a good market for stoves and accordingly made the change. It dropped the manufacture of plows for the manufacture of stoves. The name of the firm was changed from that of J. and O. McClary to the Ontario Stove Works, but the management continued as before. Later the partners decided to add to their products and started in the manufacture of furnaces and enameled wares and also commenced a jobbing trade in sheet metals.

The business continued to grow and in 1871 it was incorporated in Ontario under the name of The McClary Manufacturing Company. In 1882, a Dominion charter was taken out, thus enabling the firm to do business in any part of Canada.

Toronto was the first place chosen for a branch office. In 1879, one was opened there with David McKillop in charge. A second branch was soon opened in Montreal under the management of Andrew A. Brown. In 1880, the first Western branch was opened in charge of J. W. Driscoll. Vancouver was entered in 1894, and in 1901 and 1902, branches were opened up in St. John, N.B., and Hamilton respectively.

It was about this time that the second large building was erected in London. The foundry was moved to the new building, which now occupies nearly as much ground as the old plant where the tinware and enameled ware shops are located together with storehouses.

In 1909, the Calgary branch and a sub-branch at Saskatoon were opened and in 1910, the ninth branch was opened and Edmonton was the spot chosen.

Since the advent of Hydro-Electric power in London and the use of it having become more general for cooking, the company has started in the manufacture of electric heaters and ranges of all styles. During the early years of the war many field kitchens were manufactured for the Canadian army.

Business, the favorable trade conditions of the country in general and of his own organization in particular, is Mr. McClary's constant consideration. In this connection there is no problem too large for him to tackle, nor any detail too small to interest him. To him the news of the day, whether it be the proposal of some new foreign ship canal, political unrest in some distant kingdom, or the price of garden stuff at home, are not simply unrelated facts to be allowed to pass unheeded, but the cause for some corresponding effect upon transportation, immigration or living conditions within our home country, which will have its effects on the trade and welfare of the country. It is this habit of figuring out results that has established his reputation for an almost uncanny foresight, which is all the more remarkable in that it does not allow itself to be warped or obscured by the common defect of a personal bias. It is due to his industry and foresight that the McClary Manufacturing Company has reached its present position and it is still going strong.

Canada has 138 daily, and 921 weekly newspapers.

It takes the product of 20,000 acres of pulp-wood forests every year to supply Canadian newspapers with white paper.

The principal pulp and paper mills of Canada are located in the provinces of Quebec, Ontario, New Brunswick, Nova Scotia and British Columbia.

Items of Interest to the Pattern Maker

Improved Methods of Making Pattern For Two Standard Jobs —Writer Advises Foundry Foremen to Learn to Read Drawings

By JOHN A. McEWAN

MOLDING OVERFLOW BOX FOR FEED-WATER HEATER

Here is a pattern, shown in three views in Figure 1, which different shops might make in different ways, but the last method was a new one to me, being suggested by the boss molder. By the way, it would be a great help to pattern makers if foreman molders understood mechanical drawing well enough to be able to offer suggestions from the drawing, instead of having to wait until the pattern is nearly finished.

This job looks pretty easy at first sight, but what is easiest for the pattern-maker is not always in the best interests of the casting.

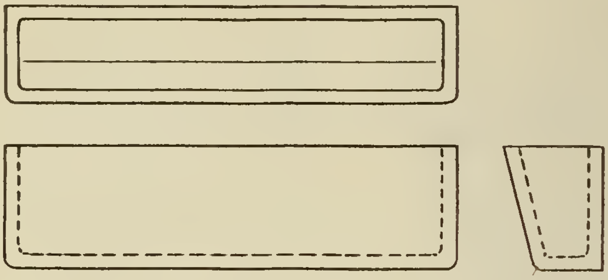


Fig. 1

Suppose we made a pattern to draw its own core? Besides being a weak pattern, the molder would have a hard time coping out the inside, and there is always the danger of a drop after the cope is closed on.

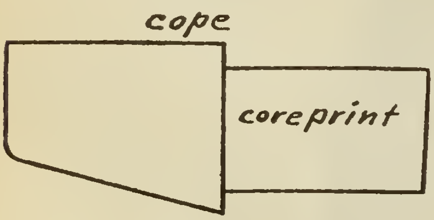


Fig. 2

Since this was going to be a standard pattern and since simple cores are cheaper than molder's time, we decided to core the inside. The first thought would be to tie the core in the cope, but if it is a little off the square, there would likely be a thick and a thin side to the casting.

Figure 2 shows it made on the flat and a core-print wide enough to more than balance the overhang of the core; but this method would require a larger dry sand core and a larger molding box, together with the danger that the core might still lift or that the casting might not be watertight.

By far the best method is shown in Figs. 3 and 4, the views being self-explanatory. We now have a pattern which is easily molded; it is no trouble to drop the core in place and the casting is pretty sure to be sound and watertight.

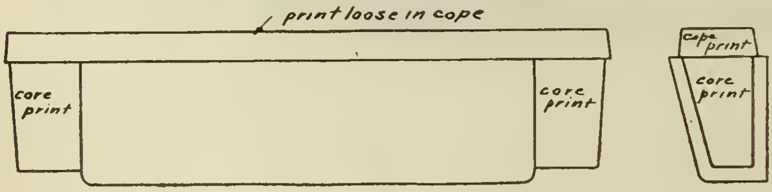


Fig. 3

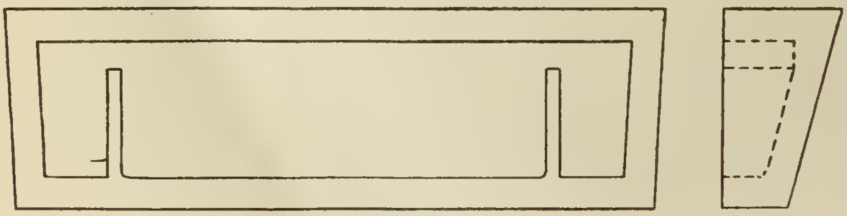


Fig. 4

MAKING A PATTERN FOR AN OIL CUP AND COVER

By J. A. McE.

It quite often happens that an apparently simple looking job can be handled in several different ways one of which is better than the rest in that it gives better results in the molding shop. This was the case with the cast iron oil cup and cover, which is shown assembled in Fig. 1. On first thought, we would for

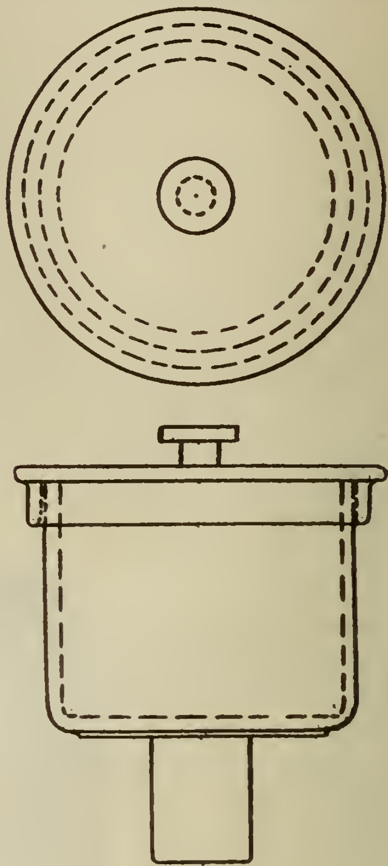


Fig. 1

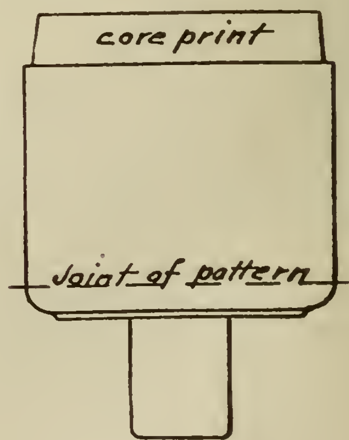


Fig. 2

the oil cup suggest a core print on the open end and the other end loose in the cope, Fig. 2.

Another way would be to tie the core in the cope, this would make the metal solid, or closer grained in the bottom of the cup and there would be less danger of a leak.

Still another, and I think the best way, is shown in Fig. 3. The core print projects out all round, to form a ledge upon which the core rests. This gives a flat cope which is usually the cheapest method of molding.

We made four of these patterns and gated them as shown in Fig. 4, both patterns and gate being fastened to a board, the bottom side of which is used for ramming the cope.

The cover might be made in several different ways. For example, the knob

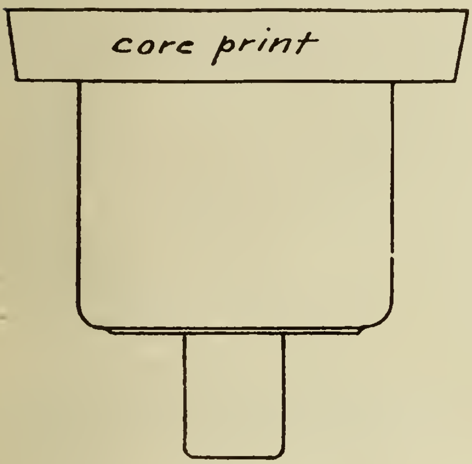


Fig. 3

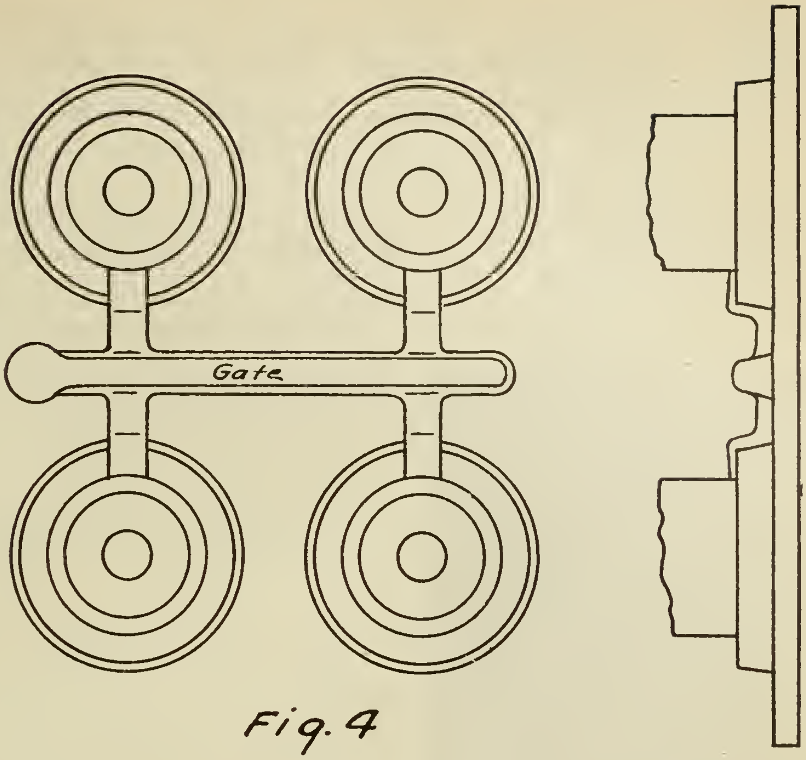


Fig. 4

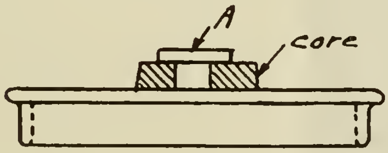


Fig. 5

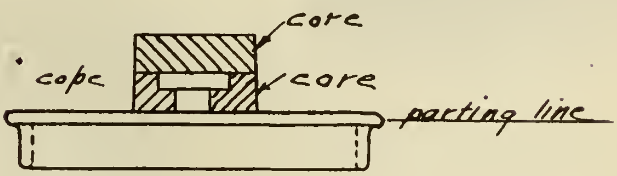


Fig. 6

A, Fig. 5, might be printed and cored, and the other side coped out, but this would be hard to mold, or, it might be reversed and the core for the knob tied in the cope, but this would take too long.

The method we used is shown in Fig. 6. The knob is made entirely in cores, these being placed on the pattern to a circle the size of the core and rammed up in the cope. We made six of these covers and let them into a board to the parting line, leaving both patterns and gate loose on the board.

The castings for both oil cup and cover were turned out in quick time and proved quite satisfactory.

FOUNDRY FOREMAN

Also appreciates the value of CANADIAN FOUNDRYMAN as a medium through which foremen and workmen may exchange each other's views and experiences, mutually benefiting both contributor and reader.

CANADIAN FOUNDRYMAN:—

Dear Sir,—I am one of the many who are always looking for improvements in the foundry, and therefore read any article covering foundry work.

I noticed your article in regard to pouring a pipe in your October number, which explained that by raising one end and pouring at the lower end a better casting was produced.

This style of pouring we have since adopted with good results in numerous cases. I believe twenty-five per cent. of castings scrapped are due to improper gating or pouring. Many molders in making a basin in runner box always make it circular, which causes the iron to form a whirling motion, carrying slag into the mold, instead of a triangular or square basin. This seems a small item, but if a casting must be sound and clean you must keep the slag out.

I am pleased to see your paper has space for foundry news, as the experience which molders have in making different jobs is welcome news to others. I have seen many improvements illustrated in the CANADIAN FOUNDRYMAN, and in some cases work has been lessened; sometimes by a molder neglecting to do what formerly was considered an important operation, and thereby finding out it was not required.

GEO. GEARY.

Foundry Foreman, Canadian Rumley.

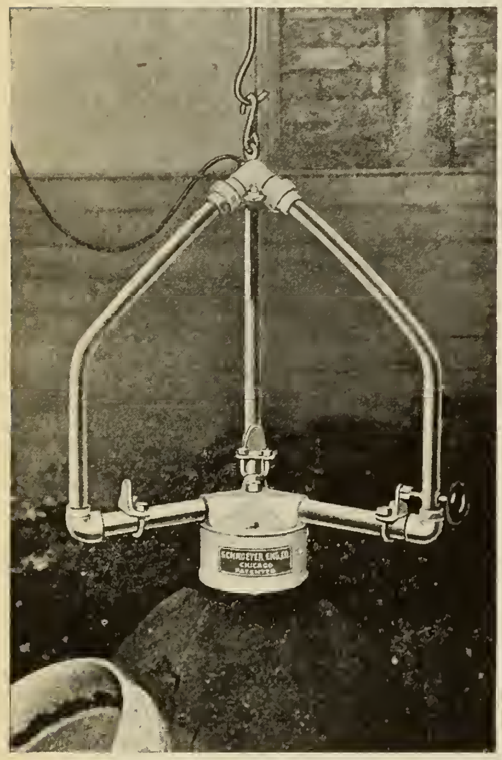
New Premises.—The Vanadium-Alloys Steel Company of Pittsburgh, and Latrobe, Penn., manufacturers of high speed and alloy tool steels, have leased the offices and warerooms at 566-568 West Randolph street. This company will carry in Chicago a large stock of "Red Cut Superior" high speed steel in all the standard sizes and shapes of bar stock, also treated bits for tool holders. Owing to the size of their new warerooms, the Vanadium-Alloys Steel Company will now carry a much larger stock than formerly with which to serve their many customers in Chicago and contiguous territory.

NEW AND IMPROVED EQUIPMENT

A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

NEW ELECTRIC SAND SIFTER

The "Sandhog" electric sand sifter shown in the accompanying illustrations, has recently been put on the market and its manufacturers claim for it many new



"SAND HOG" ELECTRIC SAND SIFTER

and novel features, among which are economy in consumption of power in comparison to large amount of work accomplished.

The gyratory motion of the motor, which is suspended below the riddle, creates a regular whirlpool of sand inside of it, throwing the sand with centrifugal force toward the rim.

Three horizontal supporting members of pipe and the hollow frame circulate the air and conduct the heat away from the motor, which is furthermore cooled by the running sand. Owing to these novel features the "Sandhog" can be made to work overtime and actually "eats it alive."

The frame is adjustable for all standard size riddles, which can be adjusted or removed by the operation of one thumbscrew.

The complete sifter weighs about 35 pounds and for size is justly called a "vest-pocket edition," but for work it is a "little giant."

The "Sandhog" is arranged for lamp socket connection and requires approximately one ampere of either D.C. or standard 60 cycle A.C. current at 110 or 220 volts.

When ordering, it would be as well to specify the kind of current and voltage available.

Ten feet of standard insulated cord with standard plug are furnished with every sifter.

The motor is fully enclosed and not a particle of dirt can get into it.

The machine may easily be raised or lowered to suit the convenience of the operator.

The Schroeter Engineering Co., 1111 Westminster Building, 110 South Dearborn St., Chicago, Ill., are the manufacturers.

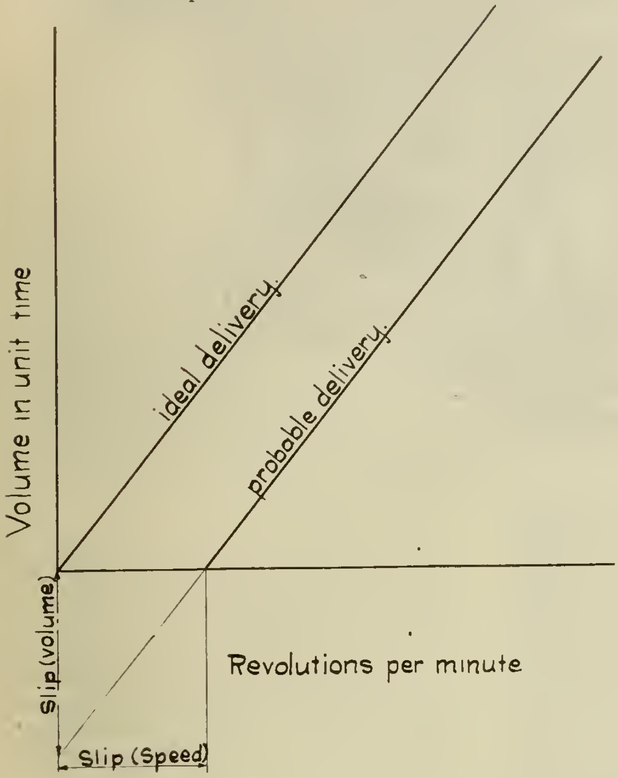
NEW FACTS ABOUT ROTARY BLOWERS AND EXHAUSTERS

TESTS to determine the volume of air delivered by centrifugal blowers are more easily and therefore more frequently made than the corresponding tests of rotary blowers, because the discharge of the latter is pulsating. Nozzles or orifices cannot be used to measure pulsating flow unless the pulsations are eliminated. But the main reason why these tests are so seldom performed on rotary blowers is that every rotary blower is a meter of the displacement type, so that the speed of the blower is a measure of the quantity of air delivered. A definite quantity of air is imprisoned during each cycle and delivered positively, except for the leakage or slip, which is constant regardless of speed, depending only upon the inlet and outlet pressures, and upon the density of the fluid being pumped.

Figure 1 is usually assumed to be correct. From it we see that at very low speeds more fluid slips back than the blower delivers, provided that the discharge pressure is maintained constant from a source outside the blower. In each rotary blower there is a speed, commonly referred to as the "slip," at which the leakage accounts for all of the air handled by the blower. Above this speed the blower delivers its full displacement to the discharge system. The probable delivery, therefore, is found by multiplying the difference between the "slip" speed and the actual speed by the displacement of the blower per revolution. Evidently the volumetric efficiency increases with the speed. When the speed of the blower is ten times the slip speed, the volumetric efficiency is ninety per cent.

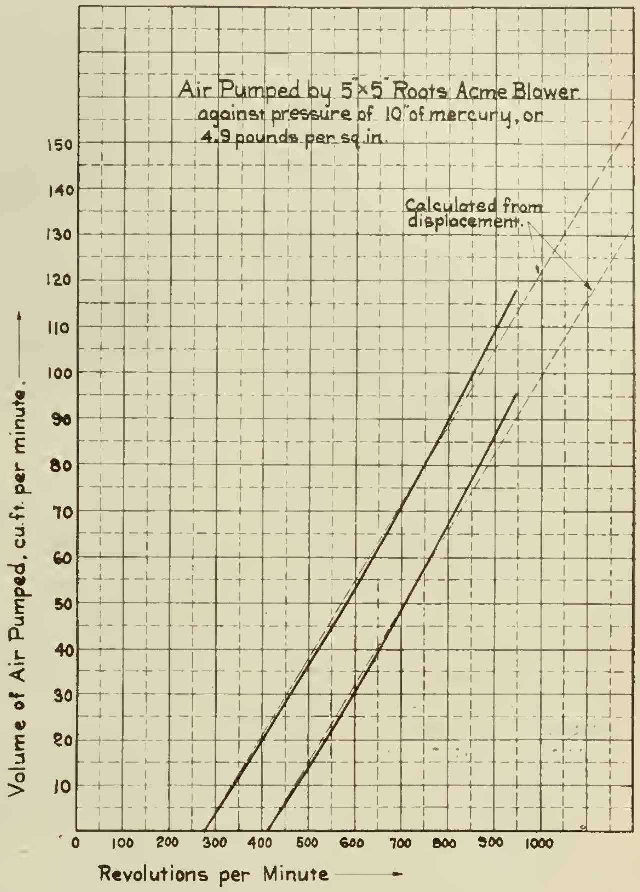
Some operators of rotary blowers and exhausters think that probably other factors enter into the rate of delivery, particularly when the blowers and exhausters are equipped with intake pipes. The

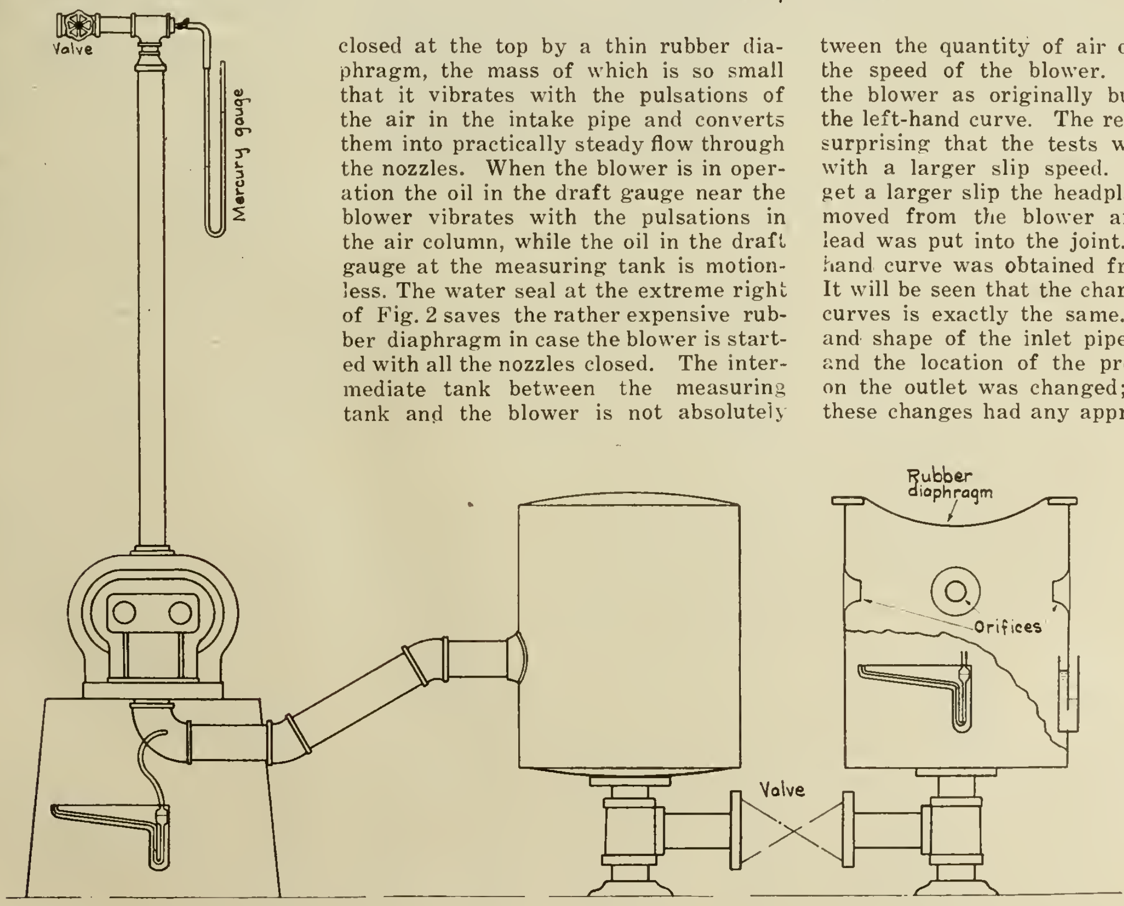
"SAND HOG" ELECTRIC SAND SIFTER IN OPERATION suspicion is rather general that pressure drop due to friction in the intake pipe reduces the delivery and counteracts the increase in efficiency due to the higher ratio of actual speed.



In order to clear up these points, Professor W. Trinks undertook a test at the Carnegie Institute of Technology on the delivery of a Roots rotary blower, furnished by the P. H. & F. Roots Company, of Connersville, Ind. The test arrangement is clearly shown in Figure 2. The air enters the right-hand tank through standard nozzles. This tank is closed at the top by a thin rubber diaphragm, the mass of which is so small that it vibrates with the pulsations of the air in the intake pipe and converts them into practically steady flow through the nozzles. When the blower is in operation the oil in the draft gauge near the blower vibrates with the pulsations in the air column, while the oil in the draft gauge at the measuring tank is motionless. The water seal at the extreme right of Fig. 2 saves the rather expensive rubber diaphragm in case the blower is started with all the nozzles closed. The intermediate tank between the measuring tank and the blower is not absolutely necessary in this test, because the vacuum produced is not greater than the rubber diaphragm will allow.

The results of this test are shown in Figure 3, which shows the relation between the quantity of air delivered and the speed of the blower. The test of the blower as originally built produced the left-hand curve. The results were so surprising that the tests were repeated with a larger slip speed. In order to get a larger slip the headplates were removed from the blower and more red lead was put into the joint. The right-hand curve was obtained from this test. It will be seen that the character of both curves is exactly the same. The length and shape of the inlet pipe were varied and the location of the pressure gauge on the outlet was changed; but none of these changes had any appreciable influ-





ence on the shape of the characteristic curves.

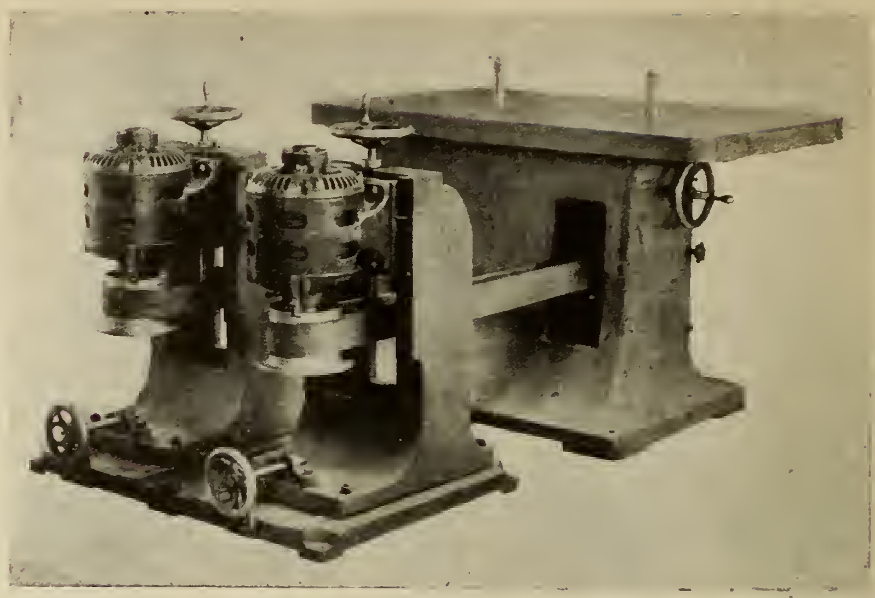
It is interesting to note that the actual delivery falls below the probable delivery at lower speeds and rises above it at higher speeds. Vibrations of the air column undoubtedly explain this peculiarity. At low speeds the whole column is accelerated and retarded, but as the speed increases the inertia of the column causes vibrations of sound-wave character to appear. At certain speeds, the phase of these vibrations corresponds with the opening of the blower to the suction and an extra quantity of air is shoved into the blower, thus increasing the delivery. This case is parallel to that of blowing engines with air intake pipes and automatic inlet valves where the delivery is likewise increased by the inertia of the air in the intake pipe.

It is an interesting fact that the vibrations have a phase-lag against the impressed vibration of the blower. This may explain why attempts to furnish an engine torque coinciding with the static torque of the blower have not been successful.

It should be noted that in these tests the discharge pressure was 5 lb. per square inch. At lower pressures the slip speed is much less.

Vibrations occur not only in the intake but also in the discharge pipe. It has been thought that perhaps at high speeds these vibrations might become destructive. It is true that vibrations increase with the speed but only up to the point where they become sound-waves. Above this speed the pitch of the sound, i.e., frequency of vibration, increases; but the amplitude, i.e., loudness, remains constant. The maximum vibration depends upon the ratio of outlet pipe size to fluctuation of displacement. The smaller the outlet pipe for a given blower, the worse the vibration becomes. With the average size of outlet pipe the vibration to either side from mean does not exceed ten per cent. of the absolute average outlet pressure. In unusually long pipes, however, resonance might increase this somewhat.

DOUBLE SPINDLE SHAPER



OLIVER DOUBLE SPINDLE SHAPER

The Oliver Machinery Co., of Grand Rapids, Mich., has invented a new and very useful as well as compact motor drive for double spindle shapers, using standard vertical motors.

As shown by the attached illustration a separate motor is used for each spindle. Each motor is mounted on vertical gibbed ways, adjustable by means of hand wheel and screw so that the motor can be located at any height desired shown by the scale as called for by the height of the spindle to suit the work.

Each motor stand is independently adjustable to and from the shaper to suit the length of belt, to allow the use of a straight vertical belt and to have means of taking up the stretch of belt so as to make belt tighteners and similar devices absolutely unnecessary.

Either shaper spindle can be run independently by merely throwing out the switch for the motor operating the other spindle.

This new motor drive arrangement takes up far less room on the factory floor, because a distance of only 5′ between centers is required, making the actual floor space about 7′ long by 5′ wide, the only amount that is taken up by the machine.

This arrangement uses standard vertical motors of any kind as called for by the electric current in the factory doing away with the need of highly specialized built-in motors. This motor drive arrangement can be furnished not only with new shapers, but for shapers now in use. Any kind of starting units for the motors can be furnished.

Question.—I wish to experiment with a zinc plating solution, plating small castings. Please tell me what kind of tank to use and what voltage would you advise for practical plating?

Answer.—Cypress tanks are most satisfactory for zinc solutions, or a good pine tank will suffice if you have one. The tank should be well lined with pitch or asphalt. Low voltages are preferable for practical plating, as the deposits obtained are tougher, softer and more durable. Some very successful zinc platers use a maximum of 2 volts for light material such as stampings, others insist on using at least 5 volts for similar grade of material. Naturally the higher voltage increases the output in a given time, but the deposits are not as smooth and tough as those obtained at lower voltage; for thick coatings a low voltage is absolutely necessary for reliable results. Large castings or cathodes will require higher voltage than small pieces owing to the increased resistance between the electrodes in the tank which must be larger to permit the article to be placed in the solution properly. Zinc solutions as usually employed do not "throw" well, in other words, the deposits do not form readily in deep recesses or indentations. You may find it necessary to use an anode suspended in such hollow portions of castings if you desire a complete coating of the article. Then thin zinc coatings are usually very effective as a protection to iron or steel. Heavy deposits wear longer, but the extra cost of production does not warrant the extra time required.

HELP THEM LEARN ENGLISH

The English language is not easy to learn, and it is especially difficult for those who come to this country after their school days are over. Therefore, when your foreign associate shows the right spirit by trying to acquire our language, be careful to encourage him in the effort.

If he wants to display what he has learned in night school, and use a few English phrases, don't rebuff him. Have patience with your foreign-born neighbor, or fellow-worker, when he talks to you in broken English. Never laugh at him or discourage his attempts, but help him to pronounce the words and form his sentences correctly.

In case you speak his foreign language, use English for choice in talking with him, and thus get him into the habit of talking English.

This may seem like a trifle, but it is of vast importance. The strength of a country is its united thought, and we cannot think in common, unless we have a common tongue.

The foreign-born among us will never become 100 per cent. Canadian until they can talk to us, understand us, read our newspapers and books, listen to our patriotic speakers, and even think in the language of Canada.

If it seems a waste of time to listen to the attempt of a foreigner to talk English, and if it seems more trouble than it is worth to help him, just consider it as patriotic service and do it cheerfully.

Canadians Quick to Learn the Steel Business

Superintendent Had to Rely on Green Crew to Run His Plate Mill, But It Was Not Long Before Record Shipments Were Being Turned Out—A Good Source of Employment For Mechanics

By T. L. CROSSEN, Superintendent Plate Mill, Dominion Foundries and Steel, Hamilton

THE steel rolling industry in Canada, especially the rolling of plates and sheets, being a comparatively new industry here, and not well understood or appreciated by the average Canadian as a means for bettering the industrial conditions and labor markets of Canada, it might be in keeping with the reconstruction period of the present time, to point out some of the benefits to be derived from the steel rolling business and some of the things most desired and necessary in the way of organization and conditions to successfully operate a rolling mill.

The first thing necessary for the operation of a rolling mill, as well as any other business, is men. Men not of the ordinary slip-shod type, but men with determination and initiative, with the disposition to do a good day's work and expect a good day's pay for doing it—men who learn something each day from their work, and put it into operation in their next day's work, or in short, men upon whom you can depend.

T. L. CROSSEN,
Supt. Plate Mill, Dominion Foundries & Steel, Hamilton.

There are so many good inducements for young men in the steel rolling industry that it is impossible for the writer to see any other line of employment that offers anything nearly so good. The work, while rather hard and exacting, possesses features which are found in few lines of work, and it has rather a gripping attitude from which a man never wants to get away, and the actual experience he gains is a stepping-stone for a splendid future.

While the man of ordinary or practical education is always a valuable asset in a steel mill organization, and is able to command a much better wage than men of other trades, still the man with the technical and practical education is the fellow who goes to the top and stays there, and the young man who comes into a steel mill equipped with a good education and determination can't be stopped until he reaches the top. But you will find him as diligently studying his text books and trade papers as though he were still at school.

The Canadian seems to take to the steel rolling business as a "duck takes to water," and as an example of the fact, the following speaks for itself. The writer came to Canada some time back to install and operate a small steel plate mill, and before leaving the U.S.A. he rounded up a good operating organization and had everything shaped to bring them on just as soon as the plant was ready. In due course of time the mill was installed; he went back for his organization, when it was found that, owing to war conditions, it was impossible to bring but two men back, as some were already in the regulation uniform and the others being exempted from military service just so long as they stayed on their jobs, which was war work. There was just one thing left to do, that was to come back to Canada, break in a green set of men and get down to business. This was in the fall of 1917 and so well did these "Green Canadians" break in that by early spring they were turning out as much steel plate as most of the old organized mills across the line, and during the summer record shipments were made, which the writer believes have not been beaten by any one with a mill of the same type and size anywhere. These boys all had the necessary spunk to stick with the game until to-day they are capable of holding their own in any company, but one difference noticeable between the Canadian and the American workman in rolling mill practice is that the Canadian does not take his job quite so seriously as does his cousin on the other side, the result being that he doesn't report for work with the same regularity as does the American. But if the Canadian is given the chance to show in the steel industry he will send an industrial thrill throughout the world, because the kind of men that went up Vimy Ridge are not to be denied, and are perfectly capable of holding their own against any set of men on earth at any line of work to which they might turn.

"What a man knows is a club for himself, and what he don't know is a meat axe for the other fellow," and the young man coming into a rolling mill equipped with a large-sized meat axe will be standing firm on his own job with his hands within speaking distance of the superintendent and looking square into the eyes of the manager, and his salary arm will soon grow long enough to reach quite a distance through the cashier's window.

In concluding, it might be well to say that so far as one is able to judge, there is no reason in the world why Canada is not sending finished rolled product to all corners of the earth, and if the Government at Ottawa will get back of the manufacturers in the way they should, we will see young Pittsburghs and Sheffields scattered throughout the Dominion, because the men, money and material are here.

Back in the 'Eighties the tin plate industry in the U.S.A. was nil, and every pound used was imported, mostly from Wales. The Government got busy in the matter, an investigation was made and the McKinley Protective Bill was passed and became a law, with the result that tin mills seemed to almost spring up over night throughout the country, and to-day the U.S. is one of the largest producers of tin plate in the world. What happened there can happen here, and right now is the time to make it happen.

The great Edison says: "All comes to him who hustles while he waits."

The development of the explosive and propellant industry in Canada has been an important achievement. It has been the policy of the Munitions Board to to establish national plants for the purpose of stimulating any important line of production which private enterprise was unwilling or unable to carry on, and seven of these plants, representing a capital investment of $15,000,000, were operated under the immediate direction of the board. The two largest manufactured explosives, and these, with privately owned plants, produced upwards of 100,000,000 pounds of high-grade explosives and propellants.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$32 75
Lake Superior, charcoal, Chicago	37 50
Standard low phos., Philadelphia	....
Bessemer, Pittsburgh	37 25
Basic, Valley furnace	32 00

Government prices.

	Montreal	Toronto
Hamilton	....	....
Victoria	....	50 00

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2-in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$ 52 00
Antimony	17 00
Copper, lake	30 00
Copper, electrolytic	30 00
Copper, casting	30 00
Lead	10 50
Mercury	100 00
Nickel	50 00
Silver, per oz.	0 98
Tin	100 00
Zinc	10 50

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$21 00	$20 00
Copper, crucible	24 50	24 50
Copper, heavy	24 50	24 50
Copper wire	24 50	25 00
No. 1 machine composition	22 00	22 50
New brass cuttings	16 00	15 00
No. 1 brass turnings	15 00	18 00
Light brass	10 00	9 50
Medium brass	12 00	12 00
Heavy brass	15 00	14 00
Heavy melting steel	24 00	22 00
Steel turnings	12 00	12 00
Shell turnings	12 00	12 00
Boiler plate	27 00	20 00
Axles, wrought iron	30 00	24 00
Rails	26 00	23 00
No. 1 machine cast iron	35 00	33 00
Malleable scrap	21 00	20 00
Pipe, wrought	22 00	17 00
Car wheels, iron	38 00	30 00
Steel axles	38 00	35 00
Mach. shop turn'gs.	8 50	8 50
Cast borings	12 00	12 00
Stove plate	30 00	20 00
Scrap zinc	6 50	6 50
Heavy lead	7 50	8 00
Tea lead	5 00	5 75
Aluminum	21 00	20 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

¼ in.	$14 35
5-16 in.	13 85
⅜ in.	13 50
7-16 in.	12 90
½ in.	13 20
9-16 in.	13 20
⅝ in.	12 90
⅞ in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 55
Solder, guaranteed	0 60
Babbitt metals	18 to 70
Soldering coppers, lb.	0 64
Putty, 100-lb. drum	4 75
White lead, pure, cwt.	16 05
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 31½
Benzine, per gal., bulk	0 30½
Pure turpentine, single bbls.	0 71
Linseed oil, boiled, single bbls.	1 98
Linseed oil, raw, single bbls.	1 95
Plaster of Paris, per bbl.	2 50
Sandpaper, B. & A.	list plus 20
Emery cloth	list plus 0 20
Borax, crystal	15
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D." per lb.	0 03
Rosin "G." per lb.	0 03½
Borax crystal and granular	0 12
Wood alcohol, per gallon	1 80
Whiting, plain, per 100 lbs.	2 20

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 8 00	$ 8 25
Sheets, black, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 00
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	....	10 70
Premier, 10¾ oz.	....	11 00
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$13 00
3-16 in.	12 50
¼ in.	11 75
5-16 in.	11 40
⅜ in.	11 00
7-16 in.	10 60
½ in.	10 40
⅝ in.	10 00
¾ in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 20%; B and C, net list; cast iron, 15% off list; standard bushings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 25 and 7½%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.58 to $0.65
Copper	.36 to .46
Tin	.70 to .70
Silver, per oz.	1.05 to 1.00
Zinc	.23 to .25

Prices per lb.

NAILS AND SPIKES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails	60%	

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium, carbonate	.33
Ammonium, chloride	.40
Ammonium, hydrosulphuret	.40
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.75
Arsenic, white	.27
Copper, sulphate	.22
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	1.80
Silver nitrate (per oz.)	1.15
Sodium bisulphite	.30
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.50
Sodium cyanide, 98-100%	.38
Sodium phosphate	.14
Sodium hyposulphite (per 100 lbs.)	5.00
Tin chloride	.85
Zinc chloride	.90
Zinc sulphate	.20

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1.35
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, bullneck	2 00
Pumice, ground	07
Emery composition	10 to 6-9
Tripoli composition	06 to 9-10
Rouge, powder	.30 to .35
Rouge, silver	.50 to .55
Crocus composition	08 to 8-9

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	55 00	48 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	55 00	48 00
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 16 oz. base	64 00	49 00
Braziers', in sheets, 6x4 base	55 00	48 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 38
Brass sheets, 24 gauge and heavier, base	0 48
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.39
British Manila rope	.33
New Zealand Hemp	.33
Transmission rope, Manila	.45
Drilling cables, Manila	.4
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor oil, per lb.	50
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	40
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	50

General Market Conditions and Tendencies

TORONTO.—There seems to be a feeling of lack of confidence in the market situation. It makes little difference in which direction enquiry is made, the same thing will be found true. Hayden, Stone & Co., of Boston, mention something this week that applies to the situation regarding machine tools, supplies, steel, iron, scrap, or almost any commodity that comes within the circle of operations covered by this group. The statement referred to is as follows:

"Until the producers and consumers of the great staple articles, particularly iron and steel, get together on a basis where they can do business freely, the business world will have such an air of uncertainty that its effect cannot but be communicated to the stock market. Reaching a basis on which business can be freely carried on cannot be effected in a moment after such a prolonged period of artificial price stimulation as we have been passing through, but we believe—before this month is ended—we shall see good progress. The first step taken was in the price reduction

announced. This was a wise movement as tending to bring producers and consumers together. . . . As a matter of fact the cycle of advancing wages has reached such an acute stage that there is really no benefit to be gained by any further advance in wages. While we all like to get as much as possible in dollars and cents, there is no gain whatever when any advance in the money wage paid is immediately followed up by a corresponding advance in everything that goes to make up the cost of living. The process has reached this point. After all it is not so much a question of how many dollars a man receives as it is how much these dollars will buy, and we may be very sure that it is not until the number of dollars received by the average laborer is decreased, that the purchasing power of the individual dollar is increased."

The result of the facts—for they are facts—contained in the above is found in the machine tool, steel, scrap, or any other line of business. The general attitude of the purchasing public is "waiting." When that attitude becomes chronic it creates a serious situation.

The Steel Trade

Warehouses report that the month of December was a good one. In some lines a very active business was done. For instance, in the matter of tubes one house informs CANADIAN MACHINERY that in December they did three times as much business as they have done in any month for a long time. The question of Canadian mills coming out openly and meeting the prices of Pittsburgh is talked of, but there are many points involved before such a move could be considered. It would tend to demoralize the whole trade in some ways. For instance, there is hardly a warehouse that has not in it stocks of steel bars that have been placed there at a cost of 4c or better. Were the Canadian mills to cut deep down in the price it would mean that these warehouses would have to sell out for what they could get, and the loss, where fairly large stocks are carried, would be serious. Although no actual cuts have been made in the last few weeks in the price of steel shapes and tubes, there is considerable flexibility in some of the price lists that is helping to meet the situa-

tion, and bringing buyers into the market whereas they would otherwise join the list of waiters.

Machine Tool Trade Slow

Machine tool dealers report business as very quiet in the metal working industries, but several inquiries are in for machinery for wood working and other lines. Plants that have been making shells are not only busy getting rid of their stocks, but are doing their best to get their adjustments made as quickly as possible. Machinery that is not good for any other operations is being sacrificed in many cases, as those having it for sale probably reckon that it does not owe them anything. Some dealers have taken in a quantity of shell shop equipment, while other houses refuse to touch it at all. There do not appear to be any hard and fast lines along which the various firms are working. Some of the tools taken in are general purpose, and have been used very little. They have been bought "at a price," and the dealers in question are content to put them away and forget about it for a while.

A Scattered Market

It has frequently been explained in these columns that the quotations for second hand materials appearing on another page in this paper do not at present represent an actual basis of operation, for the simple reason that dealers are not in the market to buy unless they have contracts that have to be filled or cancelled. One case of this came to light a few days ago when a car of copper turnings from a munitions shop was sold for 17c. The reason for the price was that a dealer had a contract to fill by a certain date, and had he not secured the material at once his contract for the entire amount might have been cancelled.

The trouble with the explanation in these columns of the prices on another page is that readers sometimes look only at the quoted figures, and are thereby led astray. With this in mind, CANADIAN FOUNDRYMAN to-day asked me of the leading dealers in Toronto for quotations at which he would buy, and these are made the basis for the quotations given in that column to-day. The reductions are more than liberal. Those having much to sell will be inclined to hold on for a while in the hope that there may be a revival in the market that will help matters. All coppers are down to 15c; heavy melting steel from $22 down to $15; boiler plate from $20 to $15, car wheels from $30 to $18, and so on. "Those prices are the ones at which we will buy," remarked the dealer, "and you will see that they represent a very substantial reduction from the figures that have formed the basis of dealing for some time back." Aluminum is given in his list at $18 per hundred, but we know of one dealer in Toronto who has a quantity on hand for which he cannot secure 14c. The scrap market is in poor shape and it does not show signs of improving very rapidly.

THE FUTURE OF IRON

In the course of his presidential address to the Staffordshire Iron and Steel Institute, Mr. G. Carrington prophesied that the demand for iron in the future will greatly exceed that of the past. Its greater suitability for sheets, whether black, painted, or galvanized, is generally conceded, its life being fully five times that of steel, and even in present conditions it is again ousting steel for railway and colliery work, ships' decks and hatches, and where there is exposure to severe weather or to acidic liquids. Then there are plates, girders and bars for bridge building and constructional and agricultural purposes, and particularly for ships; and he expressed the conviction that, given the material at a reasonable price (not the same price as steel, because it will always command a better price for these purposes than steel), we shall in our time see the all-iron ship. But it is necessary to devise methods by which the necessary output can be obtained, and in his opinion there is no way except by large gas-fired mechanical puddling and scrap furnaces of anything up to say five tons, with corresponding mill and other necessary plant. There will then be no difficulty in producing ships' plates and girders in the large sizes now required, without which an iron ship could not be economically built. The rudder and stern may give trouble, and steel will perhaps be specified on account of the thickness, weight, and shape required, and also the relative unimportance of rusting, but for plates, girders, bars, etc., for bridge building and constructional work there would be no difficulty. A Puddling Research Committee has been formed by the whole of the iron trade associations of the country, and it is to be hoped that something may be done to relieve the puddler of some of his heavy work. At present it is proposed to confine the investigations to 10 cwt. furnaces, but while that proposal represents a great advance, Mr. Carrington thinks it is much too timid. Producers must learn to talk in tons where they now think in hundredweights, and iron can be produced as economically as steel only on the same scale.

Open Welding Exhibit.—The Lincoln Electric Company of Canada, Ltd., have opened a demonstrating and welding shop at the foot of Jarvis St., Toronto

For that smooth velvety finish—

that finish which elevates your castings to the highest point of excellency, **"Grit-Blast"** or **"Shot-Blast"** your castings.

HARRISON'S DIAMOND GRIT
and
CHILLED SHOT

The most logical blasting abrasives for any foundry.

Especially adapted for cleaning **iron, steel, malleable** and **aluminum castings,** forgings or automobile bodies.

One ton of Diamond Grit or Chilled Shot will accomplish as much as **carloads** of sand. Most **economical,** quickest and cleanest blasting method known.

Write today for samples.

Harrison Supply Company

5-7 Dorchester Ave. Extension BOSTON, MASSACHUSETTS

Becoming a Bigger Man

WHAT is the difference between some men you know and others known to you? Why are some men earning $3,000 a year and some $30,000? You can't put it down to heredity or better early opportunities, or even better education. What, then, is the explanation of the stagnation of some men and the elevation and progress of others?

We are reminded of a story. A railroad man, born in Canada, was revisiting his home town on the St. Lawrence River. He wandered up to a group of old-timers who sat in the sun basking in blissful idleness. "Charlie," said one of the old men, "they tell me you are getting $20,000 a year," "Something like that," said Charlie. "Well, all I've got to say, Charlie, is that you're not worth it."

A salary of $20,000 a year to these do-nothing men was incredible. Not one of the group had ever made as much as $2,000 a year, and each man in the company felt that he was a mighty good man.

Charlie had left the old home town when he was a lad. He had got into the mill of bigger things. He developed to be a good man, a better man, the best man for certain work. His specialized education, joined to his own energy and labor sent him up, up, up. To put it in another way: Charlie had always more to sell, and the world wanted his merchandise—brain, skill and ability. Having more to sell all the time, he got more pay all the time.

Charlie could have stayed in the old home town; could have stagnated like others; could have been content with common wages. In short, Charlie could have stayed with the common crowd at the foot of the ladder. But Charlie improved himself and pushed himself, and this type of man the Goddess of Fortune likes to take by the hand and lead onward and upward. Almost any man can climb higher if he really wants to try. None but himself will hold him back. As a matter of fact, the world applauds and helps those who try to climb the ladder that reaches towards the stars.

The bank manager in an obscure branch in a village can get out of that bank surely and swiftly, if he makes it clear to his superiors that he is ready for larger service and a larger sphere. The humble retailer can burst the walls of his small store, just as Timothy Eaton did, if he gets the right idea and follows it. It is not a matter of brain or education so much as of purpose joined to energy and labor. The salesman or manager or bookkeeper or secretary can lift himself to a higher plane of service and rewards if he prepares himself diligently for larger work and pay. The small manufacturer, the company director, the broker—all can become enlarged in the nature of their enterprise and in the amount of their income—by resolutely setting themselves about the task of growing to be bigger-minded men.

Specialized information is the great idea. This is what the world pays handsomely for. And to acquire specialized information is really a simple matter, calling for the purposeful and faithful use of time. This chiefly.

One does not have to stop his ordinary work, or go to a university, or to any school. One can acquire the specialized information in the margin of time which is his own—in the after-hours of business. Which means: If a man will read the right kind of books or publications, and make himself a serious student at home, in his hours—the evening hours or the early morning hours—he can climb to heights of position and pay that will dazzle the inert comrades of his youth or day's work.

IF business—BUSINESS—is your chosen field of work, we counsel you to read each week THE FINANCIAL POST. It will stimulate you mentally. It will challenge you to further studious effort. It will give you glimpses into the world of endeavor occupied by the captains of industry and finance. With the guidance of the POST, and with its wealth of specialized information, you, a purposeful man, aiming to go higher in life and pay, will find yourself becoming enlarged in knowledge and ambition, and will be acquiring the bases and facts of knowledge which become the rungs of the ladder you climb by.

It is the first step which costs. But this cost is trivial—a single dollar. We offer you the POST for four months for a dollar. Surely it is worth a dollar to discover how right we are in our argument. If you have the will to go higher in position and pay, sign the coupon below.

THE MACLEAN PUBLISHING COMPANY, LIMITED,
—143-153 University Avenue, Toronto.

Send me/us THE FINANCIAL POST for four months for one dollar.

Money to be enclosed/remitted

Signed ....

C. F. ....

To Classified Advertising Section

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BINDERS, SAND
Holland Core Oil Co., Chicago, Ill.

BOILERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

BOILER GRAPHITE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRIQUETTING
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

BRUSHES, FOUNDRY AND CORE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CARBON BLACKING
Hyde & Sons, Montreal, Que.
Standard Machy. & Supplies, Ltd., Montreal, Que.

CAR MOTORS
Can. Ingersoll-Rand Co., Montreal, Que.

CARS, CORE OVEN AND FOUNDRY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, ALUMINUM, BRASS, BRONZE, ETC.
United Brass & Lead, Ltd., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
United Brass & Lead, Ltd., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARGING TRUCKS
Brown Specialty Mach. Co., Chicago, Ill.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, O.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Mach. Co., Chicago, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co. Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CRANES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co. Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

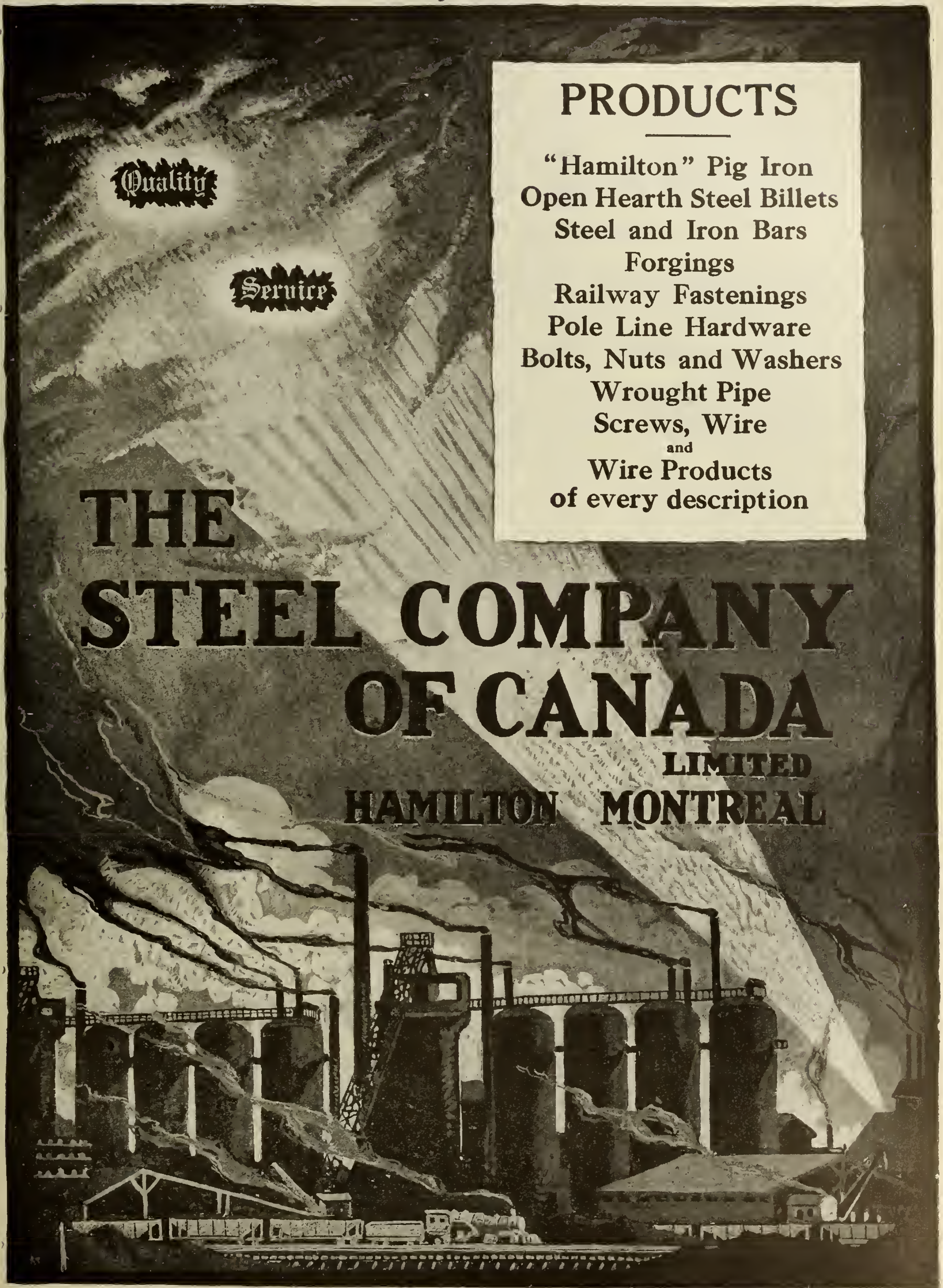
CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.


Quality
Service
PRODUCTS
"Hamilton" Pig Iron
Open Hearth Steel Billets
Steel and Iron Bars
Forgings
Railway Fastenings
Pole Line Hardware
Bolts, Nuts and Washers
Wrought Pipe
Screws, Wire
and
Wire Products
of every description
THE STEEL COMPANY OF CANADA
LIMITED
HAMILTON MONTREAL

DUST ARRESTERS AND EXHAUSTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.

EFFICIENCY ENGINEERING
Anderson's Efficiency Service, Toronto, Ont.

ELECTRO PLATING
United Brass & Lead, Ltd., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry & Machine Co., Chicago, Ill.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Wheeler Mfg. Co., Chicago.

GOGGLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

GRANITE AND MARBLE POLISHING
Harrison Supply Co., Boston, Mass.

GRANITE CUTTERS' TOOLS
Harrison Supply Co., Boston, Mass.

GRANITE AND MARBLE POLISHERS' SUPPLIES
Harrison Supply Co., Boston, Mass.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Ingersoll-Rand Co., Montreal, Que.

GRINDERS, DISC, BENCH, SWING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

GRINDERS, RESIN
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Can. Ingersoll-Rand Co., Montreal, Que.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

INGOTS, BRIQUET
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

INGOTS, COPPER, BRASS, BRONZE AND NICKEL
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

IRON CEMENTS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Wheeler Mfg. Co., Chicago.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Wheeler Mfg. Co., Chicago.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cooper Saddlery Hardware Co., H. W., Moline, Ill.
Champion Foundry & Machine Co., Chicago, Ill.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Federal Malleable Co., West Allis, Wis.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NICKEL, CHROME
Walker & Sons, Metal Products, Hiram, Walkerville, Ont.

OVENS FOR CORE BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

FOUNDRY SANDS
CORE, SILICA AND MOULDING
CUPOLA BLOCKS
FIRE BRICKS AND SHAPES
FOUNDRY SUPPLIES
SEE LIST IN BUYERS' DIRECTORY

HYDE & SONS, MONTREAL

USE KAOLIN

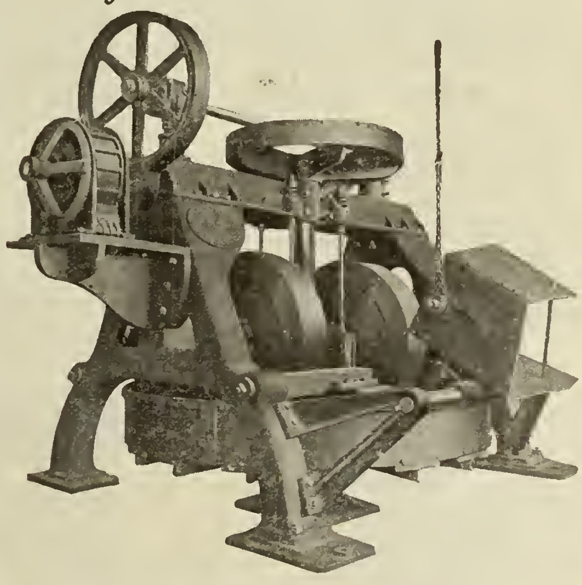
For lining and patching the Cupola or Open-Hearth Furnace, Lining Ladles, Clay Wash, etc.

It will save your fire brick and the time of your men.

Whitehead Bros. Co.

Providence
New York
Buffalo

Frost
Wet Pan Sand Mill
for Steel Foundries



The Frost Mfg. Co.
112 W. Adams St.
CHICAGO

Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Champion Foundry & Machine Co., Chicago, Ill.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

PROTECTIVE WEARING APPAREL
Wheeler Mfg. Co., Chicago.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

REFUSE BURNERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Rodgers Boiler & Burner Co., Muskegon, Mich.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Rodgers Boiler & Burner Co., Muskegon, Mich.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Cascades Silica Products Co., Montreal, Que.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frost Mfg. Co., Chicago, Ill.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Harrison Supply Co., Boston, Mass.

SAND-MIXING MACHINERY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Rodgers Boiler & Burner Co., Muskegon, Mich.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry Mach. Co., Chicago.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

SEA COAL
Obermayer & Co., S., Chicago, Ill.

SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.

SPRUE CUTTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STAND PIPES, STACKS
Rodgers Boiler & Burner Co., Muskegon, Mich.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Rodgers Boiler & Burner Co., Muskegon, Mich.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
McCulloch-Dalzell Crucible Company, Pittsburg

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Hyde & Sons, Montreal, Que.

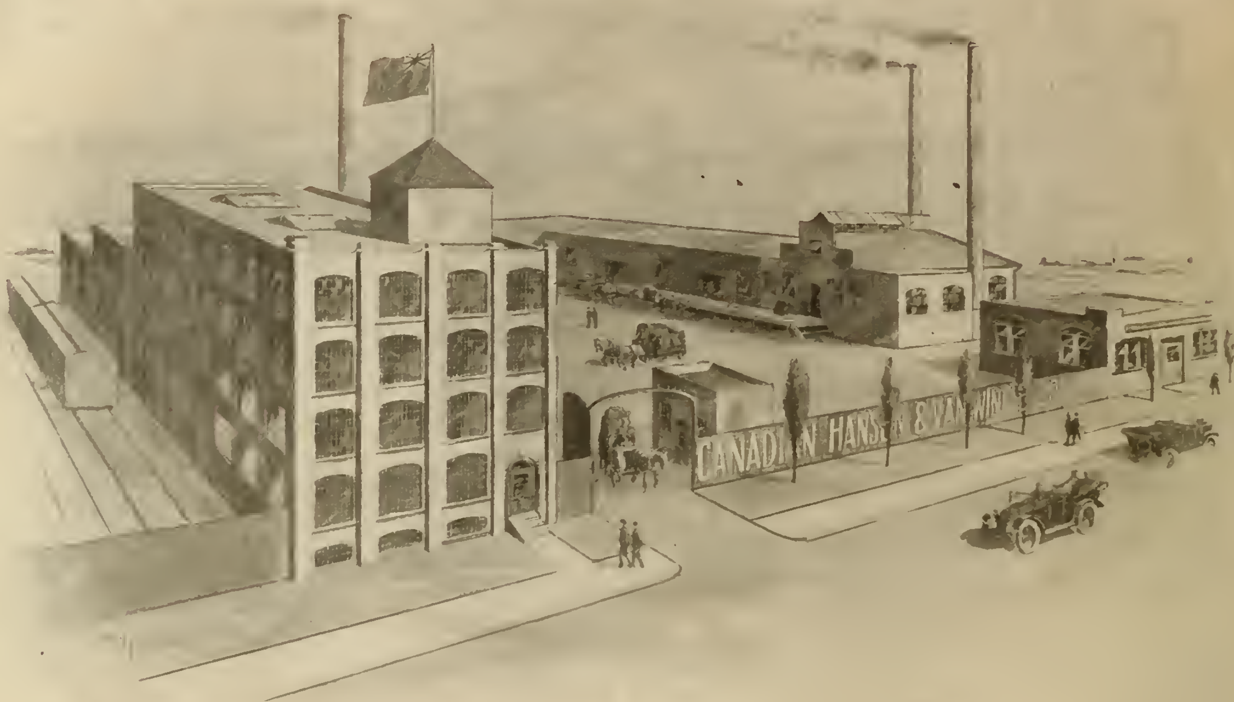
WHEELS, GRINDING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS



CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England

VOL. X. PUBLICATION OFFICE, TORONTO, FEBRUARY, 1919 No. 2

The Publisher's Page

TORONTO FEBRUARY, 1919

Biting Castings as a Test for Hardness

WE heard a story the other day about a green hand in a foundry being put to work sorting some old castings. He was told to keep soft castings in one pile, hard in another, but was not told how to tell the difference between the two. Upon asking one of the molders he was advised to bite the castings in order to ascertain whether they were hard or soft!

After several hours he expressed doubt as to the reliability of the test as he said all castings seemed hard to him!

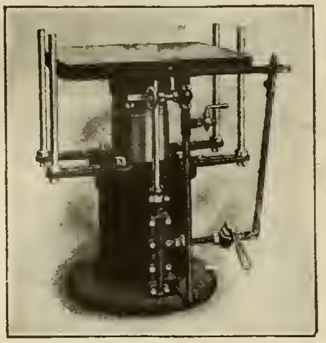
Of course, the green hand had a lot to learn, otherwise he wouldn't have been a green hand. But after all, who knows it all? Or, who knows enough? The most successful men are always learning. If we get a nice letter from a subscriber telling us that he has been helped by an idea secured in reading CANADIAN FOUNDRYMAN ten chances to one he is pretty well up in foundry practice. The possession of knowledge opens up a desire for more and the acquiring of knowledge, the achieving of success and the accumulation of riches go hand in hand.

And here's another fact that it's hard sometimes to see in the smoke and haze of the foundry — that your passing on to the other fellow the good ideas you have will help you and it will help the other fellow. It's no credit to say, "I have done nothing wrong." To be able to say, however, "I have actually helped my fellow man" is something of which you might well be proud.

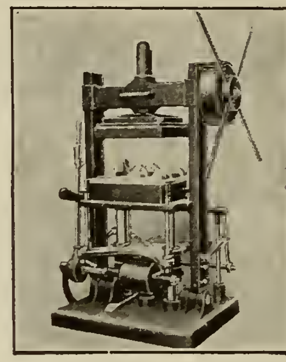
And so if you have a good idea—pass it on. Send it to Mr. Bell, our editor. Never mind if you're not used to writing. Just write as you'd talk. Language is for the purpose of expressing ideas. Don't expect to get more out of life than you give. It isn't reasonable or right. Give one idea and you'll get two in return. Give two and you'll get four. Try it and see.

British Moulding Machines

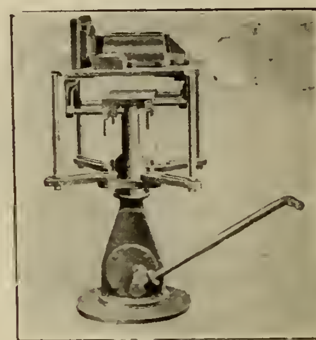
AND FOUNDRY EQUIPMENT



The JARR RAM (Pneumatic).
The Machine with a Perfect Lift.



The HEAD RAM.
Most powerful Hand Machine made.



The HAND RAM.
Adjustable to any size box.

The most efficient Machines, built to stand rough usage

Write for Catalogue to

BRITANNIA FOUNDRY COMPANY

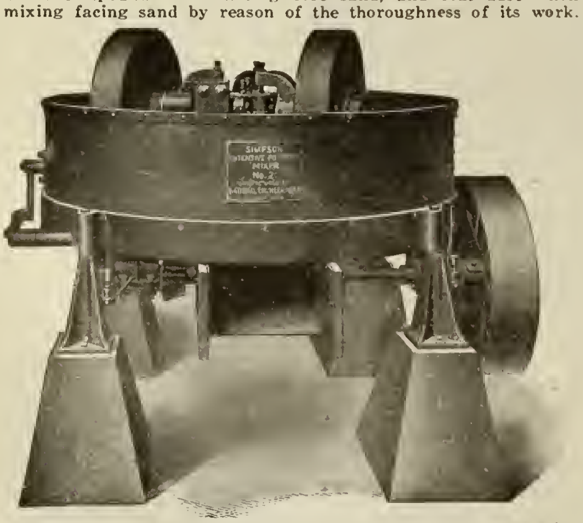
COVENTRY, ENGLAND

A Message to Canadian Foundries

INTENSIVE FOUNDRY MIXER
THE SIMPSON

Saves Both Sand and Labor

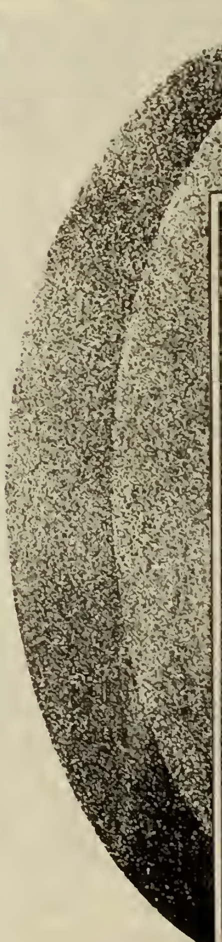
Improves the quality of the castings.
Correct "scabbing" due to imperfect mixing of facing sand. Saves compound when mixing core sand, and coal dust when mixing facing sand by reason of the thoroughness of its work.



The Simpson Intensive Foundry Mixer is in successful operation in some of the best known foundries in Canada.
Write for details and prices to

National Engineering Co.

Machinery Hall Building
549 W. WASHINGTON BLVD., CHICAGO, ILL.



Let us assist you in "Grinding Down Costs"

To do this simply give us an outline of your grinding operation and we will furnish the best possible wheel for the purpose.

Gresolite
for Grey and Chilled Iron.

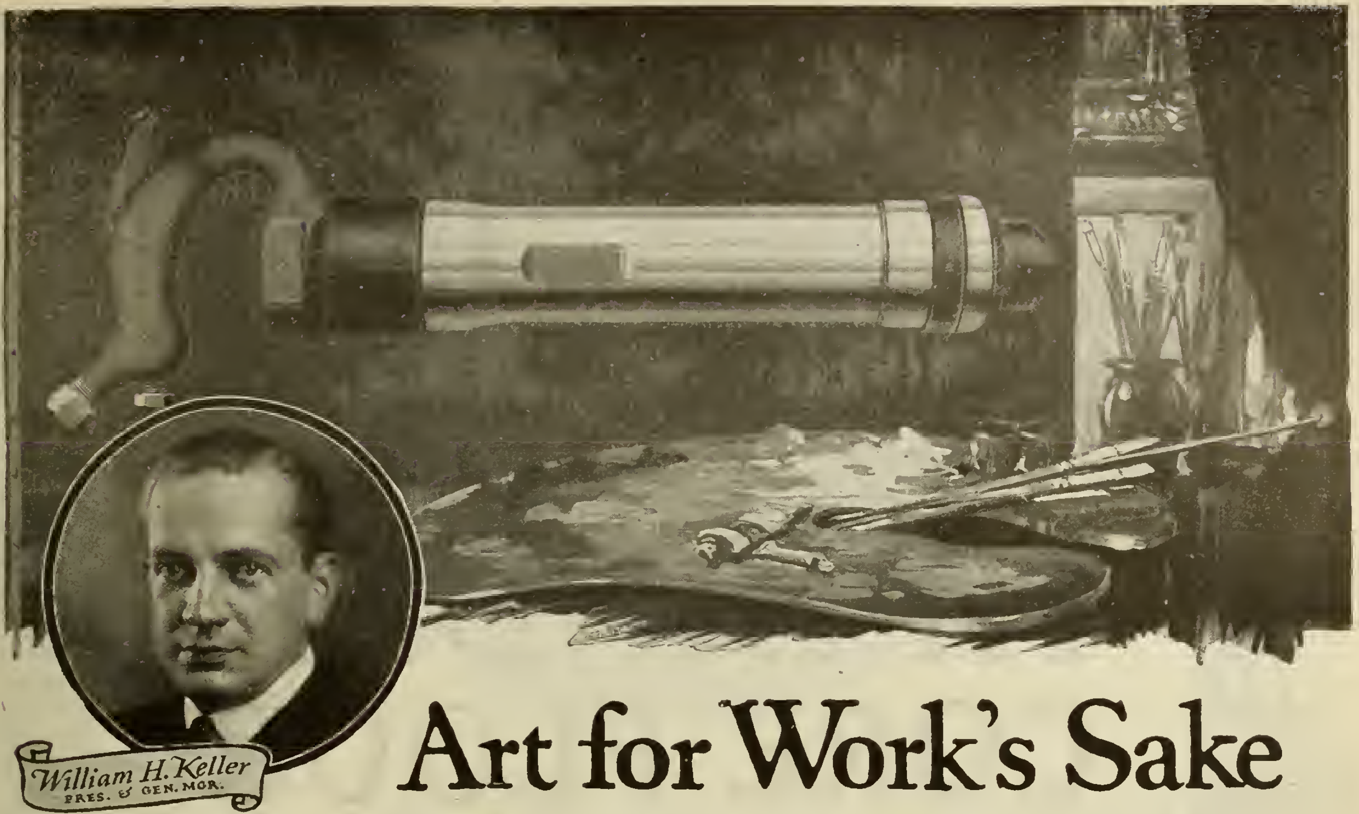
Emery
for Steel Foundry and General Purpose.

Corundum and Rexite
for Precision and Fine Tool Grinding.

Write for booklet "Safety as Applied to Grinding Wheels."

Canadian Hart Wheels

LIMITED
Manufacturers of Grinding Wheels and Machinery
456 Barton Street East
HAMILTON, CANADA



Art for Work's Sake

The longer I work at my job of designing and manufacturing Pneumatic Tools, the more profound becomes my appreciation of the truth of Emerson's dictum that "all beauty is organic."

With Emerson, I believe that the truest and most enduring forms of beauty, whether in people or buildings or flowers or machinery or tools, are structural in character, and never merely decorative. True beauty cannot be put on. It must be built in.

So when I am asked, as often I am, why we of the Keller organization spend so much of our time and effort on the external lines and finish of Keller-Made Master-Built Pneumatic Tools—why we bother about making them look pretty, as some visitors express it—I answer, we do nothing of the sort.

Our foremost and constant purpose is and always has been to produce tools that can be depended upon to give maximum service at minimum cost. It is by adhering unwaveringly to that purpose, and not through any desire to please the eye of the beholder, that we have succeeded in making our tools unusually symmetrical and attractive.

The beauty of Keller-Made Master-Built Pneumatic Tools is true beauty because it is truly *organic*—it is *inbuilt* at every stage of manufacture, from the machining of the cylinders up to the final sandblasting and lacquering of the handles.

Keller-Made Master-Built Pneumatic Tools *look* best because they *perform* best. Their appearance, like their popularity, is the just measure of their worth.

KELLER-MADE
PNEUMATIC
TOOLS
MASTER-BUILT

William H. Keller, President

KELLER PNEUMATIC TOOL COMPANY, GRAND HAVEN, MICH., U. S. A.


Holland Core Oil Company
HI-BINDER
CORE FLOUR
The Only Substitute for Flour
Hundreds of barrel-lot customers and several car-lot customers are using it every day. Why? Because it is giving the best of service and saving money.
Holland Products
Core Oils, Match Oil, Linseed Oil, Hi-Binder Dry Core Compounds, Hi-Binder for Dry and Green Sand Facing for Steel, Hi-Binder Core Paste, Parting.
Canadian Agents:
The Dominion Foundry Supply Co. Limited
TORONTO
"Everything for the Foundry"
MONTREAL
4600 WEST HURON ST.
HOLLAND PRODUCTS
CHICAGO --- ILLINOIS

GEO. F. PETTINOS FOUNDRY SUPPLIES PHILADELPHIA

We produce and can make prompt shipment of

MOULDING SANDS

Albany, North River, Furnace Bottom, Strong Silica, Sharp Silica, Fire Sand, Jersey Molding, Lumberton, Millville Gravel, Sand Blast Sand.

DELIVERY BY BOAT OR RAIL

from deposits tested and proved to be of unexcelled quality, owned and operated solely by

GEORGE F. PETTINOS

810-14 REAL ESTATE TRUST BUILDING

PHILADELPHIA

FOUNDRY FACINGS AND SUPPLIES IN STOCK

Cleveland Office:
503 American Trust Building

Boston Office:
236 Old South Building

THE STANDARD IN

CRUCIBLES

Manufactured For Over 50 Years

J. H. Gautier & Co.

JERSEY CITY, N. J. U. S. A.

GLOBE

Shot Blasting

Instead of Sand Blasting

Ensures 100%

Cleaner Castings

Globe chilled shot leaves a perfectly smooth surface—an important factor where castings are to be enamelled—sand leaves a sand coating.

SHOT DOES NOT WEAR THE HOSE, NOZZLE OR MACHINE AS FAST AS SAND, AND IT CLEANS EASILY 100% BETTER.

Let us tell you more about it.

THE GLOBE STEEL CO.

MANSFIELD, OHIO

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS
Established 1909 Published Monthly

Making Heavy Cylinder Castings in Loam Moulds

A Short Story of Why Three Cylinders of Different Calibre Are Required on an Engine, Also Mode of Molding—Written For the Edification of Foundrymen in Foundry Language

By F. H. BELL

LOAM molding is a branch of the molder's trade, which differs radically from either green-sand or dry-sand molding.

A system of building molds with bricks and loam is used, which would not be practicable in either of the other branches. The bricks used are simply building bricks and should be what are known in the building trade as soft brick. This is to allow the easy escape of the gas, which would be more difficult with hard brick. Loam is a combination of heavy sand and clay; it is sometimes found in a natural state, but it frequently requires to be mixed artificially to suit conditions. The system usually requires the brick-work to be built on top of iron plates, the bricks being built from one-half to three-quarters of an inch back from the design of mold. The loam is spread onto the bricks in a manner similar to plastering the walls of a house, and are either swept or strickled to the proper design and dimensions, or a pattern may be used, in which case the loam is first put against the pattern and afterwards backed up with the bricks. In laying the bricks, mud, made from any waste foundry sand, is used, and where extra vent is required the upright joints are filled with dry cinders or fine coke. Vent wire holes can also be pierced through the mud joints before they set. and straw is sometimes built into the joint. As is the case with any style of mold, the vent must get away and judgment should be used in devising means. Flanges and sleeves may be built out from the main casting by having drawbacks built onto plates, or by using dry cores, but much of this is done away with of late by having the sleeve and the outside of the flange the same diameter, that is to say, the flange will be on the inside of the sleeve and is drawn inward and cored from the inside. Loam molding is probably the oldest branch of the trade, and while not in such general use as in former years, it has many advantages not found in any other branch and can also be resorted to in cases where no other system would be permissible, one of its main features being its adaptability to very heavy castings.

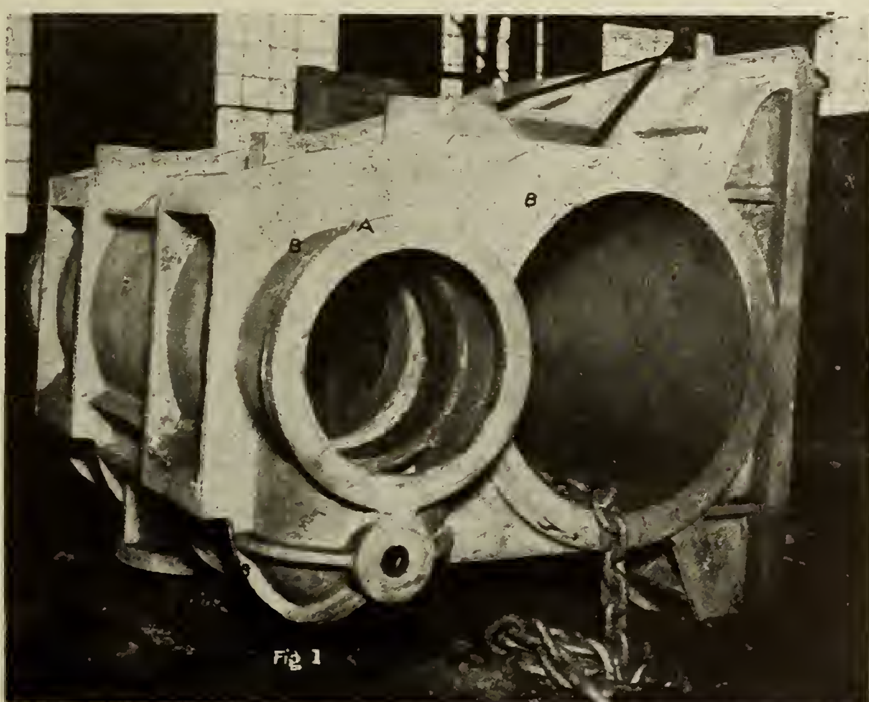
A Typical Sample of Loam Work

The casting herewith illustrated in Fig. 1 is a typical product of the loam-molder's art, being the intermediate cylinder for a 3.500 horse power triple expansion marine engine, as built by the Canadian Allis-Chalmers Co. at their Davenport plant, Toronto.

While it is primarily our intention in this article to give to the reader a somewhat comprehensive idea of how the molds are constructed, it will, perhaps, also be in order (for the benefit of those who have not given it study) to explain, even though only in a condensed form, the duties which the three cylinders are called upon to perform, as well as to give a crude definition of the term "triple expansion." The reader may then more readily grasp what the molder has on his hands in properly building the molds and placing the cores.

The word "expansion" is an expression used by engineers to denote the thought commonly conveyed in the term "pressure," although in a broader or more extended manner.

Steam confined in a boiler or in the cylinder of an engine. endeavors to expand, thereby creating pressure. The amount of power which the pressure can generate, or rather the amount of energy which this pressure can exert depends upon the amount of surface against which it is permitted to exert its energy. The pressure registered on a steam gauge represents the amount per square inch. Therefore, the larger the bore of the cylinder with the consequent larger surface of piston, the greater will be the power. Some engines are built with the low-pressure cylinder reversed with the chest outside and separate pipe leading around instead of being cast on. In Fig.2 is



INTERMEDIATE CYLINDER FOR 3,500 H.P. CYLINDER AS IT APPEARS WHEN TAKEN FROM THE MOLD. NOTE THE AVERAGE SIZED MAN HAS TO STAND ON SCAFFOLDING TO WORK AT IT.

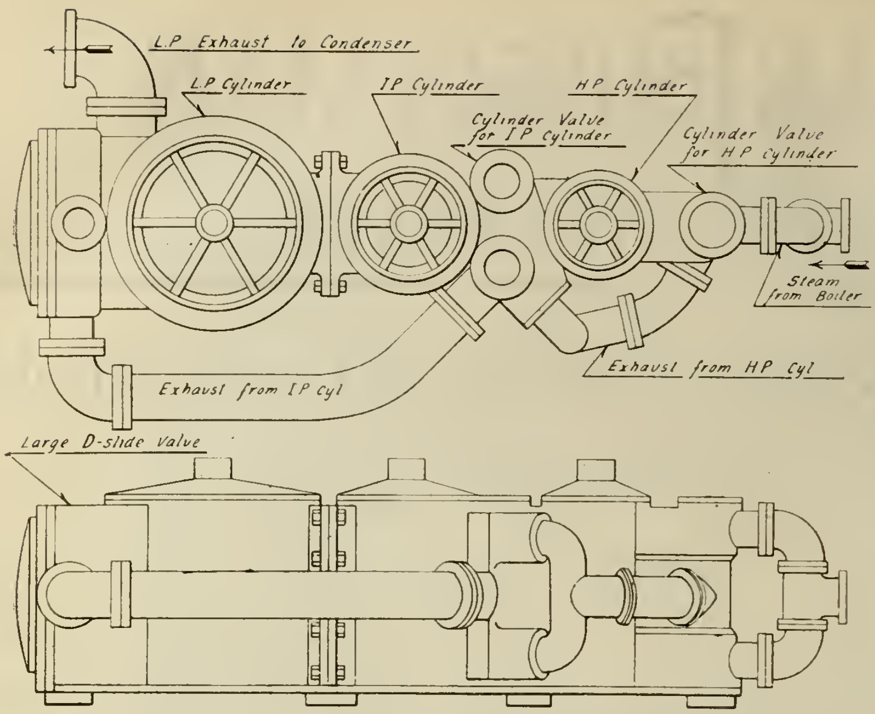


FIG. 2 ONE TYPE OF TRIPLE EXPANSION ENGINE. DIFFERING IN SETTING OF CYLINDERS. BUT OTHERWISE THE SAME AS ALL OTHERS.

shown a sketch of the three cylinders as they appear when assembled in place upon the engine.

The live steam or steam under the highest pressure enters the steam chest and is admitted through the steam ports into the cylinder where it has its first opportunity to expand. After doing its work in this cylinder it passes out of the exhaust port and into the passage way and enters the steam chest and cylinder where it expands the second time. Had this cylinder and piston been of the same dimensions as the first ones the back pressure on the first one would have been as great as the forward pressure on the second, thereby accomplishing nothing. The second being larger than the first as will be seen has more surface of piston for the steam to press against when it expands, and as a consequence has a greater pressure on the second, thereby adding power to the engine.

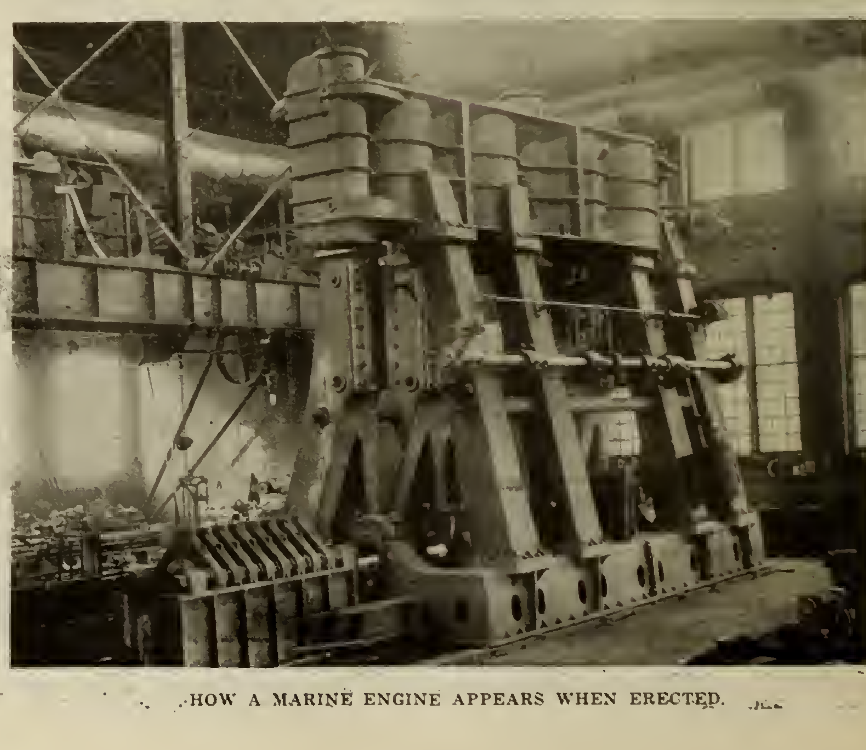
After doing its work in this cylinder it passes through the passage and enters the steam chest and cylinder, which as will be seen is again larger than where it expands for the third time, thus the term triple expansion meaning three expansions.

It will be seen that the smallest cylinder of the three is the one which really drives the engine. As it receives the live steam right from the boiler it is known as the high pressure cylinder. The next one as can be easily understood is called the intermediate, while the third one which receives the steam when it is almost spent is rightly termed the low pressure.

It will be seen that the smallest cylinder of the three is the one which really drives the engine. As it receives the live steam right from the boiler it is known as the high pressure cylinder. The next one, as can be easily understood is called the intermediate, while the third one, which receives the steam when it is almost spent is rightly termed the low pressure.

In Fig. 3 will be seen the mold for the low-pressure cylinder, while Fig. 4 is the high pressure one. Both are fully cored up and ready for their respective copes, with the exception of the main barrel cores. In Fig. 5 is shown the foundation plate on which to build the mold shown in Fig. 3. It also embodies the spindle step. Fig. 6 is a partly built mold similar to Fig. 3. Fig. 7 is the cover or cope for this same mold and Fig. 8 is the dummy or false cope on which Fig. 7 is built. Fig. 9 is the main barrel core.

In molding these cylinders it will be necessary to explain that the method of molding the low-pressure is somewhat different from that of the other two. The low-pressure while being the biggest and heaviest is the simplest to make. Being as we have already stated the least complicated in design, it is also spacious enough to allow the workman an abundance of room within it. It is also of the flat slide-valve type while the others are of the round piston valve type. We might also explain that in order to expedite the production three complete outfits of equipment are used. Therefore Fig. 5 is an exact duplicate of the one on which Fig. 6 is being built and also the one under Fig. 3. In building the low-pressure cylinder the first move to be made is to level up the foundation plate, Fig. 5, on top of which the mold is built. As will be seen in Fig. 6 the spindle C with the sweep board B attached is braced to the steam chest pattern A by means of the three sided brace D, D, D, also by means of the brace E to the permanent post. By having the bottom of the spindle in the step B Fig. 5 and the chest pattern A set up against the sweep-board and properly bedded to the brick work underneath, it is straight ahead work to proceed with the brick work, but before proceeding with the building of the wall it is understood that the brick and loam work under the steam chest has been attended to while the pattern was being placed and after it is properly placed the sweep board B is removed and a special sweep is attached which sweeps the bottom flange and the core-print. This done the sweep board is again removed and still another special board attached for sweeping the core. Fig. 9 which is built right in its place. A ring plate with bolts attached is placed in the bottom of the print and the core is built up to the top when an open grid is built into it which is in turn bolted to the bottom one making a secure job. When the core is completed it is lifted out by means of hooks attached to the bottom plate. It is now blackwashed and dried in the oven. The sweep board B is now returned to its



HOW A MARINE ENGINE APPEARS WHEN ERECTED.

place on the spindle and the outside wall is built up and loamed.

As the brick-work proceeds all ribs and branches are built in by utilizing loose patterns. For ribs such as A, Fig. 3, a straight piece of board is attached to the sweep at right angle to it and at the proper place to sweep a bed for the ring or circular rib pattern to rest upon. When this bed is formed the piece of board is removed and fastened high enough above to form the next one. A ring made up of segments is now put upon the bed and the brick and loam work proceeded with. The idea in having the ring in segments is to make it possible to draw it out of the mold as this mold is not parted anywhere excepting at the top, but cast iron plates similar to Fig. 11 are built into the brick work at intervals to support it against the outward strain of the melted metal.

In building the cover Fig. 7. The false work Fig. 8 (which takes the place of a wooden pattern and which serves continually for all the covers) is used. The loose ribs R and the bosses S and T which are of wood are put into place and the course of bricks shown in U, Fig. 7 are laid in mud and the remainder is rammed up with core sand. This is done by bedding in a core anchor or grid with bolts reaching up through the top. The core sand is now rammed in similar to ramming up any core and the plate V is bedded on and bolted to the core as well as to the brick work. This is now lifted off and rolled over and finished as shown at Fig. 7 when it is put in the oven and baked. The iron plate shown at B Fig. 3 carries the face of the steam chest, also the inside core for the same, including the prints for the port cores.

When all of the brick and loam work is done the patterns are removed, and the mold finished in a like manner to a core or a dry sand mold and blackwashed and thoroughly baked until every particle of moisture is gone. It is then assembled in the pit as shown in Fig. 3. The plate Fig. 5 carrying the brickwork is first lowered into the pit, after which the plate B Fig. 3 carrying the inside for the chest is lowered into place and securely bolted. The cores which form the ports, etc., are now put into place and tied through on to the plate B, leaving the mold as shown in Fig. 3.

The main barrel core Fig. 9 is now to be lowered into place, but before

FIG. 3 IS L.P. CYLINDER MOLD WITH STEAM CHEST AND STEAM PORT CORES IN PLACE, READY TO RECEIVE MAIN CORE. FIG. 4 IS H.P. CYLINDER MOLD.

FIG. 5—FOUNDATION PLATE ON WHICH MOLD IS BUILT. FIG. 6 IS MOLD FOR FIG. 3 IN PARTLY BUILT UP. FIG. 7 IS COVER OR COPE FOR MOLD FIG. 3. FIG. 8 IS FALSE COPE OR PATTERN ON WHICH TO BUILD FIG. 7. FIG. 9 IS MAIN BARREL-CORE FOR L.P. CYLINDER.

doing this the cover Fig. 7 is tried on while a man remains on the inside. This is done so that the man inside may have it properly placed and marked. There spaces on the back of the chest are made with cores. The brick work being left open at these places, the cores make up the deficiency. At A Fig. B will be seen

FIG. 10. INTERMEDIATE CYLINDER MOLD WITH BRICK WORK NEARING COMPLETION. FIG. 11. LIFTING PLATE FOR SEPARATING THE MOLD AND ALSO FOR SUPPORTING IT AGAINST THE STRAIN OF THE METAL. FIG. 12. COVER FOR INTERMEDIATE CYLINDER.

being no guides, this is the only way to get it centered. When this is attended to the cover is lifted off and the core Fig. 9 is put into its place and the cover put on for the last time. As will be seen every plate is well supplied with lugs. These are used to bolt the mold together, after which iron curbing shown at X Fig. 3 and 4, is placed around the mold and sand is rammed between the curbing and mold which secures it against any possible chance of giving away. These curbing staves are fitted together like a link chain and make a strong curbing which can be fitted to any size or shape.

In molding the intermediate cylinder shown in Fig. 1 a different system is adopted. Instead of sweeping the barrel a complete pattern is used. The steam chest instead of being flat is round like another cylinder. This is for what is known as a piston valve. As we have already pointed out, this cylinder stands between the other two and has pipes and pipe connections cast on to it to connect them all together and allow the steam to pass from one to another.

To accomplish this the mold is parted in several places; partly on account of convenience in drying and partly to facilitate the removal of the patterns. A Fig. 1 shows where the first parting from the bottom would be. B shows the next parting and the next parting would be at the top where Fig. 12 or 13 fits on.

In starting this mold a plate similar to the one used for the low pressure is used and instead of using the sweep a complete pattern is built right into the brick and loam. Wherever a parting is required, plates Fig. 11 are built into the joint. One of these plates could be made to do but two are used so that one has guides which fit onto the other, doing away with all trouble in returning it to its proper place. The lightening the cores which form the pockets on the outside of the head, similar to what was shown at Fig. 7 and 8. But in this case the pocket cores are made separately, and put into position on the pattern and the balance of the cope rammed onto them when they will be tied through to the top. This is for a two-fold purpose, no dummy being required as the cope is built right onto its place, which was not possible where the cylinder was swept and also on account of the shape of some of the pockets making this system much easier.

The gating and pouring is probably as interesting as any part of the procedure. Instead of gating it from the bottom flange as was formerly considered necessary, it is now popped from the top entirely. Gates measuring about 1 inch by 2 inches are placed a few inches apart all the way around the top of the mold and are connected together by a continuous pouring basin on the top. These gates are left open and are flooded with iron from two large crane ladles poured into the same basin. The iron falls a distance of from ten to twelve feet and strikes a flat bottom which consists of a thin layer of loam spread onto the flat brick surface and would naturally be expected to tear it to pieces, but such is not the case.

If one little stream of metal were to drop that distance and strike one spot it would certainly cut that spot away, but in the case of the cylinder, the iron falls in such volume and so close together that it actually falls like a cushion.

With the one stream it would continue to beat upon the same spot and flow away, leaving the spot still bare and an easy mark for the falling metal to cut away, but with this method the metal has no chance to flow away and the first blow is the only one, and as we have explained it falls in such a volume that it actually cushions itself. The risors and feeding heads are on top of the pads which connect to the frame or housing of the engine, as well as at intervals between the gates. The molding of the high pressure cylinder would be similar to that of the intermediate but less complicated and will not require particular mention.

The cylinders herewith described are 36 in., 54 in., and 72 in. bore and weigh respectively 7 tons, 11 tons and 16 tons. With this amount of metal tied up in the cylinders alone the reader can form some idea of the weight of metal required for the entire engine. And to have three sets of these under construction continuously means that the Canadian Allis-Chalmers Co., is an institution capable of doing things on a large scale. Among the other lines manufactured by this company might be mentioned locomotives, the building of which they are specially built for. Mr. Melvill R. White is the manager and Mr. Turner is the foundry superintendent and to these gentlemen we are indebted for the courtesy extended in admitting us to the works and supplying us with the required information.

FIG. 13. BETTER VIEW OF COVER FOR INTERMEDIATE CYLINDER

Reducing the Cost of Factory Production

Practical Foundryman Shows How Costs of Production Could Be Greatly Reduced by the Draughtsman, Pattern Maker, Foundry Foreman and Machinist Having Knowledge of Each Other's Difficulties

By G. W. G.

IN order to reduce the cost of castings the first step is to have the designs made that will lessen work in pattern shop, foundry and machine shop, therefore it is very important that the draughtsman should have some knowledge of what is required in these different departments in order to lessen the work. In fact each department should know what is required by the one next to handle their work.

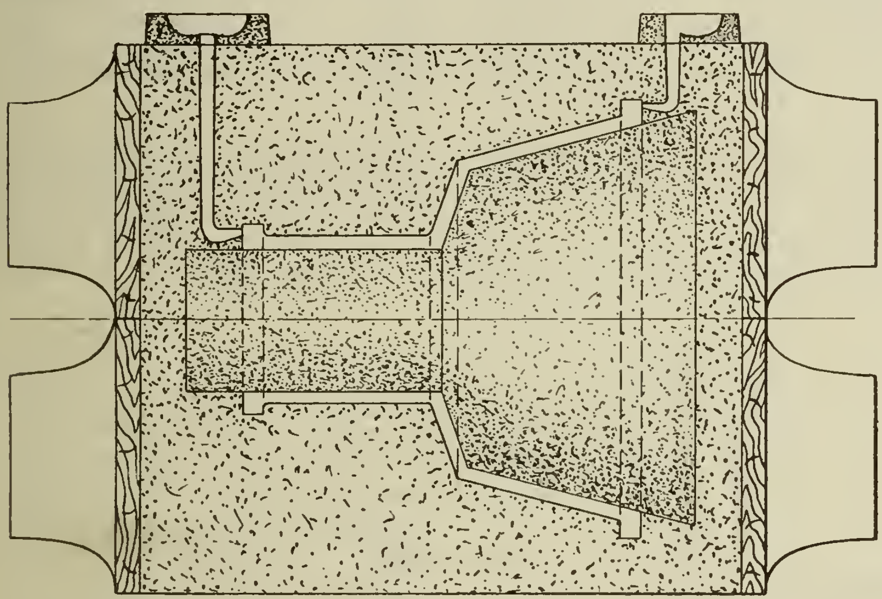


FIG. 1—MOLDING TOP OF GAS FURNACE FROM SPLIT PATTERN.

To illustrate one of the numerous cases where work was lessened and a better casting was produced, sketch Fig. 1 shows a split pattern for the top of a gas furnace; it is 28 inches in diameter, 12 inches in length of body, and 12 inches in the neck.

To make a casting from this pattern, a flask 36 inches by 30 inches was required, with cope and drag each 16 inches deep. It also requires a large body core. Sketch Fig. 2 shows the same design of pattern but made so that the molder has all the pattern in the drag. Work was lessened on this job by coremaker, having only a flat core and neck core to make instead of a large body core, and by molder having a flat cope instead of a deep one which required numerous gaggers to secure the sand.

While on the question of how best a pattern should be made to lessen molding, I have noticed very often small flange patterns made with core prints, to be cored out instead of having a hole bored through and tapered so as to leave a green sand core.

The object of this article is not to criticize, but rather to show, in order to reduce the cost of castings, there must be closer relations between these different branches of the trade, and the last few years I have noticed a marked improvement, and it is my belief that the foundry journals of to-day deserve a large share of the credit.

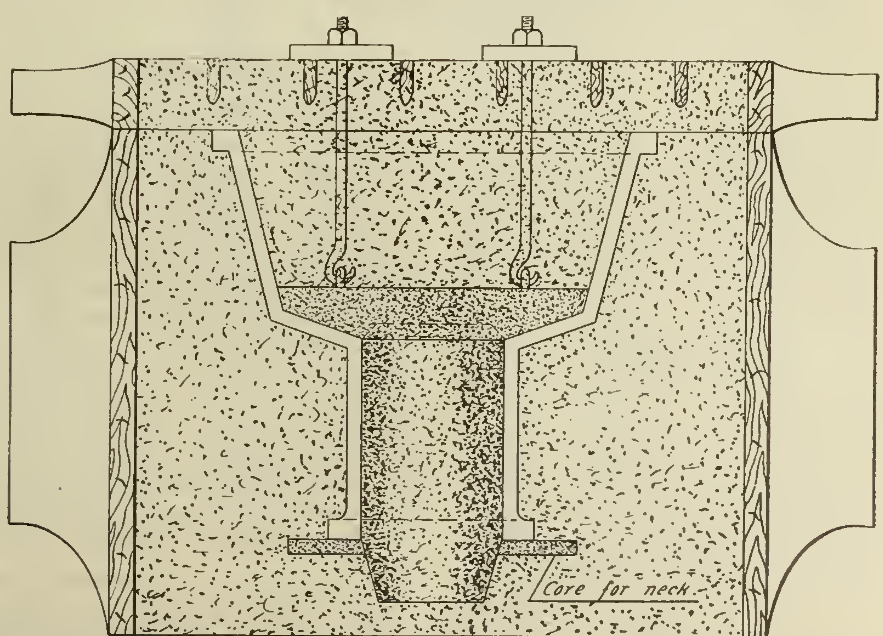


FIG. 2 SHOWS BETTER WAY OF MOLDING. NECK CORE IS BEDDED IN AS THE MOLD IS BEING RAMMED UP. AFTER BEING BEDDED IT IS REMOVED, TEMPORARILY, AND THE FLANGE WITHDRAWN. THE CORE IS THEN REPLACED AND WORK PROCEEDED WITH

BIG CHIMNEY ON NEW PLANT COMPLETED

The huge brick chimney in connection with the foundry of the Dauntless Manufacturing Company's plant here, was completed to-day. This chimney is eighty feet high and contains 85,000 bricks. It is eleven feet in diameter at the base and stands on a concrete base 14 x 14 feet. The base is seven feet deep and contains about 51 feet of concrete. In building this chimney, J. Pettit, the contractor, was favored with ideal weather. He started work on it a few days before the first of the year and worked at it steadily till to-day, with the exception of one or two days, when the high wind made it dangerous to work on the scaffolding. To build a chimney of these dimensions in the month of January is a new record in winter outside work.

Work on the roofing of the foundry is now progressing favorably and will be completed about the middle of next week. When this is finished work will be proceeded with inside and rushed along as quickly as possible. The furnaces for the foundry have not yet arrived but are expected any time.—"Redcliff, Alberta, Review."

Steel Castings Used in Ship Construction

Being a Detailed Description of the Pattern Making, Molding and Pouring of Steel Castings to Replace Forgings in the Construction of Ships in Great Britain Applicable to Canada

By BEN SHAW and JAMES EDGAR

In "Foundry Trade Journal," London, Eng.

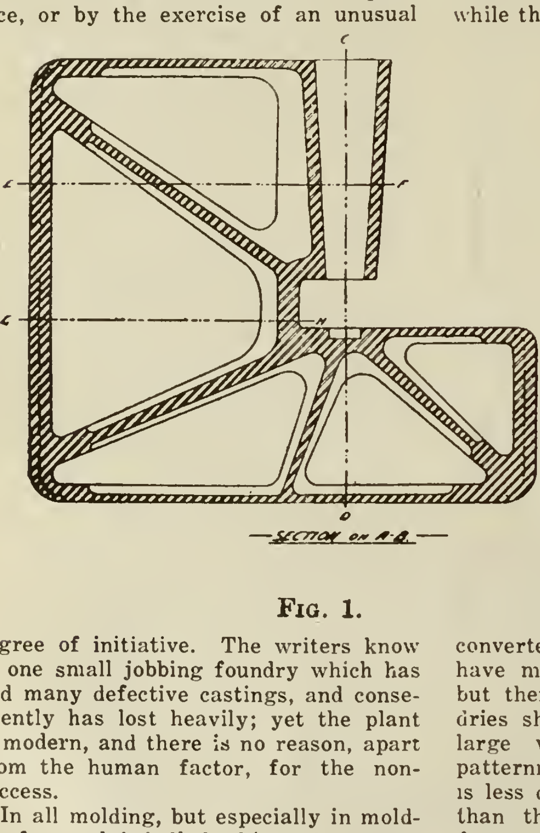


FIG. 1.

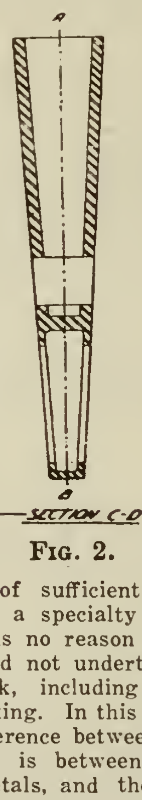
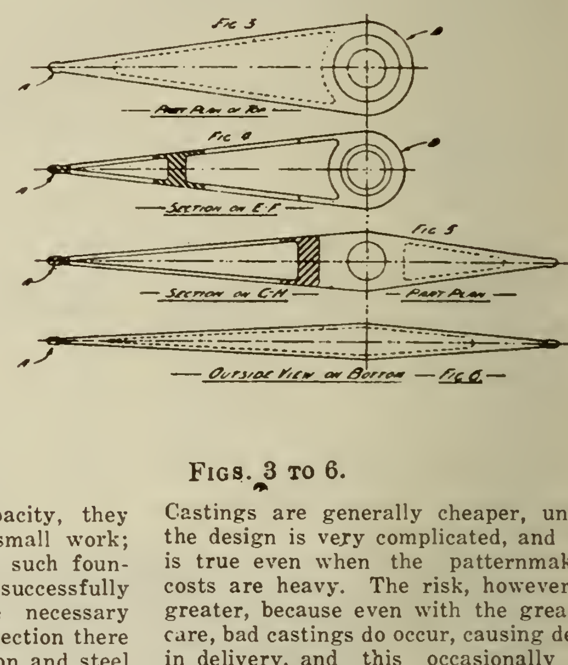


FIG. 2.



FIGS. 3 TO 6.

THE number of steel foundries in Great Britain that could cope with very large work was comparatively small at the beginning of the war, but it was probably sufficient for normal needs. As the necessity, however, for more ships has become imperative, the larger foundries have become congested with work, and small foundries have had to adapt themselves to a class of work not only differing in size but also in design from that to which they were accustomed. Steel is probably the most uncertain of the common metals to cast, and the construction of the necessary patterns and the subsequent molding differ so much in large and small work, that successful results can only be obtained after considerable experience, or by the exercise of an unusual degree of initiative. The writers know of one small jobbing foundry which has had many defective castings, and consequently has lost heavily; yet the plant is modern, and there is no reason, apart from the human factor, for the non-success.

In all molding, but especially in molding for steel, it is little things that count. Unequal cooling, to mention one thing, has to be more guarded against than with other metals.

Occasionally the patterns for large steel work are conveyed by rail from the shipyard to the foundry if at a distance, but considerable delay is caused by this in addition to the danger of their being damaged in transit; consequently it is very common for the foundry to undertake the pattern-making. The necessity for accuracy in regard to the thickness of the metal in this class of work is not great, but angles are important. The patterns are difficult to handle because of their size, and as well as the patternmaker having thorough confidence in his own judgment, he must also possess the ability to so build the work as to obtain the maximum of strength. This is even more essential with this class of work than with large engine work, because the designs are such that if the finished work yields, it is practically impossible to get it correct again. Although the metal is usually heavy, yet they are really delicate patterns. A level floor in the pattern shop is indispensable for this class of work, but this is easily made, and if the shop is too small, the work can be constructed in a convenient part of the foundry.

The case of many foundries is, that while they have a furnace, or cupola and converter, of sufficient capacity, they have made a specialty of small work; but there is no reason why such foundries should not undertake successfully large work, including the necessary patternmaking. In this connection there is less difference between iron and steel than there is between iron and non-ferrous metals, and the average iron foundry can adapt itself to brasswork. Large iron foundries have practically all the plant necessary for steel work except a converter, and with a few experienced steel molders ought to be able to cope with any steel work, however large. It is essential, of course, that a part of the foundry should be reserved for steel work.

It is very improbable that the foundry that increases its plant so as to cope with large work, will have to revert to a small class of work after the war. Steel founding is still an immature industry. Before the war a great proportion of steel castings came from Germany and Sweden, but this is not likely to happen again. Steel is gradually displacing, not only iron but steel forgings, and there are indications that in the near future all turbine engine work, to mention only one class of castings, will be made in steel. The advantages are obvious. Apart from the additional strength, there is a great reduction in weight, which is of paramount consideration.

With regard to the relative merits of forgings and castings, it may be truly affirmed that each has positive advantages over the other, and there is continual disputing by experts as to which is the better. The balance of opinion now, however, is in favor of castings. Castings are generally cheaper, unless the design is very complicated, and this is true even when the patternmaking costs are heavy. The risk, however, is greater, because even with the greatest care, bad castings do occur, causing delay in delivery, and this occasionally influences shipbuilders in favor of forgings. There is also an element of uncertainty with castings, as there are occasionally internal defects not noticeable on the face of the casting, but this danger can be almost entirely eliminated if care be taken in cooling. Also, it is a mistake to suppose that forgings are not subject to internal strains; and welded joints on large work are not very reliable. Oftentimes, also, forgings are very expensive, because of the amount of machining that has to be done. There is a class of work that does not permit of an alternative method, and because of its design castings are necessary. Indeed, the method of casting gives far greater scope to the designer. It is often possible to lighten the metal by coring, and to give a piece of work a more graceful shape if it is cast; an example of this is the propeller bracket, the "fish-back" or arm of which is frequently hollowed out.

A very large treatise might be written on large steel casting, but in the following articles the commoner types and representative designs have been chosen, and where two methods are possible, they have been explained.

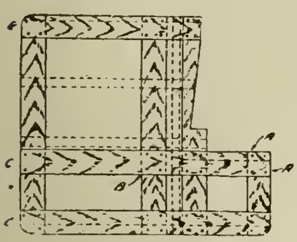


FIG. 7

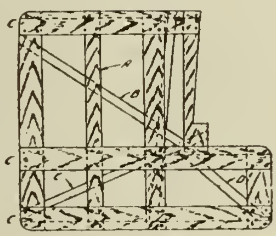


FIG. 8.

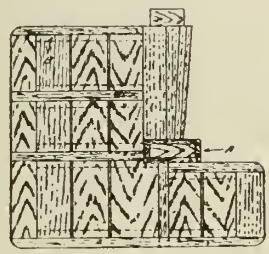


FIG. 9.

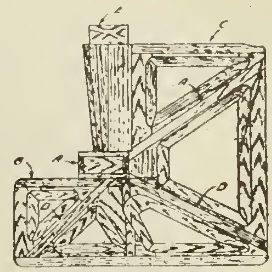


FIG. 10.

RUDDER

Making the Pattern

A representative type of rudder is shown in Figs. 1 to 6. The outlines of rudders vary somewhat, but the main features of their design are the same and the methods adopted in making the rudders shown are equally applicable to almost any rudder.

A glance at Figs. 1 and 2, bearing in mind that the height A B may be 12 or 14 ft., will give an idea of the fragility of the pattern, and the care which must be exercised in building it, to ensure that it will not break or twist. There are two ways in which the pattern may be made, and that adopted must depend on the foundry which is going to cast the work.

In some districts it is the practice to make all large patterns for steel exact models of the finished casting, unless for circular cores, in which case the molder makes his cores in place. The great advantage of this is, especially when dealing with awkward shapes, that the correct thickness of metal is assured, and another gain is that the molder sees his work more clearly, and can mark his course at the beginning of the job with greater confidence. It is, however, a slow method. If a block pattern is made, and the cores are made in separate boxes, the work can be better distributed. The latter method is, however, the more expensive in the pattern shop, although the foundry is of course the first consideration.

We shall consider making a block pattern first, although the initial step is the same whichever method is adopted—the work must be set down. The common practice is for the molding loft to supply the patternshop with a template. A drawing is provided, but for the main sizes, the template is more reliable, as it is frequently found necessary, when the frames are set out on the molding-loft floor, to change the design in places. It is not necessary, however, nor is it advisable, to set the work out on a drawing board. The drawing should be done on the floor, and on the top of this drawing the work is built. The simplest way is to screw the template to the floor, and mark a line round it. The template is, of course, the finished shape of the rudder, and the pattern-maker has to allow for contraction. The easiest way to do this is to draw the centre line C D, Fig. 1, and to measure all sizes at right angles to this line with a standard rule, and then transfer the size to the contraction rule. The sizes in the other direction, that is, in the height of the rudder can be measured from a base line. The section C D, Fig. 2, may be set down alongside the front elevation, but it is as well to put the other sections, Figs. 3, 4, 5, 6, on the top of the elevation. In painting the drawing, and it is necessary to do so, as it would otherwise become faint before the job is finished, the sections can be colored differently to the main view.

For the purpose of this article we shall suppose that the whole job is being made by one or two men, although in the average shop quite a few men would be employed on it. The joint frames should be made first. It ought to be explained, however, that there is a considerable difference between the top and bottom halves. The prints are only put on the bottom half as they are unnecessary on the top half, apart from the danger of crushing when the cope is being lowered. A glance at Figs. 9 and 10 will show the reader the main differences. Fig. 9, which is the top, is covered all over, as it is easier for the pattern-maker to cover it with plates than for the molder to fill it with loam, but the bottom, on the other hand, does not need to be covered, it being sufficient to get bearing for the prints. The difference in construction begins with the joint frames. An extra piece A, Fig. 8, is half lapped on the frames to support the ribs B, C and D. A similar piece could be put in the other frame, but it is not so necessary as this half when contracted has greater strength. These frames should not be of less thickness than 1⅝ in., thus allowing 1½-in. screws to be used, and when the joints are cut there is a sufficient thickness to ensure rigidity. Care should be taken that the half laps are not too tight. It is rather peculiar that craftsmen who are careful to leave open joints when joining timber edge to edge will persist in making close half laps. Joints on the outside of a frame like A A, Fig. 7, may be close to preserve the correct shape of the frame, but all other joints like B, Fig. 7, where the side grain is enclosed on both sides, should be left 1-16th in. or ⅛ in. open, according to the width of the rails. If this is not done, when the pattern goes into the damp sand the wood will swell, and the frame will warp and alter the shape of the whole job. The frames, when the work is finally shaped off, will be reduced considerably as C, Fig. 11, and the half laps at this end will have to be cut so that an equal joint will be left.


Fig 11

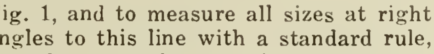
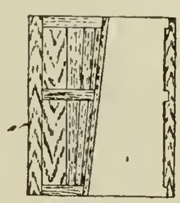


Fig 12


Fig 13


Figs 14 and 15

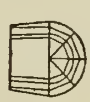


Fig 16

It is unwise, if not impossible to screw the joints C C C, Figs. 7 and 8, but it is not wise to rely upon glue only. The best job is obtained by using lead rivets. They are easily made, and as easily fixed. A piece of 3-16 in. or ¼ in. lead wire is procured, and cut to convenient lengths. When the holes are bored with a shell bit, a plate is placed under the frame, a rivet inserted and hammered down. It is an improvement to countersink the hole on the face of the frame. The lead rivets will either chisel or plane nicely. If lead wire is not handy, wooden pegs should be used. If ¼ in. holes are bored, and the pegs are made ¼ in. square and pointed, they will make a fairly strong job, but they cannot be compared with lead rivets.

The best way to make the boss B, Figs. 3 and 4, is to make grounds and screw staves on to them. Of course the inner side will be cored. An end view showing the construction is shown at Fig. 11. To get the correct shape of the grounds, and the taper of the staves it is advisable to set down an end view like Fig. 16. Three grounds are shown in Fig. 14, and they will probably be sufficient, but an extra one may be put in rather than have them more than 18 ins. apart. If they are too wide apart the lagging will yield. If the grounds are fairly thick, say 2 ins., the lagging need only be ¾ in. or ⅞ in. thick. It is as well to have one stay checked on to the face as seen at A, Fig. 14. A view of this stay is shown at Fig. 15. The circular portion of the barrels should be finished before they are screwed to the frames, but the flat top may be left full so that it can be planed off, when the pattern has been built.

Before the barrels are screwed in place the grounds which will define the shape of the rudder must be got out. They ought to be made of 2 in. timber. The grounds for the bottom half do not present any difficulty, as they may be placed where the sections are made. It would be quite possible when making the grounds, to allow for the ¾ in. covering plates or lagging, as it is sometimes called, to be screwed on top, but the alternative and probably stronger way is to make the grounds the full width, and after they are screwed in position to fit resting pieces for the lagging against them, B, Fig. 9. The great gain by this method is that there is no end grain to tear the mold when the pattern is being drawn.

A combination of the two methods is possible, of course, by making the outer grounds the full width, and reducing the inner ones, so that the lagging can be carried across, the only disadvantage of this being that the grounds cannot be tested with a straight edge as easily as when they are all the same height. The lagging can either be screwed or nailed, and open joints should be made. The barrel may be now screwed into position, and the entire top cleaned off with a plane. There is still the print A to make. It is as well to make a print on both top and bottom for this core. The danger of crushing this core is not very great, and having the top as well as a bottom print simplifies the making of the corebox. It will be seen that the top is set into the sides. A section of the print showing the sides checked for the top is seen in Fig. 18. The principle involved in setting in the top, instead of making it to the outside of the print, and that which determined us to fit the body lagging to the inside of the outer grounds is the same.

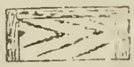
It is never wise to have end grain and side grain together on the side of a mold. Even if the work is well painted and varnished, the side grain will shrink and swell, according as it absorbs moisture or is dried, and if it does not spoil the mold, it involves making up that can be avoided. It is not always possible, however, without involving much labor, to act on this principle, as, for example, a barrel end where staves are carried across to the outside of the grounds, but whenever possible the grain of different thicknesses of timber should not be crossed. Some craftsmen in jointing timber cross them in the belief that this is the best way to prevent the work warping, whereas the more effective way is to joint different thicknesses with the grain running in the same direction but back-to-back; that is, with the annular rings of the different pieces tangent to each other.

The top half being now finished, the bottom half may be proceeded with. The position of the grounds on this half, with the exception of the outer ones A B C, are determined by the shape of the cores. The correct shape of these diagonal grounds can be found by simple projection. Some craftsmen are content in a case of this kind to screw on the outer grounds, and after roughing down the diagonal grounds, to finish them off in place, using a straight edge across the job. This is a clumsy and slow way. The correct shape of the grounds should be drawn on the floor, on the top of the elevation when the timber can be placed on top lines squared up and the height marked. Jointing the points with a steel rule, or a doctor, so as to get a sweep curve is a simple matter.

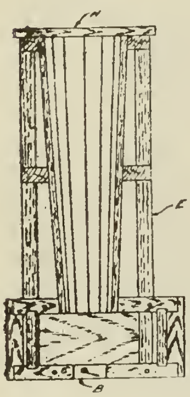
In Fig. 22 the outline of the rudder is shown, and the lines A B, C D, and E F H represent the shapes on the lines A L, K D, and E H respectively. Let us suppose we want to define the shape on the diagonal line P H. At the point R, where the perpendicular line intercepts the diagonal line, T R is drawn square to L O. With R as centre and R T as radius describe an arc and draw the line R K square to P H. The intersection of the arc with the square line gives the correct height of the diagonal line at R. The heights at the other points are obtained similarly. A number of lines parallel to A E must now be drawn. It is customary in practice to number those lines, and it saves confusion when transferring the sizes to the timber, the same numbers being used on the squared lines. With L as a centre and L B as radius describe the arc, and with O as centre and O F as radius, describe another arc. The points N M where those arcs intersect A L and E H are now joined.

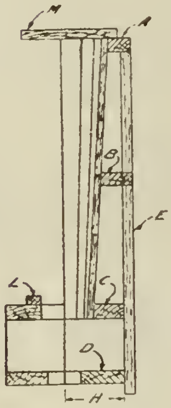
When the core dividing ribs have all been marked off, they will have to be checked where they cross each other. It is better to keep them long and check them, than to carry one through and make a butt joint of the other. The joint frame depends upon these ribs for keeping it true. When they have been screwed in their correct positions, the boss will have to be fixed. It will be necessary to slot the grounds so that the boss will bed on to the frames, and it may be advisable to reduce that portion of the ribs within the boss, so that too great a depth will not require to be cut out of the grounds, thereby unduly weakening them. The print at A will also have to be fitted over the ribs. It is now necessary to screw strips against the ribs, just sufficiently wide to support the prints. Timber about 1 in. thick will suffice, and to prevent the danger of them

—FIG. 17—

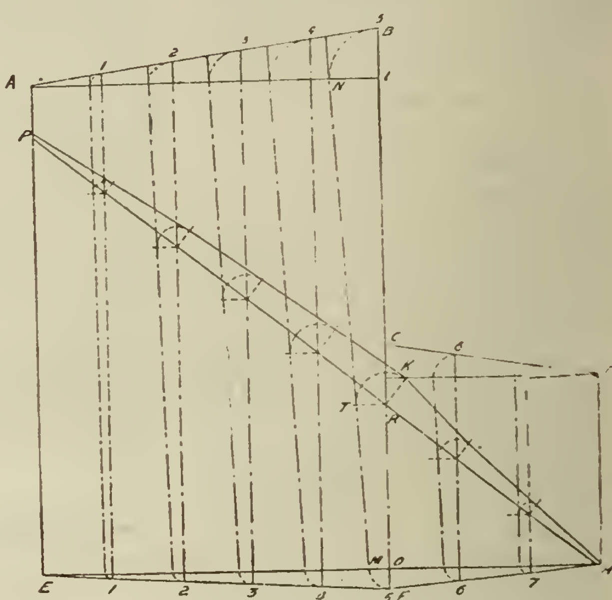


—FIG. 18—





—FIG. 20—



being knocked in when the mold is being rammed, distance pieces may be fitted between the strips and the joint plate. In order to avoid getting an irregular surface, it is better to leave the print supporting strips just above the ribs, so that the whole surface can be planed, the print A being temporarily removed to permit of this being done. To get tne correct shape of the prints, which need only be about ¾ in. thick, it is advisable to set out the shapes on the pattern, lifting the sizes from the floor drawing.

Strips of timber about 3 ins. wide can now be fitted, mitred, and cut to shape. The print strips that are running diagonally will have to be made from thick timber, and after they are bedded down they can be gauged to a parallel thickness. The easiest way of bedding them to the pattern face is to support them on two blocks, resting on the pattern face and with the aid of hermaphrodites to gauge a parallel line. If care is taken very little fitting will be needed. There is still a thin strip, usually a ¼ in. thick, to be put round the pattern faces. It is shown at A, Figs. 3, 4, 5, 6. Rudders are balanced with spruce filling, and the plating which covers the whole faces is kept in position by means of this strip. When the end print E, Figs. 9, 10, is screwed on, the pattern is finished. This print should be about 3 in. thick to give a fair bearance for the core. A view of the finished pattern looking on the top of the boss is shown in Fig. 11 and a view looking on the bottom is shown at Fig. 12.

The coreboxes involve a very considerable amount of labor. It may be here mentioned that the core of the boss is usually rough-turned at the foundry, but sufficient is left for a finishing cut. The reason for this is to ensure that the metal in the boss is sound, Figs. 19, 20 and 21 illustrate the corebox for the boss, Fig. 19 being a plan with the top half of the square box removed, and Fig. 21 is a section on the line A B, Fig. 19. The view Fig. 16 can be again used for getting out the grounds A B C and D, Fig. 21. These grounds should be at least 2 ins. thick. The box will be built on two bottom stays E, which are checked the full thickness into the grounds A and B. It is made narrower so that the bottom can be screwed between and outside of the stays.

The width of all the grounds is, of course, determined by the depth H, Fig. 21. Before building the staves into the grounds, it is well to cut the checks in grounds C for the ends of the square box. It is much easier to take these slots out with a hand or a dimension saw than to cut them with a chisel when the box is half made. After the staves have been screwed in place and the top edges planed off flush with the grounds, the square end can be completed. It is just an ordinary framed box. It must, of course, be made in two, because of the circular holes in the sides, and the top will have to be dowelled to the bottom.

A full corebox might have been made for the whole box, but it is preferable to strickle the top half of the circular core. It simplifies the molder's task when filling, and it is easier for him to make a grid. From the patternshop point of view also it is much cheaper. The strickle necessary is shown in Fig. 20. Some arrangement is necessary to guide the strickle. If it was a parallel core, a side guide and a semi-circular strickle would be the best way for the coremaker, but it is a tapered core, so there is practically no alternative to a long board. Segments L should be screwed to the outside of the square box at one end, and a ground M screwed at the outside of the box at the other end. The strickle will ride on these. When making the bottom grounds and staves for this box the strongest job is obtained by checking the stays into all the grounds alike. This, however, necessitates making the bottom pieces the same thickness as the stays, and consequently very heavy.

As the method of constructing the five lighting coreboxes is the same, it will be sufficient to describe one. All these coreboxes should have bottoms. It is a great convenience to a molder to have a bottom on a corebox. It may cheapen the pattern-making a little not to trouble about bottoms, but the cost of making a bed in the foundry is greater. Fig. 23 shows a section of the topmost box on the line E F, Fig. 1. It differs from the others in having a block to complete the diameter of the box, otherwise the centre core would break through. In getting out these boxes the bottom should be made first.

It will be seen from Fig. 24 that the bottoms are open jointed and all the pieces are tapered. This is better for battening than making it of parallel widths. The sides of the box might be drawn off before being screwed together, but considerable difficulty may be experienced in getting the box quite correct when screwing it together. A more effective way is to make all the sides the width of the deepest point of the box, Fig. 17. This enables the box to be tested on the drawing, and if correct, it is a simple matter to unscrew it, cut the sides to the correct shape, and put it together again. The depth of the box at the various points may be found by calipers; but if the pattern has been accurately made, the depth can be found geometrically in the same way as the dividing ribs for the bottom half of the pattern. The pieces A form the ribs in the top and bottom of the box, and the top pieces will have to be lessened by the coremaker. It will be seen that instead of checking the side, the bars B keep the sides in correct relation to each other. As the coremaker will have to loosen the sides, and draw them away from the core, they should not be screwed from the underside, but by means of blocks or buttons as seen in the sketch. These blocks may be 4 or 5 ins. long and about 2 ins. square.

We shall now consider the alternative method of making the pattern—that is, a pattern which is almost a replica of the casting. The pattern-maker's guiding thought right through the job must be to get the greatest strength possible, and it is difficult to make such a fragile piece of work strongly. Two plates A,

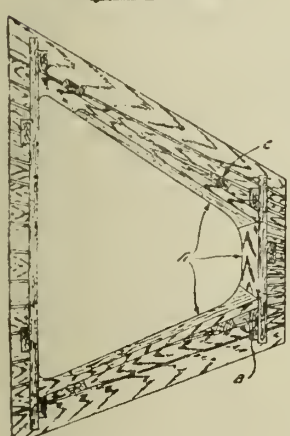


FIG. 24.

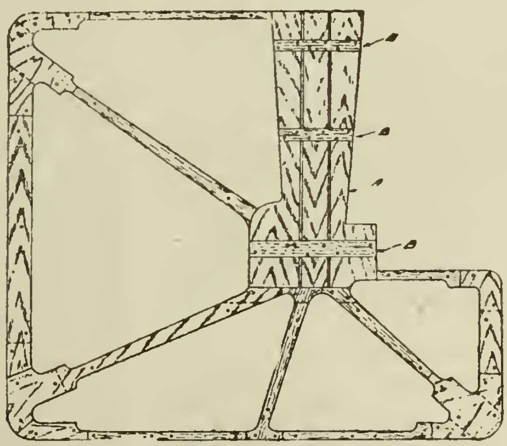


FIG. 25.

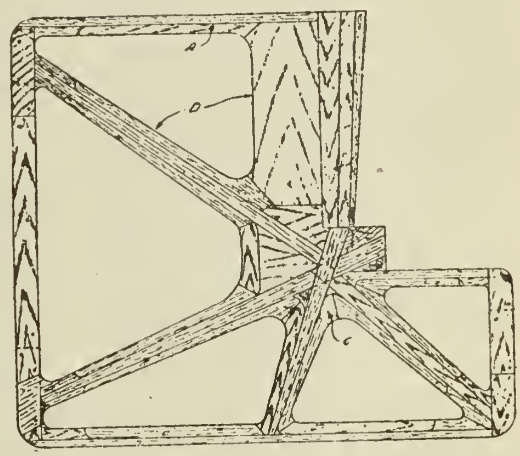


FIG. 26.

Fig. 25, will have to be made on which the boss will sit. Because of the shape it is not advisable to make an open frame as it would not be as strong as a plate. The battens B ought to be let into the plate half the thickness, and if it can be obtained, hard wood such as baywood, teak, sycamore, or maple should be used. The boss for each half will, of course, be a semi-diameter less the thickness of this joint plate. After the boss is screwed to the plate it will be well to place it on the working drawing and build a frame against it to support the ribs that separate the cores. This is a delicate job. It will be readily seen that if the ribs were laid on the floor the full depth, it would be difficult to joint them so that when the pattern is lifted the whole work would be rigid. It is better to build two thicknesses of ¾ in. timber well jointed and screwed. Fig. 25 is a view showing the plate with the box removed, and the skeleton-like groundwork with the joint arranged so as to give the greatest possible strength.

Fig. 26 shows the finished pattern. It will be seen that the boss is carried right through to the outside, but it is really better to keep it back the thickness of the rib A, so that this rib will help to bind the framework better by crossing the plate, and being screwed to the face of the boss. As will be seen from Fig. 26, the ribs are jointed across each other over the bottom plate. The necessity for this is obvious, as it is the chief means of binding the boss portion of the pattern to the outer skeleton. It will be as well now to make up the square shape at the foot of the boss. Solid blocks should be carefully fitted in, glued and screwed. The top print has been left off to show the construction. The fillets C, which should also be carefully fitted, help to keep the ribs rigid. All that remains to be done is to make and screw into position the ribs D. If the work is in a great hurry it is possible to make the two halves at the same time and dowel them afterwards, but generally it is wiser to complete the construction of one half, although, of course, the pieces may all be finished at the same time before the other half is proceeded with. The completed portion can be turned over and the other half built on top of it. If the foundry is a considerable distance from the patternshop, it is wise to screw some edge bars across the pattern. The molder can remove them before he starts his work.

There are so many loose pieces of ribs on the platform that it will save a great deal of trouble when the pattern has to be screwed together again to mark them carefully. Some patternshops are content with lettering loose pieces, but the pressed letters soon rise and cannot be seen, and paint marks are also soon obliterated. A good chisel cut or a V-tool mark is easily seen and will remain distinct as long as the pattern can be used.

About one-third of the world's supply of quicksilver is produced in Spain, the most famous mine being at Almaden, which yields annually between ten and twelve tons of this metal.

WHY CASTINGS HAVE SHRINK HOLES AND WHY THEY ARE HARD

The Following Letters Have Been Received by Canadian Foundryman re Hard and Shrunken Castings

The Editor, CANADIAN FOUNDRYMAN & METAL INDUSTRY NEWS, Toronto.

Dear Sir:—

We note by your paper that you invite your subscribers to ask any questions pertaining to foundry work.

We are at present experiencing a lot of trouble in the way shrink holes appear in our casting. Our melts average about 1,400 pounds of pig iron, 3,900 machine scrap, 700 pounds of gates and sprues.

We use half hard coal and half coke for this melt, 425 pounds of each. Our scrap is of good quality, seemingly about the same as we always used, and the pig iron is No. 1.

Can you tell us where the trouble is?

Editor CANADIAN FOUNDRYMAN.

Dear Sir:—

We manufacture the greater part of the iron castings which we use at our plant here, but of late we, on account of using a large amount of scrap iron, cannot get satisfactory results, as our castings turn out hard, and we cannot drill or bore them easily. Can you suggest anything to remedy this?

The above two letters are samples of what the foundrymen have been up against, and the same answer covers both.

Iron, which is high in sulphur and low in silicon, is invariably hard, and in addition to this, it has a greater tendency to shrink. Sulphur, in particular, causes internal shrink holes, which are difficult to overcome. No matter how carefully iron is melted, and no matter how good the material, the sulphur content will be raised and the silicon content will be lowered, with the result that scrap iron can never be depended on to produce soft castings.

As regards the pig iron, which has been supplied to the foundries of the United States, as well as to Canada during the period of the war, we have but to quote the remarks of a prominent Canadian furnace man on the subject, as follows:—

"The effect of the war on the production of pig iron, both as to quality and quantity, was a very serious one; and this was caused, not by poor quality ore, but by poor quality coke, and this condition was felt both by the producer and melter of pig iron. The coke was very poor in quality, it being dirty, high in sulphur, and, in some instances, totally unfitted for the purpose for which it was used; but we were compelled to use it, as there was no other coke available. This, however, was brought about by high pressure conditions—shortage of good coking coal for one, which induced the coke makers to use any grade they could get their hands on, and the result was coke high in sulphur and very poor in quality.

"The subject was so serious at one time that the producers of pig iron took the matter up with the Fuel Department at Washington, and through it received some relief, although it did not completely overcome the trouble."

We might add in this particular that, as far as Canada is concerned, this trouble is largely eliminated, as the Steel Co. of Canada, Limited, have recently put by-product coke ovens into operation at their Hamilton plant and are now producing coke for blast furnace and foundry purposes equal to any produced on this North American continent.

For the benefit of those who wish to use a large percentage of scrap, and also for those who may have some of this "war-time" pig iron on hand we would suggest the use of 40 lbs. of 15 per cent. ferro-silicon and 10 lbs. of ferro-manganese for each ton of metal charged. This material can be bought in small chunks and should be mixed with the metal in the cupola. While both silicon and manganese are hard, the effect which they have in freeing the combined carbon and in neutralizing the effect of the sulphur makes them valuable in reducing shrinkage and in softening the castings. Ferro-silicon is a by-product and is produced in different Canadian plants, while ferro-manganese is mostly imported from Great Britain. We are advised that the A. C. Leslie Co., Montreal, handle both of these materials. For further information on this subject we would draw your atention to the article on "Ferro-silicon as an Aid to the Iron Foundry," by W. F. Sutherland, in this issue of CANADIAN FOUNDRYMAN.

MORE TROUBLE

Question.—Some few years ago the representative of a supply house called upon us and later we received some aluminum borings from them, which worked very satisfactorily, but upon trying this lately it makes our castings still harder. Can you possibly account for this?

Answer.—If a small amount of aluminum borings is placed in the ladle and the iron tapped into it, it acts as a flux and deoxidizer, making a sounder casting, and by removing the oxygen it should act in a slight way as a softener. The trouble has probably been from the fuel.

Ferro-Silicon As An Aid to the Iron Foundry

A Brief Outline of the Reasons For Its Use and Why it Controls the Quality of the Iron From the Cupola—What it is and How it is Made

By W. F. SUTHERLAND

THE up-to-date foundryman is learning the advantages of accurate control of the cupola, and with the aids which science is offering to-day, a uniform quality of iron can at all times be obtained even from the poorest of scrap and much less pig than was formerly thought possible. Chief among the aids which are at hand for the foundryman is ferro-silicon. Many of its advantages arise from the fact that it exerts a powerful influence upon the state in which the carbon is found in the resulting casting.

Under the usual conditions of fusion iron does not absorb more than 4.6 per cent. of carbon although this percentage increases if a higher temperature is reached. Carbon in cast iron is usually found in both the following forms: Graphite or free carbon; carbon combined as a carbide of iron.

It is the free carbon which gives to grey iron its characteristic grey look, and the flakes of graphite are as the term free indicates, separate from the surrounding mass of iron. Combined carbon on the other hand exists as a definite compound of iron and carbon, and where much of it is present to the exclusion of the free carbon the iron has a whitish appearance and is much harder than the grey iron. Casting iron in chills does not give the carbon a chance to separate in the free form and in consequence the resulting casting, or rather its skin to a variable depth is extremely hard.

Silicon or ferro-silicon, as it is added for convenience transforms a part of the combined carbon into graphite or free carbon and therefore as the amount of silicon increases, the cast iron becomes greyer, softer, and more easily machined. Inversely, when the proportion of silicon in the iron diminishes, the cast iron hardens and becomes hard. This fact places a powerful instrument in the hands of the foundryman for the controlling of his iron.

Manganese on the other hand makes the grain closer, whitens the cast iron and makes it harder. Manganese is often added to control or eliminate the sulphur which is at times present in scrap and pig from various sources. When the proportion of sulphur is too high it is usually eliminated in the furnace by getting a slag which is very rich in lime. or by adding manganese in the form of ferro-manganese or by the adding of a little fluorspar to the charge. This acts on the sulphur and makes the slag more fluid, but at the same time is apt to act on the linings of the furnace.

What Ferro-Silicon Is

Ferro-silicon, as its name indicates, is simply an alloy of iron and silicon. Silicon is a metallic element which is never found in the metallic state in nature but always in combination with other elements, principally oxygen. Iron rust or ore is another example of a combination of a metal and oxygen, and the combination is called an oxide. Silicon exists in this form also, and pure quartz or silica sand is nothing but an oxide of silica.

Ferro-silicon is an alloy which can contain any variable amount of silicon. The amount of silicon present may be roughly judged by the fracture of the surface. When the silicon is less than 20 per cent. the fracture is finely crystalline but somewhat dull; with increasing percentages up to thirty the crystallization is plate-like or slatey and the fracture brighter.

Distinct crystallization is absent in high percentage alloys. High silicon alloys are never used in foundry work and find their place in the steel works. The ferro-silicon used in foundry work is of two grades, 12 to 15 per cent. and the 50 per cent. grade. Pig high in silicon is also used.

How it is Made

Ferro-silicon is made by two methods in the blast furnace and in the electric furnace. In both these processes the silica used must be freed from the oxygen with which it is combined. This is accomplished by means of carbon in the form of coke. The carbon unites with the oxygen to form carbon monoxide gas and leaves the silicon free to alloy with the iron.

The ferro-silicon made in the blast furnace usually contains less than 20 per cent silicon, averaging usually about 15 per cent. The charge consists of iron oxide, siliceous iron ore and coke and the silicon present on the iron ore unites with the iron which is reduced at the same time.

In the electric furnace no iron ore is used, the iron being added in the form of turnings. The mixture used consists of silica sand. the steel or iron turnings and coke. This charge is shovelled into the furnace, which consists of a rectangular box made of thick carbon blocks. This furnace is open at the top and the big carbon electrodes, 20 inches square in some cases, are hung on cables so that they may be raised as the furnace fills up. The current is turned on and the arc is started, the intense heat of the arc rapidly raises charge to a high enough temperature for the coke to seize upon the oxygen in the silica, and the silicon thus freed, alloys with the iron present. Tapping is done at two-hour intervals, and the ferro-silicon is run into iron cars lined with sand or carbon, or into sand moulds in front of the furnace. Because of the highly corrosive action of the metal at the pouring temperature it is never allowed to come into contact with iron moulds or ladles as they would have but a short life.

While ferro-silicon is of great value to the iron foundry it is still more useful to the steel plants. Here it is used for the deoxidation of the steel. The silicon present has a great affinity for the oxygen present and eagerly robs it from the steel. The resulting product is our old friend silica again. SiO_2, which rises to the top and forms part of the slag. Silicon thus promotes soundness in the steel ingot and makes the steel much more dense.

AN OLD FOUNDRYMAN GONE

In the death of Julius E. Waterous, which took place at his home, Bonnythorpe, Brantford, on January 11, the city lost one of its industrial leaders. He was one of the founders of what is now the Waterous Engine Works, one of that city's largest industrial plants, with which he was connected as mechanical manager and vice-president until he organized the Waterous Wire Nail Works, which he successfully conducted until he retired from active business in 1910. He was seventy-five years of age at his death. He is survived by his wife, formerly Miss Annie Van Someren, and two sons, Reginald and Bertram, who have just returned from overseas, where they were connected with the Canadian Artillery. Among the works with which Mr. Waterous was connected were the waterworks plants at Windsor, Orangeville and Lindsay, constructed under his supervision. following the installation of waterworks in his home city, the first in Canada.

IRON THAT CAN BE WHITTLED

It is well known that rapid cooling of hot metals hardens them. That the opposite is true has recently been demonstrated in striking fashion by the General Electric Co. One of their scientists annealed American ingot iron surrounded by hydrogen gas for three hours at a temperature above 1.600 deg. Fahr. The product was very little harder than the softest copper, and can be whittled with a knife.

It takes bonny Scotland, particularly Gloskee and the Clydebank, to turn out the molders. Sandy, though an expert workman, left home and secured employment in "Ole Lunnon." Annoyed at Sandy's persistent references to the good things about Scotland, a fellow workman asked him why he left there, if it was such a wonderful place. "Weel," said Sandy, "in Scotland they are all as clever as myself, but down here I do very well."

Our Future Molders; Where Are They?

By "Observer"

WHY are there so few boys learning molding? This question has suggested itself to me because of the very small number of apprentices in the foundries of the city in which I live. Or does it make any difference whether we have anybody learning this trade or not?

We see plenty of young fellows being apprenticed to almost every other branch of the mechanic arts except the molding. Why? Is it because there will be no demand for skilled molders in the future? Surely not.

Is it because the foremen molders do not care to be bothered with apprentices, knowing that they have no time to devote to this work? In that case the foreman needs an assistant. Or do they feel that they have no particular aptitude for the teaching business; or, it may be that their previous efforts along this line have been but poorly rewarded. The fact remains, however, that some one must do this work if the supply of good, all-round men is to be kept up, and I do not imagine that it is any harder to teach molding than it is to teach pattern making and the machinist trade.

Most of those who are doing the difficult molding at the present time are men of middle age with grown-up sons. Why are these boys not engaged in the same life work as their fathers?

Let us suppose that when the molders of the present retire from active service there are none of any experience to fill their places. Will it really matter? It most certainly will matter. Every business man knows that the industries which give the most stability to a city or a country are those engaged in metal working. Take away the molders and where are you? If we ever hope to be a great country industrially we must keep up the supply of well trained and competent molders.

Of course there may not be any real scarcity at the present time, but there is sure to be later on.

It may be that the introduction of the molding machine has had something to do with the present state of affairs, but it is certain that the molding machine can by no means fill the whole bill.

Across the line they have been up against the same problem and have endeavored to solve it by means of the trade school, but it may be a long time before we are in a position to teach the boys in that way.

Here are a few suggestions which, if put into practice, would go a long way towards inducing suitable young men to learn the trade:

1.—Have shop looking as clean and orderly as possible. This does not mean that the dust must be brushed off the top of every beam once a week, but it does imply that there should be a place for everything and everything in its place.

2.—Be well supplied with labor-saving machinery so that the work will be as light as possible for everybody.

3.—Offer a considerably higher rate per hour, say 75 per cent. more, to apprentice molders than to the other trades.

4.—An apprentice cannot pick up the trade without proper instruction, so let the foreman or his assistant personally direct him.

5.—Advance the apprentice step by step through all the successive stages of the work. You cannot expect to turn out good men if they are kept on simple jobs all the time, so let them have an all-round experience.

6.—Do not be too severe if the apprentice does not make a success of everything the first time; the old hands do not always do that, either.

7.—Let the management take a personal interest in the welfare of the apprentice and let them require a quarterly report from the foreman molder, of the progress of each one.

8.—If an apprentice does not show a liking for the trade after he has been given a good try-out let him have a chance to quit or he will be a disappointment both to himself and the foreman throughout the whole term.

ORGANIZING A FOUNDRY FOR THE ECONOMICAL PRODUCTION OF CASTINGS

There is probably no better posted foundryman and no better writer of foundry literature in America than Paul R. Ramp, of Muskegon, Mich. In his paper on "Organizing a Foundry for the Economical Production of Grey Iron Castings," delivered at the Milwaukee convention, Mr. Ramp voiced the right sentiment for every progressive foundryman to follow. He believes that the time to make a new foundry pay is the first day castings are made in it. He says it is surprising how many foundry foremen trust to luck and their men and get away with it. He gives a host of pointers along equally important lines, all of which are right to the point, but by far his best point is the manner of organizing the foundry. He believes that there should be no useless idlers, and no two men doing the same work. Each man should have his part to perform, and if performed systematically it is surprising how little time is required to do what had been considered a big task. He believes that the superintendent should be employed on account of his usefulness, and should personally do the work which is attached to his office. The different foremen should also work systematically and do things at the right time, thereby giving themselves abundant time which they would not have without system. Outside cost clerks are only a nuisance compared with the foreman's own reports. Mr. Ramp is possibly too enthusiastic in some of his expressions, notably such words as "force," and "drive." Of course, we know he means the work and not the men, but still these words have an awfully harsh sound. Men do not require to be forced or driven where system is in vogue. System was the whole secret of Henry Ford's success. Henry Ford got more work out of his men for a dollar than any other man in the trade, but he did it in a manner which made him popular with the men. If foundrymen and manufacturers generally will give their men a chance to earn their money without being slaves, the average man will be satisfied to do his share. Just one more point, and this time it is the molding machine. There is no better investment than for a jolt ramming machine. One of these machines will do the work of a man in a surprisingly short time, and I am thoroughly in accord with the idea of using them. One of their best points is that they do away with the hard work element on the part of the molder, but still I think Mr. Ramp has become a little over-zealous when he says, "A Corliss engine-bed weighing fifteen tons can be rammed on a jolt machine in a moment. The same work done by hand would require one day's work for two molders and two helpers." I don't know how long Paul's moments are, but I know it only takes a short time for the jolter to do its share, but I cannot see where the jolter takes the place of the two helpers. They have to put the sand in the mold, and if it took two of them all day to do it for the hand men, efficiency will certainly have the drop on them if it can make them keep up to the jolt machine and come in on time when the moment is up. However, I am a staunch advocate of efficiency and system, and also of the molding machine. I consider that the molding machine makes easier work for the molder than hand work does.

British Enterprise in Reconstruction.—In order to minimize waste, the vast bulk of war machinery in Britain is being adapted to the requirements of commerce. The Ministry of Munitions is buying, selling, and transporting machinery from useless districts to productive areas. The new productive scope of the machinery is enormous. The big pre-war firms are not only already engaged in fulfilling pre-war orders for such things as motor lorries, but are also carrying into effect schemes for the production of agricultural machinery, sewing machines, watches, clocks, and cheap motors. The shortage of prism glasses also has led, he says, to the installation of a plant for the manufacture of huge quantities of finer glasses even than the pre-war Zeiss.

A Method of Using Core Sand Without a Binder

Going Back to the Methods of Our Fathers, Mr. Hedley, of the Western Foundry, Has Been Able to Economize in Core Compounds at a Time When Economy Was Most Urgently Required

IN the January issue of the "Pacific Marine Review" was an article entitled, "Core Mixtures for Large Marine Engine Cylinder Cores," by John H. Kellogg, Jr., manager of the Foundrymen's Club of California. We will not undertake to quote the article, which is somewhat lengthy, but will confine ourselves to the one part which most interested us. It reads in part as follows: "At the Western Foundry the committee found that two mixtures were being used to good advantage. The Bayley mixture, which consists of three parts of floor sand, one part of new sand, and one to fourteen of sawdust, worked very wet. This mixture makes a good core which presents no difficulty in the process of removing it from the casting. The core made from this mixture will stand the heat well in large castings such as propeller hubs. The Bayley mixture is being used in tees, ells, hawser pipes, and all general cores." The other mixture was similar to what we are accustomed to, and will require no comment, but the one quoted seemed so worthy of looking into that we took it upon ourselves to communicate with the Western Foundry, San Francisco, of which Mr. John Hedley is the president.

In reply, Mr. Hedley says: "We received from you a few lines with regard to a method of using core-sand without a binder. This idea you have, as I understand it, gathered from the 'Pacific Marine Review.' In the main it is correct, but that no misunderstanding shall exist I thought it might not be amiss to go over it and state exactly what we do.

"This idea of using floor sand is an old one, as in my younger days, when I learned the gentle art of molding, flour was never heard of, so we are only going back to the methods of our fathers. We tried very hard to introduce the old style when binders got so costly, but with very little success, and at our Foremen's Club meetings, had Mr. H. Bayley from Mare Island, on two separate occasions give a talk on cores without a binder, and speaking on his success in this direction caused our boys to sit up and take notice, with the result that we have been very successful in making cores along such lines.

"You had the mixtures all right, three parts floor sand to one part new sand, with one to ten to fourteen of sawdust. This is to be used as wet as possible and rammed firm or even hard, and we have had good success on certain cores such as hawse pipes, steam pipes, pipe fittings, large condenser cores, marine bedplate cores or beds of any description when large massive cores are wanted. This mixture does well as long as it is not necessary to file the cores, but we do not use this mixture for cylinder cores, flour, cordek, or oil in the old way for such like stuff. When the main cores are overlarge for flour we build them up with bricks and loam. The sawdust has no purpose except as a softener after casting is poured; the sawdust then burning to ashes. The purpose of this mixture is on the score of economy in saving flour, etc., in large core making, but is not intended for cylinder port cores, gas engine cores, or anything of this class.

"I judge from your remarks that you are a molder and I hope that this is clear enough, but if not write again and I will be pleased to let you know anything that we are trying.

"'The Pacific Marine Review' is not our paper and I can not say how this article got there. Our paper is 'The Metal Trades,' in which we have a corner called 'Clippings,' and you may look in a day or two for a copy of this paper."
—John Hedley.

The foundry of which Mr. Hedley is president, makes a specialty of grey-iron, semi-steel and bronze castings for propellers, marine engines, gas engines, elevators and general jobbing, and his experience will have considerable weight.

NO MORE WATER SHOULD BE USED IN DAUBING CUPOLA THAN WILL DRY OUT

IT may not be generally understood that water does more harm to the cupola daubing than fire, but if studied in the proper light it will be easily seen. There is no doubt but that the better grades of fire clay and fire sand will last out better than the poorer grades, but neither one will last more than a few minutes if they are wet. To prove what I am trying to argue, one requires but to watch the workings of an ordinary brick yard. In making brick the mud is formed into bricks and dried in the sun, after which it is put in the kiln. When the kiln is completed and ready to be fired, very low fires are started. These fires are just kept from going out, until every particle of steam ceases to rise from the top, which takes about 48 hours. When the steaming is over with, it is known that there is no more moisture in the bricks and that it is safe to heat them red hot and accordingly the fires are built up to the required heat. If the fires had been built up in this manner at first the bricks would have melted and run down. This is precisely what takes place in the cupola. If the blast is put on and there is a particle of moisture in the daubing it will run down at once, no matter how good the material was from which the daubing was made. The fireproof material in it has no chance to be of any use. This will be observed if it should ever be found necessary to drop the bottom shortly after putting on the blast. It would be better to give it a good daubing occasionally and thoroughly dry it, and then just put on a little each heat until it required another good daubing. The heat of the kindling dries it somewhat, but not very deep (as regards material, it certainly pays to use good stuff). I remember a place where these split firebricks were recommended, and the manager bought 500 to try, but the melter pronounced them no good after giving them a trial. The trouble was that the mud which was used was no good, and when the split bricks were bedded into it the mud would not hold up against the heat and as a consequence it gave way and took the bricks with it. I know that the mud was cheap stuff, but even if it had been better and was not dry it would run out from behind and leave the bricks with nothing to hold them. The best is the cheapest in cupola daubing as well as in all things, but it must be given a chance.

PREVENTING THE GROWTH OF CAST IRON

Amongst the fascinating problems which make engineering science at once a most exacting and a most fruitful study the characteristic behaviour of metals under varving conditions provides many curious cases. For example, grey cast iron grows appreciably in volume when exposed to high temperature. This characteristic, which causes much trouble in cast dies, valve seatings and other parts, is believed to be due to internal oxidation caused by the penetration of hot gases into the metal. A remedy recently suggested in England is to eliminate free graphite from the surface of the metal, this being the cause of its porosity. Successful results have been obtained by annealing the parts for several days in iron rust at a temperature of from 1,650 to 1,830 degrees Fahrenheit.

Oil Found at Peace River.—A company drilling for oil near Peace River crossing reports striking oil at a depth of 1,120 feet. At 1,090 feet heavy impregnated sandy shale was encountered, and thirty feet lower, oil of apparent high gravity was found. This is said to be the fourth strike in this district.

Practical Hints for the Brass Founder

THE NOMENCLATURE OF NON-FERROUS ALLOYS

In perusing the contents of a volume of the Transactions of the American Institute of Metals, I came across a very interesting topic of discussion under the heading of, "The Nomenclature of Non-ferrous Alloys," and thinking that it might be of interest to the readers of this most interesting magazine I have endeavored to give it a little consideration. The first thing which the reader has to do in studying this subject is to figure out the meaning of the term "nomenclature," after which it will be plain sailing until he comes to the next snag, "non-ferrous," which, being a double-header, will require double study, as both halves of it seem to have a foreign aspect. When he gets this through his cranium he is all right, excepting for one thing, and that is, "alloy."

After getting this figured out he is in a position to enter into the discussion. Now, to begin with, we might reasonably be expected from what we have said to explain the meaning of the word nomenclature, but it will probably be better to begin at the other end and explain what an alloy is, after which we may work back to the beginning.

An alloy was originally a cheaper or baser metal mixed with a more precious one. Thus, if copper was mixed with gold, the gold would still be considered as a metal, but the copper would be an alloy. In modern times an alloy is a combination of two or more metals, precious or not precious, with the single exception of a mixture containing mercury. This is called an amalgam.

The term non-ferrous is derived from two Latin words, non means not, and ferrous appertains to the Latin word "ferrum," which means iron. A non-ferrous alloy therefore is a combination of metals containing no iron.

Now for "nomenclature." This word occupies an entire column in the dictionary, but boiled down, it simply means a list of names by which any family or set of things is designated. Thus the subject of our discourse, "The Nomenclature of Non-Ferrous Alloys" simply means, the names by which various brass foundry mixtures are known. For instance, Babbitt metal, Dandelion metal, Phosphor-Bronze, Onion's alloy, Kingston's metal, etc. A man by the name of Babbitt conceived the idea involved in the anti-friction alloy for lining journal bearings rather than the combination of metals in the alloy. Now his name is perpetuated in connection with this idea.

An alloy of 1 pound of manganese and 399 pounds of copper, tin and zinc, makes 400 pounds of manganese-bronze.

One pound of phosphorus alloyed with 199 pounds of copper and tin makes 200 pounds phosphor-bronze. All of the long list of nomenclatures or cognomens are simply names by which alloys for different purposes are known, but have very little meaning. Gunmetal and bell metal are the same thing, with the exception that the tin content of a bell is usually increased or decreased to suit the size of the bell, and is generally greater than the tin content of gunmetal.

Muntz metal is just yellow brass, but probably sells at a better price by having a trade name. It is an alloy of copper and zinc, with the zinc ranging from 40 to 45 per cent.

If we abandon these names we have nothing to fall back on excepting brass and bronze. Brass used to be a mixture of copper and zinc, while all other copper alloys were known as bronze, and later on known as red brass if it showed quite a bit of copper. Now comes the information that the brass spoken of in ancient history was either pure copper or else copper and tin.

The most rational conclusion to be arrived at is that we abandon all other names and call all non-ferrous alloys by the name of brass (which we do, excepting at conventions) and then specify what chemical combination we expect it to contain. Such names as gunmetal, and bell metal are entirely incorrect because they are not metals, but alloys.

PLUMBER—A WORKER IN PLUMBUM

How many of us are there who know what a plumber is? or why he is called a plumber. Be it remembered that gas pipe fitters and steam pipe fitters, etc., are not plumbers. A plumber is a man who works in lead fixtures, doing such work as soldering lead pipe, etc. Iron pipe may be crowding in on the lead pipe to a certain extent, but that kind of work is simply pipe fitting. Plumbing properly appertains to lead and nothing else. Now lead is only a nickname. The proper name for this metal is "plumbum," and its chemical symbol is always Pb., and the workers in lead or plumbum were formerly known as "Plumbummers"; but here again a nickname or abbreviation has been worked in, with the result that the name has been haggled down to where it now is. There is no nobler profession than that of plumbumming, and it is about time that people would learn to talk the language correctly and give to these workers their proper name, to which they are justly entitled.

Brass borings should never be put into a dry crucible, but should be added after ingots of metal have been melted to one third of crucible capacity. They should then be submerged below the surface.

HEAVY BRASS CASTINGS

In an article in CANADIAN FOUNDRYMAN a few months ago treating on heavy brass castings, in which mention was made of the brass pillars in Solomon's temple and the Great Bell of Moscow, the latter was described as the heaviest brass casting ever made. This is no doubt true. It might also be of interest to the reader to know the dimensions of this bell, as its enormous proportions will thereby be the more vividly brought to his mind. The bell is 19 feet high, 63 feet 11 inches in circumference, and its greatest thickness is 23 inches; its weight is 432,000 pounds, or 216 net tons. It may have been successfully cast, but it was short lived. It had only been made a short time when a triangular-shaped piece fell out of one side, big enough for a door. It is now used as a church instead of a church bell. This may have been the heaviest brass casting made, and it may not have been. The Colossus of Rhodes had it beat by about 150 tons, but this may not have been all cast in one piece. Some of the stories told about this statue may have been mythology, but its weight was no myth. Rhodes is an island on the coast of Asia Minor, and the Colossus of Rhodes was a brass statue of Apollo, 70 cubits high(which would be considerably more than 100 feet) and was esteemed one of the wonders of the world. It was erected at the Port of Rhodes in honor of the sun by Charles of Lindus, a disciple of Lysippus some 290 years before Christ. It is said to have stood on two moles, a leg being extended on each side of the harbor so that a vessel in full sail could enter between. Like the big bell, it also met with hard luck. It was thrown down by an earthquake about the year 224 B.C. and lay in ruins until the year A.D. 653, which would be 943 years afterwards, when it was taken by the Saracens and sold to a Jew for scrap metal. Its weight was 720,900 pounds, or more than 360 tons, but as we have said, it may have been made in sections; of this we have no authentic knowledge. The Jew used 900 camels to transport it.

OXIDIZING AND DEOXIDIZING

One of the worst nuisances which the brass founder has to contend with is the action of oxygen on the component metals in his mixtures. For instance, if a pot of melted brass is exposed to the open air, the zinc will be attacked and consumed, while the copper will be attacked in a different manner. Copper has what is termed a chemical affinity for oxygen, which implies that oxygen mixes readily with the copper; to deoxidize it is to take out the oxygen. If a mixture of copper and zinc is melted together the zinc has an inclination to deoxidize the copper but is itself wasted. The only successful way is to keep the oxygen away from it. In melting brass it is a good plan to throw a handful of salt into the crucible on top of the metal before it is melted, and on top of this put a covering of charcoal. The charcoal should be smashed up and put through a fine sieve to get rid of the dust, after which it should be put through a half-inch riddle to remove the coarser lumps. The salt will melt as the metal becomes heated and will form a sort of film on the metal, which protects it against the oxygenizing influence of the air or flame. As the mass melts, the salt acts as a deoxidizer and drives any oxygen which has entered into combination to the surface, and the charcoal acts as an absorbent and absorbs it, preventing its return while stirring or pouring.

In pouring brass it is always best to keep the lip close to the gate and keep the gate filled to the top as the copper will oxidize between the lip and the gate. The closer they are together the less chance it has, and by keeping the gate full, the oxygen is kept to the top to a considerable extent.

BISMUTH, TIN AND LEAD

Bismuth is a reddish-white metal. It has considerable lustre, and its structure lamellated. It is so brittle as to be easily reduced to a powder. Its specific gravity is 9.8, and it melts at about 500°F.

Tin is a soft, white metal. Its specific gravity is 7.291, and it melts at a temperature of 440°F.

Lead is one of the softest of metals and is of a bluish-white color. Its specific gravity is 11.4, and it melts at a temperature of 612°F. The mean temperature required to melt these three metals will be seen to be about 517°F; yet if mixed in the proportion of 3 parts lead, 2 parts tin, and 5 parts bismuth, the alloy will melt at a temperature of 197°, or 15° degrees below the boiling point of water, which is 212°. It will thus be seen that lead, which requires a temperature of 612°, and bismuth, which requires 500°, and tin, which requires 440°, if properly mixed, will melt in water, which has not yet begun to boil. This is the fusible alloy used in the plugs for the automatic fire-extinguishing sprinklers.

THOSE BIG COLUMNS AGAIN

Speaking about those big columns which Hiram made for Solomon, it would seem, according to one Pat Dwyer, domiciled over on the lake shore, not this lake but the one on the next step up and on the south side of it at that, that these columns only weighed about ten tons, and he didn't just say whether he meant both of them or just one. However it don't matter what they weighed, they suited Solomon.

Pat also goes on to explain that they were only an inch thick. He means that they were an inch thick everywhere, excepting a little bit at each end. That might go all right where Pat comes from but I don't think that Hiram was that kind of a fellow.

I remember making columns like Pat is accustomed to, with the core shaped like a rolling pin, but then I didn't make the cores. I was as innocent as a mud-turtle and never tumbled until the customer stuck his hand up inside in anticipation of this very thing. But then these were only little things and were so thick (at the ends) that the fellow could hardly get his hand in. In the case of the big ones with the six foot core, that stunt could not have been worked because Solomon would most likely have gone inside and looked around and he would have discovered the fake.

No, those columns were the width of a man's hand at the ends where Solomon measured them and they must have been the same thickness right through.

Solomon was a wise man and would not have any such characters as Pat Dwyer making columns for him.

Hiram was a different kind of a fellow entirely.

A quarter of a grain of lead will render an ounce of gold perfectly brittle, although neither gold or lead are brittle metals.

Next time you are taking off a heat of gold just drop in a little bit of lead, it will make the casting so much easier to break up in case it happens to be bad.

MAKING ZINC STATUES

A subject which I think would be in the line of the brass founders' page, and which might be of interest if not of any further use, is the casting of zinc ornament such as tre frequently seen on the top of coal heaters. These are in the form of human beings standing in different postures and holding different things in their hands. I don't know if there are any made in this country or not. I presume that they are made in Austria or in some such out-of-the-way place. There may also be different ways of making them, but one way which is quite interesting is to have an iron mold similar to what is used by the glass blowers, and of course have it parted wherever required. Instead of blowing glass into it, stand it upside down and have a pop gate in the centre of the bottom, into which the melted zinc is poured. This will make a solid casting, but after it has stood for a short time a hole is punched into the bottom and the whole thing turned over, when the inside, which is still fluid, will run out, leaving a thin shell of the proper outline of the mold. With a little practice so as to learn exactly how long to wait, a casting of any desired thickness can be procured. These goods may not be in demand to such an extent as they have been in the past, but perhaps a new demand can be created for them or for work done in this manner.

Crystalline selenium, in which light produces so remarkable a lessening of electrical resistance, proves to be not the only substances so affected. In the experiments of the United States Bureau of Standards to determine precisely the properties of different materials, such compounds as jamesonite, cylindrite, silver sulphide, bismuthinite, boulangerite, stibnite, and molybdenite showed some change in electrical conductivity with varying light in the same way as the element selenium.

ALUMINIUM ALLOYS.

Aluminium was merely a scientific curiosity a generation ago, the production in 1883 having been but 83 lb.; but it is now one of the most common metals in use, with an annual production of hundreds of thousands of tons. It is most important in its alloys, especially in those with magnesium and copper. The alloy known as magnalium is a series of mixtures containing 10 to 30 per cent. of magnesium; it is silver-white in appearance, strong, ductile, easily cast, takes a fine polish, and has a specific gravity of only 2 to 2.5, somewhat less than that of aluminium itself. With 10 per cent. of magnesium the melting point is between 650 deg. and 750 deg. C. The metal is made harder, more brittle and finer in polish with additions of magnesium up to the practical limit of 30 per cent.; it may be given a dark color by maceration, or it may be nickeled or gilded. Duralumin, with 3.5 to 5.5 per cent. of copper and about 0.5 per cent. each of magnesium and manganese, has greater hardness, tensile strength and ductility than any other aluminium alloy. It takes a high polish and may be easily hardened, but it is given special value by its resistance to the action of sea water, and dilute acids. It is a little heavier than aluminium with a specific gravity of about 2.8. Other alloys similar to magnalium, but adapted to special uses, contain small percentages of nickel, tin, lead and iron.—M.M.

DANGERS OF STORING COAL

Coal deteriorates to a sensible extent upon exposure to the weather, and supplies that are held in storage should therefore be covered by a shed or roof that will afford a proper protection. Coal that is closely confined is likely to grow hot, below the surface, and good ventilation of the bins is therefore desirable, so that the coal may be aerated and cooled as thoroughly as possible. The heating is doubtless due to the slow oxidation of impurities, and under some circumstances it may be rapid and intense enough to set the coal afire—a phenomenon known as "spontaneous ignition." Fires sometimes originate in this way, deep down in a coal pile, and smolder, unsuspected, for a long time. They are often very hard to extinguish. To guard against the indefinite spread of fires in the coal pile, whether they are of spontaneous origin or not, the bunkers should be divided at frequent intervals into entirely separate pockets, by substantial walls of brick or other noncombustible material, especially if coal comes from mines the output of which is known to be especially prone to self-ignition.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries

B. G. NEWTON, Manager.

A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1207 Union Trust Bldg., Telephone Main 3449. Eastern Representative: H. V. Tresidder. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: J. N. Robinson.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 900 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 1147. Boston: C. L. Morton, Room 733, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers, who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. FEBRUARY, 1919 No. 2

PRINCIPAL CONTENTS

What is There For the Foundry?

DURING the reconstruction period, when the country is in a restless, unsettled state, while the manufacturers are doing their utmost to secure their share in the rebuilding of devastated Europe as well as finding future foreign markets for their manufactured goods, the part which the foundryman must play is obviously and necessarily more or less of a waiting game. The foreign markets offer few direct opportunities for the output of a foundry.

While the foundry plays the leading role in the manufacture of all machinery, the orders must first be secured by someone else before being passed on to the foundry, so the best the foundryman can do is to wait and see what is coming his way. Of course when it comes his way it does not hunt him up. He must be wide-awake and watch for it. While Canadian foundrymen perhaps never go abroad to seek a market for unfinished castings, it must not be forgotten that there are people who do. Right here in this Canada of ours there are innumerable locomotive wheels running up and down the track with "Krupp" marked right on them.

The same conditions prevailed in Great Britain before the war, and Britain with all her shipbuilding activities bought her castings from this same Krupp institution.

On another page of this issue is an ably written article by two practical British mechanics (one a pattern maker and the other a molder) treating on this subject, and we think that the contents would be of interest to Canadian foundrymen as well as to British.

While the foundrymen are waiting to see what success the Industrial Commission will have in securing contracts they should not wait in idleness. They should be equipping their foundries preparatory to filling the orders which will invariably come. If Germany supplied Britain with castings there must have been something wrong and if Britain has overcome that something, Canada can overcome it.

Shake off that feeling that we are a second rate people. Don't say we can't compete, because we C-A-N.

An Agreeable Surprise

IT was a pleasant experience which we had a few days ago while on a visit to a neighboring city. While walking down the street we spied a stack projecting through the roof of a building indicating to us that it was a foundry. We secured admittance, just at the time when the molders were waiting for their iron, and found them in a circle around one who was reading a copy of the CANADIAN FOUNDRYMAN. We did not disclose our identity until we heard their comments, but when we heard one say "I wonder where a fellow could get that paper," we tapped him on the shoulder and let him know where he could get it, with the result that we got them all.

Capital and Labor

NO boys! don't ask us to discuss this subject. We are so utterly unfamiliar with Capital and so overly familiar with Labor that any discussion or arguments which we might put forth would of necessity be of such biased nature, so one-sided like a jug handle, that they would not be worth delivering.

Each issue of the CANADIAN FOUNDRYMAN will be better than the one before it from now on until the end of the year. And each year will be better than the one preceding it.

Iron—Cast and Otherwise

IRON—the mainstay of the foundry business, and for that matter one of the principal supports of the business world, is of very ancient origin, having been used in the construction of the earth. We have no definite record of the date when this took place, nor have we any authentic knowledge of the source from whence the supply was drawn, but from what data we have at our command, we deduce the following facts and figures:—"That Tubal Cain operated an iron works of considerable magnitude, with a brass foundry annex, some 5,719 years ago." And that Tubal Cain, being a brother (or rather a half brother) of Noah, probably did the iron work on the ark, but of this we have no proof.

Tubal Cain was presumably the first ironmonger worthy of mention in history, but he may not have had a monopoly of the trade, as the earth had been in a fit state for occupancy for 1,556 years previous to this when Adam took possession, and the inhabitants of the earth, being chiefly tillers of the soil, would require implements, so we may safely infer that the history of the iron industry dates pretty close to the history of the race.

Prices After War Periods

ANYTHING that has a bearing on prices is a matter of interest right now. Eliot A. Kebler, special representative at Pittsburgh of the Matthew Addy Co., has sent to Judge E. H. Gary, chairman United States Steel Corporation, the following statement as to pig iron prices after wars and shortage of pig iron capacity shown by comparison with steel:

ADVANCE IN PIG IRON PRICES AFTER WAR

Russian-Japanese War	
War declared Feb. 10, 1904—Valley Bessemer	$12.64
War ended Sept. 9, 1905—Valley Bessemer	14.95
Price May, 1907—Valley Bessemer	23.28
Spanish War	
Really began January, 1898—Valley Bessemer	$ 9.12
War declared April, 1898—Valley Bessemer	9.66
War ended August, 1898—Valley Bessemer	9.60
Price December, 1900—Valley Bessemer	24.20
Franco-Prussian	
War declared July 10, 1870—No. 1 foundry, Philadelphia	$32.75
War ended May, 1871—No. 1 foundry, Philadelphia	35.50
Price June, 1872—No. 1 foundry, Philadelphia	53.37
Civil War	
October, 1862—No. 1 foundry, Philadelphia	$18.61
August, 1864—No. 1 foundry, Philadelphia (gold basis)	29.44
Average year 1866—No. 1 foundry, Philadelphia	46.61

Of course it is possible to advance all sorts of reasons why the same thing should not work out the same way in the present situation, but against this there is the weight of precedent worked out in cold figures. The record of past performance is worth remembering when making your future plans.

A Creditable Record

THE record made by Canadian shops in the production of munitions can hardly be appreciated by the people of Canada. In years past we have been in the habit of taking it for granted that our industrial efforts would be of secondary importance. We have hardly dared come to the conclusion that as a producing people in an unknown line we could lead the procession.

When it was first proposed that Canada should undertake the production of munitions the manufacturers were inclined to be skeptical. It was something new—the war might end at any time—a lot of new and special purpose machinery was required. In fact it was some time before the more energetic manufacturers had come to the stage where they found that they could make munitions, and make them successfully.

In fact, Canada's effort in munitions was in keeping with the record made at the front by her sons. The number of decorations won on the field of battle tells the story. The figures are complete only up to July 1st, 1918, and the totals would be increased considerably.

Victoria Cross	30
Distinguished Service Order	432
Bar to Distinguished Service Order	18
Military Cross	1,467
Bar to Military Cross	61
Distinguished Conduct Medal	939
Military Medal	6,549
1st Bar to Military Medal	227
2nd Bar to Military Medal	6
Meritorious Service Medal	119
Mentioned in Despatches	2,573
Royal Red Cross	130

Why Is The Kaiser At Large?

AN outraged world should guard carefully against any pussy-footing that seeks to create a "go easy" attitude in dealing with the German nation, especially that part of it responsible for the war.

Now that the war is apparently over there is a decidedly pronounced sentiment toward tossing buckets of mercy on a people utterly undeserving of any consideration.

The German people are not repentant. Had they the power they would unloose their submarines again tomorrow.

The Huns who brought Hell to this earth, who drowned babes and butchered old men, have got to come before the jury of the Allied nations.

A Kaiser at large means trouble. It means plotting and intrigue. It means that one of the grossest miscarriages of justice the world has ever witnessed has been perpetrated. It means that the assassin has sidestepped the noose.

The Allied court should have some very direct sessions with William Hohenzollern. As things stand at present the murderer is still at large.

Speaking of Napoleon

IT'S over a hundred years ago since they fought at Waterloo, and took Napoleon by the snout and told 'im what to do.

You see he had been all puffed up, his head was out of joint—in fact it got so big at last 'twas near the busting point. The folks in them days wouldn't stand no sass from Bonaparte, so they kicked the jumpin' daylights out of his old apple cart.

They chased him round the clover crop and underneath the barn, and planted him out in the sea where he couldn't do no harm.

It's just a way the world has got with nations or with people, it's a mighty dangerous thing to do, this shoutin' from a steeple. As long as folks will stay at home and mind their own affairs, and keep from vexin' others with their high-falutin airs, they'll find this world a happy place chuck full of milk and honey, and peace that Midas couldn't get with all his mint of money.

And they can travel far and near, or stay right on the stubble, and go or vamoose to their taste without a speck of trouble.

But it's quite another thing, by gum, and there's miles of stuff to back it, that there's danger stickin' everywhere when you're searchin' for a racket. You can't go stampin' on pet corns, or jumpin' off the track, for when the deal comes round again they'll cut you from the pack.

It aint no use to buck this rule or put on injured airs —the safest thing for you to do is mind yer own affairs.

—ARK.

Candlemas Day

THE feast of the Purification of the Blessed Virgin, February 2, so called from being celebrated with processions and shows of candles, in commemoration of the words of Simeon, when the infant Jesus was presented in the Temple: "A light to lighten the Gentiles, and the glory of thy people Israel." This was the former conception of the Candlemas Day. The modern view seems to be that if the bear comes out of his winter quarters, and sees enough light from Old Sol to throw a shadow of said Mr. Bear, he crawls back into his hole for another six weeks.

As shadows were in abundance on this year's Candlemas, we may figure on another six weeks' supply of coal before taking down the stove.

THE pork packers are bustin' out in cold sweats because the price of pork is apt to come down to the point where we can once more decorate the pine table with ham and——.

* * *

A WIDOWER is advertising in a Toronto paper, stating that he wants to meet a widow who has some means of her own. That's our idea of a real optimistic optimist.

* * *

THE scrap business has gone to pieces. The first man to spoil the business was the Hun with his scrap of paper. Now the scrap in Europe has petered out and the scrap metal market here is a dead one.

* * *

SOME experts say that the era of lower food and clothing prices is on the way. So be it. Perhaps we'll soon be buying tan boots for $2 a toss and gettin' T-bone steaks for a york shillin'.

PLATING AND POLISHING DEPARTMENT

Executive Common Sense in the Workshop

Some Valuable Pointers Which Should be Carefully Considered in Other Departments as Well as the Plating and Polishing

By ABE WINTERS

STUDYING and working to increase our knowledge of the principles of electroplating, or striving to effect economies in the various operations necessary to the production of a finished product are very praiseworthy characteristics of the progressive foreman, but there are some other points which should receive attention, and at this time when the rush occasioned by the war has ceased and we can calmly devote more time and thought to the essentials of advancement the following compilation of common sense remarks may serve to help us greet the future with new ambitions and a keener realization of our respective duties toward reconstruction.

Before proceeding further, suppose we analyze the word progressive. Webster defines the word as "moving forward, advancing, improving; working for or endeavoring to secure advancement." A writer in "Forbes' Magazine" defines progressiveness as "looking forward intelligently, looking within critically, and moving on incessantly." In order to progress, the manager, superintendent or foreman of any industrial plant must give due consideration daily to these three essentials. Dr. H. A. Bruce says: "The most efficient manager is not the one who can drive men most vigorously. He is the one who can lead men most skillfully. Men are not cattle, though many managers handle them as if they were. They have rights which must be respected, and the best managers appreciate this. But if brutality is a serious defect in managers, egotism is a fatal one. The egotist never learns from his errors. Having marked out a course for himself, he persists in it, even though evidence rapidly masses to prove that he is on the way to disaster. Ability to keep on learning, ability to recognize mistakes and correct them, is assuredly magic in managerial efficiency. So is ability to select assistants wisely. This means that the manager must not only know talent when he sees it, but must be free from the defects of envy, which might prompt him to try to keep men of talent in obscurity. To know men, to respect the rights of men, to be able to develop in men the sentiment of loyalty, to keep in a learnable mood, to be willing and able to correct mistakes—such are a few of the attributes of the truly efficient manager."

This writer further refers to leadership as follows: "You must be an enthusiast, you must truly love your work, to become magnetic and to become a leader. Cultivate belief in yourself and cultivate intense interest in your work; energize yourself, energize your mind, and energize your body. How have the magnetic leaders of all generations energized themselves? By enthusiasm. They have set themselves certain tasks to accomplish, and have attacked enthusiastically. They have not gone at them in any half-hearted spirit. They have said to themselves, in effect: 'My work is the most important and the most delightful thing in the world. I want to do it just as well as I possibly can.' And because they have worked in this spirit they have found it possible not only to work well, but to do an amazing amount of work. Because they have been enthusiasts they have drawn others to them and have led others."

We are in possession of a circular letter which we understand was originally intended for the departmental heads of the Standard Oil Company. The ten rules therein presented will apply to the executives of practically all industrial plants, and form a very commendable list of common sense rules. The rules are given here with illustrative comments by present writer, and quotations from the works of H. A. Bruce and others.

"Rule 1.—Be fair, have no favorites and no scapegoats. A foreman has to act as judge many times every day; therefore he must be just."

Abraham Lincoln once remarked that "the length of a man's leg should be just long enough to reach from his body to the ground." Likewise the foreman's deductions after considering a problem or grievance should be just as concise and consistent as possible to make it. Teling a yarn to illustrate a verdict is not necessary. Be emphatic but courteous and unbiased by petty prejudices.

"Rule. 2.—Make few promises and keep them. A foreman must be exact in this particular. Sometimes a foreman forgets that his job requires a high standard of truth and honor."

"Rule 3.—Don't waste anger—use it. Anger is valuable and should not be used carelessly. Keep your most forceful language for special occasions."

A foreman who indulges in profanity or harsh words while reproving an employee does not always obtain greater efficiency from the employee by so doing. Be strict, but be reasonable, and above all be certain you are right before you speak. Then be a man and hold your proper position with reference to the matter, do not try to smooth the affair over by childish familiarity, or failure to enforce the correct performance of the duty in question. If you do you will spoil the effect of the lesson previously given.

"Rule 4.—Always hear the other side. Never blame a workman until he has been given a chance to give his point of view."

Possibly you have failed to properly instruct the workman, perhaps he has not grasped the true meaning of an order or request. His intention may have been of the very best, and it is possible that the mistake may be the source of an improvement, and it may mean a ray of light on an old cobweb-covered idea—if your frame of mind will permit the light to enter.

"Rule 5.—Don't hold spite—forgive. When you have had to scold a worker, go to him later and show him his faults in a friendly way."

Some men will take a "calling down" and profit by it, others resent a stern reprimand and nurse the recollection of a trifling grievance until it assumes, in their estimation, very hideous proportions. Study the temperament of the employee as you come in contact with him daily, and if he is really worth while, exercise tact and common sense in training them for the duties you find them best suited for. Do not, under any circumstances hold spite toward a worker, such actions will decrease your self-respect, lessen your personal magnetism, and eventually change your whole aspect of life and your attitude toward mankind in general.

"Rule 6.—Never show discouragement. Never let yourself be beaten. A foreman must have perseverance and the 'never say die' spirit.

If it be a new finish, or a difficult casting you wish to produce, and things go wrong, don't let the men see that you are annoyed. Don't start smashing the fixtures or filling the atmosphere with spontaneous oratory with reference to something in the form of hard luck. "There's a reason" why you failed. Get it and set about your task cheerfully but with determination to win, and soon you will find you have grown to be a master of your work and a genius in the eyes of your fellow-workers.

"Rule 7.—Notice good work as well as bad. Let the workers see that you can appreciate as well as condemn."

Possibly you owe your present position to the fact that someone noticed your ability to do good work—very well, give the fellow who is following you the same consideration you found to be gratifying during your earlier experience. If you are worthy the position you occupy, whether it be as manager, superintendent, or foreman, you will not ignore the honest efforts of those who look to you for guidance in their daily routine of toil. Thousands of men and women have been changed from willing, obedient workers to indifferent drones or troublesome agitators as the indirect result of continued neglect in this regard on the part of some foreman or executive of greater authority.

"Rule 8.—Watch for special ability. Take a keen human interest in your workers. Put each one where he can do his best."

Some men imagine that merely looking wise, while receiving instructions, will convince the foreman that they are interested and alert for pointers, but the fellow who really proves his wisdom is the one who thinks and acts in accordance with a well-defined purpose. Ideas are of no avail unless you use them. Do your work well to-day and it will not cause you worry tomorrow—are comments you may well remember. Our observations cause us to believe that the man who never makes a mistake does little else. Some men are natural-born expert slackers on any job. 'Tis said that a man named Dodgin was appointed foreman in a foundry; his name was not known to all the employees. One day, while on his rounds, he came upon two men sitting in a corner smoking, and stopped near them. "Who are you?" asked one of the smokers. "I'm Dodgin, the new foreman," he answered. "So are we," replied the smokers, "sit down and have a smoke." Nearly every factory to-day harbors one or more such creatures. Frequently they are troublesome cowards; sometimes inoffensive as far as speech, but always a bad example for the conscientious worker. He occupies a position which could either be done away with or which could be filled by a man worth while. Put the drones on piecework and the most then make good or vacate the premises. Possibly you have a man sweeping up who would make an ideal plater or molder if you trained him properly, and it might be to your advantage to make the change now.

"Rule 9.—Take your full share of the blame. This is the most difficult of all. The foreman who can share both blame and praise with his workers has discovered the secret of managing men."

In commercial electro-plating or polishing, as well as in general foundry practice, there are innumerable opportunities for the foreman to place the blame on an innocent worker and save himself, but the man who is guilty of such meanness is, indeed, a mean man. If the copper solution is unbalanced, or blistered deposits are common because you neglect the solutions, do not blame the operator. No doubt he has some horse-sense and could tell you a thing or two about your share in the cause of the trouble. Have you ever approached a workman who has been the innocent producer of inferior work, and in a friendly manner told him not to worry, the blame was on yourself because of your neglect or thoughtlessness with regard to certain duties governing his output? If you have never had occasion to do this, you are fortunate. If, on the other hand, you have had the opportunity and failed to use it, you have missed something. You have side-stepped a chance to prove your manliness. Try it and note the change in your influence over the men. If you are really big enough to be a manager, superintendent, or foreman, get up and lead your men, spineless "snobs" were never popular in executive positions.

"Rule 10.—Prevent accidents. Educate or eliminate the careless man. The good foreman is known by his men."

Accidents usually occur quickly and are very often serious. New men should be carefully instructed as to the character of the dangers in their way. Women should receive special attention and repeated reminders in order to avoid violation of given rules governing the operation of mechanical or electro-mechanical apparatus. In the polishing department extra care should be given the use of emery wheels, a careless worker may endanger the lives of several by using an unsound wheel or a stone out of balance. The skilful handling of the various articles during the operation of grinding, polishing, and buffing is essential to personal safety. Don't omit emphatic reference to "safety first" when instructing a novice.

Initiative

"Have you a clear idea of what initiative means? Quick thinking, intelligent planning, decisive acting, constitute initiative. Confronted in your daily work by unexpected problems, how do you react to them? Do you give alert thought to the devising of methods to get more satisfactory results, or are you content with accurately following directions given you? To be able to follow directions accurately is itself a good thing, but it is far better to be able to originate improvements. Then you are an initiator, not merely an imitator. Growth in power of initiative is largely, though not wholly, a matter of practice in constructive thinking. Study the work you now are doing with reference both to methods and to results. Ask yourself if there is not some way in which of your own accord you can effect improvements. Do not try to achieve too much at once. Be satisfied at first with working out a betterment in some detail, however small, then promptly act to realize that betterment. The expected improvement may turn out to be no improvement at all. Do not let that discourage you." With reference to employers, Dr. Bruce continues: "You have fallen into an unfortunate habit of railing and sneering at your employer; you describe him as arrogant, selfish, indifferent to your welfare, graspingly intent on grinding you down. Possibly he is all of these things. In that case I advise you to find another employer as quickly as you can. But you say all employers are alike. They differ only in degrees of greed or inhumanity. If that really is your belief, brother, I urge you to settle down and do some hard thinking. You are blinded by prejudice and class hatred; you are in a dangerous frame of mind, dangerous particularly to yourself. Shift the centre of your attention from your employer to your work, and the chances are you will work so much better that the employer you now criticize will give you more responsible duties at better pay. Unless your employer is a knave or a fool—and the average employer is neither a knave or a fool—he is bound to treat you fairly, if only from self-seeking motives. And appreciating that it is to his interest to safeguard your efficiency by safeguarding your health, he will see to it that your working place is sanitary, etc.

"Recent events with their insistence on maximum production have compelled increased attention to the subject of industrial fatigue. Improvements in ventilating devices have been shown to be greatly helpful in postponing industrial fatigue. Given a continuous supply of fresh air, workers have invariably increased and bettered their output. Experiments and observations have brought out clearly the direct relation that exist between the workers' attitude toward his work and the rapidity or slowness with which that work fatigues him. When means are taken to get the worker really interested in what he is doing even the hardest work becomes less tiring. When he is allowed to fall into a mood of indifference he tires more rapidly, no matter what the character of the work. The more that facts like these become generally known and applied the better will it be for employers of labor and for those employed by him.

The Bully

"Some day business men generally will awake to the fact that the bully is an unmitigated nuisance in industry—and more than a nuisance. He is a blight on the efficiency of any establishment in which he works. The evil-tongued and mean minded factatum functions as a human whif. He is never at a loss for a word that stings. Verbally he lashes those under him to ceaseless activity. All of which the employer may not merely tolerate but actually approve. Delusively he imagines that it is indispensible to speeding up and maintaining discipline. Yet as a matter of fact analysis always would show that it does more harm than good. Like worry—which indeed is often a direct product of bullying, it affects unfavorably the functioning of every bodily organ and process. It weakens the mental faculties necessary to good work. It hastens the coming of fatigue. Moreover, there is this fact which all employers will do well to remember: A man who bullies is always an inferior man. He has serious defects of which he is more or less conscious, and which he instinctively endeavors to cover up by lording it over those subordinate to him. Properly understood, therefore, his bullying is a confession of weakness. Of itself it is a danger signal to warn employers that the quicker they get rid of the bully—or persuade him to ascertain and overcome the cause of his bullying—the better it will be for their business interests."

Lunch Hour Jottings

The following notes were selected from many contained in the notebook of a successful foreman.

Gumption, grit and go are three good elements that most any man can acquire if he will only strive hard enough and long enough.

Many a good sample of plating is spoiled by a poor job of buffing, occasionally poor plating is saved by skilful buffing.

The amount of work you get through a plating bath is one thing, and the way it looks or wears when you get it through is another, and often a more important consideration than the first.

Sometimes a foreman plater gets bossy just to show that he can, and at other times because an incompetent helper makes it necessary. In the latter case it might be a good idea to change the tactics and get a new helper.

Nothing has ever been plated so well it could not be done better, nor so badly that it might not have been worse. A poor suction system is better than none, but a good one is the best investment.

It takes a good man to prepare a perfectly efficient solution from a new formula when orders are piling up.

Have you ever stopped to think that maybe you are losing electric current through unseen small leaks? An electric leak through a steam coil may not attract as much attention as an overheated cleaning solution but it generally wastes more money in the long run.

A single drop of oil may ruin a whole batch of work. Men who are not well balanced are like machines that are not in balance—they make a lot of noise.

Continually complaining about a poor solution does not improve the deposit, nor the helper's attitude toward the condition.

Maybe the foreman can think better by sitting down in the factory, but it is not a good example to set for the others with thinking tendencies. If your thoughts weigh too heavily for you to stand up, go to the office and sit down.

It doesn't take a weak cleaning solution long to eat up in time the price of enough compound to make it splendidly efficient.

The giving of information creates a vacuum which tends to suck in more—if the intake isn't clogged by too much conceit.

Grinding and polishing lathes put in dark corners furnish very good settings for the display of sparks but there is little else in favor of such a location, while much could be said against it.

The man who repeatedly asks his employer for an increase in pay may get ahead quickest, but the man who is advanced without asking for it generally rises highest and stays longer.

Thomas A. Edison is credited with saying that real genius is made up of three parts inspiration and ninety-seven parts perspiration.

Your success may not depend so much upon what you can do yourself as upon what you can get the employees to do for you.

Spoiled work and an exhausted nickel solution are often found in the same tank.

It's all right to ride a hobby if you know where to get off.

Even some lazy men may get busy, but the trouble is they don't keep busy.

If you gave a little more attention to preventing waste of time and material, there would not be the need of so much effort to save the results of carelessness.

Sometimes a foreman plater has the making of a good shop superintendent in him but he rarely gets made.

The good appearance of electro-plated products is essential and the good appearance of an electro-plating department should be equally as essential.

Putting an overload on a dynamo is a good way to start trouble.

Remember there are two ways of working "as if you owned the shop," and the difference between them marks the distinction between the "officious" and the "efficient" man.

Doing poor work because it does not pay much is just what keeps thousands of young workers from getting on in any position. Small pay is no excuse for doing half work or slovenly work. The pay one receives should have nothing to do with the quality of his work. The work should be a matter of conscience. It is a question of character, not of remuneration. A person has no right to demoralize his own character by doing slovenly or poorly finished work simply because it does not pay much. The way one does his work enters into the very fibre of his character. It is a matter of conscience and no man can afford to sell himself because his salary is meagre.

Questions and Answers

Question.—In preparing our product for nickel-plating, we use an electric cleaner, a solution of prepared cleaning compound operated by a current of electricity of about 6 volts pressure. At frequent intervals we experience considerable difficulty from blistered deposits. The article is steel, we clean it and transfer it directly to the copper solution; then rinse and nickel-plate. The blisters form in the copper solution and usually are found on lower portion of the work. We reduced the voltage, but the trouble continues. Kindly advise us as to your opinion regarding the cause of the blisters.

Answer.—Evidently you are using a contaminated cleaning solution, or one which requires the removal of the heavy liquid by siphon after settling over night. Naturally, much depends on the nature of the cleaning compound. Some weak cleaning solutions are productive of films when operated by an electric current. If your solution is old, remove the lower portion, fill the tank with water, heat to 212 degrees, and dissolve sufficient cleaning compound in it to make its action quick and its current-carrying capacity great enough to yield a vigorous evolution of hydrogen at the cathode. Suspend the work in the solution only long enough to remove the grease or oil from the surface of the steel. Any cleaning previous to electro-plating is most effective, when done quickly. If a test indicates improved results, proceed in this manner. If, however, the blisters continue to form, we advise the use of a weak sulphuric acid dip direct from the cleaner; then rinse and swill in a strong cyanide solution before placing in the copper solution. We do not encourage the use of any cleaning compound which requires the electric current for a period exceeding 1 minute to remove ordinary grease or oil.

* * *

Question.—We wish to request a suggestion from you relative to an operation in our polishing department. A sheet steel cup, which is part of one of our machines, is first dip-soldered; then a flange is hand-soldered to the cup, a polishing operation follows, and we find the present method rather expensive, as the flange interferes with the use of a polishing wheel to good advantage. Frequently three and four wheel operations are necessary to finish the cup properly. Do you think it possible to simplify the process and reduce the cost of polishing?

Answer.—By sheet steel, we assume you mean cold rolled steel, and naturally expect it to be of a superior quality if used in your well-known product. To produce a polished surface, free from solder on a dip-soldered piece of raw sheet steel, is naturally more difficult than to merely remove the solder from a polished steel surface. Therefore, the more logical method would be to polish the cup and flange as usual with fine emery, or grease wheel, wash, and dip-solder the cup; attach the flange and finish the whole by treatment with a circular fibre brush. The brush removes the solder very effectively and quickly. The steel surface is exposed in a finished condition, with joints, seams, etc., in better condition than would be possible by reversing the operations. A certain amount of care is required in the soldering operations to avoid surplus metal being left for removal by the brush. A fibre brush will be found to outwear at least two Tampico brushes on this class of work, and the steel will be cleaned easier. Use tripoli on the brush; emery cake is not necessary, and is more expensive, owing to waste.

AN OPEN LETTER TO THE MOLDERS

By George Paul

As a practical molder of many years' experience, I consider it a privilege as well as a duty to give my fellow-workmen a few words, not of advice, but of my opinion, and if it can be accepted as advice, all right, but if not, why, no harm is done. What I wish to speak about is "Modern Improvements in the Foundry."

During my many years in the shop I have heard molders cursing the molding machine and cursing the laborers, and in reality cursing everything in connection with the business.

Now what does it all mean? We all know that there is a lot of hard work and dirty work about a foundry, but do the molders try to improve matters? Supposing the molders came to work in the morning and found the shop cleaned up like a respectable workshop should be, and found the sand heaps all cut up in good shape to begin molding, would it not be a more cheerful outlook than if he had to lug out a lot of hot, dirty castings and get his floor ready himself? Now, supposing he worked at his trade all day and then walked out and let other men pour off his floor and put it in the shape in which he found it in the morning, wouldn't that be nicer than pouring it himself? But no, he thinks the laborer is cutting him out of his job, yet he curses the job, and curses himself for learning it. Now, to continue along this line. Supposing the sand is ready in the morning and the molder starts his first mold; when he has it ready isn't it easier to ram it with a compressed-air rammer than to pound it with a hand rammer? Is it not easier to pull a small lever or turn a small hand-wheel and see the mold jolt itself, or see a pneumatic squeezer do the work? But no, the machine is beating him out of his job. Now supposing when the mold is rammed up, which is the most desirable, to square himself away like a human derrick and lift it off, or to touch a button and see an electric or a pneumatic hoist shoot it off? Why, the back-bone of course.

Now, supposing it is the molder's lot to pour his own work; is it better to lug the iron from the cupola, or have it brought; and if brought, is it better to pour it from hand ladles or with a device such as was shown in last month's CANADIAN FOUNDRYMAN?

Now, boys, I am on your side, and I want everything to be for the best for you as well as for myself, but I want to tell you that the molding machine has come amongst us, and it has come to stay, and if you refuse to run it someone else will be found who will, and you will be defeating yourself and the object which you tried to protect, viz., keeping the work for the molders instead of the laborers. And from what I have seen of it a machine operator does not have to work as hard as the molder who humps himself upon the floor and lifts and lugs himself to pieces all day long. Machinery met with the same opposition in every line, and no matter how much opposition it meets with in the foundry it will win.

My suggestion would be to encourage the idea of having a night gang do everything but the molding, and during the day-time have machinery do as much of the work as possible. Get away from the notion that you are beating yourself out of a job, because you are not. You are, on the contrary, bringing yourself work which would otherwise be done in other lands and shipped into Canada. Increasing the output, or increasing each man's production does not throw men out of employment, it increases the demand and keeps men employed. Of course it takes a lot of different kinds of people to make up a world, and it would not do to all be machine operators. There will always be some bench and floor jobs, so don't knock the machine or anything which tends to bring the foundry out of the mire, and place it on a par with other trades. A sand sifter or sand mixer, or anything which saves hand work should be encouraged, so don't strive to keep the foundry as a second rate occupation.

THE FOUNDRY FOREMAN

The man who has charge of the foundry, let him go by the name of foreman, superintendent, gaffer, or boss, it matters not. If he is the man who is in charge of the place he should be termed the foreman. The word fore means first, or front, and the foreman is the man who is before or in advance of all others, either in authority or in any other respect, in all matters appertaining to the job over which he is in charge. A name such as superintendent should be expected to attach to one who watched the progress of the work being done, and saw to it that the resultant castings were as ordered. The superintendent would naturally have authority over the foreman in the matter of telling the foreman what work should be done, but beyond that his authority should cease, providing the work is coming along all right.

Take for instance a manufacturing company turning out a line of goods where machinists, blacksmiths, boilermakers, carpenters, painters, patternmakers, and molders are employed, how are they going to get the maximum out of each department? Is it by having a general superintendant who has charge of all the departments and a spy in each department, or is it by having a thorough executive man for a superintendent and a thorough mechanic in charge of each of the departments? Common sense should dictate the latter, but such is not always the case. Too often the superintendent, who is not a molder at all, considers it his duty to interfere with the working of the foundry, even to dictating to the melter how he shall charge the cupola. In such a case it would be reasonable to argue that the foreman was only a pensioner. If he draws pay and the superintendent runs the shop, what is the foreman for? A more logical way would seem to be to have as superintendent a first-class machinist, one who knew when a casting was right and when it was not, and then have a good educated foundryman in charge of the foundry, so that the castings would be right. How can a machinist be expected to understand melting iron, and forging, and boiler-making, etc.? If he is mixing into these things he is only a second-rate machinist. Too low an estimate is generally placed on the amount of ability required to work in a foundry, let alone take charge. If manufacturers would give more encouragement to molders to educate themselves for foremen they would get better results out of their investments, but no self-respecting man wants to be holding a position as foreman and have his men hear him being dictated to by someone who is not a molder or foundryman of any description.

RENDERING CONCRETE-WEARING SURFACES NON-SLIPPING

Floor surfaces are usually rendered non-slipping by means of grooving, and many other forms of indentation, usually made by means of metal stamps or brass rollers, having studs or channels on their revolving surfaces. There are, however, occasions when these expedients are not possible, and it is then that the use of emery can be put to good advantage.

Emery is manufactured in various grades, but that known as flour emery is principally used for concrete steps and landings, while a granular form is used chiefly for gradient concrete surfaces.

It is quite unnecessary and wasteful to mix emery throughout the whole thickness of the concrete. Such surfaces are usually topped with at least one inch of granolithic concrete, through which the emery flour or coarser-grained emery is mixed. Steps, for the sake of appearance, are usually trowelled smooth; other surfaces may be left from the straightedge, although, should the occasion arise, granular emery may be sprinkled over the soft concrete surface, and slightly pressed in flush with trowel or handfloat. One pound of emery flour mixed with two parts granite, half pail of granite-sand, and one of cement, mixed thoroughly in the dry state before wetting, will, in an ordinary case, be successful.—M. E.

ELECTRIC FURNACE INSTALLATION

The Electric Furnace Company, Alliance, Ohio, has just closed a contract with the Standard Roller Bearing Company, Philadelphia, for 190 kw. continuous, automatic, heat-treating equipment.

The set consists of one 150 kw. electric furnace for hardening and one 40 kw. electric heated oil drawing bath. There is supplied, in addition, an oil-quench bath located between the furnace and the electric-heated, oil drawing bath.

Material, which consists of alloy steel balls and ball races, is automatically handled through the furnaces, quench, and drawing baths in metal baskets.

NEW AND IMPROVED EQUIPMENT

A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

A DIRECT DRAW ROLL-OVER JOLT FOUNDRY MOLDING MACHINE

By Frank C. Perkins

The accompanying illustration, Fig. 1, shows a direct draw roll-over jolt molding machine, while Fig. 2 shows various cores made on this unique device. It is stated that this efficient molding machine has trunnions supporting the flask or core-box, which can be quickly adjusted to flasks from 10 to 32 inches outside length, and any width up to 24 inches, maximum pattern draw of 10 inches. One cylinder is used for both jolting mold and drawing pattern.

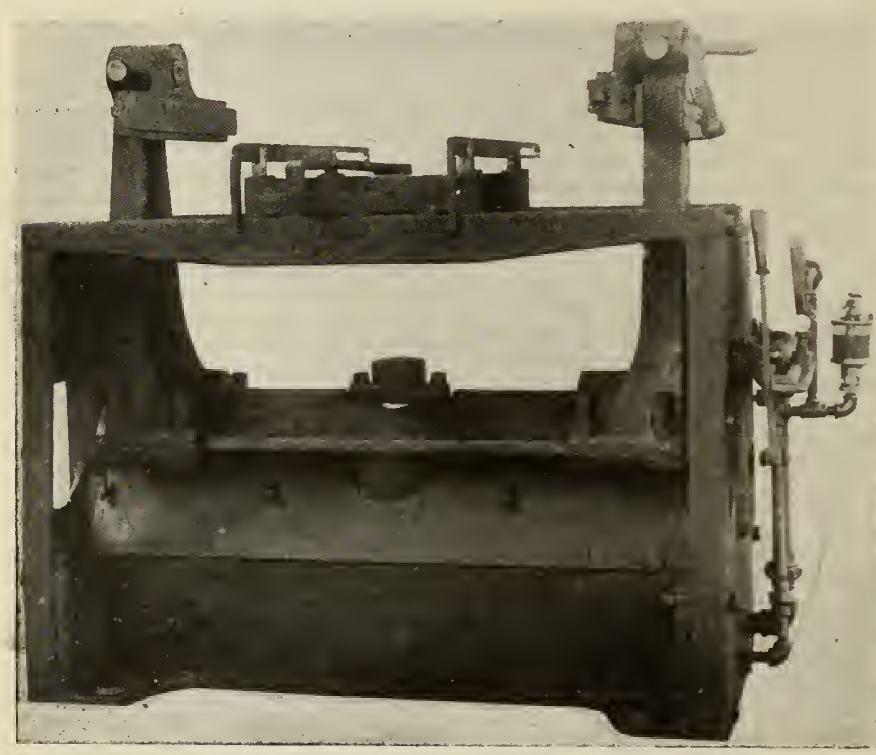


FIG. 1. DIRECT DRAW ROLL-OVER JOLT MOLDING MACHINE.

The mold is easily rolled over by hand, as it revolves on an axis passing near its centre of gravity. While drawing patterns, the mold is held in perfect alignment with pattern by simple lock device. One man handles the core boxes easily and accurately. The table is equipped with an automatic four-pin levelling device, and one lever locks all four pins in one operation.

It will be seen that the flask rests on sliding steel arms, enabling the mold to be drawn out clear of table and easily removed. The easy roll-over and direct accurate draw of pattern makes this a most efficient machine for small, deep castings used in automobile and similar work. The machine is used with great success for making piston rings, pistons, cylinders, crank-cases, flywheels, brake-drums, crankcase cores and jacket-cores, and it is said to be equally valuable in the core-room or foundry, and means economy of time and labor and increased quantity and quality of work.

THE JOLT RAMMING MACHINE

By J. B. Lloyd

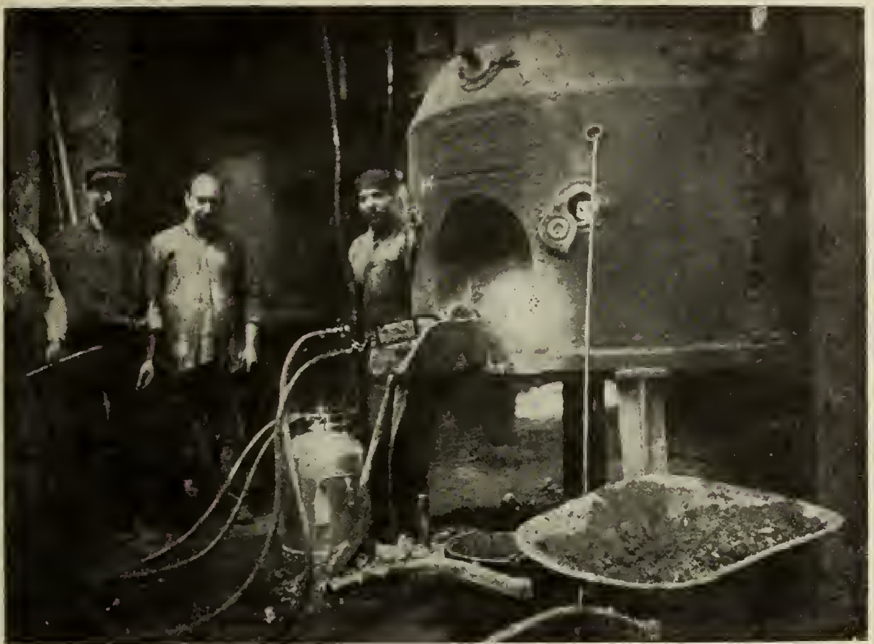
Jolt ramming machines are undoubtedly foremost as labor savers in the foundry as well as money savers. Innumerable jobs may be done on a jolter without venting which would otherwise blow even if vented. One great source of trouble in molding is the smooth surface which is left wherever the rammer has been. These smooth spots cause the vent a lot of trouble in escaping. By the use of the jolter no rammer marks are left and the vent escapes readily. In watching a power jolter in operation a person is apt to be misled with the idea that it is making the mold too hard. This idea is formed because the unthinking spectator believes that the jar of the machine affects the sand. Such is not the case. The weight of the sand is all there is to contend with. The sand lies loose in the mold and as the table of the machine jars against the bottom the sand of course keeps up the momentum with the result that it penetrates every nook and corner, making a firm compact mass, plenty hard enough but not too hard. The roll-over and drawing attachment is valuable for the reason that there is no possible chance for the pattern to get out of level, and no chance for it to move. Patterns drawn by machine are always drawn properly, whereas hand drawing is a very diffiicult matter for a practical workman. The advantage of rolling over by machine should require no arguments to convince the man who has rolled molds over by hand.

LIGHTING THE CUPOLA WITH A PORTABLE OIL BURNER

By Frank C. Perkins

The accompanying illustration, Fig. 1, shows a unique method of lighting a foundry cupola without using wood as a fuel by inserting a portable oil burner,

FIG. 2. SHOWING CORES WHICH ARE MADE ON THE JOLTING MACHINE.



LIGHTING CUPOLA WITH PORTABLE OIL BURNER, WITHOUT THE USE OF KINDLING WOOD.

the photograph showing details of operation without requiring any special description. This unique portable oil burner is also used for pipe bending, it being utilized also to great advantage in railroad, boiler, and machine shops for expanding tires and discs, as well as in boiler making and repairing engine frames and straightening out bent and battered plates of steel cars. The flame is not only powerful but very even in character, and it is maintained that it can be regulated either to heat a large surface or concentrated on a small area as desired.

These burners are also used for skin-drying molds, drying repairs on cores and for drying inside of dry-sand molds after the cores are pasted into place.

It is to be presumed that the iron mines in certain parts of Europe will suspend active operation for a year or two until the ex-shell supply is exhausted. No use digging down into the bowels of the earth for what can be found lying on the surface in millions of tons.

Current Events in Photograph

THE GREAT DAM AT BASSANO, ALBERTA

Water sufficient to irrigate 440,000 acres is diverted by the dam, which is one of the largest of its kind in the world. The concrete structure is 720 feet long and it raises the level of the Bow River by 46 feet. The dam is part of the system which supplies water for what is known as the eastern section of the territory to be irrigated. The outlay in connection with this has totalled about $8,000,000, and there are about 2,500 miles of distributing ditches which take the water to all parts of the country.

TRADE GOSSIP

The Sterling Die Casting Co., Brooklyn, has been incorporated with a capital of $120,000.

The Pan Motor Co., St. Cloud, Minn., will construct a one-story foundry, 125 x 175 feet.

The Crown Iron Works Co., Minneapolis, Minn., will build a one-story foundry on Tyler Street.

The Manganese Steel Casting Co., Norfolk, Va., plans to build a two-storey plant, 30 x 60 feet.

Improvements to the Ellen C. Manning foundry and machine shop, Portland, Me., are being proceeded with.

Grinnell Brothers Inc., New York, has been incorporated with a capital of $50,000 to manufacture stoves and heating appliances.

The Altmer Iron Works, Hoboken, N.J., wil build a new one-storey foundry, 100 x 150 feet on Manhattan Avenue, Jersey City.

The Lee Roy Plow Co., Lee Roy, N.F., is planning the rebuilding of its foundry, recently destroyed by fire with loss of about $10,000.

The Vulcan Iron Works, Wilkes-Barre, Pa., is considering the erection of a new one-storey foundry at Buttonwood for increased capacity.

The Wisconsin Die Casting Co., Milwaukee, has ben incorporated with a capital stock of $25,000, to manufacture die castings, dies, etc.

The Otto Biefield Co., Watertown, Wis., is erecting a new foundry, 65 x 215 feet of brick, steel and concrete, costing about $75,000 with complete equipment.

The American Sub-Soil Plow Co., Winston-Salem, N.C., will construct a new foundry. The Waterloo Gasoline Engine Co., Waterloo, Iowa, will build a new two-storey foundry, 150 x 200 feet.

The William Kennedy & Sons, Limited, Owen Sound, Ont., in conjunction with other interests recently took over the plant of the Owen Sound Iron Works, where it is manufacturing ship machinery, boilers, cement and saw mill machinery. The company recently erected an addition, 46 x 200 feet, which will be equipped with large travelling crane and two cupolas for melting iron.

John T. Hepburn, Limited, 18 Vanhorn St., Toronto, are extending their present plant by the erection of a new brick foundry, 100 ft. by 120 feet, of thoroughly modern design and fully equipped with 2 cupolas and electric travelling crane, for the manufacture of steam pumps and engines, cranes, brick, machinery and general machine work. Contracts have been awarded for a $70,000 addition to the plant of the Canadian Steel Foundries, 120 St. James St., Montreal.

FOUNDRYMEN HEAR TALK ON CONVERTER PROCESS

Pittsburgh, Jan. 21—Making of steel castings by the converter process was the subject of the talk last evening at the monthly meeting of the Pittsburgh Foundrymens' Association by George P. Fisher, of the Whiting Foundry & Epuiqment Co., Harvey, Ill. The speaker saw no reason why it would not be possible for iron foundries to put in small converters for making castings and exexpressed the belief that the training of iron foundrymen in the making of steel castings is a comparatively simple matter.

SAFETY APPAREL COMPANY ENLARGES PLANT

The F. H. Wheeler Manufacturing Company, Chicago, manufacturers of Wheeler Protective Wearing Apparel, announces the removal of their plant and offices to 215 West Huron Street, Chicago. This move has been necessitated by the steady growth of their business and the increasing realization by manufacturers that protection for their workmen means increased efficiency in their organizations.

"Our removal to larger quarters March 1st," said Mr. E. L. Wheeler, general manager, "is a definite indication of the rapidity with which the principle of protection for workmen is being accepted by foundry and mill owners. Nothing is such an aid to plant efficiency as satisfactory working conditions for employees, and nothing will make a man so contented with his work as the knowledge that he is fully protected while on dangerous jobs. The rapid expansion of our business is the best proof to us that protective wearing apparel is no longer considered an experiment, but is, rather, a vital necessity in every modern plant."

Not Satisfied With Bonus.—The decision of the Imperial Munitions Board to grant bonuses to those who were in their employ on November 11 only, was taken strong exception to at a meeting called by an examiner and two inspectors of the Munitions Board for the purpose of discussing the matter. A committee of eight men was appointed with Inspector Watson as chairman to interview the Provincial representatives at Ottawa, and other men of influence, with a view to sending a deputation to Ottawa to interview the Imperial Munitions Board on the matter.

WORKS OF THE INTERNATIONAL HARVESTER COMPANY, HAMILTON

The International Harvester Co. of Canada, Ltd., Hamilton, Ont., has purchased the Oliver interests in the Oliver Chilled Plow Works of Canada, Ltd., located at Hamilton, Ont. The Harvester Company assumes immediate control and operation of the property. This is the short official statement made by A. C. Dann, general superintendent of the Oliver Company, and is a follow-up of the statement made a few weeks ago by H. H. Biggert, manager of the International Harvester Co., to the effect that the company contemplated expansion by manufacturing new lines of agricultural implements in anticipation of an increased demand both for home consumption and export. The two companies have had friendly working relations in the past, and not being competitors, the International Harvester Co. marketed the products of the Oliver Company, and thus made a selling staff unnecessary for the latter company. The plants of the two companies are side by side on the water front, and no doubt there will be a saving in the matter of executive officers. The plant of the Oliver Company is recognized as one of the most modern in the country. Plows only are manufactured. In the Harvester plant practically every large farm implement except plows are made, including tractor engines and motor trucks.

CATALOGUES

A Type "H" Stoker bulletin has just been received at this office from the Combustion Engineering Corporation, 11 Broadway, New York. It covers automatic stokers for all kinds of industrial and heat treatment furnaces. Over twenty years' experience in building these stokers and in solving the combustion problems of steel mills of all kinds is the claim of this company, which enables them to furnish an especially interesting service as combustion engineers to this class of business.

We are in receipt of a circular from the New Era Mfg. Co., Inc., Kalamazoo, Mich., treating on the subject of their new alloy, "Metallic Phosphoro," the practical substitute for tin in brass and bronze mixtures. It is claimed for "Metallic Phosphoro," that it is a practical partial substitute for tin, and when thus employed, one pound of Metallic Phosphoro fills the bill; the remaining 1½ lbs. would be made up with zinc. It also gives a large list of formulae where Metallic Phosphoro may be substituted for tin.

From the P. H. & H. M. Roots Co., Connersville, Ind., and Chicago, Ill., manufacturers of blowers, gas pumps, water pumps and vacuum pumps, we have received the profusely illustrated Catalogue 68, "Roots' Rotary Blowers."

The catalogue, containing as it does, 48 pages, deals not only with the "Roots Type" of positive blower, by which they are perhaps best known to the foundry trade, since their inception in 1859, but is also a valuable book of reference on subjects appertaining to air pressure, and contains various charts and tables of pressures and sizes of pipes, etc.

CANADIAN FOUNDRYMAN is in receipt of the January issue of "Metal Trades," in which is set aside a section entitled "Foundry Chippings," and edited by Mr. David Guild, Jr., Phoenix Iron Works, Oakland.

The main feature of the number is the report of the fifth annual banquet of the California Foundrymen's Association, which was held at the Palace Hotel, San Francisco, on Dec. 21st, and a half page photo of the members "right in the act," and also separate portraits of the members of the new executive committee, Mr. David Guild, Jr., president; Mr. John Hedley and Mr. William Kingwell.

One paragraph worthy of note is: "If anyone among those present failed to have a good time, he, at least, was able to conceal it very well." This, judging from the countenances of the banqueters, we can readily corroborate.

The Dominion Abrasive Co., Mimico, Ont., have issued an attractive catalogue listing the various types of grinding wheels manufactured by the firm. Where formerly wheels were sent out by the various wheel makers with only a certain amount of regard as to the speed of the wheel, and work, and other particulars as to the conditions under which they were to be run, science has stepped in and insisted that for every operation in grinding, the proper wheel made of suitable abrasives of exact grade and grain required to give the most satisfactory results must be provided. With this in view this catalogue has been compiled for the proper choosing of the right wheel for any class of work. The various processes used in making wheels are explained and the various grades and grain sizes are tabulated. General safety requirements and tables of proper wheel speeds are given. The mounting of wheels receives careful attention and protection hoods are dealt with. The various shapes of cup, cylinder, plain and special wheels are shown by means of engravings, and sufficient data given so that a wise choice may be made. An excellent index adds to its value for ready reference.

The Canadian Fairbanks-Morse Company have recently issued a publication called "Steam Plant Material Specifications" which should prove of great value in the designing of power plants, and also in the ordering of material for their construction. The larger details of power plant designs are usually very carefully worked out in the drafting room. but in many cases the planning of detailed equipment, the installing of steam and water lines, pumps, heaters, traps, and other auxiliary apparatus is done in a more or less haphazard fashion. This state of affairs is no doubt due to the lack of available technical literature on the subjects of power plant specialties. The importance of proper design in the installing of valves, fittings, traps, heaters, and other detailed apparatus can scarcely be over-estimated, for while in many cases the material installed is small in size and of no great cost, the economies which can be effected by wise installation in this apparatus are very great. The Canadian Fairbanks-Morse Company in offering these specifications to the engineering public state that they are offered with the hope that they may prove of value to the steam power plant engineer and designer. The information is intended to be of use in the design and operation of the modern steam plant and the specifications were originally written by a well known engineer and subsequently carefully checked. General specifications are included dealing with the properties of materials commonly found in power plants. Steam lines are treated of in detail the proper sizes and weight of pipe are taken up for varying pressures. Grip piping is considered and instruction is given for the proper making of bends. The proper type of flanges for various kinds of work are given and fittings are also included. Valves for modern conditions are a subject of great importance, and this importance is recognized in their treatment in this work. Boiler feed lines are treated of in detail in a similar manner to that described above in the treatment of steam lines. Expansion joints are also shown and exhaust lines come in for their share of description. Together with this material which is of great value in the design of power plant piping is included a condensed catalogue of power plant specialties handled by the Canadian Fairbanks-Morse Company. Much data of a technical nature is also given. This publication should be of considerable value to the operator or designer or engineer who has had to deal with the many problems encountered in the design and operation of the steam plant of whatever size

THE FUEL PROBLEM IN CANADA

The fuel problem in Canada has been especially engaging the attention of the Research Council by reason of the necessity of finding new sources of fuel supply for both present and future needs, securing adequate methods of conservation and devising ways for permanently meeting the steadily increasing difficulties of equalizing supply and demand.

The report of Mr. Barnes deals with an interesting and important phase of the general problem. He shows conclusively that a more or less widespread popular conception as to the potential availability of Canada's great water powers for domestic electric heating in Canada is not tenable on scientific or economic grounds. The future of water power development in Canada lies rather in the direction of providing cheap power for transportation and industry. Coal must continue to be Canada's main reliance for heating purposes.

The broad facts as to relative costs of heating by coal and by electricity are clearly and succinctly set forth, and the conclusion is reached that "It is, therefore, hard to conceive of a time when electric energy will compete successfully and on a large scale with coal, oil, gas, etc., for heating."

THE METALLIC BEDSTEAD

An active movement is on foot by the iron and brass bedstead manufacturers over the line to revive interest in this once popular and hygienic domiciliary furnishing, and reinstate it from its state of semi-lethargy to its former place in the household. May they be successful in their efforts!

Trade Conditions.—G. T. Milne, His Majesty's trade commissioner in Canada, in an interview at Montreal. said, among other things: "It is an axiom of business that a country to export, must import," he continued. "That is rather a contradictory phrase on its face, but we must understand that if we are to sell our goods to another country we must also purchase some of their goods. If not, how are they to pay us for our goods. In gold? Never. In order to build up an export trade, one of the first essentials is to have a wide home market," he said. "This alone lays a strong foundation to an export trade. . . This was peculiarly true of the British Isles. Canada no longer is a land of raw materials and natural resources. Many things that were previously imported will now be manufactured, and the close of the war leaves us with immense factories ready to be turned over into peacetime channels for the production of finished articles."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$31 40
Lake Superior, charcoal, Chicago	38 85
Standard low phos., Philadelphia	38 85
Bessemer, Pittsburgh	33 60
Basic, Valley furnace	30 00

Government prices.

	Montreal	Toronto
Hamilton		$50 00
Victoria		50 00

FINISHED IRON AND STEEL

Iron bars, base	$5 25
Steel bars, base	5 50
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$40 00	$40 00
Antimony	10 00	10 00
Copper, lake	26 00	25 00
Copper, electrolytic	26 00	25 00
Copper, casting	25 00	21 00
Lead	8 50	7 25
Mercury		100 00
Nickel		50 00
Silver, per oz.		0 98
Tin		100 00
Zinc		10 50

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$15 00	$13 00
Copper, crucible	19 50	15 00
Copper, heavy	18 50	15 00
Copper wire	18 50	15 00
No. 1 machine composition	18 00	14 00
New brass cuttings	10 00	10 00
No. 1 brass turnings	13 00	10 00
Light brass	7 00	7 50
Medium brass	9 00	9 00
Heavy brass	.....	.....
Heavy melting steel	15 00	15 00
Steel turnings	9 00	8 00
Shell turnings	9 00	8 00
Boiler plate	16 00	15 00
Axles, wrought iron	38 00	15 00
Rails	20 00	15 00
No. 1 machine cast iron	28 00	18 00
Malleable scrap	20 00	15 00
Pipe, wrought	16 00	8 00
Car wheels, iron	25 30	18 00
Steel axles	24 00	30 00
Mach. shop turnings	9 00	6 00
Cast borings	11 00	8 00
Stove Plate	16 00	14 00
Scrap zinc	6 00	5 00
Heavy lead	5 50	8 00
Tea lead	4 50	3 50
Aluminum	18 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$47 50
Open-hearth billets	47 50
O.H. sheet bars	51 00
Forging billets	60 00
Wire rods	57 00

Government prices.
F.o.h. Pittsburgh.

PROOF COIL CHAIN. B

¼ in.	$14 35
5-16 in.	13 85
⅜ in.	13 50
7-16 in.	12 90
½ in.	13 20
9-16 in.	13 20
⅝ in.	12 90
⅞ in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 43
Solder, guaranteed	0 45
Babbitt metals	.18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lh.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single hbls.	1 10
Linseed oil, boiled, single bbls.	1 73
Linseed oil, raw, single bbls.	1 70
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37½
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lh.	0 07
Rosin "G," per lh.	0 08
Borax crystal and granular	0 12
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lhs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, hlack, No. 28	$ 8 00	$ 8 25
Sheets, hlack, No. 10	10 00	10 00
Canada plates, dull, 52 sheets	9 00	9 00
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	....	10 70
Premier, 10¾ oz.	....	11 00
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$13 00
3-16 in.	12 50
¼ in.	11 75
5-16 in.	11 40
⅜ in.	11 00
7-16 in.	10 60
½ in.	10 40
⅝ in.	10 00
¾ in.	9 90

Prices per 100 lhs.

IRON PIPE FITTINGS.

Canadian malleahle, A, add 20%; B and C, net list; cast iron, 15% off list; standard bushings, 50%; headers, 60%; flanged unions, 40%; malleahle hushings, 25 and 7½%; nipples, 55%; malleahle lipped unions, 50%.

ANODES.

Nickel	$0.58 to $0.65
Copper	.36 to .46
Tin	.70 to .70
Silver, per oz.	1.05 to 1.00
Zinc	.23 to .25

Prices per lb.

NAILS AND SPIKES.

Wire nails	$5 50	$5 45
Cut nails	5 35	5 35
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.22
Ammonium, carhonate	.33
Ammonium, chloride	.55
Ammonium, hydrosulphuret	.30
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.75
Arsenic, white	.27
Copper, sulphate	.22
Iron perchloride	.40
Lead acetate	.35
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carhonate	1.80
Silver nitrate (per oz.)	1 20
Sodium hisulphite	.30
Sodium carhonate crystals	.05
Sodium cyanide, 129-130%	.50
Sodium cyanide, 98-100%	.40
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.80
Zinc sulphate	.15

Prices per lh. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	40%
Cut leather lacing, No. 1	1.35
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, hullneck	2 00
Pumice, ground	07
Emery composition	10 to 6- 9
Tripoli composition	06 to 9-10
Rouge, powder	.30 to .35
Rouge, silver	.50 to .55
Crocus composition	08 to 8- 9

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 hase	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 34
Brass sheets, 24 gauge and heavier, hase	0 43
Brass tuhing, seamless	0 46
Copper tuhing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.39
British Manila rope	.33
New Zealand Hemp	.33
Transmission rope, Manila	.45
Drilling cables, Manila	.41
Cotton Rope, ¼-in. and up	.47

OILS AND COMPOUNDS.

Castor oil, per lb.	50
Royalite, per gal., bulk	16
Palacine	19
Machine oil, per gal.	26½
Black oil, per gal.	15
Cylinder oil, Capital	45½
Cylinder oil, Acme	36½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 50
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	12½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	40
Delta Files	37½
Nicholson	45
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	50

General Market Conditions and Tendencies

TORONTO.—Some of the dealers seem inclined to think that the prospects for the Canadian manufacturer entering the export business are not bright at the time. They see in the list of restricted material entering the Old Country more symptoms of this. Machine tools are now included in those things that can only be allowed into Britain on the securing of a license for the purpose. In fact there is a feeling in some quarters that the British manufacturer had turned from munitions work well in advance of this country, or the States either for that matter, and was well in shape to turn out old lines as well as new when the war ended. It is known that orders are not coming to either United States or Canada in anything like the volume that was anticipated, and the supposition is that the firms on the other side of the water are in good shape to handle the business, and are not going to do anything to encourage importations where the bill can be filled by material turned out at home.

As noted in these columns before there

are English lines on the market that have been absent for some time past owing to the war, and the effect is to bear down on prices by providing another active competitor in the market for business, for competition very often has more to do with prices than anything else.

No Improvement Here

Some of the transportation companies are holding their scrap rather than allow the yards to take it at present offerings, or grade it according to their own liking. Dealers state that little business is being done at the battered down price list that is quoted elsewhere in this issue. They are not anxious to buy material. Those who have any accumulation of stuff in their sheds are anxious to sell for fear that prices may go lower. They will probably lose money if they sold now, because the material they have has probably been taken in at war levels. But they figure out that it would be better to take the loss now and have it done with than to hold and take a chance on having to absorb a bigger loss a little later on. On the other hand the same condition keeps the dealers from showing much tendency to buy. They fear to move past present requirements for fear of being caught again on a declining market. As one dealer put it this morning: "There are lots of ways we can have a better time losing our money than by going out and buying heavily at the present prices." These prices are low when compared to war figures, but they are not low when lined up against a ten-year pre-war period. For instance copper sells now for about 15c, while a pre-war price over a period of years would show a value of about 12½c to 13c.

Should Hold Rubber

A number of dealers in the country that have scrap rubber have inquired for a quotation. The same question is also of interest to garage men, where old tires very often accumulate. The present price for this material is 3¾ cents per pound. This is low, and the chances are that it will reach a higher level before so very long. In fact it would not cause any surprise to see this going to 8c. It would be much better for a person to hold this material for a while, as some of the mills are known to be short of raw stock, and the move toward a better price may be made almost any time now.

Prices Are Down

Further price concessions are noticed this week. Ship plate is quoted locally with a spread of $6 to $6.50, but we quote $6 as the base price because dealers will recognize that figure. Competition for business is really the cause for the lower figure. A big job that was being figured on in the eastern part of Ontario last week caused the 6c price to be introduced to the market. The jobber figuring on the work depended on his dealers here getting him the best possible deal on the supply of material, and for this reason the price was lowered to 6c, and it stays there. Local warehouses are beginning to get their stocks replenished with material that has been secured at the lower price, figuring on the three cent. price at U. S. mills. The amount to be paid in war tax varies according to the place of production and shipment. It is fixed by the Canadian Board of Appraisers who have an office located in New York.

Sheets show a tendency to come down also from the high levels of the past year. Thick sheets like ten gauge follow plate quotations very quickly.

Dealers do not seem to care to state definitely their feeling toward lower prices, but there is a feeling growing that they show a decided move now toward arriving as quickly as possible at the very best selling proposition they can hold out to the trade. In this way they believe they will be able to give some confidence and assurance to the man who does not know whether to come into the market or not. Some of the railway companies, steam and electric, are sending out "feelers" from time to time on purchases they have in mind, and some of them are about convinced that the time is ripe for them to get out and buy, as prices are highly satisfactory when compared to the quotations they received some months ago. And what is more they can get deliveries now within very good scope, whereas a few months ago a buyer was simply at the mercy of the mills, and the mills in turn were at the say-so of the war machine.

The Canadian National Railways have sent out specifications for some 15 machine tools for the shops at Leaside, which are to be used as soon as necessary for repair work. The machines asked for are not regular railway shop equipment. but mostly general purpose lathes, planers, etc.

There is a fair volume of business moving, and several sales have resulted.

Representatives of American machine tool makers in the city this week report that some of the plants in the States are working full time and that they are sending very large shipments to Japan. In fact it seems that they are developing a business there that is greater than anything they had in pre-war times. Sales are also reported in large quantities to Sweden.

WOULD TAKE EXPLOSION NOW TO CAUSE STIR IN SCRAP MARKETS

THE scrap iron market may almost be said not to exist. There is no demand for scrap, no matter how low the price may be set. On some lines the quotations are at the ante-bellum figure, and whether the limit has or has not been reached is a matter of conjecture. The story is the same in every district, and seems to be without any relieving feature.

New York: Some of the yards here have given up trying, and are practically closed down. The situation seems to be that no one wants to buy scrap, and dealers are making no effort to stimulate an artificial demand by making further bargain prices. Quotations of as low as $14 f.o.b. New York have been made without resulting in a sale. Consumers profiting by their bitter experiences of last winter are pretty well stocked up and they are likely to be very canny in their movements till a better market develops for their own products.

Pittsburgh: The same situation exists in this district, of dealers trying to get a nibble by their bait of still lower prices, and the consumers still holding off. There is absolutely no demand, and the question of price does not enter into the matter. Heavy melting steel at $18 is meeting with no better favor, while machine shop turnings and borings are a drug in the market.

Philadelphia: There is a very small demand with prices showing marked drops in some places. Several thousand tons of heavy melting steel were sold direct from producer to consumer at $16 delivered. The general price on this material is $16.50 delivered. There has been an average drop of from $1 to $3 per ton in scrap prices in the Eastern Pennsylvania market this week.

Buffalo: Taking the fact that most consumers have large stocks on hand and the almost entire absence of any demand, it may be said that the worst is yet to come. Every grade in the market has taken a further step down, amounting generally to $2 and as mills are not interested at any price, the utmost depths have not yet been sounded.

Cleveland: The feeling among scrap men here is that the market is at its lowest, and in consequence they are laying down all the material they can get. Some of this scrap may not be turned over till the distant future, though dealers expect to move most of it in the coming year. Consumers are limiting their purchases to emergency requirements, and are buying turnings at $9 to $10 per ton, and heavy melting steel at $16 and upwards.

Chicago: From week to week quotations continue to show reductions, and the end is not yet. The scrap steel and iron market is still characterized by the almost complete absence of buying. There is a quantity of 2,000 tons offered by the Chicago Milwaukee & St. Paul, 1,000 tons of this being steel rails. One feature of the small amount of buying that does exist, is that immediate delivery is always asked, showing that the purchase has been delayed till the last minute. As there are no large holdings of scrap, it is felt by some dealers that when the market does take a change it will be in the form of a sudden jump upwards.

Cincinnati: In the absence of any trading, the time of many dealers is being spent in adjusting cases of rejections of shipments which are numerous.

The only grade of scrap in which any interest is being shown is stove plate, which is holding its own fairly well. At the other end of the line are steel turnings, which seem to be in less demand than any grade of scrap on the list.

St. Louis: As both buyers and sellers seem to think that the bottom of the market has not yet been reached, apathy is the prevailing state of the market. Dealers have made further reductions in quotations, but as no sales have taken place, the value of these is problematical. The slackness is occasioned more by a lack of demand than by any actual surplus of material, and this is the most hopeful feature of the situation. Railroad interests are holding all the scrap they have storage for, till prices adjust themselves upwards.

EFFECT OF IMPURITIES IN ACETYLENE ON THE COST AND QUALITY OF WELDS

By CHARLES BINGHAM.

THE chief impurities found in or accompanying acetylene are sulphur, phosphorus, silicon, and finely subdivided lime, which affect the quality of the weld, and hydrogen, nitrogen, and their compounds, and water vapor, which affect the cost of the weld by lowering the temperature of the flame, thereby slowing down the welding process and thus increasing the charge for labor, carbide, oxygen, and overhead charges. Occasionally other impurities are also found, but their occurrence is so rare that they need not be considered, states the author in a paper before the "British Acetylene and Welding Association."

Sulphur is found mainly in the form of sulphuretted hydrogen. Most of it is held in the sludge and in the water, but a part always finds its way into the gas and, unless removed, passes into the weld. Sulphur makes the steel or iron "short" or brittle. It is also one of the chief agents in the corrosion of metal pipes, faucets, etc. The quantity of sulphur compounds may vary from 0.1 to 2.4 per cent. by volume; the quantity always increases with an increase of temperature in the generator. Nearly all the sulphuretted hydrogen can be removed by a good water-scrubber; the remainder is easily removed by a chemical purifier.

Phosphorus attacks the metal work of the apparatus and when burnt in the form of phosphoretted hydrogen it is the chief cause of the unpleasant atmosphere often found in welding shops. It makes the weld porous and any that is present in the gas passes almost entirely into the weld. The quantity of phosphorus compounds in acetylene can be as large as 1.2 per cent. by volume. Phosphorus can be removed only by a good chemical purifier.

Silicon is usually found in the form of siliciuretted hydrogen. The gas may contain as much as 0.63 per cent. by volume. Nearly all purifiers that remove phosphorus and sulphur fail to remove silicon compound, but as yet no experiments have shown that the presence of silicon has a bad effect on the weld.

The temperature of generation influences considerably the quantity of finely subdivided lime carried by the gas. This lime dust passes freely through the water, but the quantity present is usually small and can easily be removed by any good chemical purifier. The effects of the lime dust on welds has not been carefully studied, but the dust frequently chokes the narrow passages of the blow-pipe and some authorities claim that this causes spitting of the blow-pipe.

A yellow, brown, or black patch in the sludge is a sure sign that the temperature of the welding part of the flame, that is, the inner cone, is being lowered by hydrogen, water vapor, etc. Water vapor is a most pernicious diluent. It is decomposed at the high temperature of the oxy-acetylene blow-pipe, its decomposition requiring 2300 calories per cubic meter. At a temperature of 100 degrees F., the mere passing of the acetylene through the water will cause it to be saturated with about 5 per cent. of water vapor. Where there is no water-scrubber and the generator is overtaxed, it is possible fo a considerable percentage of the vapor to reach the blow-pipe nozzle before it has been able to cool sufficiently for any condensation to take place. Even where a water-scrubber is used the acetylene will be saturated with water, and the higher the temperature of the water the higher will be the percentage of the water vapor.

Essential Factors in Oxy-acetylene Welding

Carbide expands to about twice its volume when decomposed; if there is not sufficient space for it to swell freely, overheating and partial decomposition of the acetylene follow. This is also accompanied by over-production of water vapor. To produce the best results, the generator should produce acetylene at as low a temperature as possible; the temperature of the gas and water in the holder should not exceed, by 30 degrees F., the temperature of the air. The acetylene should pass through an efficient water-scrubber, but the water in the scrubber should not become too warm and should be frequently changed so that it will not become saturated with ammonia or sulphur compounds. The chemical purifier provided for removing phosphorus and sulphur compounds must, also, be regularly renewed or regenerated. The gas must be dried. An efficient method of doing this is to pass the gas after it has gone through the water-scrubber, through a vessel containing live carbide. The moisture in this case will produce additional acetylene which will be practically dry.

THE ENGINEERING INDEX

The Engineering Index, published for 25 years in "The Engineering Magazine" and its successor, "Industrial Management," and universally regarded as the standard index to engineering periodical literature, has been acquired by the American Society of Mechanical Engineers, and hereafter will be compiled and published by this Society. The first issue of the Index under its new management appears in the January number of the "Journal."

As heretofore the Engineering Index will be regularly issued in three different forms:

1. As a part of "The Journal" of the Society.
2. As a separate monthly publication for libraries or individuals desiring to clip the items for indexing purposes.
3. As an annual volume in which all the items for the year are collected.

The Engineering Index originated with Prof. J. B. Johnson, of Washington University, St. Louis, Mo., in 1883, and for 12 years was prepared under his direction and published by the Association of Engineering Societies. It was then taken over by the Engineering Magazine Company of New York, and has since had the personal attention of Mr. John R. Dunlap, the president of that company, who has found it to be a widely appreciated undertaking by engineers throughout the world. The development of his magazine in the specialized field of industrial management, however, made it seem desirable to place the Index in the hands of an engineering organization covering a broader field and serving engineers engaged in more varied activities. The Society immediately recognized the opportunity extended and purchased the Index, thus bringing "The Journal" the prestige, name and other rights and privileges of what has been regarded as the leading index in the field. This establishes the "Engineering Index" on a secure and non-competitive basis as a logical Society activity.

Through the facilities afforded by the magnificent library of the Engineering Societies, which regularly receives 1,100 periodicals from all parts of the world, the Society has unlimited possibilities in publishing the Index. These periodicals comprise one of the most complete collections of current engineering literature in the world—in not less than ten languages and received from thirty-seven countries. The indexing of engineering articles can be best accomplished by a professional organization and the Society will consider it one of its greatest services to place at the disposal of engineers, through the "Engineering Index" in "The Journal," the means for using the wealth of data and general information published from month to month in the world's technical press.

The plan of classification to be used is as follows: The articles are listed in the general field of engineering to which they belong, and are then grouped together under the particular branch of the general subject. The following classifications give an adequate idea of the scope of the "Engineering Index" as it will be carried in "The Journal": Mechanical Engineering, 31 sub-heads; Electrical Engineering, 11 sub-heads; Civil Engineering, 9 sub-heads; Mining Engineering, 14 sub-heads; Metallurgy, 7 sub-heads; Aeronautics, 19 sub-heads; Marine Engineering, 4 sub-heads; Organization and Management, 13 sub-heads; Industrial Technology; Railroad Engineering, 15 sub-heads; Munitions and Military Engineering; General Science, 3 sub-heads.

FUTURE AND SOURCES OF INDUSTRIAL ALCOHOL

THE appointment of a Government Committee to investigate the available sources of supply of alcohol, with particular reference to its manufacture from materials other than those which can be used for food purposes, the method and cost of such manufacture, and the manner in which alcohol should be used for power purposes, has served to focus attention upon a problem of the most vital importance for England's post-war period.

For the purposes of war it was found possible to meet the needs of the explosives industry for both alcohol and acetone by a drastic reduction in the quantities of potable spirit bonded, by augmenting the capacities of the distilleries producing spirit, by importation of over-proof spirit from various parts of the Empire, and by increasing distillation from molasses. The alcohol thus obtained has been deprived practically entirely from materials otherwise available as food, and, indeed, in the case of molasses has been secured at the serious expense of the supplies ordinarily employed for stock-feeding. In the year 1916-17 the consumption of industrial spirit had reached a figure of upwards of four million gallons. With the close of hostilities a large part of this demand for alcohol in industrial processes will not be maintained. Nevertheless, it is confidently anticipated that the output of alcohol will not suffer any diminution, but, on the contrary, will be increased to many times its present magnitude.

Fuel Uses

The outlet for the alcohol of the future may be deduced from the terms of reference of the Government Committee, and also from the composition of the Committee appointed. The presence upon the Committee of Inquiry of a number of technical experts interested in petroleum supplies and their application demonstrates that the problem of alcohol is intimately connected with the development of motive power, in which a high-grade volatile fuel is consumed. The enormous increase in the applications of the internal combustion engine for transport on land, on sea, and in the air has placed a strain upon the producers of petrol supplies which shows no tendency to diminish. The oil supplies of the world, drawn upon to an ever-increasing extent, are rapidly becoming inadequate to meet the demands which arise. Thus, it will be necessary to turn more and more to other sources of fuel supply. Among these, not the least of future possibilities is presented by industrial alcohol, suitably denatured, in admixture with benzine, the production of which in large quantities from by-product ovens and town's gas is practically assured.

Grain and Potatoes

In this country, at present, alcohol is mainly obtained by fermentation processes from grain, together with some small quantities by distillation of molasses. In Germany production from potatoes by a combined hydrolytic and fermentation process has been largely used to supplement the grain fermentation process. The first stage in the operation consists of the conversion, by treatment with acids, of the starch content of the potato into glucose, a soluble sugar, which is then fermented to yield the alcohol desired. The raw materials for the preparation of starch, such as rice, maize, and sago, are also suitable for use in the production of alcohol by this process. In the main, however, the starch content of such materials is used as such, or is converted into glucose only, to be used in the many sweetening processes for which this product is suitable. In all of these alternatives, however, potential food supplies are consumed, and during periods of stringency, such as now hold, economy of such supplies is a problem of the utmost urgency.

Of the possible sources of alcohol supply other than those which have just been enumerated, attention has been directed to the utilization of wood waste, the plant producing alcohol from wood will be four times as great as in a grain distillery with equal output. On the other hand, there is a large margin in the cost of raw material in favor of alcohol from wool waste, and the fuel charges are always a much smaller item than in a grain distillery, since most sawmills produce waste in excess of their own power requirements, and the woody residues from the digestion process have a fuel value after partial dehydration. With modern plant the economic aspect of the problem becomes steadily more favorable, and the wood waste alcohol industry may leap forward to commercial success as the shortage of other available fuels for internal combustion engines becomes more acute. Such developments, which have so far been confined mainly to the United States, may be expected to occur also in Canada and other timber-producing areas.

A development of the alcohol industry from wood as raw material, which has been greatly stimulated in Sweden and in Germany during recent years owing to the rigorous curtailment of imports of petroleum spirits, is associated with the paper-making industry. Wood pulp is produced from pine-wood material in considerable quantity by digestion of the wood with solutions of sulphite of soda. The sulphite lyes contain fermentable sugars, and are therefore potential sources of alcohol. Apparently the difficulties associated with the dilution and composition of the liquors have been successfully overcome, since 11 factories are now in course of erection in Sweden, a development which suggests that Scandinavia will soon be independent of petrol supplies.

Synthetic Processes

To a country such as Britain, with no considerable timber areas, the synthetic processes of alcohol manufacture must be of prime consideration. As developed hitherto, calcium carbide is the starting point of the synthesis, a fact which suggests the necessity of cheap power production, as outlined in recent Departmental reports. By treatment of the carbide with water, acetylene gas is obtained, and this on reaction with water in presence of a catalytic material is converted into acetaldehyde. From this latter, by a further process of catalytic reduction, alcohol results. The conversion of acetylene to alcohol thus involves two separate catalytic processes. The first, the process of hydration with water, is carried out in presence of suitable acids, generally with mercuric oxide or mercury salts present to promote the rapidity of the process. Sulphuric acid and acetic acids with the corresponding salts of mercury have been employed, and, as they are unchanged in the reaction they can be utilized for long periods of time. The aldehyde produced is subsequently passed in the form of vapor, together with hydrogen, over a catalytic material consisting mainly of reduced nickel. At 140° C. 80 per cent. of the aldehyde may be converted into alcohol by one passage over the nickel, and to the synthetic production of alcohol from calcium carbide, a product which can be produced abundantly and cheaply in the electric furnace, provided that cheap electric power is available.

Utilization of Wood Waste

The principal constituent of wood is the complex carbohydrate commonly known as cellulose, and this is available in abundant quantities in the wood waste obtained in the operations of the timber trade. The problem of recovering alcohol from such material consists in the conversion by disintegration of the cellulose constituent of the wood into fermentable sugars, from which alcohol can then readily be obtained. The possibility of effecting such a conversion has been known for more than a century, and many attempts at commercial realization of the project have been made. It is only recently, however, that success has become practicable, largely owing to detailed study of the problem by the lumber interests in North America, stimulated by the assistance of Government investigation, such, for example, as that conducted by the U. S. Forest Products Laboratory at Madison, Wisconsin, U.S.A.

To convert the cellulose of wood waste into sugars suitable for alcohol fermentation, treatment with dilute acids is employed. Dilute sulphuric and hydrochloric acid and, more recently, sulphurous acid have all been tried. In the modern developments of the process the wood waste is saturated with water containing 1 per cent. of acid, and the mixture is digested at suitably elevated temperatures, corresponding approximately to a pressure of 75 lb. to 100 lb. of steam, for a definite interval of time. The moisture content is kept as low as possible for the sake of economy in the subsequent neutralization and concentration processes as well as for greater ease of handling the material and regulation of the operating conditions. It has been found that a 50 : 50 wood-acid liquor is a convenient material for such purposes.

After the process of digestion the separation of the sugars from the woody residue is effected in standard beet-sugar diffusion batteries provided with acid-proof linings. Neutralization of the acid liquors follows, generally by means of lime or a high-grade limestone. The sugars are then fermented in accordance with standard practice, a four-day fermentation period being employed, and the alcohol is subsequently distilled and rectified in the usual way.

Comparative Yields

As to yields, obtained and possible, it may be observed that 25 to 28 per cent. of the dry wood may be rendered soluble, and of that percentage as much as 80 per cent. is fermentable sugar. This corresponds to 10-11 per cent. alcohol, or 35 gallons of 95 per cent. spirit per dry ton of wood. Thus far, in actual practice, the yields have scarcely exceeded 20 gallons per ton, as contrasted with a yield of 80 gallons per ton from corn. It is obvious, therefore, that the amount of material handled in parts of and the residual hydrogen and acetaldehyde may be returned to the catalyst, after being freed by fractionation from the alcohol formed. In this way high efficiencies may be obtained.

It has been recently stated that, operating in this manner, successful production has now for some time been carried out by the Hoechst Farbwerken in Germany and by a Swiss company, the Longa Electricity Works, at Visp, Switzerland. It is hoped that this latter company will shortly be in a position to cover the total alcohol consumption of their country with the synthetic product. The economy of the process is conditioned mainly by the initial cost of carbide, which must necessarily be extremely low to furnish alcohol at a price which would compete successfully with petrol at normal rates. Large-scale production in favorable conditions as to power costs will certainly be necessary.

The production of alcohol via acetaldehyde does not exhaust the possibilities of synthetic processes. Large-scale production of ethylene hydro-carbons would lead to the development of a synthesis by direct hydration, from which alcohol would result in a one-stage operation. The whole problem is as yet in its infancy, and a considerable amount of coördinated research will be necessary to establish the alcohol industry on a sound basis. The need for alcohol as fuel becomes increasingly urgent, especially in areas such as the United Kingdom, in which natural resources of motor fuel are but small. The restrictions under which the manufacture of industrial alcohol has labored in the past will disappear inevitably as the need for alcohol grows. The growth of the industry will follow the present stimulation of investigation and research.—

NATURE OF COMBUSTION

The process of combustion consists in the active and rapid combination of the fuel with the oxygen of the air. If the coal were composed of pure carbon, and the combustion were perfect, the fuel would be entirely consumed, and would eventually pass up the chimney in the state of the invisible gas known as carbon dioxide (or, more familiarly perhaps, as CO_2 or "carbonic acid gas"); but even in this ideal case the chimney gases would by no means consist of pure carbon dioxide, because air is not pure oxygen. Four-fifths of its bulk, approximately, consists of the practically inert gas nitrogen, and hence, even with perfect combustion and a pure carbon fuel, four-fifths of the gas passing up the chimney is nitrogen, and only one-fifth, at most, is carbon dioxide. The nitrogen takes no part in the combustion, except that by diluting the oxygen it checks the chemical action and causes it to proceed far more slowly than it would if the nitrogen were absent.

In practice the chimney gases contain various other substances besides nitrogen and carbon dioxide, because the fuel is never burned under strictly ideal conditions. If an excess of air is admitted to the furnace, a certain proportion of free and unused oxygen will pass up the chimney, while if the air supply is deficient the chimney will very likely discharge more or less of the gas that is known to the chemist as "carbon monoxide," and which burns with a pale blue lambent flame in household stoves when fresh coal has been recently thrown in. Moreover, coal is never pure carbon. In addition to a certain variable proportion of entirely incombustible matter which remains behind as ash, slate, and clinker, all coal contains more or less combustible matter besides the free carbon of which it mainly consists, and the softer bituminous varieties are particularly notable in this respect. The additional combustible substances to which we refer consist mainly of carbon and hydrogen, chemically combined with each other; and when they burn they generate more or less water-vapor, owing to the oxidation of the hydrogen. The natural moisture in the coal is evaporated at the same time, and the chimney discharges a considerable quantity of water-vapor from these two sources combined. The heat-producing power of coal varies considerably, according to the proportion of these secondary combustible substances that it contains, and numerous formulas and tables are available from which the quantity of heat that will be given out by a ton of coal can be calculated.

WELDING CAR AXLES

The price of car axles has increased about 250 per cent. during the past three years, and deliveries are now very uncertain; hence broken axles should be welded whenever possible. By the electric arc method a good man can prepare and weld two 4-inch axles per day; the cost of a finished reclaimed axle is only about one-third that of a new one.

The axle is burned off by the arc to V shape, 5 or 6 inches inside the wheel fit so that only good "live" metal is used in the reclaimed axle. Two prepared pieces are laid in an angle iron with their V-ends together. They are then welded together, using a carbon electrode and cold rolled steel as filler. After the weld is partly completed the axle is rested on a simple trestle and filling-in is completed. The axle is then cut to length and machined. The weld comes nearly in the centre of the completed axle.—R. H. Parsons, "Electric Railway Journal."

IGNITION ARCH AIDS COMBUSTION

Much better combustion can be had by erecting a so-called "ignition arch" over the fire, so as to entirely protect the gases from the chilling action of the boiler until the combustion is complete. To install such an arch properly, the boiler should be set at least a foot higher than is usual in ordinary practice, and the arch should be turned over the furnace from side to side, and be extended lengthwise of the boiler so as to cover the fuel-bed from the front end of the furnace back as far as the rear face of the bridge wall. There is no serious difficulty in making such an arch last well, if it is properly built in the first place, and if it rests securely against suitable buttresses at the sides of the furnace. It has no load to sustain, except its own weight. The arch should be built of special wedge-shaped fire-brick, made with a taper appropriate to the height and span that the arch is to have; and the brick should be laid with a thin paste of fire-clay, instead of with mortar or cement. The alternate courses of the brick should be set at slightly different levels, so as to make the under side of the arch irregular instead of smooth. The corners that are thus exposed become white-hot, and the ignition of any unburned portions of the gases that come from the fuel-bed is thereby greatly promoted. The arch should be high enough above the grates to allow the fireman to throw coal upon all parts of the fuel-bed without inconvenience, and to clean and bank his fires readily whenever it is necessary to do so.

The chief objection that boiler own-

ers urge against installing an ignition arch of this nature is, that by doing so they sacrifice the heating surface that is immediately over the fire. The loss of a few square feet of heating surface in this way is far more than compensated, however, by the much better combustion that the ignition arch ensures. Moreover, the gases should be as hot as possible when they enter the tubes of a fire-tube boiler, because it is there that the absorption of heat should mainly take place.

The ignition arch, when properly put in, not only increases the economy of the plant by improving the combustion, but also obviates many of the troubles that arise in the boiler itself, under the usual conditions, from its direct exposure to the fierce heat of the fuel-bed. Bulging, burning, and cracks and leaks along the girth joints, are most likely to occur over the fire or the bridge wall. All troubles of this nature are diminished in large measure, and often eliminated altogether, by the use of an arch over the fire, as described above. It may be well to say that this device has long passed the experimental stage, and that it has been thoroughly tested by experience, and found to be excellent when properly designed and constructed.

Cars Scarce in Britain.—Extraordinary prices are being obtained for second-hand cars in England. A Rolls-Royce in good conditions has just changed hands for $15,000. The present condition of the motor industry is so behind that it is quite likely that a year will elapse before new buyers can be assured of supplies.

A New Product.—The Tolland Manufacturing Company of Montreal has recently placed on the market a new type of bearing metal, known as "Tomco" special heavy bearing metal. It is especially adapted for rolling mill and paper making machinery and all bearings where heavy pressure is a feature.

Plants Not Sold.—None of the Munitions Board war plants have as yet been disposed of by Home Smith, in whose care they were entrusted. Mr. Smith says that perhaps in about a fortnight there may be some definite move. Asked if he would dispose of the various plants by auction Mr. Smith said he had not yet decided.

Annual Gathering.—Agents and travellers of the Renfrew Machinery Co. were in Renfrew from various sections of the Dominion for the annual conference and banquet. There are about 150 of them, a record number—indicating a material increase in business during the past year. The company looked for a larger attendance than usual, but thought that perhaps the wave of influenza which has been felt throughout Canada and is still epidemic in many places would tend to keep not a few of the agents and travellers at home.

Conditions in Windsor.—The big Maxwell plant here is shut down for the present. The Kelsey Wheel Works is about ready to begin operations. The Swedish Crucible Steel Company are now employing about 45 men, but it is anticipated that the excellence of their product will make extension inevitable Another advantage of the steel casting will be that they can replace the drop forging when the manufacturer wishes fifty or one hundred articles of a kind. The cost of expensive dies is saved.

Too Much Lead—There is a surplus of lead in Canada without the support of a large demand for munition purposes, and the price has dropped materially in consequence. Mr. J. J. Warren, of the Consolidated Mining and Smelting Co., which operates largely in British Columbia, says the condition is serious. In addition to approximately 8,000 tons of pooled lead unsold, there is a large quantity remaining in the hands of the Imperial Munitions Board.

Labor in Montreal.—That the cessation of war munitions activities is resulting in a considerable amount of unemployment and that there are now many skilled and unskilled workers who are unable to procure employment, was the statement made by Mr. Joseph Ainey, director of the Quebec Provincial Labor Bureau. "As far as domestic labor is concerned,' he said, " we have always a call for it, and can place anyone who wants a job, but the industrial market shows a surplus of labor in comparison with the demands."

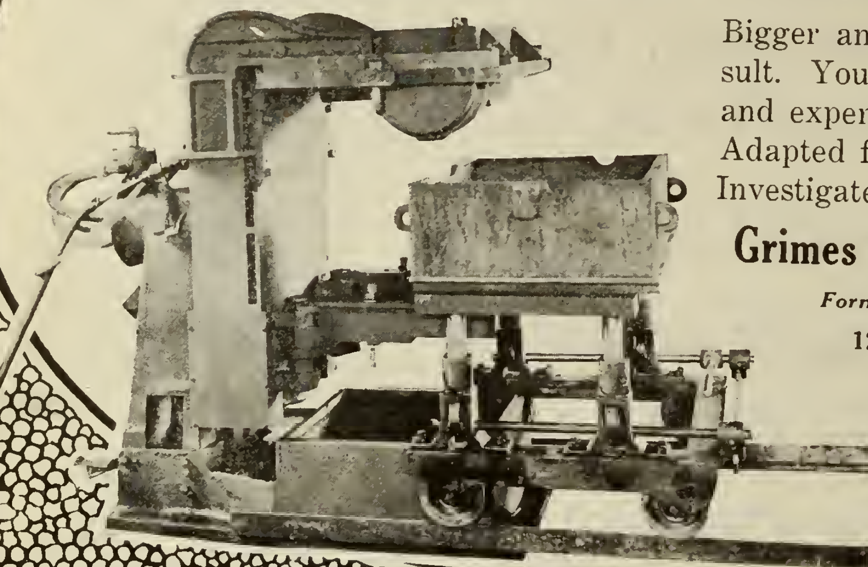
May Enlarge Plant.—Announcement comes from Hamilton that the management of Dominion Foundries and Steel are contemplating enlarging the scope of their plate department. At present the plate mill at the plant rolls 24-inch universal, and it has been the plan of the company for some time to go ahead and roll the larger sizes. There is nothing to indicate that the work will be proceeded with immediately. Plate is imported largely from the U.S. mills and there is considerable business offering for a mill that can come into operation quickly and make definite deliveries.

New York.—There was a decrease in the domestic mine output of lead and zinc during the last year. The lead and the recoverable zinc of ores mined were approximately 563,000 tons and 627,000 tons, respectively, as compared with 651,156 tons and 711,192 tons in 1917. The refined lead output of smelters and refineries was 645,000 tons, against 612,214 tons in 1917, and the antimonial lead output was 22,000 tons as against 18,647 tons. The lead available in the United States is 540,000 tons, against 515,258 tons in 1917.

Sooner or later you will equip your foundry with labor-saving facilities. Start now. Conditions demand it. Start with the

GRIMES

JAR-RAMMED ROLL-OVER MOLDING MACHINE



Bigger and better production will result. You will save a lot of labor, time and expense with this machine. Adapted for all kinds of work. Investigate without delay.

Grimes Molding Machine Co.

Formerly Midland Machine Co.

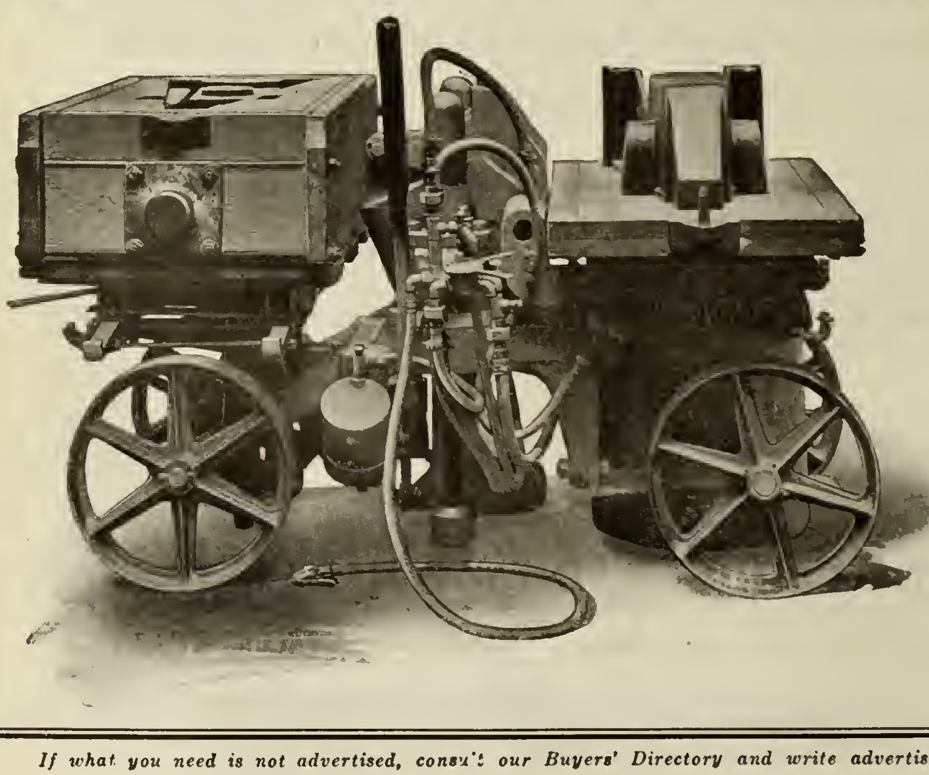
1218 Hastings Street

DETROIT

MICH.

TABOR

PORTABLE COMBINATION SHOCKLESS JARRING ROLL-OVER AND PATTERN DRAWING MOLDING MACHINE



A distinctive Tabor achievement, being a combination of two exclusive Tabor features: the Shockless Jarring Machine and the Roll-Over Straight Draw Machine. Eliminates all ramming time and is suited to a wide variety of work. Send for Bulletin M-S-H.

Tabor Mfg. Co.

PHILADELPHIA, PA., U.S.A.


HARRISON BROTHERS
DIAMOND GRIT
METALLIC ABRASIVES
For that smooth velvety finish—
that finish which elevates your castings to the highest point of excellency, "Grit-Blast" or "Shot-Blast" your castings.
HARRISON'S DIAMOND GRIT
and
CHILLED SHOT
The most logical blasting abrasives for any foundry.
Especially adapted for cleaning iron, steel, malleable and aluminum castings, forgings or automobile bodies.
One ton of Diamond Grit or Chilled Shot will accomplish as much as carloads of sand. Most economical, quickest and cleanest blasting method known.
Harrison Supply Company
Write today for samples.
5-7 Dorchester Ave. Extension BOSTON, MASSACHUSETTS

LOST!

—and LOST to YOU!

Another year gone by. Another year of LOSSES and WASTE of material in your shop and still YOU refuse to get wise to the

SAVINGS BY McLAIN'S SYSTEM

WE GUARANTEE that *every* car of coke—*every* car of pig iron—every car of scrap will produce more castings and better metal—OR NO CHARGE.

It will pay YOU to wake up. There is a new era some time in every line—there's been one in the foundries following our system for the PAST TEN YEARS.

We offer you the latest advice on the metallurgy of iron and semi-steel—we continually add valuable information as we are engaged in solving foundry problems in all parts of the world.

Clients in every country seek our advice on iron or semi-steel mixtures for EVERY CONCEIVABLE KIND OF CASTINGS, thus, in addition to our years of practical experience you receive hundreds of mixtures covering all classes of castings such as gears, auto cylinders, Diesel engine cylinders, semi-steel shells, etc., etc.

Replace Guess Work Tradition and Rule of Thumb Methods With McLain's System

Take a Chance with McLain—Later You Will Learn You Took No Chance At All

There is a great deal more to the story—WRITE or return coupon for FREE INFORMATION

McLain's System, Inc.

700 Goldsmith Bldg.

Milwaukee, Wisconsin, U.S.A.

COUPON

McLain's System, 700 Goldsmith Bldg., Milwaukee, Wis.
Send me full information on McLain's System cupola practice and Semi-Steel.
Name ....
Firm ....
Address ....
Position ....
2-19

FORD-SMITH

Grinders, Polishers, Buffers
Milling Machines
Special Machinery

Heavy Type Floor Grinder

Manufactured by

The Ford-Smith Machine Co.
LIMITED
Hamilton, Ontario, Canada

W.D. ANDERSON'S Engineering
EFFICIENCY SERVICE

Efficiency Methods installed in Industrial Plants by **PRACTICAL MEN** who thoroughly understand the subject.

GRAPHIC PRODUCTION CONTROL can be applied to any industry. It will completely revolutionize your **Production Problems.**

We will be glad to explain it to you, and point out the Economies to be effected by its introduction. It puts everybody on **Schedule. It stops Loafing on the Job.** It makes everybody a producer. It is working elsewhere and giving splendid results. Let us write you.

RING UP

Anderson's Efficiency Service

Phone: 221 Adelaide

380 Queen West, - Toronto, Canada

Does It Not Seem Reasonable

If you want to produce GOOD Castings you should use GOOD Material

Makers of cheap Blacking cannot afford to use expensive material, so the Foundryman gets just what he pays for when buying cheap blacking.

Here are some of our Leaders which carry our personal guarantee with them:

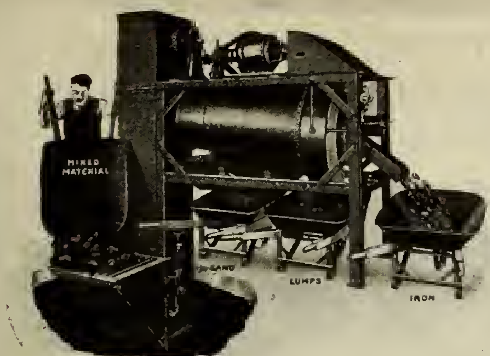
STEVENS CARBON BLACKING
STEVENS EAST INDIA PLUMBAGO
STEVENS COLUMBIA PARTING
STEVENS BLACK CORE COMPOUND and
NELSONVILLE FIRE CLAY

A trial barrel will convince you.

Prompt shipment from our Montreal Warehouse.

Standard Machinery and Supplies, Limited

261 Notre Dame Street West
MONTREAL



MAGNETIC SEPARATORS

Will save that waste iron and screen your sand as well.

Our Type "F"

Separators require no shoveling. Simply dump the material into the grizzly.
Note elevator feature. Magnetic separator can be furnished without this feature if desired, thus reducing cost.
One of Canada's largest foundries has just ordered one. Name supplied on request.

They Save Labor and Metal

MAGNETIC MANUFACTURING CO.
Windlake and Fourth Ave. MILWAUKEE, WIS.

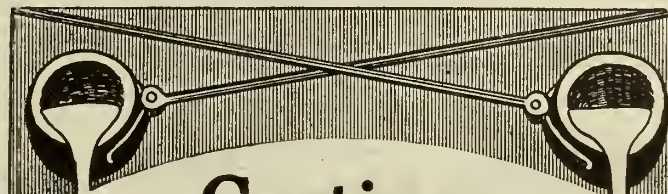
You Can't Afford To Be Without This Machine

When you consider that the Battle Creek Sand Sifter does five times the work of a riddle sifter, don't you think you require one in your foundry? Quickly pays for itself.

Any foundry supply house can furnish you with this or any one of our other cost-cutters.

Battle Creek Sand Sifter

Battle Creek Sand Sifter Co.
BATTLE CREEK., MICH.



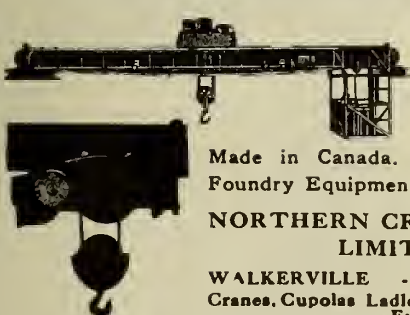
Castings

Brass, Gunmetal, Manganese Bronze, Delta Metal, Nickel Alloys, Aluminum, etc.

MARINE AND LOCOMOTIVE ENGINE BEARINGS. MACHINE WORK AND ELECTRO PLATING. METAL PATTERN MAKING.

United Brass & Lead, Ltd., Toronto, Ont.

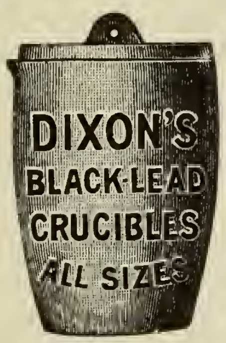
CRANES



Don't buy a crane or hoist without investigating Northern Products—Made in Canada. Also a line of Foundry Equipment.

NORTHERN CRANE WORKS LIMITED
WALKERVILLE - - ONTARIO
Cranes, Cupolas Ladles, Hoists, Tumblers Etc.

When you think of a crucible think of DIXON and remember that the Dixon name stands for the longest and widest experience in the crucible industry.



Write for Booklet No. 27-A.

Made in Jersey City, N.J., by the
JOSEPH DIXON CRUCIBLE COMPANY
Established 1827

To Classified Advertising Section

Milton Hersey Company, Limited

CONSULTING FOUNDRYMEN
AND
INDUSTRIAL CHEMISTS

Analyses and Tests on all Materials used in Foundry Work.
Expert Metallurgists and Practical Foundrymen
For Your Foundry Problems.

Montreal **Winnipeg**

FOUNDRYMEN OF CANADA: You have performed miracles of production through four tense years of fighting behind the lines.

Now comes another test; show your ability to do a still grander thing—to keep those cupola fires burning, and those strong men working at the arts of peace; for Canada, almost "over night," has become one of the strong INDUSTRIAL nations of the world and the WHOLE world will need your utmost output.

In that transformation a modern sand blasting equipment can be made to play a vastly-useful part. If you have not already such an equipment, send for our "Little Journeys of The Flint Shot Man," almost a "text-book" on sand blasting, telling how over 60 great American plants cut costs, increase tonnage and improve quality of output by "Flint Shotting" their castings. This book also contains a list of makers of sand blastequipment.

If you HAVE a sand blast equipment the book will be even more useful to you, as it tells the wonders of FLINT SHOT—the MANUFACTURED abrasive that opens up new possibilities in sand-blasting, that could never have been realized by the use of natural sand.

SEND FOR THE BOOK

UNITED STATES SILICA COMPANY

1939 Peoples Gas Building ∴ CHICAGO, U.S.A.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BINDERS, SAND
Holland Core Oil Co., Chicago, Ill.

BOILERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

BOILER GRAPHITE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRIQUETTING
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

BRUSHES, FOUNDRY AND CORE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CARBON BLACKING
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Standard Machy. & Supplies, Ltd., Montreal, Que.

CAR MOTORS
Can. Ingersoll-Rand Co., Montreal, Que.

CARS, CORE OVEN AND FOUNDRY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, ALUMINUM, BRASS, BRONZE, ETC.
United Brass & Lead, Ltd., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
United Brass & Lead, Ltd., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARGING TRUCKS
Brown Specialty Mach. Co., Chicago, Ill.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, O.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Mach. Co., Chicago, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CRANES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Dominion Crucible Co., Ltd., Montreal, Que.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DYNAMOS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.

EFFICIENCY ENGINEERING
Anderson's Efficiency Service, Toronto, Ont.

ELECTRO PLATING
United Brass & Lead, Ltd., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry & Machine Co., Chicago, Ill.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Wheeler Mfg. Co., Chicago.

GOGGLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

GRANITE AND MARBLE POLISHING
Harrison Supply Co., Boston, Mass.

GRANITE CUTTERS' TOOLS
Harrison Supply Co., Boston, Mass.

GRANITE AND MARBLE POLISHERS' SUPPLIES
Harrison Supply Co., Boston, Mass.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Ingersoll-Rand Co., Montreal, Que.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, DISC, BENCH, SWING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, RESIN
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Can. Ingersoll-Rand Co., Montreal, Que.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, HAND, TROLLEY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

INGOTS, BRIQUET
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

INGOTS, COPPER, BRASS, BRONZE AND NICKEL
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

IRON CEMENTS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Wheeler Mfg. Co., Chicago.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Wheeler Mfg. Co., Chicago.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cooper Saddlery Hardware Co., H. W., Moline, Ill.
Champion Foundry & Machine Co., Chicago, Ill.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Federal Malleable Co., West Allis, Wis.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NICKEL, CHROME
Walker & Sons, Metal Products, Hiram, Walkerville, Ont.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

CORETREEN
LIQUID CORE BINDER

VENT WAX
BUFFALO BRAND

FOUNDRY SANDS
CORE, SILICA AND MOULDING

CUPOLA BLOCKS
FIRE BRICKS AND SHAPES

FOUNDRY SUPPLIES
SEE LIST IN BUYERS' DIRECTORY

HYDE & SONS, MONTREAL

USE KAOLIN

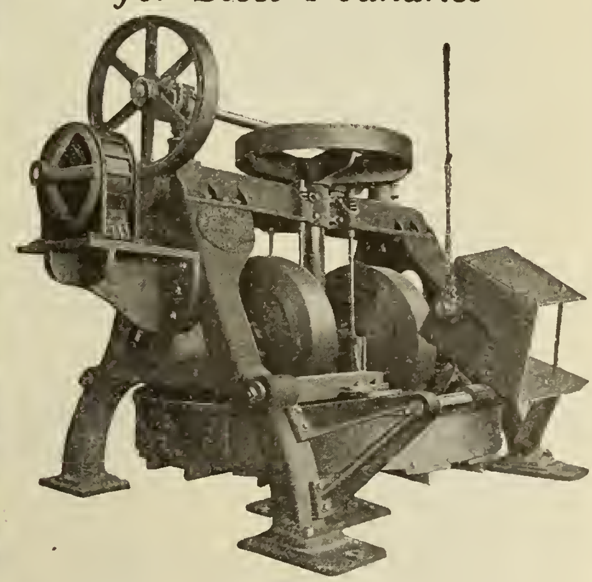
For lining and patching the Cupola or Open-Hearth Furnace, Lining Ladles, Clay Wash, etc.

It will save your fire brick and the time of your men.

Whitehead Bros. Co.

Providence
New York
Buffalo

Frost
Wet Pan Sand Mill
for Steel Foundries



The *Frost* Mfg. Co.
112 W. Adams St.
CHICAGO

Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Champion Foundry & Machine Co., Chicago, Ill.

PIG IRON
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

PROTECTIVE WEARING APPAREL
Wheeler Mfg. Co., Chicago.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

REFUSE BURNERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Rodgers Boiler & Burner Co., Muskegon, Mich.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Rodgers Boiler & Burner Co., Muskegon, Mich.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Cascades Silica Products Co., Montreal, Que.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SAND BLAST SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frost Mfg. Co., Chicago, Ill.

New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Harrison Supply Co., Boston, Mass.

SAND-MIXING MACHINERY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Rodgers Boiler & Burner Co., Muskegon, Mich.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry Mach. Co., Chicago.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.

SEA COAL
Obermayer & Co., S., Chicago, Ill.

SHOT
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.

SPRUE CUTTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STAND PIPES, STACKS
Rodgers Boiler & Burner Co., Muskegon, Mich.

STEEL, CRUSHED
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

STOPPERS, GRAPHITE
Dominion Crucible Co., Ltd., Montreal, Que.

TANKS, OIL AND WATER
Rodgers Boiler & Burner Co., Muskegon, Mich.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
McCulloch-Dalzell Crucible Company, Pittsburg.

TRACK, OVERHEAD
TROLLEYS AND TROLLEY SYSTEMS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Hyde & Sons, Montreal, Que.

WHEELS, GRINDING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS

Character in Cupola Blocks

You do not buy Fire Brick and Cupola Blocks blindly.

To use them economically and succesfully they must be bought first with knowledge of their QUALITIES and their REQUIREMENTS IN SERVICE.

Every brand is made for a SPECIFIC PURPOSE:

One brand, for boiler settings, for hand-fired horizontal boilers, which resists 2,000 degrees Fahrenheit and which must resist also the abrasion wear of the fireman when he knocks off clinkers. When the wrong kind is used not only the clinker but the brick, too, are destroyed—there is needless expense.

Another kind, for heat-treating furnace lining, where high degrees of heat prevail.

Still another kind for cupola linings, which must resist not only heat but abrasion wear of the charge as it wears down through the melting process.

So it goes; each for its purpose. I have IN STOCK the brands that have made Fire Brick history. Every Fire Brick and Cupola Block reaches the user with clean, uninjured edges and every one is thus adaptable to its exact place. Fire Brick makers, as a rule, are several months behind on orders. I can accept your order IMMEDIATELY and deliver PROMPTLY.

There is no duty on ordinary Fire Brick. Can ship Fire Brick, Cupola Blocks and Fire Clay in carlots or less. Write stating service required.

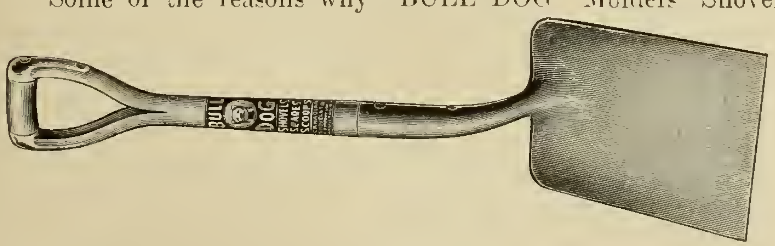
"Bull Dog" Molders' Shovels Are Great Favorites

The Blade and Socket are forged from one piece of high carbon bar steel, carefully hardened and tempered.

The socket is split at the back to permit of tightening around the handle should the wood shrink.

All Patent D Handles are made with the grain running lengthwise.

Some of the reasons why "BULL DOG" Molders' Shovels are such GREAT FAVORITES are as follows:



(A) Solid shank construction.
(B) Thick centres on top of blade where strain comes.
(C) Graduating tapers on blades.
(D) Bend in solid shank instead of the handle.
(E) Easily re-handled (not the case with bent handles).
(F) Practical tests have proven their superior strength.

Send me a trial order.

FREDERIC B. STEVENS

Manufacturer of Foundry and Electro-Plating Supplies and Equipment

DETROIT, MICH.

WAREHOUSE and OFFICE	FACING MILL	EXPORT WAREHOUSE	EASTERN SELLING AGENTS
Cor. of Larned and Third St.	Cor. of Isabella Ave. and Mich. Central Railroad.	Windsor, Ont.	Standard Machinery & Supplies, Ltd. Montreal, Quebec.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, MARCH, 1919 No. 3

KAWIN SERVICE MEANS

Proper Mixtures.
Correct Cupola Practice.
Uniform Castings.
Solving of Molding Problems.
Increased Output and Lowering of Costs.

"KAWIN" STEPS TO FOUNDRY SUCCESS

Are you getting volume of production from your foundry that you should? Is the work up to the standard you would like? Are you suffering from losses? Unless you are sure on these points it will pay you to retain our service.

Kawin Service

Guarantees Foundry Efficiency and Economy

Our trained staff of expert foundrymen know every angle of foundry practice. They have had practical experience. They have experience with the best methods of production and know how to get the best paying results.

Kawin Service Guarantees to Save you 100% over and above its cost. Why not at least investigate? Enquiries gladly answered.

Charles C. Kawin Company, Limited

Chemists, Foundry Engineers and Metallurgists

307 Kent Builning, Toronto, Can.

Dun Bldg., Buffalo, N.Y. | Dayton, Ohio | Chicago, Ill. | San Francisco, Cal.

The Publisher's Page

TORONTO MARCH, 1919

"Moulding," Making Molds

WE'VE all heard stories about men who walk in their sleep, and we all know men who "sleep" while they walk.

Just so in the foundry.

We've all watched molders making molds. That's exactly what takes place in the foundry every day. Yet, how many of us have caught ourselves becoming "Mouldy" making molds. We are satisfied to do our daily work — honestly and squarely, mind you—but outside of that what do we know?

And here's where we stop to think. We find ourselves in possession of many valuable ideas, all dealing with our daily work. Why keep these ideas crammed up in our heads? Why not pass them on to the next fellow? Ten chances to one he will pass us something better in return.

Thousands of foundrymen to-day are passing ideas and suggestions to one another. Many come to the attention of our editor, Mr. Bell, and he, in return, passes out more and more suggestions through the columns of CANADIAN FOUNDRYMAN, to be circulated amongst our subscribers.

And so, if you have a good idea, don't let it MOULD. Pass it on. Send it to Mr. Bell. You can talk with him just as you would to your shop-mate. Talk "shop."

Don't "MOULD," Molding Molds.

Canadian Foundryman, March, 1919. Vol. X. No. 3. Published monthly at 143-153 University Ave., Toronto, Canada. Subscribers price in Canada $1.00; in the United States $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under the act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.

Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
CRUCIBLES
Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

Canadian representative H. T. Meldrum 14 St. John St., Montreal, Canada.

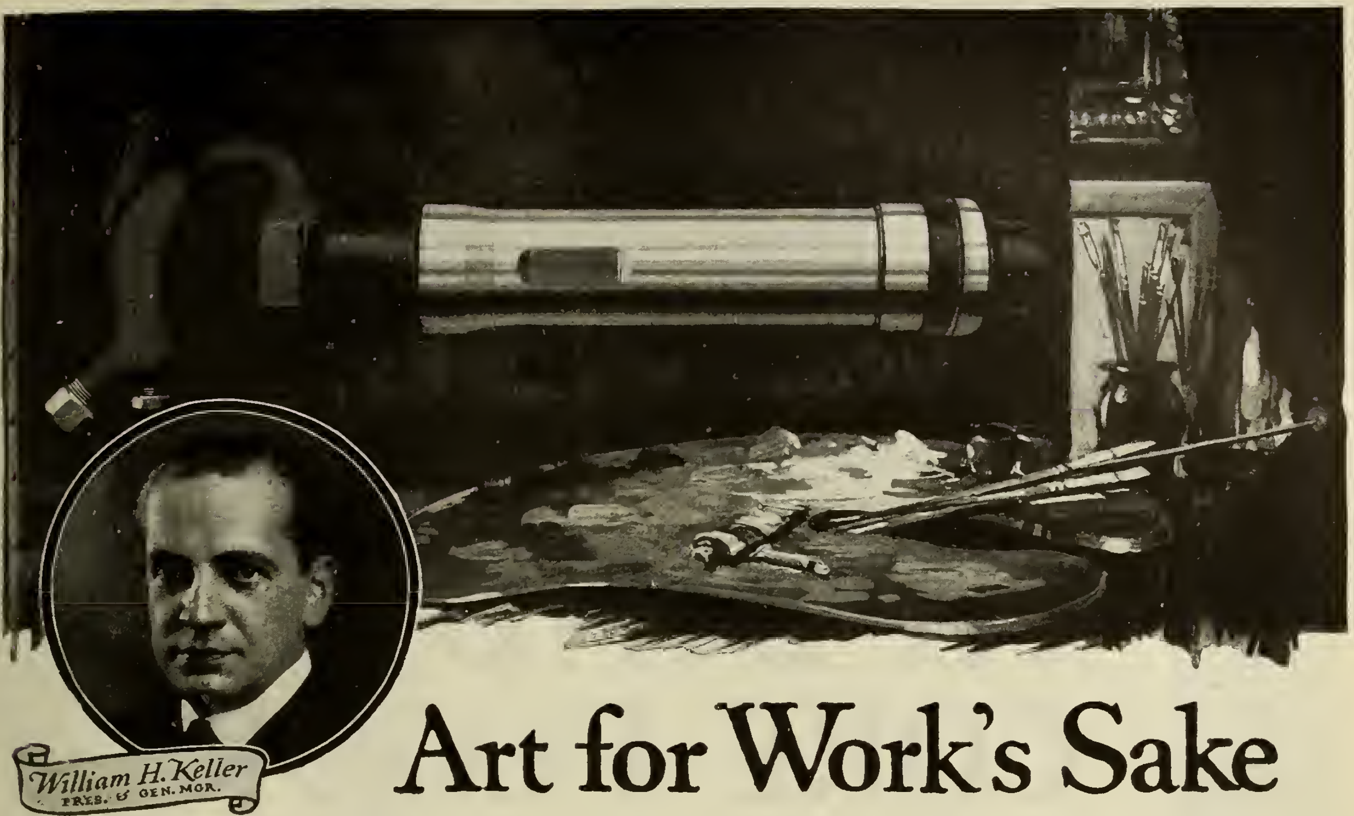
THE
W.
W.
S
L
Y
MFG.
CO.

CLEVELAND
OHIO
U.S.A.

Tumbling Mills of any size and type for any purpose

Complete Line of Foundry Equipment

Sandblast Installation   Dust Collecting Systems



Art for Work's Sake

The longer I work at my job of designing and manufacturing Pneumatic Tools, the more profound becomes my appreciation of the truth of Emerson's dictum that "all beauty is organic."

With Emerson, I believe that the truest and most enduring forms of beauty, whether in people or buildings or flowers or machinery or tools, are structural in character, and never merely decorative. True beauty cannot be put on. It must be built in.

So when I am asked, as often I am, why we of the Keller organization spend so much of our time and effort on the external lines and finish of Keller-Made Master-Built Pneumatic Tools — why we bother about making them look pretty, as some visitors express it—I answer, we do nothing of the sort.

Our foremost and constant purpose is and always has been to produce tools that can be depended upon to give maximum service at minimum cost. It is by adhering unwaveringly to that purpose, and not through any desire to please the eye of the beholder, that we have succeeded in making our tools unusually symmetrical and attractive.

The beauty of Keller-Made Master-Built Pneumatic Tools is true beauty because it is truly *organic*—it is *inbuilt* at every stage of manufacture, from the machining of the cylinders up to the final sandblasting and lacquering of the handles.

Keller-Made Master-Built Pneumatic Tools *look* best because they *perform* best. Their appearance, like their popularity, is the just measure of their worth.

KELLER-MADE
PNEUMATIC TOOLS
MASTER-BUILT

William H. Keller *President*

KELLER PNEUMATIC TOOL COMPANY, GRAND HAVEN, MICH., U. S. A.

Holland Core Oil Company

HI-BINDER CORE FLOUR

The Only Substitute for Flour

Hundreds of Barrel-lot customers and several car-lot customers are using it every day. Why? Because it is giving the best of service and saving money.

Holland Products

Core Oils, Match Oil, Linseed Oil, Hi-Binder Dry Core Compounds, Hi-Binder for Dry and Green Sand Facing for Steel, Hi-Binder Core Paste, Parting.

Canadian Agents:

The Dominion Foundry Supply Co., Limited

"Everything for the Foundry"

TORONTO MONTREAL

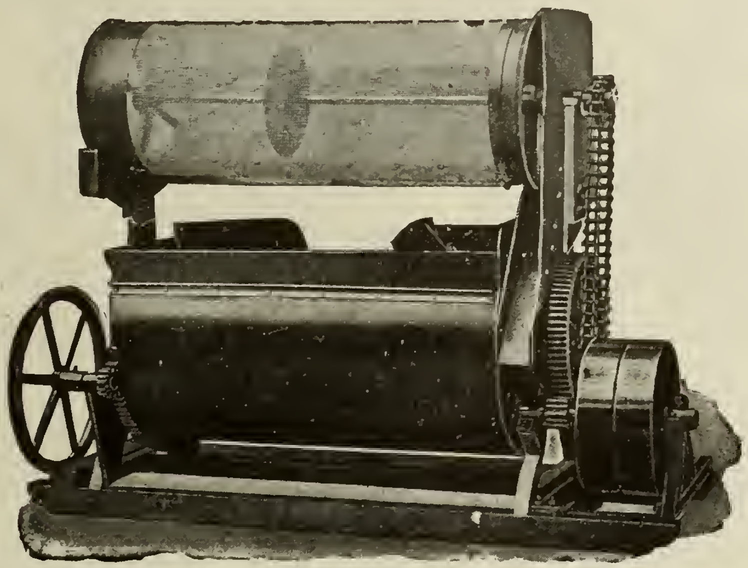
HOLLAND PRODUCTS
GOOD PRODUCTS ONLY

4600 WEST HURON ST.

CHICAGO --- ILLINOIS


CLEAN UP THE SHOP!
Stop Trying to Melt Your Brass Chips
If you could contrast the appearance of the shops of our clients with the same shops in the days when they tried to work off their Brass Chips into their own melts, you would understand why the whole force, from General Manager down to the unskilled laborers are "for"
BRIQUET-INGOTS
(Trade Mark)
No more choking fumes or oil smudge; no more of the tangly stuff messing up floors, furnaces, crucibles and their surroundings. No more time and labor and metal-value lost in handling the "dirty stuff."
Heats made quicker with more pounds of metal to the heat. Brass poured more uniformly, pure and free from iron.
Melters themselves almost fight for their share of Briquet-Ingots, because they are so easy to handle and pack.
Whether you are only producers of chips or are yourselves melters, send for our Briquet-Ingot Book.
EASTERN BRASS & INGOT CORP.
of NEW YORK
Waterbury, Conn.
METAL BLOCK CORPORATION
208 S. La Salle St. Chicago, Ill.
BRIQUET
TRADE MARK
INGOT

"BLYSTONE"



Sands thoroughly mixed. Labor reduced 50% or more. Saving of 20 to 30% Core Oil and Binders

SIMPLICITY

Simplicity, thoroughness of mixing, and durability are incorporated in the exclusive patented features of the BLYSTONE SAND MIXER.

There are no frills—just a strong, durable machine that will turn out the maximum of thoroughly mixed material at minimum cost and in minimum time. With this machine, one man in less than a half-day can mix FACING for 100 molders and SAND for 25 core makers.

The "BLYSTONE" is a thoroughly dependable and common-sense machine, accurately constructed of the best materials obtainable. It will save 25% of the cost on core mixtures and 50% on labor.

Write us for catalog and prices.

Blystone Manufacturing Company

319 IRONTON STREET - CAMBRIDGE SPRINGS, PA.

BALTIMORE . . J. W. Paxson Co.
BIRMINGHAM . . Hill & Griffith Co
BUFFALO . . E. J. Woodison Co.
CHICAGO . . . Scully-Jones & Co.
CINCINNATI . . Hill & Griffith Co.
CLEVELAND . . E. J. Woodison Co.
DETROIT . . . E. J. Woodison Co.
NEW YORK . Wonham, Bates & Goode, Inc.
PHILADELPHIA . . J. W. Paxson Co.
PITSBURGH . J. S. McCormick Co
TORONTO . . . . E B Fluery
SAN FRANCISCO . . . Ditty Bros.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

Moulding and Pouring Farm Implement Castings

Different Types of Machine Are Used For Different Styles of Castings, But the Snap Bench Still Has Its Place, so Also the Man

AS AN agricultural nation, Canada certainly stands supreme. In proportion to her population she can undoubtedly compete with any nation on earth as regards volume of business, and regardless of population she is easily the leader in quality, particularly in the matter of grain. Before the advent of prohibitive tariffs which blocked the way, every brewery of note in the United States boasted of using exclusively "Canadian malt" in their brew, thus considering their goods sufficiently advertised as a superior brand.

Likewise, Canadian wheat is the standard of the world. As the specific gravity or weight of every liquid or solid substance is compared to that of water, so in like manner is the wheat of all lands compared to that of Canadian "hard." So is it any wonder, then, that Canada is the home of some of the largest and most up-to-date agricultural implement industries in the world. A visit of inspection through one of these plants could not but be of interest and enlightenment to any one. It is not, however, the purpose of this article to describe how the implements are built, but simply to show how some of the parts are molded and cast.

In the Foundry

Foundry work is too frequently a neglected part of the manufacturing business, but in the manufacture of farm implements the foundry branch is keeping pace with the rest. Particularly so is it with the International Harvester Co. at their works in Hamilton, Ont., where the average daily output consists of thirty-five tons of malleable and seventy tons of grey iron castings. To produce this enormous output a malleable foundry with a floor space of 85 feet in width and 798 feet in length, and a grey iron foundry with a floor space of 84 feet by 661 feet are required. It will be noticed that the malleable foundry is somewhat larger than the gray iron foundry, although the melt is only half the tonnage. This is accounted for from the fact that malleable castings are invariably light as compared with gray iron castings, and thirty-five tons of malleable represents an enormous pile of castings and an enormous lot of molds. To accomplish this, ninety-five molders are required. This would appear to be quite an item for each molder, averaging

FIG. 1—COMBINATION JOLT RAMMER AND SQUEEZER MACHINE, RUN ENTIRELY BY PNEUMATIC POWER.

as it does pretty close to 800 pounds apiece. But with proper equipment and efficient management this is made possible. In melting the malleable iron, reverberatory furnaces are used, and the metal is poured several times a day, and the building being well ventilated the men do not work up much of a sweat at any one batch.

In the grey iron foundry there are 110 floors, and to melt the iron required for this department two eight-foot Whiting cupolas are provided. For an ordinary heat of seventy tons one cupola suffices, but at certain seasons, when the tonnage runs upward of one hundred tons both are requisitioned.

In making the molds for this class of work the procedure is exactly the same as for any other line of work but the mode of procedure is slightly different. The molding sand must be properly tempered and mixed, and it must be rammed to the right degree of hardness. There must be a cope and nowel with the mold between them, and the metal is poured into the gate and flows into the mold the same as in any other class of molding, and all things considered molding in a specialty shop is the same as in jobbing, with the exception that in a modern specialty shop, such as that of the International Harvester Co., nothing is left undone which will save labor and increase production.

FIG. 2—MOLDING MOWER FRAME ON ROLL OVER TYPE STRIPPING PLATE MACHINE.

FIG. 3—CLOSING MOLD FOR MOWER FRAME. ALSO SETTING CORES IN ANOTHER

Making the Molds

In Fig. 1 is shown a machine such as is used for making medium-sized pieces. This is a combination jolter and squeezer. As will be seen, the pattern is in two parts and is fastened to the machine. When a mold is to be made, the table of the machine is placed with the patterns uppermost and the two parts of the flask are put in place in the usual way and filled with sand, but instead of the workman tucking the patterns with his fingers and afterwards peening and butting the two parts, he simply turns on the compressed air and the table is jolted up and down until the sand is in a condition similar to having been tucked and peened. The squeezer is now brought into action, also operated by compressed air, and the mold is left in a state similar to having been butted. It is now struck off and the boards put on and clamped by means of clamps which are shown on the machine, after which it is rolled over and lowered into place, the patterns being drawn automatically. The table on which the molds are shown is now swung out from under the machine by means of the lever on the side of the machine, leaving the two halves of the mold as shown. This is all the work of a moment, and the mold is ready to be cored up and put on the floor and closed.

Apart from shoveling in the sand and lifting the mold from the machine to the floor, very little physical exertion on the part of the operator is required.

Molding Mower Frame

In Fig. 2 is shown an entirely different method of molding, but what would appear to be the ordinary, old-fashioned floor mold, which in reality it is, with certain labor-saving and time-saving devices incorporated. What appears to be

FIG. 4—MOLDER WORKING AT SNAP BENCH, ALSO FLOOR OF SNAP MOLDS.

the cope in this illustration is nothing short of an ordinary stripping plate or drop-pattern molding machine, which is utilized as a roll-over follow-board. This machine is placed on its back on the floor with the pattern in place as on a follow-board. The nowel is now rammed up and the bottom board clamped on and rolled over. The molder then pulls the lever shown in his hand and the machine is lifted off by means of the air-hoist and put in place for the next mold, leaving the nowel complete with the exception of the cores. The cope is made in a similar manner.

Fig. 3 shows the cope being lowered into place by means of air hoist, also workman setting cores in the next nowel. This kind of molding, as we have already stated, is the same as has been practised for years back in this class of work, only that the molder is relieved of the burdensome task of rolling the drag or nowel by hand and drawing the heavy pattern with his back for a crane. In fact all the lifting on and off of flasks before and after being rammed is done by means of compressed air.

Snap Molding

In Fig. 4 is shown a section of the snap floor, with snap molder at the rear finishing his day's work. This work is still done on the snap bench by practical bench molders.

In the Core Room

Fig. 5 shows a section of the core room with car of cores ready to be shoved into the oven. Note the design of the car. When the lever shown to the right is in an upright position the car stands rigidly on the four corner supports, but when it is desired to move the car the lever is pulled down to the position shown, with the result that a cam or eccentric attachment brings the wheels into play by raising the legs or corner supports off of the floor. This attachment as will be seen extends underneath the car and controls the other end as well.

FIG. 6—SCENE IN FRONT OF CUPOLA AT CASTING TIME. NOTE THE TWO SYSTEMS OF TROLLEY.

FIG. 5—ONE OF THE BATTERY OF CORE OVENS WITH CAR OF CORES READY TO BE SHOVED INTO OVEN. NOTE THE SIMPLICITY AND COMPLETENESS OF CAR.

The Core Ovens

The ovens are of the continuous type having doors at both ends. The car is run in at one end and taken out at the other; in this manner no delay is occasioned. As a thoroughly dried batch is taken out the partially dried ones are simply moved into the place just vacated, thus making room for a fresh batch at the entrance. These ovens are so constructed as to have all foul smells carried out through the chimney, making the surroundings much more pleasant for the workmen.

Pouring Off

The melting and handling of the metal and the pouring of the molds, always the most interesting and fascinating part of all (particularly to the onlooker) is carried on in this establishment in a most perfect and scientific manner. In Fig. 6 is shown a somewhat familiar sight in front of the cupola. As is the case in most modern foundries where the metal is delivered to the molders by means of large ladles suspended from overhead trolley system and

Continued on page 61

Practical Method of Moulding Building Column

If Moulded in This Manner Cast Iron Columns Should be Made to Compete With Steel Tubes or Beams, is Belief of the Writer

By JOHN B. LLOYD

THE subject of this paper is as old as the hills and is perhaps a little late in making its appearance, but better late than never. The cast iron column is perhaps being largely supplanted by the steel I beam or steel tubing, but these substitutes must ultimately give way to the return of the cast iron column. No fault was ever to be found with the cast iron other than that a cheaper substitute might be found. There is nothing which seems to have such a pronounced effect on a human being as pressure on his pocket, and the haphazard way in which building columns are usually molded has not been particularly conducive of any relief from this source of difficulty. Steel tubes are always of standard sizes and parallel, so are the I beams and other sorts of beams, and since builders and architects have broken away from the idea of having tapered and fancy-designed patterns and are content to use straight, plain columns, the point is to get equipped to turn out cast iron in competition with the steel, and the cast iron will soon return to its former popularity as it has many advantages such as brackets being cast onto any location and in any shape. One great annoyance in making cast columns has always been getting them the proper length, and the rule has commonly been to have a pattern of the design shown in Fig. 1 and have it of sufficient length of meet all requirements, and when molded, have a stop-off piece with print attached and fill up to the required length both top and bottom. This had to be done in a careful way so as to have the two parts meet exactly, otherwise a turning lathe job was in store. This method entailed a lot of extra work and was apt to tumble out in closing unless well spiked.

A Superior Way

In Fig. 2 is shown a plain, straight pattern, void of core-prints, and in Fig. 3 is shown the core. This core, as will be seen, has prints of the same size as the pattern. The small part of the core is the size required for the inside, and by having the pattern abundantly long the cores can be set so as to fill just such length as is called for.

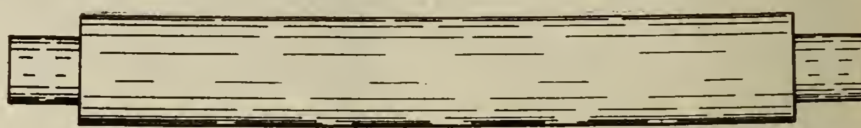


FIG. 1—SHOWING OLD WAY OF MAKING COLUMN PATTERN

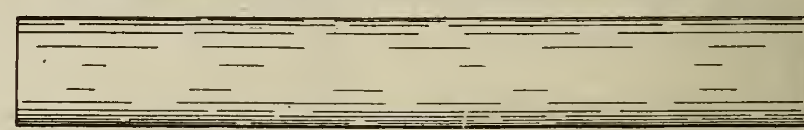


FIG. 2—SHOWING MODERN METHOD OF MAKING THE SAME JOB

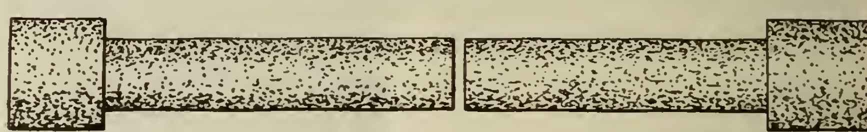


FIG. 3—SHOWING CORE FOR COLUMN MOLDS FROM PATTERN FIG. 2

Fig. 4 shows the core-box in which the core is made. By moving the block shown with two screw heads, the core can be made to any desired length, and is the exact length required of the column.

This system makes no extra work for the coremaker, and if the core is carefully jointed it makes a nice end. If exact accuracy is desired turned iron flanges can be kept in stock and slipped up against the shoulder, thus making as good a finish as could be done in a lathe. Flanges of this style might be used without having the shoulder on the core, but would probably not be an advantage.

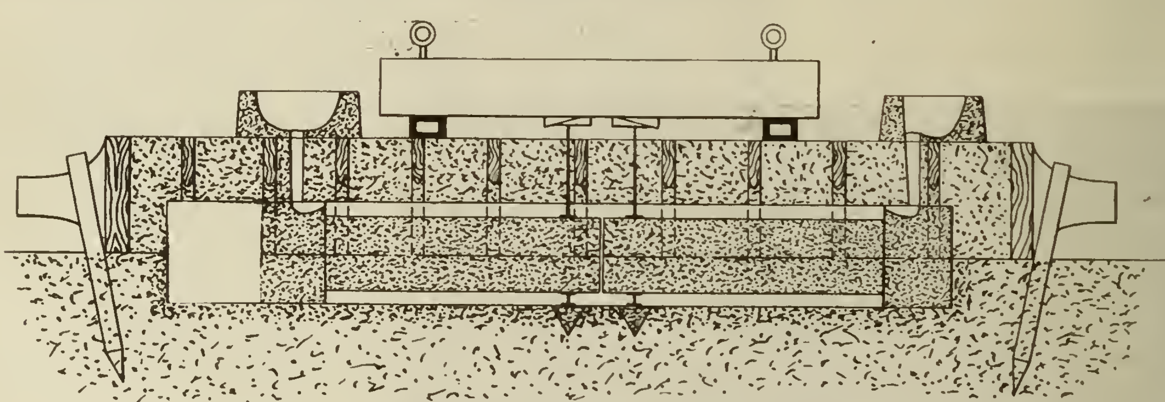


FIG. 5—SHOWS MOLD FOR COLUMN, SHORTER THAN THE PATTERN: ALSO SUPERIOR METHOD OF CHAPLETING UNDER CORE, AND WAY OF GATING.

In Fig. 5 is shown mold with cores set and chapleted into place, also showing mode of gating. The gate is cut

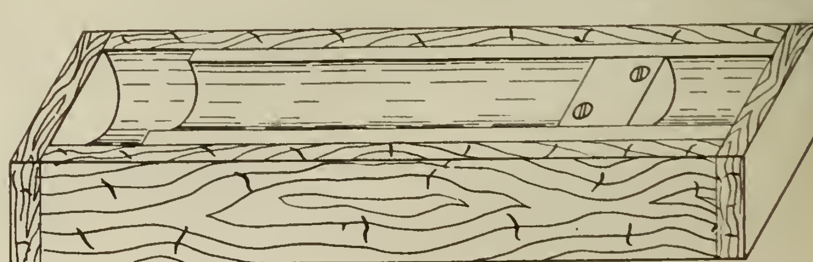


FIG. 4—CORE BAR FOR MAKING CORE FIG. 3 OF ANY LENGTH

in the print of the core and may be cut at both ends if required.

If the bottom half is bedded into the floor it is not necessary to have a plank to hold the chaplets. Conical shaped cores or chills are set in the floor on which to place the stud chaplets. Prints for these may be fastened to the pattern or they may be punched in with a stick of the proper shape.

It would be an enormous core which could not be held up by this means. These cone-shaped bearings for the chaplets may be put on the sides to keep the core from any possibility of shifting, but there is not much risk of shifting when poured from the end.

The two sizes of core-box can be dowelled or screwed to a board in such a manner as to permit changing to different sizes. Brackets or flanges of any kind can be placed on the pattern by this method the same as by any other.

The bottom half of mold may be in the floor or a drag can be rammed up and rolled over.

The same pattern does for all lengths, but flask of the proper length can be used by having one end open to allow pattern to protrude.

Another method which has advantages, which, perhaps, are superior in many respects, is to have the pattern as shown at Fig. 2, and instead of having the core as shown in Fig. 3, have it straight and of the size required for the inside, and

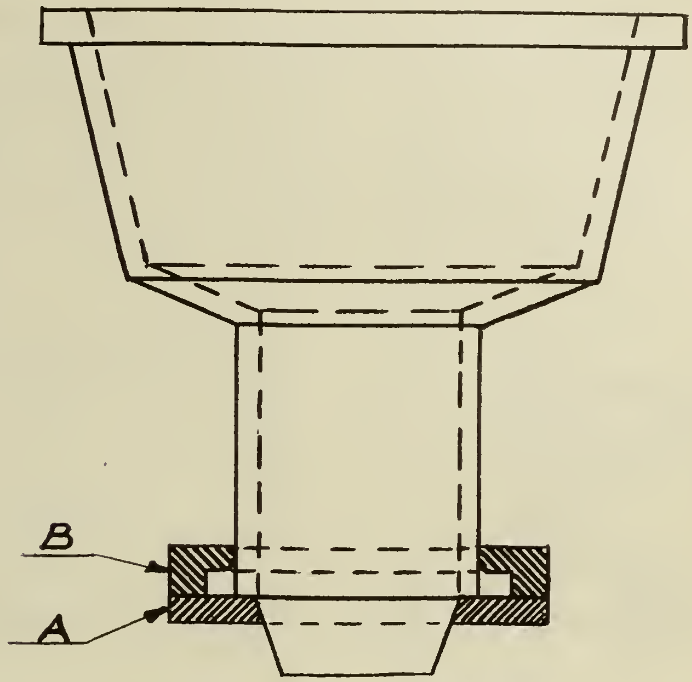
to fill the print and make the casting of the proper length, have shell cores similar to Fig. 6. These shell cores can be placed in halves, one before the centre core and the other after. If short columns are wanted and the pattern is long enough, a shell core can be placed in the centre, thereby making two columns from the one pattern and in the one mold.

A SUGGESTION RE THE MOLDING OF GAS FURNACE TOP

By J. McE.

Might I be permitted to offer a little suggestion relative to the article on page 33 of the February issue of the CANADIAN FOUNDRYMAN. I agree that the method of molding shown in Fig. 2 is a great improvement over the split pattern, but we never like to take any chances on overhanging sand if a simpler core will make a safer job, and in this case it would not increase the cost of production as the extra time taken by the core maker would be saved by the molder.

Instead of removing the neck core to withdraw the flange, could we not make the flange itself in a core? There is always a danger of the unsupported sand getting loose when rolling the box over. The illustration will make the matter clear; A, showing the neck core, and B the core to form the flange.



ANOTHER WAY OF MAKING THE SAME JOB

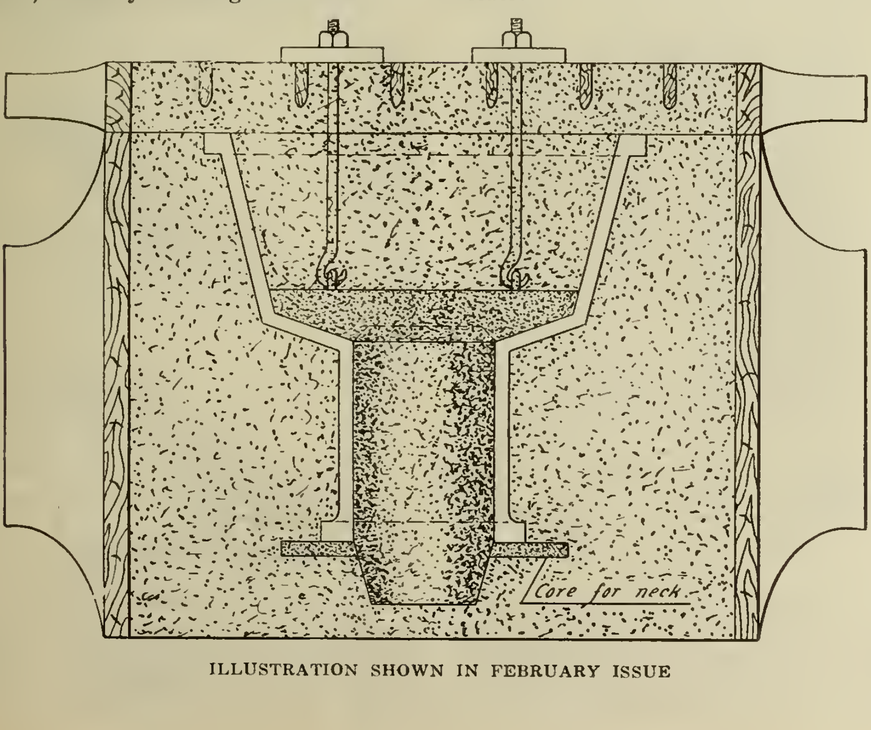


ILLUSTRATION SHOWN IN FEBRUARY ISSUE

MOLDING AND POURING CASTINGS

Continued from page 59

shoved about by hand, this system prevails here for those molders in the immediate neighborhood of the cupola. One of these ladles will be seen under the spout being filled, but when one takes into consideration the fact that this room is as long as two average city blocks, and that if the furnace was situated midway between the extremities, some of the molders would be a block away from the spout, it will be readily seen that even this method of delivering the metal would not be adequate. To overcome this the heaviest work is done on the floors farthest away and electric cranes mounted on an entirely different system of tracks are used. Much larger ladles can be handled by electricity than by hand. One of these ladles is seen suspended in the air. As will be seen, the crane man and the ladle man are carried to their destination. Much more might be written about this foundry, but the reader will no doubt appreciate something of what is transpiring in Canada's industrial enterprises. For the information herein contained the writer is indebted to the courteous treatment extended by the officials of the International Harvester Co., not the least of which was that of the retired general superintendent, Mr. Baggert, whose portrait is shown, as well as the genial foundry superintendent and also the core room foreman.

Steel Castings Used in Ship Construction

Being Continuation of Article in Last Month's Issue of Canadian Foundryman, in Which the Making of the Patterns Was Described

By BEN SHAW and JAMES EDGAR, in "Foundry Trade Journal," London, England

Preparation of the Mold

THE principles involved in preparing molds to receive molten steel are similar in many respects to those which characterize the preparation of molds for cast iron, but in practice the peculiar nature of the metal necessitates special provision for overcoming

FIG. 1—PREPARATION FOR BEDDING-IN

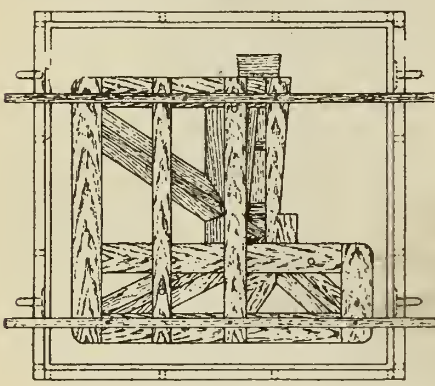


FIG. 2—SECTION OF DRAG

many of the difficulties which are encountered in a more intense degree than is the case with iron. In small castings the molds are prepared in the usual fashion, vented in like manner to those for iron, but not quite so essential. The sand, however, is rammed very hard; in fact, it cannot be rammed too hard, but the facing comprising the mold consists of a slightly different mixture to that for iron. Owing to the greater heat of the metal, a sand or composition of high refractoriness must be used, and the need for this increases with the increase in thickness of metal with which it comes into contact.

To meet demand for a special composition of this kind many firms supply what is termed "composite," and it is suggested for the benefit of those iron foundries where an endeavor is being made to assist in coping with the greater demand for steel castings for ships, to make use of these compositions, unless, of course, there is ample material at hand from which a good mixture can be milled.

A good composition can be made from broken crucible pots from which the flux, usually adhering to crucibles which have been in use for a large number of heats, has been freed, burnt ganister, or any other highly refractory material which has been in use in coke furnaces, old refractory bricks, clay from slate quarries, best hard foundry coke, all ground together in varying proportions, depending upon the degree of refractoriness required, and having water added to make it more cohesive. The loam used in steel foundries is of a similar composition, but contains more water, it being mixed to a consistency resembling that of lime. In appearance

FIG. 3 HALF PATTERN IN POSITION

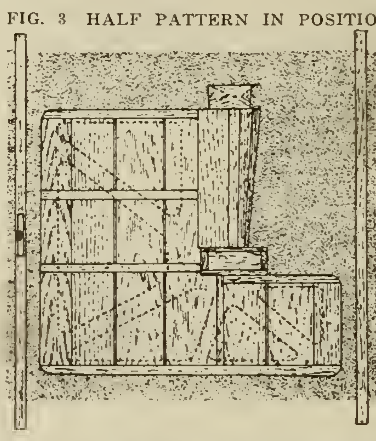
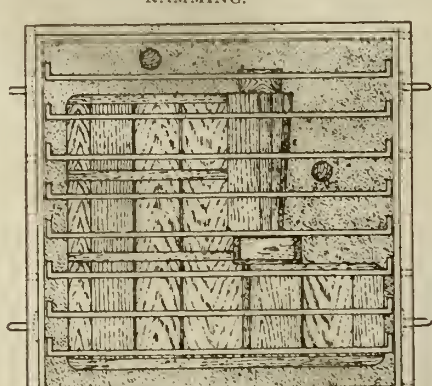


FIG. 4 PREPARING BED

the mixture is not unlike fire-clay, only coarser. Like the facing used for iron castings, once it has been in contact with the molten steel it is no longer fit to come into direct contact with the molten steel.

FIG. 5 TOP BOX PLACED READY FOR RAMMING.



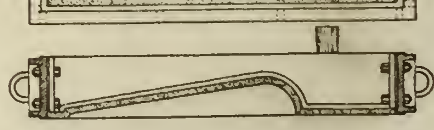


FIG. 6—SECTION SHOWING ONE OF THE BOX BARS.

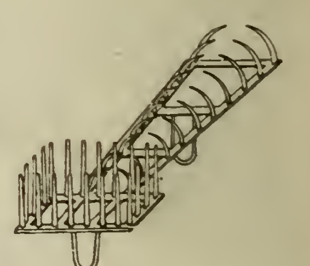
At the moment the men skilled in the art of steel founding are unable to cope with the increased output required, but skilled iron molders who are experienced in dry-sand and loam work will readily acquire skill in preparing molds for steel. Hence large foundries, being comparatively well equipped with labor, tackle and machinery, can, by installing new plant, such as, say, a Bessemer converter, do much to assist in meeting the demand, and as the amount and character of the work involving steel castings is gradually increasing, the prospects of steady employment and the success of the venture are almost assured.

With the exception of very large, unwieldy castings, the majority of molds are prepared in boxes; this method is adopted in preference to others because of convenience in ramming, and also to render the successful drying of the mold comparatively easy. In many small steel foundries, however, where larger work is being undertaken than that which was originally anticipated when erecting their premises, difficulties sometimes present themselves in rolling over the box parts. The height of lift may be insufficient or the capacity of the crane unequal to the weight required to be lifted, while it is possible to divide the top box into two parts, it is necessary that the bottom should be whole. In such circumstances it becomes imperative to bed the pattern into the sand comprising the foundry floor or contained in a box part.

This latter method is shown in the illustration (Fig. 1) in connection with the molding of the rudder. It will be noticed that a couple of straight-edged

FIG. 7 Section through centre, with gates and risers.

FIG. 8 —Grid for rudder post core.



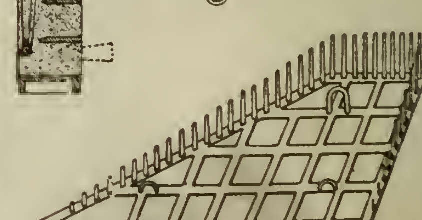
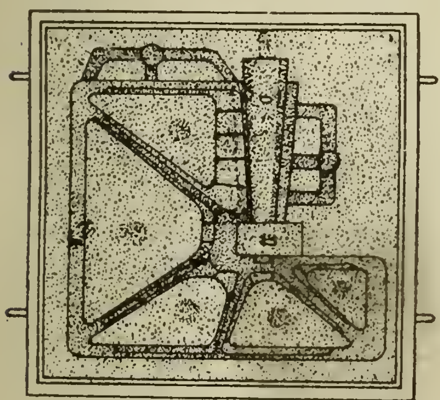


FIG. 9 GRID FOR CORE BETWEEN RIBS

pieces of wood are screwed to the bottom half of the pattern and rest on the surface of the box part or drag. This method is the more necessary in this instance because of the more fragile character of the pattern. When this bedding-in process is adopted for large flat work of this kind it is advisable to leave the pattern as open as possible consistent with rigidity, to enable the molder to have as much access for ramming. To bed in successfully requires considerable care and patience, for besides requiring very hard ramming, the sand must be of equal density. The procedure is similar to that in bedding-in for cast-iron work, the box part being rammed up with ordinary floor sand until an impression can be made with the pattern, when, the pattern being removed, an amount of this floor sand is removed from the impression thus formed, the amount removed varying with the thickness of composite required to take its place, in this instance being from about 1½ in. in those parts when the resulting casting is composed of this metal to about 3 in. at the thickest parts. It is safer to have too much composite than too little.

When this has been done and the composite facing applied, the pattern is

FIG. 10—ALL CORES IN POSITION



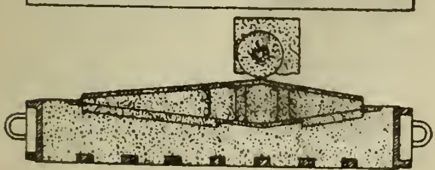


FIG. 12—SHOWING BORES IN PLACE

again used in securing an impression, much pressure being used in forcing it down until the straight edges or battens find a bearance on the box side. Often hammers are used in applying the requisite force, and although the pattern may be protected in the process, it certainly has a damaging effect.

Another means of doing the work which gives a regular pressure over a larger surface can be adopted by lowering a large casting right on to the pattern. In obtaining a regular density of sand beneath the pattern, it will be necessary to remove it a number of times, easing those parts which will not allow the pattern to take up its correct position and filling in when the density is unstable. When finally the pattern is bedded in, proceed to ram up the remaining parts until the joint is reached, when the battens can be removed and preparation made to receive the top half of pattern and box.

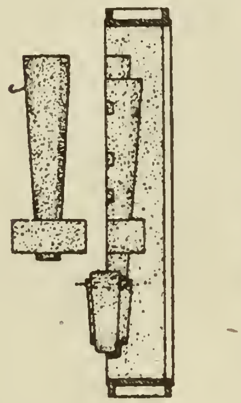
While the bottom half of the pattern has been left as open as possible, the top portion can be covered, ensuring greater ease in ramming up the top of the mold. A section of the drag showing the battens is shown in Fig. 2. The box parts used in many foundries are bolted together, and slot holes are cast in the joint flanges for assisting to secure the parts together when casting. Numbers of holes are also cut in the sides so that loose bars can be made to accommodate the work for which the box parts are suitable, and bolted into a position, following the contour of the pattern, and about 1 in. from it. The method is useful in the sense that it reduces the number of boxes kept in stock, which occupy valuable space, often in the foundry itself.

The method illustrated in Figs. 1 and 2 is one of expediency; the usual process of preparing molds for such castings as indicated is by rolling over. This is accomplished by making a level bed in the foundry floor, as shown in Figs. 3 and 4. It is not essential that the bed should be level, but it is very necessary that it should be out of winding, hence the simplest way is to make it level by bedding into the sand floor a couple of straight-edged logs, using a level while setting them, as in Fig. 3, and by means of the level and a parallel straight-edge determine their relative position. When the logs have been set and sand rammed about them to prevent them moving, the whole bed can be prepared. It is preferable to ram fairly hard and so reduce the labor required in making the joint after the box has been rolled over. When this bed has been made the bottom half of the pattern is laid in position, the logs removed, and their impression filled up, the remainder of the bed dusted carefully with parting sand, and the box part lowered over.

It is customary when adopting this method to use similar box bars to those used for the top, but care must be taken to ensure freedom for whatever runners may be required. Ordinary single bars may be used having flanges at each end, as illustrated in Fig. 5, or double bars may be bolted in. In the latter case the ends of the box become the flanges; hence the same number of bolts are required to secure the two bars as would be necessary for each of the single bars shown in the illustration. Both kinds are used, however, their value being determined by the character of work in hand and stock supplies suitable. Reverting to Fig. 3, the dotted lines shown represent the position of the prints. It will be readily seen and understood that when a bed is made in this position and the bottom box rammed in an upside-down position, a more regular density of sand is obtained and the facing sand can be regulated in depth much more easily.

When this box has been tightly rammed up, the whole is turned over. For this instance, where the weight of the pattern is considerable and the depth not great, it is advisable to set into the pattern a few screw eyes, and by passing a bar through them and wedging it against the box prevent the possibility of the pattern falling out while being rolled over. The joint having been sleeked over, it is ready to receive the top half of the pattern and the top box.

The top half of the pattern is lowered into position, determined by the dowels, and the sand forming the joint is dusted with parting sand. It may be necessary to be quite sure that the two halves of the pattern are quite close together. In the case of a pattern for a rudder the edges are comparatively light in construction, and, being in halves and subject to varying conditions, there is a tendency for them to curl. A number of weighty pieces of metal placed on top of the pattern will be sufficient to ensure a more reliable impression. Proceed to set the top box in position, its relation to the bottom box being determined by pins, or whatever method may be usually adopted, providing it ensures a safe lift and a return to its former position. Define the most suitable places for running the job and set in gate sticks; their position will depend upon whether the job is to be cast vertically, horizontally, or on a bank. In very large



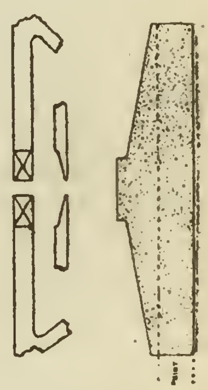


FIG. 11—CORES SET FIG. 13

work it is often impossible to cast vertically, though greater success is likely to result if the work can be so arranged. To cast the rudder horizontally two gates would suffice, each about 3 in. in diameter.

In some foundries runners suitable for various-sized castings are stocked and set into position while the work of ramming is proceeding. These are in the form of blocks, composed of ganister and firebrick, and are capable of withstanding the heat of the molten metal for a longer period than if formed from the ordinary composite mixture. Runners can, however, be made on the job if it is remembered that special care is required in their formation. Risers should be carried off at the higher points, with special attention to those parts consisting of a heavier body of metal.

In our illustration the metal surrounding the pintle is very thick; hence it is wise to bring off a substantial riser, thus allowing the casting to draw upon the riser at that point, rather than the arms or ribs connecting it with the outside framework. Proceed to ram up the top box in a similar manner as when ramming the drag box previous to rolling over.

Fig. 6 shows a section of the top of the mold, and illustrates a proximate relation of one of the box bars to the mold, and showing clearance with the sides of the box for convenience in moving it into the position before bolting up. Fig. 7 shows a section through the centre in a line with the vertical centre of the rudder post, and showing gates and risers. When the job has been rammed up satisfactorily, the gate sticks are withdrawn and the top box lifted.

Again it is necessary to provide for the half pattern being retained in the top of the mold, so that a better lift may be ensured when the box is turned over. Swab the joints and sleek off, marking out the position and number of the runners required. In sleeking the joints it is safe to cut away or compress the sand, following the contour of the pattern, so that a substantial fin will be formed on the casting, providing a cleaner edge and a way of escape for gases formed.

Withdraw two halves of the pattern and clean up in a manner similar to that adopted for a dry-sand mold to receive cast iron. To stiffen the body of the mold be unsparing with 3 or 4-in. molder's nails, more especially around edges which form a definite corner in sand. Make up the runners in the form of a spray, their area depending upon the sizes of the gates. Clear away the corners in the top box where the runners and risers form a junction with the bottom box, as it is necessary to avoid any possibility of corners crumbling during the time of pouring and running—a danger to the casting.

The necessity of following the same precaution with the risers will enable these to be used as gates, should it be advisable to do so, when running the job. In the body of the mold surrounding the thicker portions of the metal a number of prod-holes are often inserted having a diameter of about ½ in. and about 2 in. in depth. These prods or dabbers are useful in carrying off impurities, and also offer a means of escape for gases, which may otherwise be unable to find an exit.

The mold now requires to be thoroughly dried. If a portion has been formed in the foundry floor, then fires must be arranged to dry it in place, supporting the top box over it, and scaling the sides as much as possible with plates. If it is possible, however, it is preferable to place both top and bottom boxes on a bogie and run them into a drying stove. The nature and composition of the sand renders the possibility of any damage through overheating extremely unlikely, and in this differs from the sand composition for iron molds.

During the time the formation of the mold has been in progress the cores will have been receiving special attention, and considerable care must be exercised in their construction. For iron castings the contraction to be taken into account varies slightly according to the nature of the work and the method of casting, but for general purposes it may be considered to be 1-10 in. per foot; but in steel casting the general allowance for contraction is between 5-32 and 3-16 in. per foot, and this creates one of the greatest difficulties with which steel molders have to cope.

In our present illustration the outside of the mold offers practically no resistance, but all the cores are under compression, and unless great care is taken in their construction to allow them to be crushed, the casting will break or twist out of shape. Many contrivances are adopted to minimize the possibility of such disastrous results, their one object being to ease the resistance offered and make the places where compression is greatest yield to the contraction of the casting. The difficulties are increased by the comparatively sudden manner in which contraction takes place, and as the composition forming the face of the mold dries into a very hard mass resembling concrete, the formation should be so weakened in certain parts that, while it offers sufficient resistance to the pressure of the molten metal, it yields under the pressure of the contraction. Just as the mixtures of loam differ for iron, so do the mixtures for the preparation of cores for steel casting.

A composition suitable for cores used in the rudder is made by reducing the strength of the composite previously explained by adding silver sand, and to render it more plastic for working white lead might be added, using coal tar in the place of water. Cores made from this mixture possess a very hard surface after being dried, but it is advisable to complete the work on them while the sand is in a green state and ready for blacking, as, though the skin is hard, should it be broken, the interior composition is weak and rams freely.

Figs. 8 and 9 show the formation of two of the grids required for the cores, the former being for the rudder-post core and the latter for the largest core between the ribs. The prods, which can be made of pieces of wrought iron cast into the plate, should be clear of the outside of the core by an amount varying with the contraction of metal about it. Thus the clearance in the case of the rib cores should be more than for the rudder-post core, and seeing that wrought-iron prods give more readily to pressure, they are often used in preference to cast prods. In constructing the cores a bed of the weakened composition is formed about 1 in. thick and the grid bedded into it, the sides being then made up with the same composite about 3 or 4 in. thick, the inside being filled with ashes and a thin covering of composition loam on top.

For the cores between the ribs in this instance the inside of them can be left open, having only a body of sand surrounding the sides, and sufficient to form the contour of the print. Care must be taken, however, when closing the mold, to ensure the top finding a bearing on the cores, and thus cutting off any possibility of the metal finding a way inside of them. Both these methods reduce the strength of the cores and allow them to give to the pressure when shrinking takes places.

The same method is applied to the rudder-post core, but the coating of composition can be much thinner; 2 to 2½ in. will suffice. When these cores have been stripped and sleeked off, a number of parts are cut to form brackets on the casting. These brackets are cast on to counteract the tendency of the casting to become rent or torn asunder during the time of cooling, owing to sudden shrinkage. They should be used wherever the thickness of metal varies abruptly, their size depending upon this variation, but usually about ¼ in. in thickness. These ribs are knocked out when the casting is cleaned.

When the cores have been prepared in this manner and swabbed over with a thin mixture of composite and water, they are dried. When both mold and cores are dried, a considerable amount of care must be exercised in finishing, any cracks which have been formed in the surface of them must be filled up and coated with a liquid solution of composite and the best plumbago, or for heavy wire cores with coal-tar. It is usual, however, to use the former mixture when the parts of the castings coming in contact with it are to be machined. After being assured that the cores and mold are thoroughly dried, a commencement can be made to close the mold and prepare for casting.

Just as it is desirable to provide a fin about the joint of the mold, it is equally as valuable round the cores. The impressions left by prints should be tapered off at the junction with the mold about 2 in. back, and the tops of the cores should be chamfered off in like manner. Besides being useful for the purpose previously mentioned, they prevent the likelihood of crushing the corners when closing. In Figs. 10, 11 and 12 the setting of the cores is illustrated, Fig. 10 showing all cores in position and the bottom of the mold ready to receive the top box, the contraction brackets being shown by thick black lines. The thick dotted lines shown in the centre of the cores are for venting purposes through the top box. It is, however, unnecessary to insert pipes, a number of vent-holes through the top at these places being sufficient.

When the top box has been finally lowered, after runners and risers have been found to coincide with the positions required, and the bearing on the cores and joints has been assured, pouring and riser basins previously prepared are set in position and daubed round the outside with loam. The two-runner basins can be connected and used in conjunction, but it is often preferable to run into each separately. Fig. 14 shows a plan and elevation of the mold ready for casting. These basins are made fairly large to provide a good head of metal suitable for feeding the casting while shrinking.

The illustrations show the box part secured together by means of bolts, which is a very useful method of providing the necessary resistance to the pressure of the metal, although in many cases weights alone are used for this purpose when the job is cast in a horizontal position as shown. Much more care must be exercised in securing the boxes when the work is cast vertically; the head of metal is then greater, hence the pressure exerted will be increased. Steel sets very quickly owing to its composition, and its fluidity is reduced by reason of the carbon contents; hence the milder the steel the less fluidity. In such circumstances it is of the utmost importance to cast in a vertical position whenever possible, or at least on a bank —that is, inclined at an angle, thus assisting the metal in its progress through the mold. Compared wtih iron, owing to its thickness and more lazy movements, a much longer time is required to fill a mold with steel. Apart from this, it is common practice to pause a few times when casting to allow the gases to escape, while the pouring is proceeded with at another.

When the job has been cast, the riser head should be given a supply of hot metal from the ladle. When such a job is cast on a bank, as shown at Fig. 15,

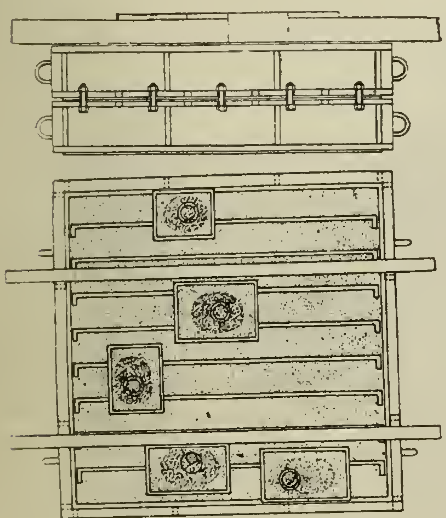


FIG. 14—CLAMPED, READY FOR CASTING

it can be run in a similar manner as that shown for the horizontal position, but the basins for the heads should be carried up level and a riser brought off the top of the metal surrounding the rudder-post.

The method described for preparing the mold for this rudder is suitable when the pattern is blocked up and the cores are made separately, but it is quite common practice in steel molding to prepare the majority of the cores in the mold.

Both methods possess disadvantages. When cores are made separately more men can be at work on any given job; hence it is likely to be turned out more quickly in the foundry, but the difficulty of making suitable allowance for shrinkage is usually greater. Successful results, however, are obtained from both methods, and it depends very greatly on district customs which method is adopted. With the exception of the rudder-post core, which would of necessity require to be made separately in any case, all the cores can be made in the mold. The bottom half of the pattern would be laid on a prepared bed as previously described, the drag-box set over it, and the whole rammed up, but in between the ribs should be filled with ordinary floor sand, and prints formed on the top being finally rammed up. When the box is turned over, this temporary sand is

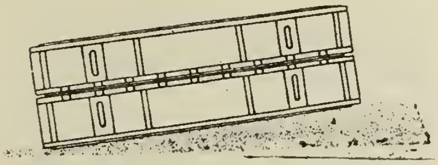


FIG. 15—PREPARATION FOR CASTING ON A BANK

cleaned out, and the other half of the pattern laid in position.

The cores are built in a manner similar to that adopted with a core-box, but while the consistency of the composite forming a bed for the grids will be in the nature of loam, and similar to that used in the previous method, the rest of the core can be ramed up; the same discretion is necessary, however, in weakening the composition. All pieces on the pattern likely to interefere with the successful drawing of the core should be loosened.

When these cores have been built up, with cinders as the central contents, and having small pieces of sheet-iron over the lifting staples so that their position may be easily defined, the top box can be lowered over, similar provisions made with regard to runners and risers, and rammed up as previously described. In this instance the top half of the pattern will remain down when the top box is lifted; hence any portion likely to cause a bad lift should be made loose so that it can be taken away in the top. Parts of the pattern which can be moved before the cores are lifted are removed, and when all the cores have been successfully withdrawn the main portion of the pattern can be taken out and the cleaning of the mold and cores proceeded with, including the provision of brackets and dabbers and the insertion of molder's nails.

Patterns of this kind are sometimes of a very frail nature, and while they may be constructed in halves in the pattern shop for convenience, they are sometimes screwed together at the foundry and bedded into the floor as shown in Fig. 16. In this way the joint

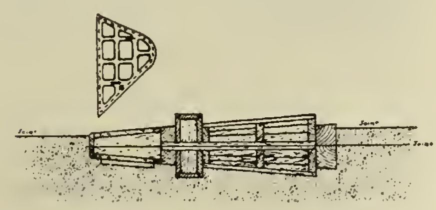


FIG. 16—BEDDED IN THE FLOOR

of the mold can be altered to reduce the amount of lift in the top. The construction of the mold is the same with this exception, but being bedded into the foundry floor determines the position in which the job is to be cast; hence, if it is desired to cast on a slope, it must be bedded at the angle desired.

In providing the molten steel for such castings, a Bessemer converter is usually installed, which receives a charge of molten metal from a cupola, where it is subjected to a blast of air at a pressure of 15 to 25 pounds per sq. in. until all the carbon is burnt out. When this method was first used a metal rich in manganese was used and converted until the desirable carbon content was obtained. This, however, was very difficult to regulate; hence the results were very uncertain. The process now employed is to continue with the blast until all the carbon is burnt out, a point more readily determined; but this would contain too much oxide and provide a poor steel owing to its tendency to crumble; a manganese mixture is added which has a stronger affinity for the oxygen than the iron, and provides the necessary amount of carbon. This mixture is termed Franklinite or spiegeleisen, and is added to the mixture in the converter in a molten form, giving a more definite result with less inconvenience and more economy. Pig-iron treated in this way must be practically free from phosphorus as that element is not removed in the converter and renders the steel both brittle and unmalleable.

The lining of the converter is heated until it is red hot, and the fuel discharged before the molten metal is run in. When the metal is in, it is subjected to a stream of air, and as the carbon begins to burn, increasing in volume and brilliancy, the metal gradually grows hotter and boils up, causing the converter to tremble to its foundations with its violent ebullition. On the metal becoming decarbonized the flame is reduced and loses its brilliancy. This occurs after the blast has been on about twenty minutes. The converter must be turned, the blast turned off, and the Franklinite added, when another flaming reaction occurs. The blast is turned on again to ensure a thorough mixture, but only for a very short time, when it is ready for pouring into a previously prepared ladle. The metal is a dazzling white, and is followed by a blanket of slag.

The Quigley Furnace Specialties Company, 29 Cortlandt St., New York City, have issued Bulletin Number 10, on their method of conveying powdered coal. Powdered coal is rapidly becoming one of the most advantageous industrial fuels and the air transport system, which has been provided for this firm, provides a sufficient means of having a central coal crushing and pulverizing plant and furnaces and other metallurgical equipment where needed.

Holcroft and Company, Detroit, Mich., have issued a catalogue on their furnaces and ovens for foundry and metallurgical work. This catalogue is descriptive of core and mold ovens for the foundry, annealing furnaces, heat-treating furnaces, and open-hearth furnaces.

The Sand-Blast for General Foundry Work

Its Applicability and Advantages For General Foundry Work, Together With Examples and Data of What it Has Actually Accomplished Clearly Shown

By H. D. GATES*

*Courtesy of the Pangborn Corporation, Hagers town, Md.

PROBABLY no other single operation in foundry practice has shown more advancement in the past decade than the cleaning of castings. Not so long ago brushing, tumbling and rubbing were the only means generally used. Although a few foundries had installed sand-blasts, up to ten years ago these were mainly a machine set out in the open or in some isolated place and the conditions surrounding its use made it a detested device, although its efficiency, even under these adverse conditions, was readily recognized.

Not to be denied the economy and advantages of the sand-blast, some more progressive foundries had figured that the investment necessary to provide suitable working conditions gave as large or larger return than any other foundry equipment of equal cost, until to-day, in the States at least, no foundry is considered completely equipped to turn out the most satisfactory castings, nor most economically, without a sand-blast installation that is adapted to their particular work and conditions.

Where the daily output is of a varied character and the tonnage sufficient to warrant, the greatest economy will be found in the selection of a separate unit for each class of work that it will handle with greatest rapidity at lowest labor cost, the whole laid out and installed to adapt itself to the routing and handling system of the plant.

For the average jobbing foundry, however, where the work runs promiscuously from small to large, and the daily output is not large enough to permit of such specialized equipment, there is no type of machine that so effectually accommodates itself to all kinds of work as the high pressure hose sand-blast, and when rightly installed in a properly designed room, working conditions are obtained that greatly reduce the occupational hazard, and provide a most valuable and profitable cleaning equipment.

The hose type machine was the first method of application of sand-blasting, and consists of a sealed container, into which the sand or other abrasive is loaded, and by the direct air pressure driven through a hose of required length, the air and abrasive being discharged in combination through the opening of a small nozzle. Compressed air at the hose line pressure is introduced into the top of the sand chamber, equalizing the pressure so that the abrasive is fed by gravity through a small adjustable valve opening into a mixing chamber at the bottom of the container, where it is combined with and picked up by the air flow. As no expansion of the air takes place before discharge at the nozzle, the greatest velocity of the abrasive is obtained by this method, with corresponding effectiveness of abrading action.

PLATE 1 HIGH PRESSURE SAND BLAST

PLATE 2—SMALL, EASILY-HANDLED NOZZLE

PLATE ANOTHER TYPE OF NOZZLE

There is another type of hose machine called the "Open Hopper," in which the container is not sealed, the abrasive being carried to the nozzle by suction. The combination of abrasive and air takes place in a chamber wherein some expansion of the air occurs with a drop in pressure. While this type of machine is admirable for many classes of work, its abrasive efficiency is hardly adaptable to general foundry requirements and will not therefore be considered in this article.

The first machines offered were of the

low pressure type, using from 15 to 30 lbs., pressure, with large hose and nozzle, and depending on volume of sand at low velocity for the cleaning action.

This meant that the standard shop pressure of approximately 80 lbs. either had to be reduced or a separate low pressure compressor provided for the sand-blast use.

This double compressor installation involved not only increased investment, but the additional cost of piping and installation, with necessary added care and attention. Initially compressing the air to the higher pressure at the greater H.P. cost and reducing to the lower pressure was a waste of energy with consequent expense, and as it developed later, with a decidedly decreased blasting efficiency, to say nothing of more dust created by the greater volume of sand flowing, to the detriment of both the operator and the rest of the plant.

As a result of this, there was developed between ten and fifteen years ago the modern high pressure sand-blast which is now recognized as the standard for general foundry use. (Plate 1).

While the travel of compressed air through a pipe or hose is approximately the same at all pressures above one atmosphere, the velocity of the abrasive after leaving the nozzle increases very rapidly as the air pressure is increased, with correspondingly greater blasting effectiveness. This permitted the use of small easier handled hose and small nozzle, in place of the large, cumbersome hose and nozzle (Plate 2) with a very decided saving in labor to the tonnage cleaned. Better operating conditions were obtained also through reduction of dust created by disintegration from the lesser volume of sand used. Some better understanding of this will be possible from the results of tests made. These show that the amount of sand blown at 30 lbs. pressure to remove one pound of metal from an iron bar was 3,361 lbs., while at 70 lbs. pressure the required sand was but 2,043 lbs., or over 50 per cent. more at the lower pressure, the same size nozzles being used in both instances. Of the reusable sand there is only 17.2 difference in favor of the lower pressure.

The amount of metal removed per 100 cu. ft. free air per minute flowing was, at 30 lbs. pressure, .1969 inches, and at 70 lbs., .4473 inches, or nearly two and one-half times as much accomplished at the higher pressure with no increase in time and labor.

The amount of air consumed in sand-blast operation is governed entirely by the size of the nozzle opening and the pressure maintained; this feature is therefore one that should have the most careful consideration of the prospective sand-blast user.

Constant wear (varying with pressure and abrasive) is occasioned in the opening of the nozzle, and a very little enlargement means considerable increase of air consumed and H.P. as well. For instance, a nozzle with ¼-in. opening flows 76 cu. ft. of free air per minute at 70 lbs. pressure (as in the sand tests above) requiring 12.7 H.P. to develop. Increase this opening 1-32 of an inch and the air flow increases to 85.5 ft. or 12.5 per cent., and H.P. requirement is 14.3. An enlargement of 1-16-in. increases the air flow to 118 cu. ft., or 16.5 per cent. with H.P. developed 19.3. And if the increase reaches ⅛ inch the air flows jumps to 171 cu. ft. or an increase of 125 per cent., while the H.P. developed rises to 28.6.

PLATE 4 ABRASIVE SEPARATOR

If this wear can be eliminated, obviously much power expense will be saved, as well as constant pressure maintained.

Different types of nozzles are pictured in the accompanying illustration (Plate 3) showing the discharge-end view, No. 1 being of a new nozzle, ¼-in. opening; No. 2, the same nozzle when worn to the point of discarding. Note the worn nozzle has still retained the inlet opening size with no increase of air consumption No. 3 shows another type of nozzle with natural increase of size causing increased air flow with power consumption.

PLATE 5 FLUSH PROOF HOOD

While it must be admitted as a general proposition that the larger the nozzle opening, the greater the area of work cleaned; still in the average plant the air consumption is desired to be predetermined, and in many instances where the air volume is limited any increased consumption means a drop in pressure, not only at the sand-blast, but throughout the entire system, often to the detriment of other air tools.

The hose type sand-blast must, of course, be operated in an enclosure, dust tight, and while a room of this character is possible of home construction, greatest economy will come from a substantial room designed and built to provide adequate ventilation and illumination and arranged as to handling methods for the greatest saving in time and labor.

As the abrasive will be used over and over and a certain amount of dust created with each operation, not only do working conditions, but the efficiency of the abrasive itself demand a thorough cleaning each time before re-use to secure greatest output with corresponding economy.

For the simple rooms where the sand-blast machine is set inside the room, an abrasive separator with a powerful air motor and equipped with double screens is provided, into which the spent abrasive is shoveled from the floor, making three separations in one operation, the fine material that has no abrasive value and the coarse material that would clog and stop the nozzle being separated, while the clean, sharp abrasive for re-use is delivered to a hopper for reloading the sand-blast machine. (Plate 4).

The more mechanical the handling of the abrasive, the more continuous the operation of the sand-blast machine with correspondingly increased output and lower cleaning cost per ton.

The construction of the modern sand-blast room is sheet steel made dust tight, with fresh air inlets around the sides near the base, the dust laden air being carried off through a hood in the ceiling of the room by a powerful exhaust fan.

The volume of dust created will be governed by the character of work cleaned, that is, whether plain surfaces to which little sand adheres, or intricate shaped pieces from which core must be blasted; also whether sand or metal abrasive is used, and, if sand, its friability.

Constant change of air should be provided in the room from five to ten times a minute, as the character of the work may demand. The natural tendency of the dust is to rise, and this is aided by the intake of the air at the base of the room and its drawing off through the ceiling.

Some provision must be made for the protection of the operator, as the dust-laden air will be present no matter how rapidly it may be removed. Various types of hoods and helmets have been devised, but the ventilated dust-proof type shown here (Plate 5) is most effective.

The helmet fits closely to the head and is tied tightly around the neck, fresh air being introduced constantly by means of a small flexible rubber hose connected

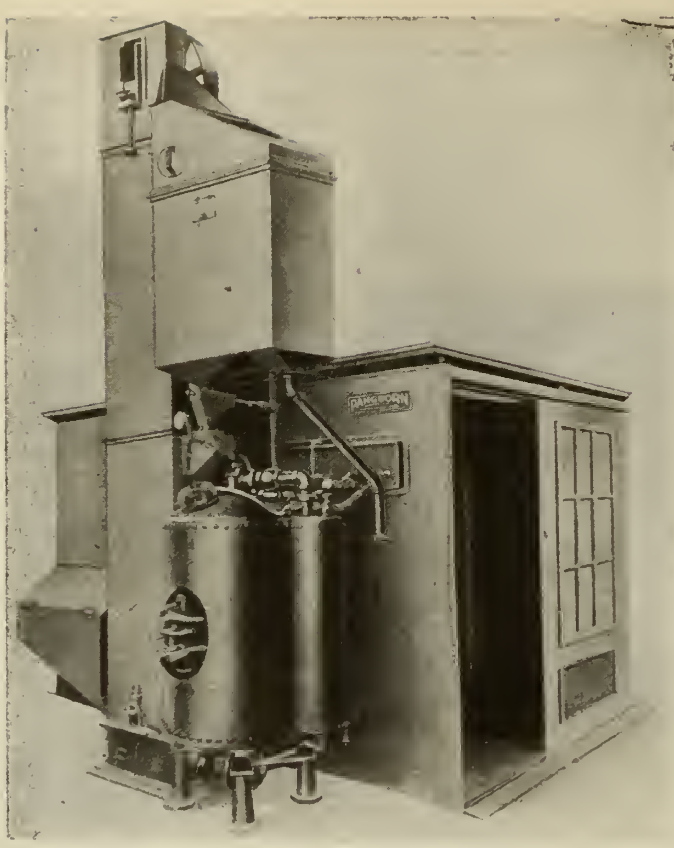


PLATE 7 ARRANGEMENT FOR DISPOSING OF SPENT SAND

to the compressed air line. This hose is long enough to permit freedom of movement by the operator, and being weighted over a pulley the slack is constantly taken up without weight becoming burdensome.

Through a series of minute openings in the adjustable sweat band, at the front of the helmet, a constant jet of air is passing before the operator's nose and mouth which prevents the screen glass from becoming fogged or misty, thus assuring free vision.

Electric light fixtures are provided, with white enameled reflectors, set into the ceiling of the room and covered with discoloid fronts to protect the lamps from flying abrasive. Ventilation and free observation of the work being so essential to quantity production, these features should not be slighted.

The room can be equipped as the demands of the plant and its output require. Large heavy castings should be loaded at the molding floor on to grated top cars, the track extending into the sand-blast room and the pieces cleaned on the car without unloading. If the plant is equipped with a monorail, this, too, can be extended into the room and the pieces cleaned while hanging without other handling. For small work a grated top bench can be provided where convenient, and for very small pieces much economy will be found in cleaning on the grates, it having the advantage of saving on tools and giving, without extra time and cost, clean scrap, which is particularly advantageous and even necessary in the use of some types of electric furnace.

One of the more modern adjuncts to rooms of this nature is the rotative table which is built into, but entirely independent of, the room structure. One-half of the table forms a grated bench on the inside of the room, while the other half is exposed outside the room for the removal of the cleaned work and loading of new work to be cleaned. A partition through the centre of the table entirely closes the aperture in the wall structure when the table is in position for sand-blasting. As a load is cleaned the operator turns the table, which travels on dust-proof ball bearings.

As mechanical means to all operations other than the actual blasting are increased, output rises without added labor cost, and in plants with large tonnage this becomes absolutely necessary to best economy.

To this end some rooms having a solid floor are provided with a chute in one wall leading to an elevator boot, into which the spent abrasive is swept or shoveled, being raised by a mechanical elevator to a combined mechanical and exhaust screen separator that delivers the clean, sharp abrasive for re-use to a sand storage bin connected to the sand-blast machine. (Plate 6). The fine dust and refuse is deposited in a refuse bin with outlet at a convenient point.

In installations of this kind the sand-blast machine is usually placed outside, leaving the room entirely free from operating equipment, controls for the operation of the sand-blast machine, the elevation and reloading of the abrasive being brought to a single control board within convenient reach of the operator.

A step further in this direction of mechanical handling is a grated floor for the room through which the spent abrasive falls to a hopper, from where a conveyor delivers it to the elevator. (Plate 7). Rooms of this type are usually made complete with a hopper of concrete and provision made for an auxiliary sand storage bin, loaded from the outside with several days' supply of abrasive, which

PLATE 6 SAND STORAGE BIN

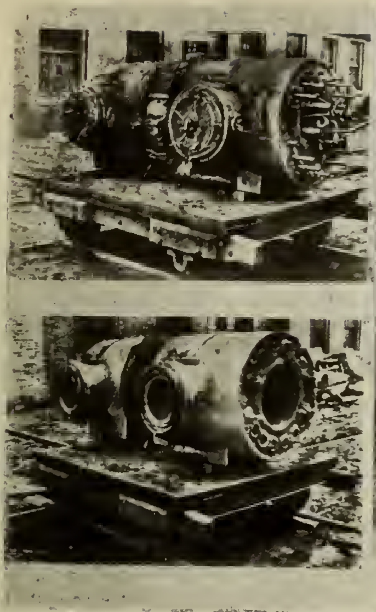


PLATE 8—5-TON CYLINDER.

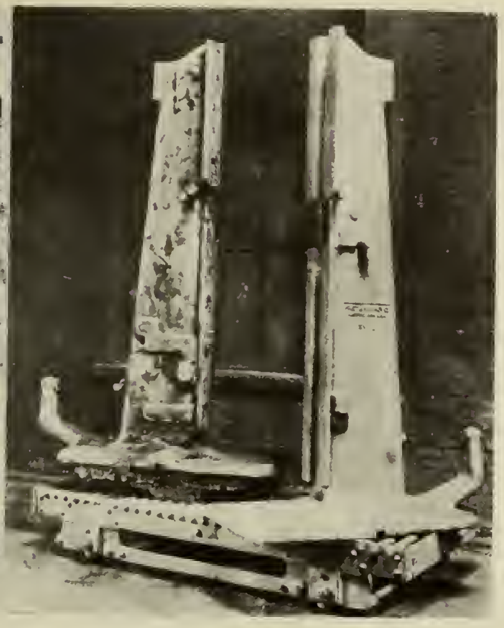


PLATE 9—OTHER CASTINGS CLEANED

is fed to the system through a sand gate as required by disintegration.

These rooms are provided complete by the manufacturer and are designed and laid out in size and arrangement, often in batteries, to meet the individual needs of each plant. Rooms of this type naturally provide for the cleaning of large castings and some idea of their adequacy and economy may be gathered from the accompanying illustrations. The large Grey Iron Gas Engine cylinder shown (Plate 8) weighs upwards of five tons and required the labor of two men each 15 hours, or a total of 30 hours, for cleaning by hand. It was cleaned with a modern high pressure sand-blast by one man in one hour including cores. Other illustrations are of various shaped grey iron work. (Plates 9 and 10).

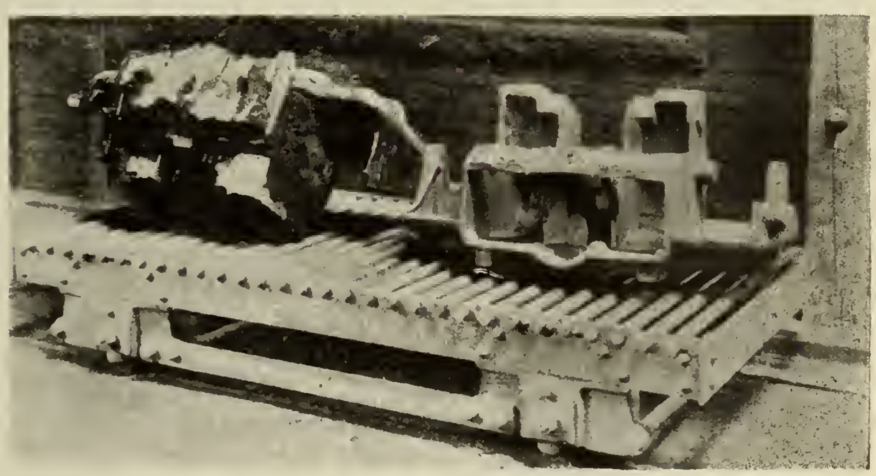


PLATE 10 BEFORE AND AFTER CLEANING CASTINGS

Of the steel car couplers shown, (Plate 11) by using sand 164 were cleaned in three hours and fifty-nine minutes including handling, an average of one minute and twenty-seven seconds for each bar, the average actual blasting time being fifty-two and one-half seconds. By the use of steel shot 182 were cleaned in four hours eight minutes of elapsed time or an average of one minute and twenty-two seconds, including handling, or an average actual time of cleaning, forty-one and one-third seconds.

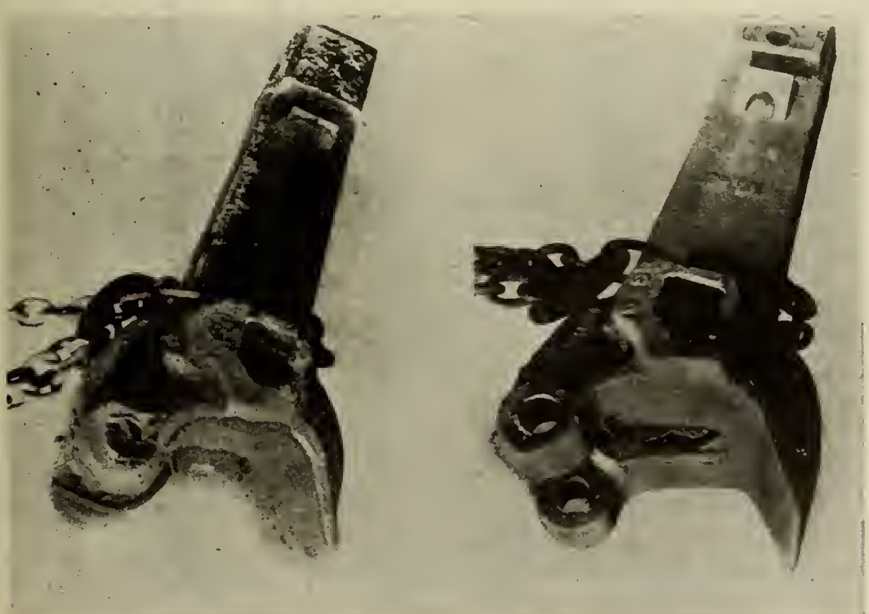


PLATE 11—STEEL CAR COUPLER CLEANED BY SAND BLAST

Continued in next Issue

CANADIAN FOUNDRYMAN has received the following announcement from the Polish National Department Commercial and Industrial Bureau, 33 West 42nd street, New York:

Gentlemen:

We wish to inform you that we have, on January 1st, opened the "Commercial and Industrial Bureau of the Polish National Department," with the object to help in starting commercial connections between the United States and Poland, and to collect all data and information which should form a basis for the work of the future official Polish commercial agencies in this country, and facilitate mutual economic relations.

Therefore, we would ask you to let us have your kind assistance in establishing relations with all those interested in the above matters and to direct to us all individuals and groups desirous of getting in contact with the Polish market.

We will be glad to send you all information concerning trade conditions and business possibilities in Poland, and would be much obliged if you would let us have any available information in this line, so as to prepare commercial connections to the benefit of both countries concerned.

Thanking you for your courtesy in assisting us in our work, we remain, dear Sirs,

Very truly yours,

Polish National Department Commercial and Industrial Bureau.

Big Auntie—"Well, Tommy, so Santa Claus was good to you, was he? Brought you lots of things?"

Little Tommy—"Huh! You can't fool me! There ain't any Santa Claus. It's Dad—and he's the stork too!"

Melting Iron as it is Done in Great Britain

The Receiver, or Fore-hearth, so Common in Great Britain and Continental Europe, Has Many Good Points Which Should be of Interest to Canadian Foundrymen

By J. F. MULLAN

THE cupola furnace shown in Figs. 1 and 2 is a typical British cupola, being built by the Messrs. Thwaites Bros., Ltd., of Bradford, Yorkshire. The melting of iron in Great Britain is fundamentally the same as elsewhere, but a perusal of their customs should interest Canadian foundrymen. No very great distinctive feature in the design of this cupola is claimed, but attention is drawn to the shape of the tuyeres, which are of vena contracta section. This section of nozzle for any given area being that which is said to give the highest co-efficient of discharge, therefore passing the largest volume of air at any given pressure. These tuyeres are flangeless, therefore can be removed from the brickwork to be replaced without disturbing the lining to any great extent. Three rows of tuyeres are still adhered to, although in actual practice the top row is very seldom used after the metal has commenced to melt. Simple valves are provided on each of the tuyeres in the top row so that these may be shut off as soon as this has occurred; this prevents the actual melting zone from spreading too far up the chimney. It is also claimed that the internal taper form of the brickwork stretching as it does from well above the melting zone to the base of the cupola is a distinct improvement over the original design of a parallel portion in the melting zone with a taper portion immediately above it. This long taper combines the advantages of a parallel cupola which is almost immune from what is known as scaffolding—that is, the form of a bridge of partially melted metal and coke immediately over the melting zone—with the advantage that the lower portion of the cupola is smaller in diameter and therefore reduces the volume of the coke bed which is required in the parallel type.

FIG. 1—OUTSIDE VIEW

As regards the receiver shown to the front of the furnace and connected to the spout, this may be looked upon as a covered-in ladle, through which hot gases pass, thereby preventing the metal from chilling. A portion of the hot gas from the melting zone passes through the passage from the cupola to the receiver and cuts through the short length of pipe situated in the top. A receiver is chiefly of advantage when heavy castings are being made as it enables a large quantity of melted metal to be collected before tapping. It is also possible, with a receiver at the end of a blow to actually shut off the blast, clearing out the cupola through the drop bottom and still have a reserve of metal from which ladles could be filled. It has many other advantages which do not appear to be appreciated by the British people themselves. With the tilting stand ladle, commonly used in Canada, the dirty iron on top of the ladle is what always comes out first, but with the receiver as shown here the dirt can float on top while the clean metal is drawn from the bottom. On the side of the receiver may be seen the spout from which slag or dirt may be drawn in case too much happens to be accumulated, and incidentally it acts as an overflow in case of the furnace melting faster than the men can handle the iron. Metal held in a receiver, as has already been explained, will keep hot longer than in an open ladle for two reasons, viz.: it is under cover, and it also has the hot gas passing over it.

Iron held in a receiver can be depended on to be well mixed, and as the hottest metal always goes to the top, the iron not yet taken can be depended on to be in good shape. Iron standing in a melted state is always working, that is to say, the different metaloids are acting upon each other, and all being more or less lighter than iron, are gradually working towards the top, so that impurities are not only on the top but in a gradually lesser degree towards the bottom; the very best being right at the bottom. Other features of this cupola are the steel angle-iron pillars and also the steel bottom, making them less liable to crack from the heat.

Very interesting work was done with these cupolas during the war in the production of semi-steel. To deal with this the area of the hearth had to be increased.

THE SCOTCHMEN

An interesting story is related of a Scotchman. The Scotch seem to have won the enviable reputation of being at the head of whatever enterprises they embark into. A Glasgow business man sent a representative of his own nationality to London on business in connection with the establishment and after about a month's stay in the metropolis he returned and on being asked how he liked the English people he replied, "Weel I did na get back to see any of them. I just attended to my business with the heads of the concerns and it took me all my time without bothering the men."

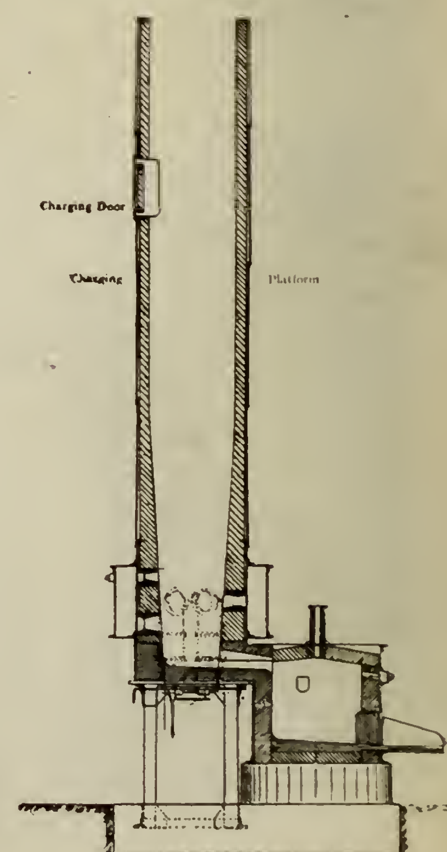


FIG. 2—INSIDE VIEW

The Integrity of the Malleable Iron Casting

By ENRIQUE TOUCEDA

THE writer can think of no subject of more vital interest to the manufacturer of malleable iron castings, or one to which for his own welfare he should pay more strict heed, than is implied in the title to this paper.

While many of the problems in connection with the metallurgy of the process have now been solved, and we know with certainty the conditions that should obtain in order to regularly produce such a character of hard iron that when annealed it will yield metal of superior strength and ductility, as well as all details of heat treatment that will uniformly produce best results, failure on the part of some to make sure at all times that castings are invariably sound throughout, remains the one deep-seated canker which if not cured bids fair to eat into the vitals of the industry.

It is not to be inferred that the malleable iron casting is unique in this particular, because the statement just made can be applied with even greater force to both steel and to non-ferrous castings generally, especially in regard to blow holes of significant size and to internal strains, from both of which difficulties the malleable casting is exceptionally free. When unsoundness does exist, it usually arises and has to do mainly with that character of porosity resulting from disproportionate sections in the casting which manifests itself as a rule, never in blow holes, as such arise from other causes, nor in voids of any size; but in a more or less fine sponginess which weakens the section at its location.

Value of Tests is Great

There is a great and unquestionable value derived from the physical tests of each air furnace heat, for it is through such tests alone that the manufacturer can be assured, as well as prove to the purchaser's inspector, that up to and through the annealing process he has produced exactly what was sought; but this is as far as it goes, for the latter is not buying test bars, nor are these being used commercially. In what has preceded it has been implied that the majority of the producers of these castings are in a position to positively guarantee both the quality and uniformity of their product when measured by physical tests on test-bars from each heat. That this is true the writer can state unqualifiedly, while in the case of a more or less limited number, a similar statement in regard to the integrity of their castings can be made with equal force and assurance; but that he is forced to make this particular qualification is exactly what has occasioned the choice of this topic by the writer. It is more satisfactory always to be specific and to furnish data where such is possible. With this object in view I subjoin figures showing the combined monthly average ultimate strength and elongation of some 32 different concerns covering May, June and July, the data being gathered from many hundreds of tests made during each month.

May	
Average ultimate strength, lbs. per sq. in..	50171
Average elongation, per cent.	10.78
June	
Average ultimate strength, lbs. per sq. in..	50235
Average elongation, per cent.	11.14
July	
Average ultimate strength, lbs. per sq. in..	50715
Average elongation, per cent.	11.59

The above data should furnish justification for what has been stated as to the ability of many makers to produce with constancy a metal of superior strength and ductility, even under the handicap of inability, due to present stress, to make use of as good a quality of pig iron and fuel as are necessary for best production. Also, in looking over these records it is only fair to consider, that included in them are bars from concerns in which high strength and ductility have been sacrificed, in order to secure such a character of metal as would machine with the greatest ease, this property in these particular cases being the predominating requirement.

In order to illustrate what is possible of accomplishment there is recorded herewith a run of 24 successive heats, the bars having been received in three batches, the first consisting of 12, the second of six and third of six.

First. Lot of Twelve	
Average ultimate strength, lbs.	58493
Average elongation, per cent.	22.91

In this lot one bar had an elongation of 29.00 per cent. and another of 27.00 per cent.

Second. Lot of Six	
Average ultimate strength, lbs.	58033
Average elongation, per cent.	18.12

One bar in this set had only an elongation of 9.50 per cent., this lowering the average considerably.

Third. Lot of Six	
Average ultimate strength, lbs.	57371
Average elongation, per cent.	23.83

One bar in this set stood 30 per cent. elongation.

The average ultimate strength of the 24 bars is 57,969 pounds per square inch, and the average elongation of the 24 bars is 21.62 per cent. If the manufacturer has been able to arrive at such a point of excellence, at a point where he can positively guarantee that the test bars from each and every heat will meet very rigid and exacting requirements, it is pertinent to inquire why in the case of many have they been so dilatory in connection with proper molding methods?

The writer is going to make an attempt to answer this inquiry correctly and to place the blame where it belongs. It is safe to assume that in the very early days of the industry, the malleable iron casting that was solid throughout was the exception. Lack of solidity, as already inferred, was not due to the presence of blow holes, but was the result of failure on the part of the founder to recognize the fact that in castings of disproportionate sections, and by far most malleable iron castings are of this character, the thinner sections, solidifying more quickly than the heavier ones to which they are attached, would draw the metal from these still fluid parts, before they in turn were able to secure their full quota of metal from the risers.

This state of affairs I presume was productive of so many failures that efforts were concentrated to better these conditions, first, presumably by varying the position and size of gates and risers, etc., but finally by some bright mind determining that the cause of the trouble was fundamentally due to the difference in the rate of cooling of thin and thick parts. Once this conclusion had been reached, it is easy to see that the use of the chills to equalize cooling was the natural and obvious outcome.

It was then perhaps found that while under the arrangement of gates and risers used the chill could not equalize the cooling sufficiently in the majority of cases to make heavy parts perfectly sound, it did serve both to lessen the unsoundness, or shrink as it is called, and to drive it from a place where its existence meant scrap, to a locality much less harmful.

Chills Are a Curse

While not positive, I feel quite sure that the use of the chill originated with the malleable iron founder. Be this as it may, its use in the early days, while an important step in advance, has since operated to deter progress along the lines of soundness, to a greater extent than has any other agency, for the reason that the founder has remained content to adhere to this as a palliative rather than seek after the real cure. There has been a continual effort on his part to shift the boil on the end of his nose to some place on his body where it will be both hidden from sight and less painfully located, instead of taking proper and effective steps to eradicate the cause.

Aside from cases of intricate and improper design in which it is practically impossible to properly feed the casting, the chill has been baneful in its influence and a curse. As already stated there are now a large number of founders who are able to guarantee that the physical properties of their castings will square with that of the test bar. Such, for the most part, have discontinued the use of the chill, and are so feeding their castings by means of large reservoirs of metal that soundness results and shrink is absent. These concerns have made a thorough study of molding principles; gates and runners are properly proportioned and properly set; also the pressure of metal entering the mold is so regulated by the height of the reservoir above the highest point the metal attains in the mold, that, by virtue of this pressure or head, coupled with the mass of metal in the reservoir, the feeding of all sections, light or heavy, continues until solidification is completed.

With these concerns the day of the chill has passed, and while a few must be used from time to time in extreme cases, even this will cease as soon as the designer awakens to the fact that slight alterations in his design will render their need unnecessary.

The Effect of the War

Do not lose sight of the fact that the changes brought about by the war have had a profound influence on all lines of business, particularly in the manufacture of steel and iron products. It has necessitated the starting of many plants as well as the enlargement of the old ones to the point of greatest possible production. This, coupled with the exigencies of munition and ordnance work has in turn necessitated the employment of a legion of men in the capacity of engineers and inspectors, educated for this particular purpose at the expense of the Government. Many of these men would never have followed these vocations had it not been for the war, so where previously a limited number were familiar with the manufacture and characteristics of steel and iron, we have at the war's end thousands of highly trained men who are very proficient, due to this varied and unusual experience; while those previously engaged in the business are still better equipped as they have had full advantage of this extraordinary opportunity.

All this, if it signifies anything at all, means that in the future we will be dealing with men who understand their business, and it does not need a prophet to forecast that all ferrous products from now on are going to be measured under higher and higher standards of inspection. Unsound castings are not going to get by, and he who thinks differently is most assuredly living in a fool's paradise. From now on there is but one safe road to follow and its direction is clearly indicated. The laxity that obtains in many plants in regard to these most important and vital considerations should cease if they have any regard for their own well-being or for the industry as a whole.

Perfectly Sound Castings

Our opportunity is at hand, because it has at last been demonstrated beyond a shadow of doubt that the most complicated malleable castings can be regularly produced by many concerns without a trace of shrink, and of a strength and ductility not thought possible some years ago. The engineer now knows this to be the case and knows as well that we have outgrown and made up for past misdeameanors. Discard the chill, and in its place substitute risers or heads of such height and section as will furnish sufficient pressure of fluid metal to make sure the casting's integrity.

Have some one on the job who understands this art and keep him busy with every pattern that needs attention. Impress him with the thought that he is the most important man in the place, which under conditions now existing is the case, and hold him responsible for any lapse in the direction of unsoundness.

In breaking hard castings in search for shrinks, do not assume that none are present until those thought solid have been annealed, because this treatment will develop a shrink not discernible prior to annealing.

In the malleable industry a new era has dawned, a fact frankly admitted and acknowledged by the trade. Let us stand shoulder to shoulder for mutual help in the matter of soundness. Let the integrity of the casting be the very first and foremost consideration, for a solid casting made of ductile metal having an ultimate strength of but 40,000 pounds per square inch is unquestionably superior to one in which shrink is present, though the test bars in the latter case yield an ultimate strength of 50,000 pounds per square inch and an elongation of 20 per cent.

Co-operation Between Chemist and Foundryman

Practical Foundryman's Troubles With Defective Material Which Might Have Been More Easily Discovered and Rectified by the Timely Aid of the Chemist

By H. E. McINTYRE

ONE of the worst troubles of the foundryman during the past few years has been to secure raw material which was up to standard, and too many times the foundyman has taken it for granted that he was getting what he ordered and did not have his supplies analyzed. The coke ovens and blast furnaces have been compelled to furnish what they could and use what raw materials they could get, too, so it has required constant vigilance to know what goes into the cupola. Two years ago we were buying coke which has been a standard coke for years, and always had a fixed carbon content of 88 to 92 per cent.; our iron became cold for a day or two, then served all right for about a week, then went cold again, everything being handled the same every day as far as humanly possible, and we changed our method of charging, changed our blast pressure, in fact did everything we could except change the amount of coke used, and the superintendent under whom I was working wouldn't allow me to change that as he had "used that coke for twenty-five years and knew it was alright." He finally consented to having it analyzed to satisfy me; we had a chemist on the plant, he always analyzed our coke for sulphur, and analyzed all pig iron, core oil, etc., but never had made a practice of analyzing the coke any further than that; it was quite a surprise to him to find that the coke we were using that day was only 82 per cent. fixed carbon, and we found one car in the yard just received that day which was less than 81 per cent.—we soon got our iron warmed up. Another time in the same shop we were having an awful time with the sulphur in the semi-steel—we were running three cupolas, one of grey iron, one of semi-steel, and one of a smaller percentage of steel for auto and tractor cylinders and heads, manifolds, etc.

The semi-steel was tapped from the cupola into a crane ladle holding 3,000 pounds to carry to the molding floors. We took test blocks from every tap before we located our trouble, one tap would show white about ¼ in. when cast against a chill, the next would be white clear through the 2 in. block. I finally worked it out to one thing: we were using drop-forge flashings for the cylinder iron, and old horse-shoes for the semi-steel, but even that didn't seem to lead to anything until I remembered reading, when a boy, of Goodyear using sulphur in the manufacture of rubber, and about half of the old horse-shoes were upholstered with pads of rubber weighing more than the steel. I got in touch with the superintendent of a tire factory that same evening about it, and he told me that the shoddy rubber such as they were made of was from 7 to 11 per cent. sulphur. There were no more of those pads went into the stock after that.

I took charge of a smaller shop after leaving there and found that they were up against the sulphur trouble pretty hard; the coke looked good and firm, we had the analysis of all the pig iron, and had some good light machinery scrap. I had some of the coke analyzed at once, though from the care we were using out of at that time it showed 3.11 per cent. sulphur, and out of four cars in the yard the best we had was 1.22 per cent.; the coke had not been bought to meet any specifications as it was bought in the open market as "foundry coke," no guarantee on it except a jobber's word that it was foundry coke.

I could cite innumerable instances of the same kind, but these two or three are enough to illustrate my point—that a chemical analysis is the cheapest thing a foundry ever bought.

Molder Came to the Assistance of Pattern-Maker

By Aid of the Foundry Foreman, the Pattern-Maker Was Enabled to Rectify an Oversight Without Making a New Pattern

By JOHN A. McEWAN

THE accompanying drawing shows a 3½ in. balanced regulating valve for a marine engine, Fig. 1 showing a cross-sectional view, and Fig. 2 an outside view looking at the branch.

I decided to make the pattern in halves leaving core prints at each of the three openings. In looking over the drawing I thought that the core which forms the part A, Fig. 1, could easily be fastened into the two core prints B and C, shown dotted in Fig. 1, and that it would make a strong enough joint to support the whole core when in position in the mold, without lifting or sagging, so I made the core prints all 3½ ins. long and did not consult my co-worker of the molding shop before beginning the pattern, which was contrary to my usual custom.

The first remark the molder made after seeing the pattern and core boxes was as to how we thought he could fasten core A, Fig. 3, securely enough into core B, Fig. 4, to make it strong enough to be rigid, and also how was he going to keep core A in a line with the opposite branch on core B? I replied that we thought that core A would be pasted and dried in position in core B, but as to holding it in the correct position, we had made no provision for this difficulty. He then asked why the core prints at F and G, Fig. 1, were so short, and why were they not long enough to more than balance the overhang, providing the joint between cores A and B was weak?

It looked at that moment as if we would have to lengthen the core prints and core box, but our boss molder is pretty accommodating, and he knows how pattern makers hate to change a job after it is finished, so the difficulty was dissolved as follows: We lengthened the core prints in core box B, Fig. 4, an eighth of an inch on each end, shown dotted at H and K, thus providing a space that could be packed tight with core sand, since before there had been no clearance between the cores, and we also made a pattern as shown in Fig. 5 to provide a support for the cores while being assembled and during the drying of the joint, the ball part of the core resting on the plate part of the casting while the three upright pieces kept the branches in line.

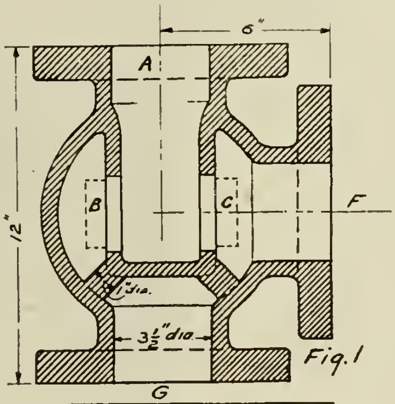


Fig. 1

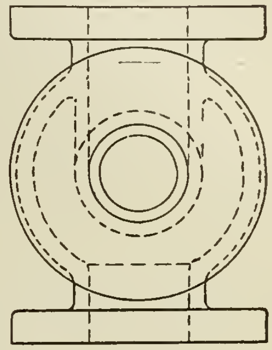


Fig. 2

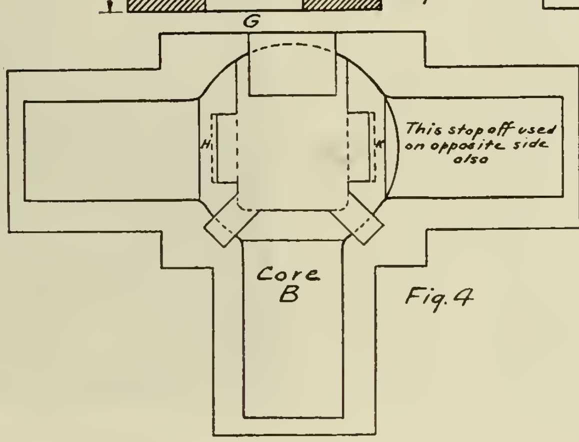


Fig. 4

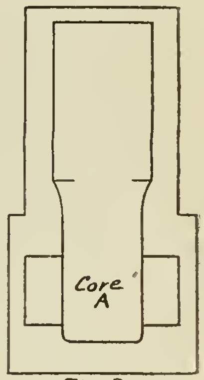


Fig. 3

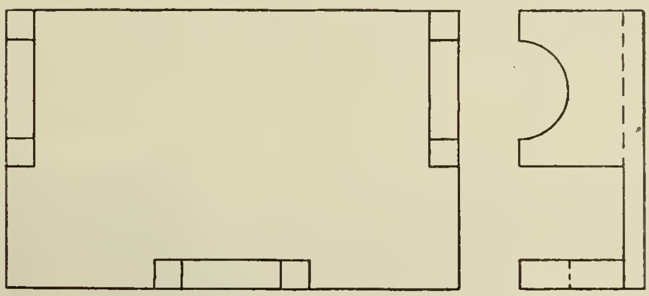


Fig. 5

The results were quite satisfactory and the shortness of the core prints permitted the use of a smaller molding box than would have been required if the prints had been lengthened sufficiently to support the overhand of core B. The casting was gated on the flange.

"USING EMPTY INK BOTTLES FOR HOLDING ORANGE SHELLAC"

By J. McE.

Most pattern makers are aware that orange shellac will discolor if kept in a tin pot or can.

Some shops use glass jars with a stopper, through which the brush handle projects, but we like something with a larger opening.

Our way is to get an empty ink bottle, about 3½ in. diameter, scrape off the paper label from around the top; take a piece of cord, and after wetting the cord in coal oil, tie it tightly round the bottle at the place where it is desired to be cut, and, after setting fire to the cord and letting it burn all round, plunge that end of the bottle into cold water. If the glass is at all uniform in thickness it will crack off nicely at the place where the string was tied.

The advantage of this kind of a pot is that it gives more room for dipping a large brush. To prevent evaporation we, of course, keep all the paint pots in a box with the lid closed.

It takes but a very short time for the sharp edges of the glass to get coated over with shellac.

Practical Hints for the Brass Founder

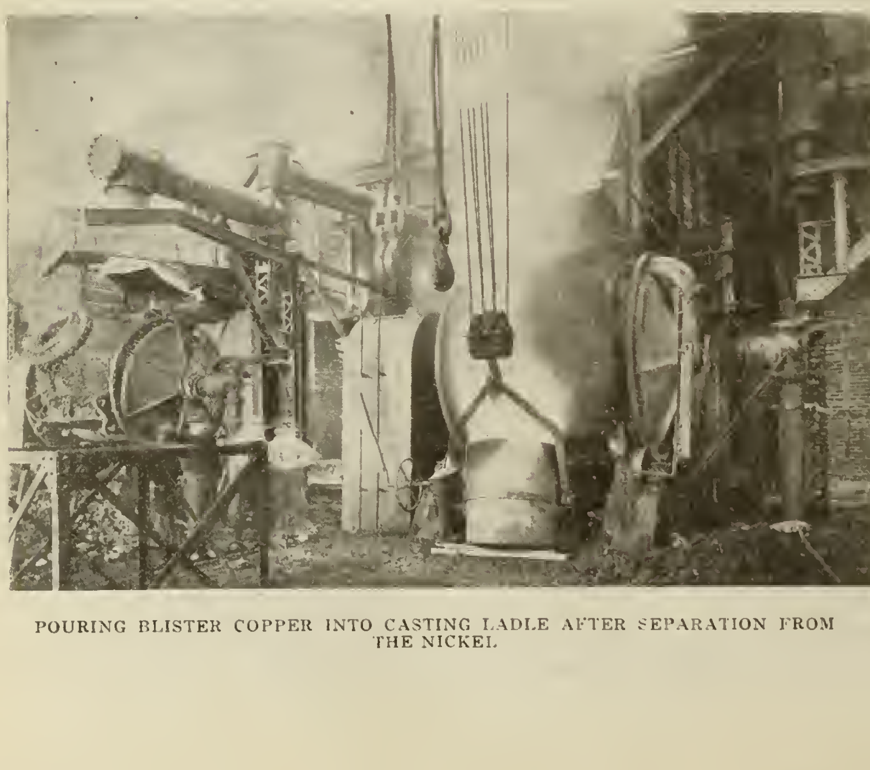
REFINING NICKEL AND COPPER

By J. F. SUTHERLAND

THE history of mining and smelting in the Sudbury region is so closely bound up with the Canadian Copper Co., now absorbed by the International Nickel Co. of Canada, that a good idea of the processes connected with the smelting of the ores may be gained by following the various operations as they are conducted at this company's smelter at Copper Cliff.

The valuable constituents of the ores are nickel and copper, and these two metals must first be separated from the useless materials and then from one another. The first step is the elimination of much of the sulphur found in combination with the nickel, copper and iron of the ore, and in the past this has been largely accomplished by heap roasting, although it is anticipated that this process, destructive to vegetation and wasteful of sulphur, will soon become a thing of the past. For heap roasting, a flat, well-drained surface is prepared, and a layer of cordwood or dead pine is laid down to a depth of a foot or eighteen inches. On this bed coarse ores are placed, followed by medium ores, and finally by fines. The heap, when completed, contains up to 2,000 or 3,000 tons, and has a trim rectangular shape with flat top and sloping sides. The wood is set fire to and burns out, by which time the sulphur is ignited and burns without further assistance. The larger heaps require three or four months to burn, and at the end of this time all but about 10 per cent. of the sulphur has burned off, and the iron is more or less completely oxidized. After roasting the ore is smelted in water-jacketed furnaces to standard matte. These copper blast furnaces are rectangular in shape and can handle about 500 tons of ore per day. The ore from the several mines owned by the company, owing to the large proportion of iron and admixture of rock with the sulphides, can be blended to form almost self-fluxing mixtures, but quartz is added as required to produce a further oxidization. The smelting results in two products, matte and slag. The matte contains practically all the nickel and copper, with much of the iron The matte from the blast furnace is next poured into basic converters, where the remaining iron is oxidized in much the same manner as is the carbon in the familiar Bessemer converter of the steel mill. The iron passes out in the slag resulting from the operation, and a standard matte ready for the refining results. The matte contains very nearly all the nickel and copper, very little of the iron. and a high percentage of sulphur. The matte is sent to the refinery at Port Colborne, where the copper and nickel are separated and refined.

COPPER CONVERTER IN REFINERY BUILDING



POURING BLISTER COPPER INTO CASTING LADLE AFTER SEPARATION FROM THE NICKEL

The Port Colborne Refinery

On approaching the refinery at Port Colborne, one is favorably impressed with the excellent architectural features of the administrative and other buildings forming a group at the entrance.

The comfort and health of the large staff have been given considerable care, and the result is shown in the staff house provided for employees. and in the club house for the accommodation of the unmarried department and executive heads.

Adjacent to the administrative building is located the combined garage, timekeeper's office, and hospital. The garage forms the lower or basement story, with the timekeeper's office immediately above. The hospital forms a somewhat detached portion of the building and is an extremely well appointed and necessary part of the plant. The laboratory is housed in a separate two-storey and basement building.

Railway sidings enter the company's property and serve every portion of the plant, all handling of materials by hand being eliminated.

The furnace building, known as the No. 1 building, is 746 feet in length by 125 feet in width, and at present houses three blast furnaces and three converters. The matte received from the smelter at Copper Cliff undergoes its initial treatment here, and the method of handling the raw materials is of interest. The matte, coke and fluxes are brought in on an elevated trestle of reinforced concrete, and which displays excellent design and workmanship. From the cars the materials are dumped into elevated storage bins, from which it goes to the feeding floor and thence to the furnaces. The standard matte, 55 per cent. nickel and 24 per cent. copper, is smelted with salt cake, the nickel separated and the copper bessemerized in the converters. These converters are of Allis-Chalmers make, and are of 84 in. by 126 in. size. Electric tilting gear controls their movement. Besides these converters this company supplied two sets of crushing rolls and a sample grinder.

Removal of Fumes and Gases

In the various operations conducted in the No. 1 building much sulphur is given off in the form of sulphur dioxide gas, and to remove this and disperse it in such a manner as to prevent damage to vegetation has been a problem of some magnitude. Each converter has a stationary hood and also a movable one for use when pouring, through which all of the deleterious gases are removed and conducted to the stack. For the removal of dust and a valuable metallic content, the gases, before entering the stack, are subject to the familiar Cottrell precipitation process.

THE BRASS FOUNDRY

The brass foundry is one of the most interesting places imaginable to study chemistry and yet very little interest seems to be displayed in it. For instance, imagine a soft metal like tin being used as a hardener. No one can tell why tin hardens copper; all they know is that it does, up to the saturation point, after which it proceeds to soften it, but before it reaches this point it makes an alloy which is so hard that it is used for telescope mirrors.

The ancients used copper for edged tools, and they had a process by which it was hardened. That process seems to have been lost, but undoubtedly it was simple, and somebody will probably stumble onto it in endeavoring to accomplish something else. Hard alloy like copper and tin would not answer because it would not hold a keen edge and it is brittle. The weapons of the ancients appear to have been pure copper.

SPEAKING ABOUT TELESCOPE MIRRORS

If 66 2-3 per cent. copper and 33 1-3 per cent. tin are mixed together, that is to say, if two parts of copper and one of tin are mixed, it makes a white alloy which has a brilliant lustre, and is susceptible of a high polish. This alloy is known as speculum metal, because speculum is the technical name for telescope mirrors or reflectors. It has a Latin derivation. Spectrum (meaning seen), spectacle, spectacular, etc., being derived from the same source. The addition of a little metallic arsenic, one or two per cent., makes the metal more compact and gives it a greater lustre and hardness, but renders it liable to be tarnished by the air. It is nearly as hard as steel and as brittle as sealing wax.

The speculum of Lord Rosse's large telescope is six feet in diameter and 5¼ inches thick, and weighs upward of three tons. The casting of this mirror was an interesting process. After repeated failures and experiments, a mold was made whose bottom consisted of hoop iron wound together like a clock spring, and pulled up as tight as possible, and a tire shrunk onto it. This bottom was turned convex on a turning lathe, true to the concavity of the speculum. This made a bottom close enough for the vent, but not the metal to escape through the crevices. This bottom was leveled up on the floor and sides rammed around it with sand, but left open at the top. After being poured the casting was carried, while red hot, and placed in a red hot annealing oven, and left there for sixteen weeks, during which time it was allowed to cool gradually. Whether or not all of this ceremony was necessary, we are not prepared to say; how be it, the others were failures and this one was a success.

Questions and Answers

Question.—I wish to obtain a non-shrinking white metal alloy suitable for pattern making. I am frequently called upon to use a part of a machine for master pattern; from that I make a number of white metal patterns, and from them I make a match plate or brass pattern; this makes the resultant castings three shrinkages smaller than the original. A white alloy, which would expand, would be the proper thing. Is there such an alloy?

Answer.—There are two metals which expand in cooking, viz., bismuth and antimony, but they are both hard and brittle. By mixing with soft metals they reduce the shrinkage, but increase the hardness. Type metal consists of about 2 parts lead, 1 part tin and 1 part antimony. This alloy is soft enough to finish fairly easy, and expands in cooling. Additional lead would soften it, but would increase the tendency to shrink. In making this alloy, melt the lead first, after which stir in the powdered antimony, and lastly, put in the tin. After getting the alloy properly mixed it melts easily and runs well and should not be overheated. While a higher temperature is required to melt antimony than lead, the difference is so slight that the lead will stand to be heated to the higher temperature in order to melt the antimony in the way described.

Expansion metal is an alloy of 9 parts lead, 2 parts antimony, and 1 part bismuth. As bismuth melts almost as easily as tin, it can be introduced after the antimony has been thoroughly dissolved in the lead. The objection to both of these alloys is that they are not soft like ordinary white metal, but they are not brittle.

* * *

Question.—We are experiencing a lot of trouble in making aluminum match plates. Can you give us any information on what to do to prevent shrink holes, which seem to come in the lighter parts rather than in the heavier parts?

Answer.—Your trouble is the usual one with aluminum beginners. Aluminum certainly shrinks a lot, and a heavy feeder does not always save it because there is not sufficient weight in it to give it force, but that is not the trouble in making match plates. Sand which is just right for iron molding is too damp for aluminum, and unless it is dried previous to being poured it will steam, and the aluminum will not have weight enough to force it through the pores of the sand. The hollow places which would appear to be shrinks are usually on the lower part, while a shrink would most likely be on the top. Use a blow torch and dry the face of the mold just before pouring it and your trouble will cease.

* * *

Question.—Can you give me a good receipt for making aluminum match plates? We have a lot of scrap aluminum which is very soft, and if we use it for plates they will bend. Is it necessary to use copper?

Answer.—There are many receipts which will harden the aluminum but they make it heavier, which is undesirable. Six pounds of scrap yellow brass, which is in reality 4 pounds of copper and 2 pounds of zinc, will harden one hundred pounds of aluminum, but it requires a crucible and a very hot fire to melt the brass. Five per cent. zinc will make a fairly good casting, but I have found 99 per cent. aluminum and 1 per cent. tin to be the best which I have ever used and the easiest to mix. If melting in a babbitt ladle, be sure that the ladle is clean, because lead will not mix but will go to the bottom of the casting.

Probably as good a mixture as can be made, particularly where match plates are liable to be on order all the time, is to make what is known as No. 12 alloy in quantity and carry it in stock. This is made by mixing half copper and half aluminum. When a plate is to be made, mix one pound of the alloy with about 7 or 8 lbs. of aluminum and a superior metal will result.

Pressure on Molds When Filled With Liquid Iron

A Few Practical Hints on How to Guard Against Failure Through Straining, etc., by Knowing How Much to Guard Against

By JOSEPH CROWE

WITH many years' experiencee in foundry practice and coming in contact with a great number of molders of all classes, I can safely say that I have only met one that has made any pretence to figure out in an accurate manner the pressure exerted on his mold. I have concluded that no one item in foundry practice has so little data or information to work upon as the present subject of "pressure" on flasks, cores, anchors, and the clamps, etc., that are used to resist it.

Every molder has his own way of doing these things, making of anchors, securing of molds to prevent running out anywhere, or from losing the casting in any way that he can avoid. Yet how few will sit down and resolutely figure out what strain a casting will give every way, what the cores will stand and what fixtures are capable of resisting the pressure and do their work on a safe and practical basis. Good judgment is essential in these matters, but often work is lost by our best mechanics through mistaken judgment. I think it can safely be said that a high percentage of lost work can be laid to these causes, not sufficient clamps, not weighted enough, or weights improperly placed. Cores break through insufficient or too light rods, anchors or chaplets, casting strained or swelled, because the flask was not strong enough to resist the pressure of the molten metal. Hundreds of such accidents occur daily through men relying on snap judgment as to what will hold a certain pressure, the molder being frequently ignorant of the true pressure.

Many molders have very peculiar ideas on this subject, some will say that it takes three times the weight of the casting to hold it, or the cope down on it, regardless of area. Others maintain it takes more to hold down a cope on a plate three or four inches thick than one of one inch thick of the same area. This practice may go along alright for a while but sooner or later is bound to collapse, the result being a bad casting through what will likely be called "bad luck." In my opinion the foreman of any shop ought to have a thorough knowledge of this subject, to be successful.

I will try, in a crude way, to make myself understood, while giving a few practical hints along these lines, hoping, in doing so, that some may take a deeper interest in this subject who are better versed than the writer.

The rule for determining the upright pressure on the mold may be stated as follows: One-quarter the area multiplied by the depth of gate is equal to the pressure exerted to force the mold apart. In the form of a formula the rule would be expressed as:—

$$P_u = .25AD$$

where Pu=the total upward pressure.

A=horizontal area at the division of the mold.

D=depth of gate from top to surface of area A.

Example:—To find the pressure on a mold, the dimensions of which are 20 inches by 24 inches, the gate depth being 6 inches.

Dimensions in inches	Total Upward Pressure	
	6" gate	10" gate
12 x 12	216 lbs.	360 lbs
24 x 24	864 "	1440 "
36 x 36	1,944 "	3,240 "
48 x 48	2,616 "	4,360
60 x 60	5,400 "	9,000
84 x 84	10,584 "	17,630 "

TABLE 1—PRESSURE ON SQUARE AREAS AT DIFFERENT DEPTHS OF GATE

Table 1 gives the approximate pressures for several stated areas and depths of gates. Others may be computed from the above formula.

In the last area given in the table, 7 ft. x 7 ft., or 49 sq. ft., with a cope covering it 10 inches deep, the amount of weight required to hold it down is 17,630 lbs., almost 9 tons on the bars, which are often wooden and cut half away, and yet wonder is frequently expressed when the casting is humpy or crooked. If it lifts the cope at one corner, or metal runs out at the back of the gates, the remark is very often made that there were not enough flow gates on the mold. The fact is, that flow gates in any quantity more than sufficient to see when fluid iron is coming up in the cope, is of no advantage in relieving the strain. Preessure on rectangular areas are found in the same way as in table 1.

$$P_u = .25AD =$$

$$.25 \times 20 \times 24 \times 6 = 720 \text{ lbs.}$$

Pressure per running foot of surface at varied depths will convince the most skeptical. Here is where we have made many mistakes in building flasks, and expecting pits, made in soft or treacherous ground. to give good service. The rule for finding the side pressure per running foot at various depths of castings, may be stated thus:—multiply the area of a running foot of the side surface bv the height of gate plus the mean depth of casting, and divide by 4. Expressed as a formula this would be:—

$$P_s = .25A(D+m)$$

where Ps=total side pressure per running foot.

A=area of one running foot.

D=depth of gate.

m=mean depth of casting.

Example:—A casting with approximate dimensions of 8 inches in thickness and 10 feet long has a 10 inch gate; what is the side pressure for the entire length?

$$P_s = .25A(D+m) =$$

$$25 \times 8 \times 12 \times (10+4) = 336 \text{ lbs per ft.}$$

Pressure on the total length would be 3,360 lbs.

Depth of Casting. in inches	Side Pressure per Running Foot.	
	6" gate	10" gate
6	162 lbs	234 lbs
10	330 "	450 "
20	960 "	1200 "
60	6400	7200 "

TABLE 2—SIDE PRESSURE PER RUNNING FOOT AT VARIED DEPTHS

Table 2 gives the approximate pressure per running foot for various thicknesses of castings, and gates of 6 and 10 inches.

This table is based on height of gate, which in this case are also given as 6 and 10 inches, this being the average depth of copes generally used; and shows the entire strain per running foot on such work, at varied depths. For instance, take a flange or rib cast on edge, 6 inches wide and 10 feet long, with a 6 inch depth of cope, we have a pressure exerted on the sides of the mold of:—

$$25 \times 6 \times 12 \times 9 = 162 \text{ lbs}$$

per running foot, and the pressure for the entire length equal to 1,620 lbs. Again, take a column 12 inches square and 14 feet long (a very common length) and see what enormous strain is on the sides of the flask or pit; such a depth would receive a pressure of about 504 lbs. per foot on each side (provided an 8 inch cope was used to cover it) or a total for one side of 7,056 lbs., making the lumber, bolts, and bars connecting them subject to a strain of over seven tons, if made in a flask. If seven tons were to be lifted no one would attempt to do it with a couple of thin cast iron plates a few inches wide, yet observation will show us rigging that is used daily where strain is far in excess of what it is thought to be.

$$25 \times 30 \times 12 \times 23 = 2070 \text{ lbs}$$

With increased depth our pressure follows accordingly. Columns are often made thirty inches deep. Imagine what strain a flask or pit is subject to, placing the length of the column at 12 feet. The table gives 2 070 lbs. per foot, or a total on both sides of almost twenty-five tons. Yet we wonder that our rigging fails and pits give way.

The rule for finding the side pressure on pulleys or cylinders cast on end, may be stated thus: one quarter of the circumference multiplied by the width of face, and half the width, equals the total side pressure. The formula would be:

$$25 \times 6 \times 3.1416 \times 12 \times 6 = 339 \text{ lbs}$$

when C=circumference and F=the width of face.

Example:—To find the total pressure on a 6 inch pulley of 12 inch face.

Pressure on Pulleys or Cylinders cast on end					
Dia in inches	12 inches deep	24 inches deep.	36 inches deep.	48 inches deep.	60 inches deep
6	339 lbs	1356 lbs	3051 lbs.	5428 lbs	8472 lbs.
12	679 "	2712 "	6102 "	10848 "	16950 "
24	1354 "	5418 "	12190 "	21670 "	33862 "
42	2376 "	9504 "	21384 "	38016 "	58400 "
54	3016 "	12066 "	27148 "	48264 "	75412 "
60	3393 "	13572 "	30537 "	54288 "	84825 "

TABLE 3—PRESSURE ON PULLEYS OR CYLINDERS CAST ON END

Table 3 embraces pressures on pulleys or other round bodies cast on end, for several diameters and different depths, and is used in the same way as table 2, showing what pressure some of our molds are subject to, but differs from table 2 in not adding depth of gate to the mean depth, only multiplying by the mean depth. For example, take a 60 inch pulley with 60 inch face, it shows a total strain on the outside surface of over 40 tons.

$$25 \times 60 \times 3.1416 \times 60 \times 30 = 85000 \text{ lbs}$$

Is it strange, therefore, that sometimes our judgment is at fault and our rigging or equipment give way and cause disaster.

Lift on Circular Areas at different heights.			
Diameter	6 inches	8 inches	10 inches
12	163 lbs.	226 lbs	282 lbs
18	382 "	509 "	636 "
24	678 "	902 "	1126 "
30	1060 "	1413 "	1767 "
36	1525	2034 "	2543 "
42	2078 "	2770 "	3463 "
48	2714 "	3618 "	4523 "
54	3335 "	4480 "	5625 "
60	4241 "	5654 "	7067 "

TABLE 4—LIFT ON CIRCULAR AREAS AT DIFFERENT HEIGHTS

The rule for the lifting pressure on circular areas is: the lifting pressure is equal to the displacement of weight of metal to finding its level when the metal has reached its full height. Put the displacement into cu. inches and multiply by the weight of a cubic inch (.26 lb.) or approximately ¼ or .25, weight of the cope extra. Assuming a drum 60 inches diameter, 24 inches deep, with a core 56 inches diameter, to be cast with a 6 inch cope, or height of gate; what is the pressure exerted upward on the cope, and core separately and combined, 2 inch thickness of iron all over the core? The solution would be:—

$$60 \times 60 \times .7854 = 2808 \text{ Sq In.}$$

$$2808 \times 6 \times .25 = 4212 \text{ lbs.}$$

for the lift on the cope, and

$$56 \times 56 \times .7854 = 2446 \text{ Sq In.}$$

$$2446 \times 22 \times .25 = 13453 \text{ lbs.}$$

for the lift on the core, the combined pressure being 17,665 lbs.

Table 5 treats on the lifts on round cores lying horizontal. Here is where many have mixed ideas. No matter what height of gate may be, or the weight of the casting, the pressure or lift is always the same, and excuses for broken or raised cores are often unsatisfactory, for when the iron once covers the core, there is no more lifting pressure, for increased height has pressure on the top of the core as well as on the bottom. The table gives the lift per foot and from this it is easy to determine the size and number of anchors, rods, etc., to hold the core. Different heights of gate than those given on the cope areas, can be easily found by multiplying the given heights, and in many other ways to advantage. Much of our present practice is to secure, until we think our work is safely held, and if not to make it over again. This condition must be eliminated to a large extent in our foundries, at no distant date. This subject involves so much that it is only possible to touch on it here in this article, but hope is expressed that sufficient has been given to prove advantageous to some of our craft.

Lift on Round Cores per Running Foot.															
Diameter.	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"	12"	13"	14"	15"
Lbs.	1.5	6	13.5	24	37.5	54	75.5	96	121.5	150	171.5	216	253.5	294	337.5

TABLE 5—LIFT ON ROUND CORES PER RUNNING FOOT

A SATISFIED SUBSCRIBER

In reply to several letters which we received regarding poor castings from apparently good stock we published in the February issue of CANADIAN FOUNDRYMAN an article on the use of ferro-silicon to improve the castings, and also a few remarks about cupola management, since which we have received some very encouraging comments. We herewith quote, in part, one of the letteers from a Western Ontario foundryman:

"We have given this ferro-silicon alloy a test in our last cast, and it works very satisfactorily. As yet we have not discovered a hard casting in the complete cast. We note your remarks regarding the fuel and we agree with you. We have been using the common coal, but used the regular furnace coal last heat. We thank you for your kind attention to this matter."

The National Catholic War Council, 930 Fourteenth Street, N. W., Washington, D.C., have handed us their pamphlet on "Social Reconstruction." The subjects dwelt upon are, "Programme of American Labor," "British Quaker Employers," "American Employers," "An Interdenominational Statement," "No Profound Changes in the United States," "A Practical and Moderate Programme," "United States Employment Service," "Women War Workers," "National War Labor Board," "Present Wage Rates Should be Sustained," "Housing for Working Classes," "Reduction of the Cost of Living," "The Legal Minimum Wage," "Social Insurance," "Labor Participation in Industrial Management," Vocational Training," "Child Labor," "Ultimate and Fundamental Reforms," "Main Defects of Present System," "Co-operation and Co-partnership," "Increased Incomes for Labor," "Abolition and Control of Monopolies," "A New Spirit a Vital Need." The subjects are ably discussed and should be of interest to every fair-minded citizen. Mr. John J. Burke is chairman.

From far-off San Francisco, the following communication has been received, which goes to show the reception accorded the CANADIAN FOUNDRYMAN wherever met with.

San Francisco, Cal., Feb. 27, 1919.

Editor, Canadian Foundryman,
Toronto, Canada.

Dear Sir:—

I have just received a copy of the CANADIAN FOUNDRYMAN which you kindly sent me, and must compliment you highly on the splendid work shown in said journal.

No molder can look through those pages and fail to gather knowledge as well as pleasure in looking over what is set forth there.

It looks so good to me that you will find enclosed ($1.50) one dollar and fifty cents, that I may become a regular subscriber. If this sum is incorrect please let me know so that I may correct it.

Yours as ever,

JOHN HEDLEY,
President Western Foundry, Incorporated,
912 Folsom Street, Cor. of 5th.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - - Vice-President
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries

B. G. NEWTON, Manager.

A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1207 Union Trust Bldg., Telephone Main 3449. Eastern Representative: H. V. Tresidder. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: J. N. Robinson.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 900 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 1147. Boston: C. L. Morton, Room 733, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers, who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. MARCH, 1919 No. 3

PRINCIPAL CONTENTS

Master and Servant

IN our last issue we made a humorous reference to the subject of capital and labor, but frankly speaking, it is not a joking subject. Unfortunately there seems to be a lack of sympathy between the different classes of society. The working man invariably looks upon his employer as a capitalist, and the employer must perforce pose as such in order to keep his standing in the business world, no matter what the condition of his finances may be, with the result that the worker continues to think that he is struggling to build up a fortune for his employer. Of course, that is undoubtedly the employer's aim, but with him it is a speculation, while with the working man it is a sure thing, providing he has employment. And in case of a shut-down it is a more serious proposition for the business man than for his hired help. The hired man can usually scramble around and get something to do to keep his soul and body together, but with the man who has a lot of capital tied up and nothing coming in it is different. Perhaps a more appropriate way of defining the two sides would be to term them master and servant. While this style of expression may have a contemptible sound, there is in reality nothing contemptible about it. A man who works for another is by all means a servant, and the man he works for is certainly master of the situation, during working hours at least.

But what ever may be their names, why should there be any great gulf fixed between the master and the servant any more than between a merchant and his customers? Everybody, unless he is a drone, is a servant to others, and because a man works in a foundry, for instance, it should not put him in a different strata of citizenship. If both master and servant would abide by the commandment: To do unto others as they would be done by, there should never be any excuse for industrial disputes. Of course, there is not the friction which might be imagined. Take, for instance, our own line (that of foundry work), when we consider the number of men employed and the number of disputes, the percentage of strikes is comparatively small, which would indicate that the majority of employers and employees are endeavoring to be agreeable, but there are some on both sides who prefer force. There are men who do not try to earn their pay, and again there are employers who look upon their hired help as so much dirt, but as we have said, the percentage is small. The CANADIAN FOUNDRYMAN is frequently asked to state its platform, whether it is with the men or with the boss. To this we can only say that we are with both. We want the gulf between them to be bridged and if we can in any measure be the bridge, we are right on the job.

There's a Mutual Interest Here

THERE are a number of shops in Canada where there are adamant rules forbidding access to the works to canvassers of any sort.

It is probably necessary that there should be rules of this sort. It is necessary for the employer to protect himself. He is paying for the time of the men in his employ, and is entitled to all of it. On the other hand, men working in factories very often prefer to have some sort of protection that will insure them against being bombarded daily by agents and canvassers who may be smart and glib enough to talk them into purchases that they will regret shortly after.

In a great number of cases representatives of the technical press are granted open door to the shops in order to give the men a chance to secure reading matter that will make them capable of doing better work and keeping abreast of the times.

CANADIAN FOUNDRYMAN has never yet asked any shop to give it special treatment in this regard. But it does not take much reasoning to see that the more men there are reading such a publication—and kindred publications as well—the higher will be the standard of shop knowledge, and the greater the efficiency of the staff.

Right now when new methods of production are being brought out—when the lessons of production gained from war work are being applied to present-day industry—is the time when it is very much to the interests of manufacturers to have the men in their shops reading CANADIAN FOUNDRYMAN. The publishers of this paper do not mean by this that they expect shop executives to agree to have the time of their men wasted or fooled away, but we do mean that, in the interests of the men who are ambitious and anxious to go ahead, there should be a reasonable amount of co-operation in the work of getting a greater circulation for a paper the sole aim of which is to make the mechanic a better mechanic by giving him the advantage of what some of the best authorities have found out by years of experimenting and research.

COST OF MELTING IRON

I have a friend who is a practical all-round molder; he served his time in a big shop and has always worked in good shops, and he now wishes to go into business for himself, but his one drawback is that he lacks knowledge along the line of handling the cupola and in figuring the cost of the melted iron as it stands in the ladle. Incidentally he would like all possible information which would be of use in figuring the cost of making castings in a jobbing foundry and has asked me to assist him in figuring it out, and in doing so I have concluded that it would be as well to submit my experiences in this line for publication in the CANADIAN FOUNDRYMAN in the hope that they may be of service to other young foundrymen who wish to embark in the foundry business for themselves.

It is to be presumed that any one who has followed up foundry work knows how the melter gets the cupola ready previous to charging on the coke and iron, so we will omit any reference to this. Sufficient kindling should be used to insure the coke being lit on all sides, and sufficient coke should be used on the first, or bed charge to reach up to twenty inches above the tuyeres after the kindling is burned out. The coke should be weighed so as to ascertain the exact amount required, thus obviating the necessity of doing any measuring after the first time. After lighting the fire it should be allowed to stand until all of the smoke is over with and the wood all consumed, when the top of the coke bed should be leveled up and the first charge of iron put on. This charge should be about three times the weight of the coke used in the bed. The succeeding charges of coke should be of sufficient weight to fill six inches in depth and the succeeding charges of iron should not exceed ten times the weight of the six-inch coke charge, preferably less. Edward Kirk, in his book on cupola management, says, "Theoretically fifteen pounds of iron are melted with one pound of coke, but this melting is done in the foundry office or in the mind of the foreman, and it takes a little more fuel to melt iron in a cupola for foundry work. Eight pounds of iron to one of coke is, by practical foundrymen, considered good melting. A little better than this can be done in a full heat for the size of the cupola and under favorable circumstances, but in the majority of foundries fewer pounds of iron are melted to one of fuel than the above amount." From this we may conclude that if we take into consideration the extra fuel used in the bed we are doing exceptionally good melting if we can melt 8 tons of iron with one ton of coke.

Loss by Oxidation

Another thing to be taken into account is the loss by oxidation. There is always more or less iron lost in the cupola. The larger the amount of surface exposed to the action of the blast and the thicker the scale of rust or dirt on the iron the greater will be the loss. Perfectly clean pig iron cast in iron molds will lose about 4 per cent., and ordinary pig iron about 5 per cent. Heavy scrap about 7 per cent. and light machinery scrap about 8 per cent., while all stoves will usually decrease about 15 per cent. From these figures it should be easy to make calculations both as regards making up the charges and in figuring up the costs. In charging on the iron it should be borne in mind that each ton of pig only represents about .19 hundredweight of real iron and a ton of old stove plate only represents 17 hundredweight of iron, and so on through the whole list. The same things must be born in mind in figuring the costs. The other expenses such as wages and wear and tear to the cupoling and overhead charges would have to be added to this. The wages would depend on what equipment the men had to work with, determining how much a man could do. The material used for daubing can be determined at each heat and added to the price of a new lining every three hundred heats. These costs, added together, should give a fairly good estimate of what the iron is worth as it stands in the ladle. The overhead charges such as interest, taxes, insurance, light and heat should be divided and proportioned according to the estimated amount of metal handled in a year. So far we have only touched on the cost of melted metal. The cost of making the molds is an easy matter to keep track of. The men are either paid a piece price or their time kept track of and the rate of wages accounted. A practical man should be able to tell how long it would take to make a piece by looking at it. To get the probable weight of a casting, there are different ways. A cubic inch of iron weighs .26 pound, or approximately a quarter of a pound, while a white pine pattern weighs approximately one-sixteenth of what the iron casting will weigh. Another way to get the exact weight of a complicated-shaped piece is to submerge the pattern in a cask of water, and after removing it figure up the number of cubic inches of water it had replaced. Thus, if the cask is twelve inches square it will have a surface of 144 square inches, and if the pattern is placed in the cask and the cask is filled with water and the pattern removed, the water will of course go down, and it can then be seen how much water was replaced by figuring up the space left above the water and multiplying it by .26, which will give its weight in cast iron.

One point where I might have been more explicit was in regard to the cupola lining. If the cost of lining the cupola from bottom to top is figured on for each year's expenses, it would just about cover what it will cost to keep the melting zone in repair during the year, in addition to the fire-clay used from day to day. There are also innumerable little items such as the wastage of sand requiring to be replaced by new. This should be done systematically and can be recorded each day, but the estimated amount to be used in the year is usually divided into each day's requirements and added to the cost of the daily production. Other things to be considered would include pouring different grades of work at different periods during the heat. By calculating as we have done the percentage of loss in each kind of iron, it is possible to have iron exactly suited for each job at the exact time, and first-class iron need not be wasted on low grade work. It is customary to have the most particular work early in the heat. Whatever else is done see that the cupola is working its best. If there is 3c or thereabouts between the value of a pound of good casting and a pound of scrap it will not take many pounds of scrap to use up all that was saved in economy of a few pounds of coke.

EFFECTS OF ALUMINUM ON MOLTEN IRON

Aluminum is frequently mentioned as a softener and purifier of cast iron, and is almost as often condemned as not being a success, and is sometimes even accused of being an injury, when in reality it was in all likelihood having no effect either good or bad. Aluminum is a very light metal and does not mix readily with iron on this account, and if introduced into the ladle it is more inclined to float on top of the iron.

As has been shown at different times, in treating with brass mixtures, aluminum is a decarbonizer even more than a deoxidizer. Iron could be mixed with brass successfully if the carbon was lacking, and aluminum is used to remove the carbon. If one-quarter of a pound of aluminum is mixed properly with 100 pounds of iron it will have a good effect both in the way of removing oxygen and freeing the carbon, making the castings into a sort of semi-wrought iron.

The best way to do the mixing is to catch a hand ladle of good hot iron and stir the aluminum through it with a rod until it is of the consistency of a stiff batter. If the aluminum has been previously melted over a forge or in the brass furnace it is all the better. When the iron to be treated is tapped, it should be allowed to run into the ladle of thick aluminum and iron, and from this to the larger ladle. This cuts it out of the hand ladle and thoroughly mixes it with the hot iron. If old wrought scrap and mild steel is used in the melt it lowers the sulphur, making a superior metal. If ferro-silicon is to be used in the mixture it can be stirred into the first ladle by having a sufficiently large amount of melted iron. It requires pretty hot iron to be treated in this manner, but it pays abundantly on account of the quality of the casting and it is not so big a job as it would appear. About five pounds of aluminum is sufficient for a ton of iron, and it is well worth the trouble.

The Alberta Foundry and Machine Company is enlarging its plant to manufacture a light farm tractor to supply the growing demand all over this country.

PLATING AND POLISHING DEPARTMENT

Question.—During the war we used a cyanide zinc solution and purchased a large stock of zinc carbonate for maintaining the metal strength of the baths. We have tried to sell the carbonate since closing the munition shop, but owing to the containers being opened the jobbers refuse to take them back. How can we dispose of the material, or can it be utilized in any of the ordinary plating processes? We may be able to profit by a suggestion along such lines as we intend operating our plating plant as before the war, doing copper and nickel plating.

Answer.—The value of the suggestion we offer will depend to a great extent upon the quantity of carbonate you have and the volume of your copper-plating solutions. Zinc carbonate added to a cyanide copper solution will effect a very decided improvement in the copper deposits if the quantity added is not too great. Copper solutions operated hot are best for this purpose. One-fourth of an ounce of zinc carbonate per gallon of cyanide copper solution is about the maximum amount to use for best results. Dissolve the carbonate in the cyanide without heating, stir occasionally to effect complete solution, allow to settle and remove the clear liquid and add same to the copper solution and mix in well. A stoneware crock is best for containing cyanide solution while dissolving the carbonate. Small amounts may be added repeatedly at intervals and no trace of the zinc will be apparent in the deposit unless you use too much carbonate, then the only effect noticeable will be a brassy or grey tinge on the copper deposit. Small additions of zinc carbonate as we suggest will produce a slightly harder copper deposit, beautifully pink and clear. For products which are to be finished in copper the idea is especially beneficial if employed with reasonable care, not exceeding a quarter of an ounce per gallon.

Question.—During the transfer of our plating equipment from the munition plant to our manufacturing plant a number of large stoneware crocks were cracked by rough handling. Quotations on new crocks are exceedingly high and prompt us to inquire if there is a practical method of repairing such vessels for use in plating processes, as containers for acids or cyanide solution employed at ordinary temperatures.

Answer.—The stoneware crocks may be made to render service for long periods if treated as per following instructions: Reasonable care must be exercised in the repair and use of these stoneware vessels or serious results may follow. Clean the crocks thoroughly inside and out, then roughen and clean the glazed surface for about four inches each side of the cracks, and an equal distance beyond the ends. if cracks terminate in fine lines. Allow cracks to dry in a warm atmosphere for at least twenty-four hours after this cleaning. Paint the cleaned surface with Mogul repair paint, taking care to work the paint into the cracks well, and flow enough paint over the cleaned area to form a good surface for the next operation in the treatment. Permit this preliminary coating to dry for at least thirty-six hours. Cut strips of heavy factory cotton to cover the painted portions and saturate the cotton with the Mogul paint, hang the strips up by one end until the adhering paint becomes slightly "tacky." Apply a thin coat of paint to the dry paint on crock and attach the strips of cotton firmly to the prepared surface; smooth out all wrinkles, and allow the crock to remain undisturbed for another period of twenty-four hours; apply a binding coat over the whole painted surface and repeat the treatment until a good hard, firm patch results. If the capacity of the crock exceeds thirty gallons we advise encircling the crock with a strong brass band previously coated heavily with the repair paint. The paint specified is impervious to the action of acids or alkalies at ordinary temperatures and may be used for a great variety of purposes around a plating room.

> **AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.**
>
> **Officers for 1918-1919**
>
> President—James Vallier, 701 Crawford St., Toronto.
>
> Vice-President—Charles Kemish, 271 Boston Ave., Toronto.
>
> Sec.-Treas.—E. Coles, P.O. Box 5, Coleman, Ontario.
>
> **PLACE AND DATES OF MEETING**
>
> The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

Question.—An ammeter which I have in an electric circuit on a copper-plating tank has recently been put out of working order several times. The indicator becomes firmly fastened at the high side of the dial. The instrument has a range covering three hundred amperes; I never use more than one hundred and seventy-five amperes on a load of work. I have tried to ascertain the cause of the indicator reaching the extreme limit of the instrument but have failed. Please advise me how to avoid this annoyance and explain the cause of the action.

Answer.—The cause of your ammeter indicator jumping to extreme limit of high side is undoubtedly short circuits at the tank. Someone working about the tank has probably made a direct contact across the terminals of the circuit and an excessive flow of current has passed through the meter. This flow may have been only for an instant, yet the current was sufficient to carry the indicator beyond the limit of the instrument; ordinarily the indicator would return to former position upon removal of the short circuit. In some types of meters the soldered joints are left untrimmed and the projecting wire may engage the short end of the indicator if the latter reaches the extreme limit of the instrument. This condition may be altered by removing the face of the meter and bending the wire inward slightly. The prevention of short circuits should receive your immediate attention. If alterations are required to the tank equipment at any time, throw the tank leads out of circuit by closing the rheostat until alterations are completed. There is no occasion for short circuits during regular manipulation of goods in process of plating in a properly-equipped tank.

Question.—Please inform me of the proper quantity of boracic acid to use in a nickel solution.

Answer.—Boric acid is added to nickel solutions in varying quantities, depending on the composition of the solution, the nature of the goods to be plated, and the character of the deposit desired. Boric acid does not dissolve in cold water very readily and but one part of the chemical is soluble in thirty parts of water at normal temperature. Therefore when employed as an addition to nickel baths the acid in powdered or crystal form is dissolved in boiling water or boiling nickel solution. For ordinary purposes the acid is used in proportions ranging from one ounce to three ounces per gallon of nickel solution. For concentrated solutions or solutions used to produce very bright deposits, the quantities range from three ounces to five ounces per Imperial gallon of nickel solution. Quantities exceeding five ounces per gallon are productive of more or less trouble if the bath is employed at temperatures below 80 degrees Fahr., as crystallization results and the suspended particles become attached to the cathodes during deposition of nickel.

Excessive amounts of boric acid do not create conditions which may be regarded as actually damaging. If crystals form too freely, allow the bath to remain idle for a day or so and skim off the crystallized acid; boric acid in a nickel solution is productive of white, tough, clear deposits. The acid is also very beneficial in nickel solutions which yield pitted deposits and will often stop pitting when all other measures fail. Nickel solutions containing common salt in proportions of two ounces per gallon or more do not yield as silvery deposits by reason of boric acid additions as do nickel solutions free from the chloride. Magnesium sulphate in combination with the acid gives more satisfactory deposits for general purposes.

Question.—I have been using an acid pickling solution for cleaning scale from steel harness clips. The clips are hung in the warm acid and a current of electricity passed through the bath in the same manner as in plating. Since using this method I have succeeded in increasing my output and improved the appearance of the finished clip, but the manager has now informed me of many complaints regarding broken clips, and he says I pickle them too much. I am not of the same opinion although it does appear to be a result of the pickling process. I shall appreciate any information you may condescend to furnish me through the columns of your very valuable journal.

Answer.—If you are processing the steel clips in the pickling tank as cathode, that is by hanging the clips in the solution suspended from the negative tank rod, there is little doubt about the cause of embrittled steel. Steel pickled in this manner absorbs hydrogen very rapidly and becomes brittle. The effect is particularly disastrous in the case of high carbon steels, and less pronounced with soft steels. Pickling as cathode also causes a lessening of the tensile strength of the steel. Change the leads to the pickling tank that the positive rod may be used to suspend the clips from while pickling. Steel pickled electrolytically as anode is not embrittled, its strength is not impaired, nor are its other physical properties altered appreciably. Tempered steel is embrittled as a result of the liberation of nascent hydrogen at the cathode in the process of electro-plating in the cyanide-copper bath, and the effect is equally pronounced in the pickling bath. The logic of this will become readily apparent if you give the matter due consideration and alternately treat a few sample clips by each method.

Question.—We are at present considering the installation of an enameling plant in connection with our factory and we are naturally anxious to obtain as much information respecting the different methods of heating the ovens and the comparative advantages of each method as possible. Knowing your publication to be a reliable medium through which to obtain opinions of practical men we apply to you for assistance in this instance. Our business will warrant the operation of a rather large enameling department, say, from four to six large ovens on dipped steel, the finish to be first class in every particular.

Answer.—The respective cost of heating the enameling ovens will depend upon the location of your plant, cost of electric power as compared to coal. Gas is preferred by several firms in Toronto who have made tests of the different means of heating. Gas permits of higher temperatures being attained than steam, and steam has been adjudged cheaper than electricity. Electricity or steam are cleaner than gas, while gas will facilitate quicker baking than steam. If the plant is where gas is unattainable, we believe you will be wise to provide for steam heat. Electricity and steam combined is quite satisfactory for some purposes, and you may find it economical to use electricity for baking at night as the rates are less and extra labor in boiler room is avoided. In an article by Mr. Wirt S. Scott, of the Westinghouse Electric Mfg. Co., he says:

1 lb. of coal contains ...13,000 B.t.u.'s
1 cu. ft. of artificial gas .. 600 B.t.u.'s
1 kilowatt hour .... 3,412 B.t.u.'s

On above basis

1 ton of coal has .....26,000,000 B.t.u.'s
43,300 cu. ft. of gas equal 1 ton of coal.
7,600 kw. hours of electricity equal 1 ton of coal.

The specific heat of iron, which is the heat in B.t.u. required to raise 1 lb. one degree Fahr., is 0.125.

Question.—In finishing the cold-rolled steel portions of one of our specialties we have been accustomed to polishing the steel before plating. Since reading the reply of your correspondent to question on page 48 of the February edition of CANADIAN FOUNDRYMAN relative to steel cups, we have tried various methods of finishing the sheet steel with a view of reducing the cost of production. The elimination of polishing the steel we use does not give us a satisfactory finish, and the nickel was badly cut through by the buffer in his attempt to produce a good color. The nickel-plating was performed in the same manner as is usual when the work is polished. Possibly our problem may be easily solved, and we shall appreciate any suggestions you may offer us.

Answer.—As we have stated heretofore, the success attending attempts to produce a satisfactory nickel, copper, or brass finish on cold-rolled steel without previously polishing the steel depends very largely upon the surface condition of the steel when ready for finishing. Cold-rolled steel is obtainable in a variety of qualities as respecting surface. If the steel is full of "slivers" or "pock marked," rusty, or badly scored by rough handling, or if the press work has left "ripples," fins, or burrs, the surface will certainly require some treatment before delivery to plating room. Tumbling in soap water with steel balls or smooth steel punchings will suffice in many instances. With a good quality of steel and skilful press work the product could be delivered direct to the plater from the punch press. It is then cleaned and plated. Usually a heavier coating of metal is given such surfaces than is customary on polished surfaces. This permits the buffer to use greater pressure on the buffing wheel and bring out the required depth of color or lustre. To facilitate the satisfactory finishing of nickel deposits on such surfaces, the nickel should be as soft as is consistent to produce; the coating will then "spread" more easily and the imperfections of the base metal may be apparently obliterated by proper manipulation of the work during the buffing operation. This treatment does not necessitate continued sawing pressure against the wheel, and it is possible to produce the effect of having filled in the scratches without serious injury to the wearing qualities of the deposit if the coating is reasonably thick and soft. Nickel deposits from hot or warm solutions are particularly suitable for coating steel surfaces which are not polished. A cold nickel solution of any composition will yield harder deposits than nickel solutions operated warm or hot. When we use the term hard here we have reference to the ductility or elasticity of the coating. Double nickel salt solutions containing an excess of ammonia are productive of hard, brittle deposits. If you use double salt solutions we would suggest the use of nickel carbonate instead of ammonia when the neutralizing of excess acidity is necessary. A double salt solution which will produce a heavy soft nickel deposit in less time than some of the more expensive solutions is made by dissolving 8 ounces of double nickel sulphate, 1 ounce of single nickel sulphate, 3 ounces of common table salt, and ½ ounce of boracic acid for each gallon of water required. The solution should be operated at 6 degrees Be. If unpolished cold-rolled steel is plated with copper or brass, the respective deposits must be such as to permit of the same covering effect as in the case of nickel-plating. Copper deposits from either acid or cyanide solutions are quite easily spread by proper buffing. Brass deposits are usually much harder and thinner than either nickel or copper deposits, and it is often economical to copper-plate and buff the article to obtain the required base upon which to deposit the brass. In our experience with brass solutions we have obtained softer deposits from solutions containing no free ammonia, and when anodes of copper and zinc were employed in proper proportions to maintain a balanced working condition a potential of 5 volts is sufficient and the current density must not be sufficient to cause a violent evolution of hydrogen from edges or lower portions of the cathode. Addition of zinc carbonate or zinc cyanide is seldom, if ever, required after the bath is once in good working condition. Sodium cyanide only is added at rare intervals. By proceeding along the lines mentioned we believe you will find it possible to at least improve the finish heretofore obtained on the raw cold-rolled steel. Steel ball burnishing will assist wonderfully in reducing the costs of finishing almost any pressed or drawn metal article of small or moderate dimensions.

HORSE-SHOEING PARLOR

Sign in Front of a Building in An American City

What other nationality but the American would show so much respect for the noble animals which did their bit to win the war, as to invite their species into the parlor to put on their shoes. In this country we do not show that much respect to ourselves. We sometimes take off our shoes in the parlor, but we invariably go to the shed in the morning to put them on.

How Pig Iron Came to Have Such a Queer Name

If the Reader Will Follow the Pictures Carefully He Will See the Similarity Between the Two

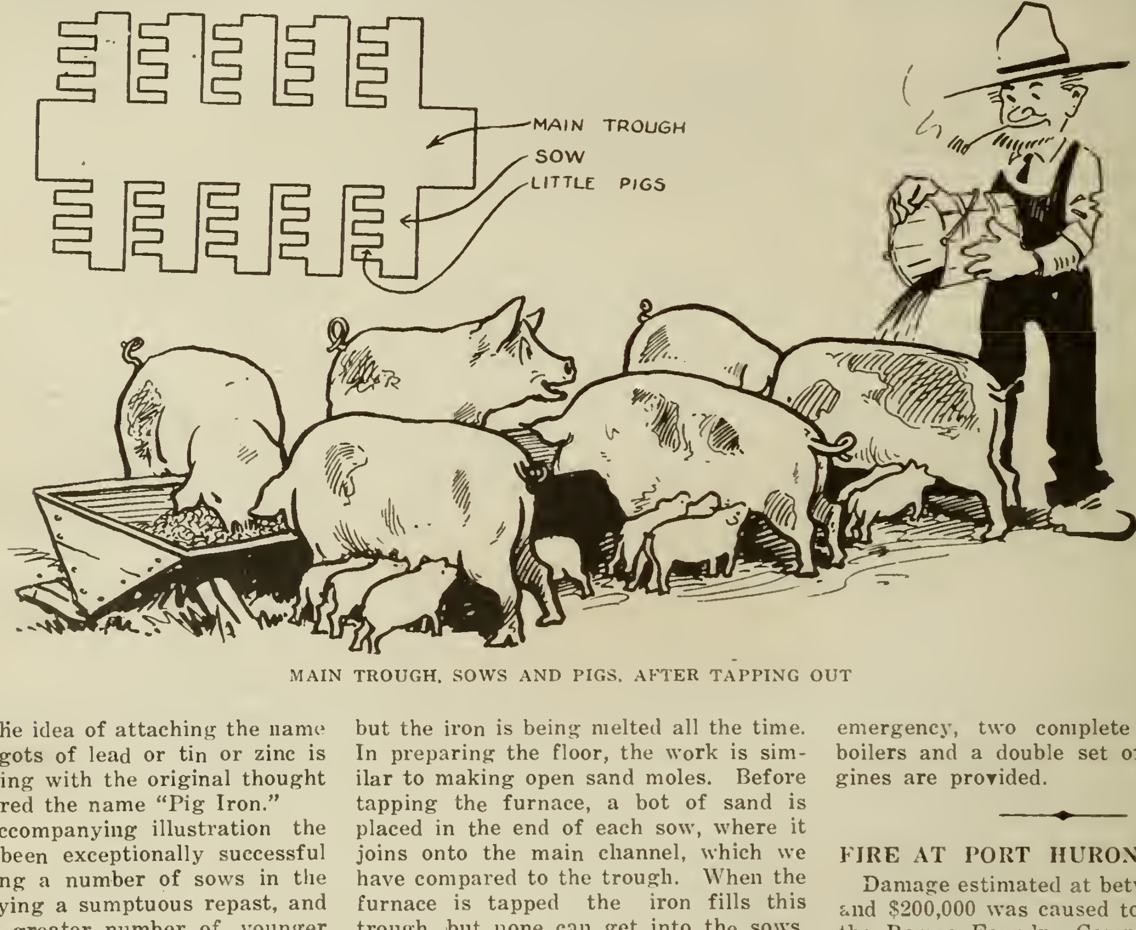
By J. H. BELL

THE name "Pig Iron" is an expression which very few people have given much study to, although there is probably no one who has not heard it expressed. Among those who are familiar with pig iron there is undoubtedly a small percentage who have any conception of the origin of the name. Pig iron, as is well known, is cast iron which has been (will I say?) refined from the virgin ore and run into shape to be used as commercial iron. That is to say, it is the product of the iron ore after it has been melted and fluxed and treated in such manner as to render it suitable for remelting and pouring into castings. But that is not where it gets its name. The idea of attaching the name "pig" to ingots of lead or tin or zinc is not in keeping with the original thought which inspired the name "Pig Iron."

In the accompanying illustration the artist has been exceptionally successful in portraying a number of sows in the act of enjoying a sumptuous repast, and also a still greater number of younger pigs enjoying a perhaps more bountiful meal. The entire scene will certainly bring to the mind thoughts of a corner on a stock farm, and not of an iron works, as it has a decidedly unfoundry-like appearance, but right here is the origin of the name "Pig Iron":

If the reader will but look upon the floor in front of a blast furnace and picture in his mind's eye this little scene, he will readily see the comparison. Down the centre of the floor and right in front of the spout is a large channel, which we will compare with our pig trough, and running at right angle to this and reaching to the extremities of the floor are channels, which we will compare to our sows, and from these are the smaller channels, which we will compare to the pigs. Now, these are the names that these channels go by, and this is exactly where they got their names.

A brief description of how the metal is made into pigs might be of interest to those who have never seen it done. The blast furnace from an outside view is similar in appearance to a foundry cupola, but on an enormous scale. It is kept stopped in for several hours at a time, while the floor is being prepared, but the iron is being melted all the time. In preparing the floor, the work is similar to making open sand moles. Before tapping the furnace, a bot of sand is placed in the end of each sow, where it joins onto the main channel, which we have compared to the trough. When the furnace is tapped the iron fills this trough, but none can get into the sows. When a sufficient head has been gathered in the trough, a workman with a long pole reaches over and knocks out one of the bots, permitting the iron to flow into one sow and her litter of pigs. When this is filled, the next one is treated in like manner, until the iron in the furnace is exhausted. The aim is to fill one side of the floor while the other is being prepared, but sometimes there is not sufficient to quite finish the side, while again it may be necessary to fill some of the opposite ones. When the metal is exhausted, the furnace is stopped up and the metal held as it melts until the floor is again prepared. Water is now turned onto the top of the pigs in order to form a crust that the workmen can walk on. Workmen with masks and wooden-soled shoes now take crowbar and sledge and proceed to separate the pigs from the sows before the under metal is hard, when it is conveyed by trolley to the yard; and the floor is immediately wet down and prepared for another batch. This procedure continues week in and week out without intermission, as the furnace never stops melting, unless it is blown out for some special reason. To insure against any possible emergency, two complete batteries of boilers and a double set of blowing engines are provided.



MAIN TROUGH, SOWS AND PIGS, AFTER TAPPING OUT

FIRE AT PORT HURON FOUNDRY

Damage estimated at between $175,000 and $200,000 was caused to the plant of the Romeo Foundry Company in South Port Huron by fire. The main portion of the plant was destroyed but operations have already been begun on a new building, and the company expect to be in full running order again in a short time.

J. R. Massie, a draughtsman at the Corbet Foundry and Machine Co., Ltd., Owen Sound, met with a most unfortunate accident on 3rd Avenue east, as he was going to work, breaking his thigh through a fall on the icy sidewalk.

TRADE GOSSIP

The Vulcan Foundry Co., London, have been busy to date, but have pretty well caught up with their work. They are, however, still working along and anticipate a successful year. Mr. Hardy, who has been manager for some years, has retired and Mr. Morley W. Calcott, formerly machine shop superintendent, has assumed the managership. New and improved machinery is being installed to cope with the new conditions which will undoubtedly prevail with the advent of normal times.

A committee of the Teeswater Board of Trade appeared before the council of February 17 and recommended that a vote of the ratepayers be taken to loan J. Olheiser & Son the sum of $1,500 for ten years without interest and exempt from taxes, except school taxes, Olheiser & Son to give a mortgage on the foundry property and machinery, secured by insurance; to pay back the loan in ten annual instalments, and to employ an average of eight men all the time if they can secure houses.

The council, after a short discussion, voted that the proposition recommended by the Board of Trade be accepted, and that a by-law be drawn up and submitted to the ratepayers.

Things are All Right in Woodstock

Four foundries are doing business in Woodstock, and all are well provided with orders. The R. Whitelaw Co. have every floor running, but report no excitement and no worry; just a nice run of work to keep going steady.

The James Stewart Stove Co. report business is picking up all right after a quiet spell. Their men had been on four days per week, but are now working full time, and orders are coming in in goodly numbers.

The Eureka Planter Co., which up to this year have been buying their castings, have added a thoroughly modern foundry to their plant and are running steady. They manufacture a line of goods which sell to the farmers and gardeners, and their season is drawing near and their orders are coming in in an encouraging manner.

This foundry is an example of what CANADIAN FOUNDRYMAN has endeavored to advocate. Four molders can put up an enormous amount of casting such as are required for planters, and a shop employing four molders has many advantages if properly constructed and managed. In the case of the Eureka Planter Co., the molding space is 40 feet square; the cupola room is by itself, so also is the mill room and grinding department. The buildings are of solid concrete and are well lighted and ventilated. The cupola room and the mill room, while not being permitted to be of annoyance to the molders, are constructed with equal consideration for the health and comfort of the workmen, both having concrete floors and abundantly supplied with windows and ventilators. Shower-bath and dressing-room are also provided. The plant employs some forty hands, but four molders can keep the other thirty-six on the go.

CHANGE IN THE DIRECTORATE OF THE WM. HAMILTON CO.

Considerable change has been made in the management of Wm. Hamilton Co., of Peterboro, the president, J. E. Smith, and the secretary-treasurer, George G. Gladman, retiring after several years of service, during which Mr. Gladman acted as general manager of the firm. There was a vacancy on the board caused by the death of Ross Cameron, who lost his life in action in France last summer. Louis Potvin and R. Munroe were re-elected as members of the board, and the three new directors chosen were Daniel Smith, Kingston; Philip Talcott, Bloomfield, near Picton, and Peter Westby, an old employee of the company. It is understood that Mr. Daniel Smith will be the new president and that Mr. Talcott will succeed Mr. Gladman as secretary-treasurer.

PROPOSES FOUNDRY

Walkerton Man Asks Loan of $7,000 From Wingham Council

Mr. Thompson, of Walkerton, was in Wingham on Wednesday and got in touch with the Town Council, stating that he would establish a foundry at Wingham for the manufacture of a certain potato-digging instrument. He wished to organize a company here, providing he could secure a loan from the town of $7,000 for a period of ten years, he to pay it back after five years at the rate of $500 per year for four years and the last payment of $5,000.

Mr. Thompson has an option on the old tannery property, which lies north of the Grand Trunk Railway, and the money which he asked the town for is to buy this site and erect the building. He would equip it with machinery and pay interest on the money. The implements were manufactured in Teeswater last year, but as the town had not satisfactory facilities for shipping, he would sooner come to Wingham.

FOUNDRIES ARE BUSY IN ST. THOMAS

The Erie Foundry Co., manufacturers of stock-raisers and contractors' specialties, are optimistic as regards the coming summer. They see nothing to fear, and while their line is not exactly in season at this time of year they are preparing for the day and are running a good staff of men.

The "Red Foundry" has abundance of work, and have every sand-heap in use. They have a good bunch of molders, but report that if any of them should for any reason decide to make a change, their places would be filled promptly. They want no vacant floors and do not intend to have any.

The Canada Iron Foundries, Limited, have been busy right along in their grey iron foundry, so much so that they had three of their molders doing grey iron work in the wheel shop. The car wheel shop had been shut down for a time but started operations on Feb. 17, and is now running full blast.

The St. Thomas Bronze Co., manufacturers of heavy and light brass and bronze castings, are busy working full time with a full staff of men, and no complaints about the amount of work coming in.

MR. T. McOUAT PASSES AWAY

Thomas McOuat, senior member of the firm of T. McOuat and Son, Lachute Mills, P.Q., died at his home in Lachute Falls on February 16th in his 69th year.

Mr. McOuat, in company with Mr. John McRae, moved from Ottawa to Lachute Falls 40 years ago and engaged in the foundry and machine shop business under the firm name of McOuat and McRae, and manufactured a line of stoves and farm implements, and later on began the manufacture of mill and general machinery, shelf and heavy hardware. In the year 1903 Mr. McRae retired from the business and Mr. A. McOuat entered the firm. About this time the company, which had already erected and operated a large hardware store, also decided to build entirely new and up-to-date foundry and machine shop buildings opposite their hardware store, and have successfully operated them since.

Mr. McOuat, who was born Aug. 20, 1850, has been in failing health for the past two years and has not been able to take any active part in the business, the superintendency of which was left to his son, Mr. Arthur McOuat, who now succeeds him.

CATALOGUES

"Dixon's Graphite Products" is the title of a new pocket catalogue issued by the Joseph Dixon Crucible Company of Jersey City. While not so complete as the large general catalogue, it furnishes a good idea of the variety of products made by this old concern. Pages have been devoted to lists of articles, especially for mills, railroads, automobiles, etc. The descriptions are brief, but the company will gladly send pamphlets dealing in detail with any of the individual members of the line.

This new catalogue should be on the file of every purchasing agent, engineer, superintendent, and others who have occasion to use lubricants, paint or pencils. Ask for Booklet No. 27-KP.

Paris. — The insurance underwriters have Paris in class "D" for the first time in the history of the town. The last inspection was held in December 17, and the following is what the underwriters require: "The installation of another pump of 600,000 gallons' capacity, and that the reservoir be just about doubled in size; where the water mains cross the river they should be duplicated to insure service in case one should be broken; an additional eight-inch main to be run from the reservoir."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$31 40
Lake Superior, charcoal, Chicago	38 85
Standard low phos., Philadelphia	38 85
Bessemer, Pittsburgh	33 60
Basic, Valley furnace	30 00

Government prices.

	Montreal	Toronto
Hamilton	$50 00	
Victoria	50 00	

FINISHED IRON AND STEEL

Iron bars, base	$4 75
Steel bars, base	5 00
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$40 00	$40 00
Antimony	8 50	8 50
Copper, lake	21 00	22 00
Copper, electrolytic	26 00	25 00
Copper, casting	25 00	21 00
Lead	8 50	7 25
Mercury		100 00
Nickel		50 00
Silver, per oz.		0 98
Tin		100 00
Zinc		10 50

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$10 50	$13 00
Copper, crucible	13 00	15 00
Copper, heavy	13 00	15 00
Copper, wire	13 00	15 00
No. 1 machine composition	10 00	14 00
New brass cuttings	8 00	10 00
No. 1 brass turnings	8 00	19 00
Light brass	5 00	7 50
Medium brass	8 00	9 00
Heavy brass	.....	.....
Heavy melting steel	10 00	14 00
Steel turnings	9 00	8 00
Shell turnings	6 00	6 00
Boiler plate	12 00	11 00
Axles, wrought iron	20 00	15 00
Rails	15 00	11 00
No. 1 machine cast iron	18 00	14 00
Malleable scrap	15 00	13 00
Pipes, wrought	9 00	7 00
Car wheels, iron	20 00	18 00
Steel axles	22 00	20 00
Mach. shop turnings	6 00	6 00
Cast borings	8 00	8 00
Stove Plate	14 00	14 00
Scrap zinc	6 00	5 00
Heavy lead	5 50	8 00
Tea lead	4 50	3 50
Aluminum	18 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	47 00
Forging billets	56 00
Wire rods	57 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.
B

¼ in.	$14 35
5-16 in.	13 85
⅜ in.	13 50
7-16 in.	12 90
½ in.	13 20
9-16 in.	13 00
⅝ in.	12 90
⅞ in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 38
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 10
Linseed oil, boiled, single bbls.	1 73
Linseed oil, raw, single bbls.	1 70
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37½
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 50
Sheets, black, No. 10	6 50	6 00
Canada plates, dull, 52 sheets	8 50	8 10
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	....	8 20
Premier, 10¾ oz.	....	8 50
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$13 00
3-16 in.	12 50
¼ in.	11 75
5-16 in.	11 40
⅜ in.	11 00
7-16 in.	10 60
½ in.	10 40
⅝ in.	10 00
¾ in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A. add 20%; B and C, net list; cast iron, 15% off list; standard bushings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 25 and 7½%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.58 to $0.65
Copper	.36 to .46
Tin	.70 to .70
Silver per oz.	1.05 to 1.00
Zinc	.23 to .25

Prices per lb.

NAILS AND SPIKES.

Wire nails	$5 50	$5 30
Cut nails	5 85	5 65
Miscellaneous wire nails	60%	

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23-.19
Ammonium, carbonate	.25
Ammonium, chloride	.55
Ammonium, hydrosulphuret	.30
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.50
Arsenic, white	.27
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.10
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	1.35
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.40
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, bullneck	2 00
Pumice, ground	3½ to .05
Emery composition	08 to .09
Tripoli composition	06 to .09
Rouge, powder	.30 to .35
Rouge, silver	.35 to .50
Crocus composition	08 to 8- 9

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 34
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 44

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.31
Packing, No. 1 Itallan	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Castor oil, per lb.	50
Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	32½
Delta Files	20
Nicholson	32½
H. and Imperial	[illegible]
Globe	50
Vulcan	50
Disston	40

THE SCRAP MARKET IS STILL A CRIPPLE AND IN POOR SHAPE

IN Canada the scrap market shows no signs of coming to life. In fact there are indications that further skidding may be done before anything approaching a basis is reached. In the United States the situation is sized up as follows:

Chicago—The feeling here is regarded as much better, and the belief is expressed that the bottom of the price slide has been reached. Certain lines of scrap have nothing to test them, as manufacturing is restricted.

New York—The mills were in the market here for a short time, but it is apparent that they have covered all their interests as no more purchases are being made for them.

Pittsburgh—A variety of guesses have been made as to whether the real bottom of the market has been reached, and the variety of answers is very large. Low phosphorus scrap would be in demand were the price to come a little lower.

Foundry Facings and Supplies

In dealing direct with us—the manufacturers—you may be sure of prompt and courteous service. For we have too much at stake to furnish an inferior product or to allow shipment delays that would displease or inconvenience you.

MADE IN CANADA

Ceylon Plumbago No. 101

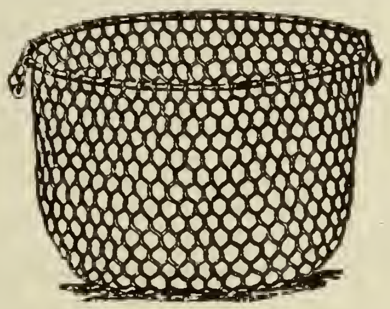
There is no better Facing obtainable anywhere. No other Facing used in Canada is so well thought of. Hundreds of users and every single one well pleased. Send in your order for a trial.

Ceylon Plumbago No. 206

Many Canadian Foundries are using this Facing with splendid success for general machinery castings. It will give you perfect satisfaction.

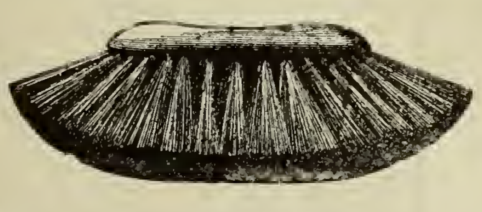
Special Stove Plate Facing

Another "Hamilton" product that will fully meet your highest expectations. Give it a trial.



Coke or Charcoal Baskets of heavy woven galvanized steel wire are strong and durable.

Our products are made in Canada — made by Canadian workmen. They are as good as any obtainable — in many cases superior to imported makes. Invariably cost less. Moreover, we guarantee that our service and our products will completely satisfy you.



Moulders' Soft Brushes as above are made from the best quality pure Russian bristle, four inches in length, wire drawn. The block is in two pieces, glued and screwed together.

Our Black Core Compound is 100% Pure

It will improve the work of your coremakers. It will make their work easier by eliminating troubles common to ordinary core compounds. It is 100 per cent. pure—and just as efficient for its purpose. We should like you to give it a trial.

The

Hamilton Facing Mill Co., Limited

HAMILTON, ONTARIO, CANADA

and several dealers are watching the market for this reason.

Buffalo—There are several cases in this district where dealers have had chances to fill orders, but have not seen their way clear to close on account of not knowing where to get the material.

Cleveland—Dealers are putting up the claim that prices right now are on a level with those of 1914. They point to increased prices for labor and freight, and allowing for these, say that they are now on the pre-war level. It is hard to see how prices can go much lower.

Cincinnati—Cancellations for scrap contracts are still quite common here. Dealers claim that they are not making ends meet on the amount of trade that is passing. In fact every sale that is made now is for some definite purpose and is generally shipped and used at once.

St. Louis—The fact that no reductions were made during the week is taken to mean in some quarters that the end of the toboggan in scrap prices has arrived. This is merely the opinion of many dealers, as well as the wish, and it may be that lower levels will yet be reached before trading is again taken on.

Birmingham—Business is at such a low ebb in this district that some of the dealers threaten to close up and wait for a return of better conditions. Some of the more pessimistic ones do not look for any improvement for three or four months.

Philadelphia—Contrary to general expectations there has been another decline in almost every grade of scrap that comes on the market, but the feeling is growing that there cannot be much space between the present prices and the lowest that can come. There is a greater willingness on the part of certain buyers to come into the market now.

SHADING PIG IRON PRICES WOULD NOT HELP SITUATION

THOSE who follow the pig iron market have many explanations for the small amount of actual business being placed. They may point to inquiries and prices, but the fact remains that not much business is resulting. The conditions at some of the producing points may be summarized as follows:

Chicago.—Many of the foundries have been forced to ask the makers to defer shipments owing to the amount of pig they are stacking in their yards. The best part of this is that these requests are not as numerous now as they were a little while ago. Some progress is being made in the matter of settling claims for the cancellation of war work.

New York.—Most of the foundries in this district have now large stocks of raw material on hand. Many of them have had large deliveries of raw material made since the armistice was signed, and output has dropped off. High silicon foundry iron is in considerable demand, owing to the amount of scrap that is being put through in some of the heats.

Pittsburgh.—Some of the inquiries that are being renewed by the larger buyers are so small as to lead to the belief that they are out more to test the market than for any other purpose. There is talk of cut prices, but such a step, it is felt, would only serve to remove the stability from the entire business at a time when it should be maintained. Production figures at some of the furnaces are starting to show a slight downward tendency.

Buffalo.—The fact that much of the buying done now is on certain well specified analysis shows that purchasing is for actual needs. Users are taking material on old contracts, but no new inquiries are bringing real business to the surface.

Cleveland. — Some furnaces report that they are shipping all the iron they can produce. Prices hold well and the only concessions are those made by interests that want to absorb part of the freight rates, so that those buying from them shall be on equal terms with purchases made from producers nearer to the point of use.

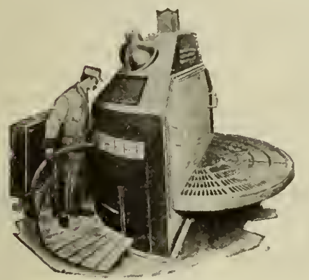
Cincinnati.—Furnaces in the south report in many cases that no interest seems to want to buy pig iron of any kind. The market is unusually quiet and there are no inquiries.

St. Louis.—Melters are not looking for any great revival in business here. In fact many of the foundries are so well filled with material that furnaces are beginning to wonder where their output is going to be marketed. The $31 price is becoming more common.

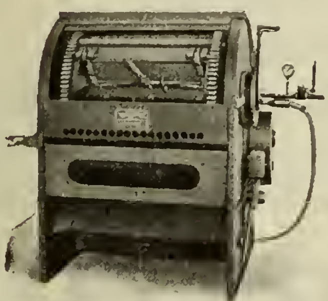
Philadelphia.—The fact that a lot of 500 tons was the best piece of business in sight for the week gives an idea of the market here, although furnaces are hopeful on account of the fact that nothing much is being piled.

Classified Advertising

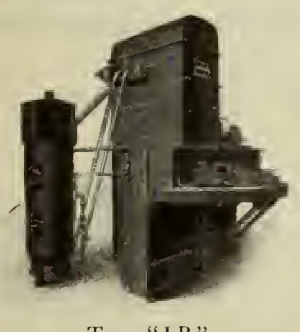
Type "AC"
Hose Sand-Blast.



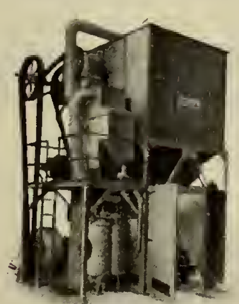
Type "EH"
Hygienic Cabinet.



Type "GD"
Barrel Sand-Blast.



Type "LB"
Rotary Table Sand-Blast.



Hygienic Room, Sand-Blast.

Some method of Sand-Blasting Castings is absolutely necessary today in the Foundry that would successfully meet competion.

Modern Sand-Blast Installations intelligently selected to your requirements and conditions, when properly installed not only mean better cleaned, better looking castings, but the cleaning cost is reduced and---they are worth more to the customer.

"PANGBORN"
SAND-BLASTS

are made in many types and sizes that, singly or in combination, meet every metal cleaning need, large or small.

"PANGBORN"
ENGINEERING SERVICE

brings to your door trained Engineers experienced in every practical application of Sand-Blasting.

Don't hesitate to ask about Sand-Blasting as applied to your own conditions but be sure to give the character and daily tonnage of your output and any other details that will help us to answer you intelligently.

PANGBORN CORPORATION
HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS

Two bags of "Chilled Shot" or Diamond Grit will do more work than tons of sand blast sand

These modern metallic blasting abrasives can be used over and over again—they work until they wear out—they never break into dust.

Their durability will save you money, by reducing the ***amount*** of material required, and by increasing your cleaning production.

"Shotblast" or "Gritblast" your castings and eliminate the dust from your cleaning room.

Let us send you samples of our Shot and Diamond Grit

Purchase your supply direct from headquarters.

HARRISON SUPPLY COMPANY

5 AND 7 DORCHESTER AVE. EXTENSION

BOSTON, MASS., U. S. A.

The Champion Electric Sand Riddle

Has been Tried and Found Superior in Foundries the World Over

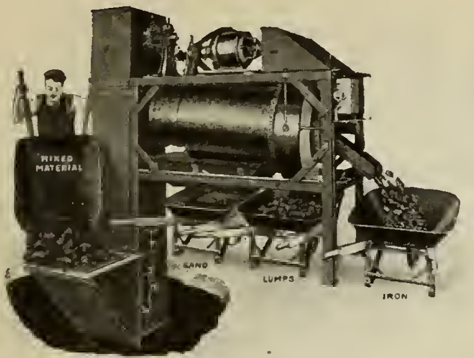
A partial list of which follows:

Alex. Fleck....................Ottawa, Ont., Can.
The Dominion Foundry & Supply Co....Levis, Que.
Canadian Allis-Chalmers, Ltd., Stratford, Ont., Can.
Castings of Ottawa..................Ottawa, Can.
Canadian Steel Foundries Co.........Montreal, Can.
Welland Machine & Foundries, Ltd...Welland, Ont.
J. G. Grey..........................Toronto, Can.
Taylor-Forbes Co.....................Guelph, Can.
T. Tomlinson & Son..................Toronto, Can.
Steel & Radiation, Ltd...............Toronto, Can.
Standard Machinery & Supplies, Ltd., Montreal, Que.
Reid & Brown Structural Steel & Iron Works Toronto, Can.
Pratt & Letchworth, Ltd......Brantford, Ont., Can.
Manitoba Engines, Ltd..............Brandon, Man.
Galt Foundry Co...............Galt, Ontario, Can.
McAvity & Sons.............St. Johns, N.B., Can.
Beaupre & Sons.....................Montreal, Can.
The Studebaker Corp............South Bend, Ind.
Nordyke & Marmon Co..........Indianapolis, Ind.
Henry Ford & Son...............Dearborn, Mich.
General Motor Corp....................Flint, Mich.
Ford Motor Company.................Detroit, Mich
Timken Detroit Axle Co..............Canton, Ohio
Holt Manufacturing Co..............Stockton, Cal.
Bean Spray Pump Co................San Jose, Cal.
H. C. McCaulay Foundry Co.........Berkeley, Cal.
Stover Mfg. & Engine Co.............Freeport, Ill.
Waterloo Gas Engine Co...........Waterloo, Iowa
Hercules Gas Engine Co...........Evansville, Ind.
Gould & Eberhardt Co...............Newark, N.J.
Hurley Machine Co.....................Cicero, Ill.
Massey Gin & Machine Works.........Macon, Ga.
McNaughton Mfg. Co.............Maryville, Tenn.
American Hoist & Derrick Co........St. Paul, Minn.
Caird Engineering Works............Helena, Mont.
The Singer Mfg. Co............Elizabethport, N.J.
Winona Machine & Foundry Co.......Winona, Minn.
Anniston Steel Company............Anniston, Ala.
Northwest Harvester Co............Spokane, Wash.
Australian Electric Steel, Ltd.....Sydney, Australia
Chappee & Fils..................Le Mans, France

Send for descriptive matter and prices

THE CHAMPION FOUNDRY & MACHINE CO.

2419-2421 West 14th Street - - CHICAGO, ILLINOIS



MAGNETIC SEPARATORS

Will save that waste iron and screen your sand as well.

Our Type "F"

Separators require no shoveling. Simply dump the material into the grizzly.
Note elevator feature. Magnetic separator can be furnished without this feature if desired, thus reducing cost.
One of Canada's largest foundries has just ordered one. Name supplied on request.

They Save Labor and Metal

MAGNETIC MANUFACTURING CO.
Windlake and Fourth Ave. MILWAUKEE, WIS.

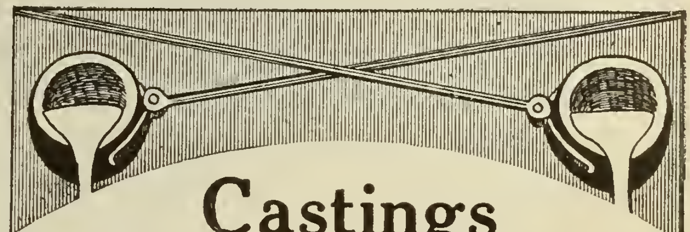
Battle Creek Sand Sifter

Why Hesitate?

Look at the illustration of the Battle Creek Sand Sifter. Sturdy and Simple in construction! And it's just as fast and efficient as it is sturdy and simple. Does five times the work of a riddle sifter. Moderate in price, too. In the face of these facts why hesitate to adopt it?

Any foundry supply house can furnish you with this or any one of our other cost-cutters.

Battle Creek Sand Sifter Co.
BATTLE CREEK, MICH.



Castings

Brass, Gunmetal, Manganese Bronze, Delta Metal, Nickel Alloys, Aluminum, etc.

MARINE AND LOCOMOTIVE ENGINE BEARINGS. MACHINE WORK AND ELECTRO PLATING. METAL PATTERN MAKING.

United Brass & Lead, Ltd., Toronto, Ont.

High Temperature Refractory Cement

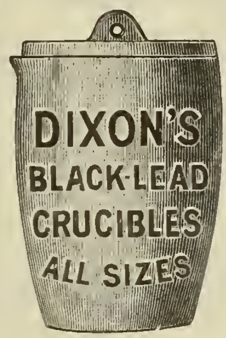
Koppers Cement, Grade B.

This is a refractory cement especially used in bonding silica brick in high temperature furnaces, by-product coke ovens, gas retorts, and metallurgical furnaces.

MANUFACTURED AND SOLD BY
THE KOPPERS COMPANY,
SAULT STE. MARIE, ONT.

Manufactured under Canadian Patent 177,077, May 15, 1917

When you think of a crucible think of DIXON and remember that the Dixon name stands for the longest and widest experience in the crucible industry.



Write for Booklet No. 27-A.

Made in Jersey City, N.J., by the
JOSEPH DIXON CRUCIBLE COMPANY

Established 1827

Milton Hersey Company, Limited

CONSULTING FOUNDRYMEN
AND
INDUSTRIAL CHEMISTS

Analyses and Tests on all Materials used in Foundry Work
Expert Metallurgists and Practical Foundrymen
For Your Foundry Problems

Montreal Winnipeg

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.

BOILERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

BOILER GRAPHITE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRIQUETTING
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

BRUSHES, FOUNDRY AND CORE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Standard Machy. & Supplies, Ltd., Montreal, Que.

CAR MOTORS
Can. Ingersoll-Rand Co., Montreal, Que.

CARS, CORE OVEN AND FOUNDRY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, ALUMINUM, BRASS, BRONZE, ETC.
United Brass & Lead, Ltd., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
United Brass & Lead, Ltd., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARGING TRUCKS
Brown Specialty Mach. Co., Chicago, Ill.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Mach. Co., Chicago, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

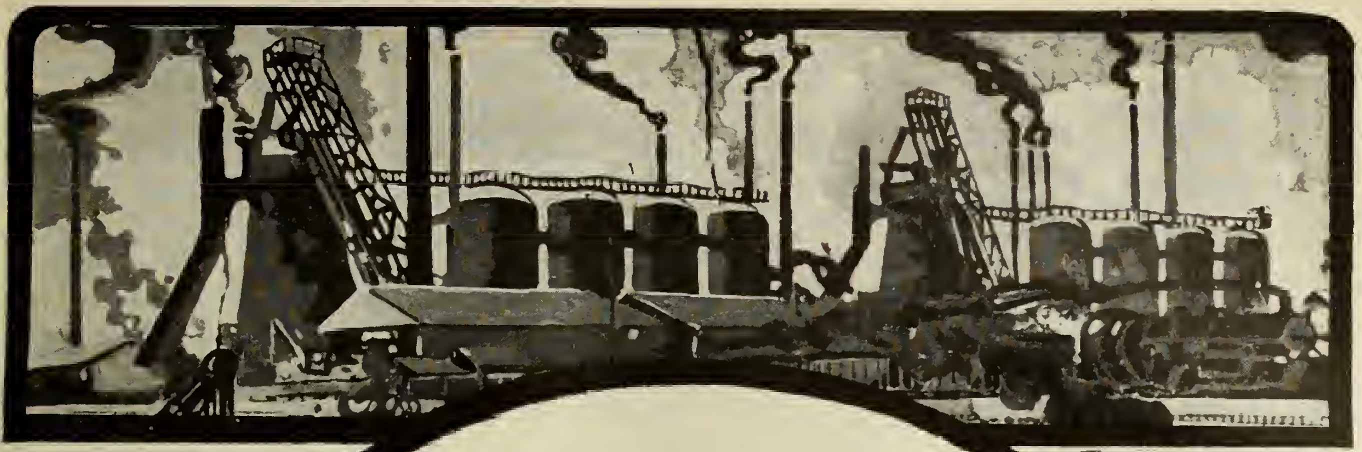
CRUCIBLES
Dominion Crucible Co., Ltd., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.



CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.
DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.
DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.
DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.
DUST ARRESTERS AND EXHAUSTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.
DYNAMOS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
EFFICIENCY ENGINEERING
Anderson's Efficiency Service, Toronto, Ont.
ELECTRO PLATING
United Brass & Lead, Ltd., Toronto, Ont.
ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.
EMERY STANDS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.
EMERY WHEELS—SEE WHEELS
FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont
FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.
FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.
FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.
FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.
FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.
FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.
FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.
FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
FOUNDRY EQUIPMENT
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry & Machine Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.
FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.
FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.
FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.
ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.
GOGGLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.
GRANITE AND MARBLE POLISHING
Harrison Supply Co., Boston, Mass.
GRANITE CUTTERS' TOOLS
Harrison Supply Co., Boston, Mass.
GRANITE AND MARBLE POLISHERS' SUPPLIES
Harrison Supply Co., Boston, Mass.
GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.
GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.
GRINDERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Ingersoll-Rand Co., Montreal, Que.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
GRINDERS, DISC, BENCH, SWING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.
GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.
GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
HAMMERS, CHIPPING
Can. Ingersoll-Rand Co., Montreal, Que.
Independent Pneumatic Tool Co., Chicago, Ill.
HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.
HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.
HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Fairbanks-Morse Co., Montreal, Que.
Can Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.
HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
HOISTS, HAND, TROLLEY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.
INGOTS, BRIQUET
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.
INGOTS, COPPER, BRASS, BRONZE AND NICKEL
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.
IRON CEMENTS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
IRON FILLER
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.
JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.
LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.
LEGGINGS
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.
LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.
LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.
LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis

CORETREEN
LIQUID CORE BINDER

VENT WAX
BUFFALO BRAND

FOUNDRY SANDS
CORE, SILICA AND MOULDING

CUPOLA BLOCKS
FIRE BRICKS AND SHAPES

FOUNDRY SUPPLIES
SEE LIST IN BUYERS' DIRECTORY

HYDE & SONS, MONTREAL

USE KAOLIN

For lining and patching the Cupola or Open-Hearth Furnace, Lining Ladles, Clay Wash, etc.

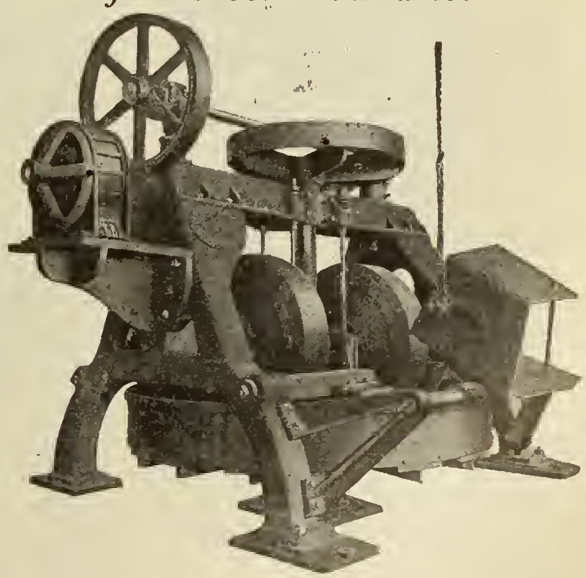
It will save your fire brick and the time of your men.

Whitehead Bros. Co.

Providence
New York
Buffalo

Frost

Wet Pan Sand Mill
for Steel Foundries



The *Frost* Mfg. Co.
112 W. Adams St.
CHICAGO

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cooper Saddlery Hardware Co., H. W., Moline, Ill.
Champion Foundry & Machine Co., Chicago, Ill.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Federal Malleable Co., West Allis, Wis.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 216 S. Geddes St., Syracuse, N.Y.

NICKEL, CHROME
Walker & Sons, Metal Products, Hiram, Walkerville, Ont.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Champion Foundry & Machine Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Standard Machy. & Supplies, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

REFUSE BURNERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Rodgers Boiler & Burner Co., Muskegon, Mich.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.
Rodgers Boiler & Burner Co., Muskegon, Mich.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Cascades Silica Products Co., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 216 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.
Rodgers Boiler & Burner Co., Muskegon, Mich.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry Mach. Co., Chicago.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SPRUE CUTTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

PIG IRON

"Niagara" Foundry Malleable Bessemer Low Phosphorus

FERRO ALLOYS

Ferro-Silicon (all grades) Ferro-Manganese Special Alloys

Structural Shapes

Steel Angles Steel Bars Steel Plates

A. C. LESLIE & CO., Limited, MONTREAL

"True To The Core"

VENT WAX

This adage can rightly be applied to BUFFALO BRAND Vent Wax.

Try it and prove to your own satisfaction that it is "true to the core."

UNITED COMPOUND COMPANY
228 ELK STREET BUFFALO, N.Y.

WHEELER
No. 512. Chrome Tan Leather Legging with extra heavy flare.

An Ideal Combination Quality and Price

WHEELER PROTECTIVE WEARING APPAREL

WHEELER
Chrome Tan Hand Leather.

A FOUNDRY NECESSITY

Here is the most complete and most substantial and satisfactory line of protective wearing apparel manufactured. The success of Wheeler products in some of the greatest mills and foundries in the country is the best proof of Wheeler quality.

Such items as Asbestos, Fireproofed Duck and Leather Leggings, Aprons, Coats, Pants, Spats, Gloves, Mittens, Helmets, etc., are described in full in our catalog. Send for it to-day and increase the morale of your men and the efficiency of your plant.

F. H. WHEELER MANUFACTURING COMPANY

215 West Huron Street - - - - - - CHICAGO

INDEX TO ADVERTISERS

Character in Cupola Blocks

You do not buy Fire Brick and Cupola Blocks blindly.

To use them economically and succesfully they must be bought first with knowledge of their QUALITIES and their REQUIREMENTS IN SERVICE.

Every brand is made for a SPECIFIC PURPOSE:

One brand, for boiler settings, for hand-fired horizontal boilers, which resists 2,000 degrees Fahrenheit and which must resist also the abrasion wear of the fireman when he knocks off clinkers. When the wrong kind is used not only the clinker but the brick, too, are destroyed—there is needless expense.

Another kind, for heat-treating furnace lining, where high degrees of heat prevail.

Still another kind for cupola linings, which must resist not only heat but abrasion wear of the charge as it wears down through the melting process.

So it goes; each for its purpose. I have IN STOCK the brands that have made Fire Brick history. Every Fire Brick and Cupola Block reaches the user with clean, uninjured edges and every one is thus adaptable to its exact place. Fire Brick makers, as a rule, are several months behind on orders. I can accept your order IMMEDIATELY and deliver PROMPTLY.

There is no duty on ordinary Fire Brick. Can ship Fire Brick, Cupola Blocks and Fire Clay in carlots or less. Write stating service required.

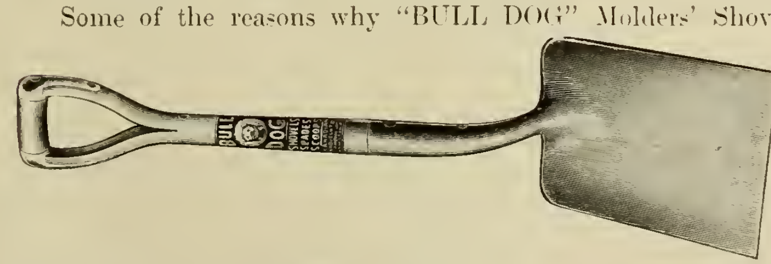
"Bull Dog" Molders' Shovels Are Great Favorites

The Blade and Socket are forged from one piece of high carbon bar steel, carefully hardened and tempered.

The socket is split at the back to permit of tightening around the handle should the wood shrink.

All Patent D Handles are made with the grain running lengthwise.

Some of the reasons why "BULL DOG" Molders' Shovels are such GREAT FAVORITES are as follows:



(A) Solid shank construction.
(B) Thick centres on top of blade where strain comes.
(C) Graduating tapers on blades.
(D) Bend in solid shank instead of the handle.
(E) Easily re-handled (not the case with bent handles).
(F) Practical tests have proven their superior strength.

Send me a trial order.

FREDERIC B. STEVENS

Manufacturer of Foundry and Electro-Plating Supplies and Equipment

DETROIT, MICH.

WAREHOUSE and OFFICE
Cor. of Larned and Third St.

FACING MILL
Cor. of Isabella Ave. and Mich. Central Railroad.

EXPORT WAREHOUSE
Windsor, Ont.

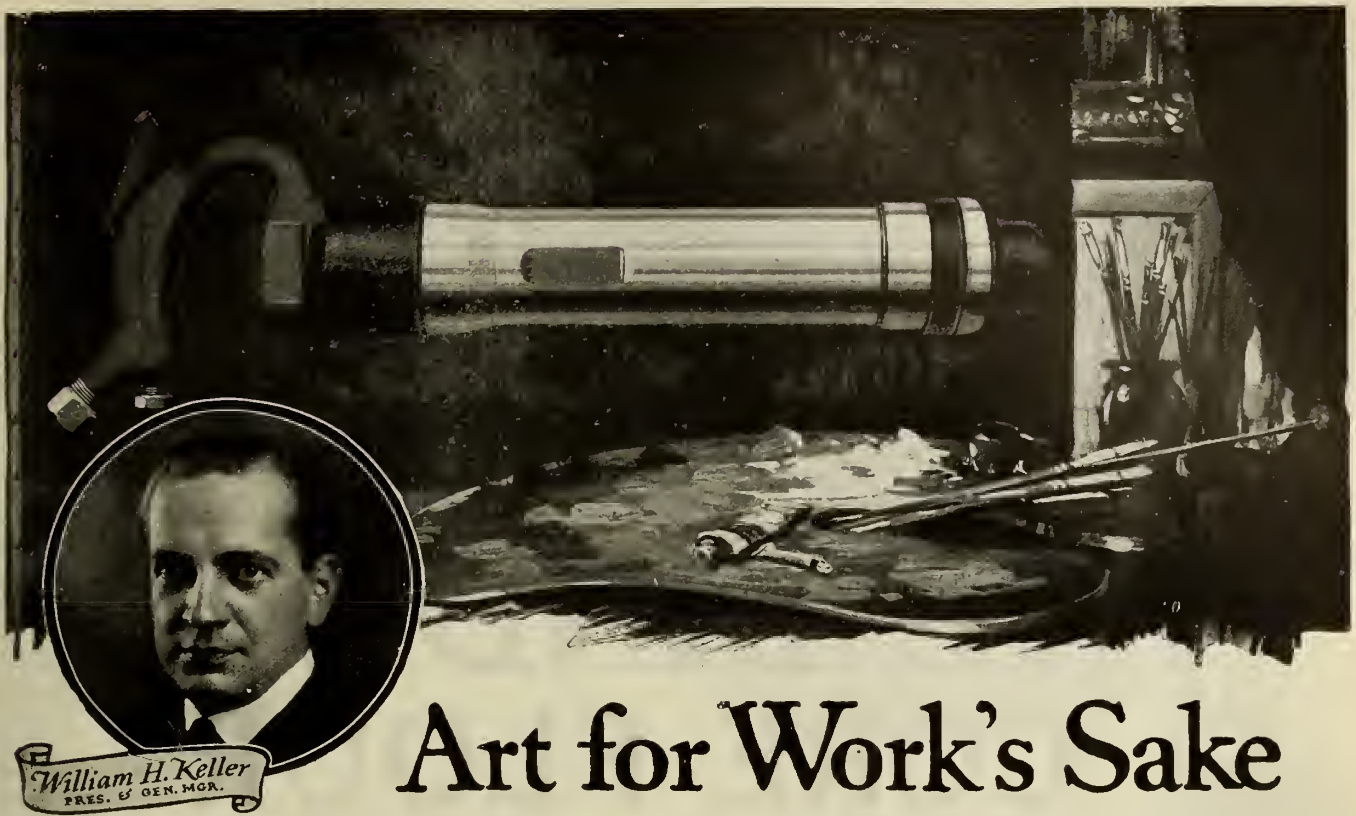
EASTERN SELLING AGENTS
Standard Machinery & Supplies, Ltd.
Montreal, Quebec.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, APRIL, 1919 No. 4

Canadian Foundryman, April, 1919. Vol. X, No. 4. Published monthly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $1.00; in the United States, $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.



Art for Work's Sake

The longer I work at my job of designing and manufacturing Pneumatic Tools, the more profound becomes my appreciation of the truth of Emerson's dictum that "all beauty is organic."

With Emerson, I believe that the truest and most enduring forms of beauty, whether in people or buildings or flowers or machinery or tools, are structural in character, and never merely decorative. True beauty cannot be put on. It must be built in.

So when I am asked, as often I am, why we of the Keller organization spend so much of our time and effort on the external lines and finish of Keller-Made Master-Built Pneumatic Tools — why we bother about making them look pretty, as some visitors express it — I answer, we do nothing of the sort.

Our foremost and constant purpose is and always has been to produce tools that can be depended upon to give maximum service at minimum cost. It is by adhering unwaveringly to that purpose, and not through any desire to please the eye of the beholder, that we have succeeded in making our tools unusually symmetrical and attractive.

The beauty of Keller-Made Master-Built Pneumatic Tools is true beauty because it is truly *organic* — it is *inbuilt* at every stage of manufacture, from the machining of the cylinders up to the final sandblasting and lacquering of the handles.

Keller-Made Master-Built Pneumatic Tools *look* best because they *perform* best. Their appearance, like their popularity, is the just measure of their worth.

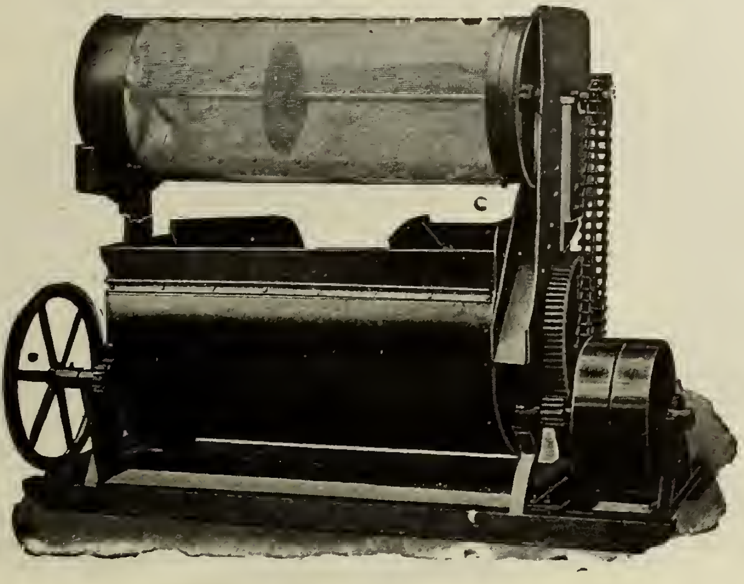
KELLER-MADE
PNEUMATIC TOOLS
MASTER-BUILT

William H. Keller, *President*

KELLER PNEUMATIC TOOL COMPANY, Grand Haven, Mich., U. S. A.


Holland Core Oil Company
HI-BINDER
CORE FLOUR
The Only Substitute for Flour
Hundreds of Barrel-lot customers and several car-lot customers are using it every day. Why? Because it is giving the best of service and saving money.
Holland Products
Core Oils, Match Oil, Linseed Oil, Hi-Binder Dry Core Compounds, Hi-Binder for Dry and Green Sand Facing for Steel, Hi-Binder Core Paste, Parting.
Canadian Agents:
The Dominion Foundry Supply Co., Limited
"Everything for the Foundry"
TORONTO
MONTREAL
HOLLAND PRODUCTS
4600 WEST HURON ST.
CHICAGO --- ILLINOIS

THE BLYSTONE



Satisfaction—

Blystone Sand Core Mixers

for the Perfect Mixing of Core Sand or Facing

Over 1000 foundries are getting satisfaction from Blystone Core Sand Mixers.

They are getting satisfaction through the source of decreased labor costs, increased production and larger profits.

If you are not numbered among these satisfied foundrymen it can be but for one reason—and that is because you have never tested out the merits of Blystone Mixers for mixing Core Sand and Facings.

Here is your opportunity. For a limited time we are going to ship Blystone Sand Mixers for 10 days' free trial.

Send in your request at once so as not to miss this opportunity.

If the Blystone doesn't prove to you a good investment, send it back at our expense.

Blystone Manufacturing Company

419 Ironton Street - Cambridge Springs, Pa.

BALTIMORE	J. W. Paxson Co.	CLEVELAND	E. J. Woodison Co.
BIRMINGHAM	Hill & Griffith Co.	SEATTLE	E. J. Woodison Co.
BUFFALO	E. J. Woodison Co.	DETROIT	E. J. Woodison Co.
CHICAGO	Scully-Jones & Co.	NEW YORK	Wonham, Bates & Goode, Inc.
CINCINNATI	Hill & Griffith Co.	PHILADELPHIA	J. W. Paxson Co.
PITTSBURGH	J. S. McCormick Co.		
TORONTO	E. B. Fluery		
SAN FRANCISCO	Ditty Bros.		

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

Malleable Iron, What it is, and How it is Made

Malleable Iron Fills a Vacancy Which Would be Hard to Fill By Any Other Means When Quality and Price Are Both Considered.

By F. H. BELL

TO properly understand malleable iron, its peculiar characteristics and its adaptability and suitability to certain requirements it is first of all necessary that we should understand the nature of iron. Not malleable iron or wrought iron or cast iron, but simply iron as nature provided us with it. It should be borne in mind that iron when pure is always the same, physically and chemically, no matter from what source it may be obtained. From this it may be understood that iron when taken from the mine may be converted into either wrought iron, malleable iron, cast iron or steel, by properly working it, and by adding or deducting such metaloids or foreign elements as the occasion requires. Of course it is not always done in this manner; ores are usually selected which most nearly conform to the requirements, thereby saving the expense of adding or deducting to so great an extent.

Iron in its pure or nearly pure state is an exceedingly ductile metal, which is to say it may be forged or hammered or rolled or drawn; its tensile strength (resistance to being stretched) is comparatively low, being only 50,000 lbs. to the square inch, but to melt it would require about 3.500 degrees Fah.

Iron, as we have described it, will be seen to conform nearly to what is known as wrought iron, and incidentally it possesses many of the characteristics of malleable iron, hence the name "malleable." Wrought iron is iron which has been "wrought" or "worked" until it is in a condition to be "malleted" or "hammered" (Latin, malleus=a hammer). But iron is not found in this state, or condition and if it was it would not do for general foundry purposes, however it is considered to be fairly good ore which contains 50 per cent. of metallic iron, and in order to reduce the ore to commercial iron is melted in a blast furnace and the bulk of the impurities removed. By properly mixing the ores and the proper management of the furnace it is possible to have the resultant metal of practically the desired chemical analysis. If it is to be used for grey iron foundry purposes it will contain, in addition to the pure iron, about 3 per cent. of silicon, .03 per cent. of sulphur, .06 per cent. of phosphorus, .05 manganese and 4.5 per cent. of total carbon, .5 per cent. of which will be combined and the balance of 4 per cent. will be graphitic carbon. The silicon content is required to change the carbon from the combined to the graphitic state in order that the castings may be soft enough to use and also to assist the metal in flowing into the molds and to reduce shrinkage. If wrought iron is required most of the silicon and carbon are removed, by a process known as puddling, after the cast iron is melted. If it were possible and profitable to make castings of wrought iron it would obviate the necessity of having malleable iron foundries. This not being the case, the next best move is to devise means, whereby similar castings may be procured.

It might be explained that in reducing the iron ore to pig iron in the blast furnace, the 4.5 per cent. total carbon spoken of was not only required in the castings but was unavoidable. The carbon is absorbed from the fuel and it cannot be prevented. The silicon however can be removed, but as has been shown, it is required, for the successful production of the castings. But as both of these elements stand in the way of the iron being malleable, the silicon is reduced to around 1 per cent. This would not be sufficient to materially affect the carbon which as a consequence will remain in the combined state. This also is exactly what is required, as graphitic carbon will not do in malleable iron. The other elements are to be kept down to near the point of elimination. Thus the iron which would be considered suitable for making malleable iron castings would analyze somewhere around: Silicon 1 per cent., manganese .6 per cent., phosphorus .2 per cent., sulphur .04 per cent., carbon 4 per cent. Iron of this kind will be as white as silver and very brittle. For very light castings a slightly higher percentage of silicon is permissible, and for heavy work a much lower percentage. The molds for malleable work are not particularly different from those for grey iron work, other than that the gates require to be larger and feeding heads are required on many castings which would not require them if made of grey iron.

Through courtesy of Mr. J. W. McKinnon of the "McKinnon Industries Limited," St. Catharines, we will en-

FIG. 1—CORE ROOM. FEMALE LABOR EMPLOYED IN THE MAKING OF SMALL CORES

FIG. 2—OVEN AND RACK ROOM. FINISHED CORES ARE PLACED ON THE RACK AND TAKEN FROM THE OPPOSITE SIDE

deavor to show how the work is performed in this thoroughly up-to-date Canadian establishment. This company manufactures a full line of carriage and saddlery hardware, automobile accessories, chains, drop forgings, and malleable iron castings of every description, employing, all told, some twelve hundred hands, of whom about two hundred are employed in the malleable iron foundry. And it is of and about these two hundred and their work that we will endeavor to interest our readers.

In Fig. 1, will be seen, what is usually the first thing to be seen in any foundry, viz: the making of the cores for the molders to use the following day. Note the layout of the room. This room is used for nothing but making the cores. In a much larger room anexed to this, the material is stored and the sand sifted and mixed by electric gyratory sifters and revolving mixers. Sand, suitable for each line of work is delivered to the core makers and they in turn are required to do nothing but make the cores and place them on the rack shown in the opening leading to the oven room. This system of operation may well be termed "efficiently." By arranging the work so that the heavy work is done by strong hands it is possible to utilize female labor to good advantage, particularly is this the case in an establishment of this kind, where so many delicate cores are made, calling as it does for dexterity and suppleness, rather than for manual labor. In Fig. 2 will be seen a section of the adjoining oven room showing the ovens. The oven men have but to lift the cores from the racks shown in the previous illustration and place them in the ovens, where they remain the exact length of time required to properly bake them, after which they are withdrawn and placed on the racks shown at end of this room, where they are allowed to cool. Workmen on the opposite side then take them from these racks and after sorting out all defectives deliver nothing but the perfect core to the molders. Fig. 3 shows snap bench section of the foundry, with abundance of light from the roof and also from the electric lamps. As might be expected machines of different types are used on certain jobs, the pneumatic squeezer predominating, for the lighter work; the aluminum match plate holding a prominent place. The sand match with brass patterns however still hold their own, and incidentally the practical green sand molder with the loose pattern outfit is to a certain extent in evidence. Fig. 4 shows line-up at casting time. This, it might be explained, takes place twice a day. In malleable work the metal is not melted in a cupola as in other foundries, but is melted in a horizontal furnace designed and built especially for this class of iron. These furnaces are built in various forms. One is the natural draught reverberatory or air-furnace, once quite common but now drifting

FIG. 4 LINE UP, PREPARATORY FOR RECEIVING THE IRON. EACH MAN KNOWS HIS PLACE AND CATCHES IN HIS TURN

FIG. 5 IRON DELIVERED IN THE SULKY LADLE IS TRANSFERRED INTO THE HAND LATHES, FROM WHICH IT IS POURED INTO THE MOLDS

FIG. 3 SECTION OF SNAP FLOOR, SHOWING SKYLIGHTS, ALSO INDICATING THAT THE PRACTICAL MOLDER STILL HAS HIS PLACE

into disuse, also the Siemens-Martin open hearth furnace, the forced draught coal-burning furnace, the latter of which is used by the McKinnon Co. The fuel used is the same as is used in gas retorts, being high in gas producing qualities and low in sulphur.

In melting malleable iron, the entire charge is melted before any of the metal is taken away. By this means it is possible to see the condition of the iron before using it. When everything is in readiness, the furnace is tapped and the molders form themselves into a sort of an endless chain from the spout to the different floors. Each molder requires to be something of a mathematician as well as an athlete. He has to figure how long it will be before his turn comes again, and he also requires to be spry enough to be back on time, but this is not difficult to accomplish, as the furnace is just tapped big enough to keep the men going. Pouring in this manner is pleasanter than a long drawn out heat would be, as it is all over with before the shop has time to fill with smoke.

Fig. 5 shows a familiar scene in the foundry. For the floors which are situated at some distance from the furnace the metal is delivered in the sulky ladle, and if a large piece is to be poured this ladle can be utilized for the purpose, but ordinarily it is done as shown; the metal being transferred into hand ladles from which it is poured into the molds. As will be seen in this illustration, a certain amount of floor molding is done. Fig 6 shows the annealing ovens and the pots of castings being put into place by means of a steam charger used for this purpose only. This department is undoubtedly the most interesting of any, inasmuch as it is an entire departure from anything seen in a grey iron foundry. As has been already stated, malleable iron, to be similar to wrought iron, must be extremely low in everything but the pure iron.

This iron which is commonly known in foundry terms as white hard iron, should contain a chemical analysis as follows: Silicon from .5 to 1.00, varying upon class of work being molded; sulphur, not over .07; manganese, not ever .40; phosphorus, under .225, and combined carbon not over 2.75. This iron is then taken and packed in iron pots specially made for this purpose, and are packed with filler which is generally some sort of iron oxide. Pots are stacked four high, and carefully sealed to prevent gas from searching in through the cracks, and are placed in annealing ovens by means of the steam charger.

The oven when filled is sealed up by means of two doors and the fire is started which slowly brings the oven temperature up to 1600 degrees, where it is maintained for about sixty hours when it is gradually allowed to cool off until the temperature is such that the door can be removed, and the pots taken from the ovens and dumped so as to get the castings separated from the filler. The temperature of the ovens

FIG. 7—SAMPLES OF CASTINGS SENT TO THE LYON'S FAIR IN FRANCE, SHOWING HOW THE METAL CAN BE CONTORTED WITHOUT INJURY.

is very carefully watched night and day by means of pyrometers. The only change which will be found in the chemical analysis of hard iron and malleable iron is in the carbon, which is changed from a combined state to a graphitic or temper state, which makes the iron strong, ductile and tough.

The fracture of a well annealed piece of malleable iron should be of a black heart with a white rim of not more than 1/16 of an inch. There has been much discussion on the relative strength of this so called white rim and black heart, but modern tests have shown that the strength is distributed all through the castings, no one portion being stronger than the other.

Fig. 7 shows photograph of board which was sent to the Lyons Fair in France by the McKinnon Industries. Note the contorted shapes that the different pieces have been bent and pounded into

FIG. 6—ANNEALING OVENS, SHOWING ENGINE PLACING LOAD OF CASTINGS TO BE ANNEALED

without damage to the structure of the metal. The centre casting in the bottom row will be identified as part of a fork handle. A wooden hand grip is fastened into this with a long rivet or bolt and the holes for this rivet are not drilled but are punched, which should be a guarantee of its quality. The motto of the McKinnon Industries is to turn out nothing but goods of the highest quality, and to insure themselves as well as their customers that they are doing this, three tests are made from iron after each heat. These tests are as follows: First, test wedges are subjected to 60 blows or more from a 70-ft. pound drop hammer. Second, chemical analysis. Third, strength test. The first is done at the works. The latter two are made by the Toronto Testing Laboratory, 160 Bay St., Toronto, and the strength test, which is the one that counts, shows the following average results:

	Elongation		Elastic Limits		Tensile Strength	
	Low	High	Low	High	Low	High
Oct. ..	..	9.5%		36847		47632
Nov. ..	..	8.3%		37757		47518
Dec. ..	..	9.9%		41477		49883
Jan. ..	..	9.3%		39379		47945
Limits	6%	15.5%	35000	46000	43000	56000

Other things worthy of note would include the mode of cleaning the castings. These must be perfectly clean before being annealed also afterwards. Simple castings are rumbled but those which have pockets or chambers which cannot be properly cleaned in this manner are sand-blasted, which takes off the last grain of burned sand. After being taken from the annealing oven they are rerumbled, which gives them a marketable appearance. Last but not least is the magnetic separator which takes every grain of iron out of the dirt and refuse of the foundry.

The company reports a fair volume of business, their average monthly tonnage of malleable castings ranging from 300 to 350 tons. They are optimistic regarding the future and as a mark of recognition for the boys who did their bit at the front they are giving them every preference over all comers, and are employing in the foundry department alone no less than 40 returned soldiers. Presumably an equal proportion will be found in the various other departments.

Paying Strict Attention to Welfare Work

Big Concern in Reading Have New Premises, Where Consideration of the Employees is First Thought — New Methods Are Employed in the Workshop

By FRANK C. PERKINS

THE Reading Steel Casing Company has completed an up-to-date welfare building for the use of its employees at a cost of over $12,000. The dues of relief association are nominal and the quarters are well equipped with lockers and shower baths. Nearly all of the employees come into the room in the morning, change their clothes, and go to work. When their work is done they take a shower bath and re-dress. The baths have hot and cold water. There is an unlimited supply of hot water coming from a large boiler and heating plant in the home.

There is provided an emergency hospital well equipped with a large medicine closet and first aid appliances. Injuries of a less serious nature are dressed here, and in extreme cases temporary relief is administered. In this new welfare building to the left of the entrance is an office for officers of the association and a store, as it is called. Cigars, tobacco and candy are sold as well as workingmen's gloves and other articles for the convenience of the employees. An airy reading and writing room is also on this floor, as is a pool and billiard room and kitchen.

TWO CUPOLAS AND FOUR CONVERTERS

A large assembly room covers the entire second floor. The kitchen is used to prepare luncheons for different functions. The assembly has an excellent dancing floor. There is a wholesome atmosphere about the home, but no liquor is permitted, and the games are purely social. In brief, the men are being bettered physically, morally and socially.

In this foundry at Reading, Pa., there are two cupolas and four converters placed along one side of the main bay. The large cupola, in which the converter charges are melted, runs continuously and has a melting capacity of eight tons per hour. This is equivalent to four converter charges, since each converter has a capacity of two tons. The converters are tilted electrically and are controlled from a platform placed across the main bay in such a position that the operations may be readily observed.

It is pointed out that oil burners are provided for baking the linings prior to a series of blows. It is customary to operate the converters in relays; according to this plan, two converters are used each day, turning out two heats, or four tons of steel each, per hour.

There can be poured 1,400 tons of steel a month, and allowing 50 per cent. for shrink heads, sprues, etc., the maximum output of finished castings is approximately 700 tons a month, this being nearly equal to the output of an open hearth foundry equipped with a 20-ton furnace. The smaller cupola, which has an outside diameter of 36 inches, is employed for melting the mixtures of ferro-manganese and ferro-silicon, used to recarburize the heats after blowing.

On account of the high prices now ruling on ferro-manganese, the company is making extensive use of spiegeleisen as a substitute. The only steels which are not recarbonized by the addition of such a mixture are those which are specified under 0.10 per cent. carbon and without manganese or silicon. To meet such special requirements the steel is removed from the converters as blown, sufficient aluminum being added to remove the oxides. Low phosphorus pig iron, containing approximately 1 per cent. copper, is used extensively.

It is of interest to note that the metal contains from 40 to 50 per cent. pig iron, with 50 to 60 per cent. steel scrap. It is stated that tests of the resulting steel, containing approximately 1 per cent. copper, have shown exceedingly satisfactory physical characteristics. This seems to controvert the contention that copper is a deleterious element when present in such large quantities. Snap flash molding is employed very extensively, all but the very heaviest castings being produced by this method. The snap molds are made on the floor, on benches and on molding machines.

It is stated that the molding machine equipment in the snap flash department includes 16 power squeezers with cylinders ranging from 12 to 16 inches in diameter and two holters with 4 inch cylinders. The core shop is equipped with three 3½ inch jolt machines and an 8 inch jarring machine also has been provided for handling large work. All the molding is done on match plates or with plain patterns. The snap flasks range from the usual small sizes up to 7 feet in length. When not in use they are kept in a separate store room which is in charge of one man who keeps the flasks in repair.

In order to get a flask, the molder must leave one in its place, thus all the flasks are continuously accounted for and none is left lying around the foundry where they take up valuable space.

The handling of snap flask molds is exceptionally interesting and permits of an extremely large output without congesting the molding floor. After being rammed, the snap molds are deposited on steel bottom boards, which are placed on specially constructed angle iron frames. These frames are 24 inches wide and 6½ feet long, each one holding from one to five molds, depending on their size.

It may be stated that as fast as the frames are covered with molds they are loaded on to trucks and wheeled into the drying ovens. The rigging consists of hooks supported on both ends of an equalizer beam which, in turn, is suspended from a hoist. The six hoists, which have a capacity of two tons each, are mounted on an overhead tram rail system which commands the entire floor space, 50 by 110 feet in the snap molding department.

It is maintained that the cranes may be transferred readily from one branch of the overhead system to another as required, thus affording great flexibility of service. The snap molding department is provided with three coal-fired mold drying ovens. One, which is of the double track type, accommodates eight trucks. The other two are provided with single tracks and have a capacity for two trucks each. Of particular interest are the two types of trucks employed. These are designed to take the maximum possible load, thus filling all the space in the ovens except such as must be left to permit the heat to circulate between the molds.

There is a portion of the foundry, 60 by 240 feet, devoted to the production of large castings, such as motor truck and tractor parts, crank shafts, large valves and fittings for steam superheaters, and other pieces not suited to snap molding. A large proportion of this work is molded on a 3-ton joltramming machine, which is served by a 1½-ton hoist suspended from a swinging boom. For the regular floor work, pneumatic rammers are used throughout.

It may be mentioned that this department is provided with two large drying ovens and is commanded by two 10-ton electric traveling cranes and 2-ton Shepard traveling hoists. It has a concrete floor, as has also the snap mold department. Adjoining the floor molding department is the core room, which is 50 by 62 feet in size. Practically all the cores are made on jolters, of which there are three in the core room, as mentioned previously. The core department, which is commanded by a 2-ton electric traveling crane, contains a machine for automatically mixing oil sand, and also is provided with an oven of the drawer type.

The oven is 36 by 8 by 8, and it contains 48 compartments, each of which may be opened and loaded without interfering with any of the others. A 40 by 200 foot section of the main bay, in which the converters are located, is reserved for pouring the molds after they have come from the drying ovens. Practically all the work is poured with bottom pour ladles, each of which will accommodate a full converter charge. This bay is commanded by three 10-ton electric traveling cranes, by which the ladles not only are transported to all parts of the pouring bay, but may be transferred, if desired, to either of the two molding bays adjoining the pouring bay.

An outfit has been designed for saving floor space in relining and repairing the ladles, which consists of a system of ball bearing trucks on which the used ladles are deposited by the cranes, and by means of which they are transferred from the main bay to a special compartment where they are put in shape for the next day's heat. These trucks are provided with circular steel platforms mounted on four wheels. The cleaning department occupies a portion of the main foundry building. In addition to a 6 x 4 foot square tumbling barrel, two sand blast chambers, several oxyacetylene welding sets, spru cutters, cold saws and a large number of stationary grinders and portable pneumatic chippers.

There are provided four portable grinders of special design, mounted on wheels, and provided with a frame which supports a motor and grinding machine in such a manner that they partly counterbalance each other. The motors, which are rated at 1½ horsepower each, are belt connected to the wheels, and both the motor and the grinding wheel are provided with guards. Handles are provided at the grinding end so that the operator can apply the wheel to any part of the work. The cleaning department has a wood block floor which admirably resists the heavy wear to which it is subjected. This department is served by a 3½ ton electric traveling crane.

In this plant the men at first hesitated to wear goggles, until one of them lost an eye which the goggles would have saved and this unfortunate accident had a salutary effect. Since this accident goggles have been worn willingly by all mended.

CONTINUOUS CORE OVEN

OVEN CAR FOR CONVEYING SNAP MOLDS

The Sand-Blast for General Foundry Work--II.

Its Applicability and Advantages For General Foundry Work, Together With Examples and Data of What it Has Actually Accomplished, Clearly Shown

By H. D. GATES*

*Courtesy of the Pangborn Corporation, Hagerstown, Md.

THE trend towards hygienic rooms that remove the operator from the sand-blast enclosure has developed devices of different types that meet every demand. The hygienic room illustrated (Plate 12) is provided with a sight screen on four sides through which the operator may see his work, while below this is a nozzle slot or opening, closed by sectional flexible curtains through which the operator directs the nozzle on the work to be cleaned. While this permits the operator to work in the open without other protection than afforded by the room, ventilation is necessary that the created dust may be rapidly removed so as not to obstruct illumination and free observation of the work.

Rooms of this nature are more adaptable to work of rather uniform size as the width and length of the room should be such as to bring the work reasonably close to the nozzle slot on all sides and keep ventilation requirements at the minimum. These rooms are particularly adaptable to large and heavily cored work and for cleaning long lathe beds and other work of this nature and are usually constructed of a length to receive a little more than half the longest piece, with the other half extending through curtains closing one end of the room, the pieces being reversed for cleaning the other half. In this way pieces 20 to 30 ft. long are readily cleaned in a room of size but little more than half their length.

PLATE 13—SHOWING HYGIENIC TABLE CABINET

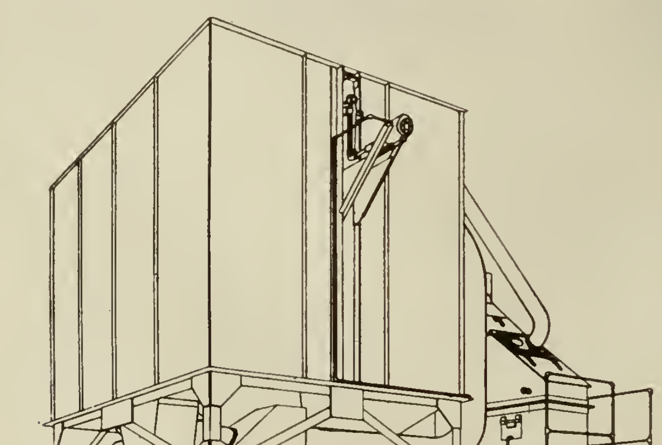


PLATE 12—HYGIENIC ROOM, SHOWING SIGHT SCREEN ON ALL SIDES

Where the output of the foundry does not include work larger than may be loaded on to one-half of a 90-inch diameter table, the hygienic table-cabinet offers the ideal equipment (Plate 13). This cabinet semi-circular has an opening at the rear to permit of revolving the table while the upright partition of the table closes the aperture entirely when the table is in blasting position the same as in the room type. By means of the semi-circular shape of the cabinet, all portions of the table are accessible to the operator who observes the work through the sight screen and directs the nozzle through the nozzle slot. The work, as in the case of the table with the room, is loaded from the outside by other labor permitting continuous sand-blast operation.

All of the installations described above provide for the sand-blast machine to be located at floor level. Where limited area makes floor space at a premium, the sand-blast machine can be located in a concrete hopper below the floor and the abrasive for re-use passed to the separator by gravity. This type of installation eliminates the use of elevator and conveyor. General utility and ease of

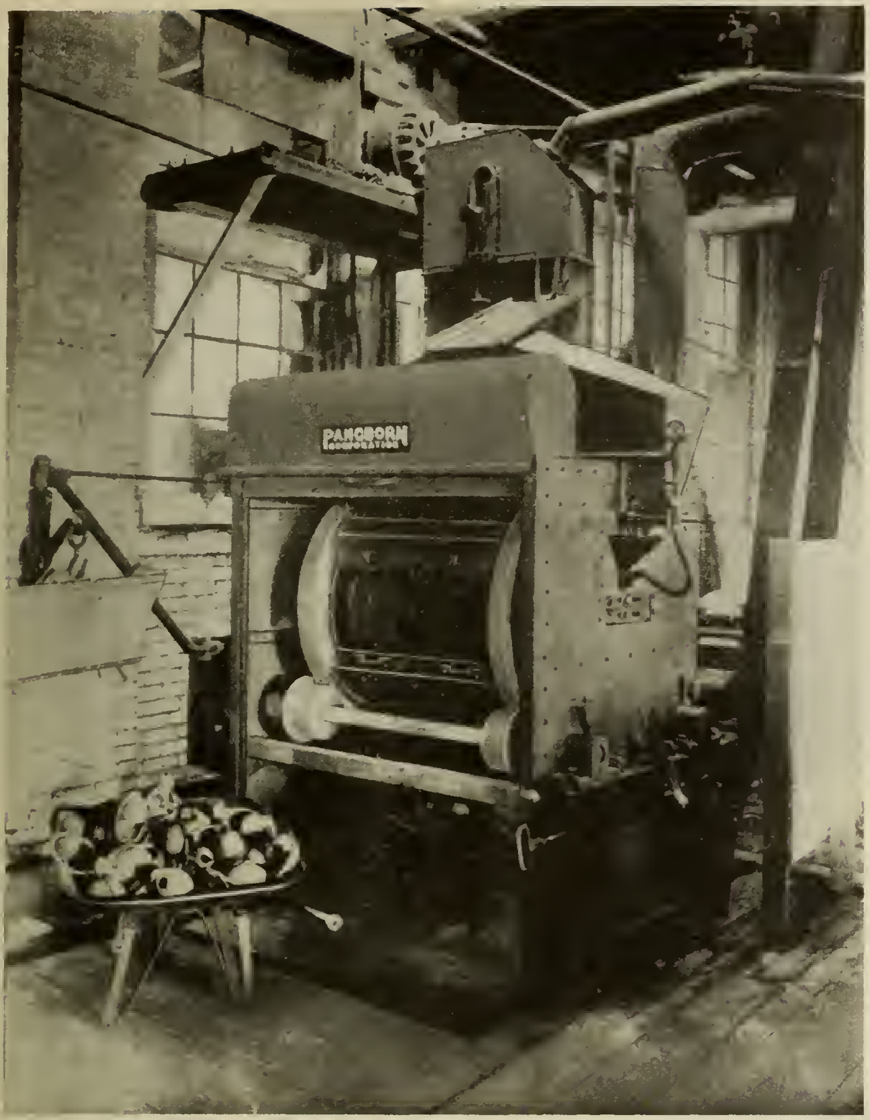


PLATE 14—REVOLVING BARREL SAND-BLAST MACHINE

access has recommended the floor level type where floor space will permit.

While the above installations with the hose machine will clean any and every character of work possible with any other type of sand-blast, the fact must not be lost sight of that economy of cleaning with this device decreases as the size of the pieces become smaller, requiring added time and labor for individual handling.

For the plant that has a tonnage of small work sufficient to warrant special equipment, the barrel sand-blast or the rotary table sand-blast or both in combination will be found time and money savers and are of further advantage in that their operation is entirely hygienic and relieves the operator from any contact with the dust-laden air.

The barrel sand-blast consists of a slowly revolving drum within a steel case, into which are introduced sand-blast nozzles that blast the pieces as they are turned over, the construction of the drum being such that a constant turning of the load is obtained to bring every surface under the action of the sand-blast nozzles. These units are self-contained, the spent abrasive falling through perforations in the drum and delivered to a hopper from where it is raised by an elevator, cleaned and screened, and delivered by gravity to the nozzles for re-use automatically. In this type of barrel (Plate 14) the interior of the drum is entirely unobstructed and it will receive pieces up to the limit of the door opening size. The plow points (Plate 15) are typical work for a barrel of this type. Other barrels of the suction type have a manifold running through the centre with a series of nozzles and as the abrasive falls through the drum perforations it is passed through a series of screens to feed boxes from where it is raised by suction to the nozzle, and in combination with the air projected onto the work. Barrels of this type are more efficient for smaller pieces, such as valve bodies and the like and from which they will remove the cores. (Plate 16). Both types are made in several sizes so that the requirements of every plant can be accommodated, and the drum rotates at a very low speed so that square corners and ornamentations are not damaged.

For work of a fragile nature such as stove plate, precision work or pieces of shape and size that will not permit rolling within the barrel drum, the automatic revolving table sand-blast is of greatest utility. (Plate 17).

In this device a grated top table is half exposed and half contained within a steel case wherein the blasting operation takes place. The opening at the front of the case to permit free passage of the castings is closed by multiple, flexible, sectional curtains that retain the flying abrasive and created dust during the passage of the work. The pieces are loaded onto the exposed half of the table by the operator and as they emerge from the blasting chamber are turned as may be necessary, to bring all parts under the blasting action, until thoroughly cleaned, when they are removed and new work loaded.

Multiple nozzles oscillate so that the pieces are blasted from all angles, the sides as well as the tops coming under

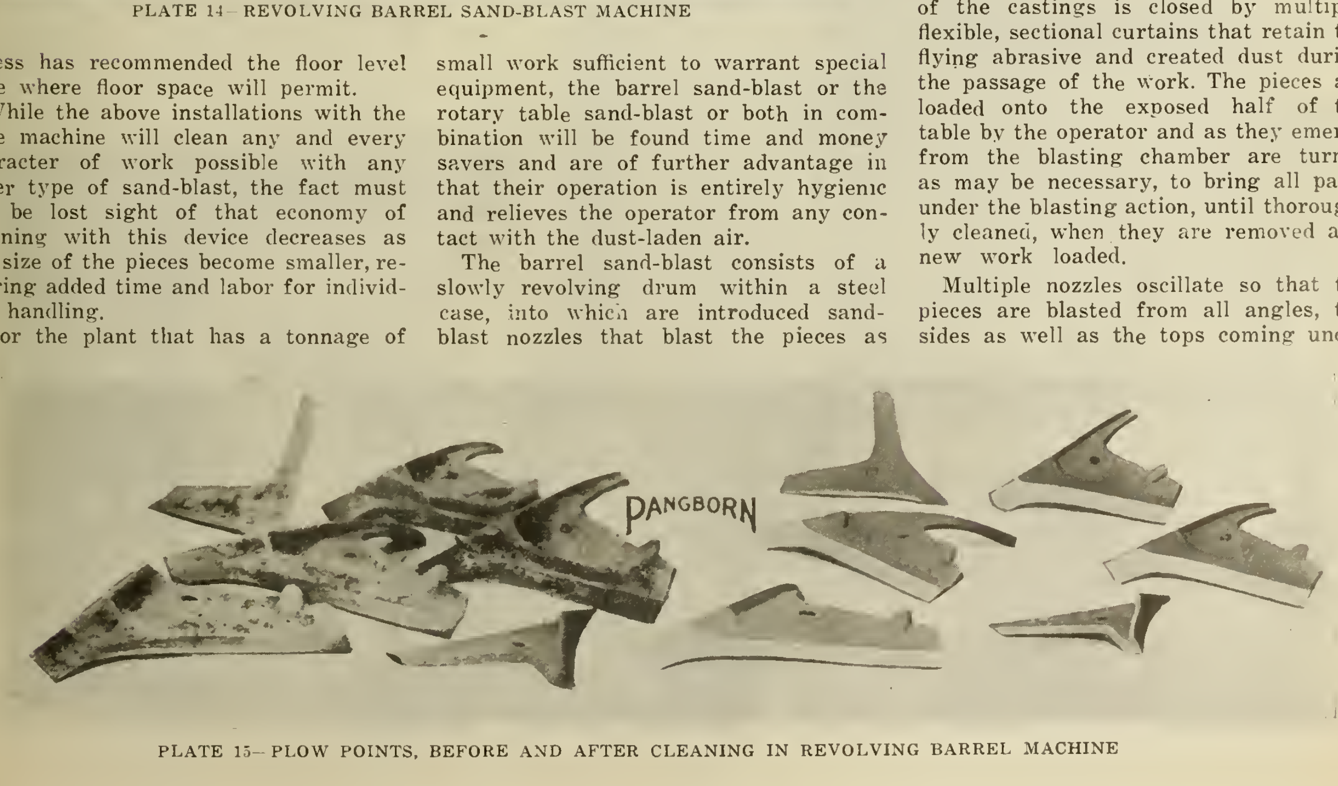


PLATE 15—PLOW POINTS, BEFORE AND AFTER CLEANING IN REVOLVING BARREL MACHINE

the blasting action. These tables will handle material as fast as a man can load and unload it. The blast action is of the direct pressure type, the nozzles being fed from a direct pressure hose machine beside the table. Operation is continuous, the spent abrasive falling through the grated table top, being carried by an elevator to the abrasive separator that cleans the abrasive and delivers it to the sand-blast machine for reloading.

Either or both of these devices can be installed in combination with the sand-blast room and ventilation provided for all in a single system.

All of the above devices while equally adaptable for the cleaning of brass and aluminum, as well as iron and steel, are of a size and capacity that is hardly warranted by the average brass foundry.

There is, however, as much advantage in the cleaning of brass or aluminum castings with the sand-blast as in the ferrous metals and cleaning on the grates means economy of time and labor with thoroughly cleaned scrap. For the small jobbing brass foundry a self-contained unit in the shape of a sand-blast cabinet meets the requirements from every point of view. The initial cost is not large, floor space required is small and being of the suction type, is self-contained and continuous feeding as well as hygenic, the operator not being exposed to the dust laden air.

PLATE 16—FITTINGS CLEANED INSIDE AND OUTSIDE BY SUCTION TYPE OF SAND-BLAST

Being simple of manipulation, they can be operated by unskilled or boy labor. These machines are made in various types and sizes, the one illustrated here (Plate 18) being 3 ft. wide by 2 ft. deep, with a door opening 10 inches high. Pieces to be cleaned are laid on the grated floor of the cabinet and the operator handling the pieces through arm holes equipped with rubber gloves and canvas gauntlets, seeing the work through a wire and glass-covered opening provided for the purpose.

Electric lights illuminate the inside of the cabinet for free vision, and the blasting action is started and stopped by a single valve, which controls the air flow. Cabinets are made with both stationary and flexible nozzles. In larger sizes the nozzle is supported by an arm adjustable in all directions and reaching every part of the cabinet. With the stationary nozzle the pieces are turned under the blasting stream, while in the larger types with the adjustable arm, larger and heavier pieces can be cleaned, the nozzle being moved as required instead of turning the work.

These cabinets are equally efficient on iron and steel castings, forgings or stampings, and make also a desirable adjunct to foundries for a small volume of delicate or precision work.

All of the above equipment, whether room, barrels, tables or cabinets, must be ventilated for removal of the created dust. This is accomplished by exhausters of various types and adequate capacity to the equipment concerned, the disposal of the dust being accomplished as conditions may demand.

Where the plant is isolated and no

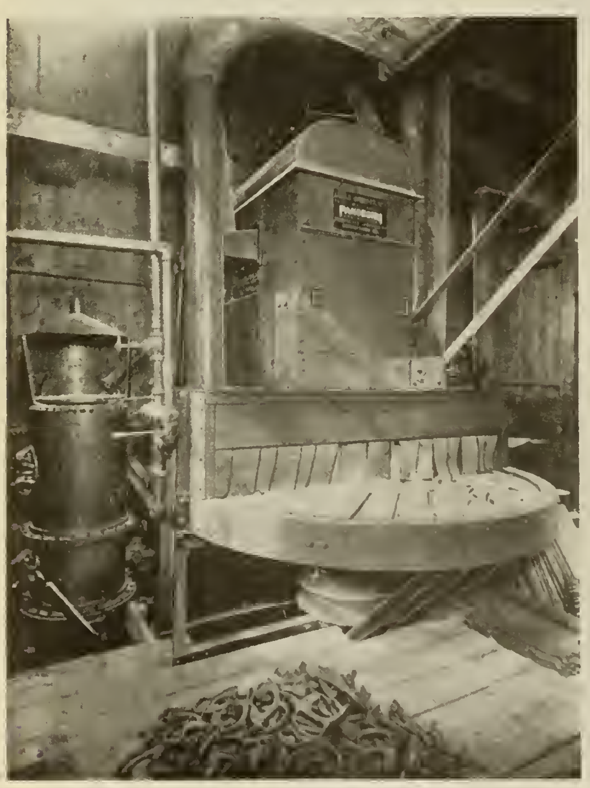


PLATE 17 AUTOMATIC REVOLVING TABLE

PLATE 18 SAND-BLAST CABINET FOR SMALL BRASS FOUNDRY

detriment occasioned, the dust may be discharged into the open.

There are very few plants to-day, however, in which either neighborhood or shop conditions do not demand some suppression of the created dust. The simplest arrangement is a settling chamber with baffles that retain the heavier particles, and even this device is found satisfactory only in widely separated plants, and where the operations of the foundry do not include machine work.

PLATE 19 CENTRIFUGAL DRY PROCESS ARRESTER

Where absolute suppression of the dust is not demanded, the centrifugal dry process arrester (Plate 19) has been found highly efficient. From 90 to 95 per cent. of the created dust is retained in the arrester and discharged through the bottom to a receptacle, from which arrangement for removal can be made as desired.

The lighter material in the appearance of light haze or smoke issues from the stack, which is capped to prevent the entrance of rain or snow.

Where, however, entire suppression of all dust is required the cloth screen type of arrester (Plate 30) is necessary. This is a steel case in which are located a series of specially woven cloth screens, the dust laden air entering on side, the screen retaining all dust and permitting passage only of the cleaned air which is drawn out the opposite side through the exhauster. A decided saving has been made in a great many plants through the use of this cleaned air, which, being warm, can be returned into the plant ventilating system or directly to the sand-blast room, as conditions may warrant.

So effective are these arresters that by their use sand blasting has been possible in large city office buildings and the diverting of the clean warm air to plant ventilating systems has saved much in fuel where this has been done.

With the progress in sand-blast equipment and methods has come also progress in the matter of abrasives. Various classes of sand are now mined and graded for sand-blast use, and with the abrasive, as with the equipment, the better the quality the greater economy and efficiency. Of sands, such as is hard, sharp, clean with the least disintegration not only shows longest of life and highest abrasive quality but creates less dust. River or bank sands are rarely economical even at lowest first cost. Ocean sands are quite satisfactory but undoubtedly the white silica sands where available are most desirable. In fact by their hardness and uniformity they would undoubtedly prove most economical at a considerable higher first cost.

Metal abrasives in the form of chilled shot, crushed steel, etc., are produced by different manufacturers, each making claims for their superiority. Of the life of the metal abrasive over sand there can be no question and this will range from 20 to 60 times. Disintegration is at the minimum and almost no dust is created from the metal abrasive itself.

In this connection, however, the much higher first cost demands an absolutely tight enclosure throughout, as any daily loss, even though small, will soon wipe out the saving in efficiency.

The selection of sand or metal abrasive will present several features for consideration. If the work to be cleaned is reasonably free from sand, considerable advantage in operating conditions will be found by use of the metal abrasives owing to their creating practically no dust by their own disintegration, but if the work is cored or carries a large volume of sand the advantage from the metal abrasive in this connection will, obviously, be greatly decreased and the dust created by the disintegration of the blasting sand itself will not materially increase the dust volume arising from the castings.

Where prices are to be galvanized or plated some complaint has been regis-

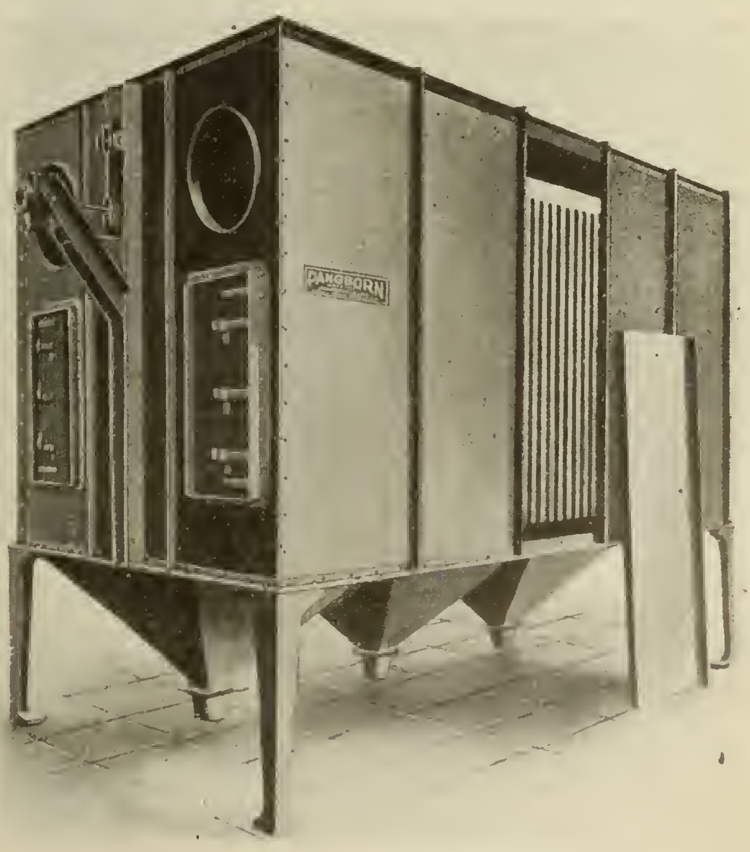


PLATE 20 CLOTH SCREEN TYPE ARRESTER

tered against the metal abrasives in that the fine metallic dust adhering to the pieces prevented satisfactory results in plating, but for general foundry output the character of the work itself with the delivered cost of the various abrasives will readily determine the economy of one over the other.

All of the modern sand-blast devices operate with equal facility with either sand or the various metal abrasives.

One of the most frequent causes of unsatisfactory operation of the sand-blast is the presence of moisture in the air line which, if in sufficient volume to make the sand at all plastic, will naturally prevent even, steady flow and in the use of the metal abrasives the mixture of moisture with the fine metallic dust frequently tends to rust the abrasive into a solid mass. Any device that will eliminate the moisture will be found of decided advantage not only in connection with the sand-blast but with all pneumatic tools. The United States Emergency Fleet Corporation in a recently issued Standard Practice Bulletin describes a satisfactory device for this purpose, from which we quote:

"It is the object of this communication to call attention to the importance of a second step which should include provision for effectually separating and draining the water of condensation from the piping system."

"The water cannot be properly taken care of merely by placing drain cocks on low points in the ordinary piping system, but should be removed by special separating tanks or chambers located at these points and near the distributing manifolds."

"The separating chambers should be large enough to lower the velocity of the air to a point where entrained water or dirt will not be carried through with the air current, and should be fitted with bafflers or connections which will change the direction of flow, so as to precipitate the entrained matter." An illustration (Plate 21) of this device is shown and its installation on the air line near the various tools will assure freedom from moisture troubles and will save in lost time their first cost in a comparatively short period.

The live foundryman who investigates the installation of a suitable sand-blast installation will realize results that are not commonly included in an inventory of sand-blast advantages. To the jobbing foundry producing castings that are to be machined, sand-blasting means the entire removal of the scale which on the contrary is intensified by rumbling. This means a big saving in tool expense to the purchaser, an added demand results if indeed a better price cannot be obtained. The appearance of the castings is very much improved and where castings are to be galvanized, painted or plated, if thoroughly sand-blasted are given a surface that assures perfect results with best finish, with a consequent saving to the plating operation.

The foundry that sand-blasts its castings and fails to feature it in their literature and advertising is not taking advantage of one of its greatest assets.

It should be realized, however, that like any other machinery, operating economy comes only through the selec-

PLATE 21 DEVICE FOR ELIMINATING MOISTURE

tion, arrangement and layout of the right devices for the conditions to be met and the work to be handled. Thorough discussion of your needs and conditions with a responsible sand-blast manufacturer and taking advantage of their experience will get best results.

The initial price of sand-blast equipment can hardly be considered an indication of its cost. Any installation so complete as to get greatest output at lowest cost per ton means a constant and accumulated daily saving, even though small, that in time not only returns the greater price but wipes out the entire cost of the installation, and becomes a money maker that will also insure most attractive castings and quick deliveries.

CASTING IN BURNT-OUT MOLDS

There is a class of molding and casting which, while having no particular value in an economic sense, has yet an occasional value, and is for this reason worth remembering. In the cire perdu process the wax pattern or model is surrounded with the plaster mold, eventually being melted out and replaced by metal, the mold then being broken off and a metal replica of the wax pattern secured. In the burnt-out process the original—say a flower, small animal, or the like—is put in place of the wax model, the mold material is poured in, dried, and then brought to a heat, which will reduce the mold to ashes, then the ashes are cleaned out and replaced by molten metal, the mold being preferably red hot, and when cold the mold is broken away and the casting cleaned up, when it should be a perfect replica of the article selected for reproduction. Obviously, plaster as used in the cire perdu process would not stand the heat, and probably the best molding medium is finely ground gannister, as used in steel furnace work, this being reduced with water to a creamy state and deposited on the model by gradual settlement from the water, fresh supplies of the reduced gannister being added until the required bulk has been secured. Pipe clay, as used for making tobacco pipes, could also be used, and one or two other refractory materials are available, but gannister would probably work best with most people. After the material selected has subsided the water should be poured off and the mass should dry naturally until the bulk of the moisture is gone and then gradual heating should drive off the rest, and as the mass becomes dry it should be gradually brought to a bright red heat and kept heated until the mold is reduced to ashes, which should be removed and their place filled with molten metal in as fluid a state as possible. As the mold is broken up in removal from the casting some little care is necessary in its preparation, while probably at first a little practice will be found necessary to get the right knack in working.—M. M.

An English authority has estimated that the war has cost the countries involved no less than 12½ million potential lives; in other words, the number of births has been smaller, by this number, than it would have been if the war had not occurred

Experts state that the Mesopotamian plain, when properly irrigated, will produce a substantial share of the world's cotton crop.

It Pays to Read Technical and Trade Papers

Practical Mechanic and Shop Foreman Proves to His Own Satisfaction That it is a Great Advantage to Himself and a Source of Profit to His Employer to Keep in Touch With Other Workmen's Ideas by This Means

By "Observer"

THE above statement may be looked upon by some, simply as a bold assertion by the publisher, but without any foundation in fact from the standpoint of the ordinary workman. Others again, there are, who have their doubts; and still others, may their tribe increase, who have found by experience that it is true.

To begin with, what is the value of the trade journal to the tradesman? Its value consists in the power it possesses to broaden his mind, giving him new ideals, encouraging him to improve himself, to learn more about his daily work and to keep abreast of the times, because the old saying is right when it says that no man knows it all.

Only the fellow who has had the experience, knows the satisfaction one feels when a new idea or a new method is discovered.

Now as to how it pays. I have in mind a young man in the machine shop. While he was serving his time as a turner it never occurred to him that some day there might be an opening for someone as a foreman; or maybe the idea did come to him, but it was promptly dismissed and all his leisure time devoted to sport.

As a consequence, he became a journeyman only in name since he was unable to understand blue prints or to do simple figuring, and the only machine he knew anything about was his lathe, but he was bright and energetic and to all outward appearances looked as if he would make good as a foreman.

The day came when he was offered the job of looking after the lathes, milling machines, slotters and vertical and horizontal boring mills and he accepted, but alas, what a failure!

Some people seem to imagine that foremen hold their position by bluff and that no preparation is necessary, and it must have been so in this case, for when it came to explaining a drawing to one of the men or doing some necessary figuring, this new foreman was up against it, and besides, he did not have enough of what we might term "lookaheadiveness" to keep the men in work and to, if need be, give them pointers as to the best way of doing it.

After about a week of sleepless nights and worried days this young man asked for his lathe back again.

And this is not an isolated case; others might be mentioned of patternmakers who knew nothing about mathematics, very little about mechanical drawing, and could not be depended upon to estimate time and material; and molders, even assistant foremen, who were perfectly ignorant of how to figure the weight of castings, or to read a blue print, or to work out the percentage of the different metals charged into the cupola for any given heat.

Speaking personally, I can say that my perusal of the trade journals has been both pleasant and profitable. It has livened up my mind, and made the work easier and more interesting, and the information gained has, in turn, benefited the firm by whom I am employed.

One instance of this occurred not long ago. I read in a monthly periodical on patternmaking and molding of a good sized pattern which was required for one cast only, and instead of making the full pattern, they made the drag half and some sketelon pieces so that, after the drag had been rammed up, it was drawn out and these skeleton pieces put into the drag mold so that the edge of the mold for 2 or 3 in. down was strengthened and the half pattern supported in the proper position and used a second time to ram up the cope. A day or two afterwards there was one cast pattern to make for a large elbow pipe, so we followed the method above referred to and effected a considerable saving in time and material, and it was the article I had read, that deserved all the credit.

I would suggest, in closing, that all tradesmen, especially the younger members, carefully study the trade publications; that parents and foremen frequently encourage those under their care to improve themselves in this way, and we will soon find that our interest in our daily work will increase; we will probably also find that there is more to be learned than we imagine, and we will in turn want to know all there is to be known about our particular calling.

OBSERVER.

THE MIXING OF IRON BY ANALYSIS

No Good Unless Done in an Efficient Manner

By "Gov."

THERE is no doubt that mixing iron by analysis is of vital importance; but it is surprising how many foundries get excellent results without resorting to other than good cupola practice. We hear, and read nowadays, a great deal on scientific methods in melting iron, and foundry work in general.

The writer has listened to a great many, so-called, scientific discourses that we would simply term good, or indifferent shop practice.

Referring to scientific melting, and mixing iron by analysis, reminds me of an instance which took place under the writer's observation which convinced me that mixing iron in a cupola by analysis did not prove a panacea. In other words, the chemist in charge was not practical enough for the position he was filling, or he would have discovered the reason his mixture did not give the results desired. The instance above referred to took place in one of seven foundries all working under the same management.

The mixture in use in these foundries may have been approximately as follows: Pig Iron, 200 lbs.; Stove Plate Scrap, 800 lbs.; Steel, 225 lbs.; Shop Scrap, and Sprues, 375 lbs.

The writer was foundry superintendent of one of the seven plants mentioned. We had no chemist, but had a man devote most of his time looking after the cupola gang, and test bars. The practice in all of these seven foundries was to cast a test bar from each tap from cupola, or track ladle. We were very successful in having our test bars show an even depth of chill; the credit of which was entirely due to the manner the iron was charged, and tapped from the cupola. Our heats in weight were from 25 to 30 tons per day. Our general superintendent on one of his periodical visits asked the writer how we were able to get our mixtures to "run" so regular; whereas, at several of their other foundries employing chemists to look after the mixtures, he stated, the results obtained were very unsatisfactory.

The point I wish to make is simply this: That mixing iron in the cupola by analysis is just as much a hit-and-miss method to get desired results as good judgment is, unless the cupola is correctly managed.

And I venture to say even if we were all chemists and perfectly competent to mix iron by analysis we still would have troubles of our own.

Molders' Health and Proper Ventilation

Roof Ventilators Are Seldom Adequate, and if Suction Fans Are Substituted, the Atmosphere of the Foundry Should be Easily Kept Pure

By A. H. OBO

MOLDING, as a trade, has always been in a class by itself. Everybody respects a molder, partly because they think he is a high-salaried workman, and partially through sympathy for him on account of what he has to endure in the performance of his daily labors. They think he is well paid, for the reason that he would be insane to work at such a job unless he was. They sympathize with him because, from his general appearance, they consider him worked beyond the limit. What is there, now, about the molder's trade which is any more arduous or laborious than that of many other occupations? Take, for instance, the building trades. Notice the stooped attitude of the bricklayer when at his work; see the heavy lifting which a stonemason has to indulge in; and look at the ugly positions which a plasterer has to get into in plastering a ceiling. Take any trade and it has its unpleasant features, either working in inclement weather or undesirable hours, or uncomfortable surroundings of some kind. It seems quite reasonable to expect each and every workman, to whatever trade or craft he may belong, to think that he made the mistake of his life by not learning the other trade which he came within an ace of learning, but certain it is, that nobody has any regrets at not having learned molding. Now, as we have said, why is it? Each class of workman may have a certain ill-will towards his particular calling, but the molder, while bewailing his lot, has the whole community with him; they all think he made a mistake, although they respect him and sympathize with him. There is a screw loose somewhere, and, where is it? Molding in itself is one of the most interesting of occupations, combining, as it does, the artistic, the scientific and the mechanical faculties of the human structure. There are artists, and there are scientists, and there are mechanics, but in what field of usefulness are the three called into action to the extent that they are in the foundry? I, for one, have followed it up the best part of my days, and there is no work which I consider more interesting, yet I gave it up for the reason that I do not consider the average foundry a fit place for human habitation. The whole trouble in a nutshell is in the ventilation, or rather in the lack of ventilation and fresh air. No matter how modern the roof of a foundry is built, it is not sufficient to carry off the fumes which are generated at casting time. And this, added to the fact that a foundry is seldom as high as the surrounding buildings, thus causing the roof ventilators to be of practically no use, makes artificial means of drawing away the foul gases necessary. When metal iron is poured into a mold, it is not the heat of the iron or the labor of pouring it which knocks the molder out; it is the poisonous gas which forms the instant the iron strikes the mold, and unless this gas is carried away before it has time to circulate through the shop, it is bound to be breathed into the lungs of the workman, with the result that he is exhausted when he gets done, and quite frequently before he gets done. The fact that he leaves the shop in that condition would be bad enough if he had anything decent to come to next day, but invariably the foundryman has everything closed up tight as soon as the men are gone, thinking that he is saving heat, and when the molder comes in the morning he walks into this same atmosphere which he left the night before, and if it is a cold day outside, it is almost worse inside. It is next to impossible to heat a foundry, because there is no proper air to be heated. That burned out dioxide or die-whatever it is, will not support heat. Take a walk through a foundry with a lantern after it is closed for the night and see how the lantern acts. It will either go out or else splutter, as though it would like to, and yet men are supposed to use that material for breathing purposes. Take a look at the back of a floor which has not been used for a few days, and what do you see? Toad stools a foot high. Fungus growing on the wall, green mould on the floor. These are not signs of a healthy atmosphere. Now, what I propose is artificial suction similar to what is used for conveying shavings from the woodworking machinery, but a very much cheaper installation would suffice, as practically no piping would be required. If a suction fan is placed in each gable and good big draught holes with dampers are placed at intervals along the bottom of the wall, it should be possible to so regulate the atmosphere of the foundry at casting time, that it would be no different than at any other time. It would not be putting the men in a draught; on the contrary, it would be keeping them out of draughts. The purpose of the fans would be to create a vacuum, into which the smoke and gas would rise with a rush, and the bottom dampers could be opened at whatever points seemed most suitable. Smoke and gas being lighter than air will go up, but it goes slowly under ordinary conditions. If a partial vacuum is formed in the upper portion of the building, the smoke and gas will certainly rise and fill the vacancy ahead of the fresh air. By this means it would be possible to keep the shop actually cold during casting time, if so desired. I am confident that there is a good opening for some enterprising person to perfect some such a scheme as this. I am as sure as I ever was of anything that it is possible and practicable to so regulate the atmosphere of the foundry that a molder can pour off his day's work without sweating and without breathing any smoke or gas or dust, and when that time comes he will be able to see life as others do, and take an interest in the trade. The environments of the present-day foundry are not such as would encourage the molders to take an interest, and not such as would invite apprentices. In studying the problem of our future molders it is not civilized to figure on foreigners. Their health is as precious to them as ours is to us, and if the foundries are made fit to work in, we do not need foreigners. I would like to hear other opinions on this subject.

GOLDEN WEDDING

On March 4 last, Mr. and Mrs. David McIntosh of Stratford celebrated their golden wedding. Mr. McIntosh was born in Kirkcaldy, Fifeshire, Scotland, on February 21, 1841, but had spent most of his life in Canada. On March 4, 1869 he was married to Miss Isabella McKay, of East Zorra, near Woodstock, by whom he had a family of three sons and five daughters, who with their families were all able to gather once more under the parental roof on this joyous occasion. Mr. McIntosh was a moulder by trade and has for some years back been employed as foundry foreman at the C.P.R. shops in Montreal, although he has continued to make his home in Stratford. The CANADIAN FOUNDRYMAN takes pleasure in congratulating Mr. and Mrs. McIntosh on the happy event.

ELECTRIC LIGHT OVER ONE HUNDRED YEARS AGO

From "Smith's Panorama of the Arts and Sciences," published in Liverpool in the year 1815 we take the following:—

"If two persons, one standing upon an insulated stool, and communicating with the prime conductor, while the other stands upon the floor, hold in their hands plates of metal, in such a manner that the flat sides of the plates shall be opposite each other at the distance of about two inches; on strongly electrifying the insulated person, dense and frequent flashes of light will be observed between the plates, forming a kind of artificial lightning."

A "One Cast" Pattern and How It Was Made

When Only One Casting is Required it is up to the Pattern Maker to Devise Means of Making the Pattern, With the Least Amount of Expense, Even Though it Causes the Molder to Deviate Slightly From the Beaten Path

By F. A. McEWAN

THE accompanying drawing, Fig. 1, shows 3 views of a table used in supporting work on a radial drill, the slots being for strapping down. It is a job that makes the patternmaker wonder which of the several different ways of moulding would be the most suitable.

In studying out a question like this, the first rule to apply is—Try to get the finished working surfaces in the drag, the reason, of course, being to get them cleaner, better looking and closer grained.

The next thing is—How best to handle the inside or cope part.

One suggestion would be to print both ends, coring out the overhanging parts and coping out the part between the prints, but these prints would need to be so wide to take up the overhang, that there would be very little space left between.

Another suggestion would be to make a box pattern and a core box for the whole of the inside, and the core would either be tied up in the cope or set on chaplets. This would have been the best if it was a standard job, but there were only a few castings wanted, so we wished to get the pattern cast down to the lowest point. We finally decided to make a core out of the inside of the pattern, to pace this core in the pattern, and tie it up to the cope.

Since a core will not go back into the box out of which it is made, we put thin pieces round the sides to reduce the core, besides pinning the strips which leave the metal round the T slots.

At A. in Fig. 2, is shown the core print for coring the slot on the edge, and we used the same slot core box for this as for the others by deepening it sufficiently to suit the print. After this core was laid in place we used a make up strip to fill in above, to the joint of the mold. This method, while being familiar to most, may be new to some, especially of the younger ones, and may serve to broaden their ideas and make for increased efficiency.

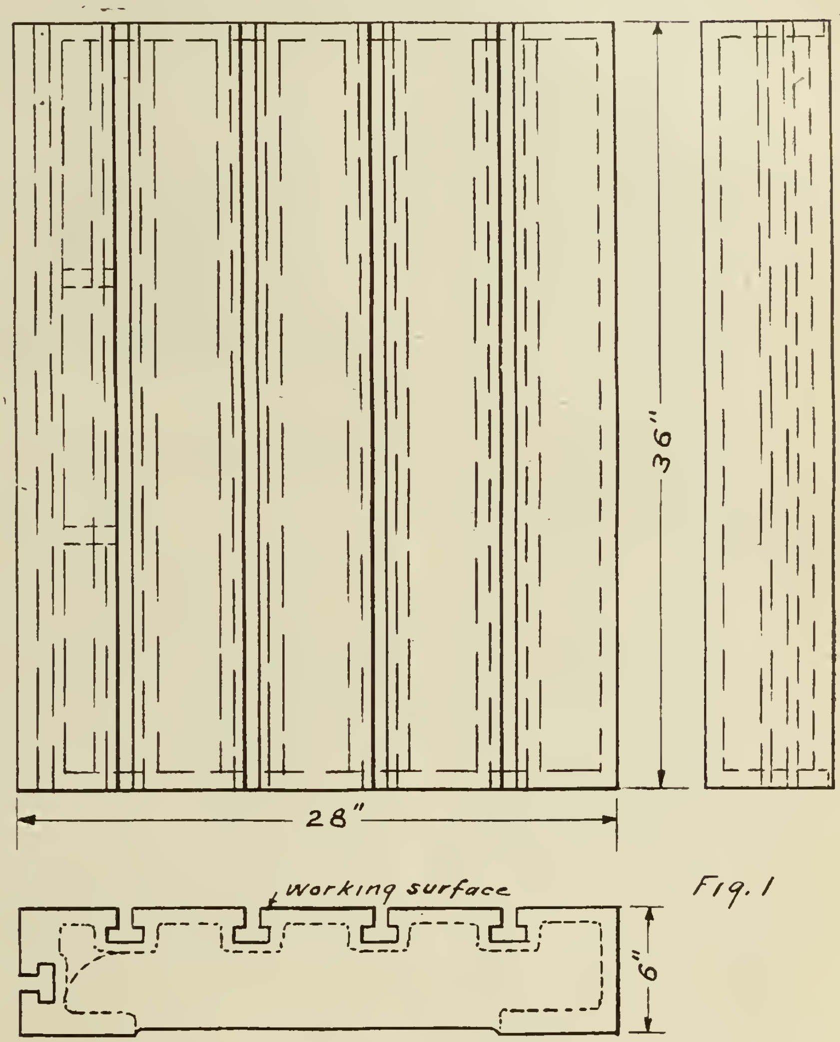


Fig. 1

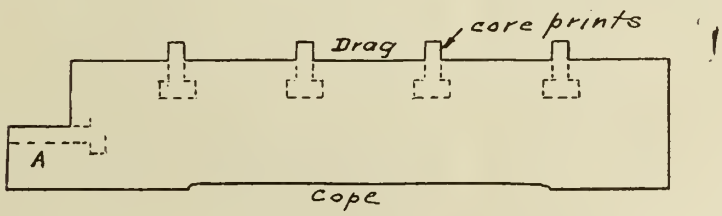


Fig. 2

PATTERN MAKING

Patternmakers may be considered as toolmakers for the foundry, and as the so-called toolmaker needs to understand the machinist's art in all of its details, so the patternmaker, to be of any real use, must understand the moulder's trade, in order to make the special tools or patterns without which no castings could be produced. He should not only be competent to produce patterns for staple goods, but most continually be making new articles, or old ones in a new form.

To this end he must be able to read mechanical drawings, and he is, in fact, constantly expected to read so-called drawings which are far from being mechanical.

Foundry Sold.—Mr. W. B. Cochrane of Vienna has purchased the Tilsonburg foundry and machine shop, which has been closed for several months. He is now putting it in shape and will re-open next week. Mr. Cochrane served his time with the late H. F. McCrae and is therefore familiar with both the shop and territory. He purposes doing a general line of repair work and castings, and will employ a staff to meet requirements of the business.

Practical Hints for the Brass Founder

THE THERMOMETER

The word "Thermometer" is a combination of two words, thermo being taken from the Greek word "Thermos," meaning "heat," and meter is a measure. A thermometer is therefore a heat measure, or, more properly speaking, an instrument for measuring intensity of heat, or temperature, by means of expansion of a liquid or gas. Mercury is generally employed, and an ordinary thermometer consists of a spherical or cylindrical glass bulb at the end of a very fine tube, the bulb being completely filled, and the tube partly filled, with mercury, whilst the space above the mercury contains only a small quantity of mercury vapor, which offers no resistance to the expansion of the mercury. A rise in temperature, which simply means that the atmosphere or air has absorbed more heat, is indicated by a rise of the mercury in the tube, owing to expansion, and conversely a fall of temperature is indicated by a fall of mercury in the tube.

A graduated scale is attached with two fixed points: the lower, or freezing point, and the upper, or boiling point of water. The distance between the two fixed points is then divided into a certain number of equal parts or degrees, which are continued above and below the two fixed points. On the Celsius or Centigrade thermometer (used by scientific men everywhere, and in general use in Continental Europe), the distance between the two points is divided into 100 degrees, the freezing point being 0° and the boiling point 100°; on the Fahrenheit thermometer (used in England and America) the distance is divided into 180 derees. With the Fahrenheit thermometer the boiling point would therefore be 180° above the freezing point, but since zero or 0° is not at the freezing point, but is 32° below at the point where salt water freezes, the boiling point is 212° above zero. The two systems make it very confusing to one not accustomed to both. In this country everyone is familiar with the Fahrenheit thermometer, but occasionally a scientific article appears where the centigrade degree is used, being marked °C, and before it can be understood by the ordinary Canadian layman it has to be translated into Fah. To do this it is simply required to multiply the number of centigrade degrees by 9 and divide the result by 5 and add 32. This will be understood because 100 degrees C = 180 degrees Fah. A degree Fah. is therefore one hundred, one hundred and eightieth, or five-ninths of a degree C., and vice versa, a degree C is nine-fifths of a degree F. If the temperature is 100°C we multiply it by nine-fifths, which makes it 180° Fah. above the freezing point or centigrade zero, and by adding the 32° we make it 212° Fah. above the Fahrenheit zero.

A peculiar coincidence in connection with the two systems is that 40° below zero means the same thing no matter which scale is used. Let us figure it out:

$$40^\circ \text{ C.} = 40 \times \frac{9}{5} = 72^\circ \text{ Fahr.}$$

Thus—
40° C. = 72° Fahr. below the freezing point, or 72° - 32° below the Fahr. zero, bering in mind that 40° C. below zero means 40° C. below the freezing point, which is the centigrade zero.

Centigrade is taken from centum, meaning 100 and grade relating to the graded or graduated scale. Fahrenheit is the name of the man who originated that system.

PECULIARITIES OF THE METALS

Metals, particularly the rare and precious ones, and we might even include the baser ones, have many peculiar and interesting characteristics, and differ greatly in their chemical properties, and also in their specific gravity and the temperature at which they may be melted. Quicksilver, for instance, requires a temperature of 40° below zero, otherwise it remains in a melted state, while platinum, on the other hand, is so opposed to being melted that it will resist the strongest heat of the forge-fire: the electric current, however, or the blow pipe will melt it.

The metal lithium is so light that it will float on top of any liquid, being approximately half the weight of water, while platinum already spoken of, is 21.53 times as heavy as water and some 40 times as heavy as lithium.

Platinum

Platinum is an interesting metal. It is not only the heaviest of the metals, but is the heaviest known substance (osmium and iridium being practically the same weight). While it has been shown that it is possible to melt it, it is almost a non-absorbent of heat. Under the electric spark it will appear to be red hot and ready to fall to pieces, but instantly the current is turned off the platinum not only loses its redness, but is actually cold.

It being so infusible a metal a certain amount of wonderment is in order as to how it is reduced from the ore to the commercial state. The ore is treated with nitromuriatic acid, which dissolves it. Pure forged platinum takes on a high lustre, is nearly as white as silver, and very ductile and malleable. It is unalterable in the air, and has a strong resistance to heat. It dissolves slowly in nitromuriatic acid, but is not attacked by any single acid. Its properties render it extremely useful to the chemist for the construction of crucibles, evaporating dishes, and stills used in the concentration of oil of vitriol.

While platinum, osmium and iridium are rare metals, it is not difficult to believe most any thing about them, but it is more difficult to realize that gold is almost the same weight, being approximately twice as heavy as lead and two and a half times as heavy as iron.

Gold

Gold is a metal of bright yellow color, but forms a green fluid when melted. It is very ductile; a grain of it can be drawn into a wire 500 feet long, and will gild two miles of fine silver wire. It is also a very malleable metal; one grain can be beaten out to 57 square inches. Gold leaf, such as is used for decorative purposes is so thin that 280,000 are required to make one inch in thickness. If gold leaf is attached to a pane of glass the light which passes through it will be green.

PHOSPHORUS AND PHOSPHOR BRONZE

Phosphor Bronze is an alloy of copper and tin with generally less than one per cent. of phosphorus.

Phosphorus is not a metal, but is a very active chemical element, usually made from bone-ash. It is a deadly poison. It has such an affinity for oxygen of the air that in its pure state it must be kept under water, otherwise it will take fire. It forms the principal substance used in making the heads of matches. Its effect on the metals differs in different metals. Copper is the only metal which is much benefited by its use, although it has some effect on the tin. In mixtures of copper and tin the addition of one-half or even one-quarter of one per cent. of phosphorus has a remarkable effect of deoxidizing the copper and it apparently unites chemically with this metal, making it harder. It tends to make the tin crystalline in form, in which condition it unites more firmly with the copper. It acts as a flux, combining with any oxidized or burned impurities in the bath of metal and driving them to the top.

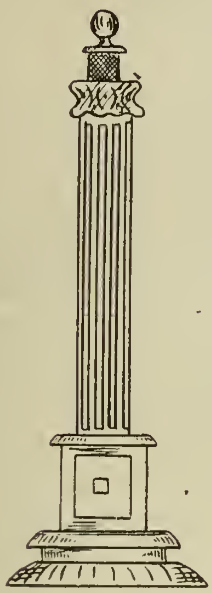
Phosphorus should not be used in nonferrous alloys other than copper and tin as it is not only useless, but positively injurious. Zinc acts as a deoxidizer to some extent, but if zinc and phosphorus are both introduced into the same mixture they work against each other and make a poorer mixture than if both had been omitted.

The International Casting Co., Sandwich, Ontario, have built a new and up-to-date foundry, equipped with every modern convenience for the production of castings.

The Ancient Moulder versus the Modern Moulder

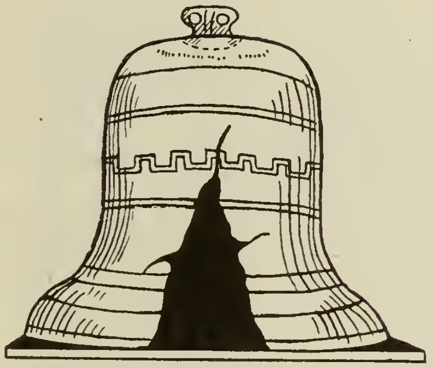
A Few Excerpts Taken From a Paper Read at the California Foundrymans' Association Banquet, August 14th, 1914

By JOHN HEDLEY



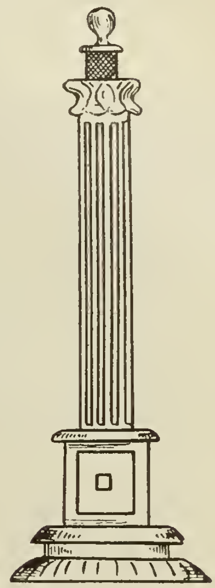
CAST ABOUT B.C. 1011. WEIGHT APPROXIMATELY 61 TONS.

And he set up the left pillar and called the name thereof "Boaz."



CAST A.D. 1733. WEIGHT APPROXIMATELY 220 TONS.

"The Kremlin Bell," commonly known as the "Great Bell of Moscow."



THE WEIGHT GIVEN DOES NOT INCLUDE THE BASE NOR CAPITOL.

And he set up the right pillar and called the name thereof "Jachin."

Our Wealth, Commerce, and Manufactures grow out of the skilled labor of men working in metal.—COBDEN.

THIS being the case it would appear that the molder or founder has been a very important and useful factor in all that appertains to the building of mechanical devices of all kinds, for, the first essential of almost any machine, whether of iron, steel or brass, is a staunch sound casting, but the molder or foundryman has never to the best of my belief been shown in print as he really exists, except in very ancient and remote times, when he appears to have been highly esteemed.

The first worker in metals of which we have any record is the Scriptures—Genesis 4th—by the name of "Tubal Cain," B.C. 3875, who taught all artificers in brass and iron, but nothing has come down to us by which we can judge of the class of work which he did.

But we do know that the Phoenicians were the earliest navigators, inventors and mechanics of those days, more especially in the working of bronze, the tin for which metal they went as far as what is now Cornwall, Great Britain; this was done in prehistoric times. The Egyptians also had a high and ancient civilization and knew the art of casting statues of men and animals 3,000 years before the Christian Era; these works were cast hollow, thus showing a high degree of skill on the part of the founder.

The first definite account of work of this kind is in the description of the building of King Solomon's Temple in the 1st Book of Kings, 7th Chapter; also 2nd Book of Chronicles, 2nd Chapter, wherein it is set forth that King Solomon sent to Hiram, King of Tyre (the chief city of Phoenicia aforementioned) for a suitable superintendent to take charge of the skilled workmen gathered together by his father, King David, and the great works in connection with the building of the Temple, who sent him Hiram Abif, who in the language of Scripture was a worker in brass and was filled with wisdom and understanding and cunning to work all works in brass and iron.

The size and character of certain large castings are shown very clearly and certainly called for great care and skill in the molding and pouring of the same.

Take the two columns in King Solomon's Temple—their height was 31 feet, diameter 7 feet, and 4 in. thick, which would make the weight about 60 tons; these columns were profusely ornamented in a manner which in itself called for a high degree of skill on the part of the molder. We read also, there was a Sea or Laver (we would call it a pan to-day) 17 feet diameter, 8½ feet deep and 4 in. thick. These pieces were all cast of bronze, because brass was not discovered till long after this period. This pan was supported on 12 brazen oxen and, like the columns, had a great amount of decoration on it. When a youngster I paid very little attention to the size of these great castings, but some years after, when I knew something about the numerous dangers and difficulties which beset a molder's attempts to make a decent casting, and found by personal experience quite a few of the thousand ways in which a casting may be lost, I began to think how these great tasks were accomplished. A full and complete account with a close description of those beautiful and valuable castings and sacred vessels, also the story of their destruction, is given in Jeremiah, 52nd Chapter.

What I believe to be the method of blowing the furnaces or cupolas, I first fell onto accidentally. This was in my youth in Australia while tramping through the bush as the wilderness is called there. I came across an abandoned mine which was again taken up by a company of Chinese and the blacksmith work was done by one of themselves, who used a pestle for a hammer and his bellows for blowing his fire were made of leather shaped like a sugar loaf, with a wooden bottom and ordinary valve with a handle on top, and with two of these alternately lifting and pressing he kept a steady blast on his fire through a little pipe from each bellows. The Egyptians had bellows similar to this, but used their feet instead of their hands. Also, I recollect reading about an explorer in Darkest Africa who saw a negro cast a steel bell and the description of the bellows was identical with that I had seen in the bush in Australia. The negro blew all his steel down in his cupola and then let it run into the mold and according to the explorer, made a bell with a good tone.

As the Chinese claim to have made no changes whatever in their civilization for two thousand years, it is likely enough that for two thousand years before that the same kind of bellows were in use, so it can be assumed that Hiram of Tyre used just such bellows as these for his furnace work, and as we are told that he had eighty thousand skilled workers in the quarries and elsewhere and seventy-five thousand helpers, it would have been just a holiday for a few thousand to come and work a lot of bellows of this kind when a large piece was cast, melting the metal in several furnaces and gathering it all in one large tank and tapping it direct into the mold.

How he managed to lift such large copes and cores is to me a mystery to this day, but the same power that could lift those immense blocks of stone in the Pyramids and other ancient buildings would certainly suffice for him.

Besides these castings there was an immense quantity of other intricate and difficult founders' work done at the same time, which speaks very highly for the skill of our ancient brethren, especially of that wizard Hiram. Another renowned piece of work was the Colossus of Rhodes, a huge bronze figure 122 feet high or thereabouts, who straddled the mouth of the harbor and was large enough for the ships of that age to pass under him. He was cast in sections. He died young, as an earthquake shook him down and he was never put up again.

In Kara, Japan, there is a colossal statue of Buddha. The casting of this wonderful piece of work was accomplished after eight failures in the year 749 by Takusho, an artist of Korea. The height of the figure is 55 feet, the face is 13 feet long, the ears 8 feet long, the nose 3 feet, and the great halo around the head has a diameter of 80 feet.

At the same place there is also a bell, cast in the year 732, which is 13½ feet high and 9 feet in diameter, weighing 37 tons.

The next piece of some time back is the great bell of Pekin, nearly sixty tons in weight; also of a comparatively recent date is the bell of Moscow of 220 tons. This immense casting is cracked and lay in the ground for over a hundred years before it was raised to its present position. The crack was a double one, the piece that fell out weighs eleven tons; this is the doorway, and the bell is now used for a chapel. It is 20 feet in diameter, 19 feet and 6 inches high and 24 inches thick in the chime. This bell was cast by Boris Godonov. The bell now in use being the third effort and was raised to its present position by Nicholas I, in 1835. There is also another large Russian bell that is in daily use, weighing 123 tons, and is the largest bell in the world in use at the present time. Godonov was entitled to a good deal of credit for handling such a huge quantity of metal, for Russia, at that time did not appear to have had many skilled mechanics like those gathered at the building of King Solomon's Temple. The crack was caused by having too hard a core—a couple of cart-loads of sand bricks would have saved it.

It has one advantage over those old Jewish castings, seeing that the bell will last likely to the end of time, while the Temple pieces were broken up by Nebuchadnezzar when the Hebrews were taken captive and both people and metal taken to Babylon. No other European country seems to want much over 20 tons for a bell.

In the Tower of London, there came under the writer's notice some Hindoo bronze cannon; spoils of war, with raised filigree work all over them, thus showing considerable skill on the part of those Oriental molders. There is also a large cannon 17 2-3 feet long and weighing 19½ tons, in Moscow, cast of bronze profusely and beautifully decorated with raised filigree work. It is called the Czar's Cannon.

In Moscow at the present time there is considerable work done in "lost wax" (Cire Perdu) of a highly artistic nature. This work is done in basements and cellars, and is usually vases, horses, and animals, etc.

To come down to our own times and cast iron, the earliest record for casting the same was in England in the manufacture of pipe in 1610 or 1670. The Germans claim nearly 100 years further back than that. It is said there is a cast iron column in Delhi cast 1,100 years ago. Very likely cast iron has been in use much longer than that in China, and has grown to be of much importance in the world at present, but steel has made great inroads into the field ever since Bessemer's invention, which has completely changed the methods in building of machinery, ships, buildings, and so forth. But as there is still a great deal of it done by the founder, it fairly comes under the notice of this article. At first it was the Bronze Age, then the so-called Iron Age, and now it surely can be called the Steel Age. And in ancient times as now, the different metals have in the first instance been used as weapons or implements of offense or defense, so even Bessemer was trying to make an improved cannon when he blundered on the making of steel. It is on record that he first made one small cannon, but to the best of my belief, made no more, although Sir Joseph Whitworth, Krupp, and others followed up that line with great success, so it must be allowed that the Father of Modern Steel Makers was a great success, as all cannon are cast with steel at this time. Since Bessemer's invention great progress has been made in the making of both steel and iron and some of the modern plants would find little out of common in making such pieces as are mentioned here. As an example—I lately read an account of a steel works in Germany casting an anvil block in which three open-hearth furnaces and one cupola were used. The block weighed about 40 tons, was cast open and took 47 hours to pour and was kept alive with Thermit between taps. This way, I suppose, is good enough for an anvil block. In 1854, Mr. Ireland, the inventor of "centre blast" and double row of tuyeres, poured an anvil block 220 tons with two cupolas, 60 inches diameter inside, from start to finish 10 hours and 45 minutes. This was done at Bolton, Lancashire (good work)—but certainly would not do for those ancient castings mentioned heretofore, as the largest of them would only be a matter of a very few minutes in the pouring.

Would like at this present time to say a few words on the low grade of skill as shown by the average molder of today and why so few attain excellence. I think it is not altogether his own fault, but modern requirements call for castings to be duplicated, so a molder gets in a rut, where he has not to think up new ways and finally becomes unfit to cope with any unusual set of conditions with which he may be confronted.

The jar machine and squeezer reduce the necessary knowledge to outfit a molder, and where such tools are used a low grade of skill enables one to get along. Such workers never really become molders. The inference seems to be that as the years roll along the good molder becomes more scarce and valuable. Another factor in the case is the limitation of work by which the naturally fast and clever one is kept back enough to enable the inferior mechanic to keep up a set day's work, thus tending to kill the individuality of the better workman.

Another cause which tends to keep the average molder from advancing is the fact that he will get about the same wages as a better man because of the minimum wages; these two reasons I think will account in a great measure for the lack of skill of the average man.

Also the tendency in many shops when an apprentice gets a little useful is to keep him at same class of work, so having served out his time he is lacking in experience, thus adding to the list of incompetents.

It will be found in such shops where a good class of work is done and a pattern not used too frequently that the highest skill must be looked for, and it is there that the real foundryman will survive and transmit his knowledge and skill to others, for casting perhaps only only one piece a deal of economy and makeshift will be employed, which calls for the best efforts of the man engaged to make good, whereas,on the other hand, if it is decided to manufacture on a large scale, there is no stint in the rig and appliances if it will only enable them to produce such work cheaply and the skill of the molder cuts a smaller figure than a like job would in a shop with less facilities.

A tired captain descended the gangway stairs and addressed the terrified passengers huddled in the saloon of the storm-tossed vessel: "Friends," said he, "we have done all that sailors can do; all that men can do. We are now all in the hands of the Almighty." "Oh, captain," piteously cried a clergyman, "don't say it's as bad as that."

An Example of the Modern Molder's Handicraft

In Contradistinction to the Ancient Foundrymen, the Modern Molder and Founder is Called Upon to Do a Line of Work, Perhaps More Useful and Perhaps Not—War Destroyed the Ancient Columns and War Has Destroyed the Marine Engine

THE illustration herewith shown is that of a 68-inch bore by 45-inch stroke, lo wpressure cylinder for triple-expansion marine engine, molded and cast in the foundry of the Canada Machinery Corporation, Limited, Galt, Ont. This company has a thoroughly modern foundry in every respect. Their specialty. however, is wood and iron working machine tools, and in their own chosen line they have turned out some of the largest and most complicated castings ever made in any Canadian foundry. The workmen who do this class of molding are of necessity the type of workmen who can do any job which comes their way, while the material and equipment required for machine tools is right in line for heavy cylinders, etc.

During the progress of the war, when the excited public scanned eagerly the columns of the daily papers and learned of the terrible destruction caused to the Allied shipping by the ravages of the U-boats, the main cause of anxiety was whether or not new ships could be built fast enough to cope with the destruction, but few thoughts were given to the fact that each ship contained a ponderous engine, and that each engine had several cylinders. However, such is the case, and while the U-boats have ceased to be a menace, these cylinders will continue to be in evidence in foundries capable of handling them for some time to come, before the wastage has been made good.

There are several ways in which a large cylinder can be made; some prefer to mold them on end, while others mold them on their side. The main thing is to get a clean, sound casting, with the main core properly centred and all cores so secured that the casting is of the proper thickness everywhere. Each method has its advantages and disadvantages.

As will be seen by the markings on the casting, this one was molded on its side.

Galt is particularly favored in regard to foundries doing pit work, for the reason that "It is founded on a rock," which is to say, that the rock comes to the surface, and a pit quarried out of the floor makes a mold as solid as Gibraltar. To mold the cylinder shown here, one half is in the floor and the other half is in a heavy iron cope. The mold is made in dry sand and gated near the bottom and poured with one ladle. This casting is of semi-steel, and weighs 14,200 pounds. The two sand-artists shown in and aoout it are the ones to whom the success of the molding operation is due.

14,200 LB. SEMI-STEEL MARINE CYLINDER, MADE BY THE CANADA MACHINERY CORPORATION, LIMITED, GALT, ONT.

Another Example of Modern Work

This is a Pretty Good-sized Piece to Be Cast in a Chill Without Checking

ON the following page will be seen another example of modern foundry work which would probably be something of a surprise to the ancient molder if he could but pay us a short visit. While he could give us some light on how he handled those big castings in his day, we might give him a few pointers on how we do things which they did not understand in his time. For instance, we might give him a scholarship in McLain's System of Melting and Mixing Iron and Semi-Steel, etc.

Before proceeding, we might say that practically the entire world's supply of asbestos is mined and prepared for the market by The Asbestos Corporation of Canada, Limited, Thetford Mines, Quebec. It is taken from the ground in the form of rock and requires to be crushed. To do this requires powerful crushing rolls. To avoid discarding the entire roll with its accompanying mechanism when worn, the roll is provided with a tire, which is removed and replaced by a new one when required. These machines were originally equipped with manganese steel tires. In the accompanying sketch is a cast iron, or more properly speaking, a semi-steel tire cast at the works of the Asbestos Foundry Company, Ltd., of Thetford Mines. The requirements of these tires are, that they stand as long as the manganese tires which came with the machine. Some of the tires supplied by this company have already been in use longer than the original ones and are still doing good service. This foundry is very well equipped, especially for chilled castings; the management having had long experience in this line of work.

These rolls are chilled 3½ inches deep on the face, and the back requires to be soft enough to machine. They are made from ordinary cast iron mixed with steel scrap and ferro-manganese on special cast iron chills, and poured in the ordinary way. After the casting has set the chills are taken off and the hot casting is buried in the pit for several days to cool. There has never been a single chill crack and the body of the casting has always been soft enough to machine without the least trouble.

From the information we had from the superintendent of the Asbestos Corporation they have a roll which has been working for over six months twenty hours a day, which is a very good record for a chilled casting.

AN INTERESTING CHILLED CAST IRON ROLL TIRE, 79 IN. DIA., 20 IN. FACE, 7 IN. THICK, 7,625 LBS. CAST BY THE ASBESTOS FDRY. CO., INC., THETFORD MINES, QUE.

FOUNDRYMEN'S CONVENTION ANNOUNCEMENT

Philadelphia, the birthplace of the American Foundrymen's Association, has been selected as the place of the 1919 Convention and Exhibit, and the week of September 29 will be the time. This announcement, we are sure, will be gratifying to members and especially to those who attended the first meeting in Philadelphia, June, 1896, when the association was organized, and also to those who attended the second meeting in 1907 and recall the generous hospitality of the Philadelphia foundrymen at that time.

Points of Interest

Many things of interest to foundrymen have been constructed and developed in the Philadelphia district since the last meeting in that city, including the great plant at Hog Island, the new foundries at League Island Navy Yard, and of the great foundries of the Westinghouse Company at Essington. Details of the programme, hotel headquarters and arrangements will be announced later.

International Meeting

With the selection of an Eastern city it is the plan of the officers to make this occasion on international affair. Invitations will be extended to foundrymen and industrial engineers generally in England, France, Belgium, Italy and other European countries, South American countries and Australia to attend this convention, since the time seems unusually opportune for holding a meeting of international scope.

Make Arrangements Early

It is none too early to make arrangements now for attending what will be, without doubt, the greatest Foundrymen's Convention of all times. Mark the dates, September 29 to October 4, on your calendar. A list of hotels and rates will be furnished soon and a committee of local foundrymen is already being organized whose function it will be to see that you are comfortably taken care of.

The Program

The officers of the Association want every member to consider himself personally appointed an unofficial member of the Papers Committee and to assist in securing good material for the technical programme. There are subjects which you can discuss and prepare papers on. Subjects which you want to hear discussed. The Papers Committee want this information from you. A blank for this purpose will be furnished with an addressed return envelope. Note the date printed thereon — "not later than April 15, 1919."

The committee will especially appreciate it if you will furnish them with the names of persons qualified to write on any particular subject. Do it now.

The Exhibits

The exhibits will be located in one of the buildings of the Commercial Museum, where larger and more satisfactory accommodation will be provided than has ever been had before. The fact that they are no longer subject to war conditions, which have handicapped the Department of Exhibits for the past three years, and with a building at their disposal that excels any previously used, the greatest of all exhibits can be looked for.

Change of Address

Your attention is called to the fact that the executive offices af tne American Foundrymen's Association are now located at 1401 Harris Trust Bldg., 111 West Monroe St., Chicago. All communications for the Secretary-Treasurer should be addressed there, and a cordial invitation is extended to you to visit their offices whenever he or any of his associates can be of service to you. Mr. C. E. Hoyt is the Secretary-Treasurer.

PRIZE ESSAY CONTEST IN INDUSTRIAL ECONOMICS

THE NATIONAL INDUSTRIAL CONFERENCE BOARD OFFERS

A PRIZE OF ONE THOUSAND DOLLARS
For the best monograph on any one of the following subjects:

1. A practicable plan for representation of workers in determining conditions of work and for prevention of industrial disputes.
2. The major causes of unemployment and how to minimize them.
3. How can efficiency of workers be so increased as to make high wage rates economically practicable?
4. Should the State interfere in the determination of wage rates?
5. Should rates of wages be definitely based on the cost of living?
6. How can present systems of wage payments be so perfected and supplemented as to be most conducive to individual efficiency and to the contentment of workers?
7. The closed union shop versus the open shop: their social and economical value compared.
8. Should trade unions and employers' associations be made legally responsible?

The Committee of Award is composed of: Frederick P. Fish, of Fish, Richardson & Neave, Boston, Mass., Chairman of the National Industrial Conference Board.

Dr. Jacob Gould Schurman, President Cornell University, Ithaca, N. Y

Henry R. Towne, Chairman Yale & Towne Manufacturing Co., New York City.

The contest is open without restriction to all persons except those who are members of or identified with the National Industrial Conference Board.

Contestants are not limited to papers of any length, but they should not be unduly expanded. Especial weight will be given to English and to skill in exposition.

The copyright of the prize manuscript, with all publication rights, will be vested in the National Industrial Conference Board.

Each competitor should sign his manuscript with an assumed name, sending his true name and address in a "sealed" envelope superscribed with his assumed name. No manuscript will be accepted the real authorship of which is disclosed when the manuscript is received by the Board, nor any which has been previously published in any way.

Manuscripts, to be considered in the contest, must be mailed on or before July 1, 1919 to the National Industrial Conference Board, 15 Beacon Street, Boston, Massachusetts, marked "For Prize Essay Contest in Industrial Economics."

The right to reject any and all manuscripts is reserved. The Board may, however, award honorable mention to several manuscripts and arrange for their publication in full or in part, at compensation to be agreed upon between the Board and the authors.

National Industrial Conference Board.

By Magnus W. Alexander, Managing Director, Boston, 15 Beacon Street, February 8, 1918.

SILICA BRICKS FROM OPEN-HEARTH FURNACES

By Mark Meredith

The results of an examination of bricks that have served in the arches of open-hearth furnaces is interesting, and the bricks examined had four distinct zones, viz.:

A.—The lower part, which had been in immediate contact with the flames, had a glazed surface with occasional protuberances or stalactites, indicating partial fusion. The fracture was light grey in color, and perfectly homogeneous in aspect though sometimes studded with bubbles.

B.—The adjacent zone, usually with a very clear line of demarcation, was black or very dark grey in color, equally homogeneous, and of considerable hardness.

C.—A transition zone, frequently appearing in the form of white spots in the middle of the black zone, and representing large initial grains of quartz which had not been completely absorbed. In other cases the black ground gave place to light brown, the original brick here appeared to have simply been impregnated with a fused brown substance.

D.—The topmost zone did not reveal any changes. Under the microscope and by polarized light, thin sections showed in zone B, large and very transparent tridymite crystals, the space between them being filled up with an opaque black matrix. In zone A the tridymite had fused, and the large crystals had been replaced by globules embedded in, but not intermixed with the opaque black constituent. In cooling, the fused tridymite was transformed into crystobalite, and in some places refrangible patches of ill-formed tridymite could be observed.

In the sections from zone C, large crystals of tridymite were also found, but gradually diminishing in size and number towards the less heated parts of the brick till in the D zone the structure was normal, as in the original bricks.

From analyses of the different zones it appears that zones A and B contain very varying and often considerable quantities of iron in various stages of oxidation, though approximating closely Fe_2O_3. The black ferruginous constituent, which does not mix with the silica in the fused portion of A, is drawn up by capillary attraction between the tridymite crystals of B. It is also probable that the lime in the brick ascends similarly in the form of a fusible silicate which impregnates zone C at the expense of the lower zones (in acid furnaces). The grey and black appearance of zone A and B has no connection with the iron content but is accounted for by the high transparency of the tridymite crystals, whilst the indefinite structure of the silicon A renders it translucent.

It is noteworthy that, as proved by direct experiment, the fusibility of the bricks is not appreciably modified by the very high proportions of iron oxide, hence the excellent behaviour of even the most strongly impregnated bricks at high temperatures.

METAL TRADES UNITE ON GENERAL SCHEDULE

For the First Time in Toronto's Labor and Industrial History

The employers in the iron industry in the City of Toronto have received from the Metal Trades Council a schedule of wages and conditions, with the request that they be put in operation by the 1st of May. This is the first time in the history of the City of Toronto that the unions have combined upon a general schedule of conditions. The unions included are pattern-makers, molders and core-makers, electrical workers, boiler-makers, machinists, blacksmiths and kindred trades. Over 6,000 men are involved, and it is stated by an employer that over 150 employers in the city have been notified. The combination of trades request an 8-hour day or a 44-hour week; overtime in excess of this at the rate of double time; triple time to be paid on all Sundays and legal holidays; night work to be paid at ten cents per hour over day work; no discrimination against shop committees, and it is requested that all employees shall be members of recognized trade unions.

The rates of pay requested are set out in the schedule as follows:

"Pattern makers, 90c per hour; electrical workers, 80c; molders and coremakers, 75c; sheet metal workers, 75c; metal polishers, 60c; plumbers, 80c; plumbers' helpers, 54c.

Boilermakers: layer out and flanger, 86c; boilermakers, 80c; machine hands, 68c; flangers' fire heater, 64c; helpers and rivet heaters, 60c.

Blacksmiths: Heavy forgers, $1.48; heater for heavy forge, 76c; helper for heavy forge, 68c; second forger, $1.25; helper on second forge, 68c.

Operators now at the trade shall receive 55, 65 and 70 cents per hour for first, second, third and fourth years respectively. No operators shall be taken on after December 31, 1918, and those already in the trade shall receive the minimum rate for machinists after four years' service as operators.

RETURNS FROM EUROPEAN TRIP

W. J. Austin, general manager of The Austin Company, Industrial Engineers and Builders, Cleveland, Ohio, has just returned after spending three months in France, Belgium and England.

Mr. Austin in company with J. K. Gannett, export sales manager of The Austin Company, sailed from New York City on December 5th, landing at Bordeaux after an eight-day trip.

While in Europe, Mr. Austin and Mr. Gannett interviewed many leaders of industry in various foreign countries, and return with a very comprehensive understanding of the prospective building business in Europe.

For a considerable time, Mr. Austin and party, which included Alvin T. Ful-

HERE IS ONE RIGHT TO THE POINT

Editor, Canadian Foundryman

To be frank with you, we like your paper. One thing we like about it is that it is small, and in this way we get the chance to read everything that is in it, and what is there is of importance.

A great many of the magazines three times as large as yours are filled with stuff that is a waste of time to read, and in that way small items that are worth while are missed.

Yours truly,

LUNENBURG FOUNDRY CO., LTD.

ler, member of Congress from New England, were guests of the British Government and were treated to a thousand-mile trip over the battlefields, so recently the scene of terrible activity.

Mr. Austin describes graphically part of his motor trip as follows:

"Leaving Bapaume, we headed for Cambrai, a short distance away across the Hindenburg Line. You might well imagine that to move the Line was a difficult task. There were row upon row of barbed wire entanglements, trench after trench, and in the road great mine craters which the Germans had blown up on leaving. Evidences of fighting were numerous indeed. The ground was completely torn up with shell-holes and the dugouts still remaining were pretty much shattered, excepting some of the deep ones and the great amount of material of all kinds, including tanks, shell cases, unused shells, sheet iron and corrugated iron, railway cars, parts of wagons and all the junk of war, gave evidences of the vast destruction which had taken place.

"Let me tell you that a battle ground is one of the most repulsive looking sights that you can imagine. The ruin is indescribably ugly, and the best description I can give is of a vast dump on which, for years and years, have been thrown the refuse of a city, with timbers, much old iron, rusty old wire, old wheels, parts of tanks, thousands of shell-cases, old cloth, shattered boxes, thousands of petrol tins, and all in a state of destruction which is hard to imagine. The iron is rusty, the wood is splintered, the barbed wire entanglements are masses of twisted wire, and here and there are pieces of furniture and parts of houses which tell you that this was a home and in it people lived."

When at Amiens, Mr. Austin had the pleasure of dining at the restaurant, "Aux Huitres," which translated means, "To the Oysters." This was the favorite eating place of Sir Douglas Haig. The party crossed the Hindenburg Line several times, climbed Vimy Ridge, where the Canadian soldiers won immortal fame, visited Lens, Lille, and thoroughly inspected the great factory district round about Roubaix. For six days the most interesting and at times gruesome territory was visited, the party returning at the end of that time to Paris, after having traveled more than a thousand miles.

Questions and Answers

Editor CANADIAN FOUNDRYMAN.—

Gentlemen:—Please give instructions how to keep a core from becoming petrified in the casting.

We have considerable trouble in the making of heavy steel castings to get 2, 2½ and 3 in. cores to stand up under the intense heat. We have made several castings with these holes in them and have considerable trouble to get the cores out, as they seem to melt and become so hard that it requires a lot of work to clean them out. Please give a formula for the same.

We are now using the following:

30 shovels new high silicon sand.
4 shovels old high silicon sand.
2 quarts rosin.

Would you advise using heavy rods to support the above size core?

We give all cores a good silica flour wash at all times.

Yours truly,
A CORE MAKER.

Answer.—Presumably your high silicon sand is the regular white quartz sharp sand used for steel work; if so I would use as a binder, linseed oil and silicate of soda. Silicate of soda is an inexpensive material commonly known as water-glass, and will stand to be diluted with about eight times its bulk of water.

If the dry sand is mixed and tempered to the proper constituency with one-half linseed oil and one-half of the diluted water-glass, it should make a good core, although it depends to some extent on the nature of the sand and may take a little experimenting to get it just right.

Your wash is all right, but I would mix it with the water-glass and water.

Rods would not prevent the core from being fused or washed, but would, of course, strengthen the core if it is in a horizontal position.

Question.—We are having trouble with cores being hard and blowing. We are using a Wadsworth round core hand machine. We would be glad if you would give us the best mixture to use to obtain satisfactory results.

Answer.—A great deal depends on the nature of the sand, but with ordinary good material, six parts of sharp sand and one part of new molding sand, and one part of flour, well mixed and tempered with water and allowed to soak for at least a day to allow the flour to swell and become sticky. When about to be used, mix about 60 to 1 with linseed oil and stir it thoroughly through. There are other binders which may be used, but they should be of the paste variety in order to hold the sand in its green state. A point usually overlooked by core makers is that the good features in flour are greatly increased and the bad ones greatly decreased by mixing the sand a day in advance. When dry sand and flour are mixed and tempered with water and used at once, the flour has very little adhesive qualities, and as the core heats in the oven the steam expands the flour, with the result that the core is frequently cracked beyond repair and is invariably swelled out of shape. Flour sand cores are credited with always being larger than the core box, but this trouble can be almost entirely eliminated by expanding the flour in advance.

Question.—Will you explain to me the difference between fluorspar and ordinary limestone, or is there any difference? Is there any truth in the saying that it attacks the cupola lining?

Answer.—There is certainly very little resemblance between the two as regards appearances, but in their chemical analysis they are similar in one respect inasmuch as they are both composed chiefly of lime. Limestone is known in chemistry as carbonate of lime, while fluorspar is know as fluorid of calcium (calcium being the metallic basis of lime). Limestone is dead or opaque in appearance, while fluorspar is a mineral of beautiful colors and much used for ornamental purposes. It is the material of which the original myrrine vessels of the ancients were made. It commonly occurs in massive pieces but crystallizes in cubes and other fancy shapes. Limestone, when charged into the cupola melts into a thin slag and floats on top of the melted iron. As the iron melts it passes through this slag on its descent and the sticky slag contained in the melted iron unites with the melted lime and the iron is thereby to a certain extent purged of this undesirable material. Fuorspar, or fluorid of calcium, is also known as fusible spar; its chemical content is essentially lime and fluoric acid. A fair sample would analyze 57 per cent. lime, 16 per cent. fluoric acid, and 27 per cent. combined water. Fluoric acid is very powerful and will dissolve glass or flint or quartz, of which glass is made, and it will therefore be seen that sand of any kind would be an easy prey to it. When charged into the cupola it acts similar to limestone but makes a much thinner slag and penetrates deeper into the impurities in the iron, making a flux which is unsurpassed. But a flux containing an acid of this nature will certainly have a deleterious effect on the silex content of the cupola lining. This is its one drawback. If fluorspar is used in conjunction with limestone it improves the limestone slag and at the same time reduces the damaging effect of the fluoric acid. The quality of the work is to be considered, and if expensive castings are to be saved by its use the damage to the lining of the furnace is of secondary consideration.

Question.—Can you furnish me some information which will assist me in producing a bright gold deposit on cheap goods? These goods will not warrant the use of sufficient gold to permit burnishing, but a bright colored gold finish must be obtained. The product is highly polished before gilding and we have been using a 14 carat gold solution.

Answer.—A method which has proven very satisfactory for brightening gold deposits, and which, we believe was originated by a Mr. Bidet, is as follows: Prepare a concentrated solution of nickel sulphate and add sodium cyanide solution to it until the precipitation of nickel ceases. Wash the precipitate several times in both warm and cold water and then dissolve the precipitate in sodium cyanide; care must be taken to avoid an excess of cyanide, just enough being used to dissolve the precipitate and no more. This may be placed in wide-mouthed bottle and kept for future needs. To use, add ½ oz. of the solution of nickel cyanide to 1 gallon of your 14 carat gold solution and operate the gold solution as usual. Rinse well and dry by means of clean boxwood sawdust or strong blast of compressed air. Small additions of the nickel solution may be necessary occasionally.

PRESTON IS ALL RIGHT

The four foundries doing business in Preston are not in a position to complain. The Machinery Corporation which was putting the weight of its ability into the manufacture of munition machinery received a sudden slackening off as a result of the signing of the armistice and have not as yet got down to quite normal, but are keeping on the move.

The Clare Brothers Co. are running some seventy molders and other men in proportion on stoves, furnaces and radiators but are not as busy as they would have been if the winter had been more severe and coal more accessible, and the price of raw material a little more stable, but still, seventy molders can do quite a lot of work.

The C. B. Shantz Foundry, manufacturers of furnaces and factory trucks is working to full capacity and finding a good market.

The Electric Fittings and Foundry Co. are very busy and contemplate a considerable extension to their foundry in the near future. They are turning out a class of castings heretofore considered out of the reach of the Canadian foundries.

GUELPH IS NOT SLACK

The International Malleable Co. are not quite as busy as they might be although they are busy in the pipe fitting department, of which they make a specialty in both malleable and grey iron.

The Guelph Stove Company is as busy as a stove company could expect to be after a winter such as has just past, but are not complaining.

The Gilson Manufacturing Co., manufacturers of gas and gasoline engines, tractors, and various other articles of a similar nature, are running full blast and finding lots of business, and as a consequence are working six full days per week.

The Taylor-Forbes Co., Crowe's Iron Works Co., Thomas Griffin Co., and the White Sewing Machine Co., are all running to capacity.

KITCHENER'S FOUNDRY

Kitchener cannot be spoken of as a great foundry centre. Almost every other line of business seems to be in evidence to a greater extent than that of the foundry, but what foundries are there are abundantly busy. The rubber tire business is one of Kitchener's best and is also one which calls for a lot of castings in the way of molds or dies in which to make the tires, with the result that the Philip Gies Foundry is so busy that the manager wishes that they had more room. Every floor is working to the limit.

The Jackson and Cochrane Co. manufacture wood-working machinery and employ mostly machinists, but they make their own castings and seem to be busy enough.

The Canadian Blower and Forge Co. have just engaged a new foundry foreman in the person of Mr. of Toronto, and are preparing for a busy season.

MERRITTON FOUNDRY IS BUSY

The James Wilson Foundry is very busy. The proximity of the paper and other mills in the neighborhood keep them busy at all times.

ST. CATHARINES

The Yale and Towne Co., manufacturers of locks, etc., got low in stock on account of doing munition work, and are as a consequence very busy with their regular line.

Steel Radiation manufacture mostly heating appliances, and like others in this line could do considerable more business, but are running a good force of hands.

Engineering and Machinery are doing marine engine work and are busy. The other shops about the city are finding work to do.

DUNNVILLE

Mr. H. L. Spence, manager of the Standard Foundry, manufacturers of high-grade grey-iron and semi-steel castings, reports business "not too bad," but not so rushing as during the war, which would indicate that while they are not complaining, they could fill orders in larger numbers.

The Canadian Engines, Limited, are not busy since the signing of the armistice, having neglected their own business in order to help win the war, but expect to do something before long.

The Canadian Car and Foundry Co., Montreal, intends building a five-storey office building on Craig St., near St. Genevieve St. Architect D. I. Spence. Tenders are being called. Approximate cost, $110,000.

The Brantford Vibrator, Sprayer and Accessories, manufactured by the Malleable Iron Fittings Company, Brantford, Conn., are now handled by the Dominion Foundry Supply Company, Montreal and Toronto.

Seth Woodbury was a tightfisted, hard-hearted old farmer. His brother William having died—the neighbors said from lack of proper treatment—Seth hitched up and drove into town to have a notice about his death inserted in the weekly newspaper.

"There ain't no charges, be there?" he asked anxiously. "Oh yes, indeed," answered the advertising manager; "our price is $1 per inch." "Cracky," muttered the old man, "an' Bill six foot two."

DILLON CRUCIBLE ALLOYS NOW WORKING AT WELLAND—TURN OUT FINE PRODUCT

WELLAND TELEGRAPH: — Dillon Crucible Alloys, Limited, which recently began operations in Welland, having purchased the Quality Beds property, and having erected a number of new buildings, is now employing fifty high-class men and turning out two tons of high speed and carbon steel every day.

The building erected were: A milling or furnace building 80 x 120 feet; a hammer shop 80 x 160 feet, all steel, fireproof buildings. The original buildings are used for the annealing process and warehousing. These buildings and plant cost over $200,000.

The men behind this industry are:

President and general manager, T. J. Dillon of Welland.

Vice-pres., E. Darte of Electro Metals, Welland.

Secretary and Treasurer, F. C. Hesch of Canada Forge of Welland.

Assistant Secretary, R. A. Gordon, Lieut. 98th Bn., C.E.F.

Director, Chas. McGhie, St. Catharines; J. T. Dillon, Buffalo, N.Y.

This steel product is used for metal cutting. It is made into tools of all kinds, chisels, for instance The writer was shown a solid piece of steel through which had been driven one of the Dillon Crucible chisels and it was still sharp when the point protruded. It is made into mining drills, knives, and cutlery where strength and keenness of edge is required.

The raw materials used are purest charcoal, iron and refined alloys. This charge is placed in crucible pots made of plumbago, each pot containing about 90 lbs. of metal. The pots are sealed, then placed in a very hot furnace. When the metal is melted the pots are taken out and the molten meal is poured into ingot moulds. These ingots are then cogged by machine into billets. The billets are then hammered into bars, round, square, octagonal—all shapes and sizes.

It is wonderful what a beautiful piece of work is done with these hammers. One would think the steel had been polished, it has such a smooth, glass-like finish.

The product has met with a very gratifying reception on the market.

Seventeen years ago a two-storey factory building was erected on the 5-acre plot now occupied by the Dillon Crucible Alloys, Limited. In this factory fences were made. The business grew and prospered. The town was small in those days and was as proud of its two industries as a boy is proud of his first team of dapple greys. Then the fence business moved away and the factory was occupied by the Barcalo Bed Co., of Buffalo, to be succeeded in 1905 by Quality Beds, Linmited.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1207 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 30 22nd Avenue, West. Eastern Representative: D. W. Towne. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: J. N. Robinson.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 900 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 1147. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers, who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. APRIL, 1919 No. 4

PRINCIPAL CONTENTS

No Cause For Worry

THINGS may be in an unsettled state throughout the country but there is certainly no panic and no prospects of one and no excuse for one. There is just as much work required now as before the war and all that is required is to get things moving. Most of the smaller cities and towns are about normal as regards their business activities but the larger cities seem to have more idle hands. People hate to pay the present prices for fear that lower prices will prevail in the near future. Similarly, manufacturers and dealers hesitate in stocking up for the same reason with the result that business is done in a hand-to-mouth way in many cases.

There must be four or five years of work to be caught up on. Practically all work, other than war material, has been suspended and should be in demand as soon as prices become stabilized.

The Poor Hobo

IT is not our intention to try and defend anyone for allowing himself to drift into evil ways, but if some poor fellow gets down and out it is himself who suffers the consequences, and nothing is gained by those who have been more favored acting in an ungentlemanlike manner towards this unfortunate class of human being. But leaving out the gentlemanly good manners and looking at it from a purely selfish standpoint, a business man is in a position to gain by being civil, and in a position to lose by being rude. Supposing a man is in the foundry business, for instance, and a hobo crawls under the gate or through the window or by any means whatever enters the works, what is to be gained by having a foul-mouthed understrapper seize him by the coat collar and in a boisterous manner proceed to eject him? That hobo has long since passed the stage when rough usage frightens him, but with all his debauchery he can be easily influenced by kindness. A pleasant smile and a good-natured admonition will be equally as effective in accomplishing the desired results and may have a more successful aftermath. Few realize how much influence that hobo has in the world and how much good or how much harm he is capable of doing, and few realize how he came to be a hobo. To be a success in life requires strong will power, ability to think, and lead in thought. to be able to form resolutions and live up to them. In fact, to be successful a man requires to be to a certain extent stern and hard hearted, or else others will take advantage of him. But there are those who have not these faculties and who have not the will power to hold their own against the bad which is in the world, and their good-hearted, good-natured disposition has been their downfall. But that type of man is his own worst enemy. He is a better friend to everyone else than to himself, and many a good turn has been done by a hobo without any possible thought of personal gain. As an instance of this, we will cite a case which came under our own personal notice. A friend of ours was in the carding and spinning buiness but was not as busy as he would like to have been. One chilly day while he was standing in his office a hobo opened the door and entered. His appearance left no doubt on our friend's mind as to what he was, still he did not order him from the place, much less did he set the bully on him. The hobo was, of course, seeking employment, but needless to say there was none to be had. However, our friend had no objection to him warming himself around the office stove, and he even entered into conversation with him and listened to his tale of woe, with the result that he learned from the hobo that a certain knitting mill company was having trouble getting suitable yarn. With the knowledge thus gained our friend entered into negotiations with the said company and secured a contract which kept his mill running night and day. But what of the hobo? Nothing. He had moved on. His acquaintance had been of short duration, but the good which he did lived after him. Motto—Be civil, even to the hobo.

Every Page a Data Sheet

A SUBSCRIBER from one of the Maritime Provinces says he likes the CANADIAN FOUNDRYMAN because it is filled with nothing but material which is worth reading, and he reads every bit of it, which he considers better than having a magazine three times as big filled with some useless material which causes the reader to miss some good articles in his efforts to avoid the useless stuff. A method adopted by some is to concentrate everything which is worth reading on one page so that the busy business man can tear it out and chuck the remainder, including the advertisements, into the waste basket.

The CANADIAN FOUNDRYMAN aims to have every page a data sheet, well worth preserving, and contributors to its editorial pages as well as patrons of its advertising pages may rest assured that their carefully penned articles are not being passed on to the wastepaper basket on their arrival at the office.

Read the Advertisements

TRADE journals, magazines, newspapers, and publications of all kinds are in the same category as regards the advertising and editorial columns. The general consensus of opinion being that the editorial columns are intended to make the paper sell, while the advertising columns are intended to make it pay. This, to a certain degree, is correct, but advertisements are of far greater consideration than this. The buyer should be just as interested as the seller, and the man who reads the editorials should be just as eager to read the advertisements. They are put there to be read and they may tell just what you want to know.

If you see something you would like to know more about, write to the advertiser and tell him where you saw his ad., so that he will know where his money is being invested to the best advantage. When you pay for a paper get all you pay for by reading everything which is in it. This includes the advertisements.

Need of Industrial Research in Canada

ONE of the great facts which has been driven home by war is the striking part which scientific research and discovery has played in the terrible conflict. It is, moreover, equally clear that this new factor will play a dominant role in the intense industrial competition which will follow since the declaration of peace. Industry is the great basis of national prosperity, and if Canadian industry is to be placed in a position which will enable it even to hold its own in competition with the great nations of the world whose industries will be "speeded up" to the highest point, the Dominion must in this New Era strain every nerve to secure increased efficiency in its manufacturing by the introduction of the most advanced and scientific methods and the widest market for its manufactured products by the most advanced and modern methods of co-operative distribution.

The extent to which Germany benefited by scientific research during the war is not even yet generally recognized.

One of the foremost requirements for the waging of a successful war is an unlimited supply of nitrates—for these are indispensable in the manufacture of gunpowder and all kinds of high explosives. It is also one of the most important constituents in artificial fertilizers, which are necessary when heavy crops are obtained by intensive farming for the support of a dense population. The great world supply of nitrates is derived from Chile. Germany had imported enough to suffice for the duration of a short war, and she did not contemplate a long one. This war was, however, indefinitely extended by Great Britain joining in the struggle, and the British Fleet having cut off Germany's access to Chile, the war ought to have been brought to a speedy conclusion. The industrial research chemists, however, had found out a method by which the nitrogen of the air might be fixed and converted into nitrates, and as there was an abundant supply of this raw material, ample supplies of nitrates were thus secured for the continuation of the war. Another prime necessity for the manufacture of gun-cotton, which is the basis of the more important high explosives, was cotton. The Germans again had secured large supplies of this in preparation for the war, and again the British Fleet eventually cut off their supplies of this staple. Once more German research came to the rescue, and a method was devised for securing the necessary supplies of cellulose, formerly obtained from cotton, by the chemical treatment of wood. When cattle food ran short large supplies of it were obtained by the chemical treatment of the waste refuse liquor from the German pulp mills. When the supplies of copper ran short, industrial research developed certain alloys which could be used to replace it, and when nickel for the manufacture of nickel steel failed they found other metals which might be substituted for it. Germany thus developed her full equipment for scientific research and trained her host of skilled workers in the field in times of peace, and was fully prepared to obtain from organized scientific knowledge all the assistance which science could render toward the solution of the successive problems with which the country was brought face to face in time of war.

In its broadest sense research means simply the acquisition and application of new knowledge. Without new knowledge, no industry can continuously flourish. In the least organized industries new knowledge comes as the result of the accumulated experience of the worker. As conditions become more exacting and refinements necessary, the assistance of the technologist is required in seeking and providing scientific knowledge. In the largest and most progressive firms, staffs of men are provided to make and turn to account new scientific discoveries. It is indisputable that an industry must stagnate unless continually kept up to date by some such methods and a firm that effectively carries on research cannot but triumph over its less progressive rivals.

An aftermath of the war will be "footing the bill," Whatever material wealth—if any at all—may be collected from our enemies, will be insignificant compared with the losses to be made up. To meet these losses we have one main source of supply to draw upon, namely, the latent energy—mental and physical—of every worker of every grade. Education and research are the two channels by which this treasury may be tapped.

Considering the various aspects of research, attention will first be given to that of the manufacturer.

It is clear that to the manufacturer research is of the utmost importance. Possibly its greatest field for usefulness lies in the development of new or improved materials. As examples of recent achievements in this direction, mention may be made of aluminum alloys of great strength and lightness, and numerous other alloys, ferrous and non-ferrous, as well as many organic products. The next field lies in the development of new and improved process for cheapening production. In this respect there is no limit or finality.

The benefit of research is by no means confined to the manufacturer, it is also of interest to the worker. Primarily, because any factor which makes for prosperity in industry ultimately makes also for well being of the worker engaged in it.

MANY of the thinkers in trade circles are beginning to see that both United States and Canada have a big foreign market that has never been touched. Strange to say, this foreign market is right at home and consists of the foreign buying power on this continent. The idea is that they should appeal to them through the foreign press, teach them that it will pay them to stay rather than to leave for Europe and take their savings with them. It looks like a case where business and citizenship can be mixed to advantage.

The British Columbia Government has found a good way in which to spend money. Tax sales were advertised. The total amount of arrears was $904,041.29; the amount collected was $100,869.44, while the amount spent in advertising the sale was $42,061.03. For instance, in Barkerville the amount of arrears recovered was $4,239.18, while the Prince George *Citizen* is credited with $10,400.40 for advertising.

PLATING AND POLISHING DEPARTMENT

QUESTIONS AND ANSWERS

Question.—The man who has been plating at this shop for several years past died recently, and I have been told to take his place. Many things about the plating room are arranged differently than I believe they should be. A nickel tank has a little old resistance coil connected in the anode line from the dynamo instead of in the line used for the work to be plated. The superintendent says, "Leave it alone." Please tell me if it should be changed. I have never seen a switch on an anode rod before.

Answer.—It is customary to place the resistance coil in the negative line. The position of the resistance with reference to negative or positive side of the circuit does not alter the reseult. The tank coil must be near the tank for satisfactory control, however. One ampere of electricity equals one volt divided by one ohm. To reduce the strength of the current it is possible to obtain results by inserting the resistance coil at a convenient point on either negative or positive line. There are many platers who operate all plating solutions with resistance coils in positive line and contend that the more logical position for the resistance is at a point where the current enters the solution rather than at a point where the current leaves the solution. In fact it is immaterial with all other factors being the same, you will accomplish equally as much by using the coil in the present position and avoiding display of officiousness on the part of the superintendent. He should have explained the case to you. Show him last month's issue of CANADIAN FOUNDRYMAN and call his attention to Rule 7 in the article on "Executive Common Sense in the Workshop."

Question. — During the past three years a large amount of scrap copper in the form of chips, defective bands and pieces of sheet copper has accumulated in the shop. Prices recently quoted by metal buyers have not been attractive and the superintendent claims we can manufacture enough copper carbonate from the scrap to supply our plating room with carbonate for years, and at less cost than even the normal market price for the carbonate. Before attempting to try out the suggestion we desire some definite information concerning the approximate amount of copper carbonate which may be obtained from a given amount of metallic copper in the form we mention herein. Would you consider the idea an economic one for our purpose?

Answer.—The conversion of metallic copper into copper carbonate in quantities such as you have reference to would require an expensive equipment and the supervision of a practical man to obtain even fair results. The metal must be converted into some salts such as copper sulphate before a carbonate can be obtained. To obtain the sulphate it is necessary to oxidize the copper and then dissolve the oxide in sulphuric acid, forming $CuSO_4$ or copper sulphate. The action of sulphuric acid, either concentrated or dilute, on metallic copper, is not sufficiently strong to make the process practical for industrial purposes, therefore the copper is oxidized and the oxide dissolved by the acid. Lead-lined towers are sometimes used to facilitate the oxidation of the copper, the towers are loosely filled with copper scrap such as machine turnings, chips, and pieces of sheet copper, and dilate sulphuric acid is sprayed upon the metal from the top of the tower. When the reaction between the acid and the copper begins, heat is produced which causes a strong current of air to enter through an opening at the base of the tower. The air becomes heated, and after oxidizing, the copper passes out of the tower at the top. The dilute acid is pumped to the top of the tower and is again sprayed over the copper, the operation continuing until the metal is reduced. The copper sulphate solution which is thus obtained is allowed to cool and the copper sulphate crystals form and are collected and washed. To make the copper carbonate, the copper sulphate crystals are dissolved in hot water and the copper precipitated as carbonate by the addition of sodium carbonate. The carbonate thus formed must be repeatedly washed to remove all traces of sulphates or soda. The following figures will give you some idea of the approximate amount of carbonate obtainable from 100 pounds of metallic copper under favorable working conditions. Copper sulphate crystals ($CuSO_4.5H_2O$) contain 25.46 per cent. copper. 100 pounds of metallic copper should produce approximately 393 pounds of copper sulphate. and about 440 pounds of soda ash will yield about 194 pounds of copper carbonate ($CuCO_3$).

Copper sulphate is now obtained in large quantities as a by-product from various processes, and in normal times is very plentiful. We advise selling the copper scrap at present price and purchasing your supplies of copper carbonate as required; price of latter will no doubt decline to a very reasonable figure long before you would consume the amount obtainable from your metal and you would be unable to dispose of the carbonate at a profit. Is it not possible that you are using an excessive amount of copper carbonate in your plating solutions? Cyanide copper solutions can be very efficiently operated without any appreciable additions of copper carbonate, the solution being maintained in proper balance by the disintegration of the anodes. Furthermore, the anode is the cheaper source of metal supply for the bath and the method entails less labor and attention. We are of the opinion that your copper solution is employed too dense. Cyanide copper solutions operated at very low density will produce very rapid deposits perfectly. Tendency to blister, flake or curl is reduced. Maintenance cost is less and the solution is more easily managed. Naturally, due consideration must be given the current strength employed and a warm solution is much more satisfactory than one operated at ordinary room temperature. Equip the tank with the maximum anode surface possible and regulate the cyanide additions by the surface condition of the anodes. For example: If the anodes coat over with a blue black crust when bath is in use and the coating dissolves off during short intervals between loads, no additions of cyanide are necessary. If the blue-black coating remains on the anode overnight or for a few hours, cyanide should be added in small quantities. Cyanide copper solutions with a color approaching a greenish yellow shade are more efficient than when of a light straw color. Do not allow the green tone to become too pronounced. Additions of cyanide should be made at the close of the day's work as alkaline copper solutions always work very irregular immediately after the introduction of cyanide in quantities usually required. An old method of terest to you, and is as follows: Dissolve the copper in warm nitric acid diluted with an equal volume of water. When the acid has ceased to dissolve any more copper, dilute the solution to twice the original volume and precipitate the carbonate by adding sodium carbonate in small quantities until no further precipitation occurs, wash the precipitate several times and place on cloth strainer to remove surplus water; use same as carbonate made from the sulphate. Boil the copper solution a few minutes after each addition of carbonate.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1918-1919

President—James Vallier, 701 Crawford St., Toronto.

Vice-President—Charles Kemish, 271 Boston Ave., Toronto.

Sec.-Treas.—E. Coles, P.O. Box 5, Coleman, Ontario.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

Cleaning and Copper Plating in One Solution

Old Customs Die Hard, and Although Ten or Twelve Years Have Elapsed Since This Discovery Was Made, it is Only Now Coming Into Popularity

By ABE WINTERS

ALTHOUGH cleaning and copper plating in one solution was first made generally known some ten or twelve years ago platers have not adopted the process as readily as might have been expected. We admit that to the inexperienced man the idea appears to be one which would work satisfactorily in a laboratory but utterly fail in the average industrial plating department. To the best of our knowledge the process was first used in a plating room by a plater possessing no unusual knowledge of electro plating fundamentals, but, when once convinced of the practical value of the conception, set to work to get results. There are several reasons why the combination solution is not more generally employed. Many platers are skeptical and refuse to investigate; others have become so indifferent to modern improvements that the least reference to recent innovations brings merely a sneer, or blank expression from them; others are handicapped by lack of co-operation on the part [illegible]loyers who will not consider a[illegible]estion from the plater, because th[illegible]y say "Plating is a process which does not interest me," thereby showing their deficiency in practical commonsense. To any of these we would say, procure a small stoneware crock, prepare the solution, equip the crock with necessary wires and a steam coil, operate the small bath a day or two until you are familiar with its action and then call the desired executive in and demonstrate the possibilities of the idea. If you are an enthusiast regarding the method you will have no difficulty in convincing the most indifferent person of the superior features of this process. If your product consists of sheet steel stampings, the results will be truly remarkable from the first. If the product is forged steel, carbonized or oil tempered steel, which has only a portion of the piece polished, it will be necessary to effect a sure contact by previous treatment for removal of the scale, as the actual plating efficiency of the combination solution is less than an ordinary copper plating solution, owing to the fact that a large portion of the current is employed in cleaning by the evolution of hydrogen. In preparing the combination solution do not introduce too great a percentage of copper salts. The best results are obtainable when the metal content is kept low, and the free cyanide only sufficient to effect normal action constantly when the bath is in continual use. Some operators have experienced considerable difficulty in maintaining a clean anode surface during prolonged operation and have experimented along various lines to promote more uniform condition. Very few of these efforts have been successful. Dr. Oliver P. Watts, of Wisconsin University, became interested in the process and in 1915 began some experiments which resulted in the finding of a suitable addition for the prevention of the black coating, which is probably cupric oxide. Dr. Watts used from 8 to 10 ounces of sodium potassium tartrate per gallon and obtained greatly improved deposits and more efficient anode conditions. Copper deposits from the combination solution are particularly satisfactory when required as a strike before a subsequent deposit of brass, nickel or other metal. Heavy deposits are easily obtainable and are as free from imperfections as similar deposits from ordinary baths operated at lower current densities. When the actual requirements of a combination solution are definitely known the bath may be operated accordingly by regulating the metallic and cyanide contents of the bath in accordance with the proportion of the total current desired for cleaning. For example: To increase the cleaning action, increase the current density and the proportion of cyanide in the bath. To increase the depositing action, increase the metallic content and raise the temperature of the solution. The solution is naturally most efficient at boiling temperature and if the tank is equipped with steam coils at side, with the uppermost coil about 2 or 3 inches below normal surface level of the solution, a constant flow of solution toward the back of the tank may be maintained at the surface by properly regulating the steam pressure. Twenty to thirty pounds of steam is sufficient pressure for good working condition. The movement of solution away from the front of the tank, at the surface, carries the oil and greases which accumulate to the section beyond the area required for removal of products being processed, and reduces the danger of contaminating the plated surface of the work by oil films or grease. Some cleaning compounds are not suitable for the combination solution; those which contain a filler are particularly objectionable, owing to the fact that the filler being insoluble quickly accumulates in such quantities as to become very troublesome when the solution is operated at high temperature. Certain cleaning compounds cause excessive "frothing" at the solution surface when the bath is used continuously at high temperature. This condition is often very annoying, especially when the tank is shallow and must be operated completely filled. Cleaning solutions containing considerable caustics sometimes prove extremely freakish when used in connection with the electric current. Concentrated solutions promote the continuous evolution of hydrogen gas in excessive quantities, and if the solution has a saponifying action upon the greases and soap is formed, the soap film entraps the hydrogen gas and soon retains a sufficient amount above the solution in the form of foam to cause a report not unlike the report from a gun, when a spark results from the removal of a cathode from the negative terminal of the bath. Cleaning compounds which form emulsifying solutions are preferred by the writer; the action is quick, positive and reliable. The solution is not charged during operation at boiling point with unnecessary foreign substances which are often conducive to rough sandy deposits unless removed from the product by mechanical means. The cathodes are free from soap films when removed from the bath and a momentary immersion in dilute cyanide dip is all that is required previous to placing the work in any plating solution for further treatment. Possibly the greatest objection which platers have to the commercial use of the combination cleaning and copper plating solution is the tendency of the copper anodes to coat over with an insulating film of deep black color, which is evidently cupric oxide. The writer has operated a combination solution constantly during the past five months and has not used an ounce of any additional agent to prevent the formation of the black film and has maintained perfectly clean anodes and a high degree of efficiency in the bath at all times. Our experience does not indicate the necessity of adding potassium tartrate or other chemical for this purpose. We use a small anode surface and keep the cyanide content very low. The density of the solution is to-day approximately 1.5 degrees on the Beaume scale. The deposits are beautifully pink, clear, clean and absolutely free from blisters or stains. Thousands of square feet of steel have been cleaned and plated in the bath without a single failure. If the steel to be processed is heavily coated with dried emery cake or tripoli when placed in the combination solution the time required to remove the dirt and obtain a deposit is usually one or two minutes. After continued operation the bath shows signs of lowering efficiency and becomes very badly contaminated, To avoid this condition it is good practice to have two or even three tanks of about same size as the combination solution tank, and in one prepare a strong solution of cleaning compound to be used as a soaking solution in which the very dirty pieces are placed for a short time to soften the lumps of polishing paste left upon the steel. The solution should be kept near boiling temperature and the rods supporting the work should be insulated from the tank by wooden strips placed across ends of the tank, at top. The soak solution may contain combination of saponifying and emulsifying compounds, or either of these, together with a strong soap, the latter combination being especially effective in cases where mineral oil or much tripoli is to be removed. In the third tank prepare a solution to be used as an electric cleaning bath subsequent to the soaking. Equip both the electric cleaner and the copper tank with brass rods or tubes of ample cross sectional area to conduct the maximum current required continuously without heating. Insulate the steam coils in both these tanks at the inlet and exhaust ends with good composition insulators; the rubber hose make-shift will prove extremely troublesome if steam pressure used to heat the solutions quickly in the mornings is above 80 lbs. Place the three tanks at least four inches from the floor, on concrete or wooden blocks, upon which is placed pieces of plate glass or porcelain ½ inch in thickness; cover the insulating material with thin strips of soft wood to avoid cracking the glass or porcelain when weight of tank shifts slightly when filled. In operating these three solutions remember the the most effective cleaning and coppering can only be obtained when the solutions are used to highest possible temperature consistent with continuous operation of this type of solution in conjunction with an electric current of 5 or 6 volts pressure. This temperature will depend largely upon the character of the product being processed, the amount in process at any one time and the character of the compound used to prepare the solution. Usually a temperature of 210 degrees Fahr. may be maintained with satisfying results; again it is found that the conditions will not permit of more than 208 degrees Fahr. In using the electric cleaner previous to coppering, one feature should receive particular consideration. Most cleaning solutions operated by the electric current direct will produce a slight discoloration on the steel if processed to long, or if the steel is allowed to remain suspended in the solution for some time after current has been used and switched off. This discoloration is often scarcely discernible, but is sufficient to prevent adherency of the subsequent metallic deposit. For the above reason it may be found advantageous or even necessary to eliminate the electric cleaning and depend solely upon the soak solution to effect a cleanliness which will permit coppering in the combination solution without excessively contaminating the latter. We have been asked how heavy copper deposits may be obtained in the combination solution. It is possible and equally as practical to produce extremely thick copper deposits from the combination bath as from the ordinary hot cyanide copper solution. Furthermore, the desired thickness may be obtained in less time in the combination solution. For example —Mr. E. G. Lovering, of Detroit, used a combination copper solution consisting of 60 grams triple X lye, 15 grams copper carbonate, 30 grams ammonium carbonate, 30 grams sodium cyanide per litre of water and obtained deposits 0.009 inch thick in 15 minutes, doing in one tank an amount of work which previously required three tanks. Boiling temperatures were employed. By adding 15 grams of zinc carbonate per litre of above copper solution, Mr. Lovering produced a brass deposit of from 0.002 to 0.003 inch thick in twenty minutes, the same thickness requiring at least two hours in the regular brass solution. The copper solution is especially suitable for work presenting flat or regular surfaces, and when boiling will deposit copper faster than the cold sulphate copper bath, because it permits the use of very high current densities. If 60 to 75 grams per litre of potassium tartrate be used in either of the above solutions the results are greatly improved. Personally we do not advocate the use of triple X lye, or any other compound of similar nature in either the electric cleaner or the combination coppering solution. Compounds which are very pleasant and harmless to use are now easily available and irregardless of price are cheaper in the long run. We greatly prefer compounds which produce an emulsifying action rather than those which saponify greases and produce soap films, which are carried out on the cathodes and cause failures in subsequent metal deposits. If the product to be treated is received in plating department with portions polished and the remainder of the surface covered with burnt on mineral oil from the hardening treatment, the successful cleaning and plating of these pieces in the combination bath may cause the operator considerable trouble, even after using two preliminary cleaning solutions, unless the oil and scale is removed at least from part of the piece in order to permit of good contact with the slinging wire or holder. Solutions for this class of work should contain rosin or oelic acid, a good solution being one composed of one-half pound soda ash and one ounce of rosin per gallon of water. There is no advantage in operating a cleaning solution composed of alkaline salts at too great a concentration. In fact, dense alkaline cleaning solutions are less efficient and more troublesome than otherwise. Strong alkaline solutions have a tendency to harden the soap and in extreme cases the soap is released from suspension in the liquid, then no surface coating is formed about the particles of oil. In emulsifying solutions a similar condition is found, it being more difficult to form and hold an emulsion in a strong solution owing to the difference in the specific gravity between the oil and the alkaline solution. Nearly every manufacturer of cleaning compounds who distributes literature relative to the use of their respective material, refers to the use of the reverse current as being sometimes desirable. Our experience does not justify our recommendation of reverse current cleaning. In 95 per cent. of the cases we have encountered the direct current proved fully adequate for every purpose. Reverse currents induce corroded cathodes and momentary reversal of the current has never satisfactorily removed oxides or other castings from cathodes during repeated tests made by the writer on a wide range of products. For general use we prefer compounds of the non-carbonate type of alkali and we make it a practice to remove the scum or oil from the surface of the solution at frequent intervals. The solutions are never allowed to become contaminated to the extent of becoming sticky; the lower strata is removed by syphon and the accumulation of dirt is taken out by carefully using an improvised scraper each Monday morning. The solution is filtered through 6 ply cheese cloth strainer once every three months, and the addition of compound is regulated according to the quantity and condition of work processed, rather than by the time the solution is [illegible] following each addition.

There are many [illegible] features regarding combination copper solutions which have not been incorporated in this article. These will reveal themselves to the operator in many different ways, depending on the character of the product to be treated and the nature of the substance to be removed from the surface of the product, together with general plating conditions in the various plants where it is employed. Like the electric cleaner, the combination copper solution has its limitations; it will not do everything some platers imagine it will. But, if used with reason and proper management, the bath will shorten the process of cleaning and coppering on a very large range of work. It will reduce the labor necessary to produce a given amount of work and yield deposits which will be superior in many respects to the ordinary copper deposit from the regular copper solution. It is not expensive to maintain, as less cyanide is required and it is not tricky if treated with reasonable care. It will produce as adherent deposits upon old deposits of nickel better than the average copper bath and may be used to successfully coat aluminum with copper previous to nickel plating. The process is becoming more and more popular every day, and the future will see it very generally employed

Foundry Facings and Supplies

In dealing direct with us—the manufacturers—you may be sure of prompt and courteous service. For we have too much at stake to furnish an inferior product or to allow shipment delays that would displease or inconvenience you.

MADE IN CANADA

Ceylon Plumbago No. 101

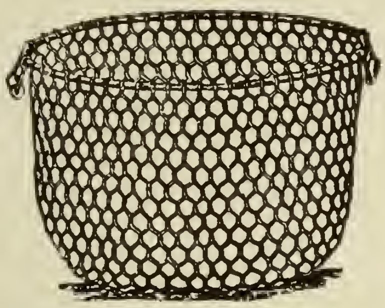
There is no better Facing obtainable anywhere. No other Facing used in Canada is so well thought of. Hundreds of users and every single one well pleased. Send in your order for a trial.

Ceylon Plumbago No. 206

Many Canadian Foundries are using this Facing with splendid success for general machinery castings. It will give you perfect satisfaction.

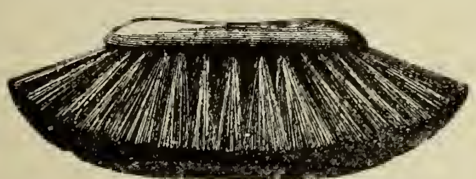
Special Stove Plate Facing

Another "Hamilton" product that will fully meet your highest expectations. Give it a trial.



Coke or Charcoal Baskets of heavy woven galvanized steel wire are strong and durable.

Our products are made in Canada — made by Canadian workmen. They are as good as any obtainable — in many cases superior to imported makes. Invariably cost less. Moreover, we guarantee that our service and our products will completely satisfy you.



Moulders' Soft Brushes as above are made from the best quality pure Russian bristle, four inches in length, wire drawn. The block is in two pieces, glued and screwed together.

Our Black Core Compound is 100% Pure

It will improve the work of your coremakers. It will make their work easier by eliminating troubles common to ordinary core compounds. It is 100 per cent. pure—and just as efficient for its purpose. We should like you to give it a trial.

The

Hamilton Facing Mill Co., Limited

HAMILTON, ONTARIO, CANADA

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$31 40
Lake Superior, charcoal, Chicago	38 85
Standard low phos., Philadelphia	38 85
Bessemer, Pittsburgh	33 60
Basic, Valley furnace	30 00

Government prices.

	Montreal	Toronto
Hamilton		$50 00
Victoria		50 00

FINISHED IRON AND STEEL

Iron bars, base	$4 75
Steel bars, base	5 00
Steel bars, 2 in. larger, base	6 00
Small shapes, base	5 75

METALS

Aluminum	$40 00	$40 00
Antimony	8 50	8 50
Copper, lake	21 00	22 00
Copper, electrolytic	26 00	25 00
Copper, casting	25 00	21 00
Lead	8 50	7 25
Mercury		100 00
Nickel		50 00
Silver, per oz.		0 98
Tin		100 00
Zinc		10 50

Prices per 100 lbs.

OLD MATERIAL.

Dealers' Buying Prices.

	Montreal	Toronto
Copper, light	$10 50	$13 00
Copper, crucible	13 00	15 00
Copper, heavy	13 00	15 00
Copper, wire	13 00	15 00
No. 1 machine composition	10 00	14 00
New brass cuttings	8 00	10 00
No. 1 brass turnings	8 00	19 00
Light brass	5 00	7 50
Medium brass	8 00	9 00
Heavy brass		.....
Heavy melting steel	10 00	14 00
Steel turnings	9 00	8 00
Shell turnings	6 00	6 00
Boiler plate	12 00	11 00
Axles, wrought iron	20 00	15 00
Rails	15 00	11 00
No. 1 machine cast iron	18 00	14 00
Malleable scrap	15 00	13 00
Pipes, wrought	9 00	7 00
Car wheels, iron	20 00	18 00
Steel axles	22 00	20 00
Mach. shop turnings	6 00	6 00
Cast borings	8 00	8 00
Stove Plate	14 00	14 00
Scrap zinc	6 00	5 00
Heavy lead	5 50	8 00
Tea lead	4 50	3 50
Aluminum	18 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	47 00
Forging billets	56 00
Wire rods	57 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN. B

¼ in.	$14 35
5-16 in.	13 85
⅜ in.	13 50
7-16 in.	12 90
½ in.	13 20
9-16 in.	13 00
⅝ in.	12 90
⅞ in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 10
Linseed oil, boiled, single bbls.	1 73
Linseed oil, raw, single bbls.	1 70
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37½
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 7 00	$ 6 50
Sheets, black, No. 10	6 50	6 00
Canada plates, dull, 52 sheets	8 50	8 10
Apollo brand, 10¾ oz. galvanized	12 25	12 09
Queen's Head, 28 B.W.G.	11 75	10 75
Fleur-de-Lis, 28 B.W.G.	11 75	10 75
Gorbal's Best, No. 28	12 00	10 25
Colborne Crown, No. 28	11 25	10 00
Premier, No. 28 U.S.	....	8 20
Premier, 10¾ oz.	....	8 50
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$13 00
3-16 in.	12 50
¼ in.	11 75
5-16 in.	11 40
⅜ in.	11 00
7-16 in.	10 60
½ in.	10 40
⅝ in.	10 00
¾ in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS.

Canadian malleable, A, add 20%; B and C, net list; cast iron, 15% off list; standard bushings, 50%; headers, 60%; flanged unions, 40%; malleable bushings, 25 ... d 7½%; nipples, 55%; malleable lipped unions, 50%.

ANODES.

Nickel	$0.58 to	$0.65
Copper	.36 to	.46
Tin	.70 to	.70
Silver per oz.	1.05 to	1.00
Zinc	.23 to	.25

Prices per lb.

NAILS AND SPIKES.

Wire nails	$5 50	$5 30
Cut nails	5 85	5 65
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23-.19
Ammonium, carbonate	.25
Ammonium, chloride	.55
Ammonium, hydrosulphuret	.30
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.50
Arsenic, white	.27
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.40
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	1.35
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.40
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30-5%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3 25
Polishing wheels, bullneck		2 00
Pumice, ground	3½ to	.05
Emery composition	08 to	.09
Tripoli composition	06 to	.09
Rouge, powder	.30 to	.35
Rouge, silver	.35 to	.50
Crocus composition	08 to	8- 9

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 34
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.09
Packing square braided	.34
Packing, No. 1 Italian	.40
Packing, No. 2 Italian	.32
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Castor oil, per lb.	50
Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10¼

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	32½
Delta Files	20
Nicholson	32½
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	40

REPORT DEMAND FOR MORE NEW MACHINERY

TORONTO—Business is better in machine tool lines than it has been for some time, certainly a long way ahead of what the firms were anticipating after the signing of the armistice. It is a good sign to see customers coming into the market for new machinery, instead of demanding to have their wants supplied from the used machinery market. Warehouses are doing a large amount of business, but they are not certain that the lower prices on plate and tubes has all to do with it. There is no indication that the new prices have made it desirable for the large buyers to come into the market on a generous scale yet.

Few More Reductions

It is just the least bit amusing to notice how, one after another, the various lines are falling in line and granting concessions to the trade which they said very plainly a few weeks ago they would not do for a long time yet. Makers of boiler tubes were quick on the job after the cuts of March 21 to announce they would not follow suit. Lapwelded tubes came down first, and now seamless is going to follow. There has not been any announcement on the latter yet, but some of the warehouses are announcing a new figure in advance of the mill statement. The American plants making seamless tubes took the matter up with the Canadian sellers, and asked them to use their own judgment in the matter, and recommend what was necessary. Later this was added to by telling them to go ahead and make concessions if such were necessary in order to secure business. The Canadian firms reported favoring a cut and also that it should be announced at once. The reduction which is given in detail on the market page, amount to about eight per cent.

The warehouse interests are well pleased with the amount of business they are securing, but this does not hold good with the firms that are selling for straight mill orders. An order that looks quite interesting to a warehousing concern holds little interest for the mill unless it happens to be one of many going in.

The National Railways and the C.P.R. are placing a lot of business for plate and boiler tubes.

There seems to be a little misunderstanding in regard to the way in which some of the prices are quoted in CANADIAN FOUNDRYMAN from time to time. For instance, one Ontario firm writes to ask if our quotation on iron bars is not too high. He has a quotation of $8.05 from a Canadian rolling mill, whereas the price we are quoting this week is $4.25. The prices quoted in our columns are warehouse prices, and they are always above the mill quotations. This same rule holds good in all lines. When plate was being quoted at 3c Pittsburgh, Chicago warehouses had a price of 4.27. With the new price of 2.65 on plate the Chicago warehouse will now be 3.90.

Selling New Machinery

Dealers in machine tools and supplies are well pleased with the business they are closing at present. Several of the firms are concentrating on the sale of new machinery and they are meeting with considerable success. One large Toronto firm has its machine tool salesman going to the United States this week to spend some time in the better machine shops there where quantity production is specialized in. We have been rather out of touch with this class of work in Canada, especially during the time of the war, as nothing much else was allowed but the production of munitions. Now that firms are turning to new lines, where they will have to meet competition, it is certain they will want the best methods known to the trade.

Motor plants are doing quite a good deal of buying now, and in several cases they are making an honest attempt to give a preference to lines they can secure in this country, but the equipment they need for their business calls for a lot that has to be imported.

Market is Firmer

Although scrap metal prices have not started to climb yet, it is easy to notice that there is a great deal more strength in the market than for some time past. There is a chance that fourth quarter copper may be hard to get. Just now dealers are not quoting or selling on that delivery, and if this should keep up for any length of time it would be certain to drive up the price in the local scrap markets. As it is those who have red brass now are asking more money for it.

In the other classes of metals much the same feeling is apparent. There have been no price changes and a certain amount of trading is going on at the lists published. But there is a growing and a well defined tendency on the part of the trade to hold material instead of making sales under present circumstances. Although dealers do not care to come out and say so it is one of those situations where it is felt that a great many things may happen on very short notice, and one of the happenings is likely to be a strengthening of prices which dealers will have to pay in order to induce holders to part with their material.

Brantford.—A tin smelter company is being organized, with Brantford capital behind the proposition. It is proposed to get the ore from the Panama region, a representative of the company now being on the ground in that region.

BOOK REVIEWS

Iron and Steel, by H. P. Tieman, the McGraw, Hill Book Co., New York. Price $4.00.

This is the second edition of this handbook on iron and steel nomenclature and processes and the subject matter has been greatly enlarged, revised and entirely reset. The number of terms and the text also has been entirely reset. The general processes of manufacture have undergone but little change, the principal development being in the greatly increased use of the electric furnace. The chief increase in the text is due to more extended discussions of subjects, such as heat treatment, physical properties, and testing, and to the numerous investigations of the more theoretical aspects of the subject, particularly those included under metallography.

For the benefit of those little versed in the metallography of iron and steel and who may desire a guide to a more sequential, and hence, logical study, than is afforded by the alphabetical arrangement of the text, which has been adopted as best for ready reference, a brief outline of the metallurgy of iron and steel has been prepared, and placed immediately preceding the text.

As has been mentioned, an alphabetical arrangement has been chosen in arranging the text, and the subjects treated of are cross-indexed throughout in such a manner that references are easily found. The subject of nomenclature has been very fully dealt with and the metallographist and mill man are enabled to meet on common ground and understand the technical terms special to each branch of the science, the laboratory and the mill.

The general treatment is a combination of dictionary, an encyclopaedia and a handbook, possessing as well as omitting some of the features of all. The definitions of isolated terms or processes are found under their respective headings, while those employed in connection with some special subject or process are found under the latter, reference being made by page numbers.

This work is of value to the millman metallographist, teacher or student interested in iron or steel.

Forging, by John Jernberg, The American Technical Society, Chicago

The art of blacksmithing is an ancient one and for centuries was the only method-working profession. Very little improvement has been effected in it up to comparatively recent times. In the last few years the adoption of new types of steel has made considerable advancement necessary in the art of forging and also in the allied art of heat-treating. The author states that this book was written for the bringing up to date of the machinist's knowledge concerning the art of forging in its more modern aspect. One chapter describes mechanical details, materials and equipments, and goes into the various types of forges, furnaces, annealing ovens, and power tools which are used. Forging operations are next taken up and the major portion of the book is devoted to this particular subject, welding, upsetting and other forging operations being all dealt with. Heat treatment and its effect on the physical properties of steel is an important subject and is covered in a simple and able manner.

CATALOGUES

The Graton and Knight Manufacturing Company, Worcester, Mass., have issued a very complete catalogue descriptive of the lines of belting which they manufacture. The first few pages are taken up in the description of the plant and of the various portions of the hides which go to make up the finished belt. The various grades of beiting are taken up next and each one of the different classes manufactured by the Graton and Knight Company are described in detail. Various types of belt drives are treated of and much valuable data is given regarding the proper calculation of belting problems and the care of the belts themselves.

We are in receipt of Catalogue No. 10, just from the press by the Illinois Manufacturing and Supply Co., Quincy, Ilinois, manufacturers of "The Illinois" exhaust tumbling mills steel case dust arresters, water cinder mills, exhaust fans and sand mixers. In the contents these articles are well illustrated and described.

The Quigley Furnace Specialties Co., Inc., 26 Cortland Street, New York, have recently issued their Bulletin No. 11, dealing mainy with the equipment and process of burning powdered coal. A list of furnaces to which the system has been successfully applied is given, as is also an exhaustive description of the different appliances which cannot fail to be of interest to all users of coal.

Buckeye Products Company, Cincinnati, Ohio, have issued their general catalogue number 7. This book contains 400 pages and is a reference work on foundry tools and appliances. Practically everything which is necessary to the successful operation of a foundry may be found in the pages of this book, and a list of reference books is included which may be purchased through the Buckeye Products Company.

The Bureau of Mines, Washington. have recently issued Technical Paper 191 dealing with central station heating. Briefly stated, the paper sums up the manifold extravagances of utilizing about 15 per cent. of the heat valve of the fuel; allowing the remainder to go to waste, mainly in the condenser cooling water. This percentage is true of the most efficient plants of to-day. A method that promises at once to increase the community value of such stations is worthy of consideration and the central station heating offers a favorable solution. The development of central station service is dealt with, methods of computing costs and rates to be charged are also gone into thoroughly.

ARE INTERESTED IN THE ELECTRIC FURNACE

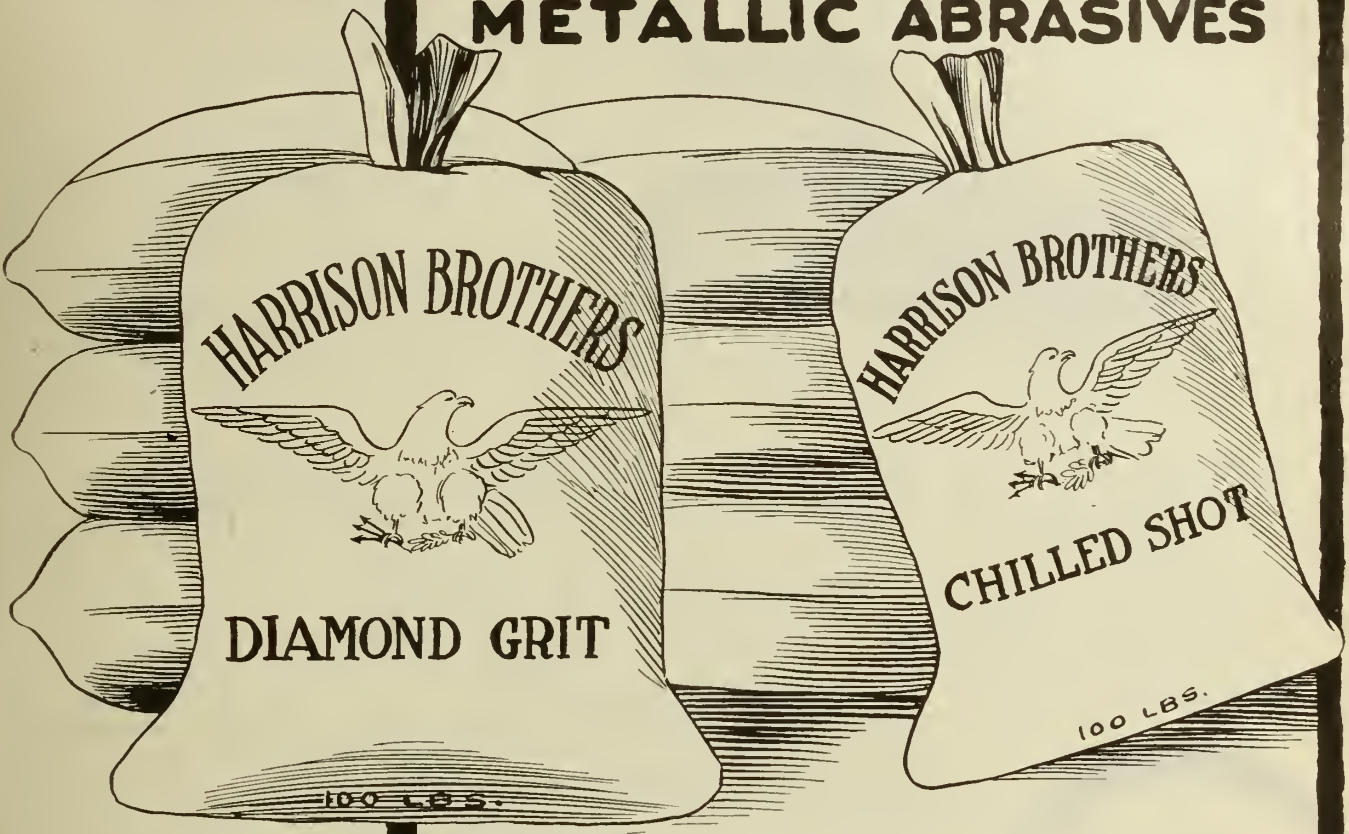
Organization Formed for Purpose of Spreading Information Bearing on This Point

Steps were taken to promote the use of various electric furnace products at a meeting called by Acheson Smith, vice-president and general manager of the Acheson Graphite Company, held at Niagara Falls on March 21 and 22.

The meeting passed resolutions inviting all manfacturers of electric furnaces,

DUSTLESS

METALLIC ABRASIVES



DIAMOND GRIT

CHILLED SHOT

The unhealthful conditions produced by the dust connected with sand blasting have placed that occupation in the hazardous list.

Harrison's Metallic Abrasives, Chilled Shot and Diamond Grit, have greatly improved blasting conditions.

Blastmen now demand Grit and Shot in place of sand, and government orders stipulate their use when placing contracts.

Improve the conditions in your cleaning room and raise the morale of your workmen —and your production will increase accordingly.

"Shot Blast" or "Grit Blast", and eliminate the dust of blasting.

HARRISON SUPPLY COMPANY

5 and 7 Dorchester Ave. Extension

BOSTON, MASS., U. S. A.

electrical apparatus and electric furnace supplies and accessories, public utility corporations, designers and inventors of electric furnace equipment and the users of electric furnaces to become members and to join in a campaign to disseminate to engineers and to the public data as to the quality of electric furnace products of all kinds.

The organization formed is to be called the Electric Furnace Association. A permanent organization was created as follows:

President — Acheson Smith, Acheson Graphite Company, Niagara Falls, N.Y.

First vice-president—C. H. Booth, Booth-Hall Company, Chicago.

Second vice-president—W. E. Moore, Pittsburgh Electric Furnace Company, Pittsburgh, Pa.

Secretary—C. G. Schluederberg, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Treasurer—F. J. Ryan, American Metallurgical Corporation, Philadelphia.

Directors—The officers and C. A. Winder, General Electric Company, Schenectady, and F. J. Tone, Carborundum Company, Niagara Falls.

The president was authorized to get in touch with all who should be interested in joining the organization and was requested to arrange an early meeting when completed publicity plans could be presented. In the meantime different committees were instructed to perfect reports as a basis for constructive work.

TRADE PUBLICATIONS

The United States Steel Products Co., New York and Toronto,. have issued "Tool Steels," containing data and tables appertaining to electric tool steels manufactured by the Carnegie Steel Co. The various classifications of steel are given according to its uses, processes of manufacture and chemical composition, together with the factors affecting the qualities of steel. The main portion of the booklet is devoted to the heat treatment of steels and especial attention is devoted to the heat treatment of alloy steels. The value of this portion is greatly enhanced by the excellent illustrations accompanying the text. Photographs of test specimens which have undergone heat treatment are shown and a color chart is given showing the actual colors together with the corresponding temperature range. Tempering is usually controlled by means of the colors produced on polished steel at various temperatures and as an aid in the controlling of this temperature a color chart and table are given for the different classes of articles usually met with. In addition to the above a list of the various tool steels manufactured by the firm together with the various uses to which they are best adapted is given.

Shawinigan Magnesium is the title of a recent publication issued by the Shawinigan Electro-Metals Co., Montreal. This booklet contains much information of value relative to the uses of magnesium. Data for this booklet was obtained from the company's own laboratory work from technical literature and from users of magnesium. A chapter devoted to foundry practice gives uses and instructions which have been of value in both the ferrous and non-ferrous foundry trades and the information given on its use as a deoxidizing agent is of interest. Physical and chemical properties are listed in separate chapters for the benefit of those interested in the scientific application of magnesium to other branches of industry. The final chapter contains much that will prove helpful to those endeavoring to make special alloys to suit special needs.

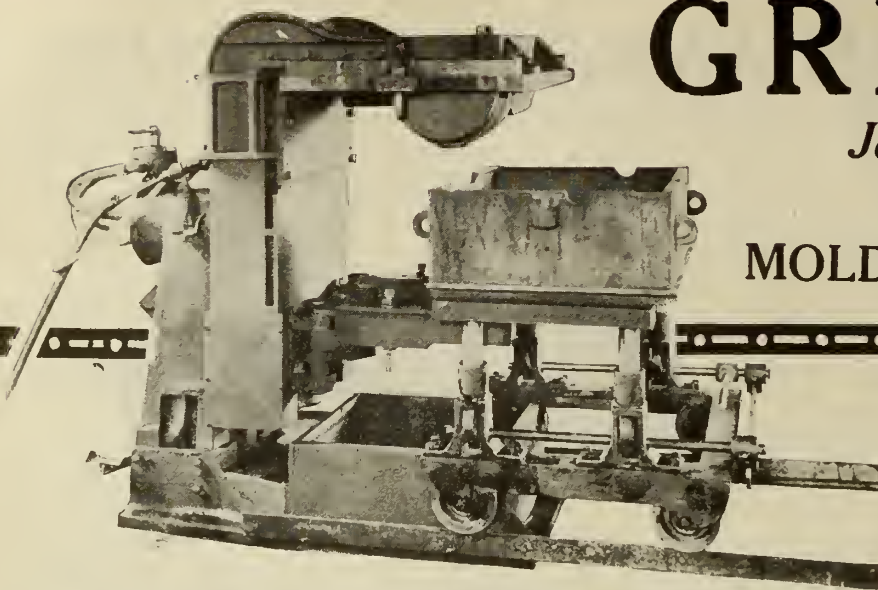
Ludlum Steel.—A handbook on tool and alloy steels has been recently issued by the Ludlum Steel Co., Watervliet, N.Y., and Detroit, Mich. A classification of tool steels together with directions for ordering various shapes is given and is followed by data on alloys and their effect on steel. In this section the effect of nickel, chromium, nickel chromium, chrome vanadium, manganese and tungsten on the resulting characteristics of the alloy produced is given in convenient form. The following section is devoted to the composition and heat treatment of carbon and alloy tool steels. High speed steels are next dealt with. The proper steel to use for various purposes is given together with a description of the various kinds manufactured by the Ludlum Company. This section also includes directions for the heat treatment of the various steels. Other information is divided into the following sections, ball bearing steels, magnet steels, carbon and alloy tool steel, high speed tool steel, a color chart giving heat colors with approximate temperatures and tables of useful information.

FERRO-MOLYBDENUM

The use of molybdenum in steel manufacture on a large scale may be said to be a product of war conditions. Its action is in the main similar to that of tungsten, which makes steel self-hardening. Its ores are widely distributed but are not very plentiful. The scarcity of tungsten, particularly in Europe, and urgent war demand, have led to the manufacture of ferro-molybdenum on a relatively large scale. Its use is so recent that very little has been made known concerning it. It is said that the large German guns which bombarded Liege were lined with molybdenum steel to increase their resistance to erosion. Parts of guns, gun carriages, motors, and automobiles are also being made of molybdenum steel of excellent quality. Canada has been especially active in the manufacture of ferro-molybdenum steel, most of which is exported to Europe. Germany drew considerable supplies of molybdenite from Norway to compensate the shortage of tungsten for high-speed tool steel.—M.E.

GRIMES

Jar-Rammed
Roll-Over
MOLDING MACHINE



Production Profitable

HERE is a machine that will handle your molding work efficiently, economically and profitably. There's no other molding machine like it for speed and accuracy of production. It increases the output and cuts the costs.
General purpose machine. Costs little to install. Easy to maintain. Easy to rearrange in your shop. Entirely above floor line. No pits to clean. Steady, reliable, quickly operated.
The Grimes Jar-Rammed Roll-Over Molding Machine is making good in hundreds of foundries—it will make good in yours. Investigate.

Grimes Molding Machine Co., 1218 Hastings Street **Detroit, Mich.**
Formerly Midland Machine Co.

TABOR

10" POWER SQUEEZER

We have had 92 of these machines operating in one shop for over nine years and the total cost of repair parts ordered has been less than $10.00 —a striking tribute to TABOR QUALITY.

SEND FOR BULLETIN M-R

There Is No Faster Machine Made
THE TABOR MANUFACTURING CO., PHILADELPHIA, U.S.A.

Becoming a Bigger Man

WHAT is the difference between some men you know and others known to you? Why are some men earning $3,000 a year and some $30,000? You can't put it down to heredity or better early opportunities, or even better education. What, then, is the explanation of the stagnation of some men and the elevation and progress of others?

We are reminded of a story. A railroad man, born in Canada, was revisiting his home town on the St. Lawrence River. He wandered up to a group of old-timers who sat in the sun basking in blissful idleness. "Charlie," said one of the old men, "they tell me you are getting $20,000 a year," "Something like that," said Charlie. "Well, all I've got to say, Charlie, is that you're not worth it."

A salary of $20,000 a year to these do-nothing men was incredible. Not one of the group had ever made as much as $2,000 a year, and each man in the company felt that he was a mighty good man.

Charlie had left the old home town when he was a lad. He had got into the mill of bigger things. He developed to be a good man, a better man, the best man for certain work. His specialized education, joined to his own energy and labor sent him up, up, up. To put it in another way: Charlie had always more to sell, and the world wanted his merchandise—brain, skill and ability. Having more to sell all the time, he got more pay all the time.

Charlie could have stayed in the old home town; could have stagnated like others; could have been content with common wages. In short, Charlie could have stayed with the common crowd at the foot of the ladder. But Charlie improved himself and pushed himself, and this type of man the Goddess of Fortune likes to take by the hand and lead onward and upward. Almost any man can climb higher if he really wants to try. None but himself will hold him back. As a matter of fact, the world applauds and helps those who try to climb the ladder that reaches towards the stars.

The bank manager in an obscure branch in a village can get out of that bank surely and swiftly, if he makes it clear to his superiors that he is ready for larger service and a larger sphere. The humble retailer can burst the walls of his small store, just as Timothy Eaton did, if he gets the right idea and follows it. It is not a matter of brain or education so much as of purpose joined to energy and labor. The salesman or manager or bookkeeper or secretary can lift himself to a higher plane of service and rewards if he prepares himself diligently for larger work and pay. The small manufacturer, the company director, the broker—all can become enlarged in the nature of their enterprise and in the amount of their income—by resolutely setting themselves about the task of growing to be bigger-minded men.

Specialized information is the great idea. This is what the world pays handsomely for. And to acquire specialized information is really a simple matter, calling for the purposeful and faithful use of time. This chiefly.

One does not have to stop his ordinary work, or go to a university, or to any school. One can acquire the specialized information in the margin of time which is his own—in the after-hours of business. Which means: If a man will read the right kind of books or publications, and make himself a serious student at home, in his hours—the evening hours or the early morning hours—he can climb to heights of position and pay that will dazzle the inert comrades of his youth or day's work.

IF business—BUSINESS—is your chosen field of work, we counsel you to read each week THE FINANCIAL POST. It will stimulate you mentally. It will challenge you to further studious effort. It will give you glimpses into the world of endeavor occupied by the captains of industry and finance. With the guidance of the POST, and with its wealth of specialized information, you, a purposeful man, aiming to go higher in life and pay, will find yourself becoming enlarged in knowledge and ambition, and will be acquiring the bases and facts of knowledge which become the rungs of the ladder you climb by.

It is the first step which costs. But this cost is trivial—a single dollar. We offer you the POST for four months for a dollar. Surely it is worth a dollar to discover how right we are in our argument. If you have the will to go higher in position and pay, sign the coupon below.

THE MACLEAN PUBLISHING COMPANY, LIMITED.
—143-153 University Avenue, Toronto.

Send me/us THE FINANCIAL POST for four months for one dollar.

Money to be enclosed/remitted

Signed ....

CF ....

OBERMAYER ESSO

TRADE MARK REGISTERED

MOLTEN IRON CLEANER

EVERYTHING YOU NEED IN YOUR FOUNDRY.

New and Better

EVERYTHING YOU NEED IN YOUR FOUNDRY.

ESSO MOLTEN IRON CLEANER is a product based on a scientific and practical method for reduction of Sulphur and other impurities in Castings, each and every component part plays an active reaction on the Molten Metal. **Esso Molten Iron Cleaner** is a development of years of experiment. We do not claim that this is a panacea for all ills, however it will reduce your Sulphur, Phosphorus, which to-day are the bugbears of the Iron Foundry Business. **Esso Molten Iron Cleaner** will also take out quite a few of the oxides that are in your metal and it will act in the ladle exactly as Aluminum does in Steel. It will give you a fine grade of Iron which will stand the Air Pressure and Water Pressure.

Our attention was called to Iron Cleaner from the mere fact that we had made such a wonderful success of our Rillton Brass Cleaner. Another great advantage of our **Esso Molten Iron Cleaner** is, when placed in the ladle it will keep your ladle clean and prevent scum, you simply skim your ladle the same as you have in the past and you will note the great improvement in your Iron.

We all know, that Coke in this Country is coming higher in Sulphur than formerly. In the days of our fathers it was not necessary to use Cleaners of any kind, our iron was better, in fact we had charcoal Iron. In those days Coke was of the best and 72 Hour Coke of ½% Sulphur, but to-day it is different and we have placed upon the market our **Esso Molten Iron Cleaner** to help your Molten Metal conditions.

We would be pleased to send you a barrel of this material on trial, Freight Prepaid on first lot, at 12c per pound, F. O. B. Pittsburgh, Cincinnati or Chicago for test, five pounds to one ton of metal, placed in the bottom is used to give the desired results for good castings.

THE S. OBERMAYER COMPANY

OFFICES AND FACTORIES:

PITTSBURGH CINCINNATI CHICAGO

WAREHOUSES:

ST. LOUIS MILWAUKEE DENVER PHILADELPHIA LOS ANGELES

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.

BOILERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

BOILER GRAPHITE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRIQUETTING
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

BRUSHES, FOUNDRY AND CORE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Standard Machy. & Supplies, Ltd., Montreal, Que.

CAR MOTORS
Can. Ingersoll-Rand Co., Montreal, Que.

CARS, CORE OVEN AND FOUNDRY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, ALUMINUM, BRASS, BRONZE, ETC.
United Brass & Lead, Ltd., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
United Brass & Lead, Ltd., Toronto, Ont.
W. W. Wells, Toronto.

CASTINGS, MALLEABLE IRON
Fanner Mfg. Co., Cleveland, Ohio.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Fanner Mfg. Co., Cleveland, Ohio.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARGING TRUCKS
Brown Specialty Mach. Co., Chicago, Ill.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCulloch-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Brown Specialty Mach. Co., Chicago, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Dominion Crucible Co., Ltd., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

EFFICIENCY ENGINEERING
Anderson's Efficiency Service, Toronto, Ont.

ELECTRO PLATING
United Brass & Lead, Ltd., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 216 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkla Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry & Machine Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Montreal, Que.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J. Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

GOGGLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRANITE AND MARBLE POLISHING
Harrison Supply Co., Boston, Mass.

GRANITE CUTTERS' TOOLS
Harrison Supply Co., Boston, Mass.

GRANITE AND MARBLE POLISHERS' SUPPLIES
Harrison Supply Co., Boston, Mass.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Ingersoll-Rand Co., Montreal, Que.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, DISC, BENCH, SWING
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Can. Ingersoll-Rand Co., Montreal, Que.
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hansen & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Toronto, Ont.

INGOTS, BRIQUET
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

INGOTS, COPPER, BRASS, BRONZE AND NICKEL
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

IRON CEMENTS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Inspection & Testing Laboratories, Montreal.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cooper Saddlery Hardware Co., H. W., Moline, Ill.
Champion Foundry & Machine Co., Chicago, Ill.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Federal Malleable Co., West Allis, Wis.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NICKEL, CHROME
Walker & Sons, Metal Products, Hiram, Walkerville, Ont.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Champion Foundry & Machine Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Standard Machy & Supplies, Ltd., Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

PNEUMATIC TOOLS
Can. Ingersoll-Rand Co., Montreal, Que.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

REFUSE BURNERS
Rodgers Boiler & Burner Co., Muskegon, Mich.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Champion Foundry & Machine Co., Chicago, Ill.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Rodgers Boiler & Burner Co., Muskegon, Mich.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.
Rodgers Boiler & Burner Co., Muskegon, Mich.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
Albany Sand & Supply Co.
United States Silica Co., Chicago, Ill.
Cascades Silica Products Co., Montreal, Que.
Frederic B. Stevens, Detroit, Michigan.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
New Haven Sand Blast Co., New Haven, Conn.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.
Rodgers Boiler & Burner Co., Muskegon, Mich.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Brown Specialty Mach. Co., Chicago, Ill.
Champion Foundry Mach. Co., Chicago.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek Mich
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J
Woodison, E. J., Co., Toronto, Ont.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek Mich.
Frederic B. Stevens, Detroit, Michigan.

SPRUE CUTTERS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

Mention this Paper When Writing to Advertisers

STAND PIPES, STACKS
Rodgers Boiler & Burner Co., Muskegon, Mich.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto. Ont.
Pittaburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison. E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton. Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit. Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Woodison, E. J., Co., Toronto, Ont.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dom. Iron & Steel Co., Sydney, N.S.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corpora..on, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto. Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES RUBBING AND OIL
Frederic B. .evens, Detroit, Michigan.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont
Can. Hart Wheels, Hamilton, Ont.

STOPPERS, GRAPHITE
Dominion Crucible Co., Ltd., Montreal, Que.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.
Rodgers Boiler & Burner Co., Muskegon, Mich.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont
McCulloch-Dalzell Crucible Company, Pittsburg

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

TRACK, OVERHEAD

TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont
Woodison E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.

WHEELS, GRINDING
Frederic B. Stevens, Detroit, Michigan.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wh-els, Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS

Character in Cupola Blocks

You do not buy Fire Brick and Cupola Blocks blindly.

To use them economically and succesfully they must be bought first with knowledge of their QUALITIES and their REQUIREMENTS IN SERVICE.

Every brand is made for a SPECIFIC PURPOSE:

One brand, for boiler settings, for hand-fired horizontal boilers, which resists 2,000 degrees Fahrenheit and which must resist also the abrasion wear of the fireman when he knocks off clinkers. When the wrong kind is used not only the clinker but the brick, too, are destroyed—there is needless expense.

Another kind, for heat-treating furnace lining, where high degrees of heat prevail.

Still another kind for cupola linings, which must resist not only heat but abrasion wear of the charge as it wears down through the melting process.

So it goes; each for its purpose. I have IN STOCK the brands that have made Fire Brick history. Every Fire Brick and Cupola Block reaches the user with clean, uninjured edges and every one is thus adaptable to its exact place. Fire Brick makers, as a rule, are several months behind on orders. I can accept your order IMMEDIATELY and deliver PROMPTLY.

There is no duty on ordinary Fire Brick. Can ship Fire Brick, Cupola Blocks and Fire Clay in carlots or less. Write stating service required.

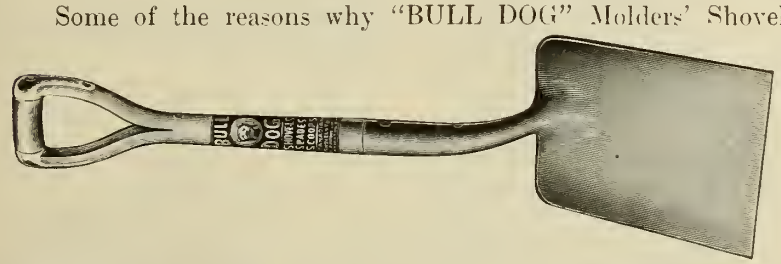
"Bull Dog" Molders' Shovels Are Great Favorites

The Blade and Socket are forged from one piece of high carbon bar steel, carefully hardened and tempered.

The socket is split at the back to permit of tightening around the handle should the wood shrink.

All Patent D Handles are made with the grain running lengthwise.

Some of the reasons why "BULL DOG" Molders' Shovels are such GREAT FAVORITES are as follows:



(A) Solid shank construction.
(B) Thick centres on top of blade where strain comes.
(C) Graduating tapers on blades.
(D) Bend in solid shank instead of the handle.
(E) Easily re-handled (not the case with bent handles).
(F) Practical tests have proven their superior strength.

Send me a trial order.

FREDERIC B. STEVENS

Manufacturer of Foundry and Electro-Plating Supplies and Equipment

DETROIT, MICH.

WAREHOUSE and OFFICE
Cor. of Larned and Third St.

FACING MILL
Cor. of Isabella Ave. and Mich. Central Railroad.

EXPORT WAREHOUSE
Windsor, Ont.

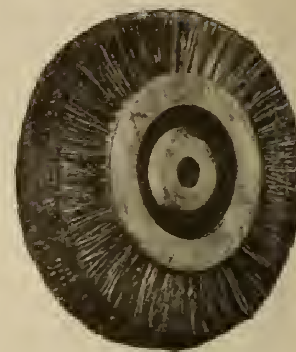
EASTERN SELLING AGENTS
Standard Machinery & Supplies, Ltd.
Montreal, Quebec.

BRUSHES

Wire, Bristle and Tompica for Lathe and Hand Use

Goblet Brush without Stem
Hub Lead Filled

Circular Brass and Steel Wire Scratch Brushes



Tampico Wheel Brushes

We manufacture a large variety of Circular Brass, Steel, Tampico and Bristle Wheels for manufacturing uses. Why not secure your wheels "Made in Canada" and save time and money? We can make any sort of wheel to suit your requirements.

Shoe Handle Brushes

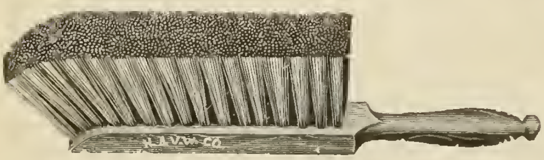
Curved Handle Brushes, "C.H."

Made in two classes, hand wire drawn and punched in Steel, Brass, Bristle, Firls and Tampico.

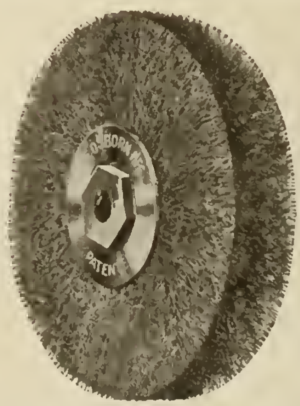
Cotton Potash Brushes

Flat Tampico Scouring Brushes, "M.M."

End Brushes for Jewelry



Sawdust Brush



Economy Steel Wire Brushes

Round Glue Brushes

Circular Bristle and Wire Brushes.
With Stem

Watch Case Brushes
Bristle and Wire

BUY GUARANTEED QUALITY SUPPLIES

Manufactured by

The Canadian Hanson & Van Winkle Company, Limited

15-25 Morrow Ave., West Toronto, Canada

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, MAY, 1919 No. 5

CANADIAN FOUNDRYMAN, May, 1919. Vol. X., No. 5. Published monthly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada,

The Publisher's Page

TORONTO MAY, 1919

THE BUSINESS OUTLOOK CLEARING

There is lots of encouragement for the business optimist nowadays, and before very long—perhaps before we realize it—the period of readjustment, or the critical stage of it at least, will have been passed. Last month it was announced that the General Motors Corporation are spending $6,000,000 on an immense plant in Windsor.

Following close on this came a report to the effect that the Maxwell Company, in a plant employing at least one thousand men, would take care of their export business from their Windsor factory.

CANADIAN FOUNDRYMAN has received requests for information from several large American manufacturers who are seeking locations in Canada. They find their British trade cut off and see in the establishment of a Canadian branch an opportunity to take care of their British business under Canada's preferential tariff and at the same time handle their Canadian trade at short range.

Some of these fine bracing mornings we'll wake up to find that a lot of buyers are in the market. It will be then that the steady, persistent advertiser will thank his lucky stars that he was born with common-sense and faith well mixed.

It will be then that advertised lines will get the cream of the business and the non-advertised, dark horse stuff the skim milk.

When you're in the market for anything, be it clothes or shoes—tooth paste or a razor, a molding machine or cupola, remember that the advertised product is not only best, but in the long run by far the cheapest.

And don't forget to perk up and look cheerful. The Western sky is clearing.

NEW MONARCH
VERTICAL MELTING FURNACE

Saves Time and Labor
Improves the Quality of Castings
Increases Production

THE MONARCH has revolutionized Melting Methods. It is the real conserver of human energy. Less labor, quicker, cheaper, better melts and a general uplift in foundry efficiency follows wherever it is introduced. The MONARCH is a furnace with a wide range.

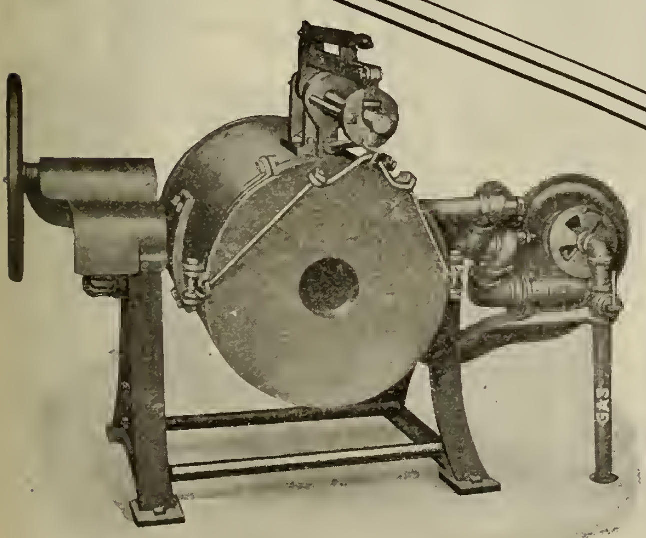
Melts Brass, Copper, Monel-Metal, Nickel, Aluminum, Bronze, Gold, Silver and any ordinary foundry mixture. Equipped with Premix Motor Blower for oil or gas fuel. **Good for any line of air or oil system.**

The saving you can make with a MONARCH is positive and practical. Write to us and let us know the conditions in your shop and we will be pleased to tell you whether or not you could use our furnace to advantage. **Expert advice free.**

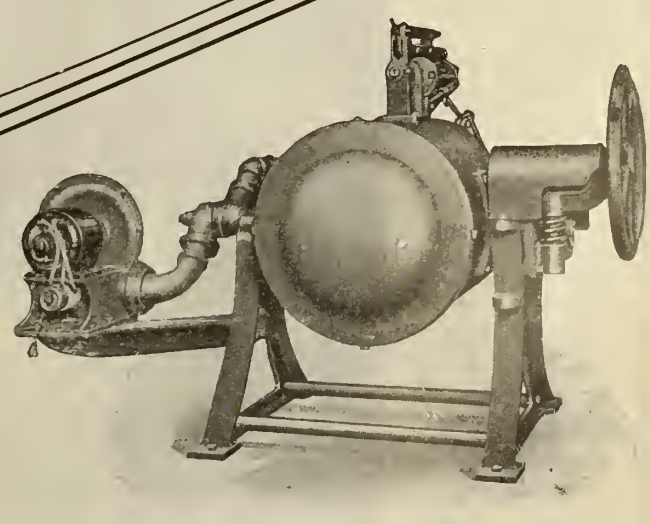
14 Varieties of Furnaces and Ovens

The Monarch Engineering & Manufacturing Company

1206 American Building
Baltimore, M.D., U.S.A.
Shops: Curtis Bay, MD.



Front view, furnace tilted for pouring. The worm gear tilting mechanism holds furnace safely at any angle.



Rear view, furnace tilted for pouring, showing round bottom. Inside bottom corners are rounded, which eliminates loss from metal adhering to lining in corners and preventing the pouring of full contents. Adapted to any existing "air or oil and gas" line.


Holland Core Oil Company
Why Not Cut the Cost of Your Core Flour?
Holland Products
CORE OILS, MATCH OIL, LINSEED OIL, HI-BINDER DRY CORE COMPOUNDS, HI-BINDER FOR DRY AND GREEN SAND FACING FOR STEEL, HI-BINDER CORE PASTE, PARTING, KLEEN CORE WASH, etc.
We make the best substitute for flour and dextrine ever conceived—it's far cheaper and gives better service. You can save a lot of real money by using—
HI-BINDER
CORE FLOUR
Barrel-lot customers are using everywhere and many big foundries order it by the car. Give it a trial and watch results.
Our Motto: "Service and Quality."
Canadian Agents:
The Dominion Foundry Supply Co., Limited
"Everything for the Foundry"
TORONTO
MONTREAL
HOLLAND PRODUCTS
GOOD PRODUCTS ONLY
4600 WEST HURON ST.
CHICAGO - - - ILLINOIS

Established 1909

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Published Monthly

Making Castings for Peace-Time Industry

Now That the War is a Matter of History and Business is Getting Down to a Peace-Time Basis, Many Interesting Things Crop Up

IN the illustrations Fig. 1 and 2 are two interesting castings molded and cast at the Waterous Engine Works Company's foundry in Brantford, Ont. These castings are made of bronze and are used in the manufacture of paper. As will be understood paper is manufactured from wet material, the drying process being the last step in the procedure. It is therefore not practicable to use iron in any part of the machine which comes in contact with the pulp when in the wet state, on account of the rust which would inevitably be formed and which would stain the paper. When it is remembered that Canada is the leading paper-pulp producing country in the world it will be easily imagined that the machinery used in its manufacture will be of considerably large proportions to cope with the demand, and that the castings used in the construction of this machinery will be of equally large proportions. Fig. 1, as will be noticed, is of a somewhat peculiar shape, being open in the centre and flanged at one end, while the other end is webbed as well as having the long projections on the webbed portions. To this must be added the fact that it is all on a twist and that all parts of it must be sharp, no miss runs being permissible. This piece is about four feet in diameter and makes a nice little job to mold, even for iron, and to pour it with brass is something requiring considerable good judgment as well as having the facilities to handle the amount of melted bronze required to pour it; but good judgment and proper material are the main requisites, the thickness being sufficient to make it possible to run with very little risk.

In Fig. 2, however, will be seen another part of the same machine which represents a more difficult molding operation as well as a more hazardous risk in pouring. This, while being a heavy piece requiring a lot of metal to run it, has many thin sharp sections as well as many complicated cores, the setting of which constitutes a greater source of anxiety than the making.

The production of a bronze casting of this description with all sharp corners perfect and no cold-shuts is an operation full of perplexities when it is considered that this metal must not be melted above a carefully defined limit without damage to the quality of the casting.

While this plant is essentially an iron works, the company has excellent facilities for doing brass and bronze castings.

In order that the reader may comprehend the class of iron castings turned out at these works we will show one sample of their equipment.

In the illustration Fig. 3 will be seen what might easily be considered to be as big an improvement in foundry equipment as anything which has been introduced in some time. The Waterous Engine Works Co., which is never satisfied with anything unless it is the latest, were not satisfied with the manner in which big castings were being poured, and as a consequence their foundry foreman devised this ladle. As may be imagined, nobody but a molder would think of an idea like this, but this company encourages molders of the thinking kind, and in the person of Mr. Alex. R. Waldron, the foundry foreman, they have not only a molder of the highest calibre but a man of thinking ability and a personality hard to beat. This ladle, as will be seen, is not particularly different from any other ladle, excepting that of the staging shown attached to it on which the operator stands while pouring. Any molder who has had experience in pouring large molds knows what this means to the molder, the usual method being to improvise a sort of scaffolding by piling up flasks and bottom boards, which is never a satisfactory way but is usually considered good enough for molders. Quite frequently a molder backs off a platform of this kind and invariably he gets into an unpleasant position in righting himself to the position of the ladle. With the attachment shown here the molder strikes an attitude which suits him and remains in that position, as the ladle can be backed up as the pouring proceeds and the man who is doing the pouring automatically backs up with it. If it is required that the ladle be lowered down in order to

FIG. 1—AN INTERESTING BRONZE CASTING.

pour a pit job in which case the operator can stand on the floor, this platform of course would not be required, and would possibly be in the way. In such a case it has simply to be lifted off, and when required for a high job it is an equally simple operation to replace it. This ladle, as will be seen, will pour twelve tons, and a molder in pouring that amount of metal requires to be in as comfortable a position as possible.

ESTIMATING THE DEPTH OF METAL REQUIRED IN A LADLE

The question is sometimes asked, "What depth of metal do I want in the ladle to form a given weight of casting?" Supposing the ladle is tapered, it is not a difficult matter to figure how much it will hold. This is done by adding the diameter of the top to the diameter of the bottom and dividing by two, which gives the average diameter. Multiply the average diameter by 3.1416, which gives the area. Multiply the area by the depth, which gives the number of cubic inches. Divide this by 4 and we get the approximate weight in pounds of the contents if filled with iron. This works out all right if the ladle is to be filled, but if the ladle is not a true taper and we only want a part of a ladleful of iron, it must be remembered that it is the top of the ladle which we are not using, and the top is where the bulk of the iron is on account of its greater size.

One method of figuring, and one which never fails, is to take a pail or kettle and get its exact weight, after which fill it with water and weigh it, and deduct the weight of pail, thus getting the weight of the water. Iron weighs 7.8 times as much as water, and in this way it is easily figured how much iron the pail of water represents, and the space required in the ladle to hold the proper amount of iron can be ascertained by using the pail for a measure. Supposing the pail held 25 lbs. of water, it would represent 195 lbs. of iron. By using this pail we can fill it with sand or sawdust, or anything we like, each pailful, which is dumped into the ladle, counts 195 lbs., and when the right amount is put in it is to be marked. This is just one way which I thought would be interesting to the reader and might come in useful some time in a pinch.

FIG. 2—A COMPLICATED PIECE TO MOLD OR POUR.

FIG. 3—A HANDY ATTACHMENT FOR LARGE CRANE LADLE.

The Tapered Ladle

Ladles are not made with very much taper any more, but a tapered ladle is the nicest ladle to pour from, for the reason that it can be hung low enough in the shank to prevent toppling over and still it will pour easily until drained. When the metal is partly gone, instead of a great weight remaining in the bottom pulling back, the extra width at the top end allows a greater weight there, even though it has not the depth, and this tends to prevent what is in the bottom from pulling back.

There is some talk of the Romeo Foundry Co., of Port Huron, constructing a foundry at Sarnia, Ont.

Messrs. F. A. Daniels, J. V. Connell and F. C. Kelleher, three practical machinery and jobbing molders of many years' experience in Canada and the United States, have leased the foundry of the Burrell Rock-Drill Co., of Belleville, Ont., and are operating it under the firm name of "Union Foundry Company," and are turning out iron, bronze and aluminum castings of all kinds. This foundry is a model foundry in every respect, and we bespeak for the Union Foundry Co. a successful career.

The Polish American Foundry Co., Buffalo, N.Y., has been incorporated with $50,000 capital. S. Machiniak, 580 Amherst St.; W. L. L. Gbowacki, 357 Amherst St., and W. Kafax, 586 Amherst St., are the leading figures in the enterprise.

Producing a Low Pressure Marine Cylinder

This Was Not One of the Regular Cylinders for Which the Proper Equipment Was at Hand, But Was a Special Order for Just One Casting

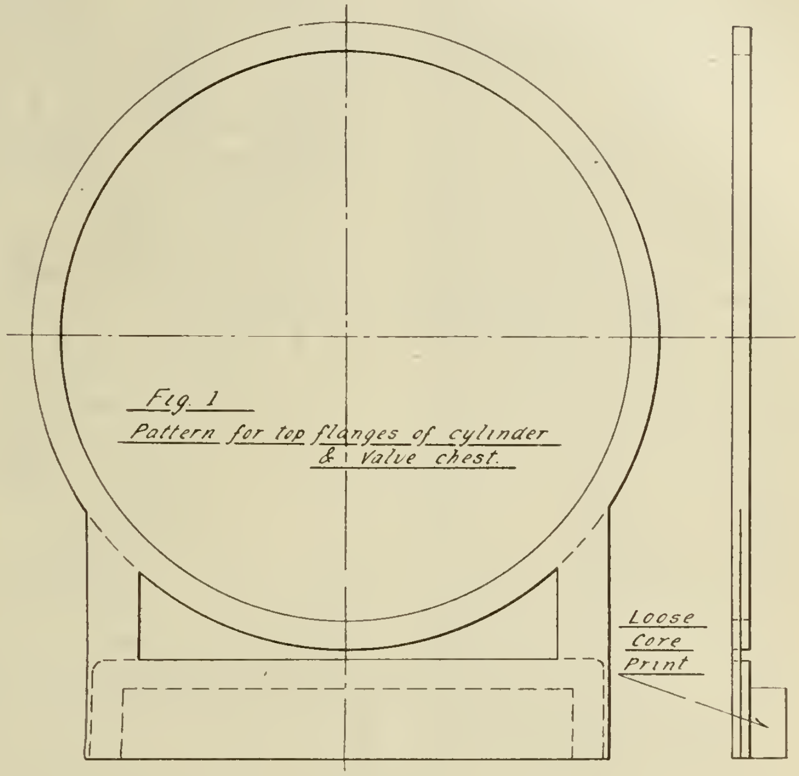
By JAMES A. NORMAN

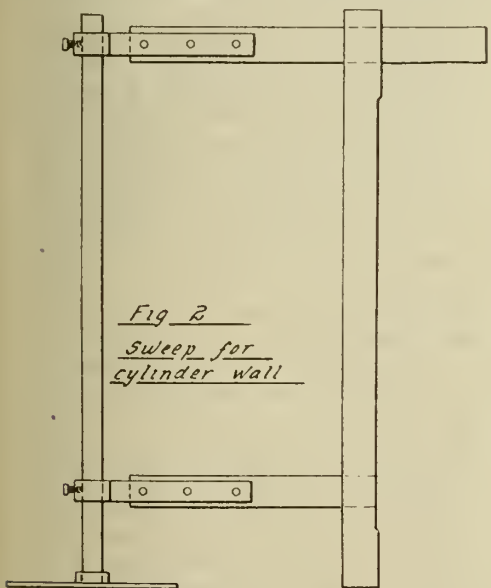
Foundry Supt. Engineering & Machine Works of Canada, Limited, St. Catharines, Ont.

THE writer was recently called upon to produce a 68 in. L. P. marine cylinder on a time limit of approximately eight weeks, including building of pattern, casting and cleaning cylinder. Following is a brief description of methods used in construction of pattern, rigging and method of molding:

This cylinder was cast bottom head up and was started from a skeleton template (see Fig. 1). The cheek or main body of cylinder was formed by a sweep (see Fig. 2), the steam chest being a boxed template (see Fig. 3), and the top or cope being built separately on a template carrying all loose ribs and feet with other projecting parts located on bottom head template (see Fig. 4). The template was placed on a level sand bed, the joint lifter ring being 1½ in. thick, with staples cast in for hook bolts (see Fig. 5). These bolts extended through holes in top plate, as did all bolts holding arbors. The top plate was cast with flat jaggers or bars downward, conforming with outside of wall of mold (see Fig. 6). The cope was rolled green and finished, cores bolted into place and dried in oven, rolled over and closed. The main barrel core was made in loam with sweep (see Fig. 7), top and bottom plates being used and bolted together.

The cylinder was ready for shipment in the time promised.

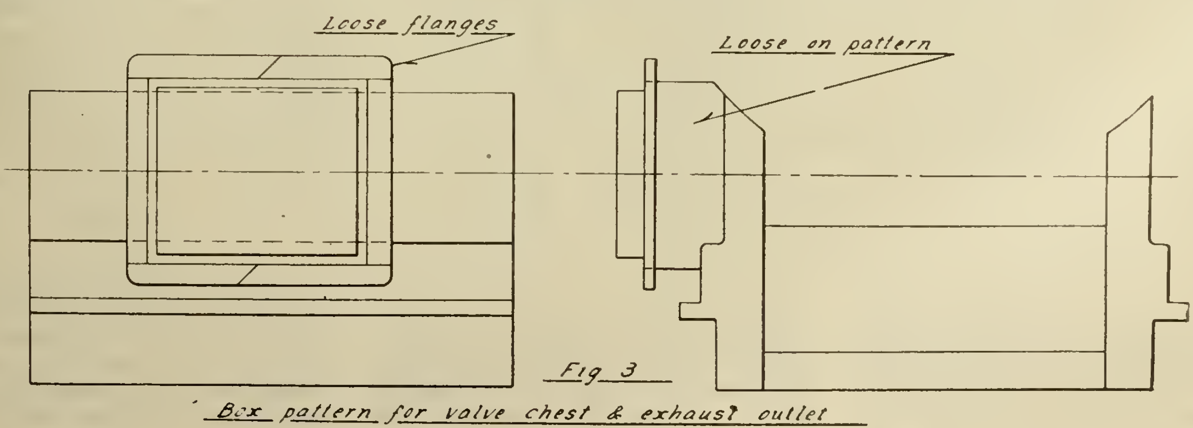




Producing Low Pressure Cylinder

This is the description which Mr. Norman was able to give us of a mold which we were fortunate enough to see being made at this establishment, and being a very busy man we could not urge him to go very deep into details. To a practical loam molder any further explanation would be unnecessary, but for those of less experience perhaps a few words might be of assistance.

During the last few months we have on several occasions endeavored to show the various different methods of molding a marine cylinder, none of which gave, perhaps, as good an understanding to the reader as the sketches here shown. The Engineering and Machine Works makes a specialty of heavy work of this nature and ordinarily would have molded this piece on end in a dry sand



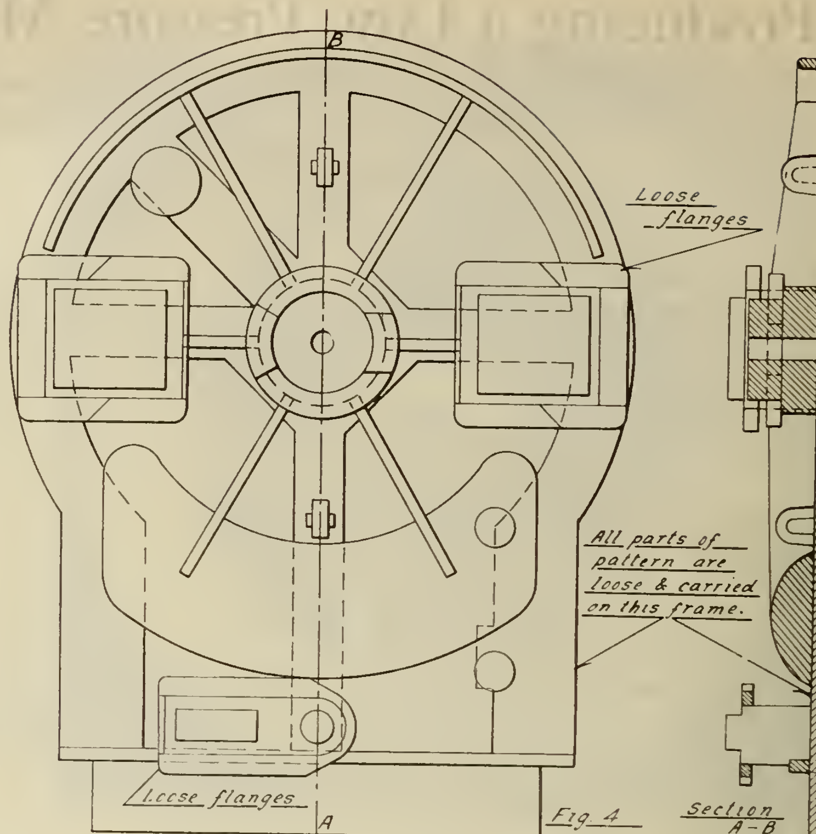
mold from a complete pattern had the order been of sufficient magnitude to make it practicable. But in this particular case the order only called for one, and as Mr. Norman says he was working on a time limit, and having all the different methods at his disposal, chose this as the proper mode of procedure.

In sweeping of a cylinder in brick and loam without a pattern, it is possible to be successful without lifting the main body or check, but in Mr. Norman's mind it is not advisable, and a lifting plate or ring is built into the bottom of the cheek and a partner made.

In Fig. 8 will se seen the bottom plate, on which the bottom portion of the mold is built.

The sweep spindle shown in Fig. 2 projects through the round opening shown in centre. The bricks of which the bottom is constructed are built in mud with the joints filled with cinders, as has been frequently explained in former articles. The skeleton template shown in Fig. 1 and described as top flange of cylinder, is, of course, the bottom flange of the mold, as the cylinder is bottom up. This flange is bedded into loam with the loose core print shown on the side sectional view, being bedded under it to receive the main steam chest core. After striking the point off true the chest pattern shown in the two views, Fig. 3, is stood in place and fitted to the sweep, Fig. 2, and secured to some outside fixture. The lifting ring on which the wall of the mold is built is of similar design to the flange pattern, Fig. 1, and is big enough to drop around the pattern losely, and heavy enough to lift the brick work without springing. This is now put in place on the loam joint and the wall built up and finished in the usual manner, as frequently described in these pages; the top being struck off level.

It would be as well to explain that in preparing the bottom of the mold to receive the flange pattern, a sweep of the shape of the flange and core print for main bore core was used. The bore core can either be built in its place which makes it of exactly the size of the print or it can be built by itself. In any event, it is dried separately from the outside. The core is built on an iron plate or ring and on top of the last course of brick is another iron plate with prickers pointing upward. The upper and lower plate are bolted together, making a substantial core, while the prickers are loamed and swept into the proper shape for the inside of the cylinder.



Pattern for bottom head of cylinder

The cover or cope, Fig. 4, for this mold is so well explained by Mr. Norman that very little can be added to it. About four courses of brick are required to make this. After leveling up the floor the pattern or template for the head with all branches and ribs is placed inside of ring, Fig. 5, and the brick and loam work built to it after which the cover plate, Fig. 6 is put on; the projecting bars or jaggers shown on side elevation, Fig. 6, bearing on Fig. 5. Hook bolts are attached to staples shown in Fig. 5, and project up through the cover plate, Fig. 6, and are securely bolted making a firm job which can be rolled over to admit of removing pattern and completing the work after which it is dried in theoven and rolled back into position for closing on to the mold. The setting of the cores and fastening the the mold together will be very little different from what has been previouly described. The main core is se cured to the bottom plate by bolts. Risors and feeding heads are taken off of the projection on top; but the grating might be explained as somewhat different from ordinary practice.

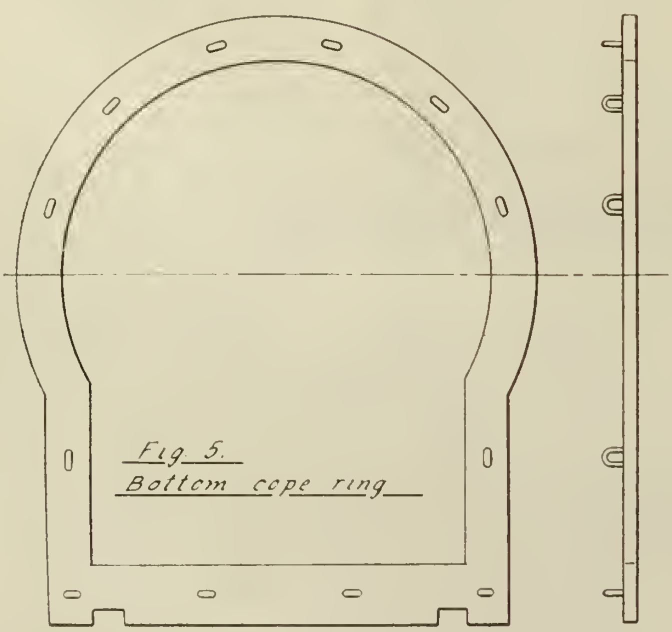


Fig. 5. Bottom cope ring

Gating

Instead of popping it from the top or gating it into the bottom flange the are placed in front of the chest in such a manner as to flow between the chest core and the outside. The down gate reaches from top to bottom with branches running in at intervals all the way up. The down gate being only of sufficient size to take the proper amount of metal, while the branches would be abundantly large. By this means the metal would always enter the mold at the lowest branch until the back pressure became too great, when it would begin to flow into the one next above. This method has all the advantages of either top or bottom pouring, and many advantages which neither of the other methods possess. Mr. Norman assures us that he always gates a cylinder in this manner and with the best of success, and we can readily concur with him.

Loam molding, while perhaps not as ecomomical as dry sand molding in filling a large order, has many advantages when an odd piece such as this has to be made besides many points in its favor which cannot be approached by any other means. A comparison of the two methods might be of interest to molders who are not familiar with different systems of moulding. Anything which can be done in green sand can be done in dry sand, as the method of molding is practically the same, with the difference that a binding material such as flour and sometimes thin claywash or molasses water is used to strengthen the mold against drying to dust. The mold is then made from a pattern in the usual manner, but blackened with a wash instead of with dry blackening. With loam molding it may be swept up as in the case just described, or it can be built up to a pattern when very heavy castings are to be made. If a ponderous piece or a comparatively light piece with considerable depth to it is to be molded, a loam mold is superior to any other mold. Loam can be mixed with fire-clay or molasses or flour; in fact with almost any binder, according to the description of the casting to be made, providing some material is used to open the grain in order to allow the gas to escape. Silica sand mixed with pure alumina or kaolin, commonly known as fire-clay, will make a facing for the brick work of the mold which will hold the metal in a molten state for hours, but the metal will not lie on it unless it is made porous by the introduction of some material such sawdust or horse manure. Sawdust opens the grain but weakens it, leaving it more liable to scab. Nothing has been found to equal horse manure if properly mixed through, as it is of a fibrous nature, the fibres touching each other, making a continuous vent, but not separating the grains of sand from each other.

A CEMENT WHICH RESISTS THE ACTION OF FIRE AND WATER

Take half a pint of milk and mix it with an equal quantity of vinegar, so as to coagulate the milk; separate the curds and mix the whey with the whites of four or five eggs. After thoroughly mixing these two substances add to them quick-lime which has been sifted through a fine sieve; make the whole into a thick paste, to the consistency of putty, when used.

This cement can be used for repairing leaky kettles or similar work, and will not be acted upon by the boiling water or the fire used in boiling it.

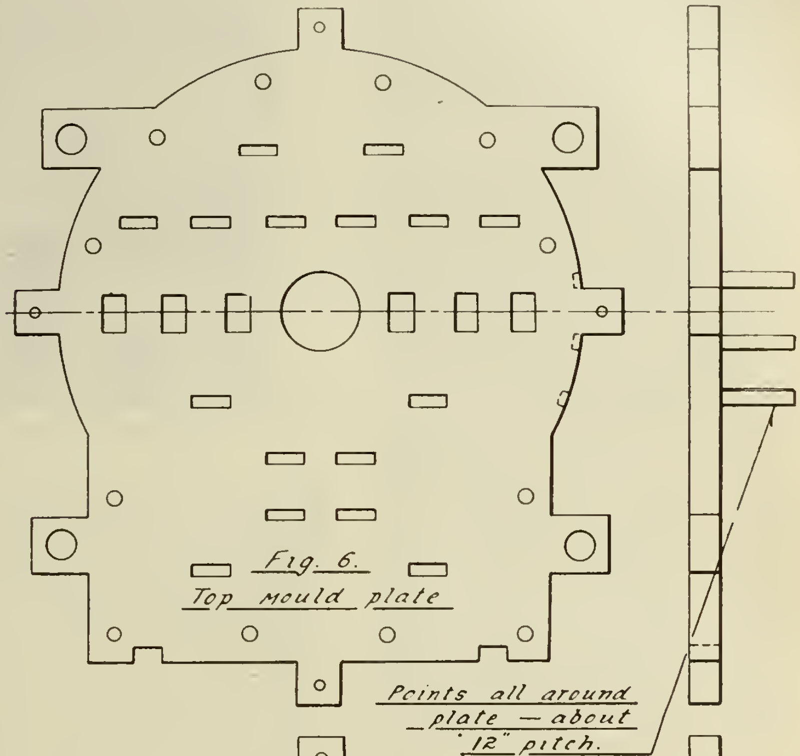


Fig. 6. Top mould plate

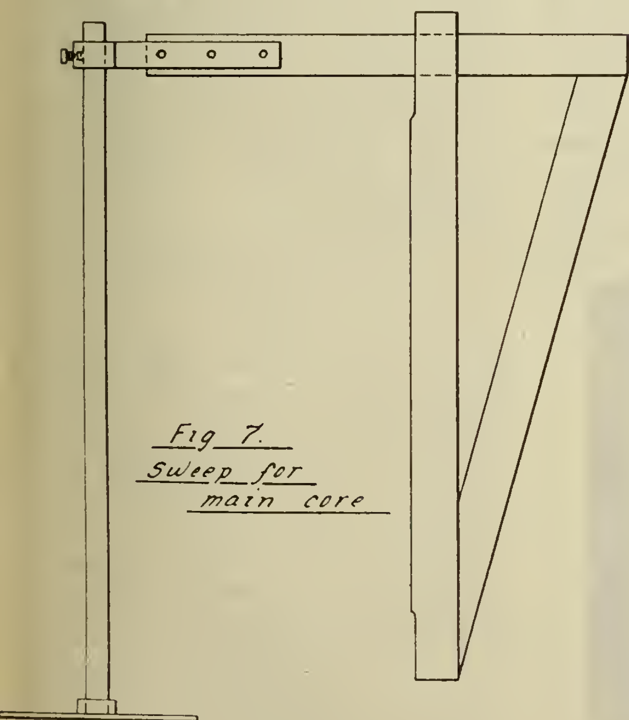


Fig 7. Sweep for main core

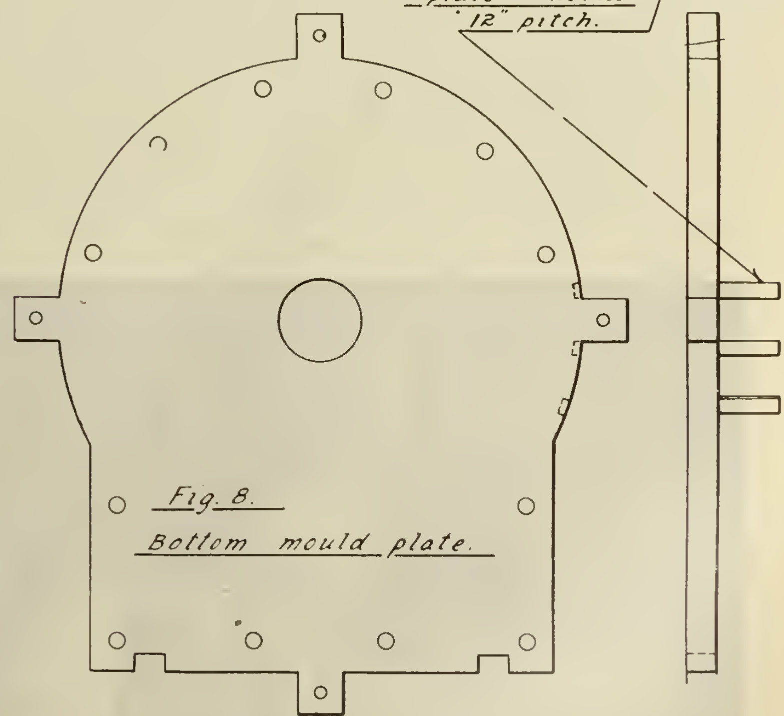


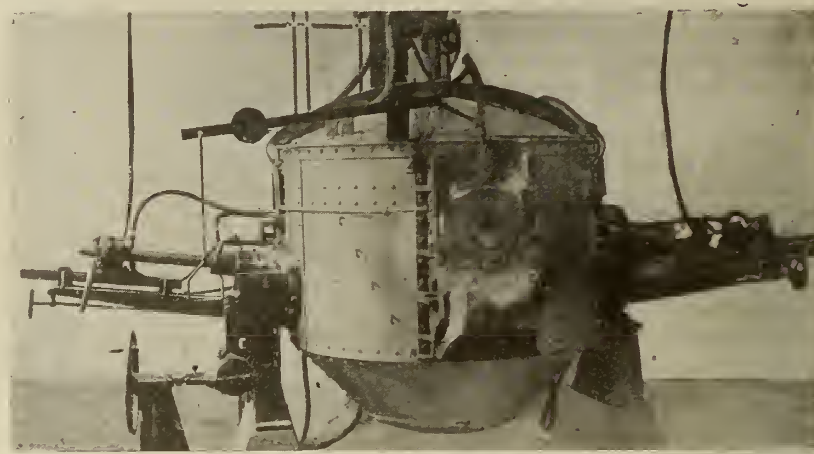
Fig. 8. Bottom mould plate.

Types of Electric Furnaces—1: the Rennerfelt

The First of a Number of Articles Dealing With Various Types of Electrical Furnaces in Successful Use in Metallurgical Industry—The Electrical Characteristics of This Furnace Are of Interest

By W. F. SUTHERLAND.

THE Rennerfelt electric arc furnace was developed by Rennerfelt in 1912 and is now in successful use for melting steel, cast iron ferro-manganese, nickel, copper, bronze, brass and aluminum, etc. It is of Swedish origin, the inventor, Ivan Rennerfelt, having conducted the experiments which led to its successful development in Sweden. The earlier Rennerfelt furnaces were built of the square or rectangular type, while others were of the later round type with domed roof. Standard practice with the manufacturers now is to use the round shell with a removable dome-shaped roof. This improved design results in a better heat distribution and a more accessible hearth. Relining is also greatly simplified.



1,000-LB. FURNACE, FRONT VIEW

Originally, all furnaces, even the largest types, were tiltable about central trunnions, and the tilting was accomplished by rack and pinion and worm gearing. This construction is now only adopted in the smaller sizes, the three ton and larger sizes now being tilted by means of a cradle and rack. This construction permits of a much smaller movement of the pouring lip and where even this amount of movement is inadvisable it is possible to support the furnace by means of trunnions immediately under the pouring lip. In the latter construction as well as in the other arrangement the actual tilting of the furnace is accomplished by means of motors suitably controlled.

Operating Characteristics

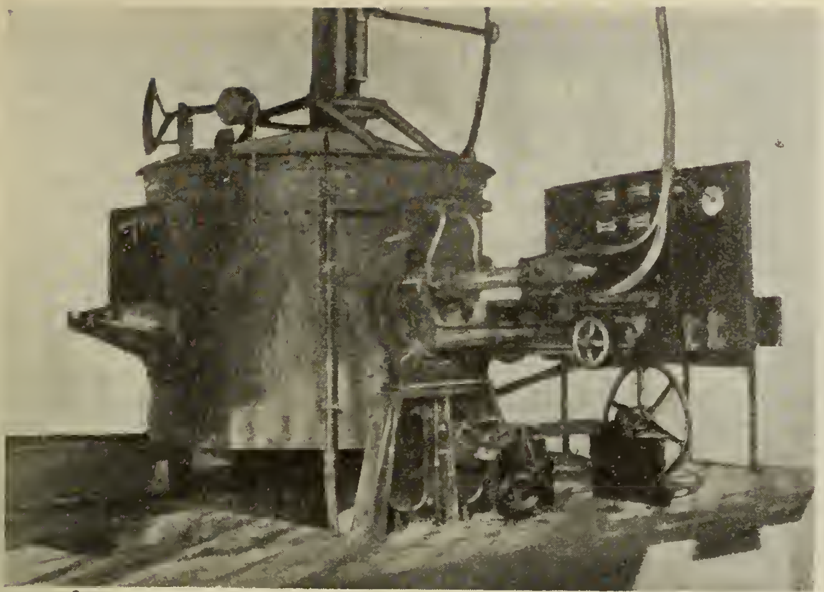
The Rennerfelt furnace, while drawing a three-phase current from the mains, differs from other makes of furnaces used in the metallurgical industries through the arrangement of and method of supplying current to the electrodes. The now well known connection devised by F. C. Scott for transforming three phase current to two-phase is used for this purpose and reference to the accompanying diagram will make the connections employed understood.

1,000-LB. FURNACE IN UNITED STATES MINT

The vertical electrode is the common return for both phases and carries 1.41 times the current carried by either of the side electrodes. The voltage employed between the centre and the side electrodes is about 100, and for steel the makers have arranged, on the transformer, for a reduced capacity voltage tap to give approximately 65 volts on the low tension side. This arrangement is of the utmost importance during refining, as the furnace will work more efficiently as an arc resistance type furnace at the lower voltage. At the same time it is evident that the same power input will not be required during the refining period as in the melting down period and excessive power would only burn out the lining. It is therefore of importance to reduce the power input from the transformer bank to the furnace, and, as mentioned, this is now done by means of taps on the transformers and not by introducing extra reactance. The reactors, which are now usually inserted on the high tension side of the transformers, are used to facilitate starting, but, due to the fact that an increase in reactance is liable to lower the power factor, it is not good operating practice to run the reactance in the circuit for any length of time. Reactance is occasionally employed in the low tension side in the larger installations, where the incoming line voltage is comparatively low.

The arc is formed between the tips of the three electrodes and on account of the two-phase current employed and the arrangement of the electrodes is thrown in a downward direction, thus creating a very intense heat where most needed, on the top of the bath itself. Thus while the arc is free burning the heat is directed where needed and a powerful heating effect secured. The character of the arc, by means of which it needs no conducting path through the metal, enables the bottom to be sintered in with little or no trouble.

It has been found that the highest efficiency and best working conditions in the Rennerfelt furnace are obtained at a certain and constant distance between the electrode tips and the top of the charge. For this reason the electrodes have been made tiltable in a vertical plane. Problems of design in connection with the maintaining of an airtight furnace have been satisfactorily overcome and specially designed stuffing boxes, external to the shell, allow the electrodes to be tilted at their maximum angle without leakage.



TILTING MECHANISM AND CONTROL

The tilting of the electrodes has introduced an important advantage. When in their lowest position arcing to the slag can take place. By this means the furnace can work as an arc resistance furnace with the slag and metal as part of the circuit.

The free burning arc for melting cold scrap will assure an even and steady operation with a current in the high tension leads perfectly balanced and of high power factor. Automatic electrode control can be used at the beginning of the melt.

If any amount of refining is to be carried out in the furnace the electrodes are tilted at the necessary angle and the furnace worked as an arc resistance furnace. The makers state that this feature is of importance in the desulphurizing period in basic operation, especially where a heavy white slag is used as in tool steel. The use of a carbide slag is made possible instead of a ferro-silicon slag at a considerable saving.

Linings

For use in the steel industry, either acid or basic linings can be used to suit conditions encountered. For basic operation the bottom consists of magnesite brick, on the top of which is the usual fused or sintered lining of deadburned magnesite. The side walls are made of magnesite brick up to or a little above the slag line. From there up silica brick is used. It is economy to use cheaper brick of neutral characteristics for the outer layers on the bottom and sides where the heat is not so intense and the basic characteristics of the magnesite are not needed.

For acid operation the bottom is made of silica brick with a rammed-in lining of gannister on top. The walls are made of silica brick. The roof is always made of 9 in. special silica brick. Since there is only one small hole in the roof and since it is of comparatively short radius, the maintenance costs are low and the inevitable expansion of silica brick is taken care of. A spare roof frame is furnished and a new roof may always be kept in reserve, making the replacement time less than one hour.

The life of the refractories is usually in the neighborhood of 250 heats for the roof and slightly more for the walls. No trouble is experienced with the bottom, which only requires an occasional patching and will last indefinitely if properly cared for.

The linings used for non-ferrous metals are in some cases different from those usually met with in steel practice. For copper, red brass, cupro nickel, bronze and silver, a gannister bottom is used, with silica brick sides and roof, while for bearing metal composed of 82. per cent. Cu., 5 per cent. lead, 6 per cent. tin, and 7 per cent. zinc, a bottom constructed of carborundum sand, mixed with fire clay and molasses for a binder was used with Chicago fire brick for the side walls and roof. This lining has lasted for 300 heats and it is claimed will be good for many heats more.

For the melting of aluminum a basic bottom has to be employed, made up of magnesite bricks with a fused-in magnesite lining. From the slag line up the furnace should be lined with firebrick. It is essential in melting this metal to avoid any contamination with silica and for this reason no silica brick is used in the furnace.

Power Consumption

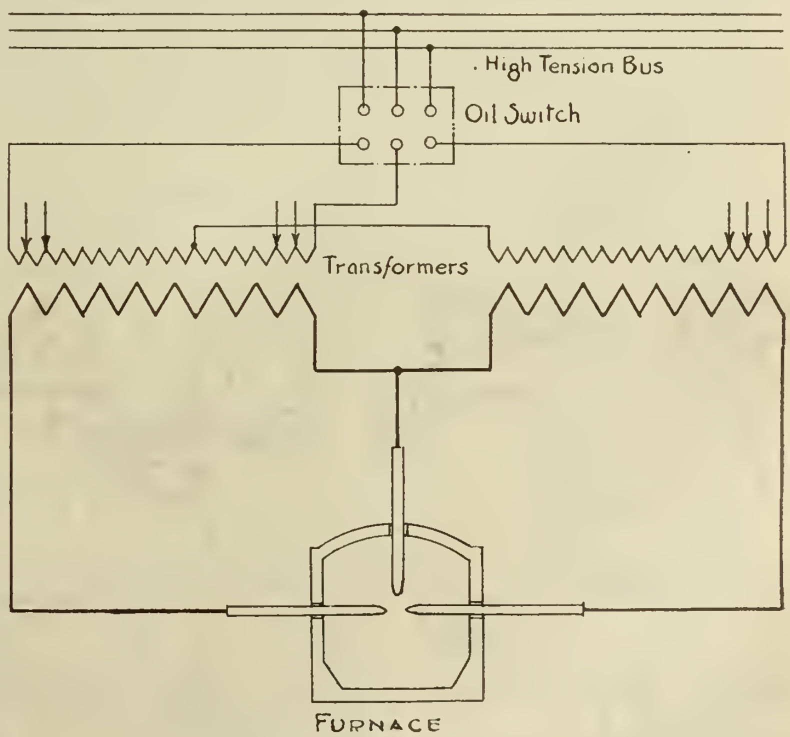
The makers of this furnace, Hamilton and Hansell, Inc., New York, have kindly furnished the following figures relative to the power consumption on various classes of work, which must, however, be read with the knowledge that variation is to be expected in this respect according to the class of work being done.

Power consumption and length of heat for four heats on steel castings, acid lining used and furnace operating only in the daytime:

Heat No.	Charge	Time	Kw. hrs.
1	1900 lbs.	4.00 hrs.	800
2	1800 lbs.	3.40 hrs.	520
3	1825 lbs.	3.26 hrs.	520
4	1800 lbs.	3.05 hrs.	490
Total	7325 lbs.	14.11 hrs.	2330
			Per ton
Aver.	1831 lbs.	3½ hrs.	637

The electrode consumption using Acheson graphite electrodes varied from 9 to 11 pounds per ton.

Another installation averaged 700 k.w. hr. per ton where no refining was required and about an additional 100 k.w. hr. for each slag taken off. These last results were obtained by continuous operation.



WIRING DIAGRAM OF FURNACE

FURNACE AND CONTROL PANELS

For the non-ferrous metals the following data are of interest:

Cupro-nickel (75% Cu, 25% Ni) in 1000-lb. Furnace

No. of pounds per heat	1,000
Kw. hr. used per ton	500
Time per heat	90 min.
Approximate loss	.32%

Bronze (95% Cu, 4% Zn, 1% Sn.) in 1000-lb. Furnace

No. of pounds per heat	1,000
Kw. hr. used per ton	300
Time per heat	65 min.
Approximate loss	.32%

Melting Silver Dollars in 1000-lb. Furnace

No. of pounds per heat	1,000
Kw. hr. used per ton	200
Time per heat	65 min.
Approximate loss	.05%

Bearing Metal (2000-lb. Furnace)

Total metal charged	8,048 lbs.
Total metal recovered	7,980 lbs.
Loss	68 lbs. (.845%)
Kw. hr. used per ton (average of 116 heats)	360 kw. hr.

This includes pre-heating, testing and melting. Average time for making one complete 2,000 lb. heat from charge to pour, 90 minutes; in other words, 12 minutes for charging, 70 minutes for melting and 8 minutes for pouring. Electrode consumption, based on 104 tons of charge, using Acheson graphite electrodes, 5½ lbs. per ton.

Rating and Transformer Capacity

The Rennerfelt furnace is manufactured in the following sizes and the transformer capacities given are advised for the various sizes.

Capacity.	Transformer rating. 40° C. rise normal rating
100-200 lbs.	40-60 Kva.
300-500 lbs.	80-100 Kva.
1,000 lbs.	150-200 Kva.
1 gross ton	300-400 Kva.
3-4 gross ton	800-1000 Kva.
5-6 gross ton	1200 Kva.

The makers give a comprehensive statement of the characteristics and salient features of the Rennerfelt arc furnace as follows:

The heat is generated with an arc with the absence of excessive strain on the power supply.

The high tension current may be of any cycle and voltage, either two or three phase, and is perfectly balanced on all three phases, if three phase current is used.

The arc is independent of any metal in the furnace and therefore can be regulated more easily with better control of the temperature.

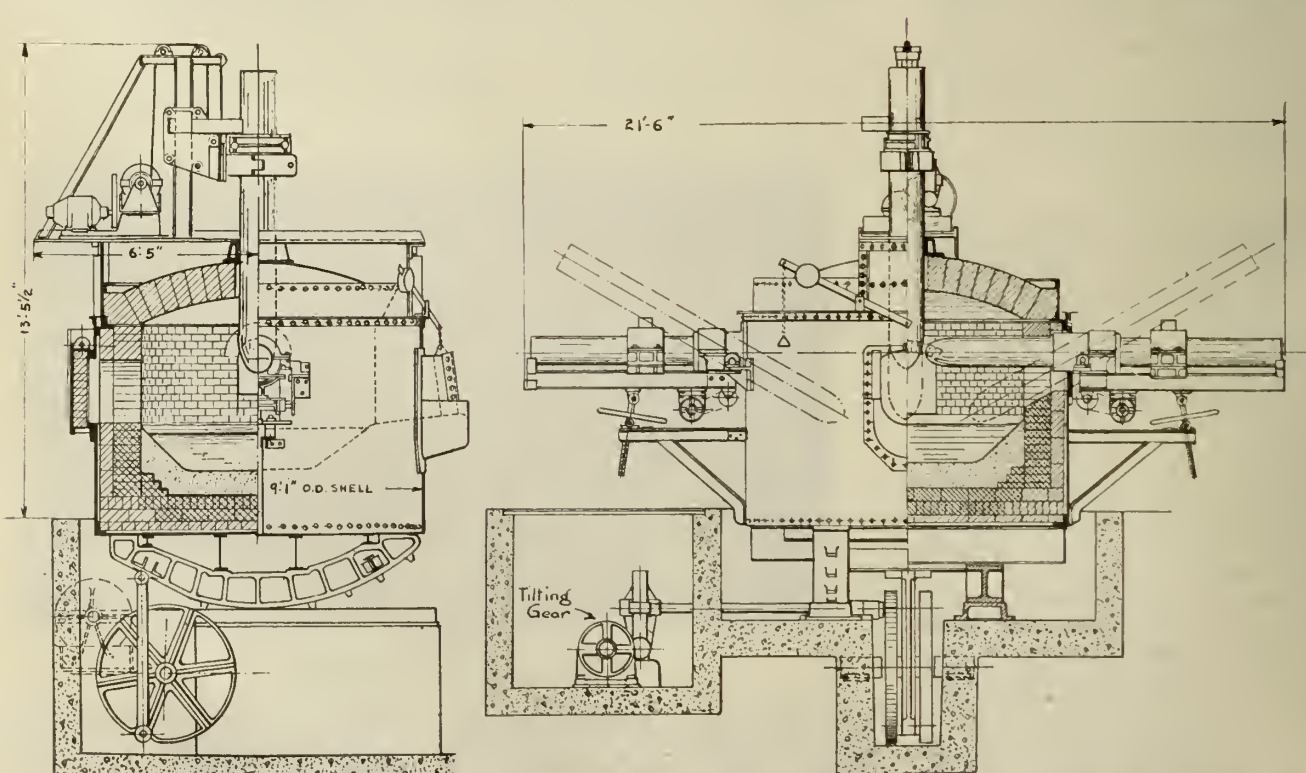
The arc is thrown violently downwards, and being a radiating arc of large volume, favors a high efficiency and the roof has a long and satisfactory life.

Due to the arc being free burning, the automatic side electrode control can be used during the melting down period without violent fluctuations in the power output.

The power factor is high—about 90 per cent. with 60 cycle current.

There is only one small hole in the short radius roof, the short radius roof and the single hole both making for strength and low maintenance cost.

A very important feature of this furnace has to do with the possibility of preheating the furnace with the free-burning arc and the bottom can be sintered in by this means without the use of coke, oil or other material. No trouble is experienced in getting contact as the arc is drawn between the tips of the three electrodes and cold scrap is never used as part of the circuit.



CROSS AND LONGITUDINAL SECTIONS OF 3-TON FURNACE, SHOWING ELECTRODE ARRANGEMENT

A New Method for the Smelting of Iron Ores

Many Ores Are Not Suitable For the Blast Furnace, and the Following Article Describes a Duplex Process For the Making of Steel From Any Ore

By J. W. MOFFAT

CANADIAN iron ores in many cases do not admit of economical reduction in the blast furnace, and the physical state in which many of them are found is such that they would have to be briquetted before being introduced into the blast furnace at all.

A new method has recently been devised for the reduction of metals from their oxide or sulphide ores, which does not necessitate the use of the blast furnace, and which at the same time enables ores of any degree of fineness to be used. In principle it employs two present known furnace processes in combination. The first step is the reducing of the ore and its conversion into the metallic state, but in the form of sponge, as it is called. The next step is the transferrence of this sponge, either hot or cold, into the electric furnace, where it is melted down and finished. This process is particularly adapted to the manufacture of iron and steel and ferro-alloys.

The iron sponge is iron in a porous form, and a definition by Raymond states that is obtained by reduction without fusion. Its weight is about one-third that of cast iron.

The reduction of iron ores into this form has been attempted by the use of gas, but the success obtained has never been very great, as complete reduction was very seldom accomplished unless by the lengthening out of the operation. Not only was this the case, but accurate control of the heat was difficult and the sponge was liable to re-oxidize when cooled or remelted if an oxidizing atmosphere is present.

These difficulties have been overcome by the aid of pyrometers for temperature control, CO_2 recorders for gas analysis and by the use of the electric furnace in which a reducing atmosphere is readily maintained.

The reduction of hematite iron ore (Fe_2O_3) is accomplished in stages, the first to magnetite (Fe_3O_4) which takes place from 300 to 450° C., and then to ferrous oxide (FeO) and finally to metallic iron, which takes place from 700 to 800° C., the iron then being in a spongy metallic state. The spongy iron thus formed is finally melted at a still higher temperature of from 1100° to 1300° C.

Previous Efforts

A number of attempts have been made to use sponge iron in various ways, a few of which may be noted. In Clay's process the reduction was effected in retorts made from fire clay, the ore having been mixed with carbonaceous material, the heat being applied externally and the sponge iron product was then further heated and balled.

Newton also used a closed container in a somewhat similar way, heating it externally to a white heat for about 48 hours and taking the product while hot to a puddling furnace, or, when cold, to a crucible furnace.

Harvey devised a process in which coarsely ground ore mixed with charcoal was placed on inclined shelves within a puddling furnace in such a position that it was heated by gas entering the furnace. When reduced, the iron was worked up into puddled balls with the aid of further heat.

Roger mixed ore with coal and effected reduction in a rotating cylinder, heated externally; this he located above his puddling furnace into which the sponge was dropped, further heated and then balled.

A number of attempts have been made to use iron sponge in the crucible furnace. For instance, Belford put a mixture of iron ore and carbonaceous material into a suitable container, heated it externally, and then transferred the sponge while hot into crucibles, thus melting it down. Later on he transferred it through a closed runner to a decarburizing chamber, where it was acted upon by decarburizing gases or steam. This was probably done to eliminate some of the carbon in the sponge. The utilization of the sponge has also been tried out in the open hearth furnace.

A number of other processes have been tried out for the using of iron sponge in the puddling crucible and open hearth furnaces, but all of them could only be considered as furnishing part of the metal used and all would certainly introduce more or less oxide into the bath of molten metal, thus increasing the finishing costs, for carbon dioxide in the furnace gases will oxidize iron sponges at as low a temperature as 300°C.

While the blast furnace at first glance might offer a means of working up the sponge, it has the serious disadvantage of oxidizing the already reduced sponge in the top part of the shaft. This action is due to the carbon dioxide, which is present in the blast furnace gases along with the carbon monoxide. This action would waste all the work previously done on the ore and the material would have to be again reduced in the reducing zone of the furnace.

In the author's process for which patents have been granted (Canadian patent No. 186,994, Oct. 15th, 1918, and U. S. patent issued Feb. 18th, 1919) for the duplexing of a reducing furnace with an electric melting furnace it is immaterial how the sponge is made. The reducing furnace must suit the materials used for supplying the heat and the means of reduction for the most convenient and economical means in one locality may not be so in another.

With modern scientific apparatus and reduction, the making of iron sponge is an easy operation to carry out successfully. Such furnaces should be mechanically charged, rabbled and discharged, and means should be provided for making small additions of carbon to the charge when necessary. Preferably the gases of combustion supplying the heat should not be passed over or through the ore being reduced. Stationary pyrometers should be provided which will indicate by colored flash lamps any variation up or down from the proper temperature.

With a properly designed furnace an intelligent laborer should be able to operate a number with resulting low labor costs.

Any electric furnace can be successfully used in the final melting down of the scrap.

Canadian Ores

Ores of high metallic iron content, say 65 per cent. and over in the crude state, are becoming increasingly difficult to get in Canada and the United States within a reasonable transportation distance of any market. One of the largest concerns in the United States catalogues the product of thirty odd mines, without showing one such ore, seven, however, range between 60 and 62 per cent. Outside of the Helen and Magpie mines of the Algoma Steel Corporation, the Atikokan Iron Co. and the Moose Mountain mine of the Moose Mountain, Ltd., the ore bodies in the older and more populous parts of Canada are not large, and are of low grade as a rule.

In Ontario, except the ones mentioned, no really large property has been thoroughly proved to contain one million tons of marketable ore, though there are a few of undoubted promise, such as the Canada Iron Mines' properties in Hastings County and the Belmont mine in Peterborough. There are, however, in Ontario many small bodies of ore situated conveniently to the market.

In the 48 years between 1869 and 1916 the Dominion Government reports show a total production of about 4,350,000 tons of ore in Ontario, an average of 90,625 tons annually, or a little less than 250 tons daily, an amount insufficient to alone supply one very small blast furnace.

In the Province of Quebec from 1886 to 1916, a period of 30 years, there was a total production of 379,953 tons, making the yearly average 12,665 tons, or a daily average of 35 tons.

New Brunswick, in 68 years, 1848 to 1916, produced 272,850 tons, a yearly average of 4,013 tons, or a daily average of 11 tons.

Nova Scotia, in 30 years, 1886 to 1916, produced 1,279,637 tons, or a yearly average of 42,655 tons, or a daily average of 117 tons.

British Columbia, in 30 years, 1886 to 1916, produced 65,078 tons and exported practically all of it to the neighboring State of Washington. This tonnage is a yearly average of 2,170 tons, or a daily average of 6 tons.

The other provinces have done little or nothing in the mining of iron ore.

Dominion Government reports also supply other statistics of the total output of all Canada. For a period of 30 years the total production was 5,759,540 tons (2,000 lbs.), a yearly product of 191,985 tons, or a daily average of about 526 short tons, or 470 long tons, the latter being the ton used in the pig iron market. This 470 long tons of ore would have to carry about 55 per cent. of metallic iron to meet the supply required for only one small blast furnace, making 250 tons of pig iron daily, which is one-half the size of what is considered a good furnace to-day, when they are being built to produce up to 600 and 700 tons of pig per day.

In 1916 the United States produced about 75,500,000 tons of ore, the population being about 100,000,000; this is equivalent to 75.5 tons per 100 of population. The same year Canada produced from her mines 340,000 tons, or 4.25 tons per 100 of population, or about one-seventeenth of what the United States did.

This is a poor showing, particularly when it is remembered that the great producing iron ranges found in the States of Minnesota, Michigan, and New York are also found in Canada, and that the last twenty years include what is called "Canada's growing time." There are undoubtedly many reasons why such a state of affairs exists, some can be removed by legislation, but the great cause of this poor showing is that few of our mines with convenient shipping facilities can produce even 100 tons per day, and the great majority of all Canadian ores unfortunately require crushing, grinding and concentration with subsequent briquetting to render them acceptable to blast furnace operators, and it is this cost of briquetting which finally proves to be the last straw.

The Canadian blast furnace operator is able to deal with one American selling agent for his entire requirements for a year's run, feeling absolutely sure of its delivery to him and of its being, according to the analysis, guaranteed at the time of its selection. Another factor which enters into the ease with which American ores can be used is the almost negligible duty of eight cents per ton and no war tax. English ores can be imported still more cheaply as regards duty as the amount in this case is only six cents.

The best solution tending towards the utilization of Canada's resources would seem to be the operation in some profitable manner of the many small iron mines, such as are to be found between the Lake of the Woods on the west, all the way down the north shore of the Great Lakes water system to the Straits of Belle Isle on the east. As there are very many large water powers available for the generation of electricity at points sufficiently convenient for the transmission of power to suitable smelting locations, the past difficulties can be largely overcome by a reversion to the use of the iron sponge of the ancients, melting it in the very modern electric furnace with its ideal conditions for that work, and without removal, finishing the metal into any desired iron or steel.

Marketing the Product

It is hardly to be expected that the electric furnace can market ordinary pig iron in opposition to that made in the blast furnace, except under most unusual conditions, such as a very long haul from the blast furnace to that market which may be adjacent to the electric furnace. Low phosphorous high silicon pig iron, however, could be made for sale to the open hearth steel furnaces and some washed metal (metal with the phosphorous sulphur and silicon practically eliminated) and other special irons would have some market.

The natural product of the electric furnace is steel, however, and to that metal is its work advantageously confined from a financial point of view. It is particularly well suited to the furnishing of the molten metal in a steel foundry, but this class of work is only prosperous in the centres of large population, and most of our smaller iron mines are situated at some distance from the cities.

During the war there was a ready market found in casting ingots for the forging of shells. The war taught us new possibilities, and if existing forging and rolling mills are not disposed to continue that practice, the electric furnace plants could cast ingots, crop them (remelting the cropped ends with the iron sponge of the next heat) and ship the ingots to a distant forging works or rolling mill which they themselves had combined to build and operate. A plate rolling mill would find a ready market for its entire output in Ontario, for instance. Rolling billets, too, would probably be satisfactory. Electric furnace steel, owing to its superior quality, will always find a sale in competition with other steels and at a higher price even when steel of high quality is desired.

Under the new process the ore should be crushed fine enough to effect the best magnetic separation of the iron oxide from its associated gangue, usually silica. It is rather expensive to get rid of rock material by means of slags made in the electric furnace, and an ore should be concentrated up until it carries as high a metallic iron content as possible, over 63 per cent. say, though no hard and fast rule can be laid down, as it all depends on the analysis of each ore.

For reduction purposes, the carbonaceous material should be ground to the same size of grain as the ore and should be very thoroughly mixed with it. Its analysis should show the weight of fixed carbon and volatile matter, moisture and ash. Theoretically the metallic iron should have one-quarter of its weight of fixed carbon present for its complete reduction, but in practice a further small percentage is added. For example, 1,000 lbs. of 65 per cent. iron ore (Fe_2O_3) has 650 lbs. of metallic iron and theoretically requires 162½ lbs. of fixed carbon for complete reduction which would be found in 275 lbs. of charcoal showing 60 per cent. of fixed carbon in analysis.

Limestone, also finely ground like the concentrates, may be mixed in the charge and will be calcined in the process, or it may be added as lime in the electric furnace. There should be enough lime present to make a very basic slag in the electric furnace.

The iron sponge may be handled hot or cold. When transferred hot, the reducing furnace should be provided with means for discharging its contents into containers having air-tight valves, taking every care that air is not allowed access to it during the discharge. The containers must be discharged into the electric furnace with like care and preferably through the roof, the furnace having been previously rendered air-tight. The current can then be put on and it will be noticed that the charge will carry the current steadily at once without the very objectionable surging found in melting cold scrap. Indeed, if the sponge is only reasonably warm this will occur and the running will be smooth.

The reducing furnace may be provided with a large air-tight cooling chamber underneath, into the top of which the iron sponge may be dropped when reduction is complete. When this chamber is constructed to hold the product of several runs, it becomes a storage bin as well, with the lowest charge cooled below the oxidizing temperature, but still being warm it can be transferred without care and be charged into the electric furnace through its regular doors.

In the case of a low grade hematite or a mixed hematite and magnetite ore, which ores do not answer well to magnetic concentration, a partial reduction to Fe_3O_4 will render it well suited as a rule.

The heat required for the chemical reactions can be either secured by burning coal or coke on a grate or by using these in powdered form, blown in with air to a combustion chamber or by using liquid fuel, such as fuel oil. The burning gases from any of these fuels should heat externally the container in which the work of reduction is being carried on, but preferably should not be allowed to enter it. If electric heat is used it can be applied in the same chamber as that in which reduction is bèing carried on.

The operation of the electric furnace in the melting down of the sponge is practically the same as in the melting and refining of scrap.

In the Swedish electric furnace (Electro-Metals Co.) it requires about 1.1 k.w. hours of power to produce 1 lb. of metal and the metal is a white iron only. This is equivalent to 2,200 k.w. hours for a net ton. It is transferred while liquid to an electric furnace, where about 300 k.w. hours of additional energy are required to finish the metal into steel, making the total energy used about 2,-500 k.w. hours from ore to steel.

Properly reduced iron sponge melts as readily as scrap, which can be melted and finished in good practice with 700 or 750 k.w. hours per ton, but as the rock material remaining in the iron concentrates will frequently necessitate a larger amount of lime to secure a very basic slag, the amount of slag used in the iron sponge process will be somewhat greater than in the scrap melting process. A fair average will be 800 k.w. hour with the sponge process, or about one-third the amount required by the electric process used in Sweden.

In this new process no high temperature heat is lost in waste gases leaving the electric furnace, as there will be practically no gases generated there, and compared with other processes using 1,700 k.w. hr. of energy more than the iron sponge process, which employs heat obtained for reduction from fuel, the economy in the process is readily seen. A six-ton electric furnace will require the iron sponge made from about 10 tons of 63 per cent. Fe concentrate per heat. Four heats can be easily made in 24 hours and a skilled operator could get five if the plant were suitable. Taking the number of heats at four a six-ton furnace would then readily produce 24 tons of liquid steel in 24 hours, and would require 60 tons of 63 per cent. Fe concentrates. If the ore mined would need concentration of 1½ into 1 to produce 63 per cent. Fe concentrate, one six-ton furnace would use 90 tons per day of such crude ore.

The following are the main claims granted in the patents issued to the author:

1. A discontinuous process of treating metallic oxide ores which consists in reducing a charge of ore without fusion in a suitable furnace, and, after reducing, excluding oxidizing gases from contact with the charge, while its temperature is above the lower limit at which re-oxidation can take place, placing the reduced charge in a separate electric furnace and fusing it there in an inert or reducing atmosphere.

2. A discontinuous process of treating metallic oxide ores, which consists in reducing the charge of granular ore without fusion in a suitable furnace, and at as low a temperature as possible to maintain the granular form of the reduced ore, and after reducing excluding oxidizing gases from contact with the charge while its temperature is above the lower limit at which reoxidation can take place, placing the reduced charge in a separate electric furnace and fusing it therein in an inert or reducing atmosphere.

3. A discontinuous process of treating metallic oxide ores which consists in reducing a charge of ore without a flux, without fusion in a suitable furnace and after reducing, excluding oxidizing gases from contact with the charge while its temperature is above the lower limit at which reoxidation can take place, placing the reduced charge in a separate electric furnace and fusing it therein with a flux in an inert or reducing atmosphere.

4, 5 and 6, cover the cooling of the charge after reduction and before fusion to a temperature below that at which reoxidation can take place as already set out in 1, 2 and 3.

MICA SCHIST AS A CUPOLA LINING

Mica schist, or fire-stone, as it is sometimes called, is a soft rock that has been used for some time in lining steel converters and furnaces, and is now coming into use for cupola linings. This material may be readily broken, and crumbles easily when handled, and cannot be cut into shape for lining before shipment. It is, therefore, used in its natural state as it comes from the mines, and fitted into the cupola as the lining is laid up. The small pieces or crumbs that are broken off in handling and fitting the lining are smashed up and mixed with a little fire-clay; this makes a fire mortar that stands the heat equally as well as the solid rock, and when heated cements the entire lining into a solid mass that glazes and does not spill off and fall out so easily as fire brick.

At several foundries where mica schist is used for lining it is said to be giving excellent satisfaction. The labor of putting in the lining would cost silghtly more on account of having to do more fitting, but once in the cost of keeping it in repair would be less than one-quarter of the cost of keeping fire brick in repair, and the original cost of the mica schist is generally about half what the fire bricks would cost, so that where it can be secured without too long a rail haul, it is to be recommended.

When putting in a lining of this material all backing or filling put in with fire-brick should be removed and the lining made as thick as possible, for the thicker it is, the more readily and quickly it may be laid up, and a backing is not required with it.

Another point in connection with cupola linings and daubing, which is usually overlooked, is that all scraps of schist or fire-brick and all old burned-out linings can be ground in the cinder mill and mixed with fire-clay, making a first-class daubing for the cupola.

If material of any kind can be ground and shipped in barrels for this purpose, surely it is worth the expense of grinding, when the material is already on hand; yet I have seen wagon loads of this material thrown on the dump and hauled away.

INJURIES SUSTAINED THROUGH THE USE OF AMMONIA

In the case of ammonia getting into the eyes or on the skin or in any way coming in contact with the flesh or vital organs, the following suggestion should be carefully followed:

For the Eyes

First—Pour a one per cent. solution of pure boric acid into the eyes, instructing patient to open and close the lids rapidly to bring the solution in contact with entire surface. Use freely as the solution is not dangerous.

Second—After thoroughly washing the eyes place a small quantity of clean, plain vaseline under lids by pulling down lower lid and applying the vaseline with a match-shaped piece of wood, having smooth, rounded ends.

For the Skin

Apply lint or linen or washed muslin, dripping wet with carron oil, changing dressing frequently. (By keeping lime water and linseed oil separately, a fresh solution may be prepared each time by mixing thoroughly equal parts of the two ingredients.)

For Nose and Throat, if Inhaled

Dip handkerchief, or a piece of gauze, folded once, in vinegar, wring out lightly and lay loosely over nose and mouth. (If liquid ammonia has entered the nose, snuff up some diluted vinegar and apply sweet oil with a chicken feather to inner surface of nostrils.)

If Ammonia Has Been Swallowed

Administer diluted vinegar or have patient suck orange or lemon juice in liberal quantities and follow up with one to four teaspoonsful of sweet oil, milk or the whites of three or four eggs and ice. (If vomiting is present, aid it by giving liberal draughts of lukewarm water.)

General Information

Ammonia gas is lighter than air, and being released, rises. Therefore, in case of accident, keep your head as low as possible.

On going to the rescue of one overcome by ammonia gas, keep near the floor and place a wet sponge or cloth over the mouth and nostrils. Water will absorb the gas and prevent its inhalation.

Keep the following supplies on hand in a clean and easily accessible cabinet:

A one per cent. solution of pure boric acid;

One bottle clean, plain vaseline;

One package, surgeon's lint or muslin;

One package plain gauze;

One pint best quality vinegar;

One pint sweet oil;

One pint carron oil (linseed oil and lime water, equal parts).

Making a Big Casting in a Very Small Foundry

"Where There's a Will There's a Way" Can be Demonstrated in the Foundry as Well as in Aesop's Fables

By JOHN B. LLOYD

THE idea of writing this little story describing an experience of my own was prompted through having seen articles appearing from time to time in the columns of your valuable magazine along the line of what could be accomplished in a small foundry. These articles always seemed of the most vital interest to me, bringing back, as they did, my younger days in the foundry. It has been my lot to make some fairly heavy pieces with scant equipment with which to work, and when the article appeared in the March edition of CANADIAN FOUNDRYMAN describing the British cupola with the receiver or catch basin at the spout, it reminded me of one particular piece which came my way. It was not a very difficult piece but I thought it was at the time. I was running a very small foundry and my cupola was bricked up to 22 inches, and I had no crane and no large ladles or flasks, but what I had was good. I had a good dry floor and a splendid core oven.

However there was an opportunity came my way to take a contract for some ten ton of castings for a draw-bridge, more properly speaking a swing-bridge, and it was all right in my line with the exception of one piece which figured up to 45 hundredweight. It was a T-shaped affair, long enough to reach the entire width of the bridge, which would be about 16 feet. It was about 18 inches wide and about the same depth. On each end was a recess into which the frame work of the bridge would sit. This would be about a foot each way. Under each end was a place for a wheel to fit into and in the centre was a monstrous boss with a pivot attached to it. For general appearance the casting would be similar to the illustration. I took the contract and it was up to me to either make this piece or get it made, so I decided to make it.

My cupola bottom was 30 inches above the level of the floor and as I have said I had no way of handling the melted metal, but like Robinson Crusoe I seemed to have everything at my hand which I really required. I located a piece of boiler shell 3 feet in diameter and 3 feet long, which was almost as near right as though made to order. It was a little too long and had several holes in it which could have been omitted, but it had one hole which was just right for an outlet. I dug a hole six inches deep in the floor and shoved this improvised receiver under the bottom plate of the cupola and wedged it tight and lined it with common bricks standing on end and made up a sand bottom the same as for the cupola. The reader will understand that the idea was to tap from the cupola into this basin

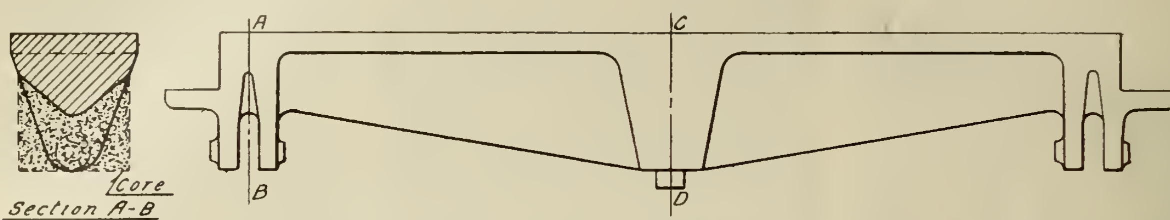


FIG. 1—VIEW OF CASTING TO BE MADE. WEIGHT 2 TON 5 CWT.

FIG. 2—METHOD OF POURING, ALSO FEEDING HEAD IN PLACE AFTER REMOVING GATE.

until the proper amount was melted, and then tap from the basin into the mold as shown in the second illustration.

The mold, of course, had to be bedded into the floor and had to be kept a little below the level on account of the bottom of this basin being low.

Making the Mold

The making of the mold was the same as for a similar job in a first-class jobbing foundry so far as the bedding of the pattern in the pit. I made my facing sand 6 parts heap sand and 3 part new molding sand and 1 part sea coal, and I tempered it with thin clay wash. I riddled all the sand and rodded up into all the corners. For the wheel slots I used flat oil sand cores, rather than take a chance on the green-sand. The pattern being flat on top with the exception of the ends, which were flat also but on a different level, I simply had to strike up straight partings onto which I fitted flat cores as shown in the illustration. I fitted all the cores before drawing the pattern so as to avoid any possibility of a crush. Before drawing the pattern I vented it well from the top; running the wire on a slant towards the centre. After drawing the pattern I needle-vented from the inside to these big vent holes before sleeking up the mold. After repairing all defects and withdrawing the little bosses which form the bearing for the wheel axle shown on the lugs, I plumbagoed the mold and replaced the cores, and weighted them with pig iron as shown in the illustration.

The manner of gating and feeding this casting was a little problem in itself. There was only one place where I could feel safe in putting the gate, and that was right in the middle and on top of the pivot. The shape of the casting made it look unwise to have the iron enter anywhere else as it would of necessity travel with considerable force and might knock off corners and do other damage. I only wanted a two-inch pop gate, and I also wanted to reserve that spot for a six-inch risor, so to overcome the difficulty I had a 6-inch hole in the core which covered the centre and on top of this I put an extra core with the smaller hole in it. After the cores were all in place I leveled the ends up with molding sand but the rest of the cores I left exposed, as there was no pressure to raise them and no place for them to leak as I floured the joint before replacing them. After standing a gate pin in place I placed a few pieces of pig around it to make support for the running basin, which I connected with my improved receiver by simply cutting a channel in the floor.

Pouring

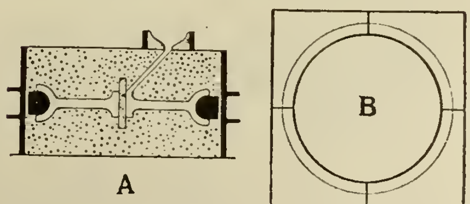
The pouring was a simple process. A casting of this kind did not require any particular brand of iron, so I used entirely old stove plate and had no trouble getting the required amount of melted iron, and abundantly hot for this class of work. When the mold was filled I had a very little bit of iron in the receiver; this I was forced to let go to waste by tearing the side out of the channel which led to the mold and allowing the iron to run into a hole dug for the purpose.

Making the Risor

This casting, particularly the heavy centre, would have to be fed, but there was no particular rush, as a chunk that size does not set very quick and I had plenty of time to remove the runner and the core with the two-inch hole, and put on my feeding head which had been prepared in advance. This was just an iron flask with a six-inch riser rammed into it. This was placed where the gate had been and sand tucked around it to prevent any leak. (See cut upper right of view). From the time I tapped out the receiver until the mold was filled and this feeding head was in its place, was a matter of very few minutes, and during this time the cupola was stopped in, so it was now tapped and a ladle of iron carried to the feeder. This was repeated until the casting was set. In this connection I want to say that my life's experience has taught me that the terrible rush to get the feeding rod to work is unnecessary. Even when I have abundance of iron at my disposal I always stop pouring when the iron starts to show in the riser, and later when the casting begins to set, I fill the riser with very hot iron and then feed it.

CHAIN PULLEYS AND CHILLED FACES

In brickyards and similar rough works power is often transmitted for long distances by means of chains, supported by cast iron grooved pulleys. This form of power transmission is a wasteful one no doubt, but it appears to answer the purpose for which it is used, no great speed being used. The pulleys, however, wear very rapidly, unless the working faces are chilled, and as this costs nothing after the first cost of the chills has been allowed for, there is no reason why chilling should not always be done. Four-piece chills are needed, and if these are turned up on the portions touched by the rim of the wheels nothing more is needed in the way of machining. In moulding half the wheel is in each half of the flask, as shown at A in the illustration, and the print for the chill forming part of the pattern, there should be no trouble in making the moulds quickly and at as low a cost as any ordinary work. A plan of the chills is shown at B, the machined part being indicated. An iron that will chill fairly deeply is necessary, and properly a good tough metal is necessary, but often a mixture of chiefly good scrap and a little hematite will give sufficiently good results.



A REPRESENTS THE MOLD. B REPRESENTS PLAN OF CHILLS.

SAMUEL GOMPERS' SERVICE TO CANADA

Business Men and Workers of This Country Will Extend Deepest Sympathies to Him in His Present Troubles

Canadians who know Samuel Gompers, or who are familiar with the great work he has done for labor on this continent, will learn with deep regret of his serious injuries, when a street car struck the taxi-cab in which he was riding. To add to the troubles of this grand old man, his wife is so very ill that she cannot even be told of the accident.

This country is particularly indebted to Mr. Gompers. When our War Mission went to Washington to solicit American business for Canadian factories and workers, they were politely received, but every effort to secure orders failed. Lloyd Harris finally discovered that the Americans wanted all the business for themselves. The Southerners, long anxious for the development of industries in these states devastated by Civil War, felt that this was their great opportunity. Their friends were all powerful at Washington, and they secured hundreds of millions for the erection of new plants.

To make matters worse for us, the German agitators, backed up by two Toronto evening papers, prevented Hon. Mr. Bryan—late Prime Minister of the United States, and intimate friend of President Wilson—from speaking at a gathering of temperance enthusiasts, and blamed it on the returned soldiers. Luckily for us, Sir Robert Borden instantly apologized on behalf of Canada to the people of the United States, and half a dozen United States secret service men who were instantly despatched to Toronto, found and reported German propagandists who were responsible for the insult. Just when so indefatigable a salesman as Lloyd Harris, head of our mission in Washington, was about to give up, he was surprised to receive the first of many millions of business for Canada. He is probably still unaware that is was the kindly personal work of Samuel Gompers that induced President Wilson to instruct his associates to pass some of the orders to Canada.

THE SPIRIT'S THE THING

Said an Irish leader: "Min, ye are on the verge of battle, will yez fight or will yez run?"

"We will," came a chorus of eager replies.

"Which will yez do?" says he.

"We will not," says they.

"Thank ye, me min," says he, "I thought ye would."—"Forecast."

Practical Up-to-date Foundry Cost System

The Working System of a Foundry With Notes on the Management Which Installed and Operated Them Successfully

By M. H. POTTER

THIS article describes specific methods and forms developed and used successfully in a foundry. Many difficulties have been experienced and delays encountered through the lack of proper system in the foundry. Although many forms and systems have been advocated; the particular ones illustrated in this article have proven their practical worth.

Casting requisitions (Form 1) are made out by the stores department in order to maintain the desired quantity of castings on hand when production orders or shipping orders bring the stock as specified on the stock sheet below the minimum. This requisition is sent to the foundry foreman. The foreman's clerk assigns the foundry job numbers consecutively as they are received. One copy of this requisition is sent to the pattern shop, and two to the foundry. One of the foundry copies is returned to the stores clerk with the foundry job numbers inserted.

On the receipt of the castings requisition the foundry clerk makes out two similar cards, the molder's card (Form 2) and the coremaker's card (Form 3). These cards attached to the pattern shop's copy of the castings requisition, and are sent to the foreman of the pattern shop. The molder's card and the pattern are then sent to the foundry. In event of the pattern having to be made, the molder's card is kept on file in the pattern shop, remaining attached to the pattern shop's copy of castings requisition until the pattern is made. The coremaker's card is sent to the foreman of the core-room.

The foundry timekeeper collects the filled in forms when the work is completed and turns them back to the foundry clerk. A daily record of work done (Form 4) from the returned cards is for the foundry foreman's guidance and information. This form is also helpful in the cleaning room in locating the various castings.

A delivery sheet (Form 5) is then made out in triplicate, one copy going to the machine shop, one copy to the production department, and one copy being retained in the foundry. After this sheet has been filled in, the foundry clerk posts on the castings requisition card (Form 1), under the column marked "Date and quantity," the date of completion and number of pieces completed. As the castings requisition sheets are filled out showing that all items have been delivered, the sheets are placed on the file of completed castings requisitions.

In order that interested parties may definitely know the date of delivery of castings, the state of completion of any job, and the number of castings scrapped, the foundry clerk fills out daily "progress cards" (Form 6). These cards are placed on file back of guide cards showing the job number. These cards are made out at the same time that the molder's card and coremaker's cards are filled out and entries are posted on these cards from the foundry delivery sheet (Form 5).

The defective castings cards are attached to these cards, when scrapped work is turned out. A copy of the scrapped or defective castings card (Form 7) is sent to the production department, so that a new foundry requisition card (Form 1) will be entered to replace the loss.

A form of workman's time card (Form 8) was found to be most satisfactory, as while easily made out, it contains all the

CASTINGS REQUISITION — DATE ______ SHOP ORDER ______

CLASS	No of PIECES	DESCRIPTION	PATTERN NUMBER	DATE WANTED	FOUNDRY JOB No

FORM 1—SAMPLE OF CASTING REQUISITION CARD.

MOULDER'S CARD — JOB No ______

NAME ______ PATT No ______

DATE ISSUED ______

QUANTITY MOULDED			
	QUANT'Y		
	DATE		TOTAL

FORM 2—SAMPLE OF MOULDER'S CARD.

COREMAKER'S CARD — JOB No ______

NAME ______ PATT No. ______

DATE ISSUED ______

SETS OF CORES MADE			
	QUANT'Y		
	DATE		TOTAL

FORM 3—SAMPLE OF COREMAKER'S CARD.

DAILY RECORD OF WORK — DATE ______

HELP		SHOP ORDER No		JOB No		QUANTITY		WEIGHT POUNDS	DESCRIPTION	PATT No
FILE No	HRS									

FORM 4—SAMPLE OF DAILY WORK CARD.

information desired by the various departments concerned.

As the castings produced, or rather test pieces from each heat were required to pass an analysis and physical test, a cupola report (Form 9) was filled out in each instance.

DELIVERY SHEET							DATE	
SHOP ORDER No	CK	JOB No	CK	QUANTITY	CK.	WEIGHT POUNDS	DESCRIPTION	PATT No

FORM 5—SAMPLE OF DELIVERY SHEET.

The systems as here referred to were applied to a foundry that was one department in the factory. However, these identical systems may be successfully, by means of obvious minor changes, adopted by a job shop.

The underlying principles of good management are of course advantageous and as necessary as proper and practical systems. Systematic control through printed forms, rules and regulations do not alone constitute efficient management. There must exist a feeling of confidence between the office executives, the foremen and their men—one of the greatest and most common barriers to success and factory co-operation is the attitude of suspicion on the part of workingmen towards their employers. Unless the management is conducted in such a manner that proper notice and honest reasons are given for changes, such as frequently occur, i.e., change of manufacturing methods, change of systems, changes in compensation, labor troubles are bound to result. Labor turn-over is most detrimental and costly and can be greatly avoided through investigation and proper control. At this time of re-construction and application of more efficient methods towards increased production and minimum costs, this subject is of vital importance.

DAILY PROGRESS CARD

JOB No		DATE	
QUANTITY MADE.			SCRAPPED
PATTERN No		QUANTITY DELIVERED	O'K. by.
DELIVERIES	WT.		TOTAL. / REMARKS
	QUAN.		
	DATE		
CHECKED BY			

FORM 6—SAMPLE OF DAILY PROGRESS SHEET.

Practical systems as here outlined will enable clerks to maintain all routine duties and permit the executives to keep constant watch on the improving of the manufactured product. In this way the concern will always be in a position to make changes at the proper time and keep the product up to date.

The accumulation of the ideas of many men is the keynote of a successful enterprise. This being granted, it is good practice to encourage the ideas for betterment of the product from every one engaged in its manufacture from the workmen up, the limitations and the higher inefficiency of the average workman being taken into consideration.

The wage system is most important and must be conducted justly and reasonably. Such systems should not be experiments but rather established mediums and maintained along the same principles as much as possible. Much of the greatly desired co-operation in the foundry may be secured through adequate wage systems. Time-study methods have not been introduced to foundry methods to any great extent, so their shortcomings and causes of dissatisfaction due to incompetent handling are practically unknown to this trade. The moderate and proper use of such a medium will however, in the near future, add greatly to

DEFECTIVE CASTINGS. JOB No

QUAN.	DESCRIPTION	DATE	SHOP ORDER No.	OWING TO

MADE BY No.

TIME LOST.

No.	HRS.	HELP.	CORE-MAKER	SUGGESTIONS TO REMEDY FURTHER LOSS
				O'K. BY.

FORM 7—SAMPLE OF DEFECTIVE CASTING SHEET.

WORKMAN'S TIME CARD

NAME No.

JOB No	DESCRIPTION	HRS	QUAN.	MOULDER * CORE-MKR HELPER

SPACE BELOW FOR OFFICE USE

* DRAW LINE THROUGH TWO.

FORM 8—WORKMAN'S TIME CARD

DAILY CUPOLA REPORT DATE

KIND PIG IRON USED	No.	LBS
TOTAL.		
NEW SCRAP		
MACH SHOP SCRAP		
FOUNDRY SCRAP		
REMELT		
TOTAL		
COKE USED		
COKE USED		
TOTAL		
FLUX USED		
MANGANESE USED		
TOTAL		
No. LBS. IRON MELTED.		
REMARKS		
By	O'K by	

FORM 9—DAILY CUPOLA REPORT.

the increasing of production. To successfully apply such means, the necessity for long and careful study on the part of the foundry executives is self-evident if good is to be derived.

The employing of sufficient clerical force to get out all the needed records and to keep all forms properly filled in and up to date is necessary. This does not necessarily mean a large number of non-producers; records that are not referred to or those which do not tend to aid in efficient management should be abolished. The same applies to copies that are filed or placed on record for the guidance of the superintendent or foremen.

During the past few years extreme difficulty has been experienced in maintaining the required number of capable foundry workmen. This difficulty has not been confined to certain localities or districts but generally. Of course, the labor shortage is undoubtedly a great factor, but the eliminating of apprenticeship systems has a great bearing on this shortage. Apprenticeship courses, if conducted along aggressive and systematic methods, will greatly help to fill the ranks with capable and efficient foundrymen.

Canadian Graphite and Ceylon Plumbago

Canada Has Immense Deposits of Graphite or Plumbago Which are in Some Respects Superior to Any in the World; Why Not Encourage Their Development?

By "Canadian"

GRAPHITE and plumbago are identically the same thing; the name of black-lead, which is sometimes used, is however not proper, as there is no metallic lead whatever in plumbago.

Plumbago or graphite is used in the manufacture of pencils under the misnomer of "lead-pencils," although as we have said there is no lead in them. It is also used in making stove polish and fireproof paint, as well as foundry facings and crucibles. Large deposits are found in the island of Ceylon, in Madagascar, and in Mexico as well as in the Southern United States and in Canada. The Ceylon plumbago has so far been enjoying the reputation for being superior to all the others, regardless of the fact that Canadian graphite sometimes runs as high as 98.6 per cent. carbon, which is not reached by the Ceylon article, but once a name is made it is hard to overhaul.

As most of the world's production of graphite goes into crucibles, the comparative suitability of Canadian, and Ceylon, graphite for this work has been the subject of much discussion.

That Ceylon graphite is superior to the Canadian, or American product for the manufacture of crucibles, appears to be an accepted fact by American crucible makers, yet, it is difficult to definitely lay one's finger upon the physical properties that contribute toward this superiority.

Chemically, the two products are identical. There are, however, slight physical differences. A physical test, that has been quoted as showing Ceylon graphite is better fitted for the manufacture of crucibles, is as follows:

Separate samples, of 100 grammes each, of Canadian, Alabama, and Ceylon crucible graphites, upon being well shaken down, occupy 135 cc, 150 cc, and 91 cc, respectively. Thus a crucible made of Ceylon graphite carries a greater weight of graphite for a given volume, than one made up of either Canadian, or Alabama graphite. Unfortunately this test gives a wrong impression. Up till quite latterly it has been the practice, in graphite milling, to subject the product destined for the crucible market to a treatment of rolling or grinding. It is entirely obvious that this final treatment tends to alter the natural shape of the flake. It is, in fact, flattened, and becomes thin and light. Naturally such a product occupies a larger volume, weight for weight, than an entirely natural product. It is certain that the tests above cited were conducted on Canadian flake that had been subjected to this final rolling, for, as a matter of fact, tests conducted on natural flakes of Canadian origin show little difference in volume, weight for weight, compared with Ceylon graphite.

The present trend of graphite milling practice is to eliminate this final rolling treatment, and to place on the market a crucible flake that retains its natural shape, and such a product should be quite suitable for the manufacture of crucibles. That good crucibles can be manufactured from flake graphite of the disseminated variety, similar to that of Canada, seems to be borne out by the fact that Madagascar flake is used most extensively in England, and the writer knows that crucibles were manufactured from Canadian graphite alone, for experimental purposes, at the works of Fried Krupp, Magdeburg, which compared very favorably with those made from the product of other countries, in number of heats. This was, of course, before the war.

Apart from the elusive crucible question, Canadian graphite is quite equal to, and in some cases better than, Ceylon, for every other use.

The Canadian graphite industry dates back some forty years; but the production has been spasmodic. This has, doubtless, had considerable effect upon its market value.

The problem of economically concentrating disseminated graphite presents some extraordinarily difficult features, and since the beginning of the industry in this country, practically every known concentrating device has been tried—with failure. The advent of the oil flotation process of concentration has, however, solved the problem, and there is not the slightest doubt that Canada will slowly grow into a steady producer of graphite for all purposes.

To-day the general metallurgical problems that have so long confronted the industry in this country appear to be solved; but certain peculiarities of the makers have to be overcome, among which is the preference displayed for Ceylon graphite.

Canada imported, during 1916, $623,491 worth of raw and manufactured graphite; while graphite to the value of $318,033 was exported. This gives an adverse balance of $305,458, which is an economic absurdity when the large graphite resources of this country are borne in mind.

Again, the production in Canada was $325,362, during 1916 and the exports $318,033, which indicates that, of the total production of $325,362, only $7,329 worth was sold for domestic consumption. In other words, we export our graphite, and then take it back again—and pay the difference.

Of course, it is obvious that certain manufactures of graphite are not made in this country, and, therefore, have to be imported. On the other hand, it is equally certain that thousands of dollars' worth of graphite is imported, that could be procured from domestic sources. This applies particularly to fine flake graphite and dust. There is really not an atom of difference between a high-grade Canadian dust, and a Ceylon dust, yet a most decided preference exists for the latter.

It is most difficult to trace the origin of this preference to Ceylon graphite, (it might be mentioned en passant that this preference is also extended to Madagascar flake, which is practically the same as Canadian flake), but in the writer's opinion the root of the whole matter lies in the fact that the refiners and large buyers have played the steady overseas supply against the domestic producer, to the latter's detriment.

The result of all this is that the Canadian graphite industry, now just getting clear of its metallurgical problems, finds itself face to face with a difficult market situation, because of this preference for Ceylon graphite.

Practical Experience vs. Technical Knowledge

Experience is Necessary Before a Man Can Expect to Call Himself a Mechanic, But Experience Without Technical Knowledge Leaves a Man With an Awful Handicap

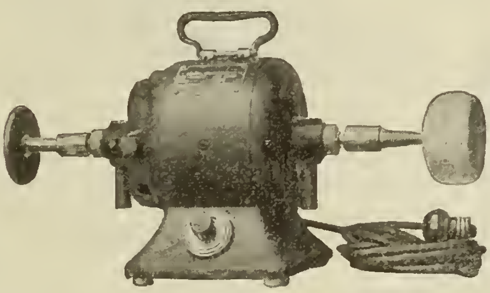
By a Union Moulder

As a molder I consider it a duty to myself to be as good a molder as I can, and while I have at present no foremanship in view I am aiming to fit myself for any eventuality which may come my way, and while I realize that it takes years of experience to become a good workman, life is too short to waste in finding out everything by experience. I am a constant reader of CANADIAN FOUNDRYMAN as well as other technical papers, among which I hold the "Molders' Journal" in high esteem, and I have no paper which I care to drop. I am sure that I have received benefit from every one of them, and whenever I read anything which looks different from what I am used to I watch a chance to try it out, and I have no hesitation in stating that I am a better workman than I could possibly have been without my book learning. Some of the things which I have read and tried out have given me ideas which were not mentioned, and in this way gave me the opportunity to try out more points and get more knowledge. Take for instance the scabbing of a mold. How many molders really know what causes a mold to scab? I have seen molders work year in and year out without making any attempt to find out why the work was scabbed. Of course it is easy to find excuses, but that does not stop the scabs. Poor sand and hard ramming are always blamed. The boss blames it on to hard ramming, and the molder blames in on to the sand, so there the matter rests and the scabs continue. I figured out the solution to this vexed question from reading an article in the CANADIAN FOUNDRYMAN which did not mention scabs at all. If the mold is gated from the lowest point it will very seldom scab. It is the iron travelling over the sand which causes it to give way. The sand becomes heated and creates steam, which rises, and there not being weight enough of metal to hold it down it rises and breaks the sand. When the iron enters at the lowest point it remains there, and the next iron flows through it and the entire mass gradually flows to the upper part. I have seen jobs like a roll casing scabbed, and the molder would keep ramming them tighter and finally took to nailing them, and even skin drying them, but all to no purpose; and I have taken the same job and just to show him that it was neither in the ramming or the sand I rammed it very hard and of course vented it well, and gated it at the bottom, and had no further trouble from scabs.

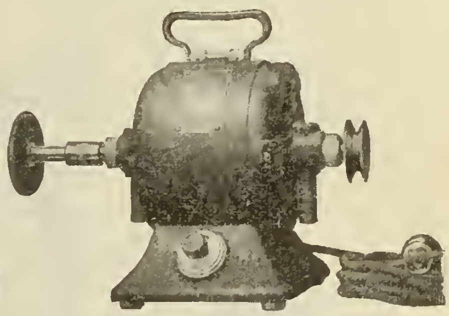
Regardless of scabs there are other reasons for using judgment in gating. If a fairly large piece is gated from one point the iron may find its way to all parts of it and make a good casting, but the sand in front of the gate will be cut to a certain extent on account of all the iron passing over it. There are innumerable little items which a molder may pick up from reading which practice would never bring before him. I have seen foundrymen losing castings right along through dirty iron and although they were getting an abundance of practical experience they were not improving the castings, while other foundries were doing a similar class of work and having success. Practice does not make perfect unless done intelligently. If a pupil in music had his piece wrong and continued to practise it he would never get it right. He must first learn to do it right or be taught to do it right, after which practice makes him do it perfect. The same holds good in the foundry. None of us know any too much, and if we see something explained in a technical paper it does not follow that we could go right at it as though we were old acquaintances, but if we followed the explanations we should be able to do the job, and then, by practising we should perfect ourselves in this particular job. Take for instance loam molding. There are very few places where loam work is done, and apprentices are not usually put on to this class of work, consequently there is a poor chance to learn it from any other source than through the medium of the trade paper, and if carefully studied and followed, any intelligent molder should be able to succeed by this means and then practice would continue to make him more proficient. In conclusion, I will say that I am a staunch believer in working men being organized in order to protect themselves, and I don't consider that the working man gets his just dues in a good many ways, but at the same time I consider that he should do everything in his power to make himself worthy, and I know of no better way to get in touch with other people's experience than by reading technical papers.

POLISHING AND GRINDING MOTORS

The accompanying illustrations show a recent development in polishing and grinding motors brought out by the Westinghouse Co. The adaptability of this machine to industrial uses is very apparent. The various chucks, wheels, drills and pulleys adapt the motor to grinding, polishing, drilling, etc.



GRINDING AND POLISHING MOTOR WITH PULLEY



GRINDING AND POLISHING MOTOR

The motor used is simple, powerful and quiet running, and the single speed feature eliminates the complications of multispeed motors and results in a simpler, more rigid and less expensive motor. A handle is provided for carrying; the motor is totally enclosed and is provided with extra long dust-proof bearings. End play is negligible. A properly designed, broad and substantial base provides stable mounting. Rubber cushions or bumpers in the base permit mounting the motor on any surface without marring. Screw holes are provided for fastening permanently in position.

The motor is furnished with a conveniently located snap switch and 10 ft. of flexible cord.

Items of Interest to the Practical Coremaker

A Few Questions From Coremakers, With Answers, Which Should be of Interest to Others

Question.—Would you kindly describe to me a machine for making round cores both large and small. I understand machines are made which will make cores of any size.

Answer.—Large and small are rather indefinite sizes, but cores are made by machine, and of practically every size, but for very large ones a different process might be advisable. We will illustrate two of the most common styles.

Core Machine 1

In the accompanying sketch is shown a machine for making cores of uniform cross section, which is to say, any core which is of the same size and shape the entire length. These machines can be made in any desired size, and can be operated either by hand or power. The one shown is operated by hand. It consists of a base frame supporting the movable parts and the vertical hopper for holding the core mixture. The hopper is shown with the one half removed, so that the reader may the more readily see the interior mechanism. The object in having this hopper in halves is for convenience in cleaning, anl also to aid in adjusting the feeder spindle and changing the bit for different sized cores. Under the machine is shown the bit on a much larger scale, and turned end for end to what it will be in the machine. Any size of machine will make a large range of sizes of cores, by changing the tube shown with the core protruding, and using a bit to correspond. If cores of a shape other than round are to be made, the tube should be round at the end where the bit works. The idea of using this machine for making cores was originated in a Canadian foundry by a Canadian founder. He probably got the inspiration from a sausage mill, as the same principle is involved. The long shank shown on the bit is for making the vent hole; it projects far enough into the tube to allow the core to be compressed around it. In making stock cores in a machine of this description the sand should be mixed with a binder which will hold the core up while green, and in addition to this it should have a small amount of linseed oil mixed through to keep the core from softening while being kept in stock.

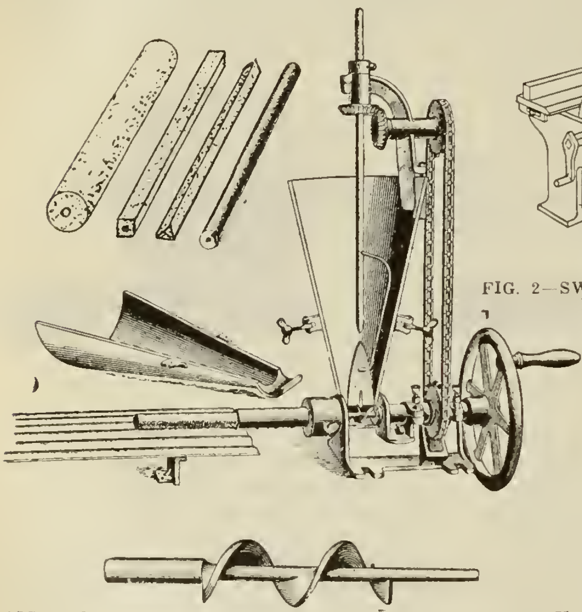


FIG. 1—MAKES STRAIT CORES FROM QUARTER INCH UP TO ABOUT 4 INCHES.

Making a Barrel Core

Where many cores of the same size are required, for instance in a plant manufacturing standard sizes of engines, there is nothing cheaper or better than a swept up core, such as is shown in the accompanying engraving.

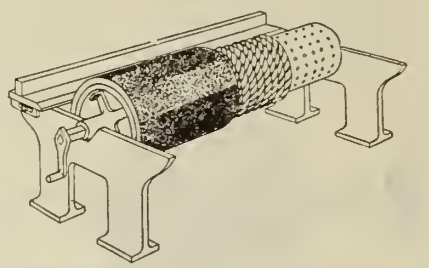


FIG. 2—SWEEPING CORE ON BARREL WITH LOAM OVER HAY ROPE.

Loam is here used for the outer shell of the core. It is probably the simplest job in which a loam mixture is employed, and is made by a coremaker more frequently than by the professional loam molder. Barrel cores are particularly advantageous where the core is long and can best be supported at the ends only.

Loam is a facing mixture, of the consistency of mortar, applied to the face of the core or mold. It contains fire and with a bond of strong, porous molding sand, moistened with thick clay wash. A natural loam can sometimes be found but if not it can be made as described. A small proportion of organic matter in the shape of horse manure is put in to aid the bond and to leave the crust of loam more fragile by burning out as the casting cools. In fact it burns out while the core is being dried, leaving the core porous and well vented. Proportions of the mixture will vary according to locality, but the principles already cited hold here as with other molding compounds. With too much bond the loam works easier but tends to choke the vents when casting. With not enough it will be weak and liable to break, cut or crumble under strain. About 4 parts of new molding sand, 2 parts sharp sand and 1 part horse manure, well mixed and tempered with clay wash, makes a good core, but for very heavy work pure silica sand would be best, and the clay wash should be made from fire-clay. The advantages of loam cores are that they are lighter, cheaper to make and carry off the gases faster than do dry sand cores. They are perfectly round, saving a lot of the boring expense in the machine shop, and by being round and of the exact size, the risk of crushing and also of runout in molding and pouring is greatly lessened.

The method of making barrel cores is as follows: A piece of pipe about three inches smaller than the outside diameter of the core is selected to form the centre. The pipe is perforated with a large number of holes. If the pipe is more than three or four inches in diameter, centres or trunnions are riveted to the ends to serve as bearings. The pipe is arranged to revolve freely on a pair of iron horses, as shown in the illustration. A crank handle is attached by which the pipe may be turned. A couple of wraps of hay rope are first given around one end of the pipe, and the loose end pinned flat by a nail run under these strands. Tight wrapping is then continued to the other end of the pipe, where the rope is fastened in a similar manner and cut off. Hay rope should be made of long wisps tightly twisted. Sizes vary from three quarter to one inch. Where only a small amount of hay rope is used, it is bought ready made. Foundries using large quantities are equipped with one or more machines built especially for making this rope.

The first coat of loam is rubbed on with the hands, then well pressed in with the flat side of a board, while the barrel is being slowly revolved. When this has set, the core board shown in the cut is placed in position, and the roughing coat worked on to the core to within about a quarter of an inch of the finished size. The core is now dried in the oven. Placing the core again on the standards, the finishing coat of "slip" is applied with the core board while the core is still hot. The diameter is tested with calipers and brought to the required size by slight adjustment of the sweep board. When the core has been built to size, move the loam back from the edge of the board, then withdraw the board while the "barrel" is still in motion.

Slip or skinning loam is made by thinning regular loam as it is rubbed through a No. 8 sieve. The heat of the core is usually sufficient to dry this slip coat enough so that the black wash may be brushed on and slicked, as in dry sand work, before running the core into the oven again for its final baking. In fact all of the work might be done before placing the core in the oven, but loam, containing as it does a considerable amount of clay, is apt to shrink out of its true dimensions, and by putting a final coat on after the core is thoroughly dry, it is possible to have the finished core exactly right. z

The service of the hay rope on a barrel core is twofold. It furnishes a surface over the smooth metal of the barrel to which loam will adhere; and it is elastic enough to yield as the casting shrinks around the core. The hay slowly burns out after the casting has set and this frees the barrel so that it can easily be withdrawn and used again.

Question.—We have been using resin as a core binder, and have found it to be very satisfactory in most ways, but it is expensive, and we have decided to use black core compound. This material is well recommended by other foundries, but we cannot seem to be successful with it; the cores are so rotten that we can hardly set them, and in the morning they are so hard that we can hardly cut them out with a chisel. Can you explain the trouble?

Answer.—Your trouble is that you do not have a hot enough fire in baking the cores. A very light fire will melt the resin and run it through the sand, leaving it in a good shape to bind itself when cold. Any hotter fire would injure the core. With the black binder the same principle is involved, with the difference that it requires a very hot fire to melt it, and unless it is melted it is practically wasted. If the core is exceptionally hard after being used it has had more binder than is necessary. If the proper amount of binder is used so that the core will be right after being dried with a very hot fire, the extra heat of the melted iron will burn it in a similar manner to the resin cores.

GEORGETOWN IS A BUSY PLACE

The Georgetown Foundry and Machinery Company is a comparatively new industry, having been established about six years ago, but at the present time they are busy and employ about twenty-five hands. They have patternmakers at work on some new lines and expect to increase their staff considerably in the near future.

Other Industries

Other industries in the town include two machine shops manufacturing knitting machines. These institutions seem to have abundance of work. The paper mills, of which the town abounds, are very busy.

The flour mills and butter factory, etc., are equally busy.

NEW MALLEABLE FOUNDRY

Fittings, Limited, of Oshawa, Ont., who have formerly been manufacturing a line of grey-iron fittings, etc., have recently added a thoroughly modern malleable foundry to their plant. The management of this establishment is in the hands of men well known, who have had long and very successful experience in malleable practice. They also have a large and well equipped machine shop, as well as galvanizing and nickel-plating plants for coating any castings required. This, coupled with their large and efficient grey iron foundry, puts them in a position to render very complete service.

SARNIA SHOPS ON FULL TIME

Every foundry in Sarnia is working six days per week. The H. Mueller Mfg. Co., who employed some twelve hundred hands during the war, are not doing so since the munition work ceased, but are busy on their regular line of plumbers', water and gas fixtures and brass forgings.

The John Goodison Co., manufacturers of traction engines and threshing machines, are very busy filling orders for the coming harvest.

The Doherty Stove Works is busy as usual; not working nights or Sundays, but still turning out the goods, and finding market for the same.

The John Whitfield Co., Limited, Toronto, Ont., has been incorporated, with the object of starting an iron foundry and also manufacture chains. The leading men in promoting the same are Edward L. Middleton and John H. Hockington.

The International Malleable Iron Co., Ltd., Guelph, Ont., one of Canada's biggest and best industrial institutions, is confident of the future business which Canada will undoubtedly enjoy, and will erect a new building 60 x 160 feet to add to their present plant.

The Canada Metal Co., Ltd., 35 Fraser avenue, Toronto, Ont., is building a brass foundry and other brass working plant and equipment at Halifax, N.S.

The Wm. Kennedy & Sons Co., Limited, Owen Sound, Ont., are preparing plans for a new 30 ft. x 46 ft. addition to their foundry.

The J. W. Pohlmann Foundry Co., Baitz avenue, Buffalo, N.Y., are erecting an edition to their foundry building.

The McKenzie Machinery Co., of Preston, Ont., is remodelling its plant, preparatory to installing new machinery for which new building will be required.

The Doherty Metal Plating Co., Ltd., Sarnia, Ont., has been incorporated with a capital stock of $200,000.

CANADIAN FOUNDRYMAN has just received the report of the twenty-first annual convention of the National Metal Trades' Association, held at the Hotel Astor, New York, Wednesday and Thursday, April 23rd and 24th. The contents include many valuable suggestions and comments on "Safety first," "Open shop compared with union shop," "Hours of labor," "Socialism," "Bolshevism," "I.W.W.," and sundry other topics important at this season of the year.

The Uniflex Coupling Company, 246 Chestnut St., Philadelphia, manufacturers of he "Uniflex Shaft Couplings," have issued their latest circulars describing couplings for pumps, marine work, motors, generators, machine tools. Their slogan is "Wherever shafts meet."

The New Era Mfg. Inc., Kalamazoo, Mich., have given to the trade their latest pamphlet on metallic phosphorus, which is a practical substitute for tin in brass and bronze mixtures.

The pamphlet gives general directions for using, and also many valuable recpies and formulas for the brass foundry.

McClain's System, Inc., Milwaukee, Wis., have just issued an interesting booklet entitled, "McLain's Semi-steel," treating as it does with the subject of semi-steel from its first inception to the present time. Included in this is a history of Mr. McLain's foundry career, as well as many instances of particular note in connection with semi-steel in the foundry business.

The name of David McClain is too well known in connection with semi-steel as well as cupola practice in general, to require any great amount of comment. We will, however, make the assertion that he has done probably more than any other man in the last few years to put cupola practice on a scientific basis, and would advise anyone interested in foundry work to ask for his booklet.

The Oliver Machinery Co., Grand Rapids, Mich., have just issued their first bulletin describing their new universal motor drive for shapers, and these bulletins are now ready for distribution for those who are interested in patternmaking and wood work in general.

Advantages and Disadvantages of Large Cupola

That Five Feet Inside Diameter is as Big as a Cupola Should be for Fast and Economical Melting is Proved by Dr. Edward Kirk in His Book on Cupola Practice

By J. F. MULLAN

THE advantages that are claimed for the large cupola which is capable of melting all the iron necessary for the entire plant in the shortest possible time are: "That it is possible to have the iron, fuel, and all cupola material concentrated at one point in the yard or stock room and that only one melter is required and fewer men are necessary to man one cupola than if two or more are used.

One blower is all that is required.

One elevator or other device for getting up iron or fuel is sufficient.

Less lining and daubing material is required."

All these claims may be correct up to a certain point, but beyond this point they almost entirely disappear. For a large blower frequently costs more than two smaller ones, and more power is required to run it than would be required to run the two small ones. With only one elevator or other device provided for getting up the stock, workmen frequently have to wait for their turns to use it. And in many cases for this reason more men are required for getting up stock for one cupola than for two smaller ones, melting the same tonnage of iron.

In cupolas melting from eighteen to twenty tons per hour the stock settles so rapidly that extra men are required in charging in order to keep the cupola filled to the charging door, and if it gets away from them it becomes so hot that it is necessary to turn the blast off until filled up.

Fuel and iron have to be thrown in so rapidly that the fuel is often not evenly distributed or the different brands of iron are not properly mixed in charging; the result being an iron of an uneven temperature at the spout, and also an uneven grade of iron from the mixture. For heavy work on water pipe or car wheels or kindred lines of work this may not be an objectionable feature, for the iron is handled in large ladles and the temperature may be equalized in the ladle and the iron mixed, and an even grade obtained from the mixture. But for light work such iron is unfit for objects to be cast, and it is only when it is handled in large ladles by the crane or on tracks that it can be used and an even grade of it in the castings obtained.

Another objection to the very large cupola for light work is the long distance the molten iron has to be carried. When this is done by crane or track, the iron frequently becomes too chill to run the work, and many castings are lost. When carried by hand the iron not only becomes dull, but more time is required for casting and hence less time for moulding.

It will thus be readily seen that while there are advantages in concentrating all the melting at one point in one cupola, there are also many very important disadvantages. As a rule it is more profitable to install two or more cupolas than one large one, and these should be placed at the most convenient point for distributing the melted iron to the work to be cast in the shortest possible length of time. For more time can be taken in bringing cold iron to a cupola than in getting molten iron away from it. What is meant by a large cupola is one capable of melting 18 or 20 or more tons per hour. When this amount of iron is required it will generally be found more profitable to install two cupolas to melt it than one, especially for light wark, and to place them at such a distance apart as will give the shortest possible carry for the melted iron. By this arrangement hotter and more fluid iron can be delivered at the moulds with a minimum amount of labor and time, and even for the heavier class of work this will be found to be of advantage in making sound clean castings. Another matter which must be considered before installing a large cupola is the method of handling the melted iron with large ladles. Almost any amount can be handled per hour if sufficient ladles and means of handling them are provided, but with small hand and bull ladles the amount of iron that can be taken from a cupola spout running a continuous stream is only about 8 tons per hour. Even this amount requires very rapid handling of ladles, and if the stream once gets away from the men and it becomes necessary to stop up the cupola to remove iron from the floor and get control of the stream, even faster handling is necessary to get rid of the iron accumulated in the cupola during the stop-in, and the danger of handling the iron is increased.

For this reason two tap holes should always be placed in a cupola melting over eight tons per hour when the iron is all handled in small ladles.

Canada's Native Ore Fields Are Below Her Needs

With All Our Mineral Resources of Different Kinds and All Our Efforts to Establish Iron and Steel Industries, Very Little Ore is Mined in Our Own Country

AN account of the known iron resources of Canada, supplemented by a description of the Wabana iron mines in Newfoundland, is given in a report entitled "Iron Ore Occurrences in Canada," compiled by E. Lindeman and L. L. Bolton, with an introduction by A. H. A. Robinson, and issued by the Mines Branch, Department of Mines.

Iron ore was discovered in Canada in 1667 and in 1733 the Canadian iron industry was born in the form of a single forge. In 1737 the industry was represented by a group of forges at Three Rivers, Que., which remained in active operation almost continuously until 1882, being at that time the oldest active iron producers in America. The growth of the industry was slow until 1896.

Sufficient ore was available locally to meet all the demands of the early smelting plants. Since then the production of native iron ores has not kept pace with consumption. It fell so far behind in 1917 that the total production in Canada was only 9.7 per cent. of the total amount smelted. The ore charged to Canadian blast furnaces increased in quantity from 142,860 tons in 1896 to 2,176,292 tons in 1917, of which 92,065 tons were of domestic origin and 2,084,231 tons were imported. The imported ore included 874,134 tons from Newfoundland and 1,210,097 tons of lake ore.

The ratio of Canadian production to ore charged has been steadily declining with the growth of the industry. This has not been due to lack of iron ore in Canada, but to the fact that native ores need preliminary treatment to make them suitable for economic smelting.

Practically all the imported ores come from Wabana, Newfoundland, or from the Lake Superior iron ranges in the United States. The Wabana ore, on which the Nova Scotia iron and steel industry is based, is owned and mined by Canadian companies for use in their own furnaces.

Negligible Quantity in British Columbia

In reference to the situation in British Columbia the report says that up to the present the production of iron ore there has been an almost negligible quantity, due not so much to the lack of ore as to the lack of a market for the latter. The different varieties of ore found in British Columbia include magnetites, hematites, limonite or bog ores and clay ironstones. The most important of the known ore bodies are a series of magnetite deposits which occur on the islands along the coast. The iron content is variable, ranging from 45 to 65 per cent. Phosphorus is often below the bessemer limit; on the other hand, sulphur is usually so high that the ore would require preliminary roasting to render it suitable for economic smelting. The coast magnetites are capable of producing a good merchantable pig iron and can be mined easily and cheaply.

No iron ore deposits of sufficient size and quality to make them of commercial importance have been found in the Middle West provinces, Alberta, Saskatchewan and Manitoba. There are, however, very large areas unprospected in which iron ores may be discovered.

The report gives a table showing that the total production of iron ores in Ontario from 1869 to 1916 amounted to 4,349,144 tons, the largest total production in any of the Canadian provinces. This table shows that the percentage of Ontario ore used in Ontario blast furnaces is declining. Previous to 1889, all the ore mined in Ontario was exported to the United States with the exception of such small quantities as were used in the earlier attempts at iron smelting. From 1889 to 1895, both years inclusive, production ceased entirely. About 1896, a system of bounties inaugurated by Federal and Provincial Governments to encourage the manufacture of iron and steel from native ores stimulated the industry. Blast furnaces were erected at various points in the provinces. Strenuous efforts were made to use Ontario ores as far as possible and thus obtain the liberal bounties offered. In Eastern Ontario old mines were reopened and for a time ore was shipped in small quantities. The quality of most of it was poor and the mines have again lapsed into idleness.

The only large body of ore of good quality yet discovered in Ontario is that at the Helen mine. Since 1899, owing principally to the output of the Helen mine, the iron ore production has averaged in the neighborhood of 220,000 tons per annum, and reached a maximum in 1913 when 394,054 tons were produced. This, however, is far below the amount of ore used annually in the production of pig iron, and the proportion of native ore used in Ontario blast furnaces is "disappointingly small."

Nova Scotia, next to Ontario, has to its credit the largest aggregate output of iron ore of any province in the Dominion. Recently, with the exhaustion of the workable deposits of better grade ore, production has declined until now it has reached the vanishing point. The extensive development of the Wabana iron ore field in Newfoundland, and the ease and economy with which Nova Scotia furnaces can obtain a supply of suitable ore from that source, have operated to decrease interest in the development of local supplies.

On Bell island, in Concepcion bay, Newfoundland, and in areas adjacent thereto, are situated iron ore beds known as Wabana mines, owned by the Dominion Steel Corp., Ltd., New Glasgow, N. S. The ore is composed of two principal iron-bearing minerals, hematie and chamosite, while a third, siderite, also is abundant. Shipments from 1900 to 1915 amounted to 7,140,046 tons.

HIGH SILICON IRON

In reading the different views published in your magazine I have become encouraged to express at least one of mine. My hobby is the melting and mixing of iron, a subject which I frequently see in your pages, but I have not noticed much about silicon.

Silicon, like many other things, is all right in its place, but all wrong when out of place. The amount of silicon to be used is just as important and requires to be just as carefully proportioned as the amount of water on a sand heap. Every molder knows that if the sand has not enough water it will not do, and if it has too much water it is worse. The same holds good with silicon in the iron; it should have the right amount, but too much is even worse than not enough. Silicon is a very hard metal in itself and iron is a very soft metal in itself, and if it were possible to procure a mixture of pure iron and silicon it would undoubtedly be a poor mixture if the silicon was in a very large proportion. Iron on being melted in the cupola absorbs carbon from the fuel and this is probably all in the combined state when the metal is first melted, and if the metal is cooled instantly the carbon is held in this state, with the result that the casting is hard, but if the casting is bulky and cools slowly it will not be so hard, for the reason that the bulk of the carbon has become free. If it could be kept in a molten state for a sufficient length of time it would likely all become free and the casting would be very soft. This not being the case, it is necessary to have some means of freeing the carbon, and silicon is the material which does it. Iron, in being melted, will absorb carbon from the fuel to the extent of 6.67 per cent., providing there is no silicon, or it will carry 23 per cent. silicon if there is no carbon, but it will not carry the maximum amount of each at the same time. This ratio appears to exist in a remarkable degree. For every rise of .01 per cent. of carbon in pig iron made under the same conditions, there is a corresponding decrease of .35 per cent. in silicon, and vice versa. Thus it will be seen that silicon regulates the carbon, and although a hard brittle material in itself, its action on the combined carbon makes it a softener up to a certain point. Silicon in excess of 3½ per cent. is injurious and makes the casting rotten and porous. If iron is low in silicon it can have the silicon increased by introducing ferro-silicon, but it should be remembered that any more than 23 per cent. silicon will not be absorbed in the iron, and if a higher percentage is used it does not melt properly in the cupola and is apt to act in an undesirable maner. About 15 per cent. ferro-silicon is the best for cupola use in building up low silicon iron.

DEATH OF DANIEL DASHWOOD

In the death of Daniel Dashwood, which took place at his home in Dunnville on March 28th, the town lost one of its industrial leaders. He was the senior member of the firm of D. Dashwood and Sons and was himself an expert workman. Mr. Dashwood was born in South Cayuga, August 10th, 1853, and in 1871 he started in buisness in that town. In 1878 he removed to Dunnville and engaged in the manufacture of plows and ultimately launched into the engine and machinery buisness, in which he was engaged up to the time of his death.

Mr. Dashwood was a man of sterling character and was of a quiet and somewhat reserved disposition. He had served his town in the capacity of alderman and was for many years treasurer of the Excelsior Hook and Ladder Co., an organization which made Dunnville famous on many occasions. He leaves a widow and grown up family, two of whom, Thomas and Curtis, were his partners in the business.

ARTIFICIAL FIRE-CLAY

The reason why common clay will not resist fire arises from the presence of impurities, such as lime, iron and magnesia. These substances may be easily removed by steeping the clay in hot muriatic acid, then washing with water, and drying. Excellent crucibles may be made from common clay prepared in this manner. This might be an expensive way of making fire-clay for cupola daubing, but if proper equipment is provided and an abundance of common clay is available it might be done profitably.

BEEN DONE

Giles returned from the city with a scarf-pin that contained a "diamond" of no usual size.

It was the pride of his heart, and the envy of his village companions.

He treated all inquiries from them as to its value and its authenticity with high scorn.

His employer, after a week of basking in radiance, asked Giles about its history.

"Giles," he said, "is it a real diamond?"

"Well," said Giles, "if it ain't I've been diddled out of one and sixpence."

Practical Hints for the Brass Founder

REPAIRING A CRACKED BELL

Editor FOUNDRYMAN: We have a beautiful toned bell on our church but of late it has been sounding bad and on investigation it is found to be cracked. Is there any way of stopping the crack from extending? and is there any way to repair the crack?

Answer.—It is doubtful if you will ever get the same tone again, although a very successful mend can be accomplished with very little trouble; the bell, however, will have to be taken down and dismantled and turned reverse side up on the ground. Take a file or a hack-saw and cut away the metal along the crack so as to leave a wedge-shaped slot in the casting. Shape a piece of pine to near the right fit, but slightly larger and drive it in with a hammer, after which shape it to the curves of the bell. This is to be used as a pattern for piece of hard bronze which will have to be made at the brass foundry. When the pattern is taken from the slot it will expand slightly, and the molder in rapping it in will also make it a little larger so that it will have plenty of allowance for shrinkage and filing. When the wedge is ready build a fire in and around the bell in a manner similar to heating a wagon tire, but keeping in mind that bell metal is easily melted. When the bell is hot all over blow the fire at the point where the piece is to be inserted, or use blow pipe or whatever means is at your disposal to heat this part to almost the melting point. Also heat the piece as hot as it will hold together, sprinkle borax on the edges of the crack as well as the wedge, and with a hammer drive it in tight and hammer the joint together and allow bell to cool off, after which it can be finished with a file.

CHARACTERISTICS OF LEAD

Lead, as has been previously noted, is a very malleable metal and therefore easily reduced to plates by hammering, but hammering neither increases its specific gravity nor hardness. Its ductility is not considerable; a wire made of lead will support a very small load.

Of the uses of lead in its metallic state we have already treated, but it has other uses. When lead is melted in an open ladle its surface quickly loses its lustre, and a scum appears, which is soon converted into a darkish gray powder. In the heat usually employed to melt lead this gray powder or oxide sustains no further alteration, but if spread out upon a suitable surface and exposed to a low red heat it becomes successively whitish, yellow, and lastly of a bright orange red. This yellow oxide was formerly known in the painting profession as "massicot"; the red they called "minimum," or merely red lead. If the heat be used much further the red lead is converted into "litharge," which is a semi-vitreous substance that by a little further heat becomes a complete yellow glass, of so fusible a nature as to penetrate and destroy the best crucibles. This glass enters into the composition of flint-glass.

Most of the acids have an action on lead, although fluoric acid, which will dissolve glass, has no effect on lead.

If nitric acid of the specific gravity of 1.26 be poured upon red lead, 92½ per cent. of the oxide will be dissolved but the remaining 7½ per cent. will be in the state of a deep brown powder. This is brown oxide of lead.

Muriate of soda is decomposed if melted with litharge, forming a yellow compound. Acetous acid dissolves lead and its oxides, forming the white oxide of lead, known in commerce by the name of white lead. Thus it will be seen that lead is not only one of the most useful of metals to the metal worker, but can be converted into oxides of almost any color, which were in olden times the base or foundation of most of the paint used.

It will also be seen that "litharge" is a product of lead. Litharge is a very powerful oxide; its main usefulness being as a dryer. If mixed with ordinary slow-drying paint it makes floor paint which dries rapidly, leaving a hard surface. In the foundry it is used as a dryer in making sand matches or follow-boards. If a handful of litharge is mixed through a shovelful of burned sand and tempered wtih linseed oil it sets the sand very hard in a few hours, making an excellent follow-board.

B. C. ZINC OR SPELTER

Zinc has a bluish white color; it is hard, but weak and brittle. The fracture shows very large crystals of characteristic shape. It melts at about 780 degrees Fah. and shrinks but little in cooling. For this reason it may be used to cast directly for small metal patterns or to form chills from which soft metal castings may be made for duplicating these patterns. If exposed to the air at high temperatures, zinc will volatilize, that is, turn to a gas and burn. It burns with a bluish flame, and throws off clouds of dense white smoke. For this reason great care must be taken to keep the air away from it as much as possible when being melted or mixed in alloy, for aside from the loss of metal, an oxide is formed in the mixture which impairs the quality of the alloy.

Zinc is known in commerce under two names. When rolled into sheets it is called zinc; when in ingot form for casting it is called spelter. These ingots are flat, approximately 8 x 17 x 1 inch thick, and weigh about 30 pounds. In this form they may be easily broken in small pieces for convenience in charging.

Zinc may be added to copper in a very wide range of proportions, the alloy increasing in hardness and losing ductility with the increase in the proportion of zinc.

The color changes from the red of the copper to a full yellow when one-third zinc is used. Further additions of zinc change the color to red, yellow, violet and gray. The alloys are serviceable up to 40 or 50 per cent. of zinc.

When zinc is mixed with melted metal, considerable reaction or boiling takes place. This tends to make a more thorough mixture and to drive impurities to the surface. For this reason a small proportion, 2 or 3 per cent. of zinc, is often stirred into bronze mixtures after the pot is drawn.

Zinc is a comparatively light metal, its specific gravity being about 7.7. It has other fields of usefulness besides that of an alloy. While, as has already been mentioned, it is hard and brittle, it can be rolled into sheets or even into leaf or drawn into fine wire if heated to a temperature 300 degrees when it becomes extremely malleable. One of its most valuable applications is as a protective covering for iron, being the best known substance for this purpose, the process being unwittingly termed galvanizing.

Galvanism and Galvanizing

To galvanize metal is to coat it with zinc. Originally it was done by means of the galvanic battery or more properly speaking by galvanic deposition. Galvanism is a branch of electric science and derives its name from Aloysius Galvani. an Italian who was born at Bologna, Italy, in 1737. He was an electrician such as existed at that time, and was likewise a lover of soup, made from frogs' legs. On one occasion when his wife was preparing a meal of frogs' legs she happened to put them, after being skinned, in proximity to a charged electrical contrivance belonging to her husband, and on touching them with a scalpel they became greatly convulsed. This gave Galvani an idea to work on and he tried numerous experiments and made a number of discoveries all of which had frogs' legs associated with them. These experiments began in 1780 and during the following decade he brought out much valuable knowledge. In 1792 another Italian by the name of Alessandro Volta discovered. or rather, correctly surmised that while the frogs' legs were conductors of electricity they were not of absolute necessity in Galvani's apparatus and he proceeded to demonstrate some of his discoveries and inventions, thus perpetuating his name along with that of Galvani in connection with things electrical. In 1820 a French electrician by the name of Ampere invented and discovered certain laws as also did Professor Ohm in 1827. Thus it will be seen that these every-day electrical expressions are handed down to us from the names of the early scholars of electricity, and while the name of Galvani will always hold a prominent place in the annals of electricity his discoveries are in no way connected with present-day galvanizing. Even in plants where electro-galvanizing is done, the electric current is supplied by other means than the galvanic battery. Galvanizing, as it is done now in most establishments, is by thoroughly cleaning the iron with acids, after which it is washed with water and dried in an oven and dipped into melted zinc.

GOLD AND SILVER COINS

Gold coin is usually made from an alloy of 11 parts of gold and 1 part of copper, although the gold coin of the United States is composed of 90 parts of gold, 7.5 parts of copper, and 2.5 parts of silver.

Silver coin is usually made from an alloy of 37 parts of silver and 3 parts of copper.

These alloys are harder than pure gold or silver, and consequently less liable to wear.

MOLDS FOR CASTING GOLD

Use a two-part molding flask, into one half of which the object to be cast is imbedded, a parting material dusted over the sand; then the other half is fitted on the flask and is rammed up with sand and lifted away, carrying an impression of half the object. The pattern is now removed; channels for the entrance of the gold are cut, and the mold is closed and poured.—"Brass World."

Good stunt. We have seen plowpoints made in this manner and they turned out alright.

KELLER'S STATUE COMPOSITION

The Keller Bros., who were celebrated statue founders, used an alloy, 10,000 parts of which contained 9,140 parts of copper, 714 parts of tin, 118 parts zinc, and 28 parts lead. This is the composition of the statue of Louis XIV, which was cast at a single jet by Balthazen Keller in 1669. It is twenty-one feet high, and weighs 53,263 French pounds. These statues are usually miscalled "bronze."

Bronze was well-known to the Romans, who took advantage of its resemblance to gold in robbing the temple and other public places of that precious metal. Thus Julius Caesar robbed the capital of 3,000 pounds of gold, and Vitellius despoiled the temples of their gifts and ornaments and replaced them with this inferior metal.

An alloy of 3 parts of tin, 2 of lead and 1 of antimony can be made into nails which can be driven into oak timber. Nails made from this composition were useful in the days of wooden ships on account of the fact that they were not acted upon by sea water.

BOOKS OF REFERENCE

As a book of reference there is nothing published which can be compared to the Bible. Here are four passages which we will use as examples:

"Drink no longer water, but use a little wine for thy stomach's sake and thine often infirmities."

"Look not thou upon the wine when it is red; when it giveth color in the cup, when it moveth itself aright; at the last it biteth like a serpent and stingeth like an adder."

"Wine is a mocker, strong drink is raging, and whosoever is deceived thereby is not wise."

"Give strong drink unto him that is ready to perish and wine unto those that be of heavy hearts. Let him drink and forget his poverty, and remember his misery no more."

These four passages are word for word as they appear in different parts of the Holy Writ, and would appear to make the Scripture contradict itself, but far from it. All that is necessary is to read the verses which accompany these and get the whole story, after which it will look a lot different.

Now as we have said, there is no publication to be compared with the Bible and we are not in the race, but when it comes to what is known in legal phraseology as second class matter we take no back seat. We ask every one who is in any way interested in foundry work to read the CANADIAN FOUNDRYMAN and read every bit of it, and if it is too copious for his comprehension, get some molder to explain it to him.

A few months ago one of our enthusiasts wrote up an exhaustive article describing the molding of a difficult piece, and any molder who could not mold that piece after reading his description would certainly be a marble-dome. However,an esteemed American contemporary took exception to one verse without giving the story, and as it will not improve matters any for us to reproduce the verse, we are contented to let it rest in peace. However, here is one on "The Brass Wo——"—I mean on our esteemed American contemporary.

A reader of the aforementioned authority on nonferrous alloys wrote to the editor the following question: "Will you kindly advise us of a good nonshrinkable (absolutely nonshrinking) pattern metal?" And the answer which he received was: "We regret to inform you that an absolutely nonshrinkable alloy cannot be made as all metals, without exception, shrink to some extent."

Now we had just got done explaining to one of our questioners that there were a couple of metals which possessed these peculiar characteristics, and, like the man who said the horse was 14 feet high when he meant 14 hands, we are not going to back down after we said it, but we will just deal with the one metal, "bismuth."

Here are a Few of Our Backers

Smith's Panorama of Science and Art, published in Liverpool in 1815, says in part: "Bismuth expands as it cools, for which reason it is well adapted for casting and is sometimes used in printer's type, etc."

Miller's Inorganic Chemistry, also published in Liverpool in 1870, says: "Bismuth mixed with tin and lead melts at a little below 100° C., and as it expands in setting it is valuable to the diesinker as it enables him to take sharp impression, etc."

Larkin's Brass and Iron Founder, published in Philadelphia, says: "2 parts of lead and 1 of bismuth gives an alloy which dilates powerfully at the time of cooling." We looked in the dictionary and found that "dilate" means to "expand." The American Encyclopedic Dictionary, published in New York and Toronto, says "bismuth" is a crystalline, hard, brittle, diamagnetic, reddish-white metal, specific gravity 9.9, melting at 264 degrees C., and expanding on solidifying." On top of all this we have the very latest edition of Liddell's Metallurgist and Chemist's Handbook, which says hhah "Bismuth, when melted, occupies about 97 per cent. of the volume which it occupied as a cold solid." This may not seem like a great deal, but it is just about exactly the amount which cast iron expands on being melted. It would appear, at any rate, as though bismuth shrinks on being melted and expands on becoming solid.

There is, however, an opening for enterprising experimenters to figure out how a soft alloy can be produced from the present available supply of nonshrinking metals, as bismuth is a very hard metal.

SILVER COATING

According to a recent patent, a fine silver coating can be produced by dissolving freshly precipitated chloride of soda, 1.1 parts to 10 parts of water, and adding to this solution 180 parts of spirits of sal ammoniac and then stirring in 800 parts of finely washed chalk. This mixture is applied and rubbed until its dries on the object being silvered, and the result is a brilliant deposit of pure silver.

Work to Start Soon.—Work is to be started shortly on the proposed Hydro line from Port Colborne to Bridgeburg, a part of the Toronto-Bridgeburg system. The entire cost of the system will be $11,000,000, but the amount to be spent on the frontier line has not yet been determined. There are rumors that the Buffalo & Goderich division of the Grand Trunk will be electrified from Bridgeburg to Port Colborne when that line is taken over by the Government.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - Vice-Presidents
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.

A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA - Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1207 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 30 Twenty-Second Avenue West. Eastern Representative: F. L. Jennings. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 1147. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. MAY, 1919 No. 5

PRINCIPAL CONTENTS

The Metal Workers' Strike

MAY DAY has come and with it the usual differences in opinion between the employer and the employee, but contrary to the usual practice of each branch of the workmen organization working separately, the aim on this occasion is to work in combination, the view taken by the workmen being that if the molders and machinists, etc., co-operate with each other, and if organized labor in all parts of the country works in unison their demands will be more effective, and the effect upon the employer less difficult to cope with.

The employer, on the other hand, while realizing that he is no more handicapped than his neighbor, sees his prospects of competing in the foreign market fading away as well as the home market becoming less secure on account of the demands from so large a proportion of the population for lower protective tariffs.

The condition of things in general has a sort of gloomy aspect, looked at from any angle, and our only suggestion is as always that the employer and the employee take a more generous and sympathetic view of each other's case and endeavor to work in harmony, realizing, as they both must, that each is necessary to the other. A strike is like a war, a losing game for both parties, and the sooner done with the better.

Education a Valuable Asset

READING, writing and cyphering was the old conception of education. Higher education included these as well as various different ologies, etc., but there are other lines of education which are frequently overlooked. Take, for instance, the present unrest amongst the metal workers. It is impossible to believe that the employers are intentionally trying to take any advantage of the working man, and it is equally as impossible to believe that the working man is knowingly endeavoring to deal unfairly with his employer. Certain it is that they both have their troubles, but the biggest trouble is that neither party gives much concern to the other one's troubles so long as his own welfare is protected. If both contending parties were properly educated they would likely see things in a different light and might have more amicable settlements when disputes arose.

Reading Trade Papers

WHILE we do not claim that reading a trade paper is the one and only way for a working man to complete his education, we do claim that it is one of the ways, and that the trade paper invariably gives such information as will be of assistance to the workman if he puts his mind to studying it. But there are two obstacles which stand in the way of this method of education. Although, as we have said on previous occasions, they are exceptional. One is the man's fault and the other is the employer's fault. We have seen workmen look over a trade paper and see the advertisements and say, "That paper is published for the manufacturer and is of no use to the worker," whereas the very things which he spurned might have been the makings of him if he had not been too narrow-minded. Then, again, we have seen employers who would go to any extreme to prevent their workmen from reading anything which would tend to elevate them from their present state, for the same reason that the slave owners of olden times kept their slaves in ignorance so that they could the more easily keep them under control. If the working man is to be a success in this life he will be wise to read everything and anything which will make him more intelligent, even though he may sometimes read things with which he does not agree.

Electricity in the Foundry

WE are frequently asked by subscribers to supply as much information as possible along the line of electricity, and we can agree with the argument that electricity is the coming power in many ways unthought of at present, but at the same time electric power transmission would hardly be in the line of a paper called by the name of FOUNDRYMAN. We would, however, point out that electricity is already getting a firm hold on actual foundry practice in the form of electric furnaces with which to melt the metal and is rapidly gaining ground, and it is a safe forecast to suggest that it will be but a short time ere the electric furnace has crowded the fuel-fired furnace out of the race for supremacy. We will, therefore, ask our readers who are not electrically inclined to forebear from harsh criticism if we appear to overdo the thing in our efforts to please this class of far-seeing enthusiasts, as we have some excellent papers on the subject which we are sure will be well received.

Prosperous Outlook

ON taking a trip through the country one cannot help but notice the difference between conditions in the smaller centres and the large cities. In the very small towns everyone is employed and plenty of money seems to be evidence, while in the larger centres of industry the reverse seems to be the case. The conclusion to be arrived at would seem to be that during the war the small towns were depopulated by the exodus of munition workers to the cities, with the result that the cities became overpopulated or underhoused, and since the return to peace time activities the small towns are short of help and the cities flooded with armies of the unemployed. To this we might add that soldier boys who left the small towns to join the colors have been so accustomed to excitement that the quiet town life is too tame. However, when things get a chance to right themselves and people get themselves located where they can find employment and prices become stabilized and the unrest among the workmen becomes amicably arranged there will undoubtedly be a period of prosperity which will be satisfactory to everyone. Certain it is there was work to do before the war and with a four years' vacation from our regular occupations there must be plenty of stored-up business waiting to be attended to.

The Unsettled Conditions

THE authorities of our cities, of our provinces, and of our Dominion should take heed to draw a straight line between legitimate trade unionism and the continental Bolshevism that certain agitators are seeking to foist on the world to-day.

Trade unionists themselves have got to make it their business to use every bit of influence they possess to see to it that they are not made a party to a lot of baneful influences being turned loose here that will make it well nigh impossible for the shops to operate at all.

There is no room in Canada for Bolshevism. There is not the disease here to call for such a poisonous remedy. Conditions that drove crowds to mob rule in Russia are not here, and when men call out in this fair land and urge others to rise up and use the torch and the gun, it is high time for our organized law to do a fair share of the rising up and put an end to this stuff.

There is another duty facing the Government. It is safe to say that most of the unrest right now is due to the fact that men's wages, though they have increased, have not kept pace with the rate at which the purchasing power of their dollars has decreased. There is a gap between income and outlay that they are not able to meet.

We have little patience with the talk that people have money to go to the moving pictures, therefore, they are not in bad shape. Surely no person has a desire to see income and expenses so closely balanced that there must be nothing left over for recreation or pleasure.

What the people want to feel is that every dollar they spend for the things they must have in order to live decently shall represent real value.

What they do not want to feel is that 67 or 70 cents a pound for butter represents not only its first cost in labor, but a certain amount of rake-off for every man who has been able to crowd himself into the line between the producer and the consumer.

Butter is only one of a long list of staple articles.

The cold storage business should be investigated thoroughly and fearlessly, and the public should know if it is true that tons of food are destroyed at intervals rather than that they should be allowed to go on the market at a reduced price.

The business of grappling with this problem is big enough to take up the best efforts and attention of any Government. There is a real task there, and in its solution rests much of the future conditions in this country.

We can never have a contented and a happy people until it is possible for them, out of their earnings, to buy from the markets of the world those things which they must have to provide decently for themselves and their families. As things stand at present, those who are unduly profiting in handling, making or holding the things people must buy in order to live are making it almost impossible for manufacturing business to go ahead and do business on a profitable basis.

The Molders' Part

WITH all the talk and excitement about the metal workers' strike, there is one redeeming feature on the side of the molder. We do not think we are prejudiced or biassed when we say that the molders' trade is one which calls for the maximum amount of mechanical and artistic ability coupled with the outside limit of heavy work, and when we look upon it in this light we can not but think that the demands of the molders are rather tame compared with some of the others.

With due respect to every trade, we have an inborn antipathy towards having the molder placed in a lower stratum of importance than his brothers of the other crafts.

A Good Feature of the Strike

ONE noticeable feature in connection with the strike is the good-natured manner in which it is being controlled by both parties to the controversy. No hard feeling seems to prevail and in some respects it is treated in a sort of a joking way.

A prominent official says that the price of Toronto real estate is low and that the cost of living is not high. This may not be a joke but it looks a lot like the ace of jokes or even the joker itself.

Do You Know This Chap?

HE was a pillar in the church, at least he said he was, his Sunday face it was a sight from eyebrows down to jaws. He had the holy look down fine, it was a treat to see him come to kirk on Sabbath day with children one, two, three.

He 'tended all the meetin's with an air of joy and grace, and never lost a single chance to open up his face.

His prayer was always six feet long, 'twas always just the same, and folks that didn't come at all knew just what he was sayin'. At every business session, too, he bobbed up in their midst, and criticized the whole machine with thumpin's of his fist.

He always had a lot to say 'bout the financial end, as though he thought the thing should pay a monthly dividend.

At every social thing they had, our friend was right on deck; of cake and all such things, he must have ate a peck. One might have thought that this here man was just one model saint, an echo of the good old school, so pompous, yet so quaint.

We saw him, though, one Sabbath morn, 'tis sad to contemplate—he sorted out his coin and got a nickel for the plate.—ARK.

IF THE people of this country were not crammed and jammed to the neck with downright grasping selfishness, chances are that there would not be so many increases and jumps in the prices of food and clothing.

PLATING AND POLISHING DEPARTMENT

QUESTIONS AND ANSWERS

Question.—In the September, 1918, issue of CANADIAN FOUNDRYMAN a question is asked regarding cleaning dirt, etc., from threads of nuts, which have been hardened by cyanide process in furnace. We have adopted the suggested method for certain portions of our products but there are several parts which must be carbonized in bone dust and sand, these pieces are now causing us much concern, owing to the marked difference in the condition of the threads when compared with the cyanide-treated pieces. Hoping you may be able to suggest a method which would assist us in producing a cleaner finished product, we appeal to you for your kindly interest in our efforts.

Answer.—The production of clean threads on carbonized steel goods is often an operation subsequent to carbonizing, while many skilful furnace operators succeed in producing highly satisfactory results by special care in heat treating and quenching. In short, the case hardener can accomplish a great amount of the success you desire, if he really tries. Some firms resort to sand blasting after hardening; others use a pickle with more or less success, or brush the threads with a steel wire circular brush to remove the dirt. Any of these processes are practical, the most economical method being to exercise extra care in packing preparatory to heat treatment, and by proper conditions during quenching. Blasting is productive of very satisfactory results; small pieces are treated in rotating sand blast machines and the cost is very low. Pickling is more liable to injure fine threads and does not leave the work in as good condition for use. Brushing is expensive and less efficient than blasting. In some cases very good results can be obtained by washing the parts in strong alkaline solution at 212 degrees Fahr. and quickly plunging the articles directly into a warm solution of sulphuric acid and water. A 50 per cent. acid solution is very effective. The objection to the acid dip is that there is no way of controlling the amount of scale or dirt removed. Some samples may clean splendidly, while others in the same plunge are scarcely affected by the treatment. The method is worthy of a trial at least, and may be what you desire.

Question.—We have always washed our nickel plated goods in gasoline to remove the buffing compound from the recesses and screw holes, and effect a saleable appearance. Some time ago we tried cleaning these pieces by the electro method in same solution as we use for cleaning the steel before plating. The results were not satisfactory, as a large percentage of the dirt remained after long treatment, and further treatment caused discoloration of the nickel plate. We have read of this operation being successfully performed by the electro method and wish to obtain a formula for a suitable solution for the work; also, is it advisable to use both reverse and direct current? If not, which is the proper method?

Answer.—Electrolytic cleaning solutions, such as used for cleaning polishing paste or grease from steel, are not usually satisfactory when used to remove buffing compositions from nickel plate. If you have a large quantity of plated goods to clean daily and your regular cleaning tank is required for preparatory cleaning, we would suggest that you install a separate tank for the final cleaning, and use a solution containing simply soda ash and a strong neutral soap. Whale oil soap and soda ash is wonderfully effective. Oakite No. 2 and Oakite plater's cleaner, 4 oz. of each per gallon, make an extraordinary good solution for the purpose and does not require the electric current in many cases. We believe that any cleaning solution used with the electric current will cause the nickel surface of the work to discolor more or less if the current is allowed to pass for more than two or three minutes. We prefer to use 10 volts, a strong solution and a large percentage of soap in the solution, and operate the bath without a rheostat. By maintaining a temperature of approximately 210 degrees Fahr. we obtain excellent results in from 30 sec. to 45 sec. Varnish produced by this method is exceedingly difficult to remove, and it is not expensive to charge and operate a cleaning bath in a manner to avoid the trouble. If you wish to use the electro cleaner you now have as a final cleaning medium, prepare a strong soap solution with either soda ash or some good cleaning compound containing no filler and use this solution at boiling temperature as a preliminary soaking solution; then pass through the electric cleaner and rinse in cold water; then dry by passing through hot water containing a small amount of the soap used in the first tank. In this way you can avoid all swabbing and save time and labor. When suspending articles in the electro cleaning tank, it is good policy to use care in having wires or holders of ample size to carry the current without heating, and to arrange the articles on the holders in a manner conducive to quick cleaning. Strips of steel should be hung flat side toward anode, and at least two inches of space should be allowed between the pieces on the holder. Use a direct current in all cases. Reverse current is sometimes beneficial in removing slight oxidation, but for general use its use is attended by failure more than otherwise.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1918-1919

President—James Vallier, 701 Crawford St., Toronto.

Vice-President—Charles Kemish, 271 Boston Ave., Toronto.

Sec.-Treas.—E. Coles, P.O. Box 5, Coleman, Ontario.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets. Second Thursday of each month, at 8 P.M.

Question.—I am operating a hot cyanide copper solution and obtain good deposits in usual time, but we are rushed with orders for copper plated goods just now and I have to work overtime regularly to get the goods out; this rush may not continue long and I cannot get a larger tank at present, at least. Can I increase the speed of plating in the tank I have by any practical method? I must get uniform results continuously, even if I am obliged to continue as at present.

Answer.—Deposition of good adherent, firm coatings of copper from cyanide copper solutions operated at temperatures ranging from 80 degrees to 150 degrees Fahr. may be speeded up by the aid of common gelatine; the imported white variety is preferred if convenient to secure. The presence of small quantities of the colloid in the copper solution facilitates the use of higher current densities than is possible otherwise, and the metal is deposited in a smoother condition, fine-grained and free from imperfections ordinarily present in rapidly formed copper plates produced in cyanide baths.

Dissolve the gelatine in boiling water before adding to the bath; stir well. Try ½ oz. per gallon and increase the quantity if required.

Question.—When reading articles relating to copper plating, brass plating and silver plating, I frequently encounter the words "free cyanide" in connection with suggestions as to the management of the several cyanide solutions. "Free cyanide" has me puzzled and I wish to enquire its meaning: also please inform me how to obtain a finish on steel same as the finish produced by a Canadian bicycle firm some years ago and called aluminum bronze. The finish was durable, and, I am told, was obtained by electro plating. I have tried aluminum with no success, and infer from trade journal information that aluminum cannot be deposited as nickel, copper, etc., in a solution of its salts.

Answer.—When you prepare a cyanide solution for depositing copper, brass or silver by the electro method, you dissolve the metallic salt in cyanide of sodium. A given quantity of sodium cyanide will combine with a definite quantity of the respective metallic salt. After all the metallic salt is dissolved, or combined with the sodium cyanide and an excess of sodium cyanide remains, this excess is termed free cyanide. Free cyanide is essential to practical operation of cyanide plating solutions generally.

The aluminum bronze finish produced on a certain make of bicycle some years ago was obtained by the following method: The steel tubing was given a uniformly scratched appearance by means of strap grinding and then copper plated in a cyanide bath, yielding a dense soft copper deposit; then the final finish was obtained in an ordinary nickel plating solution, yielding a semi-bright deposit without the matte often seen on nickel plated goods. The finish was nothing more or less than a dead nickel finish over a rough polished surface. If a matte nickel was obtained unintentionally, the required finish was obtained by application of dry pumice to relieve the matte. In actual use the durability of the finish was increased by the application of non-corrosive oil. This treatment darkened the color to some extent, but resulted in better service to the owner of the machine. You will find the finish is not particularly pleasing when produced on flat stock, such as spanners, but may be employed satisfactorily on certain lines of kitchen utensils, campers' outfits, and cheap lines of tools, etc. The nickel deposit may be comparatively thin if the finish is oiled before shipment.

Question.—We manufacture saddlers' hardware and have an order for rust-proof nickel plated sets, which we wish to fill quickly and satisfactorily. How would you advise us to proceed with the job?

Answer.—By copper plating the previously thoroughly cleaned steel in a cyanide solution and then transferring it to an acid bath for about one hour, then scratch brushing the copper deposit and finishing with a two and one half or three hour nickel deposit in a good nickel solution of moderate concentration, you will obtain a protective coating which, if not actually rust proof, will resist corrosion for a very reasonable length of time when subjected to wear and atmospheric influences such as goods of this kind are liable to encounter.

We would advise a slow deposit of long duration for the final finish, rather than a rapid deposit. A nickel solution containing boric acid and free from chloride would also be suggested. The acid copper deposit must be soft and free from sandy edges. The steel must be free from rust before the plating operations are begun, otherwise the heavy deposits will be of little protective value.

Question.—I have an order for several thousand brass castings with a silver finish. We have always nickelplated these small castings and I have been instructed to prepare a silver solution at once. Please send me a formula for a reliable bath, so that I may be ready when the goods arrive in the plating room. Some of the castings are to be oxidized.

Answer.—In a clean stoneware crock place one quart of strong nitric acid and dilute with one quart of clean water. In this solution dissolve 3 oz. of pure silver. When all the silver is dissolved, add enough water to the solution to make one gallon, and add a solution of common salt and water to it until all the silver is precipitated as silver chloride. Stir this solution and allow to settle; then syphon or pour off the clear liquid. Add clean water to the chloride; stir well and allow to settle again; then pour off the clear solution. Repeat this washing operation several times, to remove all traces of the acids, etc., and then pour the entire solution, chloride and all, onto a filter, and wash the chloride repeatedly with hot water. If you are not prepared to use the chloride as soon as made, keep it in a moist condition until you are ready. To prepare the bath, dissolve 6 oz. of sodium cyanide in 1 gallon of soft water; then add the silver chloride and stir vigorously until the chloride is dissolved. The above quantities are for one gallon of solution, which will contain 3 oz. of silver and approximately 3 oz. of cyanide. These proportions are considered standard for reliable practice or general lines of metal goods, and should give you good results with little or no difficulty, depending upon your experience or ability to prepare and operate plating baths. Use best grade of silver anodes.

Question.—We are overhauling our plating and polishing departments preparatory to enlarging our business, and notice several things which we believe could be improved. Please advise us as to the following items. Is it necessary to have the anode rods of nickel tanks three inches from side of tank? We could have greater space for the work if rods were farther apart.

Can the creeping of nickel salts on the plating tanks be avoided? Our tanks are covered with crystals. Is there any practical method of removing nickel deposits from holders? Some we have are very heavy.

Answer.—The anodes in a nickel tank do not permit any greater current density in the bath when suspended three inches from the side of tank than would be possible if the anodes were actually in contact with the side of tank. The effective anode surface would be approximately the same in both cases; therefore, you simply increase the resistance of the bath slightly by increasing the distance between the electrodes. The resistance can easily be taken care of by raising the voltage a little, or adding more conducting salts to the solution, and you get a total of six inches more working room in the tank, reducing the liability of injuring the anodes when placing work in the bath, or when removing work from the bath. Nickel salts will form on the edges of any nickel tank more or less; the temperature of the room, density of solution, and character of the solution are the prime factors in the case. But in any case a few minutes' attention daily by a boy or girl will prevent the creeping beyond proper limits. Scrape all the crystals from the tank and wash the parts cleaned with hot water; allow to dry and apply at least two coats of good paint. Lead color or slate makes a good wearing color if a good white lead body is used. An old, fine, flat file with a dull chisel-shaped end will make a good tool to remove the salts from the anode tops and inner edges of tank, and occasional washing will prevent accumulation on the painted surface. Heavy accumulations of nickel on holders, baskets, etc., are very difficult to remove satisfactorily by any known method. If the holders are stripped at frequent intervals from the beginning, the results are more liable to be successful. Some forms of holders can be cleaned of nickel deposits by hammering, although this treatment usually proves disastrous to the holders. Acid stripping solutions are slow in action and expensive to operate for removal of heavy deposits. If you can clean your product in bulk, and place on holders for immersion in the nickel bath only, it may be possible for you to protect the holders by using Bitumastic enamel or celluloid coatings. One firm at least uses adhesive tape for the purpose, and renews the covering when necessary. The reclamation of nickel from old holders has been the subject of considerable experimentation on the part of some of the teachers and students at Toronto University during the past winter, and it is possible that a simple practical process may be worked out which will greatly reduce the loss of metal from this source. At present there appears to be no market for the scrap holders, and some of the large concerns have actually sold the material as scrap steel.

Question.—We would appreciate information with respect to methods of copperizing iron castings without an electric current. We wish a smooth bright surface.

Answer.—The surface of the casting must be smooth and bright before the coppering is attempted. Wet tumbling produces very good surfaces on cast iron and is not expensive. Clean the casting thoroughly before immersion in the coppering bath and do not prolong the immersion beyond the point where first indication of matte appears. A few trials will suffice to show the time limit of each dip. Brief immersion is necessary, because the copper deposit is obtained at the expense of the iron. When the iron is coated, no more copper is deposited, as the iron is then prevented from precipitating more copper. Continued immersion will produce sandy or pulverulent coatings, which are not adherent and can be easily removed by rubbing. The acid solution used for coppering is contained in a stoneware crock or wooden tank and employed cold. Formula is: Copper sulphate, 4 oz.; sulphuric acid, 3 oz.; water, 5 gallons. If you have an oblique tumbling barrel with wooden cylinder, you may find it practical to tumble the casting in a coppering solution composed of copper sulphate, 2 oz.; sulphuric acid, 1 oz.; water, 2 gallons. A very short treatment usually is sufficient. Another formula which is used consists of copper sulphate, 2 lbs.; water, 1 gallon; and caustic soda in excess. This is not an easy method, owing to care required to obtain the proper proportion of caustic soda in solution. A formula which is quite generally used on various classes of goods consists of a saturated solution of zinc chloride and water, with 4 oz. of copper sulphate dissolved per each gallon of solution. It is used as a dip, or may be sprayed, poured or applied by means of a cotton swab. All similar coatings are thin.

Question.—I am operating a cyanide zinc plating solution, which differs to some extent from the one I have been operating previous to securing this position. I wish to test these solutions for metal at least once each week and am asking you to kindly publish a description of a reliable simple method for the determination of zinc in cyanide plating solution.

Answer.—We have found the following simple method to be very satisfactory and convenient to use. A fume cupboard or ventilating hood should be used at the beginning of this test, as the fumes given off during first operations are very poisonous.

Pipette 10 cubic centimeters of the solution into a beaker and add 10 c.c. of concentrated sulphuric acid. After the precipitate has settled add 35 to 40 c.c. of distilled water, allow to stand a brief period and filter; wash the precipitate thoroughly. The filtrate obtained contains the zinc. Add a slight excess of ammonia; then carefully neutralize with hydrochloric acid. Now add 4 c.c. of the concentrated acid.

On a spot plate or piece of white paper place a few drops of uranium nitrate indicator. Take one-half of zinc solution in beaker and titrate with a standard potassium ferro-cyanide solution, which is prepared by weighing out 41.25 grams of the pure crystals and dissolving in a small volume of distilled water and dilute to 1,000 c.c. When titrating, add a cubic centimeter at a time until a drop of the solution produces a brown color when in contact with the uranium indicator. Now take the other half of the zinc solution and after making a note of the burette reading, add within 0.5 c.c. of the amount indicated of ferro-cyanide; then test a drop with uranium indicator. If no color is produced, add ferro-cyanide carefully, stir and test after each addition of 0.1 or 0.2 c.c. until the end point is reached. Make as few tests as possible, as each drop represents loss of zinc and lowers the final result.

If the potassium ferro-cyanide solution has a strength so that 1 c.c. is equivalent to 0.01 gram of zinc by accurate trial, the metal content of the zinc solution in ounces per gallon is found by multiplying the number of cubic centimeters of ferro-cyanide required by 1.33. If 1 c.c. of the ferro-cyanide solution is not equivalent to exactly 0.01 gram of zinc, the metal content of the zinc solution in ounces per gallon can be ascertained by use of the following formula: Let A equal the value of 1 c.c. of ferro-cyanide solution in grams of zinc and let B equal the number of cubic centimeters required for titration; then A multiplied by B times 1.33 equals ounces of zinc per gallon.

The ferro-cyanide solution is very sensitive to light and decomposes easily. Keep it in a brown bottle well stoppered, or if a brown bottle is not available wrap the bottle in brown or black paper and keep it away from strong light. Make a check test of this solution at frequent intervals by using a standard zinc sulphate solution. In this way you avoid incorrect results.

The standard zinc sulphate solution is prepared by dissolving 12.45 grams of pure zinc oxide in a small volume of dilute sulphuric acid, and diluting to 1,000 c.c. with distilled water. This method may appear more or less complicated to you, but after a few trials you should be able to quickly determine your zinc values with no difficulty.

Question.—A small silver solution which I use on repair work acts strangely of late. The deposit has a rather pinkish tint, and is never a good white silvery color. I do all the work in the shop and cannot account for the condition. The color causes me to think that copper is in the solution. Would copper in small quantities cause the condition described?

Answer.—If your silver solution is an old one it may contain a very appreciable percentage of copper. The percentage of copper must be high, if it really is copper, which is accountable for the peculiar color of your silver deposits. Many old silver solutions working quite normally contain large percentages of copper. Copper is present in new baths in small amounts, but the percentage increases as the bath continues in use and the rapidity of the increase depends on the care given at least three sources of contamination. Copper may be introduced into the silver solution from impure commercial silver anodes, which contain varying percentages of copper. Copper slinging wires and hooks contribute a share under careless management. The striking solution adds a little if not cautiously used. These combined sources soon assist in contaminating the regular plating bath, while you least suspect the evil is progressing. Many platers consider the copper as actually injurious to the solution, even when present only in small amounts. This is really not the case, because the copper is not deposited with the silver unless the copper content exceeds the silver content. Silver solutions in normal condition contain considerable free or uncombined cyanide, and this fact alone would prevent any noticeable effect on the silver deposit by deposited copper. In the electro-motive series, silver and copper are found adjacent to one another, and silver electro-positive to copper. One might easily imagine that these two metals, so closely related electro-chemically, would travel to the negative electrode almost simultaneously under electrolysis. But, on the contrary, practice has proven that it is extremely difficult to deposit copper continuously with silver in an ordinary commercial plating solution, unless the solution is purposely prepared and operated to get the result, and consideration is given the proportions in the bath, together with proper regulation of the electric current used. Your solution may have become very badly contaminated with copper from some unobserved source. We would advise electrolyzing the bath for several hours with a strong current, and if the color continues to form, make a simple test for copper before resorting to any doctoring. We do not regard the condition as serious, and believe you will find it comparatively harmless.

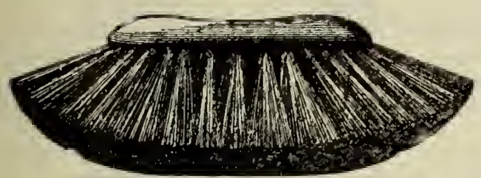
Question. — We are plating steel chains used for electric light fixtures in a brass solution. The solution has been used daily during past five years and has never troubled us to any extent. Now we get a dirty grey deposit. The solution registers 20 degrees on the hydrometer and is used quite warm with a voltage of 4 to 5. We have added various chemicals to it, but the color of the deposits does not improve. What should we do?

Answer.—Did it not occur to you when you were adding chemicals that a density approaching 20 degrees Beaume was indicative of trouble without a warning? We will admit there are men who claim to operate brass plating solutions having a density of 18 degrees and over, and with success and no trouble. We prefer they do it rather than attempt it ourselves. Your solution is too dense, and the metal content is low. Remove about one-half the solution to a clean receptacle, where you can keep it for use later on. Don't throw it down the sewer. It cost money and you are paid to guard against such waste. If you are not, get right with Mr. Employer at once, so that you will be in proper frame of mind to safeguard his

MADE IN CANADA

Foundry Facings and Supplies

"Quality to the Utmost" is our Slogan



Moulders' Soft Brushes as above are made from the best quality pure Russian bristle, four inches in length, wire drawn. The block is in two pieces, glued and screwed together.

When you deal with us you get facings and supplies of super-service quality and a prompt delivery service that will save you worry and inconvenience.

Our XX Ceylon Plumbago is preferred by all who know, in Canada. We believe there is no better facing obtainable anywhere. Try it.

Bench Rammers as illustrated are made from maple hardwood, thoroughly oiled, 13" long by 4½" diameter.

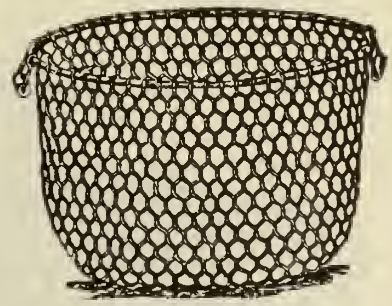
Ceylon Plumbago No. 206 is a great success for general machinery casting work. It is sure to satisfy.

Climax Stove Plate Facing, another quality line. Once known always used.

Make the work of your coremakers easier by using

OUR BLACK CORE COMPOUND
(100% pure)

This compound eliminates troubles common to ordinary compounds. It makes fast friends everywhere. Try it.



Coke or Charcoal Baskets of heavy woven galvanized steel wire are strong and durable.

MANUFACTURED BY

The Hamilton Facing Mills Co., Limited

HAMILTON, ONT., CANADA

interest, as well as plate his manufactured product. Dilute the portion remaining in the plating tank to a density of about 9 or 10 degrees Beaume and then add copper carbonate or copper cyanide plentifully; then electrolyze the bath with a strong current. By a strong current, we mean all you can get into the bath through a large slinging wire, say, ⅛ inch. Open the switch and let the current flow freely. Stir the solution at intervals during the treatment and after a few hours' continuous electrolyzing, add some zinc carbonate previously dissolved in cyanide, or some zinc cyanide. When dissolving the zinc carbonate in cyanide, make a saturate solution before adding it to the plating bath, so as to get an idea of the actual condition of the bath with relation to its cyanide content. Electrolyze the solution again and carefully note the character of the deposit, also its color; continue adding the zinc until the color comes yellow enough to suit your requirements. Work the solution on regular stock and watch the anodes and the deposit. If various colors form on the deposit, add more cyanide gradually until the deposit forms with a uniformly yellow color and the anodes work clean. In the management of the brass solution, keep the metal content high, but do not allow the Beaume density to exceed 10, or thereabouts. Trouble is more liable to occur with very concentrated brass solutions, and nothing is gained by using such a bath. Some of the most successful brass bath operators in this country maintain a density of less than 5 degrees Beaume and get out beautiful deposits in record time, and never have a moment's worry over the condition of the solution. If your anodes coat over and the deposit is satisfactory, clean the anodes by brushing, rather than adding varying quantities of cyanide at frequent intervals. Platers and bath operators often acquire a habit of adding cyanide to copper and brass solutions at regular periods, irrespective of the amount of work the bath is doing or the condition of the deposits being formed. The desire is to forestall possible difficulties, when, in reality, they are actually coaxing difficulties into the game. Think, work, and then think some.

ORGANIZING TO PUT IN BRITISH GOODS

Representatives of British Manufacturers Have Meeting in Toronto and Montreal

The Canadian Association of British Manufacturers and their representatives has been established with branches at Toronto and Montreal. Similar associations have existed in Australia and New Zealand for several years. The objects of the Association as set forth in the constitution are as follows: To further the interests of British trade throughout the Dominion of Canada and to affiliate with and work in concert with kindred associations in other centres of the Dominion having similar objects.

Provisional committees were appointed to draft the constitution of the association. The Toronto committee comprised:

Mr. G. A. Marshall, chairman (steel); Captain Harris (shoe polish); Mr. A. C. King (dry goods); Mr. C. W. Beal (pottery); Mr. E. V. Pannell (aluminum); Mr. H. Wilson (dry goods); with Mr. F. W. Field, the British Trade Commissioner in Ontario, acting as secretary pro tem of the committee. The Montreal committee comprised:

Mr. J. H. Peattie (dry goods); Mr. G. H. Bishop (dry goods); Mr. F. H. Scott (silver and electro plate); Mr. A. K. Drury (heavy metals); Mr. F. I. Spielman (paints, etc.)

These committees drafted a uniform constitution.

Those interested in the formation of the association naturally wish to increase Great Britain's share of the import trade of Canada. As Canada is buying a considerable volume of merchandise abroad each year, it is desired that the United Kingdom shall obtain a substantial share of that business. It is felt that the progress which Canadian manufacturers have made, especially during the past few years, will be exceeded by the manufacturing developments in Canada in the future. This is recognized as a welcome and gratifying feature, because as each unit of the British Empire becomes stronger industrially and agriculturally, each developing its resources, so will the great British Empire grow in stability, prosperity and influence.

The executive council of the Toronto branch of the new association comprises:

J. Wilson, president (dry goods); G. A. Marshall, vice-president (steel); H. V. Andrews (wools); C. W. Beal (pottery); Captain Harris (shoe polish); J. Haywood (groceries, coffee, etc.); E. V. Pannell (aluminum and electrical lines).

The executive council of the Montreal branch will probably be elected in the near future.

The government of the association consists of a supreme council, and each branch of the association will have its own local executive council. The supreme council will consist of the chairman and one councillor from each local executive. The association will consist of British subjects only.

(a) British manufacturers and wholesale exporters from the United Kingdom.

(b) Representatives and agents of British manufacturers and wholesale exporters from the United Kingdom.

No representative or agent of British manufacturers who enters into any agency agreement with, or in any way represents any manufacturers or wholesale exporters whose principal works or place of business are situated in any country deemed by the supreme council to be or to have been hostile or unfriendly, will be entitled to membership in the association.

Assistance in the formation of the new association has been rendered by Mr. G. T. Milne and Mr. F. W. Field, the British Government trade commissioners in Canada.

There are several hundred manufacturers of the United Kingdom represented in Canada by branch houses or agents and it is anticipated that a large number, both of British manufacturers and their representatives will enrol as members of the new association.

A substantial number have already been enrolled.

Export After Trade.—L. Allerton, representing the Nemours Trading Corporation, New York, an organization of manufacturers' agents for export trade, said at the Windsor Hotel, in Montreal, that he was in Canada for the purpose of getting in touch with the big manufacturers in order to arrange for exports of Canadian products, particularly to the British colonies. The firm had agencies abroad for American goods, but they felt that in Canada certain manufactures might better suit the people in the British colonies. Mr. Allerton felt that with agents abroad, constantly on the spot, and studying the needs of the people, there could be a great extension of Canadian business. The firm had agents abroad at advantageous points, and these kept the firm informed in respect to goods desired. In the work of reconstruction, Mr Allerton felt that both American and Canadian firms should do good business Mr. Allerton is calling upon our local manufacturers, but will leave in May for the purpose of opening up branch offices in Africa, especially at Durban and Johannesburg. Mr. Allerton has been handling export trade for years in various foreign countries for British and American firms.

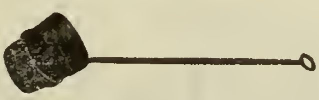
Will Employ Many.—That Canada will be able to absorb all the available labor within the near future, was the opinion expressed by E W. Beatty, K.C., president of the C.P.R. Mr. Beatty came here to meet the government. "I look for a decided improvement in the labor situation," said Mr Beatty. "I think everyone is looking forward optimistically. The present stress is gradually easing off and everyone is contemplated to step forward more briskly when the peace treaty is finally signed." Touching upon the recent announcement that the C.P.R. would make a determined effort to provide as much employment as possible, Mr. Beatty stated that preference would be given to the man who had served overseas. All former employees of the company who left to join the colors and who have applied for their old positions have been reinstated, while about 2,500 additional returned soldiers had been taken on the company's strength.

To Tunnel St. Lawrence. — The Chambre de Commerce of Montreal, at a recent meeting, gave a unanimous approval to a project for tunneling the St. Lawrence River, and the building of a central union station in Montreal. As outlined at the meeting, the idea was that the tunnel should reach the heart of the business centre of the city.

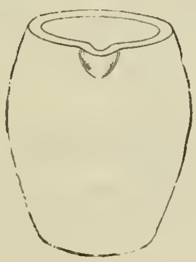
Foundry Supplies and Equipment

We are prepared to supply all foundry needs for Brass, Steel or Iron Castings. If you are not a customer of ours would suggest your joining the majority at once. It will pay you.

Whiting Cupolas and all their lines are sold by us, including Cranes, Core Ovens, etc.



Ladles of all sizes.



The Pot that gives from 30 to 40 heats.

We have both split and D Handles of best makes for prompt shipment.

Branford vibrators and sprayers are sold by us.

The Dominion Foundry Supply Co.

LIMITED

Everything for the Foundry

MONTREAL TORONTO

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	29 35
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75

	Montreal	Toronto
Toronto price	$32 75 to	$35 75
Hamilton		50 00
Victoria		50 00

FINISHED IRON AND STEEL

Iron bars, base	$4 75
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 50

METALS

Aluminum	$38 00	$35 00
Antimony	8 00	8 50
Copper, lake	18 50	18 50
Copper, electrolytic	17 50	17 50
Copper, casting	17 00	17 00
Lead	6 50	7 50
Mercury	....	....
Nickel	....	....
Silver, per oz.		0 98
Tin	54 00	55 00
Zinc	8 00	8 25

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$10 50	$-0 00
Copper, crucible	13 00	12 75
Copper, heavy	13 00	12 75
Copper, wire	13 00	12 00
No. 1 mach. comp'n	10 00	12 00
New brass cuttings	8 00	9 00
No. 1 brass turnings	8 00	8 50
Light brass	5 00	5 00
Medium brass	7 00	6 00
Heavy melting steel	9 50	9 00
Shell turnings	6 00	6 00
Boiler plate	10 00	8 00
Axles, wrought iron	20 00	15 00
Rails	15 00	11 00
No. 1 machine cast iron	17 00	14 00
Malleable scrap	15 00	12 00
Pipes, wrought	8 00	5 00
Car wheels, iron	20 00	18 00
Steel axles	22 00	20 00
Mach. shop turnings	5 00	5 00
Cast borings	8 00	8 00
Stove plate	12 00	10 00
Scrap zinc	4 00	5 00
Heavy lead	3 50	4 00
Tea lead	2 50	3 00
Aluminum	15 00	12 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices. F.o.b. Pittsburgh.

PROOF COIL CHAIN. B

1/4 in.	$14 35
5-16 in.	13 85
3/8 in.	13 50
7-16 in.	12 90
1/2 in.	13 20
9-16 in.	13 00
5/8 in.	12 90
7/8 in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 10
Linseed oil, boiled, single bbls.	1 73
Linseed oil, raw, single bbls.	1 70
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37½
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 00
Sheets, black, No. 10	6 15	5 45
Canada plates, dull, 52 sheets	8 50	8 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B. W.G.	....	....
Fleur-de-Lis, 28 B.W. G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 95
Premier, 10¾ oz.	....	8 25
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$13 00
3-16 in.	12 50
1/4 in.	11 75
5-16 in.	11 40
3/8 in.	11 00
7-16 in.	10 60
1/2 in.	10 40
5/8 in.	10 00
3/4 in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20%, on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to	$0.65
Copper	.36 to	.46
Tin	.70 to	.70
Silver per oz.	1.05 to	1.00
Zinc	.23 to	.25

Prices per lb.

NAILS AND SPIKES.

Wire nails	$5 50	$5 30
Cut nails	5 85	5 65
Miscellaneous wire nails		60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23-.19
Ammonium, carbonate	.25
Ammonium, chloride, lump	.55
Ammonium, chlor., granular	.30
Ammonium, hydrosulphuret.	.30
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.50
Arsenic, white	.20
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.40
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	1.35
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
" crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.40
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.)	6.00
Tin chloride	1.75
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3 25
Polishing wheels, bullneck		2 00
Pumice, ground	3½ to	.05
Emery composition	08 to	.09
Tripoli composition	06 to	.09
Rouge, powder	30 to	35
Rouge, silver	.35 to	.50
Crocus composition N	08 to	10

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 34
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37¼
Imperial quenching oil	39½
Petroleum fuel oil	10¼

FILES AND RASPS.

	Per Cent
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	40

ARE SATISFIED TO LEAVE LISTS ALONE

Toronto Dealers Report That Market Is Rather Dull During the Week—Exchange Rate Hurts

TORONTO.—For the second week in succession dealers in all lines covered by the markets are satisfied to let prices stand as they are, and no changes are noted this week. There is a general attitude of waiting developing, and until the trade gets over it there is not likely to be a great volume of business moving. The strike, if it lasts for any length of time, is bound to have the effect of putting the brakes on trade locally, and already the buying of basic materials in some of the plants affected has been very noticeably decreased.

Dealers in steel claim that there are going to be no drops for some time. They do not take much stock in the rumors from U.S. points that prices are going to tumble in June. There are signs of a movement in structurals, the first for some time. The inquiries are coming in from various sources and some business is being placed in small lots. The trade does not care very much whether this is small or great, so long as the movement gets a start. There is a feeling

that a movement in structurals will give greater confidence in other lines, which have been holding back in the meantime.

Some of the warehouses have been doing a good business right through this year. In fact one of the firms stated to CANADIAN FOUNDRYMAN that the trade during that period in their lines was all they could desire, but they were not so hopeful for the present month.

There is some buying going on by a local concern on account of business that is being done for the Halifax shipyards, which are still working on Government boats. Although there are some good orders like this coming in this firm contended that general business was duller than it had been for some weeks.

One good-sized shipment of iron lap-welded tubes is coming in from an Old Country firm for a Great Lakes ship-building concern. English furnaces are also being put in. Some of the importers look for a lower price in many of the British lines as soon as the actual signing of peace has taken place, and the business of dismantling the war shops has been proceeded with. The claim of these firms is that the advantage that American firms have now in the way of price in competing for business in the Canadian market is but a temporary condition, and it will be squared away as soon as the Old Country firms get back to their old lines.

Don't Like the Discount

Some of the firms that are selling American machinery in Canada find that the discount that is against Canadian currency just now is rather a serious affair. In some cases, now that competition is pretty keen, it is necessary that the price of the machine be brought down to a point where there is just enough profit to keep the things moving. The discount amounts to about 2¾ per cent. Many of the sales are made on a flat ten per cent. to the agents here, and when it is found that the consumer will not pay the exchange, if he has to foot for the discount, he finds himself out on the deal. Some of the Government purchasing departments, such as the National Railways, are also showing a strong preference to staying on this side of the line with their buying, as a matter of national policy, as they do not feel that the Government should, with the exchange so pronounced against this country, make purchases that will tend to increase it. In fact there are some who actually look to see a three per cent. exchange, which will mean just that much protection to the material that is manufactured in the Dominion.

Dealers differ as to the amount of business that is being done just now. In some of the offices the statement is made that the month of May will be a poor one, while in others they state positively that they are well pleased with the amount of business they are doing.

Scrap Market Dead

One can use the word dead, stagnant or dull in referring to the condition of the scrap metal market, according to the way he feels. In all three cases the chances are that he will be well within the mark. Dealers state that there has not been a good week's business done since the signing of the armistice. There is nothing, they claim, on the horizon to stimulate speculative buying, and neither foundries nor steel mills want anything now. "Business is as poor right now as it has been at any time since the ending of the war," was the way in which one of the largest dealers sized up the situation to CANADIAN FOUNDRYMAN, and he was not particularly hopeful of anything better in the immediate future. The drops in the price of pig iron made no difference at all in the demand for scrap for a mixture.

It is known, though, that some of the dealers in the metal markets are trying now to secure deliveries of fourth quarter copper, and they are not finding it an easy matter to do this. They seem to be certain that for the months of October, November and December, copper will be expensive. This view is hard to explain, as there is a great deal of copper scrap in the country, but the dealer was quite firm in his opinion regarding the higher price for the last three months of the year.

NEW QUARTERS FOR PHILADELPHIA SALES OFFICE OF JOSEPH DIXON CRUCIBLE COMPANY

The Joseph Dixon Crucible Company of Jersey City, N.J., manufacturers of lead pencils, crayons, erasers, silica-graphite paint, crucibles, graphite greases, and graphite automobile lubricants, have announced the removal of their Philadelphia sales office from 1020 Arch street to Rooms 801 and 802 of the Finance Building, South Penn Sq., Philadelphia, Pa., May 1st, 1919. The Philadelphia office was started in 1881 at No. 6 North 5th Street, with C. W. Brown as manager. Shortly after it was moved to 40th North 4th Street, and W. J. Coane was made manager in 1890, upon the retirement of C. W. Brown.

At the end of five years another change was made to 38 North 4th Street. History repeated itself, and in 1898 the Philadelphia branch was moved to 1020 Arch street, with larger quarters, where it has been for the last 21 years. The removal of the Philadelphia office from a store to an office building is also a change in policy, but as the trade in the Philadelphia district carry large and desirable stocks of Dixon's pencils and graphite products, a still greater dependence will be placed on them in the future. The Dixon Sales Organization in Philadelphia, under the able management of Mr. W. G. Stringer, who entered the employ of the Dixon Company in 1898, and also succeeded Mr. W. J. Coane as the Philadelphia district sales representative in 1912, is prepared at all times to be at the service of the trade.

Annual Meeting, 1919

The stockholders of the Joseph Dixon Crucible Company held their annual and regular meetings on Monday, April 21st. The following directors and officers were elected:

Directors—George T. Smith, William G. Bumsted, J. H. Schermerhorn, Robt. E. Jennings, George E. Long, Edward L. Young, Harry Dailey.

Officers—George T. Smith, president; George E. Long, vice-president; J. H. Schermerhorn, vice-president; Harry Dailey, secretary; William Koester, treasurer; Albert Norris, asst. sec'y. and asst. treas.

Of the 20,000 shares of stock, 19,512 were voted.

The report made by President Smith and the remarks made by him on the business of the company were received by the large number of stockholders present as most satisfactory and pleasing in every way.

The American Graphite Company, incorporated under the laws of the State of New York, is a subsidiary of the Joseph Dixon Crucible Company, and its annual election was held on the same day as that of the Joseph Dixon Crucible Company, and resulted in the election of the following officers: George T. Smith, president; George E. Long, vice-president; J. H. Schermerhorn, treasurer; Harry Dailey, secretary; William Koester, assistant secretary and assistant treasurer.

The directorate is the same as that of the Joseph Dixon Crucible Company.

REMOVING PAINT FROM IRON

Many experiments have shown that a paint softener made of one pound of lime to four pounds of potash mixed with six quarts of water will have the desired effect as quickly as many more costly preparations.

Where Are You Going to Get Your Future Foundry Foremen and Superintendents?

McLAIN SAYS:

"Go to the Sand Heaps—Not to Colleges for Your Future Foremen and Superintendents."

The practical molder who will be guided by McLain's System of MIXING IRONS—CUPOLA PRACTICE—and SEMI-STEEL is the best expert on *your* pay roll. He has *your* interest at *heart,* knows *your* product and with *your* co-operation will keep you ahead of your competitors.

McLain graduates are neither strictly practical nor technical—but a combination of both—which spells *efficiency and economical foundry practice.*

Modern Foundry Practice as Exemplified by McLain's System is as Far Ahead of the Average Foundryman's Practice as the Electric Light is Ahead of the Candle.

A FOUNDRY FOREMAN SHOULD KNOW EVERY LITTLE DETAIL ABOUT MAKING CASTINGS

FOUNDRYMEN EVERYWHERE---

now reap the benefit of McLain's System as it shows them in concise form the scientific mixing and melting of iron and steel scrap, the *secret of production* at the least cost.

If you are not making

McLAIN'S SEMI-STEEL

when are you going to do so?

SEND FOR LATEST SEMI-STEEL BOOKLET

McLAIN'S SYSTEM, Inc.

700 GOLDSMITH BLDG. - MILWAUKEE, WIS.

RETURN COUPON TO-DAY

McLain's System, Inc., 700 Goldsmith Bldg., Milwaukee, Wis.

Send me Semi-Steel Booklet FREE.

Name ....

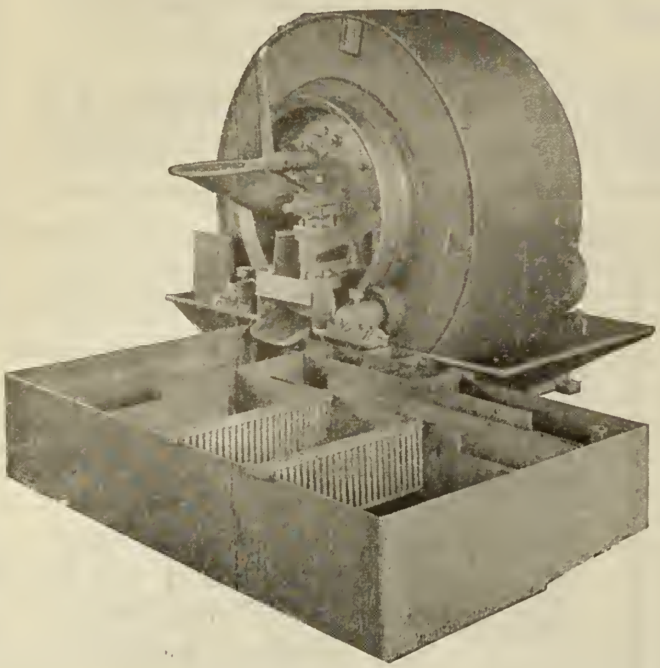
Firm ....

Address ....

Position ....

5-19

Standard Mill



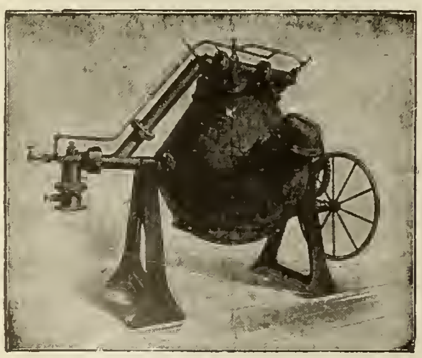
It reclaims all metal in cinders, slag, skimmings, old crucibles, etc. Built in four different sizes. Will crush and pulverize 600 to 6,000 lbs. **per hour** requiring 2½ to 7½ H.P. circulating same water over and over.

The Standard Mill is ready to operate as soon as you uncrate it. Pits under floor or special foundations are **not** needed. Lists of Canadian Foundries using it with great profit may be obtained for the asking. Write for Catalogue "C."

The Standard Equipment Company

Manufacturers of Special Foundry Machinery

New Haven, Conn., U.S.A.



The Hawley-Schwartz Furnace

The Only Perfect Melter

All metal from 50 lbs. to 10,000 lbs.

Is Absolutely Uniform

Write for catalog and complete information

The Hawley Down Draft Furnace Co.

Easton, Penn., U.S.A.

Stone Brush.

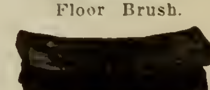
Bent Handle Washout.

Shoe Handle Washout.

A-1 Foundry Brushes

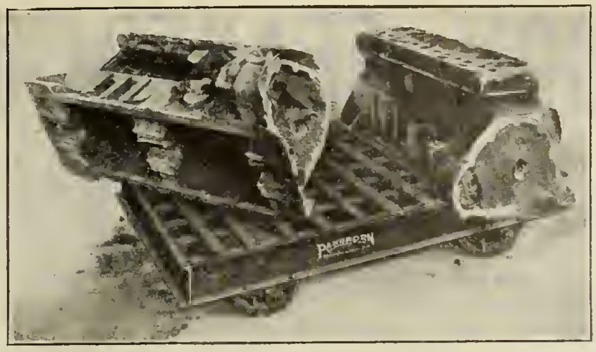
Get your next supply from us. We can meet every foundry brush requirement on the shortest notice. You'll find our prices right.

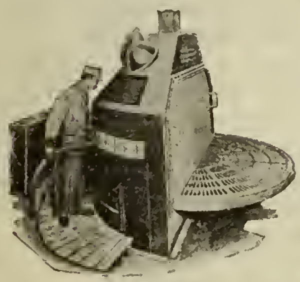
Floor Brush.



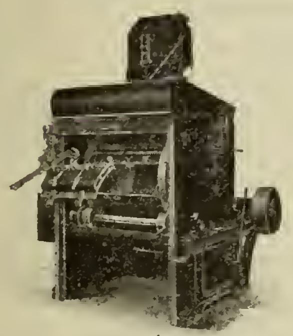
The Manufacturers' Brush Co., Cleveland, Ohio, 19 WARREN STREET NEW YORK

Type "AC"
Hose Sand-Blast.

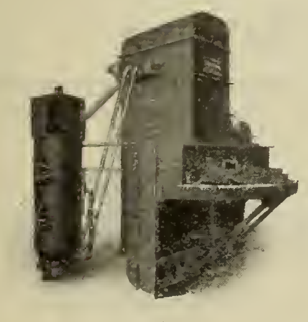




Type "EH"
Hygienic Cabinet

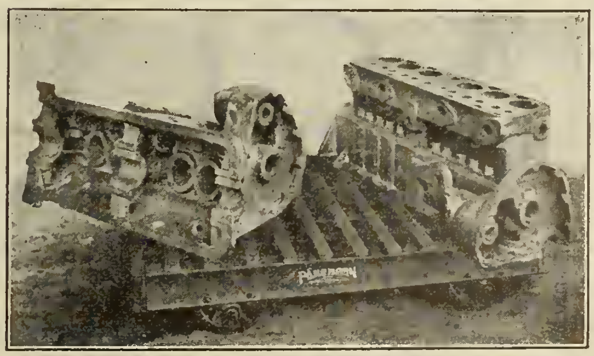


Type "GD"
Barrel Sand-Blast



Type "LB"
Rotary Table Sand-Blast.

Type "PC",
Room Sand-Blast.



OBERMAYER ESSO

TRADE MARK REGISTERED

MOLTEN IRON CLEANER

EVERYTHING YOU NEED IN YOUR FOUNDRY.

New and Better

EVERYTHING YOU NEED IN YOUR FOUNDRY.

ESSO MOLTEN IRON CLEANER is a product based on a scientific and practical method for reduction of Sulphur and other impurities in Castings, each and every component part plays an active reaction on the Molten Metal. **Esso Molten Iron Cleaner** is a development of years of experiment. We do not claim that this is a panacea for all ills, however it will reduce your Sulphur, Phosphorus, which to-day are the bugbears of the Iron Foundry Business. **Esso Molten Iron Cleaner** will also take out quite a few of the oxides that are in your metal and it will act in the ladle exactly as Aluminum does in Steel. It will give you a fine grade of Iron which will stand the Air Pressure and Water Pressure.

Our attention was called to Iron Cleaner from the mere fact that we had made such a wonderful success of our Rillton Brass Cleaner. Another great advantage of our **Esso Molten Iron Cleaner** is, when placed in the ladle it will keep your ladle clean and prevent scum, you simply skim your ladle the same as you have in the past and you will note the great improvement in your Iron.

We all know, that Coke in this Country is coming higher in Sulphur than formerly. In the days of our fathers it was not necessary to use Cleaners of any kind, our iron was better, in fact we had charcoal Iron. In those days Coke was of the best and 72 Hour Coke of ½% Sulphur, but to-day it is different and we have placed upon the market our **Esso Molten Iron Cleaner** to help your Molten Metal conditions.

We would be pleased to send you a barrel of this material on trial, Freight Prepaid on first lot, at 12c per pound, F. O. B. Pittsburgh, Cincinnati or Chicago for test, five pounds to one ton of metal, placed in the bottom is used to give the desired results for good castings.

THE S. OBERMAYER COMPANY

OFFICES AND FACTORIES:

PITTSBURGH CINCINNATI CHICAGO

WAREHOUSES:

ST. LOUIS MILWAUKEE DENVER PHILADELPHIA LOS ANGELES

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.

BOILER GRAPHITE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRIQUETTING
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

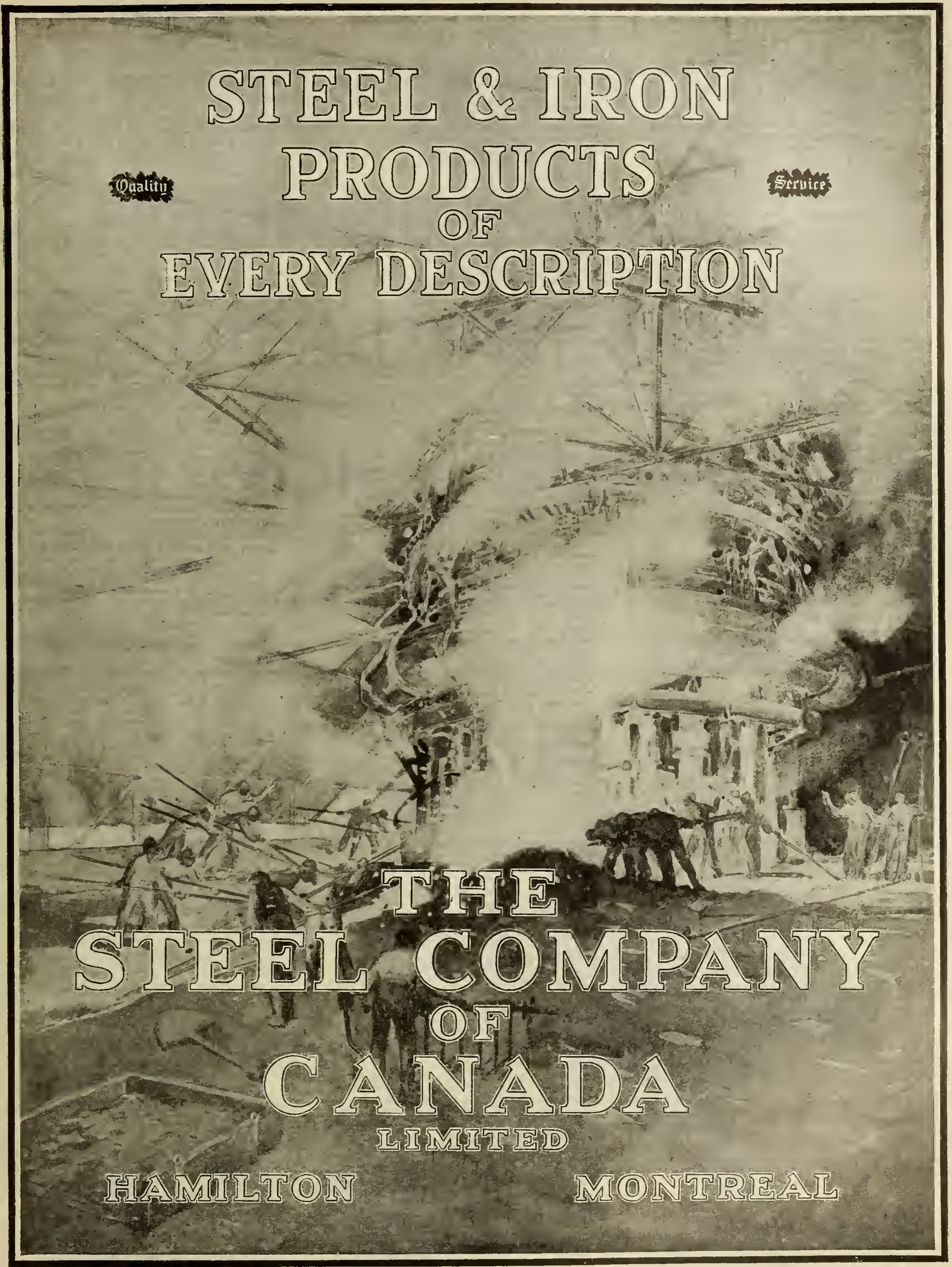
CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.


STEEL & IRON
PRODUCTS
OF
EVERY DESCRIPTION
Quality
Service
THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON
MONTREAL

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
The MacLeod Co., Cincinnati, O.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRANITE AND MARBLE POLISHING
Harrison Supply Co., Boston, Mass.

GRANITE CUTTERS' TOOLS
Harrison Supply Co., Boston, Mass.

GRANITE AND MARBLE POLISHERS' SUPPLIES
Harrison Supply Co., Boston, Mass.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

INGOTS, BRIQUET
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

INGOTS, COPPER, BRASS, BRONZE AND NICKEL
Eastern Brass & Ingot Corp., Waterbury, Conn.
Metal Block Corp., Chicago, Ill.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL BURNERS
The MacLeod Co., Cincinnati, O.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST HOSE MACHINES
The MacLeod Co., Cincinnati, O.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
The MacLeod Co., Cincinnati, O.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.

SAND BLAST TABLES
The MacLeod Co., Cincinnati, O.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corporation, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

STOPPERS, GRAPHITE
Dominion Crucible Co., Ltd., Montreal, Que.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WELDING AND CUTTING APPARATUS, OXY ACETYLENE
The MacLeod Co., Cincinnati, O.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

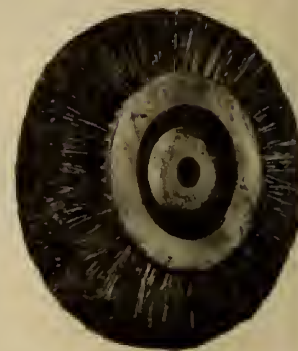
INDEX TO ADVERTISERS

BRUSHES

Wire, Bristle and Tampico for Lathe and Hand Use

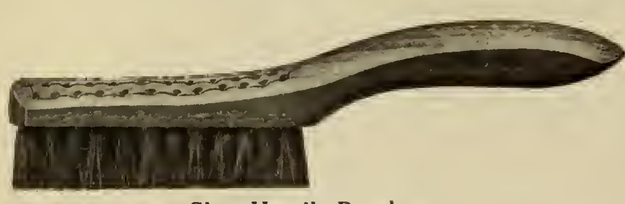
Goblet Brush without Stem
Hub Lead Filled

Circular Brass and Steel Wire Scratch Brushes



Tampico Wheel Brushes

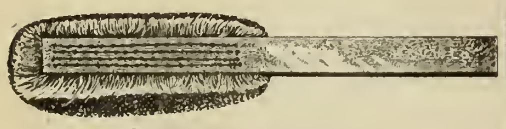
We manufacture a large variety of Circular Brass, Steel, Tampico and Bristle Wheels for manufacturing uses. Why not secure your wheels "Made in Canada" and save time and money? We can make any sort of wheel to suit your requirements.



Shoe Handle Brushes

Curved Handle Brushes

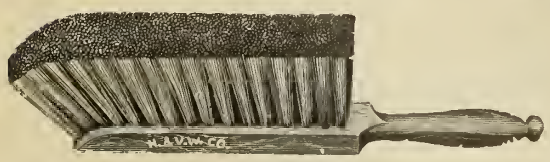
Made in two classes, hand wire drawn and punched in Steel, Brass, Bristle, Fibre and Tampico.



Cotton Potash Brushes

Flat Tampico Scouring Brushes, "M.M."

End Brushes for Jewelry



Sawdust Brush

Economy Steel Wire Brushes

Round Glue Brushes

Circular Bristle and Wire Brushes.
With Stem

Watch Case Brushes
Bristle and Wire

BUY GUARANTEED QUALITY SUPPLIES

Manufactured by

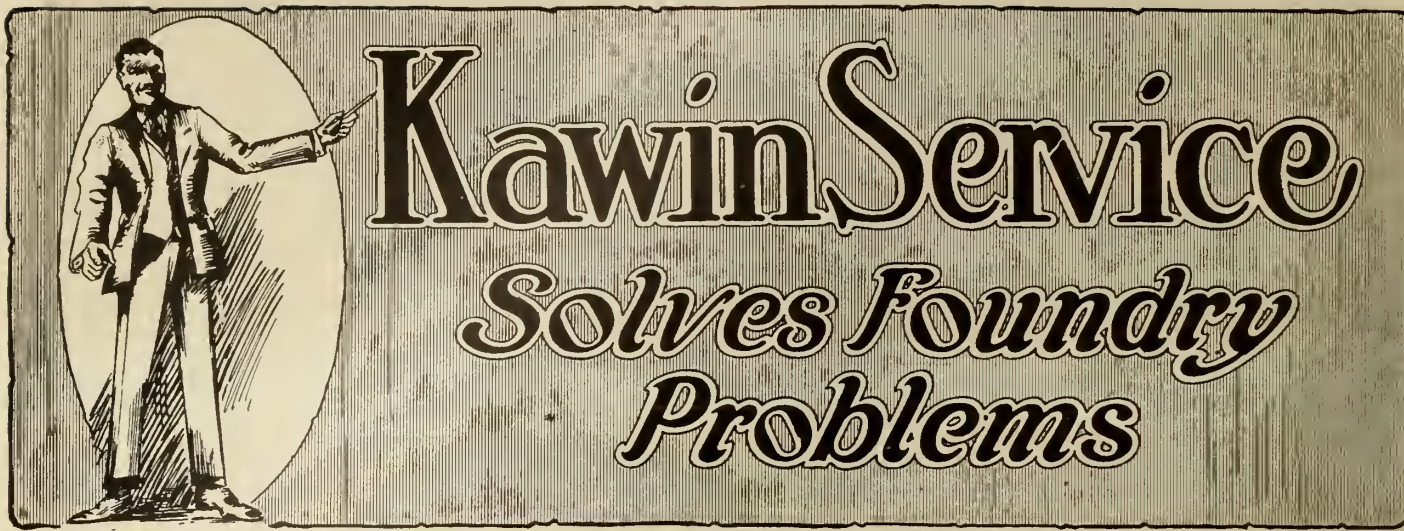
The Canadian Hanson & Van Winkle Company, Limited

15-25 Morrow Ave., West Toronto, Canada

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, JUNE, 1919 No. 6



Saves Labor, Saves Material and Promotes Efficiency

There never was a time in the history of modern industrial effort when expert advice was more needed than to-day. Top notch efficiency is necessary to assure satisfactory manufacturing results. KAWIN Service with its chain of Laboratories and Practical Experts assures every Foundryman the best results.

KAWIN SERVICE

Guides you to the most economical and efficient methods of production and demonstrates

How to Save Labor.
How to Save Material.
How to Make Proper Mixtures.
How to Secure the Best Cupola Results.
How to Get Uniform Castings.
How to Solve Moulding Troubles.
How to Reduce Losses and Increase Your Output.

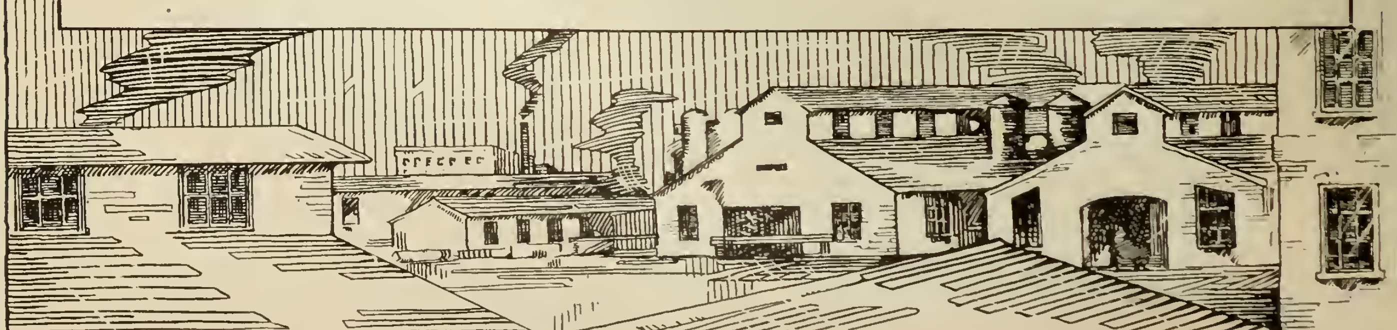
KAWIN SERVICE comes to you guaranteed to save 100% over and above its cost. This is a fair proposition. Let us hear from you.

Charles C. Kawin Company, Limited

CHEMISTS, FOUNDRY ENGINEERS, METALLURGISTS

307 KENT BUILDING, TORONTO — DUN BUILDING, BUFFALO, N.Y.

Dayton, Ohio — Chicago, Ill. — San Francisco, Cal.



The Publisher's Page

TORONTO JUNE, 1919

NO ADVERTISING MIRACLES

THERE are no miracles in advertising. Sound principles are back of every advertising success, says *The Scalpel.*

The advertiser who gives an order for a quarter-page, one time, and expects to be deluged with orders, is due for a bump. He is riding on a flat tire.

Single insertion advertising cannot be defended on any sound advertising basis. Most of the time it's money wasted. Marshal Foch confounded the enemy with a bewildering series of consecutive drives that permitted no recuperation nor organized counter-attacks. This lesson was learned after three years of uncertainty and defeat.

Advertising victories are won in this way. Give your prospect no chance to forget your goods. Force him to capitulate. Organize your campaign and push your drives with no interruption. Hammer away with direct mailing, backed by your display advertising. Display space is your heavy artillery, preceding and protecting your infantry or direct attack, either by mail or salesmen or both. Don't send your detail men over the top without machine gun (direct by mail) and heavy artillery (display space) support.

Back up the trade with service and supplies. This is your S.O.S. Department. Detail your men in the field to air scout duty in observing and reporting the effect of your promotion, on distribution, dealer interest and general demand. Have your men in the field follow up your inquiries personally whenever possible. If this is not consistent, put your inquiries in an incubator and keep them warm with gentle follow-ups. Nurse them along when they show signs of hatching, and don't, for a minute, treat them like so many scraps of paper. Once they get chilled with inattention, delay or careless handling, the stuff is all off. You can't bring them back to life.

CANADIAN FOUNDRYMAN, June, 1919. Vol. X., No. 6. Published monthly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $1.00; in the United States, $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.

Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
CRUCIBLES
Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

Canadian representative H. T. Meldrum 14 St. John St., Montreal, Canada.

Tumbling Mills for Every Purpose

We Make Mills to Suit Your Particular Work—All Sizes and Types

All kinds of modern, labor-saving foundry equipment — Mills, rooms, cabinets, specialties, rotary tables, pressure machines, drawer ovens, rack ovens, car ovens, core racks, core cars, iron cinder mills, dust arrestors, exhaust fans, brass cinder mills, resin mills, cupolas, etc.

Enquiries gladly answered. Write for catalogue.

THE W. W.
SLY MFG. CO.
CLEVELAND
OHIO

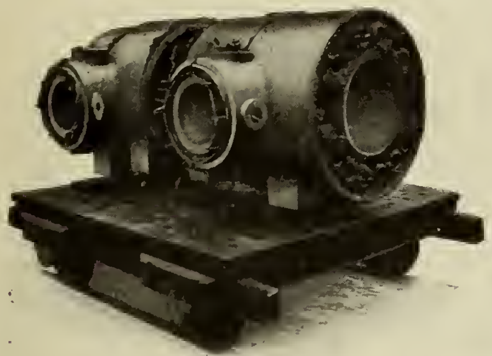
Did You Read

"THE SAND-BLAST FOR GENERAL FOUNDRY WORK"

In the March and April Foundryman ?

"PANGBORN" SAND-BLASTS

Meet every foundry requirement—whether large or small—will save you money and greatly improve the appearance of your castings.



This casting weighing 10,470 lbs. required 30 hrs. hand labor to clean. It was perfectly cleaned and cores removed by a "PANGBORN" Sand-Blast in one hour. A SAVING OF 29 HOURS' LABOR ON EACH CASTING.

Another customer saved enough, in wages alone, to pay for the complete installation in less than a year.

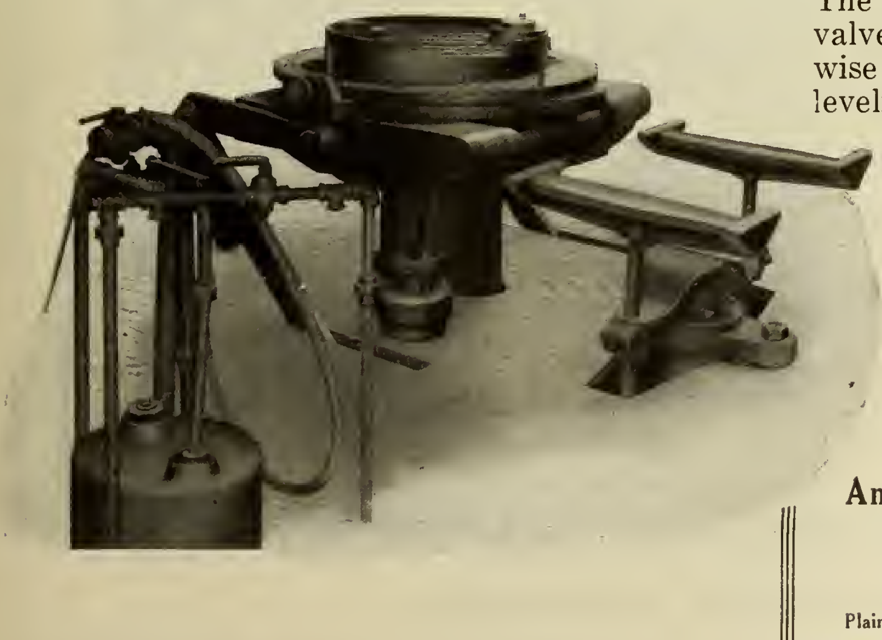
We'll tell you how much you can save—if you will tell us what you make and your daily tonnage.

Ask for a copy of "Sand-Blast Principles and Data." It will interest you.

PANGBORN CORPORATION
HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS
P.O. Box 8509

The AMERICAN JOLT ROCKOVER MACHINE

is efficiently operated by men of little experience in foundry work, because it is simple, accurate and massively rigid.



The self-adjusting internal jolting valve takes up its own wear. Likewise the automatic ball and socket leveling device requires no attention from the operator.

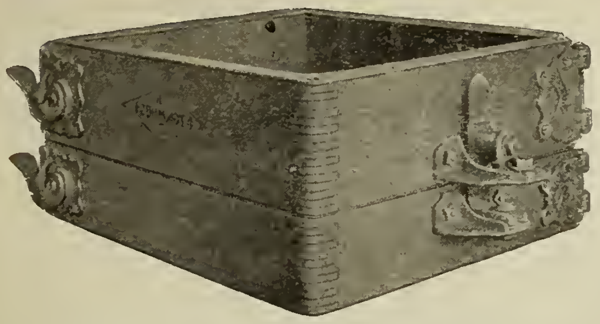
One piston jolts and rocks mold. And the plain rockover table permits pattern plate being bolted direct to table, and to project over table in all directions when necessary.

Write for Complete Particulars

American Molding Machine Co.
TERRE HAUTE, INDIANA
Box 35

Builders of

Plain Jolters Jolt Strippers Jolt Rockover Machines



Diamond Master Flask

Diamond Steel Jacket

DIAMOND

In Diamond Master Flasks the accepted principles of snap flask building have been developed and enlarged and the weak and faulty conditions overcome. Master Flasks are light in weight, easy to handle, accurate and very durable.

Their convenience and accuracy will result in a larger and better production.

Diamond Steel Slip Jackets are made to fit any make of flask, straight or tempered, and of any thickness of metal desired up to 8 gauge. Far more serviceable than cast iron or wooden jackets—they can neither break nor burn.

We also manufacture a complete line of foundry accessories, Wedges, Clamps, Varnish Cans, Pattern Benches, Core Boxes, Rapping Plates, etc.

Sold in Canada by

DOMINION FOUNDRY SUPPLY CO.
WHITEHEAD BROTHERS COMPANY
E. J. WOODISON COMPANY
FREDERICK B. STEVENS
HAMILTON FACING MILLS CO., LTD.

If interested, write any of these jobbers or to us direct.

DIAMOND CLAMP & FLASK CO.
38-40 N. 14 St. RICHMOND, INDIANA

CHAPLETS

The life of a Chaplet is when molten metal rushes against it. If the core is held in place until metal is set, and then fuse into the casting, the Chaplet has proven its value and served its purpose.

OUR CHAPLETS HAVE PROVEN THEIR VALUE.

We Manufacture Chaplets of Every Description.

Special sizes are made to order. Let us quote you prices.

Cleveland Chaplet & Manufacturing Company

Cleveland, Ohio, U. S. A.

"Make Your Own Price"

The days of "negotiated" prices, so far as reputable manufacturers are concerned, have long since gone by. A price, nowadays, is a price: it is no longer the starting point for an argument. It is fixed by the seller, and is accepted by the buyer, if accepted at all, in the expectation and belief that it represents actual cost of efficient production, plus a fair profit.

In a broader and better sense, however, buyers still can, and they still do, make their own prices. For it is buyers, and buyers only, who make possible the volume of production which is the principal factor in determining the unit costs on which prices must be based.

Many manufacturers, and some of them are in the Pneumatic Tool business, believe prices should be based exclusively on "the law of supply and demand." They believe it is right to charge all the traffic will bear, regardless alike of costs and profits.

Much can be said, and much has been said, in support of this view, but I have never been able to share it. I have always believed, and I believe now more strongly than ever before, that no manufacturer can truly serve his customers unless he shares with them the benefits accruing from the economies which their patronage helps him to achieve.

The success of the Keller Pneumatic Tool Company has been due in large measure to our steadfast adherence to this principle. We exist by and for our customers. Every new customer, and every individual order we receive, helps us by just so much to build better tools, and, other things being equal, to sell them at better prices.

That is why Keller prices are always relatively, and sometimes actually, lower than those asked for competing tools. They are "made" by our customers—the United States Government, the leading Railroads and Shipyards, and a constantly-growing number of representative industrial organizations throughout the world.

William H. Keller *President*

KELLER-MADE
PNEUMATIC TOOLS
MASTER-BUILT

KELLER PNEUMATIC TOOL COMPANY, CHICAGO & GRAND HAVEN, U.S.A.

General Sales Offices: 20 East Jackson Boulevard, Chicago · Factory: Grand Haven, Michigan

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

Modern Works of The Mueller Co., Sarnia, Ontario

Few Canadian Plants Did More to Supply the Allied Armies Than Did This One—Now Working on Peace-Time Requirements

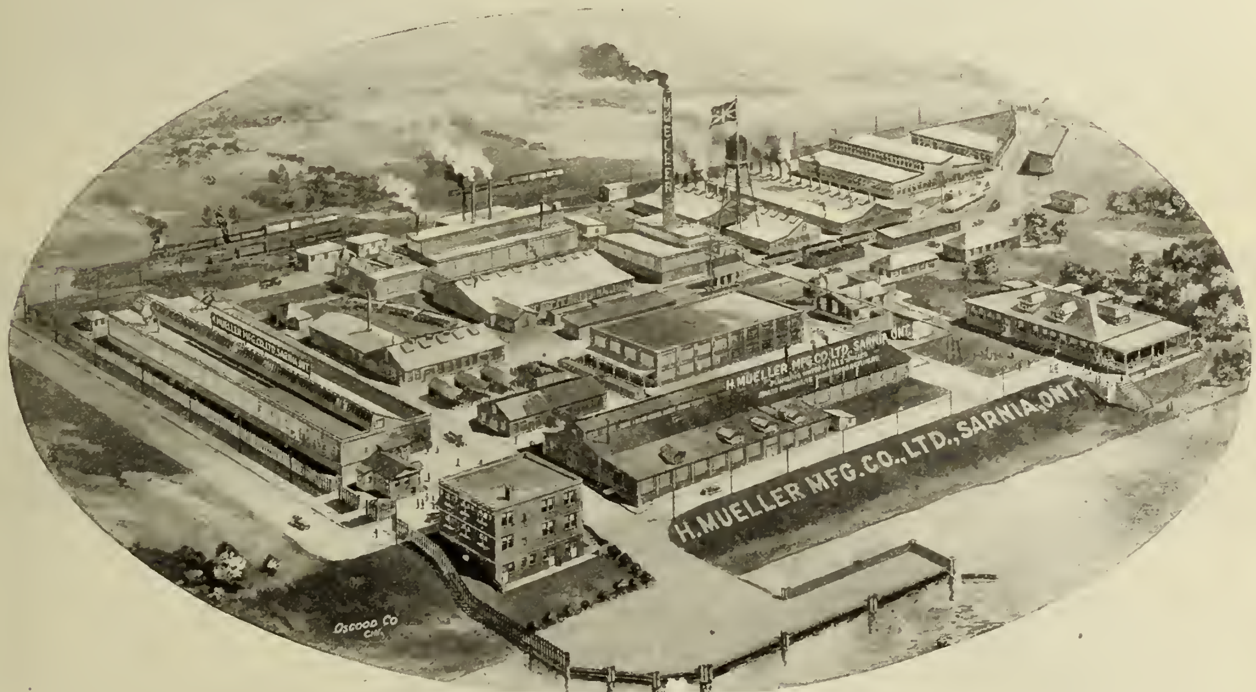


FIG. 1—WORKS OF THE H. MUELLER MFG. COMPANY, LIMITED, SARNIA, ONTARIO.

THE illustration herewith shown is of the Canadian branch of the H. Mueller Mfg. Co., Limited, manufacturers of water, plumbing and gas brass goods, with branches in various parts of the United States, in addition to the one here shown which is located at Sarnia, Ontario.

The picturesque city of Sarnia, situated as it is on the banks of the river St. Clair, faces, on the opposite side of the river, the American city of Port Huron, Mich., where another of the company's plants is located.

This company was established long before the war was thought of, but when the war broke out and the call came from the Imperial Munitions Board for shells and shell parts, they answered the call with a readiness and determination which meant much to the armies of the Allies. It is almost inconceivable that such an enormous output of brass castings could be produced from one plant as was turned out by this company in the hour of need. A few details in this connection will undoubtedly be of interest to the reader.

The machining of these castings, which is also done at the plant, is of considerable interest, but perhaps not to the practical founder, who is most interested in his own particular field.

The Foundry

The melting capacity of the foundry was 1,000,000 pounds per week during the last two years of the war. This enormous production was maintained week in and week out, and on many occasions was surpassed. Every known device for the increase of production was instituted, principal amongst which might be mentioned the permanent molds shown in the illustration Figure three. These consisted of cast iron molds of the exact shape required for the casting. The ones shown are for fuse caps, to be used in shell construction and were made by the millions. These molds were planed and bored to the exact dimensions and were placed on the racks shown, which insured their being perfectly levei, so that they could be poured even. As soon as the castings were sufficiently set, the molds were turned over, allowing the castings to fall out, when the mold would again be ready for use in pouring the next batch.

While these shell castings run into enormous tonnage, there were many other brass and bronze castings to be considered in the prosecution of the war, such as ship's bells, port lights, air pump liners, manifolds of all descriptions, and miscellaneous ship castings too numerous to mention. All of these articles, which might under the circumstances have been properly termed munitions, helped to make up the tonnage spoken of and gave employment to twelve hundred hands in the foundry and allied departments.

Melting

The melting of the metal was done in Holly-Schwartz oil burning furnaces of the cupola type. These furnaces will be seen in the illustration Fig. 4, which also shows the hoods connected to high stacks which carry away all smoke and fumes from the room, leaving the workmen in an atmosphere of pure, healthy air.

The Metals Used

As every foundryman knows, there are legions of different alloys, all nearly the same but different enough to make the resultant castings hard or soft or strong, or most anything which might be asked for. When any particular characteristic in the castings is required, the customer chooses his own formula and the mixture is made accordingly, new stock being used, but for jobs such as the fuse plugs spoken of where soundness was the chief requisite, scrap brass of every conceivable kind was made use of.

The scum and dross which usually finds its way to the refuse pile or possibly to a refinery, is all refined and purified by the Mueller Co's. own experts, in a laboratory specially built for the purpose and under the control of the company's chemist.

While the Mueller Co., rendered good service to the Empire and to the cause of civilization in general during the period of the war, it must be understood that this is not a munition plant, but is a perfectly peaceable peace-time industry, specializing in plumbers' supplies, steam, water and gas brass goods, but the few descriptive items here given, together with the illustrations, will give some idea of the magnitude of the plant and equipment. And the fact that they were engaged in the manufacture of war material, gave them the opportunity or rather forced them to keep up with the latest developments in the way of producing the best quality of goods. Among these we feel safe in venturing the assertion that none is in a more favorable way to bear fruit in the near future than that of brass forging.

Brass Forging

As we have intimated, brass forging bids fair to hold a foremost place in the brass world, but before giving any details of the process by which it is done, it will be well to remind the brass founder of the difficulties it is capable of overcoming. Every brass man knows the difficulty which is encountered in producing brass castings which are free from oxide spots and flaws of different kinds as a result of impurities in the metal, also the trouble in getting brass castings to run. He also knows that to produce a piece with bulky sections, the interior is apt to be less dense. And perhaps the most annoying thing of all is the havoc which may be wrought by a speck of iron or steel getting into the melted brass.

Many of these defects can be overcome by the introduction of aluminum into the mixture. By using aluminum it is possible and practicable to mix iron with the brass and make good castings. It is also possible to remove practically every vestige of impurity from the metal. Mixtures containing aluminum run into complicated shapes much better than ordinary brass or bronze. In fact aluminum improves the metal in a great many ways, but unfortunately the casting when cold is not dense enough to stand the pressure, and for work where pressure is called for, the metal must be free from aluminum. With brass forging this difficulty is overcome, and castings which are actually porous or are shrunken in the centre can be made as sound as a piece of forged steel.

FIG. 2—INTERIOR VIEWS OF EMPLOYEES' CLUB AND RECREATION BUILDING

By brass forging we do not mean to infer that the brass is heated in a forge and worked on an anvil, but it is to all intents and purposes the same thing. Cored-work is not forged, but for pieces such as the fuse caps for shells or any piece which is to be machined or bored from the solid, the casting is first cast,

FIG. 3—PERMANENT MOLDS FOR FUSE CAPS.

and after cleaning it is reheated to a temperature at which it will yield, when it is put into a die and squeezed by hydraulic pressure, which produces the same result as would be obtained on a piece of iron in the drop forging process, only that no blow is struck; the hydraulic pressure taking the place of the drop. If the casting has been porous or if it had shrinkage or drains, down in the heavy section, all of this is gone as a result of the compression and a sound, dense piece of metal will be found when the machine tool has done its work. Brass forging not only produces a sounder article and makes it possible to use alloys formerly considered out of consideration, but it can be employed to financial advantage on many lines of work where these points are not of importance, providing a sufficient number are called for to justify the special equipment necessary.

FIG. 4—HOLBY SCHWARTZ BRASS FURNACES.

Many pieces are done at this works by simply sawing off pieces from a plain round or square bar of brass and treating them by the forging process. For more complicated shapes, bars are extruded to almost any design and sawed off to the proper size and weight, and are easily forged into the finished design, making a much neater and sounder article than could be molded and cast, and at the same time costing less money.

Of course we must not forget that the foundry is still the leading factor and always will be. For the the regular line of brass fittings, the sand mold and the brass furnace will probably never be successfully supplanted. Snap benches, squeezers and combination squeezer and jolt rammer are the main sources from which the molds are procured. Aluminum and composition match-plates are used almost entirely and these are fitted to the machines. When the job is of such design that the squeezer will not do a perfect job, the combination squeezer and jolter are required.

Female labor is utilized to considerable extent in making the cores, as it is considered that for such delicate work as some of the cores required call for, the female touch is necessary.

The Plant Itself

While much more might be said, enough has perhaps been said to convince the reader that great strides have been made in the construction and management of a thoroughly modern establishment for the production of such goods as would be expected from a brass works. The buildings and grounds as shown in Fig. 1 and Fig. 5, will be seen to represent the last word in the story of perfection. All the roadways are concreted and every building is properly heated and ventilated, and everything in the way of sanitation has been thoroughly attended to. Nothing which tends towards the health and comfort of the employees has been overlooked. As an example of the extent to which the company has gone in this direction, we have but to refer to the employees' club and recreation building shown in Figure 6; the interior view of which is shown in Figure 2. This building, as will be seen, contains practically everything which would be found in a first-class hotel, such as kitchen, pantry, dining room, reading room, etc., in addition to locker room and wash room.

In the large auditorium is a piano for the pleasure of the employees, and on frequent occasions when the employees decide on a social evening, this room with its polished floor is converted into a dance hall in which the managers and superintendents mingle with the hands in a fraternal manner.

First Aid

The first aid department, which is also housed in the building, is a veritable hospital in completeness, although the need for this department has been reduced to a minimum through the efficient manner in which safety devices have been adopted; it is kept in readiness at

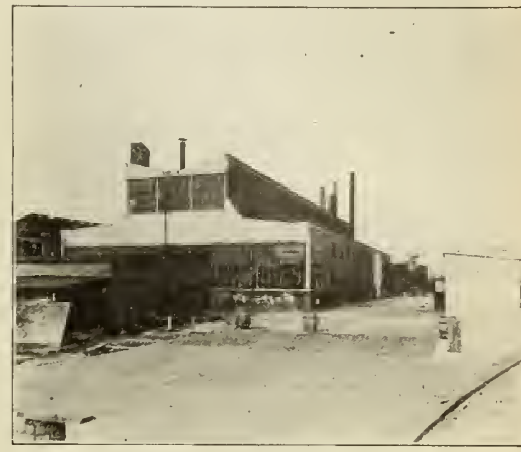


FIG. 5—EXTERIOR OF BRASS FOUNDRY. NOTE HIGH ROOF AND ALMOST ENTIRE GLASS CONSTRUCTION.

all times with a trained nurse constantly in attendance. Any further explanation on the subject would be superfluous as nothing has been left undone.

This building, known as the Employees' Club and Recreation Building, stands on an elevation facing the river, and in front of the spacious piazza with arm chairs and rockers, while on the boulevard in front of this are long back seats, in fact everything indicates a desire on the part of the Mueller Co., to make the employees feel that their services are appreciated and that their comfort and welfare are being looked after.

C.P.R. Depot at Moose Jaw.—The Canadian Pacific Railway is going to build a new depot in Moose Jaw at a cost of $250,000, according to an announcement

FIG. 6 EMPLOYEES' CLUB AND RECREATION BUILDING.

made by E. W. Beatty, the president of the road, on a recent visit. The Building will be of stone and will be located in direct proximity to the present depot. Work will be started this year.

The Booth-Hall Electric Furnace

A Conducting Hearth Electric Furnace Having Auxiliary Electrode for Starting. Automatic Control and Careful Design Produce Economical Operation

By W. K. BOOTH
Chief Engineer, Booth, Hall & Co., Chicago

THE principal difference between the various makes of electric furnaces is the method in which the power is introduced in the furnace. The general metallurgical operations of practically all electric arc furnaces are the same. The method of power regulation bringing the power to the furnace frequently means greater or less cost in furnace operation, and governs, to a considerable extent, the manner in which the furnace lining may be put in and consequently the refractory cost and the loss of time due to furnace shutdowns.

Electric furnaces may be broadly divided into two classes.

1. Vertical arc furnaces:
   (a) Conducting hearth.
   (b) Non - conducting hearth.
2. Horizontal arc furnaces.

It is not the purpose here to enter into a discussion of the merits of the various types of arc furnaces, but more particularly to describe a new type of electric furnace, which has been developed during the past year and a half, and which is known as the Booth-Hall electric furnace.

The Booth-Hall electric furnace comes under class 1-a above, and is illustrated diagrammatically in sketches Figs. 1 to 4, and in the photographs from operating furnaces.

Fig. 1 is a longitudinal section of the two-phase electric furnace, with the auxiliary electrode furnace resting upon the charge and arcs drawn between the main electrodes and the charge. A pool of metal is shown forming on the hearth of the furnace.

Fig. 2 is a diagram of a transverse section of the two-phase electric furnace, showing the crossing action of the current in the bath, and the grids embedded in the hearth.

ONE AND ONE-HALF TON BOOTH-HALL FURNACE IN POURING POSITION.

Fig. 3 is a diagrammatic representation of the electrical connections for the two-phase electric furnace, employing two single-phase, Scott-connected transformers. This diagram shows the connections from the transformer terminals to the main electrodes and to the auxiliary electrodes and grids. A two-phase electric furnace so connected gives a balanced load on a three-phase power service. The auxiliary electrode is shown in black.

Fig. 4 shows diagrammatically the arrangement of main and auxiliary electrodes in single, two and three-phase Booth-Hall furnaces. The auxiliary electrodes are shown in black.

The furnace is built either in single, two or three-phase to suit the conditions at the place of installation, the general principle being a furnace having a solid hearth which becomes conductive of electricity when hot, and the use of an auxiliary electrode which acts as a return for the electric current until the hearth becomes heated and conductive.

In starting furnace operation on a cold charge the auxiliary electrode is lowered until it rests on top of the charge, and the arc is then drawn between the charge and the main electrodes or electrode, as the case may be, the auxiliary acting as a return for the main electrode or electrodes. The auxiliary is so arranged that it presses with its entire weight on top of the charge and consequently no arc can form underneath the auxiliary: experience has demonstrated that no arc forms. The auxiliary is connected in parallel with the conducting hearth, and when the main electrodes or electrode have melted enough metal to form a pool on the bottom the hearth becomes conductive and

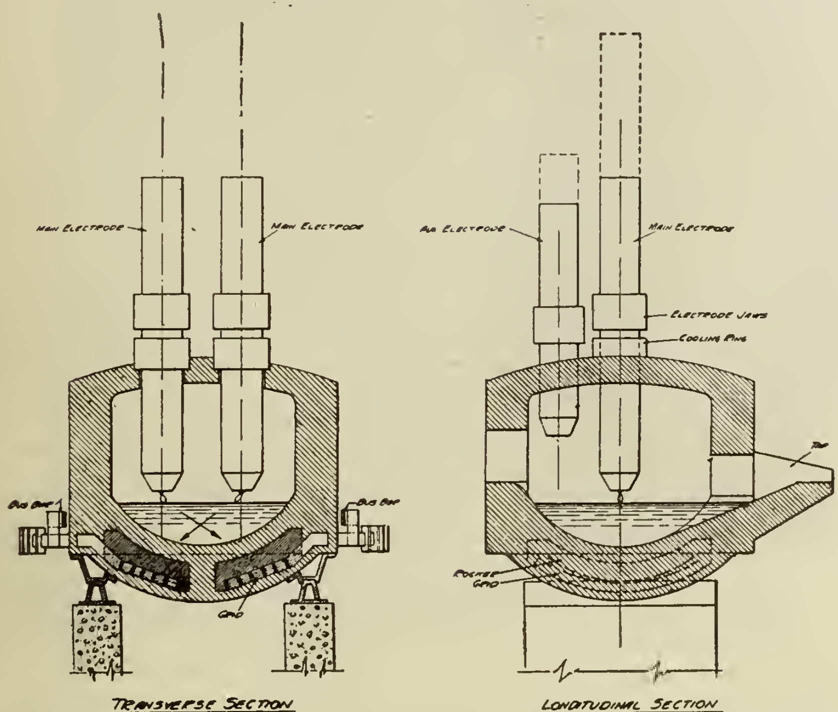
William K. Booth, Chief Engineer of the Booth-Hall Company, is the patentee and designer of the furnace, and a graduate of Ohio State University. He was identified for several years with the Snyder Electric Furnace Co. He is a member of the American Electrochemical Society, associate member of the American Institute of Electrical Engineers, and a member of the Iron & Steel Institute of Great Britain.

the auxiliary is withdrawn from contact with the charge. In a cold furnace the auxiliary is in operation from thirty to forty-five minutes, and in a furnace that is hot, less than fifteen minutes; that is, only long enough to assure a positive start of the furnace and a balanced load on the power company's line.

Furnaces from one-half to six tons holding capacity are generally built for two-phase operation, taking power from three-phase service by means of Scott-connected transformers, as shown diagrammatically in Fig. 3. In the hearth of the Booth-Hall two-phase electric furnace two sets of grids are embedded, which are electrically insulated from each other and are so related to the main electrodes that the current of the two phases crosses in the bath, thus giving a maximum of circulation of the molten metal and causing, in conjunction with the effect of the bottom heating, a very thorough mixing of the metal in the bath. This action can be readily observed in looking into the furnace after the charge has entirely melted. The conducting grids are placed as far as possible from the heated interior of the furnace, and experience has shown that they never become over-heated or require special cooling. The grids are so constructed as to handle large currents, furnishing large areas of contact with the material of the conducting bottom, and preventing local heating due to contact resistance.

By use of the auxiliary electrode a positive start of the furnace is guaranteed, and there is no possibility of failure to secure contact. Each main electrode is independent of the other, as there are no arcs in series, and consequently the regulation of the furnace is very simple, giving a balanced polyphase load on the power service lines. As with the two-phase connection there are only two electrodes to regulate, this offers the minimum number of electrodes for a balanced polyphase load, and the smaller the number of electrodes requiring regulation, the smoother becomes the furnace operation.

The hearth is either acid or basic, as desired, and in each case, the bottom is at least 24 inches (60 cm.) in thickness, being sintered in place layer by layer and forming a monolithic mass. By using the main electrodes in conjunction with the auxiliary, the materials of the hearth are sintered together in thin layers similar to open-hearth practice, thus forming a very durable bottom, and making the danger of run-outs a minimum. The furnace hearth is consequently solid, with no water cooling of any kind. With the basic hearth, dead burned dolomite or magnetite is used to maintain the slag line; in the acid furnace ground ganister is used for the same purpose. The conducting hearth gives a uniform bottom heating of the entire bath, prevents sculls and makes speedier and more thorough distribution of the heavier alloys, which tend to sink to the bottom of the bath. The effect of this bottom heating is considerable, and has been accurately measured on Booth-Hall furnaces in continuous operation.



FIGS. 1 AND 2—TRANSVERSE AND LONGITUDINAL SECTIONS OF BOOTH-HALL TWO-PHASE FURNACE

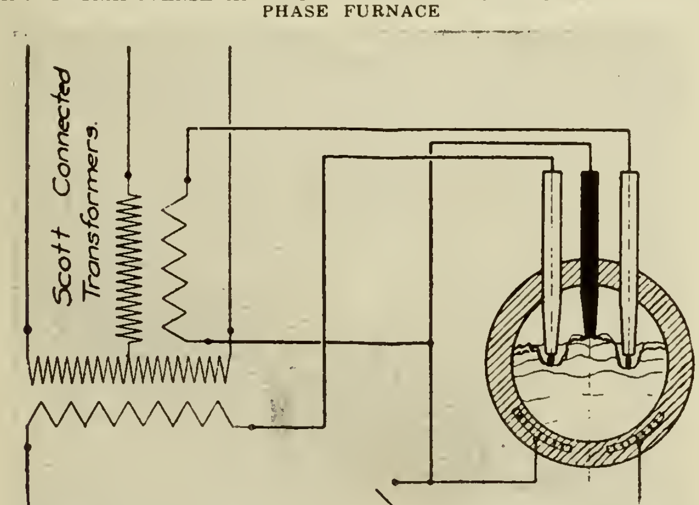


FIG. 3—ELECTRICAL CONNECTIONS OF BOOTH-HALL TWO-PHASE FURNACE

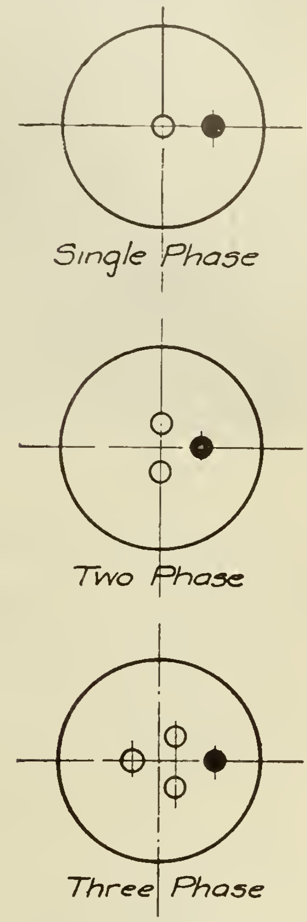
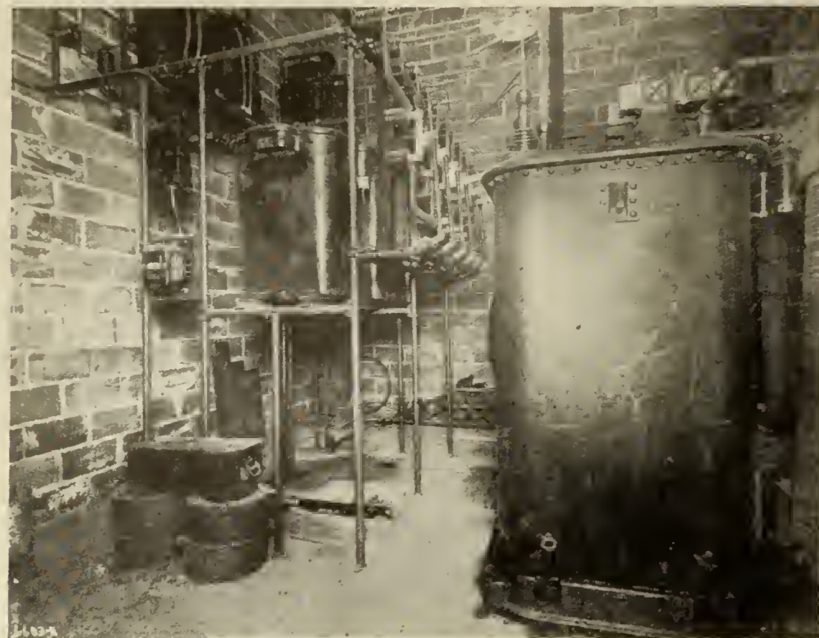


FIG. 4—DIAGRAMMATIC REPRESENTATION OF ELECTRODE ARRANGEMENT.

With the two-phase electric furnace a mimimum of electrode consumption is secured, due to the fact that a minimum number of electrodes for a balanced polyphase load is used. This means less electrodes to handle, less electrode breakage, and less surface burning. The loss on the auxiliary electrode is small because it is in operation for such a comparatively short time. The electrode jaws are made so that the electrodes can be gripped or released by turning a handwheel or lever at the side of the furnace, and it is not, therefore, necessary for the melter to climb on top of his furnace when changing the grip on the electrodes. The electrode jaws are arranged in segments so as to take up and adjust themselves to the inaccuracies in the surface of the electrodes.


TRANSFORMER ROOM SHOWING OIL SWITCHES AND TRANSFORMER.

A roomy charging door of special construction is provided in the rear of the furnace and another door provided in front over the tap. This construction is very similar to the open hearth and permits a battery of furnaces to be arranged side by side and a charging machine to serve them all.

The furnace tilts or rocks backward as well as forward, and slagging operations can be handled either from the rear or front as desired. The door is shown in the various photographs. It is designed so that it comes flush against the door frame, sealing the opening, and cannot swing open of its own accord. This prevents air getting into the furnace and also prevents excessive losses of heat through the door. The door can be opened anywhere from a few inches to a full open when inspecting the bath, taking tests or pushing scrap from the sides of the furnace into the bath, thus protecting the melter from the heat of the furnace and preventing great radiation loss. Any warping of the door or frame does not affect the operation of the door or its sealing of the opening when closed.

The furnace is motor tilted, in all sizes, for pouring, but is arranged so that it can be tilted up by hand in emergency if the motor fails to operate. The smaller sizes of furnace are built for hand operation only if desired. All parts of the tilting mechanism, including gears and motors, are arranged so that they do not come beneath the furnace, and, therefore, there is nothing under the furnace that can be injured in case of a run-out.

The main electrodes are arranged for automatic regulation and also, in every case, so that they can be regulated by hand in case the regulators or motors should require repair.

The importance of power control is universally recognized, especially when refining operations are carried on. In the Booth-Hall electric furnace the power input can be maintained at any point from one-fourth to full load by means of proper voltage reduction and control switches. The average power factor will run between 90-95 per cent.

In making steel for the ordinary grade of steel castings, the Booth-Hall electric furnace has operated with a power consumption as low as 446 kilowatt hours per 2,000 pounds (906 kg.) of steel poured, but the average will run between 500 and 550 kilowatt hours per net ton, for continuous operation. In one of the three ton furnaces a considerable quantity of tar phosphorus pig iron has been made, running under 0.035 per cent. in phosphorus and sulphur, also special steels requiring refining with two or more slags; the power consumption, of course, depending upon the degree of refining required.

Although the Booth-Hall furnace has been on the market only a year and a half, furnaces have been placed in operation or are under construction for the following companies:

Midland Electric Steel Co., Terre Haute, Ind.; 3-ton furnace (basic) (ingots and pig iron).

Avery Co., Peoria, Ill.; 2 1½-ton furnaces (basic) (castings).

Duriron Castings Co., Dayton, O.; ¾-ton furnace (acid) (special).

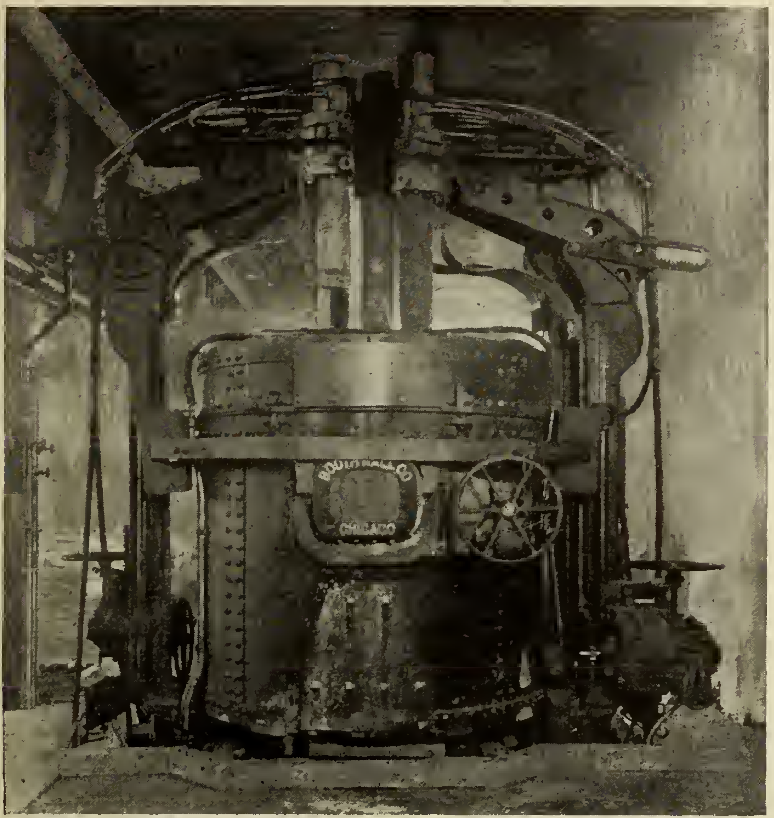
West Michigan Steel Foundry Co., Muskegon, Mich.; 3-ton furnace (basic) (castings).

Queen City Foundry Co., Denver, Col.; ¾-ton furnace (basic) (castings).

Monroe Steel Castings Co., Monroe, Mich.; 1½-ton furnace (acid) (castings).

New England Steel Castings Co., East


SWITCHBOARD AND AUTOMATIC ELECTRODE CONTROL.



REAR VIEW OF ONE AND ONE-HALF TON BOOTH-HALL FURNACE.

Longmeadow, Mass.; 1½-ton furnace (acid) (castings).

Four Wheel Drive Auto Co., Clintonville, Wis ; ½-ton furnace (acid) (castings).

Ecorse Foundry & Machine Co., Ecorse, Mich.; 3-ton furnace (basic) (castings).

Consumers Steel Corporation, Chicago, Ill.; 3-ton furnace (basic) (tool steel) .

DEFORMATION OF CASTINGS

At the meeting of the Sheffield branch of the British Foundrymen's Association, on Nov. 22, Mr. Tom Brown, of Sheffield, read the paper on "Deformation of steel castings," which was read at the annual conference of the association held in Sheffield in June last. This he illustrated with lantern slides. In introducing his paper, Mr. Brown regretted the want of interest shown by moulders in their work. Their thoughts always seemed very far removed from the job they had in hand. He sometimes wondered whether they gave a moment's thought to the reason why their foreman should tell them to do a job in a certain way. Did they, when they saw a defective casting, ever ask themselves the cause of the defect or how it could have been avoided? How often did a moulder, when given a job, ask himself, "What is the quickest time in which I can get it done, or how can it be done with the least possible waste of composition and energy?" He very much feared the moulder gave no thought to such questions; but that condition of things must be altered; the moulder of the future must think of the work he was engaged on. The sooner he began to realize that his trade was not only a skilled one, but an art, and the sooner he gave more study to his work the sooner the trade would be elevated to a pinnacle which would be second to no trade or craft in the country. He appealed to moulders to give more study to their work, and the sooner they did so the sooner would the conditions in which they worked be improved.

Mr. Watson said he was very much interested in Mr. Brown's introductory remarks, and did not mind how much he rubbed it in with regard to the moulder, because, although he had seen some of the finest work turned out in Sheffield yet there was something even for Sheffield moulders to learn. The mental attitude of the men with regard to the treatment that they got from the employers had to be altered. It was a very big problem, and he believed the solution was to be found in getting the men to understand that by increasing output they would be helping the industry and the country and their own earning capacity. They must get more money because it was necessary for them to be better fed, better housed, and to enjoy better working conditions than at present obtained in Sheffield. With regard to waster castings in steel foundries, there were so many conditions that helped to bring this about that one could not blame the moulder altogether—the way the metal was run, the way in which the risers were put in, the condition of the steel and the method of moulding, all had something to do with it. In his opinion, it was necessary to get back to the apprentice; he had to be more the care of the employer than he had been in the past. They must teach the moulder that it was no disgrace for him to go into the fettling shop and have a look at the waste castings. He personally had never been able to persuade the moulder to go and look at the wasters; he said they had nothing to do with him. It was necessary to educate the boys to the idea that in going to look at a waster they were getting education in their trade that would be good for them. The education of apprentices should be to some extent carried on in the works. Take the case of a valve casting that had blown or was cracked. There should be someone competent to point out to the apprentice moulders the cause and the cure. Waster castings were a very serious problem, and he congratulated Mr. Brown upon his treatment of it. A great deal might, as he said, be done by distorting the pattern before starting to mould, but it was a thing that could be learned only by experience, and was not easy to figure out.

FOREMEN OF HAY FOUNDRY AND IRON WORKS "GO TO SCHOOL" TO IMPROVE PRODUCTION

Mr. J. Lewis Hay, of the Hay Foundry & Iron Works, Newark, N.J., has organized a group of foremen of the various departments to study modern production methods. The object of the course is to train the men in the principles of foremanship, to develop their qualities of leadership and to give them a broad view of their work and of industry as a whole. The course is under the direction of John Calder, mechanical engineer, of the Business Training Corporation, 185 Madison Ave., New York, which has charge of all the details and supplies the text-books.

The course lasts three months and the men devote about three hours of spare time to the training. It consists of text-book study, quiz questions, practical problems, lectures and conferences. The general subjects covered by the training include handling men. materials from purchase to final product, plant plan and layout, the principles of organization, the elements of cost finding and cost accounting, record keeping, industrial relations, hiring and firing, welfare work, safety, plant teamwork. etc. Everything is taken up in a practical way and the men are encouraged to apply the ideas they acquire.

Mr. Hay hopes that the course will help to develop the men who take it as well as benefit the plant through increased efficiency due to better co-operation. He is also of the opinion that employee relations will be strengthened because of the more careful handling of problems by the trained foremen.

Copper tools were used by the Babylonians 4,050 years B. C.

Gold coins were introduced by King Phidon 869 years B. C.

Gunpowder was used at the battle of Cressy in the year 1340.

The Molding of a Marine Condenser Cover

A Few Hours of Extra Work Spent in the Foundry Saves Many Dollars in the Patternmaking Department by Resorting to the Time-Honored Spindle and Sweep

By JOHN H. EASTHAM

THE marine condenser cover casting shown at Fig. 1, 4 ft. 8 in. diameter, and weighing approximately 790 pounds, presents no unusual molding problems, assuming the molder to be served out with complete patterns, and other conditions being equal.

As two castings only were required, however, with no prospect of a repeat order, the initial cost of a pattern became out of the question, recourse being had to the time-honored spindle and sweep, the method of production and economies effected being as follows: A 6 ft. square bottom board and two-part flask were brought into use, and a sweep, with its lower or working edge conforming exactly to the convex face of the casting, with 4 ins. of straight parting allowance beyond its periphery, was bolted to the spindle arm shown in Fig. 2, levelled up to correct height so as to clear the box edge, the thickness piece shaped to the inside of the casting being next screwed to position.

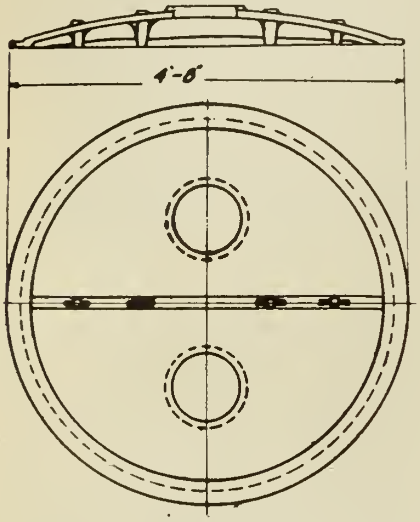


FIG. 1—PLAN AND CROSS SECTION ELEVATION.

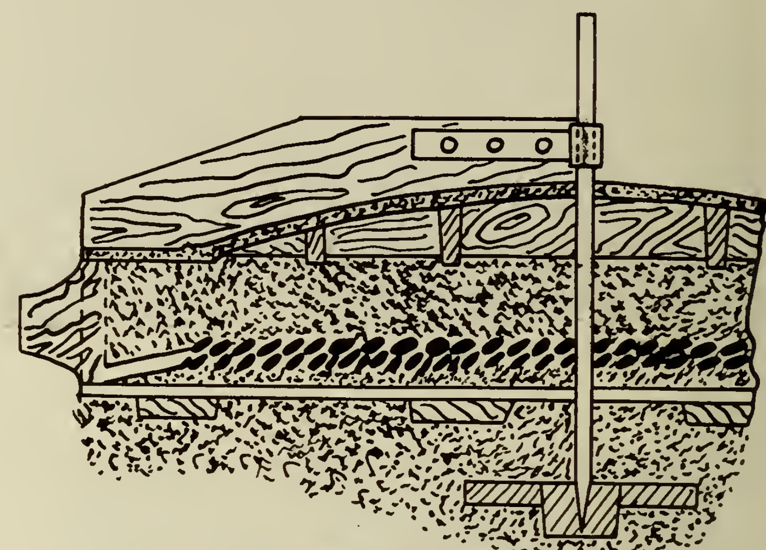


FIG. 2—SHOWING SWEEP AND SPINDLE IN PLACE.

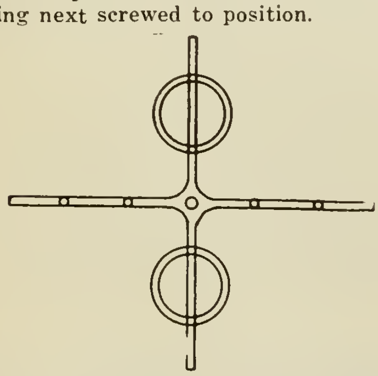


FIG. 3—SHOWING ROUGH SAWN TEMPLATE.

The spindle, as will be seen, passed through a hole in the bottom board to its seat in a three-armed spindle socket of ordinary type, set solidly into the floor about 12 inches below the usual working level.

Approximately 3 inches of floor sand was next rammed into the drag part, a coke bed being afterwards spread over this to about the full diameter of the casting, provision for the escape of the gases generated when pouring is being furnished by a plug vent taken to one side of the flask at its junction with the bottom board.

The drag flask was now rammed up with floor sand to the edge of the sweep, the cross rib and its four small hubs being next bedded to place, the thickness piece being then unscrewed from the sweep to allow the cope contour and parting to be swept up, the mold at this stage being shown at Fig. 2.

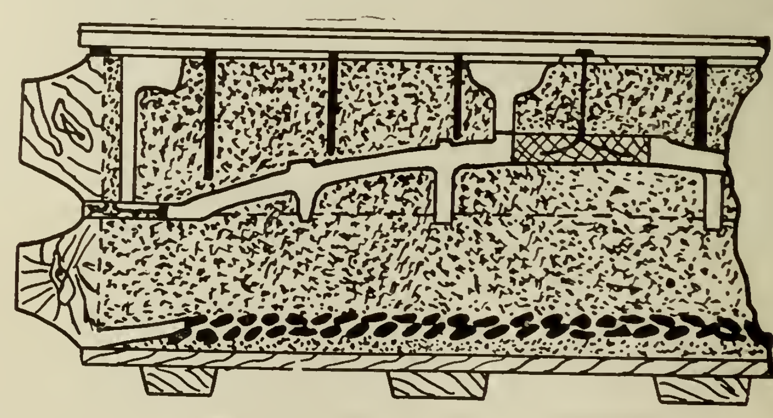


FIG. 4—SHOWING MOLD READY TO BE POURED.

A layer of parting sand being sprinkled over the whole area, the two 10 inch core prints and the four small hubs extending into the cope were now set to correct position by the rough sawn template indicated at Fig. 3, the cope being next rammed up and hoisted off in the usual way, a little extra sand being allowed under the gaggers to prevent them being rammed below the face, much "hammering back" when finishing the cope being thereby avoided.

The two 10-inch round cores were wired back to the cope, interference with the sweeping out of the drag contour being thus eliminated. The thickness strip was next screwed to position, the drag mold being then roughed up, vented, lined up with facing sand, swept to shape, finished and blacked, a skim gate of usual type being cut in one corner.

Both halves of the mold, after being blacked and slicked, were sprayed with molasses water and skin dried by means of a torch drier, a simple but advisable precaution greatly reducing the risk of scabbing or washing away of corners when taking into consideration the high speed and temperature at which a casting of this type should be poured to obtain the best results.

The mold was now assembled and clamped, cope strain being averted by a rail section placed across the centre, clamped to the bottom board, and a wedge placed under the rail on every cross bar, these details being shown in the cross section view of finished mold at Fig. 4.

A mild semi-steel mixture conforming to analysis required on engine work, was employed, excellent results beng shown when machining. The method of production above outlined, entailed about six hours' extra time for molding, as compared with the estimated cost of output from a full pattern, five days' time, and wages, and much material being saved in the pattern shop. Foundrymen just entering the jobbing field will therefore take notice and govern themselves accordingly, when tempted to spend a hundred dollars or so on a pattern of the "occasional" variety, whereas in many cases an outlay of around ten dollars or so on a skeleton or sweep mold easily suffices.

The Permanent Mold or New Method of Molding

Veteran Buffalo Scientist Said to Have Solved the Problem of the Permanent or Fire-Proof Mold by Use of Amphibole Asbestos and Actinolite

By F. B. GORDON

PROBABLY no subject has caused the founder more real earnest thought and study and rewarded him with more complete disappointment and failure than that of the permanent mold. When we consider that the regular programme of the foundry is to all interests and purposes the same as what was practiced by the Egyptians four or five thousand years ago, is it any wonder that attempts should be made to overcome at least some of the obstacles which obstruct the way to more advanced methods? Yet how far afield have all our attempts been until very recent date.

The practice of ramming sand around the pattern, which in turn is withdrawn, leaving a space into which the molten metal is poured, was the practice of the ancients, and is the practice of to-day, each mold producing one casting. No matter how modern the foundry is built, or how much up-to-date machinery is installed, it is the same old story. The sand has to be tempered and worked into shape every day by the molder, or someone else, and this same sand has to be shovelled into the mold and rammed by hand or otherwise, and so on all through the entire program, in much the same manner as was followed by the ancients, but still no redress seems to have been possible of achievement.

The two main stumbling blocks to be overcome are the burning and mold-destroying characteristics of melted metal, and the fact that metal shrinks in cooling. It has always been felt that if a material could be found which would resist the heat, the only remaining obstacle would be the shrinkage or contraction, and that in a large percentage of cases this could be overcome by properly designing the pattern. Many attempts have been made to utilize cast iron molds, and to some extent the efforts have been rewarded with a degree of success. But the field was very limited on account of the fact that the iron molds would chill the castings, and as a consequence only such castings as could have a hard surface could be made in this manner. Another difficulty with the iron mold is that it is not porous and the vent can not get away, and as a consequence of this the melted iron would not lie against it in a perfectly quiet manner, and the result would be an unsatisfactory face to the casting.

There are materials which could be used, however, for this purpose besides iron. For instance, plumbago or graphite, made up in the proper form and bound in the same manner as a crucible is bonded, has been tried with some success, but this was not very satisfactory, as the face would be more or less damaged and would be short lived, unless a suitable covering was applied to it each time. This was accomplished by applying a coating of lamp black, which is practically pure carbon and is fine grained enough to make a smooth casting. By carefully looking after it each time, fairly satisfactory results were accomplished, although the expense entailed in providing the mold and keeping it in repair more than offset the benefits derived, with very rare exceptions.

Another material on which the eye of the practical foundryman would naturally fall was asbestos. This material is found in Canada to a greater extent than in any other part of the world; in fact, to a greater extent than in all other parts of the world combined. It possesses most of the natural qualities which would be required to make it an ideal substance from which to make permanent molds. It is an absolute non-conductor of heat, which is to say that it refuses even to get hot when placed in the fire, and being of a fibrous nature and of open texture it was not a difficult matter to make a mold which would vent easily and resist the heat of the molten metal, providing that a suitable binder could be secured. This, however, has been the drawback. The matter of vent would be a small one, as very little gas would be generated in a fire-proof mold, but to get a fire-proof bonding material has been the greatest difficulty.

Wm. M. Hoffman's Discovery

Now comes Wm. M. Hoffman, of Buffalo, N.Y., with the claim that he has perfected a binder which will revolutionize the molding business in certain lines of work. Mr. Hoffman is a mining engineer of many years' experience, and an expert in minerals, such as corundum. While exploring corundum veins in the Blue Ridge Mountains of North Carolina, he came upon a broad surface of combination amphibole asbestos and actinolite. Amphibole and actinolite are in reality of the same nature as asbestos, with the addition of magnesia and other minerals, all of which are of a refractory nature and all of volcanic origin, being the scum, as it were, of the molten mass, which originally constituted our earth and which the primordial fires could not burn. Mr. Hoffman became at once interested in the material and began a series of experiments with a view to using the material for foundry and other purposes, and after much labor and many disappointments he has succeeded in perfecting a binder which is at once everything which is desired. He has associated himself with practical foundrymen and has made a thorough test of it in different foundries and laboratories in Buffalo, Pittsburgh, Chicago, and even in Toronto, with such satisfactory results as to interest capital and business men in the formation of a company to build and purchase foundries in different parts of the United States and Canada and equip them to do molding by this process. The material is also said to be economically used in the manufacture of fire-brick and fire-proof paint.

Canadians will be interested in any thing which calls for asbestos as a foundation, as our asbestos mines, which supply about 90 per cent. of the asbestos produced in the world, will undoubtedly be called upon to furnish at least some of the material used in its construction.

The Hoffman new method of molding and its development will certainly be watched with interest by everyone in the foundry business.

Patternmaking Notes—Some Hand Tools

Practical Patternmaker Shows How Convenient Labor-Saving Hand Tools May be Made, Although Most of the Hand Tools of the Past are Relegated to the Museum

By J. W. BROADBENT

It is not the writer's intention to describe all of the numerous tools used by the patternmaker as the average woodworker's tools are no doubt familiar to everyone.

The introduction of modern labor-saving machinery in the pattern shop has much reduced the patternmaker's kit, and it is no longer necessary for him to have a tool box as large as a summer cottage.

Hand-working tools have, to a large extent, been discarded, until the patternmaker's kit is almost made up of tools for measurement and laying out, and fine-edged cutting tools.

There should be no ornamental tools in the tool chest, all tools should be there for a purpose and the most modern and (highest priced) will be found to be the cheapest in the end, for one will be able to turn out more and better work with a few goods ones than with a large number of poor ones.

It is true that our forefathers did splendid work with their crude tools, but we are now in an age of rapid production, and should respect old age by consigning their tools to a museum.

The most effective work is accomplished through keeping all cutting tools in good condition, and to keep them so a good oilstone is necessary. There are many good oilstones on the market, but the best oilstone loses its usefulness when the surface resembles a "camel's back" and is allowed to get full of dirt and grit.

There are many ways suggested for getting a true surface on a worn and uneven oilstone. Bill Jones says he rubs his down on a brick wall, another mechanic suggests rubbing on sheets of sandpaper or emery cloth; these may be effective methods but are very destructive as far as the employer's stock of sandpaper is concerned.

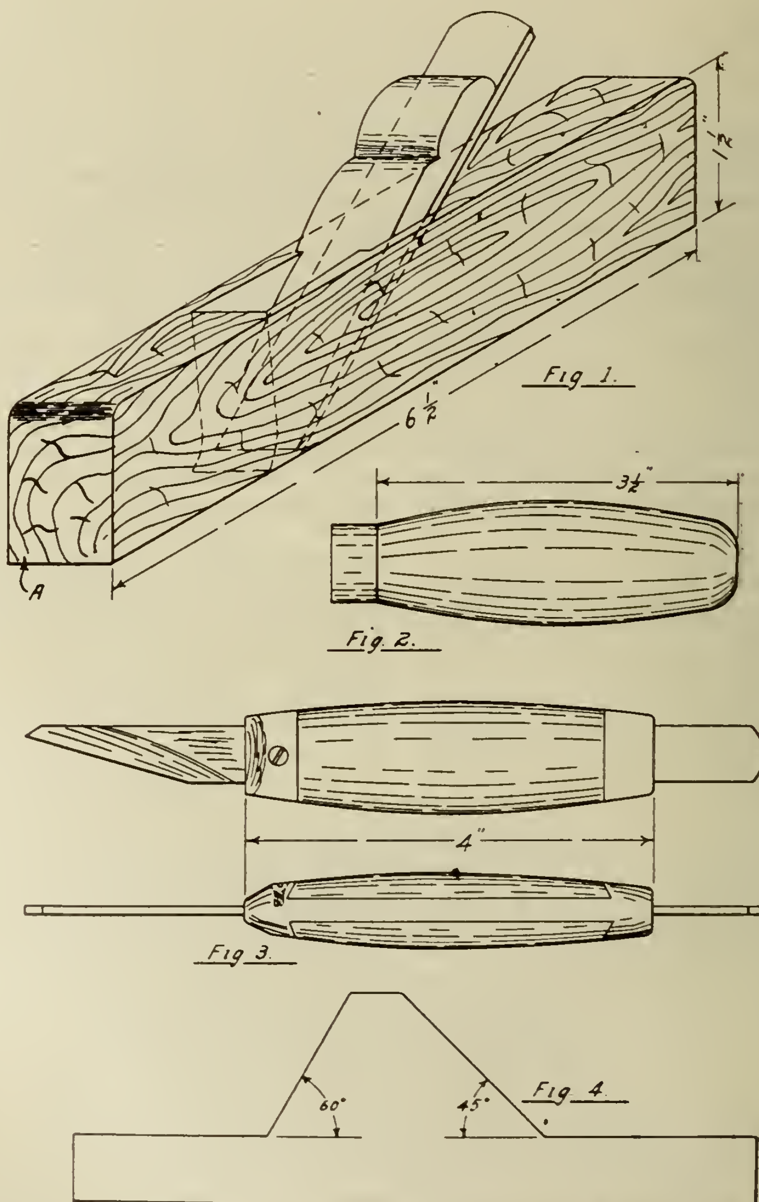
In the writer's opinion the simplest and best method is to take off the high spots on an emery wheel and then, after spreading some fairly coarse emery powder on a level iron plate the oilstone is rubbed perfectly level in a few minutes. It is surprising what a smooth, even suface may be obtained by this method.

All patternmakers are familiar with the shrink scale; the best ones are made of steel and are far superior to the boxwood ones. Owing to the necessary high price of steel scales one may practise economy by purchasing a rule-graduated standard on one side and shrinkage on the reverse. It is sometimes confusing to pick up the scale with the side wanted without glancing at the end or looking for the shrinkage mark. A good way to overcome this difficulty is to rub in the graduations on the shrink side a mixture of red lead and shellac. This will set hard and always form a visible means of identifying the side desired. In fact any scale graduated into 64th of an inch is trying to the eyes, and if the markings are colored red they are more prominent against the bright surface of the scale.

Sandpaper is a useful cutting tool if used intelligently and used after all cutting operations with edged tools. This tool should always be one of the last used on a job for it is not only a waste of valuable time to sandpaper each little portion of a pattern before it is assembled, but the angles and surfaces are better preserved when the job is completed.

Sandpaper is essentially a smoothing tool and should not be used for sizing a given piece or bringing it to correct shape; when this is done by an incompetent workman the surface has more the semblance of a piece of pig iron than a pattern.

The only time when a dull tool is better than a sharp one, is when, after varnishing, and the surface is thoroughly dry, a piece of worn sandpaper is used for rubbing down the raised grain of the wood; if there is no partly used sand-



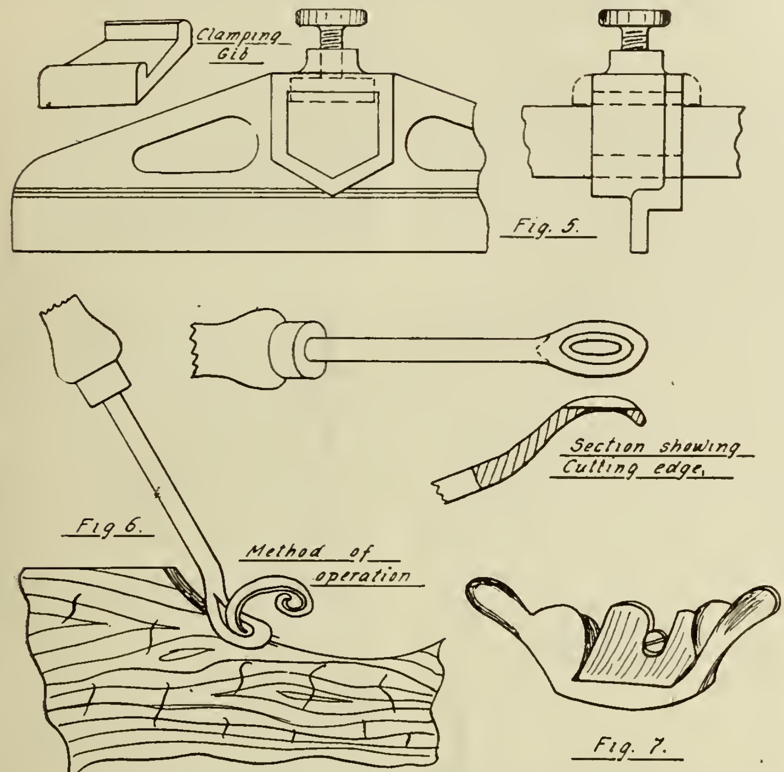
CORE BOX PLANE, CHISEL HANDLE, BENCH KNIFE, STEED HAND TEMPLATE.

paper handy, dull some by rubbing two pieces together and rubbing over a piece of wax.

Fig. 1 shows a handy core box or fillet plane; several of these may be made with the soles of different radii as shown at A. They are easily made of bevel or protractor, which tools have to be adjusted every time used.

A small, compact, light, panel gauge is shown in Fig. 5. This is made of aluminum.

The wooden beam may be made to any length desired, and the hole is so shaped



PANEL GAUGE CORNER ROUNDING TOOL, SMALL SPOKESHAVE.

hard wood, are small and compact, and do not occupy much room in the tool box. The knives may be ground out of old files.

Paring chisels and gouges comprise a part of every patternmaker's kit, and during one's travels one meets with all sizes and shapes of handles, each individual having a different taste in this direction.

As the strength of the tool is not sufficiently great to allow heavy work being done, a large fancy-shaped handle only takes up valuable room in the tool box, and a handle of the shape shown in Fig. 2 has been found to suit all requirements, a good grip being obtainable and the shape just suiting the hand without raising blisters.

Fig. 3 shows a bench knife used for laying out work and for carving. The handle is cast in aluminum, pieces of hardwood being dovetailed on the sides and shaped to suit, a clamping screw being provided to adjust the blade to any length and extend it as it wears. The blades may be purchased or made from heavy hack saws.

The core through the handle is made by using a piece of steel of the required size, this being covered with blacking before being placed in the mould.

Fig. 4 shows a handy template, this being cut out of 1-16 in. steel and comprises both 60 deg. and 45 deg. angles. For small hexagonal and octagonal work its usefulness is much greater than the that when the tool is set at any point, and the thumbscrew tightened, it is impossible for the beam to move sideways.

The sketch, Fig. 6, shows a corner-rounding tool, which may be made from a round file; this tool may be made in several sizes and can be worked by either pushing or pulling, and by tipping up or down the amount of cut is regulated. The sketch practically tells the method of using small spokeshaves, Fig. 7, with bottoms rounding from front to back and from right to left, which are useful for hollow work such as elbow core boxes and many other purposes of this character.

NATURE AND THINGS NATURAL

There is one thing about Nature which few people understand, while there are many things which none can understand. Among the things which we cannot know is, "Where did the material come from of which the earth is constructed?" But the one thing which we can know if we just go to the trouble to think about it, is that the material is here and it has come to stay. Everything which was here at the time of the creation is still here. Meteorites may bring more material here from parts unknown, but they cannot take anything away. When we speak of burning iron, we are away from the mark. All the iron which was ever in the world is still here, and will remain here for all time. People sometimes worry about what is going to become of the race when everything is consumed, but they may as well refrain from worry, because things will never be consumed. When combustible material is burned to ashes and the smoke disappears into the atmosphere, nothing has been destroyed. The smoke will all settle, and the ashes will go back to the earth from whence they came. All of the timber woods and the coal mines came originally from the earth, and they will return to it, only to rise again. Thus is the perpetual motion of the earth sustained. Iron, as we have said, cannot be destroyed by burning. It may be oxidized or changed in some chemical way, but it is still iron and is still on the earth. Chemistry brings out a lot of new knowledge, but it neither creates nor destroys anything. Iron rust is simply iron and oxygen, withdraw the oxygen and the iron remains. While all of this is true, a knowledge of chemistry is a valuable asset. But unless a person is a chemist by profession, there is not much use going very deep into it, although a general knowledge of meanings of the terms used and the results to be expected from certain causes, is a handy kind of knowledge for the practical foundryman to possess. For instance, carbon has a chemical affinity for iron, so has sulphur. Manganese has no chemical affinity for iron, but has a strong affinity for sulphur. Manganese being practically the same weight as iron, mixes through the iron in a mechanical way, and being a hard substance, makes the iron hard. Sulphur being an injurious substance in iron and having a stronger affinity for manganese than for iron, can be removed from the iron by means of the manganese in the pig iron, if the furnace is properly fluxed. If high manganese pig is charged with scrap high in sulphur and the furnace is running hot and properly fluxed with limestone, the sulphur and manganese will be carried out with the slag in the form of manganese sulphide. In this way one hard material is used to remove another hard and more objectionable substance. Chemistry brings this knowledge to light, but it neither produces nor destroys anything, neither did it soften the iron. Iron is always soft, and when we speak of hard iron we are simply referring to soft iron with some hard material mixed through it.

The Production of Fine-Skinned Castings

A Few Practical Ideas on Facing Sand, etc., by a Practical Workman

By J. B. LLOYD

IN cases where castings are to be machined, a somewhat open and coarse skin, which cuts easily, is preferable, and in the production of this rather open sand and ordinary blacking works best, owing to the metal usually being clean and free from pinholes just under the skin. This is wanted in bright work, so that waste of time and labor should be avoided, but it is doubtful whether strength is affected appreciably by the occlusion of the air or gases which cause the pinholes, the impervious character of the surface of the mould largely causing their occurrence. In cases where machining has to be avoided, it is necessary to have a fine, close skin on castings of all sorts, and as this largely depends on the face of the mould, it is necessary to, as far as possible, produce moulds that will give the desired results. In fact, it is possible with a pattern where the grain has lifted or been raised by damp and use, to make moulds showing the grain of the wood, so that this feature is repeated in the casting, but usually this is going too far for ordinary practice.

The fineness of the outside of a casting depends very largely on the grade of sand used for facing the moulds, and usually it is well to prepare a stock sand as follows: The new sand is thoroughly dried, and, if there is a mill, well ground, and then the finer parts are taken out through a 32-mesh—or finer—gauge sieve, the rejections being again ground and sieved to obtain as much as possible of the sand. This alone is used for all but iron, but for iron facings ordinary floor sand should be similarly prepared, and kept in a separate bin for use as required.

For facings for brass and the like, a proportion of pea flour is intimately mixed with the fine new sand while in a dry state, the amount varying from a pint to a quart of flour to the peck of dry sand, according to its character, and enough is damped down over night for each day's work, being rubbed "tough," as the moulders term it, on the morning of use.

For facing moulds for iron, part new sand and part floor sand is mixed together, according to the character of the new sand, and to this from 10 to 15 per cent. of ground coal, as fine as the sand, is added, the whole being very thoroughly mixed dry, and then wetted, and worked up tough by treading and beating on a clean floor, usually about three parts of new and one of floor sand being about right. This should be prepared at least one day prior to using, but, as it does not alter in storage, it can be made up in bulk at convenient times.

As only a facing of less than ½-in. in thickness is used, and the flasks filled with the ordinary sand, there is no very large quantity of the prepared facing needed, and although its preparation occupies some amount of time as a matter of course, the cost for each mould is very small, and would scarcely be felt in the ordinary costs of the year's working.

Beyond the facing sand, however, a small weight of very finely ground graphite or plumbago is necessary for polishing the surface of the moulds, this material being of good commercial quality, free from additions of clay or other matter. In some cases, also, some finely ground steatite, or French chalk, is necessary, as the plumbago would be likely to stain some metals and alloys, while as its use is chiefly to mechanically polish the surface of the mould, and the amount used is very small, the best grades can very well be used. As the casting reproduces the surface of the mould very fairly, the smoother the mould the smoother the casting, and vice versa, hence the reason for polishing.

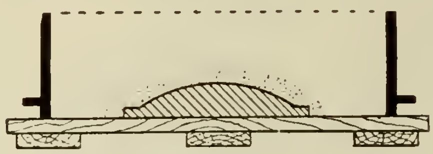


FIG. 1—PATTERN WITH FACING-SAND SIFTED ON.

In use, the facing sand is placed over the pattern, in most cases being sifted on, and when ready for the ordinary sand, a section of half the flask would appear very much as shown in Fig. 1, if the pattern was on a board for ramming up. From this point the mould would be rammed up with ordinary sand and finished off, the vent wire being freely used, care being taken that it only just touches the facing sand, however. In all cases where facing sand is used, it is scarcely possible to provide too much egress for the gases formed, and in this way the vent wire becomes valuable so long as it removes the gases from the back of the facing sand. If you penetrate the facing sand to any depth or touch the pattern with the vent wire, you secure roughness on the casting, and so nullify all the trouble taken to secure a good mould.

After the first half of the flask is rammed up it should be turned over, and the top surface or "joint" trowelled off and well dusted with the parting sand. More facing sand should be arranged over the pattern, and the flask should be completed, a runner stick being inserted at a convenient point for gating the mould. Venting should be done as well on the top as at the bottom half of the mould, and with the same precautions.

The mould being so far finished, and the runner stick removed, the flask should be opened, and the gates cut, unless it is preferred to do this after the pattern has been lifted. In any case the pattern must be lifted, and the mould finished and cleaned up, after which it should be lightly dusted with plumbago—or steatite—shaken through a cloth, and with a soft camel hair or other similar brush the powder should be polished over the face of the actual mould, any dust being gently blown out with the bellows. The mould should then be closed and poured, a section appearing as shown in Fig. 2.

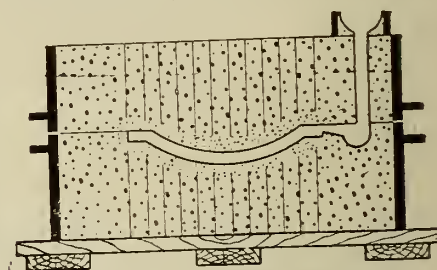


FIG. 2—MOLD WHEN FINISHED.

In some cases surface drying is necessary, but in regard to this individual practice must form the deciding factor, and in such instances smoking the surface of the mould may be adopted instead of using plumbago, the deposited carbon being polished with a soft brush. Smoke from a mineral oil lamp or torch is best for the purpose, a smoky flame being purposely produced.

The gating has to be done carefully, because, on the one hand, it has to be efficient, while, on the other, it has to be as inconspicuous as possible, this, of course, being often a difficult point to arrange. If some part of the casting has to be turned, or otherwise machined, it probably will be possible to gate the mould where this machined part will come, although this is not always feasible, but in all cases the least conspicuous spot must be chosen, consistent, of course, with efficient casting. The dressing of the casting must also aid in this particular item, but, unless on machined work, the gating must be discernible, as the skin of the metal does not cover this.

In this kind of work usually machine moulding possesses advantages over hand work, although a good moulder can work very exactly if he has good flasks and patterns, and is not too much pressed for time. The moulding machine will, however, beat the hand-moulder for precise work on account of mechanical accuracy, in most cases at least.

European Delegates to Attend Big Convention

The Fourteenth Annual Exhibit of Foundry and Machine Shop Equipment and Supplies Will be Held in Conjunction With the Twenty-Fourth Annual Convention of the American Foundrymen's Association, Inc.

CANADIAN FOUNDRYMAN and all those interested in the welfare of the foundry are again reminded that the twenty-fourth annual meeting of the American Foundrymen's Association will be held in Philadelphia during the week of September 29, and plans for the same are being rapidly perfected.

Several delegations of British, French and other European foundrymen are expected to attend as the result of arrangements now being made in Europe by A. O. Backert, president of the association. Special stress, therefore, will be laid on both the entertainment and technical features of the program this year. Considerable progress has been made in both directions. A local entertainment committee has been formed in Philadelphia and over 25 papers and addresses have already been secured for the professional sessions, which will probably open on Tuesday, Sept. 30, concluding Friday, Oct. 3. Simultaneous sessions are being planned for Wednesday and Thursday, Oct. 1 and 2, with special sessions as usual for the discussion of gray iron, steel and malleable foundry practice. The customary exhibition of foundry and shop equipment will be held in the Commercial Museum, where unusually satisfactory facilities are available, and the advance reservations for space already received indicates that the exhibition this year will be the largest ever held.

The Philadelphia local committee was formed at a recent meeting of the Philadelphia Foundrymen's Association.

Thomas Devline, Thomas Devline Mfg. Co., president of the Philadelphia Association, and Howard Evans, J. W. Paxson Co., secretary, are ex-officio members of this committee.

The other members include G. H. Clamer, Ajax Metal Co., Philadelphia; C. R. Spare, American Manganese Bronze Co., Holmesburg, Pa.; H. W. Brown, Tabor Mfg. Co., Philadelphia; Frank Krug, White & Bros., Inc., Philadelphia, and J. D. Hibbs, J. W. Paxon Co., Philadelphia. It is expected this committee will be considerably enlarged and its work organized through the medium of subcommittees a little later on.

On Historic Ground

Unusual historical interests are attached to the forthcoming convention, since it was at Philadelphia in 1896, that the American Foundrymen's Association was organized as a result of a movement led by the Philadelphia Foundrymen's Association. It is expected that the entertainment program which is being prepared for the coming convention will emphasize the prominence of the Quaker City as a foundry centre. The details are still to be worked out but it now seems assured that one of the features of the program will be a shad dinner of the variety for which Philadelphia is famous. Other unique entertainment features are contemplated.

Among the technical papers for which arrangements already have been made are the following:

"Results of investigations of steel castings on German submarines," by Prof. Wm. Campbell, Columbia University, New York.

"Training men for foundry work," by C. C. Shoen, training section, U. S. department of labor, Washington, D. C.

"The comparative qualities of electric and converter steel castings," by John Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N.J.

"Experiments with melting high sulphur malleable scrap," by A. W. Merrick, General Electric Co., Schenectady, N. Y.

"The side blow steel converter and its possibilities for the gray iron foundry," by Geo. P. Fisher, Whiting Foundry Equipment Co., Harvey, Ill.

"Mocromotion study for foundrymen," illustrated by moving pictures, by Maj. Frank B. Gilbreth, Providence, R.I.

"Electric furnaces for foundry use specially for annealing steel castings," illustrated by motion pictures, by T. F. Baily, Electric Furnace Co., Alliance, Ohio.

"Methods of determining when malleable iron is over or under annealed," by Maj. W. P. Putnam, Detroit Testing Laboratory, Detroit.

"Relation between machining qualities of malleable castings and physical tests," by Edwin K. Smith, Wisconsin Malleable Iron Co., Milwaukee.

"How to secure best results in combining hoisting apparatus with moulding machines," by W. C. Briggs, Shepard Electric Crane & Hoist Co., New York City.

"Concrete foundry floors," by H. H. Haley, American Foundry Equipment Co., New York.

"Personnel problems of modern industry," by C. D. Dyer, Jr., consulting engineer, Philadelphia.

"Foundry sand-handling equipment," by H. L. McKinnon, The C. O. Bartlett & Snow Co., Cleveland.

COMMERCIAL MUSEUM BUILDING, WHERE THE EXHIBIT OF FOUNDRY AND SHOP EQUIPMENT WILL BE HELD.

A Cupola With Novel and Interesting Features

The Inside Wind Box is Perhaps the Most Interesting Feature in This Cupola, Although the Extra Thickness of Brick at the Melting Zone is a Good Point

By J. F. MULLAN

A CUPOLA, which possesses several interesting features, is shown in the accompanying sketch, the inside construction and general design being illustrated.

As an iron melter this cupola, being of the latest design, possessing all modern features of economy of fuel and lining, rapid and continuous melting, should result in hot fluid iron of uniform grade throughout the heat, and a wide range of work.

The design looks simple and strong. While all the essential features of other designs appear to be retained, new features of importance are to be found exclusively on this cupola.

The Wind Box

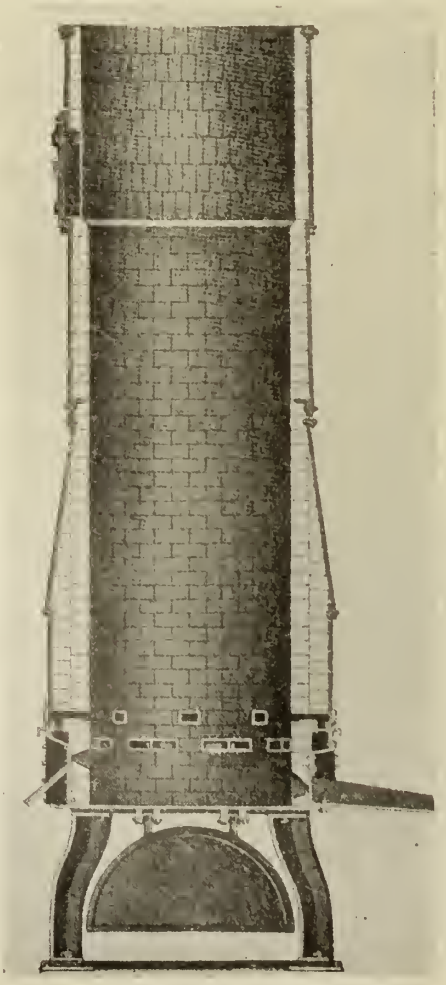
A conspicuous feature of the design of this cupola is the placing of the wind jacket inside of the shell, instead of outside, as is the case with most cupolas. This leaves the inside of the lining the same as in any cupola, but allows a double thickness of brick at the melting zone, thereby avoiding any burning of the shell due to destruction of the lining at this point. By thus placing the shell on the outside, it is easily inspected at the bottom, where inaccessible cupola shells usually fail, because of rust. The inside plate of the wind box being removable may be replaced if burned out. The conical shape of the shell results in an enlarged base, giving great stiffness and stability to the cupola. These features of the design should be readily appreciated, as they greatly increase the strength and life of the cupola. In other respects this cupola would not necessarily differ from any other style. As with all others, it is advisable to have a blast inlet at each side, so as to insure equal distribution of the blast around the cupola. The tuyeres shown in the cut are of the modern rectangular design, expanding towards the inside, and if properly proportioned to the size of the cupola and the blower, they should provide nearly continuous blast around the furnace walls. An upper row of tuyeres of much smaller size is shown. Different people have different notions regarding the usefulness of an upper row of tuyeres, but all modern cupolas have them, and it is optional with the foundryman whether or not he uses them. With this cupola they are provided with dampers for closing them if so desired. A safety tuyere is provided, near the slag spout, which prevents the melted iron rising and flowing through the lower tuyeres. Like any good cupola the shell should be of steel and angle irons should be riveted to the inside of the shell at intervals to support the lining in the event of a section of burned-out lining being removed to allow of repairs.

The Bottom Plate

The bottom plate of this cupola has a flange projecting upward on the outside to which the shell is bolted, making a tight-fitting joint. It also has the hinges to which the bottom doors are attached, and also the legs upon which the furnace rests, as well as the spout being bolted to it.

The charging door may be of the perforated plate or screen type, or it may be of cast iron, arranged for brick lining, the latter being the standard construction and most to be recommended. Peep holes should be provided opposite each tuyere.

The top spout and the slag spout would require to enter the furnace through iron frames in the wind belt, or jacket. Good and bad features can be found in any style of furnace, but the wind jacket being built into the brickwork and the outside being straight and free from joints, should make a good tight job and prevent the loss of blast so frequently experienced in wind belts on the outside.



NOTE THE INTERNAL WIND BOX AND EXTRA LINING AT MELTING ZONE.

QUESTIONS AND ANSWERS

Question.—I am all mixed up regarding too much blast and melting my iron at too high a temperature. Can you put me right?

Answer.—To give a lot of figures regarding the volume of air required to make proper combustion is evidently not what you want, as this is already published in every foundry book. The point to be considered is, that blast is not required at all. If the air could be delivered without entering in the form of a blast, it would be better, but unfortunately this cannot be done, but by having the tuyeres large it can be partially done. It is the cutting effect of the blast which destroys the iron, and not the high temperature at which it is melted, and the evil effects of the strong blast are greatly exaggerated, and are, to a considerable extent imaginary. If a sufficiently high bed of coke is provided and sufficient coke is used between the charges to maintain the bed, the blast will have to be pretty strong to do any damage, and the faster the iron is melted the less sulphur it absorbs, and consequently the softer and sounder will be the castings. To overdo anything shows bad judgment, but care should be taken to not cut too close, for the sake of economy.

METAL PATTERNMAKING DISCUSSION

By J. H. Moore

If any proof is required as to the popularity of CANADIAN FOUNDRYMAN one need only glance through the heap of correspondence which arrives on FOUNDRYMAN'S desk. Bouquets, suggestions and questions galore arrive at all times, and it is in the attempt to answer two of these queries that this article is written.

One correspondent writes the following queries: "I am a metal patternworker, chiefly on stoves and ranges, and I would like to know if there is any system or rule by which to file and fit castings to be used as patterns. My chief trouble is that after filing and fitting a set of patterns, and though they seem to be quite slack, yet when they are cast the castings are generally too tight and require a lot of grinding to get them together. I thought probably there might be a certain rule to follow in fitting metal patterns."

"I have also another question to ask. How should a metal pattern be cut, that is to be used for a pattern to make an aluminum metal plate. I cut a door the

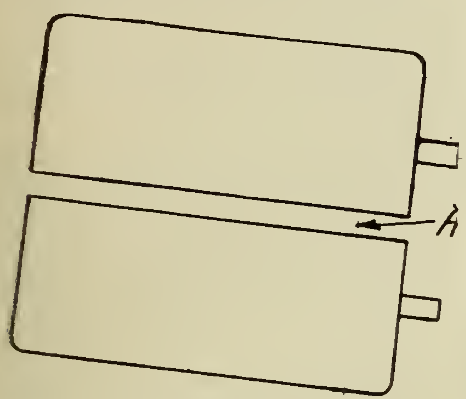


FIG. 1—PATTERN CUT STRAIGHT

other day, and discovered it was wrong after it was on the match plate. I will try and give you a rough sketch of it. (See Fig. 1.)

"I made one cut through the centre at A between the hinges for shrinkage, although the shrinkage from the top to the bottom of the door was all right, yet in beween the hinges was far from being the same as the old pattern. I took my measurements from the extreme outside points top to bottom. I would be pleased to hear from you on the subject."

Now, since we have placed before our readers this correspondent's letter, let us see how best to answer these two questions.

First let us consider the filing and fitting of the cast iron metal patterns. It is a well-known fact that the shrinkage allowance for cast iron is from 3-32 in. to 1/8 in. to the foot, and yet is it always safe to go by this figure? To quote Machinery Handbook we find they say as follows: "The amount of shrinkage in any case depends to some extent upon the shape and size of the casting. A plain casting that is long in proportion to its width will contract differently from one that is more compact, even though both castings weigh the same, and are cast from the same material."

Often the plan followed is to allow 1-10 in. per fot lengthwise, and 1-16 in. radially, but again one cannot follow these figures in every case. To quote Machinery once more: "There can be no fixed rule governing shrinkage allowance, as it is largely a question of local conditions and practice."

From these remarks it is plain to be seen that no fixed rule can safely be given, so we would say to our correspondent (who will of course read these columns), that if he has been allowing the usual amount of shrinkage, namely, 1/8 per foot, he should simply allow a little more, depending on how tight he finds his metal patterns. But once more let us say that while this may be done in this particular case it does not follow that in another foundry the present allowance given by the correspondent would not be sufficient. The writer personally has often taken certain patterns to one foundry with certain results, but on taking them to another moulder in the same foundry received different results. To put it plainly the one moulder had a different style of wrapping than the other. No doubt many moulders reading this will agree with the writer, yet metal patterns are, as a rule, used in a moulding machine, that is if made in quantities as spoken of by the correspondent, so in such a case there should be no appreciable difference. When all is said and done, we come once more to the point, that it is impossible to give a hard and fast rule for this work, so again we can only say, allow a little more if you find the present allowance not sufficient, and follow closely the moulding process.

In answer to the second question. The writer cannot understand how the length over all of the door was correct and the hinges far from right. The very fact that the over-all length was correct shows that the proper spacing was allowed between the cut A (Fig. 1) for shrinkage. Was the distance correct all the way across the door, or was the door tipped as shown at Figs. 2 and 3.

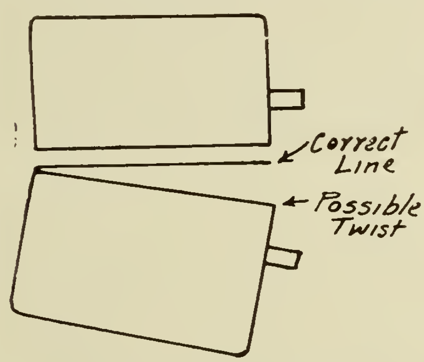


FIG. 2—POSSIBLE TWIST

Of course, in these views we exaggerate the idea in order to show the point of tipping clearly, for naturally one would notice very quickly if the work was out as much as shown in these sketches. The main idea is to illustrate the fact that

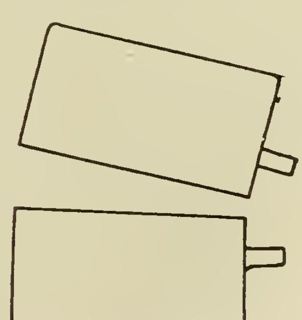


FIG. 3—ANOTHER POSSIBILITY

even a slight tipping in either direction would make a difference.

Either of these two methods would throw the hinges out, yet the length over all, at the centre at least, would be correct. If this was not the case, then once more the writer must say investigate your local conditions and see what your moulders are doing. You went about the cutting of the door in the proper manner, if you allowed from 7-32 in. to 1/4 in. for shrinkage, which is commonly used on white metal patterns for aluminum match plates.

TRADE GOSSIP

The Cleveland Osborn Mfg. Co., Inc., Cleveland, Ohio, manufacturers of molding machines, have assigned Mr. M. N. Zeeman, one of their sales engineers, to the Canadian field. He will devote his entire time to the industrial centres of Ontario, Quebec and the Maritime Provinces.

J. C. Wilson, Mfg. Co., Ltd., Belleville, Ont., has been incorporated to manufacture castings and operate a general foundry, with $200,000 capital, by F. S. Wilson, H. A. Wilson, and others.

Stickney Motors, Ltd, Peterborough, Ont., is a new industry about to be located in Canada to operate a foundry and manufacturing business. The capital stock of the company will be $1,500,000, and Charles A. Stickney, of St. Paul, Minn., is the main figure in the enterprise.

H. E. McIntyre, formerly foundry superintendent at the Sawyer-Massey works, Hamilton, Ont., has accepted the position of foundry superintendent with the Phoenix Manufacturing Co., Eau Claire, Wis., and has removed thither. He reports that he just arrived in time to see the molders going out on strike, which gave him the opportunity of invoicing and cleaning up the shop.

NIAGARA FALLS

The May Foundry Co., and the Pollard Manufacturing Co., both report things rather quiet, but both are running in anticipation of good times to come.

NEW FOUNDRY FOR NIAGARA FALLS

Niagara Falls, Ont., is to have another modern foundry along with those already in operation in that city. The buildings and equipment are already about completed, and in the course of a few weeks will be turning out castings. The personnel of the directorate is not yet ready for publication, but announcement will be made in our next issue.

ELECTION OF OFFICERS

At the regular meeting of American Electro Platers' Society, Toronto branch, the following officers were elected for 1919-1920:

President—John A. Magill, 591 St. Clarens Ave., Toronto.

Vice-President—T. G. O'Keefe, 147 Dupont St., Toronto.

Sec.-Treas.—O. Holtham, 328 Carlton St., Toronto.

BOOK REVIEWS

The **Electric Furnace Co., Alliance, Ohio,** have issued booklet 5-B, dealing with the use of the Baily Electric Furnace for melting non-ferrous metals. These furnaces are all of the resistance type and through the use of the carbon resistor very advantageous results are obtained, resulting in minimum loss of volatile metals, such as zinc. Results are obtained which are superior to those given by the oil-fired furnaces, and at a cheaper cost.

The Woodturner's Handy Book, by P. M. Havlock. Crosby, Lockwood & Sons, publishers, London. Price, 1s. 6d. This publication has been written for the imparting of knowledge on the tools, appliances, and processes used in wood turning. The various tools used in this craft are well described, the methods in use for sending out work and the actual operations in connection with the woodturning all clearly set forth. Typical examples of various classes of work, embracing practically all those commonly encountered, are given.

CATALOGUES

Of particular interest to the molders, we are in receipt of a most interesting circular from the Industrial Glove Corporation, owners of Hickory Steel-Grip Glove Co., Chicago, Illinois, in which is described and illustrated the Steel-Grip molders' spring leggings and Industrial Brand protective apparel. If there is any one thing more than another which molders should be interested in, it is protection from being burned, either by hot iron or hot sand, or from the glare of the hot metal. Even a hot ladle shank makes an unpleasant burn. Foundry managers can sometimes save damage expenses, but more particularly can they preserve the goodwill of their employees by providing them with protection of this kind, either free or at reduced cost.

We are in receipt of the 1919 catalogue of the Cleveland Osborne Mfg. Co., Inc., manufacturers of molding machines, describing in a thorough manner the history and development of the molding machines manufactured by this company, consisting of squeezer machines, jolting machines, roll-over machines, stripping-plate machines, core machines. It also shows various views of the interior of the company's plant and illustrates the manner in which the machines are built. Much valuable information is contained in its contents, and it should be in the hands of every foundryman.

CANADIAN FOUNDRYMAN is in receipt of the latest bulletin from the Ingersoll-Rand Company, New York. Its headline is "A Pipe Every 41 Seconds with 'Crown' Pneumatic Sand Rammers." The contents consist of different views of work being done with their sand rammers, together with illustrations of the Ingersoll-Rand air compressor in different sizes and styles, also some valuable tables, the main argument being that a workman is as fresh at the end of a day's work as at the beginning although a much greater day's output has been accomplished.

The Oliver Machinery Co., Grand Rapids, Mich., have just issued their bulletin, describing their universal saw bench, operated under emergency conditions by the Standard Shipbuilding Corporation for two years, and still in perfect working condition. It also shows a complete line of pattern shop machinery.

F. Lee Nicholson & Co., public accountants and industrial engineers, Chicago and New York, have just issued, from their Chicago office, Harris Trust Building, 111 West Monro Street, a neat pamphlet entitled, "Organization." The topic is vital, and cannot be given too much consideration.

The contents include a reprint of a lecture on this subject delivered at the Columbia University, New York, by Mr. Nicholson.

It is the intention of the company to publish from time to time, in pamphlet form, short treatises on modern business methods and efficiency. They will cover no single topic, but rather every phase of business where an effort for improvement is being made.

Through these mediums it is their desire to assist in the advancement and betterment of business interests. They invite consultation on business problems.

A FEW THINGS WORTH REMEMBERING ABOUT NIAGARA FALLS

Height of American Falls, 167 feet. Height of Horseshoe Falls, 158 feet. Contour line of American Falls, 1,060 feet. Contour line of Horseshoe Falls, 3,010 feet.

Average depth of river between the Falls and Rapids, 180 feet, corresponding nearly with the height of the banks.

Average recession along the whole contour of the Horseshoe has been, since 1842, about 2 4-10 feet per year. In the centre of the channel, where the bulk of the water passes, the average yearly recession is 4 8-10. At the point where the acute angle is formed, the recession from 1842 to 1875 was about 100 feet, and from 1875 to 1886, more than 200 feet.

The recession of the American Falls since 1842 has been slight.

The fall in Niagara River is, from Lake Erie to Port Day (the head of the upper rapids) 10 feet; Port Day to American Falls, 49 feet; American Falls, 167 feet; Falls to Lake Ontario, 100 feet. Total fall, 326 feet.

The green color of the Horseshoe is due to its depth.

SAVING THOSE OVER-EXPOSED BLUEPRINTS

By J. H. MOORE

While we don't like to admit that sometimes when exposing a tracing with the blueprint paper in place, we underestimate the strength of the light (natural or artificial), yet still the fact remains, and must be faced. Usually a few cuss words are said, the spoiled ? blueprint grabbed, crushed, and thrown into the waste paper basket.

Is This Altogether Necessary?

The writer believes not, for he has seen many a very badly overexposed blueprint brought back to usefulness, and almost normal color, by placing a teaspoonful of hydrogen-peroxide to each quart of water used for washing purposes.

Of course, you first wash the print in clear running water until the blue liquid, which always occurs is thoroughly washed away. The prints are now placed in the saving solution and soaked in same until the proper color is obtained.

The print is once more washed in clear water.

The describing of the process has, in reality, taken longer than the actual operation, and should readers in like difficulty care to try this, they will be surprised at the results.

GUARDING SPOKED WHEELS

By DONALD A. HAMPSON

After several accidents of the broken limb variety and one or two that were even more serious, insurance and state factory inspectors turned their attention to gears and pulleys that have spokes and are in an exposed location. If the spaces between the spokes are wide enough to admit a hand or a foot if accidentally thrust against the wheel, serious injuries are almost sure to result.

Wheels twelve inches in diameter or more are placed in the dangerous class. Plenty of these are found around machine shops—conspicuous among them being on planer type millers and the side gears of planers. Shop men recall many incidents where a misstep, a shock of some sort, a friendly nudge by another workman, have caused a loss of balance and a plunge of arm or foot into the danger zone.

Half-inch boards are circled out on the band saw, one put on each side of the wheel, and the two fastened together by wood screws. In addition to being a perfect guard, the boards are a sound deadener as well.

OBITUARY

Victor H. Wardell, who for the past sixteen years had been employed as mechanical superintendent at the Monarch Knitting Mills, Dunnville, Ont., passed away at his late residence, Bethel, Canboro' Township, in his 50th year. He had been suffering for about a year from internal trouble. He leaves, besides his widow, his mother, two brothers and two sisters. Mr. Wardell was a citizen which any community might well be proud of, and both as a mechanic and a good fellow, his demise leaves a gap which will be hard to fill.

Practical Hints for the Brass Founder

Many New Bells for London's Steeples

In Anticipation of the Great Peace Celebration Soon to Take Place, Westminster Abbey is to Have an Entirely New Octave of Bells

THE bells of London steeples, which have been mostly silent during the years of the war are now being overhauled and tested in order to find out what condition they are in, and any which have become defective through old age or hard usage or from the shock of air raids, are, in many cases, being pulled out and replaced by freshly-cast ones.

An entirely new octave of bells is being cast by a firm in Whitechapel for Westminster Abbey. Already six of the new ones are in place in the belfry, but they are not to be used until all are hung, which is expected will be in time for the celebration.

The first bell to be cast of the new peal is replacing an early fourteenth century one, which will be kept somewhere in the Abbey as a relic. The bells are being cast with a certain amount of artistic beauty, and each one has its name and a passage of Scripture cast upon it.

A short time ago the King and Queen visited the foundry where the Abbey chimes are being cast, and were shown a bell which had been made by the firm in 1594 for the Staplehurst parish church and which had been sent back more than 300 years later to be recast.

The rector of St. Clement Danes—the island Church in the Strand, alongside of the Ontario Government offices—is appealing for funds to put his bells in order for the ringing of peace, and he told the representative of a daily paper that there was a bell in the tip-top of his steeple over 330 years of age. It is called the Sanctus bell, and when the church clock strikes the hours of the day or night, the Sanctus repeats the strokes like an echo. It has a rich silver tone, and since the armistice it has been used to summon the worshippers to service.

WHY DO PROPELLERS CORRODE?

For a long time it has been a mystery why steamship propellers, especially those of fast vessels, become pitted over a portion of their surface. At first it was thought that the metal was corroded by the action of the sea-water, but a more satisfactory explanation has been found by a sub-committee formed in 1915 by the British Board of Invention and Research. Every high-speed propeller produces what is called "cavitation" in the water; roughly speaking, it bores holes in the water. Violent eddies are apt to form in the cavitated region, especially if the propeller is revolving in water disturbed by the action of other propellers or by portions of the stern frame, and these eddies are liable to collapse suddenly, throwing the water against the propeller with a hammer-like action. Calculations made by the sub-committee showed that the weight of the blow might be several tons, or even hundreds of tons per square inch. Little wonder, therefore, that holes are knocked in even the toughest phosphor bronze. Confirmation of this theory is supplied by the fact that on a fast cruiser the bearings close to the propeller resound with a deafening noise like a million pneumatic riveters. Now that British science has discovered the cause of this phenomenon, British engineering will not be slow to work out some means of removing the trouble, which can be done partly by alterations in design and partly by adopting slower propeller speeds to reduce cavitation.

QUESTIONS AND ANSWERS

Question—Can you give me a reliable receipt for manganese bronze; also receipt for phosphor bronze.

Answer.—A good mixture for manganese bronze consists of copper 58 to 59, zinc 40, tin 45 per cent., aluminum 50 per cent., manganese 30 per cent.

For phosphor bronze use copper, 80 per cent.; tin, 6 to 8 per cent.; zinc, 10 per cent.; phosphorus, .30; lead, .20. It will be seen that the manganese as well as the phosphorus are used in very small quantities and are best introduced in the form of manganese copper and phosphor tin. In melting aluminum it is well to remember that it is almost as hard to melt as copper, but should not be heated much above the melting point.

A CORE JOKE

Dear Editor:—I was in a foundry when your representative called, and heard one of the younger members of the molding fraternity make the suggestion that humorous articles or jokes would be more acceptable to him than articles on work, although he admitted that the jokes should be on the foundry business. I have in mind what seems to me to be a humorous piece of work.

I was once employed in a foundry as both molder and coremaker and I used flour as a core-binder. I might say that it was a small shop and we did not cast every day, but whenever a job came along which required a core of some peculiar shape I would stop and make it, so it will be seen that I had to carry a stock of prepared sand. I used to intentionally mix a bigger batch than I was going to use on this account. On one occasion I had a considerable lot left, and as it was hot weather I soaked a canvas sack in water and covered it over to keep it moist, but this did not prevent it from becoming fly-blown. However, a rush order came just a short time before casting time, calling for a pipe or rather a roller with a core through it for a lightener, although it was the outside which had to be perfect, and this really had to be perfectly perfect as not a speck could be allowed after the roller was turned. As I have said it was a rush order and I had to proceed at once so I uncovered my pile of core sand only to find it alive with maggots, but I did not let them bother me. The core was about 4 inches in diameter and 4 feet long, with a trunnion at each end, so small that the core had to be reduced to about an inch in diameter at these points. I made the cores in halves and put a good fire in the oven and soon had them dry, but when I came to look at them they were certainly awful looking cores. The worms had evidently become excited when the heat took possession of them and they proceeded to make things fly while they were at it, but there was no way out of it, I had to use them, so I just rubbed the palm of my hand over them which removed all loose stuff, after which I gave them a coat of black-wash, which covered up the worm vent holes. The cores were certainly well vented, because the worms were in myriads from the centre to the outside, and if an X-ray photograph could have been taken of it, it would likely resemble a sponge, but the blackwash covered up the surface and the core was of the best possible kind. Leaving out the joke I believe the worms had actually done good.

In making the mold I just molded it on the side and raised one end a little bit above the other, and placed a riser on the highest end and gated it on the side with an ordinary skimming gate which entered the casting near the lower end. My idea was to have a current running towards the riser which I calculated would carry the dirt to that point. Whether I was right or not is for the reader to decide to suit himself, but this I do know, that the casting was clean after being machined, but perhaps the worms deserve more credit than either the riser or myself. I can agree with an article in a former issue of the FOUNDRYMAN, that if flour is to be used as a core binder it should be allowed to soak over night in order to get the best value out of the flour, but if the weather is warm it soon gets to smell unpleasant, and as I have shown worms are apt to get into it, and while they worked all right in this case they could not be allowed in many cases.

WHAT A CORE IS

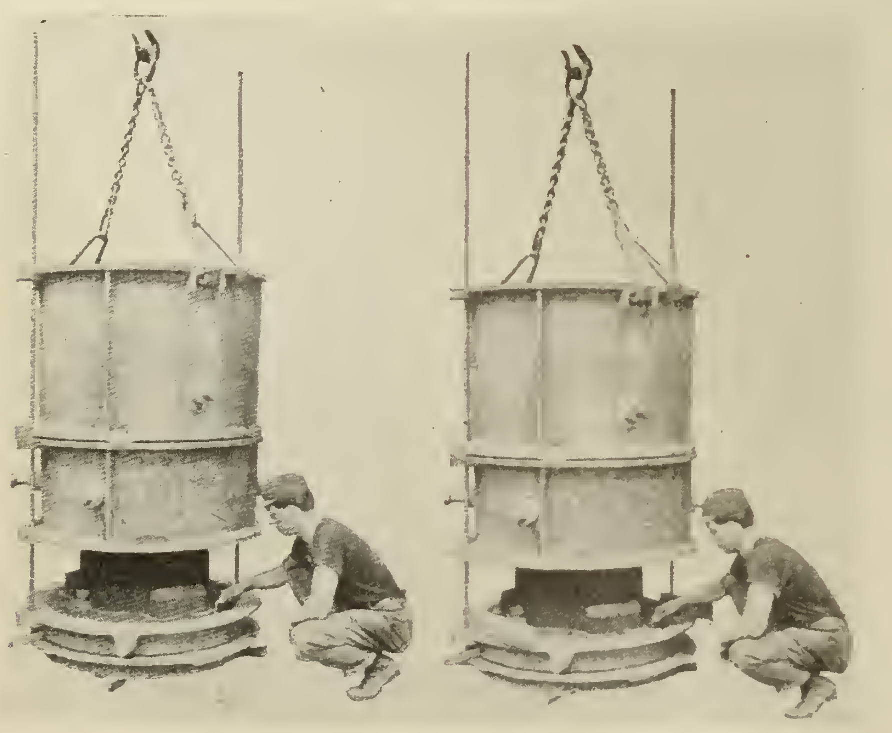
In ordinary language a core is the heart or innermost part of anything, the internal foundation or basis. For instance in making a rope or hawser, the central strand, around which the other strands are twisted, is the core, or the conducting wires in the centre of a submarine telegraph cable are the core. In fact the most central or furthest from the surface of anything is the core. Thus correctly speaking, the part of a mold which constitutes the inside or which makes the inside of the casting, is the core. The part which makes the inside of a pipe or which makes the hole in the hub of a wheel, or even that portion of a mold which makes the inside of a machine frame, even though it is a permanent portion of a green sand mold and had the pattern drawn away from it, is the core, while the dry sand parts of a mold which are used to make the arms of a wheel by having the metal run inside of them are not, correctly speaking, cores. Any part which is used to make the outside of a casting is really not a core. Thus when we speak of building up a mold from cores and are simply alluding to the building up of a mold in dry sand sections, of course it is a handy way of expressing our mode of molding, and has become universally understood in the foundry, but it would be well to keep the truth in mind in case we should be in conversation with someone not versed in foundry terms, but who might know the correct meaning of the word core.

Accident Prevention Campaign

A Few Extracts Taken From the Writings of S. W. Ashe, Head of Educational and Welfare Department, of Pittsfield Works

THERE is probably no safety device that pays for itself with a higher rate of interest than that of the safety goggle. These goggles are purchased by a company and supplied free to any employee who feels that he is in need of them. They are usually used where there is a possibility of flying particles, such as metal chips, molten metal, sawdust, emery, etc., entering a workman's eye. Where possible, the use of these goggles should be compulsory. In the foundry at Pittsfield there was formerly a very large percentage of eye cases, but since the introduction of these goggles, eye accidents have been reduced to a very low point. At the present time, at least one eye a month is saved from serious injury in this foundry by the use of these goggles.

One of the most interesting cases was that of a foundry employee who refused to wear goggles and was discharged. On coming back later he was re-engaged, conditionally, upon his wearing goggles. In about one week's time he came to his foreman with both glasses completely smashed. Both eyes had been saved. Now he is a most urgent booster for the use of the safety goggles.



THE BLOCK ON THE JOINT PREVENTS ACCIDENT TO HAND IN CASE CHAIN SHOULD BREAK.

Burned Feet in the Foundry

To reduce foot burns in the foundry, the moulder's shoe, which has been so successfully used by many of our foundries, should be introduced. They are so arranged that when metal falls on them it quickly glides off. In case metal should get in the top of the shoe, the shoe can be quickly kicked off. These shoes have some asbestos in the sole, although their principal advantage consists in the points previously mentioned. Prior to the use of the moulder's shoe, moulders have come to the hospital wearing laced shoes with pieces of metal the size of a dollar burned into their feet, the metal having caught in the laces. Asbestos leggings may also be used in addition to the moulder's shoes to reduce foot burns. A further factor which contributes toward the reduction of accidents is the use of a small ladle for carrying metal. Where a very large ladle is used, there is a tendency to spill the metal, which explodes as soon as it strikes the ground. By using a smaller ladle, less metal is spilt.

Last November, one of our deputies, who is a practical foundryman, visited one of the largest foundries in the State. The general manager asked him if he could assist him in securing 100 moulders. He said: "I am in great need of moulders. Right now, I have 30 men off with burned feet." The deputy asked him, "Why don't you stop the burns?" and then explained to him how a number of large companies had adopted the plan of purchasing moulders' shoes and selling them at cost to the moulders. This plan enables the foreman of the foundry to enforce the rule regarding the wearing of safe shoes. The manager said he would try the plan and ordered a large quantity of shoes. The deputy visited the plant a few days ago, and the manager stated that the plan of selling shoes had worked very successfully. All of the foundry men had purchased shoes, also a large percentage of the other shop men. Since the adoption of the plan the manager stated that the burns in the foundry had been reduced 85 per cent. In working under a mould or even in having a hand under it, do not take a chance on having a chain give away. It is a small matter to put a pair of horses where the cope will fall, thereby saving the man who might be under it. In lifting a cope a few inches to investigate the joint, place blocks on the joint as shown in the cut before putting a hand under. Many a smashed hand has been the result of carelessly neglecting this precaution.

Money can beget money, and its offspring can beget more.

Spend one penny less than thy clear gains.

He that waits upon fortune is never sure of a dinner.

NEW AND IMPROVED EQUIPMENT

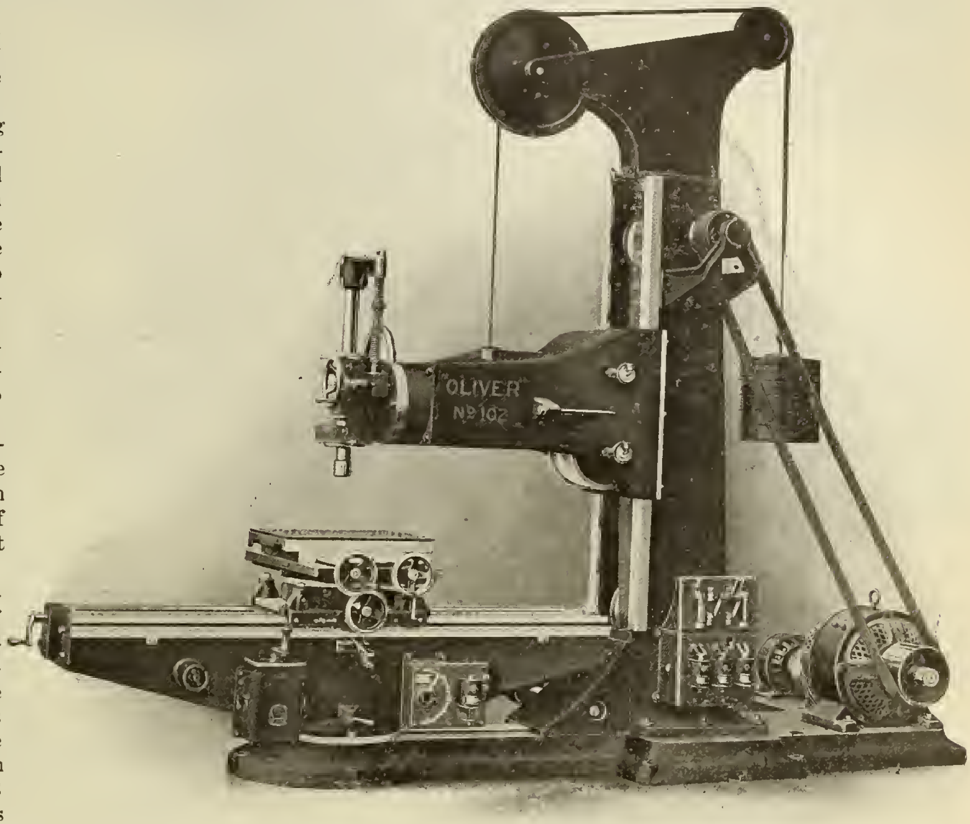
A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

THE Oliver Machinery Co., of Grand Rapids, Mich., U.S.A., has recently marketed a new and complete pattern shop machine known as the Oliver New No. 112 Universal Milling Machine, which is claimed by the manufacturers to be the most wonderful and most desirable machine for working in wood that has ever been brought to the attention of the public. For convenience and general utility it is said to have no equal; its range of usefulness being unlimited.

It is to the pattern maker and his department what the universal milling machine, shaper and drilling machine is to the metal worker in the machine shop.

For pattern and core-box work, grooving, trenching, jointing, routing, surface work, gear cutting and general pattern work, such as working out segments of circles, it surpasses any previously put on the market.

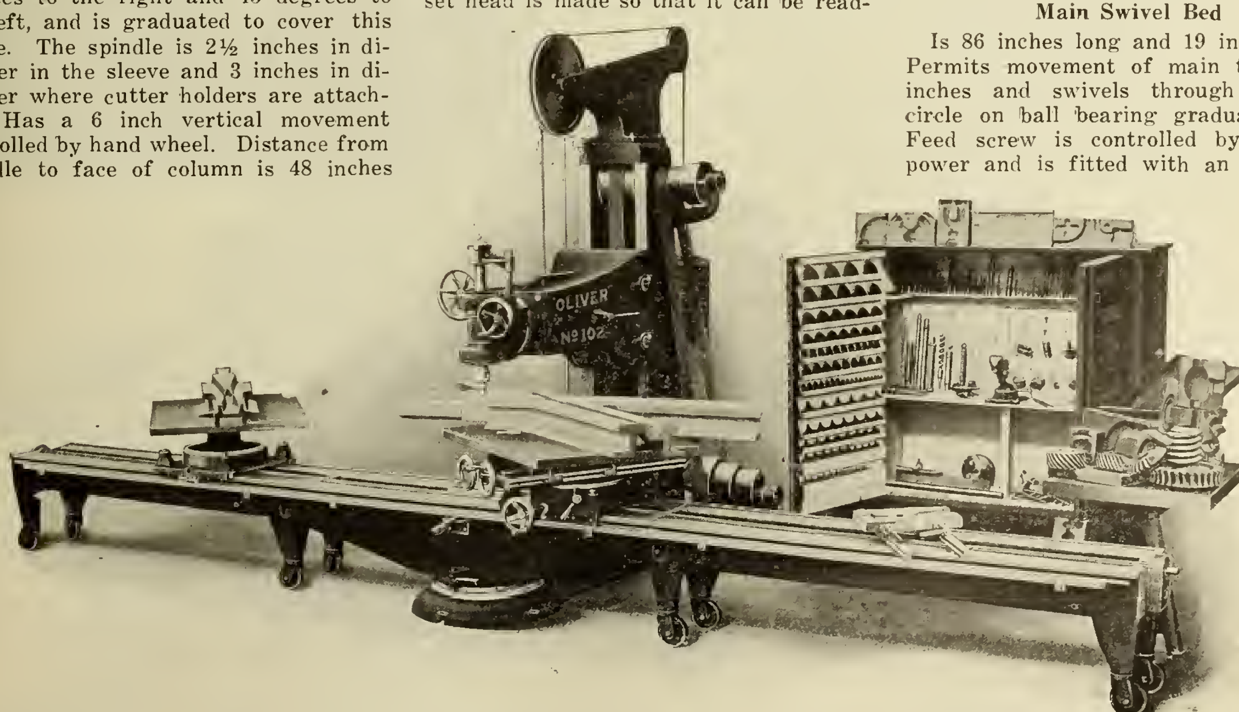
The machine seems to have no limitation for capacity as well as variety of operations, as both brass and soft metals as well as wood can be worked accurately. The dimensions of the machine are as follows: the column is 92 inches high and 18 inches wide across the face and is amply braced to support main arm and counter weights. The base is 88 inches long and 42 inches wide and is heavily flanged for firm floor support. The main arm is gibbed to face of column and has vertical adjustment of 42 inches controlled by hand and power feed. The head is made to swivel 90 degrees to the right and 45 degrees to the left, and is graduated to cover this range. The spindle is 2½ inches in diameter in the sleeve and 3 inches in diameter where cutter holders are attached. Has a 6 inch vertical movement controlled by hand wheel. Distance from spindle to face of column is 48 inches and from table to spindle when raised to extreme height is 30 inches. The offset head is made so that it can be readily attached to main head and is fitted to receive large core box cutters.



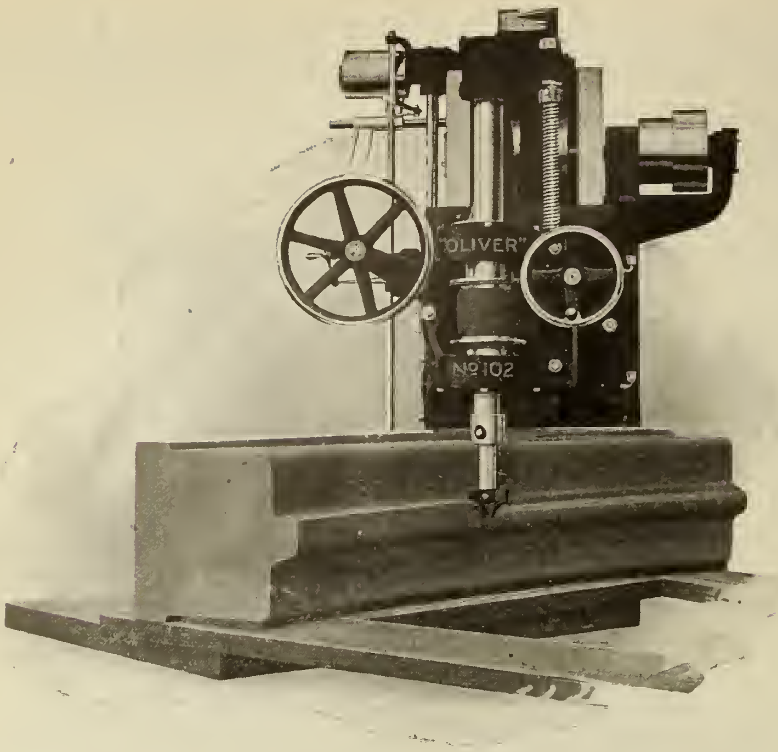
EITHER MOTOR DRIVEN AS ABOVE OR BELT DRIVEN.

Main Swivel Bed

Is 86 inches long and 19 inches wide. Permits movement of main table 62½ inches and swivels through complete circle on ball bearing graduated base. Feed screw is controlled by hand or power and is fitted with an automatic



FRONT VIEW "OLIVER" NO. 102 WOOD MILLING MACHINE 23 FEET LONG OVER ALL. POWER FEED FOR MAIN TABLE OVER ENTIRE LENGTH. RADICAL CAPACITY INCREASED BY PLACING ONE EXTENSION BED ON END OF THE OTHER BED, AS SHOWN ON PAGE 199



FINISHING INSIDE OF HEAVY SEGMENT.

stop. Front edge of bed is graduated in inches and ⅛ inch fractions.

Table

Is metal and is graduated in 1 inch sections on top to facilitate centreing work. Is mounted on ball bearing swivel carriage graduated in degrees and fitted with tapered plunger which will automatically lock the table every fifteen degrees. The swivel carriage is fitted with ball bearings with vertical adjustment, and supports the slide frame on which table is mounted. These slides give a horizontal movement of 9¾ inches to the left of centre, and 12 inches to the right for upper, and 9½ inches to right, and 10 inches to the left of centre for lower section by means of hand wheel, worm and rack. Slide for each table has two positive stops. Upper table is 20 inches by 24 inches, and is drilled and tapped for general purpose clamps and dovetailed for quick-set clamps.

Power Feed

Main carriage slide has a power feed screw located in centre of main bed actuated by means of horizontal and vertical shaft with right and left shifting clutch, giving feed speeds of 26, 34 and 45 inches per minute.

Extension Beds

Each is 88¾ inches long. They are mounted on universal casters with vertical adjusting screws. Each extension is fitted with power feed shaft and screw. These beds are templet drilled so that they can be connected together and both used on one end of swivel bed or one at each end. With both extensions attached to one end of main swivel it gives a carriage travel of 17 feet, 2 inches from spindle, and with one extension on each end of main swivel carriage travel will be 9 feet, 10 inches. For large radius work, long core boxes, frog and crossing pattern work, these extension beds are absolutely necessary.

Bearings

The main spindle, idler pulleys in main arm, upper and lower drive shafts in column, all have high grade ball bearings. Off-set head also has the ball type bearings.

Countershaft

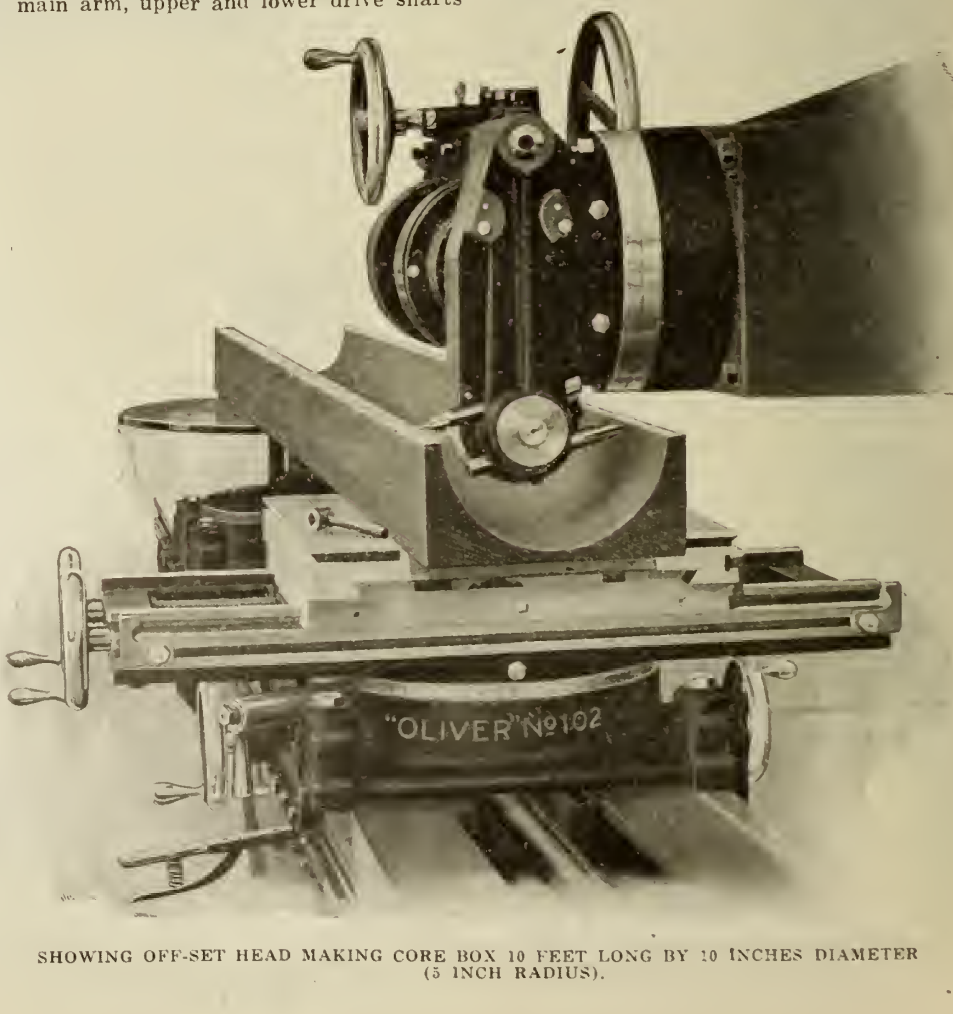
Is mounted on sub-base extension at rear of column and is fitted with two driven pulleys, 14 inches in diameter by 6 inch face, fitted with reversing friction clutches. One driving cone pulley 10-12-14 inch by 4 inch face to drive main spindle. One driving pulley for vertical feed screw, 18 inches by 8 inches. One driving cone pulley for horizontal feed screw, 8, 9 and 10 inches diameter by 1¾ inch face. Speed of countershaft to be 900 r.p.m.

Horse Power

For driving main spindle 7½. For driving vertical and horizontal feed screws, 2.

Motor Drive

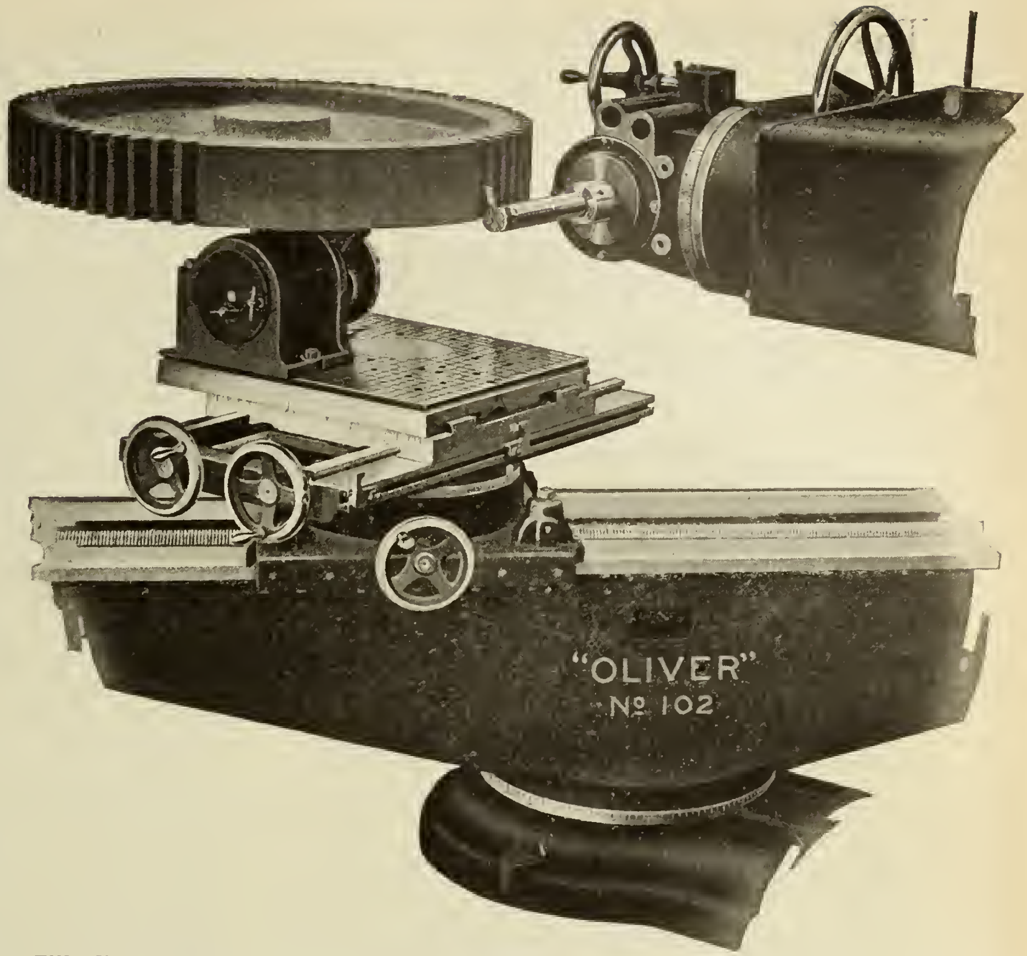
On account of the convenience to the operator we highly recommend the direct motor drive, with remote control, and preferably direct current variable speed motor for spindle and constant speed motor for feed screws, but where alternating current only is available spindle speed variations are obtained by using a 3-step cone pulley on motor. The remote control, speed regulating rheostat and necessary switches are located on front side of main swivel bed so the operator can quickly start, stop or reverse the machine. We can submit prices for motor drives suitable for any current.



SHOWING OFF-SET HEAD MAKING CORE BOX 10 FEET LONG BY 10 INCHES DIAMETER (5 INCH RADIUS).

Equipment

The regular equipment furnished with machine consists of No. 102 universal wood milling machine, with almost unlimited capacity for making patterns and core boxes; fitted with ball bearings throughout; consisting of main column, overhanging arm, spindle head, main swivel bed, two extension beds, universal swivel carriage, auxiliary carriage, power feed to both carriages, double compound universal table, geared off-set head and heavy floor plate supporting the above; fitted with internal endless belt and ball bearing countershaft for belt drive. In all cases it has been our practice to send with each machine an assortment of tool equipment, consisting of cutters, cutter holders and special attachments, together with priced invoice for same, from which you are at liberty to choose all that may be necessary for the class of pattern and core-box work to be done, and return the remainder, for which full credit will be given; or we can send our expert to go over your pattern work and select the proper equipment for you.



THIS VIEW SHOWS MACHINE FINISHING GEAR PATTERN. SIZE, 35 IN. PITCH DIAMETER.

CASTING STRESSES IN IRON CASTINGS AND THEIR RELEASE

An iron casting, when left unmachined, will move somewhat in the course of a few months, but will then remain steady until the skin is removed, when again the whole or partial removal of the outer parts will again cause the metal to move and a period of usually some months will be necessary to again secure steadiness. All cast metals in the state in which they leave the moulds are in a state of internal stress until this has been removed by annealing, or some other method of treatment, but it is iron which is now being dealt with in the form of ordinary grey castings—not what are termed amalleable cast iron, which is a special production—and in the ordinary course, as these castings leave the moulds, they are subject to internal alterations of the stresses set upon casting, which causes the casting to move, or "warp," as it is more usually termed.

In the ordinary way, if you plane off or otherwise remove the outer skin of an iron casting, and store it away on edge for from six to three months, according to its shape and size, afterwards finishing the mechanical work and giving a further short period of rest, you secure that the release of the stresses is such that future movement is practically non-existent; but this takes time, and unless time is an unimportant matter, this form of treatment becomes commercially impossible, and must either be used in combination with heat treatment, or the heat treatment must alone be relied upon.

In what is called "annealing" grey iron castings, considerable heat has to be gradually applied and held for an hour or so. and then gradual cooling must take place, the castings being cold at the start. No great change takes place in the hardness of the castings, the annealing not having the same effect as on a steel casting, which, with careful packing, can be softened very considerably, but certain small changes take place in the iron, and probably a little carbon is absorbed by the skin at certain temperatures. Probably the best method of working is to pack small castings in open flasks with chips, such as are produced by a mortising machine, mixed with a little sawdust, and to place these in a muffle or furnace, the heat being gradually raised to about 900 deg. Cent., and held there for a time, and then gradually cool off, the whole process being completed in under twelve hours. Larger castings could be placed on a bed of chips in the muffle or furnace and have chips well packed amongst them, being careful not to pack too closely, and the heat applied, the heavier articles taking possibly double the time of the small ones. The muffle may be a rough-and-ready one, a piece of a 3 ft. boiler smokestack doing very well, if the ends are roughly blocked up with dry bricks, as the smoke and gases must escape to prevent the pressure bursting some part of the oven or muffle.

After cooling, the castings should be brushed off clean and machined, if necessary; a second heating, perhaps, then being given to ensure that any unequal stress caused by the machine is set free.

Castings made from wrought iron or mild steel should be packed in ore and heated to nearly 1,200 deg. Cent., for some hours to cause the change of structure necessary to secure amalleability, the length of time depending largely on the bulk of the articles. The treatment of these castings must vary with the content of the metal, and no hard-and-fast lines of working can be laid down. For instance, it is possible to make wrought iron castings which can be bent cold to an angle of more than 90 deg. in the state in which they leave the moulds, and in such cases annealing is scarcely ever wanted, but low grade castings would have to be annealed to get the same malleability. This work, unlike the heat treatment of the grey iron castings, is really annealing, and requires the supervision of skilled workers, quite different to that given to the heating and cooling of the grey iron.

Montreal. — The directors of Armstrong Whitworth Ltd., as elected at the annual general meeting held here recently are as follows: president, Sir E. P. C. Girouard, K.C., MG.; vice-president, M. J. Butler, C.M.G; directors: Right Hon. Sir Geo. H. Murray, G.C.B.; Hon. Geo. G. Foster, K.C.; F. B. T. Trevelyan; H. B. Walker; H. H. Vaughan, Lawrence Russell. The executive committee in charge of the company's works in Canada will be M. J. Butler, H. H. Vaughan and Lawrence Russell.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)
JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - Vice-Presidents
H. V. TYRRELL - - - - - - - - General Manager
PUBLISHERS OF
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS
A Monthly Technical Journal devoted to the Foundry and Metal Industries.
B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.
OFFICES
CANADA Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: F. L. Jennings. Ontario Representative: S. S. Moore Toronto and Hamilton Representative: W. E. G. Macdonald.
UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.
GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.
SUBSCRIPTION RATE
Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.
Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. TORONTO, JUNE, 1919 No. 6

PRINCIPAL CONTENTS

Trade Unionism or Bolshevism

TRADE unionism is being put to the test in Canada today. The issue is one more grave than many near-sighted optimists realize and more serious than many of those directly concerned want to admit. It is an issue which must be met. The solution lies in the ability of the employers and trades unionists to pull together. Whether the employer is a capitalist or simply the trustee for the investors it matters not. Nobody can deny the right of the working man to organize, knowing that in union is strength—not necessarily strength for evil doing, but strength to do good. The time has come when the weight of the workingman's opinion will be felt, and if steered in the direction of trades unionism it is more to be desired than if in the direction of Bolshevism. The system of trades unionism is founded on business principles, whereby the representatives of the workmen enter into negotiations with the representatives of the employer with a view to having a contract drawn up for a term, during which both parties to the contract are bound hand and foot to live up to the deal. This would certainly appear to be preferable to a state of Bolshevism where no employer is recognized and where capital is looked upon as the spoils of a defunct class, and the former capitalist is forced into the ranks of the workmen. It is to be hoped that the present trouble in Toronto and elsewhere will be settled in an amicable manner before something more undesirable takes its place. It is certainly not a paying proposition for either side of the controversy to continue the strike, neither is it advisable to have an unsatisfactory settlement. It should not be necessary for outsiders to interfere. Surely the employers and the employees can afford to abandon their aloofness and be businesslike enough to talk business in a businesslike manner and have the thing settled.

Jealousy and Vengeance

IN digging and delving into the mysteries of the present unrest in the ranks of the striking metal workers, we are prone to think of the words of King Solomon, who in his wisdom said that jealousy was the rage of a man and that the one of whom he was jealous would not be spared in the day of vengeance.

Rightly or wrongly the workingman is jealous of the man who can enjoy luxuries which he (the workingman) is not privileged to enjoy. He, perhaps, does not realize the long hours and the worries and anxieties which the employer has to endure and that the apparent pleasure trips which his employer takes are simply recuperative trips which he is taking to clear his brain, and to nerve himself for further struggles. He does not know these things and he has no way of knowing them. He simply governs his thoughts by what he sees. He notices that the boss seems to work mighty short hours and that his work consists chiefly in leaning back in an arm chair, and that he rides about in an automobile and takes protracted trips out of town at his leisure while the hired man sticks to his steady grind. It would look in the eyes of an uninterested spectator as though the most profitable solution of such misunderstandings would be to resort to the oft-tried and successfully-accomplished method of applying prevention rather than cure. If the manufacturer would take his men into his personal confidence ahead of time and explain things to them, and if he really has a case, it should be an easy matter to present it in such a manner as to be convincing. The men certainly think they are right and will continue to think so unless some effort is made to convince them to the contrary, and as we have said this could have been done in advance much better than after hostilities have taken place, but unless something is done to prevent it, the workman can be expected to wreak his vengeance on the man of whom he is jealous.

Money Is Not Evil

WHEN the Good Book spoke of the "love" of money being the root of all evil it did not say money was evil, neither did it say that it was the root of evil. What it did say was that the "love" of money was the guilty part of it. And when the same Good Book said that "Every imagination of man's heart was only evil continually," it certainly put us all in an unenviable position, but it did not say that we must remain in this state; but certain it is that the love of money has never been more noticeable than of late. So pronounced has it become that in some countries, to a very great extent, and in all countries to some extent, the Socialistic element of the population have endeavored to introduce ways and means of controlling matters without the use of money. This should not be necessary because money, in itself, is perfectly innocent and is only a means of simplifying exchanges. But that endearing feeling or affection which mortals have for wealth, coupled with the evil imaginations which everyone has wrapped up in his bosom, makes it such a powerful weapon that we feel safe in venturing the prediction that when the end has come to Bolshevism, and the League of Nations has become a reality, and industrial unrest has found an equilibrium and peace reigns supreme throughout the world, the moneyed man will still be on top.

Would We Want It Otherwise?

WOULD anyone want to live in a world where there was no money? Where no one had any ambition? What incentive would there be to study or figure out new inventions? We must eat or die, and unless we work we cannot eat. But all work and no play is no good, so it becomes everyone to use what talents he possesses towards the betterment of the conditions of mankind, both in the lessening of hard labor and in increasing amusements. But unless there is some encouragement in the way of personal gain, no one will exert himself, so there the matter stands. Every labor-saving device which is invented lessens the labors of the man, but the inventor expects to be rewarded for his trouble. The idea that all men should be rewarded the same cannot hold good, for the reason that many men make no secret of the fact that their mind is never on their work and that their only thought is for amusement. They cannot expect to be recompensed to the same extent as the man who puts his mind to work and originates these amusements. It always did take a lot of different kinds of men to make up the world and we are afraid that it will always be the same and that each one will be rewarded according to how hard it would be to replace him. Our only advice to the man on the bottom is to study and become capable of holding a better position. Slavish labor will avail you little because you are too easily replaced by another.

The Philadelphia Convention

OUR readers are again reminded of the National Foundrymen's Convention which takes place in Philadelphia in September. There would appear to be abundant time yet in which to think of this annual event but still it is as well to be kept in mind of it. Announcement appears in this issue of FOUNDRYMAN.

WHAT'S become of the shop joker who used to be sending the apprentice out to look for a left-hand monkey wrench and a flat-faced hammer?

* * *

THE garrison in Montreal could not fire a salute on the King's birthday because they had no ammunition. However, as long as the Ottawa House stays in session the country shall not lack for explosions or the fear of them.

* * *

THERE are some folks who really have something to say, while again, there are quite a heap who simply have to say something.

* * *

A PENNSYLVANIA peanut and fruit stand man left an estate of $30,000. The man who stows away a nickel's worth of peanuts in his vest pocket will be willing to believe this.

* * *

ON A Detroit street a doctor, undertaker and tombstone maker have their establishments side by side. As the efficiency man in the machine shop would say, the sequence of operations is admirably arranged.

* * *

A TRACTOR was being demonstrated at Richmond, Mich., when it became unmanageable and ran through a drug store. Being of the caterpillar type, there was doubtless something in the drug store to meet its case.

The Meter Versus the Yard

CONSIDERABLE discussions seem to be indulged in of late over the merits and demerits of the metric system of measurement, as compared with the British yard. Undoubtedly the metric system has many advantages, but Canadians are too used to the old yards, feet and inches to tackle making the change. The meter compares with the yard in a similar manner to that of the dollars and cents with the pounds, shillings, pence, or the Centigrade thermometer with the Fahrenheit. But it is doubtful if any change will be made. The meter is 39.37 inches in length which makes it appear odd when compared with inches, but if we had never learned the inches it would have been all right. However, as an example of how the subject appears in the Canadian mind, we will present to our readers a beautiful poem written by one of Canada's leading bards which will probably meet with universal approbation.

Metric Be Tinkered

I 'VE read an awful heap of stuff 'bout metric system laws, and words of queer and curious sounds they agitate my jaws. They speak of kilograms and stuff, of centimetres, too, until the atmosphere burns out and everything looks blue.

They say we have been taught all wrong on how to measure junk, and that the system what we use is plain unvarnished bunk.

When I was young, 'twas long ago, we hastened off to school, and there into our mind was burned the 12-inch measurin' rule. And when we wished to speak of things about their width or height, the usin' of the inch and foot seemed altogether right.

We juggled then, by heck, we did, with yards and rods and chains, these things did much in days gone by to rear our childish brains.

A dollar is a hundred cents, there ain't no doubt of that, and folks what argue otherwise is whisperin' through their hat.

And yet they come and tell us now that all these things be wrong, that we should dance and tune our harp unto the metric song—that we should take our yards and feet, likewise our inches, too, and toss them all into the can and grab off something new.

I do not love these changing times, with all their notions strange, they camp beyond my mental grasp and dwell beyond my range. They make it powerful hard for folks what's built like me and you, to keep our balance through the day and know just what to do.

Why can't them meddlers take some task that really is worth while, some job that measures not a foot, but stretches out a mile. I'd like to rise up from my seat and ask that metric group, to tackle now the price of bread, of beefsteak and of soup. Yes, let them work and show to me how pork and beans and hash can come again and rest within the limits of my cash, and let 'em reckon out at once about the cuts of pie, what's slivered now to sink within the corner of your eye. These things, my friends, are worthy tasks, to me that is a cinch, more worthy far than tryin' to chase our yard and foot and inch!—ARK.

PINCH-BACK coats are going out of style, and the high price of ham and eggs keep on attending to the pinch in front.

* * *

THE Dominion Government is likely to give assistance to the municipalities that want to go into the cold storage business. What's the trouble? Is the Government afraid to lay hands on the cold storage plants already in existence? Or is it just another way of shoving the thing along to the municipalities because Ottawa lacks backbone to settle it?

The Occurrence and Testing of Foundry Sands

During the Investigations of the Bureau of Mines, Mines Branch, Valuable Deposits of Canadian Molding Sand Were Found, Comparing Favorably With Imported Brands of Sand

THE need in Canada for foundry moulding sands of different grades suitable for different classes of castings has increased greatly in the last few years, and has led the Mines Branch to investigate many Canadian sand deposits to determine their suitability for this class of work.

In the course of the regular field work several deposits of sand were encountered, which, based on the field examination, gave promise of being suitable for moulding sands. Samples of these were sent to the Mines Branch Laboratories, Ottawa, for examination and testing.

Testing Moulding Sand

The examination and testing of a moulding sand deposit can be divided into two parts, viz.: the field examination of the deposit, and laboratory examination and testing of the sand.

Field Examination

In undertaking a field examination of a moulding sand deposit there are several points to be taken into consideration:

1 Nature and extent of deposit (area and depth.)
2 Uniformity of sand.
3 Transportation facilities.
4 Location with respect to large markets.

The importance of a field examination can be readily grasped. A sand may be suitable for foundry work in every way, but if it is not in sufficient quantity, easily exploited, and is not favorably situated to the larger markets for this class of material it is of little value as a commercial venture.

The method of field examination employed is as follows: The area is tested by drilling test holes with a six-inch post hole auger in a sufficient number of places to determine the extent and depth to which the sand is encountered. These holes are indicated on a map of the area and the boundaries of the sand plotted. The sand encountered in the drill holes is carefully examined with a hand magnifying glass to note any marked difference in its character. Samples are taken from these holes and mixed together to obtain a uniform sample for testing in the laboratory. If more than one grade is noted, separate samples are taken.

Qualities to be Determined

When commencing the laboratory tests of the samples taken in the field the question arises, "What are the requirements of a good moulding sand?" From the study of the literature available, and after numerous conversations with practical foundrymen throughout the country, it was found that the qualities to be taken into consideration in the examination of a moulding sand are as follows: texture, refractoriness, bonding power, permeability, durability.

Texture

The texture or fineness of grain is one of the most important points of the sand. This will necessarily vary, according to the size and kind of casting to be made in it. Hence, it is at once obvious, that sands will have to be selected to suit the class of work for which they are required, or, in other words, sand which is suitable for light work would, perhaps, be a failure when used with heavy work, or vice versa.

Refractoriness

The capability of resisting effectively the destructive action of the heat of the molten metal is of importance. The greater the size of the casting, the longer it will be in cooling, hence the sand in contact with the metal will be subjected to the intense heat for a longer period of time. It is thus obvious that for large castings a more highly refractory sand will be required than for small castings.

Bonding Power

Moulding sands should possess sufficient bonding power or cohesiveness of their particles to each other to retain firmly the shape and form of the pattern and also to resist the pressure of the molten metal in the mold. This bonding power depends partly on the clay mixed through the sand particles, and the clay coating on the individual grains, and partly on the nature of the grains, whether they are angular or rounded, coarse or fine.

Permeability

One of the properties of a moulding sand which helps to determine its suitability for foundry use is that of allowing the escape of gases through it. The molten metal develops gases which exert a pressure on the face of the mold, and unless the spaces between the grains are sufficient to enable the gases so generated to escape freely, there will be serious danger of creating scabs or causing the castings to blow on this account. Obviously then, heavy castings will require a more open sand of a coarser grained texture than will fine castings.

Durability

The durability of life of a sand is of extreme importance. There are many sands which, when used once or twice, lose some of their desirable qualities, and soon become "dead" or useless. Obviously the sand in contact with and adjacent to the molten metal will suffer most. The present practice is to screen out the coarsest particles and add fresh sand to the remainder. Hence the greater the durability of a sand the better it is, as it will last longer, and it will not be necessary to add fresh sand to it so frequently. The methods employed by the Mines Branch in determining these points would perhaps be too deep a study to interest the practical foundryman, but, needless to say, they are severe and leave nothing undone. The practical tests on one particular deposit, located near Brockville, Ont., will, however, be of exceptional interest.

The Brockville Deposit

The deposit in question lies 2½ miles to the west of the town of Brockville, Ont., between the G.T.R. line (Montreal to Toronto) and the river road (Brockville to Belleville.)

As far as could be determined in the time at the disposal for the field examination the area underlain by moulding sand is of considerable extent, although detailed work was only carried out on the area shown in the sketch map, Fig. 2. No time was available to trace the extension of the deposit to the eastward or to the west, but this will be done during the field season of 1917.

The topography of the immediate district is decidedly rugged. The drift with which the district is overlain consists of rolling hills of boulder clay, sand and gravel, through which numerous "islands" of bare rock protrude. These patches of bare rock consist to the north and northeast of Potsdam (?) sandstone and to the south and west of Laurentian granites. All outcrops of rock examined were well glaciated, and rounded, showing clearly defined striae.

By reference to the sketch map, Fig. 2, it will be seen that the area so far known to be underlain by moulding sand lies between and around the rock outcrops already mentioned. A stream passing through the deposit has revealed clay beneath the sand.

The sand lies beneath a thin layer of loam averaging about 6 to 12 ins. thick. In most places where tested there was a definite line of demarcation between the loam and the sand.

The sand is fairly uniform over the whole deposit shown in the sketch, and will average 2 ft. 4 in. thick. In all the test holes and pits, only two boulders were encountered, each about 2¼ in. in diameter, so that the sand appears to be free from stones in the area examined. At the edges of the deposit, where the sand and boulder clay are in contact, it may be that the boulders are more frequent.

In order to determine the nature and extent of the deposit a number of test pits were examined and drill holes bored as indicated on the sketch map. The results obtained from these pits and holes are as follows:

Results of Test Pits and Borings on Brockville Sand Deposit

Hole or pit.	Amount of stripping	Thickness of mould. sand		Material below moulding sand
	in.	ft.	in.	..
1	8	3	8	Sand and clay interbanded
2	8	3	4	" "
3	14	1	0	Sandy clay
4	12	1	2	" "
5	10	1	6	" "
6	10	3	10	" "
7	15	1	9	" "
8	8	2	0	" "
9	10	1	10	" "
10	7	2	2	" "
11	10	2	6	" "
11a	Stiff clay to a depth of 3 ft.			
11b	" " " "			
	in.	ft.	in.	
12	6	2	0	Sandy clay
13	10	1	6	" "
14	4	2	6	" "
15	8	2	6	" "
16	6	3	0	" "
17	8	2	0	" "
18 pit	8	2	6	" "
19	10	2	8	" "
20 pit	4	3	2	" "

No idea can be given of the total tonnage of sand available as the complete boundaries were not located, but that there is a considerable quantity there can be no doubt, judging from the area tested.

Preliminary Tests

A sample of 40 lb. of sand was taken when the deposit was first visited, and this was applied by the Alex. Fleck Limited Foundry, Ottawa, to make molds for three iron castings, one at a time, using the Brockville sand, exclusively, each time. The weight of the casting was about 12 pounds and all three casts were perfectly satisfactory, having a good, smooth surface free from scabs, and corners showing clean definition.

This preliminary test having proved satisfactory, two lots of 600 pounds each were dug and shipped by the writer to Ottawa without preparation in any way, in order to test the lasting and wearing qualities of the sand. Care was taken to see that the samples collected were representative of the whole deposit as far as could be ascertained. One shipment was taken to the foundry of Alex. Fleck Limited, Ottawa, where the first tests were made; and the other 600 lbs. was delivered at the brass foundry of Lawson Bros., Ottawa.

At both places the tests carried on were under the supervision of the writer, who followed closely all the results obtained, and examined the sand and castings after each test.

Test of Sand at the Fleck Foundry

It was desired to gain an idea of the life of the sand when employed with fairly heavy pieces of casting. In order to obtain comparative results the same amount of fresh No. 3 Albany moulding sand, as used in this foundry, was taken and used side by side with the Brockville sand on the same pattern. After each cast, each sand was kept separate, thoroughly mixed, sampled and used again. The piece cast was an iron flange in the shape of an L, 5 ft. long, 10 in. wide, and 1 in. thick, with a 3 in. flange 1 in. thick on one side. The weight of the casting was approximately 200 lbs.

Five castings were made in each sand under ordinary working conditions, the moulding being done on the two sands by the same moulder throughout, under the direct supervision of the foreman. Care was taken that each sand was thoroughly mixed after each casting. A sample of each sand was taken when fresh, and after each burn, and examined in the Mines Branch Laboratories. No fresh sand was added to either test and only the sea coal that was absolutely necessary was employed.

The castings were examined after each cast. There was no noticeable difference between those cast in either sand or from the first and fifth cast in the same sand.

Test of Sand at Lawson's Brass Foundry

The sand sent to Lawson Bros. was used in their brass foundry on general run of work, employing whatever pattern they needed each day. The Brockville sand was kept separate throughout and the cast was varied between brass and iron, all castings being small. The sand was mixed thoroughly after each burn and no fresh sand was added to it. Samples after every alternate burn were taken for examination. Seven castings in all were made in the same sand, the weight of castings varying from 12 to 50 pounds. Five were brass and two iron. All castings when examined showed clear, sharp, well-defined edges, and the body free from scabs. No sign of burning appeared on any of the castings. A sample of the fresh Albany No. O, as used in this foundry, was taken for comparison.

We might say that Hyde & Sons, of 43 Common Street, Montreal, have recently acquired the sole selling rights of this Brockville sand development, but it is not their intention to monopolize the distribution of it. It is, on the contrary, their intention to share the sale of it with other Canadian supply houses, so that every possible opportunity will be given for the more extensive use of this Canadian sand.

PLATING AND POLISHING DEPARTMENT

QUESTIONS AND ANSWERS

Question.—We have decided to instal a small electro-plating plant for finishing the metal parts of artificial limbs. One of the directors emphatically declares it will be necessary to agitate the nickel solution for this work. The writer has seen many nickel tanks in operation but has yet to see one equipped with an agitator. I would greatly appreciate an expression of opinion from your correspondent relative to this point. The tanks we intend to instal will permit the use of about 100 gallons per tank; there will be three tanks, nickel, copper, and electric cleaner. What size generator would be required? Are electrical measuring instruments necessary in the plating circuit? I understand many plating shops are operated without these accessories.

Answer.—Nickel-plating solutions are not usually agitated. There are cases where agitation is beneficial and sometimes necessary to obtain desired results. In the plating of artificial limb parts the still plating solution should prove perfectly satisfactory in every way. Agitation permits higher current densities to be employed and prevents the occlusion of hydrogen, which causes pitting, but both these points may be gained by simple means without agitation. We advise the use of a double sulphated nickel solution operated at about 6 degrees Be and kept at a temperature of between 70 degrees and 80 degrees Fahr. Acidity should be very slight and the electrode potential for average sheet steel pieces should not exceed 2 volts. If the steel is heavily coppered, buffed and nickeled, a one-hour nickel deposit will excel 99 per cent. of the job plating now produced on artificial limb parts. With reference to the generator for your purpose, we advise a No. 4 "KDC" motor generator set. This outfit consists of 500 ampere direct-current generator. 5-6 volts, directly connected to a 5 h.p. motor, either d.c. or a.c., and fastened to a strong cast iron base. Permit us to draw your attention to the proportions of solutions you intend to operate. A one hundred gallon copper solution will enable you to operate more than 100 gallons of nickel solution, and 100 gallons of nickel solution will not care for possible increase in business; 200 gallons of nickel solution is a very reasonable amount to operate for your business, and the above outfit will furnish sufficient power for any possible emergency. Do not figure your electrical power for plating, etc., too close. A surplus ampere capacity is better than barely enough for your needs. An electric cleaner should be operated so that it does not reduce the current strength at the plating tanks, and if the capacity of the generator is not sufficient to operate the entire plant at full capacity, time is lost and unsatisfactory results are inevitable. If a 100-gallon nickel solution is considered sufficient, a 300 ampere generator would probably be large enough. Electrical instruments such as voltmeter and ammeter are not absolutely essential, but without at least one of these the process of electro-plating is mere guess-work.

Voltmeters are in most general use, although the ammeter is really the more valuable instrument of the two. Operating a plating plant without such instruments may be compared to the operation of a steam power plant without steam gauges, etc. A rheostat will be required on both nickel and copper tank, and as the most modern type of rheostat is equipped with both ammeter and voltmeter all on the same panel and at prices consistent with dependable goods, we do not hesitate in recommending them.

* * *

Question.—A few years ago the writer received an old spoon which had been coated with some metal or alloy resembling silver. The finish was brilliantly white and proved to be very durable under certain tests. We do not recall the trade name given this method of coating metals, or the details of the process, and as we wish to utilize the idea in the manufacture of our new product we shall greatly appreciate such information as you may be able to furnish relating to the process.

Answer.—The coating you refer to was not an electro deposit. It was obtained by dipping the previously cleaned article in a flux of zinc chloride, followed by a momentary immersion in a molten bath of the following metals: Lead 8 parts, bismuth 8 parts, and tin 3 parts. The metal has a very low melting point and the finished article has a very pleasing appearance. If you desire a finish which will resist the tarnishing effect of alkalies, this coating will not prove satisfactory, otherwise it is a very satisfactory coating for many purposes.

* * *

Question.—I nickel-plate a great quantity of small brass goods in rotating mechanical machines of my own manufacture. Recently I obtained a contract for plating steel cups, which are about 1 inch in diameter. The speed of my machines is such as to produce a high lustre on small brass goods, but owing to the bulk of the cups and the nature of the metal, I do not obtain a satisfactory lustre on the plated cups unless a subsequent tumbling operation is performed. Can you suggest a method which would assist in improving the finish obtained in the mechanical apparatus at same speed of rotation as is used for brass goods of smaller size?

Answer.—We would recommend trying various quantities of the steel cups until the best possible finish was obtained at present speed of rotation and then use at least an equal bulk of steel balls or small, well-rounded steel punchings with each load of cups, or procure a sufficient quantity of glass marbles of proper size to burnish the interior of the cups. The glass marble will withstand the action of the tumbler if the speed is not over 4 r.p.m. and no deposit forms on them to cause trouble after continued use. Keep the interior of the rotating chamber free from nickel coatings as such deposits would soon cause the marbles to become quite rough and ineffective. A second tumbling with steel balls and soap solution would be the more rapid method and produce a better finish. If you are not equipped to tumble by the wet method, try a clean dry maple sawdust and powdered buffing compound, together with a lesser bulk of steel punchings than mentioned above; if the lime adheres to the cups moisten the sawdust with coal oil.

* * *

Question.—We have recently undertaken to operate a nickel solution prepared from single nickel salts instead of the double salt as formerly used. We dissolved single salt in hot water and added boric acid to complete solution. In practical operation the solution has not been very satisfactory. The new nickel anodes have not begun to roughen or show wear, and the density of the solution is rapidly growing lower, the deposits are very brittle and we are unable to use as strong current as was anticipated. Kindly inform us of any errors in preparation or use of the solution, which may be apparent from the above statement of the case.

Answer.—Single nickel salt solutions for commercial purposes usually contain a percentage of the double nickel salt, also a corroding salt such as sodium chloride, nickel chloride, magnesium sulphate or magnesium chloride. Of these corroding agents we prefer the nickel chloride, as it is the more logical salt to use. It introduces no inert material, the nickel content of the solution is increased and the chlorine acts upon the anode in a very satisfactory manner. We would suggest the addition of three oz. of nickel salt per gallon, together with ½ to 1 oz. of nickel chloride per gallon. The acidity of the solution should be ascertained by litmus test, and if excessive, the condition may be corrected by addition of nickel carbonate. We strongly advise the employment of rough surfaced nickel anodes in the preparation of new bath. The normal working condition of the solution is more quickly effected as the metal disintegrates more readily and facilitates the "aging" of the solution. Nickel chloride and nickel sulphate may be added occasionally as required to maintain constant efficiency. The simple solution of nickel sulphate, boric acid and water has very slight effect upon good nickel anodes, and for this reason it is necessary to use some chemical to attack the metal and assist in breaking it so that the ionization of the solution may proceed uniformly during constant operation. In your case you have been exhausting the solution of metal owing to poor anode corrosion, as this condition increased, the resultant deposits naturally became more and more inferior and greater care in regulation of electric current was required. If you do not wish to use nickel chloride we would suggest from 3 to 4 oz. of magnesium sulphate per gallon. This chemical has a tendency to cause yellowish tones to the deposit and is objected to by some. The advantage of using the chemical is mainly the effective anode corrosion without use of chlorides, as many platers are not in favor of the intentional addition of chlorides to nickel solution, especially when nickelling iron or steel. Ammonium sulphate is also used for the same purpose. Of the two sulphates we prefer the magnesium for general purposes. It may be possible to increase the density of your solution by the further addition of nickel sulphate and by so doing effect a condition permitting a much greater current density than is now possible. Two pounds of the single salt per gallon is not uncommon in single salt solutions. See that the contact between anode hooks and positive rod is perfect, solder the joint if troublesome, use anodes of best quality and which corrode uniformly and show fine, close grain. Avoid excessive acidity. If the current appears to be correct and deposits faulty make an approximate estimate of the square foot surface area of the cathode processed for load and divide total amperes by number of square feet. It may be possible you have expected too great results from your solution. Let us know how you succeed.

* * *

Question.—I have received orders to prepare a copper solution for plating steel wing nuts and strips of steel used in book binding. The latter are to be soldered after copper plating and finally nickel plated. Would you advise a copper solution operated cold or hot?

Answer.—Use a warm cyanide copper solution. Hot copper solutions usually run at about 180 degrees F. (82 C.) and for the wing nuts or similar work this temperature would probably serve you satisfactorily if you kept the solution in good condition. But for the strips of steel which are to be soldered after plating, we would advise a cooler solution. We assume that you intend to deposit a coating which will serve as a protection to some extent, say, a thousandth of an inch. A cyanide copper solution operated at temperatures between 100 and 110 deg. Fahr. will yield splendid deposits a thousandth of an inch thick in from 15 to 20 minutes—a deposit which will not blister when heated by the soldering iron and which will remain perfectly adherent if the preparatory cleaning has been properly done. Thick deposits from cyanide copper solutions operated at higher temperatures and with correspondingly increased current density are very liable to produce brittle, hard castings which prove troublesome during soldering treatment.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1919-1920.

President—Mr. John A. Magill, 591 St. Clarens Ave., Toronto.

Vice-President—Mr. T. G. O'Keefe, 147 Dupont St., Toronto.

Secretary-Treasurer—Mr. O. Holtham, 328 Carlton Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

Such deposits absorb hydrogen during deposition to a very damaging extent and when oxidized, soldered, buffed or ball burnished the results are seldom first class. The solution operated at the higher temperature will certainly deposit copper more rapidly than the cooler solution; the product of the bath will not meet the same tests satisfactorily and therefore is not of equal value in commercial work. Naturally you may expect the decomposition of cyanide to be much greater in a solution of 180 deg. than one operated at 100 deg. In fact, the decomposition of cyanide at the higher temperature mentioned is approximately five times as great as at the lower temperature. This point alone is well worth your earnest attention at this time and in future, during actual operation of cyanide plating solutions. Do not aim at getting the solution dense. Concentrated cyanide copper solutions have been the source of untold trouble to many platers ever since the metal industry began using the solution for commercial plating purposes. You will obtain a much firmer copper deposit from a solution containing 2 per cent. of metallic copper than from a solution containing 4 per cent. or 4.5 per cent. This is specially true with reference to deposits on polished steel goods. When you prepare the copper solution use as few chemicals as possible, copper cyanide or copper carbonate and cyanide of sodium will suffice for almost all practical purposes after the bath is once aged. To effect the aging process quickly it is usually necessary to use small quantities of sodium carbonate; the first addition should be the last as the carbonates will form altogether too rapidly by the decomposition of the sodium cyanide, and further additions of sodium carbonate are not only unnecessary but actually harmful if the solution is operated constantly. Very often the density of the cyanide copper solution will increase in a very rapid and apparently unaccountable manner simply by the accumulation of sodium carbonate through the decomposition of sodium cyanide, which has been added at regular intervals without due regard for the actual necessity of such additions. The sodium carbonate content of concentrated cyanide copper solutions becomes dangerous in a comparatively short period and you will be wise to avoid extreme density. Do not base your opinions on figures obtained from experimental work or copper refining. Your problem is altogether different and failures are expensive.

* * *

Question.—The goods we manufacture are made of steel and the finished product has a protective coating of heavy nickel-plate. In finishing the nickel plate the buffer uses a composition which cuts and colors very quickly, and we obtain splendid results with a minimum of spoiled work, due to buffing. Recently we contracted to plate and finish several thousand steel pieces used in loose leaf ledger construction, and owing to low figure at which the work was taken we must give these pieces a much lighter coating of nickel than we ordinarily give our own product. In our attempt to do this we have encountered considerable trouble. Our polishing and buffing is done by the same men, and in the case of the book binders we find that the nickel-plate is seriously cut through to the steel during buffing operation, and fully fifty per cent. of the pieces must be renickelled. This, as you will understand, increases the cost of production, and if continued will reduce our profit to a very close figure if it does not eliminate it. The foreman of the polishing and plating claims it is a practical impossibility to finish the steel with less than a one-hour nickel deposit, which is one half the time given our own product. Samples treated one hour have not withstood the buffing test, and we believe that the trouble is due to either indifference or carelessness on the part of the buffer. In the past we have received many encouraging and helpful ideas from the perusal of the columns of your valuable journal, and now appeal to you for your kind consideration of our difficulty. Any suggestion relating to the above case will be greatly appreciated and acknowledged.

Answer.—Your problem is indeed a very interesting one and we trust that the ultimate result of trouble will be a change in your system, or rather, method of finishing electro-plate, either thin or thick on any metal. Considering the operations in this order we find the polisher applies the article to the wheel coated with an abrasive, with considerable pressure and with an upward movement in ordinary under-wheel treatment as is customary in this country. The maximum pressure is applied during the upward movement and the result is more effective than during the downward movement as the article is opposing the movement of the wheel in the former instance. The operator in question is a polisher or one particularly practised in using abrasive coated wheels on base metals. This practice becomes a habit, and the habit grows more and more mechanical as time of continuous employment on one line of work is prolonged. Now let us consider the buffer. A buffer of electro-plate should be endowed with some horse sense at least. Very few devote even a moderate amount of thought to the work. In buffing the wheel is usually composed of cloth: the character of the cloth varies and should be selected with due consideration of the nature of the metal to be buffed and the quality of the electro-deposit with reference to the properties facilitating proper final finish by buffing. The speed of machine, size and character of the wheel, nature, and fineness of buffing composition, are factors directly concerning the buffing facilities. An expert polisher may make a total failure of buffing if the same principle is followed as in polishing. This is particularly true in cases where a minimum of deposited metal is to be colored. The polisher proceeds to buff by placing pressure upon the article during the downward movement or by a stationary application to the revolving wheel; he begins all right possibly, but in ninety-nine cases out of every hundred he does not continue to apply pressure correctly and is soon applying pressure during an upward movement as in polishing, because he has acquired the habit. The speed of machine for buffing heavy nickel-plate could safely be considerably greater than the speed required for coloring a thin nickel plate. Furthermore, the buffing composition used for coloring the thin deposits should be mild in its action; it should color quickly with a minimum of cutting. The wheel should be small as compared to wheels used for heavy castings and with unskilled labor the softness of the fabric should be carefully chosen. A dry composition will be permissible and assist in the processing without undue waste of material such as would result if higher speed and larger buff wheels were employed. Again, proper pressure is essential. The pressure should be as light as possible to produce a satisfactory finish, and overlapping should be carefully avoided. Inexperienced buffers and polishers employed at buffing have a habit of going over the surface, sometimes once, twice, or even more times after a good finish is obtained, each application necessarily removing some metal and naturally increasing the liability to produce exposed portions of steel or base metal. A skilled buffer selects his wheel and composition so that one sweep across the face of the wheel will produce the required lustre and even finish. The nickel plate must be soft, firm, and uniform in order to secure best results. If the articles are plated on holders in a manner which causes portions to be shaded or partially covered, the deposit cannot be uniform. This holds good with any solution irrespective of its composition or manner of use. Nevertheless there are many so-called platers who continue to process large quantities of both brass and steel goods in this way and frequently raise the cry that they have repeated difficulty in the buffing department owing to cutting through the deposits. Buffers as a rule object to admitting their shortcomings; platers are equally as remiss in this trait, and as you are in a position to scrutinize the vital points from an impartial standpoint we have endeavored to point out to you the really important factors in the case and believe you will find that it is possible to plate the steel pieces twenty minutes and buff them perfectly satisfactorily. Boric acid in the nickel solution may assist in producing a better deposit, and soft buffs used with slow-cutting composition with minimum pressure will also be essential. Avoid contamination of the buffs and composition used for this work by particles of emery from the polishing wheels, etc. This is sometimes the source of very serious trouble in buffing departments located in polishing rooms. The effect is not so noticeable where heavy nickel-plate is the rule but becomes an actual menace when thin deposits are to be finished. The cleanliness of the product before plating also affects the results in the buffing. Polished steel surfaces cleaned electrolytically and plated direct are often rendered difficult to buff by a thin film of carbon-like material which remains beneath the plate and causes the buffer to exert unnecessary pressure in an effort to produce a uniform color or lustre upon the nickel deposit. The fineness of the preliminary polishing is also to be considered. Heavy soft nickel plate will color upon a roughly polished surface. Thin, soft nickel plate requires a finer cut in polishing in order to avoid the greyness consequent to the side walls of the scratches produced by the coarser grade of abrasive.

* * *

Question.—I am using a nickel solution which has given me fair deposits but becomes turbid very quickly. In fact I have added sulphuric acid and cleared the solution on a Saturday, and by Monday night the solution was nearly as turbid as before adding the acid. I am very anxious to learn how I may keep the solution clear and why it becomes turbid so quickly.

Answer.—In replying to your question we must assume that you are cautious regarding the introduction of injurious liquids such as soda solution, cyanide solution, etc. Details relative to anodes and nature of the nickel solution are lacking, and as these are important we will include reference to each. Nickel solutions composed of simply nickel salts and a single addition agent or conducting salt will quickly become turbid if nickel anodes of low nickel content are employed. If a nickel solution low in metal is used with a low percentage of nickel-iron anode, the turbidity would easily occur during the few hours' operation following the addition of acid. Turbidity does not necessarily denote low acid content. The acidity of the solution may be excessive and the solution be decidedly turbid; this condition is quite frequent in the case of depleted nickel solutions. Pure nickel anodes or anodes approximately 98 per cent. nickel will permit the maintenance of clear solutions much more easily than the iron-nickel alloy. Less sludge is formed when the higher grade anode is employed. The iron hydroxide tends to cause turbidity and sulphuric acid additions have only temporary effect upon the condition. Ammonium citrate is a solvent for the iron, and when used as an addition agent in nickel solution prevents the accumulation of sludge. Very small amounts are used, as an excess causes dark objects. Deposits from nickel solutions operated with the low-grade anode often contain from 2 to 3½ per cent. iron, the balance of the iron going to the bottom of the tank. Ammonium citrate in the bath holds the iron in suspension, prevents the excess of sludge, but causes the deposit of iron in approximately the same proportion as is present in the anode used. Iron in a nickel deposit has a darkening effect, and such deposits will not hold a high lustre as long as purer nickel deposits. For your purpose we suggest increasing the actual nickel content of the solution and reduce the acidity to almost the neutral point by the use of nickel carbonate. If you have further trouble after the addition is made, try the ammonium citrate treatment carefully, not over 1½ or 2 per cent. should be used at first. With this hint as to the causes and remedy we believe you will eventually become a staunch advocate of pure anodes and pure chemicals in plating solutions.

* * *

Question.—I have been engaged in nickel and copper plating for over fifteen years, and recently secured a position which requires plating various grades of steel and iron. As my experience has been almost entirely with brass goods I find many points which cause me to desire greater knowledge of steel and iron, steel in particular. Will you please give me some information regarding the meaning of carbon content of steel; this seems to be an important item in the handling of steel goods for final finishing?

Answer.—Your interest in the composition of the metal you are required to finish is truly commendable and indicates a trait which should be appreciated by your employer. It is true that the direct coating of steel with nickel is often made simple by knowing how to treat the particular grade to best advantage. Machinery steel is of a lower grade than tool steel. It is softer, works more easily, and can be safely heated to a higher temperature without harm to the steel. It is usually used where hardening is not required, or if so, it is simply a surface hardening, the interior being soft to obtain greater strength. It resembles wrought iron and costs about a quarter as much as tool steel. Tool steel is used for tools, appliances or parts requiring hardening. There are many brands, each brand differing in some respects. Most manufacturers of tool steel make it of different tempers. The word "temper," as used by steel makers, means the quantity or percentage of carbon the steel contains. It may be low temper, medium or high, or number, or letter, and so on. Below we give some of the most useful tempers as used by steel makers. Razor temper, or 1½ per cent. carbon—this steel is so easily burnt by being overheated that it can only be processed by very skillful mechanics. When properly treated it will do many times the work of ordinary tool steel when used on hard metals, etc. Saw file temper. or 1⅜ per cent. carbon, requires careful treatment, but will stand more heat than the 1½ per cent. carbon steel. Tool temper is 1¼ per cent. carbon, and is used for tools, drills, etc. Spindle temper is 1⅛ per cent. carbon, and is used for screw thread dies, circular cutters, etc. Chisel temper equals 1 per cent. carbon as in chisels, etc. Set temper is ⅞ per cent. carbon as in stamping and pressing dies. When a steel maker specifies a very hard temper he usually means 150 carbon plus. Hard. indicates 100 to 120 carbon, and medium means 70 to 80 carbon. A point is one hundredth of one per cent. of any element, 100 points is 1 per cent. A 20-point carbon steel contains twenty-one hundredths (.20) of 1 per cent. of carbon. The same applies to any element introduced into the composition of the steel. The steel is sometimes designated by the number of points of carbon it contains, as 20 carbon or 40 carbon steel. The amount of carbon the steel contains does not necessarily determine the quality of the steel as the steel maker can give an ordinary low-grade stock a very high percentage of carbon. This would harden under ordinary conditions but would not be of value if made into cutting tools. It is the presence of carbon in steel which causes it to harden, the amount of hardness and the degree of heat necessary when hardening depends on the quantity of carbon the steel contains. The outside of tool steel as it comes from the steel mill or forge shop is decarbonized to a considerable depth. This is due to the action of the oxygen in the air which causes the carbon to be burned out of the steel at the surface during the various operations when the steel is red hot. In order that the decarbonized portion may not give trouble it is necessary to cut away enough of the surface to remove this portion before hardening. In the preliminary treatment of steels preparatory to direct nickeling, it is good policy to give special attention to the "bite." This is the acid dip employed immediately before placing the steel in the nickel solution. Some grades of steel will stain more readily than others, strong "bites" are often detrimental to the steel even if only momentarily employed. In other cases it is advisable to use a mixture of at least two acids and reduce the time of immersion. The best "bite" can be ascertained only by testing the steel with the different acids or mixtures. These bite solutions must not become charged with metal salts as the presence of the latter is an absolute handicap to good work. It is better to use the dip for a pickle on rough work and prepare a fresh dip frequently than attempt to drain off and save the old bite solution for treatment of steel surfaces for plating.

* * *

Question.—I have several small fire extinguishers which must be lead-plated inside. Please inform me how to prepare and operate a solution for this purpose.

Answer—To one gallon of water add 6 ounces litharge and 6 ounces caustic soda. Boil for one hour, then allow to settle; pour off the clear liquor and use this as the solution. The inside of the extinguishers must be chemically clean, the solution is then poured in and plated from a circular lead anode which is hung into same. If a heavy coating is desired it will be necessary to pour out the solution and brush the inside several times. Keep the inner surface wet during the brushing treatment.

Gain may be temporary and uncertain, but expense is constant and certain.

If you would be wealthy, think of saving as well as getting.

Beware of small expenses; a small leak will sink a great ship.

Look before or you'll find yourself behind.

MODERN PICKLING MACHINES

By P. E. R.

THE accompanying illustrations, Figs. 1 and 2, and drawing Fig. 3, show the design and construction and method of operation of the improved pickling machines developed at the Mesta Machine Works at Pittsburgh, Pa. These pickling machines are in sheet and tin-plate manufacture as well as metal products, and are successfully pickling castings, wire coils, strip steel and pipe stampings, small forgings, cartridge cases, gun parts, and various other products of iron, steel, brass and copper.

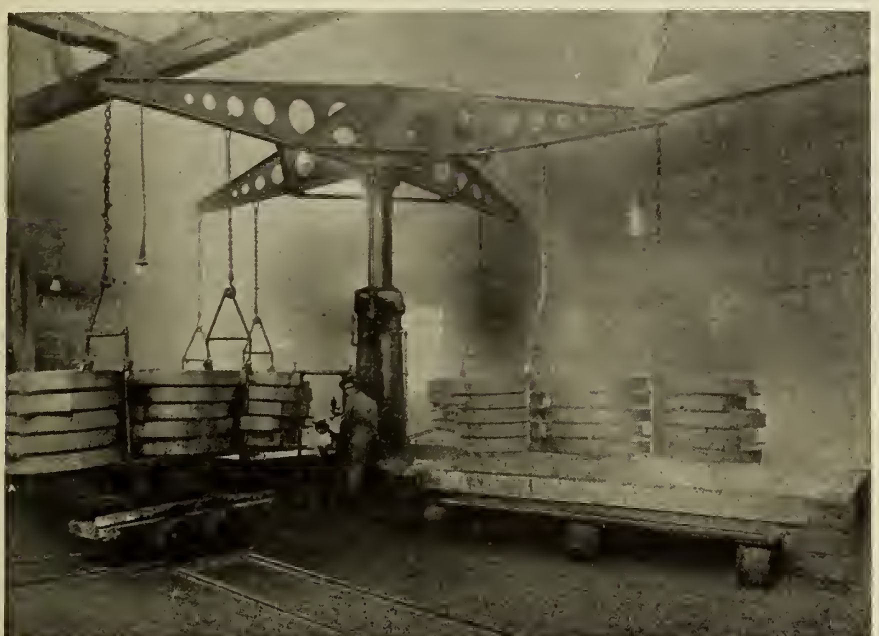


FIGURE 1.

Pickling means the removal of scale and other substances from the surface of metals by the chemical action of acid If the material to be cleaned is simply soaked in the acid an excessive amount of metal may be dissolved, with a consequent waste of acid. The cleaning is both uncertain and uneven because the acid forms in layers of varying densities, and the scale is of varying thickness. Uniform action of the acid on all surfaces is best obtained by thorough agitation and by shifting the material during the pickling, thus exposing all surfaces to the action of the acid and preventing spotting. Furthermore, if the acid washes over the surface of the metal, it has, in conjunction with the loosened particles, a scouring action which not only gives thorough cleaning, but reduces acid consumption. The acid-soaked material should be exposed to the air as short a time as possible in order to avoid the detrimental effects due to air exposure. It has been found that the above results can be properly accomplished only with the aid of machinery.

This machine brings mechanical action into play to such an extent that the material is pickled with much less labor and acid consumption than required by any other method. In operation the machine moves the material through the acid at a predetermined velocity, ending each down stroke with a slight rebound. This action, due to the sudden admission of steam to the cylinder, tends to shake off the loosened particles and separates and shifts the material being pickled so as to allow the free circulation of acid on all surfaces. In pickling sheets this feature is of extreme importance for the reason that by no other practical method can the sheets be properly separated. It has been demonstrated that sheet and tin plate plants are able to materially reduce their inspection departments after the installation of pickling machines, owing to the great reduction in the number of defective sheets produced.

It is claimed that by this method of agitating the acid and material, and by simultaneously performing the operations of pickling and washing, while loading and unloading are taking place, together with the method of changing from acid to washing vat, a more thoroughly and uniformly pickled product is obtained at a lower cost than by any other method. As has been shown in a large number of cases, by the use of this pickling machine, the saving effected in acid consumption. labor cost, waste product, etc., is very great, and pays for the installation within a very short time.

The machine is simple in construction, has few working parts, and does not require skilled operators. A central plunger, operated by steam, carries a number of horizontal arms, from which are suspended acid-proof crates. These crates are varied in size and design to suit the amount, size and character of the material to be pickled, while the number of arms is governed by the number of baths required. During the pickling process the machine is entirely automatic in its action and requires attention only while the crates are being transferred from one vat to another. This is accomplished by depressing a single lever which admits steam to the cylinder and raises the crates from the vats. No crane service is necessary, and the only labor required is that needed to load and unload the crates.

It may be mentioned that the machine takes steam on part of the up stroke only, the remainder of the stroke being accomplished under the combined influence of expansion and inertia, while the down stroke is effected entirely by gravity. The exhaust from the machine, after it has passed through an oil separator, can be used for heating the acid. In places where greatest fuel economy is desired, steam consumption can be reduced by filling the interior of the piston rod and a cylinder located in the bottom of the base with compressed air. Most of the dead weight of the moving parts can thus be balanced, so that a smaller quantity of steam is required for lifting the load in the crates. The machine per-

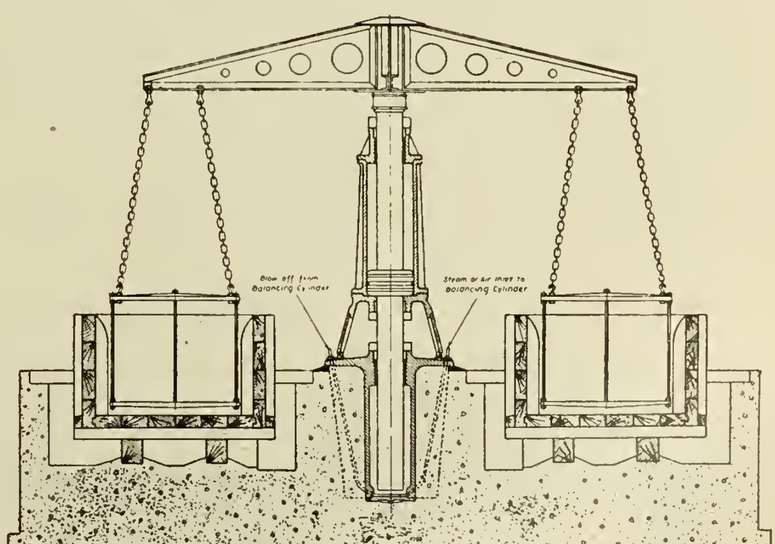


FIGURE 2

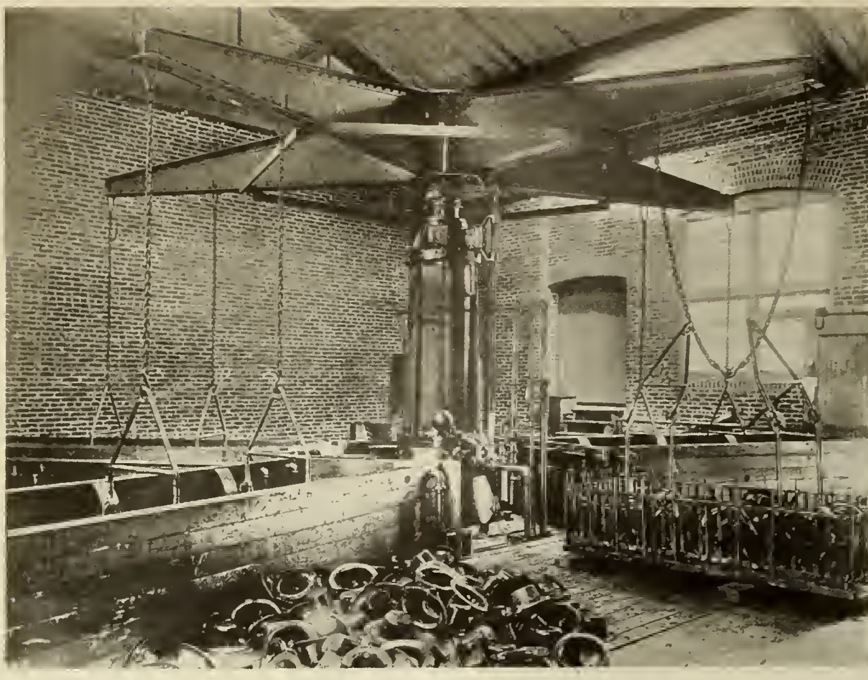


FIG. 3

mits the use of two pickling baths without an increase in labor above that required with one bath. The two-bath system is very economical in acid consumption because the acid from the strong bath, adhering to the material, provides for the strength of the weak bath. Except when employed with this pickling machine, the two-bath system meets with the objection that it increases labor cost.

It is held that much of the disagreeableness of pickling is eliminated by the use of this pickling machine. The operators are not required to work over or near the acid which, consequently, can be kept at a high temperature. As the bats are located compactly around the machine, hoods may be used for the removal of fumes and the machines located in the most convenient position in respect to the flow of material through the plant.

He that murders a pound destroys all that it might have produced, even scores of pounds.

* * *

It is easier to suppress the first desire than to satisfy all that follow it.

* * *

Buy what thou hast no need of, and ere long thou shall sell thy necessaries.

* * *

Little strokes fell great oaks.

* * *

A penny saved is a twopence clear. A pin a day is a groat a year.

Canadian Plumbago for Foundry Purposes

The Bulk of the Plumbago Which is Mined is Used for Foundry Facing and Crucibles and the Bulk of This is Used for Facing

By "Ontario."

IN the last issue of CANADIAN FOUNDRYMAN was an article dealing with Canadian graphite as compared with Ceylon plumbago, in which it was shown that the great superiority of the imported article over the domestic was mainly imagination, but also, to a great extent, through knowledge of the good qualities of the one and lack of knowledge concerning the other.

The great drawback to the Canadian article in the past seems to have been the lack of proper methods of preparing it for the market. Particularly was this the case where the product was to be used in the manufacture of crucibles, where the large flakes were essential. The process in use for years back resulted in reducing the flakes to dust, but in late years this difficulty has been overcome, and the Canadian graphite can hold its own with the other brands. As regards the ordinary foundry, bag blacking or plumbago for rubbing or brushing onto heavy work, the Canadian article was probably always able to hold its own when given an opportunity. According to one prominent mine operator from the Province of Quebec, German experimenters (before the war of course) made crucibles from Canadian graphite unmixed with any other and they compared very favorably with those from other countries in number of heats. A prominent Ontario miner of graphite says of the mine he operates, that during the year 1917, his company mined, refined and shipped 2.844 short tons, or the equivalent of 142 twenty ton cars of graphite, and in 1918, 2,867 short tons, or the equivalent of 143 twenty ton cars. About 97 per cent. of this material went to the United States, and out of this total tonnage, fully 75 per cent. of this graphite or plumbago was used in foundry practice.

The ore from the mine is of entirely different formation from any other graphite ore mined in Canada, or the United States. Briefly stated this ore carries, in combination, both the large flake, used for lubrication and the manufacture of crucibles, as well as the finer particles of flake, that have been broken up into infinitesimally small particles, in the formation period of the country rock. The large flake found in the proportion of 25 per cent. of the graphite recovered from the ore, and the smaller or broken-up flake, which is designated by way of differentiation, as plumbago, or more strictly speaking, foundry plumbago, makes up 75 per cent. of the total.

For many years prior to 1914, the foundry trade, having been accustomed to the use of Ceylon graphite only, had grown to think that no other graphite extant could be used to replace it. As a result of this well-established prejudice, American distributors of Canadian graphite found it a difficult matter to convince their customers that it could be satisfactorily substituted for Ceylon, and in consequence of the existing prejudice, a practice was made of blending the Canadian with the Ceylon, without advertising the fact. But when ocean shipping conditions became acute, and the United States had practically cleaned up all the available Ceylon plumbago suitable for foundry work, it became necessary for the plumbago grinders to sell straight Canadian graphite to their foundry customers, and as a result of this development it became thoroughly established in the trade. The special advantage Ceylon graphite offers the plumbago grinder, or jobber of foundry plumbagos, is that it carries a little brighter natural lustre, and as foundrymen have been educated up to expecting this lustre, the grinder often finds it easier to sell his high priced foundry plumbagos, when a small percentage of Ceylon dust is added, to bring up the lustre to the brightness desired.

In summing up the situation, the outstanding fact is that during the years 1917 and 1918, 75 per cent. of the output of this one mine, or 106 and 107 twenty ton cars respectively, were used by the foundries of the United States and Canada as foundry plumbago. This, we submit, effectively answers the question of whether or not Canadian graphite or plumbago can be used instead of Ceylon plumbago for foundry facings, etc.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	29 35
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 50

METALS

	Montreal	Toronto
Aluminum	$38 00	$35 00
Antimony	9 00	8 50
Copper, electrolytic	18 50	17 50
Copper, casting	18 50	17 00
Lead	6 50	7 50
Mercury		.....
Nickel		.....
Silver, per oz.		0 98
Tin	58 00	55 00
Zinc	8 50	8 25

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$11 50	$11 25
Copper, crucible	14 00	14 00
Copper, heavy	13 50	14 00
Copper, wire	13 50	12 00
No. 1 mach. comp'n	12 50	13 00
New brass cuttings	9 25	9 00
No. 1 brass turnings	8 00	9 00
Light brass	5 00	5 00
Medium brass	7 00	6 00
Heavy melting steel	9 50	9 00
Shell turnings	6 00	6 00
Boiler plate	10 00	8 00
Axles, wrought iron	17 00	15 00
Rails	12 00	11 00
No. 1 machine cast iron	15 00	15 00
Malleable scrap	12 00	12 00
Pipes, wrought	6 00	5 00
Car wheels, iron	20 00	18 00
Steel axles	20 00	20 00
Mach. shop turnings	5 50	5 00
Cast borings	5 50	8 00
Stove plate	12 00	10 00
Scrap zinc	5 00	5 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	15 00	12 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.
B

¼ in.	$14 35
5-16 in.	13 85
⅜ in.	13 50
7-16 in.	12 90
½ in.	13 20
9-16 in.	13 00
⅝ in.	12 90
⅞ in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 10
Linseed oil, boiled, single bbls.	1 7[illegible]
Linseed oil, raw, single bbls.	1 70
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A.. list plus	43
Emery cloth, list plus	37¹
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 00
Sheets, black, No. 10	6 15	5 45
Canada plates, dull, 52 sheets	8 50	8 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 95
Premier, 10¾ oz.	....	8 25
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$13 00
3-16 in.	12 50
¼ in.	11 75
5-16 in.	11 40
⅜ in.	11 00
7-16 in.	10 60
½ in.	10 40
⅝ in.	10 00
¾ in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Silver	1 05 to 1.00
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium, carbonate	.25
Ammonium, chloride, lump	.55
Ammonium, chlor., granular	.30
Ammonium, hydrosulphuret.	.30
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.50
Arsenic, white	.20
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.40
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	1.35
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.40
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, bullneck	2 00
Pumice, ground	3½ to .05
Emery composition	08 to .09
Tripoli composition	06 to .09
Rouge, powder	30 to 35
Rouge, silver	.35 to .50
Crocus composition N	08 to 10

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 3[illegible]
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	[illegible]
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10½

FILES AND RASPS.

	Per Cent
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	
Globe	50
Vulcan	50
Disston	40

LARGE TONNAGES OF IRON ARE BEING BOOKED BY THE FURNACES

THE long expected buying movement seems to have arrived at last. Tales of bookings of large tonnages come from all over the United States. Following are reports from leading centres of the trade:

Buffalo.—During the week sales of 40,000 tons of various grades of iron were sold. Some of this was for third and fourth quarter delivery. The grades were divided into 20,000 tons foundry, 10,000 tons basic, and 10,000 tons malleable. Enquiry is brisk, about 20,000 tons foundry and malleable being asked for.

New York.—An amount of business sufficiently large to warrant it being considered a buying movement has been closed during the past week. Delivery is in most cases for the third quarter. With the improved business, a tendency to stiffen prices is disclosed. Export business amounted to several thousand tons, and it is stated that while England has the advantage of price for European destinations, she has not much iron to spare compared with the U. S.

Cleveland.—Sales amounting in the aggregate to between 40,000 and 50,000 tons are reported for the past week. Delivery is in most cases spread over last half. Enquiries amounting to about 20,000 tons are reported. Malleable iron has been sold in Cleveland district by outside furnaces at $27.25 furnace, equal to $28.50 delivered.

Chicago.—With demand about equally divided between foundry and malleable grades, a fair market movement is being uncovered. A number of large enquiries are pending, and several sales amounting to 10,000 tons have been made to individual users. Buying for last half is getting brisker, while business for prompt shipment is falling off. Low phosphorus iron is quoted $40 to $41, delivered, Chicago.

Cincinnati—Both forward delivery and prompt shipment business is showing improvement. Southern furnaces are obtaining business at the regular price schedule, but in some cases concessions have been made. These amounted to supplying a higher manganese and silicon content without applying the customary differential. Local melters are not buying largely on account of the local molders' strike.

St. Louis.—An improvement is noted during the past week. Third quarter delivery enquiries for 500 to 1,000 tons are going round. The demand has been helped by fairly large building operations proceeding in this district.

Philadelphia.—With brisk selling for third quarter and second half, prices have shown a tendency to strengthen. While No. 2X is quoted at last week's range of $29½ to $30, some sales have been made at a price equivalent to $32.20, delivered, Philadelphia. One furnace reports a sale of 13,000 tons for third quarter and second half.

Birmingham. — Southern makers do not show any anxiety to take on business for third quarter delivery, although enquiries are numerous. Southern iron is being sold in Chicago in competition with iron from other districts, and prices are being shaded somewhat for that purpose.

Pittsburgh.—The market here is getting onto a better footing, although there is not much actual increase of business. Price cuts are not heard much of recently. What iron is being moved is coming out of stock, and production is remaining at a low rate. This helps the market to regain a firmer tone. The demand is chiefly for foundry iron, steel making grades not being called for to any extent.

Boston.—Business during the month of May totalled up good, a large number of enquiries being closed on the last day, after going around for some days. Enquiries for last quarter are making their appearance, one being for 2,000 tons foundry grade. Stove manufacturers are now able to get iron to suit their requirements.

U.S. CENTRES REPORT BETTER OUTLOOK FOR SCRAP MARKET

CORRESPONDING to the buying movement in the pig iron market, a better feeling is noticed in the scrap iron division. Prices are up in some districts. Following are the reports from various districts in the U.S.:

Chicago.—What may be called a dealers' market is in force here, and prices have advanced on most grades about 50 cents during the past week. This shows confidence in the future of the market, although present buying is very light on the consumers' side.

Cleveland.—Though some melters say there is not enough improvement to justify their buying scrap, the fact remains that enquiries and prices are both better. Dealers are going cautiously, fearing a sudden rise. Heavy melting steel is quoted at $16 to $16.50.

New York.—With some buying of cast scrap and stove plate, as well as heavy melting steel borings and turnings, the market is showing more life than for some time. Prices remain firm at last week's levels, with the exception of machine shop turnings, which have dropped off about $1 per ton. Buying is still for immediate requirements.

Philadelphia.—The main feature of interest in the scrap market are the offerings of Government material. A lot of 1,000 tons of shell forgings was sold at $16 Easton, which is equivalent to about $16.70 at Eastern Pennsylvania points. Heavy melting steel is around $16 delivered. The Pennsylvania is offering about 20,000 tons of scrap this month.

Buffalo.—Business is looking much better in this district, and although sales could be easily made, many traders show a disposition to wait for higher prices. A sale of between 10,000 and 15,000 of heavy melting steel is reported to a local consumer. Prices generally show improvement.

Boston.—There has been no alteration in prices since last week, though more interest has been shown in the market. There has been more active business in local scrap due to increase in the stove business. The War Department is asking for bids on 9,000 tons of steel forgings.

St. Louis.—While prices have advanced during the week, dealers are not sure whether it is due to a buying movement or to their own trading. The demand for steel and cast scrap is good, with not much offering. The Government is offering about 3,800 tons of steel ingots at the plant of the Scullin Steel Co.

Cincinnati.—There is a perceptible improvement in the market this week, and prices have advanced on most grades from 50 cents to $1 a ton. Demand for steel and foundry scrap is good. Iron car wheels are quoted at $18.

Birmingham.—Dealers are laying up stock in preference to selling at the prices offered. Trading is confined chiefly to heavy melting, cast and stove plate.

Pittsburgh.—There is not much activity in the market here, but at the same time there is very little material available. Dealers are buying in for a rise. and that, coupled with deliveries to fill contracts, keeps the supply down. The market is showing a firmer tone. heavy breakable cast being quoted at $20 delivered, and small lots of heavy melting at $16.

The Cleanest Cleaning Method—

—METALLIC ABRASIVES

WORKMEN greatly prefer "Shot Blasting" or "Grit Blasting" to sand blasting—government orders stipulate the use of grit or shot in place of sand—the use of sand for blasting has been eliminated entirely in England—*why should you continue to sand blast?*

"Grit Blasting" and "Shot Blasting" has bettered the working conditions of the blastman a hundred fold.

The use of Shot and Grit eliminates dust and does away with sand storage bins and dryers.

A 100-lb. bag will last as long and do more work than 10,000 lbs. of sand.

WRITE FOR SAMPLES

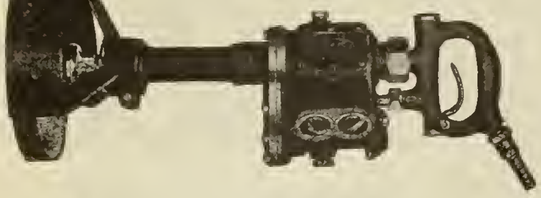
HARRISON SUPPLY COMPANY

5-7 DORCHESTER AVENUE EXTENSION

BOSTON, MASS., U.S.A.

FOUNDRY Thor TOOLS

Thor Portable Air Grinder No. 72.



Thor Chipping Hammer

Thor Pneumatic Bench Rammer.

Four hundred and sixteen foundries bought Thor Pneumatic Tools last year. Including Thor Tools sold for other purposes, 67,322 Thor Tools were sold during the year 1918.

Doesn't this speak well for Thor **efficiency?** Let us tell you how you can save time, money and labor in your foundry with Thor Foundry Tools.

Thor Pneumatic Floor Rammer.

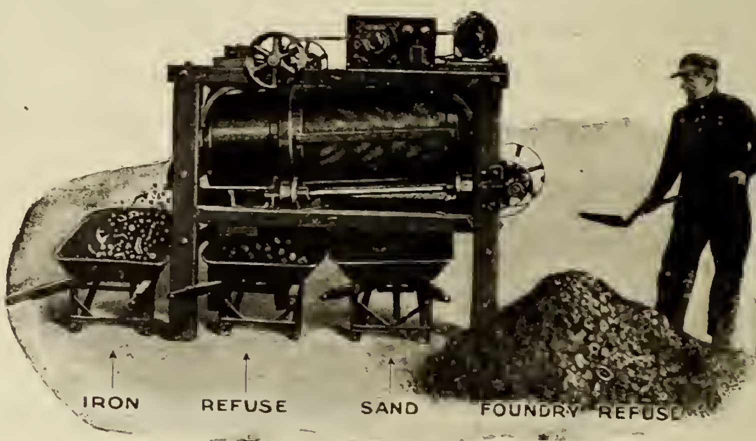
INDEPENDENT PNEUMATIC TOOL COMPANY

General Offices: 600 West Jackson Blvd., CHICAGO, U.S.A.

CANADIAN OFFICES: 334 St. James St., MONTREAL; 32 Front St., TORONTO; 123 Bannatyne Ave. E., WINNIPEG; 1142 Homer St., VANCOUVER

IRON DOLLARS

From the Refuse Pile



Recovered by Dings Magnetic Separator

Apparently valueless refuse heaps are turned into valuable account by the DINGS Magnetic Separator.

Recovers all valuable materials—separates them from the refuse. Simple, moderately-priced machine. Never clogs, runs without trouble and is easy to install.

One type—the motor-driven—can be set to work as soon as unloaded. The other, which is belt-driven, is ready as soon as the belt is hooked up.

Write for catalogue No. 16.

DINGS MAGNETIC SEPARATOR COMPANY

800 Smith Street, Milwaukee, Wis.

ANODES

Any style or shape
Quality Guaranteed

Why import your anodes when you can get guaranteed quality, quicker delivery, and can save duty and eliminate the annoyance of clearing at the customs by buying from us?

May we send you descriptive pamphlet and full particulars?

W. W. WELLS, Toronto

In Brass Bronze Copper Nickel Tin & Zinc

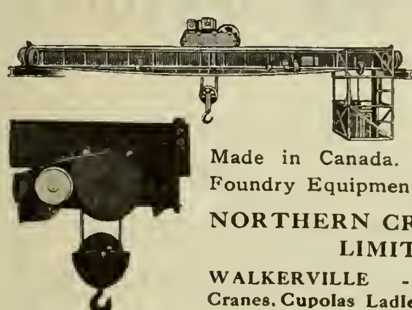
Patterns

For Marine Work
Brass and Iron Foundries
All Classes of Engines
Spur and Bevel
Gears, Etc.

The Montreal Pattern Works

242 Clarke Street
Montreal, P.Q.

CRANES



Don't buy a crane or hoist without investigating Northern Products—Made in Canada. Also a line of Foundry Equipment.

NORTHERN CRANE WORKS LIMITED

WALKERVILLE - - ONTARIO

Cranes, Cupolas Ladles, Hoists, Tumblers Etc.

THE CYCLONE
Suction Sand Blast Nozzle

A Complete Sand Blast For Cleaning
IRON, STEEL AND BRASS CASTINGS

This Outfit is Guaranteed to Give Satisfaction
No Sand Tanks to Fill — Work Can be Stopped at the Nozzle
Write for Circular and Price

W. F. STODDER

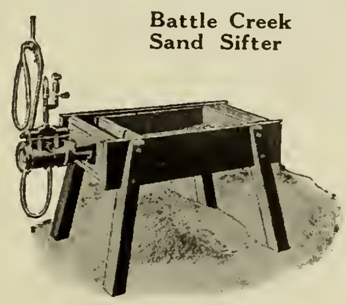
218 South Geddes Street — P. O. Box 747 — SYRACUSE, N. Y., U.S.A.

You Can't Afford To Be Without This Machine

When you consider that the Battle Creek Sand Sifter does **five times** the work of a riddle sifter, don't you think you require one in your foundry? Quickly pays for itself.

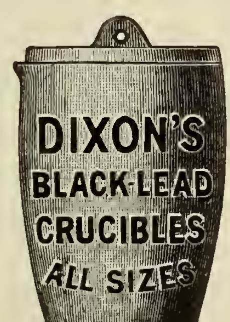
Any foundry supply house can furnish you with this or any one of our other cost-cutters.

Battle Creek Sand Sifter



Battle Creek Sand Sifter Co.
BATTLE CREEK, MICH.

When you think of a crucible think of DIXON and remember that the Dixon name stands for the longest and widest experience in the crucible industry.



Write for Booklet No. 27-A.

Made in Jersey City, N.J., by the

JOSEPH DIXON CRUCIBLE COMPANY

Established 1827

Milton Hersey Company, Limited

CONSULTING FOUNDRYMEN
AND
INDUSTRIAL CHEMISTS

Analyses and Tests on all Materials used in Foundry Work
Expert Metallurgists and Practical Foundrymen
For Your Foundry Problems

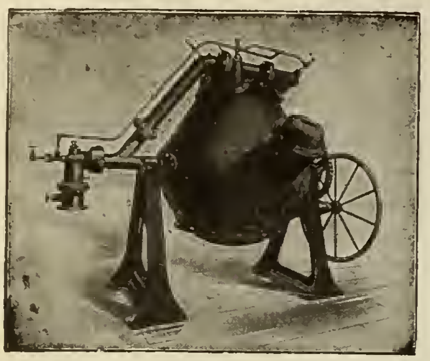
Montreal · Winnipeg

IT IS IMPORTANT!

If you have something to dispose of in goods or service that as many buyers as possible get to know you and your product. This can be accomplished through

Canadian Foundryman

143 University Avenue, Toronto



The Hawley-Schwartz Furnace

The Only Perfect Melter

All metal from 50 lbs. to 10,000 lbs.

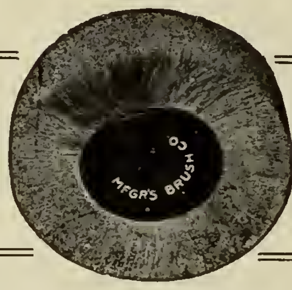
Is Absolutely Uniform

Write for catalog and complete information

The Hawley Down Draft Furnace Co.
Easton, Penn., U.S.A.

"SAMSON" Wire Wheel Brush Sections

Each Section a Brush in itself



Can be quickly mounted on a Shaft or Spindle

No Hub or Holder Required

Metal disc center punched to fit any size spindle.

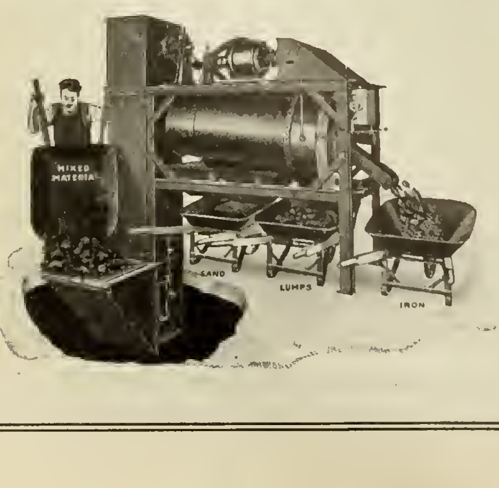
A convenient and practical method of building a wheel any desired width of face.

Especially recommended for removing scales from hot forgings, axes, shovels and tools; for cleaning brass castings, sheet brass and copper.

A trial order will convince you "Samson" scratch wheels are the most efficient and economical brushes on the market to-day.

Write for catalog and complete information.

The Manufacturers Brush Co., Cleveland, Ohio
19 Warren Street, New York



MAGNETIC SEPARATORS

Will save that waste iron and screen your sand as well.

Our Type "F"

Separators require no shoveling. Simply dump the material into the grizzly.
Note elevator feature. Magnetic separator can be furnished without this feature if desired, thus reducing cost. One of Canada's largest foundries has just ordered one. Name supplied on request.

They Save Labor and Metal

MAGNETIC MANUFACTURING CO.
Windlake and Fourth Ave. MILWAUKEE, WIS.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Montreal, Que.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRANITE AND MARBLE POLISHING
Harrison Supply Co., Boston, Mass.

GRANITE CUTTERS' TOOLS
Harrison Supply Co., Boston, Mass.

GRANITE AND MARBLE POLISHERS' SUPPLIES
Harrison Supply Co., Boston, Mass.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.
Wheeler Mfg. Co., Chicago.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.
Harrison Supply Co., Boston, Mass.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corpora..on, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD
TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, JULY, 1919 No. 7


KAWIN
Throws Light on the Weak Spots in Foundry Production
PRACTICALLY every foundry has its weak spots. A lot of them not easily recognized. Let the searchlight of Kawin Service find them out.
KAWIN SERVICE
not only throws a light on the weak spots—it shows you how to effect a remedy. Results of Kawin Service.
REDUCED EXPENSE.
PROPER MIXTURE.
BEST CUPOLA PRACTICE.
UNIFORM CASTINGS.
DECREASED LOSSES.
INCREASED OUTPUT.
The searchlight of Kawin Service penetrates to every corner of the foundry. It is guaranteed to save you 100% over and above its cost—if it doesn't the service costs you nothing. Why hesitate? You have nothing to lose.
CHARLES C. KAWIN COMPANY, LIMITED
Chemists, Foundry Engineers, Metallurgists—307 Kent Bldg., TORONTO
BUFFALO, N. Y. DAYTON, Ohio CHICAGO, Ill. SAN FRANCISCO Cal.

The Publisher's Page

TORONTO JULY, 1919

Oversold Output Is Advertising Impetus

AMONG the factors which make advertising such a dominant force in American business is the faith of the largest investors in the printed word.

It wasn't so long ago—as a matter of fact has the time really passed?—that a manufacturer curtailed his advertising because his factory was oversold. The old cry, "Nothing to advertise; I'm flooded with orders," ruled.

Fortunately for the manufacturer, this view has given way to sound merchandising. The advertiser to-day sees the value and necessity of intrenching himself in the market he has won, even though the counter attack of his competitor seems far off, even improbable.

Back in the days when the world was engaged in position warfare it was a principle that a portion of captured line must be **consolidated** without delay. The whole idea was this —a section of the enemy's line had been captured, but that enemy's dominant purpose was to reform his forces and counter attack. Sometimes the position was lost and taken a dozen times.

This necessity of consolidation, of digging in and preparing for the counter thrust, exists in business. And the more important the position held, the more tempting is the counter attack desire.

The Goodyear Tire & Rubber Company recently threw a bulwark of newspaper pages between its business and competition. This concern advertised that in spite of an output increased to an average of 24,536 finished tires a day, it had been impossible to meet existing demand for its product.

The consumer is told that the Goodyear Company regrets its inability to serve all of its customers, despite its increased production.

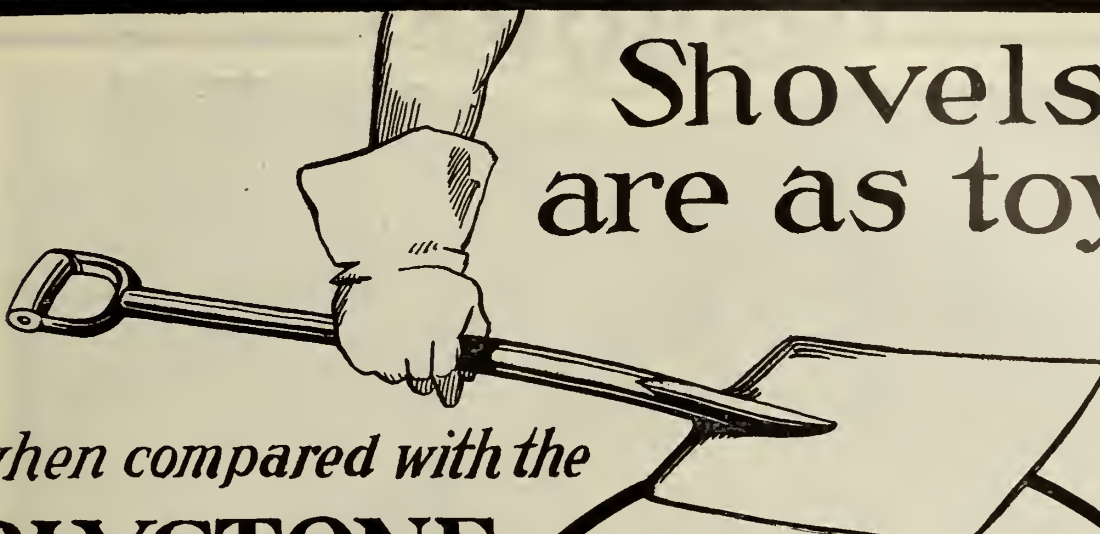
The dealer is not neglected. The consumer is asked to overlook any shortage in the dealer's stock because of the impossibility of keeping that stock complete. This is another link in a remarkably fine consolidation.

All this goes to show that this keen advertiser knows that it does pay to advertise aggressively even though the factory output is sold out a long way ahead.—Printers' Ink.

CANADIAN FOUNDRYMAN, July, 1919. Vol. X., No. 7. Published monthly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $1.00; in the United States, $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.

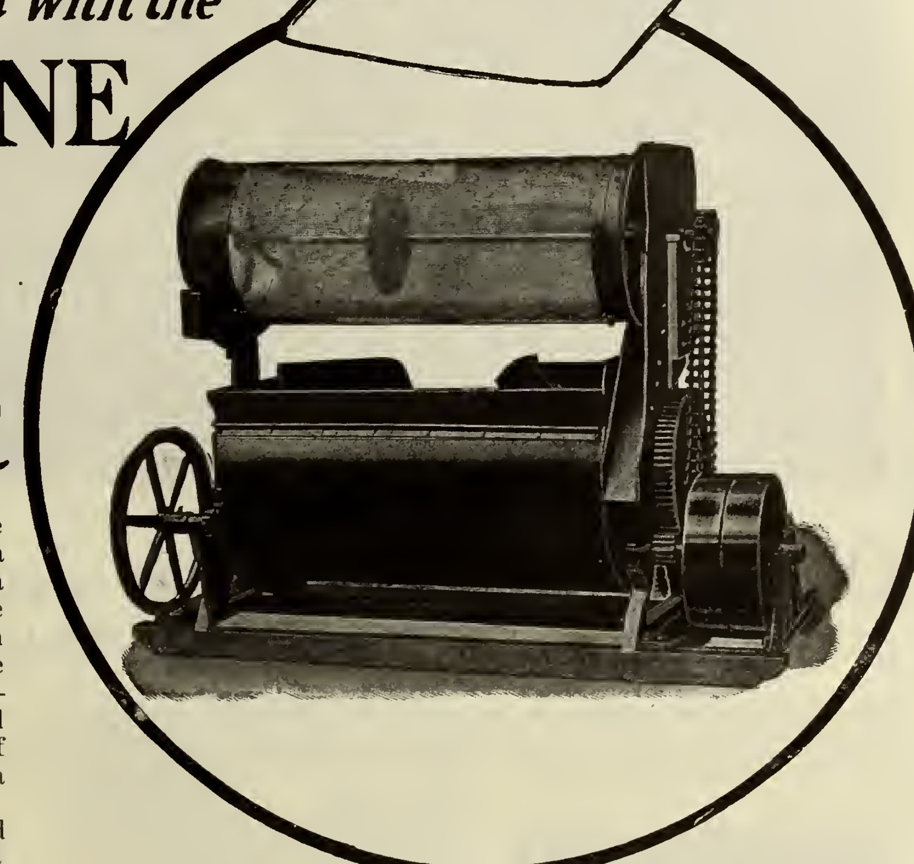

Holland Core Oil Company
There's a Money Saver
HI-BINDER
CORE FLOUR
The Only Substitute for Flour
There has never been anything invented to compare with HI-BINDER Core Flour for making cores that can be depended upon. Yet it is not expensive. In fact it will save you money. Hundreds of barrel-lot customers and a number of car-lot customers are using it with satisfactory results.
Holland Products
Core Oils, Match Oil, Linseed Oil, Hi-Binder Dry Core Compounds, Hi-Binder for Dry and Green Sand Facing for Steel, Hi-Binder Core Paste, Parting.
GIVE HOLLAND PRODUCTS A TRIAL
Canadian Agents:
The Dominion Foundry Supply Co., Limited
"Everything for the Foundry"
TORONTO
MONTREAL
4600 WEST HURON ST.
HOLLAND PRODUCTS
GOOD PRODUCTS ONLY
CHICAGO --- ILLINOIS

Shovels are as toys—



when compared with the

BLYSTONE CORE SAND MIXER



A standard type Blystone Core Sand Mixer will turn over a batch of 14 cu. ft. 44 times a minute. Compare this with the time it would take one man with a shovel to turn the same amount of sand—or five men—or even ten men and you will then have some conception of the wonderful efficiency of a "Blystone."

The "Blystone" riddles and mixes the sand simultaneously—it gets under the sand mixture, turns it over and throws it from one end of the drum to the other with each revolution of the shovel shaft.

One man in less than half a day can mix thoroughly core sand for 25 core makers and facing for 100 molders.

Write for the particulars of our special 10 days' free trial offer.

Blystone Manufacturing Company

719 Ironton Street - - Cambridge Springs, Pa.

Baltimore	J. W. Paxson Co.
Birmingham	Hill & Griffith
Buffalo	E. J. Woodison
Chicago	Scully-Jones & Co.
Cincinnati	Hill & Griffith
Cleveland	E. J. Woodison
Detroit	E. J. Woodison
New York	Wonham, Bates & Goode
Philadelphia	J. W. Paxson & Co.
Pittsburg	J. S. McCormick Co.
San Francisco	Ditty Bros.
Toronto	E. B. Fleury, 1609 Queen St. W. Phone Park. 6700

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

A. O. Backert Visits Great Britain and Europe

President of the American Foundrymen's Association Entertained in Truly British Fashion, and Made the Guest of Honor at Many Dinners and Other Social Functions

FOR the purpose of establishing closer relations between American and British foundrymen and to arrange for delegates from abroad at the foundry convention which will be held in Philadelphia during the week of Sept. 29, A. O. Backert, president of the American Foundrymen's Association, made a trip to Europe during April, May and the early part of June. While in England he was tendered a number of entertainments by the British Foundrymen's Association and other technical societies. Meetings and dinners were held in Coventry, Sheffield and Birmingham on April 30, May 3 and May 5 respectively. At Birmingham the Staffordshire Iron and Steel Institute, the Birmingham Metallurgical Society and the Birmingham local section of the British Institute of Metals co-operated with the local branch of the British Foundrymen's Association in a joint dinner and meeting. The Sheffield gathering was a national affair in which members of the British Foundrymen's Association from London, Birmingham, Coventry, Derby, Peterborough, Mansfield, Keighley, Manchester, Loughborough, Leicester, Newcastle-on-Tyne, Luton, Dumbarton and numerous other points in the United Kingdom participated.

In addition a number of plant inspection trips were arranged, including the Wicker Iron Works, Hadfield's Ltd., Edgar Allen & Co., and Steel Peech & Tozer at Sheffield, the Daimler Works and the plants of Alfred Herbert Ltd., Rowland Hill & Co., and the British Piston Ring Co. at Coventry, the Birmingham Iron Exchange, Walter Somers & Co. and other works in Birmingham the Leys Malleable Castings Co., Derby, and the Rolls-Royce Motor Co. At several of these plants the American flag was hoisted in honor of the visitor as a representative of the United States.

The first formal function was a complimentary dinner to the president of the American Foundrymen's Association, which was given by the Coventry branch of the British Foundrymen's Association on Wednesday, April 30. The guest of the day was warmly welcomed by Andrew Harley, who proposed the toast, "The American Foundrymen's Association." He pointed out that it was the first occasion on which a president of the American Foundrymen's Association had visited England in his official capacity. Mr. Harley said he sincerely hoped the brotherly feeling which had been created between the British and American people during the war would be perpetuated. The proper feeling, he pointed out, can only be secured by close

A. O. BACKERT,
President of the American Foundrymen's Association.

co-operation between important British and American technical societies and business organizations, such as the American Foundrymen's Association and the British Foundrymen's Association. Mr. Harley concluded his remarks by wishing success to the American Foundrymen's Association and inviting the guests to drink to the health of its president. In responding Mr. Backert expressed his appreciation of the unusual cordiality of his reception, which, he said, was a compliment primarily to the American foundry industry. He hoped, he said, that the day might soon come when the American Foundrymen's Association could reciprocate in kind. The speaker also laid stress on the wonderful industrial achievements of Great Britain during the war, particularly in the castings field.

The dinner at Coventry was followed by a general meeting of the Coventry branch of the British Foundrymen's Association, at which Mr. Harley occupied the chair. In an address at this meeting Mr. Backert said in part: "When it comes to precision work and quality production we Americans must take off our hats to the British foundrymen. I am specially impressed with the progress of British manufacturers in the heat-treating field. In some respects our development as regards the heat treatment of castings in the United States is in its infancy. We feel that we have a great deal to learn from Great Britain along this line, and the foundrymen of America certainly appreciate the generous spirit of co-operation displayed everywhere in the United Kingdom."

A general meeting of the British Foundrymen's Association, at which members from all parts of the country were present, was held at Sheffield on Saturday, May 3. It was presided over by Thos. H. Firth, Wicker Iron Works, Sheffield, president of the British Foundrymen's Association. The complimentary dinner took place at the Grand Hotel. The following guests were present:

T. H. Firth, president B.F.A; Alderman W. Irons, J.P., Lord Mayor of Sheffield; Prof. W. Ripper, J.P., M.I.CE., vice chancellor of Sheffield University; Capt. Mark Rundle, D.S.O., R.N.; Prof. W G. Fearnside, M.A, Sorby professor of geology, Sheffield University; Major D. Gordon, R.A.F.; Captain A. Hayes, R.A. F., general secretary B.F.A.; W. Clarke; P. B. Brown, M.I.C.E; P. Crosbie; J. M. Savage; A. S. Capron; J. M. Allan; C. E. Siddall; H. C. Else; A. Senior; F. J. Crowley; H Newbould; J. Little; J. G Crowther, past president Sheffield branch B.F.A.; T. W. Willis, president Sheffield Society of Engineers and Metallurgists; W. Mayer, past president B. F.A.; F. W. Finch, founder and treasurer, B.F.A.; J. D. Carmichael, president, Newcastle branch, B.F.A.; F. J.

Cook, past president B.F.A.; J. Shaw, past president Birmingham branch B.F.A.; H. L. Reason; J. G. Robinson; A. Whiteley, secretary Sheffield branch B.F.A.; Dr. P. Longmuir, past president, B.F.A.; Dr. W. H. Hatfield, president Sheffield branch B.F.A.; J. Watson; J. Ellis, past president B.F.A. and A. O. Backert.

Addresses were made by J. M. Savage, lord mayor of Sheffield; P. B. Brown, W. Clarke, Capt. Mark Rundle, Dr. W. H. Hatfield, Prof. W. Ripper, John Watson, Thos. H. Firth and A. O. Backert. In the addresses of welcome and response the importance of Sheffield as an iron, steel and foundry was emphasized. Sheffield district furnished 90 per cent. of British steel requirements during the war. Mr. Firth, in introducing the guest of the evening, pointed out that the British Foundrymen's Association, although founded only in 1903, now has 1,600 members, and is, therefore, the largest foundrymen's association in the world.

In responding Mr. Backert referred again to the unusual warmth of his reception. He extended a cordial invitation to visit the international exhibition of foundry and shop equipment and the 24th annual convention of the American Foundrymen's Association, which will be held in Philadelphia during the week of September 29. Mr. Backert also sketched the foundry development of the United States and made a few remarks on the labor situation and in conclusion expressed his appreciation of the great technical achievements of the British castings producers.

The final welcoming function tendered the president of the American Foundrymen's Association was held at Birmingham, Monday evening, May 5. Dinner was served at the Queen's Hotel, after which a general meeting was held at Birmingham University. As previously mentioned this dinner and meeting were held under the joint asupices of the Birmingham branch of the British Foundrymen's Association, the Birmingham Metallurgical Society, the Birmingham local section of the British Institute of Metals and the Staffordshire Steel and Iron Institute. The toast to the King was proposed by Mr. Backert. At the general meeting at Birmingham University Prof. Turner said that the Staffordshire Iron and Steel Institute is one of the oldest institutions in the world. The necessity for closer international co-operation along technical and scientific lines was also pointed out by Prof. Turner. A brief discussion of the qualities of malleable iron took place. It was stated by Mr. Cook that the tensile strength of malleable castings made in British foundries averages nearly 60,000 pounds per square inch, these figures comparing unusually favorably with the results obtained in American foundries.

In his concluding address at Birmingham, Mr. Backert again expressed his appreciation of the warmth of British hospitality and his belief in the necessity for fostering closer relations between the productive industries of the United States and the mother country. He also referred to the great achievements of Prof. Turner in the metallurgical field, and pointed out that science is really the only international language. He also urged the promotion of closer relations between scientists ond foundrymen in order to improve the art of making castings throughout the world.

PHILADELPHIA FOUNDRYMEN'S ASSOCIATION

The above association held its 28th meeting at the Manufacturers' Club, on Wednesday evening, June 4, 1919, at 8 o'clock, this being the last meeting until September.

The program for the evening was as follows:

H. A. DeFries, chief engineer of Hamilton & Hansell, Inc., Park Row building, New York, showed slides and gave a talk covering the Rennerfelt electric arc and melting furnace for melting steel, brass, copper, nickel, ferro-manganese, etc.

He based his explanations chiefly on the points of applying the proper way of electric heating at the proper moment. These points were not included in their last address.

Don't forget the A.F.A. and foundry exhibit beginning the week of September 29, at the Commercial Museum, 34th and Spruce Streets, West Philadelphia.

It will be the greatest event of the foundry world, as England, France and Italy will be there to show America what they learned in foundry practice during the world war.

The members of this association will give the delegates and their women folks a most cordial welcome.

The above is respectfully submitted.

THOS. DEVLIN, President. HOWARD EVANS, Secretary.

CHICAGO FOUNDRYMEN'S ASSOCIATION'S LETTER

The wage rate for moulders in Chicago has been fixed for another year at 80c per hour or $6.40 per day of 8 hours with 10 per cent. additional when working shift other than regular one. The Chicago Foundrymen's Association signed an agreement to that effect dating from May 1. It also provides a scale for apprentices, who are to receive 40 per cent. of the minimum rate to moulders at the start and increases thereafter fron 2 5-8 per cent. of the minimum moulders' rate at the end of 6 months and similar increases at the end of each 6 month period thereafter until the increases shall have reached 6½ per cent. at the end of 42 months.

The 44 hour week proposition of the moulders was rejected by the foundrymen as being economically dangerous at this time.

Wage Rates for Chippers

The question having arisen, "what is the proper wage rate per hour to pay chippers?" the executive secretary took a telephone survey of the membership last Friday, ascertaining the following facts:

1. Most of the foundries work chippers 10 hours.
2. Wages per hour vary from 40c to 58c.
3. More foundries pay 45c than any other rate.
4. An equal number pay 42½c, 43½c and 50c.
5. Some foundries pay various amounts, according to the man.
6. The average rate appears to be between 45c and 50c.

Hamilton, Ohio, Agreement

Founders and moulders have reached an agreement as follows: Eight and a half hour schedule at $6.50 per day until Sept. 1, 1919; eight hours at $6 from Sept. 1, to April 1, 1920.

Co-operation Between Employers and Employees

A bill has been introduced in the House of Representatives at Washington to create a commission to devise a policy of co-operation between the employing and the working elements of the U.S., by conferring and studying the relations between these elements, and to report a plan for a permanent joint council of eight members, four to be substantial, representative members of the employing element, and four to be substantial, representative members of the working element, the commission to be known as the Joint Economic Commission. The executive secretary will attempt to obtain copies of this bill for any member who may be interested.

U. S. Employment Service

House Resolution 4305 has been introduced in the House at Washington to perpetuate the United States Employment service. The bill originates in the Commerce and Labor Department and carries an appropriation of $4,000,000. It is practically the same bill as that introduced last March which carried an appropriation of $14,800,000. Our membership should freely express themselves as to whether the U.S. employment service is of any real value to them.

Keep the Benefit

If you use your ingenuity in your business, in manufacturing your product, and thus are able to "cut your costs." don't give the extra profit you make to your customer. Keep them for yourself; your ingenuity is worth it. Besides your customer expects, and is willing, to pay the normal market price.

Executive Committee Meeting

The executive committee met last Wednesday at 2 p.m. They examined and considered the draft for the constitution and by-laws and decided to recommend it for adoption by the Association at this week's regular meeting of the Association, on Thursday, at Hotel Morrison, 12.30 p.m.

This proposed new constitution will provide for admitting to membership any manufacturer of metallic casting goods, regardless of whether he elects to operate a union shop or an open shop, the two classes of members being formed in two departmentals, the closed shop departmental and the open shop departmental, for consideration and action on all matters pertaining to labor and employment, but in all other matters—matters pertaining to business betterment, the members will be associated together.

The proposed new constitution also provides a much better organization in that the board of directors (the present executive committee) will consist of the chairmen of the two departmentals and the chairmen of the standing committees, thus admitting of the closest kind of co-operation and co-ordination and of a wider use of the membership. Members are requested to study the proposed instrument and come to the meeting Thursday prepared to act intelligently on it.

The executive committee also transacted a considerable amount of routine business.

In Touch With Other Associations

Our executive secretary is constantly getting in touch with other foundrymen's associations and kindred organizations and expects in the future to give our membership the benefit of much valuable information in an exchange arrangement with the secretaries of these other organizations.

General Business Situation

From the preponderance of "entrance" cards over "leaving" cards received at the central office during the past week, the indications are that business among our members is gradually picking up. One or two report they are running full capacity, others report from 50% to 75% capacity.

It is generally conceded that the signing of the peace treaty last Saturday will be the beginning of a long period of prosperity, but this wil move on us gradually as there are a great many adjustments to be made before real peace conditions are once more attained.

Mr. M. W. Mix, president of the American supply and machinery Manufacturers' Association, when speaking before that body in recent convention at Pittsburgh, stated that from conferences with members attending the convention he ascertained there had been a "noticeable upward trend in business"; that many jobbers anticipate a shortage of materials and when business gets back to normal a more than ordinary shortage of labor.

Mr. Dickson C. Williams of the Chicago Nipple Mfg. Co., reports he returned recently from an extensive business tour of this country and that he is highly optimistic regarding the business outlook, having discussed the situation with prominent men in position to offer facts. Mr. Williams learned that a general improvement in business conditions througout the country is expected, starting particularly in the Middle West and reaching a high mark in July. Prices will not be decreased materially. He found the labor situation acute.

In view of the above outline of the situation, many of our members freely predict that prices of iron and scrap will go higher instead of lower, and that now is the time to buy for reasonable needs. Speculation buying, however, as a protection against a rising market should not be indulged in, but rather our buying should be along conservative lines, but above everything else there is nothing in the business situation but that justifies the maintenance of prices on a firm scale, adequate to meet all costs and insure a reasonable profit.

June Meeting a Success.

From the standpoint of real constructive work, the meeting of the Association last Thursday was a genuine success. The adoption of a constitution and by-laws built along broad lines for business betterment will make it possible to accomplish many things for our members which could not have been done under the old restricted instrument. It may now be plainly shown that while our labor problem will always be with us, it is not the only obstacle that confronts the foundryman on his road to prosperity, and the new constitution provides the machinery for handling these other problems.

The Peace Treaty and Labor

There is special interest for all employers in Part 13 of the Treaty, which relates to labor. An International labor office is created, and conferences will be held annually, if possible, between representatives of the governments, the employers and the workers. The conferences will make recommendations which will more or less automatically be enforced through a commission, back of which will be the League of Nations. Where a nation rejects the findings of the conference, a Commission of Enquiry is to be appointed. Its findings will carry with them a recommendation for economic pressure by other governments against any government which fails to accept and enforce the recommendations. A further appeal lies to a Permanent Court of International Justice, which also has the right to prescribe economic pressure to enforce decisions. The following methods and principles are to be considered by the various conferences:—

"First: The guiding principle above enunciated that labor should not be regarded as a commodity or article of commerce.

"Second: The right of association for all lawful purposes by the employed as well as by the employers.

"Third: The payment to the employed of a wage adequate to maintain a reasonable standard of life as this is understood in their time and country.

"Fourth: The adoption of an eight-hour day or a forty-eight hour week as the standard to be aimed at where it has not already been attained.

"Fifth: The adoption of a weekly rest of at least twenty-four hours, which should include Sunday wherever practicable.

"Sixth: The abolition of child labor and the imposition of such limitations on the labor of young persons as shall permit the continuation of their education and assure their proper physical development.

"Seventh: The principle that men and women should receive equal remuneration for work of equal value.

"Eighth: The standard set by law in each country with respect to the conditions of labor should have due regard to the equitable economic treatment of all workers lawfully resident therein.

"Ninth: Each state should make provision for a system of inspection in which women should take part in order to ensure the enforcement of the laws and regulations for the protection of the employed.

"Without claiming that these methods and principles are either complete or final, the High Contracting Parties are of opinion that they are well fitted to guide the policy of the League of Nations; and that, if adopted by the industrial communities who are members of the League, and safeguarded in practice by an adequate system of such inspection, they will confer lasting benefits upon the wage-earners of the world."

Scrap Iron Market

The past week has been one of real activity in the Chicago scrap iron market, says "The Waste Trade Journal." Almost every grade of scrap has been moving, thereby strengthening prices. All classes of users are now in the market except implement manufacturers and the railways, and when they come in, which is predicted soon, further stimulus to the market may be expected. Gross tons, dealers' buying prices, are quoted as follows on the principal items:

No. 1 machinery cast	$20.50	$21.00
Agricultural cast	20.25	20.75
Iron angles and splice bars	18.50	19.00
Stove plate	16.00	16.30
Country mixed iron	12.00	12.50

EDWARD T. MILLER,
Executive Secretary.

CORE MAKING BY BLIND SOLDIERS

The United States Government has taken up the question, in consultation with the National Founders' Association, of the employment in foundries of men who return blind from the war. An experiment made with a blind man at Baltimore inspires hope that success may be attained in teaching the blind how to make cores, although it is believed that some special devices may have to be perfected before sightless men can reach a production basis. Among others, A. B. Segur, industrial engineer, Conway building, Chicago, of the Red Cross Institute for the Blind is interested in the work. Officials of the National Founders' Association believe that the project will be successful, although some foundrymen are skeptical. Several Chicago foundries will be visited in the course of the investigation.

Moulding Mark-out Table from Skeleton Pattern

To Make a Clean Face This Was Cast Downward. The Design of Cope Was First Swept Up. After Ramming the Cope the Thickness of Casting Was Struck Out

By JOHN H. EASTHAM

A MARKING-OUT table measuring 13 feet long by 6 feet 6 inches in width, was required at short notice for the accurate laying out of bed plate, condenser, cylinder, and other marine work of similar proportions in the patternmaking department of a Great Lakes shipyard, choice of design and method of production being left to those mainly responsible in the persons of the pattern shop and foundry superintendents.

The risk of warping whilst cooling in a casting of the length mentioned and of reasonably light section being taken into consideration, evoked the idea of casting the plate in two sections of equal length, one of which is shown in plan and section at Fig. 1, of boxed out design, cross-ribbed as indicated, the ribs being the full depth of the casting to ensure stability. As the cost of a highly

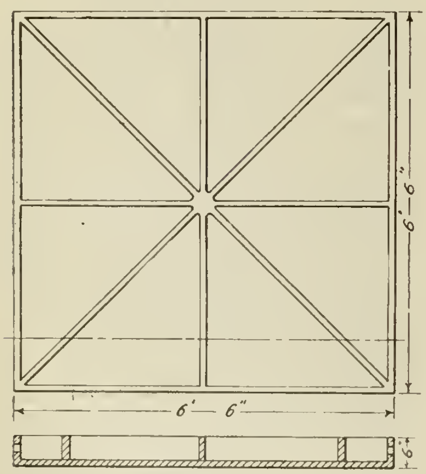


FIG. 1—HALF SECTION OF MARKING OUT TABLE.

finished complete pattern for this purpose was neither necessary nor desirable, a frame of correct size, allowing for the usual contraction, and similar to those used in the making of flask parts, was nailed together and delivered to the foundry along with a set of loose inside ribs, the proceedings in that department being as follows:

A pit approximately 9 feet square and 18 inches deep was opened up, a coke bed being spread over its bottom, and a 4 inch vent pipe laid in a sloping position from the coke to a point above the floor level and well outside the area to be covered by the cope flask, the pit being next rammed up with floor sand to a height of about 8 inches from the surface. A pair of 7 feet long straightedges were now bedded in 7 feet apart, their upper edges being 6 inches, or the casting depth, from the pit surface, a

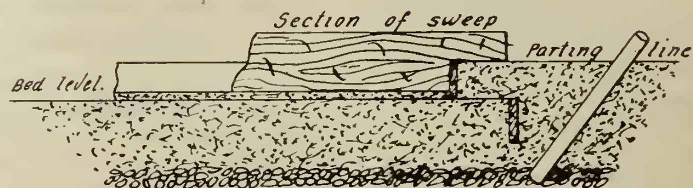


FIG. 2—THICKNESS BEING STRICKLED INTO SHAPE.

bed of floor sand being next rammed between them and afterwards struck off level, the pattern frame being then laid on the bed and the area inside it rammed up to a depth of 1½ inches, that being the thickness of metal allowed in the body of the casting prior to machining.

The rib pattern strips were now laid inside the frame, their function at this stage being to act as battens, thus preventing the frame losing its shape whilst the outside was in process of being rammed up to the joint.

That operation completed, the parting was made, the inside face being carefully strickled to correct depth of 4½ inches by a template strike. the mould at this stage being illustrated by Fig. 2. The ribs were next replaced. the cope flask being then placed over the parting and rammed up in the usual way, wood chocks wedged between the bars, with sufficient gagger reinforcement, taking care of the inside lift carried by the cope on its removal to allow of the withdrawal of the pattern and necessary finishing.

Previous to the removal of the cope after ramming, guide stakes were driven deeply into the floor at the four staking pieces provided near the box corners, the cope being then hoisted off, turned over, and finished, the inside of the drag mould being next strickled to its full depth of 6 inches, the frame pattern and inlet gates drawn out and the drag mould finished, following which the cope was lowered to place and secured by eye bolt and binder arrangement to a pit grating of type generally used in the handling of heavy pit work. The assembled mould with these details and location of gates and overflow risers is

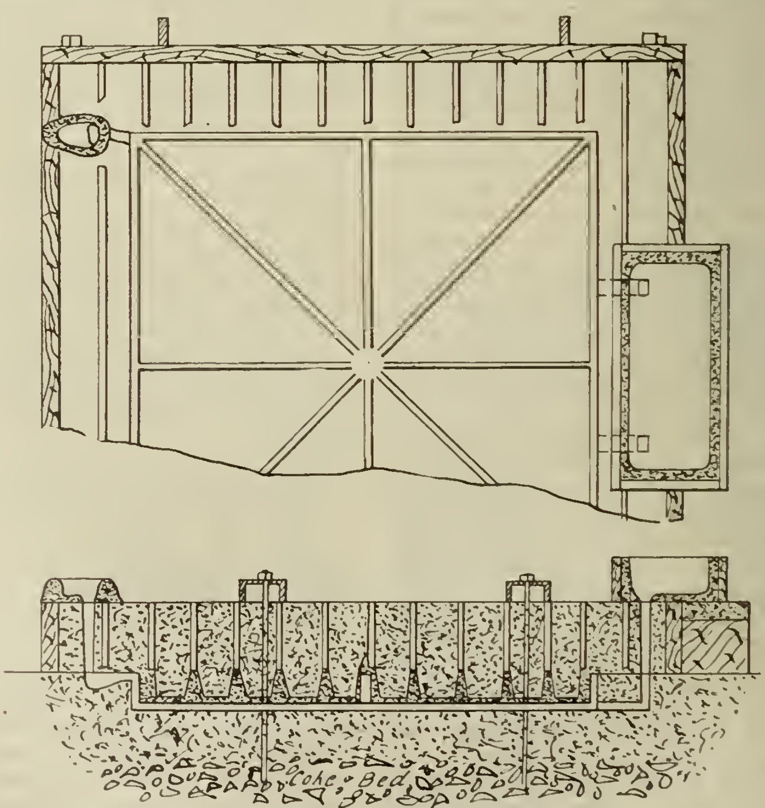
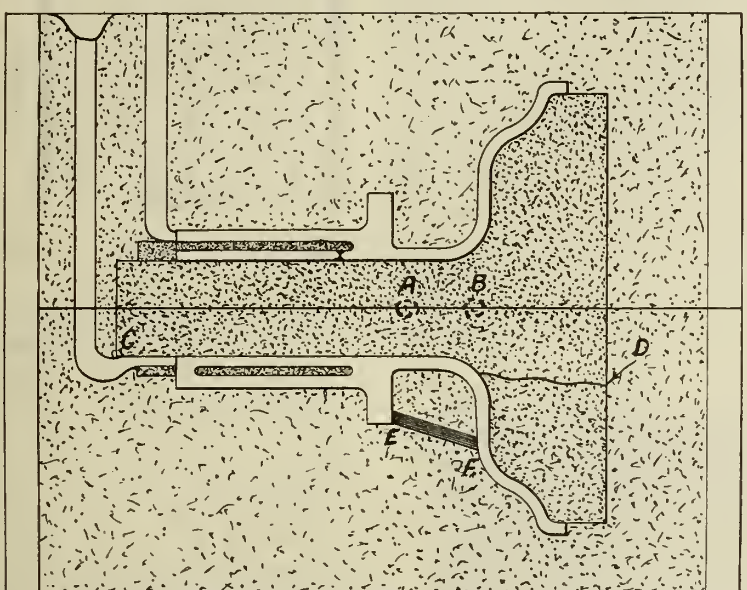


FIG. 3—PLAN AND CROSS-SECTION OF FINISHED MOULD.

shown in plan and section at Fig. 3, the "bottom pour" method of gating being employed as being less liable to scab or damage the mould during the rapid entry of the 3,800 pounds of metal required for each casting. Incidentally the four 2-inch round holes in each casting were intended to facilitate removal from place to place and turning over whilst cleaning and machining, the bolt holes at the joint or connection of the two pieces being drilled to template afterwards.



CYLINDER SHOWING HOW REMEDY WAS FOUND FOR COLD SHUT.

FREAK GRATING OF CYLINDER

A few years ago I got an order for fifty gas-engine cylinders like the above, and in checking up what success had been attained on the job before in the foundry I found that, counting what had been scrapped in the machine shop, the loss amounted to about 75 per cent.

As the casting weighed 725 pounds it had never been a source of profit to the foundry and I decided that I couldn't make it much worse, so would try to make a better record on it. The foreman in charge of that end of the shop gave it to the molder who had made the last lot, and I watched him to see where the trouble was.

I found that they had always been gated at A and B and came dirty in the bore. It was good luck that they saved any of them as the iron flowed into the crank case and backed up from there into the barrel, so I had gates cut under the core at C. The first one I had made this way failed or misrun on a line with D in the water jacket. This was caused by all the metal flowing into the crank case after the barrel was filled to this level, so I put a gate from the lugs to the crank case at E and F by having a small sprue pin rammed up at this point and drawing it out into the crank case after the pattern was drawn. I still used the gate under the barrel core and added a riser on the opposite side of the barrel core for a skimmer.

Out of the first 45 castings bored all were fine. They scrapped the 46th and I quit watching them in the machine-shop then, as I had ceased to worry by that time.

THE CONTRACTION OF CASTINGS DURING COOLING

METALS expand with heat and contract with cold, the same as many other things, and, generally, the rate of expansion has been pretty accurately determined, although in some cases it may be possible to have variations arising from well-known causes. A large cylinder cast on its side, for instance, does not contract equally both at the top and bottom, and if this is not allowed for in the pattern the cylinder, when cold, will not be round, but if cast on end the roundness will be maintained, while the bottom will be of less diameter than the top. Such points have to be considered when designing patterns, and only practical experience in dealing with the various articles will enable one to deal with the allowances which have to be made.

Leaving out special subjects, metal expands and contracts equally in all directions, but it is on the larger dimensions that either effect is most shown, a bar of cast iron an inch square and 3 ft. long apparently only shrinking in length, although in fact it has also contracted in bulk in passing from the molten to the solid state. A mould exactly 1 in. in cross-section will not give a bar 1 in. square, but the discrepancy is small, and in ordinary moulding the pattern will give enough additional size in drawing it from the mould to give an inch square casting, but this will not sufficiently increase the length to make up for the shrinkage incident to cooling.

Taking cast iron as an example, the shrinkage incident to passing from the molten to the solid state is .00,000,616 per deg. Fahr., and as the melting point varies from 1900 deg. Fah. to 2200 deg. Fahr., it will be seen that a difference in shrinkage will take place where various brands are concerned. To the melting point, roughly 150 deg. Fahr., has to be added for the heat of the metal when poured, and this may be exceeded in many cases, for which reason 150 deg. may well be taken as the minimum, the minimum pouring temperatures ranging between 2050 deg. Fahr. and 2350 deg. Fahr. This gives us a total shrinkage of between .012628 and .014476 in volume between the size of the bar when in a molten state in the mould and when at a temperature of, say, 50 deg. Fahr., and on each foot in length would show a shrinkage of roughly of from .151536 in. to .175712 in., or, say, from five thirty-seconds to eleven sixty-fourths of an inch. For practical purposes, however, it may be taken that an average allowance of three-sixteenths of an inch per foot run may be assumed to cover all requirements where work has to be machined, but where exact castings are wanted for work which has to be left as cast, from .15 in. to .175 in. must be allowed per foot run, according to the brand of iron used and the temperature at which it is poured.

In other metals the contraction is practically the same, except in what are called expanding alloys, in which bismuth forms part of the content, this metal preventing contraction; but generally with alloys the contraction is not the same as with the metals of which they are composed, each combination of even the same metals having its own rate.

Taking a bar of iron cast in a mould of 1 in. square and 1 ft. long, as shown in Fig. 1, the principal contraction would be as shown at A, the bar in soft iron very carefully melted in regard to temperature being only 11.848464 in. long by 0.987372 in. square, as shown at B,

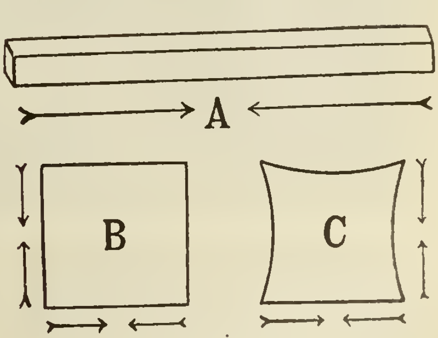


FIG. 1.

which would be scarcely noticeable without gauging. In some cases where a "hungry" iron was used and the edges were chilled, it is also possible that at the bottom in cross-section at the end, by measuring from edge to edge at the ends, an exact inch might be shown, the contraction really taking place more towards the central portions of the bar, the metal squeezing in as shown in the exaggerated section C, but usually this would be more likely to occur with poor scrap than sound new metal.

It is more with castings subject to different lines of contraction that difficulties arise, and particularly where the metal does not cool simultaneously, as in the wheel shown in Fig. 2 as an instance. In such a wheel the arms cool first and then the rim, the hub usually being last owing to its position, and usually the arms fracture at their junction with the

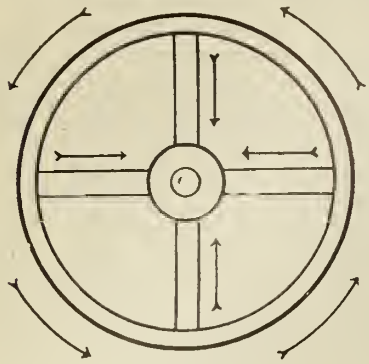


FIG. 2.

rim so far as two are concerned. Assuming the wheel is 3 ft. across inside the rim, and that the shrinkage is three-sixteenths in, to the linear foot, the shrinkage of the two opposite arms and the hub would be nine-sixteenths of an inch, or possibly ⅝ of an inch in some cases, as the metal would be poured hot. With a 3 in. rim, the extreme diameter would be 3½ ft., which gives a circumference of 10.995 ft. or 131.14 in., which is near enough 11 ft. for calculating purposes, and would show a shrinkage of 2 and one-sixteenth in. on the length of the rim, reducing the diameter to 41 and one-sixteenth in., with a diametral shrinkage of just over ¾ in., an eighth more than that of the arms and hub. If the rim could be cooled first, followed by the arms, and finally by the hub, fractures would not take place if the mould was not rammed too hard, but usually the arms have made their contraction before the rim becomes solid. If curved arms are used in a not too hardly rammed mold, there is enough elasticity to prevent fracture, but with straight arms there is certain to be a large percentage of failures unless the rims are very light. The shrinkage takes place in the direction of the arrows this, of course, involving movement on

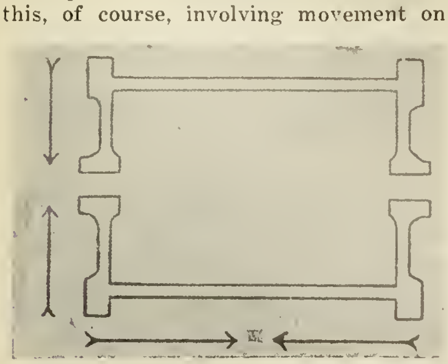


FIG. 3.

the parts of the rim attached to the arms, and to some extent such movement tends to accentuate the liability to fracture where straight arms are concerned, and a straight armed wheel with an equal number of arms will be found to suffer most.

Another form of double shrinkage is shown in Fig. 3, in which it is possible to find much trouble, a drum such as that shown coming very irregular in shape unless the core is sufficiently elastic to compress in all directions, both vertically and transversely. Even then there is always a chance of either the ends being bulged or the body being fractured, if the thickness of the metal is not well balanced and such things have to be made with great care, both in regard to design and workmanship in moulding. Some metals and alloys are worse than others to deal with in these forms, and often it is found easier to cast ends and body separate than to have them in one piece, as then the shrinkages are easier to deal with. Cores for this kind of casting are best struck up in loam on a good foundation of not too tightly wound straw or hay-band, as these are elastic enough to give under compression. In the case of arms or other projections inside cases or drums, there are other contractions which at times prove awkward to overcome, but these have to be dealt with individually as they occur, in accordance with their character.

In making wheels it is worth notice that if cast with a solid web, as at A in Fig. 4, fractures are liable to occur at the points indicated, but if cast with one or more holes, in accordance with their diameter, as indicated at B, frac-

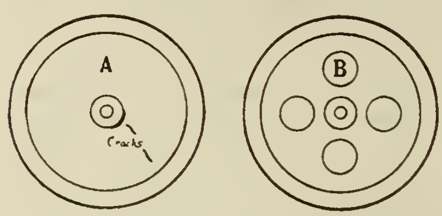


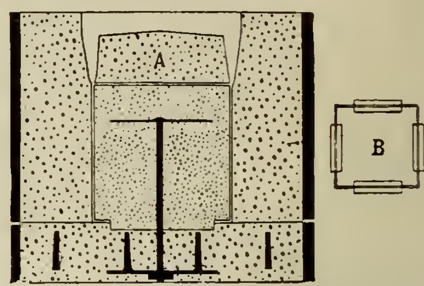
FIG. 4.

tures will not occur with iron of decent quality, and it often happens that trolley and similar wheels are best cast this way, as they wear better in addition to being sound. In some cases also it is advisable to chill the treads of wheels running on metals, but this presupposes the use of a tough iron for the job.

Advantage is taken of the natural shrinkage of metal in casting on brass or gun-metal casings to pump rams and the like, and in bedstead and other work where cast and wrought irons are combined, or where cast and wrought metals of other kinds form parts of the same article, the cast on part gripping very firmly. A soft metal cast on to a hard one, however, when subjected to a heavy rubbing or burnishing pressure will expand and become loose in time, the pressure causing it to expand, and the softer the cast on metal the more quickly will it become loosened. Thus a cast on leaden casing on iron, if passed over a "reeler" in a drawn tube mill will slip off quite easily, and even a steel tube will expand sufficiently to permit a mandril to drop out when the "reeler" is used properly.

CASTING THIN IRON BOXES

At one time the writer had to make some thin boxes for carbonizing electric filaments, and there was some trouble in getting them thin enough with a previous maker. These



SHOWING MOLD WITH PATTERN REVERSE SIDE UP.

boxes had to be made square 6 in. by 6 in. by 6 in., with an overhung top ¾ in. wide, on which a cover was luted and held down by screws in addition, the iron also having to be soft and non-chilling. The moulds were made as shown in the illustration at A, the runner arrangement being as shown, a narrow ingate about 4 in. long being on each side of the box as shown in the cross section B, the thickness necessarily being thicker than the walls of the boxes, which was 2 mm., with a permissive excess of 0.5 m.m., and the castings were well within limits everywhere, and soft at that. In regard to the metal used, this was Cartsherrie No. 3 foundry pig, and the sand was selected Mansfield, worked as dry as possible for the mould, and about half new and half old sand for the cores, these being particularly well vented. The metal was crucible melted, and used without addition of any kind, being poured at its most fluid stage. The cores were held down by bolts and nuts. as shown, to prevent the use of nails or other holding down device passing through the casting, this method being about the best that could be arranged. About 10 per cent. wasters were produced, and these did not arise from the thinness of the boxes, but from carelessness in skimming, which allowed dirt to enter the mould with the metal. Covers, 6 in. square and 2 mm. thick, were also cast, this being a very easy job in which no wasters were made, but in drilling holes for the screws one or two were broken. Of course the gates had to be sawn off and afterwards filed level, and when sent out the boxes were rubbed over with a piece of sandstone for fear that any roughness occurred on the surface. As an experiment one box was made only 1 mm. thick, but the cost would have been too much to have made any number of this thickness; although given a sufficient price they could be readily produced, but probably with a large percentage of wasters.

An Automatic Electro-Galvanizing Barrel

Many Advantages Claimed Over Old Method and at a Greatly Reduced Cost

By Frank G. Perkins

THE accompanying illustration shows an electro-galvanizing plant, developed at Brooklyn, N.Y., which is of great interest. A special automatic galvanizing barrel has been designed, which has given excellent results and a detailed description may be worth while.

It has been claimed that this automatic galvanizing barrel would galvanize materials to a state of perfection heretofore not attained, at half the cost of any other method. The operation was clean, simple and effective, and a mechanically perfect handling device. with exceptionally low cost of galvanizing, giving a durable coating, and a thickness of coating easily regulated.

The coating is smooth, bright and perfeet and threaded material requires no re-cutting. The capacity is 150 to 200 lbs. at a time, and the output, 2,000 to 3,000 lbs. per day. The cover of the barrel can be easily replaced and no expense is connected with the plant when not in operation, while there is required no heat and no fires to be kept overnight, with no gas and no odors to be obnoxious. The plant can be started or stopped instantly as desired, and the process neither affects the strength, temper or nature of the material in galvanizing.

The device is constructed so that shafting, bearings and working parts are not immersed in the galvanizing solution thereby possessing the particular advantage of avoiding the coating of these parts. In filling or emptying the barrel it need not be removed or lifted out of the solution. After picking and cleaning, the galvanized barrel is filled by means of pails, shovels, etc., with from 150 to 200 lbs. of material at a time, and is then started slowly in one direction, (in what we call the galvanizing direction), and in about 30 to 40 minutes the material is finished. Upon reversing the motion of the barrel, it therefore empties the galvanized material, (i.e., the contents of the barrel, in from three to four minutes) into a water tank, which contains a chute, and while therein, the material is washed free of the remaining solution. The chute shown in the cut is then lifted half way, in order to raise its contents out of the water. The material remains in this position for about 10 minutes to drain and dry, and is then completely finished, ready to be packed in kegs, boxes or receptacles, used for receiving the finished material.

As to the quality and thickness of coating, it is claimed that the thickness of the coating can be regulated according to requirements, and depends upon the length of time the material is allowed to remain in the galvanizing barrel while galvanizing. The coating deposited consists of chemically pure zinc, is absolutely perfect and protective, and is uniformly smooth and even over the entire surface of the material treated. In appearance the coating is bright, preferable to that of the hot galvanizing process, but, at the same time, not rough or uneven. The coating furthermore does not either affect the strength, temper or nature of the material galvanized. The material so treated need not be machined nor does the coating in any way affect it, therefore, requiring no re-cutting or re-threading of bolts, nuts, screws, etc.

It is pointed out that each barrel has a capacity of from 1,500 to 2,500 lbs. per day, depending on the weight and nature of the material to be galvanized, and upon the thickness of the coating required.

AN AUTOMATIC ELECTRO-GALVANIZING BARREL.

It is stated that one inexperienced laborer can attend to two galvanizing barrels, and turn out from 3,000 to 5,000 lbs. per day, completely galvanized, by attending to the following necessary work in connection with pickling or potashing as required, also cleaning in oblique tilting tumbling barrels and the galvanizing as well as removing from galvanizing barrel into water tank and from thence into boxes, barrels or receptacles ready for shipment.

It is stated that the cost of galvanizing depends on the number of barrels in use, thickness of coating required, and upon the nature of the material treated. It is equivalent to from 25c to 40c per 100 lbs., and up to this time, galvanizing by our process, as well as by the hot galvanizing process commanded a price of from $1 to $3 per 100 lbs. The great saving effected by the automatic galvanizing barrel is accomplished by reducing the cost of labor. It is not alone for this reason an improvement over the method employed by the hot galvanizers, but avoids a loss of spelter, the expense of fuel, prevents dross of the maintaining of fires overnight. The device is simple in operation, can be either stopped or started at will by simply stopping or starting the dynamo, and there is no expense incurred when the plant is not in use.

As to the durability of coating it is claimed that this process and device deposits a chemically pure coating of zinc. It will therefore stand any test that may be applied to the hot galvanizing process. This device will galvanize any kind of small material, as for instance, bolts and nuts (from the smallest size to 8 in. long), nails, rivets, spikes, screw, small castings and fittings, stampings, sash pulleys, lag screws, washers, springs, etc., in fact all such material excepting that having very deep recesses or hollow material which requires inside galvanizing. The solution furnished by us with the plant is permanent and need not be renewed, with the exception of small additions for maintaining same.

The British Foundrymen's Association has changed its official title to the "Institute of British Foundrymen."

It has been estimated that since 1880 Alaska has produced gold, silver, copper and other minerals valued at more than $419,000,000.

The Electric Furnace and the Non-Ferrous Metals

The Following Paper Was Read by the Author Before the Cleveland Engineering Society on March 11. The Utility of the Electric Furnace for the Melting of Non-Ferrous Metals and Their Alloys is Clearly Developed

By E. F. COLLINS, General Electric Co.

Continued from June issue

Of all the non-ferrous metals, copper has been known to and has been used by the human race from the remotest periods.

Its alloy with tin (bronze) was the first metallic alloy in common use by man, and so extensive was its employment at an early stage in prehistoric times that the epoch is known in archaeology as the "bronze age." Metallic relics of this age are still abundant.

Copper in nature is as widely distributed as iron, and occurs in all soils, minerals, waters, and ores. It occurs not infrequently in the native form, sometimes in very great masses, as on the south shore of Lake Superior, where pieces weighing 150 tons have sometimes been found.

almost all other metals, and large numbers of these alloys
Copper unites readily with
are of the greatest importance in the arts. Indeed, copper is equally, if not more, valuable as a constituent element of alloys than as a pure metal.

The primary alloys in which it is a leading element are first, brass; second, bronze; third, German or nickel silver.

Zinc, as a component of brass had currency in metallurgy long before it had an identity as a separate metal. Pliny speaks of a mineral or clay that could be used with copper in the furnace to make "aurichalum" (a copper alloy or brass). Stahl, as late as 1702, quotes formulae for brass, which included zinc ore or salts.

It is not known who discovered and isolated zinc, but we do know that zinc smelting was practised in England from about 1730.

So much the more important non-ferrous metals. Mankind, in the early days formed these metals into useful or ornamental devices largely, if not entirely through the agency of heat. Hence, the development of the furnace became necessary as the agency to be used for the melting of their metals and alloys. Due to the fact that they possess peculiar characteristics while in the molten state and while melting and forging, there has been continued effort from the earliest times to improve this most important heating device to meet the requirements.

The earliest furnaces for melting were probably the charcoal forges, and following this all classes of fuel-fired furnaces have been utilized with varying degrees of success, until we come to-day to the electric furnace as the latest type that is asking for the opportunity to demonstrate to the non-ferrous metal founder that it is free from many of the physical chemical and economic handicaps inherent in the "brass furnace" of the past.

Requirements for Economical Brass Melting

Satisfactory and economical melting of non-ferrous metals and alloys requires a furnace of the following specifications:

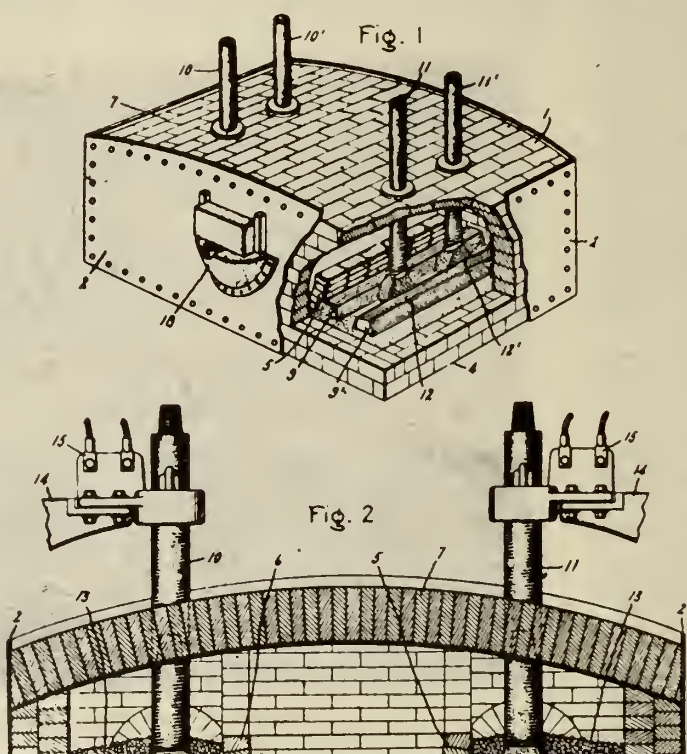
(a) Freedom from oxidation of metals or alloys while in the furnace, in fact deoxidation of metals or alloys in some degree is usually advantageous.

(b) Freedom from volatilization of metals should exist subsequent to their liquidfication and while in the molten state, to prevent loss of metal in the form of escaping vapor which usually oxidizes upon its escape from furnace to air, when the furnace atmosphere is neutral or reducing, i.e., free from oxygen.

(c) Freedom from slags during melting, which slags come from over-heated linings, dirt from scrap, oxides from metals, etc. This allows of dry skimming (during melting) of dirt, sand, and other impurities, without entrained metal in form of shot in the fused slag, that must subsequently be crushed and metal reclaimed by a more or less elaborate process. The furnace should not require the maintenance of an elaborate and expensive reclaiming plant. In other words impurities should float on the top of the bath in the furnace, in dry powdered form so that they may be skimmed from the surface of the bath. The furnace should allow of the use of sal ammoniac or other flux to aid in cleaning the metal while molten in the furnace, but it should not regularly require the use of such a flux to give perfect metal; neither should the bath require charcoal covering while melting or subsequently while held in furnace.

(d) Uniformity of the alloy and the absence of segregation should exist when the furnace charge has reached the pouring stage. i.e., test bars should show uniform physical characteristics throughout their length, and an alligator surface if you please, a perfect fracture, and satisfactory crystallation and lack of segregation under microscopic examination.

(e) Furnace linings and atmosphere must be free from sulphur in the slightest degree, and the furnace atmosphere controllable as regards oxygen when melting copper and many rich alloys rich in copper in order to produce satisfactory foundry castings of sound metal, since copper greedily absorbs sulphur and oxide when hot which give rise to trouble on cooling. In fact furnace melting chambers should be free from contaminating influences, coupled with a controllable atmosphere with respect to oxygen, in which case electrolytic cathodes, free from salts of the electrolytic bath may be melted down and be poured "at pitch" without "rabbling and poling," thus eliminating the use of the present-day reverberatory copper refin-



FIGS. 1 AND 2—SECTIONAL VIEWS OF BRASS MELTING FURNACE.

FIG. 3—INSTALLATION OF BRASS MELTING FURNACE.

ing furnace and permitting the making of brass directly from cathode copper as well as cathode zinc, thus saving one refining operation on copper and one melting or "pigging" operation on zinc.

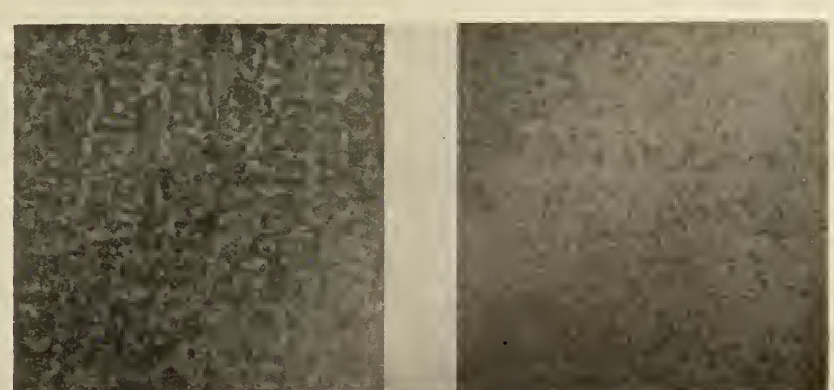
(f) Large capacity furnaces which do not involve the use of, and handling of crucibles are desirable where local conditions will permit. Large furnaces promote economy, due to higher thermal efficiency, save floor space in proportion to metal melted, save in labor, save in cost of lining per ton metal melted, especially when compared to crucible cost, their storage, drying and tempering, spill from broken crucibles, etc. To be sure where metal is melted in large furnaces, pre-heated hand ladles or crucibles are used to transfer metal to molds, especially where small foundry castings are being made, and it is important that these ladles or crucibles be well and properly pre-heated before using, especially when pouring small parts such as ½ in. brass valves, etc., in order to get satisfactory work, but the burden of the pre-heated crucible is eliminated several times over by the many advantages coupled with the use of the non-crucible tilting furnace above ordinary crucible capacities.

Refractories

Furnace linings should in the main be built from commercial refractories of moderate cost at all times available, such as standard fire brick and shapes, with limited use of special refractories where the results justify their usage, rather than use special refractories, which can be procured only at high price and with more or less difficulty and uncertainty. If the foundry man or melter will make repairs upon his linings at least once every two weeks, and when in severe service once each week, his lining cost will be much less than when special high-priced refractories are used and repairs and inspection of linings are less frequent. The refractoriness of linings should be such that it will not fuse or slag perceptibly at melting temperatures. Their inner surface should be glazed over at temperatures above the metal melting zone; this guards against slag formation during the melting process, assuming that no chemical reaction occurs between metal and hearth to reduce the fusion point of refractory. As an illustration the presence of lead in brass melting, fluxes refractories at temperatures at which they are immune in contact with the same bath free from lead.

(g) The melting chamber should be arranged so that its atmosphere may be reducing, neutral or oxidizing for certain metals and alloys, i.e., to repeat, its oxygen should be controlled. A certain flow of gas through the furnace may be required at times and at others a "dead" or "still" atmosphere is absolutely necessary. No advantage, however, is secured in attempting to hermetically seal the furnace unless some process of distillation is attempted. Hence, if doors are made to enter the furnace it is only necessary that they close in such a manner and are of such construction as to prevent an undue loss of heat and circulation of gases in the furnaces when they are closed. A single small opening in the furnace such as is required for stirring the bath or pouring may produce a sort of breathing of furnace when the vent is open, but loss of heat or metal is not appreciable if the furnace is being properly manipulated.

(h) Shallow bath promotes a more uniform and rapid melting and freedom from segregation than the deep bath. The source of heat should be a uniform mild "soaking" heat, and its temperature gradient above the bath should be moderate. This is due to a large absorbing surface, the bath takes in a large quantity of heat at a low heat potential. This transfer of heat to the metal is accomplished most successfully by radiation to the top of the bath and conduction to the bottom. Should the source of heat be only slightly higher than the charge when the fusing point of metal is reached, the metal may be held for an indefinite period within that zone of temperature above the fusing point in which vapor tensions are not sufficiently high to cause appreciable loss of metal from volatilization. In other words, if the source of heat is such that its temperature lies in the temperature zone safely below the destructive distillation point of the metal, then the bath can in no manner exceed it. A safe way in securing this heat control is to limit the temperature of the heat source by means of a pyrometer. Pyrometers are available at present, that live a satisfactory period in certain brass furnaces, which make their use entirely practical. It follows from the above that furnace design should be such as to allow of the source of heat being held at any temperature desired, just as one may vary the heat in a carbon filament carrying electric current, as against the same power expended in a carbon electric arc, i.e., the electric filament may have its temperature fixed at any point up to about 3,000 deg. C., whereas the carbon arc has a temperature of 3 000 deg. C. (approx.) which changes little with the size or power of the arc so long as the arc continues to burn. Likewise an efficient powdered coal flame or fuel oil flame is inherently a high temperature source, unsuited to best results in melting volatile metals and brasses. This is evidenced by the fact that brass alloys cannot be held in the oil furnace without



MICRO-PHOTOGRAPHS SHOWING POROSITY IN SAND CASTING DUE TO RELEASE OF ABSORBED GASES WHEN METAL FREEZES.

marked deterioration and loss of metal after it is ready to pour.

(i) Dependability and continuity of operation.

(j) Heat distribution should be fixed and if possible automatically controlled,

WIRE BAR AT PITCH.
CU—99.87
O— .084
S— .0022
CONDUCTIVITY NO. 12 WIRE—99.3
TENSILE STRENGTH NO. 12 WIRE—65207.
ELONGATION.

CU WIRE BAR (SULPHUR ASBORPTION).
SAME METAL FROM FURNACE AS NO. 1.
SULPHUR ABSORBED FROM POURING CRUCIBLE.

COPPER WIRE BAR SHOWING EFFECT OF GAS ABSORPTION.

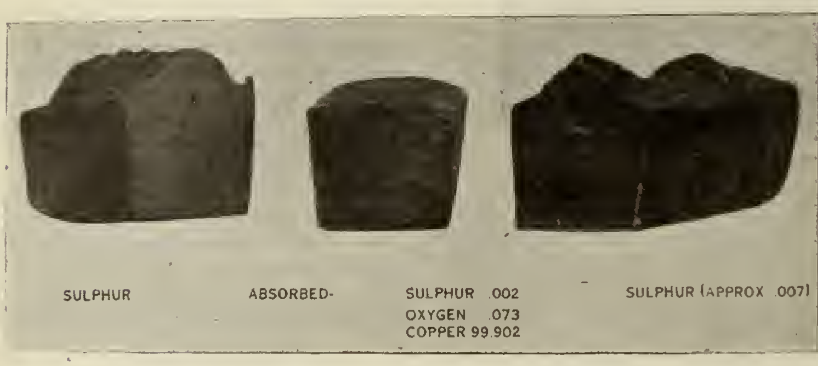


FIG. 5—EFFECTS OF SULPHUR ON COPPER.

i.e., heat received by radiation as related to that received by conduction should be such as to secure uniform heat of bath. If any variation in the ratio of heat radiated to top of bath and that conducted to bottom is permissible, this variation should allow of reduction of radiant heat at top of bath at once as the fusing temperature is reached for subsequently, due to the fact that when bath is liquid its bottom convected heat will give uniformity of temperature to the bath.

Electric Brass Melting Furnace

The foregoing sets forth more or less in detail the requirements for economy in melting brass alloys. It is now desired to consider the characteristics of the electric furnace and see how completely the electric furnace overcomes the obstacles met within the fuel-fired furnaces for melting non-ferrous metals and their alloys.

Classification of Electric Furnaces

Class 1

Furnaces in which heat is developed by the passage of current through a solid, laminated or granular conducting medium or resistor.

(A) The conducting medium may consist of material that is to be treated.

(B) The heat developed in the "resistor" is transferred to the charge by conduction or radiation, or both; a wall may or may not intervene between "resistor" and charge.

(C) A readily controllable amount of heat is generated between a fixed and movable carbon electrode, their distance apart being maintained such that the granular carbon lying between the faces gives rise to many chains of series and multiple contact or resistance arcs, enveloping adjacent electrode faces.

Class II

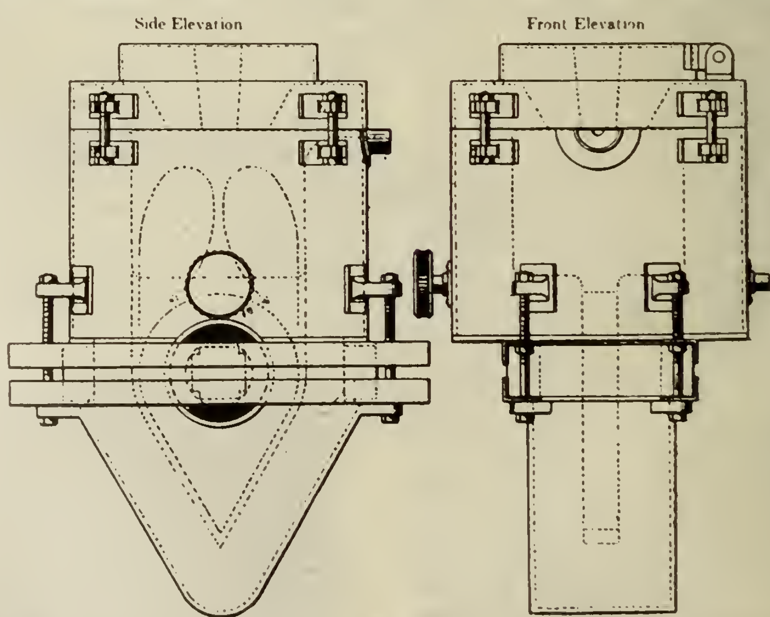
Furnaces in which heat is developed by the flow of current through a liquid or solid conductor.

A.—Electrolytic.

B.—Non-electrolytic.

Class III

Furnaces in which heat is developed by flow of current through gas or air.



FRONT AND SIDE ELEVATION DIAGRAM OF AN INDUCTION TYPE FURNACE.

(A) Arc furnaces in which arcs play between two or more electrodes near the material to be heated or between one or more carbon electrodes and the charge to be heated.

In the making of brass, furnaces lying in each of the three classes have been tried out. Furnaces lying in Class 1 and 2 lend themselves readily to the generation and control of a mild "soaking" heat such as is required for melting volatile alloys. As illustration the common resistance furnace lies in Class 1, and the induction furnace in Class 2. Furnaces in Class 3 generate too intense and burning a heat to be used with even questionable success in melting volatile alloys without the use of much unnecessary manipulation and watchfulness, requiring much skill. Control of the electric arcs in atmospheres high or low in volatile gases, freedom from surging, and low power factor and high metal loss are some of the serious problems confronting the man who would melt volatile alloys in the Class 3 arc furnace. Their employment had best be left for steel.

The speaker has had several years' experience with furnaces falling in Class 1 and Type C of the above classification, and it is upon experience gained from many tests as well as from its commercial operation in the foundry that the basis of this paper rests. I hope my hearers will, therefore, pardon me if I describe somewhat in detail the design and construction of this type of furnace and point out to you why it is suited to melting the non-ferrous metals and their alloys.

Description and Design of Furnace

This furnace is shown in section in Fig. 2. It will be noticed that it consists essentially of a refractory lined case, within which are located in the same chamber the heating units lying on either side of the melting hearth (3). The source of heat is (13) and lies in a duct separated from the bath by carborundum walls 5 and 6. This duct is fitted with cross electrodes 9, Fig. 1, and with wearing blocks, 12 under each of two vertical electrodes projecting through the arched roof. These cross electrodes in bottom of dust as well as the wearing blocks between them and vertical electrodes, are carbon. The whole duct is filled with granular coke to the height of bridge wall 5 and 6 on either side of hearth. Neutral electrodes 16 and 17 make contact with cross electrodes 8 and 9. These neutral electrodes are for the sake of automatic control as will be seen later. The vertical electrode carries a water-cooled ring where it emerges from the top arch, a cable clamp for electrode (15) Fig. 2 is also water-cooled. The two vertical electrodes (11) are terminals of one phase, while those marked 10 are terminals of another. In other words the furnace is inherently two-phase. By multiplying the two phases, however, it may be operated single-phase, or by using Scott transformer connections it may operate from a three-phase source. The phase voltage most satisfactory has been found to be 60 to 70 volts.

tween electrode 12 and wearing block 11 is held to correspond to one-half the phase voltage, i.e., 30 to 40 volts. A rheostat on the control panel allows for the setting of the control for any current value required, and when once set for a given value, this value is held until the rheostat position is changed by the furnace operator. Hence the power input is automatically held constant and is subdivided equally between the vertical electrodes. Starting with a cold furnace, heat is generated first in the granular carbon separator lying under the bottom face of the vertical electrodes. This immediately becomes incandescent by virtue of current carried by the carbon granules and is also heat generated in a multitude of contact arcs enveloping the lower end of vertical electrode. Heat is at once taken from this source by the granular coke in trench and its whole surface be-

throwing the heat received from the incandescent coke ducts on either side of the hearth uniformly on the hearth or bath. This heat is very uniform and what is called a mild "soaking heat," and hence lends itself well to the melting of brass or volatile metals, especially is this a fact since a part of heat supplied is supplied to the bath from the bottom and sides.

To enumerate briefly some characteristics of the above described furnace which make it essentially suited to melting non-ferrous metals and their alloys, we have the following: (1) Temperature of heat generating source controllable at will. (2) Heat generated is of the mild "soaking" type, uniformly distributed, and any workable temperature gradient may be maintained between the charge and heat source. (3) Heat is received by the charge from above, on

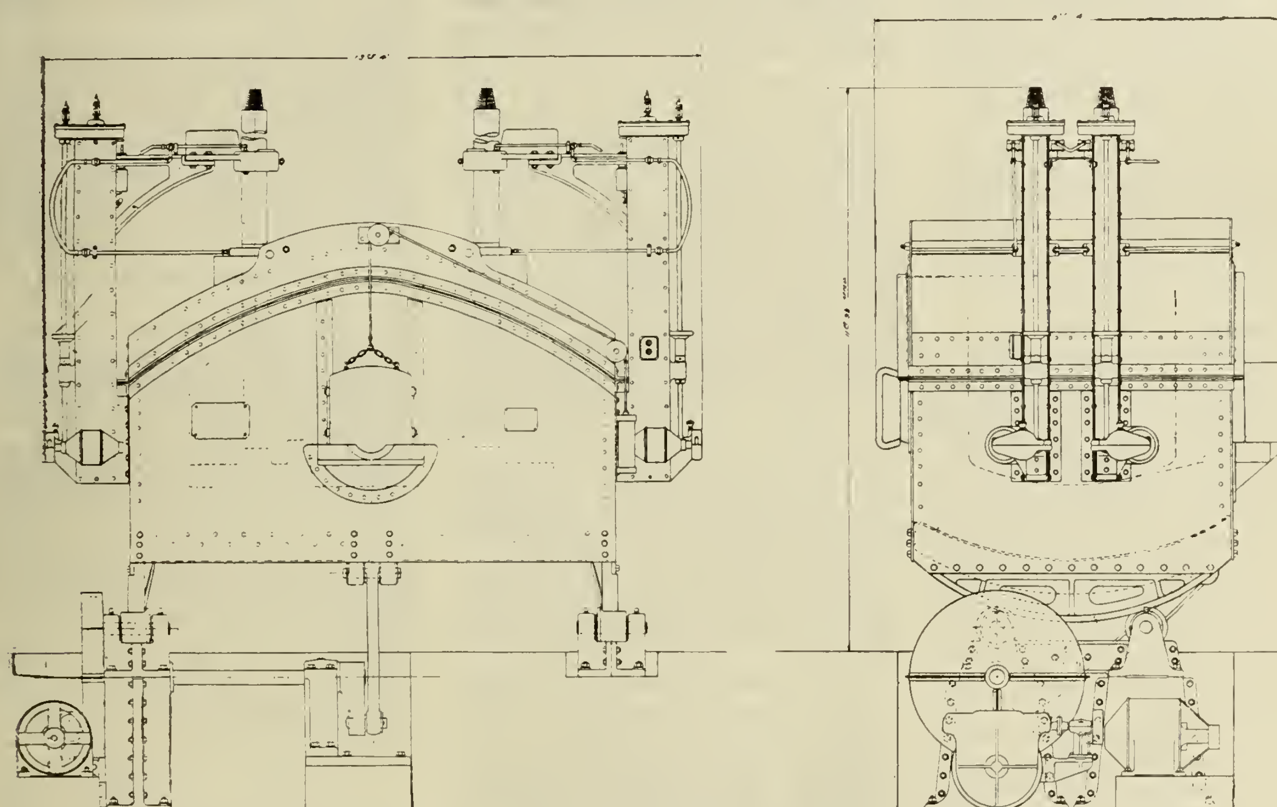


FIG. 4—1500-LB. BRASS MELTING FURNACE.

By reference to Fig. 1 the detail arrangement of the electrodes, etc., in the resistor duct is evident. The operation of the furnace in generating heat is as follows:

When current is supplied to the vertical electrodes of phases, it flows through the vertical electrodes 10 and 11 through a short space filled with granular carbon to the wearing block (12), Fig. 1, into the cross electrodes (9) into second wearing block (12) and out to line through the second granular coke strata and second vertical electrode. The value of the current is regulated automatically by varying the distance between the vertical electrodes and the wearing block. In other words by means of a current controlled relay the distance between 11′ and 12′ is governed, also by means of a voltage-controlled relay connected to the neutral bottom electrodes and vertical electrode 11, the distance be-

comes heated to the desired point. The surface of the granular carbon radiates heat to the arched roof, and the body of granular carbon and wearing block with cross electrodes, conduct heat to the furnace walls and to the sides and bottom of hearth with which they are in contact. Furthermore, as the furnace becomes heated a certain amount of current flows from the vertical electrode 11′ to vertical electrode 11 directly through the granular coke in a way similar to the simple carbon resistance furnace. This heat may be as much as 30 per cent. of that developed locally at each vertical electrode as above described through contact arcs and resistance. This heat is largely radiated to the roof since it is generated largely in the upper surface of the coke body. In addition to serving as enclosing wall of the furnace the roof is so shaped that it acts as a highly efficient reflector,

sides and through bottom. (4) Bath is comparatively shallow and large surface is exposed to receive heat, (bath depth is approximately 6 in. in 1,500 lb. furnace.) (5) Furnace has normally a reducing atmosphere, which may readily be made neutral or oxidizing. (6) Automatic control of power, requiring little attendance. (7) Furnace atmosphere free from contaminating gases. (8) "Dead atmosphere" practically restrained from escape exists normally in furnace. (9) Temperature is controllable, so that slags do not form in melting brass. Hence simplicity of metal recovery from dirt skimmed from top of bath in furnace. (10) The furnace may be "forced," i.e., heat may be fed to metal as fast as it is absorbed and high rate of melting results with all its advantages and none of the disadvantages met with in dual fire furnaces.

(To be continued.)

Semi-Steel and General Foundry Practice

Address Delivered at the Annual Convention of the Southern Metal Trades' Association, New Orleans, Louisiana, May 5-6, 1919

By DAVID McLAIN, McLain's System, Inc., Milwaukee, Wis.

WHEN your energetic and affable secretary, Mr. Dunn, extended to me the invitation to talk to you to-day, I was pleased with the honor. During the past few years I have spent considerable time in the South, and have met some very fine gentlemen among the foundrymen and other trades, and it gives me great pleasure to again meet many of these here to-day.

I know the majority present are interested in a superior quality of either gray iron, semi-steel or steel—and how to secure this quality at less cost, and this is what I will try to discuss.

With this aim in view, and the limited time, I can touch only briefly on each subject. This discussion will be from the viewpoint of a practical foundryman who has worked through the various processes of steel, iron and semi-steel, as molder to manager and advisor to foundrymen.

Originally Steel Maker

It will give you more confidence to know that originally I was a steel maker —had charge of the first successful crucible steel foundry and the first converter in the United States devoted to the manufacture of Bessemer steel castings—also had charge of the first open hearth furnace west of the Allegheny Mountains, so you see I am no amateur at the business. All claims are based on actual practice—on cupola platforms or in front of steel furnaces. It was this vast experience in the steel and iron foundries that led up to an investigation of semi-steel.

Generally you will find that it is some simple instance which really was responsible for all great ideas or inventions. When a boy, I believe the original idea of melting steel in the cupola was brought to mind while helping Scotty the blacksmith. His helper is a helper yet, if alive, as he was one of those who lacked initiative, and never would start a job until Scotty was ready.

Boy-like, I watched Scotty, and whenever Mike the helper wasn't handy, I'd grab a sledge and help. Not knowing much about cast iron or steel those days, I was just as apt to put a cast iron rod into the fire as a steel one, and frequently had both in the fire at one time—then Scotty would point out the gray iron rod.

With the bellows working hard, the steel rod generally showed signs of melting first, and I might have forgotten this fact if it hadn't been that I always firmly believed steel scrap could be utilized in the cupola, although older heads ridiculed the idea.

About 27 years ago I had charge of a Bessemer converter and learned that my predecessor allowed the gates and risers and defective steel castings to accumulate—as he did not believe steel could be melted in the cupola. However, in addition to his inability, there was no incentive to save on material, as Bessemer pig cost only $1 per ton more than scrap. We had a 7-ton converter, melting 4 to 6 heats on alternate days—a tonnage of 28 to 42 ton per melt—30 to 35 per cent. of which was scrap. Can you imagine any ambitious foundryman allowing this to continue without any effort to utilize it?

Steel in Cupola Mixtures

Melters and gray iron foundrymen unanimously agreed that it could not be melted in a cupola. Finally one evening while the melter was having his beer, I persuaded him to try some steel in the cupola the following day, which he did, without serious results, and we continued to use more and more. Before I had finished experimenting, as much as 60 per cent. steel was melted in the cupola. The ordinary run was from 30 to 40 per cent. steel, and we made better converter steel castings by doing so.

We brought foundrymen from other shops to see us charge steel in the cupola, and while they saw the resultant metal still they would remark:

"That's all right, McLain; you may be able to do this in the steel foundry, but you never could do it in the iron foundry."

A book could be filled with amusing and some serious incidents while passing through this stage of experiments, but it was not near as interesting as what led to my experiments in 1900, while in charge of the Christensen Engineering Co., Milwaukee, when Mr. N. A. Christensen, the well-known inventor of the street railway air brake, and a very efficient engineer, allowed us only 5-16 in. of metal on his cylinder heads, which had to stand 200 lbs. air pressure.

Now mind you, gentlemen, the step in advance he was making—as other engineers of that day allowed us 1 to 2 in. of metal for this same test. So here was an opportunity to demonstrate what steel scrap would do, and the result was startling.

Ordnance Dept. Specifies Semi-Steel

The real reward of my efforts in perfecting my methods, as well as trying to convert foundrymen—came when the Ordnance Dept. specified semi-steel for shells in 1918, as well as conferring upon me the honor of foundry expert, and I assure you, gentlemen, it gave me great pleasure to do my bit.

The war ended, shells were no longer required, but a new consciousness of the importance of making good semi-steel was brought home to foundrymen in America when the Ordnance Dept. requested foundrymen everywhere to submit test bars and bids, covering gas and high-explosive semi-steel shells. It caused a greater sensation among foundrymen than the war itself—as every firm believed they could make semi-steel shells—or if they couldn't, their foreman or superintendent could, so they wrote Washington for specifications.

While a minimum of 32,000 lbs. tensile strength per square inch and an impact test looked rather stiff, hundreds began making test bars, but very few were able to actually produce shells.

Why? Because it is necessary to understand the science of mixing and melting steel scrap in cupola mixtures, and very few knew that, although they thought they were making good semi-steel.

While it cost foundrymen an enormous amount of money to learn "they didn't know how to make good semi-steel"—still if they learned a lesson, it is money well spent.

Engineers of all trades—machine builders and others, are continually searching for stronger metals, and if 10 to 50 per cent. steel scrap added to cupola mixtures will increase the strength of the metal 25 to 60 per cent., progressive foundrymen are going to make it.

Following shows the increased strength over gray iron mixtures when using 10 per cent. steel:

Semi-Steel vs Gray Iron

Gray Iron	Transverse Strength	Deflection
Average trans. strength....	2252 lbs.	3/16"
Minimum trans. strength....	2180 lbs.	3/16"
Maximum trans. strength....	2310 lbs.	3/16"
With 10% Steel.		
Average trans. strength.....	2900 lbs.	3/16"
Minimum trans. strength....	2760 lbs.	3/16"
Maximum trans. strength....	3020 lbs.	3/16"

You can justly see why we claim that in the near future there will be no straight gray iron mixtures.

While many present may not have taken interest in micrographs of gray iron or semi-steel, still it might be well to cite that the microscope shows what analysis does not. Ordinary gray iron is streaked with flakes of graphitic carbon, which break the structure of the metal, making it brittle, weak and porous. A micrograph of semi-steel shows that the graphitic carbon is in exceedingly small and evenly distributed granules—which is characteristic of good semi-steel—insuring a stronger metal than gray iron, more homogeneous, free from sponginess or segregation.

The increased strength of semi-steel

permits reduction of section and we would be glad to have you examine these small auto and aeroplane pistons made of 20 per cent. steel mixture, cast 5-32 in., machined down to 3-32 in.—the aeroplane cylinder machined to a paper edge.

Flexibility of operation is one of the many advantages of semi-steel, as you may run 30 to 40 per cent. steel on bed charge; then follow up with 20 to 25 per cent. steel, or vice versa.

Foundrymen who still cling to gray iron mixtures do not realize that when melting steel in the cupola, high carbon coke is used for fuel and when the steel comes in contact with this fuel, owing to the very low percentage of the elements in the steel, it has a strong affinity for them, particularly carbon—consequently when the steel is heated to redness, it begins to absorb carbon, and when the steel and fuel both become incandescent, the steel becomes saturated with carbon. In this state it is not steel as we know it commercially, but a high carbon metal—and as the carbon increases, the melting point of the steel decreases until the temperature at which it will melt is lower than the temperature of the cupola.

Scientific Melting

It is surprising to learn that one foundryman is able to make high grade castings with minimum losses, while a foundryman in another shop using identically the same grade of material, equipment, etc., is having heavy losses with the same class of work. My answer is that No. 1 is following scientific melting.

Why is it possible for one foundryman to use 30 to 50 per cent. steel in castings of certain section, while the shop across the way uses only 10 to 15 per cent. steel in like section? Again, I say, scientific melting.

While systematizing foundries it was a continual puzzle why such poor melting conditions existed in the average foundry, as scientific melting had become my hobby and more than ever, after my experience in various shops, I decided to make cupola practice fool proof—that is, give foundrymen standardized rules for arrangement of cupola, detailed method of charging, delivering of air, etc.

The foundryman who will set aside tradition and follow these rules has learned the secret of production of gray iron and semi-steel castings of the highest quality at the least cost.

I find that 90 per cent. of the cupolas are melting only 50 to 60 per cent. of their capacity—although you can expect the best and hottest metal only when cupola is operated up to its capacity.

Again foundrymen use 60 to 70 per cent. pig iron when 30 to 40 per cent. might produce better castings, if they followed scientific mixing and melting, and used the maximum amount of steel scrap.

In my special work in foundries, invariably I find large money losses which result from castings that are not gated right, or perhaps the patterns have not been made to mold in the best way.

Frequently by changing the bottom gates to top gates, pouring from the top instead of the bottom, we make quick savings, while at other times we find it necessary to change the construction of the patterns, core boxes, flasks, in fact, the entire layout—so you see, gentlemen, while good melting and mixtures are very important, that is not all.

In my travels I frequently meet some very intelligent men in charge of cupolas, and it pleases me immensely to explain to them many points which heretofore were not clear to them. In this manner we rouse an ambition that results in a better melting condition, for they begin to specialize on the subjects we discussed.

Show Molders Actual Costs

You take the average molder who believes that only his labor is lost when probably half of his day's work is scrapped. But when you tell him of your overhead cost—of all the money spent in preparation for pouring that casting, and that you have paid for everything except the cleaning of the casting—his eyes are opened and he realizes for the first time, you lost $8.00 or $10.00 in addition to his wages on that casting.

One firm in this territory, after purchasing our system and gaining quite a reputation for making semi-steel, suddenly reported heavy losses and trouble. They asked me to visit their plant, and in witnessing their daily heat, the first few charges of semi-steel were cold. I questioned everybody on the job, but the old story,—each and every man was following the proper instructions.

Inaccurate Reports

As the cupola had been charged, I was helpless for the day, but was in the shop bright and early the next morning and found the foreman calculating a new mixture, but I demanded that the mixture of the previous day be used, which of course, he agreed to, as I was called in for expert advice.

I told the melter to call me when he was ready to light up, and discovered that after he did light up, he went on about his business. I waited on the platform to learn when he intended to put on more coke, and by so doing discovered the cause of their trouble—he allowed the bed to burn out. I did not call him as I wanted to see just how long he would wait, and when he finally happened to think it was time to throw on more coke, the first coke had nearly burned to ashes.

Of course the usual story.

"This is the first time it ever happened." Probably this is a frequent occurrence in other shops as well.

Vise Castings

For the benefit of some who are not familiar with the manufacture of vise castings, it is well to state that there is a piece of steel cast into each jaw of the vise.

It was the custom for years and probably is to-day, when making vise castings to follow an old process which was: First, the jaw steels were milled thoroughly—put in acid until perfectly clean and then tinned. Special fluxes were also used. There were great losses on several sizes of vises, and to the close observer it was apparent something was radically wrong.

The loss was caused by the steels not fusing with the iron, whether they were tinning the steels and using fluxes or not.

We helped a vise manufacturer to reduce his losses which were quite heavy, the cause being that the steel in the jaws did not fuse with the iron.

Investigation proved that by flowing sufficient metal through the mold, these steels would be fused with but small casting losses. The metal, of course, must be melted very hot and the founder should be able to judge just how much metal it would take to fuse the steels successfully. For instance:

A 4 1-2 inch vise requires a steel 3-8 inch by 1 inch thick, and to pour this 4 1-2 inch vise with gates and all, it would require 45 lbs. without an overflow of metal and this amount of metal did fuse the jaw steel nicely.

Now, a 3 1-2 inch vise will require the same size steel, but it will only require about 25 lb. of metal to fill the mold, and this will not fuse the steel.

If the steels in the 4 1-2 inch vise were fused, while those of 3 1-2 inch were not, it was evident that there was not enough metal flowing through the mold to fuse the steel.

Oxy-Acetylene

While experimenting with steel scrap in making semi-steel some twenty years ago, I found it impossible to secure satisfactory metal with high blast. This is fully discussed in our semi-steel lessons, and the chemistry of that process is similar to the oxy-acetylene process of cutting or burning steel or wrought iron.

We learned years ago that steel was violently attacked by excessive oxygen delivered under high blast pressure in cupola melting and when steel is heated to redness by the acetylene, it will then actively combine with oxygen, which oxidizes the metal along the path of the flame.

It will oxidize or slag, similar to steel in the cupola under high blast, and as the slag has a lower fusing point than steel, it will run off.

All Scrap Mixtures

We have many clients in far-off lands—in Australia, South America, British Isles, India and South Africa where McLain graduates are making better mining castings than ever before, using only all gray iron scrap, and steel scrap.

Before the war pig iron from Transvaal, South Africa, cost $100 per ton, so that they were very anxious to use as much scrap as possible, but not knowing how to make semi-steel, great difficulty was experienced in getting good castings when they cut down the use of pig iron.

After the war pig iron shipments were stopped, and the mine owners faced ruin, they thought. They wrote us that there were thousands of tons of steel scrap available at one pound ($4.87) per ton, and plenty of gray iron scrap.

Some of these clients use no pig since we taught them our system of melting steel and now we have letters to show they are producing better semi-steel castings for mining machinery without pig, than they did using 50 to 60 per cent.

Use of Chillers

Common sense is the greatest asset in any business, but good judgment combined with common sense forms a combination hard to beat in any business —the foundry is no exception.

We find that some foundrymen expect one mixture of either gray iron or semi-steel to make good castings from ¼ in. to 4 or 5 in. thick, and they may get by if it is city work or castings that are neither machined nor tested—but if the latter, I say it is very poor practice.

If the metal is soft for the small castings—it will show segregation for the large ones—if it is hard for the small ones, slow cooling, perhaps, will free the combined carbon and the large ones machine nicely.

Unnecessary Chillers on Planer Beds

Many foundries are owned by machine tool builders who still use chillers on the vees or guides, and in some of these foundries you will see more than 100 tons of different shaped chills that might be done away with by the use of close-grained metal.

Not long ago we discovered one using a mixture for vees and guides which ordinarily would be very suitable for good stove plate castings.

Malleable Iron

Since Mr. Enricue Touceda, of Albany, N.Y., has centred his attention on the improvement of malleable iron, it is now on a scientific basis, and in consequence he has been successful in increasing the tensile strength of more than 55,000 lbs. per sq. in. The malleable iron industry is now entirely operated by chemical analysis.

From a paper presented at the annual meeting of the American Foundrymen's Association, in Milwaukee, October, 1918, Mr. Touceda gave the following record of 24 successive heats on malleable, the bars having been received in three batches, the first consisting of twelve, th second of six, and the third of six.

First Lot of Twelve

Average ultimate strength, lbs.. 58,493
Average elongation, per cent .. 22.91

In this lot one bar had an elongation of 29.00 per cent. and another of 27.00 per cent.

Second Lot of Six

Average ultimate strength, lbs.. 58,033
Average elongation, per cent. .. 18.12

One bar in this set had only an elongation of 9.5 per cent., this lowering the average considerably.

Third Lot of Six

Average ultimate strength, lbs.. 57,371
Average elongation, per cent. .. 23.83

One bar in this set stood 30 per cent. elongation.

The average ultimate strength of the 24 bars is 57,969 lbs. per square inch, and the average elongation of the 24 bars is 21.62 per cent.

We agree with Mr. Touceda's statement that in the malleable iron industry a new era has dawned—a fact frankly admitted and acknowledged by the trade.

Let us hope that the malleable iron foundrymen will continue the pace set by Mr. Touceda.

Reduce Phosphorus in Basic Lined Cupola

I am wondering if any of you present have ever considered a basic lined cupola to eliminate some of your high phosphorus?

While operating a cupola in a converter steel foundry some years ago, I became greatly excited about a basic lined cupola, but my claims evidently had not much weight with my employer, as he would not allow me to experiment —nor did he take any further interest in it.

It would be a great boon for the foundrymen throughout the world if it were to operate a basic lined cupola, as we could reduce the phosphorus content of the metal.—Have any of you tried it? If not, why not?

We studied the cupola from every angle in our endeavor to learn the proper tuyere area for different size cupolas when experimenting with steel scrap in cupola mixtures, and in our desire to "standardize" cupola practice, we bettered the product—whether it was gray iron or semi-steel.

Adding steel scrap to cupola mixtures is of the utmost importance in foreign countries and in the South, where high phosphorus pig iron predominates.

Owing to the low phosphorus in steel, it should be your aim to use every pound of steel the section in question will carry —especially for castings that must stand hydraulic or other tests.

Suppose your mixture is 50-50, and the estimated analysis of phosphorus is 1 per cent. For every 5 per cent. of steel added, take out 5 per cent. of the 50-50 mixtures, and this 5 per cent. steel will reduce phosphorus .05, leaving .95 per cent.

10% steel—the approx. phos. in mixture.... .90
15% steel—the approx. phos. in mixture.... .85
20% steel—the approx. phos. in mixture.... .80
25% steel—the approx. phos. in mixture.... .75
30% steel—the approx. phos. in mixture.... .70
35% steel—the approx. phos. in mixture.... .65
40% steel—the approx. phos. in mixture.... .60
45% steel—the approx. phos. in mixture.... .55
50% steel—the approx. phos. in mixture.... .50

Oil Burning Cupola

Professor Bradley Stoughton of the Columbia University, a few years ago brought out a patent oil-burning cupola, which is now being introduced into gray iron foundries. One of these is in operation in a steel foundry in Milwaukee and the reduction of sulphur is remarkable.

Before introducing his process into the same cupola, the minimum sulphur was about .075—while the maximum was considerably higher, but since the Stoughton process was introduced, the minimum is .047, while the maximum is .058.

After 35 years in the foundry business, the writer is forced to admit a great deal of respect for the products of the cupola and as we have reported on more than 2,000 cupolas in all parts of the world, we are in a position to know that the cupola is little understood by the very men who should know all about it.

Annealed Semi-Steel

Those foundrymen who lack confidence in semi-steel will not be expected to believe that these castings are made of annealed semi-steel. This metal is made with:

20 to 30 per cent. pig.

20 to 30 per cent. steel scrap.

Balance semi-steel scrap, then annealed.

Annealed semi-steel is a very homogeneous metal that will twist or bend —may be hardened like tool steel—will stand a very high polish—will wear extremely well. Is suitable for hardware specialties, auto tools, and almost any tensile strength up to 70,000 lbs. per sq. in. is possible.

The Small Open Hearth for Malleable Castings

The Lenoir Car Works, Lenoir City, Tenn., is owned by the Southern Railway and for years they have been making car wheels, gray iron and malleable castings. In May, 1917, they installed one of our furnaces for melting steel and evidently it appealed to them for malleable, and following is a copy of a letter we received from their manager, Mr. H. N. Curd:

"As a matter of information, we took off a malleable heat in your furnace last Monday and it was absolutely the finest metal I ever saw. This may be a point in the game that you are overlooking and it might not be a bad idea to give it some thought. As you know, the usual time required for a heat in an air furnace is approximately four hours, while we took this heat off in exactly two hours from the time we commenced to charge.

"This would be a means of some of

the malleable shops who are over-crowded doubling their output, as they could take their heats in one-half the time, therefore reducing their floor space per molder by one-half, giving this additional space for an increased force.

"The open-hearth furnace may be used to make steel—semi-steel and malleable iron, but as any high grade electric or open hearth furnace of more than one ton capacity will cost from $15,000 up, we do not advise the installation of either of these, unless they might be used for all of the above—or as a strictly steel furnace."

There are four distinct and separate kinds of furnaces for melting steel:

The crucible (acid).
The converter (acid and basic).
The open hearth (acid and basic).
The electric (acid and basic).

And the different processes—the acid and basic.

In America, with one or two exceptions, converter steel is made by the acid process, which is a straight melting proposition—while the majority of foreign converter and open hearth steel furnaces are operated on basic, which is a refining process. The open hearth in America is both acid and basic.

Crucible steel the world over is acid. You get out what you put in—no refining.

Open Hearth Steel

More than 60 years of success stands behind the open hearth furnace and each year the number increases, as there is a continually increasing demand for stronger and better castings. This demand has built up 17 steel foundries in Milwaukee, with the possibility of several more within a very short time.

McLain Carter Furnace

Statistics show that previous to the war, 90 per cent. of the steel castings produced in America weighed betwe 50 lbs. and 40 tons, and our 5-ton open hearth furnace takes care of this demand very nicely; in fact, is the most flexible melting unit on the market, as it will melt up to 6½ tons, while 2-ton heats may be melted economically.

This small furnace is designated as an oil-fired furnace, although it may be constructed to use artificial gas, natural gas or powdered coal. Of course, fuel oil will melt steel faster, consequently at less cost.

In designing this furnace we simply confined ourselves to perfecting an oil-fired open hearth furnace of small capacity, which will melt steel at very high temperatures.

When the first furnace was installed 3 years ago, steel melters claimed it would burn down in 30 days, but this furnace melted 694 heats on the first run, and 842 heats on the second run.

Temperature

As refractories will burn, irrespective of whether the temperatures are produced by the electric arc, powdered coal or fuel oil, the temperature obtained by us is equal to the electric steel melting furnace—the only difference being we have learned to control the temperature.

There has been considerable misinformation given out recently in regard to the cost and quality of open hearth steel, which should be corrected, and with your consent I will endeavor to clear up some of it.

15 Per Cent. Pig

Many believe that 50 to 60 per cent. pig iron is required to make open hearth steel, but this is a mistake, as 15 per cent. pig is used with 85 per cent. scrap.

The same materials are used in the foundry, the same sand and core mixtures, gates and risers, the same equipment, whether it be open hearth, electric or converter steel, but worth more than gold is the knowledge gained on open hearth practice and a plentiful supply of practical men to operate the open hearth steel foundries.

Small open hearth furnaces may be operated intermittently or continuously. The new principle discovered allows them to obtain the very highest temperature and extremely fluid steel. 5 2-ton, or 3 5-ton heats, using 65 to 75 gallons of oil per ton of steel can be melted in 12 hours.

Good Steel Castings Are Guaranteed the First Heat

We melt the first few heats, secure you capable melters and foremen, show you how to make steel castings, show you how and where to place gates and risers, how to make facing sand mixtures, steel mixtures, alloy steels, etc., which service is worth thousands of dollars to any concern just starting to make steel castings.

Physical tests of open hearth steel made in a McLain-Carter furnace:

OPEN HEARTH TESTS.

E.L.	T.S.	ELN.	CTN.
49800	88700	24.3%	29.6%
55000	89000	23.5%	28.2%
51900	95000	20.5%	27.5%
45100	100500	17.0%	21.5%
46900	92300	22.5%	29.5%
53150	99200	16.4%	20.5%
54400	100000	17.5%	21.1%
52400	97400	20.1%	26.4%
54100	99200	18.8%	20.6%
55700	100000	17.1%	20.5%

The side blown converter has been in use for 25 years or more, and while it was supposed to die out when the electrics were introduced, the number of converters is greater than ever.

The George H. Smith Steel Castings Co., Milwaukee, specialized on converter dynamo steel for 15 years or more until 2 years ago, when they installed one of our open hearth furnaces.

Heat treatment, careful manipulation of materials, all of which are analyzed, have been instrumental in bettering their converter steel and following are several physical tests taken at random:

CONVERTER STEEL.

E.L.	T.S.	ELN.	CTN.
49800	88700		
50400	90400	21.0%	24.0%
48550	97300	22.0%	29.5%
50850	93550	21.5%	27.0%
46800	87700	22.5%	31.5%
44500	81600	25.0%	37.3%

They also manufacture high grade open hearth steel; in fact, heat treating their products has greatly improved the quality of open hearth and converter steel.

Electric Steel Furnace

Great advancement has been made in the electric furnace in America since the first one was introduced in 1908.

War necessities included thousands upon thousands of tons of small castings that would usually have been produced of crucible steel, but as the price of crucibles jumped from $2.25 to $15 each, most crucible plants installed one ton electric furnaces and hundreds of electrics are now in operation.

We have reported on quite a few electric furnace installations and the result of our observation and study is that while small steel castings may be produced of electric steel at considerably less cost than crucible steel castings, still the quality is not superior to the best crucible steel, and one ton furnaces cannot compete with oil-fired open hearth costs at all.

We find that while the cost of electric power and electrodes is increasing, this is offset by less wastage, since they cut out the use of borings and turnings.

The following charge is used by two of the most successful electric steel foundries we know of:

Materials Used in Electric Furnace

I.

Low phos. pig iron	5%
" " return scrap	50%
" " axle butts	25%
" " forgings	20%
80% Ferro-Manganese	1%
50% Ferro-Silicon	.75%
Ore	1.50%
Aluminum	2 lbs.

II.

Low phos. borings	5%
" " return scrap	50%
" " boiler punchings	30%
" " forgings	15%
80% Ferro-Manganese	1%
50% Ferro-Silicon	.75%
Ore	1.50%
Aluminum	2 lbs.

Prepared for the Southern Metal Trades Association annual convention, New Orleans, Louisiana, May 5-6, 1919.

M. J. Haney, president of the Home Bank of Canada, Toronto, and James Carruthers, Montreal, were recently elected directors of the Canadian Locomotive Co. of Kingston, Ont., to fill the vacancies on the board created by the deaths of President J. J. Hart and Senator H. W. Richardson.

Experiments in Annealing Malleable Iron

While the Manner in Which the Annealing Process is Proceeded With is of Vital Importance, the Proper Analysis of the Raw Material Must Not be Neglected

By H. E. DILLER

YEARS ago I started to anneal malleable iron, and followed in the path of others who had annealed malleable iron before me, observing the rules and customs in vogue and acting on the theories which were generally accepted at that time. But as I worked along, getting experience and making a few experiments, I began to think that some of the theories, or possibly they might be called traditions, were not essentially correct, and I have since made further experiments to learn more about the requirements for annealing iron.

In the anneal two actions take place: First, the carbon changes from the combined state to the free state and remains in the iron as temper carbon. This is the same as graphite in composition, but differs from it in form, as shown by Figs. 1 and 2. This gives us one way of finding out whether a portion, or all of a casting, was gray before it was annealed. Contrast Fig. 1 with Fig. 2. The former was taken from a portion of the casting which evidently was white iron before it was annealed, while Fig. 2 was taken from the same casting and shows from the graphite in the structure that it was gray or mottled before it was annealed.

Second, the carbon changes from the combined state and comes out of the iron.

These two actions take place in varying degrees. In some cases there is no loss of carbon, except in a very thin skin of the casting, while in other cases practically all the carbon is taken out of the casting in the lighter sections.

When only a moderate amount of carbon is removed in the anneal, the fracture of the iron is dark. Such iron is called black heart; while when the greater portion of the carbon is removed the fracture is steel colored and is called white heart. The black heart malleable is made in this country almost entirely, while in Europe the white heart is made to a great extent.

At one foundry in Europe, which was making white heart malleable, I saw a ¾-inch diameter bar pulled which showed a tensile strength of 72,050 pounds per square inch, and an elongation of 3 per cent. in 8 inches. The engineer said that this was about an average test. This is a somewhat higher test than the majority of foundries get on their black heart malleable, and I therefore concluded that in the higher tensile strength lies the reason for making white heart malleable.

No Difference in Machining Properties

One of the claims sometimes made for the black heart malleable is that it is easier to machine than the white heart variety, but in a factory in England which used both kinds, made in different foundries, I was told that there is no difference in the machining properties of the two different kinds of malleable.

I was curious to know how the white heat malleable is made. It had been told me that the carbon came out of the iron in the anneal, due to higher temperature at which the anneal is conducted, and due to the oxidizing agent used in packing. But the temperatures I saw did not run above 1,000 degrs. C., and I have run anneals at the same temperature without getting a white heart malleable. So I concluded that the temperature could not be the controlling reason for the carbon coming out of the iron. Later, when I learned that the pig iron used in making white heart malleable contains only traces of manganese, I decided that this is probably the governing feature in making the white heart malleable, and that the method of anneal is not the cause. The following are the compositions of two white heart malleable iron castings.

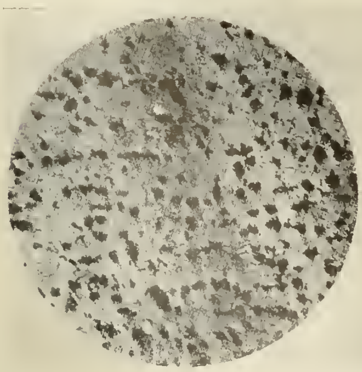


FIG. 1—MICROGRAPH OF MALLEABLE IRON THAT WAS WHITE BEFORE ANNEALING.

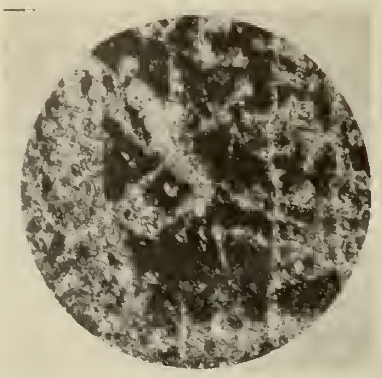


FIG. 2—MICROGRAPH OF MALLEABLE IRON THAT WAS GRAY BEFORE ANNEALING.

	Silicon	Sulph.	Phos.	Mang.	Combined Car.	Total Car.
	Per Cent.					
French Foundry	0.88	0.295	0.057	none	0.80	0.87
German Foundry	0.71	0.050	0.040	none	0.79	1.02

The casting from the French foundry was made in a cupola, while the other metal was melted in an open-hearth furnace.

The time usually taken for an anneal seems a great deal too long, but I do not believe it can be shortened appreciably without a radical change in present methods. In order to find out just how quickly a piece of iron could be malleableized, and to learn the effects of different packings and gases, I made some experiments while working in the research laboratory of the General Electric Co., at Schenectady, and the following are some details of these experiments.

To start with, a number of test bars were obtained which were all cast from the same iron. Their composition was:

	Per Cent.
Silicon	0.710
Sulphur	0.059
Phosphorus	0.168
Manganese	0.270
Combined carbon	2.680
Total carbon	2.680

The first experiments were made in an Arsem vacuum furnace where the sample was away from air and other gases, with the exception of the gases which might be given off by the sample, the carbon resistors, or by the packing, and which would be rarefied. No anneals were made which brought the combined carbon below 0.30 per cent., and the following anneal was found to give as good results as a somewhat longer anneal:

	Hours.
Time to temperature	1½
Time at 1,000 degrees Cent.	6
Time cooling to 600 degrees Cent.	3½
Total time for anneal	11

After going through this anneal a bar packed in magnetite had 0.41 per cent. combined carbon, and a bar packed in alundum had 0.38 per cent. combined carbon. The latter would indicate that an anneal could be made in 11 hours without the presence of any oxidizing agent; in fact the small amount of gas which would be in the furnace would be a reducing gas, due to the heated carbon resistors.

A rectangular bar, 0.53 by 1.02 inch, subjected to the foregoing anneal and given a transverse test 12 inches between supports, sustained a load of 1,355 pounds, and gave a deflection of 1.02 inches before breaking, while a bar 0.765 inch in diameter gave a tensile strength of 49,360 pounds per square inch. The amount of elongation was not obtained as the bar broke at the bench mark.

The next experiments were made in a silica tube, 6 inches inside diameter, heated from the outside by electrical re-

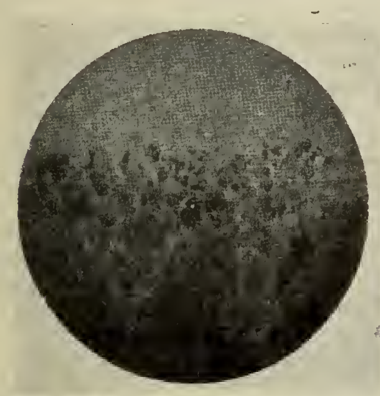


FIG. 3—MICROGRAPH FROM EDGE OF BAR—SAMPLE ANNEALED IN ALUNDUM SURROUNDED BY CARBON.

sistance. Experiments were made to find the minimum time for holding at temperature and for cooling to give satisfactory results. The following table is given showing the best results obtained, using different atmospheres and different mediums for packing. In anneals Nos. 84, 85 and 87, carbon dioxide gas was passed through the tube during the anneal, and in the anneal No. 73 hydrogen gas was passed through the tube during the anneal. In anneals Nos. 69, 86 and 89 no gas was passed through the furnace and the heated bars were in contact with the air which did not have free circulation, due to plugs of loose asbestos in the ends of the tube.

The figures are as follows:

Anneal No.	No.69	No.73	No.84	No.85	No.86	No.87	No.89
Bar Pack in—	Mill Scale	Alundum	Mill Scale	Sand	Powd. Marble	Mill Scale	Magnetite
	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.
Time to 900 degrees Cent.	8½	8	7½	7½	....	....	..
Time to 850 degrees Cent.	....	....	....	....	6½	5½	5
Time at temperature	22¼	16	16	17	17	16	18
	Deg. Cent.	Deg. Cent.	Deg. Cent.	Deg. Cent.	Deg. Cent.	Deg. Cent.	Deg. Cent.
Highest temperature	968	900	900	900	879	872	900
Average temperature during anneal	920	900	900	890	870	870	895
	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.
Time cooling to 600 degrees Cent.	8½	16	8½	28	16	16	16
Total time	39¼	40	32	52½	39½	37½	39
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Combined carbon	0.08	0.12	0.07	0.15	0.15	0.16	0.30
Transverse Test—							
Deflection, inches	1.69	0.73	1.72	1.96	1.38	1.24	1.84
Load, pounds	1150	1025	1200	1315	1125	1160	1310

Cross section of bar, inches, No. 69, 0.52x1.01; No. 73, 0.53x1.02; No. 84, 0.53x1.02; No. 85, 0.54x1.01; No. 86, 0.51x1.00; No. 87, 0.53x1.01; No. 89, 0.53x1.01.

In anneal No. 73 the sample was packed in a 1-inch pipe with alundum and the ends stopped with asbestos. This was then packed in a 3-inch pipe with coke dust and a stream of hydrogen passed through the furnace during the anneal. While there was considerable temper carbon, and only 0.12 per cent. combined carbon in the centre of the annealed test piece, at the edge of the test piece there was no temper carbon and 0.92 per cent. combined carbon. Fig. 3 is a cross section taken from the edge of the bar, and Fig. 4 is a section taken from the centre of the same bar.

From the foregoing tests it appears that if the composition is correct, the only thing essential to annealing or changing the carbon from the combined state to temper carbon is heat. Anneal No. 73 and the vacuum furnace anneals would indicate that an oxidizing atmosphere is not essential, while the other anneals would indicate that a reducing atmosphere is not essential. Anneals Nos. 73 and 85 would indicate that an oxidizing packing is not essential, while the other anneals would indicate that a neutral packing is not essential.

Effect of Rapid Cooling

In order to show the effect of rapid cooling after the iron has cooled below the recalescense point, four bars ¾-inch in diameter were annealed together, without any packing, and held at an average temperature of 890 degrees C. for 17 hours. After cooling to 555 deg. C. two of the bars, marked B1 and B2 were taken from the furnace and quenched in oil, while bars A1 and A2 were allowed to cool in the furnace. The results of the tests, as given below, would indicate that it is immaterial whether the bars are cooled slowly or rapidly after they have reached 555 degs. C., which is still a red heat. The figures follow:

Sample	A2	A2	B1	B2
Elongation, per cent. in 2 inches	7.0	7.0	6.5	7.0
Tensile strength, pounds per square inch	44,710	43,020	45,100	45,850
Combined carbon, per cent.	0.15	0.15	0.15	0.15

In all the different tests the only thing which produced a marked shortening of the anneal was a vacuum, and the reason for this I will leave for some one more theoretical than myself to explain.

As a possible practical conclusion from these tests, I would advance the statement that malleable iron could be annealed in a tunnel furnace in 48 hours or less, and that in 72 hours or less after a heat was cast it could be in the shipping room. Let us figure the following schedule:

	Hours
First pots into furnace after heat is poured	6
Time to 900 degrees Cent.	16
Time from 900 degrees Cent. to 1,000 degrees Cent. and held there	18
Cooling to 600 degrees Cent.	12
Total time for anneal	41
Final cooling, cleaning and chipping castings in first pots	10
Total time from casting until first castings are ready for shipment	60

There would be a continuous movement of pots through the furnace, and in order to take care of two heats a day, the last of the heat would be out 12 hours after the first of the heat, making in all a total of 72 hours from the time the heat is poured until every casting is ready for shipment. These estimates are based on what has been done in the small furnace and allowance made for different conditions in the tunnel furnace. Before going farther into this, a brief description of the tunnel furnace might be profitable.

Tunnel furnaces, or kilns, as they are often called, have for some time been used for heating clay ware, and are run at temperatures as high as 1,400 degs. C. The pots are placed on cars which are pushed into the furnace at the charging end at regular intervals. The cars travel on rails which slope slightly toward the discharge end. These cars are arranged with a sand seal so that the under portion of the car does not become highly heated. The cars, which are put into the furnace at regular intervals, push ahead the cars in front of them. The stack is near the charging end and the fire boxes are about two-thirds of the way from the charging end to the discharging end. With this arrangement the pots move through the furnace, getting heated on both sides and absorbing heat from the gases as they go to the stack. Thus, by the time the gases

FIG. 4—MICROGRAPH FROM CENTRE OF SAME BAR AS FIG. 3.

traveling in the opposite direction to that in which the pots are traveling have reached the stack they have given off most of their heat and are at a temperature of approximately 200 degrees C. This gives an idea of the efficiency of the tunnel furnace. The pots thus move along, getting into a hotter zone at each move, until they come to the zone of the fire boxes which could be arranged so that the pots are held at the maximum temperature any desired length of time. After the pots pass the zone of the fire boxes they travel through part of the tunnel heated only by the heat radiated from the hot pots, and so, as they lose their heat, the pots travel continually into a colder portion of the tunnel, until they are finally cooled to 600 degs. C. or less, when they pass out of the furnace and may be cooled rapidly.

The advantages of such a furnace, judging somewhat from its operation in firing porcelain, would include continuous operation; more rapid output; economy of fuel, brought about by the fact that the greater portion of the heat is extracted from the gases before they pass into the stack and by the fact that after the furnace is once brought to temperature it runs continuously and it is not necessary to heat up a cold furnace for every new anneal as is now the case; lower labor cost of operating; lower cost of maintenance; increased life of the pots, and more regular heating of the heating of the castings. Against these advantages would be the one big disadvantage of high first cost.

A Saving in Time

Coming back to the time laid out in the foregoing, 16 hours has been figured for bringing the pot up to 900 degs. C. This is approximately twice as long as was required in the experimental furnace, so that we may conclude that this rate of heating would not be injurious to the iron. It is, on the other hand, half as long as would be required for bringing the temperature to 900 degs. C. in a cold furnace charged full of pots in the usual way. We can figure on this reduction of time due to the fact that the pots are entering a hot furnace and that hot gases are continually circulating on all sides of the pots. From the time the first pot reaches 900 degs. C. until it reaches 1,000 degs. C. and passes through the hot zone, 16 hours have been allowed. This is the shortest time for holding the temperature in the experimental anneals, but in those anneals the average temperature was as low as 870 degs. C., while in the tunnel furnace the average temperature could be run at 1,000 degs. C. This high temperature can be held in the tunnel furnace without danger to the metal, because the temperature will be quite even. In the regular annealing furnace a temperature of 1,000 degrs. C. as indicated by pyrometer might endanger the metal because there is very apt to be a variation of temperature in such a furnace of as much as 100 degs. C. or more. Running the anneal at 1,000 degs. C. instead of 900 degs. C. would help to shorten the anneal, because the heat would penetrate quicker at 1,000 than at 900 degs., but I have on figures to indicate the exact effect of this increased temperature in shortening the anneal. The time allowed for cooling to 600 degs. C. has been increased about 50 per cent. over that taken in the experimental anneals.

This schedule is somewhat of a speculation but is based on enough experiments and the actual working of the tunnel furnace in the pottery industry to allow one familiar with the annealing of malleable iron to feel pretty certain that the schedule is close to what would obtain in actual practice. The suggestion is given in the hope that it may be of interest, and introduce a new viewpoint from which to look at the problem of annealing malleable iron castings.

HIGH GRADE MALLEABLE CASTINGS

According to a paper presented by Mr. J. G. Garrard, North-Western Malleable Iron Co., Milwaukee, Wis., to the American Foundrymen's convention, the idea that malleable iron castings should never be made with heavy sections, as they cannot be properly annealed, is still in the minds of men who have been using malleable castings for years. Every effort should be used to correct this impression and convince them that heavy sections can be thoroughly annealed. This false idea, coupled with poor design of patterns is the greatest difficulty the malleable foundryman has to contend with. When changing over from malleable cast iron to steel, the steel sections are always increased and ribs eliminated for the purpose of reducing shrinkage, whereas the failure of most malleable castings can be eliminated by changing the design. Abundant evidence is available to prove that good malleable castings can be used in place of steel.

There is more or less of a trick connected with making castings with heavy sections. First, one must get the metal high enough without too great a reduction in carbon, it being a known fact that carbon oxidizes much more rapidly than silicon and can be readily identified in the test piece by the short crystals. This condition with the silicon under 0.50 per cent. cannot possibly give good results. The metal, however, can be changed in the furnace with the addition of low-silicon pig iron to increase the carbon.

Gating with heavy shrinkers and close attention to the ribs on any particular casting is very important. Chills can and should be eliminated in most cases, as they do not correct the trouble, but simply drive the shrinkage from one place to another. The author's firm has experimented a great deal with their furnaces in reference to top blast, as it is his contention that excessive top blast not only causes more shrinkage, but produces unsound and weak castings.

His firm adopted a method of practically eliminating pressure on the top blast, and in doing this they do not have any trouble with high heats, as the firemen cannot force the heat to the extent of excess oxidization. The blast at the tuyures shows only two-thirds of an ounce, and the author believes this accounts for the following results:

Test No.	First iron Silicon %	First iron Tl. carbon %	Last iron Silicon %	Last iron Tl. carbon %
2	0.90	2.65	0.90	2.51
3	1.04	2.62	1.04	2.61
4	1.02	2.56	1.00	2.49
5	0.92	2.61	0.95	2.59
7	0.98	2.40	0.99	2.42

A furnace run to turn out uniform first and last iron, annealed with the use of pyrometers to insure the proper temperatures, is bound to give a tensile strength of 45,000 lbs. and over per sq. in., with an elongation of 7½ per cent. and over in 2 in. There has been a great deal of confidence placed in castings showing a deep skin. This skin is carbonless iron produced with strong packing which absorbs the carbon from the outside of the casting. Such a skin can be increased by more than one annealing, but it does not show any great advantage over the casting annealed without packing or in a straight cinder packing.

GRAMMATICAL

Highlanders have the habit, when talking their English, such as it is, of interjecting the personal pronoun "he" when not required, such as "The King he has come," instead of "The King has come." Often, in consequence, a sentence or expression is rendered exceedingly ludicrous, as the sequel will show:

A gentleman of high standing tells us that he had the pleasure of listening to the sermons of an exceptionally clever divine (let his identity and locality remain a secret), and recently he began his discourse thus: "My friends, you will find the subject of my discourse this evening in the first Epistle General of the Apostle Peter, the fifth chapter and the eighth verse, in the words, 'The devil he goeth about like a roaring lion, seeking whom he may devour.' Now, my friends, with your leave, we will divide the subject of our text this evening into four heads. Firstly, we shall endeavor to ascertain 'Who the devil he was'; secondly, we will inquire into his geographical position, namely, 'Where the devil he was' and 'Where the devil he was going'; thirdly, and this of a somewhat personal character, 'Who the devil he was seeking'; and fourthly and lastly, we shall endeavor to solve a question which has never yet been solved, 'What the devil he was roaring about.'"

HAIL TO THE KING

Joseph Horton, British correspondent of the "Iron Trade Review," narrates an incident relating to a recent visit of the King and Queen to Sheffield. The royal personages frequently expressed a desire to inspect the great plant of Cammell, Laird & Co., and of course they wanted to see it while in operation. A royal visit, however, is such a great occasion in England that when their majesties arrived at the plant they were disappointed in seeing "only a mass of motionless machinery. All the "workpeople" laid off to cheer the King and Queen in their ride through the streets.

Practical Hints for the Brass Founder

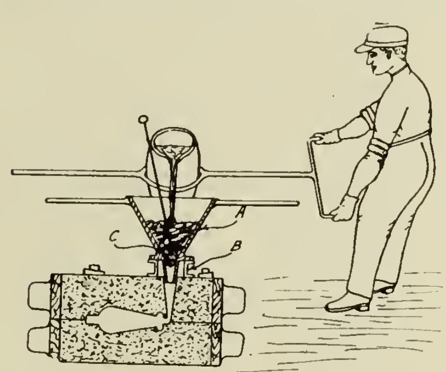
Question.—I have at different times seen formulas in your paper for making babbitt metal, but not of late. Will you kindly give me a few mixtures of different grades for heavy-duty machinery as well as for cheaper work?

Answer.—Originally babbitt metal consisted of about 88 parts of tin, 8 parts of antimony, and 6 parts of copper, and this makes a bearing metal which is hard to surpass, but owing to the high price of tin and the difficulty of melting copper, cheaper mixtures are generally used. There is no better antifriction metal than lead, but it will not hold up against a load, but by hardening it with antimony it works well; 80 parts of lead and 20 of antimony makes a cheap babbitt, which will answer in ordinary light machinery, but a better grade, and one which will hold up against almost any load can be made by mixing 68 parts of lead, 16 of tin, and 16 of antimony. Slightly more antimony will make it harder if required.

In mixing babbitt metal it is well to study the nature of the different ingredients. Lead melts at a temperature of 612 degs,, antimony at 830 degs., and tin at 440 degs. If no copper is to be used it is best to melt the lead first, after which the antimony, which has been pounded to a powder, is stirred through, and when well mixed the tin is to be dropped in and stirred slightly. While antimony melts at a much higher temperature than lead, it will burn if put in the melting pot alone, and the lead is not materially injured by superheating to a temperature sufficient to melt the antimony. If copper is to be used it should be melted first, after which the lead is introduced, and the other ingredients stirred in as stated. Copper and antimony are obstinate metals and do not mix readily, but by introducing the lead as soon as the copper is fused the rest of the procedure is easy.

Question.—Is it possible to melt copper and get sound castings? I have some heavy chunks to make, but they must be without a speck. I use the crucible furnace and have a plenty big enough one.

Answer.—The difficulty in getting sound copper castings is that the oxygen in the air attacks it and mixes through it. Probably the best remedy for this is silicon. Silicon is beneficial to both the strength and homogeneity of copper, brass and bronze castings to remove as much as possible of the oxides or occluded gases arising from the absorption of oxygen as is possible. For this purpose an alloy of copper that contains 5 per cent. silicon is used. The unfitness of this mixture is due to the oxygen having a greater affinity for the silicon than for the copper, hence the oxygen in the metal unites with the silicon and forms a silicate that rises to the surface and can be skimmed off. About a pound of this copper—silica alloy—to one hundred pounds of copper well stirred through with a rod should make your metal free from pin holes, but the great difficulty with securing sound copper castings is that although it may be clean while in the pot it absorbs more oxygen while passing from the lip of the pot to the gate, no matter how close they are together or how hard they are poured. To overcome this I devised a sort of receiver which worked satisfactory. It was simply a cast iron funnel as shown in the sketch, with an iron plug fitted to it. Just before pouring I heated this funnel so as to prevent it chilling the copper, after which I dropped it into the gate, and after putting the plug in place I threw in a handful of charcoal about the size of grains of wheat, also



a pinch of salt. When the metal was ready I took it without even skimming and dumped it, or rather upset the crucible right into this funnel so that the air got little chance at it. The object in having the charcoal and salt was to make an instantaneous covering in case the slag already in the crucible should be lacking in any part. By withdrawing the plug the metal entered the mould without passing through the air. The funnel was at once removed and turned upside down on the floor.

Question.—I have a quantity of heavy yellow brass scrap which is very hard; I would say that it would be 40 per cent. zinc and the balance copper. I also have a lot of copper wire. The brass being heavy and the copper wire being light, I propose to melt the chunks first and stir the light wire in afterwards. Am I right?

Answer.—Your method is certainly not the proper way to do. If you study the temperature at which the different metals melt and the effect of overheating them you will understand why you are wrong. To melt copper requires a temperature of 1996 deg. Fahr., while to melt zinc requires a temperature of only 773 deg. Fahr., at which temperature it is hardly red hot, and if heated very much above melting point it will be destroyed. As the melting temperature of an alloy is below the mean melting temperature of the metals forming the alloy, the heavy brass scrap will melt considerably below the 1996 deg. required to melt the copper wire, and will have to be superheated to 1996 deg. in order to melt the wire, in which case the zinc content will be considerably volatilized. It is a mistaken idea to think that because the scrap is heavy that it is harder to melt. It takes longer to melt but does not take any hotter fire, while the copper requires the high temperature to melt it even though it is light.

MELTING BABBITT

It is not advisable to keep melted babbitt clean. It is preferable if there is dirt, coal and other refuse floating on the surface. If the metal is clean it is well to throw in a little dirt. It prevents the oxidation of the metal. Oxidation causes dross to form on the surface of the molten babbitt and consequently uses up a considerable amount of the metal. If the top of the melting pot is kept covered it will aid in preventing the forming of dross.

TUNGSTEN

Twenty years ago tungsten was little more than a mineral curiosity. It is described as "a rare element of the chrominm group found in certain minerals as wolfram and scheelite, and isolated as a heavy steel-gray metal, which is very hard and fusible." It has both acid and basic properties. Later on it was learned that when alloyed in small quantities with steel it greatly increases its hardness. One of its main uses, however, is in the manufacture of the filaments for incandescent electric lamps, which were formerly made of bamboo and known as carbon. About 90 per cent. of the tungsten supply of the world comes from the neighborhood of Boulder County, near Denver, Colorado, U.S.A., and in the United States alone some 250,000,000 tungsten lamps are sold annually.

Its effect upon steel is remarkable. About ten years ago it was first used as an alloy to harden steel, and its marvelous properties as an alloy were demonstrated. A steel cutting tool hardened with tungsten will retain its temper and hardness when it becomes red hot by friction, and will cut iron and steel for hours as if it were cutting wood.

Lake Simcoe and the Georgian Bay District

A Few Interesting Spots Visited by Our Staff Reporter on His Trip Through One of Canada's Most Interesting Sections

It may perhaps not be realized that the county in which Toronto is situated borders not only on Lake Ontario but also on Lake Simcoe, and that on the opposite border of Lake Simcoe is the world-famous Muskoka district, which is unsurpassed as a haven for summer-resorting and pleasure-seeking tourists from the more densely-populated centres during the sweltering days of summer.

It may also have possibly been overlooked that in the territory which lies between these points is the south shore of Georgian Bay as well as the shores of Lake Simcoe, which, were it not for the smoke and hustle of industry, possesses many of the charms for which the neighboring district of Muskoka is famous.

A visit to these industrial centres and a short story of their doings will undoubtedly be of interest to our readers.

Barrie Out of the Game

One of the prettiest, and at the same time healthiest places which any one could want to meet with is Barrie. Situated on the Kempenfeldt Bay, which is a sort of lean-to of Lake Simcoe; it presents an appearance which attracts the eye of the traveller, but strangely enough, and for what reason it is hard to say, there is not a particle of foundry work done in the town. Two foundries once did a thriving business in this town, but to-day they stand unused. Tanneries, sawmills, wagon works, planing mills, shoe factories, in fact everything but the foundry business seems to flourish.

Those foundries should open up because moulders and founders make the best class of citizens.

Orillia a Foundry Centre

As a foundry centre Orillia has always kept pace with other manufacturing towns throughout Canada, but during the period of the war the foundry had to take a sort of back seat for shells, and practically every industrial plant of any description was converted into a munition plant, with the result that Orillia became one of the leading points from which heavy shells were secured. Now, however, the shells are out of the way and foundry work is again booming. The National Hardware Mfg. Co., manufacturers of locks, dome dampers, and other hardware specialties, as well as contract work for light duplicate orders of castings are very busy, and report good prospects for continuation of the same The general manager of this thriving industrial concern is a thorough optimist and sees nothing to fear from labor unrest. He sees no reason why the worker should not look after his interests when he knows that the boss is looking out for himself, and as a consequence he has been successful in arranging conditions which are entirely satisfactory to all parties concerned.

The E. Leong Mfg. Co., who were so bent on cleaning up the Hun difficulty that they had even utilized their moulding shop as well as the machine shop for the production of shells, are again back onto the sand heaps with a good bunch of moulders, and are turning out some very heavy machinery for export to the devastated districts so recently the scenes of the conflict.

Midland Doing Its Share

If Midland is not a big foundry centre it should be one, judging from the enormous piles of pig iron which are in evidence on the grounds of the Canada Iron Corporation who have smelters located here. This town is an ideal site for just such industries. Situated along the banks of the Georgian Bay, with the docks on one side and the G. T. R. tracks on the other, the blast furnaces, or smelter as it is called here, is in a very advantageous position for the handling of iron ore, coke, limestone, and such other sundry articles as are used in the production of the pig iron, and also for the shipping of the pig iron, which is the finished product of the furnace while being the raw material of the foundry.

There are a couple of foundries doing a thriving business in this town. One is in connection with the furnace with Mr. Nicholson as manager, while Mr. Taylor is foundry superintendent. They do a line of ships' windlasses and hoisting engines as well as the repairs incidental to the furnaces.

The Midland Gas Engine Works is another Midland industry which is finding lots of work to do, not only in the gas engine business but also in marine work, of which there is an abundance in and about Midland.

There is still room for some enterprising, honest foundrymen to make a good investment here. Right on one of the most favorably situated sights in the town stands a foundry building of a most modern design but only in a partly finished condition. Perhaps the war had something to do with it and perhaps lack of funds on the part of the promoters. How be it, the new building stands there almost finished, with the town holding the lion's share in the way of claims against it, and we are inclined to the belief that the authorities of the town might be very liberally disposed towards any responsible company which would care to talk business.

Penetanguishene

In our younger days we were wont to associate the name of Penetanguishene with that of a penal colony or a place of dire punishment for such youthful law breakers as were unfortunate enough to be apprehended. Such was the boyish conception of Penetanguishene, but it was a cruel and unjust version of it. The authorities, no doubt, aimed to provide wayward and refractory boys with a home and school where the atmosphere and the general surroundings would be such as to inspire in their young minds something higher and more ennobling than the life which they had begun to live, and in selecting this beautiful spot on the shores of the Georgian Bay no better choice could have been made.

To-day the pen. is gone, but the beautiful surroundings, the invigorating atmosphere, and the balmy breezes are still there, and "Penetang," as it is now known, is a flourishing manufacturing town as well as a summer resort of no small magnitude.

Stretching along the shore of the bay are immense tanneries, saw mills, shipyards, box factories, pail factory, flour mills, and incidentally a couple of good foundries.

The Dominion Stove and Foundry Company are working full time on every floor, turning out stoves and ranges for coal, wood, and gas, also furnaces and radiator boilers. Times are certainly back to normal at this plant, and everybody is in good spirits.

The P. Payette Co. are also very busy on saw-mill machinery and marine work. They are, in fact, busy enough in the machine shop to crowd in another man or two if such should happen along.

Collingwood

Collingwood is essentially a shipping port or sailors' town. Situated as it is on the Nottawasaga Bay, which is in reality an extension of the Georgian Bay, which is in turn but an annex of Lake Huron. The shores of the bay are admirably adapted for bathing, and the groves along the shore are equally as interesting for camping parties, and during these hot days both the camping grounds and the bathing beaches are patronized to about their limit.

The main industry of the town centres in the works of the Collingwood Shipbuilding Company, which employs some fifteen hundred hands. This company at the present time is quite busy.

The "Canadian Signaller" of Montreal, a large ocean-going steamer is almost ready for the water (probably in the water ere this article appears in print), while another one of similar proportions is well under way. As soon as these boats are off the stocks others will be immediately proceeded with.

The boilers and engines, as well as the propellers and other auxiliary machinery are built by the company right on the grounds. To accommodate this branch of the business as regards the castings a well-equipped foundry is provided. As will be readily understood, moulders to do this class of work have to be number one men, and as a consequence the company granted them the

44-hour week at 75c per hour, and no kick.

Meaford

Meaford is situated on the Nottawasaga River where it empties into the bay, and is quite a busy little place, with several manufacturing establishments of different kinds. One foundry and machine shop is located here, being owned and operated by Charles Barber & Sons, manufacturers of water-wheels and accessories. "Seeing is believing," and without seeing it would be hard to believe the amount of business which is being done at the present time in the production of water-wheels. Mr. Barber Sr. is an old patriarch in the business, having been established in the year 1867, and judging from the list of institutions which he has supplied it would look as though he had done what was done in the water-wheel business during the last half century.

Mr. Barber, although well advanced in years, sees a wonderful future for the water wheel. Electricity, which is expected to supplant steam power must depend on steam for its own power or else fall back onto something cheaper, and this something is the water-wheel. Water-wheels can be placed in any out-of-the-way locality where there is a head of water, and the electricity which is generated can be transmitted to any place where it is required, and one of the latest discoveries is that the surplus power can be utilized to grind up the limestone boulders, which, until now have been a pest to the farmer, but which can be converted into one of the best fertilizers known.

Owen Sound

Owen Sound is a city in every respect but in name. With a population of twelve thousand it might easily have been incorporated as a city long ago, but the inhabitants think better of its present status. The town was originally known as Sidenham, and Owen Sound was the name of the stretch of water which connected it with Georgian Bay, but sailors on entering always spoke of the Sound rather than of the town until finally the real name of the town was forgotten and Owen Sound was made the legal or official name of the land as well as of the water.

Owen Sound is undoubtedly the most important centre in the Georgian Bay district. Stretching along the shores of the Sound for miles are its many mills and factories, but typical of the entire district, the saw-mills, tanneries and wood-working factories predominate. There are, however, four grey-iron foundries, one steel foundry and one malleable iron works, all doing a thriving business. The William Kennedy & Sons, Ltd., in their grey iron foundry, do an enormous trade in propeller wheels, and during the submarine days they did valuable service for the munition board in supplying propellers. Although pretty well caught up in this department they are putting up a 46 by 200 ft. addition, with two new cupolas and an electric crane, as well as modern heating and ventilating systems in anticipation of busy days to come. This company also owns and operates the steel foundry in which they are pioneers.

When Canada only had two steel foundries this was one of them. It is well equipped for doing any kind of steel castings and is at present fairly well supplied with orders, among which are a considerable number of steel propellers. A modern car annealing furnace is now being installed by Holcroft and Co., contracting engineers, Detroit, which it is expected will still improve the quality of the steel castings. A large sand-blasting machine for cleaning castings is also being installed by the Pangborn Corporation of Hagerstown, Md.

The Wm. Kennedy and Sons also have the controlling interest in the Owen Sound Iron Works, and in this plant they are manufacturing ship machinery, boilers, cement and saw-mill machinery, and are quite busy.

At the annual meeting of the Canadian Malleable Iron Co., which is situated at 1020 First Avenue W., Mr. D. J. Kennedy was elected president and Mr. M. Kennedy Sr. was made vice-president; T. D. Kennedy, M. Kennedy Jr., and E. Lemon are the directors. From this it will be seen that the Kennedy people have control of this institution also, and with the infusion of the Kenendy blood into it there is no possible doubt but it will forge ahead in a manner similar to the others already spoken of.

The Stove Company is very busy and has had no labor or other trouble to contend with. This company had adopted the idea of endeavoring by every means to make the shop conditions as pleasant as it is possible to have conditions in a foundry. Among the improvements already installed might be mentioned a system of hot air pipes, which can be converted into a cold air system for cooling and ventilating purposes during the hot weather. Their latest addition to the men's comfort is a complete lavatory with flush closets, also shower baths, with an abundance of hot water, so that the men can go home in a clean and decent condition.

The Corbet Foundry & Machine Co., Ltd., manufactures a line of anchor windlasses, cargo winches, and towing machines, and in so doing seem to have struck the right key, as they are exceptionally busy filling orders from practically every seaport and lake port in Canada, as well as having invaded the American field, particularly with their towing machine, which takes the place of the timberheads or draw posts on a tug and are such a saving in tow lines and hawsers as to pay for themselves in three seasons from this item alone, to say nothing of their other advantages.

WHAT PUZZLES SOME LAWYERS

In order to settle a dispute, will some one kindly give us the correct answer to this?

Mary is twice as old as Ann was when Mary was as old as Ann is now. Mary is now 24. How old is Ann?

TRADE GOSSIP

WESTON FOUNDRY TAKING ON MEN

The Moffat Stove Company of Weston, Ont., do not feel any depression. They have found it necessary to increase their staff of molders, as well as other operatives to a considerable extent during the last few weeks. Their line of stoves and ranges for coal, wood, gas, and electricity, finding ready sale.

The hot spell during June gave an added impetus to the demand for electric ranges.

OSHAWA'S FOUNDRIES

The Hugh Park Foundry Co. are now comfortably installed in their new shop and have a full complement of men. They find business brisk, with plenty of work in view to keep them running steady. They are getting an early start into the field of farm tractors and contemplate adding to the dimensions of their erecting room.

From the Oshawa "Reformer" of June 27 we clip the following: A new machine, known as the Once-over Tiller will soon be manufactured in Oshawa. The Hugh Park Foundry Co. have secured an order for several hundred of them, and after the initial model has been tested out, which is expected to take place in a few days, they hope to turn them out in lots of 25. They are aiming at manufacturing 500 this year.

The Ontario Malleable Iron Co. is jogging along with their regular run of work, but find nothing unusual about business, in fact, have no complaints and no excitement.

The Oshawa Brass Foundry is very busy with brass and aluminum castings, having recently installed a new brass furnace to their already extensive battery and are now contemplating the installation of an oil-burning furnace.

They have also added a new building to their plant for the manufacture of automobile accessories, and find business in this line such as to warrant further extensions in this branch.

Littings, Limited, manufacturers of pipe fittings and pipe fitting machinery, who have recently added an up-to-date malleable iron foundry to their business, have already found an addition to the annealing department necessary in order to cope with the amount of business which has been offering. An overhead tunnel is also being added to connect the different departments, thereby saving the trouble and expense of outside trucking. The new malleable foundry is under the charge of Mr. Alex. Storey and Mr. Harry Smith, both expert malleable men, and the prospects are for a successful season if the labor unrest in other sections of the country does not find its way into Oshawa.

HOME FROM TRIP

Mr. Milton Beatty, of the firm of Beatty Bros., Ltd., Fergus, has returned from an extended business trip to Europe. He attended the big fair at Lyons in France, which city is situated about 260 miles south of Paris, has a population of about 1,000,000 people and is the centre of the silk industry. The purpose of his trip was to develop a foreign trade for their products, and in this he was very successful, securing large orders for ladders, churns and washing machines. He sold to the large jobbers in France and England and opened up a branch in London, Eng., to be managed by Mr. Roy Stewart, formerly of Fergus, who has obtained his military release. Mr. Beatty had an opportunity of seeing the battle-fields of France and also visited different places in the British Isles.

Harry L. Kaplin, Cleveland, will take passage early in July to return to Palestine, where he is president of a foundry and machine shop which was abandoned to the Turk early in the war and later was recovered and operated by the British. Mr. Kaplin expects to rehabilitate his plant and make needed extensions prior to returning to Cleveland in November.

OHIO MINE PRODUCES BOTH COAL AND MOLDING SAND

According to a writer in the "Scientific American," there is located in the State of Ohio a mining plant which produces both coal and molding sand. This unique mine covers about 150 acres.

The surface stratum is high grade molding sand, and has an average depth of about nine feet. It is deposited on a bed of shale about five feet in thickness, and under this is a seam of excellent coal averaging from four to five feet.

Shipments of sand already have been made to foundries throughout the country. A considerable tonnage of coal also has been mined. As the shale stratum is uncovered by the removal of the sand, steam shovels will be utilized to strip the shale, thereby exposing the seam of coal, which will be mined in the open.

In comparatively few localities is the coal seam sufficiently near the surface to permit of stripping. The sand is mined by steam shovel and is conveyed by mine cars to a stock house, from which it is loaded into cars by a belt conveyor. A force of nine men can load 400 tons of sand a day.

The Cuyahoga Spring Company at Berea Rd., near Detroit, have awarded the contract for the construction of a two storey factory mill type building to the Austin Company. This building is to be of Austin Standard No. 8 type mill construction, 80 ft. wide x 146 ft. long.

The contract includes plumbing, heating and lighting, together with the installation of a new heating plant in the company's existing building.

The amount of the contract is $57,000 and the building is to be used for the manufacture of coiled wire springs, made necessary by the increased demand of automobile manufacturers and others for the products of this well-known concern.

The Bourne Fuller Co., E. 55th and Lakeside avenue, Cleveland, Ohio, have awarded another contract for the erection of a one storey mill type storage warehouse, 136 x 330 ft., estimated cost, $146,000.00, to the Austin Company, industrial engineers and builders, Cleveland.

Homestead Valve Company, Homestead, Pa., has awarded to the Austin Company, Cleveland, Ohio, a contract for the erection of a foundry building at Homestead, Pa.

The Copp Stove Foundry, Fort William, Ont., burned out three years ago, has been taken over by a local syndicate and will shortly be reopened as a general jobbing and stove plate business, the Copp patterns having been purchased intact. Messrs. Reid and Coombes are the promoters.

The 90 ft. by 40 ft. foundry extension recently added by the Port Arthur Shipbuilding Co. to their existing premises is now fully occupied, the 3,600 feet of floor space thus gained being devoted mainly to the production of cylinder, pump and propeller castings, about one-fourth of the new addition being concrete floored to give more room to the output of the smaller lines of brass castings.

CATALOGUES

We are in receipt of a copy of "Oakite News Service," the news organ of the Oakley Chemical Co., 22 Thames Street, New York. It contains many valuable suggestions for users of chemicals, not the least of which is the electro-plating department. One section of particular interest to our readers is a reprint of an article which appeared in a former issue of CANADIAN FOUNDRYMAN, entitled, "Cleaning and Copper-Plating in One Solution," by Abe Winters, which demonstrates how our plating and polishing department as well as all our departments are read and appreciated.

The Herman Pneumatic Machine Co. of Zelienople, Pa., U.S.A., have just issued their "Molding Machine" catalogue, describing in detail the various types of molding machines manufactured by this company. Numerous explanations of use to foundrymen on the subject of foundations, etc., are dealt with. The book contains many valuable tables as well as a partial test of the users of these machines.

The Gill Manufacturing Co., 351 West 59th Street, Chicago, with Canadian factory at the Brown Engineering Corporation, 415 King Street West, Toronto, Ont., have handed us their Piston Ring Size Directories, which they have just prepared. This is considered the most complete and up-to-date piston ring size directory that has ever been published and we feel sure that many of our readers will be interested in receiving a copy. It is sent to dealers free of charge, and, in order to discriminate between dealer and consumer inquiries, the Gill Manufacturing Company is charging 25 cents a copy of everyone but dealers or others who might be similarly interested. We refer our readers to the description of the gill ring on page 3, to the instructions for installing on pages 10, 11 and 12, to the price list on page 13, to the location of stocks and distributing centres listed on pages 28 and 29, and the prompt shipping service advertised on the last page of the book.

The Bastian Blessing Company, West Austin, at La Salle Street, Chicago, have recently issued their booklet on Rego welding and cutting apparatus. It is profusely illustrated and shows the different apparatus used and the mode of using them in the process of cutting off car axles, I beams, channel irons, etc., as well as a thorough explanation of the Rego welding torch.

The report for 1918 of the Workmen's Compensation Board of Ontario is to hand and gives a very comprehensive review of the work done by the board during 1918. The total expenditure for the year in compensations was $3,514,-648.47. The daily average number of accidents of all kinds reported during 1918 was 158, the total number being 47,848. The Act has now passed the experimental stage. There is no longer controversy as to the soundness of the principles upon which it is based, and in its practical working out it has probably exceeded the expectations even of its authors.

An interesting catalogue entitled, "The Canadian Turbine Water Wheel," published by Charles Barber & Sons, Meaford, Ont., has been handed to us. The book is full of exceptionally interesting information, describing and illustrating the various styles and sizes of water wheels built by this company from their establishment in 1867 up to the present time, including a partial list of firms from Halifax to Vancouver, who are using these wheels. It also contains many valuable pointers on how to instal a wheel, and which style of wheel to order for the particular conditions under which it will work.

The latest edition of "Catalogue of Scientific, Mechanical, and Industrial Books," published by Henry, Carey, Baird & Co., Inc., Morton Building, 116 Nassau street, New York, is just to hand. This business was established in Philadelphia in 1785 and was incorporated in New York in 1918, this giving them the slogan, "A house in touch with three centuries."

FOUNDRY BUSINESS PICKING UP IN THE STATES

That the foundry industry in the middle west is suffering no depression is clearly evidenced by the extensive building operations throughout that section. A large percentage of the demand for castings finds its source in the automobile business, but other lines also show great activity. Holcroft & Company, contracting engineers, Detroit, say that a close survey by their Philadelphia office show considerable improvement in foundry conditions through the eastern section, that many concerns are getting out plans for extensions and are replacing considerable old equipment.

In addition to a large volume of work not given general publication, and many large contracts pending, Holcroft & Company have the following jobs under construction. Two batteries of core ovens for the D. J. Ryan Foundry Company, two batteries of core ovens for the D. J. Ryan Foundry Company, two batteries of core oven for Whitehead & Kales Irons works, and a battery of core ovens at the Kelsey Wheel Company, and batteries at the Monarch Foundry Company and Chas. B. Bohn Foundry Company, all of Detroit. A battery of five ovens for Novo Engine Company, Lansing, Mich.; a battery of six core ovens for The Hamilton Foundry & Machine Company, Hamilton, Ihio; two batteries of 4-core ovens for the Saginaw Malleable Iron Company, Division of General Motors Corp., Saginaw Mich.; 32 core ovens for Central Foundry Company, Saginaw, Mich.; 30 ovens at the Wilson Foundry & Machine Company, Pontiac, Mich.; another battery of 4 core ovens for The Nash Motors Company, Konosha, Wis.; and two more batteries of four oven each for the Maxwell Motor Company, Dayton, Ohio. The construction of a 20-ton open hearth furnace was completed for the Monarch Steel Castings Co., Detroit, last week and other open-hearths will be started at other locations within the next few weeks. During July will also build a large care annealing furnace for the William Kennedy & Sons, Owen Sound, Ont.

Holcroft & Company say there is a scarcity of fire-brick masons and skilled workmen in building trades and the situation is becoming acute despite the high wages paid.

CONCESSIONS ARE WITHDRAWN

Prices are firm in the steel market. A. T. Enlow, president of the Sheet Metal Corporation, Hamilton, stated to MACHINERY this week that there was a firmer tone to the market for sheets and kindred lines. "I would not state that we could look for higher prices right away, or even soon," he remarked, "but it is a fact that in nearly all the mills the concessions that have been common for some time have been almost entirely removed, and some of the mills, you will notice, have retired from the market for the time, being well filled with business."

The trouble just now is that buying is too local. Were it as big all over as in some points it would be great. Plates are being asked for in two Ontario shops in very large quantities. In one order there were two items worthy of notice. One was for nine plates with a total weight of 31,000 pounds, another for eight plates that weighed 30,000 pounds. There was enough material to make five cars or so, and the business went through a Toronto warehouse early this week.

OBITUARY

One of the most deeply regretted and generally mourned losses which has been suffered recently by the staff of the McClary Mfg. Co., of London, Ont., was that caused by the death, on April 27, of Mr. Thos. Hogg.

The late Mr. Hogg, who was foreman of the gas range department of the foundry, had been in the company's employ for about thirty-three years. For two years past he had been in poor health, but never gave up until the early part of February, when he was compelled to take to his bed with the illness from which he never recovered.

The late THOMAS HOGG.

He was a very sincere and active welfare worker, a loyal employee, an upright man of pleasing personality and a sound judgment which was always at the service of those who sought his advice.

He is survived by his widow and six children, to whom is extended the profound sympathy of the members of the staff to whom the late Mr. Hogg's generous and kindly disposition had endeared him.

Wilmot D. Matthews, a prominent Toronto financier, passed away on May 24, at the age of 70.

Mr. Matthews was president of the Canada Foundry Co., the Consolidated Mining and Smelting Co., and a director of the Hamilton Steel and Iron Co., and the Steel Co. of Canada, as well as being connected with numerous railway and other interests.

THE PIG IRON MARKET

After a steady decline in the output of pig iron since September last, when it reached its highest peak, the turn has again been made upward. The output for June was the highest for any month since that date. Following are reports from various U. S. points:

Pittsburgh.—A slackening off in the market for foundry iron has been noted this week, the reason being that most makers have covered their requirements for the last half. There is no demand so far for Bessemer or basic grades. Prices are keeping firm, with basic at $25.75.

Chicago.—After a heavy rush of business during June, the market is going through a period of rest. It is held that many makers were conservative in their buying for last half, and will have to come into the market again. Enquiries for small lots up to 1,000 tons are still coming in for foundry grades.

Philadelphia.—There is a disposition on the part of some furnace interests to blow in idle stacks as soon as business offers, and this will tend to keep prices from going up. There is one sale of basic reported between 6,000 and 7,000 tons at $26 furnace. Enquiry is weak for foundry grades.

Buffalo.—After the first three weeks heavy buying the last week of June showed a falling off, and the past week's sales have fallen off still further. Third and fourth quarter requirements are responsible for a fair enquiry for foundry grades. The March 21st schedule is being maintained, and the outlook is held to be good.

Cincinnati.—Quite a few sales of small lots, averaging about 500 tons, were made for last half shipment, mostly to Ohio smelters. Sales generally were considered good, but the enquiry is not very brisk. Another furnace will be blown in shortly.

Birmingham.—The demand in this district is keeping steady, and the Republic is reported to be about to blow in another stack. A good volume of sales has been made for fourth quarter, and a large interest is said to be fully stocked up for the last half of the year. The output of iron castings is increasing.

St. Louis. — There have been no changes in price though the market still continues dull. Neither sellers or smelters are willing to engage themselves very far ahead, and it will take an active general movement to make any change.

New York.—A period of quietness has apparently set in in this district. For No. 2x $27 Buffalo is quoted, and the same grade of $28 eastern Pennsylvania. Till ocean freight rates are better export business is stagnant. One sale of 250 tons for Dutch East Indies is reported.

Cleveland.—There has been an easing up after the brisk market movement of the past few weeks, but a fair volume of business was done during the week. Foundries seem to keeping pretty busy, which is keeping up the demand for pig iron. Steel making grades are not in demand.

PORTABLE CONVEYORS REDUCE COST OF HANDLING COAL AND ASHES

TO secure economical operation and greater efficiency in handling material, labor must be supplanted by machines, and those selected which are best adapted for the particular work. Men with wheelbarrows are too costly to use in storing, moving or loading material, but, at the same time, the old style conveyors required a great deal of labor in shovelling the material up into the receiving hoppers.

A new type of portable conveyor, which cuts the labor of feeding one-half, is shown in the accompanying illustrations. The most distinctive feature of this machine, called the scoop conveyor, is the scoop on the feeding end, which can be pushed or completely buried in

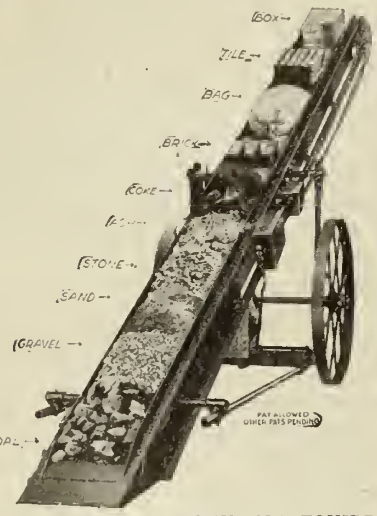


FIG. 1—A 19 FT 8 IN. CONVEYOR EQUIPPED WITH 16 IN. WIDE BELT AND DRIVER BY 2 H.P. MOTOR.

the material to be conveyed. This makes it possible to simply scrape the material onto the carrying belt, instead of lifting it up by shovelfuls into the feeding hoppers of ordinary conveyors.

Another exclusive feature of this machine is the construction of the sides or skirt plates, as they are called. These form a trough, which enables a 12-inch wide belt to equal in carrying capacity a 20-inch ordinary troughed belt. This is readily understood when one remembers that on a troughed belt the material is carried in the centre or trough, that on the sides falling into the trough or rolling back, whereas the side plates on the scoop conveyor hold the material together, giving the whole width of the belt carrying effectiveness. It is due to the skirt plates, also, that a 24-ft. long scoop conveyor will convey material as high as a 30-ft. troughed belt. The resultant saving in belt expense is considerable, as two new 12-inch x 24-ft. scoop conveyor belts can be purchased for the price of one 20-inch x 30-ft. troughed conveyor belt.

The money savings resulting from the use of a scoop conveyor are due, first, to the saving in labor; second, to the speed at which material is conveyed. In comparison with handling material by hand, one or two men with a scoop conveyor will do the same work as from four to twelve men, depending upon conditions. The scoop conveyor will load trucks in one-fourth to one-sixth the time required by men shovelling. It often enables one truck to do the work of two trucks and of getting two days' work done in one day.

Storage capacity is another factor of saving attributed to this machine, as it increases the available capacity of a shed or yard space by enabling the men to pile higher.

FIG. 3—LOADING TRUCKS WITH A CONVEYOR.

A few statements of actual savings made by the use of portable conveyors may be of interest:

Gay Bros. Co., (Cavendish Woollen Mills), Cavendish, Vt. One man now used instead of four to pile coal for storage and to move it into boiler house. Average saving is $7 per day.

FIG. 4 UNLOADING FROM COAL CAR TO STORAGE PILE WITH A SCOOP CONVEYOR.

Baird Machine Co., Bridgeport, Conn. Reduced yard force from five men to one. Now unload coal from cars quickly, without having to pay demurrage charges.

Fonda Glove Lining Co., Fonda, N.Y. Load from 2 to 3 tons of soft coal from ground into auto trucks in from 3 to 5 minutes.

Colonial Steel Co., Pittsburgh, Pa. Unload coal from hopper cars with scoop conveyor at 50 per cent. of former cost. They figure machine has paid for itself more than once in a year.

J. L. Prescott Co., (shoe polish manufacturers), Passaic, N.J. Former cost of unloading coal from cars and putting it into storage bins was 28c per ton. It is now done with a scoop conveyor at 4c per ton, or a saving of 85 per cent.

FIG. 2—UNLOADING FROM WAGON TO STORAGE PILE.

Marcus S. Wright, (miner of foundry sands and clays), South River, N.J. Before using the scoop conveyor employed 6 men to load railroad cars. Now do the work with 3 men and get out larger tonnage. Load 150 to 175 tons of silica sand into cars with scoop conveyor in a 9 hour day with 3 men, which was impossible with 6 men working without the machine.

Capacity and Uses

The carrying capacity of the scoop conveyor, based on handling coal, is one ton per minute, provided a sufficient amount of coal is maintained at the receiving end of the machine. If the storage pile is of sufficient height, one man can easily feed one ton in one and a half minutes, or if the pile is low, he may require from two to four minutes. Where speed is required two men may be provided for feeding. In unloading hopper bottom cars the machine and one man can remove one ton per minute.

Large size coal, coke, crushed stone, etc., fed by one man, require from three to six minutes for one ton, or half that time with two men.

The scoop conveyor is used principally for storing, reclaiming and loading bulk material and light articles. There are an unlimited number of uses for the machine, in addition, such as elevating material to tanks or platforms in chemical and industrial works, feeding from cars and delivering into fixed conveyors or stoker magazines at power plants, etc. Almost any kind of material can be handled, such as coal of all kinds, ashes, sand, earth, crushed stone, blast furnace slag, ore, fertilizer, salt, chemicals, grain, bags and light packages.

The scoop conveyor may be used singly, in tandem or in triplicate, as may be required. The employment of sets of two or more allows for an increase in height of the storage pile or conveying distance. Fig. 5 illustrates three machines unloading coal from hopper cars up a long steep incline.

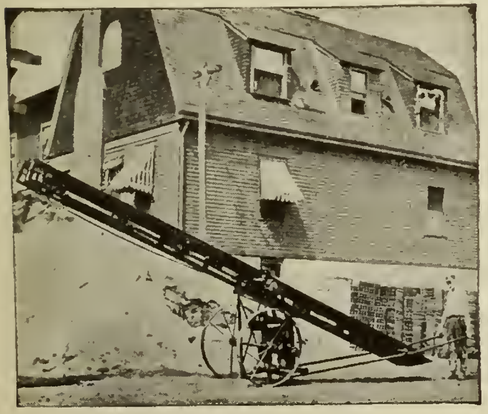


FIG. 6—ONE MAN CAN MOVE THE SCOOP CONVEYOR FROM PLACE TO PLACE.

Construction

As may be seen from Fig. 1, the scoop conveyor is strongly constructed, light in weight, compact and portable. The steel frame holding the rollers and conveying belt is mounted on the wheels so the balance is perfect. One man, by inserting the pipe handles into the ends of the horizontal members, can easily lift and move the machine around.

The electric motor or gasoline engine mounted under the frame transmits power to the conveyor by means of a chain and sprocket connection to a shaft extending beneath the conveyor. From a sprocket on the other end of this shaft the power in turn is transmitted to the driving sprocket, located at the upper end of the conveyor.

FIG. 5—USING THREE SCOOP CONVEYORS TO UNLOAD FROM HOPPER BOTTOM CARS TO LARGE STORAGE PILE.

The carrying belt is a high grade of heavy duck and rubber conveying belt and duck cross strips. These transverse cleats are provided to prevent the material from slipping back down the incline.

The scoop conveyor is made in three different sizes: 13 ft. 8 in., 19 ft. 8 in., and 24 ft. The width of the conveying belt on any of these sizes may be either 12 in. or 16 in. wide, as desired. Size 13 ft. 8 in. elevates to a total height from the ground of 5 ft. 9 in.; the 19 ft. 8 in. size may be adjusted for any height from 6 feet to 9 feet, and the 24 ft. size may be adjusted for any height from 9 feet to 12 feet. The machines are furnished with either electric motor or gasoline engine, or where customer prefers to furnish and install motor himself, motor support and drive from motor shaft are provided.

For catalogue and other information address the manufacturers, The Portable Machinery Co., Inc., Passaic, N.J.

COPPER EXTRACTION FROM PYRITIC ASHES

By L. P.

A new method for the electrolytic extraction of copper from pyritic ashes has just been discovered and is based on the electrolytic conversion of sulphide or sulphate of copper into cupric or cuprous chloride by the action of chlorine at the anode. If in an electrolytic bath containing hydrochloric acid in solution the anode is surrounded by a mass of pyritic scoria, the chlorine liberated by the hydrogen attacks the oxides, sulphates, or sulphides of copper more rapidly than the oxides of iron, and combines with them to form cupric chloride. This reaction extends to the entire mass of scoria, so that the latter acts as an electrode. The copper loss by this method is only 0.1 per cent.

FROM LINER TO SEAPLANE CARRIER

Many a strange vessel sailed the seas under the British flag between 1914 and 1919, but few stranger than H.M. seaplane carrying ship "Argus." With a level platform extending from the bow to the stern, she looked like a portion of a dock wall which had been floated out to sea. The absence of funnels, masts, and the usual picturesque upper works, combined with "dazzle" painting on the hull (for the purpose of concealment) to render her anything like a thing of beauty, but from the engineering point of view she was a joy forever. She began existence as a first-class passenger and cargo steamer, but before her hull was finished the war broke out, and the Admiralty decided to finish her as a sea-plane carrier. The shelter deck was transformed into a hangar, with the workshops; and above it was erected the flying deck from which the planes could rise and on which they could land. Elaborate experiments were made to discover the structure best suited to prevent eddies which would disturb the planes on landing, and an ingenious system of horizontal funnels, discharging at the stern, had to be designed to carry the hot gases clear of the flying deck. The navigating bridge was placed under the flying deck and near the bow, but the charthouse was placed on a hydraulic lift, so that it could be raised clear of the flying deck in order to command an open view. Electric lifts were installed to raise the aeroplanes from the hangar to the flying deck, and at the stern and amidships, were placed electric cranes for hoisting planes from the water. At night the flying deck was illuminated to guide the pilots when landing. In every respect the ship was a complete success, and reflected great credit on the British engineers and shipbuilders who improvised her under the stress of war.

The Bessemer Process of Steel Manufacture

How the Impurities Are Burned Out of Iron by One of the Most Spectacular Performances Known to the Trade—Story Told in An Interesting and Plain Manner

THE "Bessemer Process of Steel Manufacture" is dealt with in a most interesting manner by P. N. Case, editor of *The Dragon,* a little booklet issued monthly by the Fafnir Bearing Co., of New Britain, Conn. In an explanatory note, Mr. Case states that the idea is to make the matter descriptive and interesting, rather than putting it in such purely technical shape that only a technical man could appreciate it.

The year 1856, when Sir Henry Bessemer read his paper, "The Production of Pure Iron Without Fuel," marks an epoch in the history of the steel industry; for previous to the invention of the Bessemer Process, steel could not be produced economically, and wrought iron was extensively employed for purposes for which "soft" steel—that is, steel containing relatively small percentages of carbon—is now used almost universally. Not only did the Bessemer Process make possible the production of steel at lower cost than wrought iron could be produced, but the former is far superior for many purposes to wrought iron, which is apt to be considerably weakened through mixture with slag.

DEFINITION OF STEEL

In order fully to comprehend the principles involved in the manufacture of Bessemer Steel, it is essential that the reader appreciate the fundamental distinction between the two broad terms, "iron" and "steel." Chemically pure iron does not exist commercially, but is invariably associated with other elements in varying proportions. In other words, iron as we know it in everyday life, is in reality an alloy consisting chiefly of iron and much smaller percentages of several other constituents, such as carbon, silicon, manganese, phosphorus, and sulphur. Of these elements found in combination with iron, carbon is the most important, since it is the most useful and because it exerts the most powerful influence on the physical character of the metal. Broadly speaking, steel is simply pig iron (which is iron in the molten state as it is reduced in the blast furnace) containing relatively small percentages of those secondary elements, especially carbon. While there is no sharp line of demarcation by means of which pig iron can be differentiated from steel, it will suffice for the purposes of this article to assume that pig iron which has been refined to the point where its carbon content is less than 1.5 per cent. becomes steel.

Therefore, the conversion of pig iron to steel is a process of refinement, consisting essentially in the removal of the excess of impurities. This is accomplished by oxidation, the volatile substances—such as the oxides of carbon—passing off as gas, while the solid oxides, being lighter than the metal, float on the surface of the bath from which they are easily separated. In all but the Bessemer Process this is a slow operation, and is accomplished in some sort of furnace with the addition of much heat from an external source. The Bessemer Process, however, makes use of a radically different principle, as we shall now see.

THE BESSEMER PROCESS

If we touch a lighted match to a scrap of paper, it burns quickly, accompanied by the liberation of considerable heat. Now when a piece of old iron rusts out in the dump, precisely the same thing happens—only more slowly. In both cases, oxidation takes place. Oxidation is the chemical reaction which occurs when some element, such as carbon or iron, combines with oxygen of the air, forming an oxide. The phenomenon of "burning" is merely very rapid oxidation. Moreover, when iron rusts, heat is generated, but is not noticeable because the process is so very gradual. However, if the iron or its impurities could be made to "burn," a vast amount of heat would be generated within a short space of time, and this is just what happens in the Bessemer Process.

Pig iron is tapped from the blast furnace at approximately 1,400 degress Centigrade (2,552 degrees Fahrenheit), at which high temperature its several constituents will "burn" much the same as the piece of paper just mentioned by way of illustration. Here the reader may wonder why the iron does not burn as soon as it leaves the blast furnace. The answer is simple. The oxygen of the air does not penetrate throughout the molten mass, but merely comes in contact with the surface of the metal. A simple illustration will serve to make this point clear. The coal on the grate of a locomotive, for example, would not burn to any extent if the air merely passed over its surface. It is necessary that a strong current of air be forced up through the grate bars and the overlying layers of coal. In fact, in every boiler plant where coal must be burned rapidly, provision must be made to obtain a strong draft. In this way two things are accomplished: first, a large amount of air is provided, containing sufficient oxygen to facilitate rapid "burning" of the coal; second, the air is brought into intimate contact with every particle of coal. This last consideration is just as important as the first; for obviously, the coal cannot be oxidized (burned) if oxygen does not come in contact with it. The same principle holds good in the case of pig iron; it is only necessary to force a large enough quantity of air all through every particle of the hot, molten mass, in order to make it "burn."

However, there is another factor of fundamental importance in its influence on the Bessemer Process—indeed, the process could not possibly exist otherwise—which I shall now explain. At the particular temperature at which pig iron is tapped from the blast furnace, the impurities—such as silicon, manganese and carbon—have a greater affinity for oxygen than has the metallic iron itself. Consequently, if a strong blast of air is forced through a mass of pig iron, those impurities will "burn" before the iron does. Moreover, some of the oxides thus formed are volatile and vanish of their own accord, while the others which are liquid are lighter than the molten metal and, consequently, rise to the surface, forming a viscous layer of scum (slag) on top of the metal. This slag can then easily be separated from the metal.

It was these principles which inspired Sir Henry Bessemer to conceive the method which bears his name of converting pig iron into steel. As practised in America, 10 or 12 tons of pig iron are placed in an eggshaped converter, or vessel, of suitable size, and an air blast injected through the bottom. When the impurities have been oxidized or "burned" (which requires only about 15 minutes) and separated from the bath, the remaining metal is as nearly chemically pure iron as is ever attained, except, possibly, in the experimental laboratory. It remains only to calculate and add to the metal the proper proportions of carbon, silicon, manganese and any other elements desired, to give the steel the composition which has been definitely predetermined. This operation is known as "recarburization."

The "burning" of the impurities in the pig iron results in the generation of a vast amount of heat, some of which is lost in the surrounding atmosphere, while the balance serves to raise the temperature of the molten metal to a "white" heat. This is very fortunate, since when the impurities are "burned" out of the pig iron, the melting point of the metal becomes much higher, and it is essential that the steel be liquid when finished, in order that it will flow freely. The final step consists in pouring the liquid steel into molds, which are withdrawn as soon as the metal is sufficiently chilled. The steel ingots are then ready to be transferred to the rolling mill where they are rolled into sheets or billets for commercial use.

From the above outline, it will be evident that the outstanding features of the process are: the rapidity with which pig iron can be converted into steel; the fact that no fuel is required, other than that contained in the pig iron itself in the form of impurities; and that the pig iron thus refined does not have to be remelted.

PHOSPHORUS AND SULPHUR

Before concluding this introductory chapter, however, it will be well to note that there are two variations of the Bessemer Process. The one originally developed is known as the "Acid" Bessemer Process, and by this method, neither phosphorus nor sulphur can be eliminated from the pig iron and discarded in the slag with the other impurities. However, both phosphorus and sulphur greatly injure steel; the former makes the metal "cold short," or brittle when cold and, therefore, liable to fracture; the latter makes steel "red short," which means that it is brittle while hot and, consequently, cannot safely be forged. Therefore, it is of paramount importance that the pig iron used shall contain no larger percentages of those two elements than are allowable in the finished steel. For commercial purposes, the standard limits are 0.1 per cent. phosphorus and 0.8 per cent. sulphur. Pig iron which comes within those limits is known as "Bessemer Pig Iron."

A modification of the "Acid" Process, known as the "Basic" Bessemer Process, was subsequently developed, by means of which virtually all of the phosphorus and most of the sulphur can be removed from the pig iron. However, only pig iron which contains very little silicon and a relatively high percentage of phosphorus can advantageously be treated by this process. In Europe, where pig iron of this character is available at a low price, the Basic Process is extensively used. In fact, it is hardly an exaggeration to say that the Basic Bessemer Process has been one of the salient factors contributing to Germany's industrial development during the past generation. On the other hand, in the United States, where iron ore containing very little phosphorus is more abundant, the Acid Bessemer Process is exclusively employed.

A PENNSYLVANIA man named Hart got a quantity of maple syrup poured into his car instead of oil. And now we presume the neighbors will say, "There goes 'sweethart' for a drive!"

* * *

SOME of those whose pay envelope depends upon their ability to write newspaper headings must make a great and a generous living. The Cobalt *Nugget*, for instance, upon reading that the Government was able to buy steel plate for $2.75 against a previous $3.25, announces: "Price of Steel Plate on the Toboggan." The fact is that steel plate was deliberately taken from 3.25 per pound to 3c, and later, on March 31, to 2.65. There was no toboggan or panic about it, simply an attempt to get away from war levels as quickly as possible.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - Vice-Presidents
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: F. L. Jennings. Ontario Representative: S. S. Moore Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. TORONTO, JULY, 1919 No. 7

PRINCIPAL CONTENTS

The Strike Situation

THE metal workers' strike in Toronto and neighboring districts stands just where it was two months ago. It is a sort of trench warfare, with both sides resting; each one waiting for the other to make a move. Which one will move first we are not prepared to say. Of course, the manufacturer wants to run his factory the way which suits him best, and the workman feels the same independence about himself and his work. The manufacturer invested his money in the business and he does not propose to have someone else dictate to him how he is going to operate it. On the other hand, the workman has his labor for sale and he reserves the right to dispose of it in whatever manner he sees fit. If he only wants to sell eight hours of it at any one time, he considers it his privilege to do so, and he also feels that he has the right to set the price on what he has to sell, and then it is up to the customer who uses his services to pay the price or do without; so there the matter stands. We cannot suggest anything in the way of a remedy unless the two parties to the controversy will come together and talk common-sense. They must both be losing by the idleness.

It is quite a common argument that the manufacturer can hold out the longest and that the workman can be starved into submission, but if such is the case then the argument that the manufacturers are not capitalists is incorrect. However, if the combatants cannot or will not settle it we don't know who can.

The Business Outlook

IT is not good policy to exaggerate in reporting on any subject, as an exaggerated report is nothing but an out-and-out prevarication, but as near as we can come to the truth from what we can see there is every opportunity for all of our industries to be running full blast.

On the American side, things are beginning to hum and many large contracts have been let.

On our own side there is no lack of work to be done if the manufacturers and the men will get down to business and do it. Once outside of the strike zone, the factories and foundries are booming. The fear that prices would drop is no longer a consideration. On the contrary, prices are soaring as they never did before on most commodities and unless some sort of co-operation is established between so-called capital and labor, things will not be pleasant to anticipate next winter. While there is work to be done it would look wise to go to it.

Possible Trade With China

IT was our privilege a few days ago to listen to an interesting and instructive address on the subject of "Opportunities For Developing Business in China," by Mr. Ross, Canadian Commissioner to China.

In his address Mr. Ross placed great stress on two big enterprises which would assuredly be undertaken in the very near future in China, namely, the developing of the mines, of which China has an abundance, and the building of railroads, of which China has few. With undertakings of this kind under way, a big demand would be created for mining machinery and machine tools. The mining machinery would require to be kept constantly in repair, so also would the railroad equipment, thus necessitating numerous machine shops. Canada should be in prime condition to supply her share of both mining machinery and machine tools. but how does this affect the foundry business? One thing which is beyond our comprehension is, "What advantage does any other country possess over us in the production of ordinary grey iron castings?" Take, for instance, our good neighbor the United States. How can the American foundryman turn out castings in a jobbing foundry and sell them in Canada in the face of our protective tariffs? It might be argued that with their enormous home market they could equip their shops for turning out certain specialties to better advantage than could be expected in a less populous country. but this is not the point at issue. We happen to know of Canadian machine tool builders who operate foundries of their own, yet buy enormous tonnages of castings in the United States, not from American patterns but from patterns made in Canada and sent over there to jobbing foundries to be cast. We also know of firms in the manufacture of mining machinery who are doing likewise.

Can it be that the Americans are a smarter race of people than we are? We think not. Canadians are holding down some of the best positions over there. It must just be force of habit. Canada showed the world something during the last four or five years, why not show ourselves something now and make our own castings?

Twelve Times One Makes Twelve

IN speaking of the big home market for the products of the American industries as compared with the smaller market in Canada for our manufactures, we are prone to ask the question, "Have they as big a market as we have?" Supposing, for even figuring, we say that they have twelve times the population that we have, which is to say that for every consumer we have, they have twelve; how does their producing power compare with ours? It is a safe assumption that they have a great deal more than twelve to one. This means that if a man starts a business in Canada he does not have the opposition to contend with in proportion to population that he would have if he started in the United States.

There are certainly many things which it would not be advisable to try to manufacture in Canada at the present time, but surely the jobbing foundry is not one which should be included in the list of institutions which cannot compete. We urgently advise our foundrymen to keep an eye open and keep their foundries in an up-to-date shape. Of course, there are two sides to the question, and Canada ships quite a considerable amount of iron work into the States and the other countries, but the balance is not in our favor by any means.

The Hot Weather Did It

THE weather during the last few weeks has been at such a pitch that it was out of the question to expect much from the already overtaxed brain of our erstwhile energetic and enthusiastic contributors, and as a consequence the present issue of CANADIAN FOUNDRYMAN may not be quite up to its usual high standard of excellence, but we don't want our readers to think that we are backsliding. On the contrary, we are just reserving our latent energy for bigger and better service than ever.

Our August Number

WHILE this issue is a little shy of practical foundry work it should be of more than usual interest to the foundry manager.

However, the August number will be especially for the working man, and we hope and trust that all differences between the working man and his employer will be over with, and that they will all be back to work and in a position to read some of the most interesting foundry literature which has been published in some time.

The September Number

THE September number will be especially written for the Foundrymen's Convention which takes place in Philadelphia the week of September 29. This will be an exceedingly interesting number, as much so to the workman as to the employer.

Our Annual Picnic

THE Annual Picnic of the MacLean Publishing Company was held at Centre Island, Toronto, on June 21, and was a huge success. The trip on the boat, the games, the refreshments and the speechifying were enjoyed by everyone. Everything was harmonious and for one day in the year the CANADIAN FOUNDRYMAN felt as important as *MacLean's Magazine*.

The Foundrymen's Convention

FOR the benefit of those who have not taken an interest in the meetings of the American Foundrymen's Association, we might explain that it is not only a gathering of foundrymen who come together to learn what they can and tell what they know, but it is also an exhibit or exhibition of foundry equipment and supplies such as cannot be seen elsewhere. For the benefit of those who cannot possibly attend, the CANADIAN FOUNDRYMAN will publish everything which would be of interest to the foundry workman or owner.

Toronto Street Railway Strike

THE street car strike is over and everything is back as near to normal as the T.S.R. ever seems to be able to get, even to being in the hands of the same old company and the same manager. One thing we would like to have seen tried out was the experiment of making one car take the place of two by putting a little more "juice" into its motor and making two trips in the time now required for one. For instance, if the trip from Yonge Street to the Woodbine were made in twenty minutes instead of forty, the usefulness of the car would be doubled because it would do twice the amount of business in a day.

Amateurs and Experts

THE editor of the Toronto *Telegram* was called to Ottawa a few days ago to appear before the Commission that is now investigating the high cost of living, or simply the cost of living, because it would be poor business for anyone connected with a Government to say living was too high.

The Toronto editor and the committee had a real session. It was no parlor meeting, accompanied by the tinkling of tea cups or the trickling and dripping of soup.

They all went out into the backyard, left their smocks, caps and trinkets on the steps, and set to.

Many things were said. Even the sergeant-at-arms, who is supposed to play the part that an Indian plays for a cigar store, was wheeled out to look through the knot-hole while the game was on.

When it was all over the yard was badly mussed up and the committee and the editor were all ready for a spell with the clay dab in the shade of the wood-pile.

The cost of living hadn't been brought down—not a dent made in it, but there had been one single, lonesome truth that stuck up like a sore thumb.

It was tossed in by J. R. Robinson, editor of the *Telegram*, when he said:—

> "I stated an obvious truth that a committee of amateurs cannot examine an expert."

There have been more committees at Ottawa at times than they have had rooms to put them in. When they got tired calling them committees they changed the shingle to read "commissions."

And these committees or commissions have proceeded to spade up the garden lot for facts that should be gone after with a derrick and a stump puller.

In fact, it might not be a bad idea for some of the handy men they have choring around the Ottawa House to carve a bit of a sign and nail it on the door of the investigation chamber:—

"A committee of amateurs cannot examine an expert."

IT COSTS more now to get your picture painted than formerly. Still that is one form of dissipation that we can side-step and still have a fairly good time.

* * *

TO HEAR some Western grain growers talk on tariffs and Eastern profits at times, one might think the Westerners were right down to a shoe-string and nose-bag of wild oats. At the Ottawa inquiry it comes out that the Grain Growers earned 23 per cent. on a large capital, paid handsome salaries and bonuses and piled up a big reserve.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

A STUDY IN COLORS—PART 1

WHEN one thinks or talks of art or artists, painters, sculptors, musicians, etc., usually occupy the stage of action which the mind pictures before it. But art includes many lines of human endeavor other than those alluded to above. Metal coloring is an art, and in fact, electro-plating in its various branches may be regarded as an art commerciallized by modern industrial requirements. In this article we will confine our reference to art, to the study of colors as may be of interest to metal colorers using pigment and electro-chemical processes. The most remarkable feature of the famous Baptistery of Florence, Italy, are the magnificent bronze doors, with their beautiful bas-reliefs. Fifty years were required for their completion. But, these doors would not appear as beautiful as they do were it not for the coloring nature has effected upon the work of man. The reproduction of this effect has been accomplished by the artist's taste and the ingenuity of past masters in the art of metal coloring. Many otherwise capable platers have failed at metal coloring simply because of the exaggerated, florid character of their productions. Instead of keeping the effect strong and simple, they aim to produce elaborate and delicate combinations, which upon being copied, prove tasteless and extremely common, nor are they pleasing to the eye. The imitators do not realize why the original masterpiece was so good, and in copying have overlooked the real fineness and beauty, therefore, the results were very uninteresting.

The most successful workers have been and now are those who look beyond the crude products of modern commercial wares for their ideas. Nature is ⁿnd in some cases 33 1-3 pe rcent. Rea- their study, and the beauty of some finishes produced by our younger platers is indeed wonderful. These men are thinking for themselves and are seeking new schemes quite independent of existing formulas. The application of these new principles will naturally result in many unique and pleasing color finishes, and yet, these new principles are based on really ancient principles.

"For I have learned to look on nature";
Not as in the hour of thoughtless youth; but hearing oftentimes the still, sad music of humanity,
Not harsh nor grating, though of ample power to chasten and subdue."

As the alchemists of old were nearly always wrong in interpreting the results of their experiments, so too, many platers are wrong in their estimation of probable results when calculating the percentage of chemical used in the various solutions employed in metal coloring by the electro-chemical method. Modern chemistry would be impossible had it not been for the unreal science of alchemy and the careful, trained student in metal coloring is the result of the unreal but eager attempts made by imitators who wrestled with a fact, which being part of a truth, is a true science. These men were indeed skilled workmen, but they knew nothing at all of many facts which to-day is common knowledge—facts, many of which they discovered themselves. Some platers are satisfied when able to produce a particular color or finish, while others of the real progressive class show a decided interest in the how and why-for of each reaction taking place during the preparation and operation of dips, electrotypes or pastes, and for this later class this article is intended, not as guide, but rather as an aid to a more thorough study of harmony in colors and a greater interest in the fundamentals of a truly important branch of electro-chemistry and the art of coloring by other processes. Possibly the finest specimen of pigment coloring is produced naturally by nature, not upon a metallic surface, but upon the surface of the skin of the chameleon. Though extremely foreign to metal coloring, this animal affords ample scope for an interesting study in pigment coloring, and is easily procurable. After studying thoroughly the color characteristics the animal may be metalized and beautifully finished. Coloring pigments are responsible for the distinguishing characteristics between fair and dark persons. In fair persons the quantity is small, while in dark persons there is much more pigment. When this pigment ceases to be formed, the hair turns grey. The action of light upon these pigments is certainly a chemical action and the action of light is a very important factor in the study of colors. We must understand that color is caused by waves of light of different lengths, which can be taken up by certain structures in the eye, just as sound is caused by other waves taken by the structures of the ear.

We find that white light is a mixture including red. If any rose, or anything else that does not shine of itself is seen in a light that does not contain red, that thing will not appear red. The redness of roses does not depend on the roses themselves, but upon many things. No rose is red in pure green light or in the dark, and in pure red light a white rose is red. It is now apparent that the reason roses are red is that there is red light in sunlight. But if there is red light in sunlight, how do we account for white roses? Roses differ in their way of dealing with the sunlight that falls on them. Red rays as well as all rays of other colors, fall upon a white rose; but it is not red, because it reflects to our eyes all the light that falls on it. The red rose does not reflect all the rays that fall on it, it absorbs, or keeps to itself all the rays that make up sunlight except the red ones. These it reflects to our eyes, and we call the rose red. An object may have color at night or at any other time if it gives out color of its own, as a fire or candle flame. Such things are termed luminous. If there is no light there is no color. An orange is yellow because when yellow light, or white light containing yellow rays, is thrown upon it, it has the power of throwing the yellow light back to our eyes, and we call the orange yellow. If no light falls upon it, it can throw no light back, as it produces no light of its own, and so, naturally, it has no color in the dark. In brief, what we call color is a kind of light, and where there is no light there can be no color. The color of anything may be a mixture, because it sends back to the eye two kinds of light together. The mixture varies in different cases, as sunlight differs from artificial light and sunlight has a different mixture of colors at different hours of the day. If we take white light and pass it through a prism, we get a band of colors called spectrum, and when we look at it we get an impression not of a regular, even change of color from one end to the other, but of comparatively few colors to which we give definite names. Of these colors, which are commonly referred to as seven in number, some impress us as being mixed, while others appear pure. For example, the color

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1919-1920.

President—Mr. John A. Magill, 591 St. Clarens Ave., Toronto.

Vice-President—Mr. T. G. O'Keefe, 147 Dupont St., Toronto.

Secretary-Treasurer—Mr. O. Holtham, 328 Carlton Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

called purple is mixed, a red and blue together. What we call orange is mixed, red and yellow together. Prussian blue is not a pure blue, but a mixture of blue and green. Crimson red is simply red, it is not a mixture. Ultramarine blue is not a mixture, and there is also a tone of green of which the same is true. Probably these are the only three colors which are not regarded as mixtures, and we therefore call red, green and blue primary colors. By terming these colors primary colors we are not saying anything about light, we refer to the way the eye sees. By mixing these primary colors in various ways we can obtain the impression upon the eye of every kind of color that it can see. As a rule color-blindness occurs in both eyes, but there are cases where it is found in one eye only, and that, of course, suggests that it is the eye rather than the brain that is responsible for color vision. White light is composed of seven distinct colors, but it is not necessary to combine these seven colors in order to form white light, as for instance, yellow light and blue light when mixed will produce white light. The seven colors are: violet, indigo, blue, green, orange, yellow and red. If an object absorbs all the rays of light that fall upon it, the object is black, an object which partially but equally absorbs all the rays of light in grey, while an object which reflects equally all the visible rays of light is white.

Difference Between Colored Light and Colored Pigments

The difference in effect produced by mixing colored lights and mixing colored pigments should be constantly considered. A yellow light and a blue light will produce a white light; on the other hand, a yellow pigment and a blue pigment yield a green pigment, because the light is subjected to a double absorption—one due to each of the colors, yellow and blue. It is the light which is not absorbed by both which gives its color to the mixture.

In the use of pigments, blue, yellow and red are recognized as the three primary colors, since these colors cannot be produced by mixing other colors. Pigments are never pure colors. Colors produced by mixing two primary colors are termed secondary colors, and different colors placed adjacent to one another become modified as to their shade of color.

When possible, natural earth pigment should be employed for tinting purposes in preference to the manufactured material. Raw ambers, raw siennas, etc., will be found more durable than burnt ambers and burnt siennas. In compounding pigments it will be well to remember that all blue pigments are not chemically suitable for mixture with yellow or reds, nor all yellows with reds, therefore, it would be time well spent if the plater who is required to use pigments, studies the chemical source and chemical affinities of the various pigments.

In the use of pigments, lacquers, varnishes, etc., for the purpose of metal coloring. a certain degree of skill is absolutely essential and the effect is often decidedly ingenious, but after all is said and done the result is simply adulterated art. To produce metal-coloring legitimately the coloring matter must unite with the metal in a manner resembling amalgamation and not cause the metal to have the appearance of having changed its real nature. A certain make of cash register made of metal is now finished with an imitation wood finish, but the really beautiful metallic finish of the earlier type was by far the more pleasing to the eye, and a fair sample of common sense in commercial utilization of natural and artificial coloring for metal surfaces of this class.

Modern Taste in Metal Coloring

Forcing results by quicker methods, the result of modern commercialism has destroyed the solidity and coalescence of metal finishes as produced upon a great many lines of metal products today. The connoisseur revels in the fatina, the curious and interesting green rust adhering to the old bronze. The ærugo nobilitus, is no less distinctive in the early work of Japan than that of Europe. This beautiful fatina, so varied with the alloys, was affected by natural chemical processes or long burial in the earth, forming a crust of decomposing metal, a rust which may be veined with tints of reds, analachite green, and turquoise, a crystalline coating which though a valuable test of age and authenticity, may be counterfeited. But by scraping the surface of the imitation with a knife, or by boiling the object in water, the deception may readily be discovered. These faked finishes are often used on wax molds. Chemists have endeavored to secure a rust of identical nature as the green fatina of nature, but no process has been completely successful thus far. A natural fatina has a slow change similar to change of tone in china and pictures, and can be copied with only poor results. The old bronzes of Japan of archaic form have a fatina which may be easily distinguished from the fatinas produced in the 17th century. Bronzes of the later period are severe in style, the execution is strong, sober and restrained, and lastly, the fatina is usually a dull black.

The colorers of old Japan were and are now, in many cases, uneducated working men having wonderful skill, yet they seldom know the name of a single ingredient used in the composition of the liquid or paste employed. For some years past the preference has been for metal finishes of plain, quiet character. This is indeed gratifying; it indicates advancement in artistic taste by the public and a possibility for future ingenuity to assert itself. There are metals of various shades which may be used to blend perfectly in almost any form of decorative art and produce effects much more pleasing and enduring than is possible by superimposing pigments upon the surface. Certainly we must protect these metal surfaces, and it may be done without detracting from the actual or artistic value of the object. Glaring examples of crude finishes may be seen in almost any city, and should be studiously viewed by the plater desiring to improve his finishes and his taste.

Alloys

Alloys permit of some truly wonderful effects in colorings as compared to the pure metals. Very small percentages of certain metals will cause almost incredible changes in the properties of a principal metal, facilitating surface coloring. These changes are not always favorable to surface coloring, and in order to correctly gauge the proportions and choose proper metals from which to prepare an alloy, the nature and characteristics of the various metals must be considered with care. Sometimes an alloy may possess the desired color, but be too hard or too brittle to work into suitable condition for its desired end. In such cases it is necessary to imitate the color as closely as possible by means of pigments, pickling, or some form of electrolytic treatment. For example, equal parts of antimony and copper unite by fusion to form a pleasing violet alloy, this alloy cannot be worked with success and it becomes necessary to use a mere surface coloring on some other alloy or pure metal to obtain the effect required. We may take an iron casting, coat it with copper in a cyanide plating bath and scratch brush the surface, then immerse in a solution containing antimony for a moment and obtain a thin film of antimony which, when properly finished, produces a surface color of violet tone nearly identical in appearance with the copper-antimony alloy. Metals in alloys have very variable coloring powers, some exert more powerful decolorizing action than others when used for alloying. In the electro-deposition of alloys from aqueous solutions we are guided to a great extent by the electro-motive series and the possibilities of forming electro deposited alloys, which may be used commercially as decorative coatings, are thereby limited to a very few combinations.

ABE WINTERS.

To be continued

Readers' Queries

Question.—What is a blue dip used for in silver-plating, and of what is it composed?

Answer.—A blue dip consists of a solution of bichloride of mercury, sal ammoniac, and water, or muriatic acid may be used in place of the sal ammoniac. The solution is employed by platers as a quickening dip for Britannia metal previous to placing the work in the striking solution. Its use facilitates the plating of Britannia metal with silver by forming an intermediate film which receives the silver and prevents failures durng subsequent burnishing treatment.

* * *

Question.—The company I am employed by have resorted to tumbling steel and brass articles preparatory to the plating and have installed some second-hand tumbling barrels which are to be used with steel balls and punchings. Can you furnish me with any information which will be helpful in getting the goods through this operation? I have had no experience with tumbling and it looks like a mountain before me. Please do not spare details.

Answer.—Large ball-burnishing barrels usually rotate at from 15 to 20 r.p.m. on your class of work, the exact speed must be determined by experiment on your part, but the above is correct for ordinary purposes. The usual custom is to use twice the bulk of balls or punchings as work being treated. That is, to each pack of work use two pecks of balls. The proportions must be varied with some classes of goods in order to obtain best results in shortest time. When finishing brass work use a piece of cyanide about the size of a hickory nut in the solution as it keeps the brass from discoloring. The lubricant may consist of any good pure soap or one of the mild cleaning compounds now on the market may be used. Fresh solution should be made for each load and sometimes it is necessary to use fresh solution to finish a load properly. Do not expect to tumble all grades of work in the same period of time, the process requires time; it is not expensive but cannot be hastened beyond certain limits. To separate the work from the balls, place a large pan under the barrel and within the pan place a sieve of sufficiently coarse mesh to allow the balls to fall through. Dump the contents of the barrel into the sieve and shake the ball through. Work which is to be plated will be of better finish if given a short treatment in clean solution following the regular treatment. Results depend on the speed of the barrel, manner of loading, nature of lubricant, time of treatment, and form of barrel. On some lines of work you may find it advisable to rough the work in sand and water and finish with balls in a wood-lined barrel. Use the skimmings from your cleaning solutions as a lubricant in the roughing barrel, thus reducing cost of the treatment and utilizing a waste.

* * *

Question.—Kindly publish a formula for a good arsenic black finish. I wish to use same on polished steel goods and as an oxidize for brass parts.

Answer.—To prepare an arsenic black solution of 15 gallons, dissolve 5¼ lbs. of sodium cyanide in a portion of the water; when cyanide is dissolved, heat the water to about 200 deg. Fahr., and in it dissolve 15 lbs. white arsenic and 12 ozs. of copper carbonate. Equip the solution with either cast brass or copper anodes and use a current tension of about 1 volt. A good deposit for polished surfaces may be produced in 5 minutes and will not require buffing. Exceptionally heavy deposits may be produced in 20 to 30 minutes and buffed to a high finish in the usual manner. The solution will prove very satisfactory for brass oxidizing or by using stronger current greyish effects may be obtained. The solution acts very uniformly and is easy to operate and simple to manage. The absence of acids facilitates both easy operation and management. In case the solution requires refreshing, add the three chemicals in exact proportions as given here and no trouble will follow. Owing to the tendency of decomposition in the case of cyanide it sometimes becomes necessary to make small additions quite frequently. The metal content should remain practically constant for month without additions. The Beaume density may safely vary from 6 deg. to 15 deg.

* * *

Question.—I have read with interest the article on coppering and clearing which appeared in the April issue of CANADIAN FOUNDRYMAN and wish to try the process, but cannot obtain an iron tank at present. I have been using a pitch-lined wooden tank for cyanide copper plating solutione the bath is heated by means of steam coil at bottom of tank and temperature of solution during operation of same is usually about 120 degrees Fahr. Would this wooden tank answer for the new formula? Would a temperature of, say, 150 degrees be sufficient to give satisfactory results? Our work consists of cold rolled steel stampings, wire goods, etc, nearly all of which undergo a soldering operation previous to plating. In fact, all the work is completely assembled before plating and we fear we may encounter serious trouble if we use a strong alkaline solution at high temperature. We herewith send you two samples of our product for use in testing the operation.

Answer.—We cannot advise you to use the pitch-lined wooden tanw for the copper bath as you suggest. It is contrary to good practice to employ wooden tanks for hot cyanide solutions unless the tanks have a metal lining and it is cheaper in the long run to install a good sheet iron tank for the purpose; furthermore, while you may have operated a warm cyanide solution in a pitch-lined tank for several months successfully, you would meet with disappointment if you attempt to get satisfactory results from a cyanide solution operated at over 200 degrees Fahr. in the same tank without some form of lining to protect the solution from the effects of its action on the pitch. A thin wooden interlining, if properly placed with care, would suffice for a limited period and afford you an opportunity to give the method a trial. A temperature of 150 degrees Fahr. is not sufficient for cleaning surfaces, which are covered with mineral oils or greases. If you can substitute cutting or stamping compounds prepared from soluble oils, water, and an emulsifying compound for the ordinary oils used in general machine shop practice, it will render the use of lower temperatures when insoluble oils or greases are to be removed. It is always logical to first take into consideration the nature of the material to be removed from an article by a cleaning solution before preparing the solution or operating it. If you have thick patches of dried emery paste to be removed from the steel, a temperature of 150 degrees would not prove satisfactory in a one tank operation. By using a soaking solution or an electric cleaner previous to immersion of work in the combination bath, you may get fair results in the later at low temperature. Remember, as stated in the article referred to, the combination copper-clean solution has its limitations and we have no doubt that you will become more or less disheartened in your attempts to use the method as you describe, but with reasonable patience, persistent care and the application of common sense you will overcome all obstacles and succeed.

* * *

Question.—Will you kindly inform us why the operation called scratch brushing is performed on brass plated metal goods? Why would buffing not serve the same purpose?

Answer.—Scratch brushing a brass, copper, silver or gold deposit effects a hardening and smoothing action at one operation without the loss of metal. When brass or copper is deposited rapidly the metal forms on the surface of the article being plated in a condition similar to the erect scales on a fish. This may be seen by using a strong magnifying glass. Now, if the deposit thus formed is lightly scratch brushed with a fine brass wire scratch brush, these scales or particles of metal will be laid down or smoothed and the surface will become more or less polished in appearance. This treatment also hardens the metal and makes it more resistant to wear and moisture. If several deposits are given an article and each deposit is scratch brushed crosswise to the preceding one, the finished deposit will be many times more resistant to moisture and wear than where only one scratch brushing treatment is given, the porous condition of the deposit as it comes from the plating bath will be changed to a very non-porous coating. In the operation of buffing a variable amount of metal is always removed, the amount varying with the skill of the operator and the condition and character of the metal. The necessity for scratch brushing depends to a great extent upon the rate of deposition and the thickness of the deposit. We must admit that many firms who formerly scratch brushed a large portion of their plated wares have dispensed with the treatment and now simply buff the surface of all metal coatings. The result is obviously less satisfactory to the customer, but enables the manufacturer to make his profit without increasing the price of the product. Furthermore, buffers employed on these goods have been specially trained to use great care and some judgment when buffing such coatings. The structure of the metal deposits have been improved and as a result the public are quite well satisfied with present-day metal coatings.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	29 35
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 50

METALS

	Montreal	Toronto
Aluminum	$38 00	$35 00
Antimony	9 00	8 50
Copper, electrolytic	18 50	17 50
Copper, casting	18 50	17 00
Lead	6 50	7 50
Mercury		.....
Nickel		.....
Silver, per oz.		0 98
Tin	58 00	55 00
Zinc	8 50	8 25

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$11 50	$11 25
Copper, crucible	14 00	14 00
Copper, heavy	13 50	14 00
Copper, wire	13 50	12 00
No. 1 mach. comp'n	12 50	13 00
New brass cuttings	9 25	9 00
No. 1 brass turnings	8 00	9 00
Light brass	5 00	5 00
Medium brass	7 00	6 00
Heavy melting steel	9 50	9 00
Shell turnings	6 00	6 00
Boiler plate	10 00	8 00
Axles, wrought iron	17 00	15 00
Rails	12 00	11 00
No. 1 machine cast iron	15 00	15 00
Malleable scrap	12 00	12 00
Pipes, wrought	6 00	5 00
Car wheels, iron	20 00	18 00
Steel axles	20 00	20 00
Mach. shop turnings	5 50	5 00
Cast borings	5 50	8 00
Stove plate	12 00	10 00
Scrap zinc	5 00	5 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	15 00	12 00

COKE AND COAL

Solvay foundry coke	.....
Connelaville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

¼ in.	$14 35
5-16 in.	13 85
⅜ in.	13 50
7-16 in.	12 90
½ in.	13 20
9-16 in.	13 00
⅝ in.	12 90
⅞ in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 10
Linseed oil, boiled, single bbls.	1 72
Linseed oil, raw, single bbls.	1 70
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37½
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$6 55	$6 00
Sheets, black, No. 10	6 15	5 45
Canada plates, dull, 52 sheets	8 50	8 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 95
Premier, 10¾ oz.	....	8 25
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$13 00
3-16 in.	12 50
¼ in.	11 75
5-16 in.	11 40
⅜ in.	11 00
7-16 in.	10 60
½ in.	10 40
⅝ in.	10 00
¾ in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20%, on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Silver	1 05 to 1.00
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.14½
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.23
Ammonium, carbonate	.25
Ammonium, chloride, lump	.55
Ammonium, chlor., granular	.30
Ammonium, hydrosulphuret	.30
Ammonium, sulphate	.15
Caustic soda	.17
Copper, carbonate, anhy	.50
Arsenic, white	.20
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.40
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	1.35
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.40
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, bullneck	2 00
Pumice, ground	3½ to .05
Emery composition	08 to .09
Tripoli composition	06 to .09
Rouge, powder	30 to 35
Rouge, silver	.35 to .50
Crocus composition N	08 to 10

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 34
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 43

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10½

FILES AND RASPS.

	Per Cent
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	....
Globe	50
Vulcan	50
Disston	40

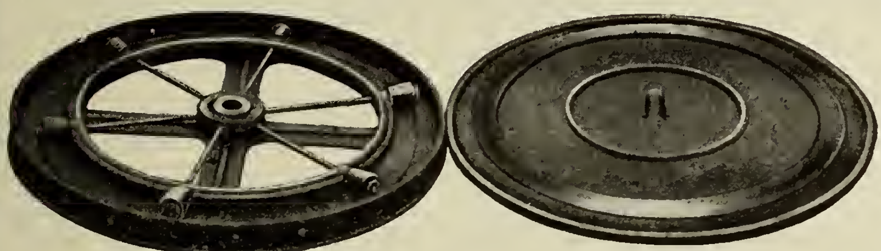
Foundry Equipment

Are you intending to install anything new now that the reconstruction period is at hand? If so, let us have your specifications as we represent

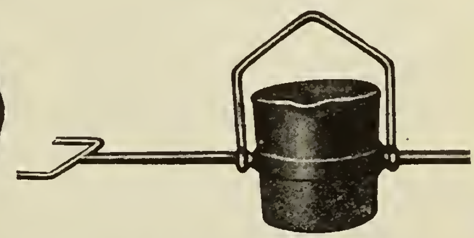
THE WHITING FOUNDRY EQUIPMENT CO.

HARVEY, ILL.

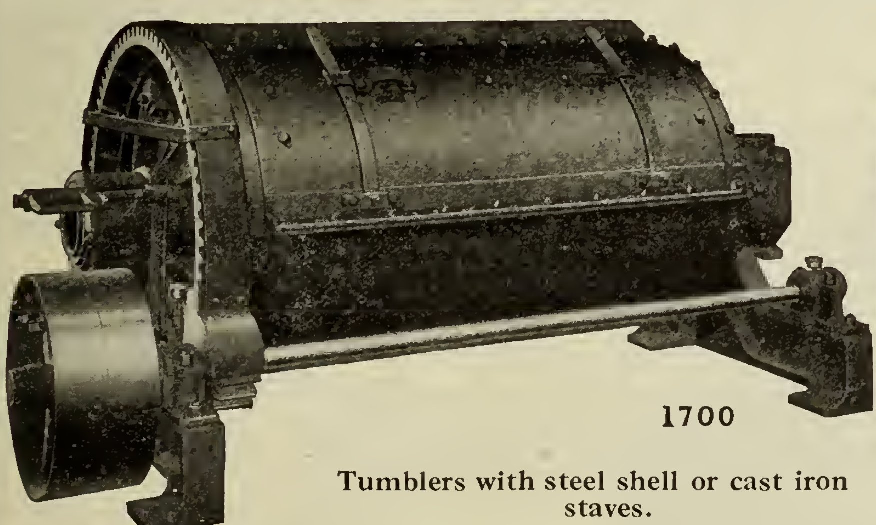
who manufacture **CRANES, CUPOLAS, TUMBLING BARRELS, CORE OVENS** and other requirements for making Brass, Steel or Iron castings.



Turntables with plain, grooved or raised tracks.

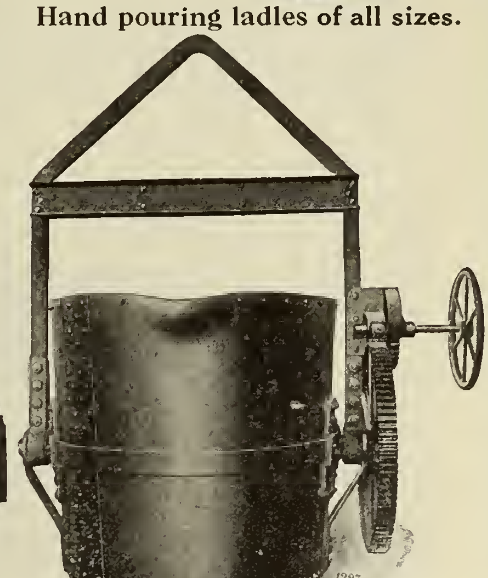


Hand pouring ladles of all sizes.



1700

Tumblers with steel shell or cast iron staves.



Crane ladles of all sizes.

We Carry and Handle Everything for the Foundry

The Dominion Foundry Supply Co.

LIMITED

MONTREAL TORONTO

SOME FIRMS TAKE IN LARGE AMOUNTS

But the Business in Several Lines is Largely Local Rather Than General

TORONTO.—If buying in general were as good as it is in some local instances there would be a very large amount of business moving in the Dominion just now. As it is buying is very heavy in some lines, and practically at zero in others.

There are several large propositions under way, and announcement of these will no doubt be forthcoming in a few days or weeks now. There is still the same feeling of uncertainty regarding the outcome of the strike in this district. It is poor business that it is not settled, and the continuance of the strike is doing harm to both sides that it will take some time to overcome.

More Railroad Equipment

The western divisions of the National Railways are coming in for their share of attention just now, and big lists have been out for some days, asking for tenders on a list that has some 60 machine tools of all kinds in it. Many of the dealers have sent in their bids for this equipment, and the award should mean good business.

The same buyers are now in the market for the small tools such as drills, taps, reamers, etc., for the St. Malo shops. The lists for the machine tools for this was out some time ago, and the work was pretty well secured between the Canadian makers and the equipment which the Government had on hand in the gun shop at Quebec.

The chances are that there will be some fairly keen bidding for the last list that is out, viz., the drills, taps, reamers and other similar lines. Some of the agents have been waiting for this business to show up for some weeks, and are well prepared to go and make concessions to land it.

There is a fair amount of buying going on now, and some of the machine tool men are well pleased with the amount of business they are securing. There are several good-sized developments under way, and they are going to count largely in the volume of business that is booked. Buildings are being put up to house good-sized plants. As noticed in previous reports there is no material change the strike situation in this district. It is making the going poor in more ways than one, and business continues to drift into new and strange channels because the people who want work done cannot receive any promises of delivery from the shops. There are rumors, some of them apparently well founded, that say that a settlement is near. Others again say that many of the strikers have left the district to secure work elsewhere.

Buying In Old Way

"We are buying now as we did before the war," stated on of the warehousemen to MACHINERY this week. "For a long time past nearly all our business has been of the hand-to-mouth sort. We have simply taken the business that came and passed it on to the mills. Now we are buying in quantities that should put our stock in good shape for a quarter. Deliveries are spread over this time and will be more or less protected against any increase in price. We do not look for a decline at the present time. In fact prices are firmer, and the man who is putting off his buying is going to be left."

The Old Country Trade

One contract that came up a few weeks ago, and tenders for which are placed this week, called for chains and anchors. Bids were asked from Old Country firms by their Toronto agents, but there is very little chance of them securing the business. In the first place they are high in price, and in the second place they will not place their tenders as they are asked, in order that comparisons may be made with bids from the States. "There were too many qualifying clauses in the English tender," stated the Canadian firm handling this line. They had provisions that meant that their price was off if changes were made in hours of work or half a dozen other things. In fact their bid was not definite enough to put in. Then again the English concerns insist on putting in their bids their own way. They lump the chains and anchor, and put in a price to cover the whole equipment, whereas the firms buying in this country ask for and insist upon a price per pound on chains and a price per pound for anchor. The Old Country houses will simply let us go by the board rather than make the concession."

It is understood that the British firms are still quoting about ten per cent. too high, and, in consequence, the business, or all of it that does not specify Old Country lines, is going to U.S. points.

The Scrap Metal Markets

There is a movement on the part of some of the dealers to let go of a considerable part of their holdings. They figure out that prices are not going to jump very much higher, especially in coppers. In fact it may be that they are now near the level that will make about as good selling as can be expected for some weeks.

Fairly large shipments of iron and steel are being made to the U.S. market. Canadian mills and foundries are not taking up very much material.

GETTING OVERSEAS BUSINESS

A report issued by the Canadian Trade Commission shows that up to the present time more than $15,000,000 worth of orders have been secured overseas as a result of the credits established in Europe. One of the largest buyers so far on this basis is Roumania, which, among other items, has taken binder twine valued at $940,990, paints and oils worth $189,845, edged tools worth $130,743 and dairy utensils valued at $12,790. In addition to the business that has come through the trade commission many Canadian firms have, by their own efforts, been securing orders in England. A lot of inquiries are being received that indicate future orders in all parts of the world. It would appear that there is quite a lot of business to be had in various oversea countries for Canadian firms. It is apparent also that there will be plenty of competition.

NATIONAL STEEL CAR REFUSED THE OFFER

HAMILTON.—The offer of the American Car & Foundry Co. for the purchase of the National Steel Car Co., of this city, was rejected. Negotiations between these two large companies have been in progress for many months, and the deal was expected to be completed. After careful consideration the National Steel Car Co. decided to refuse the offer and Sir John Gibson announced that the deal was off. The failure of the transaction to go through will not affect the operations of the local plant, and business will be carried on as usual, said Sir John.

Numerous reasons were given why the National Steel Car shareholders declined to accept the offer. The American concern agreed to pay all bank liabilities and pay in full the shareholders according to the stock they held, but they were willing to pay this only from the profits. If the plant was not operated vigorously it would take twenty years, probably, to meet these demands, and the local company shareholders were not altogether in favor of this idea of payment.

Sir John Gibson stated that the shareholders were not assured that the plant would be operated as vigorously as it might be and failing to give this assurance negotiations were suspended. "They wanted too much of their own way in operating the plant, and we could not see our way clear to favor all their ideas," said Sir John.

The announcement came as something of a surprise. A week ago it was announced that it was only a matter of a few days when the American Car and Foundry would take over the local plant.

Hamilton will not be affected in any way by the decision of the National Steel Car Co. shareholders. The local palnt will be operated as usual. It is in good running order, very busy, and has large orders.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.
Magnetic Mfg. Co., Milwaukee, Wis.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co., Cleveland, O.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Magnetic Mfg. Co., Milwaukee, Wis.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MAGNETIC; STANDARD AND SPECIAL
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Oot.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corporation, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wella, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS

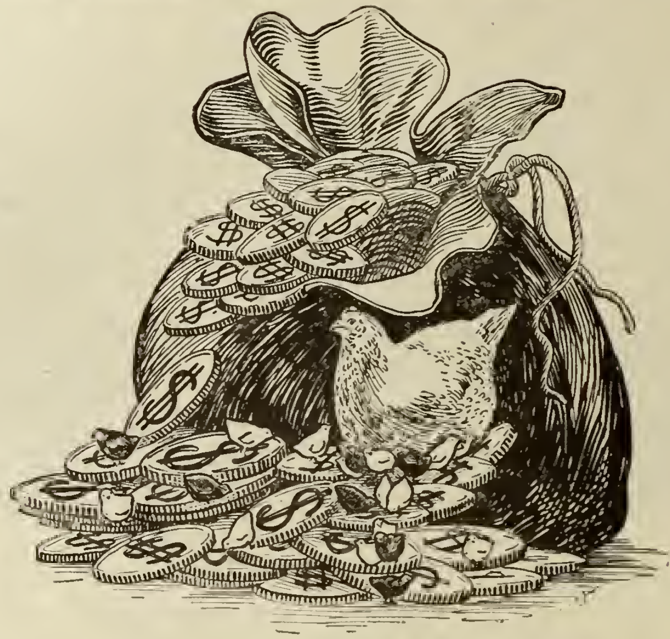
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, AUGUST, 1919 No. 8

SERVICE
KAWIN

Hatches Profits **In the Foundry**



This picture aptly illustrates just how **Kawin Service** acts in your foundry. It hatches profits. It hatches them where you least expect them. Chas. C. Kawin & Co. are chemists, experts in moulding and cupola practice. They know how to turn losses into profits. Leaks in production not apparent to the ordinary eye are discovered by the Kawin experts and eliminated. They boost production and advise means to put foundries on a better paying basis. In a nutshell Kawin Service includes:

- Design and Construction of Foundries.
- Co-operation and Creation of an Organization.
- Development of Production.
- Development of Suitable Cost Systems.
- Expert Assistance in all Branches of the Plant.
- Industrial Engineers.
- Industrial Accountants.
- Cost Specialists.
- Structural Engineers.
- Foundry Engineers.
- Expert Foundrymen.
- Cupola Experts.
- Metallurgists.
- Chemists.
- Five Service Stations.

Kawin Service is guaranteed to save you 100% over and above its cost. Why not investigate?

Charles C. Kawin & Company, Limited

Chemists, Foundry Engineers and Metallurgists

307 Kent Building, Toronto, Can.

Buffalo, N.Y. Dayton, Ohio Chicago, Ill. San Francisco, Cal.

New "Homeopathic Treatment" of Core Room Troubles

"Clinics" recently held in core rooms of many progressive foundries have demonstrated that FLINT SILICA makes better cores with **half** the usual amount of core oil than was ever made with **double** the amount.

In other words, the tradition that a washed, dried, clean Silica core sand requires **more** oil because it is itself free from bonding material is ALL WRONG—when applied to FLINT SILICA.

Indeed, we are showing customers who formerly mixed ordinary core sand with core oil in the proportion of 50-to-1, how to reduce their oil to 100-to-1 and even 150-to-1 for the same kind of cores, by the use of FLINT SILICA washed, dried core sand.

This is because the oil forms a very thin uniform **film** all over the surface of the clean, round, polished surface of FLINT SILICA granules, instead of in pockets. The cores when baked were not only firmer, but were very much more porous and free-venting.

In other words, a "Homeopathic" dose of oil is more effective than allopathic treatment—and it costs much less.

Send for a working sample of FLINT SILICA, and try it out on this basis.

United States Silica Company

1939 People's Gas Bldg. Chicago

Crucibles of Quality

UNIFORM

Service and Durability Ensure Economy.

Tilting Furnace

CRUCIBLES

Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

Canadian representative H. T. Meldrum 14 St. John St., Montreal, Canada.

SLY Foundry Equipment

To help your men have a bigger showing at the end of each day's work, give them Sly Foundry Equipment.

This is one way you can keep your output above normal in spite of labor shortage.

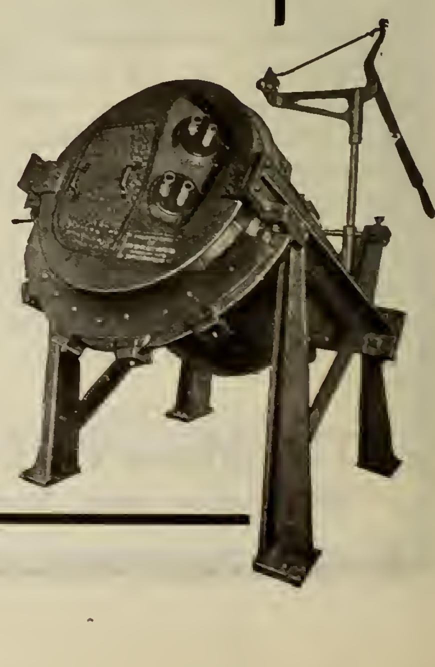
For example, the Sly Sand Blast illustrated will clean more castings daily than any other you can procure. It has great strength where others are strong, and it is strong where others are weak. There is practically no wear out to the nozzle.

May we explain in detail?

These are Some of Our Lines

- Tumbling Mills
- Cinder Mills
- Resin Mills
- Dust Arresters
- Core Sand Reclaimers
- Cupolas

Full list upon request.

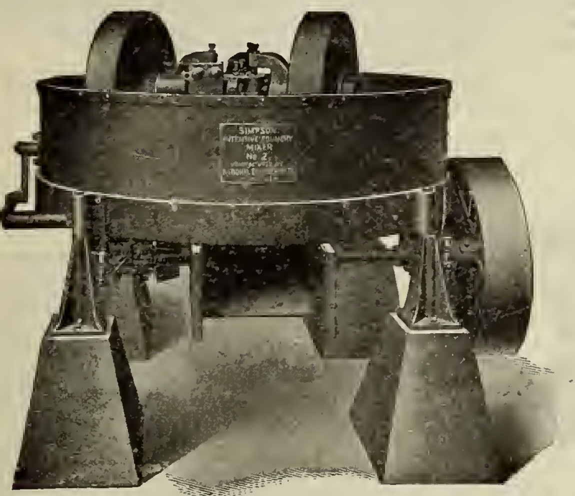


THE W. W. SLY MFG. CO.

CLEVELAND, OHIO, U.S.A.

THE SIMPSON INTENSIVE FOUNDRY MIXER

Economical and Efficient for all kinds of Foundry Sand Mixtures



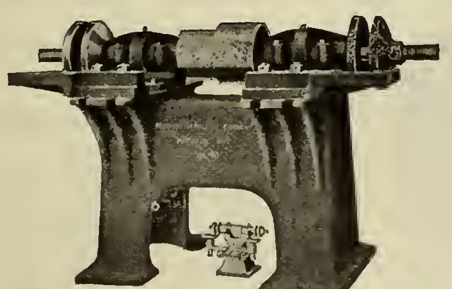
Automatic Discharge. Saves Labor and Materials. Produces a thorough mixture, gives large capacity with small cost of maintenance and operation. Its success demonstrated in a great many of the best known plants in the country.

Write for list of users, details and price to

NATIONAL ENGINEERING CO.

Machinery Hall Bldg.
549 W. Washington St.
CHICAGO, ILL.

FORD-SMITH



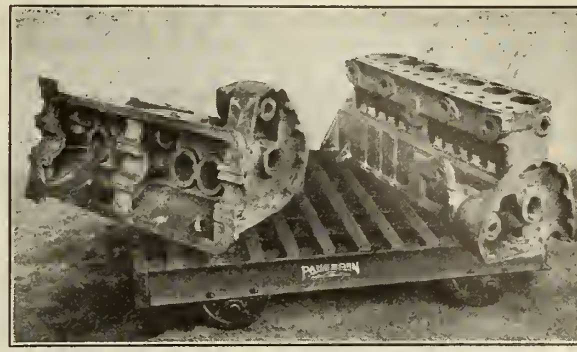
Heavy Type Floor Grinder

We manufacture a wide range of Floor Grinders, Polishers, Motor-Driven Grinders, Disc Grinders and Swing Grinders. We would like your name for our mailing list, and our new Grinding Catalogue.

Write to-day.

Ford-Smith Machine Co., Ltd.
HAMILTON. ONTARIO

How long would it take to clean this cylinder by your present methods—and what would be the labor cost alone?



How long would it take to pay for a Sand-Blast Installation from the saving in labor cost if you cleaned it in three minutes? It is being done by

"PANGBORN" SAND-BLASTS

Whether your requirements are the cleaning of

Castings
Forgings
Stampings
Sheet
Plate or
Structural

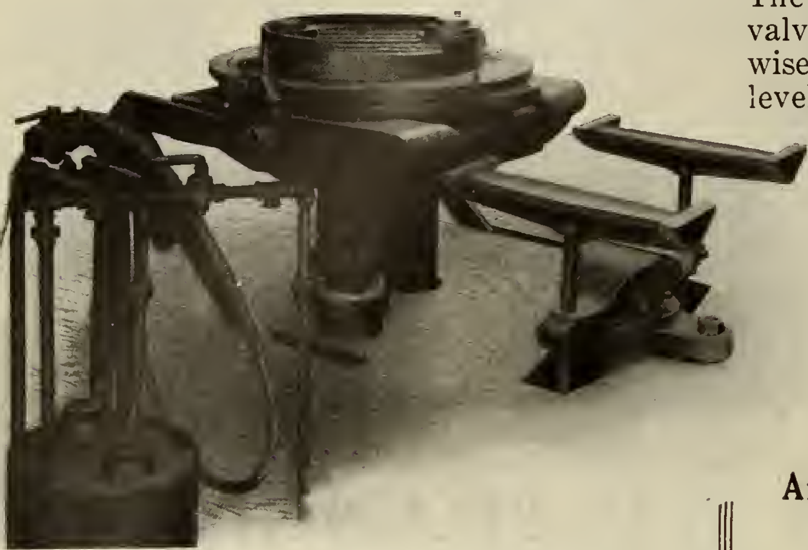
or the removal of scale from heat treated parts, there's a "PANGBORN" Unit or Combination for every need, large or small, that will make a saving for you—and a more attractive product.

Your enquiries are invited and create no obligation.

PANGBORN CORPORATION
HAGERSTOWN. MD.
SAND-BLAST SPECIALISTS
P.O. BOX 8503

The AMERICAN JOLT ROCKOVER MACHINE

is efficiently operated by men of little experience in foundry work, because it is simple, accurate and massively rigid.



The self-adjusting internal jolting valve takes up its own wear. Likewise the automatic ball and socket leveling device requires no attention from the operator.

One piston jolts and rocks mold. And the plain rockover table permits pattern plate being bolted direct to table, and to project over table in all directions when necessary.

Write for Complete Particulars

American Molding Machine Co.
TERRE HAUTE, INDIANA
Box 35

Builders of
Plain Jolters Jolt Strippers Jolt-Rockover Machines

DOMINION CRUCIBLE CO.
LIMITED
ST. JOHNS, QUE.

HAMILTON FACING MILLS CO. LIMITED
HAMILTON, ONT.
SOLE CANADIAN DISTRIBUTORS

Foundry Equipment For Sale

1—Henry Pridmore Roll Over Moulding Machine, 22″ x 18″—8″ drop.
1—Henry Pridmore Drop Plate Moulding Machine, 24″ x 24″—8″ Drop.
1—Foot Power Sprue Cutter, depth of throat 10″ travel 1″, 4″ between jaws.
1—Foot Power Sprue Cutter, depth of throat 6″, travel 1″, 1″ between jaws.
2—No. 275 Monarch Type Furnaces.
1—Rockwell Type Furnace, 600 pounds capacity.
1—Sherbrooke Machine Co., Roots Type Blower, outlet dia. 10″.

Standard Machinery & Supplies, Limited
261 Notre Dame St. West Montreal

"Make Your Own Price"

The days of "negotiated" prices, so far as reputable manufacturers are concerned, have long since gone by. A price, nowadays, is a price: it is no longer the starting point for an argument. It is fixed by the seller, and is accepted by the buyer, if accepted at all, in the expectation and belief that it represents actual cost of efficient production, plus a fair profit.

In a broader and better sense, however, buyers still can, and they still do, make their own prices. For it is buyers, and buyers only, who make possible the volume of production which is the principal factor in determining the unit costs on which prices must be based.

Many manufacturers, and some of them are in the Pneumatic Tool business, believe prices should be based exclusively on "the law of supply and demand." They believe it is right to charge all the traffic will bear, regardless alike of costs and profits.

Much can be said, and much has been said, in support of this view, but I have never been able to share it. I have always believed, and I believe now more strongly than ever before, that no manufacturer can truly serve his customers unless he shares with them the benefits accruing from the economies which their patronage helps him to achieve.

The success of the Keller Pneumatic Tool Company has been due in large measure to our steadfast adherence to this principle. We exist by and for our customers. Every new customer, and every individual order we receive, helps us by just so much to build better tools, and, other things being equal, to sell them at better prices.

That is why Keller prices are always relatively, and sometimes actually, lower than those asked for competing tools. They are "made" by our customers—the United States Government, the leading Railroads and Shipyards, and a constantly-growing number of representative industrial organizations throughout the world.

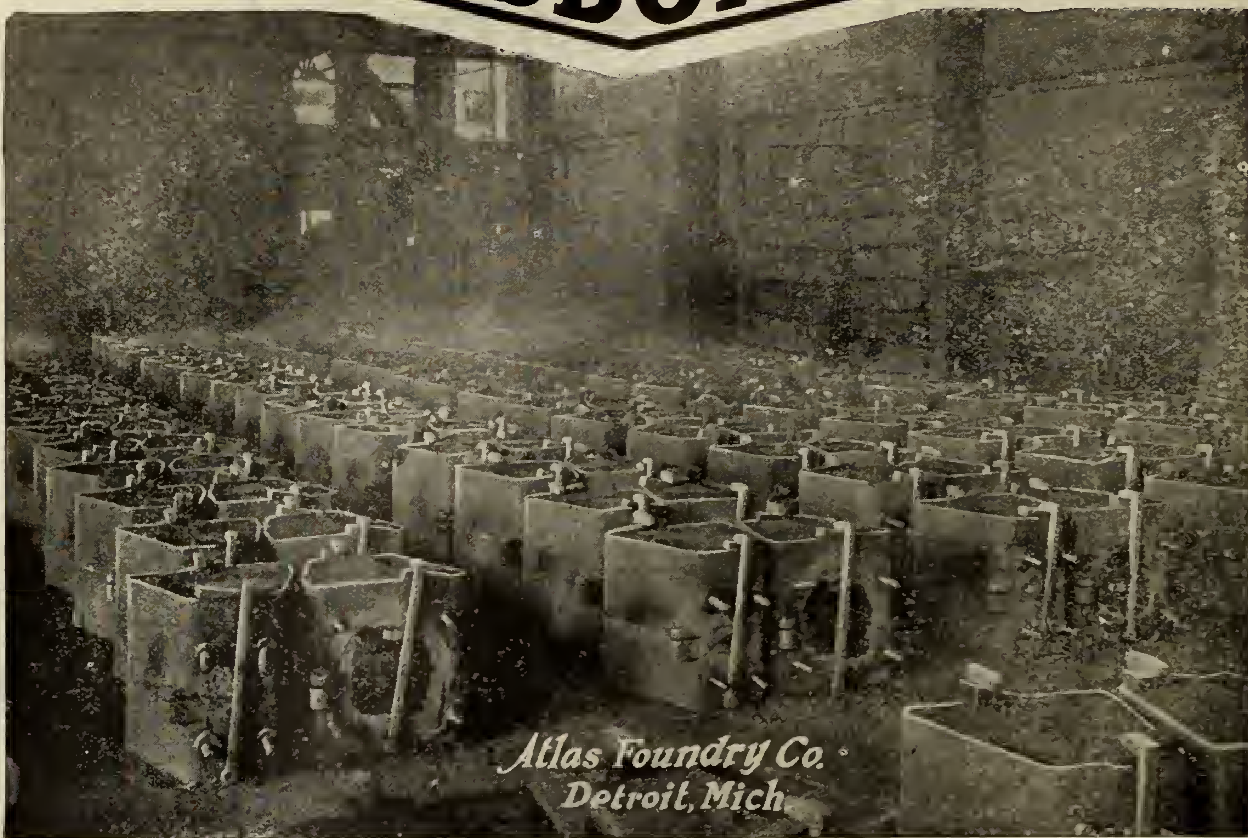
William H. Keller *President*

KELLER-MADE
PNEUMATIC TOOLS
MASTER-BUILT

KELLER PNEUMATIC TOOL COMPANY, CHICAGO & GRAND HAVEN, U.S.A.

General Sales Offices: 20 East Jackson Boulevard, Chicago · Factory: Grand Haven, Michigan

OSBORN



STRIPPING-PLATE JOLT SQUEEZER MACHINES

The above shows a floor of moulds of transmission cases in the Atlas Foundry, Detroit. Size of flask 21" x 19" x 11" deep, halves. Two Osborn No. 80 Stripping-Plate Jolt Squeezer Machines are making possible a big daily production. The advantage of this type of machine is that both cope and drag of the mould are jolted and squeezed, no clamping or rolling being necessary. Both cope and drag being barred no bottom boards are required, thus giving the fastest working equipment on duplicate work. Because of their reliability uninterrupted performance and capacity for work, these machines can produce like results in your foundry.

The picture at the lower left hand shows the pattern fastened to the table of one of these machines ready to receive the flask. At the lower right is shown the mould after it has been stripped from the pattern.

Osborn Moulding Machines give these results:

(1) Insure rapid production.
(2) Lower direct moulding costs.
(3) Accelerate delivery.
(4) Effect saving in metal.
(5) Lower overhead per ton.
(6) Reduce grinding.
(7) Lessen pattern repairs.

Made regularly in the following sizes:

	Table. Size.	Pattern Draw.
No. 78	13½" x 29"	5"
No. 80	21" x 22"	8"
No. 81	25" x 29"	8"
No. 82	24" x 36"	10"

THE CLEVELAND OSBORN MANUFACTURING CO.

5403 Hamilton Ave., Cleveland, Ohio

Address replies to Main Office or Branches to DEPT. C.

Chicago
155 No. Clark St.

San Francisco
61 First St.

New York
3d. Ave. at 35th Street
Bush Terminal, Bldg. No. 5, Brooklyn

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

To the Members of the Foundrymen's Association

Have You Marked on Your Calendar the Dates of the Annual Convention, to be Held in Philadelphia, September 29 to October 3, 1919?

IF you have not already marked your calendar we hope you will do so immediately after having reading this bulletin and learned of the splendid program being prepared by the committee on papers, the interesting and worth while demonstrations assured by the Department of Exhibits, and the enjoyable entertainment features being provided for by the Philadelphia Foundrymen's Association.

Technical Program

To the members an unusually extensive and interesting technical program is promised by the committee on papers, which announces that thirty-four papers and addresses already have been secured, covering all branches of foundry practice. The authors include some of the most prominent foundrymen in the United States and Europe. A number of the papers will be illustrated by motion pictures, showing operations in detail. Sufficient material is assured to provide special sessions on gray iron, malleable iron and steel foundry problems. Attention will also be devoted to the educational problems of the foundry industry, and in a broad way, to questions of management and personnel.

Among the interesting papers for which arrangements have been made are the following:

Ships built of steel castings, from a technical foundry standpoint, by Myron F. Hill, president Cast Steel Ship Corporation, New York City.

Micro-motion study for foundrymen, with motion pictures, by F. B. Gilbreth, Providence, R.I.

Training men for foundry work, by C. C. Schoen, Yale & Towne Mfg. Co., training section U.S. Department of Labor.

Investigation of steel castings on German submarines, by Prof. Wm. Campbell, Columbia University, New York City.

Education and welfare in the foundry industries, by C. A. Prosser. director Federal Board for Vocational Education, Washington, D.C.

Exhibition

Without doubt this will be the greatest of all exhibits. More space has already been reserved than the total used at any previous convention. Equipment will be operated and demonstrated on a larger scale than ever before, and many manufacturers are planning to introduce to the foundrymen at this convention new and improved machines.

Entertainment

An interesting and instructive program, consisting of entertainment and shop visits, is being planned by the live committee of the Philadelphia Foundrymen's Association. The program for the men will be planned so far as possible so as not to interfere with attendance at technical sessions or exhibits. The entertainment for the ladies will be more interesting than usual, and you are urged to bring the ladies with you.

C. E. HOYT
Secretary-Treasurer American Foundrymen's Association, 1401 Harris Trust Building, 111 W. Monroe St., Chicago.

Hotels

The printed list of hotels and rates will be mailed to you within a few days. If you do not receive yours write to the secretary, C. E. Hoyt, Harris Trust building, Chicago. The Hotel and Reception Committee have plans for making advance reservation for all guests. When you receive their announcement reply promptly, thereby securing good accommodations and making easier the work of the committee.

Foreign Attendance

President Backert has just recently returned from a trip to England and France. While in these countries he attended several meetings and banquets as the guest of foundrymen's associations, and the reports that many foundrymen from the other side will attend the Philadelphia convention. Look for a full report from president Backert in a later bulletin, giving an account of his experiences and observations.

As previously stated the CANADIAN FOUNDRYMAN'S booth will be headquarters for Canadians attending the convention, and we invite you to call and register. We also earnestly request all who intend to attend the convention to write us of their intention. Any service of which we can be to you between now and the end of the convention ill be cheerfully and freely given. Don't forget the date. The week beginning with September 29.

The next issue of the CANADIAN FOUNDRYMAN being the last one before the convention, will be devoted especially to topics dealing with the convention, and will include many interesting and historic views of Philadelphia as well as much interesting matter dealing with foundry practice, but mainly of interest as a convention number.

The Societe Pour Valeurs de Fer et D'Acier, Schaffhouse, Switzerland, have asked us to inform our readers of the existence of the Metallurgical Exchange, Tonhalle, Zurich, Switzerland, and to invite them to visit the exchange during ther stay in Switzerland in order to secure connections. The exchange is visited every Friday from 2 to 4 o'clock by Swiss and foreign manufacturers, by foreign consuls, etc.

The Moulding of a Screw Propeller in Loam

Propellers May be Molded in Green Sand From a Complete Pattern or in Dry Sand From a Single Blade or Swept Up in Loam Without a Pattern as Shown in the Following

By JOHN H. EASTHAM

THE production of "one-piece" propeller castings varies as to method in different foundries, shop facilities, coupled with the desire to economize in the direction of pattern-making, being the dominant factors which determine the system employed.

The casting shown at Fig. I., suitable for a freight-carrying, ocean-going steamer of three thousand five hundred tons, is fourteen feet ten inches diameter from tip to tip, weighing five and a half tons as delivered to the machine shop, and in the average foundry would, on account of its very large area and complicated design, be a difficult proposition to handle on a paying basis, regarded as a unit. Standardization of ships, leading to the issue of orders in series, have, however, smoothed the path of the foundryman somewhat, and encouraged the manufacture of propellers in loam, casting losses by this method being negligible, and by the exercise of ordinary care after pouring, four to six castings may be safely taken from a single mould, a little mending, wet blacking, and redrying, being only necessary before again assembling in each case.

A circular drag or foundation plate 16 feet 6 inches diameter, as shown in Fig. II., was first swept up in open sand, the lightening holes "A, A, A, A," reducing its weight to fourteen tons when filled with metal to a

FIG. 1. SHOWS FOURTEEN-FOOT TEN-INCH PROPELLOR WEIGHING FIVE AND ONE-HALF TONS. NOTE THE SMALL ONE UNDERNEATH.

thickness of four inches, twenty-four wrought iron staples or "eyes" being cast in as shown to facilitate the securing of the blade copes when closing the finished mould, the plate when thoroughly cold being lowered into a pit on a hard levelled bed, there to remain as long as in use.

Incidentally floor drying was resorted to in these cases as being most advisable, time in loading on oven car and unloading when dry being saved, as well as

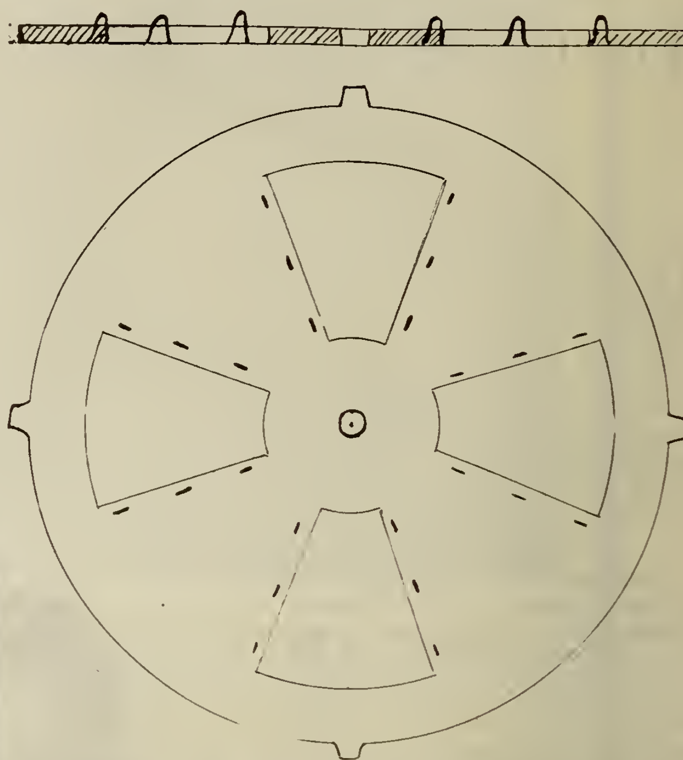


FIG. 2.—FOUNDATION OR DRAG PLATE, WEIGHT, 14 TONS.

considerable strain on the cranes and equipment. A course of mud stuffed brickwork was next laid in the circle shown at Fig. III., the foot socket to contain the sweep spindle being also built on a brick base at the plate centre, a strickle being afterwards bolted to position and a thickness of stiff loam struck off in readi-

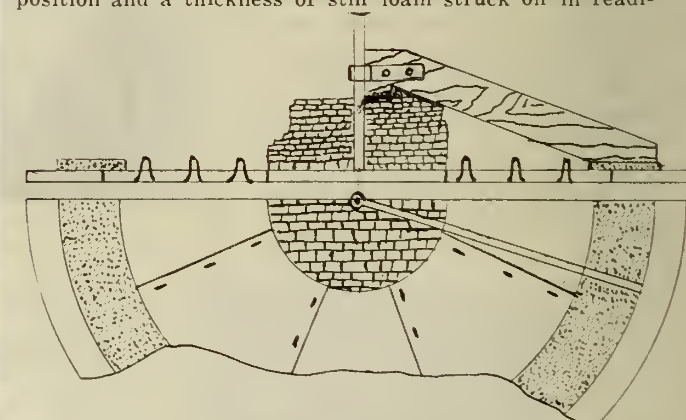


FIG. 3. SWEEP, FORMING THE BED TO RECEIVE PITCH TEMPLATE.

ness for the pitch guide or template segment illustrated in Fig. IV. A word here as to this template. Three-sixteenths plate is the best material to use for its purpose, its upper or working face being cut to correct shape before bending, while after bending a steadying base or foot arrangement of four by two wood battens, set screwed to the outside bottom diameter, will serve the double purpose of preventing the sheet sinking into the soft loam or falling over whilst working the sweep.

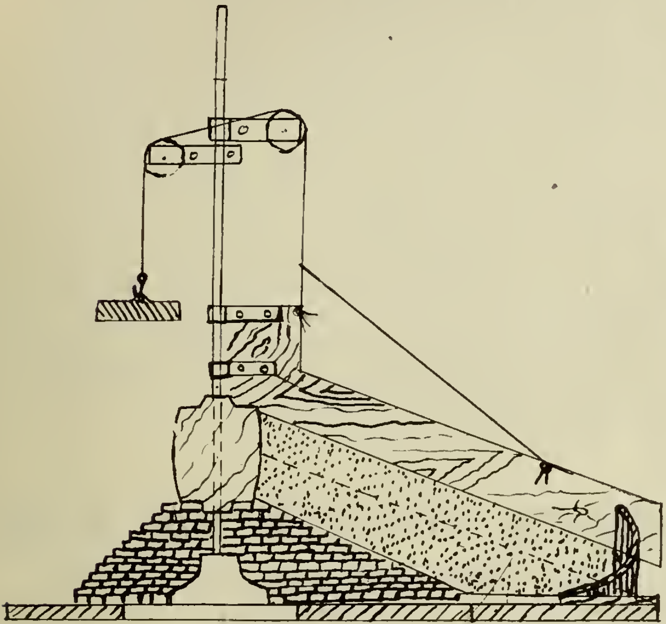


FIG. 4.—SEGMENT, STRICKLE, AND PULLEY ARRANGEMENT FOR SWEEPING UP DRIVING SURFACE OF BLADES.

Failing the use of plate, however, an all-wood arrangement is permissible, in this case a sheet strip secured to the working edge to prevent rapid wear being advisable.

A strickle as shown at Fig. IV. is now bolted to one long or two short sliding arms and counterbalanced by a rough and ready pulley arrangement to ensure ease in moving up and down the spindle whilst building and striking out the four drag or "driving" faces of the

FIG. 5.—DRIVING SURFACES SWEPT UP AND THICKNESS PIECES IN POSITION. NOTE DRAW BACK MARKED "X."

blades, in each case a few inches of this building being left over till the hub pattern is bedded to place, a parting at half the hub depth being made and a small drawback built up on a grid at each of the four points of contact with the hub, these being obviously necessary to allow of the removal of the pattern before drying the mould.

These details are very plainly shown in the photo at Fig. V., a built-up drawback to the left and the open parting to the right of the hub, as also are the blade thickness pieces placed in position after the driving face sweep has been removed, the space between the strips being next filled in with sand, rammed hard and strickled off to the contour of the "after" or "astern" face of the blades, parting sand or paper being now spread over these four surfaces prior to the building of the four cope

FIG. 6.—SHOWING COPE BUILT ON ONE BLADE, AND ASTERN SURFACE ON ANOTHER.

moulds whose character is plainly illustrated in the photograph at Fig. VI.

As will be observed, the cope structures are of bird-cage design, five bars each about six inches wide, conforming in shape to the contour of the blade at various

FIG. 7.—SHOWING COPES FINISHED READY FOR OVEN.

distances from the hub being held together by a similar number of straight bars wedged in transversely through slots left in the curved bars for the purpose.

Stiff loam is first tucked under the bars and all over the face of each mould, bricks and mud forming the usual backing, a number of cut-away guides being cut in the outside diameter of the cope to allow of correct closing afterwards. A small crown plate is next swept up perforated in the usual way for runners and risers as near to the outside edges of the hub as possible, a

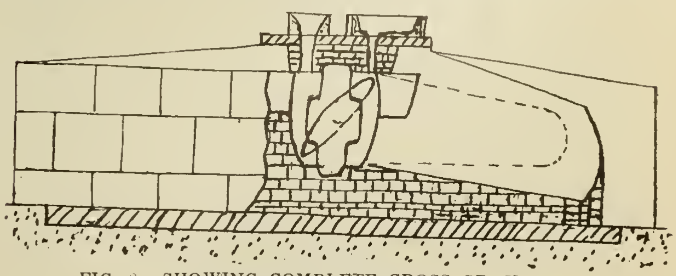


FIG. 8.—SHOWING COMPLETE CROSS SE[illegible] ASSEMBLED MOLD.

clean drop for the metal to the bottom of the hub without striking the chamber on the shaft core, and consequent risk of scabbing being thus avoided. The four blade copes are now hoisted off, lowered on trestles as shown at Fig. VII., finished, and, together with the crown plate, oven dried before black washing, the thickness pieces and sand packing being next removed from the drag mould, which after the withdrawal of the hub pattern and replacement of the drawbacks is finished and fired, a fence of cribbing plates and a cover of sheet iron giving the mould the full benefit of the fuel.

When thoroughly dry and whilst reasonably hot the several parts are given a final finish and blackwashed, prior to closing, the copes being placed correctly by number scratched on them and the outside of the drag before separation. As soon as the copes are closed all joint marks are made up and broken edges made good, the hub core being then lowered to place and the crown plate covering the whole, a tapered parting of usual type employed in loam work guaranteeing its correct position. The mould is now tied down by special binder bars to the foundation plate, surrounded to its full depth by crib plates, the whole being rammed up securely in the usual way, the sand for the purpose being taken from a cylinder casting pit and dumped by means of a grab bucket or large crane ladle.

When making up the runner and riser head boxes it is advisable to place a long box on the runner, three desirable objects being thereby attained, namely, ease of operation, a cleaner casting, and the opportunity to tap the metal from the runner into a trench on the foundry floor, the labor entailed in breaking up the scrap being thus greatly minimized. The metal mixture employed for castings required to bear the heavy strain thrown on a propeller must, of necessity, be of great strength, and when of a purely ferrous nature should be kept low in silicon, exceptionally good transverse strength being secured by a high manganese content, a high grade semi-steel mixture being the logical means of attaining the desired end. As from its design, a casting of this shape is poured reasonably slowly, a high temperature is advisable, very heavy risers, with refilling or rod churning taking care of the hub shrinkage.

The Best Flask is the Cheapest in the Long Run

Iron Flasks, if Properly Made, Will Last a Lifetime, and Although Expensive in First Cost, the Money so Spent is a Good Investment

By F. G. MOLAND

BY special request I am writing a short story on what might seem at first glance and first thought to be an unnecessary topic, namely, the molding box or flask. Some of the sketches have already appeared in CANADIAN FOUNDRYMAN. Some are original and some are borrowed from eminent writers of foundry literature. Every molder knows how few foundries are equipped with first-class boxes or anything else which is first-class for that matter, yet the amount of money required to instal one good machine tool in the machine shop would be sufficient to equip a good-sized foundry with the best of flasks. In Fig. 1 will be seen an example of what we might call a first-class general purpose flask for a jobbing foundry or for any foundry doing a line of work for which special flasks could not be profitably supplied. These flasks can be made in different sizes and different depths. All flasks of the same size should be made interchangeable so that any cope will fit any drag or cheek. By this means combinations of different depths to suit the jobs in hand can be arranged. The pinholes should be bored to templet to be sure that they are all alike. The pins shown on these flasks are slotted so as to admit of using tapered key, thus obviating the need of clamps, although clamps can be used as an auxiliary if considered advisable for any particularly heavy or deep job. Internal flanges may be cast on the bottom edge of the cheek to suit any kind of work they may be used for. Or a small internal flange may be cast on to hold up the weight of any kind of lifting plate which may be used. By this I mean to say that plates or grids of the same dimensions as the inside of the flask may be cast with opening to fit any job which is to be done and this plate will rest on the flange on the inside of the cheek. For instance, in the case of a flanged cone pulley where a flask of large dimensions is required but where an exceptionally large amount of overhanging sand is in the bottom of the cheek a plate with opening to fit the bottom flange saves a lot of trouble. In the bottom section of the picture will be seen the drag exposed so as to show the flat bars cast onto it. The bars help to strengthen the flask and also help to support the mold against strain in case the molder has depended on keying the pins instead of clamping the

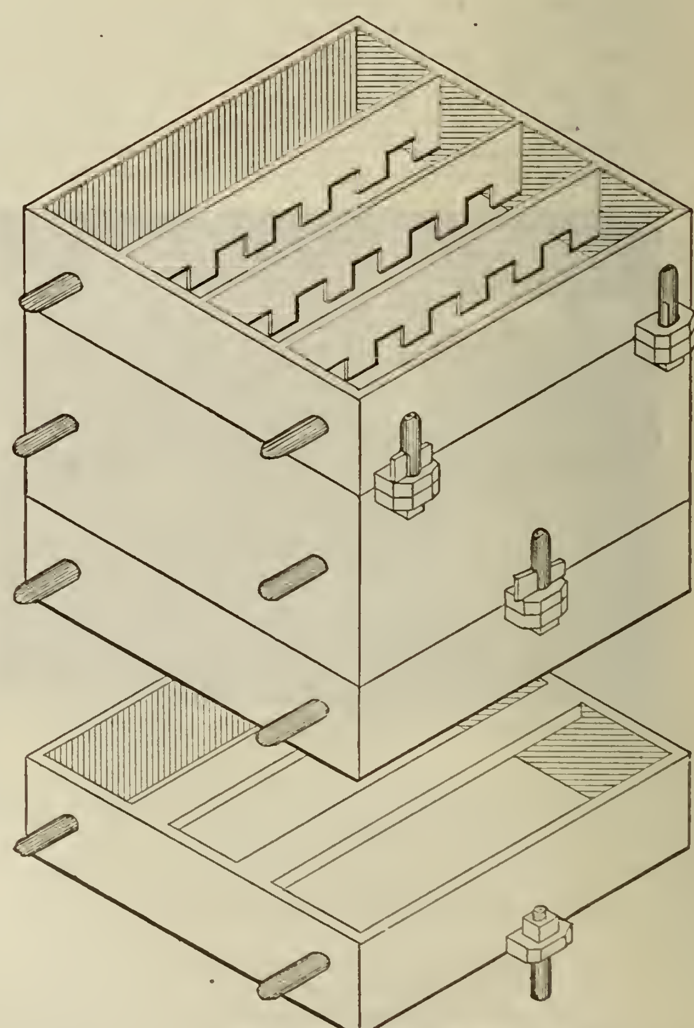


FIG. 1 A HANDY GENERAL PURPOSE FLASK WITH MANY ADVANTAGES. NOTE THE METHOD OF KEYING PINS TO SAVE CLAMPING

flask to the bottom board. In fact it is quite possible to do without bottom board on many jobs when the drag is barred in this manner.

Fig. 2 shows flask of similar design but of larger proportions arranged so as to show different ways of lifting it. It also shows grids, A and B, placed in the corners for lifting sand from around round or square pattern. These grids can be made in sections for removing, where a complete one would have to be broken or it can be made complete if the design of the job will permit.

In the bottom half of the picture is shown several details of the flask. A is bar as it appears in the cope and B shows how it would appear in the drag. C is trunnion cast onto the flask by means of core placed against the pattern when molding it, while C in the upper section shows a steel trunnion fitted into the flask. D is a cast handle made in a core and set against the pattern when molding it. Wrought may be substituted, which is even better than the cast.

E is a plain lug into which the ring-bolt F can be made fast if it is desired to lift by this means. A is staking strip which is cast on at different place where it is to be used for work bedded into the floor, in which case these strips act as guides for the stakes which are driven into the floor. For flasks of large dimensions it is preferable that they be made up of loose sides, ends and bars. By using the proper care in having all bolt holes interchangeable it is quite possible to make flasks of many different dimensions from a limited number of pieces, thereby saving the expense of making and storing all the different sizes and shapes of flask required for different jobs. Thus the same sides used in the illustration, Fig. 3, could be used with longer ends, making a wider flask, or the same ends can be used with shorter sides, making a smaller flask. Extensions can also be bolted to the sides, making a longer flask. In Fig. 3 it will be seen at A that the bars may be cast to fit any form of pattern. The sides may be made to fit together as cope and nowel, holes for pins being drilled as shown at B and C; the flanges can be bracketed to any degree of strength. Let the flanges stand in from the edges

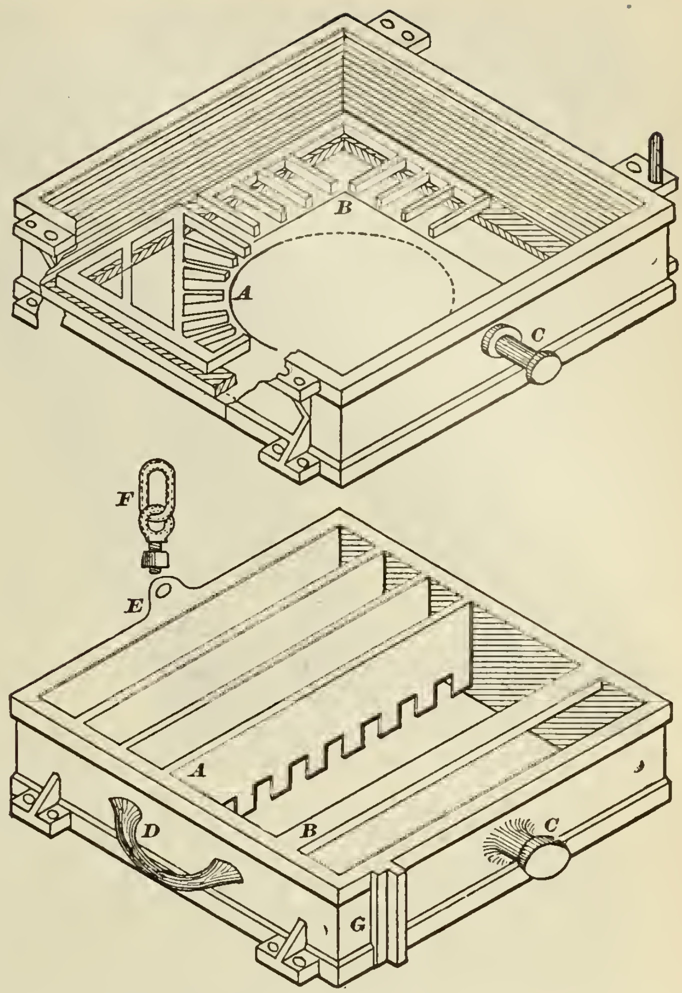


FIG. 2—DIFFERENT WAYS OF LIFTING FLASKS, ALSO GRIDS FOR CHECKING OFF.

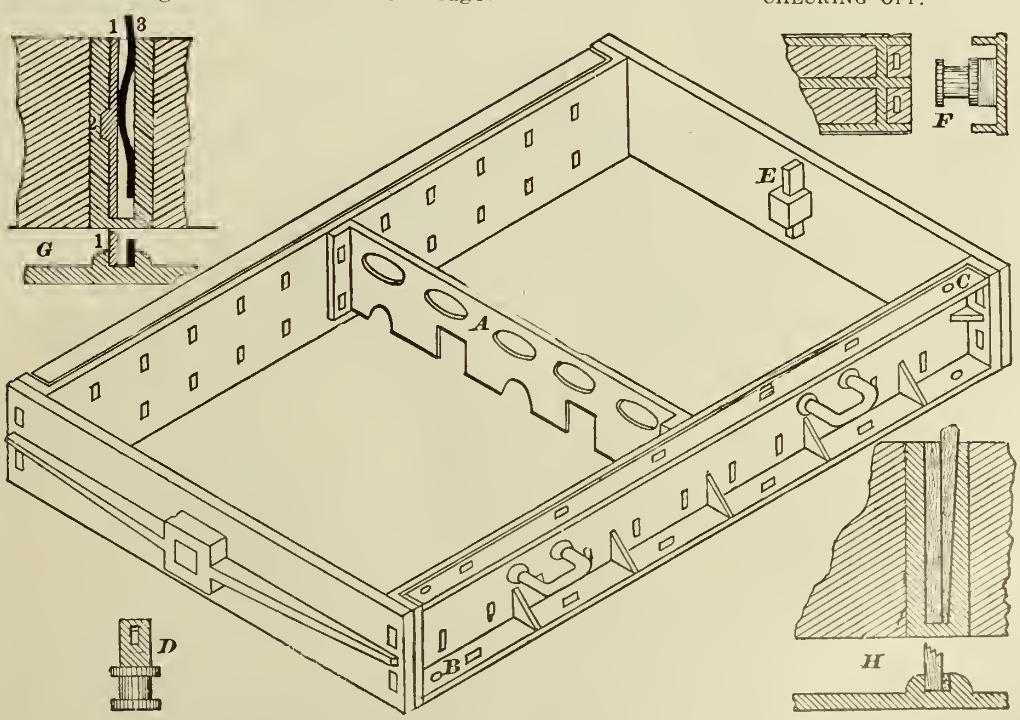


FIG. 3—VIEW OF LARGER FLASK, BUILT UP IN SECTIONS.

about a quarter of an inch so as to leave a space when closed up so that mud can be pressed into it to prevent possible runout. Swivels may be cast on or fitted in as in those previously shown, but the one shown is perhaps the best for boxes of this description as one set of trunnions is all that is required and in storing the flask sections the trunnions are out of the way. As will be seen, the trunnion D is loose and is secured to the flask by a key as shown at E. Should the box be very wide and require to be turned over on the swivels, the ends can be still further stiffened as shown at F. At G is shown another method which saves bolting of all the bars; this method necessitates the casting of pockets on the sides to receive the end of a plain bar, as shown at 1. These pockets are made wide enough to admit of the projection 2 sliding in easily; when the bar rests on the bottom this projecting piece is opposite the recess

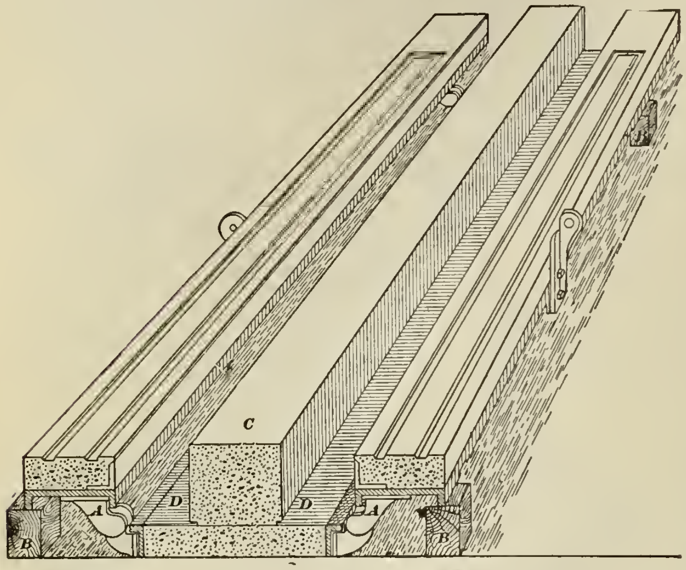


FIG. 4—HINGED FLASK FOR MOLDING PANNELED COLUMNS, ETC.

cast in the pocket to receive it, and is driven home by the bent iron 3. This iron or wedge is a plain piece of wrought iron an inch wide and quarter inch thick, bent as seen, and driven down so that the bar is pressed close into the groove; by letting this bent bar project above the top an inch or so it can be easily knocked out and the bar loosened instantly. This is a very quick method and only requires a long bolt here and there along the length to make it equal, in strength, to the other. Another advantage where pockets are cast to receive the bars is shown at H, where, as is frequently the case in a pinch, wooden bars may be substituted for iron ones and made fast with wooden wedges.

Hinged Flasks

In a former issue of CANADIAN FOUNDRYMAN I described a hinged flask for lathe beds, the advantages of which were described, among which were opportunities offered for finishing the sides which could be rolled back and if necessary could be lifted away and placed in the oven. The idea was not condemned by anyone that I know of but I heard a few hints that it was all right theoretically but not practically, which is to say that it looks all right in a magazine but would not work out in the foundry. This is in keeping with a great many of the arguments of the average founder and molder but it is a misconception. To back me in my argument I will quote the late Simpson Bolland, a molder of British and American reputation second to none. In his book, "The Iron Founder," he says: "Although to show the substitution of hinges for pins in molding boxes is the primary object of this article, I was necessarily led into other important subjects in connection with use. My experience has taught me that in the majority of foundries all the ingenuity of the molder is expended in devising methods that will enable him to mold nearly every large green-sand casting in the floor. This is generally done with a view of saving cost of flasks, and when only one or two such castings are needed, I believe it is the correct thing to do. But other reasons are advanced for this almost universal bedding-in system, the foremost of which is that it is the safest plan to adopt when the job to be made is one of great magnitude; and while I partly admit the force of such a reason, yet I am fully persuaded that much better results are assured by adopting a system which can be made equally safe and at the same time enable the molder to examine and finish all the parts of his mold with equal facility. It is well known that very many large jobs having critical parts are made in dry sand or loam for no other reason than to secure a well-finished casting which could not result if it was made in green sand by the ordinary methods on account of the difficulty of reaching its remote parts. If such extra expense in the production of these castings can be saved it must surely be folly to persist in such a course.

Enter almost any foundry and examine such castings

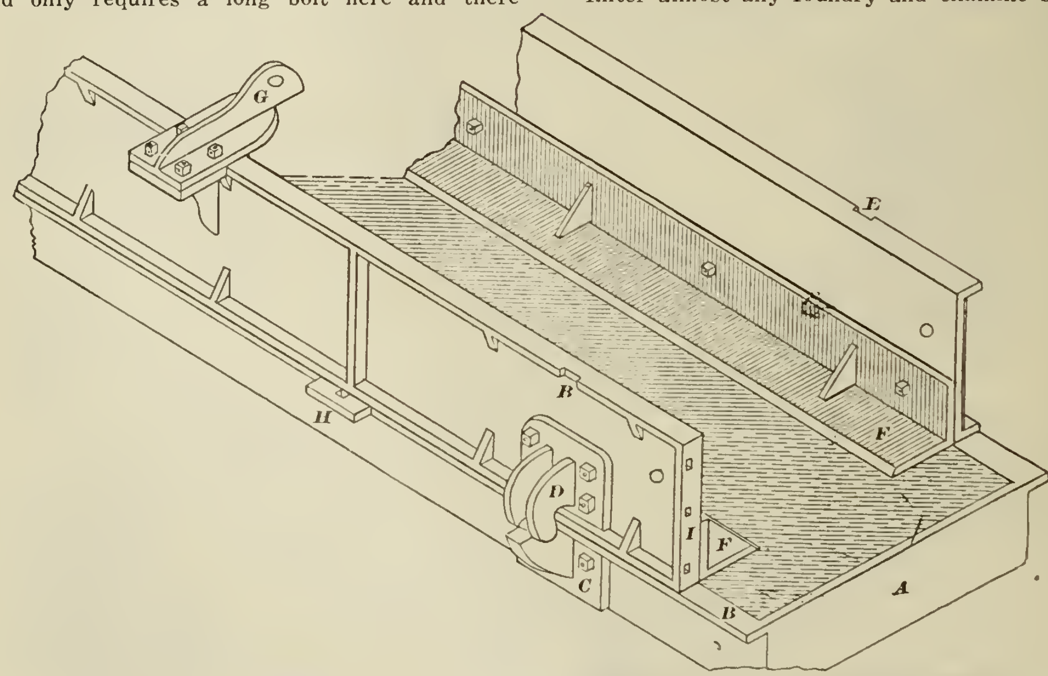


FIG. 5—SHOWING NECESSARY APPLIANCES FOR MAKING CASTING BY THE ROLL UP METHOD.

as we are speaking of and the ugly fact of smooth upper surfaces, and equally rough and unsightly lower surfaces presents itself. To particularize, let it be an architectural works or a foundry making castings for tool and engine work; what do we find? As before stated, all the ingenuity possible has been expended to have castings made in the floor without separation or parts. Brackets are made in cores and rammed against the pattern, leaving in almost every case an unsightly mark if not something worse; chipping cases and moldings are pinned on loose to be withdrawn after the pattern has left the sand, and as a natural consequence portions of the face of the mold are disturbed and fall into the bottom, or, worse still, are forced away when the iron enters the mold and rise to the surface. And yet, inconsistent as it may seem, the greatest care is taken with the very small surface which can be reached by the molder to make that as smooth as tools and hands can make it; which, by the way, only shows up the more by comparison the deficiencies of those parts of the mold which cannot be reached. This is seen more particularly on square and rectangular columns having two or more face sides, with panels and other ornamentation; lathe beds, foundations for engines, etc.

Some firms desiring quality rather than quantity partially overcome this difficulty by lifting out the sides of the mold when practicable on drawbacks, which are plates bedded alongside the pattern and partings made where requisite. After the mold is rammed and the pattern taken out, then such portions of the mold as rest on the plates can be lifted away; but this method necessitates still more digging and ramming, and, of course, adds to the cost, whilst it is oftentimes but a sorry makeshift.

It is to facilitate the making of such castings that prompts me to suggest the use of hinges. Fig. 1 is a perspective view of the mold of an ordinary square column, the dimensions of which are 18 inches by 18 inches by 12 feet, with panels on three sides. I have shown the mold cut across at the first hinge so that the working parts can be seen. The cheeks are thrown back on the hinges A, the top flange resting on lugs B, exposing the core C its full length, as well as the bottom of the mold D. It will be plain to anyone having a knowledge of such matters that all the parts of such a mold can be treated with the same care, the result being a casting equally perfect all over.

In Fig. 5 I have shown the necessary appliances for making castings by this method and as this view is drawn isometrically the whole details can be seen at a glance much more readily than would be possible by the ordinary plan and elevation. Only a section of the sides is shown but this is all that is needed for a clear understanding of the whole. I have selected a square column of the dimensions specified because it is a class of work which is going on all the time, and serves well to illustrate the method suggested.

As I do not in this article propose to explain the details of molding such a casting, I shall confine myself to the subject of hinges and the securing of the flask. The bottom of flask A is shown longer than the cheeks as it is supposed to be a fixture in a foundry exclusively engaged in this work. It is best to have such a bottom flask made with deep sides well down in the floor and good, stiff crossbars bolted across; such a bottom flask serves to make ordinary columns or beams and girders in the cope, of course being made to correspond with the flange B to which it can be bolted or clamped, thus saving both time and expense of weighting down. It is on just such a flask that these sides rest. The lower half of hinge C, into which the upper half works, serves the same purpose for the regular cope when the bottom is being used for ordinary work; but in this case when the cheeks are being used the cope can be pinned or iron slides bolted on to fit the recess at E. At F is shown the lifting plates secured to the cheeks. These plates serve the double duty of stiffening the cheek as well as carrying the sand and may, of course, be taken into consideration when the mold is being bound together. By referring to A, it will be seen how the cheek is turned on its hinges, and without giving dimensions, it will suffice to say that one or more of these lugs may be used according to the length of the cheek and also that they must be made with leverage sufficient to turn backward and forward easily. The lug shown at H is for binding purposes. Let as many of these be cast on the bottom flange to correspond with similar ones on the cope as may be considered necessary for effectually securing the mold when closed. Holes must be cast in these lugs large enough to admit a strong bar reaching from one to the other and wedged firmly between the bar and cheek. Sometimes it may not be required to use any ends to the job in hand; if so, bolt holes cast in the sides at each end can be utilized when the way is clear for the bolt or provision can be made for bolting on loose ends as shown at I, Fig. 5.

Should it be required to lift away the end as well as sides of the mold, this may readily be done by continuing one cheek round the ends to meet the other or carry one half to each; but if the job in hand be too unwieldy for such a method, as for instance, tanks, hot wells, cisterns, etc., of large dimensions, then, of course, separate cheeks can be made and turned back on their own hinges. To bind such ends provision can be made to bolt them to the cheeks when they are turned into place or they can be treated the same as directed for the cheeks. At Fig. 6 is shown front and side elevations of both halves of a hinge suitable for the job described, with figured dimensions. This hinge is certainly the best as well as the cheapest that can be made, requiring no machinist on it whatever; it is ready for use as soon as it leaves the sand. It is an absolute fit, cannot get out of order, and must therefore commend itself especially to foundries having no machine shop. In conclusion a hinge like this can be almost universally applied on ordinary work where the lifts are not too deep or the parts of the mold too high to clear as it closes on the circle. It will save considerable to a firm using large numbers of top and bottom flasks.

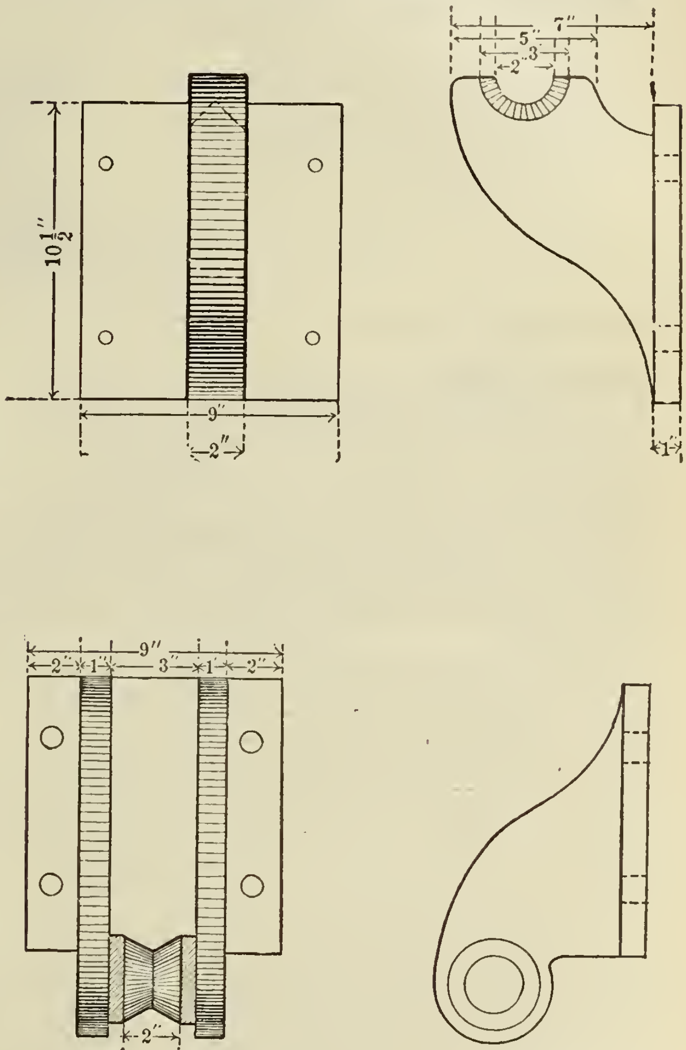


FIG. 6—HINGES FOR ROLL UP FLASK.

Making Steel in Canada

GREAT Ore Deposits in the Eastern Section of Canada — The Various Things That Enter into the Making of Our Steel—The First of a Series of Articles.

THE purpose of these articles is to describe accurately and in simple, non-technical language, the various steps and processes by which the finished steel product is produced. By finished steel product we mean the product of the steel mills, such as billets, bars, rails, structural beams and angles, steel plate, rods, wire, etc.

During the past four years many persons, both male and female, who previously had had nothing whatever to do with the iron and steel industry came in contact chiefly with the materials used in munition work, and many of them were led to ask questions concerning the materials they handled.

Their questions would be founded on the various terms they heard used from day to day. They would ask the difference between iron and steel, the meaning of "high carbon," "low carbon," and why steel, high in sulphur, should be looked upon as such a dangerous quantity.

They would ask what is a blooming mill, how do mills work, from whence came the forgings, the round bars, and why they had to be rolled, why they could not be made direct from the blast furnace, and what was the difference between open hearth steel and Bessemer steel, and what was the meaning of the duplex process, etc., etc.

It is with the intention of bringing information to such inquiring minds, and of shedding more light to those who are better acquainted with one process, but not with the whole, that these articles are written.

Of the importance of steel little need be said. Steel and civilization go hand in hand. Take steel from our modern life and we return at once to the ages of barbarism. Transportation systems would break down, education, without printing, would be very nigh impossible, and printing without steel could not be effected.

At a meeting of an agricultural society, held not long ago, one of the leading men made the statement that civilization was dependent upon agriculture, but he forgot to state that without the steel industry modern methods could not be employed with regard to that most important industry. Right here let us give credit to the coal industry upon which even the steel business to-day is dependent.

Practices in Canadian Plants

We are not concerned just now with the historical side of the iron and steel industry—deeply interesting though that study is—we are going to deal with modern methods and in particular with the methods as practised in Canadian plants. The war has put the iron and steel industry in Canada on a basis that could not have been obtained in ten years of peace. Companies that doubted their own ability, that doubted the energy and enterprise of their men, have been forced because of war conditions to venture their all, and to take steps, sometimes chances, that otherwise they would not have dared to take—and let it be here recorded that in the majority of instances the results have absolutely justified the means.

Our subject is a large one. We will try to handle it in such a manner as to be interesting as well as instructive. As far as possible we will describe the various processes in their correct order or sequence.

We must first have raw materials. The most important are—iron ore, coke, and limestone.

Iron Ore the Basic Material

Iron ore is the basis of all iron and steel products. Iron itself is one of the most common elements in nature. It has been stated that between four and five per cent. of the earth's crust is composed of this element in one form or another.

Iron is seldom, or never, found in its pure condition. It is usually found as an oxide of iron. By an oxide we mean that an affinity has taken place between the native iron and oxygen, resulting in an oxide of iron, or to put it crudely—iron rust. The iron ore will contain anywhere from twenty-five to seventy-five per cent. of iron.

Iron ores may be divided roughly into four principal different kinds: Magnetite, Hematite, Limonite, and Siderite.

Magnetite ore is so named because of its magnetic properties. It is one of the purest ores known. There are some magnetite deposits worked in the United States, but the largest deposits at present in operation are situated in Norway and Sweden.

Hematite ore is generally of a reddish color. Good hematite ore will run between sixty and seventy per cent. iron. It is particularly suited to blast furnace operation, as it contains very little moisture, and what moisture it contains can be readily driven off at a low temperature. A large percentage of the ore mined and used in the United States is of this variety, and practically all of the ore used by the large steel companies in the Eastern Provinces of Canada is hematite ore.

Limonite ore is of a brownish to reddish-black color. It runs between fifty-five to sixty per cent. iron.

Siderite ore is of a light gray color. It contains between forty and fifty-five per cent. iron, and has a high moisture content. Siderite ore usually requires a previous treatment, such as roasting, before reducing in the blast furnace. A large deposit of siderite ore is at present being worked by the Algoma Steel Company, near Michipicoten, Ontario.

Not Much Iron Ore Mined

Iron ore has been found and mined in New Brunswick, Nova Scotia, Quebec, Ontario and British Columbia. The output of iron ore in New Brunswick never amounted to very much. Nova Scotia has produced as much as 100,000 tons in one year, but of late has dwindled down to almost nothing. Quebec never produced more than 22,000 tons per year, and in 1916 produced only about 3,000 tons. Ontario, starting with a very small amount, has increased its shipments to 400,000 tons per year. British Columbia has not produced any ore since 1907. The total amount of ore produced in Canada in 1916 was about 600,000 tons, and yet compare this small tonnage of ore produced with the fact that in 1913 (before war conditions) Canada imported from other countries iron and steel products to the value of $145,226,972.00. At an average value of fifty dollars per ton this would mean nearly 3,000,000 tons of steel, or five times the tonnage of ore the country produces.

Although Canada herself produces so little iron ore at the present time, her sister colony, Newfoundland, is much more favorably situated.

Newfoundland is a rocky, rugged island, to the east of Canada. It has been called "the Norway of Canada." The coast is formed of high cliffs, rocky promontories, and deep gorges. The whole aspect of the country suggests the upheaval of nature, which usually results in mineral deposits of great value. The people of this island for very many years did not realize the value of deposits. They are an honest, simple folk, and earn their living by fishing, and some farming in the interior. A story that has often been told, and will bear repeating, will illustrate the knowledge of the general people upon mineralogy, etc.

An Englishman, touring probably, visited Newfoundland. One morning he took a stroll along the coast, and stopped to discuss the weather, etc., with one of the natives, who happened along. The following conversation ensued:

Englishman.—"Pretty rocky coast you have around here. Has it always been like this?"

Fisherman.—"Yessir, yessir, — allays been like dis since I recommember."

Englishman.—"Hm! Probably so. But there's been an earthquake or some great upheaval of nature sometime or other?"

Fisherman.—"Nossir, nossir, — not whilst we been here."

Englishman.—Getting rather wrathy at the contradiction, and wishing to get some information on the subject, —"But, my dear man, you're wrong! Do you mean to tell me that there has never been an earthquake here? I am sure there has!"

Fisherman.—By this time doubting his own knowledge, scratched his head, and replied,—"Well sir, now I come to think on't, sir, I do believe you're right, sir. I did hear tell that Cap'n Skipp'r Jones caught one in his nets the other night. Yes, sir, he did!"

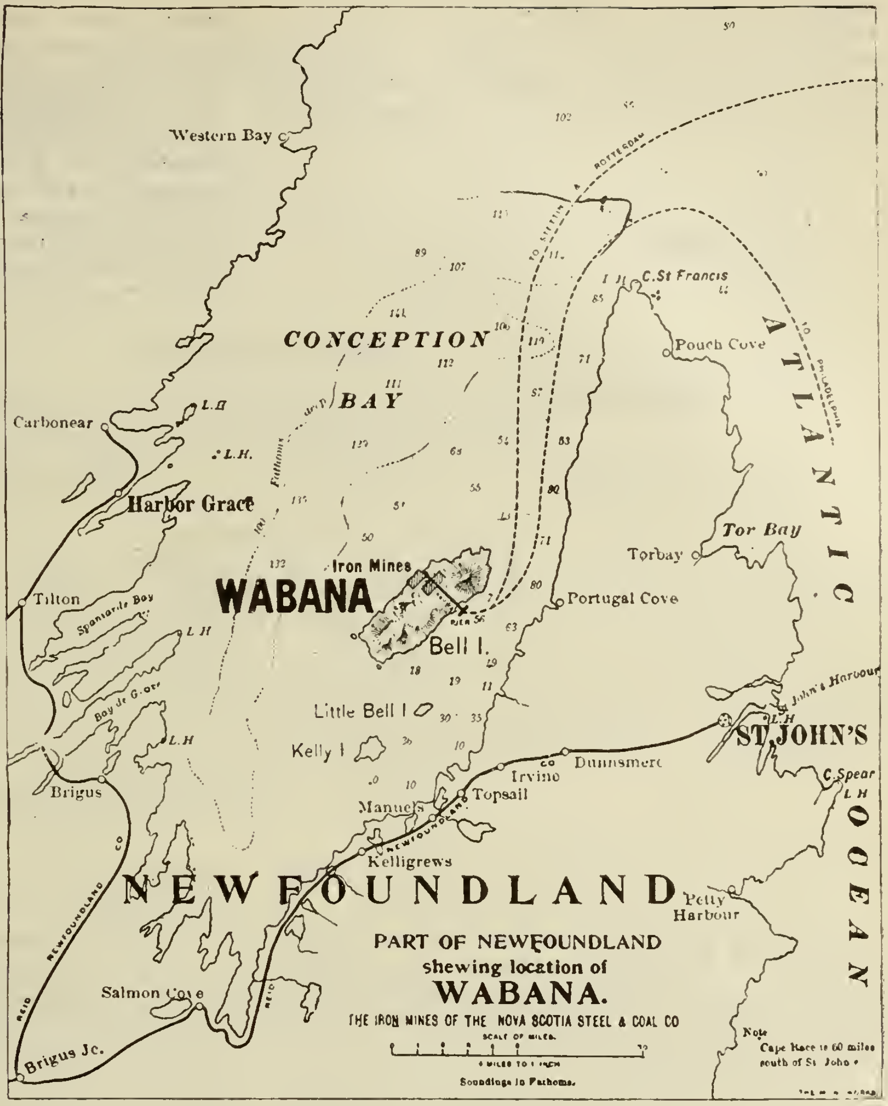


FIG. 2—LOCATION OF ISLAND AND WORKINGS.

Where the Big Output is Located

On the eastern shore of this island there is a deep inlet, known as Concepcion Bay. Up the bay there is an island, known as Belle Isle, so called from a peculiarly shaped rock situated at one end. But for this island, one of the most valuable and important deposits of iron in the world would have remained unknown, for its northern shore forms a suitable place for the outcropping of the ore beds to expose themselves. The mine has been named "Wabana." This is an Indian word, the literal translation of which is "the easternmost place on the continent," the real word being "Waban," meaning "light," and "Woban," meaning "daylight."

See Fig. 1 and 2 for the location of island and the workings.

The outcrop of hematite ore on the shores of the island does not seem to have attracted very much attention until 1893, when the mining rights were purchased by the Nova Scotia Steel & Coal Company, Ltd., from Messrs. Butler, of Topsail, Newfoundland. This company, whose history is closely interwoven with the history of the steel industry of Canada, commenced at once to develop their holdings on the island, and on Christmas Day, 1895, the first shipment of ore was made to the company's blast furnace, then stationed at Ferrona Junction, Pictou County, Nova Scotia. Since this day the Wabana Mines have been in continuous operation and approximately 17,000,000 tons of ore have been extracted. Some idea of the tremendous amount of ore available in this deposit may be realized when we remember that Mr. James P. Howley, F.G.S., the director of the Newfoundland Geographical Service, stated that the Wabana basin contained in his opinion, 3,635,000,000 tons of ore. This deposit, the pioneer work connected with which was undertaken by the "Scotia" Company, was afterwards sub-divided to enable the Dominion Iron & Steel Company, which was formed in 1899, to have a share.

In the early years the ore was mined by simply attacking the outcroppings, as in an ordinary stone quarry. As time went on and the amount of "cover" over the deposit became greater, due to the dip of the seams, stripping was resorted to. Later on still tunnels and shafts were sunk, extending to two or three miles under the waters of the bay. The ore is mined by what is known as the room and pillar system. That is to say, at various distances along the main tunnel, headings are driven off at right angles. Off these headings rooms are opened parallel to the main tunnel. The rooms are located about 35 feet apart and are 15 feet wide, and are thus separated by a solid pillar, 20 feet in thickness. Every 40 feet this pillar is broken through, connecting the rooms together. The ore is loaded into cars and by means of a haulage system conveyed to the surface. At the surface the necessary plant is situated for crushing and loading into other cars, by means of which it is transported to the other side of the island, where the storage docks and shipping piers are situated. Few people have any idea of the loading facilities which have been developed by the companies concerned at Wabana. Ore has been loaded at the rate of 2,200 tons per hour through a single chute, and on occasions when two chutes could be used simultaneously, 12,500 tons have been loaded in 3½ hours.

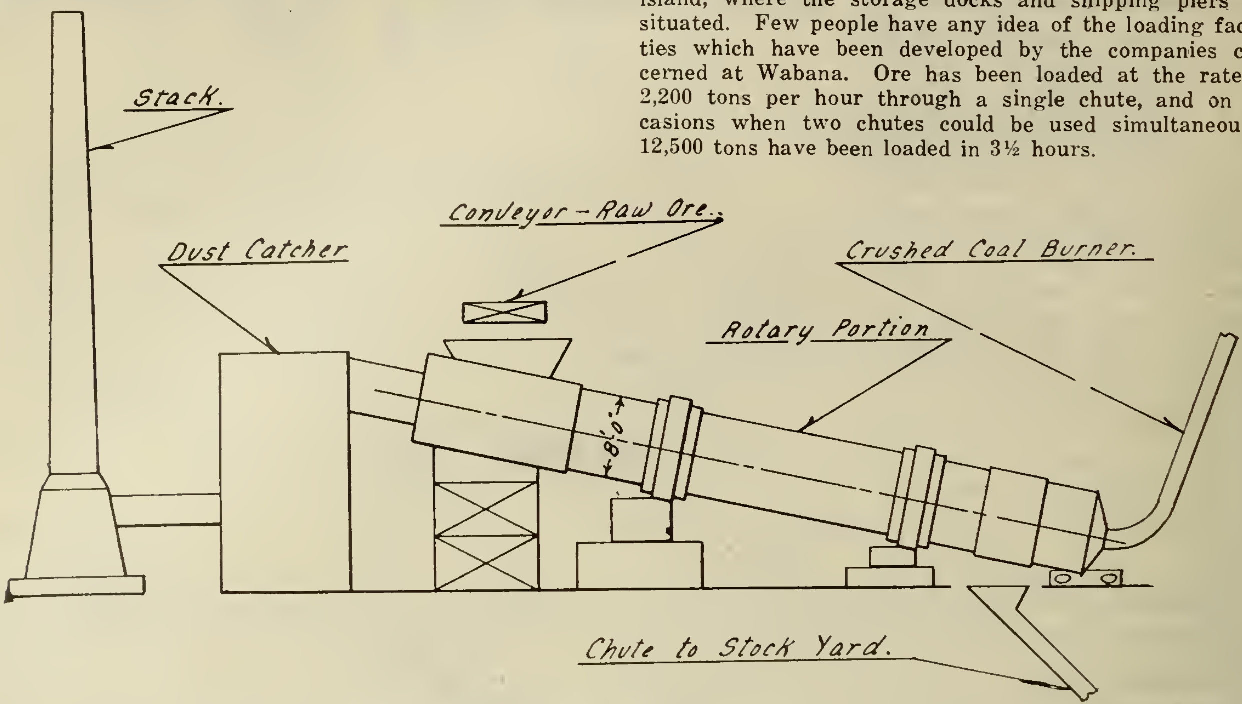


FIG. 3 ROASTER FOR SIDERITE ORE.

Shipping The Iron Ore

In the case of the Dominion Iron and Steel Company, the ore is conveyed by steamers direct to Sydney, Nova Scotia, 412 miles from the island. Here it is unloaded by modern unloading machines and conveyed by means of cars to the stock pile.

In the case of the Nova Scotia Steel and Coal Company, the ore boats are unloaded at North Sydney, and the ore taken by means of cars to the blast furnaces at Sydney Mines.

Coming back to Canada,—it must be remembered that the vast deposits just previously described belong entirely to Newfoundland—we find that the only deposits at present being worked to any large extent are the "Helen" and "Magpie" Mines near Michipicoten, Ontario. The ore from the "Helen" mine is of the magnetite variety, but high in sulphur. The ore from the "Magpie" mine is of the siderite variety. It contains about thirty-four per cent. metallic iron content.

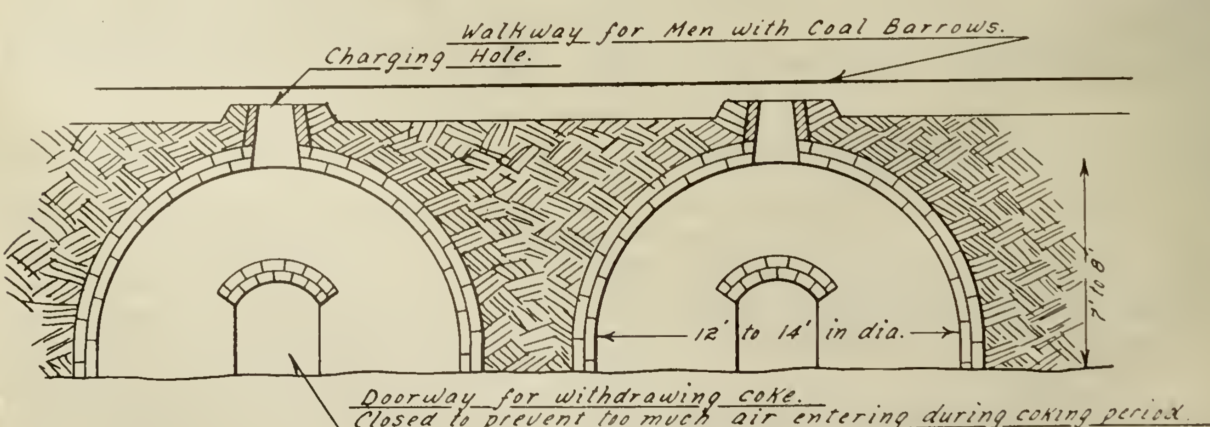


FIG. 4—BEE HIVE COKE OVENS.

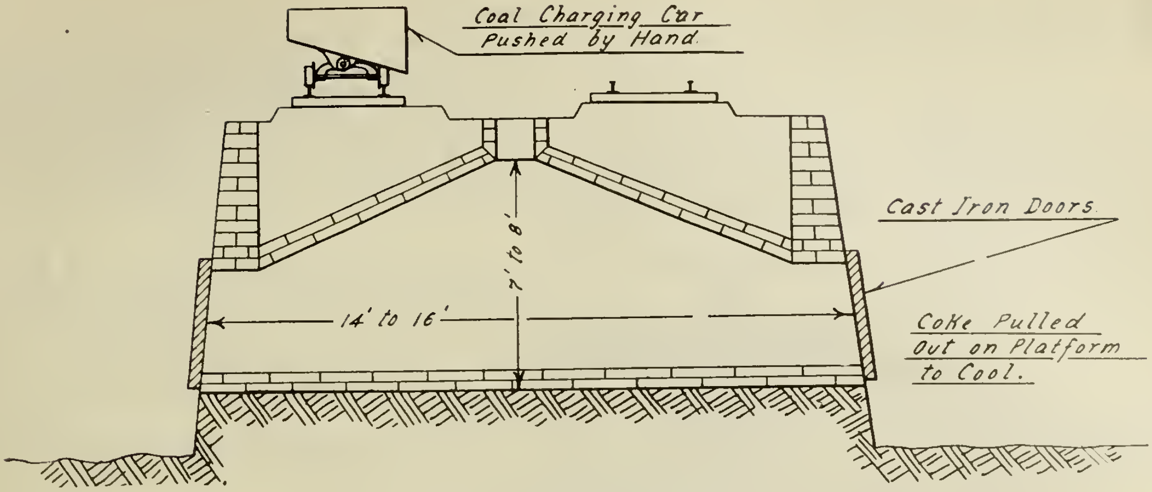


FIG. 5—BELGIAN COKE OVEN.

In order to reduce the bulk of the material to be handled in the blast furnace, and to drive off some of the other objectionable ingredients, this ore is roasted.

The roasting process consists in passing the ore through an inclined rotary kiln, about eight feet diameter, and one hundred and twenty-five feet long. The kilns are fired with pulverized coal. The roasted ore passes out from the kiln to a stockyard where it is handled by overhead cranes, into cars and sent to the blast furnace. The diagram Fig. 3 will assist to make clear this process.

Other Canadian Ore Deposits

There are many other ore deposits in Canada, but, owing to the nature of the ore and their situation they are not at present widely worked. If the reader desires a more detailed description of the iron ore occurrences in Canada, he should send to the Department of Mines, Ottawa, for some of the publications that are available on the subject.

The difficulty with regard to smelting low grade high sulphurous ores is one of the problems that confronts the steel works engineer of the future. Some one of the rising generation is going to attack the problem and find the solution—it should be a Canadian, trained in one of our own schools.

We have also to learn how to use our low grade coals and to consider the possibilities of peat as a fuel, and a producer of important by-products.

Up to this time we have simply been taking ore as a single substance. Let us now look at it a little closer and see what it is composed of. There is, first of all, the iron,

FIG. 6.

and the oxygen, which has taken such a strong affinity to it. This we have called oxide of iron. The oxygen has got to be divorced from it so that the pure metallic iron can become available. There is also a number of other earthy substances, such as silica, alumina, phosphoric acid, lime, manganese, sulphur. All these substances are known by the name of "gangue." They have to be gotten rid of before the iron can be used for industrial purposes. When the nature of the ore demands it, some are expelled by roasting, but in the majority of cases the work is done in the blast furnace.

Let us examine some of these impurities a little closer, and see what they really are:

Silica is a portion of the earth's crust, a species of sand. If allowed to continue in the metal it causes planes of weakness, and the product would be unreliable.

Sulphur is one of the worst impurities that the steel maker has to contend with. It causes what is known as "red-shortness," that is to say, the material is brittle when at red heat. High sulphur billets, instead of being ductile, and rolling with ease into various shaped bars, frequently break and crumble. Sulphur is usually limited to .05 per cent. in good grades of steel.

Phosphorus produces what is known as "cold-shortness." This is the very opposite to "red-shortness," and means that while the material can be worked when hot, yet is to a certain extent very brittle when cold.

Manganese is desirable as it strengthens and adds a certain wearing quality to the steel up to a certain point. Above that point, however, it produces a brittleness. In ordinary steel it is kept down to .03 per cent. or .05 per cent.

We have not touched in the above on the subject of carbon. The amount of carbon in the blast furnace product varies from 2½ to 3½ per cent., and in determining the ultimate use and strength of the finished product a few points difference in the carbon content makes a vast difference.

As we are only dealing with ore, the subject of carbon, sulphur, phosphorus, manganese, etc., will be left now until we again consider them in their proper places.

Having now mined our ore, crushed it, delivered it to the steamer, unloaded and transported it to the stock pile at the blast furnace, we will consider briefly coke and lime before describing the blast furnace.

Coke

Charcoal and coal were both used for blast furnace fuel in the early days, but for modern furnaces of large capacity whole districts would have to be laid waste to provide charcoal for a single year's service.

For a few small furnaces, working on special iron, charcoal is still preferred, on account of its freedom from impurities.

Coal packs too tightly in the furnace stack and prevents the blast and gases from passing upward. Some furnaces are working on a mixture of coke and anthracite coal.

The ideal fuel for a furnace must be free from foreign matter, fairly open in structure, to allow of gas passage, and strong to stand the weight of sixty to eighty feet of ore and fuel. Good coke is the answer, but never yet have I heard a furnace superintendent speak of the coke he received as good.

All Coal Will Not Coke

To make coke you must have coal, and coal of the right kind. All coal will not coke—just why no one seems to know exactly.

Coking consists of heating the coal and thus driving off the volatile or gas portion, the residue consisting chiefly of carbon, ash, a little sulphur, and is termed coke.

As a general rule, 2 000 pounds of coal will make 1,400

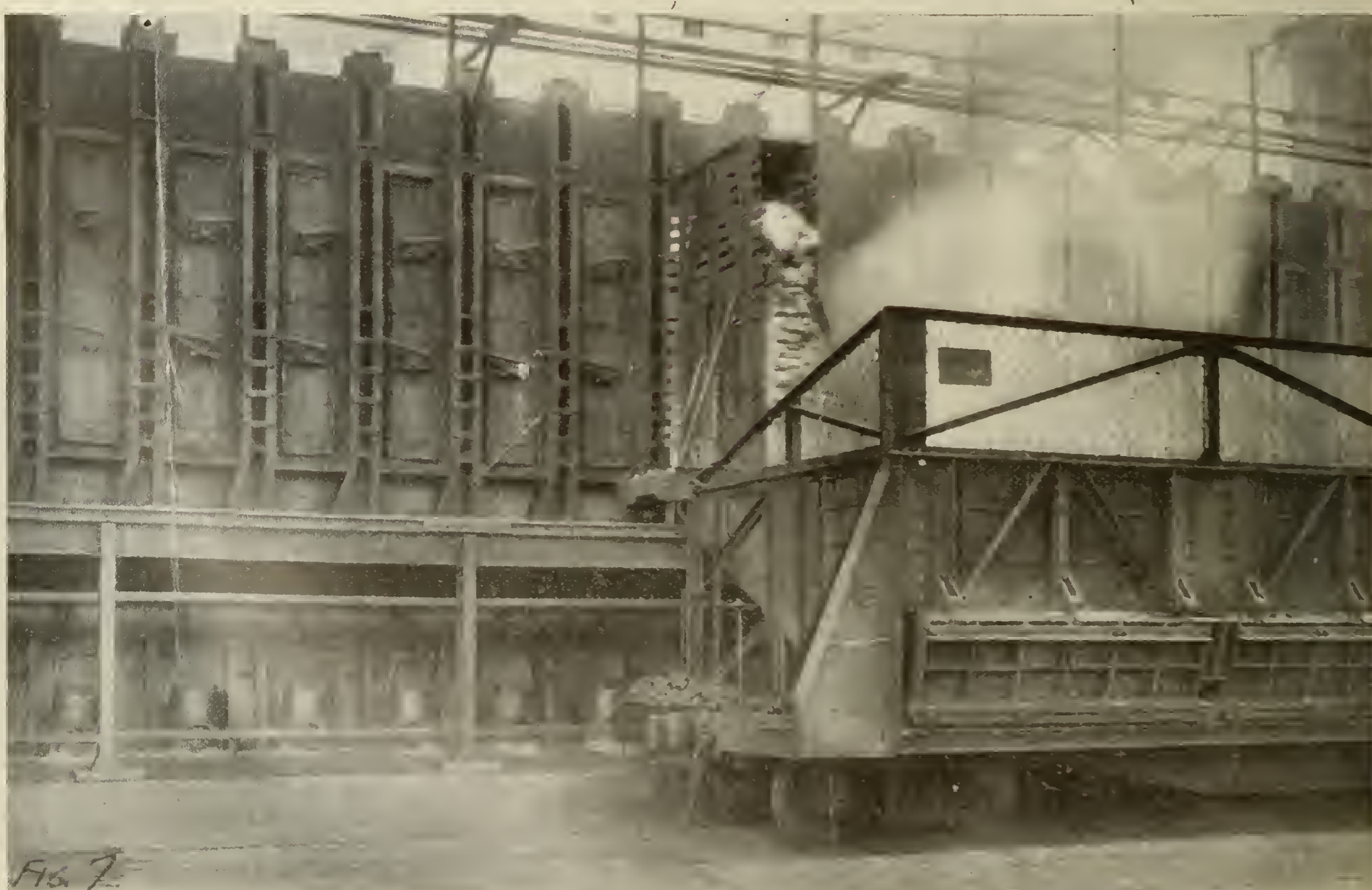


FIG. 7 DISCHARGING COKE INTO THE CAR PRIOR TO COOLING.

pounds of coke, that is to say, 30 per cent. volatile is driven off.

Now let us consider what happens to coal when it is heated in any kind of coke oven.

First, like most other substances, heat causes expansion, then the coal softens, and it becomes a tarry mass, gas forms and passes upward, causing passages in this substance, and as the gas passes away it hardens, leaving a hard open grained material.

Coke is made in ovens. The crudest type is the Beehive. (See Fig. 4). One oven helps to heat the other as they are charged alternately.

These ovens were in many cases charged by hand and coke pulled out by hand and quenched by hand, then forked into cars by hand, and if you wish to know what hard work is—try forking coke for eight hours.

The next step was the Belgian oven. (See Fig. 5). Charged by an overhead car or lorry in most cases but still pulled by hand, but from both sides. Due to shape more heat was obtained from adjoining ovens, and less time and heat was lost in charging and taking out the finished coke.

The next form of oven was built by many firms, it was a step in the right direction, but not quite far enough. The oven was charged by machinery—a pusher was introduced, and some of the gas was used to heat the ovens, but still the valuable surplus gas was allowed to be burned or wasted without giving up its by-products.

The Modern Coking Plant

A modern coke plant is a beautiful sight for an engineer to look upon. He sees the coal coming by rail or water, passing over silent running conveyor to the storage bin, taken from the bin with the regularity of clockwork and fed to the ovens without the touch of men's hands. He sees a machine take off a heavy oven door with the same care as a mother handles her child, the pusher with its ram, fifty to sixty feet long, pushes out seven to eight tons of red hot coke into a waiting car, the car under its own power starts off for a gigantic shower bath, and then spills the coke onto an inspection bed before the eye of the man who has planned to make these machines obey his will.

From the bed it slides onto belts and over screens to the cars.

The whole picture is one of power and regularity of movement, and one who has seen the wasted energy of olden methods, only ten years ago, cannot fail to marvel at the progress. (See Figs. 6, 7 and 8).

The early ovens produced four tons of coke in ninety-six hours, a modern oven will produce eight tons in sixteen hours.

Nothing has been said of by-products. In the modern plant every cubic foot of gas is passed through coolers, absorbers, etc., to extract the sulphates, benzols, tars, etc.

In many cases the products pay for the coal and the coke is obtained free.

But with all this we have no business. Our subject is steel, and our only use for coke is to melt the ore. We have described the process roughly so that the reader may know from whence the coke comes.

The most modern plant in Canada is located at Sydney, N.S., but both the Steel Company of Canada at Hamilton, and the Algoma Steel Corporation at the Soo, have good plants.

We now have our ore and coke, what more is required? Limestone. We said there were earthy matters with the ore, they must be caused to become liquid and float on top of the iron at the bottom of the furnace (the hearth it is called), so that it may be drained away.

A certain amount of crushed limestone renders this possible, and the foreign matter or gangue combine with the limestone and form a fluid slag.

There is, of course, a chemical reason for this, but we are concerned only with materials now.

Limestone is obtained from quarries in the usual manner—drilling and blasting, crushed, and conveyed to cars.

Now, we have all our materials, the proportions vary with the nature of each, say, 20,000 pounds of ore; 10,000 pounds of coke; 5,000 pounds of limestone.

FIG. 8—ANOTHER VIEW OF THE PLANT.

We will next consider in more detail the largest piece of mechanical apparatus known—a modern blast furnace.

Credit must be given for some of the information with regard to Wabana to a book published by the N. S. S. & Coal Co.

To be continued.

A low-temperature treatment of steel and iron in contact with zinc is being used commercially by a British concern to give tools and parts of machines a rust-proof finish which is not injured by abrasion or denting due to usage. The parts to be treated are placed in a slowly revolving drum, where they are brought into contact with zinc powder. The temperature at which the drum is maintained causes the zinc to penetrate slightly into the iron, producing an outer coating of zinc, beneath which is a zinc and iron alloy. If continued usage bears out the claims of the concern employing this process, its adoption may become almost unlimited.

A new indicating gauge, somewhat resembling an ordinary caliper but having special features requiring that it be used a little differently, has been placed on the market. The tip of one of the legs of the instrument consists of a pivoted lever connected with an indicator attached to the side of the leg. The latter shows small fractions of an inch much magnified. After adjusting the gauge by means of a micrometer, it is placed inside or outside the object in work, and any variation from the size desired will be shown by the changed position of the indicator hand.

The number of amperes required by an electric motor, when the horsepower and voltage are known, is quickly indicated on a calculating scale simply constructed of cardboard and celluloid. On a square paper table vertical ruled lines read in horsepower, horizontal lines in amperes. A straightedge pivoted at one corner is graduated in volts. The meeting point of the known voltage and horsepower lines, when the straightedge is swung on the scale, indicates the required amperage. Separate arcs on the scale measure alternating current, and in additional scale may show the size of conductor needed.

The Continuous Tunnel Annealing Furnace

Proper Decarbonization Depends on Proper Method of Packing and Also Proper Packing Material

By PHILIP D. H. DRESSLER

THE malleable iron produced in the U.S. is almost entirely of the type known as black heart. It combines a good tensile strength with greater ductility than usually is found in the white heart malleable produced in Europe. A good average tensile test is about 50,000 pounds per square inch with an elongation of 8 to 10 per cent., and in some cases more.

To obtain the best results, the manufacturer finds that the residual combined carbon should be not more than 0.05 to 0.08 per cent. Furthermore, the temper carbon must be completely graphitized, and a certain amount of decarbonization must take place, dependent upon the use the malleable will be put to. The conditions of annealing required to produce these results are complex. The factors influencing the success of the process may be summarized under the following heads: Temperature; time; packing; and furnace atmosphere.

Time and temperature are mutually dependent and may be conveniently considered simultaneously. As usual in physical and chemical changes, the higher the temperature, the quicker is the conversion of carbon from the combined to the free state. In fact, the speed of change is found to be proportionate, roughly, to the temperature above 1300 degrees Fahr. There is, however, a double limitation upon the temperature that can be carried. imposed first by the fact that overheated malleable develops a coarse structure and suffers a loss of ductility, and second, by the excessive depreciation of the iron pots at high temperatures.

After the completion of the change of the carbon from the combined state, the cooling must be sufficiently slow so that all the carbon may separate as graphite. It is found that this process occurs at temperatures down to 1300 degrees. Quenching at lower temperatures, Mr. Miller states, has no bad effects.

Experiments show, also according to Mr. Miller, that the nature of the packing has no very marked effect upon the rate of conversion of the carbon, although a packing of mill scale, by promoting the decarbonization, reduces the active mass of the temper carbon, and probably permits the conversion from combined to temper carbon to proceed a little more rapidly and completely.

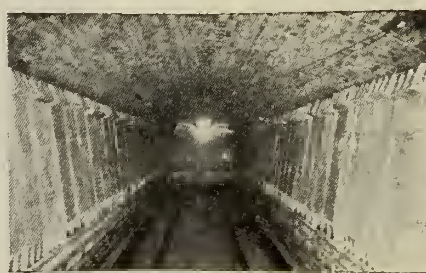


FIG. 2.

Decarbonization is, however, naturally very dependent upon the packing. Mills scale promotes it and neutral packing does not. Temperature has also a marked influence, the rate of decarbonization being much more rapid at high than at low temperature.

The atmosphere of the furnace has a bearing upon the decarbonization. Under slightly oxidizing conditions, the packing around the castings is kept active. It is probable also that there is some direct oxidation of the carbon by the atmosphere. This is particularly seen where the annealing is carried out in mufflers, without packing, when the carbon content is reduced by the oxidizing action of infiltrating air and gases. If the atmosphere is more that slightly oxidizing, the pots suffer from excessive scaling.

The Dressler continuous annealing furnace is producer gas fired, of the tunnel and car type. The material to be annealed is loaded on a train of cars progressively pushed through the furnace by means of a mechanical device, as shown in Fig. 1. The kiln is divided into three regions: The heating zone in which the material is brought to the desired temperature; the soaking zone in which it is maintained at that temperature; and the cooling zone.

The furnace differs from others of the continuous type in that it is a complete muffle; neither the air for combustion nor the products of combustion are brought into contact with the work. On either side of the kiln in the heating and soaking zones are lateral combustion chambers, as shown in Fig. 2. These combustion chambers form continuous tubes throughout this distance. The gas and air are introduced into them at intervals in the soaking zone. Combustion takes place within them, and the products of combustion are drawn off through them by means of a fan, toward the entrance of the kiln, in an opposite direction to the progress of the cars.

The kiln resembles other types of muffle kilns in that the flame is screened from the pots, but differs in the im-

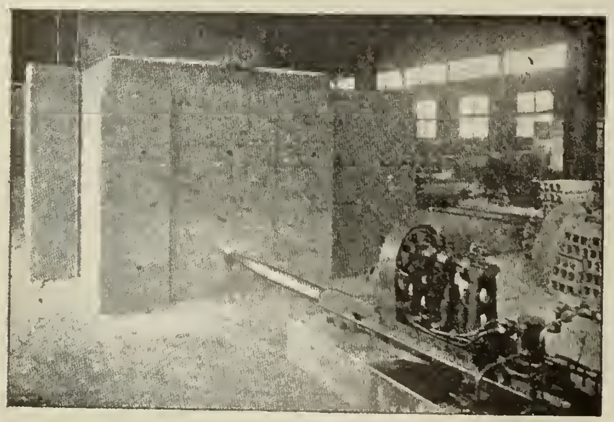


FIG. 1—ENTRANCE END OF DRESSLER TUNNEL FURNACE, SHOWING HYDRAULIC PROPELLING GEAR..

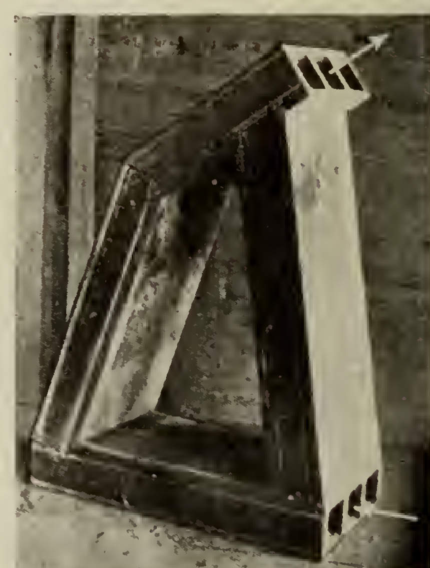


FIG. 3.

portant feature that there is no structural connection whatever between the chambers and the kiln proper. They simply rest on a bed of sand and are free to expand and contract independently of the film, thus avoiding the strains which rapidly destroy some muffle kilns. The combustion chambers may thus be described as floating.

How Combustion Chambers Operate

The combustion chambers are made in sections dovetailing into each other and luted with fireclay. Each section is composed of four refractory pieces, somewhat resembling thin-walled, hollow tile, as shown in Fig. 3. The space between the inner and outer walls is continuous around the combustion chambers. The mechanism by which the heat is transferred from the flame to the pots is as follows:

The inner wall of the combustion chamber is directly heated by the flame. The vertical portions of the chambers thus act as hot flues and draw the atmosphere of the kiln through the openings at the bottom and discharge it at the top. On emerging, this is somewhat hotter than the pots on the cars; it is cooled by them and falls through the passages provided to the level of the bottom of the chamber, around which it is once more drawn. A constant and vigorous circulation of the kiln atmosphere is thus maintained, and the heat in this way is evenly distributed throughout the mass of the pots.

The outer wall of the combustion chamber facing the pots act as a screen, cutting off the direct radiation from the hot inner wall, thus permitting a very hot and efficient combusion to be maintained without local overheating. The circulation is clearly shown by the arrows in Fig. 4.

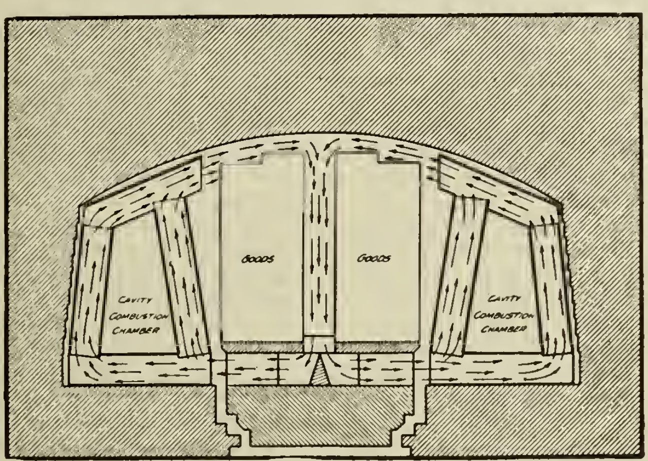


FIG. 4—DIAGRAMMATIC SKETCH SHOWING MECHANISM OF HEAT DISTRIBUTION IN HEATING ZONE.

In the cooling zone, the heat is abstracted from the pots by means of a series of cast iron pipes occupying the same relative position on either side of the kiln as the combusion chambers do in the heating and soaking zones. This is shown in Fig. 5. Through these pipes, air is drawn from outside of the kiln. During its passage, it cools the pots, and is itself heated to about 700 degrees Fahr., at which temperature it is delivered to the combustion points, thus giving the kiln the benefit of the principle of recuperation. In the case of kilns for annealing malleable iron, between the end of these iron pipes and the beginning of the combustion chambers, a space is left in which the plots are allowed to cool slowly down in 1,300 degrees Fahr.

Double Doors Form Air Lock

At either end of the kiln are double doors forming air locks, so that cars can be put into the kiln and withdrawn without allowing air to enter from outside. If it is desired to carry a reducing atmosphere in the kiln, after closing the outer doors the air in the locks between the doors can be swept out with gas or the products of combustion before the inner doors are opened.

The economies effected by this type of furnace can be grouped under the following heads: Fuel, pots, labor, time, and improved quality of product.

The principle of continuous firing, involving a cool exhaust and the recuperation of the heat of the cooling pots by means of the air of combustion leads to great economies. Furthermore, it is possible to carry a very much hotter and more efficient combustion in the chambers without overheating the castings than is possible where the flames come directly in contact with them.

FIG. 5.

The usual fuel consumption in annealing malleable iron in intermittent furnaces is from 800 to 1,000 pounds per ton. Figuring that the total weight of the malleables, packing and boxes is three times that of the castings alone, this represents 260 to 330 pounds per ton of the total weight heated. In the Dressler kiln, the fuel consumption is from 90 to 100 pounds per ton of total weight.

The chief destruction of pots in the direct-fired kilns is due to the direct action of the flame upon those nearest the fire boxes. In order to attain the minimum temperature of annealing in the coolest portions of the kiln, the hottest portions are heated to nearly 1,800 degrees Fahr., at which temperature the iron scales very severely, particularly if the flame is oxidizing. In the Dressler kiln, the atmosphere can be regulated, as described, to be reducing or only slightly oxidizing conditions. Moreover, the flame not coming into contact at all with the pots, the periods of excessive heat, when the fires are fed are avoided. The result is a lengthening in the life of the equipment, even though a higher general temperature is carried than in the direct-fired furnaces.

Labor Cost Reduced

The loading and unloading of the cars is all performed outside the kiln under the best conditions. It is invariably found that a considerable labor saving results.

The usual annealing furnace is of the down-drift type with the fireboxes on one side. In such a furnace, the pots next to the fireboxes are always from 200 to 250 degrees hotter than those near the floor on the opposite side of the kiln. The time of annealing of the furnace full of malleables is really determined by those in the coolest part. If a higher temperature could be carried without overheating the pots nearest the fireboxes, a saving of time would be effected.

In the Dressler kiln, owing to the distribution of heat, there is no lag of one portion behind the other, so that the highest practicable temperature can be carried over the whole mass—that is to say, supposing 1,800 degrees to be the highest temperature at which annealing can be carried out, the period that the castings would have to stay in the heat would be that necessary to anneal them at 1,800 degrees, and not that necessary to anneal them at 1,550 degrees, as in down-draft kilns. Furthermore, in the case of the intermittent furnace, the whole mass has to be started from cold, whereas in the tunnel furnace small masses at a time are introduced into an already hot kiln, thus cutting down the time required to heat up to the annealing temperature. In cases where the castings do not tend to warp, they can be placed in trays without packing, and the atmosphere of the kiln kept suffcently oxidizing to bring about the necessary decarbonization, exactly as in the present intermittent muffle process. The cutting out of the packing lessens the lag between the inside and the outside of the pot or tray, and enables the annealing to be carried through more quickly.

(Continued on Page 50.)

Practical Hints for the Brass Founder

THE USE AND ABUSE OF CRUCIBLES

By A. C. Bowles

A few days ago a local foundryman called me up and complained, in language more forceful than elegant, that the last batch of crucibles he had received "was rotten" and that they fell to pieces before he was able to get even one heat out of them. He asked indignantly what we were going to do about it. Of course I told him that I was sorry he had trouble and that we would make good any crucibles proved defective, but that I would like to see the crucibles to determine, if possible, the cause of their failure. To make a long story short, he had attempted to dry them in the moist atmosphere of the core-oven, with the inevitable result that they had scalped upon coming into contact with the fire.

Crucibles respond so readily to proper treatment that it is worth while emphasizing again the points that have to be observed if the maximum of service is to be obtained from graphite pots. There is nothing new about the right procedure. Most crucible users have known it, but probably on account of the stress of business during the past few years, have neglected to make use of their knowledge.

The manufacturer is not infallible, and occasionally a bad batch of pots slips through, but the complete system under which he works, and the long years of practice in repeating the same operation reduce the chances of mistakes on the part of the factory to the minimum. It is safe to say that 90 per cent. of the failures of crucibles are traceable directly to poor treatment on the part of the user.

The principal cause of the failure of crucibles is the lack of proper annealing. When the crucible comes from the kiln it contains but ¼ per cent. of combined moisture, and in this condition it is impossible to scalp it. However, during transportation from manufacturer to user, it, like salt, absorbs moisture from the atmosphere, and once absorbed, a temperature of not less than 250 deg. Fahr. is required to dispel this moisture.

Most crucible troubles occur in small shops. The large consumers have found it well worth while to equip their plants with drying ovens, especially to dry and anneal their crucibles before they are put into the furnaces. Whether annealing in a special oven or on top of the crucible furnace, there are four points that must be observed:

1. The temperature must go above 250 deg. Fahr.
2. This temperature should be reached gradually.
3. This temperature must be held a sufficient time to allow the moisture to thoroughly disappear.
4. The crucible must go into the fire with a temperature above 250 deg. Fahr.

It is a mistake to think that after the first three rules have been followed the crucible has had its annealing and is impervious to moisture, for, if allowed to cool below 250 deg. Fahr., it will again take up moisture just as readily as the first time.

Another enemy of the crucible is misshapen tongs. When the crucible is hot it is in somewhat plastic condition and is easily squeezed out of shape or ruptured. The best tongs are the basket variety, which grab the crucible both below and above the bilge and hold it firmly without squeezing. It has been found good practice to have an iron crucible cast, over which the tongs can be straightened and shaped at frequent intervals. This method is not only much quicker and simpler, but gives a better result than sending to a blacksmith. Some shops find it advisable to have tongs of two sizes, one for the new crucible and one for the old pot, which is considerably smaller.

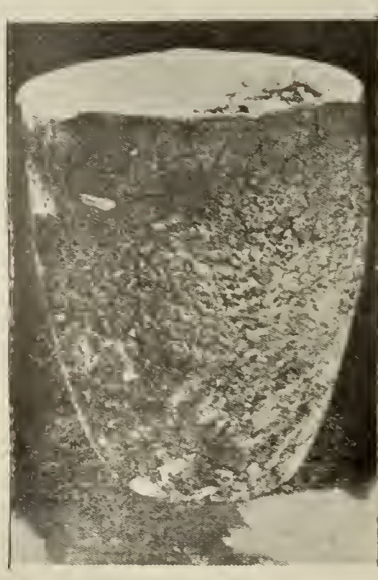
In using an oil-furnace the flames should never be allowed to play directly on the crucible, as scoring will follow, and the crucible will soon wear through on that side. In addition one side will heat faster than the other, which is also bad practice. Oil-furnaces giving a rotary flame seem to be the most satisfactory and to give the most even heat on all sides of the crucible.

The use of wet coke is also bad practice because steam comes in contact with the crucible and forms checks known as alligator-cracks. These will likewise form when a crucible is exposed to the moist gases on top of the furnace, while it is being annealed. Therefore care should be taken when annealing a crucible on top of the furnace, to see that it is kept away from direct contact with the flame.

The activities of the furnace-tender with his iron poker often shorten the life of the crucible. Many shops make a practice of keeping account of the number of melts each tender gets from a crucible so that the careless tender can be checked and the average number of heats increased.

(Continued on Page 50.)

CRUCIBLE BURST IN FIRE ON ACCOUNT OF MOISTURE.



RESULT OF ALLOWING FLAME FROM OIL-BLAST TO TOUCH CRUCIBLE.

CRUCIBLE SQUEEZED AND RUPTURED BY BADLY-SHAPED TONGS.

The Electric Furnace and the Non-Ferrous Metals

The Following Paper Was Read by the Author Before the Cleveland Engineering Society on March 11. The Utility of the Electric Furnace for the Melting of Non-Ferrous Metals and Their Alloys is Clearly Developed

By E. F. COLLINS, General Electric Co.
Continued from last issue

Fig. 3 shows a working installation of furnaces of this type, having melting capacity of 1,500 lbs. of brass per hr. The most recent design of this type of 1,500 lbs. furnace is shown in Fig. 4, which illustrates a class 1 type furnace, in the furnace classification table already given.

The induction type of furnace is said to be exceptionally efficient thermally while melting. We shall see, however, that its overall working efficiency for the week is not appreciably from furnaces of Class 1, and it is desired to call attention to the fact that kw. hours per ton consumed in melting by no means indicates the highest overall working efficiency. Suppose for illustration we concede that the induction type of furnace has the highest thermal efficiency in melting. A certain furnace of this type has a crucible capacity of 400 lbs., and no load loss or radiation of 8 kw. hrs. per hour, and melts a charge of red brass each hour. Suppose a charge is poured at 1,300 C., it is necessary to use hand ladles pre-heated in pouring the charge. The furnace must be kept hot 24 hours per day, when the crucible has once been heated up. Let us now compare the effective working kw. hrs. consumption per ton with that of a 2,250 lb. per hour tilting type furnace of design described by the speaker, and melting 18,000 lbs. of red brass per 8-hour day. It will be noted that this furnace may be charged by machine, whereas the crucible furnace must be carefully charged by hand. One man's labor will operate, i.e., charge and melt this metal, say at $4.50 per day, or for $1 per ton labor. Pouring of charge will be by hand ladle, preheated, and should cast the same as pouring a like quantity of metal from crucibles.

It seems that since 5 to 6-400 lb. furnaces must be employed to give same metal output as one 2,250 lb. tilting furnace, that the labor of attendance, charging and melting should cost at least 2¼ times as much in the crucible furnace as in tilting hearth type, or 2.25 per ton. Hence, it follows from above that:

Metal melted per week in 400 lb. crucible induction furnace, 8-hr. working day, will be 48x400=19,200 lbs.

Kw. hrs. to melt 19,200 lbs. at 200 kw. hrs. per ton will be 200x9.6=1,920 kw. hrs.

Kw. hrs. to keep furnace hot while not melting, 24x7=168; 168—48=120 hrs. per week will be 120x8=960.

Total kw. hrs. per week 2,880.
Kw. hrs. per ton, 2,880/9.6=300.
Power cost per ton at $.01 ...... $3.00
Excess labor cost of 400 lb. crucible furnace over 2,250 lb. tilting hearth per ton 1.25
$4.25

This $4.25 is the power costs that may be allotted per ton to the 2,250 lb, furnace and maintain equal all week efficiency for the same total amount of metal melted by either furnace. In other words if the large tilting furnace melts with the not unexpected consumption of 425 kw. hrs. per ton it has equalled the performance of the induction crucible furnace, which, offhand, seems much more efficient because we say it melts for 200 kw. hrs. per ton. Large capacity induction furnaces might change the above somewhat, but the writer does not know of any successful design on the market at present for melting brass in capacity exceeding 600 lbs. In fact these are limited in their use to certain mixtures only. Leaded brass above three per cent., I believe, cannot be successfully handled due to fluxing action on crucibles.

The above clearly shows that a furnace should not be selected merely because it melts at a low kw. hr. per ton, but all its other characteristics should be studied, and its overall cost of turning out metal considered when conforming to local conditions, since different working cycles may give widely different overall results.

Cost of Electric Melting vs. Fuel Fired Furnaces

The speaker wishes to call attention to certain characteristics, losses, handicaps, etc., which influence the overall cost of melting, and must be considered in making up true melting costs. These will now be considered and their effect shown upon costs as tabulated in the table.

Sources of Melting Loss in Melting

(1) Temp. control, electric, excellent; fuel fired, indifferent. (2) Size of charge, electric, controllable; fuel fired, controllable. (3) Gas flow from furnace, electric, negligible; fuel fired, large volume of combustion gases must pass out. (4) Furnace atmosphere chemical condition, electric, free from oxygen and injurious gases; fuel fired, contaminated by impurities of fuel, protection against oxygen only through excess fuel supply. (5) Speed of melting, electric, much greater than fuel fired; fuel fired, much less than electric.

The above statement is the principal loss in melting brass alloys. It will be noted that conditions are under absolute control in the case of the electric, whereas in fuel fired places the control of temperature is indifferent, and large vol-

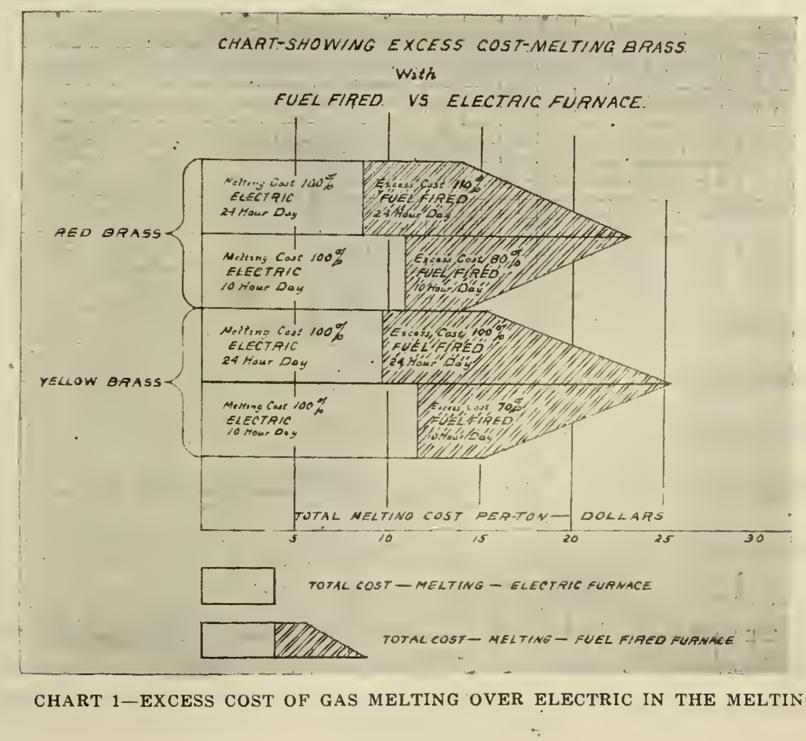


CHART 1—EXCESS COST OF GAS MELTING OVER ELECTRIC IN THE MELTING

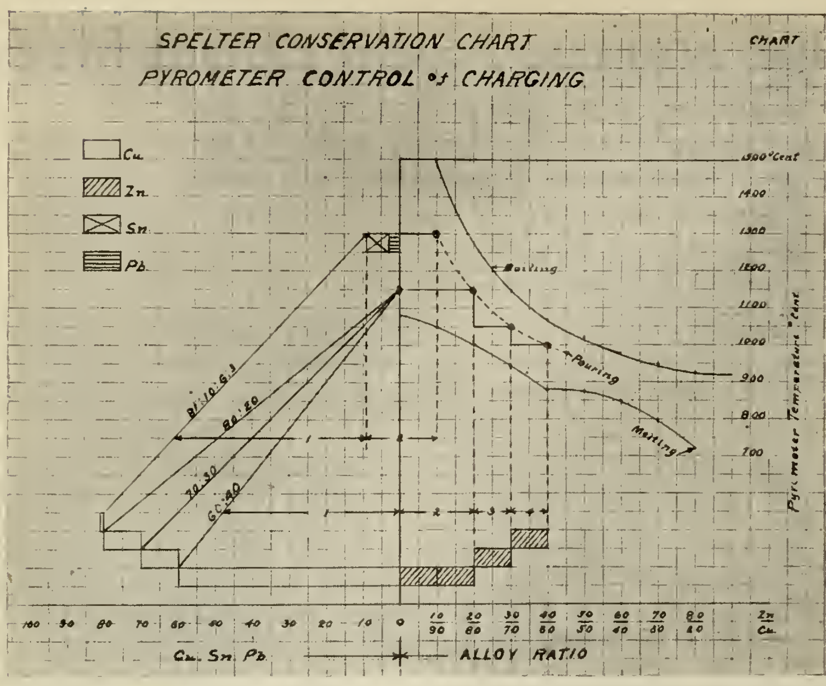


CHART 2—SPELTER CONSERVATION CHART WITH PYROMETER CONTROL OF CHARGING.

umes of gas of combustion must pass through the furnace and likewise since heat is generated through oxidization of fuels, the furnace chamber cannot be free from oxidizing and contaminating influences upon the metal.

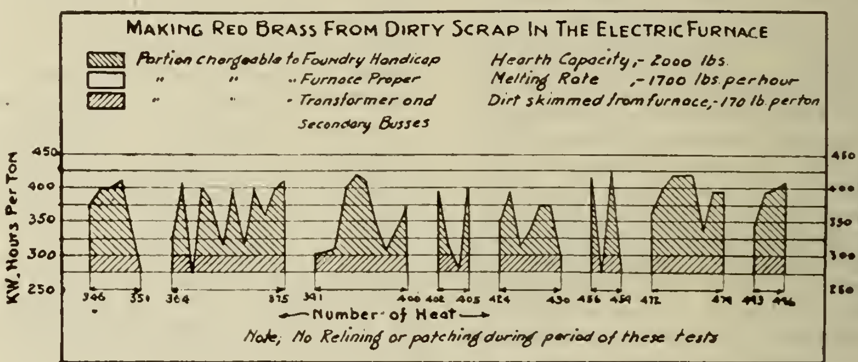


CHART NO. 3.

First Source of Loss
Temperature Control
In a Given Electric Furnace, Pounds of Metal Lost in Melting Increases As The Temperature for Forming Lies Above Melting Point of Alloy

In illustrating how lack of temperature control may increase metal losses in melting brass, let me present the following test: First, 70:30 brass is made in the electric furnace taking 420 lbs. of copper and melting down and then adding 180 lbs. of zinc, at 1,170 degrees C., pouring at 1,150 degrees C. Second, 420 lbs. of copper was melted down and 180 lbs. of zinc added at 1,100 C., and poured at 1,100 degrees C., with the following tabulated results:

The results in Table 2, showing the effect of temperature on the same metal (yellow brass) are consistent with a curve shown as melting and boiling curves, chart 2. If one follows the pouring temperature curve shown he will not get excessive metal loss in melting in the electric furnace. If one can keep under this curve then losses will be decreased. Hence, one may control his melting loss readily in the electric furnace by observing this alloying and pouring temperature.

Second Source of Loss in Melting
The Number of Pounds Lost on Melting Is Independent of Charge in a Given Electric Furnace, Free From Ventilation

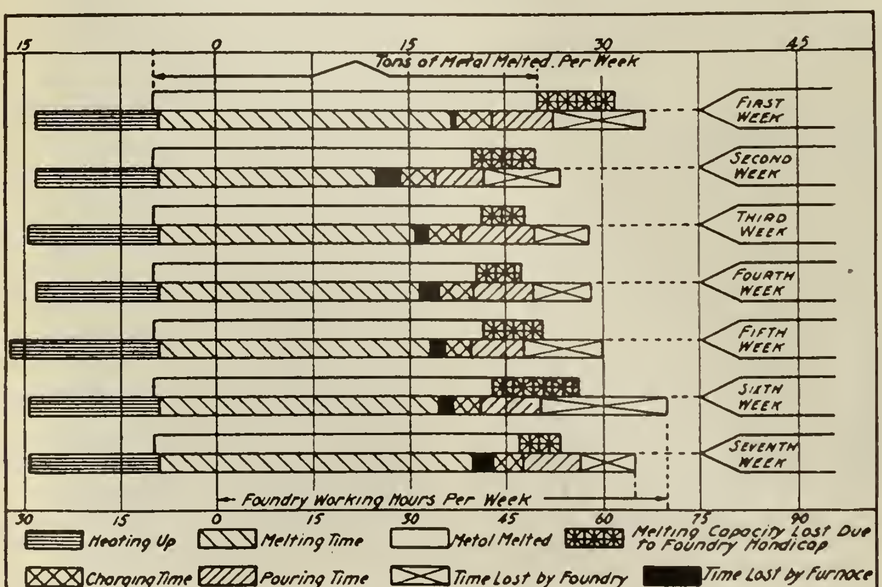
Metal Melted	Charge Lbs.	Temp. Melt.	Metal Loss
2696 lbs.	674	1100° C	1.4%—37.6 lbs.
3727 lbs.	832	1200° C	1.3%—38.4 lbs.

Third Source of Loss in Melting

In the fuel fired furnace the magnitude of loss from this source is influenced by speed of melting and pressure, volume and velocity of gases flowing over the melting metal; thus increasing the atmospheric pressure in furnace, decreasing the volume and velocity of the gases tends to reduce volatilization loss. For each fuel there is a maximum limit to gas speed or velocity through the furnace since each fuel in developing the required heat units to get the heat out at a given speed must develop a certain volume of gases which must pass out. Hence the proper gas velocity is inseparably connected with products of combustion results from various fuels. Approximate volume of flue gases average in coal, coke and oil furnaces from 3,350 to 5,800 cu. ft. per 100 lbs. of metal melted. Hence, it is easy to see how the flow of gas may bring about a very large volatile loss in the fuel fired furnace. In the electric furnace the gas flow is very small and consequently, though its atmosphere be saturated with metal vapors, so little gas leaves the furnace during the melt that the loss resulting is negligible.

Fourth Source of Loss in Melting Oxidization

Copper, zinc, tin and lead, the constituents of commercial brasses, are all



THIS CHART SHOWS THE CONTINUITY OF ELECTRIC FURNACE SERVICE IN MELTING BRASS COMMERCIALLY.

TABLE 2.

Yellow Brass Metals lbs.	Temperature of alloying.	Pouring Temp.	Alloy recovered	Per Cent. Zn. loss	Per Cent. Metal loss
(a) 420 cu. 180 zn.	1170° C. 2140° F.	1150° C. 1150° C.	565 lbs.	19	5.8
(b) 420 cu. 180 zn.	1100° C. 2010° F.	1100° C.	590 lbs.	5 6	1.6
CHEMICAL ANALYSIS.		Test Corresponding to Above.			
(a) Cu. 70 Zn. 30	1170° C.	1150° C.	Cu. 75.9 Zn. 24.1	24	7.3
(b) Cu. 70 Zn. 30	1100° C.	1100° C.	Cu. 71.3 Zn. 28.7	5.5	1.6

very readily oxidizable at the temperatures to which they must be heated for melting and pouring. Oxidizing results in loss of metal and actually burns the metal to a dross. One can readily maintain a neutral or reducing atmosphere in the electric furnace, but it is certain that carbon monoxide must be so high and oxygen so low that one cannot, in ordinary fuel furnaces, hope to maintain a reducing atmosphere without sacrificing many heat units through burning carbon to CO instead of CO_2.

Gas absorption is proportional to the temperature and the time metal is held in contact with gases. Incidental and intimately connected with oxidization of metal is the absorption of gases. In melting the constituents of an alloy, a gas may enter into chemical union with some of its metals, forming oxides, or they may be occulated in the alloy. As an illustration, when silver is molten (1,020 degrees C.), it can absorb about 20 times its own volume of oxygen. On cooling it gives up the oxygen absorbed as evidenced by the well-known spitting of silver on freezing. Absorption of gases is greater as the temperature increases, since when the metals freeze, absorbed or dissolved gases are given up. If they are unable to pass through the metal before it freezes sponginess and blow holes in the alloy will be produced. The same effect may be produced by air trapped in pouring, by gases evolved by moulds or cores when hot metal enters them, but dissolved gas is unquestionably a principal source of porosity and blow holes. All fuels used in the foundry at the present time contain sulphur in some degree. This sulphur is a very common cause of trouble. Melted brass absorbs sulphur greedily and gives it up upon cooling in the sand moulds, forming porosity and blow holes. One successful brass foundry asserts that many of the failures usually attributed to oxygen are really due to sulphur. In the most careful crucible melting in coke fired furnaces, the metal will absorb .002 to .005 per cent. sulphur, Figs. 5 and 6. Sulphur accumulates in a metal each time melted, which accounts for the dark skin of rerun castings, as compared with first melt metal.

In fact even though melted under a charcoal cover and CO blanket, copper needs a deoxidizer to free it completely from oxygen. The above troubles should not appear in connection with electric melting, since the furnace chamber may be kept uncontaminated and free from oxygen and injurious gases.

Fifth Source of Melting Loss

Loss of zinc is proportional to the temperature and length of time a metal is held at the high temperature. This statement means that if you melt one charge at the rate of 100 lbs. per hr, and the second charge at the rate of 200 lbs. per hr., then, all else being the same, the melting loss of second charge will be less than the first charge. Electric methods of melting lend themselves to much quicker melting or higher melting rates than with fuel fired furnaces, viz., melting rate electric, 1,500 lbs. per hr.; fuel fired, 1,500 in 2¼ hrs.; 600 lbs. electric in ½ hr.; fuel fired, 600 lbs. in 3 hrs.

Metal loss in melting is ordinarily best judged from chemical analysis of metal charged. This test eliminates errors arising from furnace wall absorption or the reverse, also losses in pouring.

To show the inconsistency of actual recovery methods of loss test, the following results of comparative tests on coal fired crucible furnace and electric furnace (crucible capacity 250 lbs., electric furnace capacity 1,500 lbs.) are presented. Metal was poured from crucible direct, whereas auxiliary ladle was used to pour 1,500 lbs. electric furnace, giving chance for more loss in pouring.

METAL RECOVERY TEST
(Actual test on Red Brass.)

Metal Charged	Metal recovered	% Loss	Type Furnace
1 heat 1500 lbs.	1465 lbs.	2.33	Electric Tilting
1 heat 1500 lbs.	1484 lbs.	1.07	Electric Tilting
4 heats 250 lbs.	980 lbs.	2.00	Coal fired crble.
4 heats 250 lbs.	990 lbs.	.85	Coal fired crble.

Chemical analysis for melting loss on the same electric furnace, and same metal showed approximately .4% Zn. loss.

Analysis of metal charged:—

S.N.	Pb.	Cu.	Zn.	Fe.
4.30	6.55	80.80	8.02	.25
4.29	6.60	81.46	7.61	.25
(Poured ele.)		(No charcoal.)		

ACTUAL TEST (YELLOW BRASS) ELECTRIC FURNACE.
Metal Recovery Test.

Metal Charged	Metal poured	Loss
600 lbs.	590 lbs.	1.6 %

Analysis Metal Loss.

Charged	Cu. 70	Zn. 30	
Poured	Cu. 71.3	Zn. 28.6	1.4 %

Average Cost of Melting Brass with Fuel-Fired or Electric Furnace.

Furnace type	Pit	Pit	Tilting	Pit	Reverb.	Pit	Tilting	Crucible	Crucible	Tilting	
Furnace draft	Natural	Forced	Forced	Natural	Natural	Forced	Forced	Burner	Burner	Electric	
Furnace fuel	Coke	Coke	Coke	Coal	Coal	Oil	Oil	Natural Gas	City Gas	Electric	
Fuel cost price	9.75	9.75	9.75	8.00	8.00	0.098 gal.	0.098 gal.	0.30M	0.60M	0.015 kw.-hr.	
Cost per Ton Making Red Brass. Pouring at 1300 deg. C. (Zinc 10 per cent. or less).											
Fuel quantity	1400	700	600	1200	900	50 gal.	60 gal.	4800	7000))	400 kw. hr. 10 hr.	250 kw. hr.-24 hr.
Metal loss	70	30	30	70	124	30	44	40	40		15
Fuel cost	$6.82	$3.41	$2.92	$4.80	$3.60	$4.90	$5.88	$1.44	$4.20	$6.00	$3.75
Zinc value at 10c lb.	7.00	3.00	3.00	7.00	12.40	3.00	4.40	4.00	4.00	1.50	1.50
Cost reclaiming	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.15	0.15
Renewals and repairs	0.40	0.40	0.35	0.40	0.50	0.50	0.50	0.35	0.30	1.00	1.00
Cost preheating crucible	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.40	0.40	0.10	0.10
Furnace labor	2.25	2.25	2.25	2.25	1.50	2.25	1.50	2.25	2.25	1.00	1.00
Miscellaneous and labor and fuel..	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.40	0.40	0.20	0.20
Cost charcoal	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.05	0.05
Air for blast	....	0.15	0.15	....	....	0.15	0.15	0.15	0.15	....	....
Crucible cost	5.00	5.50	5.50	5.00	....	8.00	....	8.00	8.00	....	....
Interest crucible stock	0.10	0.10	0.10	0.10	....	0.10	....	0.10	0.10	....	....
Lining pouring crucible	....	....	0.30	....	0.30	....	0.30	0.30	0.30	0.30	0.30
Electrodes and coke	....	....	....	....	....	....	....	....	....	0.60	0.60
Cost per ton—total	$23.09	$16.33	$16.09	$21.07	$19.82	$20.32	$13.85	$10.01	$20.72	$10.90	$9.65
Cost per Ton Making Yellow Brass (Zinc 10 to 40 per cent.)										(350 kw. hr. (10-hour day	220 kw.-hr. 24-hour day
Fuel quantity	1000	600	400	700	400	40 gal.	45 gal.				
Metal loss	100	40	56	100	200	60	70			30	
Fuel cost	$4.88	$2.92	$1.95	$2.80	$1.60	$3.92	$4.41			5.25	$3.30
Zinc value at 10c lb.	10.00	4.00	5.60	10.00	20.00	6.00	7.00			3.00	3.00
Cost reclaiming	0.50	0.50	0.50	0.50	0.50	0.50	0.50			0.15	0.15
Renewal and repairs	0.40	0.40	0.35	0.40	0.50	0.50	0.75			1.00	1.00
Cost preheating crucible	0.40	0.40	0.40	0.40	0.40	0.40	0.10			0.10	0.10
Furnace labor	2.25	2.25	2.25	2.25	1.50	2.25	1.50			1.00	1.00
Miscellaneous and labor and fuel..	0.50	[illegible].50	0.50	0.50	0.50	0.40	0.40			0.20	0.20
Cost charcoal	0.12	0.12	0.12	0.12	0.12	0.12	0.12			0.05	0.05
Air for blast	....	0.15	0.15	....	....	0.15	0.15			....	....
Crucible cost	4.50	5.00	5.00	4.50	....	4.50	....			....	....
Interest crucible stock	0.10	0.10	0.10	0.10	....	0.10	....			....	....
Lining pouring crucible	....	....	0.30	....	0.30	....	0.30			0.30	0.30
Electrodes and coke	....	....	....	....	....	....	....			0.60	0.60
Cost per ton—total	$23.65	1[illegible].34	$17.22	$21.57	$25.42	$18.84	$15.35			$11.65	9.70

ELECTRIC FURNACE MELTING PHOSPHOR BRONZE.

Metal Recovery Test (Actual)—

Metal charged, 2696 lbs.; metal poured at 1100° C, 2656 lbs. Loss, 1.4%.

Metal charged, 3727 lbs.; metal poured at 1200° C, 3678 lbs. Loss 1.3%.

Physical Test of Metal—

Open flame oil furnace and electric furnace melting same brass.

	Elec. Furnace	Oil Furnace
Ten. Strength	27900	24969
Yield Point	10844	9850
Elas. Limit	7300	7000
Elong. in 2"	19.4%	16.9%
Elong. in 8"	17.2%	14.9%
Red. Area	21.4%	19.7%
	Crucible Furn.	Elec. Furn.
Ten. Strength	30250	30820
Elas. Limit	17833	18000
Elong.	16.14%	19.37%
Red. of Area	16.1%	22%

Tables 3, 4 and 5 show performance on the average to be expected from the use of the electric furnace with the furnace charge in different physical form, etc. Table 6 shows like results for fuel fired furnaces.

TABLE NO. 6.
Average Melting Results, Realized in the Average Foundry with Fuel Fired Furnaces.

Type	Furnace Draught	Fuel Kind	Per Ton.	Metal Loss	Red Brass Low Zn. 10% Yellow " High Zn. 10% above
Pit	Nat.	Coke	1400 lbs.	3.5	Red Brass.
			1000 lbs.	5	Yellow Brass.
Pit	Forced	Coke	700 lbs.	1.5	Red Brass.
			600 lbs.	2	Yellow Brass.
Tilting	Forced	Coke	600 lbs.	1.5	Red Brass.
			400 lbs.	2.8	Yellow Brass.
Pit	Nat.	Coal	1200 lbs.	3.5	Red Brass.
			700 lbs.	5	Yellow Brass.
Reverb.	Nat.	Coal	900 lbs.	6.2	Red Brass.
			400 lbs.	10	Yellow Brass.
Pit	Bumers Tangentail	Oil	50 gal.	1.5	Red Brass.
			40 gal.	3	Yellow Brass.
Tilting	Open Flame. Atomizing Bumer.	Oil	60 gal.	3.2	Red Brass.
			45 gal.	3.5	Yellow Brass.
Tilting Crucible	Bumers. Tangentail.	Nat. Gas	4800 cu. ft.	2.75	Yellow Brass.
Tilting Crucible	Bumers. Tangentail.	City	7000 cu. ft.	2.75	Yellow Brass.

The results given in tables 1 to 4 are average figures and will be influenced to meet any particular foundry by (a) promptness of pouring, (b) temperature (since pyrometers are seldom used), (c) local conditions such as physical condition of metal charged, its cleanliness, volume of air and products of combustion which pass through the furnace in natural draught furnaces. This varies from day to day, depending on the weather, (d) design of furnace, (e) manipulation of furnace, (f) size of crucible, (g) percentage of composition, (h) length of working day, (i) whether observations are based on hot furnace and hot crucibles or whether first heat of the day is excluded, (j) pouring light castings require hot metal, and heavy ones metal at lower temperature, (k) whether results are from careful tests or whether they represent actual foundry or rolling mill practice and extend over a considerable period.

Chart 4 illustrates how a furnace able to turn out metals for 300 kw. hr. per ton, due to foundry handicap, averages only 350.

Cost of Melting Brass in Fuel Fired and Electric Furnaces

The writer presents table as a resume of that which precedes it in the paper, relating to cost of melting brass per ton with the various typical fuel fired furnaces, and also with the electric brass melting furnace. This table is an average table and results for individual foundries may be readily found by substituting in the itemized costs those which obtain there, i.e., .5 cents per kw. hr. has been used as electricity or power cost, if this is 1 cent in plant under consideration then this figure should be substituted. Likewise other values may be converted to actual ones for an actual local condition. It is believed that the values used in this table are fair and represent well averaged conditions, and they may be considered directly without substituting for local conditions, in fact, in their direct form they allow of judging correctly of the general problem of electric vs. fuel fired furnaces.

Final

In conclusion permit me to present chart No. 1, made up from the other curves and tables. Here I have assumed that all the brass in the country is melted (1) in fuel fired furnaces, all types being employed equally, (2) that the same work is done in the electric furnace.

Four conditions are shown, viz.:

10-hr. day (1) melting yellow brass,

(Continued on Page 50.)

TABLE NO. 3.
Nonferrous Metals Melted in Electric Furnace.

Metal	Condition of Metal Charged.	State of Metal After Melting.	KW. hrs per Ton to melt.	Metal loss in melting.
Copper	Electrolytic Cathode	Pig at pitch without		
	Pig	rabbling or poling	300	No oxidation; a
	Scrap—Heavy.			certain amount of
	Scrap—Light.		to	copper oxide is
	Scrap—Dirty.	Wire bar.		reduced.
	Chips—Oily.		500	
	Chips—Clean.	Foundry Castings.		
Zinc	Electrolytic Cathode	Pig.	90	Dross and
	Pig.	Foundry castings.	to	Oxidation under
	Punchings.	Billets for rolling.	120	2%.
	Chips.	Battery electrodes.		
	Heavy scrap			
Nickel	Shot.	Pig.	500	No oxidation loss.
	Bar.	Foundry castings.	to	
	Scrap.	Billets for rolling.	750	
Alum.	Pig.	Pig.	400	Less than 1%
	Scrap.	Foundry castings.	to	oxidation.
	Punchings.	Billets for rolling.	750	
	Turnings.			
Tin	Bar.	Bar.	40	No oxidation.
	Pig.	Pig.	to	
	Scrap.	Wire.	60	
Lead	Pig.	Billets for rolling.	20	No oxidation.
	Scrap.	Casting.	to	
	Sheet.	Pig.	40	

TABLE NO. 4.
Nonferrous Alloys Made in Electric Furnace.

Metals	Condition of metal charge.	State of Alloy after melting.	KW. hrs. per Ton.	Metal Loss.
Red Brass—				
Cu. 80	Scrap pig, electro. cathodes.	Foundry castings.		
		Wire bar.	250	.25 to .7, depend-
Zn. 10	Scrap—bar.	Billets.	to	ing upon manipu-
Sn. 6	Scrap—pig.		400	lation of furnace.
Pb. 4				
Yellow Brass—				
Cu. 60	Scrap, Pig, Electro. cathodes.	Foundry castings.	220	
		Wire bar.	to	.50 to 1.5.
Zn. 39.5	Scrap, Pig.	Billets for rolling.	350	
Pb. 00.5				

TABLE NO. 5.

Alloy.	Condition of alloy charged.	State of alloy after melting.	KW. hrs. per Ton.	Alloy Loss	Temp.
Red Brass	Yellow brass and copper	Foundry castings.	225	.15	
	or Red Brass and Zinc	Wire bar.	to	to	
	Pig Scrap and sprues.	Billets.	300	.50	1300°
	turnings and chips.				
Yellow Brass	Red Brass and Zinc or	Foundry casting.	200	.40	
	Yellow Brass and Zinc	Wire bar.	to	to	
	Pig Scrap and sprues,	Billets.	275	1.00	1100° C.
	turnings and chips.				
Monel					
Copper Nickel	Scrap and billets.	Foundry casting.	500	No oxidation.	
		Billets.	to		
			750		1600° C.
Aterite Cu.	Sprues, Scrap.	Foundry casting.	500	2% zn.	1650° C.
		Billets for Drawing	to	loss	
	Ni. Virgin metal.	Rolling.	750	Out of 32%.	
	Zn.				

Pioneer Foundry Days in Butte, Montana

Much Knowledge Can be Gained by a Trip Such as This, But For Those Who Are Not in a Position, or Have Not the Inclination to Make Such Trips, the Perusal of a Brother Molder's Experience Will No Doubt be of Interest

By JOHN WOODSIDE

IT was getting a long way from home, and the little pioneer shop in Tara, Ontario, the founding of which has already been recorded in the pages of the FOUNDRYMAN, when a small band of adventurers, with prairie schooner and cayuse team, drifted into Helena, Montana, early in the '80's. Last Chance Gulch they had called the old camp, which had grown into the capital of the mountain territory, and about the last chance it seemed for a molder, when I discovered that the city contained only one small brass foundry, run by one molder, whose main trade was nozzles for the hydraulics still washing down the edges of the old gulch. However, our lone brother cheered me up with the tale of two iron foundries in the new camp of Butte City, just over the ridge, said ridge developing as the backbone of the continent, the watershed for Atlantic and Pacific. The report that things might be brisk in the building line over in the new city was also good for our party, which boasted of a bricklayer, and a couple of "rough carpenters." I also was now not without some knowledge of carpentry, both rough and smooth, acquired in the practical school of the U. S. Army.

In the strenuous days of 1876 I had been caught in the storm and driven across the border toward Philadelphia, where the great Centennial Exhibition and general jubilee was centred, and which, on that account, promised some activity amongst the continent-wide depression. My summer's wanderings might frame up an Odyssey, although not so thrilling as Jack London's tale of "The Road," but toward autumn I drifted into New York, pretty thoroughly disgusted with the fight for existence. I had been cheered somewhat in my pilgrimage by posters in some of the cities asking for recruits for the U. S. Army, and as the country was all aflame over the slaughter of Custer and the 7th Regiment by the Sioux, and I always had a hankering for military life, I at last exchanged my well-worn civies for a suit of blue and the grey blanket of the doughboy, and my changeful bed for a permanent place within the breezy chambers of Castle Williams. I soon was sent out with a detachment of recruits yclept "Custer Avengers." What deeds I did against the turbulent Sioux may never be told, but having enlisted as a mechanic, an iron molder, they put me on as carpenter, when need arose, for some repairs to Government property after a bit of a hurricane at Omaha Barracks. I soon became so proficient at the new trade that I gained the rank of company artificer, and had worked for many months at the building of Ft. McKinney, under the Big Horn Mountains, where the pines of the mountains did not work as smoothly as the cedars of Lebanon, under the hands of Hiram the Builder, and the sound of many tools was heard; and I learned the art of shingling on those acres of roofs. A freighter, who had just come over from Butte, further braced us up by declaring that a crowd like ours would not be stuck, for there was good demand for cordwood at the mills, and new smelter; and there was dandy timber in the gulches near by, open to any one who wanted it; so we kept up good heart and climbed that ridge, stood where the waters flowed east and west, and looked down upon the solidest little camp in America. It was new, it was growing fast, and being far from the refining influences of the railroad, it still remained, in many ways, peculiar to the frontier, a wide open camp. The main street seemed to be occupied mainly by saloons, licensed for both gambling and liquor selling, which ran full blast for about 22 hours out of the 24, a couple of hours being necessary in the morning to clean up a bit, sweep out, and, indeed, in some cases, to wash up blood stains, and repair bullet holes, for, although they never, during my sojourn, had to cord up the "stiffs" outside the door, like unto Bret Harte's tale of Gilgal, there were occasional casualties usual to a mixture of alcohol and cards. Sunday was always a busy day with them, their main business being to separate the miner, mechanic, and freighter from his pay roll as quickly and painlessly as possible.

As to the chances at the foundries, they were what might well be termed negligible. The Lexington, owned by the millionaire mine owner, old Judge Davis, had two molders, Charley Farrel, and George Thurleway, he of the melodious voice, who became a public character on the national holiday, in that he led the crowd in singing the "Star Spangled Banner." The other little shop, down in the west end, owned by Cameron and Aiken, was held down by one molder, whom I only remember as "Old Jim." In fact, the molder seemed to be the main stay of the place, a machinist was called in as work demanded, and the boss, Aiken, as a nondescript helper, constituted the working staff. Business was not rushing and as the three molders were settled for the winter, the chances were nil. The building boom was also over for the season, so as a last resort we turned our horses' heads towards the timber, and were lucky enough in making a short-cut over the foothills to come upon an empty cabin in good repair, near a stream of good water and with a road right to the door, and good fir timber all around. We did not hasten to possess the cabin, knowing the rules of the mountains, and in half an hour we were called upon by a weather-beaten mountaineer, who claimed the shanty and the road up the gulch, his own habitation was a half mile down the gulch, where he kept guard over the road, we had inadvertently slipped in a back door; his business was wood-hauling to the smelter, so we soon came to an agreement to occupy the shanty and cut him 100 cords of wood. Now, as my earliest recollections had been of the timber, and my first toy a small, but serviceable axe, which, as there were no fruit trees around as yet, found service in the doomed forest surrounding the pioneer home, as well as on my foot, where I still bear a mark of it. I felt really more at home in the timber than as a carpenter, and entered upon this new phase of the adventure with some zest. My traveling companions, true knights of the road, as soon as they had renewed the grubstake, decided to move on, but I decided to stay in Butte for a season; even the owner of the gulch decided he would not winter in such high altitudes again, and for 30 cords of wood, cut from his mountain, he turned over to me all rights and title to the gulch. The cabin was considered the property of the man who built it, and the road, built by him to reach the timber, was considered personal property also, though it was all upon Government land, but no one ever attempted to collect stumpage here; the mills needed the wood and any man who wanted to supply them was welcome to the timber. So, in a measure, I became a house and land holder in the U. S.

(Continued in Next Issue.)

The Jointer; Commonly Known as the Buzz Planer

Any Other Machine Which is Used in the Pattern Shop Could be Dispensed With Rather Than the Buzz Planer

IT has been said that the pattern maker is the father of everything which is made of metal; few castings being made without a pattern of some kind. Even though it is only a flat plate which is being struck up on the floor with a straight edge, the pattern maker is requisitioned to make the straight edge. In fact, the pattern maker is the mainstay of the foundry. So important a personage is he, that he can usually claim the maximum wage which is being paid in any plant. But pattern making now-a-days, like every other line of activity, must compete in the price market as well as in the matter of quality, and no successful business man can afford to have a high-priced pattern maker spending his time with anything but the best in the way of equipment.

If it is not within the limits of the possibilities to have everything which goes to make up a fully equipped pattern shop, there is one machine which is certainly more indispensable than any other, viz: "The buzz-planer or jointer."

Even the work done with a saw can be done by hand to better advantage than the work of pointing a piece of untrue lumber, with only a hand plane and a keen eye, coupled with a strong right arm and shoulder.

Perfect buzz planing is the basis upon which all subsequent operations depend for truth and exactness. The first thing a woodworker does after he selects his stock is "to take it out of wind," in other words, he establishes a perfect plane on one side of his board or plank, and the next is to make one edge straight and square with the first surface. When done by hand this is very often a laborious and exacting process which can be done in a moment on a buzz planer. Often what would require thirty minutes to do by hand can be accomplished in thirty seconds by a machine. At the present rate of wages a workman would show very little result for the money expended. Again, when it is necessary to remove a considerable amount of stock from a thick or cumbrous object that cannot well be put through an ordinary surfacer, the surplus can very often be readily cut off on a buzz planer.

The uses to which a good buzz planer can be put are innumerable. In fact, no machine lends itself so readily to so many purposes—taking out of wind, squaring, edging, grooving, rabbitting, jointing, hollow jointing, making, small mouldings, special cuts, etc. In fact, the buzz planer can be made to do practically any job which can be done on an ordinary surfacer, but no other device can be made to take the place of the buzz planer.

In no woodworking plant is a buzz planer so essential as in a pattern shop. Pattern work is nothing if not various—like life, it is just one darn thing after another, and the buzz planer takes care of a lot of things. A pattern shop without a buzz planer is like a home without a mother, or a farm without a wagon. We can get along without them, but it is most inconvenient to say the least.

The buzz planer in the past was the cause of many serious accidents, and held the all-round championship as a finger chopper. But when equipped with round or safety cylinder as shown in illustration, Fig. 2, and the automatically adjustable guard as shown on accompanying illustration, Fig. 3, it is almost harmless if used with any discretion. A careless workman may have the ends of his finger cut, but will not lose any considerable portion of the member.

In the illustration, Fig. 1, will be seen a machine of modern pattern designed to fill the most exacting requirements of a buzz planer and jointer. It embodies many distinctive features of merit, which ensures simplicity, strength, durability, true alignment and convenience in adjustment.

The frame, as will be seen, is of box pattern and cast in one piece. It is deep, strongly braced, and rests on three points of bearing. This feature of having only three bearings on the floor does away with any possibility of twisting of the frame or throwing the machine out of true on the most uneven of floors.

The tables are especially heavy, strongly ribbed, and are absolutely rigid. The incline wedge blocks support each table on the floor corners and have in-

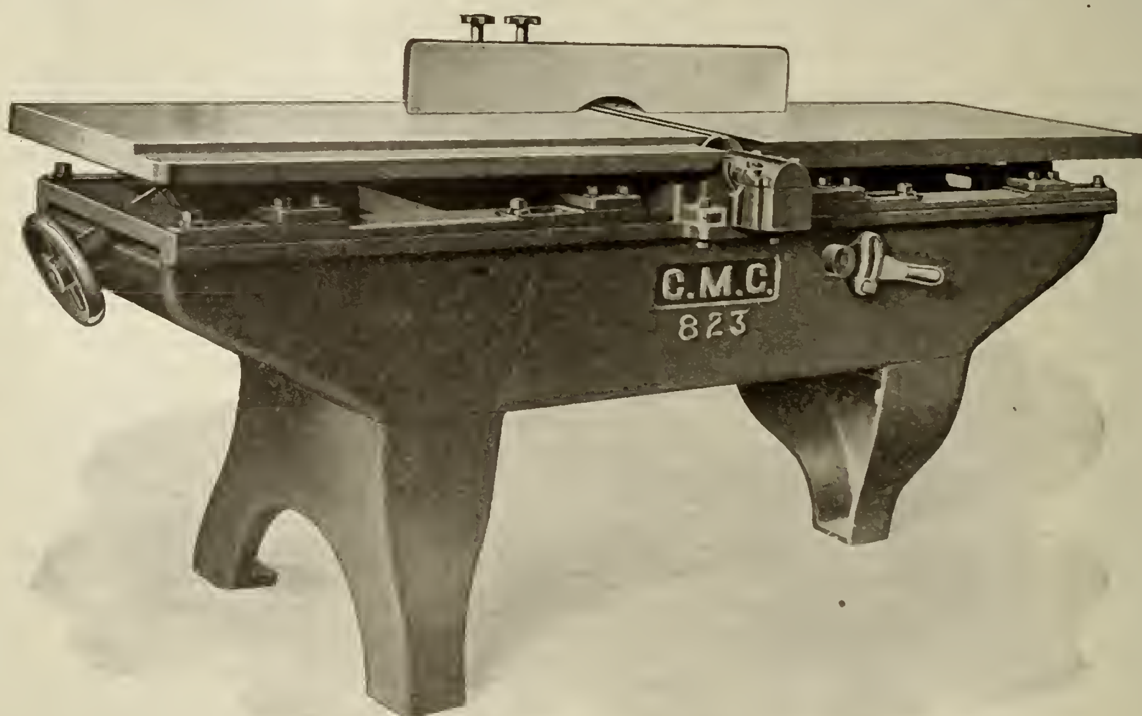


FIG. 1.—SHOWING A MODERN BUZZ PLANER AND JOINTER.

dependent adjustment, thus making it impossible for them to rock, twist, strain or be displaced. Both tables are raised and lowered by hand wheel, convenient to the operator. Both tables can be drawn away from the cutter heads on a level, independent of the incline ways, leaving an opening about ten inches wide. The rear table has a rabbitting groove, five eighths of an inch deep. An eccentric arrangement is provided under the front or working table, allowing the table to tilt for hollow or glue joints.

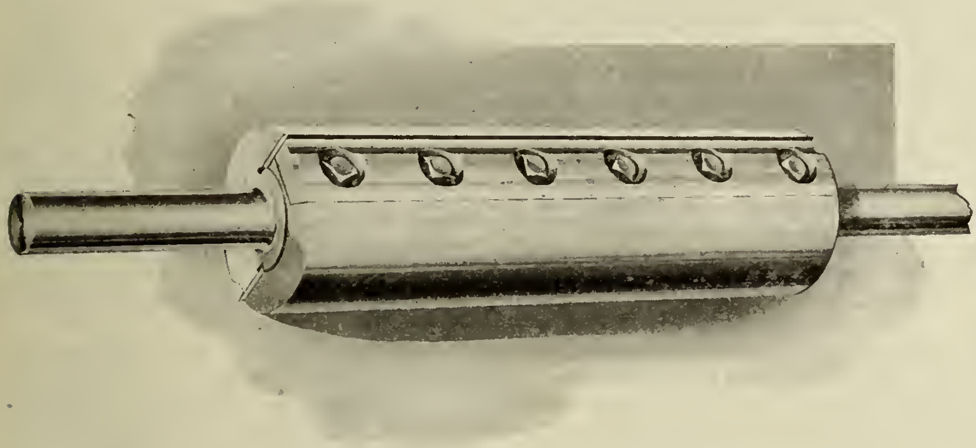


FIG. 2.—SHOWING SAFETY CYLINDER FOR BUZZ PLANER.

The safety cylinder shown in Fig. 2 is unsurpassed as a safety device. This type of circular cutter head has been designed and built to give the utmost protection to the user. It is very simple in construction, and therefore, easy to set and adjust. The body is a solid high-carbon steel forging, carefully turned and ground. It is fitted with high-speed steel knives, which are held firmly in position by steel wedges securely bolted to the body. The guard shown in Fig. 3, while being the very embodiment of simplicity, is undoubtedly the safest guard yet offered. The wooden guard is held over the knives against the fence by a strong spring. It is, therefore, impossible for the operator to disregard it, and equally as impossible for him to put his fingers onto the knives, even though a careless workman. The spring allows the guard to be forced away from the fence just enough to permit the board which is being pointed to enter. The only time that the knives are exposed is the instant that the last board is finished, when it might be remotely possible to put the finger tips on the cylinder, in which case the danger of injury is reduced to the minimum.

For the priviledge of using the engravings with which to illustrate this little narrative we are indebted to the kindness of the Canada Machinery Corportation, Limited, Galt, Ont. And for the information contained in the said narrative we are indebted to the numerous pattern makers who have enjoyed the comforts of using a good buzz planer, as well as to those who have suffered the inconvenience of trying to make headway without one.

GRAPHITE MINING GROWS IN CANADA

New Milling Process Places Product in Competition With the Best

Graphite mining in Canada has become a science. It was speculation—and rather unprofitable at that—until the Spearman devices in particular and flotation practice in general solved the problem of saving the larger flake, leaving the inferior grades in negligible quantities. At least four Canadian graphite mills have demonstrated that Charles Spearman, graduate of Queen's and post-graduate of Columbia, can provide graphite for crucibles—graphite so standardized that it can be disposed of in competition with the Ceylon product, and which actually is being sold at from 12 to 15 cents a pound.

One Canadian mine and mill located near Perth, Ont.—financed and designed and constructed by Canadian scientists—is achieving a producing record that insures its enterprising owner very satisfactory returns upon his capital. The plant, when extended, is said to be capable of putting out as much high grade carbon as the whole State of Alabama—now the chief American source of graphite. In this forecast Mr. Spearman is sustained by his associates. Two other plants in Ontario and another in Quebec, equipped with simple mechanism which effects maximum recovery of the graphite content while eliminating whatever detracted from such products in the past, establish the fact that Mr. Spearman has rendered a distinctive service.

It is not to be assumed that graphite mining will attain to the importance of nickel and asbestos. Deposits of the latter are strongly centralized. Graphite is more widely distributed, hence those who have geographic advantages, quantity and quality will have first call upon markets, markets in which competition will be keen. Standardization is being accomplished in Canada; bulk samples of the improved grades have brought buyers who seek assurance that "the goods will be according to sample." It is this knowledge that lends confidence to the statement that there is a graphite industry in the making. There never was one of sufficient magnitude to command markets. Haphazard existence awaited those who ventured without mature deliberation.

As pure carbon—when offered as such—Canada's graphite will now enter diversified industries.

There are now 43 automobile factories in Germany, this number being 5 more than in 1914. During the war these 43 factories turned out about 30,000 motor trucks for the German army.

There are already 32 surrendered German aeroplanes assembled at Toronto, and all will be displayed or flown at the Canadian National Exhibition, August 23 to September 6. Canada owns nearly 100 German or Allied planes, and they will eventually become part of the official museum display or be distributed around the various cities by the Ottawa Government.

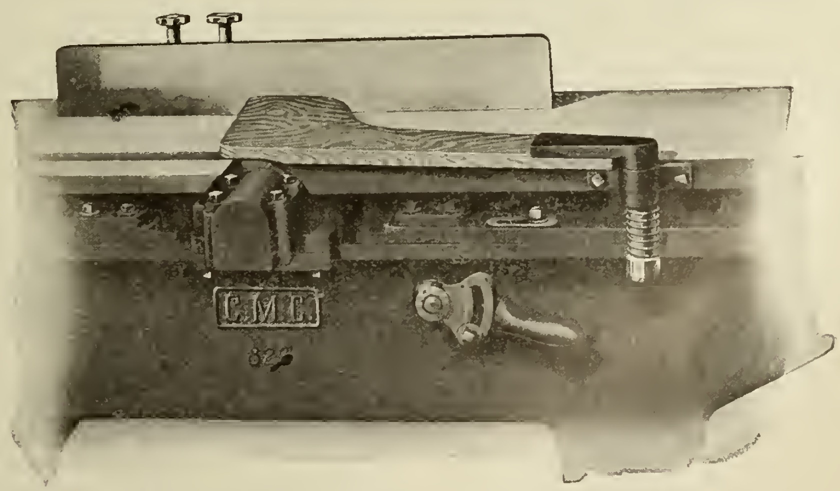


FIG. 3.—SHOWING A MOST SATISFACTORY AND SIMPLE SAFETY GUARD.

The Modern Core Room and Its Equipment

A Few Points on the Present Accomplishments of the Core Room, Together With a Few of the Possibilities of the Future

By E. A. COLEMAN

THIS paper is written from the engineer's point of view; it deals with the tools and equipment the core maker uses; not with the manner in which he uses them, or the methods he has for making cores.

The temptation is strong in places to stray from the text and take up the interesting things in connection with core making, but the result would be a volume instead of a paper.

The care making department includes all the various operations from the preparation of the sand to the delivery of the finished core to stock ready for the moulder.

It is necessary to consider the remarkable changes which have taken place in the foundry during the past few years, to appreciate that the making of cores has more than kept pace with the co-ordinate branches of the foundry business; in fact, many problems successfully solved by the modern foundryman were unsolved until the core maker gave the answer.

The advancement in the art of core making is all the more remarkable when it is considered that while the foundry as a whole has had a hard struggle in most cases to get ahead, yet the poor, despised core room has been the rubbish can, the dump anything you want to call it; it was a nuisance which could not be eliminated. The statement may sound foolish, yet the writer is willing to wager that many a foundryman a few years ago could not tell where his so-called core making department was located.

If the core makers ever adopt a patron saint, I would suggest she be called "St. Auto," for it is the automobile engine which has given the wonderful impetus to the core making industry; when the rate of the automobile is told and the man behind the casting gets his credit, then it will be known that the core maker, be he ever so humble, has contributed the skill and found the knowledge that made the engine live and the auto have its being.

Probably many a core maker will smile at this somewhat flowery point of view; but let the core maker stop and rise above the apparent level, daily grind of work, to turn backwards and view the place from where he started; then perhaps he will agree, that after all he has done a great work; he has been moving upwards; he has not only solved many hard and apparently unsurmountable problems, but in doing so he has changed the old drudgery of core making into a fine art; he has transformed the old, degraded core room into a modern work place, where working conditions have been wonderfully improved to the advantage of both the work and the worker, where the equipment—but there was not equipment in the old days—the present equipment is all modern; if it is not modern it is not equipment; the old things, or methods are dead and buried; the core maker is getting each day to be more of a practical scientist; he is learning the "why" of things.

The old hit or miss methods of core making are doomed, and to-day the core maker and his ally, the engineer, are busy investigating the new things heretofore thought not worth while.

Soon we will know the secret of the relation between the core binder and the sands; many other things will be made clear and very soon one more despised and lowly craft will be raised to where it belongs.

In speaking of the core room, we have in mind the place or places where the various operations are carried on.

No particular branch of the foundry will be considered, only the work in all its branches contributes all of the things mentioned.

For the purpose of this paper, the core department consists of the equipment, the arrangement or location of the equipment, and the space for doing the work.

If we forsake this definition, then we get into the methods and management.

The equipment consists of devices for preparing the core sand, for making the cores. for baking the cores, for performing other operations using the baked cores.

The space for doing the work provides for storage of the core sands, storage of the fuel, place for equipment, place for the workers, places for core storage, places for keeping small tools, equipment and supplies, place for sanitary conveniences.

The arrangement of this equipment and the location of the various spaces with respect to each other comprise what might be called the physical core department: it is the core department before operations have begun; it is the body without the soul.

Taking up the equipment for the core making department, it will be conceded that the proper preparation of the core sand is the first consideration: in fact, in many cases it is vital. We know this from practical experience, and we are now beginning to understand why it is so.

The sand preparation being important, it would seem to be the logical thing for the core maker to determine what sand is available, on what sand should be used; and then decide on the binder. If the sand and the binder are fixed, then the problem of determining the equipment to be used is simplified.

The great thing in making core sand is to intimately run the binder all over each particle of the core sand; to thoroughly incorporate the binder and the sand into a homogeneous mass, preferably composed of uniformed sized particles, is what makes a good core sand.

The mere sifting, or riddling together of the ingredients, is not a real mixing; it is neither efficient or economical as to binder

The statement can easily start a discussion about methods, and because it is such a vital and wonderfuly interesting subject the discussion would fill a book.

Please mentally agree or disagree with the statement as made, and then arrange for a paper on "Core Sands and Binders."

There are several types of machines on the market for preparing sands for making cores.

The riddles have screens which are round, rectangular or cylindrical in form; such machines riddle or shake the sands and the binder together, after there has been a rough shovel mixing, but they do not make a real mixture.

The rubbing type of machine first riddles the mixture, and then intimately kneads or rubs the binder and sand together; this style of machines uses paddles, or screws, which force the mixture, producing pressure, or rubbing by friction, in the mass. The centrifugal type depends upon the centrifugal action of the arms, or fingers, moving at high speed; the sand and binder are first riddled, and as the mixture is fed into the moving fingers, it is broken up a tremendous number of times, the spatter from one finger being caught by dozens of other fingers, which in turn break it up, the result being that all the various particles of the sand and binder rubbed or thrown into intimate contact with one another.

The roll type of machine depends upon the pressure exerted by rolls, which rub the particles against each other, also between rigid surfaces; this type of machine also produces a uniform size of grain; the writer thinks it is the coming type of machine.

Many of the core sands used contain old, or burned sands; this should be broken up and reduced so as to mix with the other sands.

The use of old sand is, of course, a great economy, and every foundryman wants to use as much of it as possible.

There is one machine on the market which washes all sand; the finer sand and burned binder pass off, leaving uniform-sized grains as good as new.

Devices for the handling of sands from cars into bins, bins to mixers, mixers to core-makers, etc., should be taken up under core-room management, since they cut no figure in the equipment required for the actual making of the cores.

The equipment for making cores consists, in its simplest form, of core-boxes, which are rammed with sand, the finished core being baked on core-plates, or in forms, or driers.

There are machines which make straight cores of various sections, which are cut to length; this form of machine uses a screw or plunger and makes either solid or vented cores.

Special machines for making numbers of cores at a time in gangs are used in a few places.

Core-making machines similar to molding machines promise great things for the future.

The Jar Ramming Molding Machine had not been long in use before the keen-eyed coremaker saw its possibilities and now there are several forms of machines depending upon jarring action.

Another type works by compressed air and makes irregular cores by blowing the sand into the box.

The Roll-over Molding Machines are being adapted to the making of different cores; so are the stripping plate and drop pattern molding machines.

We have seen remarkable changes brought about in the output of the foundry by many new types of molding machines, and for the same reason we will see similar changes in the output of the core-room.

The venting of cores is very important and there are several devices which press vents into the half cores, doing mechanically better and cheaper work than can be done by hand.

Core plates still constitute a considerable part of the core-room equipment and are made either of cast iron or steel. Cast plates should be as light as the work will permit; ribbed so as to keep down the weight, retain strength, and prevent warping.

Machined plates are better than rough, and where vented plates can be used they hasten the baking considerably.

X-RAYS ON STEEL

How Hidden Defects May Be Revealed
From Sheffield "Daily Telegraph"

Formed in 1903, with the late Lord Kelvin as its first president, the Faraday Society has now at its head Sir Robert Hadfield, who presided yesterday at Burlington House over a joint meeting of the society and the Rontgen Society, when a general discussion was held on the examination of metals by X-rays. Over a dozen papers were submitted by various famous scientists on the many phases of the subject, and translations were read of treatises by French and German authors.

In his introductory remarks, Sir Robert stated that when he first suggested that the Faraday Society should hold a symposium on radiometallography, he was impelled to do so because it seemed to him that in this method of examination there lay a great future for the detection of flaws and imperfections in various ferrous, non-ferrous, and other products upon which the safety of human life depended. He was aware that such an examination, if unfairly used, might give the manufacturer great trouble and expense; but we must never hesitate to consider and, if necessary, adopt, means for improving general practice in the production of constructive materials, besides the knowledge so gained and improvements which would be brought about would, in the end, far more than compensate for the difficulties experienced. He pointed out that the Rontgen Society was a growing one and now had over 300 members. He also paid a tribute in glowing terms to the research work of Professor W. H. Bragg, who delivered for the first paper, a comprehensive and detailed examination of the elements of the subject, combined with the more advanced stages.

The president was also responsible for the translations of the two German papers by Frederick Janus, of Munich, and Max Reppchen, of Cologne, from which short extracts were given by Professor A. W. Porter.

Improvements in Methods

He further contributed four papers in collaboration with Mr. S. A. Main and Mr. J. Brookshaun. One dealt with steel, and the authors submitted that the possibilities of X-ray examination in steel manufacture would be readily apparent. The means which it provided for enabling the metallurgist to see the interior of steel castings, and thus to diagnose and localize the disease to which steel was subject just in the same manner as the X-rays had been sometimes of such incalculable service to the surgeon, must prove of considerable benefit.

The chief difficulty hitherto, and one reason why progress in regard to steel had not been made approaching that in medical science, had been the limited thickness of metal which could be penetrated, but considerable strides had been made within the last year or two in this direction. Thicknesses up to four inches were now said to have been successfully radiographed. It is obvious that to be of service it must be possible to examine articles of a practical size, and otherwise the chief advantage of such a method of examination was lost, namely, its non-destructive character. A few years ago, and even now with the larger articles, it was necessary in order to examine a casting to cut out a section to obtain a radiograph, thus destroying the article for practical purposes, while this served its purpose for research examination it still left the wider application untouched.

The advantages of applying the method to the routine examination of special steel castings and forgings in the course of their manufacture to ensure their being thoroughly sound, will be at once apparent. X-ray examination need not necessarily be confined to the steel products themselves, but also to materials used by the steel manufacturer. Our application, which suggested itself, was the examination of welds.

Bugbear of Internal Defects

The question of internal defects had always been a bugbear. In the case of an habitual tendency, such as the well-known "pipe" in ingots. This usually reproduced itself under similar conditions of manufacture, and could be controlled by the cutting up and examination of an individual ingot out of a lot, this forming a criterion of the whole. Many of the defects met with were, however, of a casual nature, and the use of X-rays would help in these cases by individual examination and elimination of the defective articles.

The routine operation of X-ray examination would be much facilitated if the necessity for photography could be avoided. A further point to be kept in view was that of expense. Present apparatus for the purpose was costly and delicate, and its operation of a rather expert nature to be applied to routine purposes.

A still further application for X-rays in metallurgy which might perhaps be mentioned was the analysis of steels. Chemical methods were so well established, and on the whole so satisfactory, that X-ray examination could hardly take their place. Still the subject was one which might well be worked upon, both for its own sake and the additional viewpoint which it provides as to the constitution of steels.

Another paper by the same authors described experiments carried out some time ago by the Hadfield Research Laboratory, Sheffield, and illustrated an early attempt to apply the benefits of X-ray examination of steel.

In the third paper the radiographic examination of carbon electrodes used in electric steel making furnaces was considered. and was stated by the authors to be demanded by the trouble experienced with electrodes in electric steel-making furnaces due to various causes, but principally to fracture in use or handling.

A paper on the detection of haircracks in steel by X-rays was delivered by Lieut.-Colonel C. F. Jenkin, who said considerable claims had recently been made for X-rays as detectors of hidden flaws in steel. A practical test, however, had shown that the method was useless for finding haircracks.

Prince Joachim's helmet, the plume of which alone is worth $350, is among the war trophies owned by the Canadian Government, to be shown at the Canadian National Exhibition, August 23 to September 6.

Interesting Experiences in the Small Foundry

Being the Experience of One of Nova Scotia's Leading Foundry Foremen, But Typical of What Many Others Have Had to Contend With.

By "The Gaffer"

MUCH has been writtten of the system employed in the large foundry, while one seldom hears of any novel system in vogue in the small shop. Now, I suppose the reason is obvious; the elaborate and costly systems sometimes employed in large foundries make the operator of the small shop a bit timid, for, in reading descriptions of many of them, he cannot but think that the word system to him spells expenditure, and considerable expenditure at that. But a small shop is just as much in need of a proper system in its management as the large one; not the same system to be sure, but nevertheless a particular one that best suits its needs.

It can also be inaugurated without great expense if taken in hand properly. It was the writer's lot some few years ago to be placed in charge of a small foundry, and the methods (not system) used to produce castings in that shop were, to say the least, antiquated.

This shop ran a line of cast iron ranges, heaters, furnaces, (hot air) and odd fitttings or linings, and made, in addition to these, a general line of light jobbing.

The firm listed in their catalogue about forty ranges, cook stoves and heaters, and three sizes of hot air furnaces, altogether too much for the size of the shop, which permitted floor space for four stove plate molders, two bench men, and three machinery men. At the time the writer took charge, the shop was handling little machinery, and most of this was in the form of odd jobs, usually not running over three or four cwt.

The machinery floors were largely given over to the molding of the firebox fittings for different stoves manufactured throughout Canada, of which the firm carried a line of no less than one hundred and twenty-five.

On account of the nature of the work on hand the tonnage at that time was little in excess of 4,500 lbs. a day, and the shop was just about keeping its head above water.

The metal was furnished from a cupola lined to 28 in., which gave good satisfaction in the future, although at that time two of the front tuyeres were almost closed with metal, and the writer was informed by the furnaceman that they had been that way for some time, consequently the lining in the front of the furnace was burned almost to the shell by the action of the blast from he two back tuyeres. Just how they got iron for stove plate out of that furnace is a wonder.

The shop was not equipped with a cinder mill, and all the iron and coke smaller than the furnaceman's hand went to the dump, and, believe me, there was some iron in that dump. The furnace-room was equipped with an elevator, which was operated by hand, and took three men to hoist; it would carry a load of about 1,000 lbs. without killing the operators.

Analysis of raw materials was not practised, and a carload of coke in stock looked as if it might run as high as 2 per cent. sulphur. Pig iron was ordered by asking for the best, while most of the scrap iron was made up of old stove plate.

In mold-boarding patterns a peculiar practice was carried out. For instance: a cover and a lifter would be placed on the same board, or two or three light slides and a grate together result—the heavier pieces running and the light ones failing, which left a lot of the light pieces to be made up, and the molder, with a large mold-board, which was of little use to him. Patterns were also placed in this fashion on match-plates, which totalled only about half a dozen and were cast in iron. The pattern storage was a room partitioned off the warehouse, and was large enough to contain just the stove and furnace patterns and their mold-boards, piled stove by stove, largest board on the floor, and so on to the top of the pile. When one wanted a pattern it was usually the one on the bottom, and then the whole pile had to be taken down and then placed carefully back, an operation guaranteed to test the patience of a modern Job.

For the small unmold-boarded patterns, tin boxes were provided for each stove and placed in a corner of the storage by themselves.

The odd linings or fittings were stored in racks, built at one end of the foundry, where they accumulated the dust of the shop, and some of the patterns not in constant use were so covered with rust as to be almost unrecognizable.

Needless to state the piece-work system was not practised in this shop, all work being done by day's pay.

Naturally, the firm was not in a position to revolutionize this shop at one stroke, as we had to go slowly.

They were first persuaded to take a contract for some medium heavy casting so as to increase the tonnage, even if this work were to be made at cost, it would bring the cost of the production of stove plate to its level in figuring on total output.

The first of these contracts was for one hundred tons of rough castings, running in weight from six to ten hundred lbs. and by using proper equipment it was found that not only was the cost of the stove plate lowered, but a neat profit had been made on the contract. After that there was no trouble getting the firm to look for machinery contracts.

The tonnage was increased in this way to about 9,000 lbs. daily.

Attention was next turned to the patterns. As the firm carried so many stoves nearly alike, they were persuaded to drop some of the poorer sellers, which gave us a chance to concentrate our efforts on the remainder. One store was taken and all parts that could be match-plated were cast in aluminum plates; large parts were placed, as many of one kind as practicable, on mold boards, up to the large single parts.

Cut or irregular joints were done away with as much as possible, so that when castings were lost, many of the flasks could be used interchangeably and the castings caught up.

A system of storing patterns was next worked out, and an old shed some short distance from the foundry and not used for anything in particular, was made water-proof, if not fire-proof, and racks built of scantling, made just large enough to accommodate each pattern and its board. Each set of patterns for each stove was divided by a black line drawn from top to bottom, and the name of the stove placed above each action; each rack had the name of the particular pattern contained stamped on it, and as each mold-board was also stamped, anyone who could read English had no trouble in locating a pattern.

The patterns for the odd linings were taken from the foundry and stored in a partitioned corner of the warehouse (which was conveniently situated to the foundry), where much the same system was carried out as in the case of the thinner stove patterns.

This was done because space permitted just room enough in the main storage for the ranges, heaters, and furnaces. As business increased it was found necessary to install, a squeezer and an Adams-Farwell hand-power machine was purchased, which greatly aided production. In addition to stove parts much of the small machinery work was pressed on this machine.

By extending a partition of a bay of the shop, space was allowed for two additional floors, which were utilized for the production of stove plate.

An electric elevator took the place of the three-man power one, and believe me, it was some improvement over the old.

Pig iron and coke were bought by analysis, so one always knew what one was working with. Although the piece of the coke was somewhat higher than before, the difference in results fully justified the change.

A cinder mill was installed which reclaimed, on an average, 300 lbs. of iron daily, and required no additional help, being attended by the furnaceman's helper. Much iron was also reclaimed from the dumpings of the past, all of which was "like getting money from home."

A gangway man was hired, who carried patterns in and out of the shop as required, took care of flasks, etc., and assisted in pouring off.

No matter how small the shop, if a daily cast is run a gangway man is essential. Many times in a small shop it is not thought necessary, and the work is done by apprentices, who are usually none too careful, or by the foreman, who should not have to bother with such work, except to oversee it. But a green hand can soon learn the patterns and the system of keeping them, and can make himself invaluable around the foundry.

The style of small foundry here described is fast disappearing, but there are still a few of them, and perhaps the reason they remain small is the old-fashioned methods they still practise. Given plenty of work and proper shop management the small foundry should soon develop into the larger and better paying one.

TRADE GOSSIP

MOVEMENT ON FOOT FOR BIGGER BELLEVILLE

7,000 Acres of Waterfront Served by Three Railways Required for Ambitious Project

A movement is now in foot which may insure a bigger and better Belleville. A meeting of the property owners of the front of Sidney, west of the Belleville cemetery was called by W. C. Mikel, K.C., for Saturday evening, the 26th of July, at 8 p.m., for the purpose of laying before them a proposal to acquire the land from the Belleville cemetery west to Trenton, in the first and broken front concessions from the Grand Trunk Railway to the bay, some 7,000 acres. If satisfactory arrangements can be made for acquiring this property it is to be turned over to a company which will lay it out for industrial development. About half this tract of land will be utilized to provide free sites for large industries, having all modern appurtenances, also for parks, streets, schools, libraries and other public purposes. A large portion of the balance will be made available for homes for employees of the industries at a very small price per lot so that the workmen and their families can have spacious garden areas and healthful, pleasant surroundings, which will be an inducement for a large, happy and contented labor population.

Advantage will be taken of the Ontario Government's housing scheme by which the Government will advance money to build houses on these lots and extend the time for repayment over a period of twenty years with interest at 5 per cent. per annum, so that every family will have an up-to-date, comfortable home, which may be paid for monthly as rent.

This land lies on the main line of three transcontinental railways of Canada, also on the main waterway between the head of navigation and the sea and is in the great Trent power basin, where there is 50,000 horsepower available. There seems to be no reason why this should not be one of the greatest industrial centres of Canada if the people will only co-operate and act in unison.

PRINCE ALBERT FOUNDRY DOES VALUABLE WORK

Only Institution of its Kind To-day in Northern Saskatchewan

The Prince Albert Foundry, located just opposite the Canadian National depot, occupies the unique distinction of being the only institution of the kind in Northern Saskatchewan. It has a complete foundry equipment, with excellent machine shop, and turns out good work in all departments. It makes a specialty of boring cylinders, and its repairing department on engines of all kinds, tractors and farm machinery fills a much required utility in that country. The foundry does a large trade from the outlying districts of Northern and Central Saskatchewan, and its work in this respect is a great convenience to the country. In fact, before the advent of this foundry the people of Northern Saskatchewan were exposed to serious delay and loss of money through inability to secure repairs and castngs.

RIDGETOWN

The damage done to the buildings of R. Watt Machine Works by the storm which passed through this section some time ago, has been repaired to the extent of rebuilding the erecting room, but the three-storey storehouse was so badly damaged that it was not considered possible to repair it, and it has been entirely torn down. Mr. Watt reports an exceptionally busy season in his business which consists of grain and bean threshers, Lindsay feeders and Leader windmills.

Thorold.—The one foundry which this town supports is running to about capacity. Some changes have been made in the executive. Mr. J. H. Servos, of St. Catharines, has been appointed foundry superintendent, and all labor troubles have been satisfactorily arranged. Plenty of work is in evidence.

St. Catharines.—Some of the foundrymen in this vicinity have settled with the moulders, and have started operations again, but some of them are still out. Plenty of work is to be had if the shops get going.

Merritton.—The Jas. Wilson foundry in this town is running full blast, with the same molders which have been here for some time. No labor trouble here, a good employer has no trouble when he has good men.

Welland.—All the foundries in this city are busy. The Edistrand Foundry Co. have leased the foundry in connection with the M. Beatty & Sons' works and are doing the casting for the Beatty people as well as for the shipyards and other plants in the neighborhood.

The Welland Iron & Brass Co. is quite busy, particularly in the brass department. This company, while well equipped for doing iron castings is particularly well equipped for doing brass and bronze castings, and is getting its share of it to do.

The steel foundry has resumed operations after a short lull and are running a good staff of hands.

The Welland Machine and Foundries, Limited, have made some changes in the personnel of their staff. Mr. H. Hatt has been engaged as manager and Mr. R. Gotard is now the foundry foreman. A full complement of men is employed and a plentiful supply of work is coming their way.

Port Colborne.—There are no foundries in operation here at the present time but there is a blast furnace here which is supplying quite a bit of the foundry trade with pig iron. They are running night and day and are finding sale for the output.

Dunnville.—Mr. H. L. Spence, manager of the Standard Foundry, reports business as being good with good p rospects, but always open for more business. This foundry was considerably enlarged and improved during the period of the war in order to cope with the demand for shell parts, and as a consequence is in better shape than ever to produce high-grade grey iron and semi-steel castings. manager.

The Canadain Engines, Limited, have been reorganized and are preparing for a busy season on gas and gasoline engines and certain automobile accessories. G. H. Orme is the president, W. O. Smith is the manager, H. G. Chatter is the superintendent and M. Kitchen is sales manager.

Superior Foundry Company, Cleveland, Ohio, has awarded a contract to The Austin Company, Cleveland, Ohio, calling for engineering and construction work on alterations and extensions to foundry. A two-storey and basement brick, steel and concrete building 75 ft. x 200 ft. will be erected for the core department.

Karn Dodge, Morris Building, Philadelphia, Pennsylvania, awarded a contract to The Austin Company, Cleveland, Ohio, for the erection of a foundry building 116 ft. x 180 ft. Amount of contract about $55,500.

Over ten thousand dollars in cash prizes and trophies will be awarded the successful flyers in the Canadian National Exhibition aeroplane race from Toronto to New York and return.

"OVER THERE" AND "OVER HERE"

"Over there" the soldiers of Canada and the men from the States were good friends. The traditional good-will of one for the other was strengthened by the hardships and dangers which were the common lot of those who, side by side, fought in the good fight. The men who have returned to their homes on both sides of the border are daily bearing willing witness to feelings of admiration and respect for one another which the great conflict fostered.

"Over here" it is pleasant to recall the ways in which the business men of the two countries assisted one another in the severe demands of the war-time for munitions and foodstuffs. The confidence in Canada manifested by financiers and industrial leaders in the States by their investments in Canadian Government war securities is a chapter in the commercial relations of the two countries, which, to treat adequately, should be the subject of an extended review. It is our desire in this short article to refer to one fine example of this confidence in the future of Canada deserving of more than passing notice and approval.

One of the leading industries of the kind—perhaps the largest of its class in the world—is the Joseph Dixon Crucible Company, of Jersey City, N.J., U.S.A. It is a graphite house, making a wide line of pencils, crucibles, lubricants and paint. Its Canadian representative for the pencil line is A. R. MacDougall & Co., Ltd., of Toronto, Canada; and its representative for grease, lubricants and paint is the Canadian Asbestos Co., of Montreal, Canada. It has come to light that the Dixon Company, for the past two years, has invested all its cash returns from sales of its products in Canadian Government bonds, and in the provincial and municipal bonds of the Dominion.

This is, indeed, showing a full measure of confidence in the future of Canada, for which this strong American house is entitled to a like measure of support in grateful acknowledgment.

The British Grenadier Guards Band will take part every evening in the spectacle at the Canadian National Exhibition. H.R.H. the Prince of Wales is a captain in the Guards, and the band will have a place of honor in the various functions in honor of His Royal Highness during his stay in Toronto.

At a Welsh railway station that rejoices in the name of "Llanfairpwilgwyngyll" a new porter was engaged.

He was an Englishman and he meant to do his duty.

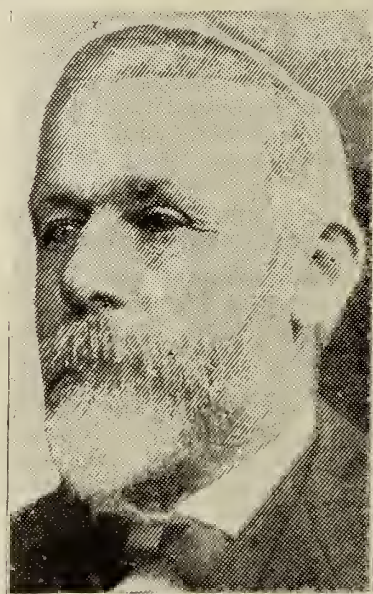
When the first train arrived he tackled the name of the station, but failed miserably to pronounce more than the first few sections.

But he was a man of brains and, running along the platform, he pointed to the sign which bore the lengthy name and yelled out: "If there's anybody there for here, this is it!"

OBITUARY

Allan Studholme

Labor member in the Provincial House for the riding the East Hamilton, died at his home in that city on Sunday, July 27. from paralytic stroke. Mr. Studholme was born in Manchester, England, and from his youngest days was a staunch advocate of organized labor. In 1870 he emigrated to the United States, but the effects of the Civil War had not yet ceased to cause unrest, and conditions in general were not to his liking, so he came over to Canada and first settled in Dundas. His first few years he spent in going from foundry to foundry, changing from one place to another as better wages were offered, always taking an active interest in unionism. In 1907 he was nominated by the Labor Party as candidate for East Hamilton in opposition to J. J. Scott, Conservative, and W. M. McClermont, Liberal, and was elected by a large majority, and has since been successful at every election. He held the unique distinction of being the only labor member in the House, and was extremely popular on both sides of the House. Besides being a member of the Legislature he was a member of the general executive of the Single Tax League and vice-president of the Social and Moral Reform Council of Canada. He is survived by his widow and three sons and one daughter.



THE LATE ALLAN STUDHOLME.

Premier Expresses Regret

General regret was expressed at the Parliament Buildings over the death of Mr. Studholme.

"I regret very much," said Premier Sir William Hearst, "to learn of the death of Mr. Allan Studholme, for many years the member for East Hamilton. In a marked degree Mr. Studholme earned and enjoyed the respect of the members on both sides of the House. In spite of the burden of advanced years he displayed to the last, remarkable energy and unfailing devotion to duty.

"Always most constant in his attendance at the Legislature, no one followed more closely than he did every subject that came before the House. Mr. Studholme was a keen debater, possessed a wide knowledge of public and social questions and was fearless and onscientious in the discharge of his duties. The cause of labor loses a strong friend and able advocate through his death. To those who mourn his loss I extend the earnest sympathy of the Government."

Mrs. Priscila Stern Studholme, wife of Allan Studholme, late M.P.P., survived her husband just one week, passing away at the family residence, 3 Reginald St., Hamilton, late Sunday afternoon, August 3. Three sons, Foster, who is Mayor of Olean, N.Y.; Gordon, also of Olean; Edward, of Smithport, Pa., and one daughter, Mrs. Earl Morrow, of Hamilton, survive her.

CATALOGUES

H. MUELLER MFG. CO., LTD.

We are in receipt of a handsomely bound and printed catalogue describing the various lines manufactured by the above named firm.

The company operate an extensive factory at Sarnia, Ont., making complete lines of steam fitters' and plumbers' brass goods, besides their well-known tapping and drilling machines for tapping water and gas mains while under pressure. Twenty-four pages of the book are devoted to these tools, and they are well illustrated. Another line closely connected with corporation work is that of hydrants of various types, and service clamps and clips for all sizes of pipes.

A long list of plumbing and sanitary fittings and an excellent lot of ground key work is described. Each line is well illustrated, the engravings being very clear.

Reducing and regulating valves are included. These include valves for steam, water and ammonia, with or without strainers.

This catalogue should be on file in the offices of all users of these supplies.

THOR

The new perfect hose coupling manufactured by the Independent Pneumatic Tool Co., with main office at 600 West Jackson Boulevarr, Chicago, anr Canadian branch at 32 Front Street West, Toronto, is described and illustrated in a thorough and comprehensive nanner in the No. 99 bulletin which is just from the press. These couplings, as the name of the manufacturers would indicate, are for use on pneumatic tools or tools operated by compressed air, and are arranged for connecting hose to hose for extension of length or for connecting hose to pipe. One feature of particular note is that the new Thor perfect house couplings are absolutely interchangeable between the various sizes of combinations up to ¾ inch inclusive. Each hose end is identical with the other, no rght or left, no male or female, makng a unversal coupling which requires no reducers. Different clamps and menders are also shown. The bulletin is well worth asking for.

THE FOUNDRY EQUIPMENT CO.

The Foundry Equipment Co., engineers and manufacturers, Cleveland, Ohio, have just handed us their profusely illustrated catalogue of Coleman ovens for cores and moulds, and other Coleman equipment. The ovens illustrated cover the entire field of foundry requirements, including installations in some of the best establishments on the continent. The other equipment described includes the Coleman brass furnace, Coleman aluminum furnaces, Coleman spruce cutter, Coleman water tumbler wall cranes, hand power travelling cranes, trolley systems, etc.

THE NATIONAL CATHOLIC WAR COUNCIL

The National Catholic War Council Bulletin for July is to hand and is an interesting volume of articles by interesting writers, such as Michael Williams, John Fitzpatrick, John A. Lapp, Clare I. Cogan, Rev. Dr. John O'Grady, W. McDonald Scott and Very Rev. Francis C. Kelly, D.D. The illustrations include views of different courses of education, such as wireless telegraph school, etc., for disabled soldiers. The council has different institutions for the benefit of this worthy cause.

Magnetic Manufacturing Co., Milwaukee, Wisconsin, have recently issued their catalogue illustrating and describing their Type "L" Magnetic Separator in which many new and original features are shown together with instructive explanations regarding the principle of operation. This type of separator is extremely simple to operate and all parts are very accessible. There are very few wearing parts to it, as the only moving parts are the revolving drum, the stirring shaft and the feeding shaft. All bearings are provided with compression grease cups for hard grease.

The power required to operate the machine is very small as the revolving drum is light and the magnets remaining stationary. there are no heavy parts to turn.

LETTERS TO THE EDITOR

THE CURSE OF WORK

Adam is the first man of whom we have any record, and this same Adam is the man who introduced working for a living, and not only that, but he worked until the sweat ran down his face, and along with this he was given to understand that all his generations after him would have to scramble for a living. There is not a doubt but that this order has been obeyed pretty well ever since. for with very few exceptions and wherever an isolated case of some fellow escaping the curse (if such we call it) somebody else has to get more than his share; but don't forget it, the fellow who disobeys the injunction of the Creator and refuses to earn his bread by the sweat of his brow but prefers to get his living out of the sweat of others, will get his in the next world, where the climate will be such that he can work up a sweat without any special effort. However, there are very few who don't have to work, and if work must be, we might as well make the best of it. Nature has provided us with plenty of work and plenty of material to do it with, and in all probability the inhabitants who lived in Adam's time depended on nature for a great deal in its crudest form.

Things have changed since Adam's time, and it is not longer necessary to work at the pace the old timers worked at. Machinery has lightened the labor of man in some respects but it has added to it in others, but on the whole the labors of man are not what they were years ago. The one great difficulty which is yet to be surmounted is the division of the proceeds of man's labor. The question is, "Has one man a right to collect profits from the labor of another?" And the answer must be that: "It depends on circumstances" or "on how we look at matters." A man working in a factory or on a farm gets his pay, and then the profits or the losses which may come after this are to be considered as interest on investment and remuneration for the owner on account of his skill and the risk he runs. Some of the arguments which are put up by the working men are no doubt open for discussion and criticism, but there are others which not not. For instance, the argument that the working man should get all that he earns, meaning, of course, that the man for whom he is working should get nothing because he had earned nothing, is no good. No sane man would go into business just for the sake of being in business and employing help. When a man goes to work for an employer he should know that the employer is entitled to his profits, and if the employer devises means whereby he can make big profits it is his rightful due that he get the benefit. If a man worries his brain to invent some improved machine and is successful in accomplishing his dream, it is unjust to begrudge him the benefits which would accrue therefrom. But on the other hand, the benefits which are to be derived from his invention should come out of the people who use it and not out of the men who do the work. Now the point which I am trying to emphasize is that in putting anything on the market the manufacturer should use some consideration for the men who do the work, in arriving at what the cost of production is going to be and whether the men are working piece work or by the day it should not be the aim to keep cutting them down. This is what made organized labor spring into existence. To make my point clear, I will relate my own experience: I was once employed as foundry foreman where some of the men worked day work and some of them piece work, and I did all the scheming that anyone could do to get the maximum amount of work out of the day hands, and I also set the piece prices so as to make the piece men earn their pay, but there were fellows over me, and these fellows used to get in sand bins and such like places and peek through cracks so as to time the piece workers and see if the other ones idled away any time, and then they would report to me that certain jobs were paying too high a price and certain molders could easily make more molds. Of course I differed with them, but finally they demanded of me that I keep myself concealed as much as possible and keep my watch in my hand and see to it that no jobs paid any more than a certain wage, no matter how hard the molder worked.

This was only my experience, but many others have had similar experience with the result that molders were forced to organize and elect shop committees, whose duty it was to set a pace for the man, beyond which they must not go. It certainly looks like a crime to limit the output, but the employer is the one on whom the blame rests. If he can afford to pay the price to a slow man it is remarkable that he should find himself losing money as soon as a swift man gets on the job. If a job paid 5c and had been paying it for years, just as soon as some fast workman gets hold of it and makes a couple of hundred in a day and undertakes to draw ten dollars per day, just that soon the boss discovers that the price is too high. Now, as I have said, it is unjust to begrudge a business man his legitimate dues, but when a business man refuses to allow the workman to get his nose off the grindstone what encouragement is there for the workman to exert himself? Another contemptible scheme which is frequently tried is the bonus system, which is to say: "Pay a workman a wage which he cannot live on and then give him a percentage of what he earns above this so that he can make up enough to make ends meet. Now when we get right down to brass tacks, the workman should be put in the same position as the manufacturer. A price should be agreed upon which will allow the man a living and also allow the boss a profit. We all know that the more the boss sells, the more profit he will get, and the same thing should hold good with the man; the faster he worked the more money he would get, but as we have pointed out, this is not allowed. He can work as hard as he likes and the boss wants it all, so the whole thing resolves itself into the present system, whereby the men organize and hold themselves in check, while the manufacturers organize to buck the men's organization. It is a shameful state of affairs all round, but I am confident that if the human race was so constructed that one man could hire help without continually knifing them, organized labor and the consequent unrest would never have come into existence. It certainly is wrong for a workman to go out on a sympathetic strike after signing an agreement to work a stipulated time for a stipulated wage, but it is equally as wrong for the employer to keep a continuous watch on the men to see if he can scrape a little off one man's pay here and another one there, only to pocket what rightfully belongs to the workman. Life is short and there is plenty in the world for us all while we are here if we would be honest with each other and abide by the commandment, to "Do unto others as we would have others do unto us."

Question:—Can you advise me how to get the exact cost of iron at the spout? having special reference to the place occupied by sprues and remelt, or can you refer me to some reference book on foundry costs or other source of information?

Answer:—Cost systems are usually to be found in all publications, but the main thing is to bear in mind that the bed charge of coke has to be reckoned with over and above the other charges which are usually considered when speaking of percentage of coke to iron. Also that a hundred weight of iron weighed in the charge only represents about ninety pounds of melted metal, and the other ten pounds is actual loss. To this must be added the fact that sprues and remelts will have an additional loss at second melting. Thus, not knowing the size of cupolas I will give measurements in depth.

After putting in the kindling put in enough coke to reach about 30-inches above the tuyeres after the kindling is burned out. This can be arrived at by having a rod of the right length to reach down from the sill of the charging door to where the coke should be before putting on the iron. The coke should be weighed so as to know how much to put in afterwards without measuring. The first charge of iron should weigh approximately three times the weight of the coke in the bed. The succeeding charges of coke should be sufficient to make a thickness of six inches and the succeeding charges of iron should weigh approximately ten times the weight of coke on the charges. To this will have to be added the power used in melting and also the labor in conection with preparing for the melt, and the burning out of the fire brick, etc. It will be seen that some of the expenses are about the same for a large heat as for a small one, and the cost per pound must be figured from the cost of the heat compared wth the number of pounds melted. As regards the sprues and remelt it only differs from other scrap in that its chemical content is better known than outside scrap. In spite of all theories, my experience is that the fire is hotter near the bricks than in the centre and I usually put the heaviest metal there and fill the centre with the lighter material.

* * *

Question.—I was impressed with an article which I read in CANADIAN FOUNDRYMAN a few months ago entitled: "Molders' Health and Proper Ventilation." Now I want to ask you if there is not some legislation regulating this matter. If there is not I am of the opinion that it is high time that something should be done. Will you kindly tell me how the Factory Act reads as regards foundries?

Answer.—We certainly hope that we are not going to be instrumental in bringing up any more strife, but as soon as the present state of unrest is settled we would strongly advise all foundrymen to study the question of proper ventilation. The question of future molders depends to a great extent on this subject. Molding would be a much more pleasant occupation if the foundries were made more sanitary and comfortable. The Factories', Shops', and Office Buildings' Act for the Province of Ontario, revised to 1913, reads in part:

"The employer of every factory or shop shall keep it in a clean and sanitary condition and free from any effluvia arising from refuse of any kind.

"Keep water-closets and urinals in good repair and in a sanitary condition.

"Heat the premises throughout and regulate the temperature so as to be suitable for the work to be performed therein, and not to be injurious to the health or comfort of the employees.

"Ventilate the factory or shop in such a manner as to keep the air reasonably pure and so as to render harmless, as far as reasonably practicable, all gases, vapors, dust, or other impurities generated in the course of any manufacturing process or handicraft carried on therein that may be injurious to health. Provide a wash-room, clean towels, soap, and a sufficient supply of wholesome drinking cups for employees, and water taps which shall be at least eight feet distant from any water-closet or urinal, and also in the case of a foundry, shower baths for the employees."

It further states that in every factory or shop where any process is carried on by which dust is generated and is inhaled by the workers to an injurious extent, then, subject to the regulations, the inspector may, if such inhalation can, by mechanical means be prevented or partially prevented, direct that such means shall be provided within a reasonable time by the employer, who shall be bound so to provide them.

INDUSTRIAL CONGRESS AND PROVINCIAL TOUR OF THE ALBERTA INDUSTRIAL DEVELOPMENT ASSOCIATION

The above association is sending out invitations to attend the Industrial Congress and provincial tour to be held in Alberta from August 11 to 16 of this year.

The congress will place before its visitors data in relation to the natural resources and industries of Alberta and the Canadian West, with the object that serious consideration may be given the economic development of the trade of the Dominion, the extension of markets, Oriental and Pacific trade routes, and generally the whole phase of the Western era now dawning.

Addresses will be given by the following men of international reputation:

Mr. W. E. Beatty, president Canadian Pacific Railway Company.

Mr. Henry Ford.

Mr. John N. Willys, president Willys-Overland Company.

Mr. Augustus L. Searle, general manager Peavy Grain Company.

Mr. D. B. Hanna, president Canadian National Railways.

Mr. A. R. Erskine, president Studebaker Corporation.

Mr. Harold McCormick, president International Harvester Company.

Mr. Robert Dollar, president Dollar Steamship Company and vice-president National Trades Council of the U. S.

Mr. Joseph Oliver, president Oliver Plow Company.

Sir Edmund Walker, president Canadian Bank of Commerce.

Mr. Thomas Finley, president Massey-Harris Company of Canada.

Sir Clifford Sifton, late chairman Canadian Conservation Commission.

Mr. Finley P. Mount, president Advance-Rumley Company.

Col. J. S. Dennis, chairman Canadian-Siberian Trade Commission and head of C.P.R. Colonization Department.

Mr. Hedley Shaw, general manager Maple Leaf Milling Company of Canada.

In all probability Sir Robert Borden, Prime Minister of Canada, and Sir Thomas White, ex-Minister of Finance, will atttend and address he congress.

In all probability Mr. Samuel Gompers will attend and address the gathering.

The delegates will assemble at Medicine Hat on August 11th and will be conveyed by special train to Lethbridge the following day, thence to Calgary, where the two days' session of the industrial congress will be held on August 13th and 14th, after which the journey will be continued to Edmonton, the capital city of the province, where the delegates will be entertained by the Government and city during Friday and Saturday. That night the train will leave for Banff, arriving there Sunday morning. The delegates can then continue their trip through the Rocky Mountains, or in such direction as they may desire.

August is usually a delightful month in Alberta, cooled as this area is at that time by breezes from the Rockies.

The people of Alberta desire that there be no lines of demarcation in Canada as between East and West. They hold firmly to the belief that the destiny of Canada is truly great, and that its greatness lies as well in the proper development of its industries and its natural resources as in its agriculture and other lines of endeavor. They believe in a United Canada for the future.

The first Chinese steamship, Hwa Hwu by name, to appear on Pacific waters carrying the flag of the Chinese Republic, arrived at Seattle last January.

BANKING THE CUPOLA ON ACCOUNT OF BREAKDOWN

How many of us are there who have not seen an accident during casting time? I will venture to say there are few. I could name dozens of them in my own experience. I remember working in a foundry where the heats would run about 18 tons a day. We were just going to start pouring when a pulley began to slip—it was a wood pulley clamped on to the shaft, and every revolution, of course, made it less secure. The shaft was stopped and every effort made to fix it, but all to no purpose. After several unsuccessful attempts it was decided that nothing could be done, and as a consequence there was no other alternative but to drop the bottom. The cupola was then in such a state that it was easily seen to be impossible to do anything next day until regular casting time, so the molders had to take the day all but an hour or so at the end of the day, by which time the melters had it ready. Of course every one demanded a day's pay and got it. Altogether it cost the company several hundred dollars. Now what I want to explain is that all of this could have been avoided if the foreman or melter had understood how to bank the fire in the cupola. It is a well-known fact that fire will stand practically as it is at the instant the supply of air or oxygen is cut off. Shutting a damper is only a partial hindrance, but if every particle of air is cut off the fire neither contines to burn or go out but just remains ready to begin where it left off as soon as air is admitted.

As soon as it is found out that the heat cannot be taken off, the first thing to do is to stop up the tuyeres and cover up the top of the charges in the cupola. The top hole will of course be bottled up. In stopping the tuyeres, they should first be backed up with coke in a similar manner to putting the breast in, after which molding sand is rammed in tight. It will thus be seen that no draft can enter from the bottom. In covering the top, nothing is better than the dust or dirt which settles at the bottom of the coke bin. If the iron charge is leveled off and a foot or so of this coke dust put on it and rammed tight, the fire, as well as the partly-melted metal is bottled in similar to being in a sealing jar. The repair work may now proceed, and at any convenient time the tuyeres can be cleaned out and the coke dust taken from the top and the heat proceeded with. In uncovering the top, it will not be possible to get all of the coke dust removed, but any which remains will do no harm for the reason that it is good foundry coke and will burn if it gets down into the fire, but if enough is removed to let the wind get through it will in all probability be blown out through the stack and do no further good or harm. As I have said, I have had many experiences in shops where such trouble was taking place, but I have also had some where it was my own affair to attend to it. and I have demonstrated that even where the iron has started to melt that it works all right if the melted iron is drawn off. An experiment which anyone can try without expense to prove how fire can be made to serve its master is to bury the foundry stove in the sand heap. By this I mean to take off the stove pipe and throw a plate over the hole, after which cover the stove entirely out of sight with sand, and in about forty-eight hours afterwards remove the sand and put the pipe back on again, and see the fire go right along as though nothing had happened. I have done this with a wood fire, and I have no doubt but what a coal fire would last a much longer time if the sand were well tramped so as to render it as near to airtight as possible.

Now, my interested readers, if you ever have trouble with your belts or pulleys. don't be in too big a hurry to drop the bottom, but just give a little heed to what I have endeavored to explain and damp up your furnace until the repairs are made, after which you can proceed with the heat.

WHAT CONTRACTION CAN DO

I have a little story which is perhaps injurious to the foundry business, but it is so closely connected to foundry work, or at least, it came so near to being connected, that I cannot refrain from giving the details. I was at one time the owner and manager, and in fact, almost the entire staff of a small jobbing foundry in a small town. On one occasion a country customer called at my office with the flywheel of an engine which had been through a fire. The engine had been very little damaged, excepting this wheel, but it had evidently been struck when red hot, with the result that the rim was knocked off, but not broken in any other respect. Some of the arms were attached to the rim and some to the hub, but the wheel was in two separate parcels, every arm being broken. He wanted me to put it together and make a casting off it, but there was the sticker—I could not get it together. We both tried everything we could thing of, but all to no purpose. Finally it was decided that the rim would have to be heated and shrunk on like a wagon tire, and Mr. Farmer decided to take it home and build a bon-fire of sufficient size and of proper shape to heat the rim red hot so that it would expand sufficient to allow him to drop the hub and arms into the proper place. I heard no more about it until some months afterwards when I met the farmer and asked him how it was coming along, and was surprised to learn that the heating and shrinking was entirely successful, so much so that he put it back on the engine and to the best of my knowledge and belief it is still working, and it is quite reasonable to suppose that it would be as good as a new casting. Nothing but sentrifugal force to make it come loose, and that would have to be far greater than it would ever be called upon to stand. Any work it would be called upon to perform, such as driving a belt would hold it tighter. The broken arms could not slip by at the break on account of the ragged nature of the break being welded together, and the enormous pressure which the rim exerted towards the centre would more than hold against anything which the engine would ever have to do. However, I did not get the wheel to make.

CONCRETE FOUNDRY FLOORS

By George Moyer

My practical experiences with concrete foundry floors extend over the past 10 years. I have paid the closest attention to this particular subject and I find the concrete floors to be superior to any other foundry flooring for the following reasons:

The floors can easily be kept clean with very little expense of labor and time.

The molds will always stand level and straight, and because of this we avoid the not inconsiderable loss of castings resulting if the molds are not level.

The molder cannot dig holes in the floor with his shovel, which is frequently the case on other floors.

The absolute straight and smooth surface will always give the men carrying iron a safe path and prevent them from stumbling into the holes of an ordinary clay or gravel floor.

Cores Distributed by Truck

In the foundry with which the author is connected, we distribute all the cores with an electric truck, and on account of the concrete floor we can transport in this manner any style of core without breaking it. In case a sand-cutting machine is used to cut the sand the numerour advantages are obvious. The strain on the machine is naturally much less on a level, solid foundation, and it can cut all the sand clear down to the ground without taking any chance of damaging the machine.

The argument that concrete is hard on molders' feet does not hold good, as experience proves that the molders are always standing on sand just as they do on gravel or clay floors.

In conclusion, I have found the concrete foundry floors to be a complete success, and I know that if I would give our molders the choice between clay and concrete floors they would all prefer the latter.

FOX RIVER VALLEY STRIKE SETTLED

Word was received from Mr. Sample, business agent of the molders, that the strike among the molders in the Fox River valley, Illinois, was settled Wednesday. The molders accepted $6.00 per day and an 8-hour day beginning September 1st. Work resumed in the various shops of the valley yesterday. The apprentice agreement is similar to the one with Chicago Association.

A new alloy chisel steel has been produced which can be made so hard that it will cut glass, yet may be bent over the edges of an anvil.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1888)

JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - Vice-Presidents
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: F. L. Jennings. Ontario Representative: S. S. Moore Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address giving both old and new.

Vol. X. TORONTO, AUGUST, 1919 No. 8

PRINCIPAL CONTENTS

The Strike Situation

THE machinists in the Toronto district have returned to work with conditions satisfactory to both parties. The wage demand of 80c per hour was reduced to 75c per hour, an the 44-hour week, which was the main bone of contention, was dropped for the time being and the 48-hour week substituted. Otherwise the men's demands were met by the employers. The molders still feel that they are entitled to better consideration than what has been offered so far but both sides are looking forward to a settlement which will be agreeable to everyone in the very near future.

Emancipation Day

THE First of August has long been known as a glorious day to the colored portion of our population, but few there are who seem to know from what source it emanated. The bulk of the colored population of the North American continent is descended from the slaves of the Southern States, commonly known as "Away Down South in Dixie," and strangely they appear to believe that August 1st was the date on which their ancestors were liberated, but such is not the case. "The celebration ob de imancipation ob de cullud indowigels on de fuss of Austust" was the order long years before that. The American slaves were liberated by proclamation of President Lincoln on January 1st, 1863, while slavery was abolished in England on March 25, 1807; but in 1833 an act was passed in the British Parliament by which £20,000,000 was paid to the slave owners in the British West Indies whereby 770,280 slaves were set at liberty, the act to come into force on the First of August, 1834. And again on the First of August, 1838, slavery was abolished in British India, by which act the last slave on British soil became free and the entire colored race henceforth looked upon this one day of each year as their great day. Even those who were still in bondage in America recognized it and when once they could slip over into Canada and become free they celebrated it along with the others. Slavery existed in the Spanish West Indies until 1886, and in Brazil as late as 1888, but it is now entirely done away with on this side of the Atlantic.

Very Large and Very Small Castings

IN our last issue we made a comparison between the population of the United States and their foundry business, and that of our own country in which we made the claim that we had even better chances of success in Canada than they have in the States. Few Canadian founders care to admit the fact, while some claim that they are prepared to make any ordinary casting which comes their way. This is no doubt true, but there are castings which might be termed "out of the ordinary" which seem to cause no trouble in the American foundries. Take, for instance, a casting weighing from fifty to a hundred tons. How many foundries are there in Canada which are prepared to make this class of work? There may be some, but so far we have been unable to locate them. We would not expect to find very many, but working on the same hypothesis that we did before, namely, that there are twelve times as many Americans as there are Canadians, if America has twelve foundries where this class of work can be done, Canada should be able to provide a good living for at least one. There are certainly twelve American foundries which can do the trick and if there is one in Canada it should make itself known and get the trade which is leaving the country. While the large work amounts to a big item, there is another line which is really more to be wondered at. This is the very light class of work. There are all kinds of opportunities for foundrymen to do casting for electrical machinery, not big frames for dynamos, but little thin pieces which require to be perfectly clean, also strong, and at the same time soft. Now there are lots of foundries in Canada who are in the best of shape for doing this kind of work if they would just put their minds to it and then come out where people can see them and keep this work in Canada.

The Toronto Exhibition

THE Canadian National Exhibition, which will be held from Monday, August 25th, until Saturday, September 6th, 1919, promises to be by far the best in the history of the Exhibition. The gates will be open on the 23rd but the formal opening will not take place until Monday, when H.R.H. the Prince of Wales will preside over the inaugural ceremonies. In addition to the usual attractions, the addition to the Fine Arts Gallery is worthy of special consideration. Many paintings, both war memorial and historical, will be in evidence, some of which are over 20 feet long.

The war trophies alone will be a big attraction.

Any of our readers who happen to be in the city attending the Exhibition are particularly invited to pay us a visit. We are always glad to meet any of our foundry friends.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

Question.—As I have read in your answers to platers annoyed by pitting, that this condition was due to a lack of metal in their solution, I should be greatly obliged if you would care to give me your opinion on the following extract:

"Pitting upon nickel work * * * * is usually found upon work * * * * * hanging quietly in a solution with plenty of metal in it, with a good anode surface."

I am somewhat at a loss about this pitting, which I have experienced for a long time in different solutions of nickel, and I am sure that you will greatly assist me in giving the explanation requested.

Answers.—Your reference to the extract above as a comparison to views given in these columns is fully appreciated by the author of the latter. In all the literature on electro-plating there probably is no subject upon which such contradictory opinions have been expressed as the subject of pitting. Standardization of nickel plating supplies, nickel plating solutions, together with uniform methods of operating and maintaining nickel solutions of a given composition would no doubt assist in the compilation of reliable data relative to the conditions favoring pitting and how to avoid such conditions. Pitting may occur in a "solution with plenty of metal in it, with a good anode surface." We venture to state that 99 per cent. of pitting of nickel deposits is directly due to the deposition of hydrogen during electrolysis, the remaining one per cent. may be credited to hydrogen carried upon the surface of the work from acid dips or water tanks. We have seen gas bubbles present upon steel emerging from a sulphuric acid dip to the extent of being similar to thin foam. This steel was subsequently rinsed in cold running water and immersed in a cyanide solution (15 per cent.) for ten minutes, rinsed again in cold water and passed through muriatic acid dip, rinsed again and placed in neutral double sulphate nickel solution, which had never yielded a pitted deposit. The result was as might be expected, a mass of pin holes covering such portions of the steel that held the bubbles before deposition began. We have investigated cases of pitting when the source of the trouble was apparently the nickel solution, but was found in the cyanide copper solution, gas having remained upon the cathode during the period of transfer from copper bath to nickel solution. In our experience we have successfully dealt with nickel pitting by maintaining a high metallic content and very low acidity. Sometimes nickel sulphate is used to increase the metal strength of the nickel solution and pitting which was absent before, appears on the first batch of work plated after the addition was made. This may be due to more than one condition, possibly the solution was not sufficiently neutralized, or an unreasonable current density may have been employed. We believe that the acidity, or rather the neutrality of a nickel solution is the really important factor to be considered in combating the pitting nuisance. The same degree of acidity or neutrality will not apply to all cases. Other conditions such as temperature, concentration, conductivity, composition, and current density each have some bearing on the results. The inclination to increase the rate of deposition of nickel has been instrumental in producing a certain confused mental condition among some platers, and while encouraged by results in general, they have neglected to duly consider what might be termed a reasonable limit in current densities. Some do not consider current densities, they rely wholly upon the voltmeter and possibly use a greater current strength than they figure on. Nickel solutions which are rich in metal, not supposedly so, but proved to be so by analysis, and which are not acid enough to turn blue litmus paper more than a faint purple, and which are operated at high current densities, with pitted deposits as a result, may be used to produce deposits absolutely free from pin holes by either further neutralization of the solution, or lowering the current density, or both. A nickel solution which is loaded to capacity and worked continuously from the time of its preparation will be more likely to produce pitted deposits than a nickel solution which is electrolyzed with very small cathode for several hours immediately after preparation. We have overcome very serious cases of pitting by increasing the metallic content of nickel solutions, neutralizing the acidity with nickel carbonate and using reasonable care not to exceed the speed limit after the preliminary electrolyzing treatment just mentioned. We would invite your special attention to the fact that the acidity of some nickel solutions is not easily determined; also, that some nickel solutions will pit when absolutely neutral. If you have reduced the cost of polishing by a reduction of operations and now plate your product heavily in order to facilitate a proper finish by buffing, we would suggest that you improve the polishing and decrease the speed of plating, as the heavier the deposit the greater is the effect of pitting. A nickel solution of low metal strength which pits may be made to yield perfect deposits by increasing the metal strength and operating at same current density as before the addition was made. A concentrated nickel solution which yields pitted deposits may be made to produce perfect deposits by operating at lower current density, sometimes a 5 per cent. reduction will suffice, while a 25 per cent. reduction in current may be necessary in some cases. These solutions may acquire a condition after a short period of use, which will permit of appreciable increase in current being employed. With direct reference to the comparison of opinions in question we may add that we do not agree with the quoted statement. We would eliminate the word "usually" and then accept the statement as correct, and advise operating such nickel solutions as described above. We regret to say that no positive cure for all cases of pitting is known. We hope you may obtain some help from this reply and feel free to make known to us the result of tests made along the line indicated. Pitting of nickel deposits is one of the problems which remains unsolved after many years of experiment and research on the part of skilled practical men. Platers have successfully met the trouble in individual plants, but the remedy is not always applicable to cases of apparently similar nature. "Many men have many minds," and as long as nickel solutions are prepared and operated in so great a variety of conditions as at present, there will be very little advancement made in the endeavor to solve the pitting problem. Scientific management of nickel solutions must eventually come, but progress is slow.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	29 35
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 50

METALS

	Montreal	Toronto
Aluminum	$36 00	$35 00
Antimony	9 50	8 50
Copper, electrolytic	25 00	17 50
Copper, casting	25 00	17 00
Lead	7 00	7 50
Mercury		.....
Nickel		.....
Silver, per oz.		0 98
Tin	54 00	55 00
Zinc	9 00	8 25

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$13 50	$11 25
Copper, crucible	17 25	14 00
Copper, heavy	17 50	14 00
Copper, wire	17 50	12 00
No. 1 mach. comp'n	13 50	13 00
New brass cuttings	10 00	9 00
No. 1 brass turnings	8 00	9 00
Light brass	7 00	5 00
Medium brass	8 00	6 00
Heavy melting steel	12 00	9 00
Shell turnings	6 00	6 00
Boiler plate	12 00	8 00
Axles, wrought iron	17 00	15 00
Rails	12 00	11 00
No. 1 machine cast iron	18 00	15 00
Malleable scrap	15 00	12 00
Pipes, wrought	8 00	5 00
Car wheels, iron	20 00	18 00
Steel axles	20 00	20 00
Mach. shop turnings	5 50	5 00
Cast borings	5 50	8 00
Stove plate	14 00	10 00
Scrap zinc	5 00	5 00
Heavy lead	5 00	4 00
Tea lead	4 00	3 00
Aluminum	15 00	12 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

1/4 in.	$14 35
5-16 in.	13 85
3/8 in.	13 50
7-16 in.	12 90
1/2 in.	13 20
9-16 in.	13 00
5/8 in.	12 90
7/8 in.	12 90
1 inch	12 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 50
Linseed oil, boiled, single bbls.	2 92
Linseed oil, raw, single bbls.	2 90
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37½
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 00
Sheets, black, No. 10	6 15	5 45
Canada plates, dull, 52 sheets	8 50	8 00
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B. W.G.	....	....
Fleur-de-Lis, 28 B.W. G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 95
Premier, 10¾ oz.	....	8 25
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$13 00
3-16 in.	12 50
1/4 in.	11 75
5-16 in.	11 40
3/8 in.	11 00
7-16 in.	10 60
1/2 in.	10 40
5/8 in.	10 00
3/4 in.	9 90

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20%, on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Silver	1 05 to 1.00
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.30
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.15
Ammonium, carbonate	.25
Ammonium, chloride, lump	.55
Ammonium, chlor., granular	.30
Ammonium, hydrosulphuret.	.30
Ammonium, sulphate	.15
Caustic soda	10
Copper, carbonate, anhy	.50
Arsenic, white	.20
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.25
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	.75
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.55
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	.80
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.		$3 25
Polishing wheels, bullneck		2 00
Pumice, ground	3½ to	.05
Emery composition	08 to	.09
Tripoli composition	06 to	.09
Rouge, powder	30 to	35
Rouge, silver	.35 to	.50
Crocus composition N	08 to	10

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd	0 34
Brass sheets, 24 gauge and heavier, base	0 43
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	27½
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10½

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	40

Question.—We intend enlarging our plating department and wish to have your correspondent's opinion as to the relative merits of concrete, asphalturn, wooden blocks, or a combination of any of these materials for plating room floor. Our plating plant will be located on the ground floor, and the proper flooring for this place seems to be a matter we cannot settle agreeably among ourselves. An early reply will be appreciated.

Answer. — Personally, we have no fault to find with a properly laid concrete floor. The question of mixture, depth of foundation, and surfacing, are probably the most important points aside from the drainage. Irrespective of material used, it will be necessary that you attend closely to the fall obtained, so that when dry you may have sufficient drainage to clear the entire floor of water. Many otherwise good floors have been ruined by low spots here and there over the surface, or by too little fall per foot. A good cement base covered with about 4 or 5 ply of tar paper and finished with asphaltum will give excellent service if protected from punctures, which may be caused by prongs on ladder ends, or other sharp instruments. We have seen concrete (Portland cement and sand) floors, which became worthless in less than two years owing to unreasonable carelessness in the use of acids and strong alkalies. The average cleaning compound in use to-day in solutions employed for the preparation of metal goods for plating is not injurious to good asphalt floors. Strong acids, or mixtures of strong acids, will gradually eat away the best asphalt or wooden floor it is possible to lay. If a well-laid foundation is laid and a strong mixture of cement and sand used to build a solid floor, not a mere shell, and the whole given a top dressing of extra fine mixture, we do not believe that imperfections would deevolp during a number of years of constant use. A plating room floor should be well washed every day after dipping operations are finished; turn the hose on every nook and corner, wash the sides of tanks off and avoid the accumulation of metallic salts, pools of acidulated water or other matter. A plating room 25 feet wide should have a floor with not less than a 4-inch fall from either side to the centre. The slope should be uniform. This is a feature which depends almost entirely upon the foundation. Creosoted wooden blocks, parafine-coated blocks, and "sawdust brick" have been used in some large plating plants in the U.S. with some degree of success. Vitrified paving brick laid in asphalt has been used; it is more expensive than the concrete and asphalt floor, and we are not aware of any joints of actual merit which are possessed by the former type only. If you build wooden sections of narrow strips on 2 in. x 4 in. scantling and cover the floor in the vicinity of the tanks and wash the wooden covering and floor well and regularly every day, we believe you will receive general satisfaction from a good concrete floor. Avoid imbedding steam pipes in either concrete or asphalt floors. Water pipes are not injurious, but it is not good practice to place water pipe where it is liable to require removal of the floor in case of defect in water pipe. We would advise letting the contract to a first-class workman in any case, and then give the work your personal attention to insure satisfaction regarding points we have mentioned. Do not use floor too quickly after it is completed.

Question.—Can you inform me of a material which may be used in a hot cleaning solution to remove vaseline from steel as received from foreign manufacturers. I am using soda ash solution and subsequently an electric cleaning solution made from a mild washing compound, which we buy prepaired. An additional operation with brush and pumice is necessary to properly clean the steel. This means too much labor and slow production.

Answer.—If the steel is in form of manufactured article and can be tumbled, we would suggest tumbling in clean sawdust for 30 minutes. If this is not possible, try cleaning with sawdust by hand; a boy or girl could do the work. If, however, these methods are of no value, prepare a solution of soda ash and water, 8 oz. soda per gallon of water; add to this 4 oz. of good soft soap; use at 210° Fahr.; rinse in hot water; then run through the electric cleaning solution, as you have been doing. A hot copper strike would assist you and effect a cleaner surface condition on the steel. Keep scum removed from surface of all solutions used by frequent skimming.

* * * *

Question.—I have a brass solution which has gradually gone wrong. The deposit is more like bronze than brass. During latter part of each day the color is quite grey. I have added copper and zinc and cyanide until I fear something worse will happen. Can you tell me how to correct the action of the solution?

Answer.—If you have added the various salts in sufficient quantities to raise the density of the solution above 10 degrees Be., remove enough of the solution to enable you to dilute the portion left in the tank to about 8 or 10 degree Be. Electrolyze, note the color obtained on the cathode and if still too grey add copper cyanide or copper carbonate in small quantities until the required color is obtained. In replenishing brass plating solutions you may generally act exactly the opposite to what would ordinarily be considered correct when replenishing solutions of other composition. In other words, add copper when zinc appears to be required. Brass baths require very little zinc after first prepared in correct proportions. If you will use copper anodes and zinc anodes, 2 of copper to 1 of zinc, and be careful in the addition of zinc salts, keeping the cyanide content as low as possible, we believe you will have very little trouble with your color. Try the method in a small tank or crock for a few weeks and study the nature of the changes as compared with changes taking place in your old solution, then act accordingly. We have never been able to operate a bath such as yours as economically as one prepared as we have stated. Aside from economy this method will eliminate the frequent annoyances which are common with the old style of bath, the color of deposits is more easily controlled and heavy castings rapidly obtained.

TUNNEL ANNEALING FURNACE

(Continued from page 215)

Owing to the even distribution of heat through the same pots, and the fact that every car has to go through the same treatment as every other car, the writer believes a much more uniform product is obtained by use of the Dressler kiln than is possible with any other kiln. When the correct conditions for annealing have once been established, there is no difficulty in maintaining them. The temperature throughout the kiln is controlled by thermocouples placed in the vault. A slight adjustment of the gas dampers will correct any tendency to vary. It is always very much easier to maintain a constant temperature in a continuous furnace than to raise the temperature of an intermitent kiln in accordance with a set schedule.

USE AND ABUSE OF CRUCIBLES

(Continued from page 216)

The number of heats obtainable from a crucible depends largely on the metal to be melted and on the temperature required for the melt. A crucible that will last only three or four heats with nickel will heat 25 heats with copper, or 40 or more with composition metal. If a flux is used it lowers the life of the crucible by attacking the clay that holds the graphite together.

In general, poor results are caused to a large extent by poor treatment. More attention to the details of storing and annealing the pots and to their treatment while in the furnace will pay large dividends in the increased service obtained.

THE ELECTRIC FURNACE

Continued from page 8

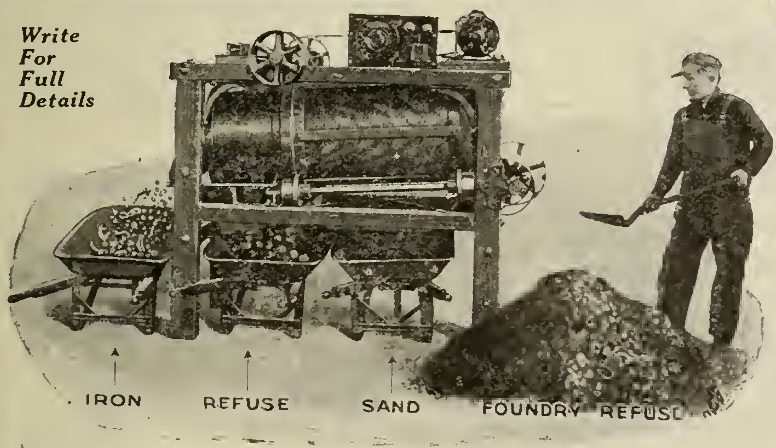
(2) red brass, 24 hr. day, (3) melting yellow brass, (4) red brass.

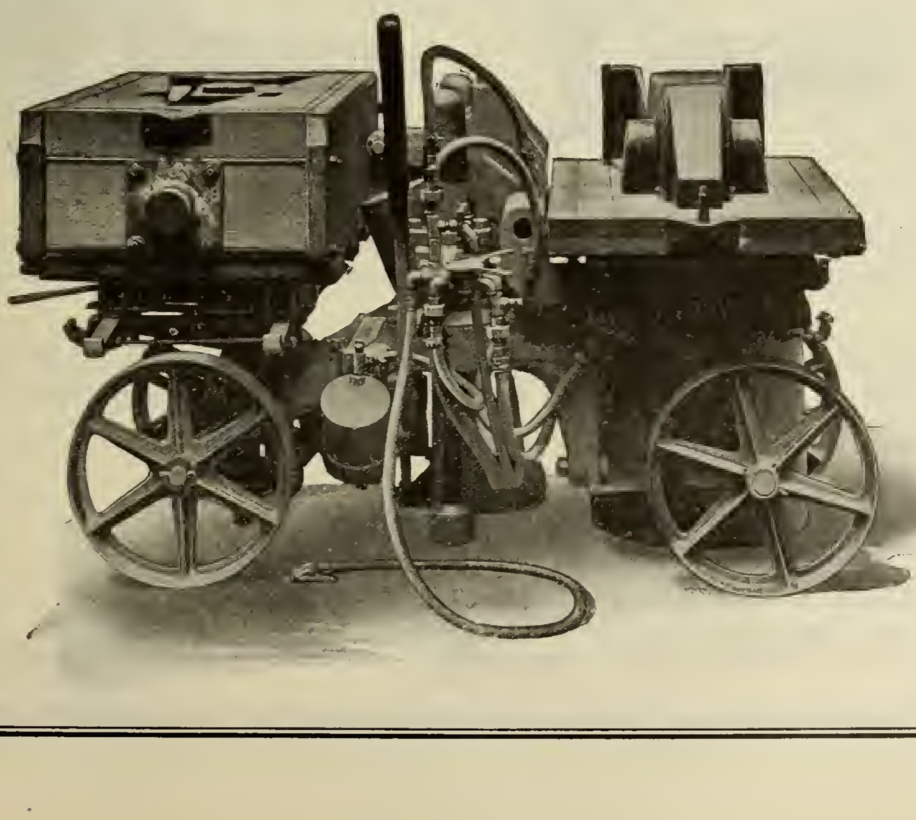
The shaded portion of each wedge shows the saving in total cost between melting with fuel and with electricity.

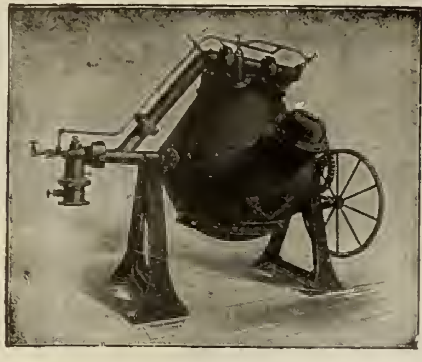
This chart stated in words and figures is as follows:

Furnace	Alloy Melting	Length Working day	Per cent. savings over fuel fired
Electric	Yellow Brass	10 hours	100%
Electric	Red Brass	10 hours	80%
Electric	Yellow Brass	24 hours	110%
Electric	Red Brass	24 hours	700%

These margins of savings are of such magnitude that we cannot longer doubt that the electric furnace is destined to dominate the brass melting field.


IRON
REFUSE
SAND
FOUNDRY REFUSE





The Hawley-Schwartz Furnace

The Only Perfect Melter

All metal from 50 lbs. to 10,000 lbs.

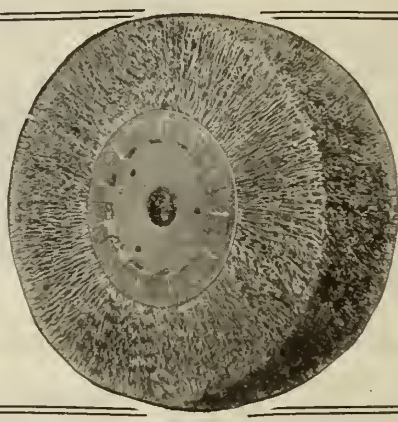
Is Absolutely Uniform

Write for catalog and complete information

The Hawley Down Draft Furnace Co.
Easton, Penn., U.S.A.

"SAMSON" Wire Wheel Brush Sections

Each Section a Brush in itself



Can be quickly mounted on a Shaft or Spindle

No Hub or Holder Required

Metal disc center punched to fit any size spindle.

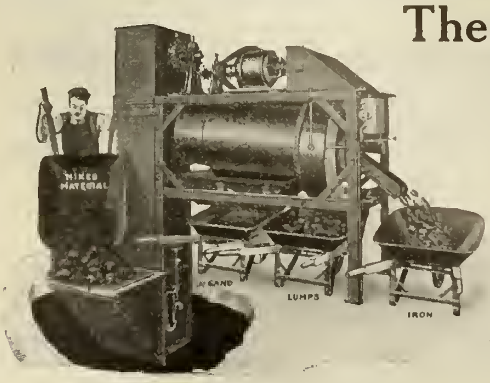
A convenient and practical method of building a wheel any desired width of face.

Especially recommended for removing scales from hot forgings, axes, shovels and tools; for cleaning brass castings, sheet brass and copper.

A trial order will convince you "Samson" scratch wheels are the most efficient and economical brushes on the market to-day.

Write for catalog and complete information.

The Manufacturers Brush Co., Cleveland, Ohio
19 Warren Street, New York



ALL STEEL CONSTRUCTION

There's lots of good iron in that scrap heap

You can save it and screen your sand as well with a

MAGNETIC SEPARATOR

Simply dump the material into the grizzly. Our Type F requires no shoveling.

Soon pays for itself in metal and labor saved.

This Magnetic Separator will deliver a cleaner product and has a larger capacity than any other separator on the market. The savings effected by this Separator will pay the initial cost in from two to three months.

Drop us a line for full particulars.

MAGNETIC MANUFACTURING CO.
957 Fourth Ave. Milwaukee, Wis.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.
Magnetic Mfg. Co., Milwaukee, Wis.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co., Cleveland, O.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Magnetic Mfg. Co., Milwaukee, Wis.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MAGNETIC; STANDARD AND SPECIAL
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

When Writing Advertisers Mention this Paper

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corpora..on, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. .evens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD

TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison. E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wh-.ls, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd.. The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

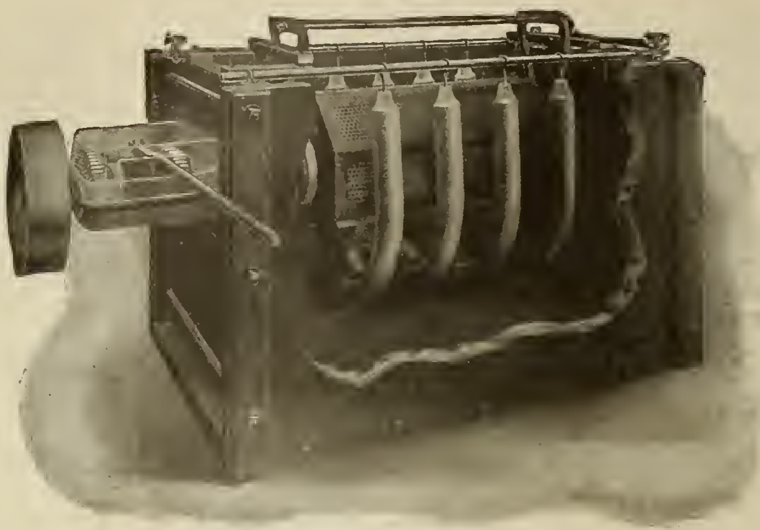
WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison. E. J., Co., Toronto, Ont.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison E. J, Co., Toronto, Ont.

INDEX TO ADVERTISERS

Mechanical Electro-Plating Apparatus



Type B Apparatus Gear Driven

The most modern method of Electro-Plating small articles of any nature. They are such a great labor and time-saving device that all modern plating shops should be thus equipped in order to successfully meet competition.

Some of the Articles Plated in the Operation.

Can be used for plating Nickel, Brass, Copper, Zinc in small or large quantities.

"Made in Canada"

Canadian Hanson & Van Winkle Co., Limited

TORONTO :-: :-: :-: :-: CANADA

PRE-CONVENTION NUMBER

CANADIAN FOUNDRYMAN and Metal Industry News

VOL. X. PUBLICATION OFFICE, TORONTO, SEPTEMBER, 1919 No. 9

A CORDIAL invitation is extended to all Canadian Foundrymen to call at our Display in Machinery Hall, the Foundrymen's Convention, to be held in Philadelphia the week of September 29th, 1919. Our Display will consist of a complete line of Foundry Air Tools in operation.

FOUNDRY AIR TOOLS

For All Classes Of Work

PORTABLE EMERY GRINDERS

CHIPPING HAMMERS FOR CLEARING ROOM

SAND RAMMERS FOR FLOOR FLASK, BENCH AND CORE RAMMING

Cleco Pressure-Seated Air Valves

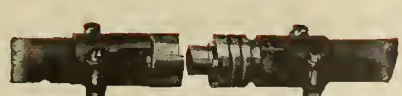
For Foundry Air Lines

THE VALVE THAT IMPROVES WITH USE

THE VALVE THAT REQUIRES NO ATTENTION

Bowes Air Hose Couplings

Absolutely Air Tight Under All Pressures



Instantly Connected Or Disconnected

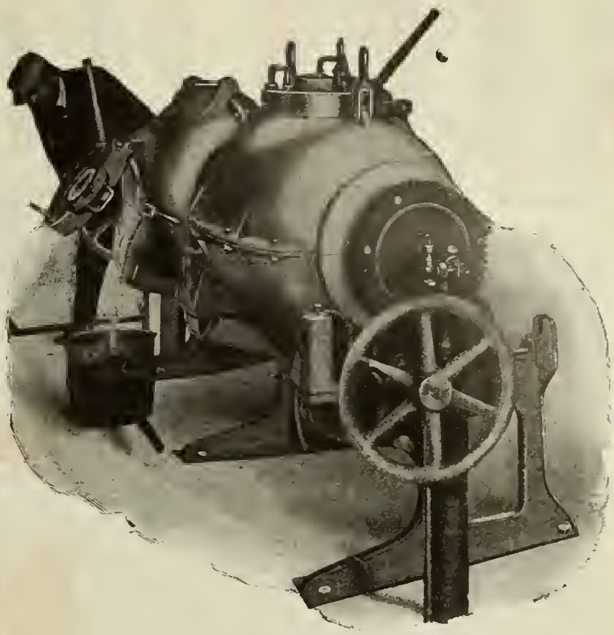
STANDARD EQUIPMENT EVERYWHERE

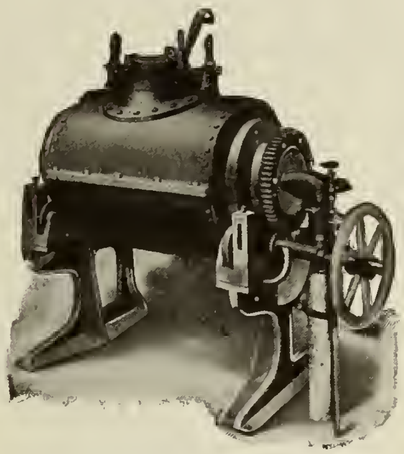
CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut Street, Toronto

337 Craig St. W., Montreal

CANADIAN FOUNDRYMAN, September, 1919. Vol. X., No. 9. Published monthly at 143-153 University Ave., Toronto, Canada. Subscription prices in Canada, $1.00; in the United States, $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.





HOLLAND PRODUCTS

GOOD PRODUCTS ONLY

Match Oils

Linseed Oil

Hi-Binder Dry Core Compounds

Hi-Binder Green Sand Facing for Steel

Core Oils

Hi-Binder Core Paste

Kleen Kore Wash

Parting

Etc.

Holland Products Reduce Costs

During the war business came easy, and lots of it. Now, as in pre-war days, competition has to be reckoned with. In order to meet it and win you must produce on the most economical basis. HOLLAND PRODUCTS will assist you to do this. HOLLAND PRODUCTS are specially made to reduce the costs and promote efficiency in the foundry. Take Holland Core Oil for instance with its three great features—binding strength, fast drying properties and low price. Then there is Holland High Binder Core Flour—not only cheaper than ordinary flour or dextrine but gives better service.

Holland Match Oil, Parting, Kleen Kore Wash, Hi-Binder Core Paste and Hi-Binder Green Sand Facing for steel—all spell economy and efficiency for the foundryman. Why not use them?

Canadian Agents:

The Dominion Foundry Supply Co., Limited

TORONTO *Everything for the Foundry* MONTREAL

HOLLAND CORE OIL COMPANY

4600 West Huron Street
CHICAGO

A Complete Heating Plant For Foundries

This furnace is a complete portable hot air blast heating and ventilating system ready for operation —requiring small space only.

Equals 100 Salamanders—
Less trouble and fuel than one—
The Blower does it

Designed for factory and industrial buildings requiring heating and ventilating at the smallest possible cost.

Mechanical Hot Blast Heater

FREE TRIAL

Not knowing your requirements, we cannot here quote prices. Send us a plan or sketch of room, building or space you desire to heat, including, if possible, but not absolutely necessary, cubic contents, glass and wall exposure of building, and we will be glad to send you one of our trial propositions, giving the prices and our liberal guarantee that if our heater does not do all that we claim for it, and you are not satisfied, send it back in thirty days and we will refund money.

GUARANTEE

Nothing but the best of workmanship and material is used throughout the construction of the above apparatus, and it will handle the air specified, heat the cubic space mentioned in our proposition to the temperatures mentioned therein, which is an unqualified guarantee that comes with each heater backed by an established, thoroughly responsible organization of heating and ventilating engineers.

Will burn any kind of coal, coke, oil or gas. Made for belt drive or with direct-connected motors. They are decidedly economical in operation — simple in construction—nothing to wear out or get out of order.

For drying purposes it is especially recommended for drying clay products, asbestos, magnesia, cereals and all other products dried by warm air up to a temperature of 400 degrees F.

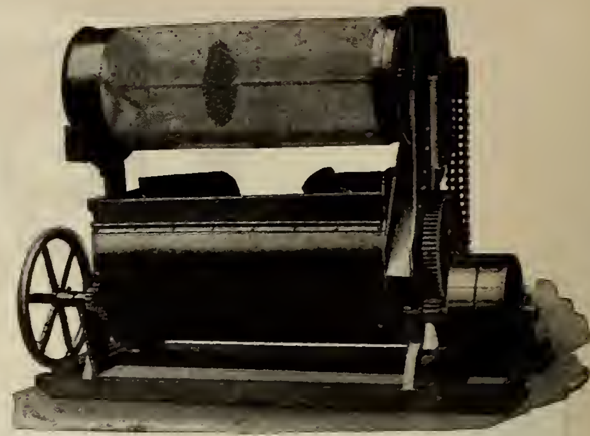
Correspondence invited from prospective Canadian Agents.

Meet us at the convention in Philadelphia. Our booth is Number 245.

ROBERT GORDON, Inc., Sole Manufacturers

OFFICE AND FACTORY, 622 WEST MONROE ST., CHICAGO, ILL.

BLYSTONE
SAND MIXER



Cut Your Mixing Costs 50%

These are the days of keen competition. In order to meet it and make a profit you must equip your foundry with modern, efficient, labor-saving facilities. You can't afford to overlook the productive, money-making features of the BLYSTONE SAND MIXER. Cuts labor cost of mixing at least 50%. Reduces time required to mix your sand 60%. Produces absolutely complete and uniform mixture. With it 25% to 30% less core oil and other binders are required, it mixes so thoroughly.

Loaded and Unloaded Without Stopping the Shovels

The BLYSTONE is a continuous worker. You can load it and unload it without stopping the shovels. The mixer (without screen) is loaded by shoveling the sand into the drum. With the screen type the sand is thrown in the end of the screen. All you have to do to discharge the load is to tip the drum, a very easy operation by hand or power. Discharge control enables operator to dump as much or as little of the batch as desired.

The work of the BLYSTONE MIXER is thorough and uniform as well as economical. The secret of its efficiency lies in its reverse spiral shovels—three shovels that work opposite direction to the other three. These six powerful shovels move at 22 r.p.m. and dig down under the mass, while a longitudinal thrust throws the sand from one end of the drum to the other 44 times a minute. This method of shoveling, stirring and troweling the materials assures a more thorough mix than is possible by any other method.

The BLYSTONE is the only mixer with adjustable shovels. This saves purchasing new shovels in case of wear. It is the simplest mixer made, yet strong and durable. Contains no superfluous parts which might eat up power and get out of order.

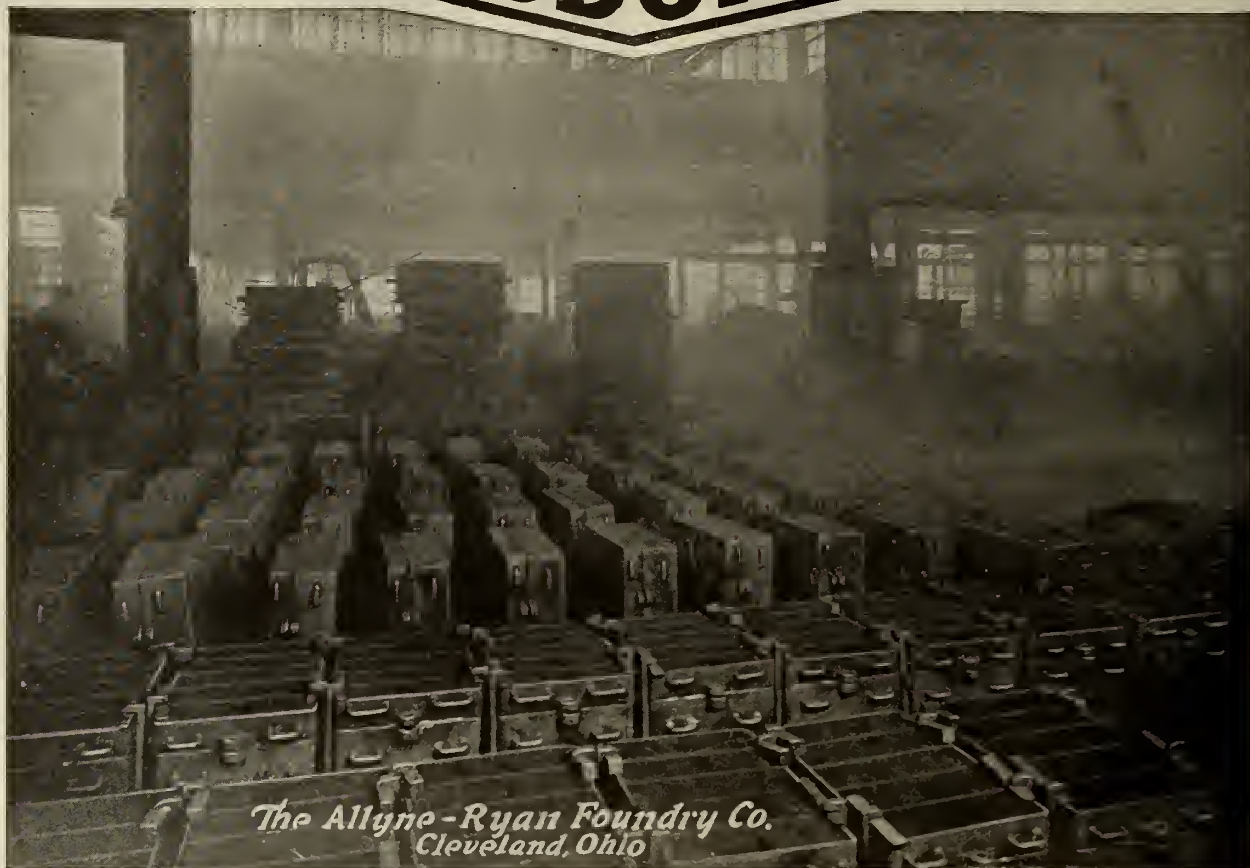
Foundrymen in Canada and United States highly endorse the Blystone Mixer. Users are saving time, cutting costs and increasing their profits. One man alone with a Blystone can do the work of six men working by hand. This alone should decide you to use it. Write for the full story of its efficiency.

Baltimore..............J. W. Paxson Co.
Birmingham..........Hill & Griffith Co.
Buffalo..............E. J. Woodison Co.
Chicago..............Scully-Jones & Co.
Cincinnati............Hill & Griffith Co.
Cleveland............E. J. Woodison Co.
Detroit..............E. J. Woodison Co.
New York...Wonham, Bates & Goode, Inc.
Philadelphia............J. W. Paxson Co.
Pittsburgh..........J. S. McCormick Co.
San Francisco, Cal..........Ditty Brothers
Seattle, Wash.........E. J. Woodison Co.
Toronto........E. B. Fleury, 1609 Queen St. West, Phone Park. 6700

BLYSTONE MANUFACTURING CO.

819 Ironton Street Cambridge Springs, Pa.

OSBORN



Direct Draw Roll-Over Jolt Machines

The above picture shows a floor of Cylinder Head Moulds. This big, daily production is made possible by an Osborn No. 403 Direct Draw Roll-Over Jolt Machine. Three men are used on this job. The size of the flask is 27" x 16½" with a 7" drag, and 3½" cope. This mould produces two castings, each weighing thirty-eight pounds.

Osborn Roll-Over Machines are highly recommended for difficult work on which there is considerable duplication, particularly on long runs. Two patterns of the same, or somewhat different heights, can be used side by side when desired to do so, using separate bottom boards and flasks. These machines are automatic, simple in design, and are noted for their large production, and low upkeep costs.

THE USE OF THESE MACHINES—

(1) Reduces direct moulding cost
(2) Insures rapid production.
(3) Accelerates delivery.
(4) Effects savings in metal.
(5) Lowers overhead per ton.
(6) Reduces grinding cost.
(7) Lessens pattern repairs.
(8) Creates larger labor market.

ROLL-OVER JOLT MACHINES
made regularly in the following sizes:

No. 399 Table size 20 x 30 inches
No. 403 Table size 30 x 37 inches
No. 404 Table size 30 x 49 inches
No. 405 Table size 39 x 61 inches
No. 406 Table size 48 x 72 inches
No. 407 Table size 48 x 92 inches

THE CLEVELAND OSBORN MANUFACTURING CO.

INCORPORATED

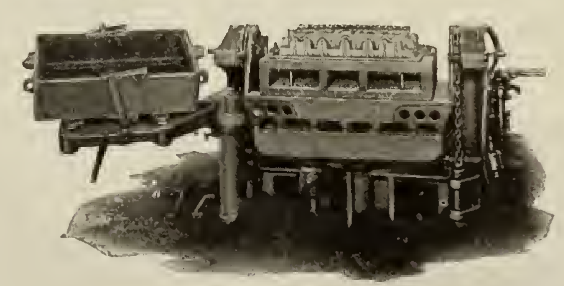
Please Address Replies to Main Offices or Branches to Dept. C.

5403 Hamilton Avenue Cleveland

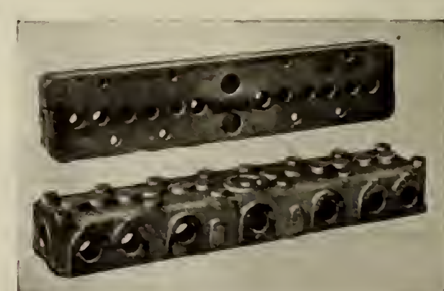
NEW YORK
3rd Avenue at 35th St., Bush Terminal, Bldg. No. 5
BROOKLYN

SAN FRANCISCO
61 First St.

CHICAGO
155 No. Clark St.



No. 403—Osborn Direct Draw Roll-Over Jolt Machine



Cylinder Head Casting

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

Foundrymen's Convention Sept. 30-Oct. 3, 1919

Commercial Museum Building, Philadelphia, where the twenty-fourth Annual Convention of the American Foundrymen's Association will be held.

IN selecting Philadelphia as an appropriate place wherein to hold the Annual Convention and Exhibit of the American Foundrymen's Association in conjunction with the Institute of Metals Division of the American Society of Mining and Metallurgical Engineers, the aim was to secure a location convenient to visitors from across the Atlantic and at the same time not too remote from the foundry centres of the United States and Canada. Several delegations of British, French and other European foundrymen will be present as will also be practically all the foundrymen in the United States and Canada.

On Historic Ground

Unusual historical interests are attached to this convention, since it was at Philadelphia in 1896, that the American Foundrymen's Association was organized as a result of a movement led by the Philadelphia Foundrymen's Association at that time.

The convention was held in Philadelphia a second time in 1907, but since that time many changes have taken place in the city and vicinity and many things of interest to foundrymen have been constructed and developed. Among these might be mentioned the great plant at Hog Island, the new foundries at League Island Navy Yard, and those of the Westinghouse Company at Essington.

Philadelphia's Real History

Apart from being a great foundry, commercial and manufacturing centre, Philadelphia's history is bound up with that of the American Republic. It was there in September, 1775, that the first continental congress assembled prior to the revolutionary war. It was there also that Thomas Jefferson wrote the Declaration of Independence, and it was there that it was signed on July 4th, 1776.

Philadelphia was the capital of the United States until the year 1800.

Philadelphia was founded by William Penn in 1682, the site and region having been previously settled and contested by Swedish, Dutch, and English colonists.

Philadelphia as a City

Philadelphia is a metropolitan city, and one of the great cities of the world. It is situated on the Delaware and Schuylkill rivers, 90 miles south-west of New York. and 138 miles north-east of Washington. It has more owners of real estate than any city in the United States. It has a water frontage for piers and docks of 38 miles. The city is laid out on a gently sloping plain, rising from the Delaware, and on both sides of the Schuylkill, in regular squares or blocks, with streets from 50 to 120 feet wide, the blocks numbering west, from the Delaware and north and south from Market Street, 100 numbers to the block, regardless of the actual number of the buildings.

The Great Centennial

In 1876, the year memorable in the annals of the Republic as the 100th anniversary of the Declaration of Independence, a great centennial exhibition was held in Fairmount Park, Philadelphia, and buildings costing over $5,000,000 were erected.

Parks

Fairmount Park, containing 2,791 acres, is laid out along the Schuylkill, and is one of the largest and most beautiful parks in the world. It contains a zoological garden of 33 acres and other natural history collections, including specimens of most of the known minerals, some thousand varieties of plants and innumerable species of fish and birds. The park has 50 miles of carriage drives, 100 miles of by and bridle paths and 6 miles of river border on the Schuylkill, along which steamboats ply, besides a water course for row boats 2 miles long on the Wissahickon Creek.

Stenton Park and Bertram's Garden, the latter being the first botanical garden established in America, are also interesting parks.

Historic Buildings

Philadelphia is rich in buildings and points of interest that represent early history. Independence Hall is the most notable of these. It fronts on Chestnut St., having Independence Square in the rear. It was finished in 1734. The wings, extending to Fifth and Sixth streets, are modern. In 1744, most of the wood work of the old steeple was taken down, leaving only a small belfry to cover the town clock. In this hall the continental congress met in 1775, and Washington was appointed at the head of the colonial army; and here on July 4th, 1776, the Declaration of Independence was adopted. Other points of historic interest are the old Swede's Church, the first building erected on the site of the city; Christ Episcopal Church, where Washington attended, and where the remains of Benjamin Franklin and Robert Morris are buried; Carpenter's Hall, where the first congress met; the old building on South Street that was the first American theatre; William Penn's house, now preserved in Fairmount Park, and the site at the corner of Seventh and Market streets, where stood the house in which Jefferson wrote the Declaration of Independence.

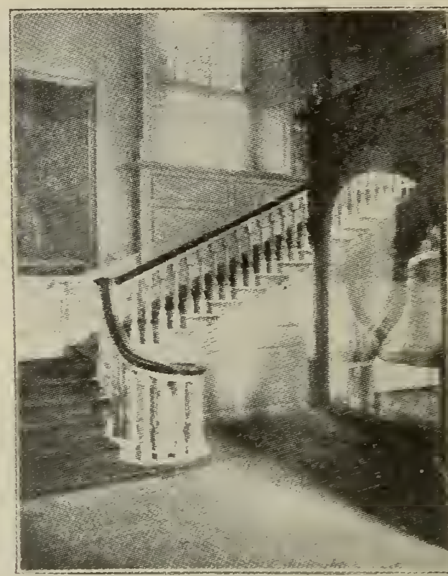
Notable Modern Buildings

Among the notable buildings of Philadelphia comes first the City Hall, which was some 20 years in the process of erection, at a cost of $16,000,000, and is one of the most remarkable buildings of the world. The tower, completed in 1894, is surmounted by a bronze statue of William Penn, 37 feet high, the head of the statue being 547 feet above the pavement, higher than any steeple on earth. The sides of this building are 470 by 486½ feet. Other fine buildings are the Masonic Temple, opposite the City Hall; the new postoffice, considered the best in the United States; the custom house, of white marble, built after the model of the Acropolitan Parthenon; the U.S. Mint, the Gerard Bank, the Pennsylvania Railway Station, and the Bourse, erected in 1894, as a building for the exhibition of Philadelphia's products of all kinds, containing 400 offices, and a hall 250 by 125 feet in dimensions.

WM. PENN'S MANSION, FIRST BRICK HOUSE BUILT IN PHILADELPHIA.

Public Libraries

Philadelphia is rich in public libraries. Among them the Philadelphia Library, founded by Wm. Penn, and the oldest in America, contains over 100,000 volumes and not



STAIRWAY TO SECOND FLOOR, INDEPENDENCE HALL. ALSO SHOWING LIBERTY BELL.

many years ago moved to a new building, which is one of the finest library buildings in the United States. The Mercantile Library contains 150,000 volumes, and has the largest circulation of any. The Ridgway branch of the Philadelphia Library contains 500,000 volumes; it is a granite building of the Doric order, with dimensions of 125 by 220 feet. Other notable libraries are the Franklin Institute's, the American Philosophical Society's and the Pepper Free Library. In all there are more than 100 libraries, either free or easily accessible to the public.

From its earliest history, the city was enterprising in providing educational facilities. Schools, academies, colleges and universities are in abundance. Churches of every denomination are here.

Commerce and Manufacture

In commerce and manufacturing, Philadelphia ranks among the first cities of the world. To describe it would be out of the question.

Philadelphia as a Foundry Centre

PARTICULARLY fortunate are those who will attend the Inter-Allied Foundrymen's Convention and Exhibition at Philadelphia during the week of Sept. 29. Philadelphia, the third city of the country in population and the second greatest seaport of America, is third in the roll of cities operating foundries. Counting the territory in the immediate vicinity, probably more castings are produced in Philadelphia than in any other community in the United States. There are 133 foundries which belong to Philadelphia. These include 74 which melt brass or other non-ferrous metals either exclusively or as an adjunct to other main manufacturing processes, and 15 steel casting plants of great size and capacity. One steel company in the environs of the city produces ingots, castings, forgings and rolled products. Directly preceding the war this company made over 2,200 tons of acid and 6,500 tons of basic open-hearth steel castings per annum in addition to 9,000 tons of iron and 30 tons of bronze castings for plant use. Philadelphia leads the country in the production of hardware including springs, locks, mechanics' and household tools and appliances. The city manufactures annually over $40,000,000 worth of general hardware which is approximately 40 per cent. of the entire country's production. With nearly 75 miles of waterfront along two rivers, Philadelphia proved the ideal port for the construction of urgently needed tonnage during the war. The visitor at the twenty-fourth annual convention of the American Foundrymen's Association will be given opportunity to visit and inspect three of the largest commercial shipbuilding yards in the world, and in addition, Uncle Sam's navy yard at League Island, where recently completed steel and iron foundries embody some of the best modern practice in foundry design and operation.

The Foundrymen's Convention

Provisional Programme

Meetings, Bellevue-Stratford Hotel, Philadelphia
Exhibition and Registration at the Commercial Museums

Monday, September 29

10.00 A.M.—Opening of Exhibition of Foundry and Shop Equipment, Commercial Museums.

Tuesday, September 30

10.00 A.M.—Opening joint session with Institute of Metals Division of American Institute of Mining Engineers, Ball Room, Bellevue-Stratford Hotel.
11.30 A.M.—Opening session, A. F. A., Ball Room, Bellevue-Stratford Hotel.

Wednesday, October 1

10.00 A.M.—General Session, Ball Room, Bellevue-Stratford Hotel.
10.00 A.M.—Steel Session, Clover Room, Bellevue- Stratford Hotel.

Thursday, October 2

10.00 A.M.—Gray Iron Session, Ball Room, Bellevue-Stratford Hotel.
10.00 A.M.—Malleable Session, Clover Room, Bellevue-Stratford Hotel.

FIRST EPISCOPAL CHURCH, WHERE WASHINGTON ATTENDED, ROBERT MORRISON ARE BURIED.

OLD SWEDE'S CHURCH, THE FIRST BUILDING ERECTED ON THE SITE OF THE CITY.

10.00 A.M.—Industrial Relations Session, Red Room, Bellevue-Stratford Hotel.
7.00 P.M.—Annual Banquet, Bellevue-Stratford Hotel.

Friday, October 3

10.00 A.M.—General Session, concluding with Installation of Officers, Ball Room, Bellevue-Stratford Hotel.

The Technical Programme

The Committee on papers has provided an unusually extensive and interesting technical programme. Sessions devoted specially to steel, malleable and gray-iron foundry problems will be held. In addition a large number of papers on general foundry subjects will be presented including a group of papers on apprenticeship and the broad aspects of the question of industrial relations. The papers and reports to be presented are as follows:

Annual Address of the President, A. O. Backert.
Annual Report of the Secretary-Treasurer.
Annual Report of Board of Directors of A. F. A., Inc.
Report of A. F. A. Committee on Foundry Costs, by J. Roy Tanner (chairman), Pittsburgh Valve Foundry & Construction Co., Pittsburgh.
Publicity Work of Foundry Equipment Manufacturers' Association, by Franklin G. Smith (chairman), publicity committee, Foundry Equipment Manufacturers' Association, Cleveland-Osborn Mfg. Co., Cleveland.
A Note on Britain's Experimental Foundry, by G. Ernest Wells, Edgar Allen & Co., Sheffield, England.
The Elimination of Strains in Iron Castings, by C. J. Wiltshire, General Electric Co., Schenectady, N. Y.
The Value of a Scrap Pile, by Henry Traphagen, The Toledo Steel Castings Co., Toledo, O.
The Electric Furnace as an Adjunct to the Cupola, by George K. Elliott, Lunkenheimer Co., Cincinnati.
Report of A. F. A. Committee on General Specifications for Gray Iron Castings, by Dr. Richard Moldenke, Watchung, N. J.
Side-Blow Converter in Iron Foundry, by George P. Fisher, Whiting Foundry Equipment Co., Harvey, Ill.
Cerium in Cast Iron, by Dr. Richard Moldenke, Watchung, N. J.
Oxygen in Cast Iron, Wilford L. Stork, Detroit Valve & Fittings Co., Detroit.

Steel Foundry Problems

Electric Versus Converter Steel, by John Howe Hall and G. R. Hanks, Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Effect of Sulphur in Steel Casting, by Professor A. E. White, University of Michigan, Ann Arbor, Mich.
Repairing Castings on Transport Northern Pacific, by

Arthur F. Braid, Metal & Thermit Corp., New York. (Illustrated with Motion Pictures).

Comparison of Costs of Electric and Open-Hearth Furnace Practice, by E. H. Ballard, General Electric Co., West Lynn, Mass.

Report of A. F. A. Committee on Steel Foundry Standards, by W. A. Janssen (chairman), Canadian Steel Foundries, Ltd., Montreal, Que.

Operation of the Acid Electric Furnace, by L. B. Lindemuth, Carney & Lindemuth, New York.

Temperature Control in Electric Furnace, by F. W. Brooke, Electric Furnace Construction Co., Philadelphia.

Investigation of Steel Castings on German Submarines, by Professor William Campbell, Columbia University, New York.

Malleable Foundry Problems

Burning Fuel Oil in an Air Furnace, by J. P. Pero, Missouri Malleable Iron Co., East St. Louis, Ill.

The Application of Powdered Coal to Malleable Annealing Furnaces. by Charles Longenecker, The Bonnot Co., Pittsburgh.

Efficient Use of Pulverized Coal in Malleable Foundry Practice, by Milton W. Arrowood, Ground Coal Engineering Co., Chicago.

Powdered Coal as a Fuel in the Foundry, by H. A. Grindle, Combustion Economy Corp., Chicago.

Relation Between Machining Qualities of Malleable Castings and Physical Tests, by Edwin K. Smith and William Barr, Wisconsin Malleable Iron Co., Milwaukee.

The Refining of Cupola Malleable in the Electric Furnace, by A. W. Merrick, General Electric Co., Schenectady, N. Y.

Report of A. F. A. Committee on Specifications for Malleable Castings, by Enrique Touceda (chairman), Albany, N.Y.

Methods for Determining When Malleable Iron is Over or Under Annealed, by W. P. Putnam, Detroit Testing Laboratory, Detroit.

Malleable Castings, by Professor Enrique Touceda, Albany, N. Y.

Effects of Annealing Gray and Malleable Iron Bars in Copper Oxide Packing, by H. E. Diller, "The Foundry," Cleveland.

Industrial Relations

Training Men for Foundry Work, by C. C. Schoen, Training Section, U. S. Department of Labor, Washington, D. C.

Personnel Problems of Modern Industry, by C. D. Dyer, Jr., Commercial Trust Building, Philadelphia.

Industrial Democracy and the Foreman, by John Calder, Business Training Corp., New York.

Report of A.F.A. Committee on Safety, Sanitation and Fire Prevention, by V. T. Noonan (chairman), U. S. Mutual Liability Insurance Co., Quincy, Mass.

Vocational Training for Foundry Occupations, by J. C. Wright, Federal Board for Vocational Education, Washington, D. C.

Safety Appliances and Welfare Works in Foundries, by F. G. Bennett, Buckeye Steel Casting Co., Columbus, O.

Handling Materials

How to Secure Best Results in Combining Hoisting Apparatus with Molding Machines, by W. C. Briggs, Shepard Electric Crane & Hoist Co., New York.

Foundry Sand-Handling Equipment, by H. L. McKinnon, The C. O. Bartlett & Snow Co., Cleveland.

Concrete Foundry Molding Floors, by H. H. Haley, American Foundry Equipment Co., New York.

The Care of Foundry Equipment, by G. L. Grimes, Grimes Molding Machine Co., Detroit.

Uniform Methods of Cost Accounting, by C. E. Knoeppel, C. E. Knoeppel & Co., New York.

The One Best Way to do Work, by Frank B. Gilbreth, Providence, R. I., (Illustrated by Motion Pictures).

The Testing of Clays for Foundry Use, by Homer F. Staley, Bureau of Standards, Washington.

The Economical Control and Handling of Patterns in a Large Foundry, by W. D. Jones, Canton Steel Foundry Co., Canton, O.

Progress in the Application of Electric Arc Welding, by Robert E. Kinkead, Lincoln Electric Co., Cleveland.

A New Cutting Gas, by Alfred S. Kinsey, Air Reduction Sales Co., New York.

Welding Castings of Different Metals and Different Sections, by George B. Malone, Bayonne Steel Casting Co., Bayonne, N. J.

Report of the A. F. A. Committee Advisory to the United States Bureau of Standards, by Richard Moldenke, Watchung, N. J.

High Temperature Cement for Lining Furnaces, by W. S. Quigley, Quigley Furnace Specialties Co., New York.

Considerations Affecting Brass Melting in the Gray Iron Shop, by Russell R. Clarke, Eagle Brass Foundry, Seattle, Wash.

The Weeks Electric Brass Furnace, by F. J. Ryan, Philadelphia.

Audible Signals in Foundries, by Professor Vladimir Karapetoff, Ithaca, N. Y.

CITY HALL, COVERING FOUR AND HALF ACRES AND COSTING, WITH FURNITURE, $25,000,000, TWENTY YEARS UNDER CONSTRUCTION.

Technical Sessions

The technical sessions for this Convention will be unusually interesting; the meetings of the American Foundrymen's Association will be held Tuesday, Wednesday, Thursday, and Friday mornings, at the Bellevue-Stratford Hotel, and the meetings of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers will be held at the Ritz-Carlton Hotel.

The exhibits will open at 10 a.m. Monday, September 29th, and will be open daily, closing at 5 p.m. Friday, October 3rd. The only evening opening will be on Tuesday, between the hours of 7 and 10.30. The annual banquet will be held at the Bellevue-Stratford, Thursday evening.

Those who have attended previous exhibits will be interested in the following figures by way of comparison, giving some idea of the magnitude of the Philadelphia Exhibit:

Space used at Atlantic City, 1915, 34,000 square feet; Cleveland, 1916, 38,000 square feet; Boston, 1917, 44,000 square feet; Milwaukee, 1918, 42,000 square feet; already taken for this year, 60,000 square feet. Total H.P. for operating exhibits in 1918, 300; necessary for this year, 700 H.P.

List of Exhibitors

The following is a list of the exhibitors who will be represented, together with the number of the booth which each will occupy. This list will give some idea of what those who attend will be privileged to witness. In looking over this list it would be hard to imagine anything in the way of foundry supplies and equipment which is not in evidence, and by consulting the number which succeeds each name it will be an easy matter to at once locate whatever it is most desired to see. The benefits to be derived from an exhibit such as this must be apparent to every foundryman.

Abrasive Company	Philadelphia, Pa.	8
Acheson Graphite Co.	Niagara Falls, N.Y.	75
Air Reduction Sales Co.	New York, N.Y.	320-2
Ajax Metal Co.	Philadelphia, Pa.	98-104
American Gum Products Co.	New York, N.Y.	65
American Kron Scale Co.	New York, N.Y.	10
American Man. Bronze Co.	Philadelphia, Pa.	38
American Oil & Supply Co.	Newark, N.J.	178
Amer. Wd. Work. Mchy. Co.	Rochester, N.Y.	289-90
Arcade Mfg. Co.	Freeport, Ill.	185-91
Armstrong Cork & Ins. Co.	Pittsburgh, Pa.	88
Arrow Forging & Tool Wks.	Chicago, Ill.	130
Asbury Graphite Mills	Asbury, N.J.	71
E. C. Atkins & Co., Inc.	Indianapolis, Ind.	2-4
Audubon Wire Cloth Co.	Audubon, N.J.	315
Austin Co., The	Cleveland, O.	3
American Tool Works	Cincinnati, O.	..
Booth-Hall Co.	Chicago, Ill.	168
Barrett Co., The	Chicago, Ill.	311
Bartley, Jonathan, Cruc. Co.	Trenton, N.J.	29-31
Berkshire Mfg. Co.	Cleveland, O.	160
Besly, Chas. H., & Co.	Chicago, Ill.	81-3
Birkenstein, S., & Sons, Inc.	Chicago, Ill.	34
Black Dia. Saw & Mch. Co.	Natick, Mass.	45
Blystone Mfg. Co.	Cambridge Springs, Pa.	..
Borgner, Cyrus, Co.	Philadelphia, Pa.	312
Brass World Pub. Co.	New York, N.Y.	30
Brown Instrument Co.	Philadelphia, Pa.	36
Browning, Victor R., & Co.	Cleveland, O.	193
Buch Foundry Equip. Co.	York, Pa.	230-2
Bullard Machine Tool Co.	Bridgeport, Conn.	322-3
Carborundum Co.	Niagara Falls, N.Y.	216
Champion Fdy. & Mch. Co.	Chicago, Ill.	269-71
Chase, Frank D., Inc.	Chicago, Ill.	91
Chesapeake Iron Works	Baltimore, Md.	341-3
Chicago Crucible Co.	Chicago, Ill.	101
Chicago Pneumatic Tool Co.	Chicago, Ill.	333-5
Cincinnaty Pulley Mch. Co.	Cincinnati, O.	329-30
Clark. Chas. J.	Chicago, Ill.	110
Cleveland Osborn Mfg. Co.	Cleveland, O.	361-4
Cleveland Pneumatic Tool Co.	Cleveland, O.	96
Clipper Belt Lacer Co.	Grand Rapids, Mich.	51
Coale, Thos. E. Lumber Co.	Philadelphia, Pa.	260-2
Combined Sup. & Equip. Co.	Buffalo, N.Y.	221
Combustion Economy Corp.	Chicago, Ill.	151
Collieries Sup. & Equip. Co.	Philadelphia, Pa.	318
Corn Products Refining Co.	New York, N.Y.	132
Curtis Pneumatic Mch. Co.	St. Louis, Mo.	198-200
Davenport Mch. & Fdy. Co.	Davenport, Ia.	271-0
Davis-Bournonville Co.	Jersey City, N.J.	287-8
Dayton Molding Mch. Co.	Dayton, O.	..
Debevoise-Anderson Co.	New York, N.Y.	141-3
Dings Magnetic Separ. Co.	Milwaukee, Wis.	127-9
Disston, Henry, & Sons	Philadelphia, Pa.	89-91
Joseph Dixon Crucible Co.	Philadelphia,	18
Electric Furnace Co., The	Alliance, O.	263
Electric Furnace Con. Co.	Philadelphia, Pa.	140
Emmert Mfg. Co.	Waynesboro, Pa.	43
Federal Foundry Supply Co.	Cleveland, O.	234-6
Foreign Crucibles Corp.	New York, N.Y.	223
Foundry Appliance Co.	Newark, N.J.	238
Foundry Equipment Co.	Cleveland, O.	237-9
Foundry Manganese Co.	Philadelphia, Pa.	316
Gardner Machine Co.	Beloit, Wis.	122-8
General Electric Co.	Schenectady, N.Y.	324-6
Geometric Tool Co.	New Haven, Conn.	..
Gordon, Robert, Inc.	Chicago, Ill.	245
Graceton Coke Co.	Graceton, Pa.	132-9
Grand Rapids Grind. Mch. Co.	Grand Rapids, Mich.	206-8
Great Western Mfg. Co.	Leavenworth, Kas.	114-6
Grimes Molding Mch. Co.	Detroit, Mich.	106
Hardy, Clement A., Co.	Chicago, Ill.	57
Hardy, F. A., & Co.	Chicago, Ill.	12
Harris, Benjamin, & Co.	Chicago, Ill.	5
Hauck Mfg. Co.	Brooklyn, N.Y.	136
Hausefeld Co., The	Harrison, O.	194-6
Haynes Stellite Co.	Kokomo, Ind.	166
Hayward Company	New York, N.Y.	212-4
Heald Machine Co.	Worcester, Mass.	254-6
Herbert, Alfred, Ltd.	New York, N.Y.	241-3
Herman Pneumatic Mch. Co.	Pittsburgh, Pa.	258
Higley Machine Co.	So. Norwalk, Conn.	..
Hoevel Mfg. Co.	Jersey City, N.J.	242-4
Holcroft & Co.	Detroit, Mich.	310
Hyatt Roller Bearing Co.	New York, N.Y.	97-99
Industrial Electric Fur. Co.	Chicago, Ill.	337
Ingersoll-Rand Co.	New York, N.Y.	175
Inter. Molding Mach. Co.	Chicago, Ill.	39
Interstate Sand Co.	Zanesville, O.	32
Iron Age	New York, N.Y.	15-17
Inter. Machine Tool Co.	Indianapolis, Ind.	..
Jennison-Wright Co.	Toledo, O.	20
Keller Pneumatic Tool Co.	Chicago, Ill.	215
Kellogg, Spencer, & Sons, Inc.	Buffalo, N.Y.	144
Kelly, T. P., Co.	New York, N.Y.	259
King, Julius, Optical Co.	Chicago, Ill.	61
Klaxon Co.	New York, N.Y.	181
Knoeppel, C. E., & Co.	New York, N.Y.	27
Kempsmith Mfg. Co.	Milwaukee, Wis.	..
Lane, H. M., Co.	Detroit, Mich.	172
Leeds & Northrup Co.	Philadelphia, Pa.	170
Liberty Supply Co.	Pittsburgh, Pa.	251
Liberty Steel Prod. Co., Inc.	New York, N.Y.	255
Lincoln Electric Co.	Cleveland, O.	338
Lindsay Chaplet & Mfg. Co.	Philadelphia, Pa.	211
Link Belt Company	Philadelphia, Pa.	90-2
Louden Machinery Co.	Fairfield, Ia.	78-80
Lupton's Sons Co., David	Philadelphia, Pa.	95
McCormick, J. S., Co.	Pittsburgh, Pa.	113-5
McCrosky Tool Corporation	Meadville, Pa.	41
McLain's System, Inc.	Milwaukee, Wis.	103
MacLean Publishing Co.	Toronto, Can.	22
Macleod Company, The	Cincinnati, O.	278-80
Magnetic Mfg. Co.	Milwaukee, Wis.	201
Mahr Mfg. Co.	Minneapolis, Minn.	203
Malleable Iron Fittings Co.	Branford, Conn.	240
Marden, Orth & Hastings Co.	New York, N.Y.	77
Mason, Arthur C., Inc.	Hawthorne, N.J.	205
Maxon Premix Burner Co.	Muncie, Ind.	6
Menefee Foundry Co., The	Fort Wayne, Ind.	112
Mercury Mfg. Co.	Chicago, Ill.	177
Metal Industry	New York, N.Y.	59
Metal & Thermit Corp.	New York, N.Y.	16
Mich. Smelt. & Refining Co.	Detroit, Mich.	138
Mifflin Chemical Co.	Philadelphia, Pa.	7
Milburn, Alexander, Co.	Baltimore, Md.	282
Mine & Smelter Supply Co.	New York, N.Y.	339
Monarch Eng. & Mfg. Co.	Baltimore, Md.	72-6
Monarch Machinery Co.	Philadelphia, Pa.	161-7
Mott Sand Blast Co.	New York, N.Y.	286
Mumford Molding Mch. Co.	Chicago, Ill.	158
Napier Saw Works, Inc.	Springfield, Mass.	162
National Engineering Co.	Chicago, Ill.	117-9
Nicholls, Wm. H., Co.	New York, N.Y.	153-5
Norma Co. of America	New York, N.Y.	49
Norton Co.	Worcester, Mass.	131-5
Oakley Machine Tool Co.	Cincinnati, O.	..
Obermeyer, S., Co.	Chicago, Ill.	66-70
Ohio Blower Co.	Cleveland, O.	180
Oldham, George, & Son Co.	Philadelphia, Pa.	169
Oliver Machinery Co.	Grand Rapids, Mich.	157-9, 118-20
Oxweld Acetylene Co.	Newark, N.J.	331-2
Pangborn Corporation	Hagerstown, Md.	264-76

Paxson, J. W., Co.	Philadelphia, Pa.	305-9
Penton Publishing Co.	Cleveland, O.	23-25
Pettinos, Charles E.	New York, N.Y.	222
Pettinos, Geo. F.	Philadelphia, Pa.	13
Philadelphia Grease Co.	Philadelphia, Pa.	207
Pickands, Brown & Co.	Chicago, Ill.	9-11
Pittsburgh Crushed Steel Co.	Pittsburgh, Pa.	224
Pittsburgh Furnace Co.	Milwaukee, Wis.	195
Pridmore, Inc., Henry E.	Chicago, Ill.	145-9
Portage Silica Co.	Youngstown, O.	182
Providence Gas Co.	Providence, R.I.	250
Quigley Furnace Spec. Co.	New York, N.Y.	40
Racine Tool & Machine Co.	Racine, Wis.	210-2
Railway Mechanical Eng.	Chicago, Ill.	53-5
Rainey, W. J.	Philadelphia, Pa.	24
Reed, Fears & Miller	Philadelphia, Pa.	..
Republic Creosoting Co.	Indianapolis, Ind.	179
Rich Foundry Equip. Co.	Chicago, Ill.	225-9
Richards Wilcox Mfg. Co.	Aurora, Ill.	33-5
Robeson Process Co.	New York, N.Y.	37
Rogers, Brown & Co.	Cincinnati, O.	62-4
Roots, P. H. & F. M., Co.	Connersville, Ind.	73
Sand Mixing Machine Co.	New York, N.Y.	231-5, 186-92
Sellers, Wm., & Co., Inc.	Philadelphia, Pa.	121-3
Shawinigan El.-Metals Co.	Cleveland, O.	317
Shepard El. Cr. & Hst. Co.	Montour Falls, N.Y.	82-86
Simonds Mfg. Co.	Fitchburg, Mass.	47
Skinner Bros. Mfg. Co.	St. Louis, Mo.	252
Sly, W. W., Mfg. Co.	Cleveland, O.	265-226
Smith, R. P., & Sons Co.	Chicago, Ill.	63
Smith, Werner G., Co.	Cleveland, O.	58-60
Spencer Turbine Co.	Hartford, Conn.	291
Standard Sand & Mach. Co.	Cleveland, O.	111
Stand. Shop Equip. Co., Inc.	Philadelphia, Pa.	171
Sterling Wheelbarrow Co.	Milwaukee, Wis.	218-20, 257
Strauss & Buegeleisen	New York, N.Y.	249
Sullivan Machinery Co.	Chicago, Ill.	292-3
Swan & Finch Co.	New York, N.Y.	184
Swind Machinery Co.	Philadelphia, Pa.	85
Tabor Mfg. Co.	Philadelphia, Pa.	294-300
Thomas Elevator Co.	Chicago, Ill.	164
Thomas Iron Co.	Hokendauqua, Pa.	183
Thompson, Lewis, & Co., Inc.	Philadelphia, Pa.	318
Truscon Steel Co.	Detroit, Mich.	1
United Compound Co.	Buffalo, N.Y.	219
United States Graphite Co.	Saginaw, Mich.	142
U.S. Molding Machine Co.	Cleveland, O.	197-9
United States Silica Co.	Chicago, Ill.	217
VanDyck-Churchill Co.	Philadelphia, Pa.	42-52
Vibrating Machinery Co.	Chicago, Ill.	336
Willson, T. A., & Co.	Reading, Pa.	209
Wadsworth, H. L.	Cleveland, O.	340
Wadsworth Cr. Mch. Eq. Co.	Akron, O.	176
Wangelin, Walter H., & Co.	St. Louis, Mo.	110
Wallace, J. D., & Co.	Chicago, Ill.	56
Warner & Swasey Co.	Cleveland, O.	327-8
Westinghouse El. & Mfg. Co.	Pittsburgh, Pa.	246-8
White & Bro., Inc.	Philadelphia, Pa.	26
Whitehead Bros. Co.	New York, N.Y.	261
Whiting Foundry Equip. Co.	Harvey, Ill.	105-9
Wood's, T. B., Sons Co.	Chambersburg, Pa.	69
Woodison, E. J., Co.	Detroit, Mich.	146-56
Whitman & Barnes Mfg. Co.	Chicago, Ill.	125
Young Bros. Co.	Detroit, Mich.	79

Remember that in addition to the meetings and exhibits Philadelphia, as has already been shown, has much of interest to visitors historically and industrially, and that attractive entertainment features are being prepared for Association members.

Registration

Members of the American Foundrymen's Association and their guests will register at the exhibition at the Commercial Museums, Thirty-fourth Street near Spruce Street. From Broad Street take Walnut Street cars to Thirty-fourth Street, about ten minutes' ride

Registration will commence at 10 a.m. Monday, Sept. 29, and continue throughout the week.

Entertainment Features

Philadelphia affords unusual opportunities for recreation, enjoyment and sightseeing. An attractive entertainment programme has been provided by the local committee, it being felt that an unusually large number will participate in the social features of the meeting this year due to the fact that this is the first convention in five years to be held under peace conditions. Special entertainment will be provided for the ladies and in addition a number of attractive joint affairs are planned. Special arrangements also will be made for visiting foundrymen who wish to inspect plants in Philadelphia and vicinity. The details of the entertainment programme are as follows:

Tuesday, September 30

2.00 P.M.—Boat ride on Delaware River viewing shipyards and large industrial plants, concluding with an inspection of the great Hog Island shipyard.

Wednesday, October 1

11.00 A.M.—Automobile trip for the ladies to Valley Forge where luncheon will be served.

2.00 P.M.—Golf Tournament, Whitemarch Valley Golf Club.

8.15 P.M.—Theatre party for ladies and gentlemen at Keith's.

Thursday, October 2

1.30 P.M.—Visit to Wanamaker's store, Curtis Publishing Co. plant and Independence Hall for the ladies.

7.00 P.M.—Annual banquet, ladies invited.

10.30 P.M.—Dancing at Bellevue-Stratford Hotel following the banquet.

Hotel Accommodation

Philadelphia, the third city in size in the United States, is not only replete with points of great historical interest and scenic beauty, but in addition is unusually well provided with modern hotel facilities. A committee on hotel accommodations has been organized by the Philadelphia foundrymen, of which H. W. Brown, Tabor Mfg. Co., Eighteenth and Hamilton streets, is chairman. Hotels may be communicated with direct to arrange accommodations. Following is a list of the principal Philadelphia hotels with rates for both single and double rooms for the American Foundrymen's convention. Owing to the large number which will attend the convention from all parts of the country, the reservation of hotel accommodations as far in advance as possible is recommended.

RITZ-CARLTON HOTEL, WHERE THE MEETINGS OF THE INSTITUTE OF METALS DIVISION OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS WILL BE HELD.

BELLEVUE-STRATFORD HOTEL, WHERE THE AMERICAN FOUNDRYMEN'S ASSOCIATION WILL HOLD THEIR MEETINGS, AND WHERE THE BANQUET WILL BE HELD.

Hotel	Room with Bath		Room without Bath	
	Single Room	Double Room	Single Room	Double Room
Adelphia, 13th and Chestnut Sts...	$4 to $6 and up	$8 and up		
Aldine, 19th and Chestnut Sts.....	$4 and up	$6 and up	$2.50 and up	$4 and up
Bartram, 33rd and Chestnut Sts..	$4	$5		
Bellevue-Stratford, Broad & Walnut	$5 to $7 and up	$9 to $11 and up		$5 and up
Bingham, 11th and Market Sts...		$3 to $3.50		$2.50 to $3
Belgravia, 1811 Chestnut St.	$4	$6		
Continental, 9th and Chestnut Sts.	$2.50 and up	$4.50 and up	$1.50 and up	$3.50 and up
Colonial, 11th and Spruce Sts.....	American plan	$3.50 and up		
Covington, 37th and Chestnut Sts.	Suites with bath, for 3 people, $15; for 2 people, $12			
Dooner's (Stag), 23 S. 10th St...	$3	$4	$1.50	$2
Green's, 8th and Chestnut Sts...	$3 and up		$2 and up	$3 and up
Hanover, 12th and Arch Sts.....	$3 and up	$3.50 and up	$2 and up	$3 and up
Irving, 917 Walnut St.	$3	$3	$1.50	$2
Lincoln, 13th and Locust Sts.....	$3 and up	$5.55 and up	$2 and up	$3.50
Little, 225 S. Broad St..........		$4 and $5		
Lorraine, Broad and Fairmont Av.	$3.50	$4.50	$2.50	
Majestic, Broad and Girard Ave...	$3.50 and up	$5.50 and up	$2 and up	$2.50 and up
Normandie, 36th and Chestnut Sts.	$3	$5	$2	$3
Powelton, 40th and Filbert Sts...			$1.50 to $2.50	$2.50 to $3
Reading, 12th and Market Sts....	$2 and up			
Rittenhouse, 22nd and Chestnut Sts	$3.50 and up	$4.50 and up	$2.50 and up	$3.50 and up
Ritz-Carton, Broad and Walnut Sts	$6 to $9	$8 and up		
St. James, 13th and Walnut Sts...	$3.50 and up		$2.50 and up	
Stenton, Broad and Spruce Sts.....	$4	$4.50 and up	$3	$3.50 and up
Strathmore, 1208 Walnut St. ...		$5	$1.50	$3
Tracey, 36th above Chestnut St...	$3	$4	$2	$3
Vendig, 13th and Filbert Sts..	$3.50 to $5	$4.50 and up		
Walton, Broad and Locust Sts.....	$4.50	$5.50 and up	$3 and up	
Windermere, 224 S. Broad St.....	$3	$4	$1.50	$2.50
Windsor, 1217 Filbert St.	$2.50 to $3	$3 to $4	$1 to $3	$2 to $3

BEEBE PLAIN, VERMONT, AND BEEBE PLAIN, QUEBEC

WITHOUT parallel or counterpart in any other spot on earth, the quaint little structure portrayed in our illustration stands unique, in that it is the only one of its kind known to man; yet it stands as a lone monument in the wake of civilization and civilized laws. The building itself tells no story, being typical of many others, but the signs over the doors tell a tale worthy of note. On the one is inscribed the words, "Beebe Plain, P. Q.," and on the other, "Beebe Plain, Vermont," showing conclusively that it is an international building, if not an international post office. The lesson to be learned is that civilization requires only just laws, strictly enacted, both national and international.

Who would exchange this little dual structure for all the forts, and arsenals and cannons in the universe?

Beebe Plain, Quebec, is a quiet little town of not many hundred inhabitants, and Beebe Plain, Vermont, is a similar little community, but peaceable and contented they live side by side, each attending to its own affairs and each having its own post office, although both are housed under the one sheltering roof. There are few places on the boundary line where this could be conveniently effected and probably fewer where it would be any advantage, but it should be an object lesson to the world, showing what can be done by peace-loving people. Three thousand miles of boundary line divide our Dominion from the great republic to the south of us, and this is a sample of the way in which it is defended.

Along the Niagara frontier and similarly situated places may be seen a few old relics of a hundred years ago, but only preserved as relics or souvenirs of the past.

On each side of the boundary is a peace-loving people, each having its own institutions and ideals, and each proud of its accomplishments, but free from petty jealousies on either side. On the contrary we are proud of each other and proud to be neighbors, as was evidenced by the thousands of American visitors who attended our great Canadian National Exhibition in Toronto, which has just completed the most successful season in its history, both as regards quality and quantity of exhibits and number of attendants. So also will the great American Foundrymen's Convention, which will be held at Philadelphia during the week of Sept. 27, be by far the greatest in its history and attended by the greatest number of Canadians, as well as American and European visitors.

BEEBE PLAIN POST OFFICE. THE ONLY BUILDING IN THE WORLD HARBORING THE POST OFFICES OF TWO NATIONS.

Before taking leave of our little emblem of peace and good will (the post offices of Beebe Plain), let us look once more upon it with its little assemblage. In the auto sits the genial postmaster of Beebe Plain, Canada, Mr. M. P. Dixon, together with his wife and family, while on the platform are to be seen representatives of the offspring of Uncle Sam's citizenship, together with some of our own Canadian juveniles. Little are these youngsters thinking of nationality. Neither do they realize that they

Continued on page 68

Convention-alities of a Former Convention

Being the Authentic Account of a Trip to the Foundrymen's Convention and Little Jimmie's Bicycle.

By "CONVENER"

THE years of grace 1912-13 were not, as most foundrymen will remember, remarkable for any great pressure of business in the engineering world. You could, of course, get contracts if you tendered low enough, and when your estimating department had raked up an order for you at a less price per lb. f.o.b. the cars than iron costs at the cupola spout to-day. If you were superintendent of the casting you usually contracted brain trouble trying to devise a means of turning out the job on a paying basis.

Of such a nature was the pile point casting shown in cross section at Fig. 1, a simple bee-hive affair, with a small flange round its outside diameter a couple of inches from the open bed, weighing ninety pounds each. That is to say, the customer stipulated that he would pay for ninety pounds of metal in each casting, and no more. The manufacturer could have made them a little heavier if he felt like it, and there would be no complaint, but payment to be for ninety pounds only. The first order was for five hundred pieces, with no prospect of a repeat, and after a council of war as to the respective merits of a metal pattern leaving its own core, or a wood block pattern and dry sand core arrangement, the latter method was decided on as being the best, in view of the fact that only partly skilled men would be entrusted with the job.

And so the pattern was rigged up on a stool follow board, with shallow drag and deep cope parts, two bars in each

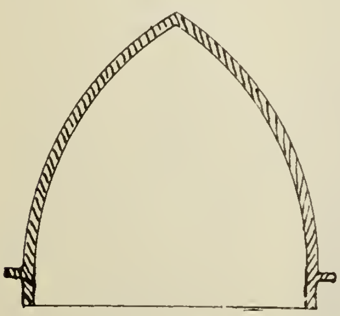


FIG. 1—CROSS SECTION OF PILE POINT.

cope, poured in one corner at the parting, the grate being cut in the flange and a heavy conical riser, as indicated in the sketch of the finished mould at Fig. 2. Two improvers, by valiant effort, turned out sixteen castings per day between them, keeping a coremaker very busy handling the sixteen cores in the ten hours then constituting a working day. Overhead charges, deductions on bad work account, and other incidentals considered, the company just about broke even on the contract, the chances for a nice profit being altogether overlooked, and the job, pattern and rigging being relegated to the limbo of forgotten things, just as the foundrymen's convention at Buffalo came along, and with it, or just before it, a change in the foundry supervision. Now, the new superintendent, from a variety of causes, chief amongst them being a good

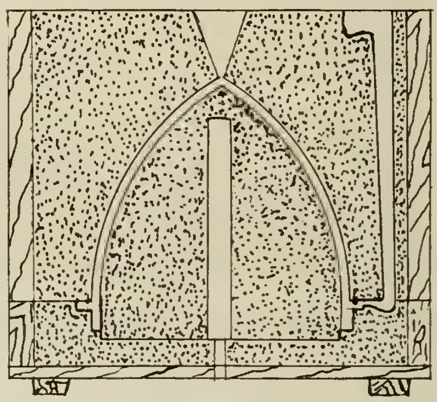


FIG. 2—HOW IT APPEARED IN THE MOLD.

line of work to drop into, and former acquaintance with the powers that were, made good, and took the eye of the general manager, or great mogul, or "G. M.," as hereafter designated, with the consequence that he was, for being a good boy, promised a trip to Buffalo when the time for the convention arrived, the promise, it so happened, being handed out the same day as another order for one thousand pile points, at the same price per lb., and observing the same general conditions as before, save that the customer insisted on a delivery of twenty-four castings daily, instead of sixteen, as in the previous order.

So the boss had more boxes made, two extra patterns, two extra follow boards, additional bottom boards, clamps, set gates, and everything else needed, put the coremaker and a helper on overtime to cope with the demand; packed his suitcase, and slipped over the line to Buffalo via Niagara Falls, making a bee-line, after registering at the Statler, for the Armories on Broadway. The first glad-hand was tendered by CANADIAN FOUNDRYMAN at its booth, almost in the centre of the big building, gaily decorated with flags and copies of the current issue of the paper in its pale blue cover of those days, followed by a tour of inspection of the many types of labor-saving devices on view, most of them giving demonstrations of economy and rapid output.

Then came a sudden stop and attention to the activities of a small jolt ramming machine, with table 15 in. x 15 in., operated by a salesman who was turning out cores at the rate of about one a minute, each square core being a cube measuring about eight inches every way. Here was the "dernier cri" in equipment for the pile point and similar propositions, visions of a cut in cost were quickly followed by a deal and an order by telegraph for delivery from stock of one machine in good order, etc., accompanied or preceded by an explanatory blueprint. Verb. sap. All conditions were duly filled, the machine arriving at the works the same day as the purchases and after an installation and initiation lasting five hours (a small percentage of that time being devoted to shocking language every time the pipe wrench slipped and damaged the erector's fingers) we started to jolt cores in the regulation core box mounted on a stool arrangement as illustrated at Fig. 3.

And now little Jimmie enters the limelight. He had since leaving school three months before devoted his efforts to the production of one-inch, two-inch, and most other inches, round stock core, mixed with the cake and slot cores that the youngest apprentice is heir to, his princely remuneration being ten cents

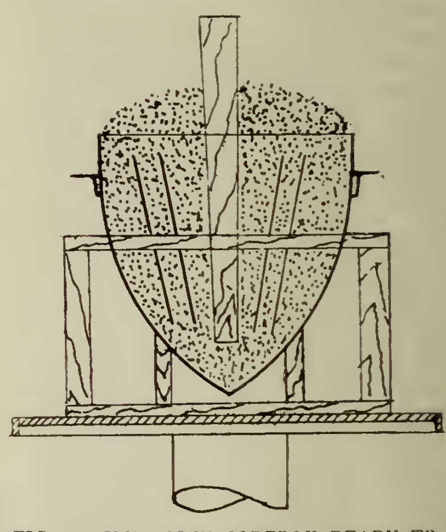


FIG. 3—PILE POINT COREBOX READY TO BOLT ON MACHINE TABLE.

an hour as a beginner, and was as fed up with stock cores as the average apprentice knows how to be. He watched the boss demonstrating the value of the new machine (that word should have a big "D" Mr. Printer). for the edification of the G. M., and when the coast was clear, that gentleman having retired to his habitat, presumably to measure up the safe on account of the uncertainty of its sufficient ability to hold the future increased profits, pounced on his innocent victim, the manner of his attack being as follows:

"I wanna buy a bike."

"Well," answered the boss, "what about it?"

"Lemme make the pile point cores on this machine, an' gimme a bonus? I can keep the job going."

"How many a day can you turn out?"

"Thirty, I guess."

"Go to it, Jimmie. A dollar extra every day you make thirty, and extra pay in proportion for all above thirty."

And it was so. The first day he made twenty-four, besides smashing a few by way of getting into his stride, and afterwards he made thirty-nine, besides carrying a few on stock for emergencies. The three moulders on the job showing an amazing increase in speed as soon as a nice piece work price was offered, each making thirteen per day as against a former eight. They came in one hour earlier in the morning, a couple of special charges being put in the cupola first for their convenience, about fifteen hundred pounds being taken to them in a crane ladle three times, to secure a high pouring temperature, each man taking his turn at first, second, and last cast, the last man each day being usually out of the shop by four-thirty, the richer in pocket by about seventy-five per cent. above their regular day work rate.

The customer was mildly surprised on receiving the full shipment of one thousand castings in about five weeks and ordered two thousand more immediately to meet the requirements of a forthcoming contract.

Summing up the situation, the company, from the net profit on the whole quantity, got the machine for nothing, plus the expense of the foreman's trip to the convention, besides a substantial balance of profit, the foreman derived pleasure from the outing, while the city and environs became the richer by one speed maniac who tore off miles and incidentally his trouser legs, much quicker than his mother could keep them mended. So to my readers, as foundrymen, in conclusion I would say, to proprietors, if you have never yet done so, send your foundry superintendent or foreman to the big show, give him a chance to see if anything there will suit your needs, particularly if you manufacture repetition work; if he does not see anything worth buying he will almost certainly see ideas he can bring back and use at home, and, anyhow, Mr. G. M., you will admit, that for running a foundry he needs a holiday.

TWO SIDES TO THIS QUESTION

To the Editor: I frequently see an article in your paper about reading technical and other papers, and becoming as enlightened as possible, and I wish to point out to you that you are only looking at one side of the story, and will ask you to put yourself in the boss's place and see how you would feel about it. Now, supposing you had saved up a little money and had invested it in a foundry and had adopted a line of work which did not call for a very high degree of skill on the part of the molders. And supposing you had been successful in securing a lot of foreign laborers who could neither read nor write, nor talk English, and who had come from a part of the world where comforts were unknown. And supposing you had, through a process of signs and gesticulations, succeeded in educating them to such an extent that they could temper the sand as good as the best molder in the world and could also shovel it into the flasks and ram it all right, and after this lesson was thoroughly mastered you had still taken a keen interest in their welfare and proceeded to show them how they could do two days' work in one day by simply making each movement in half the time usually employed on it, you would certainly feel justified in thinking that you were doing your duty toward the poor stranger who had wandered into your fold.

And supposing that after you had gone to all of this trouble and inconvenience you had taken them into your confidence and had shown them how you had been spoiled; how your parents had made the mistake of bringing you up to a lot of extravagant ideas in the way of eating and dressing, which was entirely unnecessary and even injurious. You felt it your duty to warn them against falling into the same error, and you even went so far as to prescribe a diet, which, if strictly followed, would sustain life by the expenditure of very few cents per day, and by dressing in a similarly simple manner it would be possible to live on a comparatively small wage and have all the comforts which they ever had in their native land and at the same time have the additional satisfacton of living in this democratic country, where one man is just as good as another, and everybody has the same chance. Now as I was about to say, after you had done all this for your men, you would certainly consider it unjust for some of the busy-bodies about the neighborhood to lay for these men after hours when they should be in their beds enjoying the rest which they so much required, and drag them up to some night school and endeavor to lead them away from the realization that they owed a duty to their native tongue and should insist on learning them the English language.

But, of course, you would be powerless to interfere, being as it was after their long day's work was over.

However, there is a limit to one's toleration, and if these fellows for whom you had done so much persisted in frequenting these night schools until they could converse in the language of our country just about as fluently as you could yourself, how would you like it to have some fellow deliberately walk through the door of your private property during the noon spell, when your men were eating their lunch, and persist in showing them a copy of a paper, which he could let them have all the year around for about a dollar, and which, if carefully read, and the information thus gained should be added to the abundant store of knowledge which you had already given them for nothing, they would be in a position to forget that they were under any obligation to you for your kindness and could go elsewhere to some job, where the work would be more interesting and the remuneration more satisfactory?

I will venture to say that you would not stand for it, and that you would arrange things so that trespassers would not get in during the noon hour. And I will also make a guess that if any of these information bureaus should try to gain access by way of the office you would make short work of letting them know where they got off at. Of course, if you were running a shop where the men needed to know anything you would be glad to have them read and you would perhaps supply them with such material as the trade papers, but it all depends on circumstances.

Now, leaving all jokes out, there are manufacturers who would actually stand in the way of their employees becoming capable of taking a better position, from a purely selfish standpoint, but there are a far greater number who would gladly assist them to become more proficient if the men themselves would show any inclination to read and study. There are mistaken views, no matter which side we look from. There are jobs which require very little skill, and if a man quits one of those jobs, it is an easy matter to replace him, as there is always a superabundance of that class of men, and the employer who stands in the way of an ambitious workman is certainly an undesirable citizen. On the other hand, the workman who thinks that the sweat-shop workman is going to drive him off the market, is equally as far astray.

As long as the world remains there will be work, and as far as the foundry is concerned it will be better every year. Molding machines are an absolute necessity if we intend to hold our own with the outer world, but they do not drive men off the market; on the contrary, they bring work. But the man who prefers hand-work will always find plenty to do. The biggest trick which the foundrymen will have to contend with in the future will be to get men to do the hand work. For my part, I would advise every employer to encourage his men to study, and I would also advise the men to avail themselves of every opportunity to become more adept workmen.

SOMETHING TO WORRY ABOUT

"You used to hate work."

"I hate it yet," replied Plodding Pete. "But I'm goin' to keep at it. If you get in the habit o' loafing now, some members of the I.W.W. is liable to step up any minute an' call you 'brother.' "—Toledo Blade.

Moulding and Casting a Turbine Water Wheel

A Water Wheel is a Queer Looking Casting, But is Not Particularly Different From Many Other Jobs, Once the Proper Equipment is Secured

By F. H. BELL

THERE is, perhaps, no more crooked or more complicated looking casting for the molder to tackle than that of a turbine water wheel, yet, when properly designed and the patterns properly made, it is not a difficult matter for any good molder of ordinary ability to be successful in turning out castings of this sort.

It is not likely that many molders will ever be called upon to mold water wheels, but the principles involved in molding a piece of this kind will frequently be of service to the man who follows up general jobbing in the foundry.

Water wheels, while perhaps not in as common use as some other lines of machinery, are still used to the best of advantage where water power is available, and when once installed the expense in connection with furnishing power is practically nil.

Water power is probably the oldest

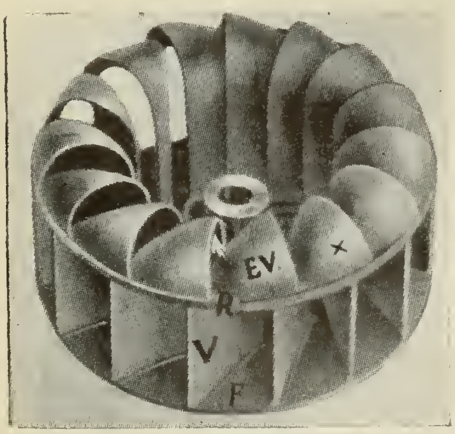


FIG. 1—MAIN CASTING OF A TURBINE WATER-WHEEL.

power known to mankind, but the mode of harnessing the water and putting it to actual work for all there is in it has been radically changed during the last few decades from what it was in days of old. The pictures shown in story books of a wheel of large dimensions, so situated as to have the tips of the blades or buckets projecting into a moving stream, or of a similar wheel so placed at the bottom of a water-fall as to allow the water to strike the tips from above, is about the generally accepted idea of a water wheel, but it is far afield. A turbine water wheel, as built now-a-days, consists of what is to all intents and purposes a section of an augur encased in such a manner as to allow the water to pass through it, the dead weight of the water being the motive power.

Water wheels have now reached such a state of perfection that they can be regulated to as great a degree of accuracy as the steam engine. When not in operation the gates in the casing are closed, but when about to be used the gates are opened from any convenient place with the same ease as in starting an engine. If required to be used where the load is changeable, automatic governors are used. From this it will be seen that the water wheel is keeping pace with other forms of power equipment.

In Fig. 1 will be seen what is of real interest to the foundryman. This is the water wheel proper with all the frills removed. It is made of cast iron or semi-steel, and is all cast in one piece. It is made in green sand entirely with the exception of the core through the centre of the hub.

As will be noted, it consists of two flanges, or, more properly speaking, one flange and one ring, between which the vanes or paddles are situated, and beyond the flange, which we have designated as the ring, are the ends of the vanes, which somewhat resemble scoops. In order that the molder will understand the different parts by name, we will call the flange by the name of F, the vanes we will call V, the ring flange we will name R, and the scooped end of the vane we will designate as E V, meaning end vane.

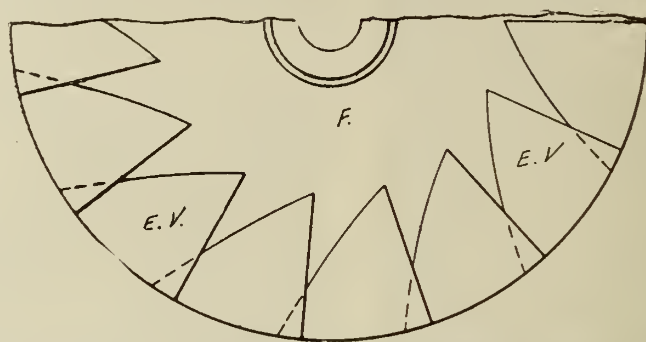


FIG. 2A—SHOWS PLAN VIEW OF HOW PATTERN WOULD LOOK WHEN LYING ON THE HOLLOW-BOARD.

In Fig. 2 will be seen the different parts in the order in which they would be placed when beginning to ram up the mold. This casting will be poured with the flat side up, but will be rammed with the reverse side up and rolled over.

A smooth board is bedded on the floor the same as for a washer or any flat-backed job, and on top of this the flange F is placed, but previous to this the vanes V are all screwed securely to the flange F and the ring R is also fastened in its place with screws. (The end vanes E V are simply held in place by means of dowel pins, and will not be put in their place until after the rest of the pattern is rammed in.)

The cheek of the flask is now put in place and this part of the mold is ram-

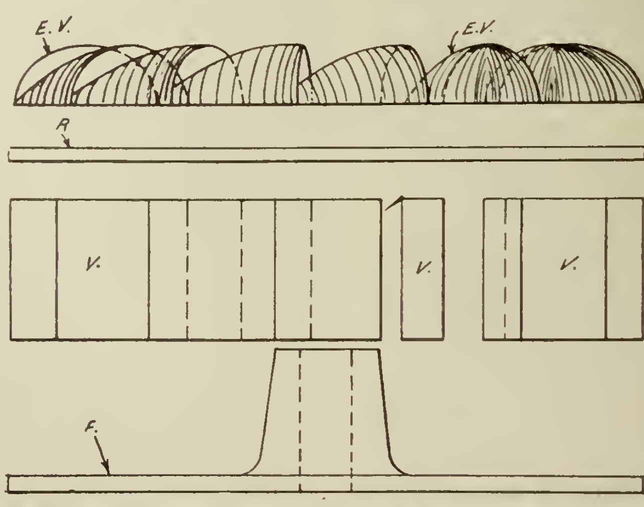


FIG. 2B—SHOWS ORDER IN WHICH PATTERNS WOULD BE PLACED AS THE WORK PROCEEDED.

med up, which is by the ordinary process of tucking and rodding and venting. A flat parting will be made right across the entire mold before putting the section patterns E V in place. After slicking the parting and putting on parting sand, the E V patterns are put into place and each pocket is made up separately. The pockets are secured by means of anchor irons similar to Fig. 3. These anchors not only project into the pocket, but also extend beyond a portion of the next E V in order to make sufficient weight to counterbalance what will be overhanging when the mold is rolled over. When these are completed and the partings made on them, the next part of the mold will be rammed up. This part we will have to call the nowel, although it is for the time being a real cope, all barred to fit the pattern. When this part is rammed up it is lifted off and finished. The patterns E V are drawn and this portion of the mold is finished. The drawing of these patterns is something of a chore. As will be seen, it would not be possible to draw the first one without first removing one of the anchors, and it would be equally as impossible to remove the anchor without first removing one of the patterns. This might appear at first to be a deadlock, but it is not, because "Where there is a will, there is a way," and the way this is done is to cut away some of the sand from one of the anchors in order to facilitate the removal of one pattern. It will be understood that in order to draw these patterns it will be necessary to lift away one of the anchors every time a pattern is drawn so as to allow the next pattern to be drawn. After a couple of patterns and anchors have been drawn, it will be a simple matter to replace the first one and make up the sand which was taken from the anchor, after which it will be plain sailing right around the mold. It is not necessary to have all the anchors out at the same time; as soon as one section is in proper shape the anchor may be replaced and the joint slicked over. It will be seen that these skeleton anchor irons answer the purpose of holding the sand together while the sand is being handled outside of the mold, and also to keep it from sagging down when the mold is turned over. After this part of the work is finished and the ring pattern R is unscrewed and drawn, the cope (or drag-cope as we might call it) is replaced and the bottom board bedded on, clamped up and rolled over.

The parting being attended to, the cope proper is now rammed up and lifted away. The screws are withdrawn from the flange F, leaving each vane free. The flange F is now drawn, and any tucking, nailing or needle venting which is required can be done, after which the the vane patterns V are drawn separately and the mold finished in the usual manner.

This casting will be gated on the hub and poured from one ladle. If reasonable care is exercised there is very little cause for defective work. Of course, no carelessness can be permitted. No loose corners or soft spots should be overlooked. Every molder will know that the design of the casting is such as would call for considerable venting, crosswise and in every direction. This, of course, required to be done while the patterns are still in the sand as much as possible. Some venting and scoring may be done before drawing the flange F, but this must be done cautiously, remembering that the patterns E V are already removed and that the sand is hanging. It would be an easy matter for a mold of this description to scab and quite possible for it to blow up, but this can only be traced to bad management.

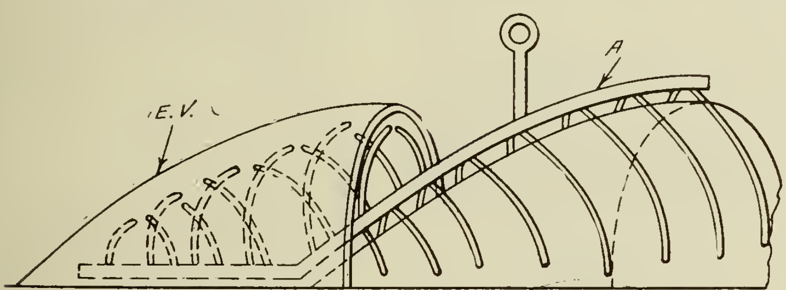


FIG. 3—SHOWS HOW THE LIFTING ANCHOR IS PLACED. THE PART MARKED A DOES NOT NEED TO GO SO FAR UP.

In preparing the metal for this class of work, a mild form of semi-steel can be used, although ordinary cast iron is sometimes used.

As we have already stated, this particular job is not frequently offered to a molder, for the reason that not many foundries are apt to be making water wheels, but the method of molding might be used to good advantage in many other castings. I have seen good molders worry themselves into a headache trying to figure how a casting was ever molded, and it never occurred to them that part of the pattern was removed before the mold was rolled over. Then, again, there are molders who would never discover that the end vanes E V could not be drawn until they came right up to that part of the operation where either the pattern or the anchor would have to be lifted, and then they would be stuck, but a little study would show them that if they wanted to begin with the one marked E V in Fig. 1 they could cut away the sand back of it marked with the arrow, after which E V is lifted away with ease. After lifting the anchor from this section, the next pattern, marked X, can be easily lifted, and also its anchor. At any time after this the first E V can be replaced and the sand which was removed from the point marked with the arrow can be tucked back in place again. Some care will be required to have the parting cut right, but this can be reduced to a minimum by having a line drawn or scratched on the pattern E V to show where the parting belongs. This, of course, will be floured and the mold closed and taken off to see that no crush or fin is in evidence.

SATISFIED READER

Dear Editor,—Whilst looking through some of the back numbers of CANADIAN FOUNDRYMAN for a possible remedy for a trouble of mine I came across an article upon reducing cost of factory production, which showed how, by each department head having a general knowledge of the other department's needs, a great saving could be accomplished. I can support the writer's contention through actual experience. Some time ago some new castings had to be made which later were assembled or mounted in another department. The superintendent of the plant, together with the manager, had the patterns taken into the molding shop, the foreman told how to gate them and they began to make the castings. When the time came to commence assembling the castings together it was found that the gates on quite a few of them had been put on the fitting edge or face. This involved extra fitting for the assemblers, for sometimes the grinder who first ground off the remnant of the gate that was left on casting after leaving the molding shop, ground too deeply, thereby causing more trouble still.

Now, if the gates on these castings had been placed where the foreman of the assembling room eventually had them placed it would have done several things. It would, first of all, have done away with the need of grinding, as that edge or face of the casting did not touch or interfere with another part, and what gate remained after the molder had finished with it could have been left on.

Not having to grind the castings meant the saving of the man's time and the use of the power and the wear and tear of the grinding wheel, and the time saved by the assemblers was considerable, so by gating in the proper place there would not only be greater economy in cost but greater production would be the result. Many things of such a nature have occurred in the same shop, and it is needless to add that the shareholders' dividends are not very large.

I may say in conclusion that I have benefited very much through the reading of your publication.

Yours truly,
A. B. C.

To mend holes in castings, take 1 part powdered sulphur, 2 parts powdered sal-ammoniac, and 80 parts fine iron borings. Make into a thick paste and fill the holes.

Molding Gear Casing With A Green Sand Core

Can Canadian Foundries Compete With Those of Other Countries in the Production Castings, Such as the One Here Illustrated?

THIS is a question which is frequently asked through the columns of the CANADIAN FOUNDRYMAN and invariably answered in the negative, meaning, of course, that the demand in Canada is so small that it could not be expected of the founders in this country to go to the expense of equipping themselves in the same manner that they would if the market were bigger. This certainly is a mistaken idea, but it is hard to get it into some people's heads that the market is as big here as anywhere else if we consider the opposition which has to be contended with in the larger or more densely populated countries.

But all Canadians are not troubled with this pessimistic idea, as our own personal experience has proved on a very

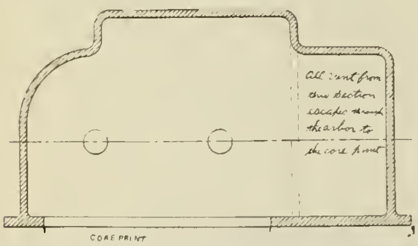


FIG. 1—SIDE VIEW OF GEAR CASING, FLANGED INSIDE AND OUTSIDE. BOSSES ON SIDE PROJECT INTO THE CORE AS WELL AS ONTO THE OUTSIDE.

recent occasion. It has been our pleasure and privilege to visit the works of the Renfrew Machinery Co., Ltd., Renfrew, Ont., and a little information regarding what they are doing and how they do it will undoubtedly be of interest to all progressive foundrymen.

This company does not make any pretensions to be a jobbing foundry, but operates what might be termed strictly a specialty shop, their specialty being cream separators.

This class of work may not appear to the ordinary molder to be difficult, but few of them have tried it out to be sure.

Cream separator castings must be smooth and clean; they must also be true to the pattern, so as to fit together without any trouble, and, incidentally, they must be sound; a casting which leaks is of no possible use on a cream separator. Added to all of this is the question of cost. This last item is the one on which our discussion is chiefly based. "Can it be profitably done in competition with imported ones?" A visit to the works of the Renfrew Machinery Co.'s works will convince the most skeptical doubter that it can be; not that the workmen are converted into slaves, or that the work is slighted, but because the equipment is such as to produce perfect castings at minimum cost. In general appearance the foundry is similar to most foundries, but some of its features are different. The floor, for instance, is of brick, placed on edge, with the joints left slightly open at the top, permitting them to fill up with molding sand, and the brick being rough-faced, adheres to the sand, making it to all appearances a perfectly level sand floor,

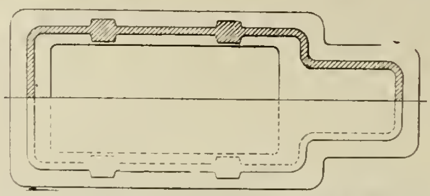


FIG. 2—CROSS SECTION OF GEAR CASING CUT THROUGH BOSSES. OUTSIDE LINE SHOWS FLANGE. INSIDE LINE SHOWS THE ONLY OPENING IN THE CASTING.

easy under foot, never out of true, and proof against splashing in case of iron being spilled.

The Pattern Equipment

Each part of the machine is fitted to whatever style of pattern is most suited. Some are molded on plain pneumatic squeezers, while others are on the combination jolter and squeezer, and still others are rammed up on the snap bench.

Exclusive Features

Two points which probably no other shop in Canada, or for that matter, in the world, can boast of, is that there is

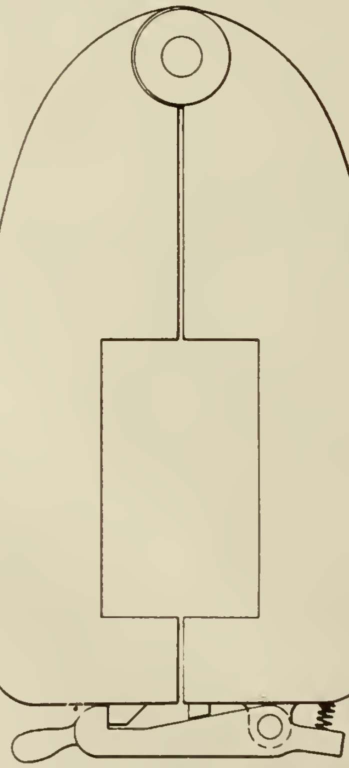


FIG. 3 SHOWS HINGED CORE BOX. IN OPENING THIS THE BOSSES AND PORTIONS OF THE INNER FLANGE ARE AUTOMATICALLY DRAWN.

neither a molding box nor a dry sand core used in the shop. These ideas might at first appear to be of small importance, but if carefully looked into it will be agreed that they are of the greatest importance. Every mold is made in a snap flask with iron bands rammed inside. This makes it lighter on the molder and easier to shake out. In fact, there is no shaking out to be done, all that is required is to tip the mold over and take out the board.

In discontinuing the use of dried cores the idea was not so much a matter of first cost in producing the casting as of the quality. A dry core is never true to the pattern, and the casting can never be depended on to be of uniform thick-

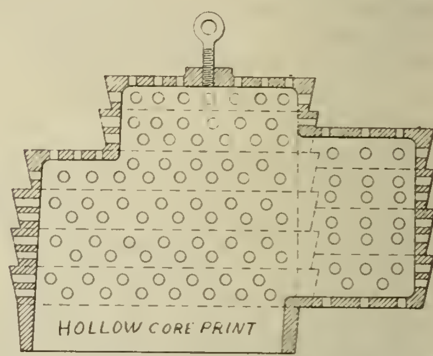


FIG. 4—SHOWS CORE ARBOR. NOTE THE PROJECTIONS WHICH HOLD THE SAND. ALSO THE NUMEROUS VENT HOLES.

ness. It is always more or less rough and finned, necessitating considerable grinding and filing, and even machine work, to make it right.

By resorting to the green sand cores it simply means that the casting is exactly what the pattern called for, and that the inside of the casting has the same smooth face and exactness of detail as the outside.

Green Sand Cores

Of course, it is no trick to make a green sand core for a plain job, but the more complicated parts, such as are to be found on a cream separator, it requires some little bit of ingenuity to devise the means of successfully accomplishing it without adding to the cost, or running too much risk of defective castings. Take for instance a casting such as is shown in the cuts, Fig. 1 and Fig. 2. This casting stands in the mold as shown in Fig. 1, and, as will be seen, the iron flows over the top of the core and the vent has to be taken from the bottom. The mold for this casting is made on the Tabor combination jolter and squeezer, while the core for the inside is made on a jolter. The core box is hinged at the back, as shown in the illustration, Fig. 3. The arbor shown in Fig. 4 is wide open at the bottom and is well perforated with vent holes. This arbor is placed on the machine and the core box closed around it, holding it as though in a vise; the sand is jolted into place in less time than would be required to do the pasting on a dry core, or to gather up the dryers if it were made complete. The core box is now unhooked and opened and the core lifted into place in the mold, and not into the oven as formerly. Castings made in this manner are of superior quality, as we have already shown, and in addition to this a great saving is effected on account of the molding sand being used over and over again, whereas core sand requires to be discarded after being used once; no core binder has to be purchased and no baking of cores, which requires time as well as fuel. Whereas dry cores have to be made a day in advance, the green sand cores are used as made. Another feature not to be overlooked is that the sand heaps are clean; no scraps of core to be riddled out and no burned core sand, which must of necessity mix with the sand heap to its detriment. The Renfrew Machinery Company, Ltd., have certainly demonstrated that Canada can produce high-grade castings in competition with any country with whom they have to compete.

The reader will excuse the design of the illustrations, particularly if he is posted on cream separators. The sketches were made off-hand and are not true to proper design, but are true to principle, and demonstrate what can be accomplished with proper equipment. It also demonstrates that the jolt rammer is an innovation in the right direction, saving the molder a lot of hard work, making a more evenly rammed core, and accomplishing an amount of work far in excess of what could be done by hand.

FREE EDUCATIONAL FILM EXHIBIT

The Bureau of Commercial Economics, an altruistic organization exhibiting educational films all over the world, has started a nation-wide campaign to get free motion picture theatres into factories, department stores, mining towns, country crossroad centres, lumber camps —every place where there are workers.

The bureau has the largest educational motion picture library in the world—21,000,000 feet of film—on almost every conceivable subject, such as government, economics, industry, history, travel, nature, science, health, commerce, agriculture. All these pictures will be loaned without charge to those who will exhibit them free to audiences.

In order that thousands instead of hundreds of business men and organizations will become borrowers of these films the bureau is sending out questionnaires, the answering of which will enable the bureau's engineer to advise as to the equipment most suitable under the circumstances, how best to adapt the workshop, church, hall or factory lunchroom for motion picture exhibitions, and any other questions the individual case requires.

In addition the bureau is sending eight traveling motion picture theatres—specially built auto trucks—all over the country to arouse persons and organizations, particularly employers, as to the possibilities of educational pictures. These trucks carry a projection machine, an electricity generating plant, and portable screen. Thus they are able to show pictures at an isolated Western ranch centre as well as in a city.

In New England one truck is showing samples of the films that employers could exhibit in a darkened workshop at noon, or at night, when the wives and kiddies may see, too—if employers spend $200 or $300 for equipment.

If the masses of Russia had been as educated as the American people, Bolshevism never would have raised its venomous head. Dr. Francis Holley, director of the bureau, knows there are thousands of workmen in this country who really believe that the shortest cut to a fatter pay envelope is through the destruction of the present employers. The professional agitators have told them so, and nobody in particular has ever told them differently. Well, the 21,000,000 feet of educational film are ready.

The bureau has films taken in Russia under the Bolsheviki. These and pictures of life in America form an elegant contrast. Sitting in the silence of an improvised theatre in a work shop, the employees can take their pick—the American or the Soviet plan.

One big reason for the social unrest is the narrowness of the lives of many of the workers. Educational pictures will enable them to step out of the rut of a life bounded by factory, home, and corner coffee club and begin to live in the wide world.

Dr. Holley believes an employee's interest in his work would be increased if he could see motion pictures showing how the men on the other end of the job work, getting the raw product to the factory door, and other pictures showing the ultimate uses of the finished product.

Industrial films, notably a great many produced under the supervision of Harry Levey, manager of Universal's Industrial Department, are used to show one part of the country how the other half works —and lives. Miss A. Maris Boggs, dean and co-founder of the bureau, who passes on all films accepted into the bureau's library, is eager for more of the industrial pictures, and wishes manufacturers who have had films made of their own plants, would submit them.

The bureau is indebted to the Universal Film Mfg. Co. in another particular. For years all the bureau's films had to be borrowed through the Washington, D.C., headquarters. Believing in the bureau's work, Universal officials offered the free use of its seventy-six distributing exchanges in all parts of the world as branch circulating libraries for the bureau's educational pictures. This makes educational films much more accessible to employers over the country.

Dr. Holley believes employers would find it a good plan to let employees feel that the picture show belongs to them. The employer could offer to provide space and equipment if employees would run the show—select programmes from the bureau's catalogue, attend to the details of ordering the pictures, etc. Thus a point of co-operation would be established between employer and employees which would be worth many times the cost of providing the "theatre."

The bureau, making no profits on its films, is supported by endowment, annuity and voluntary subscription. The United States Government and principal foreign Governments are co-operating with it. It is endorsed by churches and leading business men of the world.

Its films are now teaching mothers of India how to stop their babies from dying. The bureau's films go by dog sled to the tuberculosis-stricken Esquimo, by camels to the dwellers of African deserts and by llamas over the Andes to the Inca Indians.

EXHIBIT OF PANGBORN CORPORATION AT THE CONVENTION

And List of Attending Representatives

The exhibit of the Pangborn Corporation, manufacturers of sand-blast and allied equipment, will be more extensive than even in past years. Spaces occupied will have a frontage of 80 ft. and the equipment, which will be in operation, will include in various types and sizes, cabinet sand-blasts, barrel sand-blasts, hygienic rotating table cabinet sand-blasts, rotary table sand-blasts, hose machines, sand separators, dust arresters and exhausters.

In addition to the operating equipment they will use a stereopticon to illustrate actual installations made and installed throughout the country in varied lines of foundry and other manufacturing practice. The exhibit, taken as a whole, will cover comprehensively the advance in manufacture, design and application of sand-blast equipment for more than a decade.

The company will be represented by the following: Thomas Pangborn, president: John C. Pangborn, vice-president; Harry D. Gates, sales promotion engineer; W. C. Lytle, sales engineer; P. J. Potter, district sales engineer; Geo. A. Cooley, district sales engineer; Chas. T. Bird, district sales engineer; Jesse J. Bowen, district sales engineer; Roy C. Koch, district sales engineer; J. F. Tracey, district sales engineer; T. R. Ditty, district sales engineer; Hugo F. Liedtke, designing engineer; Foster J. Hull, erecting engineer.

CHANGE OF ADDRESS

Messrs. Eagland & Co., Ltd., publishers of "The Foundry Trades Journal and Pattern Maker," have changed their address from 165 Strand, London, W.C., Eng., to "Bessemer House," Adelphi, Strand, London, W.C.2, England.

The first description of the Falls of Niagara was published by Louis Hennecin, a Frenchman, in 1683.

Moulding Hawse Pipes, Alternative Methods

If the Reader Will Carefully Compare the Story With the Drawings at Each Stage, He Will See Many Interesting Points of General Use

By JOHN H. EASTHAM

IF you are producing castings for the standard fabricated type of ship now being turned out of many American yards, with straight sides, sheer from a flat bottom to the forecastle deck, you may possibly get good results from a permanent standard hawse pipe pattern, or pair of patterns, pitched to suit port or starboard elevations, direct from the blue print, but should "camber" and "dead rise" control the pitch of your castings, as they inevitably must in all moulded hulls, you are entertaining a vastly different proposition.

As may readily be seen from the forward and starboard sectional views of Figs. 1 and 2, the pitch of the pipe at junction with the line chock at the forecastle deck, as well as at the outside flange, is best determined by the use of a light wooden template—corresponding to the view of the pipe as seen in Fig. 1.

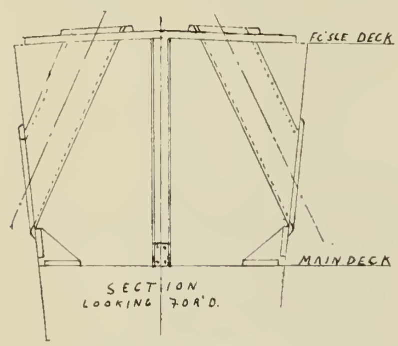


FIG. 1—SHOWING SECTION LOOKING FORWARD.

As this template is usually made by the pattern department a week or so before the date of launching, the pattern alterations being next in order, the job is usually in the "rush" category by the time it reaches the foundry, the rapid production necessary, coupled with accuracy, being perhaps best obtained by the pit and drawback method hereafter described.

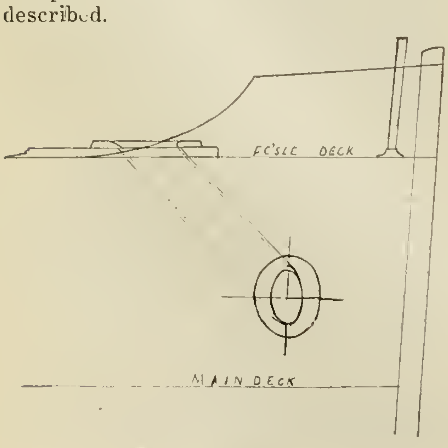


FIG. 2—SHOWS STARBOARD SECTION VIEW.

An ordinary dowelled split pipe pattern of whatever diameter ordered, for example as in this case, sixteen inches inside, is made with a plain open end and coreprint at one end, and a flat blank end of outside pipe size at the end intended to be flanged, the flange being afterwards screwed to position, being backed up by "V" filling pieces to suit the template above mentioned, one half flange being attached to the drag pattern, and the other to the cope half, or the full circle screwed to the drag pattern to ensure rigidity. The drag half pattern is bedded into a pit, an iron bearing under the core print at the plain, or deck end, and a chaplet bearing at a suitable distance from the flanged end, the pit being then rammed up to the joint, boards being packed up outside the flange whilst ramming, then removed and the undercut parting made linable with the inside or back face of the flange. This undercut parting is next lined up with wet parting sand, sleeked, and the area in front of the flange levelled off to receive drawback box shown in cross section at Fig. 3, and in perspective at Fig. 4.

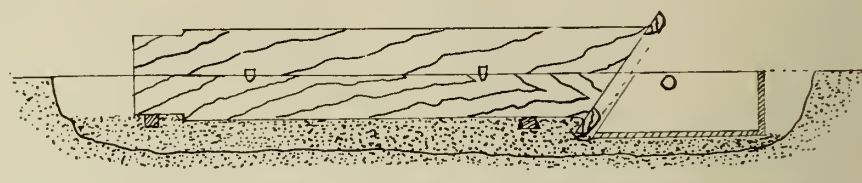


FIG. 3—SHOWS PATTERN DRAW-BACK BEDDED IN.

A brief description of this drawback and its economical manufacture may be in order at this juncture, by way of soothing the qualms of those foundrymen who do not care to risk much in the way of investment on rigging.

A three-sided frame of pine or other suitable lumber, open at top and bottom, is made, sloped at its open end to suit the pitch of the pipe flange, one of its sides being made longer than other for the same reason, the frame being screwed up so as to be easily reversible, thus making a pattern of right or left hand type to suit starboard or port pipe requirements. A hole is dug of the drawback's full depth, sufficient room being allowed all round for comfortable working, a bed being then struck off level, the frame being next laid on the bed, rammed up about half way inside and out, even ramming being necessary to avoid bulging or warping the pattern. Stakes as shown at Fig. 5 being now driven down in the inside a couple of inches from the pattern, the tops of the stakes being driven down to an inch or so below the face of the finished core.

A cinder bed is next spread over the inside to facilitate venting, with the usual vent-pipe as shown, the remaining filling and ramming being then completed, the upper face being afterwards strickled out and a runner of open sand type made up prior to the pattern being drawn. The three lifting holes may be either cored or afterwards drilled, as desired.

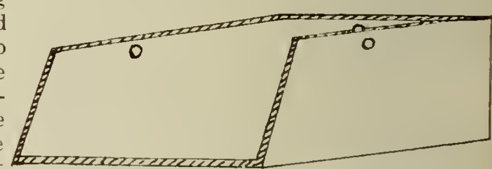


FIG. 4—PROSPECTIVE VIEW OF DRAW-BACK.

The drawback is lowered in front of and almost touching the front face of the pattern flange, the upper half of the pipe pattern being then placed in position, the area outside the drawback box being next rammed up to the pipe parting level, whilst the inside is carefully

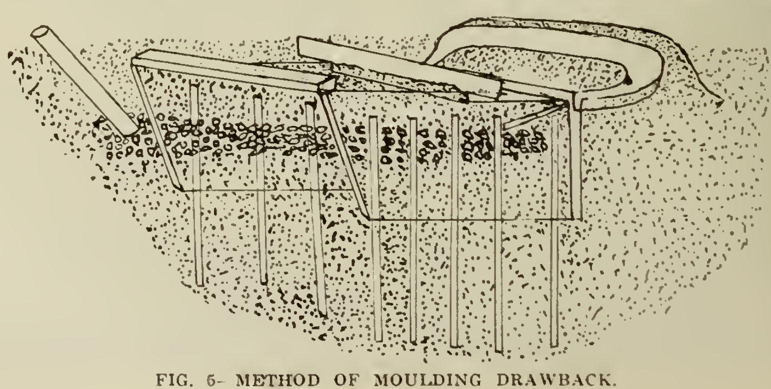


FIG. 6- METHOD OF MOULDING DRAWBACK.

rammed up and reinforced by loose irons wherever sand projections are likely to occur, "humped" up to follow the shape of the flange from the upper edge of the box, wet parting sand or paper being then spread over the hump.

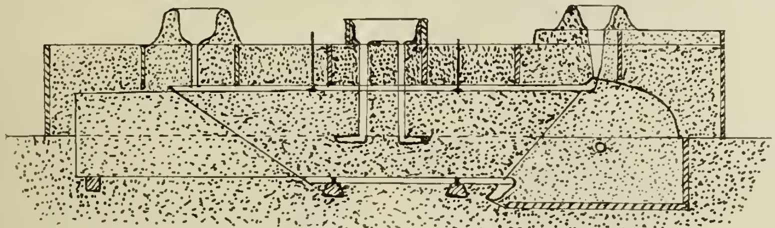


FIG. 6—CROSS SECTION OF ASSEMBLED MOLD.

The cape flask is now lowered to place, and rammed up in the usual way, with gate and riser pins in position, the flange riser being of fairly heavy design to allow shrinkage replacement.

While opinions vary somewhat on this point, the writer has found the practice of ramming up the chaplets in the cope a fairly good one, a perpendicular position for them being thus easier attained than by pushing them through afterwards. Guide stakes having been driven at each corner or staking piece, the cope is hoisted off and taken away, the upper half of the pattern coming with it, a pair of eyebolts screwed into rapping plates holding it to position till the cope is rolled over to its desired attitude for finishing, about a shovel width of sand being then dug away from the three

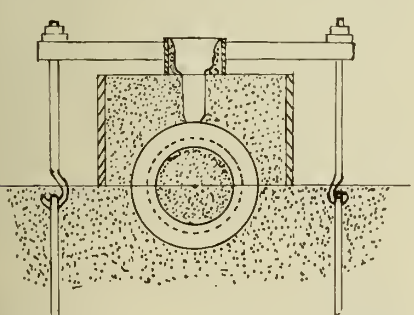


FIG. 7—END VIEW SHOWING METHOD OF BINDING MOLD.

sides of the drawback to its extreme depth, three chains on three turnbuckle lifters being next hooked to the box by the holes provided for the purpose, the drawback being eased up from its bed a fraction of an inch, and "drawn back" clear of the flange and bell mouthed opening at the end of the pattern, then hoisted clear of the hole and set down on wood blocks or a soft sand bed to be finished. That duty performed, on cope and drag parts as well as the drawback, a coat of blacking is applied to all three, and in most shops a molasses water wash, followed by a blaze from a torch dryer, the fairly heavy section and undercut type of mould making this advisable, the drawback is next lowered to position again, but the cut-away space behind the box should never be rammed up before the core has been tried in and finally set, as in case of a possible crush during these proceedings much extra labor would be entailed.

The cope flask is now tried on, and after inspection finally closed, runners and risers built up, and the whole fastened down by weights or pit binders, cross-section and end views of the assembled mould, with method of binding being shown at Figs. 6 and 7 respectively.

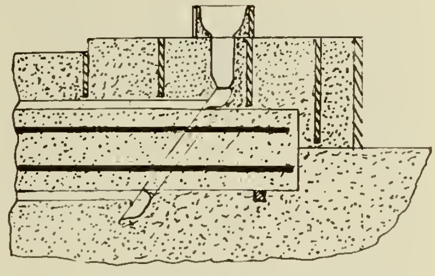


FIG. 8—SHOWING ALTERNATIVE SYSTEM OF "DRAWING" FLANGES

Incidentally the alteration at the plain end of the mould, from a rectangular end to the required pitch, is handled by stopping-off pieces matching the template, placed in the cope and drag halves after removing the patterns, as in ordinary pipe practice, the joint in both cases being marked to correct length, plus the usual contraction allowance, this detail, as well as the "humped" joint line in the drawback being very plainly shown in Fig. 6.

Fig. 8 shows an alternative method of moulding hawse pipes, the flanges being drawn inward in this case, the core carried right through, and the drawback abolished, a method which at first sight appears very economical, but which in actual practice is unsafe, the "feather-edged" mould set up at the flanged end inside the bell-mouthed opening being impossible to handle correctly, crushes with their consequent dirt and malformation being the principal objection and owing to the increased chipping to shape

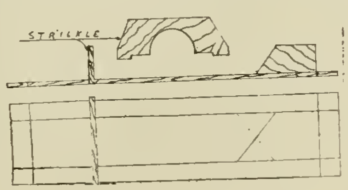


FIG. 9—SHOWS SIMPLE COREMAKING RIGGING

when cleaning the casting, an unsightly bell mouth is the result, consequently the practice has nothing to commend it, save that in the case of a single break-down order it might serve, much paint usually being employed to partially cover a multitude of sins. Obviously, as a medium course between the "drawn-in" method just mentioned, and the drawback box system before described, it is possible to use a flat plate drawback with perfectly satisfactory results, but if you are going to make castings of this description in quantities a little extra initial outlay will very soon come back in the way of reduced ultimate cost. The coremaking is usually handled on a similar system to that practised in the mould, a larger core box of sufficient length can be lined to reduce its diameter to correct dimensions, or a plain frame and strickle employed, stop-off blocks marked "cope" and "drag" respectively, being rammed up in the frame as shown at Fig. 9. Great care being observed in jointing the two halves after drying and correct pitch being maintained, will reduce the moulder's troubles considerably and abolish the fin likely to be left at the junction of the core and drawback in the event of an overlapped or broken end due to careless coremaking.

MACHINERY EXHIBITION

The Merchants' and Manufacturers' Exchange of New York are announcing the holding of an International Machinery Exposition in the Grand Central Palace, New York City. This is to be one of the most advanced steps made in the machinery industry since the close of the war, and will be a permanent affair. October 15 is scheduled as the opening date, at which time it is expected that hundreds of machines will be in actual operation. Mr. Lloyd L. Warfield is manager of the Machinery Exposition. Mr. Fred W. Payne is general manager of the Merchants' and Manufacturers' Exchange, and has general supervision of all of the expositions. Inquiries should be addressed, prior to Sept. 15, to Suite 421, 405 Lexington Ave., New York City, and after that date to Grand Central Palace.

BOLSHEVIK DEFINITIONS

Capitalist—A citizen of better standing in the community than yourself.

Martyr—Anyone who has been shot in an argument.

Torch of Freedom—Any instrument by which a fire may be started.

Tyrant—A person in whose mind pay is unalterably associated with work.

Soviet—An organization of which all the members are president and treasurer.

Medievalist—An extraordinary individual who still considers family ties binding, debts payable, and that a man should work for his living.—Life.

To find the weight of a ball, multiply the cube of its diameter by .5236, which gives its solid contents, after which, if it is to be of cast iron, multiply by .26.

Something Different in the Brass Foundry

Brass Founding Presents Many Difficult Problems to an Iron Founder, But by Doing a Little Thinking, the Difficulties Can Be Overcome

By H. E. McINTYRE

WHEN an iron foundryman tries handling a non-ferrous foundry he is liable to do most anything. His worst crime usually consists of scattering brass all over the shop. He wouldn't bother to pick up a two-ounce piece of scrap iron, so why bother with a two-ounce piece of brass? Brass runs into money faster than one would think and every brass foundry I have ever seen presided over by an iron moulder had a small fortune on the floor. I have just finished house-cleaning such a place and my experience may be of use to someone else: I hope it will, anyhow.

I took charge of a shop on May 1st and started house-cleaning right away to see just how much more business I could make room for. I had been two days on the job before I uncovered two pit furnaces which were in good condition. These were buried under an assortment of junk such as always finds its way to unused floors. I was told that at one time the firm had a nice little brass trade, but had let it go to pieces because the foreman did not understand brass. Now I do not claim to understand brass, in fact, I am mightily ignorant about it, but I am going to find out if the "brass foundry" department of the CANADIAN FOUNDRYMAN is any good, also take two other trade magazines running a brass foundry department.

About the time I got the furnaces disinterred the machine shop developed a craving for bronze castings. You know how they are always looking for something for the foundry to do. I decided I'd try anything once, so I spent an evening on "Trials of the Brass Foundry," by various authors and next day picked out enough red brass scrap to fill a crucible, melted it under charcoal, added .25% phosphor tin (phosphor content unknown), and poured it into moulds. Now, while this may not be a good mix it made a hit with my only customer, our machine shop, so I decided to go a little further. I watched my work through the machine shop and at the same time watched the machining of some brass from an outside foundry. The outside brass had little pockets of stuff which resembled slag to some extent, so I got out my magazine file again to find out what it was so that I could avoid the same trouble myself, and found it to be tin oxide, and the very next day I melted a batch of metal which showed all the symptoms of tin oxide, became mushy after I added the phosphor-tin, so I threw on a handful of salt and stirred it up, and my metal cleared up nicely.

Business got so rushing that I decided to clean up the brass foundry and start fresh, so I would know where I was at. I scraped the floor around the furnaces and started riddling the junk through a No. 2 riddle, but when I saw the amount of brass caught in the No. 2 I dug it up and took a No. 6. I picked out all the brass noticeable, and threw the balance into barrels, hoping to sell them to the junk man, but he was not very favorably impressed with the idea, and I can not say that I blame him much, as it was a poor looking lot—nails, gravel, coke, kindling wood, etc., but I was satisfied that there was enough metal in it to salvage at a profit some way.

After I got the floor cleaned up I had an awful collection of miscellaneous junk, and about the same time I got an order "nothing particular, just brass," so I said to myself: "That's just what they'll get." I picked out all the odds and ends of copper wire and red brass and piled them into the crucible. When they were melted I fed in pieces of the gates, slugs off the skimmer, souvenirs of remelts, etc., until the pot was full, added 2% lead pipe, and .5% phosphor-tin and said: "Here's hoping," and poured it. "Very good brass." About that time the orders quit coming for a couple of days, so I took my riddlings out to the cinder mill, and loaded them in. I had five barrels full, but as it washed out quick I got it all through in half a day and it looked worse than I expected when I got it out, as I had been unable to wash out the gravel. I knew it was almost hopeless to try melting it in the crucible so I let it lay on the floor under the cinder mill while I thought it over. Then I took an old sheet iron barrel and made a cupola of it, cut a hole for the breast and one ten inches from the bottom for a hose for the blast, lined it up as follows: One ring of furnace blocks 4 inches thick, next a ring of splits broken into halves and set on the outside edges of the first ring with small cracks between the halves. I was careful to get a solid piece in front of the blast hole to throw the air around the improvised wind box. The next ring was brick broken into halves or rather some bats I had found in the cupola room. These were daubed carefully as was the bottom of the ring to prevent leakage of either air or metal. Above the bats I daubed the rest of the barrel as I would a ladle, rammed in a breast and a sand bottom with lots of slope, and started my fire. I was very careful to use kindling wood free from nails. While the fire was burning up I had the "ore" hauled out under the crane magnet and spread on a piece of canvas and the iron cleaned out with the magnet.

It was then ready for the cupola or blast furnace as you choose to call it. I used a coke bed to ten inches above the tuyeres and charcoal for the balance of the melt. The first melt went into green sand ingot moulds for future consideration. The metal looked pretty good only that the ingots showed some swell on top from sulphur. The next melt I tapped from the furnace into a heated ladle, added 4% lead, .5% phosphor-tin, and poured some test sprues. They turned up very well, showed a few specks of tin oxide, so for the balance of the work I used a little salt, and while I admit it was not No. 1 brass or bronze it did satisfy the customer, and any foundryman who can satisfy the home machine shop can cease worrying.

I had to make four melts with the furnace to reduce all of it, as the gravel made a lot of slag. When the slag got to blowing out of the top of the furnace we had to quit charging it, melt down all we could, add a pail of coke and tip the cupola over. Then turn the blast on again for fifteen minutes to cut the slag out, shut off the blast, and let it stand until morning. I saved all the slag and by the time I had finished the "ore" I had almost a barrel of it, so it went back to the cinder mill for another crushing and washing. It was full of shot metal which cleaned up fine in the mill and went into the fourth melt.

Following is the record for the job:

Castings	285 lbs.
Test bars	22 lbs.
Ingots	615 lbs.
Total	922 lbs.
Moulding, hours	6
Riddling, hours	8
Cinder mill, hours	7½
Magnets(2 men, 2 hours)	4
Melting (3 men, 12 hours)	36
Total	61½

As the six hours moulding was regular work, it could hardly come under the head of salvage, but I did not weigh up the first lot of scrap I melted until it was in the casting, so I lumped the whole thing. Since then I have melted several hundred pounds of borings from the machine shop in the same manner, run some of the metal into ingots, and some into castings, add 2% to 4% lead in the ladle, and 5% phosphor-tin, and salt if the metal gets mushy. I also cut down the blast if the metal gets mushy, give it less oxygen, and it clears out all right. My first melt of borings was 338 pounds. Part of it, which was used for castings, had additional metal to bring the total to 346 pounds melted. The total loss for the melt was 11 pounds and I hope to salve at least half of that from the slag.

Questions Answered

Editor Brass Page.—Is there such an alloy as will imitate gold? Answer. —There is an alloy known as Mannheim gold, which consists of 3 pounds of copper, 1 pound of zinc, and ¼ pound of tin. If these metals are pure, and melted in a covered crucible, containing charcoal, the alloy bears so close a resemblance to gold as to deceive skilful persons.

* * *

To the Editor.—Will you explain to me the theory of mixing bell metal? I understand that different sizes require different degrees of hardness.

Answer.—For a very large bell a slightly softer metal will be required than for a smaller one. If a large bell is too hard it has a sharper tone, but cannot be heard at so long a distance. Bell metal usually consists of an alloy of about 4 parts of copper and 1 part of tin, and this will be almost white. The Indian gong, so much celebrated for the richness of its tones, contains copper and tin in the above proportions. The proportion of tin in bell metal varies, however, from one-third to one-fifth of the weight of copper, according to the sound required, the size of the bell, and the impulse to be given. If it is desired to make a small or thin gong with a soft tone, one to four makes a good mixture, and the casting should be taken when red hot and plunged into cold water, which makes it quite malleable and free from the sharp, harsh tone which it would otherwise have had.

* * *

Sir.—Kindly answer following question: Could you give me any idea of getting rid of pin holes that seem to appear in heavy bodies, such as heavy valves? These seem to affect me most of all, as other sizes are very free from holes.

I have tried my metal hot, also chilled my metal with sprues. Do you think I would be right or wrong if I used, say, one pound of silicon to one hundred pounds of brass? Seeing your sketch in July CANADIAN FOUNDRYMAN, I believe it a great help, but when you have, say, 80 or 90 boxes to pour, of all sizes, it would be pretty hard to use a funnel.

Answer.—The funnel shown in a former issue would be for very heavy casting, which required to be perfect.

For work such as your heavy valves, it is doubtful if there is a better deoxidizer than salt. Salt makes no chemical change in the mixture, but it gathers up impurities and also prevents the oxygen of the air from coming in contact with the metal. To be effective it should be introduced before the metal is melted. It then forms a slag, which floats on the surface, making an air-tight covering. Before skimming off the slag, if a small piece of borax is stirred through the melted mass it makes the metal boil and assists the salt to get at the impurities. The greatest trouble with all non-ferrous metals is in pouring. The oxygen attacks it between the ladle and the mold, so keep the lip as near the gate as possible. It is not a good plan to melt the brass too hot and then cool it down. It is better to just melt it hot enough to pour. If the stirring rod can be withdrawn without any brass adhering to it, the metal is hot enough.

Silicon is excellent for deoxidizing copper, but I have not seen it used in general brass work.

* * *

Mr. Editor.—Will you answer me this question? Supposing a molder goes out on strike and finds that his strike allowance is not sufficient to keep his soul and body together, is he justified in taking a job as a laborer? If he is, what about the laborer who would have had the job if the molder had not taken it? Is he justified in taking the job which the molder threw up? Or supposing a man has been working in a foundry as a helper, doing all the dirty work for the molders, but not allowed to do anything which would help him to become a practical man, and spoken to as though he was a reptile if he touches one of the molder's tools, is he supposed to love those molders so much that he will help them to win out in a strike, or would it be more in keeping with wisdom to take a chance when it is offered and learn the trade while the wages are good?

Answer.—This is a little too deep a subject for me to pose as an authority on. In this free land each man is privileged to do as he likes on such matters, so I presume that it is up to you to use your own judgment.—Editor.

* * *

Question.—Now that organized labor has become such a powerful factor and is meeting with such strenuous opposition, would you mind explaining the nature of the boycott?

Answer.—It is not necessary to associate organized labor with the boycott. A more appropriate reference would have been to the Sinn Fein movement.

About forty years ago an Irish landowner's manager by the name of Boycott, residing in the West of Ireland, got himself in so wrong with the working class that he could get none of them to assist in taking off his crops, and, like the dog in the manger, they would not allow any imported men to work either until the authorities took a hand in it and provided a bodyguard to protect the men who were brought in. The word boycott has since been used as an appropriate expression whenever any body of men unite together and refuse to patronize anyone whom they consider has been unjust to them.

THE AMERICAN MALLEABLE CASTINGS ASSOCIATION

An Association of Malleable Iron Foundries Formed for the Purpose of Establishing a Uniformly High Standard of Quality by Co-operative Scientific Research and Education

When an industry, by the concerted effort of its members, evidences a determination to establish a high standard of quality for its product, it is but natural that considerable interest should be aroused.

But when such determination is expressed by a body of men representing so many distinct organizations as those composing the great malleable industry, the importance and difficulty of the task is at once recognized.

This in brief was the responsibility which the American Malleable Castings Association assumed at the time of its organization. And its recent announcement of the course pursued and the results obtained is an interesting commentary on its most commendable activities.

Aside from the various laboratories of its members the association maintained at Albany a Research Department for investigation and experiment, and for the testing and analysis of the daily output of each member of the association. Impartial tests were made and the results, together with direction for improvement, where the need was indicated, were forwarded to the respective members.

So successful has the work of the association proved that to-day it is credited with bringing all its members to a high average quality in their product known as "Malleable Castings."

Having accomplished that result, the association, it is said, will continue these daily tests and analysis for the purpose of grading the product of each member When a member's product has daily met the requirements of the prescribed standard for a period of three months a "certificate of quality" will be issued to that member, who may designate his output as "Certified" malleable castings.

These certificates will be renewed quarterly where the quality required is maintained.

At the same time, the association is issuing a booklet on malleable iron and its production, which will prove very interesting to those who desire a better understanding of the methods employed in the improvement of malleable. The book can be obtained by any of our readers without charge by writing to the American Malleable Castings Association, 1900 Euclid Building, Cleveland, Ohio.

Making the Pattern for a Four-Bladed Propeller

Being a Full Pattern, Follow Board, and Molding Box for a Propeller Wheel, 6 ft. 6 in. Diameter, 8 ft. Pitch, Right Hand

By J. A. McEWAN

THE accompanying notes are the result of actual experience in the making of a pattern, which was out of the ordinary for the shop in which it was made, but the results in the foundry were quite satisfactory, and the pattern was as fit for use after 40 castings were produced as at the beginning:

1. Make a model of one blade to

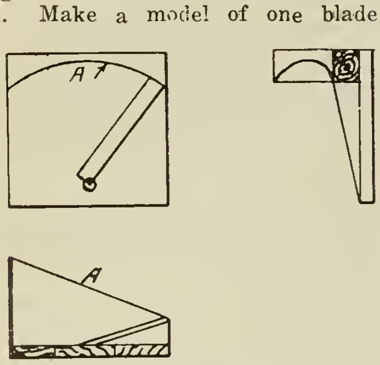


FIG. 1—BUILDING FORM FOR THE MODEL BLADE.

such a scale that the model blade will be no more than 10 or 12 in. long.

We decided to have the pieces put together like a spiral stair, or like a fan when it is partly opened out.

To do this you must have a form to build the pieces in.

2. Make a building form for the model blade, as shown in Fig. 1.

3. On the curved pitch surface A, lay off horizontal lines corresponding to the joints on the blade; these lines will also give the width of pieces required.

4. Right here is a point that might be overlooked. Let us call the pieces that are to be built up, the staves. Well, then, the staves will not do to be parallel in thickness, as one might suppose; they must be thinner on one edge than on the other. This is seen by referring to Fig. 2.

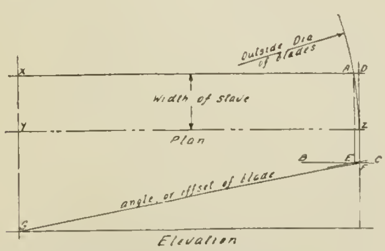


FIG. 2—SHOWING STAVES THINNER ON ONE EDGE THAN THE OTHER.

5. After building up the model blade, pare it to the slope and proper thickness on the back.

6. Lay off the shape of blade and draw in the line, but do not cut to this shape, as it is not necessary.

7. Make a full size form, as per Fig. 3.

8. Decide, off the model blade, as to the width for the full size staves, both at the centre and at the outside, and get out the staves, but do not taper them on the width till the thickness has been tapered. Cut them on the band saw on the outer end and make the inner end just to touch the centre.

Bore screw holes for screws to hold staves down when the glue is drying, being careful that the screws which are covered, towards the centre, are not in the way of paring operations afterwards.

Make up fresh glue and see that every joint is perfect, since there will be feather edges afterwards.

9. Be careful at the hub ends of the staves, for you can bandsaw a piece off on the angle and it will save a great deal of end wood paring afterwards. Pay close attention to the model, and note how the four blades will fit together at the hub afterwards.

10. After building up all four blades we struck the line of pitch on the ends of staves and pared and planed the face side, after which we did the backs.

11. Fit all four blades together. To do this properly we put one blade into the form, screwing it in place, after which we ran out a piece at right angles to the 1st blade and inclined up at the proper angle, upon which to rest the 2nd blade when fitting it to the 1st.

12. We screwed the blades together at the hub with 3 or 4 5-in. No. 18 screws in each one.

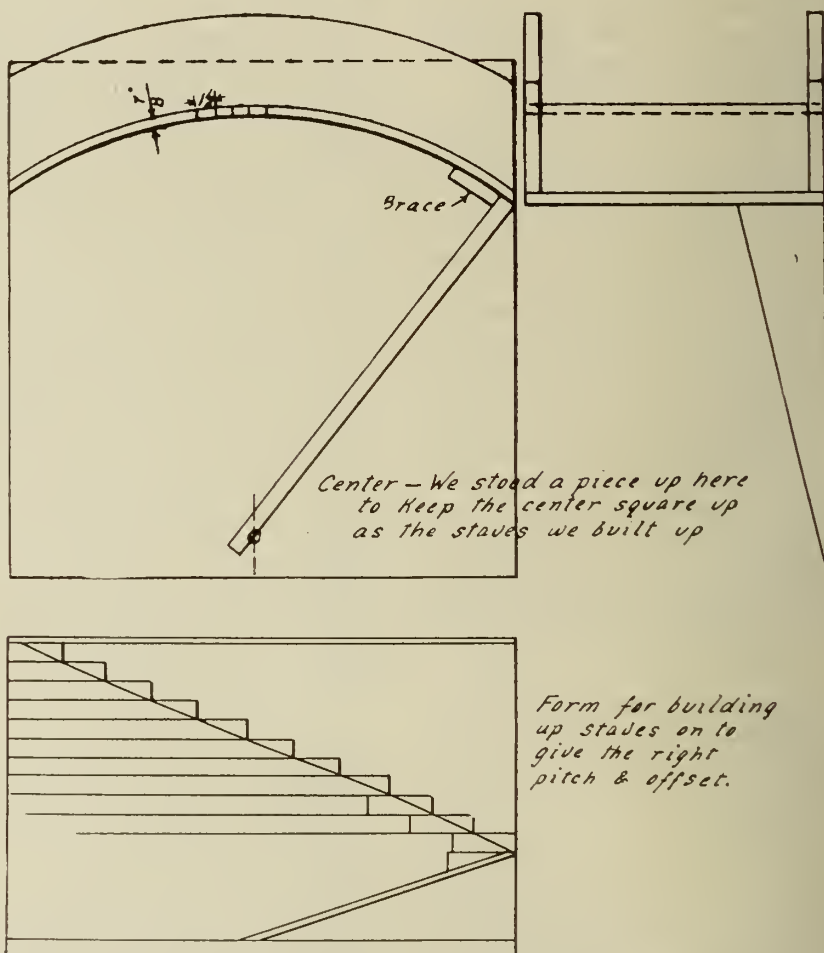


FIG. 3—SHOWS DIFFERENT VIEWS OF HOW THE STAVES WERE BUILT UP

13. Next we laid off the shape of blade on all four, and removing one we cut it and screwed it back on, doing the same with the rest. We did not glue them, but put 5-in. hard maple dowels in with thick shellac, two dowels for each blade.

Next we fitted pieces in the corners to get stuff enough for the hub.

14. After this we put ¼-in. round brass plates on each end of the hub.

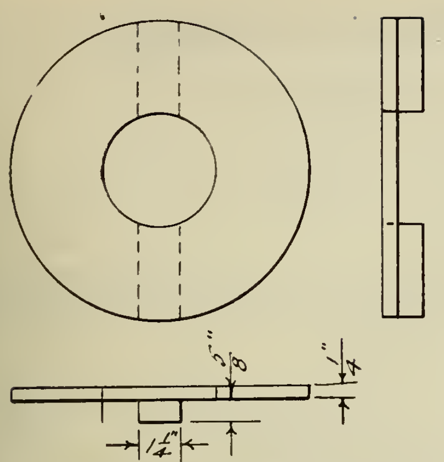


FIG. 4—CAST BRASS PLATES FOR ENDS OF HUB.

angling the screws away from the centre.

These plates were cast brass and were thickened up on opposite sides to ⅞ in. thick for more thread on the 5-in. tapped holes, which were on both ends. See sketch, Fig. 4.

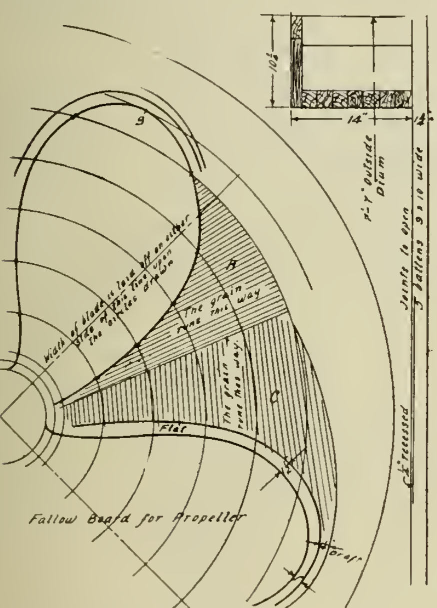


FIG. 5—MAKING THE FOLLOW BOARD.

15. The next step was to carve out the hub and the backs of the blades, but before we did this, in fact, before we put the blades together for the last time, we made the round board, 7 ft. 7 in. outside diam. upon which to make the follow board. This board was planed off true and it served as a face plate upon which to rest the pattern and the framing square when we were finding the parting lines on the hub.

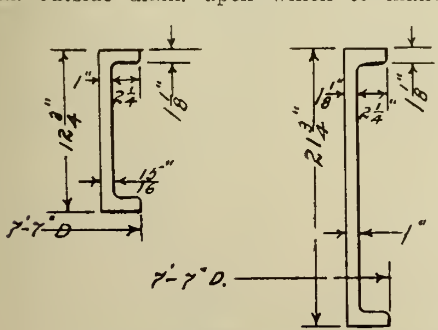


FIG. 6—DRAG SEGMENT TO THE LEFT AND COPE SEGMENT TO THE RIGHT.

16. After the paring and sandpapering was finished we screwed the joints on top and bottom of each blade—80 screws in each, 40 to a side.

Follow Board

17. The next thing was the follow board, which was almost more work than the pattern. Referring to Fig. 5 we recessed the hub down into the board ¼ in. to keep it central principally; we then decided on the level of the surface, where the drag rests, and built on the outer ring, using 3½-in. wire nails and 2-in. stuff, and screwing it to the board so it would come off while we built up the inner ring. After closing in the space between we laid the pattern in, glued up chunks for parts A and B, and fitted them in; then fitted supports underneath the blades down on to the follow board, after which we closed in with pieces C.

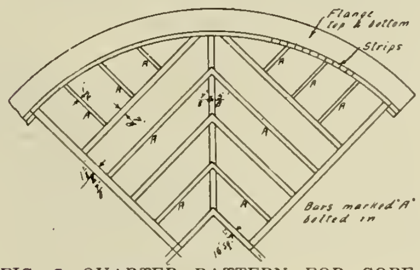


FIG. 7—QUARTER PATTERN FOR COPE.

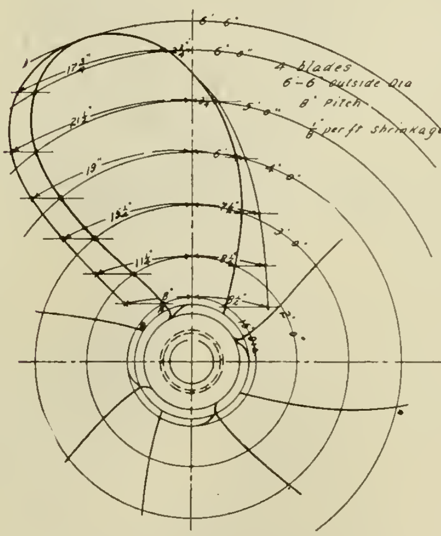


FIG. 8—POSITION OF BLADES AT HUB.

If the blades where they touch the hub as at A and B had been much closer together we could hardly have got a straight lift. We might have had to worm it out.

Before the supports were all fastened we fitted templates to the run of the pattern for making the bars in cope box. See Fig. 6.

To locate the cope we put 2 plates in, having match board pins, these being located from holes previously drilled in the drag box.

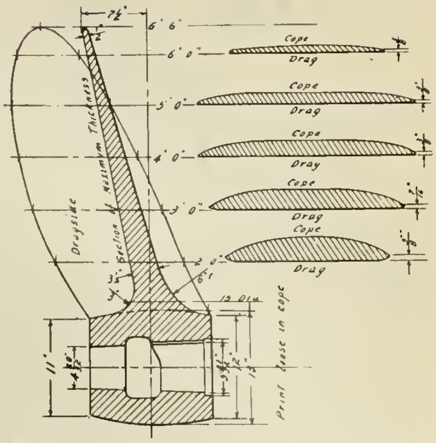


FIG. 9—SHOWS THICKNESS AND SHAPE AT DIFFERENT PARTS OF BLADE.

For lifting purposes, we bored 4 1⅛ in. holes through the outer ring, halfway down and equally spaced.

Molding Box

18. We made a segment and sticks for the drag and a segment and sticks for the cope.

We made these segments 38 in. long and tapered them a little on the length so they would draw round easier.

19. As stated on the preceding page, we fitted templates against the blades to get the shape for the cope bars, after, of course, having marked off on the follow board where each bar would come.

We then made a quarter pattern as shown in Fig. 7. The 16-in. square hole was printed and cored, the print being fixed with an 1 15-16 in. hole, with the cap part to screw on. We figured on the bars being from ¾ to 1 in. clear of the pattern.

To make sure that the shape of bars was right, they rammed up a drag, rolled it over, took away the follow board and tried the quarter pattern in place. Then we chalked the position of the pattern on the drag, so they could place the cope box on without difficulty.

Theodore Roosevelt said of trade unionism:

"The union must accept the responsibility that comes with power. It must recognize its obligation to the industry and to the community as a whole. It must be judged by its conduct precisely as a corporation is judged by its conduct. It must do its utmost to promote the efficiency of its members, for unless the business is increasingly productive there will be no sufficient reward for anybody, no profit to the shareholders, no adequate wage for the working man, no proper service to the public."

Fire and water-proof cement for covering. Equal parts of gum-arabac, plaster of paris, and iron filings. Keep in a dry place, and mix with water when wanted.

The New Moffat Electric Steel Furnace

Features of Design Which Make For Economy in Operation and Refractory Endurance Are Incorporated—The Arrangement of Electrodes is Also of Interest

By W. F. SUTHERLAND

RECENT developments in the smelting of iron ores by a duplex process employing the electric furnace as the final step for the melting of sponge were described in the June issue of CANADIAN FOUNDRYMAN by J. W. Moffat. While the electric furnace which will be used in this duplex process may be of any type, it is of interest to note that Mr. Moffat has developed a design for the refining of steel which is capable of very economical operation.

In some respects this electric furnace resembles the three phase types now in common use, the three electrodes projecting into the bath from above. Usually in such furnaces, however, the refractory lining of the walls and the shell are circular in shape, and the electrodes are arranged one at each angle of an equilateral triangle equidistant from the walls.

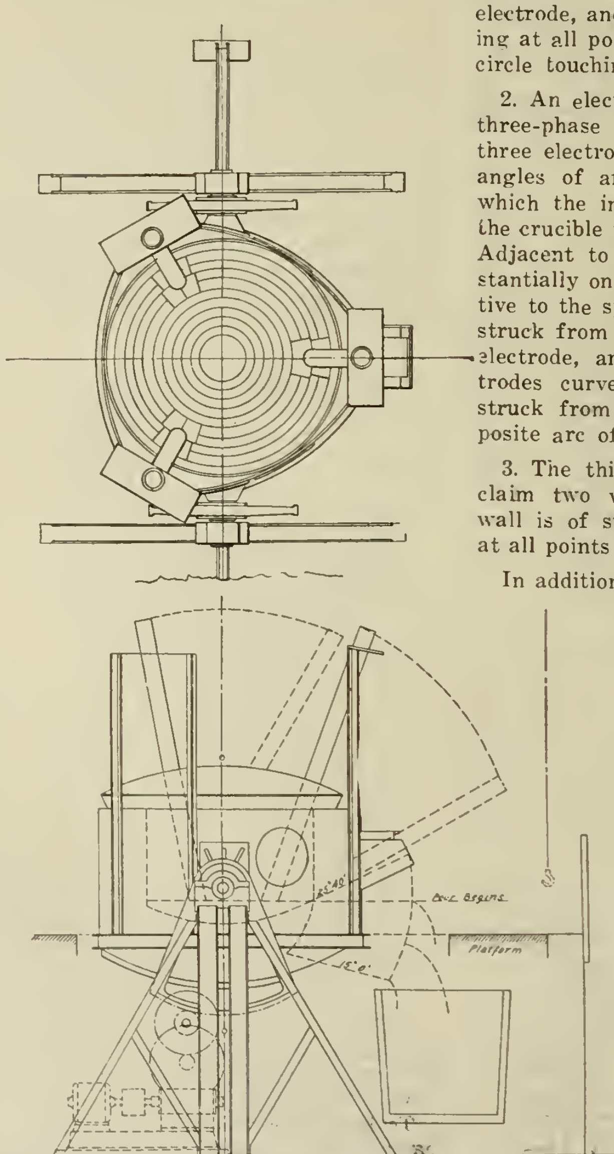
In the operation of such furnaces trouble is frequently encountered by reason of the crescent-shaped masses of partially fused raw material found clinging to the walls between the electrodes, this material being thickest at the point midway between any two electrodes. These masses are often difficult to get into the bath, as in their partially fused state they adhere to the colder wall of the furnace. In endeavoring to remove them by mechanical means, injury is often done to the lining of the furnace, portions being carried away and into the bath.

The more usual practice is to increase the input of electrical energy and to melt off the partially fused material. This procedure, however, increases the length of time for the manufacturing of the steel, often as much as one-half hour in a heat which should be taken off in about four hours, and means an increased cost amounting to 12 to 15%. This practice is also objectionable, as it leads to overheating the already fused material in the bath, and also to the overheating of the furnace walls nearest the electrodes.

New Design

In the design developed by Mr. Moffat, for which patents have been recently issued, these difficulties in operation have been overcome by shaping the body to conform to the lines of current flow in the bath of molten metal. The characteristics of current flow in a flat plate or an approximation thereto are well known, and the current is distributed throughout the metal, the lines of equal current density being in the form of current arcs from pole to pole. The shape of the walls is well illustrated in the accompanying diagrams, and it will be seen that the walls are brought inward between electrodes in such a fashion that no cold spot occurs, and the growth of partially fused nodules of metal avoided. In other words, the furnace walls are so shaped as to conform to the isothermal lines of temperature in the furnace.

It is also found that to secure the best results in wall life, that the wall itself should be of equal thickness at all points in any horizontal plane, and by so arranging it, the radiation is the same at all points, thus rendering it impossible for any one point of the inner lining to become heated to a higher temperature than other parts of the same wall. In this way the overheating of portions of the wall is avoided, and one of the most fruitful causes of short refractory life avoided.



PLAN AND ELEVATION SHOWING GENERAL ARRANGEMENT.

The claims made for this furnace in the patent specifications are of interest, and are given below.

1. An electric furnace, operating with three-phase current, and provided with three electrodes arranged in plan at the angles of an equilateral triangle, in which the inner surface of the wall of the crucible in plan is shaped as follows: Adjacent to each electrode curved substantially on an arc of small radius relative to the spacing of the electrodes and struck from a centre in the axis of the electrode, and between the electrodes lying at all points within a circumscribing circle touching each of the arcs.

2. An electric furnace, operating with three-phase current and provided with three electrodes arranged in plan at the angles of an equilateral triangle, in which the inner surface of the wall of the crucible in plan is shaped as follows: Adjacent to each electrode curved substantially on an arc of small radius relative to the spacing of the electrodes and struck from a centre in the axis of the electrode, and between any two electrodes curved substantially on an arc struck from a centre adjacent the opposite arc of smaller radius.

3. The third claim is a repetition of claim two with the addition that the wall is of substantially equal thickness at all points in any horizontal plane.

In addition to the above operating advantages, the shape lends itself to the securing of a number of other important advantages. The lining is built up entirely of key and wedge bricks. This results in their being held rigidly in place relative to one another, and they are, in consequence, unable to work inwards to the open space of the bath. The bottom is an inverted arch formed with an outer lining of arch brick, silica or firebrick, and an inner lining of magnesia key brick on top of which may be placed another course like that last, or a burnt-in bottom of grain magnesite may be used of equal thickness.

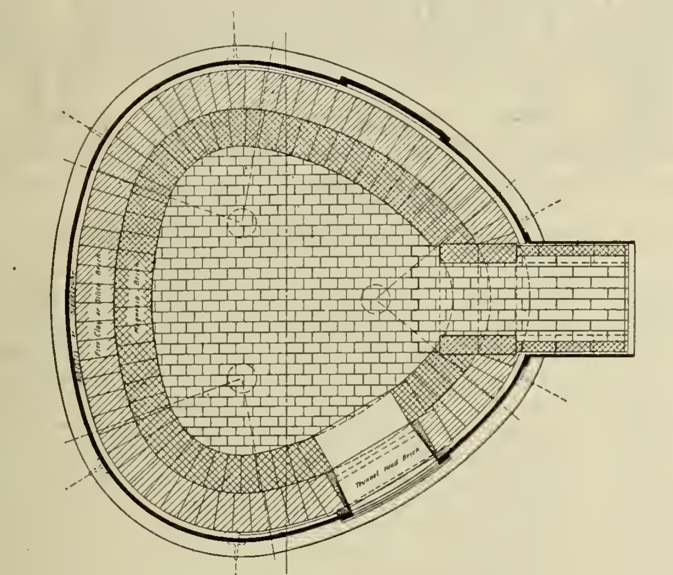
If the operator in taking a heat is careless and not watching his slag, there is no fear of a run-out caused by a brick floating up, as they are all keyed.

The Roof

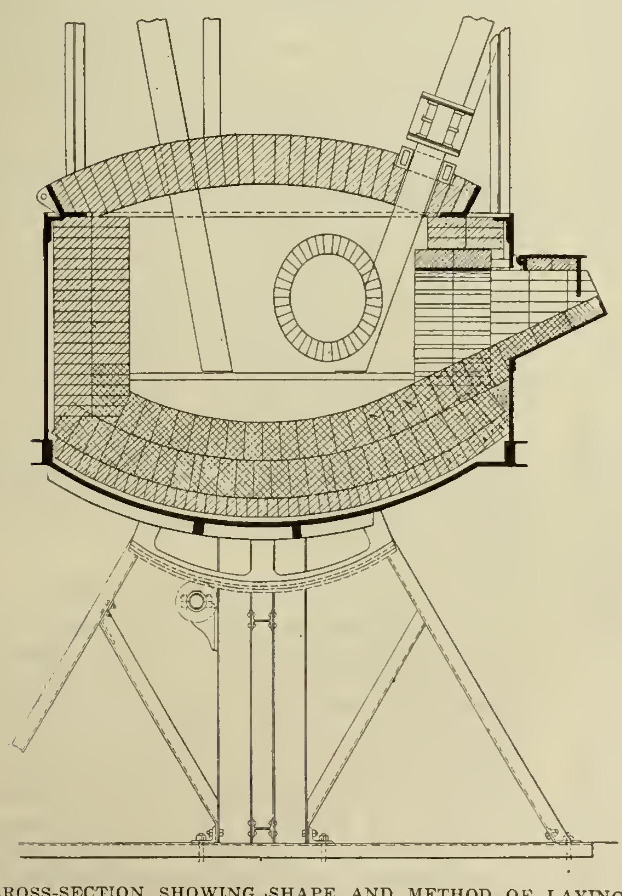
When the furnace requires a new roof it can readily be placed in position with the aid of a crane in about one-half hour, owing to the convenient arrangement of the electrode guides.

On each electrode two upright guides are spaced equidistant from the electrode opening in the roof. At the top of these uprights the guides pass downward at an angle of 70°, and are fastened to the roof cooling casting inserted in a gain made in the roof brick around the electrode opening. These guides are hinged at the top of the uprights.

When a new roof is to be placed in position two bolts are loosened, and after the electrode has been raised to clear the roof all that is required is to lift the roof cooling casting about two inches, enough to clear the gain in the roof, and the whole assembly can be swung out of the way of the old roof being taken off and the new one being placed in position.



SECTIONAL PLAN SHOWING SHAPE AND METHOD OF LAYING UP LINING.



CROSS-SECTION SHOWING SHAPE AND METHOD OF LAYING UP LINING.

THOR EXHIBIT AT THE AMERICAN RAILWAY FOREMEN'S ASSOCIATION CONVENTION, HOTEL SHERMAN, CHICAGO, ILL.

The exhibit of the Independent Pneumatic Tool Company, manufacturers of Thor pneumatic and electric tools, at the American Railway Tool Foremen's Association, Hotel Sherman, Chicago, on August 27 to 29 inclusive, attracted considerable attention. A complete line of Thor pneumatic and electric tools for drilling, reaming, tapping, flue rolling, wood boring, chipping, calking, beading, driving rivets, etc, was on display. Among the new devices was the Thor "Perfect" hose coupling, which has been mentioned in this paper in another article.

The Thor exhibit was in charge of Mr. F. J. Passino, who was assisted by Messrs. W. A. Nugent, E. F. Bertrand, G. H. DuSell, and Van W. Robinson, manager of the Independent Pneumatic Tool Company of Detroit, Michigan.

Other members of the Independent Pneumatic Tool Company who were present at the company's booth were Mr. John Hurley, president; Mr. Ralph S. Cooper, vice-president; Mr. A. Levedahl, consulting engineer of the Aurora factory; R. A. Norling, chief designer of Aurora factory; Mr. H. S. Nielson, Chicago office, and Mr. F. F. Leavenworth, advertising manager.

The Vibrating Machinery Co., Ltd., 546 West Jackson Boulevard, Chicago, Ill., have taken over the entire business of the Schroeter Engineering Company, who manufactured the "Sandhog" electric gyratory sand sifter. The new company will continue to manufacture this sifter but with larger motor and other improvements. They are getting new literature prepared, but in the meantime are using the literature of the old company, which will be distributed together with all information regarding the same.

The New York "Sun," in commenting upon the report adopted by the American Federation of Labor for a still shorter work day, says pertinently:

"But let it also be set down that in the aggregate labor earns and pays its own wage. Nobody else pays it; nobody else can. Out of what labor in the aggregate produces, labor takes its own return. The more that labor produces the more it can take. The less that labor produces the less there is for it to take."

It must be perfectly obvious that if the workers in a foundry are to have a voice in its affairs, they should bear equally the burdens which develop in the conduct of the business. If the employer shares his profits with the workers, the worker should be willing to share the losses of the employer.

Making *Foundry* More Attractive

BETTER and More Wholesome Shop and Working Conditions Would Do Much to Make the Foundry a More Attractive Place in Which to Work.

By F. H. BELL,
Editor Canadian Foundryman

Old Egyptian picture showing Molders or Iron Workers at their work—about the time of Thothmes III., 1490 B.C.

IS there any good reason why work in a foundry should not be carried on in surroundings far more cleanly, bright and wholesome than in the majority of shops at the present time?

It is a hard matter to get apprentices for the foundry. Men who are in the trade do not, in many cases, advise their boys to follow in their footsteps.

What is the remedy? Why not consider better shop conditions, better ventilation, better facilities for the handling of heavier work?

There has been a falling off of moulding shop apprentices—almost to the zero point in many cases, and some of the large employers go as far as to state that it will be a matter only of a few years until the molding business is largely in the hands of foreigners.

In order to properly comprehend the significance of the subject under discussion, it would be as well to first consider the origin of the term "foundry," which has its derivation in the word "found"—to begin, to establish, to originate, to endow, etc. Thus a foundry is a place where things are begun, or established, or originated, or endowed, or in other words, where they are founded. The man who operates a foundry is a founder because he does founding, which is to say, he produces the foundation on which the machine, or implement, or device is founded or built.

The mighty steam engine would avail but little were it not for the castings, which are in reality the foundation upon which the machinists and engineers have to begin in order to show their mechanical ability and skill as well as practising their handicraft.

Take the molder's and founder's bit out of the automobile or the flying machine, out of the factory or the farm, and what have we? We do not need to answer the question. The world simply can not do without the foundry and the men who work therein.

From time immemorial the founder has held a prominent place in providing mankind with implements of every description, but never to a greater extent than to-day; the only difference being in the manner in which his services were appreciated in olden times compared with what they are to-day.

Undoubtedly the metal workers spoken of in the Scriptures and in other ancient histories were founders in the same sense as the term "founder" is used to-day, notably they melted their metal and poured it into molds rather than forging it into the required shape. Wrought iron, which is to say, "worked iron," is the product of later ages and is of comparatively modern origin.

Goldsmiths, silversmiths, coppersmiths, etc., were of necessity melters of these metals, so likewise were all the workers in metals of any kind, all of whom bore the name of "smith." The esteem in which the metal-"smiths" were held and the extent to which the trade was practised may be judged by the extent to which the name smith has been perpetuated. The smiths of ancient days were of no greater necessity than the molders and founders (as they are now known) are to-day, and if they are not now held in the same esteem as formerly the fault rests entirely with themselves, and the object of this letter is to interest, not only the managers of foundries, but those who are employed therein, either as practical molders or helpers, or in any way connected with the foundry.

Some of the Old Methods

Of the methods employed by the ancient smiths, or the shop equipment at their disposal we have very little knowledge, but the Egyptian wall painting shown in the engraving in the heading probably gives as reliable an idea as can be found. The fire was built in a slightly depressed place in the ground; a forced draft was given to the fires by an attendant on either side, who worked the bellows which were placed on the ground in such a manner that they would blow the fire. The attendants worked the bellows by standing on them and alternately throwing their weight from one foot to the other and pulling up the bellows with a rope as the weight was relieved, thus permitting the instruments to be filled and emptied alternately. The little figure opposite the smith's head was probably for fuel or water.

The smiths of those days, no doubt, worked hard and became tired, but the work was likely done out-of-doors, and the men would work up healthy appetites and restful sleep. The present-day molders are placed in a different position and should be treated with even more consideration.

The Molder of To-Day

As things are now, to be a first-class molder and founder is an accomplishment which, as has been frequently pointed out, calls for several distinct characteristics in the makeup of the man. He must be physically able-bodied and muscular, otherwise the work will be a lifelong drag. He must, like all other craftsmen, be mechanically inclined, else he will never be able to comprehend the "why and wherefore" of the different traits or features of his trade. He must be artistically inclined, otherwise he will not be able to make such jobs as have to be done without a perfect pattern, and if his aim is to be a top-notcher, capable of taking charge, he must be in the scientific class in order to master the intricacies of the furnace in the melting of his metals.

To secure boys who will ultimately emerge from their

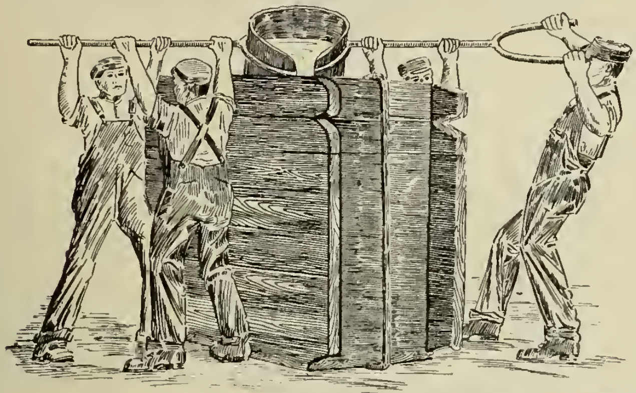


FIG. 2—SHOWING HOW HIGH MOLDS ARE USUALLY POURED.

apprenticeship with all of these natural propensities properly developed and with a will to enter upon life's journey in the foundry, the foundryman must realize that he has on his hands a problem which will be hard to solve unless he makes the environments of the foundry such as will attract the proper class of boys. It cannot be expected that in this 20th century, when so many opportunities are offered to the youth of our country that young men and boys can be found who will voluntarily tolerate a life such as the molders of the immediate past were wont to endure. The requirements of the present and the future are that the foundry must be kept up to the same standard as other industrial institutions both as regards healthy surroundings and labor-saving equipment.

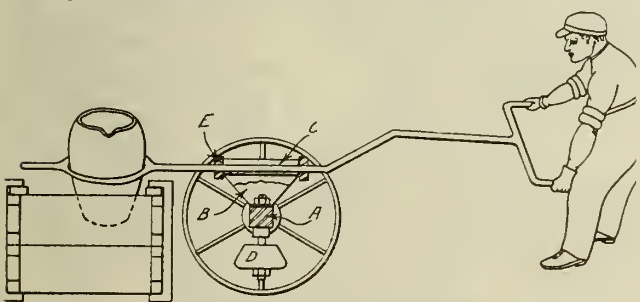


FIG. 3—SHOWING SULKY LADLE ARRANGEMENT. A IS THE AXLE, B IS THE SUPPORT FOR SHANK, C IS SLOT IN WHICH SHANK IS HELD.

The Place of Machinery

The expression "labor-saving" can be translated into two different conceptions. The one is to utilize machinery to replace the man wherever an opportunity offers, while the other is to make the necessary labor of the man the least laborious possible. The first conception is usually

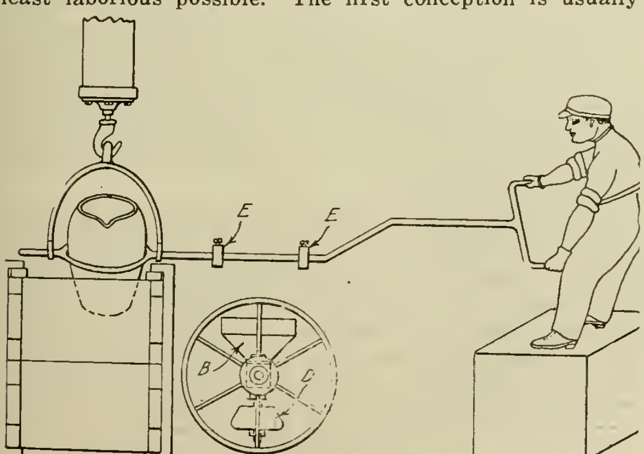


FIG. 4—SHOWING HOW LADLE MAY BE HOISTED FROM SULKY TO POUR A HIGH MOLD.

adopted by the modern foundryman while the latter is seldom considered. There are many improvements which could be introduced into the foundry to make it more attractive, and now that the reconstruction period is at hand and the world must needs be run on a different basis, the foundry must take its place with the others and wake up. Labor-saving appliances which will increase the output of each man will, of course, always be in order but the desire of the writer is to inspire interest in the installation of labor-saving devices for the saving of the labor exacted from each man. Perhaps a few illustrations of what molders have to endure would make more clear the need for improvements.

Things That Should Not Be

In Fig. 2 will be seen a common way of pouring a high mold. A cable hanging over a grooved pulley attached to the roof would be an improvement to this, but inexpensive pouring devices are on the market which

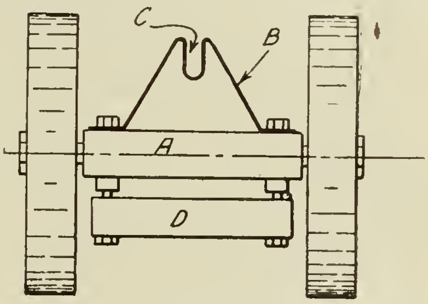


FIG. 5 SHOWS END VIEW OF SULKY WITH LADLE REMOVED.

can be used on jobs such as this or they can be used for pouring snap molds. Sulky ladles similar to Fig. 3 are in use in a limited number of places, but should be more generally used. They are so arranged that they can be used in pouring molds of from a few inches high up to 18 or 20 inches, or they can be lifted from the wheels by any kind of a device and used for pouring very high molds similar to that which is shown in Fig. 4.

Fig. 5 shows end view of the details of the sulky with the ladle removed.

In Fig. 6 will be seen a sample of what the average molder has to put up with in many a factory.

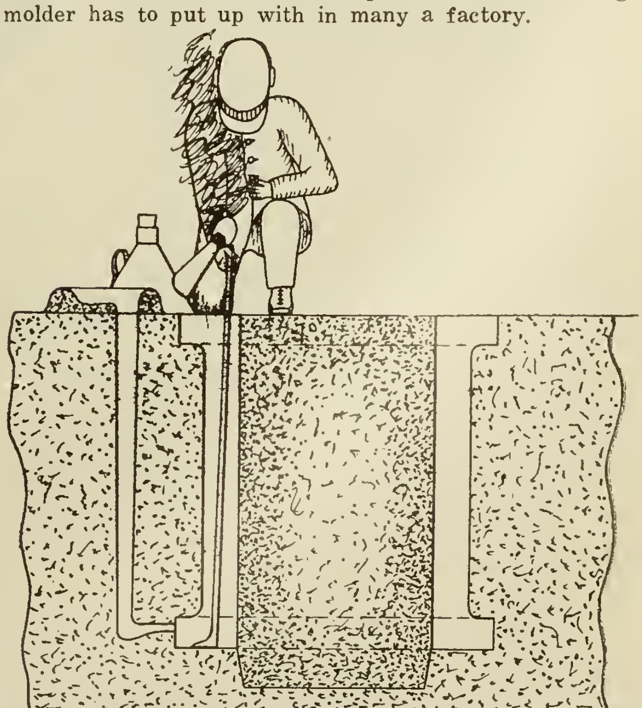


FIG. 6—SHOWING THE USUAL METHOD OF LIGHTING A DEEP MOLD. THE SMOKE AND FUMES FROM THE OIL LAMP ALL COME UP INTO THE MOLDER'S FACE.

torches are actually on the market for molders' use. They consist of an iron oil can with a wick made of several strands of candle wicking shoved down into the spout, a bon-fire is lit on the end which sticks out, and as it burns away it is pulled up with the assistance of a nail.

Fig. 7 shows an attachment which might give some relief, although it is only a suggestion. While it would be better than breathing the smoke it would only be a makeshift at best. What is wanted is a light shop, when in most cases a mirror would reflect more light from the window into the mold than will be accomplished with the coal-oil torch. Of course illuminating the shop by artificial means is very little called for any more, excepting in extreme cases, the eight-hour day making it possible to work by daylight most all the year around, providing the proper arrangements have been made for admitting daylight into the shop.

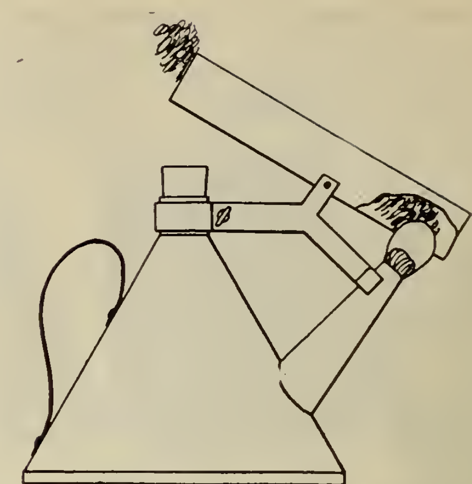


FIG. 7 SHOWS A SHEET METAL ATTACHMENT WHICH WOULD CARRY AWAY SOME SMOKE.

In Fig. 5 will be seen a ventilator such as can be used in the gable. These ventilators are used in rubber factories, tanneries, soap factories and kindred places for the purpose of carrying off foul smells, and if used in the foundry would carry away the gas and smoke and dust, so that the men could work in comfort, and also that the shop would fill up with fresh air which could be properly heated. If a little more consideration were given to the systematizing of the working programme it would be quite possible to make it pleasant for everyone concerned.

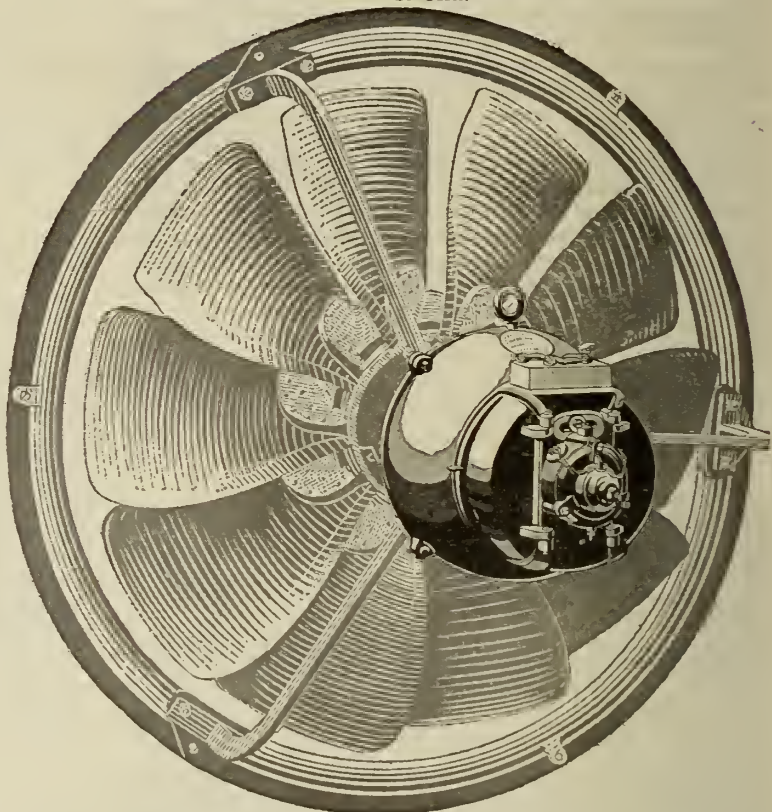


FIG. 8 SHOWS TYPE OF VENTILATOR WHICH WOULD MAKE BETTER CONDITIONS IN THE FOUNDRY.

No molder should ever be allowed to shake out or cut over sand heaps. This does not mean that he is handing over the hard work to some less fortunate person. It simply means that if a fresh man with a dry shirt comes into the shop after the molders are gone he can open all the doors and windows and start the rotary ventilator and suck all the steam and dust out of the shop. This will not do him any harm because he has not been sweating and he is amply working as though out of doors.

Once the foundryman awakens to the need of labor-saving devices not only to take the place of the men he dispensed with but also of labor-saving and health-saving devices for the ones he retains, he will have no further need of fear regarding his future supply of molders. Even though the molding machine became so perfected that a common laborer could do certain jobs, it must be borne in mind that the commonest kind of a common laborer is generally pretty hard pressed for employment when he hits the foundry, but there is certainly no excuse for this state of affairs as foundry work is one of the noblest and most interesting of occupations.

Pages might be written on what could be done to ease the molder's burden, but the molder can do his share of work if the shop is made fit to work in. "Cleanliness is next to Godliness" and it is as easily accomplished in the foundry as in the office. The first thing to do is to clean it up, after which keep it clean. Wash the windows and keep them washed. Repair the broken windows and the misfitting doors and keep them repaired, and put in a proper heating and ventilating system.

The future of Canada, industrially, seems to look bright to the outsider, judging from the number who are looking across this way from the other side of the border. Mr. C. W. Kirkpatrick, Commissioner of Industries and Publicity for Hamilton, informs CANADIAN MACHINERY that there is a very pronounced increase in interest among our neighbors regarding Canada. There have been scores of inquiries, and there have been seven new industries from the United States located in Hamilton this year, including the following: Hoover Suction Sweeper Co., of North Canton, Ill.; Beaver Motor Truck Co., Chicago; Quaker City Chemical Co. (a branch of O. F. Zurn & Co., Philadelphia), oils, greases, finishing, etc; Gerard Wire Tie Co., New York (this company is incorporated for $400,000 in Canada); Lynat & Co., of Philadelphia, hat linings.

"The prospects for the future are extremely good," says Mr. Kirkpatrick. "We have at least one hundred United States concerns now negotiating for locations in Canada. They are feeling their way now, with a view to locating within the year. The unsettled condition of the labor market is keeping them back somewhat. They are also waiting to see what the preferential tariff will be. If it is high, there will be a great deal of manufacturing done in Canada for export. The Hoover Sweeper Company came to Canada for that reason.

A cubic inch of solid coal has a superficial area of 6 sq. in.—but the combined area of an equal weight of pulverized coal is over 30 sq. ft. or an increase in area of approximately 700 times.

The Kilkenny Cats Brought Up To Date

By GIMMIE PEACE

IT is now a home classic how the man, his wife, and the mother-in-law scrap, spit and generally raise a fuss throughout their natural existence. What they do after they shuffle from this mortal coil, is no concern of ours.

The writer cannot help but see a great similiarity between this trio and another trio, who likewise seem to pass through the same procedure of fighting between themselves.

Of course, one might say that all men, their wives and mothers-in-law do not quarrel, which is quite true, and for which we offer up due thanks, but the same holds good for the other trio we speak of, namely, the moulder, the pattern maker and the draughtsman.

While as a general rule these three trades have no brotherly love for each other, still there are a good percentage who see fit to get together as it were.

However, we are chiefly concerned in this article with the trouble-making variety, and why we should sit on them.

This being a foundry paper, I suppose the most diplomatic course would be to say that the moulder is always right, but as the writer feels in a truthful mood he will bravely state that quite often the moulder is to blame, just as much as either of the other two trades for the ill feeling existing.

For example, we will first look at it from the draughtsman's point of view. This gentleman in the high collar, who pushes a pencil industriously all day, designs a certain piece of work, we will suppose in this case, a bed for some special machine.

Being a machine which may not have a great call on it, he instructs the pattern maker to make a cheap pattern as it would not pay to spend too much time on it. Right at this point let us raise our eyes upward and pray that the time may soon come when that expression, cheap pattern, may be no more.

What is more annoying to the pattern maker than a poorly constructed pattern, but what about the poor moulder's feelings when he must make a good casting from a poor pattern?

But we are getting ahead of our story.

The order has been issued to make a cheap pattern quickly. The same is done and it is rushed to the foundry.

The moulder commences work, the core maker contributing his little share of the job. But—what's this—the cores are too big for the mould and leave no wall of metal. The phone is soon in commission and the draughtsman arrives on the scene. Ten chances to one, he blames the pattern maker before he ever measures the core box to see if such blame is correct. But the pattern maker has now arrived on the scene and denies the accusation.

The core maker is now blamed by the pattern maker, who claims the core has swollen, for his box was all right to begin with. All this, and still the core box remains unmeasured. Suddenly they get a bright idea to measure the box to find out who is actually to blame, and find that the pattern maker has actually made an error of 1 inch over all, enough to take away the ½ inch wall on each side.

This may seem an exaggeration, but it is the recital of an actual happening that the writer was interested in. Of course, the moulder and draughtsman join forces (for the time being) and roast the pattern maker unmercifully. To hear them talk, one would believe that about the most stupid people on the face of the earth were pattern makers. All this backbiting does not help to bring the three trades in closer co-operation.

Next we will consider another actual happening. This time it was the bed of a grinder, which had inside bosses, and outside bosses which must line up. The casting was made without noticing that these bosses were very much out of line, and of course, when it was found out trouble ensued.

Again the two gathered and chewed the fat, but in this case the argument seemed to lead nowhere. The pattern was measured—it was O.K. The core box was measured—it was O.K. It looked bad for the moulder, when suddenly another moulder who had entered the scrap found a most unusual thing. "Hey, lookat," he yelled. They looked. Someone had moved the bosses on the core box to line up, for the old nail marks were still to be seen.

To be brief, it was discovered that the previous evening, the chief engineer had acquainted the draughtsman of the trouble. This pencil pusher suddenly remembered he had been instructed to change these bosses and had not done so.

He kept his thoughts to himself and vowed to change those bosses unseen and pass the buck and puzzle the crowd. He did—and would have got the moulder into a fine pickle, but for the sudden discovery. Here is a case where the draughtsman was actually willing to lie, fake, in fact, do anything rather than shoulder the blame.

Of course, he got a tin can tied to his pay envelope, which he richly deserved. Still, it's things like these that keep up the existing bad feeling. It was a standing joke in the foundry spoken of, from that time on, that some draughtsman had come down overnight and changed the pattern. This condition existed, no matter how ridiculous such a statement could be, in other words, one poor speciman of the business had spoiled his fellow tradesman.

Last but not least, we are now going to blame the moulder.

This story concerns a saddle for a milling machine. There was a certain loose piece went in this pattern, which was numbered plainly No. 1, to go against a face, No. 1. Full instructions were given before the first casting was made. These numbers were painted in black against the yellow background, as is the regular custom.

The casting was made, but it was wrong, as one portion of it, where this loose piece existed, was upside down.

The moulder was blamed right away, but on looking at the pattern, we saw that he had placed the piece in as directed, for the No. 1 was placed against No. 2. The pattern maker was accordingly blamed, although he swore up and down that he had marked it right. With the suspicion that unfortunately rests between these trades fully aroused, Mr. Pattern Maker suddenly announced in no meek terms that the lettering was not his. This caused quite a flutter and an indignant Irishman (who was the moulder), wanted to know if he imagined he could make figures like that.

The pattern maker was floored, for a moulder, as a general rule, does not go in for fancy lettering, so the subject was dropped—for a time.

About three days afterwards the pattern maker in this story got hit with a bright notion.

There was an apprentice in his department who was a son of the moulder concerned. Suspicion and distrust once more got to work, and he studied this chap's lettering, but readers can easily guess the rest, for after considerable threatening the youngster admitted being called to the moulding shop by his father and later making the change quietly. In other words, he merely painted over the first number and added it to the other end. This, of course, reversed the piece to all appearances.

All this deception, where by honestly coming out and taking the blame, quarrelling would have been avoided.

What is the answer?

Simply this, that these trades still unfortunately distrust each other. There is no reason why such a condition should exist—but yet it does—and we must admit it.

All are human and liable to err, one without the other is not of much account, but all together and working in

(Continued on page 68)

Making Steel in Canada

THE Blast Furnace, With Its Various Intricate Parts, is Something Not as Familiar to the Mechanical Trade as it Should be. "Furnaces, Like the Female Sex, Are Sometimes Hard to Handle."

Part II—The Blast Furnace

IT would be interesting to try and describe the evolution of the blast furnace; to describe the primitive furnace of Tubal Cain, the hole in the rock and the bellows of goat skin, but the task would be too long. Sufficient to say that the history of the blast furnace has been one of progress, small beginnings, gradual growth, based on experience and knowledge, and the end is not yet.

Let us consider first what makes up a complete furnace plant.

1st—Bins for storage of raw material, ore, limestone and coke.

2nd—Water supply for cooling purposes.

3rd—Blowing engines for blast air.

4th—Stoves for heating blast air.

5th—Furnace for actual melting or reduction purposes.

6th—Rolling stock, cars for raw material, ladles for cinder and hot metal.

7th—Mechanical appliances, hoisting engines, cranes, bell operating cylinders, mudguns, etc.

To discuss all these portions we must first have a knowledge of the various parts and their names. Fig. 1 gives a good idea of a modern furnace; all the important parts are numbered and the names generally used listed below:

1—Furnace foundation
2—Hearth or crucible bottom blocks
3—Hearth jackets
4—Hearth
5—Bosh
6—Bosh bands
7—Bosh coolers
8—Mantle
9—Inwalls
10—Furnace shell
11—Stock hopper
12—Little bell
13—Stock distribution
14—Lower hopper
15—Large bell
16—Abrasion plates
17—Bell operating mechanism
18—Skip bridge
19—Skip car
20—Furnace columns
21—Hot blast main
22—Bustle pipe
23—Tuyere pipe or stock
24—Iron notch
25—Tuyere zone jacket
26—A frame furnace top
27—Gas outlet
28—Breeder pipe
29—Downcomer pipe
30—Stove
31—Cold blast main
32—Hot blast valve
33—Gas main
34.—Equalizing pipe.
35—Scale car
36—Cinder notch

The usual arrangement of plant is shown in Fig. II, but sometimes space causes stoves to be placed at an angle to the furnace.

The reader should endeavor to get firmly fixed in his mind the path of the gas and air by studying Fig. II and the following explanation.

The air is compressed to about 16 lbs. per sq. inch pressure by the blowing engines (6,000 cubic feet of air for each 100 lbs. of pig iron are about the usual requirements), passes along pipe A (cold blast main), is admitted by means of a cold blast valve to whichever stoves are "on air." Stoves will be described more fully later, for the present we can consider them as steel shells containing a checker work of brick, capable of receiving heat from gas and imparting heat to air.

The cold blast passes through the stove, is heated, passes out through the hot blast valve, along the hot blast main (B), to bustle pipe and furnace tuyeres.

While this is happening in say "A" stove, the gas passing from the top of the furnace through the downcomer, dust catcher, and gas main, C, is being burnt in, say, B and C stoves, the waste gases passing through the chimney valve to the stove draft stack.

It will be seen at once that, by the proper manipulation of the various valves, stoves can be changed from gas to air at will. The usual period is one hour on blast or air, three hours on gas; the temperature of the heated air is around 1,300 to 1,400 degrees Fahr.

It is, of course, understood that the skip car is used to convey stock to the furnace, which is admitted by means of the small and big bell.

Now that we have a general idea of what a blast furnace consists of, and the way the various portions are arranged, let us consider things more in detail.

First, look at Fig. 1, and notice how the furnace is built, the columns (20) support the mantle. (8), the mantle consists of a stiff circular girder, carrying not only the furnace shell and top gear, but all the brick lining above the mantle; in a modern furnace this weight is about 2,000 tons. Consider the responsibility of designing columns to carry this load and the necessity for good foundations under the columns.

The purpose of this construction is to allow the hearth and bosh to be relined without touching the inwalls.

The hearth jacket, (3), is an important item. Fig. 1 shows one form; a better construction consists of an inner cast iron jacket containing cooling pipes, and an outer steel jacket 2½ in. to 3 in. thick, riveted together and surrounded by steel bands, Fig. III.

The purpose of the hearth jacket is to prevent the liquid metal being forced out of the bath by the pressure inside. This sometimes happens and a stream of metal shoots out, cutting and destroying all and everything in its path.

The iron notch, (24), deserves attention, for it is the business end of the outfit. It is usually located about 12 inches above the bottom of the hearth. It is one of the most simple parts of the furnace;no water cooling,small,about 10 in.x

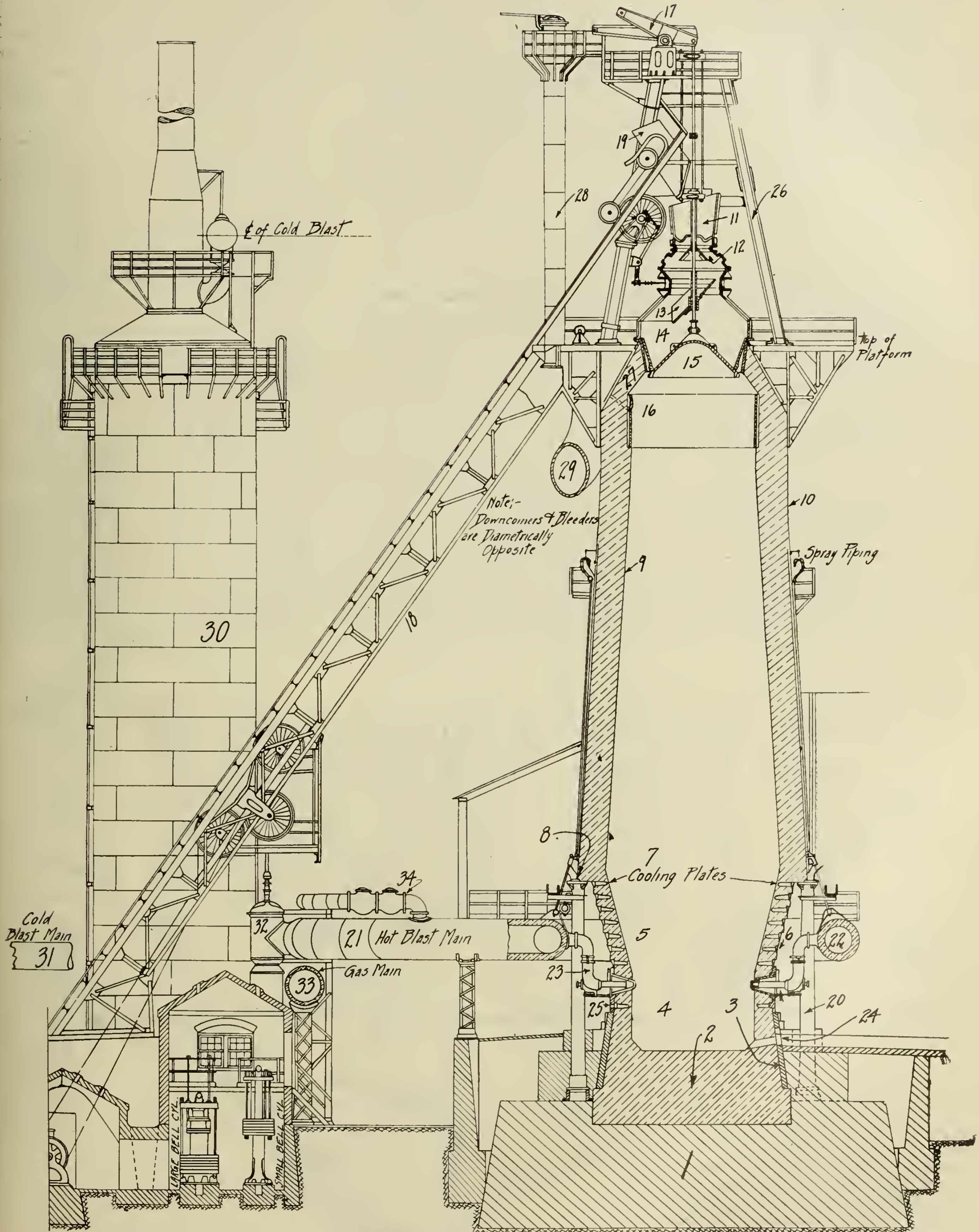


FIG. 1 (CONT.)—RIGHT HAND PORTION OF MODERN FURNACE INSTALLATION.

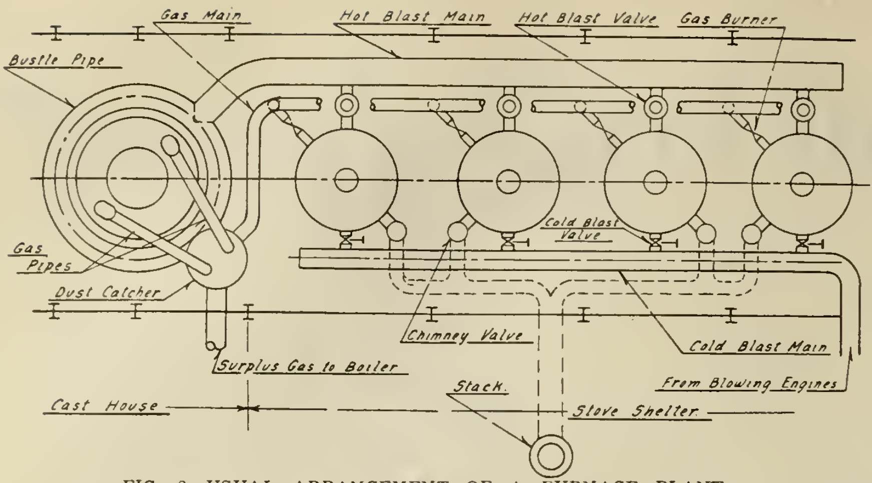


FIG. 2—USUAL ARRANGEMENT OF A FURNACE PLANT.

6 in., open when pouring and closed at other times by forcing balls of clay into it by a machine called a mudgun. The clay, of course, soon burns into place and is as solid as the furnace lining.

In normal operation tapping takes place at four hour intervals, and is effected by drilling with a long rock drill and sledge; a dangerous job, and one demanding skill, strength, courage and care.

Some 4 ft. to 6 ft. above the iron notch are located the cylinder notches, (generally one on each side of the furnace). Now notice a peculiar thing; liquid iron will flow through clay or brick and will not affect it; cinder or slag will cut brick work quickly. Therefore, a metal opening must be provided for cinder, and to keep it from burning away it must be water cooled. The cinder notch is usually built up of three parts; monkey, intermediate cooler and cooler, (Fig. 4). The monkey is closed by means of a ball of clay.

Above the cinder notches we have the tuyeres; one of the most important parts of the furnace. Because of the heat of the blast the hot blast main, bustle pipe and tuyeres are all lined with fire brick, a beautiful piece of brickwork, for every joint must be fitted and close else the fierce cutting blast, with a temperature of 1,400 degrees Fahr., and a pressure of 16 lbs. per sq. in., will come in contact with the steel work and cut through it in a short time.

A modern 500-ton furnace has twelve tuyeres, equally spaced (see Fig. 5), notice the water-cooled portion extending into the furnace, the blow pipe, which often has to be renewed; notice how the elbow section, or boot leg, as it is called, can be swung back to allow of a quick change of blow pipe or cooler. The eye sight is closed by a piece of heavy glass or mica, and is used by the furnace operator to inspect the working of the metal. The portion of the furnace above the hearth and below the mantle is called the "bosh." The actual melting takes place in this region, and the brickwork is subjected to intense heat and abrasion. The usual construction consists of heavy steel bands spaced about 12 inches apart, and cooling plates inserted at frequent intervals to keep the brickwork from overheating.

Fig. 6 shows a typical cooling plate; usually made of a brass mixture, sometimes the plates are set direct in the brickwork, sometimes in a cast iron housing, or box; the object of the housing is to facilitate renewal should a plate burn out.

Operating a furnace is a simple and routine proposition when all is going well, but furnaces are known to their keepers as members of the female sex, and they have all the beauties and uncertainties of that sex, and at times they do not go well. The iron notch cannot be opened, the cinder reaches the tuyeres, or the stock sticks, scaffolds and freezes, to say nothing of blow-outs and gas leaks. All these things call for a high degree of skill and intelligence on the part of the operator, for a false move on the part of someone may endanger a life and property.

Yet how strange that this fascinating field is neglected by college trained men; often because it means a few years of hard toil before reaching a position where they can employ their technical training.

To stand in front of a furnace pouring is a wonderful sight. To see the cinder notch opened and watch the tons of slag drained to the huge ladle; to see the preparations for casting pigs in the floor of the cast house, or the less picturesque operation of pouring through the iron runners to the iron ladles, is a sight, which, if witnessed for the first

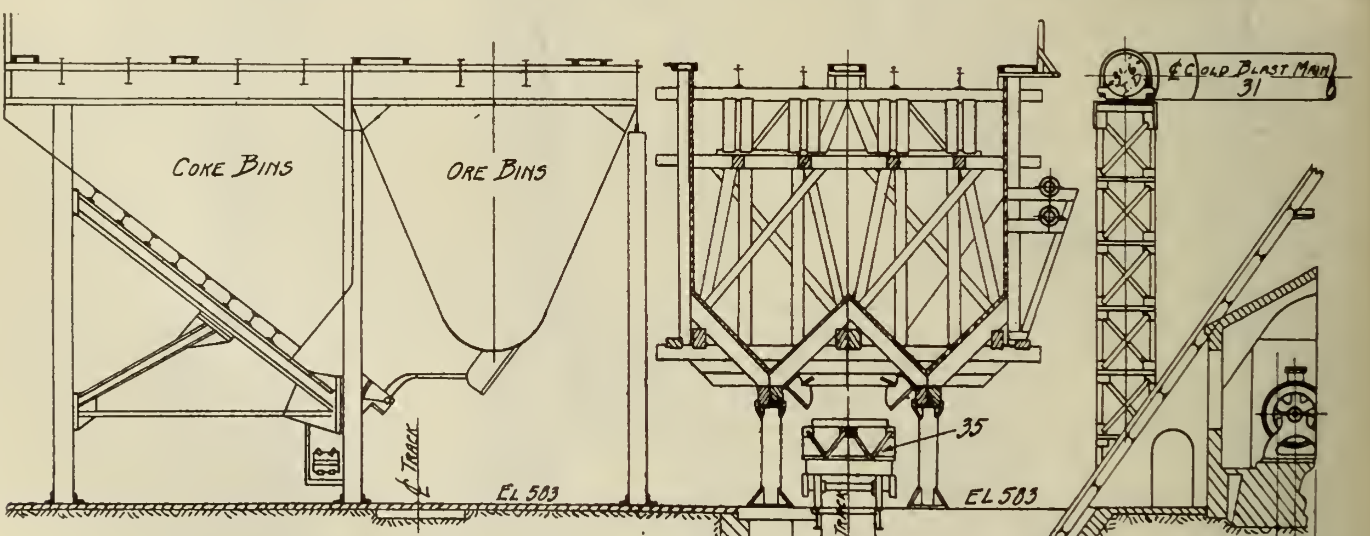
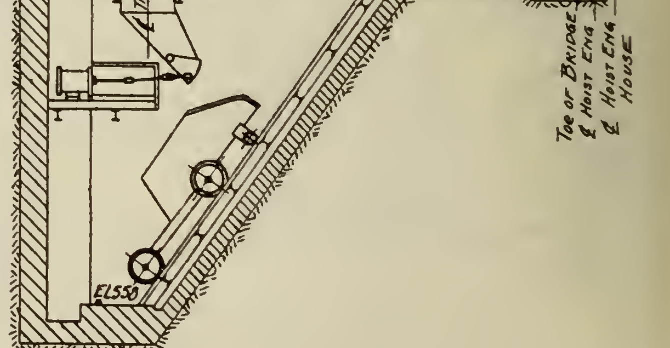



FIG. 1—LEFT HAND PORTION OF MODERN FURNACE INSTALLATION.

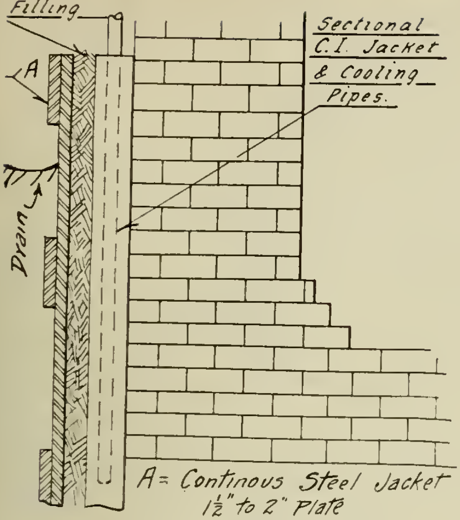


FIG. 3—HEARTH JACKET.

time at night, will never be forgotten.

I remember two brothers who worked at a steel plant; they often talked of their work at home, and their mother, who listened, formed a vague idea of the operations she had never seen. One evening she was persuaded to visit the plant, she saw the mills, the huge revolving fly wheels and rolls, they visited the open hearth and saw 100-ton furnaces roll over and pour out their contents; they reached the blast furnace just as pouring commenced; the younger brother pointed out the pouring stream, with its scintillating sparks, with pride. Mother grasped his arm; "John," she whispered, "where do we go when the blamed thing starts to go round?"

But let us return to our furnace. The brickwork above the mantle is often protected by cooling plates or pipes. The furnace shown in Fig. 1 is cooled by a spray on the outside of the shell. This is not a successful method in cold climates, or where high winds are encountered.

The steel shell is of heavy plate work, ½ in. to ¾ in. plates, for as the lining wears hot spots appear on the steel work. At the stock line, or throat of the furnace, cast iron abrasion plates are inserted to prevent wear to the brick work.

The brick lining deserves a few words. At the bottom of the hearth the pressure is the greatest, and the temperature is about 3,000 degrees Fahr. Large blocks are employed here. They are of high grade fire clay, laid with a thin joint and fitted by rubbing down with carborundum stone. All joints are carefully staggered, for a leak here would be fatal. In the bosh the temperature is higher, 3,200 degrees Fahr. to 3,500 degrees Fahr., and brickwork of very highest grade must be employed. From the mantle up the temperature drops to 500 degrees Fahr. at the stock line, and second class bricks can be accepted about half way up the inwalls.

Notice the thickness of brickwork, 3 ft., 0 in., to 3 ft., 6 in., insuring a body of material to hold the heat and stand the abrasion of a long campaign. Thin wall furnaces have been unsuccessful, mainly because an excessive amount of water cooling was required, and it is just as bad for a furnace to be too cold as too hot.

The furnace top is a source of contention among blast furnace engineers; history for just a minute, please. All furnaces were at first filled by hand, men or women, carts, wheelbarrows or baskets, and the ore, lime and coke could be distributed just as the superintendent of the furnace desired. If one side of the furnace was cold additional coke could be fed to that side; if hot, vice versa. With the first mechanical tops this could not be done and many operators were dissatisfied. Patent tops with distributors were developed by the score, some worked, many did not, often because the inventor forgot that a blast furnace top is at the best a dirty, hot, mechanical rocking place, where springs, cams and gears have only a short life, where adjustments cannot be maintained and the hammer is often the favorite tool in more senses than one.

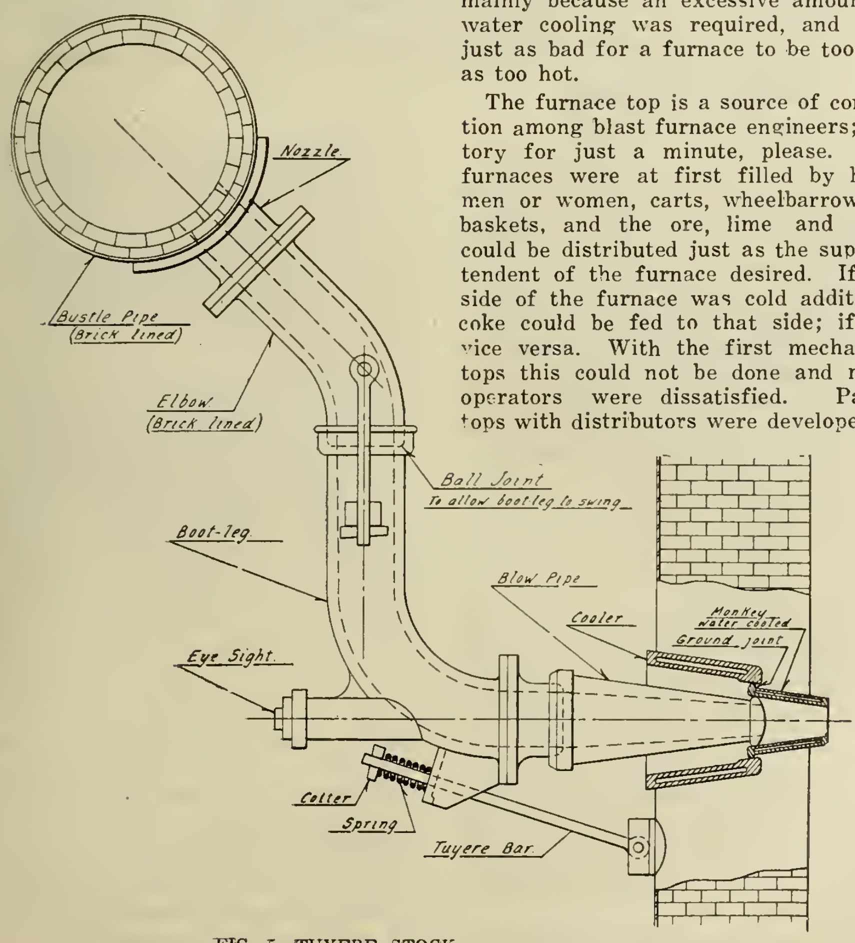


FIG. 5—TUYERE STOCK.

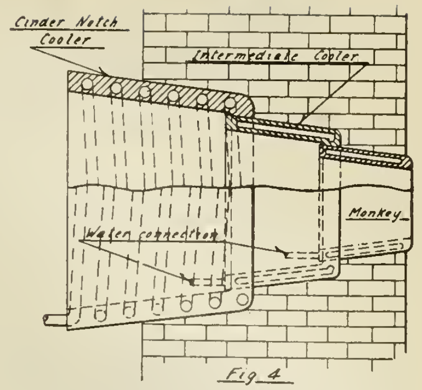


FIG. 4—CINDER COOLER.

Let us consider what we must have on a furnace top.

1st—A support for the sheaves of the skip car rope.

2nd—A hopper into which the skip car can dump.

3rd—A bell to admit the charge to the inner hopper.

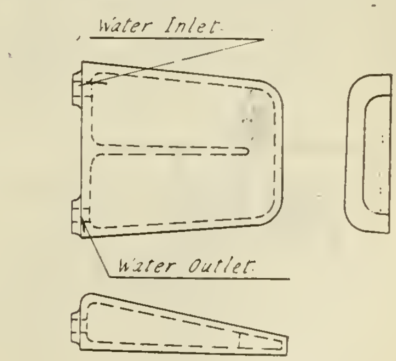


FIG. 6—BOSH COOLERS.

4th—A bell to admit the charge to the furnace.

5th—Mechanism for operating the bells.

The two bells are, of course, to prevent the escape of gas each time a charge is admitted into the furnace. One bad accident to a furnace is to drop or lose a large bell. Fig. 1 shows all these parts very clearly with the addition of a simple distributor, that in part meets the demands, but there is room for much engineering skill on a furnace top yet.

At the furnace top are also located the gas outlets. The modern way is to arrange two to four outlets, as shown in Fig. 7, the ascending gas carries with it many particles of fine dust, coke or ore, especially when small or large explosions occur. The valve at the top takes care of explosions, acting as a safety valve, the long riser gives the heavy dust a chance to fall back to the furnace, so that the gas going to the dust catcher is fairly free from large particles of dirt.

Dust catchers take many forms, but

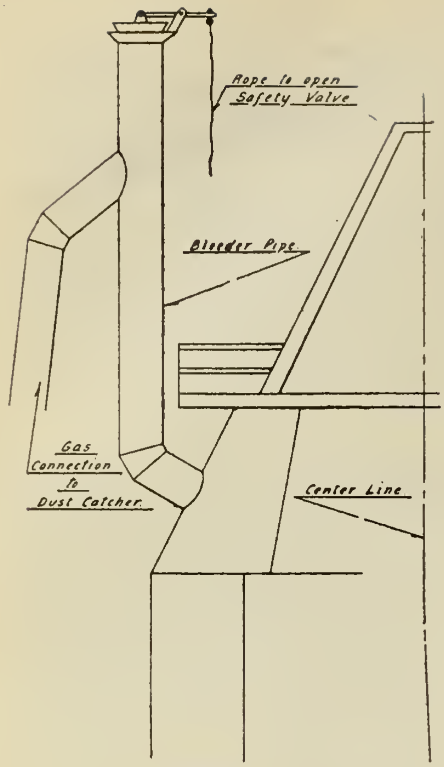


FIG. 7—BLEEDER CONNECTION.

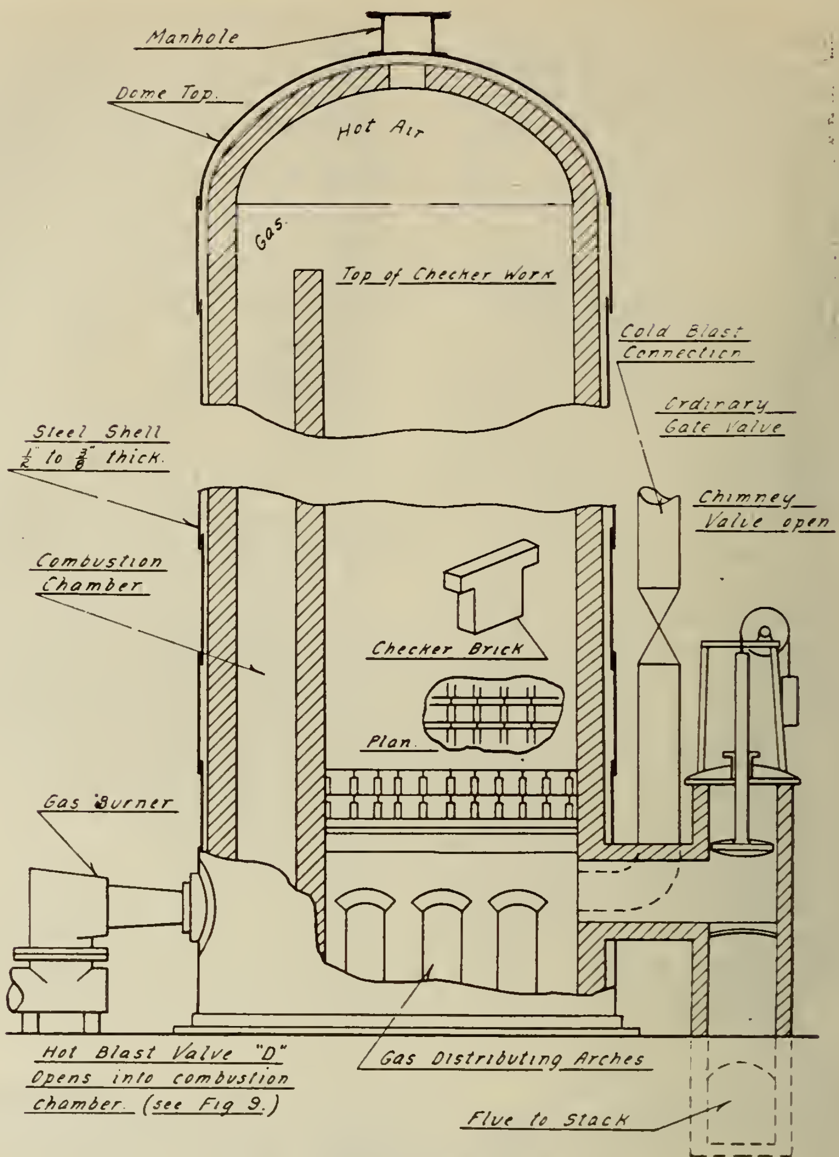


FIG. 8—SECTION OF A STOVE.

are mainly based on the principle that if the velocity of the gas is lowered dust will be allowed to be deposited.

Skip engines are steam or electric driven. Absolute freedom from breakdowns is more important than absolute economy.

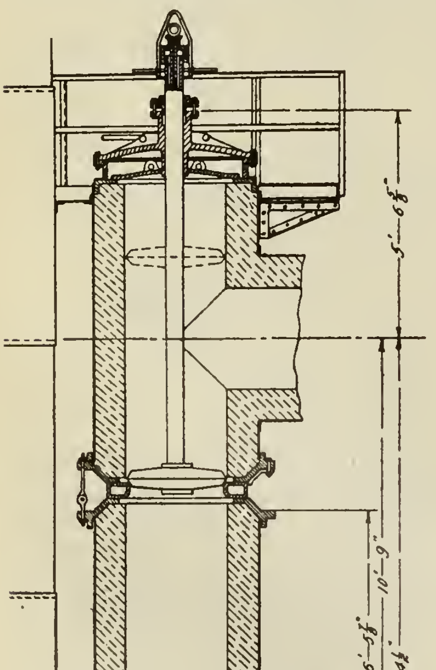


FIG. 9—HOT BLAST VALVE.

Bells are lifted by steam cylinders or electric hoist; dependability again being the chief feature desired.

Now let us consider the stoves more in detail. There are shown two main classes, those that have the draft stack on top as shown in Fig. 1, and those that have a common stack for all four stoves and separate from any of them as shown in Fig. 2. Most Canadian plants favor the latter design. A section of a stove is given in Fig. 8.

Just at this point we cannot resist going into history for a few minutes. Away back in 1825 James Neilson started using preheated air for furnace blast. The saving was so pronounced, even with low temperatures, that he patented the idea and several forms of stoves, but there were avaricious men in those days, even as to-day, and a combine of Scotch furnace owners, anxious to save a few pence in royalties, took a pledge to break the patent by any means, legal or otherwise. The fight was long and bitter, but in the end the pence-saving Scotch lost the day.

The early stoves were cast iron pipes set in brick chambers, and if the temperature exceeded 700 or 800 degrees Fahr. the life of the tubes was very short. In many cass the stove was located on top of the furnace.

Referring to Fig. 8, this stove is known as a two-pass stove, the gases passing up and down before going to the chimney flue. Other designs have three or four passes, but many passes often cause trouble with blocked passages, etc.

The gas from the furnace top is burnt by a special burner at A. The products of combustion pass up the combustion chamber, down through the many openings in the checker work, heating the whole mass of brickwork on the way, finally the waste gases pass out by way of the chimney valve B. The draft of the stack is, of course, the actuating force.

After heating the gas is shut off, air doors closed, chimney valve closed and cold blast valve, C, and hot blast valve, D, opened. The cold blast is then heated for furnace operation.

Notice the hot blast valve in Fig. 9, the seats are water cooled and arranged so as to be easily removed. the valve

Continued on page 263

NEW AND IMPROVED EQUIPMENT

A Record of Machinery Development Tending Towards Higher Quality, Output and Efficiency in Foundry, Pattern and Metal Work Generally

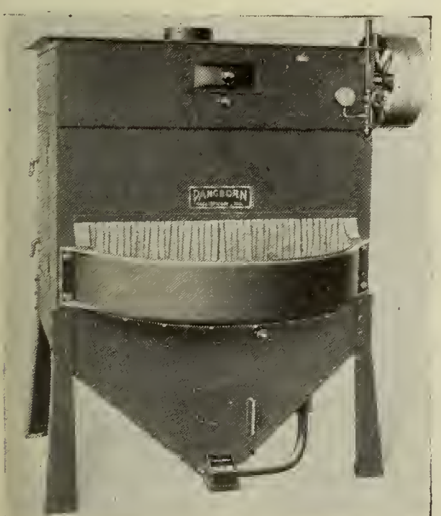
NEW AUTOMATIC SAND-BLAST FOR WORK OF LIMITED SIZE AND VOLUME

THE demand for hygienic sand-blast equipment that protects the operator, naturally arising in the shops of large volume, first efforts to meet these demands have been in this field, and while some efforts have been made to meet the needs of the shops producing a small volume of work and of limited size, this has heretofore been largely in the nature of efforts to adapt existing equipment to these conditions or with devices that did not provide automatic cleaning.

The success of the automatic rotary table, with its continuous operation, ability of the operator to see progress of the cleaning, while at the same time working in the open free from dust, has created a demand for a machine of this type that in size and cost would be within reach of smaller plants.

We illustrate herewith a new machine just marketed by the Pangborn Corporation, Hagerstown, Maryland, that combines all of these features in the highest degree.

It consists of a rotating table half exposed, and half in a dust-tight housing in which the blasting action takes place. Work to be cleaned is loaded, turned as required, removed and renewed, while the machine is in operation. The table top is 42 in. in diameter and the entire device requires a floor space of but 4 ft. 8 in. by 4 ft. 3 in.



HYGIENIC SAND-BLAST MACHINE.

The sand-blast acting is of the suction type, the spent abrasive falling through the grated top of the table and returned to the blasting member in a continuous cycle.

The blast projector takes air nozzles interchangeably from 1/8 in. to 5-16 in. diameter and at 80 lb. pressure the air consumption, with the smaller size nozzle, is as low as 21 cu. ft. free air per minute, while the entire power for driving the table is but 1½ horsepower. This makes the machine adaptable to the smaller shop as also an admirable auxiliary to larger equipment for special uses, or to take care of periodical peak loads.

The table top is provided with a 4 in. high guard, which acts as a retainer for light work, which otherwise might be dislodged or blown off by air force, and with a 10 in. opening for passage of the work to and from the blasting zone it is available also for pieces of some considerable size and weight. This opening through which the pieces pass from the exposed portion to the blasting zone is closed by multiple, sectional, flexible rubber curtains, which retain the flying abrasive and dust, making it a hygienic machine and available for installation with other machine tools, without detriment.

The table is equally adaptable for use with either sand or metal abrasive.

The weight of the machine is only 1,750 pounds, and provision is made for connection to an exhaust system for quick removal of dust and disintegrated material.

A NEW SAND MIXER

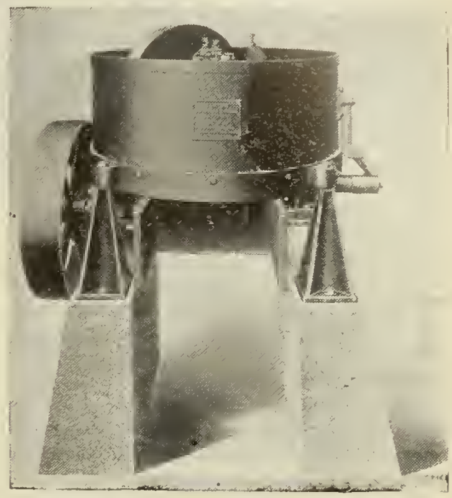
The National Engineering Company, 549 W. Washington Blvd., Chicago, Illinois, manufacturers of the Simpson Intensive Foundry Mixer, have announced an additional size machine which they call their No. 0, 3 ft. diameter Simpson Mixer, shown on the accompanying illustration.

The new size is constructed along the exact same lines as the two other sizes which they manufacture, namely, No. 1, 4 ft. diameter, and No. 2, 6 ft. diameter Simpson Mixers.

The Simpson Mixer enjoys an enviable reputation all over the United States, Canada and in foreign countries as it is being used by a great many of the best known foundries for mixing core sand, facing sand and other foundry sand mixtures.

The Simpson Mixer is a muller type of machine, having an automative discharge and accomplishes very efficient results by a combination of mullers and plows. The new size Simpson Mixer with 3 ft. diameter pan will be in demand by smaller foundries who do not require the capacity of the larger size machines and who will be able to use the new small size as its price and capacity will warrant their using the small Simpson Mixer. Also in larger foundries where it is desired to use more than one machine for sand mixing purposes located in various parts of the foundry, the small size Simpson Mixer can be used to advantage in this respect.

Progressive foundrymen concede the efficiency of the muller type of machine, which has proven so successful in preparing various kinds of sand mixtures in foundries producing grey iron, steel, malleable, aluminum and brass castings.



SIMPSON NO. 0 SAND MIXER, 3 FT. DIAM.

MAKING STEEL IN CANADA

Continued from page 262

and stem are water cooled, and every part is brick lined; this is indicative of all blast furnace work; heat to be resisted and yet working parts arranged just the same.

Furnaces are rated by their production per day of twenty-four hours. Their heights are for the most part the same, 70 ft. to 85 ft., if made higher the weight of stock would crush itself; if lower the top temperature would be too high, and there would not be space for the various changes. The diameter of hearth, therefore, controls the size. Roughly, a furnace having a 13 ft., 0 in. diameter hearth will produce 250 tons per day. A furnace having a 16 ft., 6 in. diameter hearth will produce 500 tons per day.

To produce 500 tons of metal, 1,000 tons of ore, 1,200 tons of coke, 500 tons of limestone and 3,100 tons of air must be handled.

We have covered a big field in a short time. Study the illustrations and reason out the why of the various parts and more information will be obtained than by mere reading.

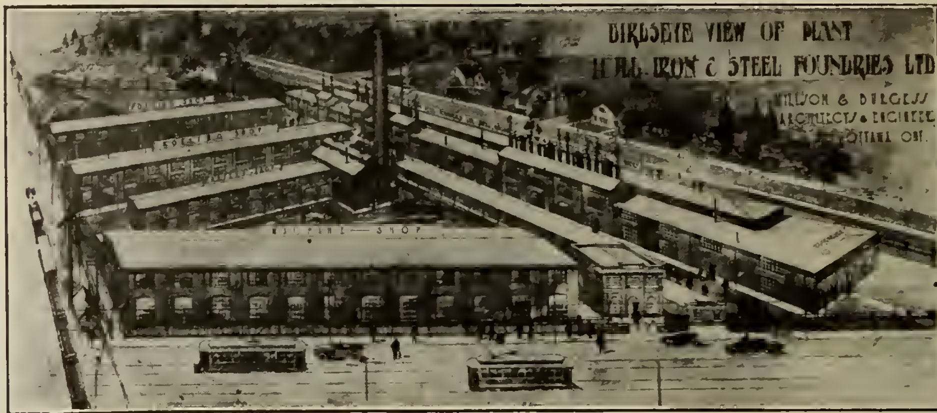
Our next subject will be "Operation and simple chemistry of the blast furnace."

Science eliminates guesswork chemically, improves quality metallographically, insures uniformity physically.

Plant of the Hull Iron and Steel Foundries

A COMPREHENSIVE story of the business from its inception up to the present, including the system of recording and cost keeping.

By F.H.B.



BIRD'S-EYE VIEW OF THE "HISCO" PLANT OF THE H. I. & S. FDY.

THE Hull Iron and Steel Foundries, Limited, whose works are shown in the accompanying illustration, is an establishment of which its promoters and founders are justly proud. As its name would imply, it is essentially a foundry, although a machine shop of no mean proportions accompanies it. As its name also implies, its products are both of iron and of steel, although the steel predominates.

Grey iron foundries are not an uncommon part of the make-up of most every industrial centre, and the grey iron department of this plant is practically a duplicate of other foundries which are equipped for doing heavy work. The melting capacity of this department runs into tons and the equipment consists of enormous cupolas and ponderous cranes. With the foundry specially equipped. as it is for doing large work, they have no particular advantages in the way of doing small castings, and do not cater to that trade, but for such castings as fit their capacity they take second place to none, and are prepared to fill orders for grey iron castings of very large dimensions.

The Steel Foundry

It is to the steel foundry branch of the plant, however, that we will pay particular attention on this occasion. Although not built for a munition plant or in any way as a war-time necessity, it appeared on the steel producing horizon at a most opportune time and did much toward deciding the issue and winning the goal toward which all were struggling.

In the year 1913, when times were not any too good in any line of business, when in fact many industries were working with very reduced staffs and hundreds of workmen were in idleness, Mr. A. H. Coplan, of Ottawa, with a keen eye to business, saw an opening for just such a business as this, and with characteristic determination and enterprise succeeded in completing the structure and getting it in first-class running order at just about the time of the beginning of hostilities. The war did not bring much business to Canada at first, but on the contrary, it added to the depression; however, in no time it was found necessary to call upon Canada for supplies other than foodstuffs and while our machine shops were found to be of inestimable value in the production of shells, etc., the foundries, particularly the steel foundries, were also called upon to produce enormous tonnage of steel castings, with the result that the Hull Iron and Steel Foundries found themselves very busy and getting busier. In fact, it was found necessary to strain every muscle in order to meet demand for castings, and many additions were added to the plant as a consequence.

MODERN STEEL FOUNDRY PRACTICE HAS BEEN SO PERFECTED THAT TOP POURING CAN BE DONE SUCCESSFULLY ON MANY LINES OF WORK.

Now that the war is over and the country is calling for such lines as were neglected for so many years, the experience gained during the war, particularly in making goods which would pass the rigid examination of the munition board and also in producing the maximum output in the shortest possible time, places them in an enviable position for filling large orders, particularly of large castings, on surprisingly short notice.

It must not be inferred from this, however, that the experience gained during the war is all they have to fall back upon. The company was very fortunate in securing the services of Mr. A. Baillot as foundry superintendent. Mr. Baillot is a thorough master of the steel foundry business, having had exceptionally wide experience in Belgium and France, especially in Paris, France, and this, along with the experience of the last six years, places them where they are to-day.

Unlike many plants of the mushroom order, which sprung up as it were during the night in order to do munition work, and which suspended operations as suddenly as they began on the conclusion of peace, the Hull Iron and Steel Company never even slacked down, but on the contrary are busier than ever and are at present making extensive additions.

Present Capacity

The present capacity of the foundry is 600 tons per month, and the equipment consists of electric as well as open-hearth furnaces, ordinary foundry cupolas and Trapman Converters. They are also well provided with annealing furnaces and drying ovens, in addition to special equipment for heat-treating manganese steel castings.

Special Features

A unique feature of this plant is that they can produce practically all of their own raw material. With the aid of the electric furnace steel turnings make ideal raw material, while wrought or even cast turnings can be used if so desired. It has also been demonstrated that first-class metal can be produced direct from the crude iron ore. Of course, none of the metal procured from any of these sources is poured into steel castings. This metal is poured into pigs, after which it is tested and analyzed for carbon, silicon, sulphur, phosphorus, etc., and graded accordingly.

Moulding Equipment

In the moulding shop the equipment includes pulley and gear machines for work up to fifteen feet in diameter and electric cranes capable of handling castings of this size, in addition to the regular run of foundry requisites. Another interesting operation for which they are well equipped is that of heating and compressing certain castings in order to make the grain more dense and sound.

Sure of Quality

Steel castings are not ordered in the manner so commonly in vogue in grey iron foundries, where the principal requisite is that they be soft. Steel castings are ordered to be made to specified chemical content as well as physical strength, and from every batch of metal used test bars are poured which are analyzed by a competent analyst, and physical test taken on powerful testing scales. The company has both the physical testing apparatus and complete testing laboratory of their own in charge of F. H. Young, a practical chemist and metallurgist. A view of the laboratory is shown in the accompanying illustration.

Additions Under Way

At the present time two additional buildings of large dimensions are under construction along with some smaller ones. One is a complete two-storey pattern department remote from the main building, with five bays downstairs and six upstairs. These bays are separated from each other by automatic fire-proof doors, in fact, the entire building is to be as near fire-proof as man's ingenuity can devise. One large bay is to be equipped with machinery and tools for doing pattern work, while the remaining ten will be for pattern storage purposes. The other building will be a modern machine shop equipped with tools for keeping the shop equipment in order, and also for machining such castings as have to be machined before shipment. Many of the castings turned out of this foundry are of such proportions that few machine shops could handle them. Among the tools in the present machine shop might be mentioned a boring and turning mill capable of handling work 75 feet in diameter, and other machines of equally large proportions.

Undoubtedly the grandest feature of the entire business is its "system." System is certainly the keynote of success, and system has certainly played its part in the successful upbuilding of this business.

Calculating Recorder

Probably the most interesting feature of the entire "system" is the Bishop Electric Calculating Recorder, by which the actual cost of producing a job is recorded in the office by the workmen in the shop. To describe this in detail would be a greater undertaking than an article of this kind calls for, but it will be interesting to note that every pattern which is brought to the shop is registered and given a number. This pattern is placed in the pattern vault and its location is registered. When any pattern is wanted, it can be located instantly. When the pattern is given to a moulder, he does not have to leave his floor in order to register the minute he began work on it and when he finished it, by a simple movement on his part, he lets the office know what pattern is being moulded, who is moulding it, and how long he took to mould it. So complete is the system of recording that it is quite possible in answering a long distance call to tell at once just how any job is progressing, which jobs are being done, how many are completed, and how many are being done per day.

TESTING LABORATORY OF THE HULL IRON & STEEL FOUNDRY, LIMITED.

The output of this business consists of locomotive wheels, bridge work, crane castings, railroad contracts, in fact, all kinds of steel castings of whatever chemical content is required.

Mr. A. H. Coplan, the founder of the business, is president and general manager, and Mr. F. H. Cross is assistant manager.

DON'T TINKER WITH ECONOMIC PRINCIPLES

Lowering the standard of living by artificial methods makes for popularity, but this course ignores economic principles, thus setting aside temporarily the law of supply and demand. But, back of all is that economic law which grows out of the experience of years and which, in the end, will prevail. Governments, and more especially those recently engaged in war, have borrowed heavily under inflated conditions. It would seem unreasonable to expect that there would be any attempt to meet the interest obligations on such indebtedness contracted under inflated conditions out of taxes to be raised under a deflated condition.

Such being the case, it would appear to be sound business to expect the Governments to refrain from any drastic measures to bring about a general widespread deflation until the public debt had been cared for in permanent form on a basis where the revenues from direct taxation under a moderate revenue law would be ample to meet the interest charges and provide the necessary sinking fund.—Continental and Chemical National Bank, Chicago.

EXCHANGE NO FACTOR IN BASIS OF TARIFF

Ottawa.—The Customs Department has had many requests from importers that, in view of the fact that the British pound sterling has heavily declined, this should be taken into consideration when Canadian importers pay customs duties on imports from Great Britain. The practice is that they pay on the par value of $4.86. They believe that they should be given the benefit of current exchange.

The Customs Department points out that the practice is fixed. The matter of exchange is not taken into consideration as the value of the pound sterling is fixed by the Currency Act of Canada as compared with the dollar. Officials claim there is no injustice to the importer, as the goods he imports are worth at the rate of $4.86 2-3 in Great Britain, and under the customs law goods are valued at the time and place whence they are shipped direct to Canada. The importer gets sufficient advantage in the favorable rate of exchange.

The matter has been up for consideration several times. The practice is the same in the United States, the valuation for customs purposes there being $4.86 2-3, as here. The department has refused to entertain all requests to accept payment at the exchange rate.—T.M.F.

The Black Donald Graphite Mines at Calabogie

Few Canadians Realize That These Enormous Deposits From Which Much of the So-called "Pure Ceylon" Foundry Facing Has Been Taken For Many Years, Lie Within Our Own Borders

TO the molder who reaches his hand into the barrel of heavy facing and fills his box, or bag, with blackening, to shake or rub onto his mold, the name of graphite, or plumbago, has little or no significance, and if he ever refers to it in any other terms than that of bag blackening, or heavy facing, it would simply be to call it lead, or black lead, which expression shows clearly that he has a mistaken idea of what this material actually is. Plumbago, or graphite, are, to all intents and purposes, one and the same thing. But they are in no way associated with metallic lead, as is so commonly and erroneously supposed. Plumbago might be considered as one brand of graphite, while the name graphite would cover the entire field in describing this mineral.

While it is primarily our intention to describe in fairly complete manner the ore deposit of the famous Black Donald Mine, together with the mining and refining operations, and the home lives of the miners and their families at Black Donald, it will perhaps be best to first explain some of the peculiar characteristics of this mineral, how it is found and how it differs in different localities.

Graphite, properly speaking, is a form of carbon; but all carbon is not graphite. Carbon occurs in the uncombined state in three forms—diamond, graphite and amorphous carbon—which differ radically in their physical and chemical characters. While the diamond crystallizes in octahedra, or other forms characteristic of the cubic system, graphite belongs to one of the rhombohedral classes of the hexagonal system. The crystals have a six-sided tabular form, but are not usually well developed, the mineral, as a rule, being either quite compact or occurring in flakes, irregular prisms, or films. Compact graphite is sometimes, especially in North America, referred to as amorphous, and the other forms, as crystalline, but this is not correct, as all graphite is crystalline, and must be carefully distinguished from amorphous carbon. It is better to refer collectively to the non-compact varieties as flake graphite. The color of graphite varies from steel gray, resembling that of molybdenite, to iron-black, and the streak is similar, being grey to greyish-black in color. The lustre may be metallic, or dull, but the streak is nearly always shining and metallic in appearance.

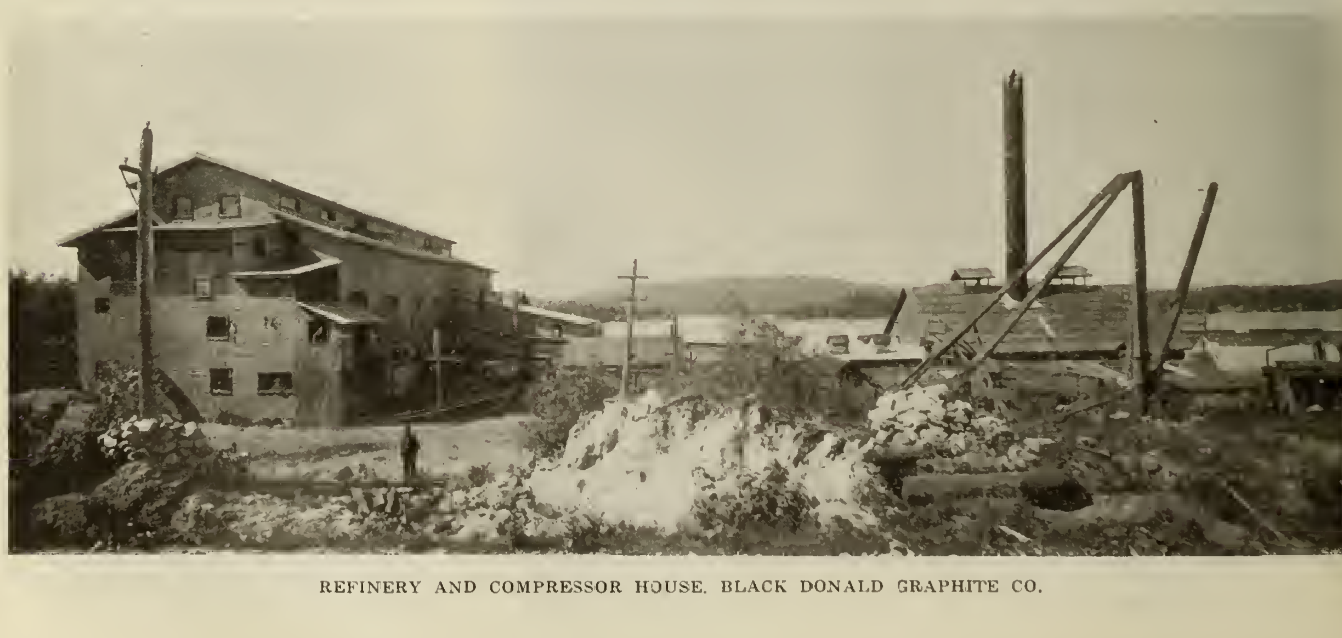
Mode of Occurrence

In nature graphite appears to originate in two entirely different ways. In some cases it is formed by the action of intense heat, on coal, or other carbonaceous material, such heat being the result of the presence in the immediate neighborhood of intrusive igneous rocks. As examples of graphite deposits formed in this way by contact metamorphism, we might mention those found in Rhode Island, U.S.A., and Sonora, Mexico. Graphite formed in this way is compact, being the so-called amorphous graphite. It includes dull and earthy varieties, and the special type already referred to presents a close resemblance to anthracite.

The more usual mode of occurrence of graphite is, however, as a secondary mineral, deposited in pre-existent rocks by gaseous emanations from the interior of the earth, usually following on the intrusion of igneous dykes or masses It may occur as a local impregnation of the rock as veins, beds or pockets. Typical deposits formed in this way are those found in Cumberland, England; Bavaria, Bohemia, Southern India, Ceylon and the now famous Black Donald Mines, in Renfrew County, Ontario, which we are about to describe. Much more might be said about graphite from the mineralogist's standpoint, but to the average layman, it might become wearisome. And enough has already been said to make it plain that while the occurrences in different localities have been caused through somewhat similar action, the results in each case differ, and consequently a method of refining that would prove eminently successful in one case, would, in all probability, prove to be entirely unsuited to the peculiar requirements of other deposits.

Uses

The uses to which graphite can be put depends on its resistance to the action of heat and corrosive agents, its conductivity of heat and electricity, the softness and smoothness of the finer, or compact varieties, which spread out under pressure to form a uniform and almost frictionless surface, its opaque black color and streak, the ease with which the latter can be produced and its permanent character. It must also be free from occluded gases, which are present in all forms of amorphous carbon. When possessing all of these qualifications, it is adapted to the manufacture of crucibles, which seems to have been the earliest use to which graphite



REFINERY AND COMPRESSOR HOUSE. BLACK DONALD GRAPHITE CO.

was put, having been used for this purpose by the alchemists in the Middle Ages. Another important use of graphite which dates back some four hundred years is in the manufacture of pencils, known in commerce as lead pencils.

BLACKSMITH SHOP, MACHINE SHOP, MINE HOIST, COMPRESSOR HOUSE AND REFINERY.

Graphite is also used in the manufacture of stove polish, metal paints, various electroplating and electro-chemical processes, and for making dry batteries. One of its most important uses is as a lubricant for machinery, especially in cases where the pressure on the bearings is very great, as it completely eliminates friction, and being a natural conductor of heat, keeps the bearings cool. And last, but by far more important than all of the foregoing, by reason of the heavy proportion used, is its particular fitness for, and use as a foundry plumbago.

It is in connection with these last two that we will speak most particularly in dealing with Black Donald graphite.

Origin of Graphite

As we have already stated, the ore from the Black Donald Mines is of the secondary mineral origin. Graphite of secondary origin may either be flakey, prismatic, fibrous, or compact in structure. The Black Donald ore carries the peculiar distinction of combining both flake and compact, high carbon graphite. the latter, because of its density and color sometimes being erroneously called amorphous graphite. Although the secondary graphite deposits are usually of better quality, yet the irregularity of their mode of occurrence often renders mining almost impossible. But here again, the Black Donald ore differs from all others, in that it carries both a phenomenally high graphitic carbon content, and is at the same time found in the largest vein so far uncovered in either the United States or Canada.

The "Black Donald" Company

The Black Donald Mine is owned and operated by the Black Donald Graphite Company, Limited, with head office and warehouses at Calabogie, Ontario. Calabogie is situated on Calabogie Lake, along the line of the old Kingston & Pembroke Railway, now a branch of the Canadian Pacific Railway. The mines are fourteen miles to the southwest, on the south shore of Whitefish Lake, in the Township of Brougham, Renfrew County, Ontario. The mined and refined graphite is transported from the mine to the railway by motor trucks in summer, and by sleds in winter.

The deposit of graphite on this property was discovered in 1896, and development work was commenced the same year by the Ontario Graphite Company, Limited. This company first erected a refinery at Ottawa to treat the ore chemically, but of the 300 tons of graphite ore produced in 1897, only 100 tons were refined, while the remaining 200 tons were shipped in the crude state. In the year 1902 a three storey refining plant was erected at the mine, and a power plant was constructed on the Madawaska River, 2¼ miles to the south-east. A great part of the underground workings on this property lies under Whitefish Lake. During the year 1902, a cave-in occurred on the shore line, due to carelessly mining too close to the cap rock, which resulted in a flooding of the shaft and open cut workings, and necessitating its temporary abandonment. In 1904 the property was leased from the Ontario Graphite Company, Limited, by Mr. R. McConnell, who constructed a dam around the break to shut out the water from that portion of the lake overflowing the mine. In 1908 the property was taken over on a long term lease by the present owners, the Black Donald Graphite Company, Limited. In 1909 the mill was completely overhauled and an entirely new refining process installed by the lessors and from that time on, the yearly production of refined graphite greatly exceeded the entire production of all the other Canadian refining plants combined. In 1917 the Black Donald Graphite Company, Limited, although holding a long term lease, purchased the entire property from the Ontario Graphite Company, Limited. They also purchased five thousand acres of timber land adjoining the property. This timber limit insures a perpetual supply of cordwood for heating the mill and other buildings and drying the finished products refined by the wet flotation system used, as well as furnishing mine timbers and lumber for all building purposes.

Unknown to Canadian Public

During all the years from its inception in 1896, until its purchase by the Black Donald Graphite Company, Limited, in 1917, the output of this mine, although surpassing all others in both Canada and the United States, was little heard of, for the reason that the graphite produced was sold to supply houses, who put it on the market under whatever name or brand suited their purposes best, with little, if any credit being given to the country or the people who produced it. Prior to 1915, sufficient ore was mined during the summer months to keep the refining plants supplied for the whole year. But since the beginning of 1915, owing to the heavy demand developed for Black Donald graphite, the mine has been operated on a double shift, winter and summer, while the mill capacity was correspondingly increased. During 1917 the company shipped 2,905 tons, or the equival-

COMPANY COMMISSARIAT BUILDING AND AMUSEMENT HALL.

ent of 145 twenty-ton cars, and in 1918, 2,867 tons, or 143 twenty-ton cars of refined graphite, either year of which exceeded the total production of all other Canadian mines for ten years previous.

Possesses Unusual Features

The Black Donald deposit exhibits very unusual features, as compared with the general run of flake graphite occurrences, chief among them being its enormous size and the richness of the ore. This deposit of graphite is the richest and largest body of flake graphite so far uncovered in either the United States or Canada. The average graphite content of this ore is 65 per cent., but zones of richer material ranging as high as 80 per cent. occur locally. Much of the ore secured, therefore, has been pure enough in its natural state to find employment in foundry work in competion with Ceylon graphite.

Immensity of Ore Body

The ore body in the vertical vein worked consists of a more or less homogeneous mass of flake graphite, averaging for the first 700 feet about twenty feet in width. The maximum width as determined in the underground workings is 75 feet. The ore body strikes north-east and has been traced for a distance of eight hundred feet, the width increasing from about fifteen feet at the south-westerly outcrop to 75 feet in the north-eastern workings. The deposit has a vertical dip, with well defined hanging and foot walls, and can be best described as being in the shape of a book resting on one edge and dipping to the north-east at an angle varying from twenty to forty degrees. The depth of the vein from the upper to the lower edge is 125 feet. Its thickness varies from eighteen to twenty-four feet for a proved distance of 700 feet, from which point it swells out to a width of seevnty-five feet.

Quality of Flake Products

While the ore consists entirely of crystalline flake graphite, the greater part of the flake is of such small size as to preclude its use in the manufacture of crucibles. Disseminated through this fine flake graphite is a certain amount of larger flake. The proportion of such flake to fine dust graphite in the average ore is approximately one to three, which is to say, that for every pound of large flake there will be three pounds of dust. Both varieties are of the highest quality, comparing favorably with any other graphite productions in the world. The dust is what is used for foundry facings, while the flake is used as a high grade lubricant.

As It Looked to a Novice

To take a trip down into this mine is an experience never to be forgotten. To properly appreciate what it is like, the reader should imagine himself in the top of a twenty-storey building, some seven hundred feet long, with stairs connecting each floor with the one below it, in such a manner that in descending the stairs he would begin on the west side of the twentieth storey and emerge from the building on the east side of the first floor. And even then he might not fully comprehend the magnitude of the task, until he had reversed his course and retraced his steps to the twentieth floor, when in all probability he would realize, as the writer did, on making the ascent, that he had made some trip. Now, transfer this thought to the bowels of the earth, and imagine yourself going down one flight of stairs after another, each one landing on a safety-first staging and each one bearing towards the lake, until at the end of the journey you find yourself not only seven hundred feet north-east from where you started, but two hundred and forty feet below the level of the lake. But don't imagine yourself in a dungeon, or a death trap, because every foot of the walls and ceiling is heavily timbered and lagged, so as to prevent any possibility of scale slipping from the side walls. And as an extra precaution, a heavy flooring of swamp cedar is placed every twenty feet, which makes doubly safe the lower portion of the mine from any ore or rock from the sides which might possibly fall. The entire length and breadth of the mine is illuminated by electric lights, makit hard to realize that you are in an out-of-the-way mining camp. As might be expected, a certain amount of water trickles down the walls and lodges in the bottom sump, but a powerful electrically-driven centrifugal pump takes care of this inflow.

Crude Ore

To remove the graphite ore from the lower workings a cable car is drawn by an electrically-driven drum, over an inclined track which leads to the surface, where it is automatically dumped from the skip dump car to a surface or unloading car used for distributing the ore on the stock yard, which usually carries from five to ten thousand tons, while drying out and awaiting to be transferred to the refining plant.

Electrical Equipment

The 400 h.p. generator at the company house on the Madawaska River, furnishes all the motive power and lighting facilities required in both mining and milling operations. The power generated at the power house, 2¼ miles away, is at 4,400 volts and is carried to the mine by a transmission line and stepped down at the transformer house to 550 volts, from which point it is distributed over the property. To supply the electric energy the company has in use a complement of electric motors consisting of four 75 h.p., one 60 h.p., two 30 h.p., one 20 h.p., two 15 h.p., and two 5 h.p. Besides this, the boiler house equipment consists of two 120 h.p. boilers, with all modern equipment attached. The compressor house von-

RIGHT STOPE OF MINE 700 FEET FROM MOUTH.

tains two Ingersoll Rand Air compressors and one Blaisdell, all of which were used until December, 1918, for operating the air driven pumps and air drills. Two of the compressors and the air driven pumps were at that time discontinued and an electrically driven, centrifugal pump installed in their stead for pumping out the mine. Only one of the compressors is now used, and that for operating the air drills.

Camp Life at Black Donald

The old dime-novel stories of mining camp life, with an aggregation of desperadoes, heavily armed with murderous weapons to defend themselves in their gambling and drunken carousals, finds no place at Black Donald. The slogan here is that no disreputable character shall be allowed on the grounds, and to make this possible the company has spared no pains in making Black Donald "city" as we might almost call it, an ideal place to dwell. The make-up of this little city consists of seventy-seven buildings, included in which are a three-storey refinery, boiler house, compressor house, hoist house, warehouses, blacksmith shop, machine shop, garage, three barns, granary, and unloading storehouse. Also the office building and the superintendent's house, with a strictly modern cookery and dining hall combined, three sleeping camps for the single men and thirty-six dwelling houses for the married men and their families. There is also a commissary building and barber shop. In addition to these, there is public school house and a new Catholic church of modern design, heated by hot air furnace and lighted by electricity, furnished gratuitously by the company. And last, but not least, is the amusement hall, which is fitted with a stage and moving picture outfit. The seats are all movable, so that the building can be readily converted into a dance hall on Saturday nights and other occasions. Every building in the place is painted and lighted by electricity, while the streets are also well lighted by electric lights. The company's policy of furnishing electric lights to the householders, allotting a plot of ground to each family for gardening purposes. and furnishing pasturage for a cow, all without cost to the employees. has done much towards building up a little community of happy and contented people.

How Graphite is Refined

As so little is known by the public about graphite, and especially the method in vogue of refining this material from the crude ore mined, a little explanation as to this procedure will no doubt prove of unusual interest. The crude ore as it is mined and raised to the surface is stacked in great piles in order to give it an opportunity of drying out, before being cobbed, which expression stands for cutting out the excessively lean ore and odd pieces of crystalline limestone which is frequently encountered in the mining operations. This cobbed ore is then passed up an incline railway to the crusher house, where it is passed through an especially constructed jaw crusher which reduces the crude ore to a size not exceeding two inches in diameter. This crushed ore is then elevated to a stock house above, which immediately adjoins a battery of ten gold tamps, into which it is fed as occasion requires. The crushed ore is retained in the stamps until such time as it is sufficiently pulverized to enable it to slosh through brass wire screens and, as it passes through, this crushed ore pulp is conveyed to a type or buddle or settling tank, that is especially adapted to the separation of the foreign matter, or gangue, from the finely pulverized ore. The concentrates from this buddle are then automatically carried to a wet agitator, which in turn passes the slimes on through a set of revolving wet screens which wash out the finely pulverized particles of foreign matter. It is then carried through a set of steam driers, from which point elevators carry it into the stock room where the dry concentrates are stored. From this point the dried concentrates are passed through a series of French burr stones, which by their polishing powers restore the lustre of the lubricating flake and at the same time crush any foreign particles of silica which are later on bolted off. After this the milled products are passed through silk bolting cloths, which automatically clean and separate the refined graphite into the different grades turned out in the refinery. It might be stated in this connection, that the equipment used in this refinery is as complicated as any modern flour mill.

The American Foundrymen's Association Convention

IF there is anything which we have neglected to tell our readers in connection with the American Foundrymen's Association, we don't know what it can possibly be, but if such has been the case we will refer them to the gentlemen whose portraits are herewith shown. Mr. Backert is president of the American Foundrymen's Association, and and his headquarters are in the Penton Building, Cleveland, Ohio. Mr. Hoyt is the secretary-treasurer, and his headquarters are at 111 West Moure St., Chicago, Ill. We believe, however, that if carefully read, every line of our story of the convention will be exceedingly interesting reading and will explain every detail of the greatest convention in the history of the American Foundrymen's Association. We believe also that everyone who attends will be well repaid. Special attractions are being arranged for the ladies, and any ladies who decide to attend need not fear that they will be out of place. Any further information which we can give will be gladly given on receipt of communication. Once more we invite all Canadians who attend to visit our booth and register his or her name. Remember the date, Sept. 29-Oct. 3, 1919.

A. O. BACKERT, President.

C. E. HOYT, Secretary-Treasurer.

Malleable Iron is the name of a most interesting and instructive book just from the press by the American Malleable Casting Association, 1900 Euclid Building, Cleveland, Ohio. The contents include a history of the malleable industry from its beginning in 1720 up to the present, as well as many illustrations of what can be done with malleable. On another page of CANADIAN FOUNDRYMAN we give an explanation of what the American Malleable Casting Association stands for.

Pioneer Foundry Days in Butte, Montana

In Our Last Issue We Described the Trials and Tribulations of the Writer in the Wilds of Montana, and How He Spent His First Winter

By JOHN WOODSIDE

It was a bit lonely, but I adopted a lively young dog and settled down to the most care-free year of my grown-up experience; the harder I worked the more good, solid fir wood I had for sale to the teamsters, who came regularly after it. If I felt like taking a holiday, there were no excuses to make, I picked up my rifle and went up the ridge to pick up a few grouse, or perchance a deer, or, if that were too lonely, I betook me to the busy streets of the city, lying some three miles across the valley of the Silver Bow; called to enquire as to the state of trade in the shops, or studied the busy life of Main street, where one of the lively industries of the city flourished, faro, and poker. Then, when sated with city life, away back to the quiet cabin under the firs and great pinnacle of rock backing the gulch, from under which gushed my spring of mountain water. A load of supplies to feed the physical man, and a few of the favorite authors done up in cheap seaside library form, for the inner man, was the city's contribution to my welfare. The utter freedom of such a life has a charm to hold men. My nearest neighbor, a quarter mile or more down the gulch, was a bricklayer, who could get $7.00 per day at his trade during the summer in the city, but declared he would not lift a trowel under $10.00 per day, and preferred to take it easy and make $3.00 to $4.00 per day in the timber. That he was a good workman was apparent from his woodpiles, which were sawn and built as squarely as a brick wall. There was not much snow up there in winter to interfere with bush work, though there was fairly good sleighing for a couple of months; there were "dips" now and then, which made me prefer the snug cabin and a plentiful supply of fuel. Once the weather observer of the city reported 56 degrees below zero, but fortunately we were under the influence of the Pacific chinook winds, and such temperature did not last long. Then it was hot in summer on the mountain slopes, and at night the wind roared around the great rocky pinnacle, or moaned amongst the firs as though mourning for their slaughtered comrades, and it grew lonely. So I sold out my holdings to a countryman from Quebec; them fellows were beginning to rule the timber here, as they generally do elsewhere, where they make a settlement, and found a cooler job at one of the small mines on the outskirts of the city, and took to boarding-house life again. My bed for the rest of the summer was in a big, old prairie schooner, which had come to anchor in a corner of the yard, just across a lot from a busy 20 stamp mill. The house was crowded and close, the old schooner was well covered and roomy, and the mill would soon restore me to normal after my quiet year. They say everything will come to you if you only wait long enough; so in the fall an opening came in Cameron and Aiken's shop, Old Jim having decided that he would not winter again in such high altitudes, and set his face toward the east, and home. As I was the only molder on the waiting list I was called upon to fill the vacancy. Old Jim, in his farewell instructions, warned me that I might find it like learning the trade over again, so peculiar were the conditions. It was not quite so bad as that, but I picked up some points as time passed; it proved a sort of a Robinson Crusoe job, where I had to rely upon my own muscle, and ingenuity to carry me through, for I was sole occupant of the works a good deal of the time, the molder being the main revenue producer. Of the owners, Cameron owned a mine somewhere out of the camp, and we seldom saw him in the shop, although he was the main capitalist of the firm. Aiken, who had "Honorable" attached to his name, having represented some part of U. S. domain at one time in Congress, was the shop boss and was a kind of a general utility man, from running the engine to keeping the books, the latter job being about the only agreeable job around the works, for they usually showed a fair balance in his favor each month; but he did not profess to know anything about a foundry except that it had been represented as a good money-maker for an investor by the old pioneer, who had built the rough log structure and equipped it with a couple of lathes, a drill, a cupola and fan, some molding flasks, and had dug out of an adjacent bank what, by a wide stretch of imagination, was pronounced molding sand; they had bought him out, and now, after a couple of years' experience, Aiken had decided that he did not yearn for foundry practice, and would willingly unload the business upon someone who knew more about running a foundry, nor did he care how much they knew of it if they possessed the necessary capital to reimburse him for his outlay. The profits were fair, wages were only $3.00 per day, though we managed to push them up to $4.00 per day in the course of the next year, without having recourse to a strike. The foundry was run on scrap obtained from the mills, and it was good heavy stuff, too, requiring dynamite and a heavy sledge to reduce it. It cost two cents per pound, and the new castings sold for 12 cents per pound, and a molder of average ability could put up a ton of shoes and dies in a day. The coke to melt with came rather high, having to be hauled so far from its native ovens, by rail, to Ogden on the U.P.R.R. and then 800 miles of a haul up those mountain roads by ox or mule team. A good binful he introduced me to, as the prospective melter, and of which he implored me to be careful, cost him $80.00 per ton, laid down at the shop, and there was no chance for relief. The blacksmiths all used charcoal made from the small white pines of the mountains, a very good article, but too light for melting with. True, the old pioneer builder of the shop had a coal mine somewhere down the western slope; he had brought in a couple of tons, and declared he could melt iron with it. It was a fair grade of bituminous coal. Old Jim had warned me that he had given it a trial, but to satisfy all parties I gave it another. Making sure that I had a safe bed of coke under, I put some on the top charges. We filled all that section of the town with a rank, yellow, bituminous smoke as soon as we put on the wind, and when the coke gave out our melt was about over for the day, so I persuaded the boss to put it to useful purposes under the boiler. The sand proved something "fierce." A piece further down the gulch a brickyard was using it for making rough "slop" brick; the cupola was lined with such brick and stood the fire very well, in fact I always valued it more for the cupola and ladles than for regular molding. However, as it got burned it improved, and improved the look of the castings. As we had no facings we had to run the iron over its unprotected surface, and it generally took some patient work with a cold chisel to separate the scale from the castings. It was easy to ram, lighted well, was hard to shake out if left until morning in the boxes. A ventwire was a favorite tool. The "flasks" were in fairly good condition, made with projecting corners with a wooden guide block nailed in the opposite corners of the cope; this, if carefully pressed to the corner of the drag or "sun-a-bout," generally gave a good joint, but as there was always a chance for a slip, I resolved to make an improvement, so one slack day I whittled out a pattern for a plate and pin, cast a few pairs, and thus won the proud distinction of having introduced the regular guide pin into Montana. But the stamp shoes, the source of greatest revenue to the shop, proved our greatest cause of trouble. They had to be cast of the hardest white iron, famous for its brittleness, and its shrinking qualities; if you cast it properly, face down, the neck was sure to be weakened by shrinkage, so that it would not stand the tremendous pounding of the mill; it would not feed with a rod, as it set quickly, and was very cloggy; so we were forced to give it the "Black Hill feed," so called because some genius over in a dead workshop had worked out a plan to keep up with the rapid shrinking, by cutting out an oval top; then as soon as the casting was safely "skinned over," removing the cope, and carefully; carefulness was the essence of the job, rubbing the oval skin down with the butt of a rammer to the level, but woe betide you if you forgot it for a few minutes too long and the to do the charging, tapping, pouring, and feeding, there was probabilities of disaster; so for my own ease, as much as for the safety of the castings I devised a centre piece, cast of soft iron, in a previous heat, and set inside the neck and shoulder; this effectually disposed of the shrinkage and rendered life more endurable on casting day. The device proved so successful that the neighboring shop heard of it and borrowed it. Our core-sand was obtained from the tailings of one of the old mills that from some cause had ceased to grind, after running out several tons of very fine, smooth sand. It had made a fair core, so we had a small supply on hand. I found that mixing it in freely improved the looks of the castings, so I soon worked out a fairly good working molding sand. I carelessly "gave it away" to the boys of the larger shop, and they were so impressed with the value of the sand that they sent teams and secured the pile, our boss refusing to take any interest in it, as "Old Jim got along without it all right." And now, during a slack spell, I decided to get up a mill to supply the long felt want of facings. The boss did not veto the project so long as I did not run up a bill for patterns. I found that I could extemporize with what I could pick up around the shop. I could not attempt the old shell and ball mill, so familiar to the days of my apprentice life, when we used to grind all our own facings, blacksmith's coal for mixing, and how that soft coal used to clog in the old shell till the ball would threaten to bang the affair to pieces, nor would I have been filled with regrets. We ground Lehigh coal for heavy facing mixed with a little charcoal to slick easy, and we turned out good castings in those days, too. But to return to my filling in for slack days. An old packing boy supplied me a three-part flask; a 16-in. pulley ring did to make up the outside, while a smaller ring made a core, dried in sections on the floor under a sheet of iron and a wood fire. A six-inch piece on one end formed a door, and also a vent; journals were cast on each end, and a flanged door and heavy roller for inside completed the outfit. The cast was decidedly successful. The machinist, who worked the other end of the establishment spasmodically, as work demanded, trued up the journals; we set the barrel upon a stout stand in line with a pulley on the shaft of the machine shop, tapped in two lugs to hold the door with skin got too hard; and when the molder had but one indifferent helper and had a pin and wedge; we used hardwood bearings, ran a belt over the barrel, loaded up with a charge of the once-despised bituminous coal, and set her free. It worked well, and I soon had a quantity of "sea coal" facing on hand, which proved to be about what the close sand needed, and it produced such a marked improvement in the looks of the castings that even the conservative boss had to declare that Old Jim could not beat it; but he could not forbear to remark, as he saw me hunting after the bitumen, that I did not know my own mind for a day, as a couple of weeks ago I had condemned the pile to the boiler room, and now I was gathering up the leavings as though they were gold. He failed to realize the difference between the soft coal in the cupola and in mixed facing. A rumbler might have been the next had I remained, as it was a tedious job, with hammer and block to extract every fragment of coke and iron from the cinders, and owing to the costliness of the metal and fuel they checked us up pretty close. The Lexington molders told of the old millionaire owner, Judge Davis, spending an hour one drizzly day picking over the cinder dump, and coming in with a handful of iron-like buckshot, and complaining that they would ruin him yet by their carelessness. About this time the Union Pacific pushed a branch from Ogden, Utah, up through the mountains clear to Butte, and as we linked up with the busy world outside, a new and enterprising firm bought out the Lexington and enlarged the plan to keep up with the demands of the camp; they also pulled down the price of castings to 10 cents per lb., and shoes and dies for the stamp mills to 8 cents per lb. The anti-shrinkage neck made the casting of them cheaper, and the new mixture of molding sand saved expensive hauling from the east, they could now get some facing if they wished to pay for this improvement; yet when I went over one day to make a call, and see some life; I was lonely and would have readily joined the larger gang, but the new boss, and newly imported Scotch foreman turned me down, and intimated that as I was probably picking up pointers for the benefit of a rival shop, my visits had better be discontinued; my intimation that there might be pointers the other way around aroused some heat, and I was shut out from the new world of progress. Of course, had I the recommendation of having come "fra the Clyde" it might have been different, but I was a mere Canadian, and this was decades before Canada was really discovered, and the majority of our progressive neighbors expected that we all talked French. In fact, the ignoring of Canada was part of the American educational system; happening to pick up one of their authorized school atlases on one occasion, I naturally turned over to see what was said of my home land, and much to my surprise; amongst elaborate maps, with full descriptions of each state I found this concise statement: "Canada is a very cold country and very few people live there." But to relieve the monotony of life about this time came a call to come home and join in a family enterprise in the future Chicago of the west, the new town of Prince Arthur Landing, at the head of navigation on the Great Lakes, which the new Canadian enterprise, the Canadian Pacific Railways, had linked up with the great new Northwest; and which, it was then confidently asserted, would outdistance even its newly planted rival, Winnipeg. The boss gave me a good offer if I would take the shop off his hands, and perhaps there is where I made one big mistake in not staying with it; but the pioneer fever still burned, and I saw new worlds to conquer; so giving my job over to Charley Farrel, who preferred it to the more modern push of the new shop, I turned my back on Butte and the grand old mountains; I had entered from the east by cayuse team and wagon, I left from the west side by the more modern railway. The Utah & Northern was the name of this first road to pierce Montana, the Northern Pacific was now busy boring its way through the Rockies via Helena and the Mullen tunnel. I have never had the pleasure of visiting Butte since, but I have read of it occasionally since those days when Doc. Beale and Bill Owsley used to alternate for mayor; and Daly was opening his Anaconda mine. I have also read of it as on the transcontinental route for autos, which would indicate that there has been much improvement worked on some of those roads we used to travel over in the pioneer days.

WHY COST OF LIVING IS HIGH

It would seem that the high cost of labor is the real cause of the high cost of living, but this is only partially true, for labor has had to have its wage increased to keep pace with the increase in the cost of living. The true cause, as we have stated before, is because millions and millions of the world's workers turned from production to destruction and the world cannot escape from that great economic loss. It must pay the bill. It has resulted in an inflated currency, which in turn has brought about a national extravagance, and people are complaining not because they cannot live in the manner in which they have been accustomed, but because they cannot live in the manner to which they would like to become accustomed.—"N. Y. Commercial."

There is a dead-line of work and production, below which mankind, compelled by the laws of Nature to earn its living, cannot go without committing economic suicide.

TRADE GOSSIP

BUSINESS IS BRISK IN THE FOUNDRIES VISITED BY OUR REPRESENTATIVE

Renfrew.—There are three foundries doing business in this town, and all three are overflowing with work. The Renfrew Machinery Co. are so rushed that they were compelled to add a considerable extension to cope with the demand for their output, and are still crowded with orders. The other two shops are working to the limit.

Merrickville.—Two foundries are operating in Merrickville. Mr. T. Kyle, manager of the Thomas Kyle Malleable Iron Works, reports having had a lively season, although not quite up to capacity at present, but good prospects.

The Percival Plow and Stove Co. are exceedingly busy, and are negotiating for land on which to erect a large addition to their foundry.

Perth.—This town boasts of two foundries. One was closed down during the uncertain period succeeding the war and has not yet resumed operations. The other is running in good shape on hardware specialties. Extensive shipments of mantel grates are being made at present, and there appears to be no dearth of orders.

Smith's Falls.—This town is noted for its foundries. There are only two of them but both are what might be considered among Canada's leading industries, notably, the Smith's Falls Malleable Iron Works, and the Frost & Wood Agricultural Work. Both of these industries are working full time, with lots to do.

Ottawa.—While politics takes precedence over everything else in Ottawa, it is not the only thing which counts. The name of Ottawa seems to suggest Governments, and caucuses, and party conventions, etc., but it is, nevertheless, a lively industrial centre. Timber land is still in abundance along the Ottawa River and its tributaries, and consequently lumber mills and paper mills have big opportunities here. Foundries also find this a desirable location. Six iron foundries and four brass foundries constitute the foundry programme, and all are at present as busy as bees.

Hull.—The Ottawa River banks, which we have just mentioned, are so teeming with industries of different kinds, which were attracted here on account of the immense power to be developed from the Chaudiere Falls, that both banks appear also to be together, but they are not. A bridge connects the two opposite sides, and the trolley lines run right across as though in one city, but on one end of the bridge we see the old familiar sign, "Safety First," while on the other side we see one which reads "Prenez Garde," which tells us that we are in French Canada, or properly speaking, in the Province of Quebec. French Canada is exactly the same as any other part of Canada, but the French Canadian, proud of his ancestry, adheres to the old language of the French, and the signs on the buildings attest the fact. But not in every case. For instance, the sign on the lumber yard gate which formerly read, "Toute Personne Passant sur Cette Propricte Sans Autorite Sera Poursuivie Selon la Loi," has been superseded by one which reads, "Any Person Trespassing on this Property will be Prosecuted According to Law," so that both sides of the bridge can take the hint.

But to get back to our story. When we cross the river we find ourselves in the city of Hull, Quebec, a city long famous for the production of matches and kindred lines of manufacture. But Hull does not consist entirely of woodworking plants, as one large foundry finds its home here, and is well provided with work. On the whole the foundry business in Canada has seldom been better than at present, and every sign points to a prosperous future.

The Dominion Iron and Steel Co., Sydney, N.S., has closed down temporarily, but none of the employees have been laid off. Employment of some kind will be provided for every man until operations are resumed. Most of the men will be given employment at the plate mill now being rushed to completion, while others will be used in repair work.

Iron molders at the plant of the Durban Foundries Co., East St. Louis, Ill., are out on strike with demand for wage scale of $6 per day and an 8-hour day. The plant has been working on a 9-hour basis.

What promises to be another iron and steel industry of importance for Ontario is foreshadowed by an announcement of the incorporation of the Consolidated Iron and Steel Corporation, Ltd., 20 King Street East, Toronto, with a capital stock of $8,000,000, backed by Detroit and Toronto interests, engaged in the mining business. The company own two large deposits of iron ore lands, and has opened a large hematite mine 25 miles north of Brockville, Furnace Falls, Ont., where it has 1,500 acres. It is announced that the town of Brockville, Ont., has offered inducements to the company to build a blast furnace there, and this is being seriously considered.

The extension of the rail mill at the plant of the Algoma Steel Co., Sault Ste. Marie, Ont., which was announced several weeks ago, and which will cost several hundred thousand dollars, is but the beginning of an extensive development of the plant. The whole plan laid out by the officials of the company involves an expenditure of from $5,000,000 to $7,000,000, and includes the production of structural steel shapes of all kinds and sizes.

Burnett and Crompton, Rigaud, Que., are having plans prepared for the erection of a foundry to have a capacity of ten tons per day.

The International Malleable Iron Co., Guelph, Ont., are having plans prepared for a considerable addition to their plant.

Steel and Radiation, Ltd., Toronto, are having plans prepared for alterations to their plant, which will include a new foundry.

Wiliam C. Hunt, 59 Paton Road; A. C. Crocker, 322 Symington Ave., and others, have been incorporated under the name of "The W. C. Hunt Manufacturing Co., Ltd., with a capitalization of $40,000, to carry on the business of iron and brass founders at Toronto, Ont.

Practically every stove foundry in Belleville, Ill., will be idle for some time as a result of the strike of the Union Foundry employees. The manufacturers consider the demand for a raise of from 45c to 60c per hour unreasonable for common labor, and the strike, a breach of contract, the union men having signed a contract for the year 1919.

Some 7,000 employees of the Crane Co., Chicago, have been on strike since about July 1. On August 21 operations were resumed with about half the usual force but the strikers objected, and street cars, carrying strikebreakers, were damaged and some of the occupants badly injured.

Dissatisfaction at the plant of the Frick Co., Waynesboro, Pa., manufacturers of boilers and machinery of different kinds, caused a strike of several thousand employees, the whole plant being closed with the exception of the foundry. No comments please.

Labor troubles at the plant of the Algoma Steel Corporation, Sault Ste. Marie, Ont., have resulted in an almost complete shut-down.

The first fall meeting of the New England Foundrymen's Association will be held at Boston, September 10, at which time, A. O. Backert, president of the American Foundrymen's Association will present a paper.

OBITUARY

Arthur M. Rowles, who for the last fifteen years had been employed by the Canadian Shipbuilding Co., latterly being manager of the boiler department, died on August 7 at his home in Toronto, after a prolonged illness. He was 68 years of age.

CATALOGUES

Why Didn't You Tell Me So? is the heading of a neat pamphlet just issued by the Oliver Machinery Company, Grand Rapids, Michigan, describing their line of swing cut-off saws. Several views of pattern shops fitted with these saws are shown, together with different designs of swing saw manufactured by this company. The pamphlet is well got up and should be in the hands of every woodworker.

Simpson Intensive Foundry Mixer.—The National Engineering Company, Machinery Hall Building, 549 W. Washington Boulevard, Chicago, U.S.A., have just issued their catalogue No. 50, showing in detail their intensive foundry mixer. One view shows the new No. 0 mixer exposed in such a manner as to show the mechanical or working parts as they would be in operation. In addition to the descriptive matter relating to the mixers, the book also contains considerable interesting information relative to the proper mixing of facing sand, core sand, and other foundry sand mixtures for foundries producing gray iron, steel, malleable, aluminum and brass castings. Mention is also made of other machines manufactured by this company including Simpson National screen separator, Simpson continuous core reducer, Simpson sand handling equipment, and other foundry appliances.

S. F. Bowser & Company, Inc., Fort Wayne, Ind., are issuing a most interesting and unique folder describing and illustrating the Bowser battery storage system for lubricating oil. The folder can be arranged to show one outfit, two outfits, three outfits, or a battery of four tanks, so that the prospect may understand that he can buy as many units as he requires and the folder will show him how the units of any various capacities line up in uniform manner.

THE METRIC SYSTEM AND THE YARDS, FEET AND INCHES

It is interesting to study how standards of measurements are arrived at, or least how they were arrived at in days of old. It is doubtful if anyone would try to get up anything of the kind in these modern days. For instance, the "metre," which is the standard of measurement used in France, is based upon the length of a quadrant of the meridian, measured between the equator and the North Pole. The ten-millionth part of this quadrantal arc was adopted to be the lineal measuring unit. The reader will understand that a meridian is a line, or rather an imaginary line running from the North Pole to the South Pole, and, of course, passing straight through the equator at right angles to it. Correctly speaking, it goes right around, making a complete circle. Now, if we take the quadrant or quarter circle of this meridian, which reaches from the equator to the North Pole, and divide it by ten million, we have the "metre" or the French standard measure of length, which is 39.370432 inches, or 1.09332311 yards; the yard being the English standard measure of length, and having equally as interesting a history. The original way of proving the standard English measure was to find the length of pendulum vibrating seconds of mean time in a vacuum at sea level in the latitude of London. The length of the pendulum which would make this beat in exactly a second, was supposed to be 39.1393 inches, or almost the same as the Frenchman's metre. Why they did not call this the yard is hard to say, but the yard had to be the proper fraction of this to make it 36 inches. Of course, in the first place, there were no inches, but the length of the pendulum divided by 39.1393 made an inch, and this multiplied by 36 made the yard. When the British Parliament Buildings were burned in 1834 the standard Imperial yard went with them, and when an effort was made to replace it by means of the pendulum, it was found to be inaccurate—so much so that finally all attempts at reproducing the lost standard by this means were abandoned. It was then decided to construct a new standard yard by reference to copies that had been previously made, and that had been compared with the original standard yard. The next thing was to get a material which could be relied upon of which to construct the new standard. This work was entrusted to Sir Francis Bailey, who, unfortunately, died before its completion. As the result of a great many experiments, Sir Francis had decided on an alloy composed of 16 parts of copper, 2½ parts tin, and 1 part zinc, as the most suitable material for a standard bar. This alloy is still known by the name of Bailey's Metal." The work of restoration was finally completed by Rev. R. Sheepshanks, and the new standard imperial yard bar that he produced is now known as "Bronze" No. 1. It is made of Bailey's metal; it is 38 inches long and an inch square.

At a distance of 1 inch from each end of the bar, holes are drilled, in which gold plugs are inserted. The upper surface of the plugs is made to coincide with the axis of the bar, to obviate the influence of flexure. Defining lines are parallel, and at right angle to the axis. They represent the yard at a temperature of 62° Fah. Four copies, known as Parliamentary copies, were then made and distributed to the Royal Mint, and the Westminster Palace. The original bar is kept within the walls of the House of Parliament, while the copy known as "Bronze No. 6," which is the accessible standard used for comparison, is preserved in the strong room of the old Treasury. Additional copies were eventually made, two of which were delivered in 1856 to the United States Government. These are technically known as "Bronze No. 11" and Low Moor Iron No. 57."

It is a curious fact that while the bars presented to the United States are the standard which Americans depend upon when great precision is required, no standard of length of the English system of measurement has ever been formally legalized in the United States, but in 1866, ten years after receipt of these bars, Congress passed a law declaring a metric bar in the possession of the Government to be the legal standard, so that the only standard of length recognized by law in the United States is the metric. However, Great Britain and Canada, as well as the United States, have used the old yards, feet and inches so long that it is doubtful if a proposed change would find much support, and while the pendulum system of finding the correct yard was proved to be a joke, it might be possible that if a pedestrian with a stride of a metre undertook to step off ten million paces from the equator that he would be a few kilometres astray by the time he reached the ninetieth degree, commonly known as the North Pole.

FEELING FAVORABLE TO BRITISH TRADE

Continued from page 68

There is a feeling of more confidence in the steel market, as there seems to be no likelihood of a strike at the mills for the present at least. A week or so ago the Canadian selling agents of some of the U.S. mills seemed to be certain that there would be trouble. Some of the warehouses here were none too well fixed for material, and prospects of a strike, or of a holdup of material were not pleasing. Warehouses in several cases are buying heavily at present, preferring to get their stock in good shape while they can do so, and before there is any tie-up of the transportation system. It cannot be said that they are looking for increased prices, although bars do look as though they would not stay long at present figures, one Canadian mill already having announced an increase of $2 per ton.

The Supply Market

There has not been a very brisk selling of small tools during the last week. Nearly all the dealers in this district report that trading was a little off color, and they are at a loss to give any good reason for it. It may be that the fair had interfered largely with business or that the holiday season has not been fully concluded. Business in certain of the establishments that are running to capacity, such as the automobile shops, is good, and buying is satisfactory.

The metal situation (non-ferrous) is reported satisfactory. There was just a little doubt as to the course of copper a few days ago, it being held that it was at its peak and was likely to recede. The trade here is not disturbed, electric being quoted at 26c. There is a good demand for the other metals as well, with prices unchanged.

Scrap Market Quiet

Business is fairly good in the scrap metal market, and this is about all that can be said for it. The larger dealers are shipping to the United States market, but only on contract, and no new business is being taken on for the present. It looked last week as though some reductions might be made in certain lines, as there was an apparent weakness in the lists, but this has not taken place. Rather have some places made slight increases.

Copper continues to be fairly strong. There is quite an amount of copper turnings yet in this country, the property of the U.S. Ordnance Department. A certain part of this has been disposed of, but sales have not been made against the entire holdings. As far as the shell steel scrap is concerned, the market has been cleared out, as all that the U.S. Government had stored here has been sold or removed, while that of the British Government has in a large measure been shipped back to Britain.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1887)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President.
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: G. E. Pearson. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address, giving both old and new.

CONTENTS

Our Pre-Convention Number

THIS will be our last opportunity to greet our readers previous to the Foundrymen's Convention, which takes place at Philadelphia during the week of Sept. 29. And we can only reiterate our former request that as many as can make it at all convenient to be present at the convention do so. We again extend a hearty invitation to all who attend to make the CANADIAN FOUNDRYMAN'S booth their home during their stay in Philadelphia. Be sure and call on us and register your name and shake hands with us and tell us how you find conditions in your locality. We will certainly be glad to meet you.

The Trade and Technical Papers

THE position and business of the trade paper is coming to be more and more recognized by those who have occasion to dig beneath the surface in any particular line and get down to real facts.

The trade press does not appeal to the mob. It is not a political organ, nor is its purpose merely to entertain. Its mission is to present information along specific lines, to publish the views of men who have succeeded, to give methods and schemes for doing mechanical things the best and most efficient way, to make a mechanic a better mechanic, or a salesman a better salesman. In reality the trade paper is the medium through which the man who wants help can get it. The CANADIAN FOUNDRYMAN is no exception to the rule and is always ready and anxious to assist anyone who wants assistance. Many foundrymen have testified to the assistance which they have received from reading its pages and from patronizing our Questions and Answers Department.

Trade Secrets

SPEAKING about trade secrets makes one do some thinking. Take a foundry secret, for instance. Is there any one thing in connection with foundry work which is not known the world over? There are lots of people who do not take the trouble to learn, but for those who elect to be educated there is always a way to accomplish their desire. The average molder tires of his job and moves on to see if he cannot locate somewhere more suited to his liking; he seldom finds it, and continues to move on—but every time he moves he makes an opening for someone else.

Imagine a shop secret with a new gang every few weeks. No, Mr. Foundryman, you have no secret. Your opposition will get it by some means if he really thinks he requires it.

Nothing could be more beneficial to foundrymen than to gather together periodically and exchange views. There was a time when secrets prevailed among foundrymen as well as others, but at this advanced age it is education which is required to make the wheels of industry go round, and with education secrets must be relegated. Malleable iron was, not so long since, considered a great secret, now it is the favorite topic of discussion at conventions and it is worthy of note that a society has been formed in the United States with the sole object of learning what there is to learn about malleable iron, and the knowledge thus gained is published, showing conclusively that secrets have dropped out of the malleable business. The convention which will take place in a few days found its origin in this very idea—get together and learn all we can from each other. But if we go to conventions keeping our secrets, from whom are we going to learn?

The Strike Situation

THE strike situation is pretty much the same as a month ago, although a settlement has been arrived at in a couple of the foundries, the molders going back to work for 75c per hour and a 45-hour week. The original demand of the men was for 75c per hour and 44 hours per week, and for any work done after the 44 hours the rate of pay was to be doubled. With the settlement which has taken place in these two shops the extra pay does not begin until after the men have worked 45 hours. The men claim, however, that they do not want overtime, but prefer to cease operations when they have done a day's work, and with wages at $1.50 per hour it is not likely that the boss will be particularly anxious to have them doing overtime work to any extent, so on the whole we would say that the men got about what they went after.

Of course there are only a few men back so far, but it is a favorable augury that there will be a settlement along these lines. It is to be hoped that it will soon be settled. The men feel that as long as the cost of living keeps soaring the wages must soar likewise, and the argument used for combatting this is that as long as wages keep going up the cost of living must go up with them. From this kind of calculating there would appear to be no way of having a permanent peace unless one side gives way, and the question is: "Which side is the best able to afford to take the lead and try to reduce the cost of living?"

While the war was raging there was some excuse for the high prices of commodities, but why living expenses should be getting greater from day to day we cannot make out. Workmen must have sufficient income to live, but still it does not hold that the employer is always in a position to meet his demands, so a little sympathetic consideration on both sides is necessary if peace is to be maintained.

While we would go to any extremes and strain any point in order to take the workingman's side and give him the benefit of every doubt, there is one point where we could never agree with certain factions among the men, to wit, the subject of the non-producer. The workingman invariably looks upon the office staff as a lot of useless idlers, but if they were to go into the matter deeply enough it should not be difficult to see that no sane business man would keep a gang around him drawing salaries if he could avoid it. Supposing he does pay them with the workingman's money, he would more likely put the workingman's money in his own pocket than pay it to men who could be disposed with. To be sure, the office man does not produce, neither does the manager, but if we did not have them we would not need the producer either. When a workingman punches his check and goes into the workshop he has the satisfaction of knowing that there is work to be done, but he does not know what effort it took on the part of the management to secure it, or what arrangement had to be made in order to secure payment for it. If work would always come to the shop and everybody would pay cash it would be easy to figure the exact cost of production, but such is not the case. Business, from a business point of view, is an entirely different proposition from working for wages, and unless we have business men with a sufficient staff of assistants to carry on the business end of the institution we fail to see where the workingman is going to get his living unless he goes into business on his own hook, and, of course, he has that privilege now.

The Molder and the Molding Machine

WE are frequently asked by molders if we don't think that we are unjust to the molders in boosting the molding machine, to which we have to confess that we have not been doing the boosting. Our pages are open for any legitimate argument along the line of foundry and if any molder cares to show any good reason why he opposes any particular thing about the foundry we have never refused him the privilege. Neither do we refuse the man who wishes to praise it up. Our own personal views have always been that the foundry is a big enough field for all classes of workmen and if a molder prefers hand work he will certainly always find it to do. Molders, like all other mortals, are continually dropping out of the arena and their places are not being filled by capable workmen, and it is a safe assumption that the molder who is capable of doing job work in the old familiar way will never lack the opportunity of practising his calling. This, however, offers no excuse for condemning the molding machine. The machine has a place to fill and it will surely continue to forge ahead, no matter what we think, and no matter what the molder thinks. Few molders seem to realize that lack of machinery has driven foundry work off the market to an enormous extent. Structural ironwork was once a big feature in the foundry programme, but it had to give way to the rolling mill. Steel girders and columns could be made by machinery for less money than cast ones could be done by hand. The same story goes right on through the whole category. Every teamster who uses a bob-sleigh knows that cast iron shoes are the only thing for crossing railroad tracks or bare spots on the highway, but steel can be produced for less money, so the easy-running cast ones have to drop out. Even in culinary utensils, such as frying pans, stew kettles, etc., cast iron had to make way for stamped ware on account of the price, notwithstanding the fact that the flavor imparted to the food went with it. Every molder knows that beefsteak cooked on a sheet iron spider takes him back to his boyhood days when he cooked frogs' legs over a bonfire, yet the price gives them the advantage, and he has to eat scorched victuals.

Yes, brother molder, we are with you in everything which is for your good. Nobody knows better than we do what a molder has to endure, but don't stand in the way of progress or it will run over you. The molding machine will be the salvation of the foundry and will bring you work which you cannot get by any other means. It takes molders to make the molding machine, and the more molding which is done on the machine, the more machines there will be to make, so we cannot figure out anything bad about the machine. To get down to serious calculating, just imagine machinery being eliminated from every line of business, and what would we have? Farmers cutting grain with a sickle and threshing it with a flail and grinding it by some crude hand process. Builders hewing timber with the broad-axe, and so we might go over the entire list, but what's the use? It cannot be thought of. There was a time when this manner of living passed inspection but not now. People in those days had few comforts and lots of work, but who wants work? It is work we are trying to escape. Shorter hours have been the keynote of late, and it is machinery that makes the eight-hour day possible, so don't keep the foundry in the background. An electric crane is a machine as compared with lifting by hand, and few molders object to working under an electric crane. Molders who use the pneumatic rammer do not hanker after hand ramming. In fact, when once used any improvement is accepted, but it is hard to convince men that they stand in their own light by being obstinate. It was our privilege once to work with a molder who served a long apprenticeship in England and who held down some exceptionally good positions in his day, but in his old age accepted a position running a jolter. He was reluctant to taking the job but his age was against him in trying to hold his end up on a floor job so he took this on trial. After he became accustomed to it he freely expressed himself as being agreeably surprised. The work was less arduous and the castings were of superior quality. In fact, he pronounced it the best all-round invention he had ever known. Now this man was a staunch union man and an Englishman, while the machine came from the United States, and it is not at all likely he would have put himself about to sing its praises if he had not first convinced himself.

How a Business Man Sees Things

THERE has been a lot said about conditions in Canada being unfavorable to the development of business along sound and sane lines. And the trouble is that a good deal of what has been said has been true.

Allow for all that and more, admit that there have been strikes, that production was shut off when it should have been increased, that conditions for buying for future needs have not been the best—yes, there are a long list of things that can be admitted without argument. But after all that has been done, face the truth and admit that business in general has been good.

As a matter of fact, business has gone ahead seemingly in spite of conditions rather than with their assistance.

It is a safe thing to state that there are not enough molders, were they all to go to work, to handle the trade there is in Canada at the present time. Every paper in the country that circulates in an industrial centre carries advertising matter for "Molders Wanted."

There is one way out, and it is being adopted more and more, namely, the introduction of the molding machine. The average molder does not like the machine. He looks upon it as a mechanical contrivance that is going to discount his skill and some day his earning power.

But that is not the whole story. There are no molders out of work; there are very few apprentices learning the business. Where is the molding of the future to be done? The molding machine is coming to be more and more the answer.

One Canadian concern has been in need of castings for a long time. In fact, they were so urgent that they helped foundries to equip with molding machines in order that the castings might be turned out without interruption.

The molding machine is going to stay just as the typesetting machine came to stay in the printing industry. There were those, who, when the first typesetting machines were brought out, were ready to strike and demonstrate in this way their opposition to the mechanical device that was showing a skill almost equal to their own and a speed five times as great. But what would happen to-day were the typesetting machines taken out of the publishing business? There would be next thing to a complete tie-up. The typesetting machine has not kept men from getting work. It has made more work and better work.

There is going to be a greater market in Canada for the molding machine. It makes more certain that the shop will operate under all conditions, and production is what the foundry business in this country needs above all else.

Plating and Polishing

WE wish to call the attention of our readers to how closely allied the plating and polishing business is to the foundry business. Almost every manufacturer who does metal work of any kind has some plating or lacquering to do. Sometimes they have it done outside but usually it forms a part of the plant. Some plants are far better equipped than others, and some platers are better posted on the art of plating than others. CANADIAN FOUNDRYMAN has a section devoted to plating and polishing, in charge of a plater who is a recognized authority of international repute. We recently received a letter from a large plating establishment in New York City stating that these articles were the best he had ever read. We also had a similar letter a short time ago from an establishment in Montreal. In our last issue we had an article on color which is continued into the present issue. This article is of exceptional interest, even to those entirely outside of the business. We earnestly urge our readers to read these articles and also to ask any question relating to the subject and receive the benefits of which a lifetime's experience and study has brought to an expert who has made it his life's work. Our advertising columns are also alive with information along the plating and polishing line. As we frequently point out, the advertisements often contain information which would be hard to get by any other means.

Steel Making in Canada

IN this issue we begin a short series of articles on steel making in Canada and we ask every subscriber to read it through. Few people seem to realize what a very small difference there is between common cast iron and the different brands of steel, or how great a difference there is in the resultant metal from a very slight change in the chemical content. It is hard to realize that carbon, sulphur and phosphorus which are all inflammable from a considerable proportion of the impurities contained in iron, and that by combining them with the oxygen in the air they will burn out, leaving the iron almost pure. Once studied, it is more easy to understand that by forcing cold air into the melted iron the temperature is raised, which is to say, that the iron is much hotter after being blown than it was before. This is caused by the oxygen of the air combining with the carbon, etc., in the metal and consuming it, thereby superheating the metal as well as removing the carbon, some of which has to be replaced.

The Exchange Rate

THE why and the wherefore of the exchange rate on money passing from this country to United States, or the other way, is not clearly understood by many. As far as this country is concerned, it simply means that we have bought too much from United States, in proportion to our sales to them, and the balance is enormously against us.

But apart from that the thing is being abused, and it does not work out fairly even in this country. In the larger centres, where banks are plentiful and easy of access, the exchange rate can be secured for any American money that one may have. There are other places, though, where dealers regard American money as not one whit better than Canadian, especially when it is coming their way, although it is worthy of notice that very seldom does any of the American currency get handed out in the way of change.

United States is not in an enviable position by reason of the rate of exchange which it is able to declare against the money of the world. The Italian lire, the French franc, the British pound sterling, the Canadian dollar—they have all been discounted and set back severely in United States markets. It simply means that the purchasing power of all this currency is severely discriminated against in the U.S. markets. There is nothing new or startling in the situation, as history will show, if one cares to go back a few years to the American Civil War, that their dollar on this side of the line was regarded as being worth only sixty cents, a discount more severe than has been put on the currency of any Allied country in the markets of United States.

The rapidity with which the exchange rate changes is something that causes no small amount of worry. For instance, one day the British pound, which should be worth \$4.86⅝, brings in New York \$4.19¾, while on the very next day it is slated at \$4.12¼.

The most natural thing in the world is that the nations whose money is at a discount should seek to avoid making any more purchases than they can help in the market where the discount exists. Nations are the same as individuals, and that is the course the individual would pursue. Were he to find that his dollar was being pruned by five cents at a certain store he would look elsewhere, and he would buy at that store only when circumstances made it necessary that he should do so. That is the very thing that is happening in United States. Their exports are falling off, and as the rate of exchange becomes more severe, or even sustained, they will continue to fall off. It certainly is not to the advantage of United States to have the purchasing medium of its customers at a discount and it is a condition that, in the long run, hurts many and benefits few.

There should be no barrier in the way of adjusting this matter. It is the veriest nonsense to tell us that a Canadian dollar, because it is spent in New York, is only worth 95 cents, and there are plenty of places where they will credit only 90 cents against it. That Canadian dollar has security behind it second to none. Likewise it is fallacy to say that a British pound is worth only some \$4.12 or \$4.19, as the fluctuations of the day may indicate. A British pound is worth \$4.86⅝, no matter whether it is offered as payment in New York, London or Toronto. It has value behind it, and it is tough business that it should be discounted because the British nation was up to its neck in fighting the battles of the world, and had to import and import to keep going, regardless of any such puny peace-time matters as balance of trade.

The Governments of the Allied countries should get together on this matter and straighten it out. It is to the benefit of United States that it should be done, and done quickly. The exchange drives trade away. It does not attract it.

THE peace treaty having been duly signed, the anti-Bolshevik forces have proceeded to boot the Bolshevik out of Odessa.

A Study in Colors, From the Plater's Point of View

Being the Second Instalment of a Series of Articles on Electro-Plating in Which Coloring Plays a Prominent Part

By ABE WINTERS

A WELL-KNOWN writer states that "While the theoretical considerations involved in the deposition of alloys from electrolytic solutions are extremely complicated, the practical difficulties to be overcome are equally formidable. An electrolytic solution may contain a number of different metals and yet yield only one at the cathode as the result of the passage of a normal electric current."

Le Blanc explains this phenomena as follows: All the ions in the solution take part in the conduction of the electric current, but only those ions the separation of which requires the least expenditure of work or energy are deposited or separated at the electrodes. Those ions separate first which give up their electric charges most easily. The other ions must wait their turn in the order of their ease of deposition. The ions most easily giving up their charges are, of course, the electro-negative ones.

The conditions necessary for the deposition of alloys from aqueous solutions differ somewhat from conditions usually considered as satisfactory for the deposition of a single metal. First, the solution must be such that the compounds of the metals contained are as nearly as possible equal in the values of their heats of formation; this denotes the specific E.M.F. required for decomposition. In such a case the metals concerned require practically the same E.M.F., and so long as the ions of each are present in the correct proportions the tendency will be for them to deposit simultaneously so long as this value of E.M.F. is maintained, or secondly, the current used, being of a sufficient E.M.F. to liberate the more electro-positive metal, is also of a density so high that the number of more electro-negative ions in the vicinity of the cathode is not sufficient to convey all the current from the solution to the cathode, and therefore the more electro-positive ions are called upon to take part in the process as well as the electro-negative. Both the above conditions obtain to a greater or lesser extent in the practical electro deposition of alloys. Conditions which tend to raise the E.M.F. increase the percentage of the electro-positive metal in the deposit. Such conditions are: Dilution of solution and increase of temperature. For nickel-silver deposition a mixture of the double cyanides is used. Nickel, 15 to 20 per cent.; copper, 55 to 60 per cent.; zinc, 25 to 30 per cent.

Ions

Just a few words about ions may assist the reader in grasping the full meaning of references to ions which may be encountered in this or any other article on deposition of metals. Ions are small particles bearing electric charges and moving through the solution under the influence of an electric current. There are cathions and anions, and some of these have characteristic colors. For example, cathions of nickel are green; cobalt, pink; cuproris copper, blue; ferric iron, yellow-brown; ferrous iron, pale green. The anions of bichromate are red; permanganate, pink; chromate, yellow, while all other anions are colorless. The ion in solution has absolutely none of the properties of the metal, also the behaviour of the ion is different from the metal. When an electric current is passed through copper chloride solution the copper chloride equals copper and chloride, the + iron copper moves to the cathode and the — iron (chloride) moves to the anode. The copper ion loses its charge at the cathode and plates out as copper, the chlorine ion loses its charge on reaching the anode and escapes as chlorine gas. Using symbols, we may describe the action in a copper sulphate solution as follows. $Cu\ So_4 = \overset{+}{Cu} + \overset{-}{So_4}$. $So_4 + H_2O = H_2SO_4 + O$ or an abnormal result; $SO_4 + Cu = CuSO_4$ or a desired result. Hydrochloride acid (HCL) dissociates into hydrogen ions and chlorine ions. Sodium sulphate $= Na\ So_4 = \overset{+}{Na} + \overset{-}{SO_4}$; at the cathode the Na ion loses its charge and becomes sodium. Na decomposes water and produces $NaOH + H$; at the anode we get sulphuric acid and oxygen. In this case we obtain a change in both ions when plating process is in operation.

In experiments relative to electro-chemical coloring we find that many tests have been based on theory rather than a well-founded law. Louis Kahlenberg explains the difference between theory and law as follows: "Facts are the result of actual observation and experiment. When a large number of similar facts have been found, and these are expressed in a general statement, the latter is a law.

A theory or hypothesis, however, is neither a fact nor a general statement of fact, it is merely an assumption made for the purpose of correlating, explaining, or accounting for facts that have been collected and formulated into laws. A theory, however, not only enables one to see facts in their relations and thus satisfies the natural craving of the human intellect for a better comprehension of things, observed, but it also suggests new avenues of inquiry and experimentation by means of which further facts may be acquired. On the other hand, theories by implication also suggest that it is useless for actual inquiry to proceed in certain directions, and that certain things are impossible, when, after all, they are quite possible, and thus a theory may be a bar to progress." The result of several modern electro-chemical processes has proven that theory has been a bar to progress. We encourage the plater to familiarize the various laws and theories relative to coloring by the different methods, but also to endeavor to originate new ideas regardless of the doubtful results which seem inevitable from due consideration of fundamental laws.

Arthur H. Hiorns say: "Metal coloring is essentially associated with art, and no workman can beautify a metal without he possesses some artistic taste. It has, unfortunately for us, become the idea among many manufacturers that bronzing is a very simple mechanical operation and can be left to an ordinary dipper to accomplish who may not have learned the art and who may not have the remotest idea of the nature and harmony of colors . . . . We do not sufficiently realize how exceedingly beautiful a common metal can be made to appear with little expense as regards materials, if only tastefully and suitably colored. . . . The Japanese, however, are the real authorities to whom we must turn for examples of the highest kind of coloration in metals. They combine the most perfect artistic taste with marvellous manipulative skill in executing any design their imagination may suggest. In certain lines they are inimitable, and, as colorists they are almost perfect. Their commonest works generally contain a bit of good coloring, and their best efforts are marvels of harmony. Their colors are usually warm, simple and quiet, but always effective. Even the bloom on the surface of fruit is very faithfully reproduced by them. These facts are all the more remarkable when we consider how impure their ordinary commercial metals are compared with ours, and how infinitely we excel the Japanese in the knowledge of metals from a scientific standpoint." We have only to observe the specimens of Japanese coloring found in the leading museums of art to confirm the above statement, for nowhere do we find such noble expression of dignity, such penetration and force in the expression of feeling; pathos, passion, fun; such extraordinary realism in the representation of animals, birds and flowers. Shakudo is a Japanese alloy of bronze and gold, and Shibuichi an alloy of bronze and silver, in both the proportions of the precious metals varies according to the effect which the metal worker wishes to produce. The Shakudo has a peculiar quality—by pickling and boiling it acquires a rich coat or patina of beautiful deep bluish violet, which takes an exquisite polish. The Shibuichi assumes a remarkable silver-grey tone. The gold alloy consists of about 95 per cent. copper and 1.5 to 4 per cent. of gold, 1 to 1.5 of silver, and traces of lead, iron and arsenic. In chemical analysis, a trace is an amount of an ingredient which is present in the substance analyzed in quantities too small to admit of quantitative determination. It is supposed to be less than one-hundredth of one per cent. Less than this is usually disregarded. This alloy possesses the curious quality of recovering its patina when worn out; if it is handled, the moisture from the hands and the atmospheric oxidation bring the color back. The silver alloy contains from 50 to 75 per cent. of copper and from 30 to 50 per cent. of silver, with traces of other metals. Shibuichi means one-fourth, so the amount of silver may be set down as a quarter of the whole alloy. From the variation in the alloys various tones of color were derived. The Shakudo has a range of golden greens, yellows and reds, of which the Japanese made wonderful use. The pickling process was either hot or cold, and the pickle itself consisted largely of verdigris and copper in water or vinegar, to which some patina, nitre, common salt, and sulphur were added. We must admit that the methods adopted by the artists of old Japan would be too tedious and expensive now when the merchants buy and sell and compete in Western markets. The processes used required time; results could never be paid for in proper proportion to the labor expended on them. The old methods have gradually given way to more economic production on Western plans and formulae, so that in time, perhaps, the Eastern and Oriental influence and characteristics of Asiatic bronzes, so charming and so much appreciated, may diminish, if not disappear altogether.

Modern Methods

The general methods used for the treatment of metals previous to coloring are usually those employed prior to electro-plating, therefore, any reference to the operation of cleaning should be unnecessary. Experience and long association with platers of various classes teaches us that constant warning in this direction is essential. At the present time when we have the advantage of a very wide range of cleaners and wonderfully efficient methods, it seems useless to admonish the plater to be cautious of the surface conditions before proceeding to color a metal object, but the fact is, modern methods of cleaning have made some platers careless; they rely too greatly upon the solution and give too little attention to the actual results obtained. An article which is imperfectly cleaned, or only partially pickled, or improperly dipped, will invariably prove defective in finish no matter how complete and accurate the coloring operations may be performed.

Electro-chemical metal coloring processes are not as generally employed for ordinary purposes as are the chemical methods, some of which are given here. The methods as described are widely recognized as practical and may be successfully used by operators of ordinary skill in finishing electro-deposited copper plaques, panels, busts, or statuary, lighting fixtures, den accessories, and scores of other metallic objects, including builders' hardware, novelties, and even toys. Sometimes the plater desires to design a piece of work and finish it. For the beginner we would suggest the use of the butterfly form for very effective though simple decorative treatment. In fact, bugs, beetles, metalized objects such as frogs, fruit, baby's shoe, photo frames of deposited copper are all good subjects for the amateur colorer to use when designing or wishing to use a design.

Mahogany Red

This is a color which may be employed in many valuable ways; it is particularly useful in finishing plaques, panels, etc. The article should be copper-plated in a sulphate solution and scratch brushed. In the case of electri-deposited objects the scratch brushing is performed directly after removal from the bath, then given momentary immersion in very diluted sulphurette solution and rinsed in cold water. Do not dry by use of hot water. If the conditions have been correct and the manipulation properly performed, the resulting color will be a peculiar mottled brown with streaks of red, black and blue scattered over the surface. Dry by wiping with clean cloth or dry compressed air, and lacquer at once; after lacquering the blue tones will not be discernible. Success may not result from first trial, but a few attempts carefully made will yield surprising effects on good designs. The tones may be intensified by using stronger sulphurette solution. "Leoxide" is used now as a substitute for liver of sulphur, and may be employed for preparation of all solutions where sulphurette is mentioned in this compilation of coloring processes.

Barbedienne Finish on Brass.—In a quantity of hydro-sulphurette of ammonia dissolve equal amounts of arsenic trisulphide and antimonic sulphide until a deep yellow solution is obtained. Place the brass in this liquid until the brown shade appears, scratch brush with fine brass wire brush and lacquer. Use the solution at 100 degrees Fahr.

Florentine Bronze.—This color is constantly in demand as a finish for interior fixtures. Brass goods are dipped in bright acid dip and thoroughly rinsed in several waters and then obtain the red Florentine tone by coppering in a sulphate copper solution. The latter may be prepared by dissolving 1½ pounds of copper sulphate in 1 gallon of rainwater, then adding about 4 to 5 ounces of sulphuric acid. Florentine browns may be got by using iron oxide upon copper surfaces. These brown and red shades, together with the greens easily obtained, may be used to produce very beautiful effects on many lines of decorative designs. With a suitable alloy upon which to work, the results of the various combinations of colors obtainable from these three solutions will provide ample opportunity for very pleasing effects.

Antique Brass.—There are several methods of producing antique brass, and while some very complicated methods find earnest advocates among well-known colorers, we fail to see the superiority of their production when carefully compared with some of the effects obtained from solutions of simple composition. Brass immersed in copper nitrate solution, made by dissolving copper in nitric acid and then exposing the article to a moist atmosphere for a short time, will assume a very antique surface, which may be usefully employed in combination with the colors previously mentioned. Copper chloride, copper acetate, or either of these in combination with ammonium chloride or iron oxide, will yield very beautiful effects. Some operators prefer atmospheric action, others insist on burying the article in earth or sawdust which has been moistened with the chosen solution. Time is an important factor in the latter process. Nitrate of iron, 1 oz. dissolved in thiosulphate of sodium solution, composed of about 6 oz. of the soda per gallon of water, makes a splendid dip when used at a temperature of 130 to 180 deg. Fahr. for the production of beautiful greens. The solution may be employed for treating either cast brass or brass stamping. Occasionally when finishing articles in antique we desire to work in portions of the surface with imitation Flemish iron. This may be effected by applying any reliable dead black "lac," such as is used for general household purposes; allow to dry, then work the proper surface effect by using medium grade emery and a few drops of low gravity oil. Wipe free of oil and lacquer same as remaining portions of article. If you can devote a little extra time on the article, try the smoke finish if it be suitable. The best method is to place the brass or copper article, which may have previously received some preliminary coloring, or it may be plain, in a position at the outlet of a smoke stack or some similar location where the metal will receive the direct action of the gases and soot. The effect of this treatment is more satisfactory if the metal be exposed to the weather and a damp period is preferable to dry weather. Some decorative panels which were moistened with copper nitrate before hanging in the smoke area, were beautifully finished by an application of wax. Naturally the treatment following the smoke treatment must be carefully and skilfully performed in order to avoid ruining the appearance of the portions required to be of this finish. The smoke treatment may be prolonged for several days with beneficial results.

Chocolate Brown.—This is a beautiful reddish brown bronze color which is used for certain styles of medals, medallions, etc. It is a very useful color and may be employed on interior decorations of many kinds. Make a cream of rouge and water, cover the copper surface with the cream and allow to dry. When quite dry place the article over a candle flame until the surface of the article is coated uniformly with carbon; now burn off the carbon by inserting the article in a hot flame such as a Bunsen burner produces; perform this operation carefully so that the burning is not too quickly effected. When carbon is completely burned off allow the object to cool. Now scratch-brush lightly with small fine brass wire circular brush; dry brushing is preferable for this method. If the surface treated is matte, the cream should be a few shades darker than otherwise in order to compensate for the lighter color usually obtained by the matte treatment. Some operators prefer to use the dry rouge for matte surfaces while others use the pigment in a plastic form. When finished, immerse in good grade of colorless lacquer and dry. The foregoing formulas are all simple to apply and will be found practical and efficient if properly employed. They are more or less essential in coloring copper and brass goods for many lines of commercial wares and may be utilized in the finishing of various artistic metal designs, which frequently are delivered to the plater without specific instructions as to finish, the results depending upon his ingenuity.

(To be concluded in Part III.)

PLATING AND POLISHING DEPARTMENT

QUESTIONS AND ANSWERS

Question.—I have recently prepared a new double nickel salt solution and equipped the tank with new nickel anodes. Density of solution was 11 degrees Beaume. Litmus test indicated great acidity, neutralized with liquid ammonia. Deposit of one hour was a mere fibre and very silvery, much gas was given off, in fact the gassing was violent. Increased current aggravated the trouble. I then added 2¾ oz. of common salt; deposit good, but a reddish-brown foam gathered during the day. Solution plated slow; test indicated nearly neutral condition; added sulphuric acid; results since have been satisfactory. I was told to dump the solution when it first gave me trouble, but did not do so. Please inform me whether materials I used were the best to use under the circumstances. Also kindly advise me respecting following questions: What do the terms "free acid" and "free cyanide" mean? Is nickel carbonate better than ammonia for neutralizing acidity of nickel solutions? Is a single nickel salt solution better for stove work than a double nickel salt solution? What is a double sulphated solution? How should I make up a copper plating solution for stove work? Is it a cyanide solution or an acid solution? How long should castings be plated, and what current is used? Thanking you in anticipation of a reply, I remain, etc., A.B.C.

Answer.—When preparing a new nickel solution and using new nickel anodes, it is advisable to electrolyze the solution for several hours prior to loading with the regular commercial product. The operation is effected by merely suspending a bunch of small wires or other metal articles from the cathode rod of the tank, in the solution and passing full strength of current through the bath. The operation facilitates the rapid disintegration of the outer crust or skin of the anode and a roughened and porous anode surface is obtained quickly, thus permitting the plating of usual loads of work without exhausting the metal strength of the solution or interfering with the normal chemical changes in the bath. A density of 11 degrees Beaume is unnecessarily high for a simple double nickel salt solution. A density of 7 degrees should permit of equally good deposits and less liability of trouble in actual operation. We are inclined to believe you tinker with your nickel solutions too much. Work the solutions with reasonable care and they will not require such frequent additions of chemicals. A new double nickel salt solution with new nickel anodes, plating on cast iron and at a density of 11 degrees Beaume, would naturally gas freely if acid. The reddish-brown foam appearing after addition of the common salt was possibly iron hydro-oxide which was forced to the surface by the liberation of air and gas during electrolysis. The iron may have been introduced as an impurity in the nickel salt; we assume that you skimmed it off, if so, it did no harm. The silvery appearance of the deposit as you describe would indicate acidity in spite of the fact that you added ammonia. Remember, it requires at least 3 drops of strong ammonia to neutralize 1 drop of commercial sulphuric acid. It is possible that your acid test was quite inaccurate unless the litmus paper used was fresh and your deductions based on careful observation and experiment. The addition of common salt should not have been necessary. The ammonium salt in combination with the nickel salt used should give sufficient conductivity for a considerable period of time. However, the common salt evidently helped you over a difficulty. Liquid ammonia should be carefully used when neutralizing a nickel solution. It has caused serious trouble for many platers, but remains in favor owing to its comparatively low cost. The correct neutralizing agent for acidity in a nickel solution is nickel carbonate; its use in excess can do no harm, and it adds to the metal strength of the solution. A new double nickel salt solution with new anodes will not produce a given weight of deposited metal in the same time as an older solution with roughened anodes, because the anodes do not give off metal freely and the deposit is obtained almost entirely from solution. Common salt is about the cheapest conducting salt you could obtain, but we would prefer to use ammonium sulphate or magnesium sulphate in a double nickel salt solution used for plating cast iron. Your decision to not throw the nickel solution away as advised, was a commendable one; do not allow yourself to be beaten by a solution. The practice of dumping troublesome solutions is easy to acquire but mighty expensive in more ways than one. The employer loses the cost of material, and the operator loses an opportunity to gain knowledge, experience and confidence. Dumping out plating solutions, dips, etc., is good business for the supply house. but the man guilty of the act retards his own progress every time he does it.

There are several points respecting your experience as you describe it, which would require detailed information, obtainable only by personal interview or investigation, before a positive statement relative to them could be made. We have, therefore, assumed that conditions are very much as you describe, and must reply accordingly. Boric acid tends to whiten the nickel deposit, and under proper conditions may cause a tough de-

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1919-1920.

President—Mr. John A. Magill, 591 St. Clarens Ave., Toronto.

Vice-President—Mr. T. G. O'Keefe, 147 Dupont St., Toronto.

Secretary-Treasurer—Mr. O. Holtham, 328 Carlton Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets. Second Thursday of each month. at 8 P.M.

posit; it also permits of greater range of current conditions. Citric acid is used to acidify nickel solutions, and is particularly effective when low percentage nickel anodes containing appreciable quantities of iron are used. The citric acid causes the iron to remain in solution. It is a rather expensive chemical and not in general use for this purpose; the ammonium citrate is usually employed when the iron hydroxide is under consideration. We would not advise you to use either of the chemicals until you have had further experience with the simple solution.

"Free acid" and "free cyanide" are terms used to denote the amount of uncombined acid or cyanide present in solution. When you dissolve copper carbonate in sodium cyanide solution, the cyanide remaining after the carbonate is dissolved is called "free cyanide," same is true with acids or other solvents. Single nickel salt solutions have given and are giving excellent satisfaction in stove plating. With proper preparation and consistent care these solutions will produce remarkable deposits in 1-3 to ½ the time required by the double salt solution. The term "double sulphated" which you mention is incorrect; the double nickel salt which you use is the double sulphate nickel salt; or the double sulphate of nickel and ammonium. The crystals contain certain percentages of these two sulphates, and a nickel bath prepared from these crystals would be called a double sulphate nickel solution. The single nickel salt is nickel sulphate. The ammonium sulphate in the double salt merely acts as a conducting salt. In the single salt solution the conducting salt is added separately and may be chosen from the various sulphates or chlorides usually employed in nickel solutions. Preference would depend largely upon the character of the product to be plated. We would advise postponing the preparation of a single salt solution until you have studied the requirements of bath quite thoroughly.

To prepare a copper plating solution for stove work proceed as follows: For a 100 gallon bath dissolve 20 lbs. of sodium cyanide in about 40 gallons of cold water (rain water is best if you can get it). When cyanide is dissolved stir in 12 lbs. of copper carbonate and continue to agitate until carbonate dissolves; if the carbonate does not dissolve readily and the solution remains black, add more cyanide and continue to stir the solution until a deep straw or amber-colored solution is obtained; add water to make up the 100 gallons and pass a strong current through the tank. Use electrolytic copper anodes and plenty of them. Operate the bath with strong current and small cathode for a few hours; if anodes turn black and remain so, add cyanide solution; if color is jade or streaked, add copper carbonate in small quantities by dissolving it in a portion of the solution removed from the tank; do not add any solid material direct, dissolve it first. Operate with current of 6 to 10 amperes per square foot at 4 or 5 volts; keep solution at about 120 to 150 degrees Fah. This will give you a reliable density solution which will not produce blistered deposits. The use of sodas is not advisable for your purpose, the accumulation of sodium carbonate will result naturally and quickly enough without adding it to the bath.

We have endeavored to reply to your several questions in a brief manner, and trust the information may prove of value to you. Study the fundamentals of electro disposition of metal until you get a thorough understanding of the principles involved, then the handicaps of to-day will be removed to a great extent.

Question.—I am anxious to secure information with reference to producing a grey or steel black color on silver plate. The finish desired is similar to the genuine platinum grey seen on expensive silver goods. Ordinary French grey obtained by use of liver of sulphur and ammonia will not give us the effect wanted.

Answer.—A solution which is quite generally employed, and which produces a very pleasing antique finish upon artistic silverware, is prepared as follows: Reduce about one ounce of iron sulphate crystals in an evaporating dish with about 1½ ounces of hydrochloric acid and one ounce of nitric acid. When the iron is dissolved, evaporate by heating, to one fifth the original volume. Allow to cool and add one third the amount of alcohol as you have iron sulphate. Transfer to a suitable bottle and keep closely stoppered. To use, apply the solution to the silver with a brush, the operation being carried out with cold soluation and without heating the article, as the action is quite rapid. A very pleasing dark brown shade is produced by the cold treatment. If the article is heated the heat causes a red slime to form on the lower surfaces, and by relieving the high lights the finished article has a very beautiful appearance. This solution may be used to obtain almost any tone of color it is possible to get with platinum. It is very inexpensive and has certain advantages peculiarly its own; if the red cast is too pronounced, add a very small pinch of lamp black and thoroughly mix before using.

Question.—I have used sodium chloride as a conducting salt in my nickel plating solution for several years, and have never been satisfied with the bath, but could get no definite information regarding anything better, until recently I read an article on plating, which included a reference to nickel chloride as a conducting salt. Now, it appears to me that nickel chloride should be the correct chemical to use if one wants a chloride in the solution. I have tried several small quantities of solution by adding nickel chloride, and can say I am very favorably impressed. Before making additions to the large solution, I wish to enquire how I can make my own nickel chloride, and what quantity to use in a 200 gallon bath?

Answer.—Your desire for improved conditions is inded commendable, and your deductions correct. Where chlorides are not objectionable in a nickel solution, the nickel chloride is the logical salt to use. In nickel solutions containing boric acid, the nickel chloride will permit the use of higher current densities than is possible with sodium chloride, and while any soluble chloride will assist in effecting better anode corrosion, the character of the deposit will be detrimentally affected as compared to deposits from a nickel solution containing nickel chloride. To prepare the nickel chloride you may proceed as is the custom of several well known platers, thus, to any volume of chemically pure hydrochloric acid add plastic nickel carbonate until no action occurs. Test for acidity with lituhus paper, if the solution is not absolutely neutral heat to about 80 degrees Fah. for a few minutes, and stir well. Allow to settle and use about ten ounces of the clear green liquid for a 200 gallon bath equipped with 85-87 per cent. nickel anodes, and about 15 ounces for same volume of solution using 92-95 per cent. nickel anodes, and about 20 fluid ounces for 200 gallon bath with 95-98 per cent. nickel anodes. This amount is calculated for baths containing 2 oz. of boric acid per gallon, and may be increased in case of single salt solutions using very pure anodes and a higher percentage of boric acid. In the preparation of the nickel chloride solution allow ample space in the container for increase in volume of solution as a result of dissolved carbonate; an excess of carbonate will do no harm, as it will simply settle to the bottom of the container and may be taken off when fresh chloride is required. We would not advise operating nickel baths strongly acid to litmus, when chlorides are used as conducting salt. By proper management you will be able to operate the nickel solution indefinitely without the addition of acid other than boric acid. Some platers are now using hydrochloric acid in place of sulphuric acid, to correct the neutrality of nickel solutions. The practise is not very general, and will require further experimentation before being advised for general practise.

It is estimated by scientists that it has taken from 35,000 to 75,000 years for the waters of the Niagara Falls to cut away the Coraline limestone and other varieties of stone, which are found in the Gorge, and to bring the Falls to their present location from Lewiston, seven miles. It is estimated also that 15,000,000 cubic feet of water passes over the Falls in a minute. This would equal a cubic mile per week.

Bomentaig is the name given to a compound used for filling defective castings. It probably got its name from that of its inventor. It consists of 2 parts sulphur and one part of plumbago. Melt the sulphur in a ladle and stir in the plumbago and pour out before it adheres to the ladle. This can be broken up and used to fill up holes by rubbing it in with a hot iron.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	29 35
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 50

METALS

	Montreal	Toronto
Aluminum	$36 00	$35 00
Antimony	10 00	10 50
Copper, electrolytic	25 50	26 00
Copper, casting	25 50	25 00
Lead	7 25	7 00
Mercury		.....
Nickel		.....
Silver, per oz.		0 98
Tin	60 00	58 00
Zinc	9 00	8 25

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$16 00	$13 75
Copper, crucible	19 00	18 00
Copper, heavy	19 00	18 00
Copper, wire	19 00	18 00
No. 1 mach. comp'n	17 66	16 75
New brass cuttings	13 00	10 75
No. 1 brass turnings	10 00	9 00
Light brass	8 00	7 00
Medium brass	9 00	7 75
Heavy melting steel	13 50	13 50
Shell turnings	7 00	6 00
Boiler plate	13 50	16 00
Axles, wrought iron	20 00	20 00
Rails	14 50	13 50
No. 1 machine cast iron	23 00	18 00
Malleable scrap	15 00	17 00
Pipes, wrought	10 00	5 00
Car wheels, iron	20 00	20 00
Steel axles	20 00	20 00
Mach. shop turnings	6 00	6 00
Cast borings	7 00	8 00
Stove plate	17 00	13 00
Scrap zinc	6 00	6 00
Heavy lead	5 00	5 25
Tea lead	3 75	3 50
Aluminum	21 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

1/4 in.	$13 50
5-16 in.	11 50
3/8 in.	10 50
7-16 in.	9 30
1/2 in.	10 15
9-16 in.	10 00
5/8 in.	11 75
7/8 in.	11 75
1 inch	10 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 50
Linseed oil, boiled, single bbls.	2 92
Linseed oil, raw, single bbls.	2 90
Plaster of Paris, per bbl.	4 50
Sandpaper, B. & A. list plus	43
Emery cloth list plus	37
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 00
Sheets, black, No. 10	6 15	5 45
Canada plates, dull, 52 sheets	8 50	7 10
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 50
Premier, 10¾ oz.	....	7 80
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/4 in.	$16 75
3-16 in.	15 40
1/4 in.	14 20
5-16 in.	11 50
3/8 in.	10 50
7-16 in.	9 30
1/2 in.	10 50
5/8 in.	10 00
3/4 in.	9 70

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20%, on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Silver, per oz.	1 05 to 1.00
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.06
Acid, hydrofluoric	.30
Acid, nitric	.14
Acid, sulphuric	.06
Ammonia, aqua	.19
Ammonium, carbonate	.25
Ammonium, chloride, lump.	.30
Ammonium, chlor., granular	.25
Ammonium, hydrosulphuret.	.30
Ammonium, sulphate	.15
Caustic soda	10
Copper, carbonate, anhy	.50
Arsenic, white	.20
Copper, sulphate	.17
Iron perchloride	.40
Lead acetate	.25
Nickel ammonium sulphate	.25
Nickel sulphate	.35
Potassium carbonate	.60
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.25
Sodium carbonate crystals	.05
Sodium cyanide, 129-130%	.40
Sodium cyanide, 98-100%	.55
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	.80
Zinc chloride	.80
Zinc sulphate	.15

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$3 25
Polishing wheels, bullneck	2 00
Pumice, ground	3½ to .05
Emery composition	08 to .09
Tripoli composition	06 to .09
Rouge, powder	30 to 35
Rouge, silver	.35 to .50
Crocus composition N	08 to 10

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd.	0 34
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	36
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37¼
Imperial quenching oil	39½
Petroleum fuel oil	10¼

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	40

FEELING FAVORABLE TO BRITISH TRADE

But Trouble is in Getting the Supplies Through at Present Time

TORONTO.—Weeks have been much the same lately, nothing has happened during the past few days to break the sameness. There is still a fairly good volume of business moving, and some very large contracts are being worked on just now. Warehouses have, in several cases, been asked to get ready to take care of fairly heavy specifications. If they materialize it is certain that the shops taking the work on will be well employed for the remainder of the season.

Although no general announcement has been made of an increase, there is a feeling in machine tool circles that a rise is likely to come in the very near future. Deliveries are not as good as they were some time ago, in fact it is a notable thing that each successive month makes delivery dates a little less satisfactory on several lines.

Again, it is pointed out that the prices of some of the machines were put down after the war by the makers, on the assumption that the prices of labor and material would soon drop. These latter things have not taken place, with the result that prices of many lines of machine tools are likely to be placed back almost at the point where they were during the period of the war, when a person had almost to have a Government order and a Government shot-gun in order to secure any of the much-wanted machine tools. It must be said that there is a tendency in many circles to keep the prices down, it being felt that further increases now will not help matters. There are times when intimation of a price increase will help to close up a lot of business that has been lying around. There is a case in point right now, where notice was given that a machine used largely in the publishing business was going to be increased in price. The selling price as a general thing has been around $2,700, and the proposed increase was going to be around the ten per cent. mark. The result seems to have been that every prospect in sight was closed with, and the firm is now swamped with the business that resulted. That is generally the way of the market, but in the machine tool field just now, salesmen find it harder to get any more for machine tools than the present lists call for.

One large warehouse reports that it finds a strong desire to secure Old Country material in many cases.

This house reported that it ought to be easy for a British house to come in here and do business, as there are many cases where specifications ask for these lines. Dealers who have been handling British lines, in some cases exclusively, report that it is a serious matter for them to get shipments through, regardless of whether the price is too high or not. There are certain lines of steel, cutlery, etc., on which it is impossible to secure deliveries. From reports that these agencies have in this country improvement is slow in Britain, and they can see no reason for expecting anything like a real improvement in the near future.

Some boiler work may be placed in Canada for shipment to Egypt. The specifications for this call for acid plate. This is about the first time in months that the firms asked for figures on the business have been asked to supply this particular kind of plate, as practically all the plate business is straight basic. There are not many mills where the acid process plate is turned out, and the price charged for it will be about $1.50 per hundred above the basic.

Reference was made in the markets of last week in regard to business for steel for a bridge in an Ontario city, and as far as can be learned that business has not been placed. One dealer took it at 3.10 laid down in Peterborough, and apparently depended on being able to place the business at one of the Ontario mills at a price that would allow him a profit at the 3.10. One mill replied with a 3.23 price in Peterborough, while the nearest another of those able to handle the business would come was 3.13. Just what the holder of the contract is going to do with the business remains to be seen.

Continued on page 273

THE KILKENNY CATS BROUGHT UP TO DATE

(Continued from page 257)

harmony, make a mighty powerful asset to the machine tool industry. In conclusion, let all readers who are moulders, patternmakers, or draftsmen decide to, as far as lies in their power, change this state of affairs, and to work in harmony together. In union is strength, we are told, and we cannot expect to be successful in obtaining strength, if we do not co-operate.

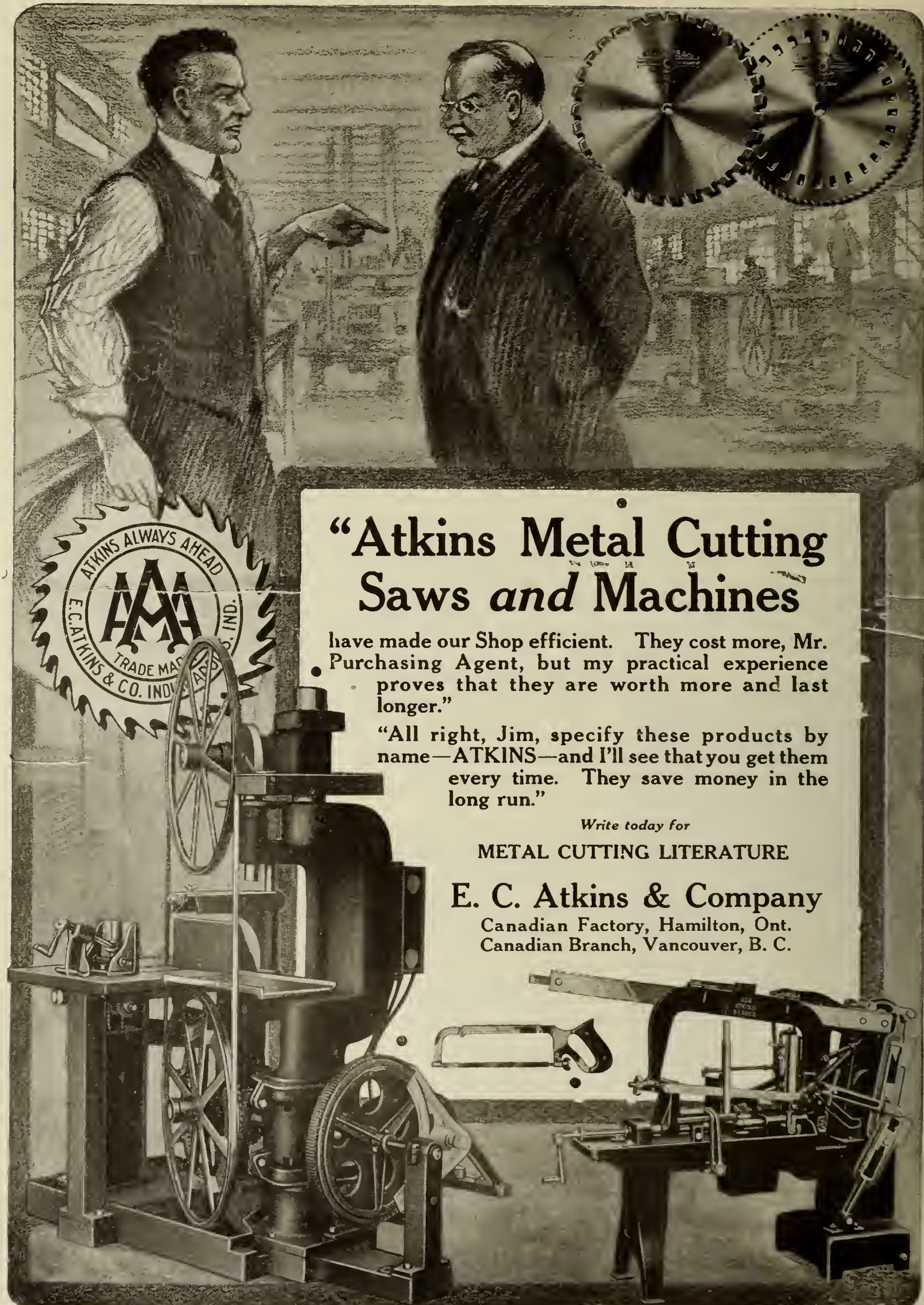
Trust each other, don't be continually trying to put one over the other chap, and the result will be better work, more production, and better still—real brotherly regard for each other.

BEEBE PLAIN, VERMONT, AND BEEBE PLAIN, QUEBEC

Continued from page 239

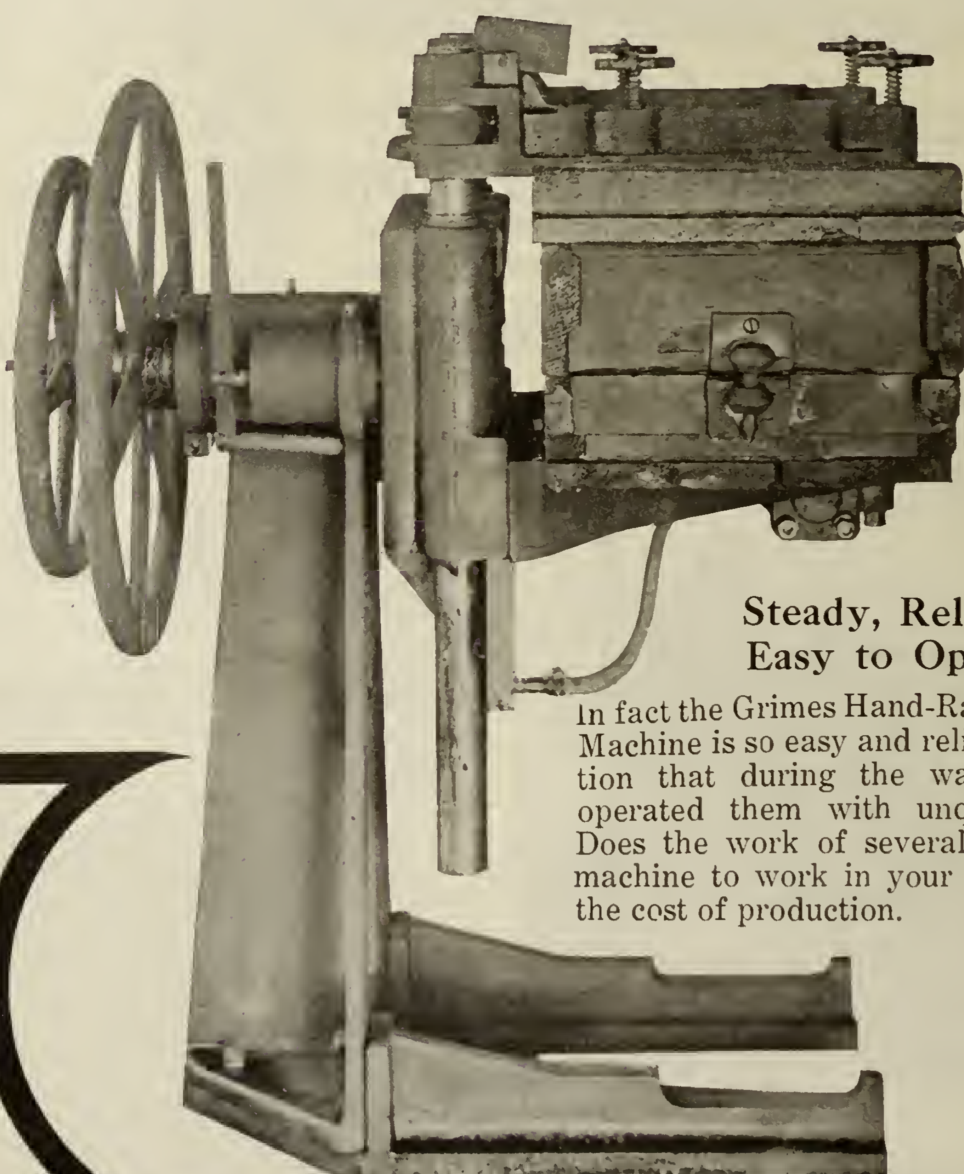
are spending the happiest days in their lives. What they do know is that they are having their picture taken and that is enough to think about at one time.

Who knows but that the future President of the United States or some great Canadian statesman to be is in that little group? Time alone will tell. Would that devastated Europe could take a lesson from what is taught here and that a repetition of the last half a decade shall never be enacted, but that international boundaries and international laws shall be respected and protected. "So mote it be."


ATKINS ALWAYS AHEAD
E.C. ATKINS & CO. INDIANAPOLIS, IND.
TRADE MARK
"Atkins Metal Cutting Saws and Machines
have made our Shop efficient. They cost more, Mr. Purchasing Agent, but my practical experience proves that they are worth more and last longer."
"All right, Jim, specify these products by name—ATKINS—and I'll see that you get them every time. They save money in the long run."
Write today for
METAL CUTTING LITERATURE
E. C. Atkins & Company
Canadian Factory, Hamilton, Ont.
Canadian Branch, Vancouver, B. C.

GRI

Hand-Rammed Roll-Over Machine



Steady, Reliable, Easy to Operate

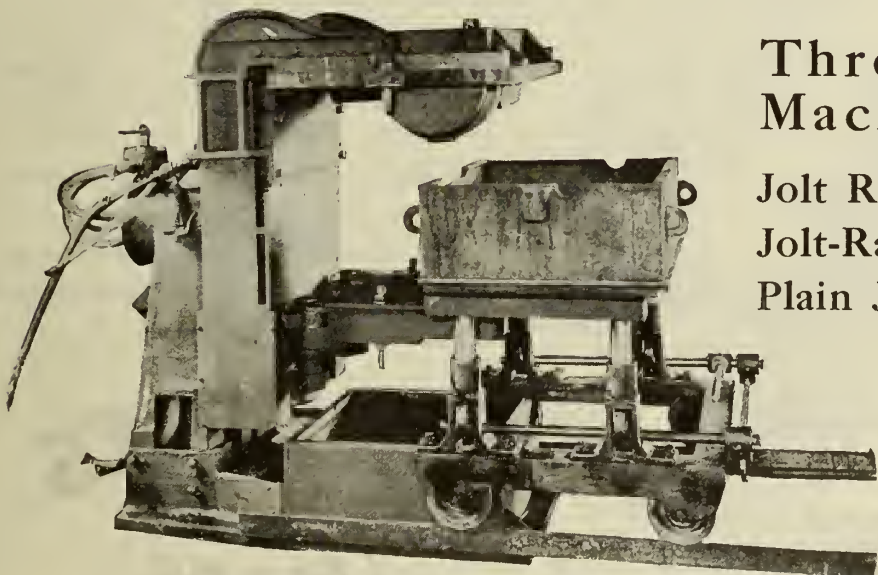
In fact the Grimes Hand-Rammed Roll-Over Machine is so easy and reliable in its operation that during the war many women operated them with unqualified success. Does the work of several men! Put this machine to work in your foundry and cut the cost of production.

Grimes

1212 Hastings

MES

Jolt-Rammed Roll-Over Machine



Three-in-One Machine---

Jolt Roll-Over
Jolt-Rammed
Plain Jolt

Meets all Requirements

The Grimes Jolt-Rammed Roll-Over Machine meets every requirement of a modern labor-saving appliance. Here are some of its features: Low cost to install; easy to maintain; easy to rearrange in your shop; entirely above floor line; no pits to clean—and it is a general purpose machine that meets all requirements.

Pay you to learn more about Grimes Labor-Saving equipment. Questions gladly answered.

Molding Machine Company

DETROIT, MICH.

Formerly Midland Machine Company

GLOBE

Shot Blasting

Instead of Sand Blasting

Ensures 100%

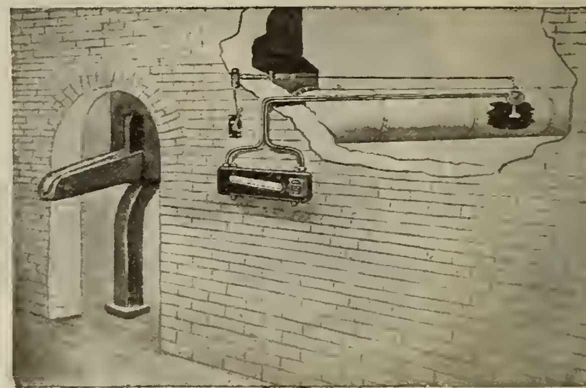
Cleaner Castings

Globe chilled shot leaves a perfectly smooth surface—an important factor where castings are to be enamelled—sand leaves a sand coating.

SHOT DOES NOT WEAR THE HOSE, NOZZLE OR MACHINE AS FAST AS SAND, AND IT CLEANS EASILY 100% BETTER.

Let us tell you more about it.

THE GLOBE STEEL CO.
MANSFIELD, OHIO



THE VOLUME OF BLAST

entering your cupola, not the pressure, governs the melting.

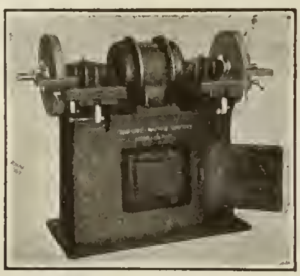
The Clark Blast Volume Meter shows how much blast goes into the cupola, regardless of the pressure. Its use insures rapid melting, hot, clean iron, reduced melting loss, and saves fuel and cupola lining. Nearly a thousand foundries use it.

Write to-day for instructive booklet.

CHAS. J. CLARK
1716 W. ADAMS ST. CHICAGO, ILL.

Ford-Smith Grinders

FOR EVERY CLASS OF WORK



MILLING MACHINES
SPECIAL MACHINERY
MOTOR DRIVEN GRINDERS
DISC GRINDERS
FLOOR GRINDERS
WET TOOL GRINDERS
BENCH GRINDERS
POLISHING MACHINES
BUFFING MACHINES
SWING GRINDERS

Built by

The Ford-Smith Machine Co., Limited
Hamilton, Ont., Canada

CRUCIBLES

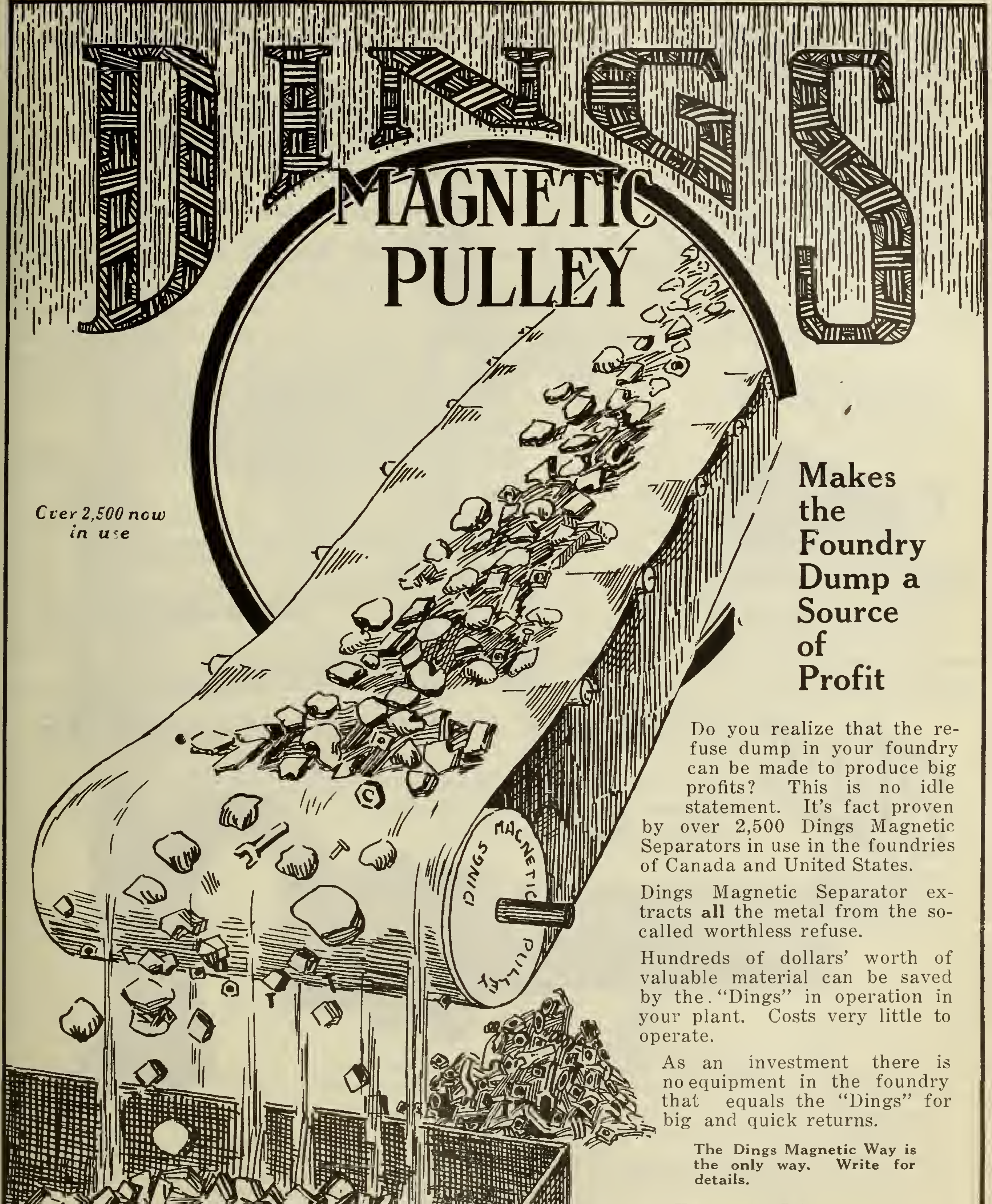
DOMINION CRUCIBLE CO.

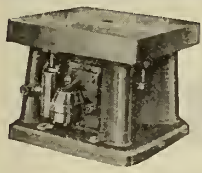
LIMITED

ST. JOHNS, QUE.

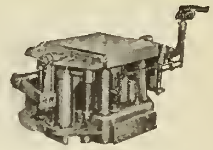
HAMILTON FACING MILLS CO. LIMITED
HAMILTON, ONT.

SOLE CANADIAN DISTRIBUTORS


DINGS
MAGNETIC
PULLEY
Over 2,500 now in use
DINGS MAGNETIC PULLEY
W. BALSDON



DAVENPORT



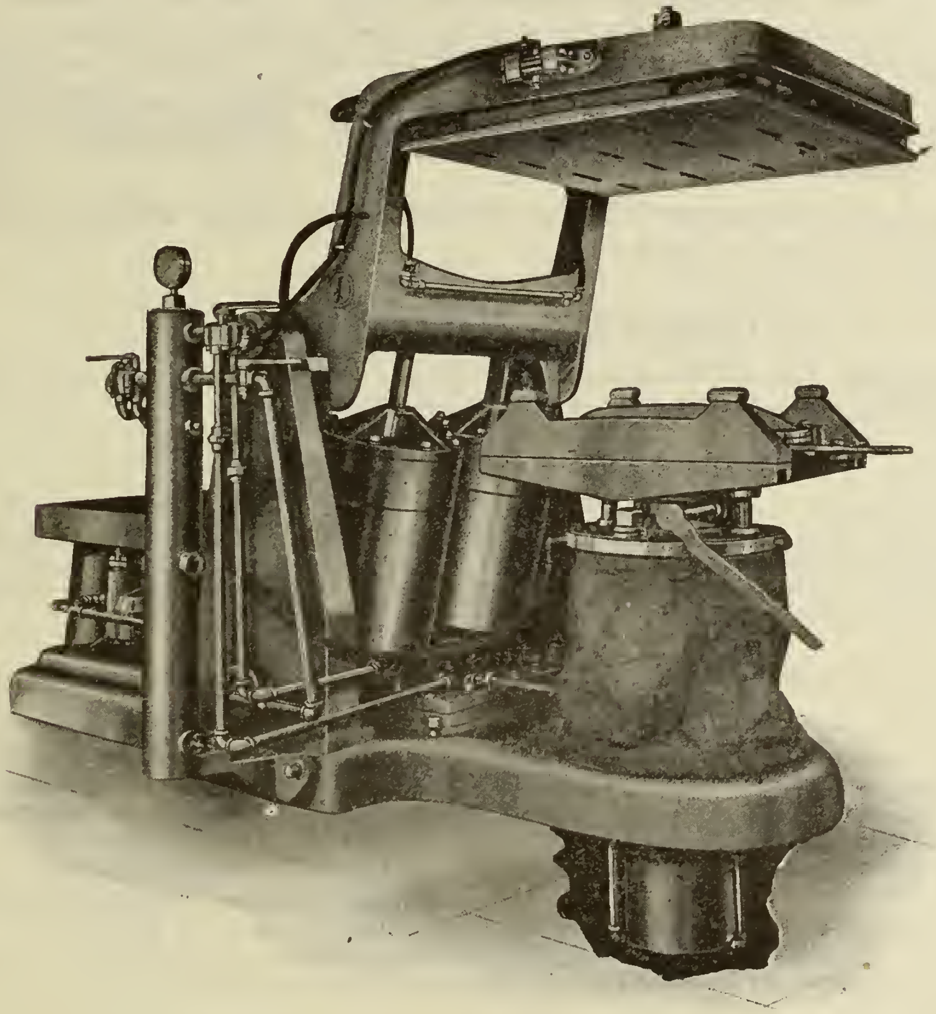
JOLT-ROCK-OVER-DRAW MACHINES

Stationary and Portable

DESIGNED AND BUILT UNDER EXPERT SUPERVISION

Simple to Operate

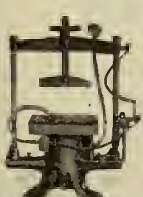
Durable in Construction



Fast in Production

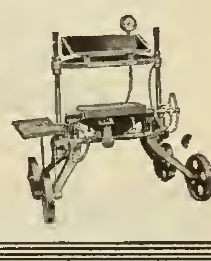
Manufacturers of

PLAIN JOLTS, CORE JOLTS, JOLT STRIPPERS, POWER SQUEEZERS, JOLT SQUEEZERS



Davenport Machine & Foundry Co.

Davenport, Iowa



Visit us at Philadelphia. Booth No. 277-279

Foundrymen of Canada

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.
Sullivan Machinery Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GATES
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
Clark, Chas. J., Chicago.

BLAST METERS
Clark, Chas. J., Chicago.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison Co., E. J., Toronto.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CONVERTER BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison Co., E. J., Toronto.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Roots Co., P. H. & F. M., Connersville, Ind.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIE MAKING MACHINERY
Oliver Machinery Co., Grand Rapids, Mich.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.
Magnetic Mfg. Co., Milwaukee, Wis.
Woodison Co., E. J., Toronto.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY SHOES
Smith & Sons, R. P., Chicago, Ill.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.
Woodison Co., E. J., Toronto.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

FURNACE BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Black Donald Graphite Co., Calabogie, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison Co., E. J., Toronto.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co., Cleveland, O.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACE BLOWERS
Roots Co., P. H. & F. M., Connersville, Ind.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN MAKERS' LATHES
Oliver Machinery Co., Grand Rapids, Mich.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Black Donald Graphite Co., Calabogie, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Magnetic Mfg. Co., Milwaukee, Wis.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Woodison Co., E. J., Toronto.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, Ohio.
Woodison Co., E. J., Toronto.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SANDERS, ALL KINDS
Oliver Machinery Co., Grand Rapids, Mich.

SAWS, BAND
Oliver Machinery Co., Grand Rapids, Mich.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MAGNETIC; STANDARD AND SPECIAL
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

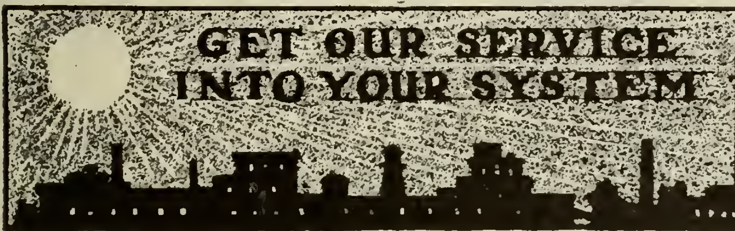
SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.



SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison Co., E. J., Toronto.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corporation, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD

TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Pressed Steel Co., Muskegon, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Woodison Co., E. J., Toronto.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIND GATES
Roots Co., P. H. & F. M., Connersville, Ind.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

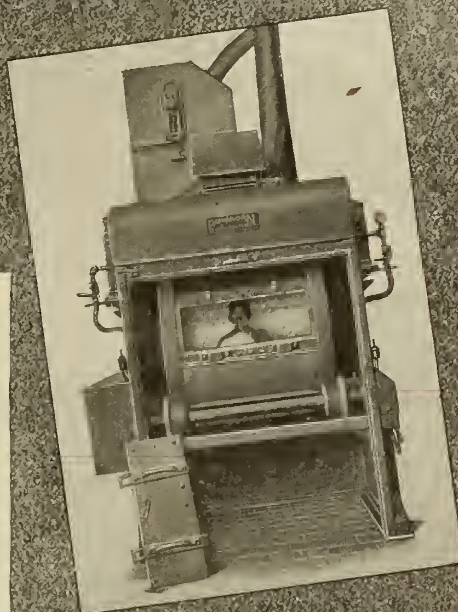
WOOD MILLING MACHINES
Oliver Machinery Co., Grand Rapids, Mich.

WOOD TRIMMERS
Oliver Machinery Co., Grand Rapids, Mich.

INDEX TO ADVERTISERS

CANADIAN FOUNDRYMAN and Metal Industry News

VOL. X. PUBLICATION OFFICE, TORONTO, OCTOBER, 1919 No. 10



CANDAIAN FOUNDRYMAN, October, 1919. Vol. X., No. 10. Published monthly, at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $1.00; in the United States, $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.

High Costs

Confront Every One in the Foundry Business

Wages have gone up in keeping with other necessities of production. As these wages are more or less permanent, it is important that the time of every workman be conserved to the fullest extent.

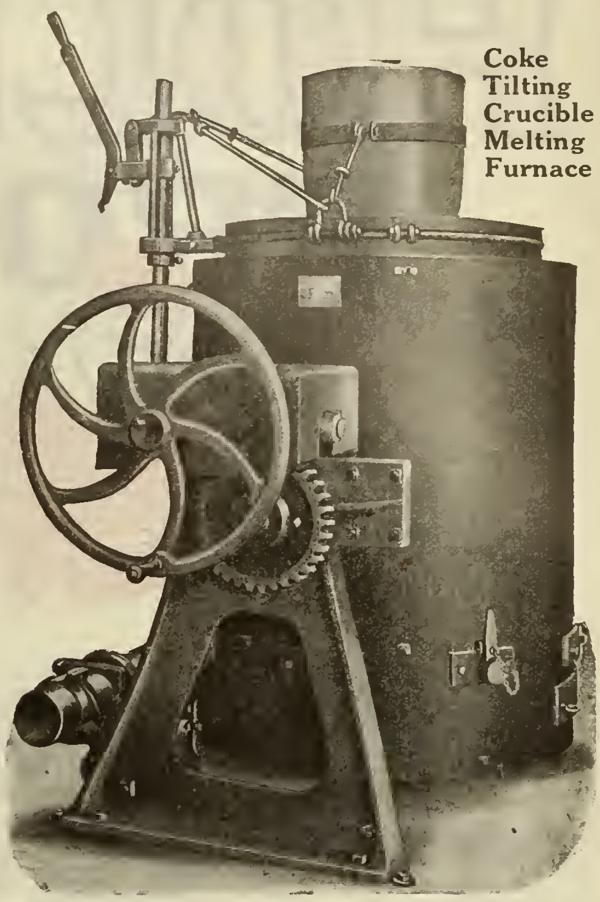
Monarch Melting Furnaces

are designed to save time

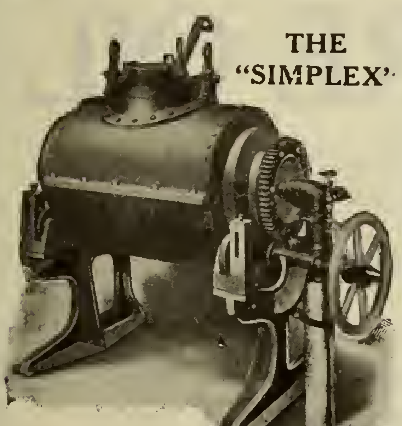
They will help you to conserve valuable time—not a little time, but a lot of it. There's no better method for counteracting the increased cost of production than through the adoption of Monarch furnaces. They assure you **quicker, better melts.**

Monarch Coke Tilting Crucible Melting Furnace

A fast, economical melter, equipped with Hopper Feed and Shake Grates. Above ground. Made for various size crucibles. Built on sturdy lines and very easily operated.



Coke Tilting Crucible Melting Furnace

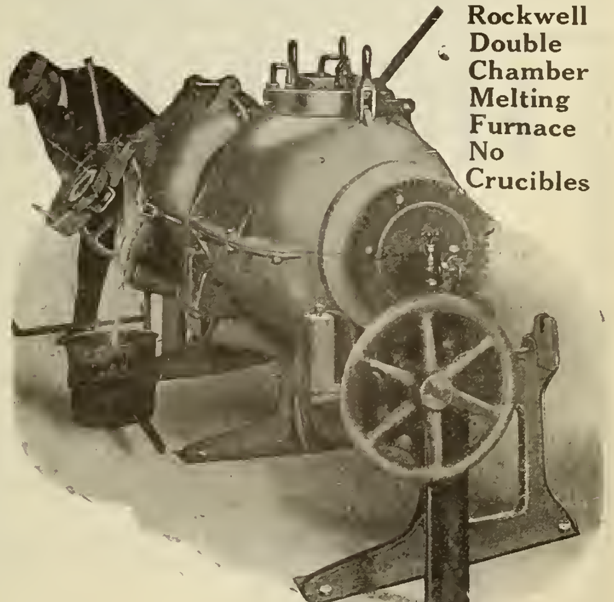


THE "SIMPLEX"

Monarch Rockwell Single Chamber Melting Furnace—No Crucibles.

Monarch Rockwell Double Chamber Melting Furnace—Requires no crucibles. Burns oil or gas. Melts almost twice as much metal as any other furnace without additional cost for fuel, because it utilizes all the heat from its one burner. While melting in one chamber exhaust heat brings the metal in the other chamber to the melting point. For speedy melting this furnace has no equal.

"Simplex" — Monarch Rockwell Single Chamber Melting Furnace—Built on the same lines as the double-chamber furnace, but without its continuous heating capacity. Still the fastest melter and best fuel economizer of its kind.



Monarch Rockwell Double Chamber Melting Furnace No Crucibles

HOW CAN WE SERVE YOU?

The Monarch Engineering & Mfg. Co.

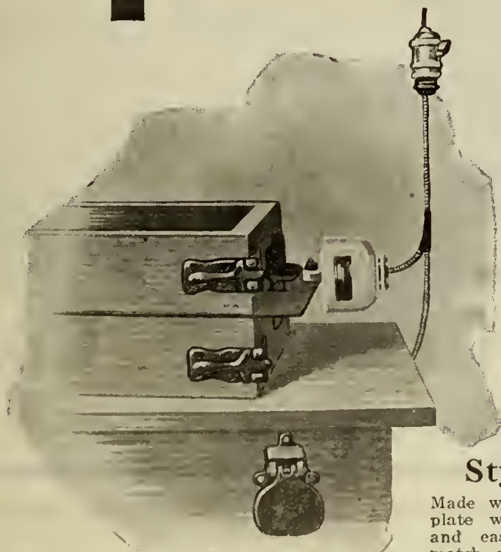
1207 American Bldg., Baltimore, Md., U.S.A. **Shops at Curtis Bay, Md.**

"L&A" Vibrators

(Protected by U.S. and Canadian Patents)

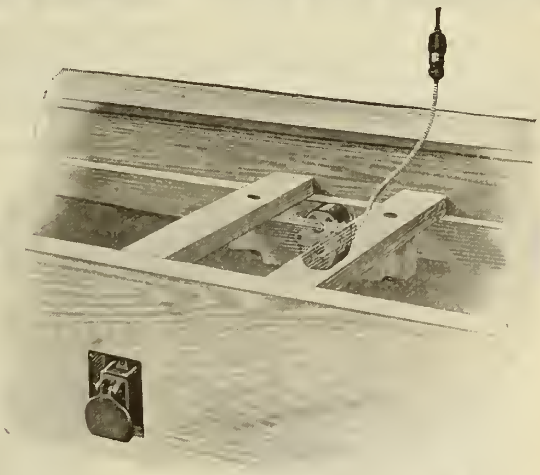
HAVE PASSED THE EXPERIMENTAL STAGE—SEVERAL THOUSAND DOING THEIR DUTY IN CANADIAN, FOREIGN AND UNITED STATES FOUNDRIES—OPERATION COSTS PRACTICALLY NIL

"L. & A" Electric Vibrator will meet requirements of most exacting service. Its efficiency makes it almost indispensable. Works quickly, thoroughly and without unnecessary air compressors, tanks, hose, etc.



Style "A"

Made with one plug for plate work. Is quickly and easily attached to match or pattern plates



Greater Production
At a Lower Cost

The foundry owner who buys the L. & A. Vibrator takes a positive step towards greater production. What's more, he is keeping expenses cut down to zero. Hundreds of foundries operated with L. & A. Vibrators to-day on the "More Work—Less Cost" plan.

Size	Weight	Cost per day to Operate	Equivalent to Air Vibrator	Price
1	2¼ lbs.	6/10c	½"	$10.00
2	2¾ lbs.	7/10c	⅝"-¾"	12.00
3	3¾ lbs.	8/10c	1"-1⅛"	14.00
4	4¼ lbs.	1c	1¼"-1½"	16.00
Knee switch				2.50

Style "B"

Made with two ears for tub, bench and machine use.

Write for complete information

In ordering mention precisely type, size, voltage and cycle. If your jobber does not handle write direct—sent on ten days trial

The Pressed Steel Company

MUSKEGON, MICHIGAN

Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
CRUCIBLES
Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

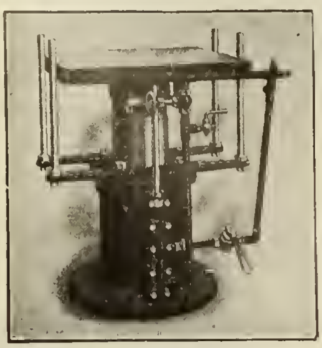
Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

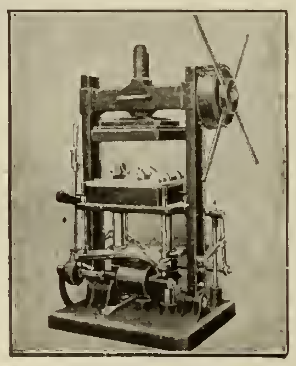
Canadian representative H. T. Meldrum 14 St. John St., Montreal, Canada.

British Moulding Machines

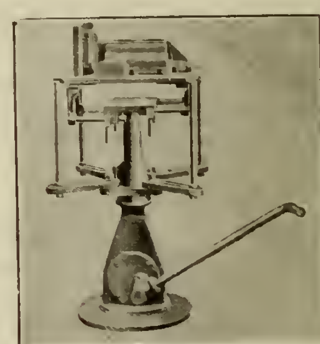
AND FOUNDRY EQUIPMENT



The JARR RAM (Pneumatic).
The Machine with a Perfect Lift.



The HEAD RAM.
Most powerful Hand Machine made.



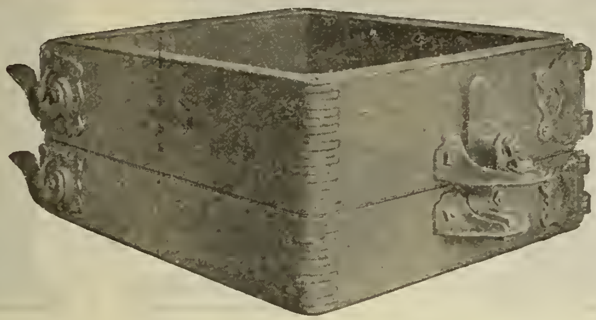
The HAND RAM.
Adjustable to any size box.

The most efficient Machines, built to stand rough usage

Write for Catalogue to

BRITANNIA FOUNDRY COMPANY

COVENTRY, ENGLAND



Diamond Master Flask

Diamond Steel Jacket

DIAMOND

In **Diamond** Master Flasks the accepted principles of snap flask building have been developed and enlarged and the weak and faulty conditions overcome. Master Flasks are light in weight, easy to handle, accurate and very durable.

Their convenience and accuracy will result in a larger and better production.

Diamond Steel Slip Jackets are made to fit any make of flask, straight or tempered, and of any thickness of metal desired up to 8 gauge. Far more serviceable than cast iron or wooden jackets—they can neither break nor burn.

We also manufacture a complete line of foundry accessories, Wedges, Clamps, Varnish Cans, Pattern Benches, Core Boxes, Rapping Plates, etc.

Sold in Canada by

DOMINION FOUNDRY SUPPLY CO.
WHITEHEAD BROTHERS COMPANY
E. J. WOODISON COMPANY
FREDERICK B. STEVENS
HAMILTON FACING MILLS CO., LTD.

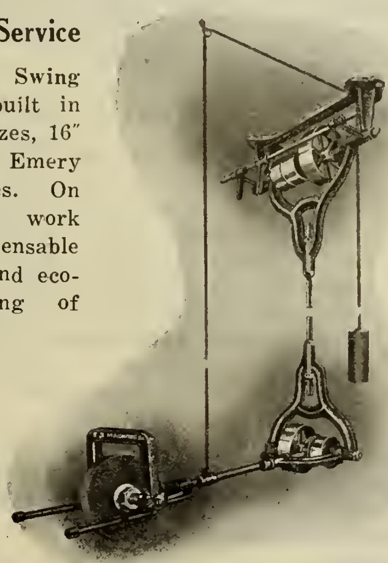
If interested, write any of these jobbers or to us direct.

DIAMOND CLAMP & FLASK CO.
38-40 N. 14 St. RICHMOND, INDIANA

Ford-Smith
GRINDERS

For Foundry Service

Our "All-Steel" Swing Grinders are built in two standard sizes, 16" and 20", for Emery Wheel or Brushes. On heavy foundry work they are indispensable for the rapid and economical cleaning of castings.



Our catalogue will give you full detail on our wide range of Grinders. Mailed on request.

Manufactured by

Ford-Smith Machine Co., Limited
Hamilton, Ont., Canada

CRUCIBLES

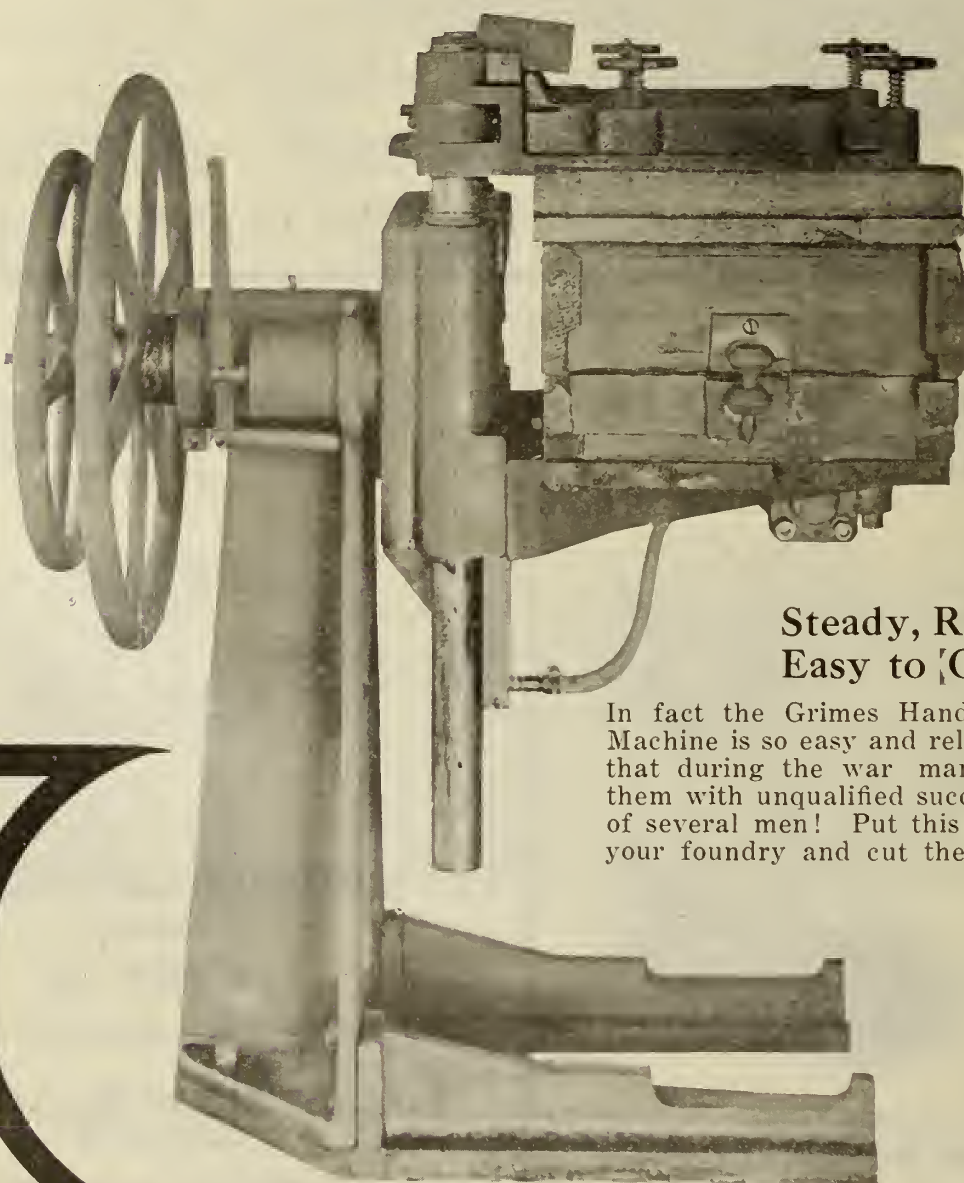
DOMINION CRUCIBLE CO.
LIMITED
ST. JOHNS, QUE.

HAMILTON FACING MILLS CO. LIMITED
HAMILTON, ONT.

SOLE CANADIAN DISTRIBUTORS

GRI

Hand-Rammed Roll-Over Machine



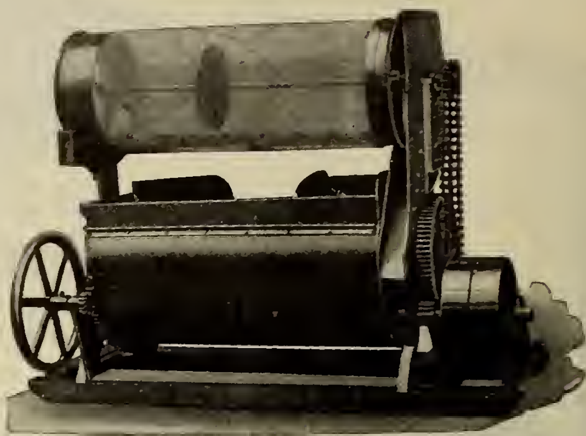
Steady, Reliable, Easy to Operate

In fact the Grimes Hand-Rammed Roll-Over Machine is so easy and reliable in its operation that during the war many women operated them with unqualified success. Does the work of several men! Put this machine to work in your foundry and cut the cost of production.

Grimes

1212 Hastings St

BLYSTONE SAND MIXER



Cut Your Mixing Costs 50%

These are the days of keen competition. In order to meet it and make a profit you must equip your foundry with modern, efficient, labor-saving facilities. You can't afford to overlook the productive, money-making features of the BLYSTONE SAND MIXER. Cuts labor cost of mixing at least 50%. Reduces time required to mix your sand 60%. Produces absolutely complete and uniform mixture. With it 25% to 30% less core oil and other binders are required, it mixes so thoroughly.

Loaded and Unloaded Without Stopping the Shovels

The BLYSTONE is a continuous worker. You can load it and unload it without stopping the shovels. The mixer (without screen) is loaded by shoveling the sand into the drum. With the screen type the sand is thrown in the end of the screen. All you have to do to discharge the load is to tip the drum, a very easy operation by hand or power. Discharge control enables operator to dump as much or as little of the batch as desired.

The work of the BLYSTONE MIXER is thorough and uniform as well as economical. The secret of its efficiency lies in its reverse spiral shovels—three shovels that work opposite direction to the other three. These six powerful shovels move at 22 r.p.m. and dig down under the mass, while a longitudinal thrust throws the sand from one end of the drum to the other 44 times a minute. This method of shoveling, stirring and troweling the materials assures a more thorough mix than is possible by any other method.

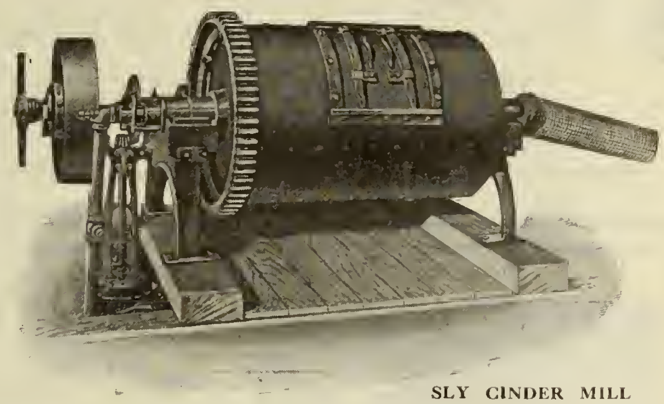
The BLYSTONE is the only mixer with adjustable shovels. This saves purchasing new shovels in case of wear. It is the simplest mixer made, yet strong and durable. Contains no superfluous parts which might eat up power and get out of order.

Foundrymen in Canada and United States highly endorse the Blystone Mixer. Users are saving time, cutting costs and increasing their profits. One man alone with a Blystone can do the work of six men working by hand. This alone should decide you to use it. **Write for the full story of its efficiency.**

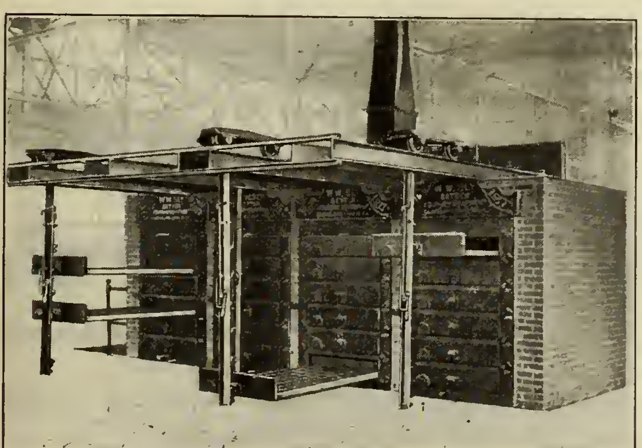
Baltimore	J. W. Paxson Co.	Cleveland	E. J. Woodison Co.	San Francisco, Cal.	Ditty Brothers
Birmingham	Hill & Griffith Co.	Detroit	E. J. Woodison Co.	Seattle, Wash.	E. J. Woodison Co.
Buffalo	E. J. Woodison Co.	New York	Wonham, Bates & Goode, Inc.	Toronto	E. B. Fleury, 1609 Queen St. West, Phone Park. 6700
Chicago	Scully-Jones & Co.	Philadelphia	J. W. Paxson Co.		
Cincinnati	Hill & Griffith Co.	Pittsburgh	J. S. McCormick Co.		

BLYSTONE MANUFACTURING CO.

819 Ironton Street Cambridge Springs, Pa.



SLY CINDER MILL



SLY DRAWER TYPE CORE OVEN.

The Publisher's Page

TORONTO OCTOBER, 1919

The 1919 Convention

THE great Inter-Allied Convention of the American Foundrymen's Association, which was held at Philadelphia during the week of Sept. 29-Oct. 3, was without a doubt the biggest and best in the history of the Association, both as regards the number in attendance and the quality and variety of the exhibits. Over 200 exhibits were shown and between eight and nine thousand were in attendance. The war cloud which darkened the four previous conventions no longer dampened people's ardor, converting their thoughts into other channels. The dangers of sea travel having been reduced to normal permitted visitors from all quarters of the globe to attend. Canadians, free from the anxieties of munition work and war preparation were there in full strength, eager to grasp new ideas and learn what the rest of the world is doing in the way of improved foundry management and equipment, and everything which the most exacting foundryman could wish to see or hear was there to be seen and heard.

CANADIAN FOUNDRYMAN'S booth, which was situated directly opposite the main entrance, was a centre of attraction and many Canadians registered their names and made our booth their headquarters during their stay in the exhibition building. In addition to this, many visitors from far-off Japan, India and even from the island of Java called and not only recorded their names in our register, but also on our subscription list. All united in expressing their belief in the great benefits to be derived from attending the Convention. Those who attended the Convention from Canada came away feeling that they had had their eyes opened and that the labor-saving devices which they saw in operation would be necessary in all the Canadian foundries if Canada is to compete in the race for industrial supremacy.

Those Canadian foundrymen who were not at the Convention should have been, but not being able to see the equipment in actual operation, their opportunity now lies in perusing the columns of CANADIAN FOUNDRYMAN and learning the things which they were not in a position to see, and also in carefully reading the advertisements of many of the leading exhibitors which appear in the advertising section of CANADIAN FOUNDRYMAN. The advertising section is always full to overflowing with interesting material, and the advertising section of this particular issue of CANADIAN FOUNDRYMAN will be found to be of an unusually interesting character.

SIMPSON INTENSIVE FOUNDRY MIXER

Economical and Efficient for all kinds of Sand Mixtures

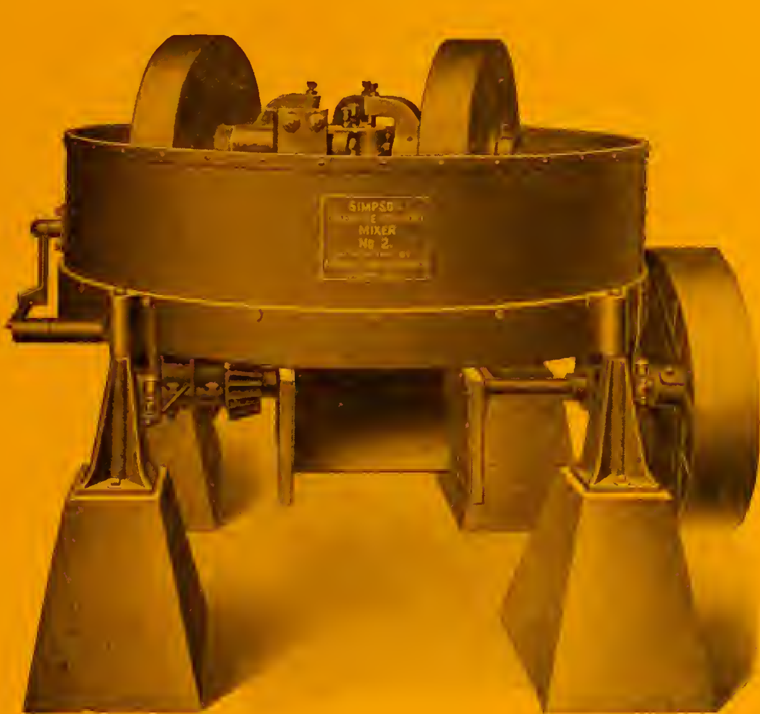
Note the AUTOMATIC DISCHARGE

It saves LABOR BINDER and NEW SAND

It improves the quality of the castings

Its work is done thoroughly not partially

Elasticity and toughness of sand are enormously increased



"The Product of a Practical Foundryman"

Thoroughly amalgamates the mixture

Small H. P. required with a minimum of repairs

Pays for itself in an incredibly short time

Original porosity of sand mixture maintained

Large capacity with a minimum of labor

Will reclaim old and worn out sand for reuse

The large number of Simpson Mixers in use all over Canada and the United States testifies to its efficiency. Send for our pamphlet No. 50 and list of many users.

The Six Points of Perfection

1. Correct size and speed of mullers.
2. Effective arrangement of plows.
3. Automatic discharge.
4. Large capacity per area of floor space occupied.
5. Minimum power and maintenance cost.
6. Considerably less new sand and binder required.

NATIONAL ENGINEERING COMPANY

Machinery Hall Bldg., 549 W. Washington St.

CHICAGO, ILL.

KELLER

KELLER-MADE

HOW ABOUT TIME YOUR MEN LOSE WAITING FOR REPAIRS?

THE individual workman is not to blame for the time lost while waiting for repairs on inferior tools. The foreman is not to blame for the occasional decrease in his output when he is denied first-grade equipment.

KELLER-MADE MASTER-BUILT PNEUMATIC TOOLS save time for the workman, increase output for the foreman and cut down expense generally by converting non-productive time into productive labor. They are the logical answer to the modern demand for increased output combined with better quality of work.

KELLER-MADE MASTER-BUILT PNEUMATIC TOOLS have been adopted as **standard equipment** by leading railroads, shipyards and a majority of the foremost shops and foundries throughout the country. There's a KELLER-MASTER TOOL for every purpose—and every KELLER-MASTER TOOL is **the best for the purpose.**

Write our nearest branch office for the NEW KELLER CATALOG, which illustrates and describes our complete line—mailed free on request.

KELLER PNEUMATIC TOOL CO.

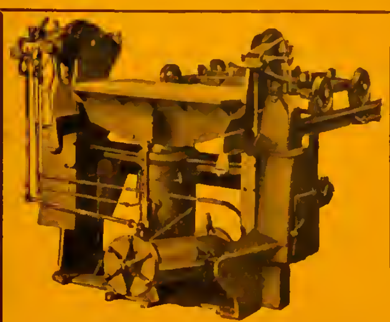
FACTORY: GRAND HAVEN, MICHIGAN, U.S.A.
SALES OFFICES: 20 E. JACKSON BLVD., CHICAGO

BRANCH OFFICES

BURMINGHAM - BOSTON - BUFFALO - CLEVELAND - DENVER - DETROIT
MILWAUKEE - NEW YORK - PHILADELPHIA - PITTSBURGH - RICHMOND
SALT LAKE CITY - SAN FRANCISCO - SEATTLE - ST. LOUIS - ST. PAUL - WASHINGTON, D.C.

CABLE ADDRESS — "KELLERTOOL"

MASTER-BUILT



No. 405—Osborn Direct Draw Roll-Over Jolt Machine.

Sprocket for Farm Tractor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 | Published Monthly

The Philadelphia Convention a Grand Success

The Foundryman's Convention and Exhibit in Philadelphia Was Without Doubt the Most Successful in the History of the American Foundrymen's Association.

ONCE more the great American Foundrymen's Association has held its annual convention and exhibit of foundry equipment and supplies, and once again it has demonstrated to foundrymen and all those interested in the metal industries throughout the world, the enormous importance, and the great benefits to be derived from these annual events. The great gathering of foundrymen from all the allied countries in the late war, giving it the just title of "Interallied Convention."

Members from India, Ceylon, Java, Japan, Australia and similarly far distant lands were in evidence, as well as those from Great Britain, France, Italy, Belgium, United States and Canada.

Best in Its History

The Interallied Convention and exhibit which has just drawn to a close at Philadelphia, was the 24th convention in the history of the association, and the fourteenth exhibition in conjunction with the same, and the third to be held in Philadelphia, and the people of Philadelphia have certainly shown that theirs is a proper and ideal city in which to hold a foundrymen's convention.

As we have repeatedly stated, Philadelphia is the home of the Foundrymen's Convention, as it was here that the first one was held twenty-four years ago, the second one for Philadelphia being in 1907 and the third having just terminated on Friday, Oct. 3, 1919.

The Exhibition

The Commercial Museum Building, in which the exhibits were displayed, is 295 feet wide and 296 feet long. The total floor space occupied, exclusive of aisles, was 60,300 square feet, and the total number of exhibits was 206. Some 200 electric motors were used to operate the equipment, representing a total load considerably exceeding 800 horse-power. The approximate weight of the material on exhibition was 750 tons.

To describe with anything like accurate detail the vast display of exhibits would require volumes, consisting as it did of jolters, squeezers, strippers, combination machines, etc., with various degrees of automatic operation. Core making machines, core compounds, sand mixing, sand blasting, and right on down the list, which includes everything which can be used in a foundry.

Machine shop equipment also held quite a prominent place in one section of the building, but what would interest

CANADIAN FOUNDRYMEN'S ASSOCIATION, BANQUET AT THE BELLEVUE-STRATFORD HOTEL, PHILADELPHIA, THURSDAY, OCT. 2.

CANADIAN FOUNDRYMAN BOOTH AT THE CONVENTION.

some spectators to perhaps the greatest extent, was the display of oxy-acetylene gas welding and cutting.

Some of the Exhibits

A partial list of the exhibits which would be of the most interest to the foundryman is as follows:

Ajax Metal Co., Philadelphia, electric furnaces.

The American Foundry Equipment Co., New York, sand mixing machines, sand blast equipment, core machines, charging trucks, Duplex shakers.

American Gum Products Co., New York, sand molds and Goulac core binder.

American Moulding Machine Co., Terra Haute, Ind., moulding machines.

American Woodworking Machinery Co., Rochester, N.Y., pattern shop machinery.

Arcade Mfg., Co., Freeport, Ill., moulding machines.

Armstrong Cork Insulation Co., Pittsburgh, Pa., insulating brick for furnaces and ovens.

The Audubon Wire Cloth Co., Inc., Audubon, N.Y., foundry riddles.

The Austin Co., Cleveland, Model foundry building.

Jonathan Bartley Crucible Co., Trenton, N.J., crucibles and other graphite products.

Berkshire Mfg. Co., Cleveland, Ohio, moulding machines and flasks.

Blystone Manufacturing Co., Cambridge Springs, Pa., sand mixers.

Booth-Hall Co., Chicago, electric melting furnaces.

Victor R. Browning Co., Cleveland, Ohio, electric hoists and cranes.

Buck Foundry Equipment Co., York, Pa., moulding machines and flasks.

Champion Foundry and Machine Co., Chicago, moulding machines and electric riddles.

Frank D. Chase, Inc., foundry designers and engineers.

Chesapeake Iron Works, Baltimore, Md., electric travelling cranes.

Chicago Crucible Co., graphite crucibles, etc.

Chicago Pneumatic Tool Co., Chicago, Ill., oil engines, pneumatic and electric hoists and tools.

Combined Supply and Equipment Co., Inc., Buffalo, N.Y., "angle stem" chaplets and "Dandy" skim gates.

Core Products Refining Co., New York, core binders.

Curtis Pneumatic Machinery Co., St. Louis, Mo., air compressors and cranes.

Davenport Machine and Foundry Co., Davenport, Iowa, moulding machines.

Davis-Bournonville Co., Jersey City, N.J., oxy-acetylene apparatus.

Dings Magnetic Separator Co., Milwaukee, Wis., magnetic separators for every description of foundry.

Joseph Dickson Crucible Co., Jersey City., N.J., foundry facings, crucibles and clay-graphite products.

The Electric Furnace Co., Alliance, Ohio, electric furnaces.

Electric Furnace Construction Co., Philadelphia, Pa., Greaves-Etchells System.

Emmet Mfg., Co., Wynesboro, Pa., pattern making machinery.

The Federal Foundry Supply Co., Cleveland, O., moulding machines and foundry supplies.

Foreign Crucible Corporation, Ltd., New York, imported graphite cricibles.

Foundry Equipment Co., Cleveland, Ohio, Coleman core and mould ovens.

General Electric Co., Schenectady, N.Y., electric arc welding and centrifugal air compressors.

Robert Gordon, Inc., Chicago, mechanical hot blast heater.

Great Western Manufacturing Co., Leavenworth, Kansas, gyratory riddles.

Grimes Moulding Machine Co., Detroit, Mich., jolt rammed roll-over machines.

Clement A. Hardy, Chicago, consulting foundry engineers.

F. A. Hardy & Co., safety goggles and other safety appliances.

Hauck Manufacturing Co., Brooklyn, N. Y., oil burning apparatus for skindrying, patching and general heating purposes.

The Hausfield Co., Harrison, Ohio, melting furnaces.

The Hayward Co., New York, clamshell and orange peel buckets for handling material in the foundry.

Herman Pneumatic Machine Co., Pittsburgh, Pa., plain jarring machines.

Howel Mfg. Corporation, Jersey City, N.J., sand blast machines.

Holcroft and Co., Detroit, Mich., metallurgical furnaces and foundry ovens.

Hyatt Roller Bearing Co. bearings for all classes of foundry equipment.

A VIEW DOWN ONE OF THE AISLES, PHILADELPHIA CONVENTION.

Industrial Electric Furnace, Chicago, electric furnaces and other foundry equipment.

Ingersoll-Rand Co., New York, pneumatic tools.

International Moulding Machine Co., Chicago, Ill., different styles of moulding machines.

Interstate Sand Co., Zanesville, Ohio, moulding sand, silica wash, etc.

The Jannison-Wright Co., Toledo, Ohio, kreolite wood block foundry floors.

Keller Pneumatic Tool Co., Chicago, pneumatic tools.

Spencer Kellogg and Sons, Inc., Buffalo, N.Y., core oils.

T. P. Kelley and Co., Inc., New York, foundry supplies.

Julius King Optical Co., New York, I-safe goggles, helmets and shields.

Klaxon Co., New York., calling instruments and signals.

C. E. Knoepel and Co., Inc., New York., foundry cost systems and production control.

H. M. Lane Co., Detroit, Mich., original devices for improving foundry practice.

Leeds & Northrop, Philadelphia, Pa., pyrometers for core ovens and molten metals.

Liberty Supply Co., Pittsburgh, foundry chaplets and supplies, core oils, etc.

The Lincoln Electric Co., Cleveland, Ohio, electric arc welding apparatus for foundry welding, foundry motors operating under water.

Lindsay Chaplet and Manufacturing Co., Philadelphia, Pa., foundry chaplets.

Link-Belt Co., Nicetown, Philadelphia, Pa., electric hoists, silent-chain drive and rapp revivifier.

Louden Machinery Co., Fairfield, Iowa, overhead carrying equipment.

J. S. McCormick Co., Pittsburgh, Pa., magnetic separator and sand mixing machines.

McLain's System, Inc., Milwaukee, Wis., semi-steel castings and small steel castings, made in McLain-Carter open hearth furnaces, also demonstrations of the McLean system of producing semi-steel.

The McLeod Co., Cincinnati, Ohio, sand blast and other foundry equipment.

Magnetic Manufacturing Co., Milwaukee, Wis., "High Duty" magnetic separators.

Mahr Mfg. Co., Minneapolis, Minn., foundry torches and various heating and drying appliances.

Malleable Iron Fittings Co., Branford, Conn., vibrators and vibrator accessories, etc.

Marden, Orth and Hastings Corp., New York, liquid and powdered core sand binders.

Maxon Premix Burner Co., Munsie, Ind., gas and oil burner, double chamber crucible brass furnace.

The Manefee Fdy. Co., Fort Wayne, Ind., Monco pattern compound.

Metallic Abrasive Mfrs. Assn., Pittsburgh, Pa., metallic abrasive for sand blasting.

Mifflin Chemical Corp., Philadelphia, Pa., core binders.

Mott Sand Blast Mfg., Co., Inc., Brooklyn, N.Y., sand blast and allied equipment.

Mumford Moulding Machine Co., Chicago, Ill., jolt ramming machine.

National Engineering Co., Chicago, Ill., the Simpson intensive sand mixer for mixing foundry sands.

W. H. Nichols Co., Brooklyn, N. Y., moulding machine with drawing device.

The S. Obermayer Co., Chicago, Ill., "Hott Patch" furnace cement, ladles, riddles, core ovens, sprue cutter, bellows, shovels, tumbling barrels, brass furnaces.

The Ohio Blower Co., Cleveland, Ohio, core ovens, ventilators, air separators, air trap, gas-oil burner.

George Oldham and Sons, Philadelphia, pneumatic tools for foundry use.

Oliver Machinery Co., Grand Rapids, Mich., complete modern pattern shop equipment.

Oxweld Acetylene Co., Newark, N.J., Welding and Cutting Outfits.

Panghorn Corporation, Hagerstown, Md., sand blast and allied equipment.

Safety First Shoe Co., Providence, R.I., moulders' safety shoes.

Wm. Sellers and Co., Inc., Philadelphia, centrifugal sand mixing machine.

Shephard Electric Crane and Hoist Co., Montour Falls, N.Y., cranes and hoists for foundry use.

The W. W. Sly Manufacturing Co., Cleveland, Ohio, sand blast, rumblers, rosin mill and dust arrester.

R P. Smith and Sons Co., Chicago, Ill., moulders' safety shoes.

The Werner G. Smith Co., Cleveland, Ohio, core oils.

The Spencer Turbine Co., Hartford, Conn., air compressors for cupolas and furnaces.

The Standard Sand and Machine Co., Cleveland, Ohio, core and facing sand mixing machines.

Sterling Wheelbarrow Co., West Allis, Wis., foundry wheelbarrows and flask pins.

A GOOD REPRODUCTION OF THE INDEPENDENCE HALL, BUILT WITH SENNET-SOLWAY CAKE. PICKANDS, BROWN & CO., CHICAGO, ILL.

J. W. Paxson and Co., Philadelphia, blast and allied equipment.

Charles E. Pettinos, New York. plumbago and sundry foundry supplies.

George F. Pettinos, foundry facings and supplies.

Pittsburgh Furnace Co., Milwaukee, Wis., electric steel furnaces.

The Portage Silica Co., Youngstown, Ohio, moulding sand, sand blast and core sand.

Henry E. Pridmore, Inc., electric and hand operated moulding machines.

Quigley Furnace Specialties Co., Inc., high temperature cement, fire sand, etc.

Republic Creosoting Co., Indianapolis, Ind., "Kreodone" wood block floors.

Richard-Wilcox Mfg. Co., Aurora, Ill., overhead carrying systems.

Robeson Process Co., New York, gluten core binder.

P. H. and F. M. Roots Co., Connersville, Ind., blowers and gas pumps.

W. F. Stodder, Syracuse, N.Y., sand blast equipment.

Struss and Buegeleisen, New York, safety goggles, etc.

Swan and Finch Co., New York, core oils, etc.

Tabor Manufacturing Co., Philadelphia, Pa., complete line of moulding machines.

Truscon Steel Co., Youngstown, Ohio, pressed steel foundry flasks.

United Compound Co., Buffalo, N.Y., vent wax and pattern wax.

The United States Graphite Co., Saginaw, Mich., Mexican plumbago products.

The U. S. Moulding Machine Co., Cleveland, Ohio, power moulding machines.

United States Silica Co., Chicago, flint shot for sand blast and flint silica for core and steel moulding.

Vibrating Machinery Co., Chicago, Ill., electric sand sifters.

H. L. Wadsworth, Cleveland, Ohio, sand cutting machines.

Wadsworth Core Machine & Equipment Co., Akron, Ohio, core making machines.

J. D. Wallace and Co., Chicago, Ill., pattern making machinery.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., electric arc welding, etc.

F. H. Wheeler Mfg. Co., Chicago, safety wearing apparel.

Whitehead Bros., Co., New York, foundry sand and supplies.

Whiting Foundry Equipment Co., Harvey, Ill., all kinds of foundry equipment.

T. A. Willson and Co., Reading, Pa., safety goggles.

T. B. Wood's Sons Co., Peerless tapered snap flasks and automatic adjustable jackets.

E. J. Woodison Co., Detroit, moulding machines and general line of foundry supplies.

Young Brothers Co., Detroit, insulated steel ovens.

The Technical Sessions

The technical programme of the sessions, which were held at the Bellevue-Stratford hotel, were most interesting. The main business began on Tuesday morning with a joint session of the Foundrymen's Association and the Interstate Metals Division. The institute members were chiefly interested in brass and other non-ferrous metals, while the association members were interested in steel, malleable, and grey iron.

The first number on the programme was the address of welcome by Thomas Devlin, of Thomas Devlin Mfg. Co., Philadelphia, "America's Premier Foundryman," as he is called by his friends, because he has been in the business sixty-five years. P. Pero, past president of the American Foundrymen's Association, responded to the address of welcome. The report of the secretary-treasurer and the report of the board of directors were then read, after which Mr. A. O. Backert, the president, delivered his opening address.

Papers Read

The papers which were read and the discussions which were provoked, brought out much valuable information to foundrymen. Many of the subjects dealt with were comparatively new and little known to the average foundryman, among which might be mentioned the welding of cast metals, and the ensuing discussions brought out the points that in order to weld a broken casting, either of cast iron, steel or malleable, it is necessary to bring the two parts to a melted state, and this being an impossibility beyond the part immediately adjoining the weld, an uneven strain is produced when the casting cools. The fact was also elicited that if a broken malleable casting is brought to a welding temperature it is at the same time brought back to its former state of white hardness, which would require re-annealing, and in re-annealing this part the balance of the casting will be over-annealed.

Another point brought to light is that if melted iron is not fluxed it will absorb oxygen and be unsound just the same in a weld as in pouring a new piece. Then again, there is the subject of "Which is the preferable method, oxyacetylene or electric arc welding?"

When the reader takes into consideration the number of points which have to be considered in discussing a single subject like the one just mentioned and the arguments used to combat them, and the methods and devices adopted and proved effective in overcoming the seemingly impossible obstacles, it will be easily understood how interesting and instructive the entire programme must have been. The different papers which were read and the discussions which followed will appear from time to time in future numbers of the CANADIAN FOUNDRYMAN.

Number in Attendance

The approximate number of those who registered as members of the association was three thousand, and those who bought single tickets would be above five thousand. All told, between eight and ten thousand were in attendance.

Other Attractions

Apart from the foregoing, the local committee had arranged a programme of amusements as well as pleasure and educational trips. On Tuesday afternoon about two thousand members and guests were entertained to a trip up and down the Delaware River, first visiting the famous Cramp's shipyard, where formerly most of the larger American boats were built. The next in order was the League Island navy yard, where many of the sightseers viewed for the first time real battleships and cruisers and submarine chasers. After passing this the steamer was tied up at the dock of the now-famous Hog Island shipyard, where the visitors were escorted through the yards and shown what was most interesting, among which was a trip through a freighter which was about ready for the sea, and were finally permitted to view the launching of the fifty-seventh boat built at this yard. It is a steel cargo carrier 400 feet long, with a capacity of 7,825 tons. She was named the "Afoundria" in honor of the American Foundrymen's Association. The first A standing for American, and the last for association. A description of the shipyard will no doubt be of interest.

STATEMENT OF THE AMERICAN INTERNATIONAL SHIPBUILDING CORPORATION, HOG ISLAND, SEPTEMBER 30, 1919

50 shipways.

7 outfitting piers, 100 ft. long and 100 ft. wide.

846 acres of barren land converted into a shipyard.

80 miles of railroad track in the yard.

36 warehouses.

4 fire stations, with 16 pieces of motor apparatus.

30,000 men employed in the entire yard at the present time, of which number approximately 5,500 are returned soldiers.

Contract signed, September 13, 1917.

Actual construction begun, September 20, 1917.

Yard 50 per cent. complete, February 12, 1918.

First keel laid, February 12, 1918.

56 ships have been launched. The "Afoundria" will be the 57th ship launched.

48 ships have been delivered to and accepted by the United States Shipping Board. These ships have steamed over 400,000 miles and have carried over 500,000 tons of cargo.

Hog Island contracted to build 145 oil-burning ships; 110 7,825-ton, 11½-knot cargo ships, propelled by 2,500-h.p. Curtiss type steam turbines, double-reduction gears, Babcock & Wilcox boilers; 35 8,000-ton 15-knot troop ships.

500,000 tons of steel will be required.

80,000,000 rivets will be driven.

27 steel mills rolled the plates and shapes.

70 fabricating shops fabricated the steel.

540 boilers will be used.

3,500 concerns have furnished supplies.

This plant was created to build ships to meet the losses due to the submarine menace, and if the work had continued on war-time basis, ships would have been turned out at the rate of fifteen per month. But when the armistice was signed work was cut to a peace-time basis of an 8-hour day, or 44-hour week. However, during May, June, July, August and September, 1919, ships were delivered at the rate of seven (7) per month, or one (1) ship every 28 working hours on this peace-time 44-hour week basis.

On Wednesday afternoon the visitors were shown through the plants of the Baldwin locomotive works and the Westinghouse Electric and Manufacturing Co. These plants will be described in the next issue of CANADIAN FOUNDRYMAN. Thursday afternoon was devoted to visiting places of interest in the city, and in the evening the banquet was held in the ballroom of the Bellevue-Stratford Hotel. Needless to say, it was a success; 425 guests doing full justice to the repast.

The Speakers

The speakers of the evening were A. O. Backert, president of the American Foundrymen's Association, who acted the part of toastmaster. Major R. A. Bull, past president of the association, who responded to "Our Hosts." Sir Ellis W. Hume-Williams, M.P., Knight of the Order of the British Empire; Dr. Marcel Knecht, Member of the French High Commission, representing the French Government; Hon. James M. Beck, former District Attorney-General of the United States, and a noted author and lecturer. The subject dealt with was mainly in the line of the promotion of good will and trade relations between the countries so recently fighting on the side of the Allies. To comment on the remarks of the speakers would be superfluous. Their points were well chosen and ably defended. On the whole the evening was most enjoyably spent by all who were fortunate enough to be in attendance.

To the Ball Room

After the banquet the banqueters and their friends were privileged to attend

C. S. KOCH, President A.F.A.

the dance which took place in the ballroom immediately adjoining the banquet hall. This item on the programme seemed to be appreciated by a goodly number as a fitting climax to a rather strenuous session of business. On the whole, the 1919 Foundrymen's Convention and Exhibition may be considered the biggest and best in the history of the organization both as regards number and variety of exhibits, number of attendants, and volume of information received from the sessions and from the demonstrations in the exhibition hall.

Election of Officers

At the meeting of the board of directors of the American Foundrymen's Association at the Bellevue-Stratford Hotel, Philadelphia, the following officers were elected for the ensuing year: President, C. S. Koch; vice-president, W. R. Bean; secretary-treasurer, C. B. Hoyt.

As president of the association for the ensuing year we predict for Mr. Koch a successful career. Mr. Koch comes to the convention representing the Fort Pitt Steel Casting Co., of McKeesport, Pa., and is a thorough steel man, both in his own business affairs and in his work for the Foundrymen's Association.

As vice-president, Mr. Bean will certainly make good. Mr. Bean comes from the Eastern Malleable Iron Works, Naugatuck, Conn., and is a hustler. As Mr. Backert, the retiring president, says of the vice-president of the American Foundrymen's Association, he differs from the vice-president of the United States, inasmuch as he requires to be a worker, and from what we saw of him at the convention and what we heard from him on the platform and in the discussions, we know he will hold his own.

As regards the secretary-treasurer, Mr. Hoyt has been tested and tried and re-elected, which is evidence that he was the right man in the right place. Even the lady stenographers proclaim him a dandy. Further evidence of his qualification for the position is not required.

AT THE CANADIAN FOUNDRYMEN'S BOOTH

Among the Canadians who called at the CANADIAN FOUNDRYMEN'S booth at the Philadelphia Convention and registered their names and made the booth their headquarters and resting place as well as place for meeting each other, are the following: George Hyde, of Hyde & Sons, Montreal; A. E. Cambridge, of Mussens Ltd., Montreal; J. F. Nellis, of Charles C. Kawin Co., Toronto; J. D. Wisman, Toronto, representing Bridge Co., Harvey, Ill.; A. E. Pipher, Port Hope Sanitary Mfg. Co., Port Hope, Ont.; J. H. Runchey, Hamilton Facing Mills, Hamilton, Ont.; E. Drolet, Iron and Steel Foundry, Quebec, P.Q.; C. D. Garner, Cleveland Pneumatic Tool Co., Toronto; Joseph Stewart, Sheldons Ltd., Galt, Ont.; M. Oliver, Sheldons Ltd., Galt, Ont.; G. C. McAvity, of T. McAvity & Sons Ltd., St. John, N.B.; H. P. Tait, of T. McAvity & Sons, Ltd., St. John, N.B.; C. J. Seely, of T. McAvity & Sons, Ltd., St. John, N.B.; L. Edwards, Canadian Driver-Harris Co., Walkerville, Ont.; D. B. Dauphinee, Acadia Gas Engine Ltd., Bridgewater, N.S.; Andrew Cairns, Pittsfield, Mass., late of Galt, Ont.; C. E. Rehder, Bowmanville Foundry Co., Bowmanville, Ont.; Roland Yates, Bowmanville Foundry Co., Bowmanville, Ont.; Thomas E. Day, of T. McAvity & Sons, Ltd., St. John, N.B.; George H. Hammond, supt. Taylor Forbes Co., Guelph, Ont.; A. J. Palmer, Empire Mfg. Co., London, Ont.; H. W. Maxwell, Maxwells Ltd., St. Marys, Ont.; J. B. Walton, McClary Mfg. Co., London, Ont.; T. B. Bennett, Maxwells Ltd., St. Marys, Ont.; J. E. Riffer, St. Catharines Brass Co., St. Catharines, Ont.; R. J. Hopper, Pratt and Letchworth Co., Brantford, Ont.; Wm. Maybank, E. J. Woodison Co., Toronto; Mrs. Wm. Maybank, Toronto; J. Donaldson, Miller Bros. & Sons, Ltd., Montreal, P.Q.; James W. Allan, Allan & McKelvie Engineering Co., Vancouver, B.C.; J. A. Paquette, Singer Mfg. Co., St. Johns, Que.; C. M. Chase, Toronto Hardware Mfg. Co., 420 Dufferin St., Toronto; John B. Pegg, Fort William, Ont.; Thomas W. Turner, Toronto, with Ingersoll-Rand Co., N.Y.; D. Languedoc, Steel Co. of Canada, Montreal, P.Q.; Herbert H. Walker, St. John, N.B.; A. E. Storie, Fittings Ltd., Oshawa, Ont.; W. E. Clark, Ontario Malleable Iron Co., Oshawa; R. M. Hamilton, Galt.; B. W. Neill, Canada Machinery Corporation Ltd., Galt; E. G. Yeates, Hamilton, Ont.; A. H. Coplan, Hull Iron & Steel Co., Hull, P.Q.; A. Bailot, Hull Iron & Steel Co,. Hull, P.Q.; J. W. McKinnon, McKinnons Limited, St. Catharines, Ont.; W. J Carmichael, McKinnons Limited, St. Catharines, Ont.; G. O. Johnson, Robert Mitchell Co., Ltd., Montreal, P.Q.; R. T. Bunting, Black Donald Graphite Co., Calabogie, Ont.; D. P. Muer, Toronto, Ont.; F. T. Kaelin, Montreal, P.Q.; James Garland, Shawinigan Falls, Que.; Alex. R. Waldren. Waterous Engine Works, Brantford, Ont.; Geo. H. Weaver, Dominion Foundry Supply Co.. Montreal, P.Q.; S. B. Chadsey, Massey-Harris Co., Brantford, Ont.; Norman Prowse, Massey-Harris Co., Brantford, Ont.; Daniel Bell, Dominion Coal Co., Ltd., Glace Bay, N.S.; Charles E. Plummer, Plummer Bros., Bolton, Ont.; Wm. Beatty. Beatty Bros., Ltd., Fergus, Ont.; Mrs. Wm. Beatty, Fergus, Ont

C. B. HOYT, Secretary-Treasurer.

W. R. BEAN, Vice-President.

VISITORS FROM FOREIGN LANDS

Among the many who registered at the CANADIAN FOUNDRYMEN'S booth, were the following foundrymen from far-off Japan and Java: T. Sakaguchi, of Shingu & Co., mechanical engineers, Otura, Japan; Takeshi Murayama, acting manager, The Tobatta Foundry Co., Tobatta, Japan; Takeshiro Matsuda, iron founders, etc., Tokio, Japan, with office at 4331 Larchwood Ave., Philadelphia; Tomosuhe Tahara, heavy iron and steel castings, Osaka, Japan; J. J. Braat, general managing director, Machinefabrick, Braat, Ltd., Sourabaya, Djocja, Tegal, Java, with offices at Medan, Sumatra, and Rotterdam, Holland.

These gentlemen are all fine fellows and thorough practical foundrymen, and incidentally readers of CANADIAN FOUNDRYMAN, Mr. Tahara, of Osaka, even going to the extent of signing for a second subscription so that he might present it to a friend in Japan.

SOME OF THE EXHIBITS AT THE CONVENTION

Among the many interesting devices for speeding up production and easing the labors of the workman, there was none of more real interest than that of the cope handling device, manufactured by the Foundry Appliance Co., of Newark, N.J. This device can be attached to any make of air squeezer of the piston type in about an hour, with no other tools but a monkey wrench. The mold is prepared in the ordinary way for squeezing by having both cope and drag filled with sand, and having a squeeze board on top and the bottom board underneath, and the squeezing is done by turning on the air and forcing the piston upwards. When the gauge shows the proper pressure the operator locks the cope against the head of the machine, with his left hand, and starts the virbrator. There is plenty of time to do both before the piston starts down. By holding the air-valve handle the operator can have the drag start slowly as necessary.

It draws the pattern out of the cope and drag as the piston goes down.

When the pattern is out of the cope, the ears on the frame or plate rest on the pattern drawing lugs and the drag goes down with the piston.

This leaves the pattern suspended between the cope and drag.

The pattern is slipped out and the mould is closed by lowering the cope with the device.

Absolutely no skill or strength is required of the operator.

The time required to squeeze the mould, draw the pattern and close is not over 30 seconds.

This device handles any cope that can be squeezed with an air squeezer, no matter how heavy the cope is nor how difficult it is to lift, the machine does it perfectly.

The head of the squeezer is fastened in the upright position, instead of pulling it forward and throwing it back.

This allows fastening the cope board to the head of the squeezer, the flask stops on the table insuring the board entering the flask properly.

The Grimes Moulding Machine Co., 1212 Hastings Street, Detroit, Mich., had a good display of hand rammed and jolt rammed Roll-over machines, and demonstrated the ease with which the operator could remove the mould from the machine after the machine had practically made the mould itself.

The Champion Foundry and Machine Company, 2419-2421 West 14th Street Chicago, Ill., showed their 16-inch "Type O" jolt Roll-over machine, which is the size which is most called for by most foundrymen. It is an exceptionally handy machine for both moulding and core making, and draws the pattern or core box perfectly.

The Tabor Manufacturing Co., of Philadelphia gave a fine display of moulding machines for practically every kind of moulding, from little snap jobs up to ponderous work which was formerly done in the pit. They also showed and demonstrated their line of metal working tools, such as cutting-off saws, milling cutters, etc.

The Davenport Machine & Foundry Co., Davenport, Iowa, had a good display of plain jolts, core jolts, jolt strippers, power squeezers, jolt squeezers and combination jolt rockover pattern drawing machines.

There is a vast difference between the man who has always enjoyed the comforts of a properly heated and ventilated office and the man who has shivered over a gas and smoke-producing contrivance such as is too often used for heating purposes in the foundry. From the standpoint of the foundryman who has spent his early days in the moulding shop and who wishes to be human with his men, there was probably nothing shown at the convention which offered more good value than the mechanical hot blast heater, manufactured by Robert Gordon, Incorporated, 622 West Monroe Street, Chicago. The inventors claim for it that during their years of experience in warming and ventilating buildings, they were confronted with the problem of designing a portable and compact heating apparatus that would give high efficiency and low operating cost. The portable fan actuated mechanical hot blast heater shown at the convention was the result of the mature experience and inventive genius of two engineers, who have been for years, and are at present, designing warming and ventilating plants for some of the finest factory buildings in the country. To describe it in anything like an intelligible manner would be quite a chore, but from our experience in improperly warmed foundries it looked to us like the proper idea of heating and ventilating a foundry.

The Oliver Machinery Co., Grand Rapids, Mich., had a fully equipped pattern shop, demonstrating how patterns can be made by machines which were formerly considered hand jobs.

The American Woodworking Machinery of Rochester, N.Y., had an exceptionally interesting line of pattern making machines. One in particular was a motor driven jointer of small dimensions, but abundantly large for a large percentage of the work done in the pattern shop.

To try to tell of the many foundry appliances and devices shown would be beyond the limit of space at our disposal, but our advertising columns will tell most of the story, which will be of interest to Canadian foundrymen.

Two of America's Most Revered Relics

William Penn's Mansion

THE sketch here reproduced is of what is familiarly known to the people of Philadelphia as Penn's Mansion and a short story of its history will no doubt be of interest to readers who enjoy antiquities. A few points touching on the history of William Penn himself should also be of interest.

It must be remembered that Wm. Penn, the founder of Philadelphia and the entire State of Pennsylvania, was an Englishman, and made his home in England. He was a Quaker in religious belief, but he was not born in a Quaker family. He was the son of a wealthy and distinguished naval commander and was among the most cultured men of his time, polished by study and travel, deeply read in law and philosophy. He had fortune, and many friends at court, including King Charles II himself. He needed but to conform, and great place was his. But conform he would not. True to the inner light, braving the scoffs of all his friends, expelled from Oxford University, beaten from his own father's door, imprisoned nine months in London Tower and six months in Newgate prison, this heroic spirit persistently went the Quaker way. In despair of securing in England freedom for distressed consciences, he turned his thoughts toward America, there to try his "holy experiment." His father had left him as part of his legacy, a claim against the Government of England amounting to sixteen thousand pounds. This he offered to exchange for the tract of land in America, which offer was accepted. This was in the year 1682. He accordingly sailed for America and established his Quaker colony, but returned to England in 1684, where he remained for fifteen years.

In 1699 he again visited America and

remained another two years, making four years in all that he resided in America. In 1701 he returned to England, where he remained until his death in 1718. His remains were buried in the plot connected with Jordan's Meeting House in Buckinghamshire.

PENN'S MANSION, AT ONE TIME THE ONLY BRICK HOUSE IN PHILADELPHIA.

Penn's Mansion

The little mansion, which is now preserved in Fairmount Park, is not what could be termed a palatial mansion, but being the only brick house in a settlement of log houses, it would be quite distinguished in its time. It is a two-storey structure of about sixteen by twenty-four feet. The downstairs consists of one fair-sized room in the front and two smaller ones in the rear, with a narrow hall between them, connecting the front room with the back door. One of these rear rooms probably contains the stairway leading to the upper storey, where articles formerly belonging to Penn are said to be kept. The doors, however, leading to these rooms are locked. A good-sized fire-place is built into one corner of the front room. This building was erected in 1682 and was occupied by Penn during the remainder of his first sojourn, which terminated in 1684. It was for two hundred years located in the heart of the city, but in 1883 it was moved several miles to its present location in Fairmount Park, where it is open to the public and where many facsimile documents of historic value are kept behind glass.

The Liberty Bell

There is probably no one object in the American Republic which is held in such high esteem and spoken of with such profound reverence as the Liberty Bell, yet to the stranger within the gate it has only the appearance of a bronze casting which had served its purpose and passed out of the field of usefulness, but knowing as all the civilized world knows, the feeling which the American citizens have for this silent emblem of what they hold dearest, it would be impossible to look upon it without feeling, to at least some extent, the same emotions which they feel.

Its History

To know the history of the Liberty Bell would undoubtedly place it in a different position in the minds of the average lay citizen of the United States as well as of other lands.

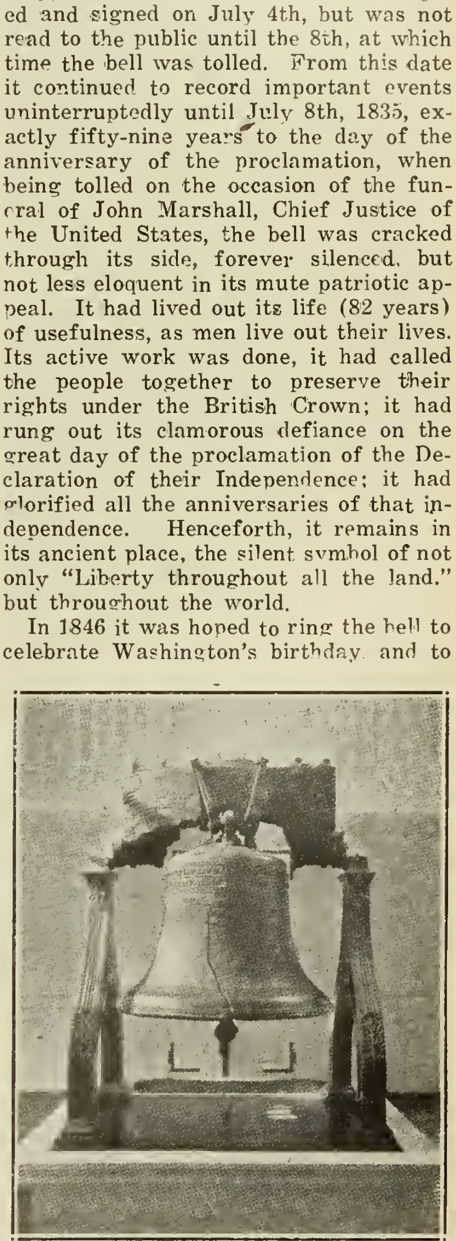
To the average mind the name of liberty has been attached to this bell on account of the duty which it performed on the Fourth of July, 1776, when it proclaimed to the colonists that the ties which bound them to the mother country had been broken. But far from it; this bell was known as the Liberty Bell for long years before the revolution. The word "Liberty" was the biggest word in the language to the first settlers on American soil. It was for religious liberty that the Pilgrim Fathers landed at Plymouth Rock and laid the foundation of the New England states, and it was for the same reason that Lord Baltimore and his followers settled in Maryland, and likewise, why Wm. Penn and his sect settled the state of Pennsylvania, and the word "liberty" forms part of the inscription which was cast in raised letters on the bell.

The Liberty Bell is much larger than generally supposed. Its measurements follow: Circumference around the lip, 12 ft.; circumference around the crown, 7 ft. 6 in.; lip to the crown, 3 ft.; height over the crown, 2 ft. 3 in.; thickness at lip, 3 ins.; thickness at crown, 1¼ ins.; weight, 2,080 lbs.; length of clapper, 3 ft. 2 ins.; cost, £60 14s. 5d. The wooden yoke which supports it is the original wooden one hewn from rough timber. The round trunnions, bound with iron are still intact, but are of course no longer required.

The Liberty Bell was cast by Thomas Lister, of Whitechapel, London, England, and on its outside surface was cast in raised letters the following verse taken from the Bible: "Proclaim liberty throughout all the land unto all the inhabitants thereof.—Lev. XXV. 10." It arrived in Philadelphia in August, 1752, but was never hung in the tower which had been prepared for it, for the reason that in testing it in the state house yard it was cracked. It was, however, used as a model and a new one was moulded and cast at the foundry of Pass & Stow, of Philadelphia, from the same metal which was in the English bell, but with the addition of a small percentage of American copper to soften it and reduce its brittleness.

The first attempt by this concern was unsuccessful, but undaunted, they tried again and succeeded in casting the bell which is still on exhibition in Independence Hall. This bell was used as a general purpose state bell, and one of its acts was to ring at the proclamation of the Declaration of Independence, not on the 4th of July, but on the 8th of July, 1776. The declaration was adopted and signed on July 4th, but was not read to the public until the 8th, at which time the bell was tolled. From this date it continued to record important events uninterruptedly until July 8th, 1835, exactly fifty-nine years to the day of the anniversary of the proclamation, when being tolled on the occasion of the funeral of John Marshall, Chief Justice of the United States, the bell was cracked through its side, forever silenced, but not less eloquent in its mute patriotic appeal. It had lived out its life (82 years) of usefulness, as men live out their lives. Its active work was done, it had called the people together to preserve their rights under the British Crown; it had rung out its clamorous defiance on the great day of the proclamation of the Declaration of their Independence; it had glorified all the anniversaries of that independence. Henceforth, it remains in its ancient place, the silent symbol of not only "Liberty throughout all the land," but throughout the world.

In 1846 it was hoped to ring the bell to celebrate Washington's birthday and to accomplish this the crack was drilled and filed to separate the parted sides in the hope that the sound would be clear, but the experiment proved unsuccessful, and the Liberty Bell must continue to hold its peace forever.



THE LIBERTY BELL.

The Moulding of a Flanged Overhead Pipe "T"

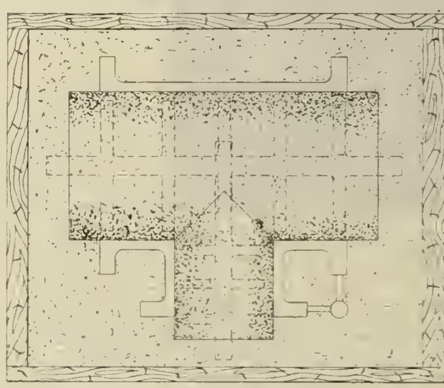
This Work Can Be Done in Three or Four Different Ways, But the Green Sand Mold With Green Sand Core is Exceptionally Interesting

IN moulding the pipe T, shown in the accompanying sketches, there are different things to be considered, chief among which are: How many are to be made? What equipment is at the moulder's disposal? and sundry questions of like nature. If only one is to be made a different course of procedure would be called for than what would be if a dozen were to be made, and still different if a greater number were to be made. At the works of the T. Lawson & Sons Company, Ottawa, there is probably as good an equipment for this class of work as will be found anywhere in Canada. For very large castings or where only an occasional one is asked for the usual way is to make it in loam, on which occasions the work is done under the personal supervision of Mr. Charles Lawson, sr. On other occasions it is the rule to skin-dry the mould and use a dry sand core, but the most interesting procedure, and the one which attracted our attention sufficiently to prompt the writing of this article, is that of moulding a flanged T, or three-way pipe connection 42 inches in diameter, with a 12-inch branch, and weighing 84 hundredweight, entirely in green sand, in which case one half was bedded in the floor, while the other half was rammed up in an iron cope; said cope when rammed up weighing five and one half tons. The pattern, which is well ribbed and strengthened, is built up of staves with the ribs loose and dowelled or bradded on. The branch pipe is secured by screws and is easily removed in case it is desired to change the size of branch, thus making the same pattern do for different combinations. The moulding of a piece such as this has no peculiarities worthy of special notice, being bedded in the floor, and a flat parting made. The cope is staked to the floor and after ramming, is lifted off by the crane and rolled over. All of this is the same as any moulder would do. What I wish to dwell upon most particularly is the green core.

Making Green-Sand Core

The core box is an ordinary half box as shown in illustration, with the ends all in for the bottom and a similar half with the ends left out for the top. An anchor iron similar to the one shown is made by attaching any sized branch which is required to the side of a straight core arbor. A staple in the back of the large one is provided, into which the shank of the smaller branch is inserted and secured by means of a key. This answers the double purpose of making an arbor which can be changed to fit different combinations and also that it may be disconnected for convenience in removing it from the casting.

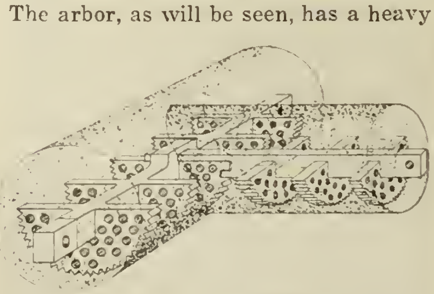
In beginning to make the core, a little sand is sprinkled into the bottom of the core box and the anchor or arbor, after being clay-washed, is placed in position and tucked just the same as the bars of a flask. If gaggers are found to be of any use they can be placed just the same as in gaggering any cope. The sand will now be shovelled in and rammed in layers as in ramming a cope.



MOLD BEDDED IN FLOOR

This may be vented as the ramming proceeds, and when this half is filled the other half of the core box is put in place on top of this and clamped. The sand is now shovelled in and rammed from the ends. No rods or arbors are required in this part; all that is required is to have it rammed to the bottom part so that no seam exists, and the iron will not be able to get under it to raise it. This half of the core will be vented lengthwise, and these lengthwise vent-holes will be connected by slanting ones with the bottom half. If the core is securely rammed and well vented there is no reason for losing it, and we have not heard of any being lost. The core, of course, requires to fit neat in the prints, and to insure this it should be floured and tried.

The arbor, as will be seen, has a heavy



CORE FOR SAME

section running the entire length and projecting beyond the ends. By attaching the slings of the crane onto these the core can be lifted out of the box and any defects made good, and if so desired, can be plumbagoed. It will now be ready to set in place the same as a dry core, and after closing on the cope for the last time, the ends beyond the core are rammed full of sand to prevent any possible chance of metal leaking out; provision, of course, being made for vent to escape by ramming in a stick which is afterwards withdrawn.

One point which a novice might overlook is that of holding down the core against the upward pressure of the metal. The ends of the arbor which project beyond the core may be secured to the hooks which are in the floor of the foundry, or they may be clamped and strapped down when clamping the mould. The part of the core which is above the arbor has nothing to raise it for the reason that the upward pressure is calculated from the number of square inches of bottom surface of core exposed to the melted metal, and in this case the largest part is attached to the arbor, and no bottom surface of the upper half is exposed to the metal.

As shown in the cut the gate strikes the two flanges, distributing the metal to good advantage. In other respects the mould is the same as any mould.

SAND—GREEN OR DRY

In the above article where we have shown that a heavy casting can be made with a green sand core just as well as with a dry core, is there any reason why it should not be just as good? The whole thing resolves itself into the conclusion which we have so often arrived at, viz.: accuracy. If molders were trained to be exact the same as machinists are and were given accurate appliances to work with, many things could be done which are not done. To use a green sand core it must be exactly the same size and shape as the print. If it is slack, it will shift unless secured perfectly by means of binders, and if it is flush it will crush. If a green core shifts the least particle it is almost sure to mean disaster, whereas with a dry core it is not necessarily fatal. The deductions which we must admit are that if a pattern is to be used to any extent it pays to have it made perfect so that a core, if made perfect, will fit perfectly, and green sand can be used in a great many places where dry sand is generally used. Green sand can be secured in most any shape for the outside of a mold, why not on the inside? Molding has always been done in too crude a manner with the result that tons of metal have been wasted. A chain is only as strong as its weakest link, and a pipe is only as strong as its thinnest spot. If the core is not exact, some parts of the casting will be thicker than the rest, and the metal which goes to make up the parts which are thicker than the thinnest spot is only wasted.

Stamped vs. Cast Wheels for Light Railway Cars

Pressed Steel is Lighter Than Cast Iron, but Not So Durable, but Both Have Their Advantages.

IN a recent number of *Canadian Machinery*, there appeared an article on the adaptation of automobile busses to railroad work. The matter of wheels is of greatest importance in the success of an application of this kind and as this may be new to some of those who wish to experiment with such cars, a little information on the subject will be given, though without going into technicalities.

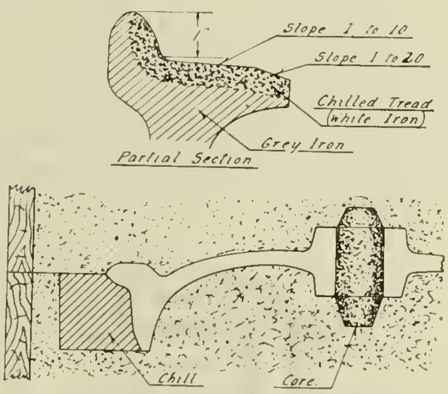
The pressed steel wheel is the lightest that can be secured as well as the most inexpensive in the first place. They are carried in stock in sizes up to 22 in., and may be had on order larger than that. These wheels are tamped and formed out of sheets of steel of 3/16 in. to 5/16 in. thickness, the tread, flange, and spokes being all one piece. Cast iron or steel hubs are riveted to the spokes. These wheels are extensively used on motor cars for workmen's use, their light weight makes them valuable where one man has to go to a distant point to do work and he must alone remove the car from the track while working.

In daily service on a heavier class of work these wheels have only one thing to commend them and that is their availability—as they are carried in stock in standard sizes and can be obtained on short notice (and at low cost). Where the weight on each wheel is as low as 500 lbs., the speed up to 30 miles per hour, and, say, a hundred miles running per day, the wheels will cut through at the base of the flange in three months; as a matter of fact, they are not intended for such severe usage, though they serve the purpose admirably if watched and renewed in time.

The vast majority of wheels in general use are of cast iron with chilled treads and such wheels naturally do unusually well on motor cars. The objection that rises to them is their over-strength and the excess of weight over what is needed for the work. Unlike the pressed steel wheel which is sold by the piece or pair, the chilled wheel is sold on a basis of cents per pound of weight—at this time around 4½ cents per lb.—and in such buying the customer pays for a great deal more weight than he needs. Some foundries have 30 in. patterns and chills but most of them make sizes 33 in. diameter or larger and these wheels weigh 500 lbs. or more and have capacities of eight to ten tons, under which loads they are supposed to give about 70,000 miles of service.

Thus the stock chilled wheel is somewhat expensive and its weight puts additional stresses on running gear parts at high rates of speed on curves. Foundries which cast street car wheels are in a position to supply lighter wheels for motor cars because the street car wheel is spoked which reduces the amount of metal in the "plate," as that part of the wheel between the hub and the rim is called. And the street car wheel is amply strong for any motor car usage. The one disadvantage of the stock street car wheel is its narrow tread, made purposely narrow so the wheel will not ride on the paving bricks laid next to the outside of the rail. Where the gauge of track is not carefully looked after, there may be sections such as on curves where the gauge is so wide that the narrow wheels will drop in between.

The objection to street car wheels noted in the last paragraph may be overcome by making new patterns and chills, but that is expensive unless a large number of wheels are required. As the additional width of tread is used and needed but little, an inexpensive method of getting this width with stock patterns



CROSS-SECTION CAST CAR-WHEEL

may be resorted to. A temporary piece is added to an existing pattern, building the tread out to the standard M.C.B., or any width desired. Then the castings are made as before except that there is a ring of unchilled metal at this one point and this soft ring answers the purpose of a safety—it gets so little service that the wear is negligible.

It is possible for any iron foundry to make car wheels of a sort. If a chill of correct proportions is made up and castings made against this, a certain amount of chill will be apparent on the face; however, it will not be the white iron of the car wheel foundry and the chill, instead of being ⅝ in. deep, will be only 1/16 in. to ⅛ in. deep. Such wheels will give a certain amount of service and have the advantage of being everywhere available. A few words in regard to the work may not be amiss.

The web (plate) or the spokes should not be straight, that is, they should not coincide with the plans of the wheel, but should be curved or reverse curved with liberal fillets at the hub and tread. The shrinkage makes necessary the precaution just named. The wheel pattern does not have to be exactly fitted on the outside, for the chill forms this part of the casting and with this machined out, the wheel should come smooth and true within 1/32 in. A pattern, of course, is required for the chill; it includes only the inner half of the flange; it should be three or four inches thick to provide mass enough of cool metal to cause chilling. Sometimes the foundryman uses water on the chill to assist. With one chill, one wheel a day may be cast.

Regular car wheel foundries use an entirely different mixture of irons from general foundries and this is responsible for the hard face obtained on their wheels. This latter is so hard that the castings have to be annealed for a week in special ovens called "soaking pits" before it is safe to use the wheels.

CHARCOAL IRON

Charcoal iron is just the same as any other iron, because, as we have often pointed out, all iron is the same. The main characteristic of charcoal iron is that it is low in silicon. Iron, as we have said, is always the same, but the different brands of iron are the result of different metaloids which are associated with the pure iron, making strong or brittle, white or gray. In melting iron, it absorbs carbon from the fuel. It also absorbs sulphur. The sulphur tends to set the carbon, which is to say, it causes more of the carbon to be in the combined state. Silicon on the contrary tends to counteract the effect of the sulphur and free the carbon, but both sulphur and silicon are weakeners, and iron high in these two foreign substances will not be strong. If an iron can be produced which is low in sulphur it can stand to be low in silicon also, and still be soft and at the same time stronger than ordinary iron. This is where charcoal iron excels. Charcoal has not the sulphur in it and the iron consequently does not absorb it, thus charcoal iron can contain about 1 per cent. of silicon and be soft. Charcoal is not easily procured these times, but if an imitation can be produced with the proper silicon and sulphur content, all well and good. Sulphur tends to increase shrinkage, while silicon tends to prevent. Iron low in both makes good car wheel iron because it chills hard on the rim without shrinking unduly, causing cracks or strains.

Following a shut-down of nearly a month, the Sydney plant of the Dominion Iron and Steel Co. has commenced operations on single shift, and it is anticipated that regular work will be resumed in the very near future. For some time prior to the closing down of these works the orders had been falling off, and economic operations of the plant was deemed impossible.

Britain's Experimental Foundry

Showing the Value of Up-to-Date Chemical Laboratories and a Knowledge of Requirements

I SHALL endeavor in this brief paper to give a short description of the foundry built during the war by the British Government at Brentford, and the reasons which prompted the British ministry of munitions in establishing it. Primarily the purpose was to enable researches to be made into all questions affecting the manufacture of malleable iron castings. In Great Britain the output of most firms is small and the result is that with one or two exceptions, practically no producer does sufficient business to enable it to conduct the manufacture of malleable iron castings on thorough and up-to-date scientific lines.

Before the war, makers of pig iron specialized in irons suitable for use in the manufacture of malleable iron castings, and each maker used a brand or trade mark by which his iron was known. The malleable iron founder made tests of the different brands and eventually bought those particular ones, which, in his opinion, best suited his methods.

Supplies Were Cut Off

After the outbreak of the war, many of our supplies of raw material were either cut off or sidetracked for different purposes with the result that although malleable iron founders still continued to buy the brands of iron which had given them satisfaction in the past, they found all sorts of new troubles cropping up for no apparent reason. Had all the founders been in possession of up-to-date chemical laboratories before the war, they would naturally have quickly discovered that the analysis of their material had completely changed and would have acted accordingly, but in view of lack of facilities for carrying out this work, it was felt by the ministry of munitions that the best thing to do was to equip a small foundry with trained technical staff, in order that the difficulties experienced should be submitted to impartial and independent investigation.

The plant erected contained an up-to-date cupola, a number of pot-holes, one or two different types of annealing furnaces, and a completely equipped physical and mechanical testing laboratory. This laboratory was put in charge of Mr. Mason, a skilled research chemist who had specialized in malleable iron problems, while the foundry itself was in charge of a malleable iron founder of considerable experience.

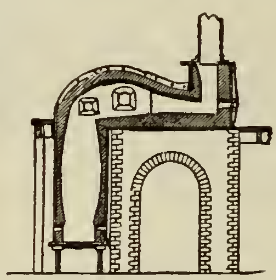
As the work developed, difficulties of all sorts experienced by manufacturers were put up to the Government's experimental foundry for solution, and after a thorough investigation a report was made which was at the disposal of any founder who wished to see it.

Results Were Valuable

In this way a great deal of valuable work was done, and in certain cases raw materials were successfully used which hitherto had been considered valueless for the manufacture of malleable iron castings. At a later date, a good deal of help was given to firms who were experiencing difficulty in the manufacture of so-called semi-steel shell, and John Shaw arranged demonstrations at the Brentford foundry so that contractors were able to send their technical men to see exactly how success was to be attained.

THE CUPOLA FURNACE

It is doubtful if very many foundrymen know why the furnace is called the cupola, or if they even know the meaning of the word cupola. Cupola is not a foundry word, it is just a name that has been absorbed by the foundry. Webster's definition of cupola is: "A spherical vault on the top of an edifice; a dome or the round top of a structure." The dome of St. Peter's Cathedral in Rome is illustrated as a fine sample of a cupola, and the resemblance or similarity of appearance between the foundry furance and the dome of a building gave the name a permanent place in the foundry. Now, pardners, whenever you get on a sanctimonious streak, just take a good look at the old cupola and imagine that you are in Rome looking at the cathedral. However, the cupola of today is different in appearance to what they used to be.



CUPOLA-FURNACE.

How the Cupola Used to Look

Here is a picture of the original cupola furnace, and here is how it was described in an old book:

"A furnace for melting iron in a foundry. The name is derived from a cupola or dome leading to the chimney, which is now frequently omitted. A cupola of ordinary size may be thus described: At the base is a pedestal of brickwork 20 to 30 inches high, upon which stands a cast iron cylinder from 30 to 40 inches in diameter, and 5 to 8 feet high; this is lined with fire-clay, brick, or other refractory matter, which contracts its internal diameter from 18 to 24 inches. The furnace is open at the top for the escape of the flame and gases, and for admission of the charge, consisting of pig-iron, waste or old metal, coke and lime in due proportion. The lime acts as a flux, and much assists the fusion; chalk or oyster-shells are used when conveniently accessible. At the back of the furnace are several tuyere-holes, one above another, through which the air is urged by a blower. As the fluid metal collects below, the air is admitted at a higher aperture, and the lower blast hole is stopped. The front of the furnace has a large opening at which clinkers, slag and unconsumed fuel are removed when cleaning the furnace. This aperture is closed by a guard plate, fixed on by staples attached to the iron case of the furnace.

In the centre of the guard plate is the tapping hole, which is closed during the melting by a ramming of sand. Dome furnaces are made rectangular or cylindrical, with separate plates like staves, bound by hooks, so that the furnace may be taken down if the charge should accidentally become solidified therein.

REMELTING CHILLED CASTINGS

A question which is frequently brought to light in the foundry is that of remelting chilled castings such as old car wheels or plow points, and it is truly laughable the views some people seem to take. I once worked in a foundry where the foreman would not allow water to be squirted under the cupola after dropping the bottom, because it would harden the iron which would be mixed with the cinders. I remember in that same shop a lot of small car wheels were being made for a mine or quarry of some kind, and they were chilled the same as a freight car wheel, although made from the same iron as was used for the other work. One of them spoiled, and the foreman was greatly incensed about it because, he said, it is not only the wages which are lost, but the metal also, because if we put that back into the cupola it will spoil the whole heat. I could hardly refrain from laughing, and I tried to explain to him that he took a wrong view, but I only annoyed him all the more, so I dropped the argument and I presume that he still thinks that he was right. Chilling a casting has no effect whatever in changing the chemical content of the metal, and if it was hard iron before being chilled it will be hard after remelting, but if it was soft iron before being chilled it will be soft after remelting.

Melted iron picks up carbon from the fuel up to a certain limit. This limit varies according to the silicon content of the iron. When the melted iron is poured into the mold, the longer it can be kept in a fluid state the more opportunity is given to the carbon to change from the combined to the graphite state, but if it is chilled at once, the carbon has no chance to change, and, as a consequence, the part which was chilled will be hard. Now, if this is remelted, it does not pick up any more carbon because it already has its full quota, and if poured into ordinary work it will proceed in the ordinary way to change from the combined to the graphitic state just the same as it would have done had it never been chilled. To carry the point a little further and get down to fine points, the recast from the chilled casting would be slightly softer than that from an unchilled piece. For instance, take a sample of the hardest part of a chilled car wheel and a sample from the hub, and the rim will show the highest in silicon for the reason that silicon continues to leave the iron as long as it is in a melted state. And the silicon in the rim did not have the chance to escape which that in the hub had. Now, as we have said, the silicon regulates the amount of total carbon, hence the melted rim will not absorb so much carbon as the melted hub. It should not require much study to see that my argument is right, but a busy foreman may be excused for not thinking about it. We all know that chilling a cold chisel makes it hard and that reheating it brings it back to its original state. Certainly there is room for much study in the foundry, yet foundry work receives about the minimum of thought.

PECULARITIES OF MELTED IRON

MELTED iron is always peculiar, but some of it is more peculiar than others. What I mean to say is that in handling melted iron it is sometimes necessary to take more precaution than at other times, but on the whole it is not as much of a trick to get good results as is sometimes imagined. I remember making some rings 3 feet in diameter and one eighth of an inch deep and 3 inches broad. This, it will be understood, was of the nature of a washer, not a hoop. We had round iron flasks which were as small as could be used, but with lots of space on the inside, so we gated them on the inside on opposite sides, and poured them double, and no matter how hard we poured them or how good the metal was there was always risk of cold shot on them, and quite frequently they were not properly run. The metal from the two ladles would not always knit together as it should, and strange as it may seem, I began pouring them singly, but leaving them gated double, and all my trouble was gone. It may be that the unused gate liberated the enclosed air, and it may be that the iron only had to knit at one place, and this place was right at the unused gate, and instead of coming to an abrupt meeting as it had to do on the sides when poured double, the two streams met and went up the risor together, leaving no mark or sign that there had been a meeting. I believe that both of these considerations had something to do with it, but, at any rate, it was successful pouring them single and not a success pouring them double.

Another queer experience which I once had was in making a small cylinder. The cylinder was only a very small one, weighing about 200 lbs., but I misjudged it and tried to pour it with a ladle holding 150 lbs. When I had poured in the 150 lbs. of iron I looked down the risor and could still see the core. I grabbed a hand ladle and ran to the spout and got about 30 lbs. of good hot iron and poured it down the gate, and noticed that the metal came up but not to the risor. I repeated this last move and succeeded in bringing the metal up the risor. Now anyone versed in foundry work would count that casting lost before looking at it, but not so, it was a perfect casting, without a speck the size of a pin point when bored out. The mould was gated on the parting, and the first ladle of iron filled the mould above the joint, and as a consequence, no dirt could get in when the ladle was emptied. When I brought the hot iron it cut right into what was there, not over it as would have been the case if I had poured it down the risor. By cutting through it, the whole mass was forced upward. The second ladle of iron worked the same way with the result as described. Had the casting been thin it would undoubtedly have been cold shot, but being chunky it never showed a scar.

DRY SAND VS. GREEN SAND

A GREAT many arguments are brought out on foundry practice, which if properly studied, would answer themselves. For instance, some founders try to avoid dry sand moulds and cores as much as possible and depend on green sand for some very complicated work, while others will use cores where there would appear to be no occasion, while still others will ask the question: "Which is the safest and best method?" A little investigating of the plant and equipment should tell the story. If a foundry is properly equipped with first-class core ovens and has business enough to keep them in operation, there is no possible doubt but that dry cores can be used to such advantage as to make them advisable in many places where it would be possible to do without them. For light castings or work requiring to be neat and smooth, green sand will make a nicer casting, but for heavy castings where quality is essential and where cost must be a consideration, cores can often be used. For instance, wherever there is a sharp angle or corner which might wash or cut, an oil core can be placed in the pattern before ramming up the mould, and the core makes a part of the mould and is cheaper and better than nailing the green sand. Even on flat surfaces, where the sand might scab from the iron running over it, a flat core will often save it and represent less outlay than trying to strengthen the sand with nails. Where iron flasks are used I have frequently found it advantageous to dry the cope and leave the nowel green on certain moulds. Where there is much hanging sand and the accompanying high places with pockets which are apt to blow as well as fall off, the drying will often eliminate the risk sufficient to more than pay for the expense of drying. Dry sand mixture for moulds does not count for much as regards trouble or expense. If the iron enters the mould in such a way as to flow up without passing over the bare sand, practically no binder is called for. A little molasses water, a day wash, is usually sufficient, but a little flour mixed through is generally resorted to if the casting is any way heavy. Such mixture should soak over night before being used.

LETTERS TO THE EDITOR

To the Editor.—In your September issue you say, "To find the weight of a ball, multiply the cube of its diameter by .5236, which gives its solid contents, after which, if it is to be of cast iron, multiply by .26."

Is the diameter in inches, feet or yards? And is the final result of this calculation in ounces, pounds or what? Of course, you know, and I know, but I imagine this sort of information is put in the magazine for those who don't know. I think a worked-out example would have been a very good thing. With apologies, H. D.

Answer.—No apology is needed, as the definition was rather vague, to be sure, although in foundry practice, calculations are usually made in pounds and inches. However, a better way of defining the problem would have been to find the weight of a ball, multiply the cube of its diameter in ches by .5236, which gives its solid contents or volume in inches, after which, if it is to be of cast iron, multiply by .26, which gives its weight in pounds. Thus, if the ball is 6 inches in diameter its volume or solid content would be $6 \times 6 \times 6 \times .5236 = 113.0976$, and if this is to be of cast iron it will be multiplied by .26, which makes 29.4034, or slightly less than 30 lbs. To make this more clear we will work this out in a multiplication sum:

```
         6
         6
        --
        36
         6
       ---
       216  cube of diam.
       216
     .5236
     -----
      1296
      648
     432
   1080
   --------
   113.0976 volume
       .26
   --------
    67854
   22618
   -------
  29.4034 wt. in lbs.
```

A San Francisco foundryman says that with the introduction of the motor tractor and the passing of the horse, loam-moulding must drop out of the game or undergo considerable change.

The Pattern Makers Section: Making a Core Box

To Properly Make a Core Box Requires as Much Care and Mechanical Ability as Making a Pattern

By JOSEPH HOMER

AS much detailed work is often involved in the making of a core box as in that of its pattern. Some boxes are very intricate, notably those for force pumps and motor cylinders. The patternmaker may hamper the core-maker if he neglects to provide for the withdrawal of parts, or makes or divides a box in such a way that the work of the core-maker or moulder is increased unnecessarily. Almost every principle and detail of practice which concerns patterns, relates to the core boxes also; but some differences and distinctions have to be borne in mind.

A pattern lies within the sand in which it is moulded, the frame of a core box is outside the sand rammed within it. Hence, to settle any initial difficulty, one remembers that timber in a pattern corresponds with the metal of the casting, and the sand in a box with core or space in the casting. The core takes out a recessed portion of a casting which could either not be produced at all, or not so readily by self-delivery from the pattern itself if made like its casting. The methods of delivery, of support to the sand, and of venting, are generally simi-

FIG. 1.

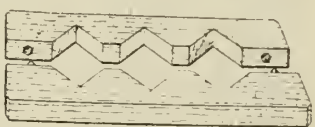


FIG. 3.

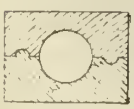


FIG. 2.

FIG. 4.

lar in cores and moulds. Prints usually, though not invariably, locate the positions of cores in moulds. In by far the largest number of instances a core is rammed in a box entirely distinct from the pattern, but this is not invariably the case. It is sometimes cheaper and may be more convenient to ram within a pattern, than from a separate box. It happens, too, that a pattern-maker will construct a pattern for self-delivery, and then the moulder will ram a dry-sand core in it, and set it in the mould by measurement. Much of this work comes on that border line where opinions are found to differ.

But the largest proportion of cored work is of such a character that there can be no two opinions as to the better method to adopt, and most of this is work that cannot be done by any really practicable method, and often not at all, unless the cores are made in boxes distinct from the patterns. It is in this sense that the term "core" is used and commonly understood in the foundry. A green-sand core rammed in its pattern is considered a portion of its mould—a "cod" of sand. In constructing boxes the principal objects to be regarded are:

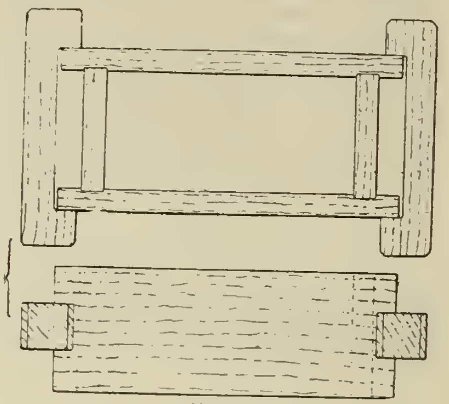


FIG. 5.

(1) To make them in such a manner that no distortion shall arise in consequence of the pressure of ramming; (2) To provide for taking them apart for removal of the cores without fracturing them and without unnecessary expenditure of time and trouble, and (3) facilitate rapid reassembling for the next ramming.

The most elementary forms of boxes are those shown in Figs. 1 to 4. Though common, a few words of explanation may be offered. Figs. 1 and 2 are the standard boxes for small round cores, the first being in iron, the second in hardwood. The place of round dowells is taken by the registered joints which run the whole length of the boxes. But the bores wear in time, and the cores become elliptical, or are larger near the ends than about the centre. Hence, in many foundries, core-making machines are used for the small standard cores, the sand being compressed in unjointed cylindrical boxes, and pushed out endwise.

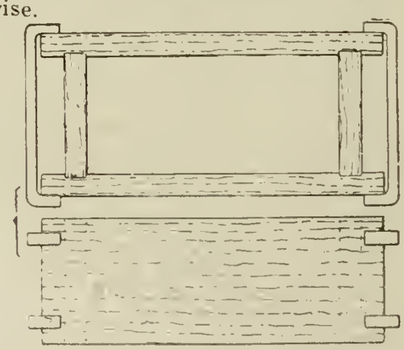


FIG. 6.

The standard square cores are made in boxes like Figs. 1 and 2 when of considerable length, and shorter lengths are cut off after the cores are dried. Shallow cores wanted in quantities are rammed in boxes like Fig. 3, oblong cores in Fig. 4. In each case it will be observed that the holes are cut diagonally in order to facilitate delivery. In boxes shaped like Figs. 1 and 2, but for square cores, the sides of the squares would lie at angles of 45 deg. with the joint faces.

The most usual method of framing the larger rectangular boxes together is shown in Fig. 5. The ends are fitted into the sides by means of shallow rebated grooves which range from ⅛ in. to ¼ in. deep. The sole reason for grooving is to prevent the ends from becoming displaced by the ramming of the core sand. The pressure of ramming is severe, and the mere screwing of abutting ends would not suffice to maintain them in position. Rapid separation of the parts is also necessary. They are held together during ramming either with nails, screws, or clamps. If nails are used they must only be put in at opposite diagonal corners, since the framing has to be taken apart before the core can be withdrawn, and this would be impossible if all four corners were nailed. Two diagonal corners may be made fast, but the nails in the others

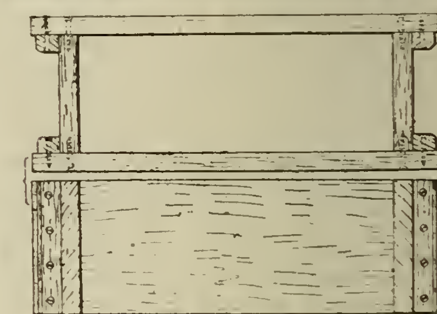


FIG. 7.

must project far enough to be withdrawn with pincers. Similarly, if the sides are held by screws, those at diagonal corners are taken out after the core has been rammed, and the two sides, with their adjacent fast ends, are drawn away in opposite directions. Very often, when boxes have a number of internal parts attached to the sides, it is necessary or desirable to detach both sides and both ends, in which case all the screws have to be withdrawn.

Since some time is occupied in running screws in and out as often as a core is made, and under heavy ramming, and when boxes are in frequent use, the screws will strip the wood and permit the sides to be thrust outwards, it is common to employ clamps by preference, which can be knocked off or put on in an instant. These are of wood, as in Fig. 5, or of iron, as in Fig. 6. Either one or two clamps will be used at each end, according as a box is shallow or deep. Iron clamps are kept in stock in considerable numbers in the foundry, and pairs are selected suitable for box widths.

They, however, damage the boxes more than wood clamps. Screw clamps are sometimes used.

Another way of fitting the corners of boxes is that shown in Fig. 7. It is used chiefly on those of large dimensions. The box ends are cut to the neat length, to abut against the sides. Cleats are nailed to the sides outside the ends

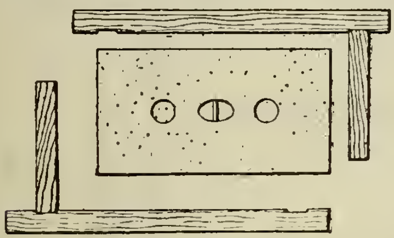


Fig. 8.

to prevent the latter from being rammed outwards.

The parting of boxes and the delivery of cores are as important as the similar treatment of patterns. In most cases the boxes are removed from the cores rather than the cores from the boxes, and generally boxes are withdrawn piecemeal. Many like patterns will contain separate loose pieces held temporarily by screws, or skewers, which are taken out as the ramming proceeds, or on its completion, and so permit of the withdrawal of the loose pieces one at a time. Taper must be imparted to these, precisely as to similar pattern parts, and the more awkwardly situated the locality, and the shape, the more taper must be given to the loose piece to favor delivery and to avoid mending-up. Prints are often carried in cores to receive subsidiary

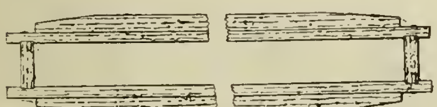


Fig. 9.

cores in their impressions. As in some patterns so in many boxes, local taper is not required, but the method of withdrawal ensures free delivery. Thus, in the rectangular boxes shown, taper is not required, because as soon as the screws of the clamps are taken away the box sides are moved in diagonal directions from the core, Fig. 8.

When ramming a core in a box, a condition exists which is the opposite to that present in the ramming of a pattern, the first being rammed on the inside, the second on the outside. Ramming does

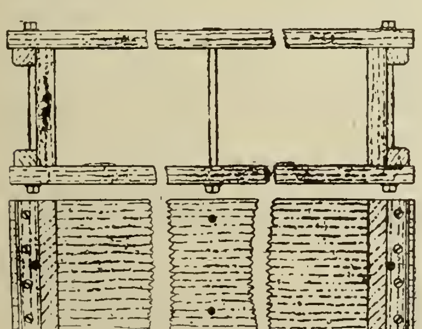


Fig. 10.

not affect the dimensions of a pattern, flimsy kinds excepted, but it will often alter the dimensions and shape of a box. Many patterns are rammed on inner faces, but since outer faces are also present, the moulder can generally counteract a tendency to bulge by ramming up equally and alternately on both inside and outside. In the case of a core box, bulging is prevented either by using stout material in the box sides, by securing the ends and corners sufficiently, or by reinforcing the sides.

Stout timber should be used generally for box sides. Very few boxes of any considerable dimensions should be made of stuff thinner than 1¼ in. to 1½ in., while some will be thicker. In boxes of lengths exceeding two to three feet the sides will curve outwards unless additional precautions are taken to prevent them. One way is to screw stiffening ribs outside the sides, Fig. 9; or, in very large boxes, bolts become necessary, Fig. 10. These are withdrawn previous to the removal of the box sides.

The actual working parts of a box

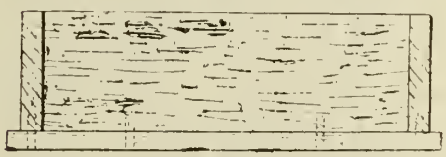


Fig. 11.

must be prepared as carefully to dimensions and shape as the pattern work. Standard boxes ought to have even the outside non-working faces varnished or painted like the interiors, in order to protect the grain from the effects of moisture or heat. Many boxes are put on bottom boards. These are used chiefly when portions of the interior of a box

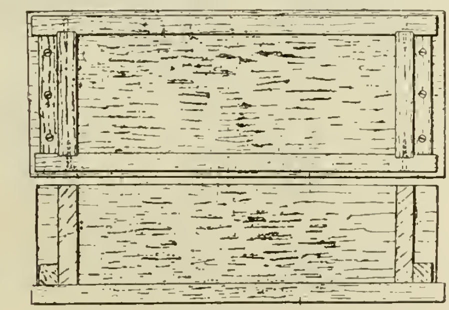


Fig. 12.

have to be set in certain exact positions relatively to the encircling framing, which could not otherwise be done properly. This, too, must be so secured by the sides that it and the pieces which it carries cannot by any chance assume any positions different from those in which they are first fixed. Two methods of secure setting are available, one by the use of dowels, Fig. 11, the other by the employment of cleats, Fig. 12. Either method permits instant detachment of the frame and bottom board, and return to the original position. The dowells are driven tightly into the bottom board, and fit freely in the framing. The cleats are nailed on the bottom-board or screwed, fitting close to the ends and sides as shown. In these examples illustrated, the cores have been plain. But, in many cases, boxes contain loose

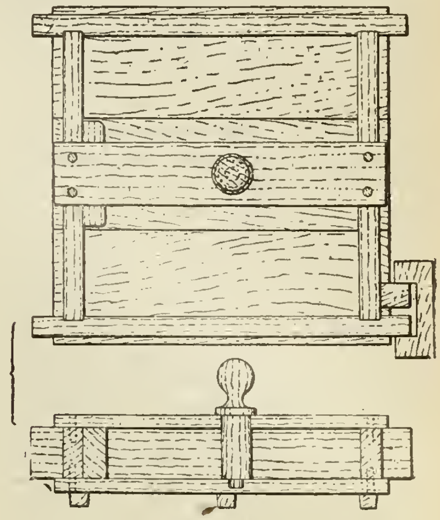


Fig. 13.

pieces. Often a box can be so constructed that loose pieces can be attached to its sides. But this cannot always be done. Some may have to go both in the bottom and in the top. As their exact location is imperative, extraneous means of attachment have to be employed. Bottom-boards are used in the bottom, bridge pieces in the top.

Fig. 13 is an example of bottom-board

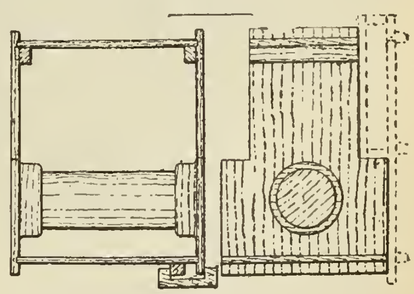


Fig. 14.

and bridge-piece in one box. The principal reason for the combination is the location of a round print to carry a core. But there may be more than one print carried, and also bosses, lugs, facings, etc. In the absence of such fittings the box would not require the bottom-board shown, since it might rest by its plane edges on the core bench. Wide bottom-

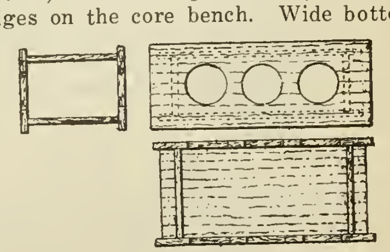


Fig 15

boards must be made with narrow strips, open joints, and battens to keep them true. A method of clamping is shown at the bottom right-hand corner, alternative to using screws or employing long clamps to embrace the box width.

Fig. 14 is another example of a rather

different class. Neither of the box edges are plane, yet the cost of a bottom board need not be incurred. A shouldered bed of sand can be strickled, and the box laid on that. Or a piece of wood of the same thickness as the shoulder can be laid under it. But if a considerable number of cores is required, a bottom-board should be made, as indicated by the dotted outlines. This box may be screwed at the corners, or short clamps fitted as shown at one corner, if numbers are required. This box carries two bosses, and a long core print between them for the body core of a condenser. Fig. 15 has a bottom and a top board each to receive holes that are rammed in one with the main core. These are located on the framing either with screws or dowells—the latter preferably—or with cleats, as in Figs. 11 and 12 respectively, either being suitable. In Fig. 16 the head of a warehouse crane-post is cored, not because the pattern would not deliver readily if made like its casting, but because a block print is necessary to afford support to the otherwise very flimsy bearings and brackets. The core box is shown in Fig. 17 to match the rectangular block print in Fig. 16. This print, A, boxed-up, is seen to be fitted over an extension of the turned pattern column, and on it and the column the shaft bearings and the supporting brackets are fitted as shown, making a sufficiently strong pattern structure, the details of which are shown clearly by the timber shading. The box in Fig. 17 corresponds in outline and dimensions with the print A. No bottom-board is required. The two thin facings seen are there to complete the thickness of the shaft bearings, and two large radii are for the brackets. The round print in the box is used to fit the core on the end of the column core, so centering the latter at that end without having recourse to chaplet nails.

The core box shown in Fig. 18 is for a turbine ring, the mould for which, with the exception of the plain top and bottom, is made entirely with these cores without any pattern work. There are three tiers of buckets of different depths, all made in the one box shown. The loose sliding curved pieces, which form segments of the circular dividing webs in the casting, are drawn endwise out of the box after the core has been rammed. The edges of these sweeps bound the actual casting. The spaces that lie beyond, fulfil the function of print impressions, but only in the fact that when the cores are laid round in a circle, abutting by their radial edges, they complete and fill the inner and outer annular spaces. They are merely set to circles struck on the bed without print impressions. When they abut by their radial edges, the cores give the correct thickness of the turbine blades. As large numbers of these rings were ordered, the interior working parts of the box were lined, as shown, with mahogany on pine backings, being fitted, glued, and screwed to them, and shaped afterwards.

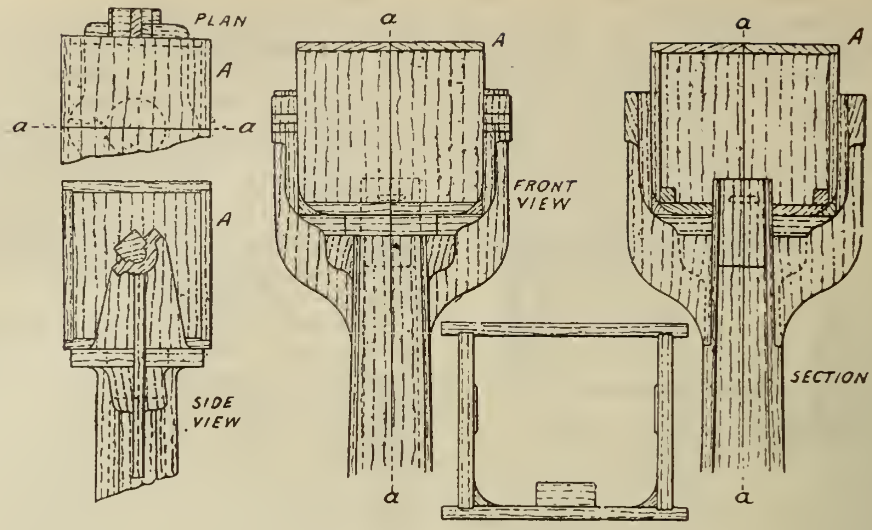


Fig. 16. Fig. 17.

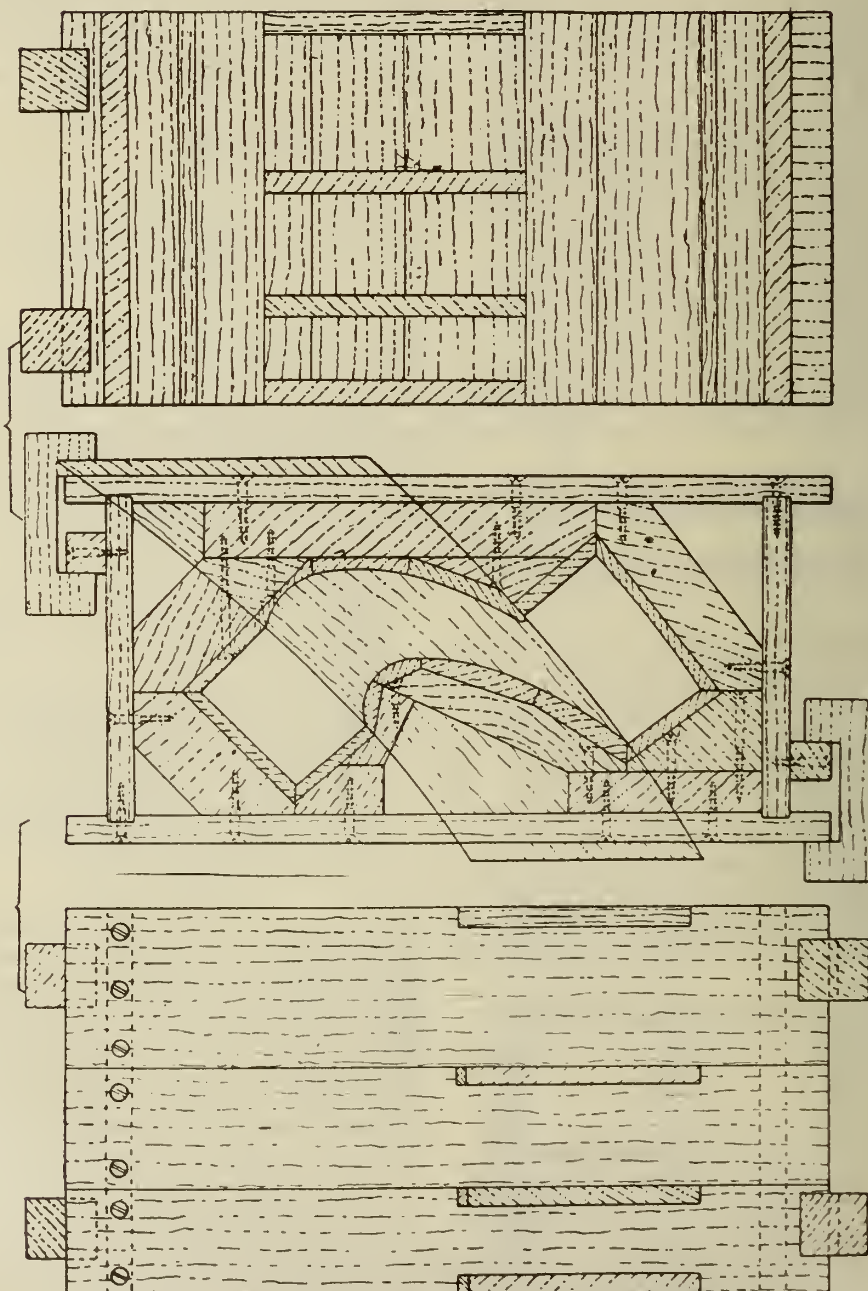


Fig. 18.

Considerations Affecting Brass Melting

If Brass Work is to be Done in an Iron Foundry, There Are Many Things to be Guarded Against, Not Found in a Brass Shop

By R. R. CLARKE, Seattle

MELTING stands high among the particulars of brass practice. Representative experience will scarcely dissent from the opinion that inferior castings more frequently result from incorrect mixing and melting than from all other causes combined. Molders make their own scrap; furnaces can make everybody's.

All reputable brass foundries appreciate the significance of melting and equip along the lines and policies dictated by experience. The iron shop making brass occasionally is not so favorably situated. Lack of time, knowledge or inclination sponsors neglect of the importance of melting and often forces the inevitable consequence in the castings. Discussing the question from the iron viewpoint, we can scarcely realize that exhaustion of detail so absolute to exclusive brass experience. We shall, however, aim to cover the general features, hoping that those interested may be able of themselves to fill in the more important particulars.

From a melting standpoint, nonferrous is by no means ferrous; neither is an alloy of either a combination of the other, nor is any alloy of any constituency identical with any alloy of any other composition or to any one metal element entering into the composition. Every metal element has its melting peculiarities in both single and combined state and these broad facts of difference are fundamentally requisite to results. With them iron men must strive to do as brass men do, recognize and reckon with these differences.

The subject may best be discussed under its separate heads. First let us consider metal selection and mixing practice. Common practice among iron men leans toward loose brass scrap of unknown composition and indefinite antecedents. This tendency is a bad one in that all the constituents in the different nonferrous alloys are not congenial to each other when thrown together in a conglomerated mass. Thus a quantity of loose scrap containing some yellow brass, some red, some Tobin bronze, manganese bronze, Muntz metal, some phosphor bronze and some aluminum bronze for instance—and in indiscriminate scrap it is easy to find all these types of alloy—would make a bad metal to handle besides yielding physical properties in the casting entirely unfit for any practical purpose in general. Experienced brass men can fairly well judge brass scrap by color, fracture, etc., though the best brass foundries go farther than that through analysis in their laboratories. To the average iron foundry these advantages are denied so the better policy is to purchase and use selected scrap approximating known composition. It would perhaps be better still to purchase scrap brass ingot under analysis; this comes but slightly higher than loose scrap. In so purchasing, it is well to patronize reputable sources, since not all the firms making scrap ingot turn out a high grade product. Scrap ingot usually may be divided between that containing zinc or that high in zinc and that including no zinc or low in zinc.

Zinc is highly determinative of certain alloy qualities. It controls color, density, toughness, malleability and cleanliness, but loses out in hardness and in antifrictional qualities. Thus we want zinc in golden color metals, in most pressure metals and in the softer, tougher metals. But we cannot have much of it in the harder metals or in the bearing metals. On tin and lead we must rely for these respective requisites.

If the iron foundries doing occasional brass work would keep two kinds of ingots on hand, the one inclusive and the other exclusive of zinc, and at the same time carry a limited stock of virgin copper, tin, lead and zinc they could approximate at reasonable cost a high grade alloy of most any desired constituency. They could do this by adding one or more new metals at the expense of others in the ingot as the case might require. Out of an ingot approximating copper 80, tin 10 and lead 10, which is an excellent bearing metal, they could by adding 90 pounds of copper and 10 pounds of zinc to 100 pounds of the ingot realize a high grade red brass applicable to the average purpose. This metal would approximate very closely the formula copper 85, tin 5, lead 5 and zinc 5, which is quite common and reputable in brass foundry work.

When loose and indiscriminate scrap must be resorted to, some effort at least should be made to pick it over and get the best for the more particular cases. The better grades of brass will usually be found in such castings as valve bodies, stems, disks, bonnets, glands, plugs or keys; and also in the better class of plumbing goods, in locomotive steam castings, and in most cases where the casting is known to have rendered some particular red brass service.

In making up alloys from new metals altogether, the order of adding the metals is important. The general and safe rule is to melt the copper to a fair liquid state, add the tin and lead and finally the zinc, stirring the bath well during the entire process of adding all metals. The zinc should be added in small rather than large pieces and thoroughly stirred into the bath. Though somewhat foreign to the subject, a passing glance at the more common metals used in brass alloys and their effects on each other might be worth while. These metals are copper, tin, lead and zinc. An idea of the function of each will appear in the following table:

		Color	Prevailing property	Oxidizing tendency	Fracture	Common Alloy	Uses
COPPER	÷ tin =	pale	hardness	strong	fine	cop. 80, tin 20 cop. 83⅓, tin 16⅔	Bells
	÷ lead =	grayish	plastic	strong	medium coarse	cop. 70, lead 30 cop. 50, lead 50	Bearings and steam packing
	+ zinc =	yellow	soft and tough	overcome by zinc	fine	cop. 70, zinc 30 cop 66⅔, zinc 33⅓	Tubing, sheeting, ornamental and rolling mill work
	+ tin + lead =	pale	medium hard and strong	strong	medium fine	cop. 80, tin 10, lead 10 cop. 78, tin 7, lead 15 cop. 80, tin 8, lead 12	Bearings
	+ tin + lead + zinc =	reddish	medium hard strong and tough	controlled by zinc	somewhat crystalline	cop. 85, tin 5, lead 5, zinc 5 cop. 86, tin 3½, lead 3½, zinc 7	Steam pressure metals
	+ tin + zinc =	reddish	hard, strong, tough	strong and proportionate to zinc	crystalline	cop. 88, tin 10, zinc 2 cop. 87, tin 8, zinc 5	Bushings, large valves, gear wheels
	+ phosphorus =	pale	hard brittle	completely dominated by phosphorus	fine	cop. 90, phosphorus 10 cop. 85, phosphorus 15	These alloys are never used except as concentrates to facilitate introducing phosphorus into the different alloys

Contamination is a great evil in a brass alloy and of these contaminating metals none is more detrimental than iron. The eternal vigilance of the brass foundry man is required to keep iron strictly out of his alloys. From this simple fact iron foundries can learn a valuable lesson in the use for brass purposes of furnaces, ladles, gates, stirring rods, etc.

The second consideration is the melting medium. For brass melting we have as a possibility the use of crucibles in a pit furnace with either natural or forced draft. The air and oil furnace, the gas-fired furnace, the electric furnace, and, in some cases, the cupola, also are employed. Pit melting with proper equipment is very efficient, but at the same time expensive, due to the crucible item. It takes more than a mere hole in the ground lined up with fire brick and connected with a stack to make a good pit furnace. Certain dimensions and relations must be observed as shown in Fig. 1, which is taken from a very satisfactory furnace used by the author for years. Good practice in pit melting consists in a substantial bottom bed of coke, in keeping the crucible in a centrally standing up position, in being careful to keep the coke from covering or falling into the melting or molten metal and in protecting at all times the surface of this metal from the oxidizing influence of the atmosphere and from the gases of combustion. One of the best known and efficient protectives against these is common charcoal pounded up into small pieces and placed in goodly quantity over the metal surface. Another common practice is to use pulverized glass which fuses and forms an almost seamless covering.

Pit melting expense can be greatly reduced by proper care of crucibles. In this connection the following will be found valuable:

1.—Crucibles should be kept in a warm, dry storage room.

2.—When not in use for any length of time they should be returned to this storage room.

3.—They should always be properly annealed before entering the furnaces.

4.—Proper annealing consists in a very slow raising of the temperature to at least 150 degrees Cent. The applied temperature should likewise be uniformly distributed.

5.—They should be given careful protection in poking the fire.

6.—Pigs or chunks of solid metal should never be placed in wedging form into crucibles.

7.—Heels of metal should not be permitted to freeze up in them.

8.—Tongs should be made and kept in such condition as to lift the crucible without squeezing it unduly or at any one point.

9.—Using the top edge of a crucible as a lever fulcrum by which to lower heavy pieces of metal or throwing chunks of metal into crucibles carelessly is destructive practice.

10.—Direct contact of flame on a crucible not annealed or on one in process of annealing is superlatively injurious.

11.—When melting by air and oil, an end to be striven for is to avoid striking the crucible with the air and oil jet or flame. Such practice scores the crucible away rapidly.

Pit melting by gas instead of coke is quite practicable, though dependent largely on facility and cost of fuel supply. Insofar as metal results are concerned there seems to be little, if any difference.

Air and oil melting is the decided tendency of the day. Properly executed it is an efficient and convenient method, comparatively inexpensive. There is much about it, however, to engage judgment and common sense. Primarily essential is proper and dependable auxiliary equipment. This lies at the very foundation of successful manipulation. Good air supply is represented by ample volume, but not too great pressure.

The proper flame, and consequently the correct proportions, of air to oil are best judged by color. A flame too white or clear or one tinged with green is oxidizing and decidedly detrimental. Personally, we prefer a soft flame, clear and all but smokeless yet not absolutely void of a remote yellow suggestiveness. The temptation to conserve oil is always strong, but it is well to remember that oil is cheaper than metal when the conserving desire becomes unwisely active.

Selection of the Furnace

The different makes of air and oil furnaces are many, and for the most part reputable. In stating a preference we base our opinion entirely on the results we have obtained from the object of our partiality. Nor do we presume to intimate that, given the same careful study and attention for the same time, other makes of furnace would not have yielded results equally satisfactory. We prefer the Schwartz furnace, because in our present position we inherited it, studied it and realized the very best results from it. With a Rockwell or a Monarch, for instance, we have little doubt but that we could have made a similar showing, as others have done with them. In every detail we have found the Schwartz eminently satisfactory and have melted all kinds of alloys, of scrap and different metal elements with a very low percentage of impaired metal. For a long time now we have melted exclusively in Schwartz furnaces and cannot see that any other types of furnaces or methods of melting could have given any better results. They must, however, be given careful attention in which the following points are chiefly important:

Furnace Operation

1.—Keep them scrupulously clean. Slag out and clean well after every heat.

2.—See that no sutures or bare spots are allowed to exist in the lining.

3.—Do not permit undue accumulation of slag on the molten metal.

4.—Watch the flame closely, seeking to realize a good reducing flame not too violent.

5.—Use a good grade of oil.

6.—Do not allow the air to be on while the oil is off.

7.—In melting large heats change the position of the furnace frequently by rocking it.

8.—Never expose the metal to the flame a moment after the proper metal temperature has been reached. Soaking

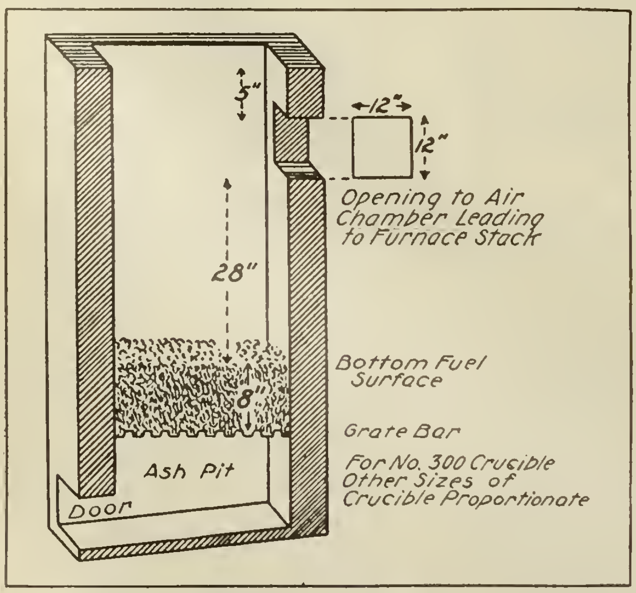


FIG. 1—A DESIGN FOR A SIMPLE CRUCIBLE-TYPE NON-FERROUS MELTING FURNACE.

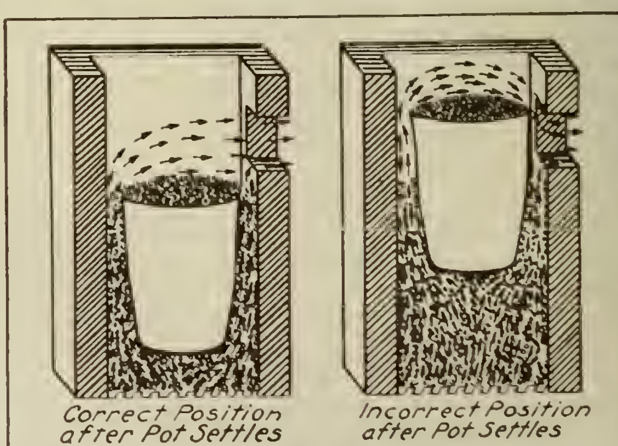


FIG. 2—EFFECT OF IMPROPER FIRING IN A CRUCIBLE MELTING FURNACE.

metal is one of the primary evils of melting.

9.—Melt and dispose of the metal as quickly as possible.

10.—Strive as far as practicable to keep charcoal on the metal surface, especially during the period from its first molten state up to its pouring temperature.

11—After the metal has been reduced to a fairly liquid state, open the furnace, skim off the accumulated slag and dross, throw on a good sized shovelful of coarse charcoal, and then restart for heating up to proper temperature. Other than this no interruption should occur in the melting process.

12.—When transferring metal from the furnace to the mold, ladles should be clean, well preheated and the metal surface always should be covered with a fresh layer of pounded charcoal.

The Electric Furnace

Involving the essentials and meeting the conditions of orthodox doctrine in brass melting, the electric furnace represents the ideal possibility. Though now beyond its experimental stage and making long strides toward a stable basis, so far as we have been able to learn, it has yet to attain its perfected practical state. When it does reach that point in dependability, in facility, in cost of upkeep and of melting, etc., all other methods, we believe, will become secondary considerations.

Cupola melting has never been favorably considered by brass men. It is nevertheless possible and in some cases practical. We have personally found it so in melting down foundry sweepings, screenings, etc., and we know high grade manganese bronze to have been made in the cupola. In making this metal the copper only was melted by cupola and the zinc stirred into the hot copper bath after the latter was drawn out into the ladle. It is scarcely necessary to add that only large heats were thus melted.

Metal Temperatures and Protection.

Next, we strike the question of metal temperatures and metal protection, the latter including the important question of fluxes and reagents. All these can be best considered jointly. The two great evils attending brass melting are oxidation and gas absorption. The former will be best understood from the statement of the fact that practically all known metals at certain temperatures combine rapidly with oxygen, producing either an oxidized metal or a complete metal oxide. To oxidize really means "to combine with oxygen" and is in many respects synonymous with the common expression "to burn."

The difference between "oxidized metal" and metal oxide we observe as that between a metal only partially oxidized and one completely oxidized. In the one case we have, as it were, a "scorched" metal, in the other a metal completely burned to dross or ashes. Oxidation is a consequence chiefly of contact with the atmosphere, which is a mechanical mixture of oxygen and nitrogen. Oxidation increases with temperature, with exposure and with time. To minimize oxidation in melting then means to get the metal no hotter than necessary, keep its surface well protected from the atmosphere and get it out of the furnace and poured on short order as soon as it is ready. Oxidation causes weak, drossy and spongy metal, wholly unfit for any general purpose. Many castings are lost and many others fail in service by it.

What Gas Absorption Is

Gas absorption consists in the taking up of gases by molten metal at high temperatures and releasing them in the process of solidification. The active and expelling stage of these gases is strong in the plastic state of the metal and results in a most distressing honey-combed and porous effect in the casting. Though given considerable study by both practical and technical men, the nature and origin of these gases have not been definitely determined or at least agreed upon. That they are allied more or less intimately with oxides and oxidation seems fairly certain since they arise from similar conditions and respond to like cures, in part at least. A fairly complete discussion of their nature, cause, prevention and remedy will be found on page 121 of the March, 1919, issue of "The Foundry" and those interested may find this discussion of value. It is only necessary here to remark that this condition is usually characterized by a swelling up of the gate head in cooling and follows such evils as poor grades and bad combinations of metals, dirty and slag-polluted furnaces, damp furnace and ladle linings, poor grades of fuel, soaking the metal, and extremely high pouring temperatures.

The rule is fairly general, though not infallible, that a correct pouring temperature will not seriously admit the evil even though the metal at that temperature represent a reduction from a higher one. Oxidation is the brass man's inevitable curse. He cannot escape the atmosphere nor the chemical reactions it induces. True, there is much he can prevent, but despite the greatest caution much will ever develop and remain to be cured. The cure lies in the fluxes, which are of two kinds, neutral and active, representing respectively those that do not become a corporate part of the metal nor alter its inherent properties and those that do. Of the neutrals, the most common are charcoal, plaster of paris, and common salt used principally as surface coverings. Personally we use nothing but charcoal and find that it proves amply sufficient.

Function of Charcoal

A word explaining its function is worth while. Charcoal is carbon and at its "kindling" temperature has a great affinity for oxygen. Oxides floating on the surface of the metal are combinations of oxygen and metal. The function and power of charcoal is to take up the oxygen of the oxide and leave the metal clean and clear. This it does admirably, besides forming a protective covering to exclude the atmosphere. Charcoal's greatest value is in the burning which represents the chemical reaction or oxidizing process. Obviously then the top of the metal in the ladle should be well covered during pouring, with charcoal in burning state. Once burned to ashes its function practically ceases. Our charcoal bill is always high, but our castings are for most part sound.

Active fluxes are sometimes referred to as reagents and deoxidizers. Always they are highly oxygenating substances. Most common among them are zinc, phosphorus, silicon, magnesium and manganese. But three of these will require comment here, they being the most widely used and covering general requirements. If we melt pure copper and pour it into molds, chances greatly favor its rising and flowing back through the pouring gate, resulting in a porous and oxidized condition in the casting. If to this pure copper we add 3 per cent. of zinc, or ½ of 1 per cent. of phosphorus, or a small amount of silicon the evils will at once be corrected. In the copper tin-lead alloys, zinc or phosphorus only are used, silicon being accorded no standing. Zinc is seldom used for deoxidizing purposes exclusively while phosphorus usually is. The reason is that in a great many alloys zinc is used for the quality it supplies and because its presence obviates the need of any further reagent. With phosphorus, this is not the case. It is used purely as a deoxidizer in those alloys from which zinc and its qualities are barred. Zinc quality is wanted in pressure-resisting metals, so it forms an equal part with tin and lead in the 85 copper alloy. It is not wanted in a bearing metal, so the 80-1010 copper, tin, lead alloy is fixed up with from 0.5 to 1 per cent. of phosphorus. The use of both zinc and phosphorus in the same alloy is considered bad practice, especially high percentages of either. Used purely as a deoxidizer from 2 to 5 per cent. of zinc and from 0.25 to 1 per cent. of phosphorus will suffice for the average purpose.

Zinc and Phosphorus Burn Out

With high temperatures and repeated remelting, both zinc and phosphorus burn out of the alloy. In melting all scrap it is therefore good practice to add small quantities, from 1 to 2 per cent. of zinc and 0.1 to 0.25 per cent. phosphorus, to reciprocate that lost and control the oxides. In the case of zinc this is invariably our practice. Phosphorus is added to the alloy in the form of a concentrate which itself is an alloy of either phosphorus and copper or phosphorus and tin and known respectively as phosphor-copper and phosphor-tin. The use of either presupposes wide-awake figuring. Phosphor-copper is usually copper 85 per cent. and phosphorus

15 per cent. To get 1 per cent. of phosphorus consequently means the use of 6 2-3 pounds of phosphor-copper; and to make a 100-pound mix reading copper 79, tin 10, lead 10, phosphorus 1 requires copper 73 1-3, tin 10, lead 10, phosphor-copper 6 2-3 pounds.

Relying on phosphorus as a cure-all for loose melting practice is bad policy and it should be resorted to at times and in quantity only as unavoidable conditions require. Silicon is used almost exclusively with pure copper to reduce its gases and oxides. In practice we have never reduced its quantity to a percentage basis relying instead on judgment as influenced by varying conditions of melting and prompted by the appearance of the molten copper mass. The use of manganese and magnesium is not widespread. Charcoal is not a logical flux for aluminum which does better under chloride of zinc.

The Question of Pouring Temperature

On the pouring temperature depends largely the cleanliness and solidity of brass castings. No wide margin lies between a proper temperature and one too low or too high. Generally it is better to pour hot than cold, though the consequences of either extreme are equally distressing. From cold metal come bad shrinking, drawing, drossy and spongy metal and improper metal unions between different casting sections. From metal too hot arises the porous and honeycombed effect caused by the dreaded gases.

To discuss pouring temperature at length is not within the province of this paper. In passing we pause to point out an important particular, namely that there is a heavy loss of temperature between the furnace and the mold with the mold the determinate point and that the more this loss can be reduced by well preheated and clean ladles, by rapid disposition of metal, etc., the better the results will be. It is a fundamental principle of good brass melting practice to get the metal no hotter than necessary and hold it no longer than absolutely required.

Summing up this paper we note the following:

1.—Good metal is essential to good castings.

2.—Unknown scrap indiscriminately used can never be trusted to produce a clean, solid casting.

3.—Percentages of new metal along with scrap greatly improve quality.

4.—Whatever the melting method, dependable equipment and right ways of doing things are indispensable requisites.

5.—Iron must be kept strictly out of brass.

6.—Brass can be melted by pit-crucible furnace, air and oil furnace, electric furnace and by cupola. Present day practice is largely air and oil.

7.—Cleanliness of furnaces, ladles, etc., makes for metal quality.

8.—Slag is distinctly detrimental.

9.—Rapid melting and quick disposition of metal favors results.

10.—A reducing flame is a melting flame with a minimum of oxidation and represents correct proportions of air and oil at proper pressure. Its color is white, remotely yellow.

11.—An oxidizing flame melts and oxidizes seriously. Its color is extremely pale intermingled with green and the flame is very thin.

12.—Good fuel is a melting asset.

13.—Holding (soaking) metal in the furnace following its readiness is among the worst of evils.

14.—Absorption of gases originates chiefly in high metal temperatures in the furnace and at pouring. Pouring temperature is therefore an important item.

15.—Oxidation derives mainly from atmospheric contact and increases with time, temperature and surface exposed. Its prevention lies in the protection given the metal surface and in the neutral fluxes. Its cure lies in the active fluxes or deoxidizers.

16.—Charcoal has an indispensable value in preventing and reducing surface oxides. It should be generously resorted to as a covering.

17.—Phosphorus, zinc and silicon are the more common deoxidizers. With pure copper any one can be used when not otherwise barred. Phosphorus and zinc are used chiefly for the alloys, the former occurring principally in those to which the latter is not included. In most any alloy not too high in zinc, copper 88, tin 10 and zinc 2, for instance, a mere trace of phosphorus makes for cleanliness and solidity of the casting.

18.—Lead and copper mix very imperfectly. Alloys containing more than 10 per cent. lead should therefore be stirred vigorously in pouring to insure a uniform mixture.

19.—To slag out furnaces use lime, fluorspar, soft coal, oyster shells or common charcoal.

20.—Alloys containing phosphorus sand-burn the casting severely if poured too hot.

21.—Prevention in melting is better than cure.

We are in receipt of the September number of "The Link," the house magazine of the Coventry Chain Co., Ltd., Spon End Works, Coventry, England. The book describes the company's line of power transmission machinery, including their "chain drive" system. It also describes their mode of handling the hired man question and the fraternal manner in which employer and employee work together. Interspersed with enough humorous material to keep the reader's attention, it is altogether an interesting volume.

We understand that in England the scrap dealers are handling "wire worms."

SALT FUMES

Editor, CANADIAN FOUNDRYMAN:

I wish to compliment you on the increasing interest in your shop columns. Many of the illustrated articles are well up to the highest standard, but what I am kicking about, and desire some more information on, is that salt cleanser for the brass crucible. I have tried it several times and find that its effect is good, but a fellow needs to be sound in stomach and lungs to stand the fumes; even after putting it safely in the bottom of the crucible it lasted through the melt, and as our shop is somewhat deficient in ventilation it nearly drove us out. Is the salt fume injurious or otherwise? Please answer in next issue.

Answer:—Salt fumes in themselves should not be particularly injurious to the health, but carrying fumes from the melted brass would make a difference. I would not like to pass an opinion on the matter from a health standpoint. The fumes would certainly be disagreeable, and if there is no way of carrying them out of the shop, it might not be possible to use salt, but I would certainly advocate putting in ventilators. Every brass furnace should have a hood over it to carry away the gasses, as all fumes from brass are bad. I also strongly advocate mechanical means of sucking the smoke and gas out of a foundry. A suction apparatus in the gable will carry away smoke far better than natural draft. I have seen brass foundries with ordinary roof ventilators, equipped with a small electric fan such as is used in restaurants, etc. This fan keeps the air in circulation and carries it away from over the furnace and gives the ventilator a chance to get it out through the roof. Of course, that salt is chiefly to keep the oxygen of the air from coming in contact with the melted metal, and powdered charcoal makes a good substitute. About two per cent. of zinc mixed into good bronze does not do it any harm, but has a beneficial effect in deoxidizing the copper. I always had a habit of using a small amount of borax and have never had reason to find fault with the idea. I will be particularly grateful to any brass founder who will pass an opinion on this salt purifier.

COMPANY REORGANIZED

The Booth-Hall Company, electrical furnace builders and engineers, 53 West Jackson Boulevard, Chicago, has been reorganized, and will, in future, be known as the Booth Electric Furnace Co. Their paid-up capitalization is $1,000,000, one half of which is preferred stock and the balance common. The new company has acquired all the patents, assets, and goodwill of the Booth-Hall Company, and have associated with them in the management of the company some of the best known engineering and operating experts in the public service. L. E. Myers, president; C. H. Booth, vice-president; W. K. Booth, secretary; L. J. Clark, treasurer. In addition, Martin J. Insull and E. W. Lloyd are on the board of directors.

Nichrome Castings for Heat Treatment

The Subject of Proper Material For Heat Treating Receptacles is a Vital One and Herein Are Described Points of Merit in the Properties of Nichrome For Such Use

By HARRISON JENKINS

IN heat treating processes such as annealing, carbonizing, hardening and tempering, there is a demand for containers or receptacles made of metals or alloys which will maintain their strength and durability at high temperatures. Such receptacles undergo repeated cooling and heating from 1,500° F. to 1,850° F. and in order to avoid costly maintenance due to additional expense for labor, fuel, material and constant replacement, the heat treating containers must not be subject to cracking, changing in form, forming a surface scale or warping. Where the walls of annealing boxes, carbonizing boxes, etc., increase in thickness due to growing, or form a hard surface scale, relatively more time is required for the completion of the heat-treating process. In this case it takes longer for the heat to penetrate into the work. Where the physical strength of the material is comparatively small, it is necessary to increase the dimensions and weight of the receptacle to such an extent as to make handling difficult and to require considerable labor. The walls of heat treating containers are preferably to be made thin as possible in order to facilitate the greatest heat penetration.

Strength of Materials at Low and High Temperatures

Although many metals and alloys have almost any required physical properties at ordinary temperatures, still all undergo a reduction in strength, change of form or scaling of the exposed surface at high temperatures.

There is a destructive reduction in the physical strength of cast iron, cast steel, structural steel, and wrought iron, and other ferrous materials when subjected to relatively high temperatures. Athough in one set of experiments, structural steel at 400° F. showed an increase of 32 per cent. of it normal strength of 70° F. and similarly wrought iron at 570° F. had a 16 per cent. greater strength than its normal strength at 70° F., nevertheless both of these materials had a tensile strength at 1,500° F. less than 18 per cent. of their normal strength at 70° F. At 1,100° F. cast iron had lost 42 per cent. of its normal strength at 70° F. and copper and bronze showed reduction in strength at as low a temperature as 200° F. The figures given would be, in general, subject to variation because of differences in the composition of materials of this class. Nevertheless, they are examples of the destructive effects mentioned above.

When cast iron is repeatedly heated to 1,700° F. it undergoes a change in size, which is generally known as "growth," always accompanied by an increase in weight, equivalent to approximately 7 or 8 per cent., which is due to the absorption of gases in the formation of oxide.

At high temperatures the oxidation of the heated metal causes a scale to be formed on the surface of cast steel and wrought iron containers, which usually reduces the size of the pot upon repeated heating, as in the case of annealing and case-hardening processes where the original scale cracks off, thereby exposing a fresh surface, which again scales.

FIG. 1—TUBES OF CAST NICHROME.

Properties of Nichrome

The injurious effects referred to are claimed to be avoided in many cases by the use of a nickel chromium alloy known as "Nichrome." This alloy made by the Driver-Harris Company, Harrison, N.J., is composed of about 60 per cent. nickel, and the remainder principally chromium. It is melted in an electric furnace, and is cast in various shapes and in any weight up to 5,000 lbs. Nichrome is already well-known since it has been used for some time in the manufacture of resistance coils and elements, for electrical heating apparatus and rheostats. The surface of nichrome boxes and containers does not oxidize at high temperatures, except in oxidizing atmospheres when a thin film of the oxide is formed, which is extremely strong and durable. This oxide film resists the action of alkalies and of such acids as sulphuric and hydrochloric. It is non-flaking and affords additional protection against corrosion or further oxidation.

Unlike iron or steel, nichrome is said to show no growth or appreciable change of form, as a result of alternate heating and cooling.

It will bend considerably before breaking, even when red or white hot. This quality may be demonstrated by heating to a red heat a plate of nichrome ¾ in. thick, and then striking it with a 20 lb. sledge upon the unsupported centre of the plate. The result is a very gradual bending.

The tensile strength of cast nichrome at 1,500° F. is approximately 24,500 lb. per sq. in., or about 30 per cent. greater than the tensile strength of cast iron at 70° F. When cold, nichrome has a tensile strength of about 50,000 to 55,000 lb. per sq. in. It softens at about 2,500° F., and melts at approximately 2,750° F.

For heat treatment, cast nichrome is adapted for annealing and carbonizing boxes, heating retorts of various kinds, cyanide hardening pots, lead tempering pots, etc.

Some of the most useful applications of this alloy will be mentioned to illustrate the possibilities of cast nichrome as a substitute for other materials, in order to avoid cracking, growing, scaling, warping, change of form, corrosion or reduction of strength.

Nichrome castings are used extensively for annealing and carbonizing boxes. (See Fig. 1). They are much more durable than boxes made of cast steel. Whereas a steel box must be made quite thick in order to withstand reduction of thickness caused by scaling or oxidation, nichrome containers can be made thin and correspondingly light. Thus, efficient heat conduction is insured, at the same time maintaining sufficient strength. The durability of ferrous boxes is limited to approximately two hundred and fifty hours' service at

1700° F., whereas cast nichrome boxes under the same conditions quite commonly give seventy-five hundred hours' service, and in some cases as many as eleven thousand hours' service has been obtained. While nichrome castings are more expensive than cast steel or cast iron containers, the difference in cost is more than offset by the superior qualities mentioned, and by the low operating cost per hour, which its use assures.

An important industrial application of cast nichrome is the dipping basket and holder used in immersing small heated iron or steel parts in a carbonizing cyanide bath at 1700° F. Similar baskets or utensils are used for pickling purposes and heat treating work. These nichrome baskets may be used for a considerable period of time without being appreciably affected by the cyanide, nor do they shrink or lose weight They are about one hundred times as durable as iron or steel wire baskets.

Rotary retorts (see Fig. 2) of cast nichrome for gas furnace applications are used in a great number of plants throughout the country with a life at temperatures of 1600° F. to 1800° F. of from eighteen months to two years, as against twenty days to four weeks with ferrous materials.

Tubes of cast nichrome are used in many processes, as in the manufacture of hydrogen and rare gases from the atmosphere, or the treatment of wire in the manufacture of lamps, and also in the ball bearing industry.

Miscellaneous Applications of Cast Nichrome

The fact that cast nichrome withstands high temperatures, has enabled this material to be used for many important industrial purposes, besides containers for heat treating processes.

Cast nichrome is being substituted for other materials for many parts of special glassmaking machinery, for equipment for melting, pouring, conveying and rolling molten glass. The nichrome molds withstand a high temperature and produce more highly polished glassware. As in other applications, the molds are strong while hot, and therefore can be made much lighter than cast iron molds.

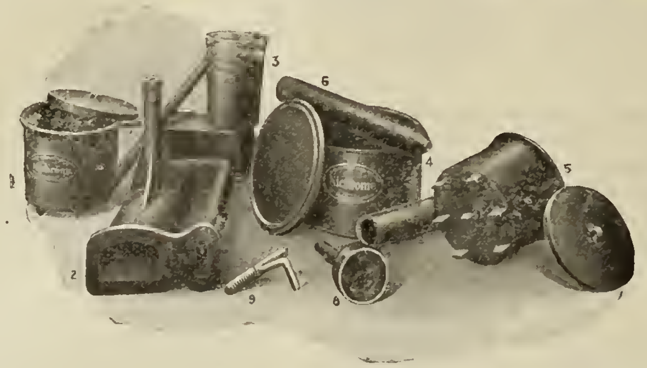


FIG. 2—ROTARY RETORTS.

MALLEABLE CAPACITY IDLE

In connection with the insistent demand for malleable castings the American Malleable Castings Association reports that this condition has been anticipated and that ample facilities have been provided for both the present and future expansion of the industry.

It is stated, however, that at the present time the shortage of unskilled labor will not permit this great capacity being used. Fully 200,000 tons of malleable capacity is to-day idle, but would be immediately available if the necessary labor could be secured.

Improvement in this direction is not looked forward to with any great hope until the activities of other industries are curtailed or until there is a flow of immigration sufficient to build up the supply of labor available for foundry work.

This means, therefore, a large percentage of capacity idle continuously in every plant regardless of heavy unfilled orders.

Fire at Ingersoll.—Damage was caused by fire to the roof of the moulding shop of the T. E. Bissell factory. The fire started near a small cupola, the roof of which, as well as the centre section of the moulding shop, was completely destroyed. There had been a heavy cast in the moulding shop in the morning, but the moulders had the afternoon off. The fire had evidently been smouldering for some time before it burst through the roof and was discovered. The loss will probably exceed $2,00, while the delay of several weeks which will necessarily follow will also be serious, as the firm has large orders which will keep the moulding shop running for several months. The building is owned by the John Morrow Company, and the loss is covered by insurance.

A Big Corporation.—With the incorporation of "International Bushings," with a capital of $25,000,000, and headquarters at Toronto, one of the biggest industrial movements of recent months is noted. While the company is not talking of its plans, it is surmised by those who are in a position to know that the company has been formed to take over the rights of the Pressed Metal Company, in respect to bushings. This will give the company control of the patent rights in England, France and Germany, and probably other countries. The directorate will be composed mostly of Toronto men, and most of the capital is being found in Toronto.

CATALOGUES

The Main Belting Company of Canada, with head offices at 10 St. Peter St., Montreal, has just issued a new "Book on Belting." This is not in the form of a catalogue, but is more for the purpose of advising and instructing the engineers and the users of belting, as to the proper method of using Leviathan and Anaconda belting under varying service. The pages are profusely illustrated with views of Main belting installations under every conceivable range of service. Many line drawings are used to illustrate the proper arrangement of pulleys and belts in conveyor systems, so that the maximum efficiency will be attained and the life of the belt extended. Many points, incidental to power transmission, are thoroughly treated in this volume, and by the use of rules, tables, and charts, the book is practically an engineers' text-book on every form of power transmission problem. The volume is made up of 144 pages of loose leaf formation, so that additions can be easily made from time to time. The book is one that should be in the possession of every engineer.

Iron and Steel, by Erik Oberg and Franklin D. Jones. The Industrial Press, New York.

Steel having almost any desired physical characteristics may now be obtained and great progress has been made in the making of iron and steel castings, but these products of the steel maker and metallurgist have not always been used to advantage by the designer and manufacturer. Expensive materials are often employed where cheaper grades would meet every requirement, or this order may be reversed and low-grade materials be used where the best would prove economical and necessary. Because of these facts, the relation between the different grades and qualities of iron and steel and the particular use for which each kind is adapted are emphasized in this book.

As the transformation of crude iron ore into various classes or grades of iron and steel requires the knowledge of the chemist, the experience and skill of the iron and steel maker, and a great variety of mechanical and electrical equipment for the various processes, it is manifestly impossible to cover the whole field. No attempt, therefore, has been made to compile a complete treatise for metallurgist and other specialists, but rather a text-book suitable for students in technical schools and those in the machine building and mechanical engineering fields who want a broad general survey of the iron and steel industry, with definite practical information pertaining to the various commercial forms and grades of iron and steel products, and the particular class of service for which the different grades are applicable.

The various refining and mechanical processes of the iron and steel industry have been described quite completely in some instances because of the close relationship between the manufacturing method and the characteristics of the product. The chapters dealing with iron ore and the making of pig iron are followed by others on wrought iron, structural steels, tool steels, alloy steels, cast iron, steel castings, and the methods of rolling and drawing bars, flat plates, shafting and wire. The treatment of these different subjects will be appreciated by designers of machinery or tools as well as manufacturers and workers in metal.

Making Steel in Canada

CONSIDERING operation, and some of the reactions that occur in the furnace, with various elements described. The third of a series of articles.

IN our last article we described the construction of a blast furnace and some of its accessories. Now let us briefly consider the operation and some of the changes or reactions that occur in the furnace.

The first step toward operation upon the completion of the furnace is to thoroughly dry out the brickwork. As previously described, all the joints between the firebrick are made with the thinnest possible layer of fire-clay, but there still remains a large amount of moisture to be driven off before the brickwork can be subjected to high temperature without cracking.

This drying out process of the furnace is accomplished by building small furnaces opposite the cinder notches for either wood or coal fires. Products of combustion pass up the furnace stack and out through one of the bleeders, which is left slightly open. The process is a lengthy one, anything from two to six weeks being occupied in properly drying out the brickwork; the temperature being gradually raised and gradually dropped.

When the cost of the lining is considered and the importance of a thorough drying out realized, it will be seen that this is a very important operation.

The stoves are dried out by kindling a wood or coke fire in the bottom of the combustion chamber. The temperatures in the stoves are only about one-third as high as the temperatures in the furnace, the same amount of time and care is not given to drying out the stove brickwork.

Starting up the furnace is known as "blowing-in." In the olden days blowing-in a furnace was usually attended with some ceremony, especially if the furnace was new and had been named after the owner's daughter or some such important personage. In these more matter-of-fact days blowing-in is simply a commercial operation, and instead of a ceremony, dinners and wine, careful check of the cost is kept.

Over the bottom of the hearth is spread a layer of fine coke dust. This serves as a bed upon which the first iron melted can fall, and prevents chilling. Cord wood placed on end is then charged into the hearth, and about one-half way up the bosh, some of the intervening spaces being filled with small kindling. Coke is then charged to a point two or three feet above the mantle and a little limestone mixed with it. The regular charging of the furnace now begins.

A charge is known as a "round," and consists of so much coke, ore and limestone. The ratio between the ore and the fuel is known as the "burden" of the furnace. In beginning operations the amount of fuel used in very much increased over the usual run of operations.

When the furnace is charged up to the stock line, the wood in the hearth is lighter through the tuyeres, and all openings and gas pipes to boilers and stoves closed tightly off. One or two of the bleeders at the top of the furnace are opened and the blowing engine started to operate at a very low speed. Smoke soon begins to appears out of the bleeders, and when it becomes sufficiently gassy it is lighted and allowed to burn. As operations continue the various gas mains are opened up, but great care is exercised to make sure that the gas drives out all air, otherwise an explosive mixture would result, which might cause serious damage.

In some plants steam connections are made and the gas lines filled with steam to drive out the air. A few hours after the furnace is lighted a light slag falls away, and after about ten hours a little iron will have accumulated in the hearth. This first iron is, of course, very often of a low grade, but indicates that the furnace is getting into its stride. Charging operations become more regular, and after about three days iron can be tapped at regular intervals of four hours, but it is usually a month before the furnace obtains it full capacity.

In starting up the stoves, it is usual at first to use some of the early gas to bring all four up to a temperature of four or five hundred degrees. Then one stove is put on a light blast and the other three on their regular gas schedule. As operations continue, stoves must be cleaned at regular intervals, especially when the furnace is working on soft ores, and a large amount of dust is carried in the gas.

There are many difficulties that occur in the operation of a furnace, such as scaffolding, sticking or adhering of the stock to the walls of the furnace just above the mantle. This obstruction causes the uprising gases to pass with greater velocity through any free area, and the scouring action of the gases cuts deep channels in the brickwork. Severe cases of this kind have to be treated by inserting an extra tuyere at the seat of the trouble to cause intense heat to bring away the obstruction, or at times a charge of dynamite is resorted to. At other times break-outs occur with serious results. Tuyeres and cooling plates may be melted, or due to an error in charging, the stock may become chilled. In fact, a blast furnace superintendent has ever to be on the watch for some outward and visible sign that indicates some inward trouble.

Now let us consider what happens inside a furnace. Four things go into the furnace; iron ore, coke, limestone and air, and four things come out; iron, slag, gas and a little steam. How do the changes take place?

Let us take all the various ingredients, pull them to pieces, and see what they are made of:

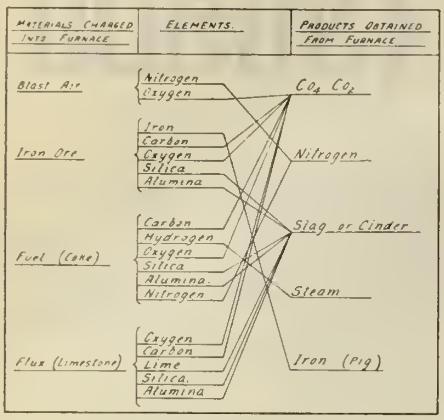


FIG. 1—A TABLE SHOWING THE COMBINED PRODUCTS.

Iron ore—iron, silica, carbon and oxygen.

Coke—Alumina, silica, carbon, nitrogen, hydrogen and oxygen.

Limestone.—Alumina, silica, lime, carbon and oxygen.

Air—Oxygen and nitrogen.

Iron—Iron, and many impurities in slight percentage.

Slag—Silica, alumina and lime.

Gas—Oxygen, carbon and nitrogen.

Steam—Oxygen and hydrogen.

Now look at Fig. 1 and see how they combine to form the products mentioned above.

Before going any further let us get acquainted with some of the gases mentioned.

First—Carbon Dioxide

When any substance rich in carbon burns in a plentiful supply of air, carbon dioxide is formed. The gas is colorless and has no smell; it is heavier than air, and is sometimes known as carbonic acid gas.

The chemical expression for this gas is $C+O_2=CO_2$, or one part of carbon and two parts of oxygen. This gas will not burn and will not support combustion.

Second—Carbon Monoxide

The blue flame often observed burning on the surface of a coal fire is carbon monoxide gas. It is produced by carbon dioxide passing through the upper layers of heated coal, thus absorbing more more carbon.

The chemical expression is CO, or one part of carbon and one pare of oxygen. This gas is colorless, tasteless and odorless, is about the same weight as air, but if inhaled is an active poson.

The presence of this gas hanging around a furnace top is a source of great danger, and men are often overcome by the fumes.

Third—Hydrogen

This gas is lighter than air, burns with a pale blue flame, but will not support combustion. It is colorless and odorless, and when mixed with air it forms a highly explosive mixture.

The chemical expression is H.

Fourth—Oxygen

Oxygen has no taste, color, or smell, ordinary combustible substances burn more brightly in oxygen than air. This gas in indispensable to life, and is the part of the atmosphere which is used up in the process of combustion, decay and fermentation.

The chemical expression is O.

Oxygen combines with many things and forms oxides.

Fifth—Nitrogen

Roughly, the atmosphere contains eighty parts of nitrogen and twenty parts of oxygen. Nitrogen will not burn and does not support combustion, and, as may be expected from a gas forming so large a part of the atmosphere, it is without smell, taste, or color.

The chemical expression is N.

Now what happens in the furnace, hot air is blown in the tuyeres and meets hot coke; the oxygen in the air combines with the carbon in the coke and forms CO_2. This gas comes in contact with other portions of red hot coke and changes to $CO_2 + C = 200$, or carbon monoxide.

There is also some vapor in the air; the oxygen combines the carbon of the coke and leaves free hydrogen.

The nitrogen in the air blast remains to all intents and purposes unchanged.

This mass of gases rises upward with great pressure, and at a temperature varying from 2,200° Fahr. at the tuyeres to 400° Fahr. at the furnace top.

Starting at the top, let us see how the limestone and ore are influenced by these gases. At about twenty feet down from the top the limestone begins to crack and give off CO_2 gas; forty-five feet down it begins to soften and melt, uniting with the silica in the ore and the ash of the coke, the whole uniting to form a slag that floats on the iron, protecting it and forming a collecting blanket for impurities.

The iron ore begins to give up its oxygen at a lower temperature and increases in action as the temperature increases; deprived of the oxygen, the ore becomes a pasty mass, which melts upon reaching the bosh and drops in large drops into the hearth.

The above is a very simple expression of the changes that occur, stated without going into the necessary chemical expressions essential if a full explanation is desired.

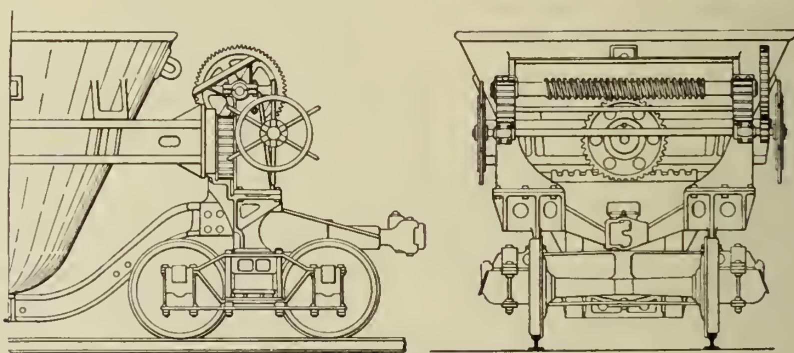


FIG. 3—A GENERAL VIEW OF CINDER CAR.

The gases that are given off from the furnace top are roughly as follows:

Gas	By Weight	By Volume
Nitrogen (N)	52.59	54.51
Carbon monoxide (CO)	33.80	34.97
Carbon dioxide (CO_2)	13.47	8.36
Hydrogen (H)	.14	2.16
	100	100

Part of the surplus or waste gases are used for heating the stoves as already mentioned. About 40 per cent. of the total gas generated is usually sufficient for this purpose, leaving 60 per cent. available for burning under boilers supplying steam for electric power and blowing engines.

Electric power, of course, is coming into greater use every day. Furnace bells that used to be raised either by steam, air, or hydraulic cylinders are, now being electrically operated. Skip hoists that only a few years ago were

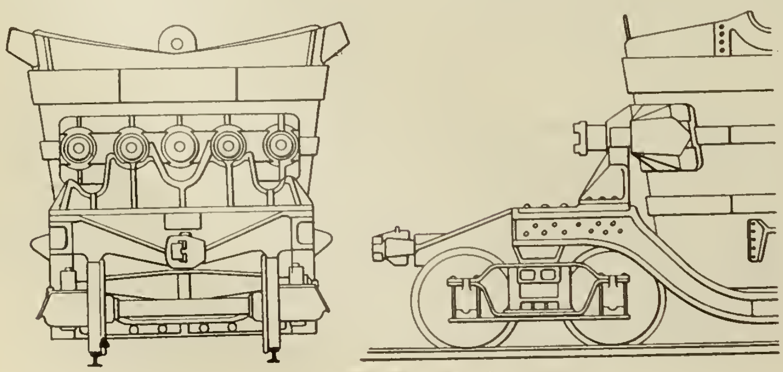


FIG. 2—THE HOT METAL CAR.

always driven by steam engines are now being operated by electric motors.

Blowing engines are for the most part of the reciprocating vertical type, but already the turbo blower is entering the field, and on account of the vast saving in floor space, is fast superseding the more picturesque but less efficient vertical engine.

If the blast furnace is connected with the steel plant the product is usually conveyed in hot metal cars (see Fig. 11) to the mixer in the open hearth department. If otherwise, the product is usually cast into pigs of a convenient size for handling. The casting of the pigs was at one time effected by making molds in the sand floor of the cast house. With the increased cost in labor, pig machines have come into use where the molds are attached to a moving chain. The chain passes underneath the pouring spout of a ladle, each mold is filled, passed down the chain into a tank of water, is cooled, comes out of the tank, and is discharged into a waiting car.

The disposal of the slag is quite a problem. When the plant is situated near a river or ocean shore the slag is poured into cars (see Fig. III) and dumped at the water's edge. If the plant is inland, great mountains are built up of the slag.

For a young country, Canada is fairly well supplied with blast furnace plants. The Dominion Iron and Steel Company, Limited, Sydney, N.S., have six furnaces, five having a capacity of 280 tons per day, and one having a capacity of 350 tons per day. The Nova Scotia Steel and Coal Company, Limited, Cydney, N.S., have two blast furnaces, one in operation and one under construction, each having a capacity of 250 tons per day. The Steel Company of Canada, Limited, Hamiltan, Ontario, have two blast furnaces, one of 200 tons capacity per day and the other 300 tons per day. The Algoma Steel Company, Limited, Sault Ste. Marie, Ont., have three blast furnaces, two of 250 and one of 450 tons per day. Atikokan Iron Company, Limited, Port Arthur, Ont., have one blast furnace of 175 tons capacity per day. The Canadian Furnace Company, Port Colborne, Ont., have one furnace of 300 tons capacity per day. There are several other furnaces in the country, but mostly of small capacity or not in operation at the present time.

The product that we now have is iron, free from its earthly impurities, strong but brittle, possessing great compressive tsrength, but very little tensile strength.

We will next consider its cause of weakness and the way it is refined and the results of that refining.

Some Hints on the Care of Pneumatic Tools

A Talk on the Various Conditions Under Which Pneumatic Tools Are Used, with Suggestions as How Best to Meet These Conditions

By A. W. SWAN

THERE are few modern machines of such importance, considering weight and size, as the pneumatic tool, more particularly in connection with shipbuilding. Considering the conditions under which the average pneumatic tool is operated, in all temperatures, exposed to unfavorable weather conditions in outdoor work, or in dusty surroundings in machine shop and foundry, it is not surprising that care of the tool is well repaid by increased work and longer life.

In the first place, whatever the tool, riveter, grinder, chipper, drill, etc., the air supplied must be as clean and dry as possible.

The cleanliness of the air can be assured by having the intake for the compressor suitably placed; the dryness depends also on the compressor. In two-stage air compression, a large percentage of the moisture contained in the air is removed by a moisture trap in the intercooler. For large installations, it is well worth while to supplement the intercooler moisture trap by an aftercooler, in which the air is again cooled after the final compression, and still moisture removed. The Hog Island Shipyard compressed air installation is the second largest in the world; all the air is compressed in large two-stage machines, and passed through aftercoolers.

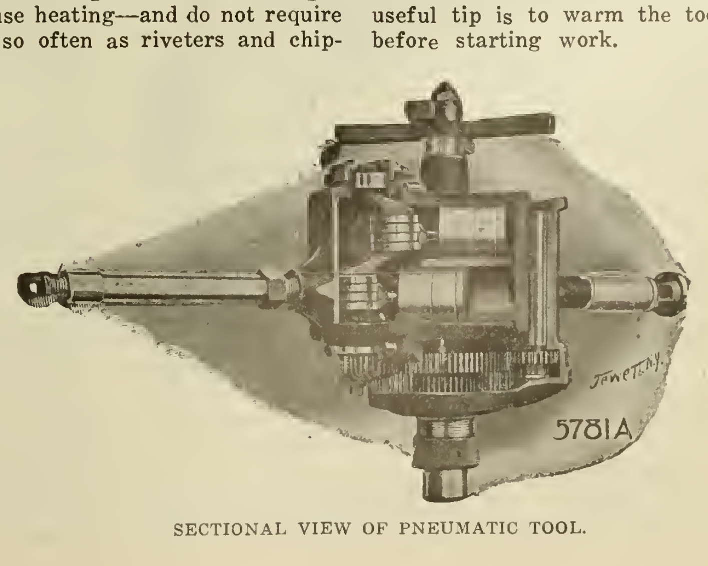
The main difficulty due to moist air comes in cold weather; air exhausting from pneumatic tools is very cold in any case, due to expansion, and the cooler the air the less moisture will it hold, the result being that in cold weather the exhaust of the tool rapidly becomes clogged with ice deposited from the air, unless means are taken to prevent this happening. Still another preventive is to have a reheater in which the air is heated just before reaching the tool; the air is then too warm to deposit the moisture in the form of ice, and the reheater has the further advantage of expanding the air, increasing the supply to the tool. It seems at first rather absurd to cool the air after leaving the compressor only to heat it before reaching the tool; the point is that the air would cool anyway, and it is better to catch the moisture in the aftercooler trap, than to have it deposited in the pipe line. Marble cutters who use the small carving pneumatic tools sometimes in the winter put a lubricator filled with alcohol on the discharge line and allow it to feed with the air and this prevents freezing, but the quantity has to be carefully gauged.

Good lubrication is the secret of good performance for pneumatic tools as for other machines. Riveters, chippers, and other reciprocating tools require a light bodied oil of high grade, and should be oiled three or four times a day. Drills, etc., should be packed with a grease that is not too light—if it is too light it will cause heating—and do not require attention so often as riveters and chippers. They should, however, be turned over frequently to allow the grease to reach all working parts. Grinders, close corner drills, etc., sometimes use 600 w. steam cylinder oil with excellent results on a mixture of grease and 600 oil.

Pneumatic tools of all kinds should be cleaned once a week. Riveters, etc., should be taken apart and cleaned in a bath of kerosene. For drills and grinders it is sufficient to pour in kerosene, run the machine light for a few minutes, drain out the kerosene, and fill with grease.

In case of trouble with valves, etc.. the less tinkering the better. The pneumatic tool is made up of parts of selected material, generally high grade steel, heat-treated and ground to close limits, and a very little filing will usually do a great deal of harm. For the same reason home-made substitutes for parts that need replacement are decidedly false economy.

In cold weather on outside work, a useful tip is to warm the tool slightly before starting work.



SECTIONAL VIEW OF PNEUMATIC TOOL.

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1887)

JOHN BAYNE MACLEAN - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President.
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449 Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: G. E. Pearson. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address, giving both old and new.

Vol. X. Toronto, October, 1919 No. 9

CONTENTS

The Philadelphia Convention

THE Annual Convention and Exhibition of the American Foundrymen's Association, in conjunction with the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, has once more become a thing of the past, but the treat which the members and visitors received will not soon be forgotten. As regards the attendance, it was a record. Between eight and ten thousand were in attendance. The exhibits also were superior in numbers as well as in quality and variety to any former exhibit. And all those who were fortunate enough to attend from Canada came home feeling that they had been greatly benefited. The exigencies of the war had brought out many new innovations in the noble art of molding as well as in methods of founding and foundry practice in general, and those who participated in the convention were privileged to witness many improved and novel devices never before exhibited. We certainly commend this form of education to all foundrymen, and would advise them, even this early, to prepare for the next convention. For those who were not in attendance we will do our best to keep them posted on what transpired, and the papers which were read and the lessons learned will appear in our columns from time to time in the future editions of CANADIAN FOUNDRYMAN. We have endeavored in this issue to give a fairly detailed account of what took place, but to tell it all would require the best part of a year.

Automatic Machinery

WHILE it may be a little premature at this early date to try to interest our readers in next year's convention, we do believe that it is not any too soon to begin a series of educational talks to employers. We believe that if foundrymen would look into the possibilities of labor-saving devices and would make some attempt to win over the molders from their position of obstinacy that things would run on more tranquil in the foundry, and that there would be less labor troubles through misunderstandings. We would suggest that at the next convention the employer will not only send one of his foremen or superintendents but select one of his refractory molders and let him see how machinery can be made to lessen the labor of the man and at the same time increase the output of this same man. We would not, however, advise waiting until next year to begin fitting out to compete with opposition from abroad, but we would advise getting the men on the side of improved methods rather than keeping them in the dark.

The molding machine will never do the molder any harm. On the contrary, it will be a blessing the same as all machines have been. Molding, as a trade, is about the most undesirable of trades; not that it is any worse than it always was, but because other trades have forged ahead, leaving the molders plodding away in their primitive method, which cannot much longer endure. Once the molder sees things as others do his opposition will cease and the foundry will be reckoned in a different class from what it now is.

What is in a Name?

"WHAT is in a name?" is an old adage, but it is full of meaning. This fact was brought to our attention in a most forcible manner a few days ago while attending the convention in Philadelphia.

While sitting in our booth in the most prominent part of the Commercial Museum building in which the Exhibition was being held, with the placard on our desk appealing to Canadians to come in and register their names and make themselves at home, and the sign overhead bearing the inscription: "The MacLean Publishing Co., Toronto, Ont.," we were accosted by a cheerful-countenanced foundryman who approached and held out his hand, saying that he had not called to register but to thank us for what we had done for him. Our own countenance began to beam as we prepared to learn the manner in which we had been able to be the Good Samaritan to some poor fellow in distress, but it soon turned to a deep crimson as we listened to him pouring out the information that before he had taken our course in cupola practice and the melting and mixing of iron and semi-steel he had only been a poorly-paid, overworked workman, and now he was—but we had to butt in on him and explain that he had struck the wrong booth and that it was David McLain, of Milwaukee, that he sought. We were, however, in a position to explain to him that David and his able staff were but a short distance away on the same aisle as ourselves and that the merits of the McLain System were being expounded and demonstrated to the satisfaction of a host of interested spectators.

But, boys, we are still proud of the MacLean Publishing Company, of Toronto, and while the McLain System of Milwaukee is doing a noble work in teaching foundrymen the systematic method of producing high-class castings, The MacLean Publishing Co., of Toronto, is also doing a noble work, and while the CANADIAN FOUNDRYMAN, which emerges monthly from its doors carrying its message to the foundrymen of Canada and elsewhere, is one of its humblest messengers, we have yet to learn of a dissatisfied subscriber or a dissatisfied patron of its advertising columns.

America and Royalty

OUTSIDE of the United States people are apt to think that the Americans are averse to royal personages, but such has not been our experience. While passing through the city of Buffalo a few days ago we found ourself just in time to witness the arrival of the royal train bearing King Albert of Belgium and his royal consort Queen Elizabeth, and the Crown Prince.

If the inhabitants of Buffalo were down on royalty they certainly did not show it, as practically every policeman in the city was on duty, along with soldiery by the thousands, and even members of the fire department were requisitioned to assist in protecting them as well as holding back the myriads of citizens who swarmed like flies to get a glimpse of the first reigning monarch who had ever visited Buffalo. There was not the remotest possibility of any harm befalling the royal visitors, but there certainly was not going to be any chances taken.

Likewise when we were down in Philadelphia to the Convention we could not refrain from following the lead of all true Americans; in fact, we lead them in some respects. We visited the old Independence Hall and reverently touched the Liberty Bell, the table which once belonged to Benjamin Franklin, the desk on which the Declaration of Independence was signed, and we sat on the sofa which once adorned George Washington's parlor. We gazed upon the tomb of Benjamin Franklin and attended divine service at Christ Church, where President Washington used to worship. This was not through curiosity but through respect and admiration for our good neighbors, the Americans.

Penn's Coat of Arms

WHILE attending service at Christ Church, Philadelphia, we were amazed to see the British coat of arms holding a prominent place on one of the pillars of the edifice. Perhaps we were rude but we inquired of one of the congregation if this emblem had been in this position since colonial days, when we learned that it had originally belonged to Wm. Penn, and had formerly held a prominent place, but that during a certain period in American history it had held a very quiet and retired position in a dark closet, and that about the time of the Cuban War it had been resurrected and placed in its present position, where it will undoubtedly remain.

The Coal Business

THERE appears to be too much man-made machinery between the chap who wants to buy a load of coal and the company that owns it when it comes from the mine.

There are coal dealers in the city of Toronto who cannot buy coal from the mines. Were they to approach the company that takes the coal from the mines and ask to be allowed to purchase one or a hundred cars, the answer would be, "Get out of here!" Perhaps not in those words, but the meaning would be the same, and the net result of his purchasing expedition would be likewise.

These dealers are of the opinion that there is so much juggling between the mines and the coal bins of the nation that the last buyer is paying more than necessary.

It is strange beyond explanation that just at a certain time each year there should be a shortage of coal. The well-to-do will tell you to buy in the spring.

Very well, but there are thousands of homes where they cannot afford to buy in the spring. There are thousands of homes where they have to buy coal a ton at a time. There are thousands of little buyers who have no association or organization to protect their interests. Not much. They can shiver or sweat as their luck comes or goes.

The coal business, from pit to furnace, has been raked over and pawed over times without number, and each raking and pawing has seen the ultimate buyer going down a little deeper into his pocket, and has seen the little buyer standing in line a little longer.

The Joys of Autumn

The autumn is a wondrous time, its glories poets sing; they say it's fifty times as good as winter or as spring. By heck, they rave about the skies, about the tinted trees, and write six miles of silly stuff about the autumn breeze.

They speak about the falling leaves, their many tinted hues, about the colors in the clouds—the greys, the greens, the blues. They write a yard about each gust that sweeps across the map, and throw a fit 'bout flowers and frogs that take a winter's nap.

Of course, the poets sell their stuff, they get the ready cash to buy a suit of underwear, some turnips and some hash. But why should we believe their lines, or weep big tearful sobs, because the poet's got to write or be bounced from his job? Ah, let us have the naked truth, begone poetic fire—we yearn for facts in every case—skidoo poetic lyre!

We got 'bout seven tons of coal—we owe most ninety bones, which causes us to loosen up a cloud of sighs and groans. We view that pile of diamonds black, we count 'em peck by peck—they'll warm our systems when the snow is campin' on your neck.

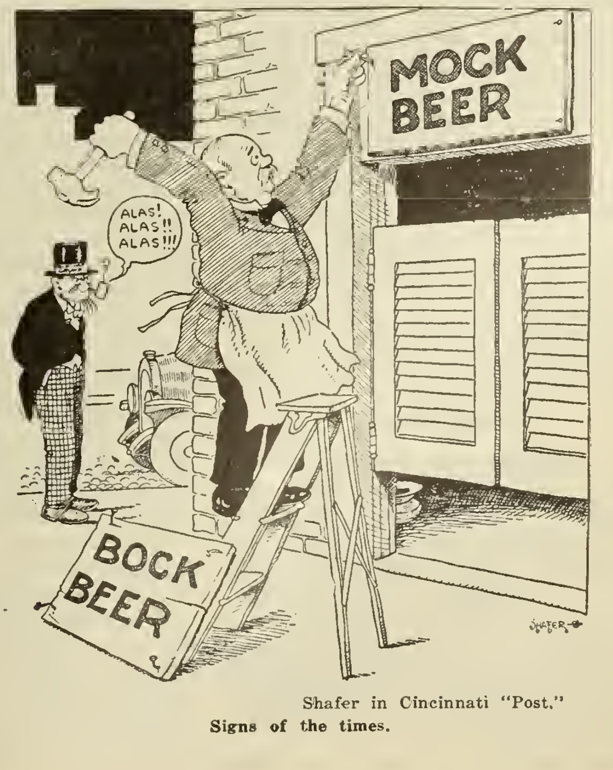
The furnace is—you bet she is—a peach for burning coal—she has an appetite immense—she is an ardent soul. We fondly rattle at the works, we whack the pipes for soot, and swear she's ready for the blast, our jolly old galoot. It is with air of calm repose we view the autumn's march, our spirits rise within our smocks as stiff as Monday's starch.

But woe is mine, we shake again, and then in grief we shout: "Ding bust our luck—just look at that—the bottom grate's burned out!"—ARK.

WEATHER man is being most powerful kind to one Mr. Coal Bin.

* * *

THIS is an age of production along special lines. New machines are constantly coming on the market. The mechanical papers are your best chance for keeping up to the times.



Shafer in Cincinnati "Post."

Signs of the times.

The Mineral Resources of North Hastings

Anyone Wishing to Study Minerology in Almost Any of Its Branches Should Visit This Locality—Seeing is Believing

By One Who Saw

NOT being a mineralogist myself I will not attempt to talk on the subject from the standpoint of one who could pose as an authority, but being a foundryman I look at things through foundry eyes and talk in a similar manner.

In operating a foundry many things are required besides coal and iron. Among the other requisites might be mentioned sand (which is granulated quartz), clay, soapstone, limestone, fluorspar, plumbago, acids of various kind for plating and galvanizing, mica, mica-schist, asbestos, and numerous other minerals.

To find all of these and many others not used in the foundry business all within a stone-throw of each other is a sight worth anyone's while to witness. Although Canada is rich in these minerals, the bulk of them are imported for reasons hard to explain. About 30 miles north-east of Belleville in the County of Hastings lies the picturesque little town of Madoc, and within a very small radius of the town will be found these interesting mines.

Iron Mines

No less than three different varieties of iron deposits are found here. Iron pyrites, from which sulphuric acid is produced, is found here in considerable quantity and is being worked to quite an extent, but the Bessemer ore, which is said to be of good quality and which was formerly shipped to the United States, is now standing dormant. The red hematite or deposits, which were exploited perhaps beyond the limit some years ago, are still believed to be of good value. A few carloads of ore from these mines, which had lain in a heap for some twenty years, was shipped to an American furnace a few months ago and was found to be of excellent quality, so much so that the price paid was 25c per ton above the market price of similar ore mined in the United States. Twenty-five cents is not much, but we are informed that European ore in the mine is only valued at about ten cents per ton.

Soap Stone

What is probably the most extensively worked in the district is the white talc, of which an abundance is to be found. Several mines, as well as the mills for preparing it for the market, are in operation. This material is used for toilet purposes in the form of talcum powder; also for filler in paper making and soap manufacturing, but does not seem to be used to any extent in the manufacture of foundry facings, for which it is admirably adapted.

Fluor spar is a mineral from which fluoric acid can be taken, and it is also used as a flux in the steel mills. These deposits are being worked to quite an extent; the demands of the war having given them quite an impetus. They could, however, be used to advantage in producing flux for the grey iron cupola.

Graphite

The graphite flakes which occur in disseminated form in the limestone quarries, are said to be not exactly suited for the manufacture of crucibles and could only be used for foundry purposes. But alas! they are not being used for this purpose.

Pages could be written about the possibilities of this district, but what is the use? The people of the district are powerless to make much use of their opportunities and seem to be waiting for American capital to develop them, but why American capital? Canadians can raise money to loan at interest, why can it not be raised for developing our resources?

Early History

A few words about the early history of this district should be of interest.

In the early part of the last century, when blast furnaces were practically unknown in Canada, a fairly good furnace was erected right in this district, and everything required to operate it was found right on the ground. The furnace was lined with talc, which it might be explained, is absolutely fire-proof. Charcoal produced right on the ground was used as fuel, and the hematite iron ore already spoken of was used. The spar and limestone of the district was utilized as flux and iron of excellent quality was produced. The country was well wooded and enormous quantities of potash was shipped from the district. This was procured by burning the timber and making lye from the ashes, which was in turn boiled down to potash in heavy iron kettles. These kettles were made from the iron produced at the furnace just described, and the potash being hard on the kettles, there was a constant demand for new ones. Thus the iron industry flourished in those days, and should flourish still.

The owners of the iron mines referred to, contemplate using the diamond drill during the coming summer with a view to learning the exact depth and extent of the ore, and confidently believe it feasible to open them up and at least put the ore on the market.

The story of this early furnace brings out ideas which might be used to profitable advantage. For instance, talc is so refractory or unburnable that if sprinkled or shook through the bag onto a mold, the melted metal has little or no effect on it, the casting coming out with the talc or soapstone as it is commonly called, still white, and the burnt sand separated from the casting. This coupled with the fact that this talc was cut into blocks and used to brick the furnace, would lend the thought that this material might be used as an ingredient in the manufacture of fire-brick. The drawback to the blocks of talc was that they were inclined to be too soft, and although they withstood the fire they would cut away by the abrasion or scraping of the metal in its downward course. With ordinary fire-brick the trouble has always been that they were apt to be too hard. Every melter knows that a soft fire-brick will outlast a hard one. One drawback to fire-brick is that the fluor spar, or even the limestone used as a flux, tends to dissolve the brick. Canadian magnesite can be made into bricks which withstand the action of the slag, but unless the crude material is put through a very expensive process before making it into bricks the bricks are short-lived.

Mixtures of different kinds of metals usually make an alloy which is superior to the original metals and, working on this theory, it might be possible that talc could be used in a mixture and make a more durable brick than any of the materials so far in use.

My object in writing this article is because of the persistent habit Canadians have of boosting foreign-made goods. Even Germany could learn us something on this score. When a German made a mouthorgan or a doll, or any trivial thing, he was proud to stamp it "Made in Germany," but we prefer to speak of New Jersey fire-brick, Georgia soapstone, and Ceylon plumbago, etc., instead of Canadian fire-brick, Canadian soapstone and Canadian plumbago. Even in exporting apples and cheese and such things as we lead the world in, our exporters hesitated to give the credit to Canada until a law was made compelling them to do so.

If any ambitious-minded capitalist would care to study the possibilities in connection with any of these things he might go to many a worse place than North Hastings, because almost any kind of mineral is there. They even have a section known as Eldorado on account of a gold mine which is located there, and it is only about ten miles to the big Deloro silver mines, which are being operated on an extensive scale, the refining also taking place on the grounds.

One more deposit which is being worked to a considerable extent is the marl, which is used by the Canada Cement Co. in the manufacture of Portland cement.

PLATING AND POLISHING DEPARTMENT

A Study in Colors

Being the Third of a Series on This Most Interesting Subject

By ABE WINTERS

COPPER is one of the more easily oxidized metals and may be finished in a great variety of colors. To more thoroughly understand the action of the coloring process we may turn our attention briefly to what takes place in the production of the colors. Unless a coloring film is sufficiently dense or opaque to entirely prevent the color of the base metal penetrating it, the natural color of the film will be affected by the color of the base metal. When coloring copper the colors produced depend on the formation of oxygen and sulphur compounds. These compounds change the surface into either cuprous oxide, cupric oxide or cupric sulphide. Cuprous or red oxide of copper, Cu_2O, may exist greatly modified as regarding color, the shades obtained ranging from brilliant red to brownish black, the thickness of the film determining the particular shade of color. Cupric oxide, CuO, or black oxide of copper, is obtained by heat and also by the use of copper nitrate. A film of oxide may consist of both cuprous oxide and cupric oxide, the first-mentioned being in contact with the copper base. The cupric sulphide, Cu S, is formed by the use of sulphur in one form or another, and produces the darkest of oxides obtained on copper. For all ordinary oxidizing purposes the liver of sulphur solution or a modern substitute is generally used; every plater is more or less acquainted with this dip, but there are many who have not used the barium sulphide solution, to such we would suggest a trial be given it. It is prepared and used in the same manner as the ordinary sulphurette solution. For certain articles the barium sulphide is particularly adapted and is largely used on hardware and chandelier work.

Royal Copper

This is a popular finish, but, the simple method of dipping the coppered article in melted nitre is, however, not the best. To obtain the full beauty of the royal copper finish, proceed as follows: Deposit a film of lead upon the copper, the lead bath being composed of litharge, 6 ounces; caustic potash, 6 ounces, and water, 1 gallon. Boil for half and hour then allow to settle; pour off the clear liquor and use this as the solution. After obtaining the lead film on the copper the article is heated to a low red color by means of a blow pipe. A black coating is formed by this operation. Now, by removing this superficial oxide with a soft buff and coloring rouge we expose the royal copper and its regal beauty.

When preparing copper or brass for coloring it is often desirable to obtain a clean, bright surface quickly; the bright acid dip is then used and as much of the success of the subsequent labor depends upon the effect produced by the bright acid dip it will be necessary to give due thought and study to the composition and manner of using this dip in order to avoid serious delays in production or perplexing results when attempting to match a certain finish. Place the stoneware crock containing the acid in a tank containing cold running water, the solution is thus maintained at a nearly uniform temperature and therefore exerts a nearly uniform action upon the metal surface immersed; heat will cause effects such as the presence of excess nitric acid produces and may render the dip practically worthless for certain purposes. Do not expect to obtain proper results by acid dipping greasy or unclean metal. The electric cleaner furnishes a quick method of cleaning, or almost any of the alkaline still-cleaning baths will suffice for ordinary wares. Dry the article before immersing in the bright dip as water is more or less injurious to the bath. If water is introduced by accident, stir the solution well before using. The solution absorbs moisture from the air and should be kept closely covered when not in use. If the dipped metal surface has a blue tinge when rinsed, add nitric acid in small quantities; if the matte produced is too coarse, add sulphuric acid and stir well.

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1919-1920.

President—Mr. John A. Magill, 591 St. Clarens Ave., Toronto.

Vice-President—Mr. T. G. O'Keefe, 147 Dupont St., Toronto.

Secretary-Treasurer—Mr. O. Holtham, 328 Carlton Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

Verde Antiques

Of all the decorative finishes produced on a copper surface, the beautiful green shades obtained by the action of chemicals and the moisture of the air are, without exception, the most pleasing. A solution which gives excellent satisfaction is composed of muriate of ammonia, 1 pound; copper sulphate, 1 pound; sea salt, 1 pound; acetic acid, 12 ounces; zinc sulphate, 2 ounces. Dissolve the chemicals in five gallons of boiling water, clean the articles and slightly oxidize in a sulphurette dip, rinse and immerse in the hot solution. If color is too heavy dilute the bath until the color produced is as desired. Repeated immersions may be made after drying without rinsing. After the final immersion and before the color is too dry. variegated tones may be produced by stippling with a small round soft brush moistened with the solution. To impart a greenish shade to the lacquer used on green surfaces, add a little green dye dissolved in methylated spirits. If the article is waxed, the wax may be colored while in a melted condition or by applying the dry green dye to the wax during the process of brushing. Beeswax is preferable for best results.

On pale copper surfaces the following will produce splendid effects: Acetic acid, 1 quart; rock salt, ½ oz.; aqua ammonium chloride, ½ ounce. Stipple at least twice, then dry. To regulate the shade of green, use yellow or green chrome. Lacquer and wax as usual. Antimony sulphide dissolved in liquid ammonia will produce an excellent patina for statuary coloring.

In the production of various green finishes on copper and brass by the corrosion method it must be borne in mind that the condition or humidity of the atmosphere in which the verde is formed has a very marked effect upon the results obtained, the interior of ventilating canopies may be employed as drying chambers for some finishes. Articles suspended over a bright acid dip after immersion in corroding solution will often acquire the desired shade of green very quickly. Boxes containing sawdust moistened with the verde-producing solution, and resting on steam coils, are convenient in cases where uniformity of color must be carefully watched, as the temperature of the enclosed air may be regulated easily. Do not use common transparent lacquer on green verdes unless due allowance is made for darkening effects of the lacquer: for best results use a good flat transparent lacquer as it will not alter the color or appearance of the finish; improper lacquers and careless application waxes frequently ruin the appearance of otherwise good cerde finishes.

A Few Black Finishes

The black nickel solution may be employed to good advantage in the production of several superior finishes. The sulphur cyanide solution is not as well adapted to some finishes as the more common arsenic solution. Brass goods acquire a very pleasing finish by buffing, cleaning and running in a solution of muriaitc acid, 1 gallon; arsenious acid, 1 pound; iron sulphate, 2 ounces, then relieve on a tampico wheel with fine emery and oil. The manner of relieving is an important part of the process. Wash in benzine, dry in sawdust, and lacquer. Sulphurette dip may be used with this by immersing in each dip alternately. For brown shades use carbonate of iron in place of sulphate of iron.

An arsenic black solution to be operated with the electric current is made by dissolving 10 ounces white arsenic in 2 quarts of hydrochloric acid, diluting with 2 quarts of hot water, adding 4 ounces of fine iron filings, and finally heating to 180 degrees. Allow to cool, use brass anodes and 2 to 3 volts with solution cold.

Burnt Black.—Make a saturated solution of nitrate of copper by adding copper to nitric acid until acid will take no more, also a saturated solution of nitrate of silver. Then, to 1 gallon of water add 1 ounce of the copper solution, and from ⅛ to ¼ ounce of the silver solution. Dip the articles in the solution or apply with brush, and heat the article until the black oxide has formed. Repeat the treatment if the depth of color is not as desired.

Black Nickel.—Dissolve the following chemicals in boiling water and in the order here given; stir the solution well after the introduction of each chemical. Water, 25 gallons; double nickel salts, 12½ pounds; ammonium chloride, 3¾ pounds; potassium sulpho cyanide, 3⅜ pounds; zinc sulphate, 2½ pounds; sodium carbonate, 10 ounces. Use old nickel anodes and a very low current density. This solution will produce a very beautiful black which will withstand quite severe buffing. The finish wears well and has been used for many lines of commercial finishing where durability combined with pleasing appearance is essential. A simpler and more common black nickel formula is: Double nickel salts. 8 ounces; potassium sulpho cyanide 2 ounces; zinc sulphate, 1 ounce; water 1 gallon. Bath to be maintained strictly neutral, voltage not to exceed 1 volt. Neutralize acidity with nickel carbonate. Too strong current will cause grey or streaked deposit.

Ammonia—Copper Dip

Dissolve ½ pound of plastic copper carbonate in 1 gallon of liquid ammonia. Keep the solution at about 150 deg. Fahr. Dip and rinse until desired black is obtained. The addition of 3 or 4 ounces of sodium carbonate per gallon of solution will often assist in the production of the correct shade. After rinsing the article subsequent to final immersion in the coloring dip, it is good practice to immerse the article in a dilute hot solution of caustic soda.

Leather Finish

To imitate leather finish, it is necessary to resort to the enameling or japanning process. Apply a fairly thick coating of japan; when tacky, shake coarse bran over the surface, then bake in an oven at a temperature sufficiently high to carbonize the bran; remove the dust carefully and follow by as many coats as may be required to give the surface the correct appearance.

Black Smut

Make a solution of sodium carbonate to 5 deg. Beaume. Add nickel carbonate and liquid ammonia until tendency to show grey deposit, then add copper carbonate previously dissolved in ammonia until the smut is obtained. Use moderate current, old nickel anodes, and if the deposit becomes too hard add more copper carbonate, if too smooth, add nickel.

Steel Facing

This finish is valuable in coloring bas-reliefs on medallions, plaques, tablets, etc. Dissolve 1 pound ammonium chloride and 4 ounces sodium carbonate in 1 gallon of water; place in a wooden tank, using a soft steel plate as anode; the anode should be as large as dimensions of tank will permit. Suspend a small steel as cathode and electrolyze the solution for at least 48 hours with full strength of current available. Duration of plating for a facing finish should be about ten minutes, then scratch-brush, using fine emery and water. Repeat if necessary. The deposit obtained from a bath of this composition is exceptionally tough, malleable and heavy. Some platers vary the treatment given the deposit, and by exercising care and attention to harmony in shading they are able to produce some remarkable effects.

Miscellaneous Finishes

Antique Gold.—For brass, buff to good surface, clean as for plating, bright acid dip and momentarily immerse in the sulphurette solution, rinse quickly in cold then hot water, dry well in clean sawdust and apply a gold lacquer of best quality. Now apply a little burnt umber with a fine brush, wipe off the high lights with a clean cloth moistened with turpentine and allow to dry. With a rich gold lacquer to bring out the antique appearance and tastefully relieved high lights, this process makes a splendid one for many purposes.

Multi Chrome.—Dissolve 4 ounces sodium hyposulphite in 1½ pints of water, add a solution of 1 ounce acetate of lead in 1 ounce water, mix well before using. Article to be colored is placed in the solution and the latter heated to 212 degrees Fahr. Iron is given the color of blue steel; zinc becomes bronze colored; copper and brass become successively yellowish, red, scarlet, deep blue, blue, light blue. By substituting sulphate of copper for acetate of lead in preparing the solution, brass may be colored, first a fine rosy tint, then green, and lastly an iridescent brown color.

Ivory Finish.—Ivory finishes are obtained by spraying dull white enamel over the surface of articles. The old ivory finish is simply an ivory finish wiped over with burnt umber as described for antique gold. A green ivory finish is very attractive for many purposes, the yellow and green chromes being used in place of the umber as specified for old ivory. The pigment method of coloring many forms of electro-deposited coatings require considerable skill and artistic taste on the part of the finisher, His production may be crude and unattractive, or it may easily be made a thing of beauty and reveal a marked degree of ingenuity possessed by the plater. By simply changing the proportions of the colors in combination, a wonderfully interesting range of finishes can be produced which will harmonize beautifully with all obtainable shades of color on any metal used in the various industries.

To produce a golden color on steel, copper plate and dip in a solution of barium sulphide. This method is easy when proper proportion of barium sulphide is used. The amount is very small per gallon, and, as we have reason to believe it advisable to allow each operator to acquire the proportion best suited to his individual needs, we refrain from quoting a stated formula.

Military Green on Brass.—Water, 1 gallon; copper sulphate, 8 ounces; ammonium chloride, 8 ounces; iron sulphate, 4 ounces. Use at temperature of about 150 to 180 degrees Fahr., immerse momentarily and alternate with dilute sulphurette dip for dark shades. This finish is used on small metal goods which may be briefly tumbled in clean sawdust free from rosin and then lacquered with flat transparent thin lacquer. Large pieces may be lightly scratch-brushed on circular brass wire brush, wiped and lacquered.

Contrasting Colors. — The following may assist the colorer to produce desired effects easily. Yellow contrasts are purple russet and auburn. Red contrasts are green, olive and drab. Blue contrasts are orange, citrine and buff.

Harmonizing Colors.—Yellow harmonizes with orange, green, citrine, buff and drab. Red harmonizes with orange, purple, russet, citrine, auburn and buff. Blue harmonizes with purple, green, auburn and drab.

Scratch-brushing is absolutely essential to the production of many finishes and should be regarded as a necessary operation in getting the various shades of color. One effect may be obtained by scratch-brushing wet, while another effect distinctly different is produced by dry brushing. It must also be remembered that a given formula in the hands of one man may fail to yield even remote indications of the color or finish expected, while a more experienced or careful operator will quickly and easily obtain results from the same chemicals, therefore, in coloring metals it is advisable to study the various stages of the process selected, practise manipulating the identical article as required and familiarize the changes occurring by reason of varying temperatures and densities of solutions, strive to produce the best possible effect rather than the most glaring. Study nature and the wonderful coloring by nature's unseen artists and your artistic taste will improve until your daily experiments become actually fascinating

---

QUESTIONS AND ANSWERS

Question.—Some of our goods are made from steel and brass, the brass portions we now send out to a nearby concern operating a plating plant, to be


DIRECT FROM MANUFACTURER TO CONSUMER
Can. Mach.

nickeled. Since we began doing this our shipments have been delayed on several occasions by slow delivery of these plated pieces by the plating firm. More recently the labor situation has tied us up completely, and through no fault of ours, as we are not otherwise affected by the strike. We now propose installing a nickeling outfit and finish our product on our own premises. Kindly advise us whether we should use a nickel solution made from nickel ammonium sulphate or one prepared from the nickel sulphate only. Please understand our work is of superior quality and we must have a high grade finish.

Answer.—With respect to quality of the finish which it is possible to obtain from the two solutions you mention, there need be no practical difference. It is as easy to obtain a high grade finish from one solution as from the other. The principal advantage gained in using the single salt solution is reduction of time required to deposit a given amount of nickel, and for your class of work we know of nothing objectionable in connection with the use of the single salt solution at moderately high current densities. Deposits from single salt solutions may be produced more rapidly than from the double salt solution; the deposits may be equally as ductile, malleable, adherent, smooth and white, and the management of the solution is extremely single. Both single and double nickel salts made to-day are practically pure. The percentage of nickel in the single salts is, approximately, 21 per cent., while the double salt contains approximately 15 per cent. of metal. One disadvantage attached to the use of the double salt is the accumulation of ammonium sulphate residues in the solution from the nickel salts. These residues are in a certain sense harmless and inert salts, but they serve no useful purpose. The double salt solution has a comparatively poor solvent action on the anodes, and as high solvent efficiencies assist in maintaining a metallic content at about the original value a single salt solution is preferable where ideal conditions are desired. Concentrated sulphate of ammonium as present in some nickel baths has the peculiar effect of causing the nickel in solution to precipitate out in the form of double salt and very often a solution may show a Beaume density of 7 or 8 degrees and yet not contain an ounce of metallic nickel per gallon. If you are content to allow ample time for plating in a double sulphate solution and have any aversion to use of the single salt solution, by all means install the former. On the other hand, if you must obtain a deposit quickly and wish to use a small tank for large outfit, and are willing to give a modern formula a fair trial, we would certainly recommend the single salt solution.

* * *

Question.—I am in charge of a plating department in which several different metals are deposited. At present I am having serious trouble with my silver. On one line of work we buff spun sheet brass articles and silver plate the interior—it is used as a reflector. The piece finishes splendidly and does not show a blemish; often in less than one week these same pieces develop small dots of a cream color with a small dark centre; the spots increase in size, often becoming as large as a ten-cent piece. Nickeling previous to silvering does not prevent the trouble. In fact we have exhausted our patience trying to stop the spotting. I am taking the liberty to ask you for any suggestion or advice which you may be able to offer, and will heartily appreciate any effort you may make to assist me.

Answer.—"Spotting out" is one of those peculiar troubles which occur to cause us platers to spend anxious, sleepless nights and miserable days of worry. To prescribe a remedy for your specific case would be impossible as the few points relative to the matter do not reveal anything radically different from thousands of other cases of spotting out. There has been very little progress made in endeavors to find a "sure cure" for the difficulty. We will briefly state a few of the methods that have been used with some degree of success by various men. You may find among them one or more which you have not tried. A remedy which fails in one case often succeeds in another, which may appear to be almost identical. Boil in solution of cream of tartar, or rinse repeatedly in cold and hot water alternately. Silver solution may be excessively charged with sodium carbonate as result of excess use of sodium cyanide, spots in this case being a form of sodium emanating from a minute hole in metal. Certain forms of buffing compound have been found to cause the trouble owing to unsaponifiable nature of the greases, the cleaning process in this case can be improved or the buffing compound changed. Metal may be porus or possess imperfections due to rolling mill operation. which are not discernible to the naked eye; an examination with a strong microscope might surprise you. Agitate in 10 per cent. solution of hydrochloric acid and water immediately previous to final rinse, then nickel in solution which has strong acidity; agitate cathode during plating operation. This has proven very successful in many cases where very minute holes were found in apparently good metal. Do not become discouraged, keep busy with your experiments and success will surely result. We regret we can not be more definite in our reply.

* * *

Question.—Do you know whether the reported claim for a method facilitating the direct plating of iron or steel with copper from an acid sulphate solution has any merits warranting the interests of the manufacturer. We have not credited the many stories told us regarding the method, but would not hesitate to try it if it is practical.

Answer.—We do not know the nature of the claim to which you allude, but a process discovered by Mr. John Satka, of Chicago, Illinois, recently, has proen very successful, and has attracted the attention of platers and manufacturers throughout the country. The process consists in immersing the the iron for a few moments in an acidifiefid solution of arsenious oxide, previous to placing in the sulphate copper solution. No electro deposit is required to coat the iron before the acid copper plating treatment. The sulphate copper solution deposits a perfectly adherent coating on the iron, owing to the fact that the potential of arsenic in acid solution is such as to render it possible to deposit copper upon it in the correct condition. If the potential were far below the potential of copper, the deposits would be non-adherent and powdery. The success of this method is not due to any property peculiar to arsenic only, as the substitution of antimony or lead will effect equally as satisfactory results. We believe the process may be very successfully employed for a variety of purposes. We have not tested the process and base our opinion on the statements of several platers who have either used the method or seen it employed for commercial plating.

GRAMMATICAL

Highlanders have the habit, when talking their English, such as it is, of interjecting the personal pronoun "he" when not required, such as "The King he has come," instead of "The King has come." Often, in consequence, a sentence or expression is rendered exceedingly ludicrous, as the sequel will show:

A gentleman of high standing tells us that he had the pleasure of listening to the sermons of an exceptionally clever divine (let his identity and locality remain a secret), and recently he began his discourse thus: "My friends, you will find the subject of my discourse this evening in the first Epistle General of the Apostle Peter, the fifth chapter and the eighth verse, in the words, 'The devil he goeth about like a roaring lion. seeking whom he may devour.' Now, my friends, with your leave, we will divide the subject of our text this evening into four heads. Firstly, we shall endeavor to ascertain 'Who the devil he was'; secondly, we will inquire into his geographical position, namely, 'Where the devil he was' and 'Where the devil he was going'; thirdly, and this of a somewhat personal character, 'Who the devil he was seeking'; and fourthly and lastly, we shall endeavor to solve a question which has never yet been solved, 'What the devil he was roaring about.'"

Trouble seems to be brewing between the moulders and their employers at Walkerville, Ont., and foundrymen refuse to guarantee any deliveries of castings on account of the impending strike.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	38 40
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 25

METALS

		Gross
Aluminum	$33 00	$35 00
Antimony	9 75	10 50
Copper, electrolytic	25 50	26 00
Copper, casting	.....	25 00
Lead	7 25	7 00
Mercury		.....
Nickel		.....
Silver, per oz.		0 98
Tin	59 00	58 00
Zinc	9 00	8 25

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$15 00	$13 75
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper, wire	18 00	18 00
No. 1 mach. comp'n.	16 50	16 75
New brass cuttings.	13 00	10 75
No. 1 brass turnings	9 00	9 00
Light brass	7 50	7 00
Medium brass	9 00	7 75
Heavy melting steel	13 50	13 50
Shell turnings	7 00	6 00
Boiler plate	13 50	11 00
Axles, wrought iron	20 00	20 00
Rails	14 50	13 50
No. 1 machine cast iron	21 00	18 00
Malleable scrap	15 00	17 00
Pipes, wrought	10 00	5 00
Car wheels, iron	20 00	20 00
Steel axles	20 00	20 00
Mach. shop turnings	6 00	6 00
Cast borings	7 00	8 00
Stove plate	15 00	13 00
Scrap zinc	6 00	6 00
Heavy lead	5 00	5 25
Tea lead	3 75	3 50
Aluminum	18 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

¼ in.	$13 00
5-16 in.	11 00
⅜ in.	10 00
7-16 in.	9 30
½ in.	10 15
9-16 in.	10 00
⅝ in.	11 75
⅞ in.	11 75
1 inch	10 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs. per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 50
Linseed oil, boiled, single bbls.	2 92
Linseed oil, raw, single bbls.	2 90
Plaster of Paris, per bbl.	4 [illegible]
Sandpaper, B. & A. list plus	43
Emery cloth list plus	3[illegible]
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28.	$ 6 55	$ 6 25
Sheets, black, No. 10.	5 15	5 25
Canada plates, dull. 52 sheets	8 50	7 10
Apollo brand. 10¾ oz. galvanized	....	....
Queen's Head. 28 B. W.G.	....	....
Fleur-de-Lis, 28 B.W. G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 75
Premier, 10¾ oz.	....	8 05
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

⅛ in.	$16 75
3-16 in.	15 40
¼ in.	14 20
5-16 in.	11 50
⅜ in.	10 50
7-16 in.	9 30
½ in.	10 50
⅝ in.	10 00
¾ in.	9 70

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20%, on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.04
Acid, hydrofluoric	.30
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride, lump	.22
Ammonium, chlor., granular	.18
Ammonium, hydrosulphuret	.50
Ammonium, sulphate	.30
Caustic soda	10
Copper, carbonate, anhy.	.41
Arsenic, white	.14
Copper, sulphate	.16
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.16
Nickel sulphate	.18½
Potassium carbonate	.60
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.18
Sodium carbonate crystals	.06
Sodium cyanide, 129-130%	.38
Sodium cyanide, 98-100%	.55
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$4 00
Polishing wheels, bullneck	2 25
Pumice, ground	0 06
Emery composition	0 08
Tripoli composition	0 09
Rouge, powder	0 45
Rouge, silver	0 50
Crocus composition	0 12

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd.	0 34
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	36
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10¼

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	50
Globe	50
Vulcan	50
Disston	40

DELIVERY DATES ARE FARTHER OFF

TORONTO, October 14.—Canadian shops are doing well, considering that their source of supply is largely interfered with, that is, if they are depending largely on the U. S. mills for steel and iron and all that means. Some of the plants are getting pretty close to the boards, especially those that use a lot of semi-finished material as their raw stock. Shipments are coming forward, to be sure, but there is an increasing time between the date of delivery and order.

The Matter of Delivery

Delivery, as in war days, is coming once more to be one of the great considerations in the machine tool business. There is quite a difference in the policies of several of the houses regarding promises and deliveries. In some of the large shops, where business is done on schedule, the customer is told straight that he cannot expect his machine until February or March, as the case may be. The firm then tries to improve on that delivery as much as

When You Lift the Cat—

Do you carry her near the ground so that her claws catch in the carpet, or do you lift her clear?

—When material is moved from place to place in your factory or warehouse, is it lifted clear of the ground—as you would lift a cat—or is it carried in Trucks?

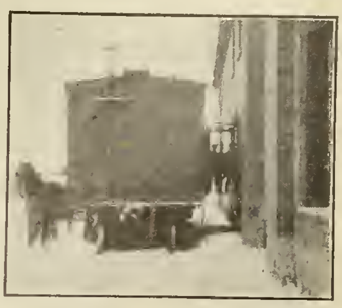
Every obstruction on the ground, every uneven patch in the floor, all the other traffic in passage ways blocks a truck. It is impossible to carry much of a load at a time. A piled-up truck is hard to steer and manage. There is every chance for a truck to collide with corners, machinery or other trucks—resulting in lost time.

How small castings can be carried overhead.

BT Overhead Conveyors

With BT Overhead Conveyors, material is moved quickly and with a minimum of handling. The obstructions on the ground do not matter. For running between buildings or out into the yards, they are ideal. The cost is trifling compared to the money they save. Our experience in designing conveyors for different industries is at your disposal. We have equipped steel plants, coal sheds, ice houses, leather tanneries, lime kilns, brick yards, pickle factories and a number of others. Our conveyors can be installed in any building.

An opportunity to give you further particulars would be greatly appreciated. An expression of your interest will bring full details. Your written request for further information will place you under no obligation whatever.



How a fruit company uses a BT overhead conveyer to unload freight cars.

BEATTY BROS., LIMITED. Head Office: FERGUS, ONT.

Branches at—Winnipeg, Man., Edmonton, Alta., Montreal, Que., St. John, N.B.

possible. In other cases, the idea seems to book the orders and then fight it out about delivery, on the general assumption that every person loves a fight. Some of the best known machine tool makers lose business by this direct way of dealing, but it is very doubtful if they lose in the long run.

There is a good sized volume of business moving in supplies. Dealers seem to be expecting that there will be some arrangement arrived at whereby the giving of special discounts will be done away with. They claim that they are not making money handling many of the lines of taps, dies, reamers, cutters, etc. In fact, one dealer stated to CANADIAN FOUNDRYMAN that he knew for a fact that in some cases small shops that would not buy over $100 in small tools in a year were getting as good a figure as his firm, that handled a large volume of business.

The Effect of the Strike

The average warehouse man and machine tool dealer will tell you, "Oh, we are getting along all right," when you ask about the strike conditions and how they are working out on this side of the line.

Plate comes through slowly, and there is quite a time now between the date of order and delivery. One car came to Toronto this morning from Philadelphia, addressed to a local warehouse. It was flooring material, and was actually ahead of the regular schedule maintained by this company.

It can be said, and we believe the experience of purchasing agents who have had occasion to go into the market will bear this out, that sheets are about the worst hit of any line. There is quite an accumulation of business already. "There is hardly any limit on the tonnage of sheets that could be sold in this country right now if we could get the material," is the way one dealer stated the case to-day.

Black sheets, galvanized sheets, etc., are almost off as far as delivery is concerned. Were this condition to last for any length of time it would hurt stove concerns and kindred lines. Stocks in the country at the present time appear to be low—abnormally so in many cases, so there is very little in the way of reserve from which to draw.

There may have been some shipments of tubes through during the week, but if so they were small and not frequent. It is believed now, though, that shipments will be better. Some shipments of skelp for Canadian pipe mills have come across the border in the last few days, and this is looked upon as a hopeful and significant development.

One warehouse got word a day or so ago that a car of sheets had come over the border to its address, and the firm has been deluged with queries for a part of this stock. It happens to be special automobile stock and much in demand. Prices remain firm. There seems to be no tendency to take advantage of the strike situation to boost the selling prices here, although there are always some cases coming up where a fair premium has been paid for some much-wanted stock.

The Scrap Metal Market

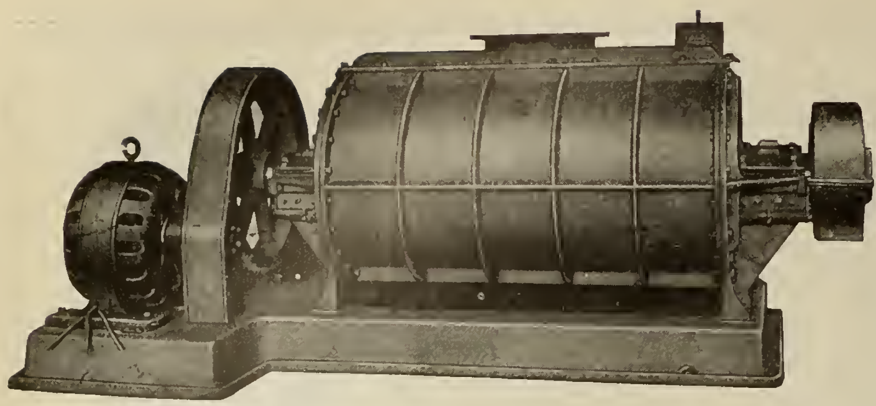
About the only feature in the scrap metal market just now is the shortage of stove plate, although dealers are not yet offering any higher prices for this line. Some of the yards state that there is an acute shortage of plate and very little in sight.

Agricultural scrap iron is also short, and it is in demand just now. There was a great quantity of this and similar irons used during the war, and no accumulations are reported.

The yards on this side of the line are feeling the effects of the strike in United States steel mills, and shipments are interrupted, and sellers here know there is little use looking to United States buyers as outlets for their stocks. In fact, there is not a very large volume of business moving in any department this week.

Coppers are holding fairly firm, with no change in the prices offered by the dealers.

CANADIAN FOUNDRYMAN would again draw the attention of readers to the fact that prices quoted on another page are "Dealers' Buying Prices." That is, one of the largest firms in the Dominion correct the list every Monday, and will pay the prices stated. There may be many deals put through at prices above the list, but for local and particular reasons. It is not possible to publish, as far as we can see, a list of scrap metal prices, showing what the customer will have to pay if he comes into the market. No doubt if firms wanting to secure scrap material would insert a line in the advertising columns stating that they were in the market for certain grades and quantities, or had these to dispose of, they would find a better market than at present, either buying or selling.



CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.
Sullivan Machinery Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GATES
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
Clark, Chas. J., Chicago.

BLAST METERS
Clark, Chas. J., Chicago.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison Co., E. J., Toronto.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CONVERTER BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison Co., E. J., Toronto.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Roots Co., P. H. & F. M., Connersville, Ind.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIE MAKING MACHINERY
Oliver Machinery Co., Grand Rapids, Mich.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 216 S. Geddes St., Syracuse, N.Y.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.
Magnetic Mfg. Co., Milwaukee, Wis.
Woodison Co., E. J., Toronto.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY SHOES
Smith & Sons, R. P., Chicago, Ill.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.
Woodison Co., E. J., Toronto.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

FURNACE BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Black Donald Graphite Co., Calabogie, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND-TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison Co., E. J., Toronto.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co., Cleveland, O.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.
Stodder, W. F., 218 S. Geddes St., Syracuse, N.Y.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACE BLOWERS
Roots Co., P. H. & F. M., Connersville, Ind.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN MAKERS' LATHES
Oliver Machinery Co., Grand Rapids, Mich.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Black Donald Graphite Co., Calabogie, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Magnetic Mfg. Co., Milwaukee, Wis.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Woodison Co., E. J., Toronto.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Stodder, W. F., 218 So. Geddes Ave., Syracuse, N.Y.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, Ohio.
Woodison Co., E. J., Toronto.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SANDERS, ALL KINDS
Oliver Machinery Co., Grand Rapids, Mich.

SAWS, BAND
Oliver Machinery Co., Grand Rapids, Mich.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MAGNETIC; STANDARD AND SPECIAL
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Harrison Supply Co., Boston, Mass.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

Mention this Paper When Writing to Advertisers

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison Co., E. J., Toronto.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corporation, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD

TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Pressed Steel Co., Muskegon, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Woodison Co., E. J., Toronto.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIND GATES
Roots Co., P. H. & F. M., Connersville, Ind.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

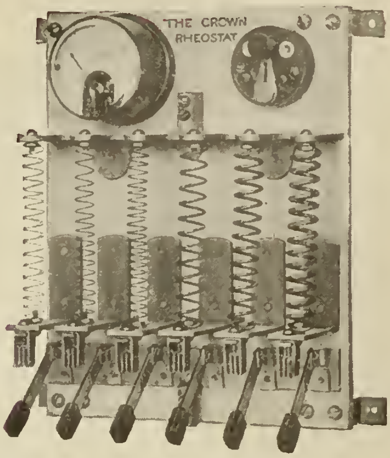
WOOD MILLING MACHINES
Oliver Machinery Co., Grand Rapids, Mich.

WOOD TRIMMERS
Oliver Machinery Co., Grand Rapids, Mich.

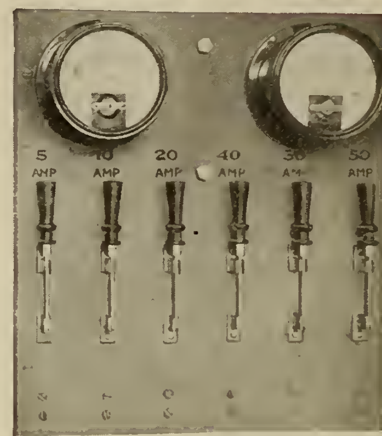
INDEX TO ADVERTISERS

Crown Rheostats

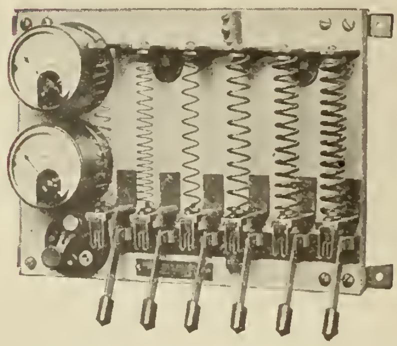
MADE IN CANADA



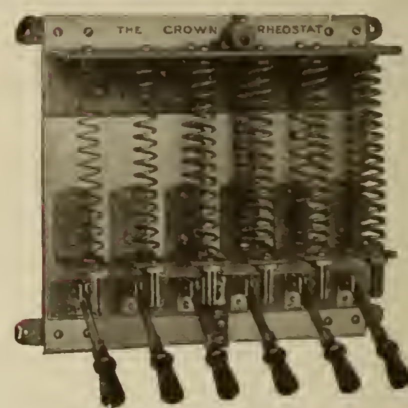
TYPE "M.V." RHEOSTAT



TYPE "M. P." RHEOSTAT
The Crown Panel Board



TYPE "M. V. A." RHEOSTAT



TYPE "M." RHEOSTAT

We are now manufacturing in Canada the famous Crown Rheostats, having purchased the patent rights for Canada, and are prepared to supply these instruments promptly from Toronto stock.

Crown Rheostats will give you perfect regulation and are suitable for all kinds of plating.

Write for Bulletin No. 149

MANUFACTURED BY

Canadian Hanson & Van Winkle Co., Limited

TORONTO, - - CANADA

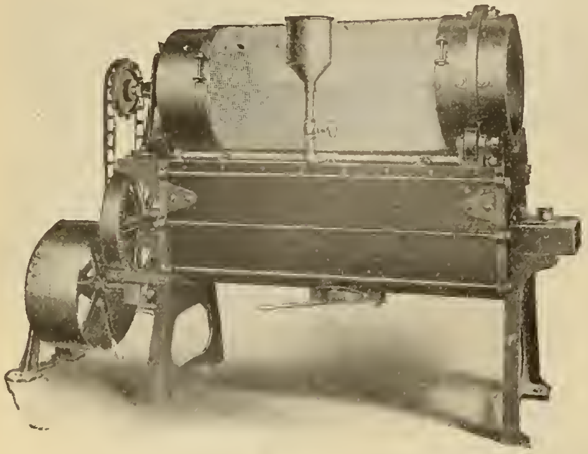
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, NOVEMBER, 1919 No. 11.


KAWIN

The Standard
Core and Facing Sand Mixing Machine



No. O-A Standard Improved Sand Mixer

Cuts over and mixes 4 cu. ft. of sand 120 times a minute—equivalent to the labor of 50 men.

Screens, tempers and mixes sand in one continuous operation and with but one handling.

When the batch is prepared it may be emptied into a wheelbarrow or car by opening the discharge gate underneath the mixer.

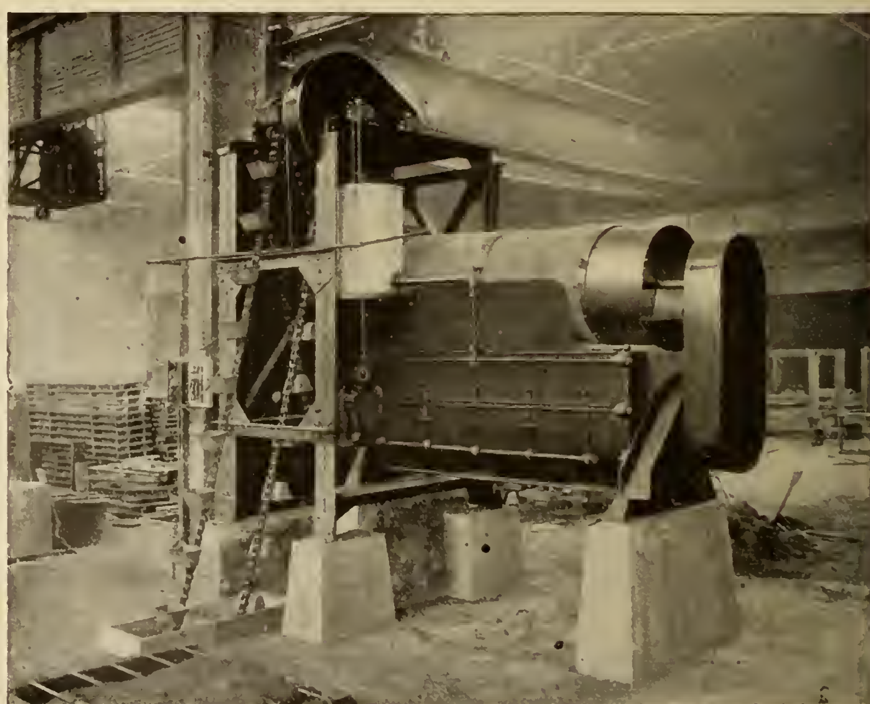
From three to five minutes mixing will uniformly blend and temper Core and Facing Sand with any tempering liquid or binding compounds which may be used. The cost of hand labor to do this work would pay for a STANDARD MIXER in a few days. Furnished with or without screen.

WE MEET THE TONNAGE REQUIREMENTS OF DIFFERENT FOUNDRIES WITH SIX SIZES OF "STANDARD" MIXING MACHINES, RANGING FROM 1 TO 60 TONS PER HOUR.

No. 4 Standard Improved Sand Mixer

Cuts over and mixes 27 cu. ft. of sand at one batch—EQUIVALENT TO THE LABOR OF 200 MEN.

Designed to meet the requirements of large foundries. Will mix sand in large quantities for core, facing, heap or backing sands.



THE STANDARD SAND & MACHINE CO.
CLEVELAND, OHIO, U.S.A.

CANADIAN FOUNDRYMAN, November, 1919. Vol. X., No. 11. Published monthly, at 143-153 University Ave., Toronto, Can. Subscription price in Canada, $1.00; in the United States, $1.50. Entered as second-class matter July 1st, 1912, at the Post Office at Buffalo, under Act of March 3rd, 1879, and at the Post Office Department, Ottawa, Canada.

HOLLAND PRODUCTS

HOLLAND CORE OIL

Hundreds of foundries are buying it by the barrel and saving money. The big foundries buy it by the carload or tank car and save more money.

Use these Holland Products and Reduce YOUR Costs

- CORE OIL—Our customers appreciate the FACT that Holland Core Oil is always uniform and dependable. Among the REASONS are our thirty years' experience and our specially constructed gas fired kettles with pyrometer attachment for accurate heat regulation.
- HI-BINDER DRY CORE COMPOUNDS.
- HI-BINDER DRY AND GREEN SAND FACING FOR STEEL.
- HI-BINDER CORE PASTE.
- HOLLAND CORE ROSIN—An excellent substitute for rosin, costing much less.
- HOLLAND PARTING—Made in a modern improved mill that insures uniformity.

Holland Products are made specially to facilitate foundry production. Their use means economy and efficiency in your moulding operations. Give them a trial.

HOLLAND PRODUCTS
GOOD PRODUCTS ONLY

Canadian Agents:

The Dominion Foundry Supply Co., Limited

TORONTO *Everything for the Foundry* MONTREAL

HOLLAND CORE OIL COMPANY

4600 West Huron Street

CHICAGO

HOLLAND PRODUCTS
GOOD PRODUCTS ONLY

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

The Westinghouse Foundry at Philadelphia

One of the Industrial Plants Visited by the Delegates From the American Foundrymen's Association on the Occasion of the Convention at Philadelphia

As a part of the interesting programme provided by the local Foundrymen's Association of Philadelphia for the edification and enjoyment of the members of the American Foundrymen's Association, and others who attended the Convention, there was probably nothing which was of more real interest than the visit to a couple of the largest, and at the same time most modern, foundries in the world, notably, the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Co.

The illustration herewith shown is that of a group of visiting foundrymen, in the foundry yard of the Westinghouse Co., after having been shown through the plant. A detailed description of these enormous works would undoubtedly be of interest, but we will confine ourselves, on this occasion, to a few details of the foundry and pattern shop. The pattern shop building and the foundry are connected by underground tunnel.

The Pattern Shop

The pattern shop building is constructed of reinforced concrete and tile, with steel roof trusses throughout, and is 400 feet long and four stories high. The floors are of reinforced concrete. The pattern-making department comprises half of the top floor, is splendidly lighted, is equipped with the most modern tools, and the very best facilities are provided for the comfort of the workmen. The remaining portion of this floor is devoted to the general office work. The other three floors are provided for pattern storage, a portion of the first floor being taken for the construction and repair of foundry flasks, etc. The basement is utilized for the storage and mixing of sand for the foundry.

The Foundry

The foundry building is of steel construction, with one main bay having an 80-foot crane span carrying 60 and 100 ton cranes, with three five-ton jib cranes on each side. The melting department is located in the centre of a side bay, and consists of three cupolas and three air furnaces, with a combined capacity of approximately 300 tons. The space at either end of this bay is served by 20-ton cranes, for medium-sized castings. The bay on the opposite side of the foundry is also served by 20-ton cranes, and is used for core-making department and brass foundry. The core ovens are in an additional bay, which also provides for a foundry store room, blacksmith shop, metallurgists' quarters with chemical laboratory, testing machines, etc., and offices for the supervising force.

At one end of the foundry, suitable grinding cleaning and sand blast rooms are provided for both brass and iron, with adequate dust collecting appliances.

This company manufactures a line of electrical machinery and turbine engines, and specializes on ship equipment, in addition to their other regular lines. The foundry is equipped for turning out castings weighing 125 tons, as well as smaller castings, and with their different air furnaces and cupolas, it is possible to produce castings of any quality or chemical analysis required. For heavy work, the floors are provided with different-sized concrete pits, with binding irons and bolts built into the concrete, making the molds perfectly secure when strapped into these pits. Every thing about the place is done by power, if power can by any means be utilized; electric power, of course, predominating, although compressed air has its place and its duties to perform.

Charging the Cupolas

In making up the charges for the cupolas, the charges are made up in the yard on trucks, delivered to the elevator, and taken to the charging floor, where, by means of suitable trackage, the trucks are stored till required. When charging, the loaded trucks may be taken to any of the cupolas by means of a transfer truck. The cupolas are equipped with pneumatic charging tables, by which the truck, having been placed on the table, is discharged by the tilting of the table, through the action of compressed air. Each cupola is equipped with an individual blower.

The core oven capacity is capable of drying the largest cores required. Loam, dry sand and green sand work is done, as is also brass casting. The shop is well ventilated and heated, making it an ideal place of employment for those who have chosen foundry work as their means of earning a livelihood.

A GROUP OF CONVENTION VISITORS AT THE WESTINGHOUSE ELECTRIC AND MFG. CO., SOUTH PHILADELPHIA.

A Miniature Hot-Blast Cupola Furnace in Action

This Little Cupola May Look Like a Toy, But It Has Features Which Should be Worthy of Consideration in Full-Sized Foundry Cupolas

By F. H. BELL

THE illustration shown in Fig. 1 is from a photograph of the float which represented the part taken by the Owen Sound Iron Works, Limited, in the Trades procession in honor of the returned soldiers a short time ago.

A story of the procession and the reception given to the returned heroes would make interesting reading, as such stories always do, and any story treating on this subject should be appropriate in any class of magazine, but to do it justice requires ability beyond that possessed by the writer of this humble narrative. We will therefore refrain from saying much about the reception, suffice to say, Owen Sound did herself nobly, as she always does; the procession alone being of sufficient magnitude to require ninety minutes to pass a given point.

FIG. 1—FLOAT CARRYING HOT-BLAST CUPOLA, SHOWN IN FIG. 2.

As we have already said, the float shown in the illustration is that of the Owen Sound Iron Works, of which Mr. James Higham is the foundry foreman. On the wagon will be seen the little cupola shown in Fig. 2, and it is of this little cupola that we wish to speak.

This cupola is the the invention of Mr. Higham, and to show that it is no toy we might explain that Mr. Higham had it in blast all through the procession and had men making moulds and pouring them with metal taken from this cupola.

Dimensions of Cupola

From the sand bottom to the top it is 36 inches and the outside diameter is 12 inches, inside diameter 8 inches. It has two tuyeres, each 1½ inches in diam. It is small, but can and does melt iron, and as Mr. Higham says, it is because it is a hot blast furnace The tuyeres never get bunged up, because the slag slips right past them.

There are lots of furnaces which will not melt continuously for ninety minutes.

Now it is not its size which we will dwell upon so much as its design and the ideas involved. The line sketch shown in Fig. 3 will, perhaps, show more clearly the details of its different features. As will be seen, it is on trunnions and can be swung over on its side for convenience in preparing for the succeeding heat. By this means the workman can do a lot of his work without working in the dust and draught. This feature can be adopted on the largest-sized cupolas which can be tipped by mechanical means. But this is only one of its minor characteristics, the main point being the blast arrangement.

As is well known, every cupola has what is known as the melting zone above which iron does not readily melt, and cast iron blocks have frequently been used to good advantage instead of bricks in this part of the lining, standing the abrasive action of the descending iron and fuel better than fire bricks. But of course every part of the cupola is hot, and while this part of the lining does not get hot enough to melt and run down, it gets near to it and in time it burns out.

In the furnace here shown the lining above the melting zone consists of a one-piece cast iron pipe of the proper inside diameter. This pipe is flanged at the top to fit the inside of the shell. The bottom of the pipe rests on top of the ganister lining of the melting zone, which zone would, in a larger furnace, of course, be bricked up with fire bricks. This makes the entire furnace above the melting zone a continuous hollow jacket. The blast pipe connects to this as shown in the illustrations, and from this to the tuyeres by outside pipes, also shown. The cold blast on entering this jacket has a cooling effect on the inner tube, thereby prolonging the life of the tube, while at the same time absorbing the heat from the tube, and delivering hot air to the tuyeres.

It must be remembered that this hot air is not burned air as every bit of oxygen which the cold air contained is still in it in addition to the numerous heat units, which radiated through the inner tube into the wind chamber.

Now, as we have shown, this is a very small sample of a melting furnace and if a larger one were being constructed, certain changes in the proportions might be found advisable. Characteristic of coke fires in a cupola, the height of the melting zone does not vary in proportion to the size of the furnace, and if the furnace was a large one, projecting up to the second storey of the building, the melting would still be done

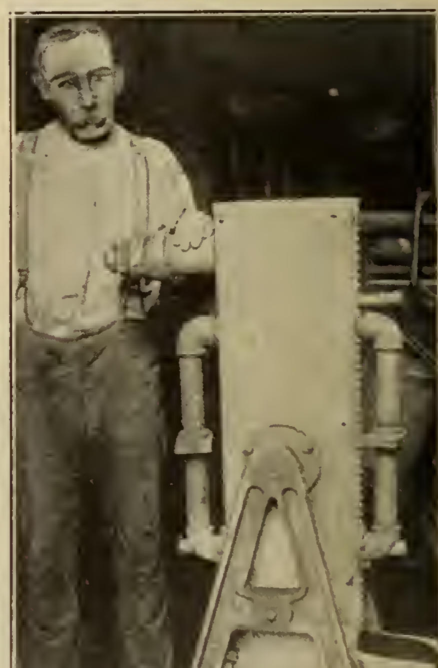


FIG. 2—HOT BLAST CUPOLA.

at the bottom and the zone would not be much higher than in this one. In such a case the inner tube could reach down close to the melting point, and this

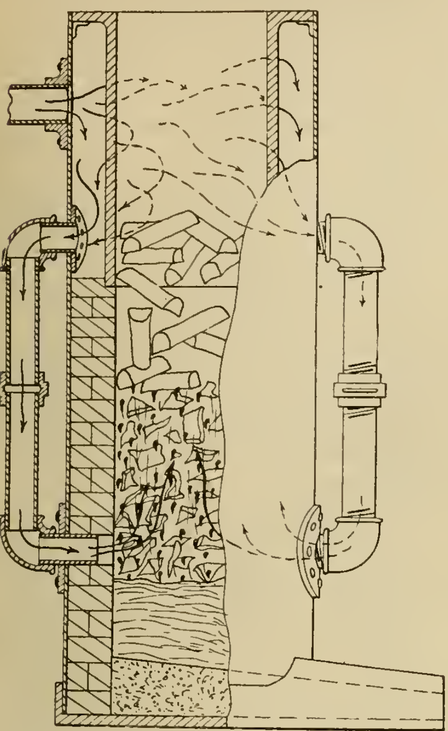


FIG. 3, SHOWING CROSS SECTION OF CUPOLA.

change would make other possible changes loom up. For instance, the cold blast might be made to enter at the lower part of the belt, where it would be more effective in cooling the inner tube where it most required it and also where it would absorb more heat from the inner tube. It might also be advisable to have the pipes leading to the tuyeres connect at the top, where the heated air is most likely to be. But Mr. Higham has all of these points thought out. He has some notion of presenting this one to the Owen Sound Technical School, and building a somewhat larger one for Labor Day celebrations, etc.

Mr. Higham is a native of Stockport, Cheshire, England, and some years ago operated a foundry at Levenshulme, near Manchester, and it was there that he worked out his idea of adopting hot air to cupola practice, and took out patent rights.

We clipped the following item from a circular issued by the Sheppard Electric Crane and Hoist Co., of Montour Falls, N.Y., and it seemed to fit so well into present-day conditions that we take the liberty of reprinting it:

To handle by man-power when electricity is available, not only makes dissatisfied workmen, but delays the world's progress. Production, and yet more production, is the only means by which the present acute situation may be relieved.

Are you using antiquated methods for handling materials in your shop?

Your visit at the Foundry and Machine Exhibit in Philadelphia must have impressed you with the vast resources at your disposal to help improve the working conditions of your men and to speed up production.

The hardest work in any plant is moving and conveying materials.

Cupola Daubing

The subject of cupola daubing is one which has caused foundrymen probably as much consideration, if not more, than any other one item of foundry expense. To brick up the cupola with the best brick on the market and then see it badly burned out after once using, is certainly annoying, yet it apparently can not be avoided.

The next thing is to know how to repair the damage, so that the lining will not be entirely destroyed after taking off a very few heats. This is usually done by applying fire-clay, mixed with sand and tempered with water.

Another material commonly used is Scotch gannister, which is a refractory rock ground to coarse grains. This material resists the heat, but has no bond, and fire-clay has to be introduced in order to hold it. Abundance of fire clay is available, but fire clay has one drawback, which is hard to overcome. This one drawback shows itself in all clay, as the loam molder will be able to tell us, which is to say, it shrinks or contracts with the heat. This would not matter in a cupola, were it not for the fact that it cracks and falls away from the bricks and finds itself floating on the iron in the ladle shortly after putting on the blast.

All of this could be avoided if it were possible to find a material which would counteract the contraction.

Clay certainly holds the record for reducing its volume under the influence of heat. The old-time pyrometers, known as the pyrometer of Wedgwood, was simply a piece of potter's clay of an exact size. It was used in the pottery business where the Wedgwood china was made, to record the temperature of the kiln fires. The hotter the fire, the more the clay would contract.

Now, there is no pottery kiln which has a temperature approaching that in the cupola furnace, so it will be easily seen that clay is not an ideal material unless something can be found which will neutralize the effects of the clay.

Certain it is there are many things which expand with the heat, and if fireproof material, which also possesses this characteristic, can be found, the ideal cupola daubing will be found. This being a well-known fact, it is not to be wondered at that efforts should be made in this direction and with satisfactory results. There have been for some few years back different plastic fire brick compounds on the American market, but while they had some redeeming features they did not come up to the required standard.

There has recently been put on the market a material known as pyro putty, which bids fair to replace some of the things which have been used for the purpose of cupola daubing. It seems to consist of the very ingredients referred to. It is said to contain nothing but natural refractories, so that when it is subjected to heat it fluxes together naturally and adheres to the fire brick behind it, thereby making a permanent job of the daubing. Laboratory tests, recently made, seem to show that it will hold up against the temperature required for melting iron and such being the case it would be well worth trying out. The old saying is that the proof of the pudding is the eating thereof.

The Pyro Products Company, P.O. Box 685, Toronto, are the manufacturers of this material.

MOLDING SAND

Not nearly enough thought is given to the matter of molding sand, yet there is nothing about a foundry which calls for much more careful consideration. A lot of money can be wasted in the extravagant use of sand, but even more can be lost by the careless neglect of the sand heap. I have always contended that clay wash can be used to a limited extent to build up old sand, as clay is the bond which is contained in new sand.

The most serious losses of a foundry are often caused by sand, either by improper use of good sands or by sand actually deficient in quality. Opinion varies radically among founders from casual examination. One will say a sand is useless, another with the same years of experience behind him will declare the sand the finest ever seen. Both can prove a fair case when they give their personal attention to the affair, all of which shows that manipulation is a considerable factor. But such supervision is not given and cannot be given to every molder and every case. We have to deal with practical conditions and available labor.

Precautions

Sand must be standardized, and as far as practicable, method of use made uniform, and the quality of floor sand carefully kept between definite limits. It is necessary that the bond of the floor sand be kept as low as is commensurate with good work, because constant exceeding of that point indicates undue use of new sand and therefore unnecessary expense. If the bond falls too low, drops, runouts, and other trouble will occur. The logical method of keeping down loss from sand is first to determine what sands are needed, then to buy them under specifications, test the quality of that received, and maintain the quality of floor sand by suitable tests.

Some Needs of the Malleable Iron Industry

Realizing That Although Much Progress Has Been Made in Recent Years the Author Believes That Much Yet Remains to be Accomplished

By W. J. PUTNAM

WITHIN the past 10 years manufacturers of malleable iron have awakened to a realization of the necessity of applying more scientific methods in the melting and annealing processes. The gradual change-over from rule-of-thumb methods to exact processes is not yet complete. There are still a number of plants that adhere to the old order, but the chemist, the metallurgist and the mechanical engineer working in close harmony with the foundryman have made many advances in the manufacture of malleable castings. It has taken some hard knocks to bring about these changes. The inroads made by the steel casting industry into the malleable business was the first big alarm which was sounded and it served well to stir the malleable interests to action.

Chemists and metallurgists have been pointing the way by systematic and painstaking methods of melting and annealing, the mechanical and combustion engineers have made many improvements in heating devices both for melting and annealing furnaces, and the foundrymen have steadily improved their equipment until now we have many modern plants producing better castings than ever before.

Work Yet to be Done

In spite of all that has been accomplished there yet remains a number of improvements that must be generally adopted before we can say that we have reached the highest possible standard of excellence.

It is the aim of this paper to point out briefly some of the improvements that still need attention.

First, Research. Much good has been accomplished by the research work individuals and groups of individuals have been carrying out in a more or less spasmodic manner. The work of the American Malleable Castings Association has been instrumental in making marked improvements, and yet it has not in the nature of things been able to meet all conditions in such a wide field. It is further desirable that the results of research work be made known to the users as well as the makers of malleable castings. The work to be done on metals will require our combined efforts for many years to come in an endeavor to reach perfect results. Some mooted questions in the malleable iron industry can be enumerated as follows:

1.—What are the exact annealing temperatures that should be used to produce consistently uniform results with any given chemical composition?

2.—What time intervals should be used on all grades of castings for heating up to annealing temperature?

3.—What is the proper time interval at the proper annealing temperature?

4.—What time interval is best under all conditions in the cooling operation?

5.—What are the exact conditions that cause a pearlitic ring in annealed castings?

6.—What chemical compositions will produce the best castings for light, medium and heavy duty?

7.—What is the best type of furnace for melting to produce the greatest strength and ductility in the annealed casting?

8.—Is there a combination of melting and refining operations that will give a better product than is possible with a single type furnace?

9.—What is reasonable to expect by way of increasing the desirable physical properties on malleable castings?

The foregoing are points in the processes of malleable iron production that have already been given a great deal of attention and will still require much elucidation before we have solved the difficulties in the process.

Remarkable Properties

As long ago as 1910 the writer had occasion to inspect a lot of malleable castings that exhibited remarkable physical properties, namely, 21 per cent. elongation in 2 inches; reduction in area 15 per cent., and tensile strength 53,000 pounds per square inch. To-day it is not an uncommon occurrence to find malleable castings with a tensile strength of 55,000 pounds per square inch and with an elongation in 2 inches of 12 to 20 per cent. The regrettable feature is that all of our malleable castings do not meet these specifications. It is the responsibility of this association to raise the standards until everyone will be obliged to meet what now seems unattainable.

Second, Equipment. For many years there has been a crying need for better equipment for the control of annealing and melting operations. Most malleable manufacturers prefer the old air type furnace and for many years this type has proved the best in general use. With the advent of modern metallurgy in which the electric furnace has played such an important role, is it not to be expected that even in the malleable iron industry this type of furnace will assist in the production of better quality castings? An interesting combination of the cupola for melting, the converter for partially decarbonizing and the electric furnace for refining offers a most attractive field for the future development of the industry.

As pointed out in previous paragraphs, much needs to be done to accomplish certain fixed points in the annealing process. After these points have been carefully established by experimentation and careful study they must be regularly carried out in quantity production and this can never be accomplished until the importance of close pyrometric control is recognized by the managers of the plants making malleable iron.

Supervision is Necessary

There are many reliable and accurate pyrometric systems on the market to-day that are capable of fulfilling every requirement if given intelligent supervision and the attention necessary to produce uniform results. The trouble has been and largely is to-day a lack of appreciation on the part of foundrymen as to what can be done with carefully watched pyrometric control. The pyrometer as it is to-day is not fool proof. It is valuable in the hands of intelligent supervision, but worse than useless if not given proper care. The many ills that have been attributed to pyrometers are too numerous to mention here. It is hardly fair to expect pyrometers to render accurate records of temperatures if mistreated as they so frequently are. In the opinion of the writer, a first requisite for annealing malleable iron is an adequate pyrometric equipment under the direction of an experienced metallurgist. The equipment and supervision will pay handsome dividends in the shape of uniform product, better quality castings and satisfied customers, to say nothing of lifting the load of uncertainty from the shoulders of the manufacturer.

To accomplish the work outlined in these pages the first step would be to establish a research foundry in charge of an experienced foundryman and metallurgist. This foundry should be equipped with all of the various types of melting furnaces and provide room for the construction of different types of annealing ovens. This work, to be authoritative, should be made the official research department of the American Foundrymen's Association and would be a forerunner for research in the steel casting and gray iron industries. The results obtained should be made available by frequent publications.

This may sound visionary to some and yet there could be no undertaking that would prove of more lasting benefit to the castings industry and the public that uses our product than a well organized and equipped research foundry to study the great variety of perplexing problems that wait a solution. Indeed it seems almost imperative that such a step be taken at this time if we are to hold our own in the great onward march of world development.

RESEARCH WORK ON MALLEABLE IRON

By ENRIQUE TOUCEDA

THE author presents an account of four years of research work undertaken for the American Malleable Castings Association as a plea for industrial research among manufacturers and as a striking example of what such research can accomplish. He sketches the organization and purpose of the association and shows how the quality of the product of its members has steadily increased since the beginning of the research work. Malleable-iron castings, due to lack of uniformity and dependability, were rapidly being replaced by other materials. There were many fallacious ideas and theories regarding the physical properties of such castings and the methods of annealing them. Records of tests of 1-in. bars from seven different concerns made by the author in 1911 showed that the average ultimate strength was 39,882 lb. and the elongation under 5 per cent. A report dated March, 1919, to the members of the association, each of whom regularly submits test bars from some one heat of each day's runs, showed that 44 per cent. of the test bars submitted during that month had an ultimate strength over 52,000 lb. and an elongation of 14.67 per cent., indicating the progress made since research work was undertaken.

It is further stated that the average of test bars of the association from January 1, 1917, to March 31, 1919, has shown an ultimate strength of 51,000 lb. and an elongation 12.5 per cent. The records of tests show, contrary to generally accepted theory, that the elongation increases with the ultimate strength. The purpose of the association, however, is not to increase ultimate strength and elongation, but to increase the uniformity of a product upon which the engineer can rely, and this is being accomplished through exhaustive research and advice to members through the consulting engineer of the association.

A description is given of the process of manufacturing malleable iron, of the air furnace, and of the annealing ovens and the annealing process. The structures of iron containing free carbon and iron containing combined carbon are shown by micrographs and the metallurgy of cast iron is carefully explained with abundant micrographs of typical structures.

The effects of the time element in cooling through the critical temperature, of successive anneals, of varying percentages of carbon, sulphur, silicon, phosphorus and manganese and of subsequent heating to high temperatures are clearly described and illustrated. Picture-frame fractures are also discussed.

The author closes by exploding three popular theories with regard to malleable iron. He shows that the strength of malleable iron is not confined to its skin, but that this may be machined off without destroying strength, if the quality of the iron is as it should be. Secondly, he shows that it is possible to eliminate the carbon throughout the entire specimen and not merely near the surface. Lastly, he shows that thick as well as thin castings can be annealed successfully.

The above is a synopsis of one of a series of articles which will appear regularly in the CANADIAN FOUNDRYMAN for the next few months. Fear began to reign in the minds of malleable founders that their product would be crowded out of its legitimate place, unless determined effort was put forth to make it reliable, with the result that research societies have been formed for the purpose of finding the best methods of procedure and to eliminate any unnecessary expense which might have been in common practice in the malleable business. We believe we will be able to interest our readers with the results of their findings.—Editor.

FOUNDRYMEN HONOR COMRADE WHO AIDED FRANCE IN DIRE NEED

As an aftermath of the convention at Philadelphia, we publish the following extract from the "Press" of that city, under date of Thursday, Oct. 2, 1919, which speaks for itself:

In the fall of 1914, when the foundrymen of France, while the nation was at bay before the invader, were at wits' end to produce the steel for shells and artillery, David McLain, a foundryman of Milwaukee, Wis., came to the rescue. The invaders were teaching at a terrible cost the British and French the tremendous importance of artillery. The leading steel foundries, representing eighty per cent. of the steel-producing capacity of France, as well as most of the important machine shops, were in the hands of the Boche. The fate of the nation rested on the ability of the French authorities to secure an explosive shell which, according to an official statement, should be "as easy to make as a cast iron shell, of firing efficiency approaching a steel shell, and of absolute security."

Last night the Foundrymen's Association, now in convention in this city, gave a dinner in the Green Room of the Adelphia to the man who, in this crisis of the affairs of the Allies, appeared on the scene and taught them a new process of making steel explosive shells by which only twenty-five to fifty per cent. of steel is used, the rest of the composition being a mixture of gray iron. These shells met every requirement and McLain's semi-steel process enabled the Allies, with their limited resources, to produce millions of shells that finally blasted the Hun out of France.

About fifty delegates of the Foundrymen's Association attended the dinner. A. O. Backert, president of the Foundrymen's Association, was the principal speaker of the evening. He spoke very feelingly of his high regard for Mr. McLain, both as a man and foundryman who had done more to encourage serious thought, systematic effort and to make better castings than any other man.

He also pointed out that McLain's system was now being followed as standard foundry practice in all parts of the world, and closed with the following:

"To show you what they think of Dave in foreign countries, let me give you an illustration: At 9 o'clock this morning two foundrymen from Glasgow, Scotland, arrived in New York—3 p.m. they arrived in Philadelphia—at 5 p.m. they reached the convention hall and at 5.05 were asking for Dave McLain."

Frank H. Goodfellow of Philadelphia, a well-known foundryman in the East, was chairman of the meeting, and all agreed that he was a thorough "good fellow."

Clifford B. Connelley, Dean of Carnegie Institute of Technology, Pittsburgh, Pa., but now State Labor Commissioner of Pennsylvania, delivered a very interesting talk on the possibilities of semi-steel and the future in store for men following McLain's System.

Walter A. Janssen, American Steel Foundries Co., Chicago, Ill.; Wm. T. Dunning, the Chester Steel Castings Co., Chester, Pa.; Robert H. Thorne, Darling Valve & Mfg. Co., Williamsport, Pa.; and Robert O. Patterson, Smith, Patterson Co., Blaydon-on-Tyne, England, also made short speeches, and many sincere tributes were paid to the guest of honor.

David McLean came to this country from Ireland when he was five years old. At the age of ten he began his foundry career, twisting hay ropes for core barrels in a Pittsburgh pipe foundry, at $2.25 a week. He married at eighteen while working as a moulder, and at the age of twenty-one he became superintendent of a gray iron and steel shop. In 1902 he perfected the process for making the semi-steel which has made him famous.

In 1908 he founded McLain's System—a method of instructing foundrymen by mail. Now over 3,200 foundrymen in all parts of the world testify to the value they receive every day from this system of cupola practice, semi-steel and steel foundry practice. Thus it was fitting honor to Mr. McLain that these delegates, also graduates of his system, gathered to pay tribute.

Practical Hints for the Brass Founder

A New Oil-Burning Rotary Melting Furnace

THE new oil-burning, rotary melting furnace shown in the accompanying illustrations is the latest effort of the U. S. Smelting Furnace Company, of Belleville, Ill., U.S.A., and the claims made for it by its manufacturers are that it will not only melt the heaviest chunks, but will melt, as well as purify and refine, the dirtiest of scrap, making it possible to pour the melted metal directly into the mold, making a superior quality of castings in brass, bronze, copper and aluminum, etc. To back up their claims the following tests are submitted:

Red Brass Turnings—No. 1

This test heat was run for the Globe Metal Company, Chicago, Ill. 600 pounds of red brass turnings were charged in the No. 3 U. S. furnace at one time. The complete charge was melted in an hour. As the No. 3 furnace consumes 15 gallons of oil at 5c per gallon, the fuel cost on this heat was 75c.

The recovery was 581 pounds of pure ingot metal. 19 pounds was unaccounted for, making a loss of 3.17 per cent.

Considering melting, ease of operation, low fuel cost and small metal loss, this heat demonstrates the profitable use of the U. S. furnace for reclamation work.

Red Brass Emery Grindings—No. 2

This heat was run for the Great Western Smelting & Refining Company, St. Louis, Mo. A complete charge of 456 pounds of red brass emery grindings containing a large percentage of dirt was melted in the No. 3 U. S. furnace in 1 hour, 30 minutes. Borax and soda ash were used as flux.

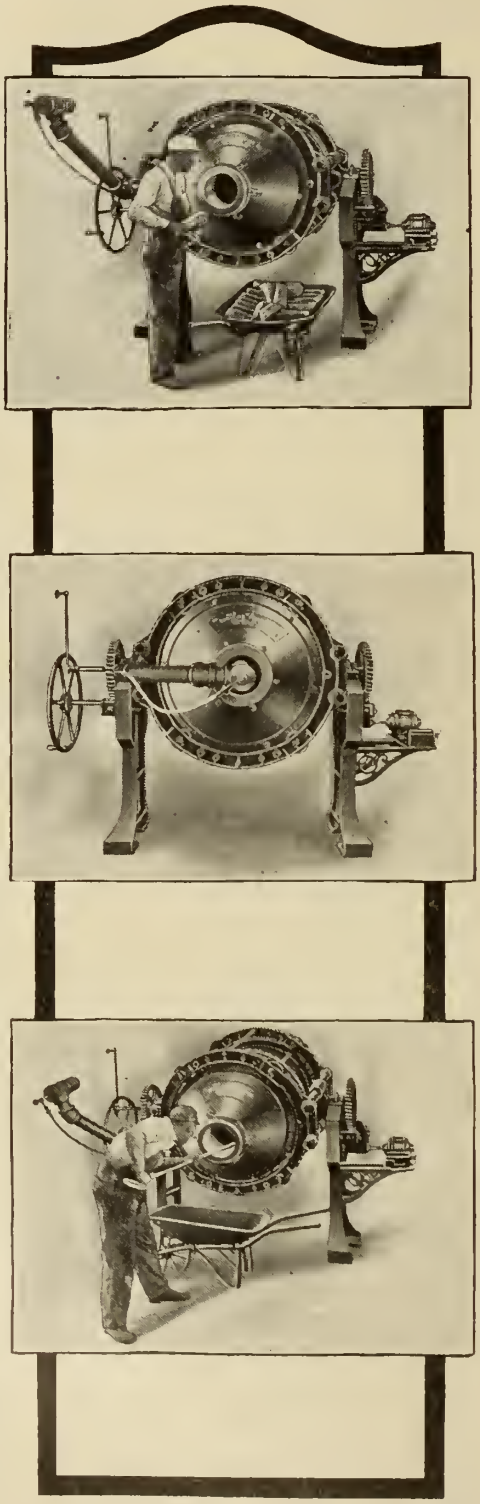
After 100 pounds of slag had been drawn off in a fluid state, 375 pounds of pure ingot metal was recovered.

To secure an absolutely accurate record on this heat, the Great Western Smelting & Refining Company submitted samples of the grindings and the ingot metal to their laboratory for analysis. Following is the report from their metallurgist:

Laboratory Report on Grindings

The total metallic contents as shown by the laboratory report was 84.67 per cent. The recovery showed 82.24 per cent. yield from furnace. The sample piece of ingot analyzed as follows:

Copper	85.13%
Lead	7.20%
Tin	5.30%
Zinc	2.35%
Iron	Trace
Total	99.98%



THREE DIFFERENT VIEWS OF OIL-BURNING ROTARY SMELTING FURNACE.

It is interesting to compare these figures with the analysis of the grindings given on the following page.

The sample of grindings taken from the barrel out of which the grindings were charged into the furnace, showed the following laboratory test:

Wet Assay

Copper	70.65%
Lead	6.27%
Tin	4.46%
Zinc	3.04%
Iron	0.25%
Silica	8.16%
Volatile matter (By difference)	7.15%
Total	99.98%

Allowing for the volatilization of the zinc, tin and lead, which, of course, is more pronounced in the zinc, you will find that the wet assay on the grindings compares favorably with the analysis of a sample piece of metal sawed off of the ingot selected out of the lot obtained from the furnace run.

After making wet analysis on the grindings, we reduced the remainder of the sample to a metallic button and in this operation obtained a metallic yield of 83 per cent. with which you can compare your total metal recovery in the furnace. This brass button obtained through the fire test, showed following analysis:

Copper	84.90%
Lead	7.38%
Tin	5.12%
Zinc	2.55%
Iron	Trace
Total	99.95%

The story of this heat is told by these figures: metallic yield of brass button, 83 per cent.; yield from U. S. furnace, 82.24 per cent. No further comment is needed on these figures, which prove that the U. S. furnace recovers practically all of the metal in the material.

Red Brass Grindings—No. 3

Two heats were run on red brass grindings for the H. Mueller Mfg. Co., Decatur, Ill. We charged 875 pounds of red brass grindings. Total melting time was 1 hour, 45 minutes. Fuel oil consumption was 28 gallons. The fuel cost was $1.40.

747 pounds of pure ingot metal was recovered, 123 pounds of slag was drawn in a fluid state before pouring. This slag was absolutely free from metal. The metal recovery was 85.37 per cent.

Tailings—No. 6

This material was melted for G. Mathes Iron & Metal Co., St. Louis.

The laboratory report on the mixed brass tailings showed a metal value of 38 per cent. The recovery in the U. S. furnace was 35.5 per cent. The analysis showed the following results:

Tailings

Copper	72.48%
Lead	13.48%
Tin	5.72%
Zinc	7.55%
Iron	.75%
Total	99.98%

Ingot Metal

Copper	75.62%
Lead	13.83%
Tin	6.37%
Zinc	4.12%
Iron	Trace
Total	99.94%

You will note that in the process of melting, the iron present in the tailings which showed .75 per cent. was largely eliminated, so that the metallic button showed but a trace of iron. This proves our claim that during the process of rotating the melting chamber the heat from the hot lining below radiates upward, driving impurities out of the metal and actually does a refining as well as a reclaiming process.

Yellow Brass Ingot—No. 7

Yellow brass ingot made of 60 per cent. copper and 40 per cent. zinc, after being melted three times analyzed as follows:

Copper	63.53%
Zinc	36.45%
Total	99.98%

After the sixth re-melt another analysis was made. The laboratory report is as follows:

Copper	69.13%
Zinc	30.46%
Total	99.59%

In the first three heats the pyrometer reading showed 2100° F. In the last three heats the pyrometer reading showed 2250° F. The last three heats were exposed for 12 minutes. At this temperature a considerable volatilization undoubtedly occurred while the metal was exposed.

A study of the laboratory figures shows this result:

Zinc melted was 40 per cent. of the entire charge.

Zinc recovered was 30.46 per cent. of entire charge.

Loss of zinc was 9.34 per cent. of entire charge.

The average loss was 1.36 for each of the 7 melts.

Even this result can be improved under actual working conditions.

Mixed Washer Rumblings—No. 4

Mixed washer rumblings having a metal content of 84 1-3 per cent., determined by analysis, were melted for the Great Western Smelting & Refining Company. The charge consisted of 650 pounds. Soda ash and borax were used as flux. Following are the results:

Yield in ingot	508 lb.
Skimmings and spillings	15 lb.
Iron	18 lb.
Total recovery	83.10%

The laboratory reports on the rumblings and the ingot recovered are as follows:

Mixed Washer Rumblings Ingot Metal

Copper	77.30%
Lead	6.51%
Tin	2.51%
Zinc	13.03%
Iron	.60%
Total	99.95%

Copper	77.86%
Lead	7.05%
Tin	2.42%
Zinc	12.35%
Iron	.30%
Total	99.98%

You will again note that in the above operation we have succeeded in eliminating some of the iron. The results obtained from the above tests are satisfactory, not only as far as the metallic yield is concerned, but also as to the time required in melting, which is 1 hr. 30 min., including the time necessary to pull off the slag. The metallic recovery in this heat showed 83.10 per cent.

Heavy Red Brass Scrap (Dirty)—No. 5

This material was melted for the Miller Lightning Rod Co., St. Louis:

Weight of heavy red brass scrap charged (dirty), 500 lb.; recovery in ingot, 485 lb.; loss in weight, 15 lb. The loss in this heat is 3 per cent., which, in view of the character of the scrap, is a very excellent showing.

Aluminum Turnings—No. 9

Melted for the Great Western Smelting & Refining Co., St. Louis, Mo.

Salt and feldspar were used as flux. The ingot recovery was 82 per cent. of the entire weight of the turnings which were melted.

Aluminum Turnings—No. 8

There is a vast difference in the quality of aluminum turnings. Clean large chips furnish a high metal yield, while small dirty oil-soaked chips furnish a smaller recovery.

In the plant of the Howe Safety Appliance Co. of Granite City, these results were secured in a No. 2 U. S. furnace. Large clean chips, 84.4 per cent. ingot recovery from turnings. Oil-soaked chips, 73 per cent. recovery. Small, dirty, oil-soaked chips, 64.5 per cent. recovery.

Aluminum Borings—No. 10

Melted for Hoover Suction Sweeper Co., North Canton, Ohio:

300 lbs. aluminum borings were charged and melted in quick time. Ingot metal recovered was 79.83 per cent. of the weight of the borings charged. Following is copy of the laboratory report on the ingot metal and the borings:

Description of sample.	Tin	Lead	Copper.	Zinc.	Iron	Aluminum
Aluminum Ingots.	.95	.55	9.90	1.00	.15	87.45
Aluminum Borings	.75	.50	8.55	1.20	.40	83.30

Grease	3.20
Dirt	2.10
Brass (not included)	5.90

Remarks of metallurgist—"Record shows recovery on aluminum borings to be 79.83 per cent. As a general rule a 50 per cent. recovery is considered good. The melting time for that kind of stock was very short."

White Metal Drosses and Oxide—No. 11

This material was melted for I. M. Jacobson & Sons Co., Detroit, Mich.

Miscellaneous drosses were melted with a recovery of 55.17 per cent. Mixed tin, antimony and lead drosses were melted with a recovery of 75 per cent. High-grade tin bearing dross was melted with a recovery of 77½ per cent. Lead dross was melted with a recovery of 71 per cent. All slag removed was absolutely free from metal. Melting time was quick and fuel cost was low. Under continuous operation these results could be improved.

Tin Ashes—No. 12

Melted for R. Wallace & Sons Mfg. Co., Wallingford, Conn.

The material melted was tin ashes composed of pulverized and screen residue and sweepings and contained zinc chloride, zinc oxide and chloride of tin and iron. Wet assay showed the material to run from 43 per cent. to 45 per cent. tin.

540 pounds of the ashes were charged in five heats with a net recovery of 246 pounds of pure ingot metal or an average recovery of 45½ per cent. Fuel consumption was low, the melting time was short.

BRITISH IRON FOUNDRY WORKERS STILL ON STRIKE

Compromise Rejected — Galvanized Sheets and Tinplate Advancing

London, Oct. 19.—The ballot taken among the iron foundry workers overwhelmingly rejects the agreement reached between their executives and the Employers' Federation. Their demand for a 15 shilling weekly advance is reaffirmed and the strike continues. The outlook is serious, for many big engineering and other branches of the steel and iron industries are already working half time, and unless a settlement is quickly effected widespread entire stoppages of plants will be unavoidable. Several important announcements of intention to close down entirely have been issued.

Steel galvanized sheets have advanced to £23 under large demand, with much business turned down. Welsh tin plates are firmer at £1 19s. 6d. under good Far Eastern demand.

Molding a Marine Engine Thrust Bearing Block

This Casting Stands Between the Engine and the Propeller to Take the Thrust of the Propeller and Save the Engine. It is Quite a Complicated Piece to Mold

By JOHN H. EASTHAM

THE thrust bearing block casting shown in detail at figures 1, 2, 3, weighing approximately 3,700 lbs. (three thousand seven hundred) pounds, and intended for use in a canal-sized freighter, fitted with triple expansion engines of thirteen hundred horsepower, is of ordinary design, strength and rigidity, combined with lightness, being the factors contributing to a choice of several methods of production in the foundry.

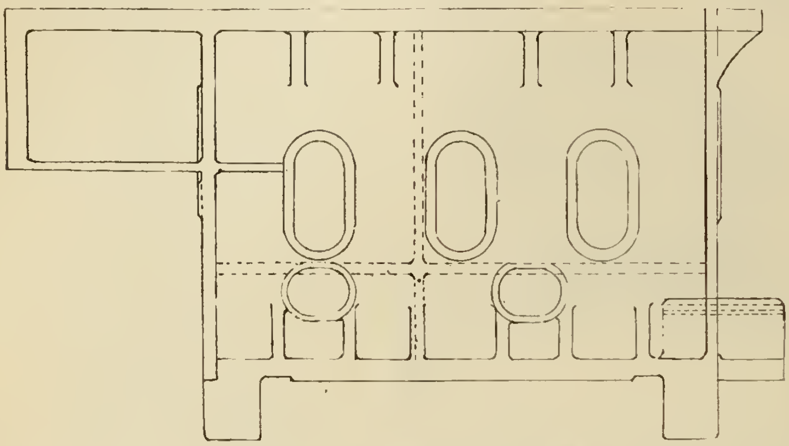


FIG. 1—SHOWING LINE SKETCH OF MARINE ENGINE THRUST BEARING BLOCK.

Its boxed-out design, together with the transverse internal strengthening web plate and ribs, the babbitt arrangement in the shaft bearing, the hand-holes, outside flanges and brackets, necessitate the use of a good many dry sand cores, much of the molder's energy being in the direction of their correct assembly before closing the mold prior to casting. Roughly, three general methods of molding the piece are permissible, namely, the skin-dried mold with lower flanges and brackets drawn inwards or bared by the removal of a full depth draw-back plate at each side, the all-dry sand method, using block cores to cover the full area of the pattern along each side, thus forming the upper and lower flanges and brackets, the hand-hole cores being pasted into special prints rammed up in the block cores for the purpose, or the green sand mold, with lower flange and brackets formed in core to ensure safety when pouring, this latter method being denominated "A," whilst the second mentioned or block core method is marked "B," in the cross section view of the finished mold at Figure 4.

The first named, or draw-back method, while reducing the cost of coremaking to perhaps the minimum, has nothing further to recommend its adoption in foundries where low cost of production and high grade output are of primary importance, any advantage gained in the pattern shop and core room being offset by the element of risk and additional molding expense incurred.

In method "A," shown to the left in Fig. 4, the pattern is built up as for ordinary green sand practice. The upper flanges and brackets being screwed or nailed to the main pattern, and the hand-hole prints held in place by dowel pins or screws, these being removed in the usual way when the outside is rammed sufficiently high so as to allow the print and strengthening bead to be drawn inwards in one piece after the removal of the body pattern, no prints of any kind being necessary to mark the position of the lower flange cores, as the procedure hereafter described will show.

A pit some 12 inches deeper than the overall height of the pattern is first prepared, sufficient clearance at each end and side being allowed to permit perfect freedom of action while lowering the flange cores to place and ramming round the pattern, a coke bed being next spread over a slightly larger area than that occupied by the casting, and a vent pipe sloped, as shown from the coke to a point above the floor level and clear of the area to be covered by the cope flask.

Paper or straw having been spread over the entire surface of the coke bed in the usual way, floor sand is now rammed up over the whole to a depth of about ten inches, a hard facing sand bed being next levelled at full pattern depth from the pit edge, struck off and vented down to the coke all over its area, two round or square plugs being also rammed up on the coke in the centre of each half of the lower main core print's location, the orifice left on their withdrawal allowing the gases generated in that portion of the casting below the transverse web in the lower main core to escape. The pattern is now lowered to place and roughly bedded in, care being taken to preserve the bed along each side, following which the side cores "A" are placed into position, the mold being next rammed up to the joint and the parting made, reinforcing rods being placed in the bracket corners and at intervals round the hand-hole prints, or wherever necessary.

The cope flask is next rammed up, with runner, risers, and upper body core vent plugs in correct positions, hoisted off and the pattern drawn out after the necessary preliminaries in the way of swabbing and loosening, the lower main core print, shaft bearing extension piece with its core print, and hand-hole prints all remaining to be drawn afterwards, in accordance with good molding practice. The lower main print serving as a working platform, and being removed last immediately before placing the cores in the mold.

As shown at Fig. 4, the method of gating differs considerably from the usual practice of bottom pouring, a pair of one-inch round plugs being rammed up in the upper main core, and the metal "plumped" down through these two one-inch round holes onto the lower main core, the casting being thus gated near the centre, on the transverse web, a reasonable fillet being provided at the junction of each gate with the casting, the danger of "breaking in" being thus avoided.

Excepting those placed on the lower

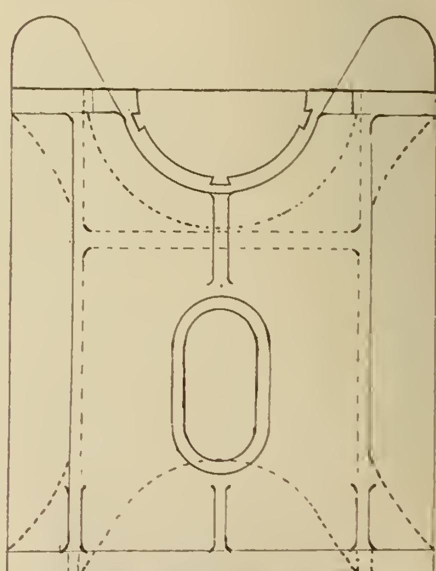


FIG. 2—SHOWING ANOTHER VIEW.

main core to support the upper one, thus leaving the one-inch space occupied by the cross web, comparatively few studs or chaplets are needed, outside of those required to keep the shaft bearing core in place, the babbitt space cores being pasted into it by the coremakers before handing over the cores to the molder, whilst the hand-hole cores along the sides and at each end act as buffers, and resist any tendency to move on the part of the upper main core.

Method "B" differs from "A" to the extent that both upper and lower flanges and brackets are made in core, as shown at the right of Figure 4; core prints of full pattern depth and length added to the pattern in this instance, a plain outside "ram up," and less mold finishing being thus encountered, the onus being thrown on the core room, two or three hours' molding time being saved, and five or six hours' core-making added to the job, with the extra difficulty of placing the pair of deep nar-

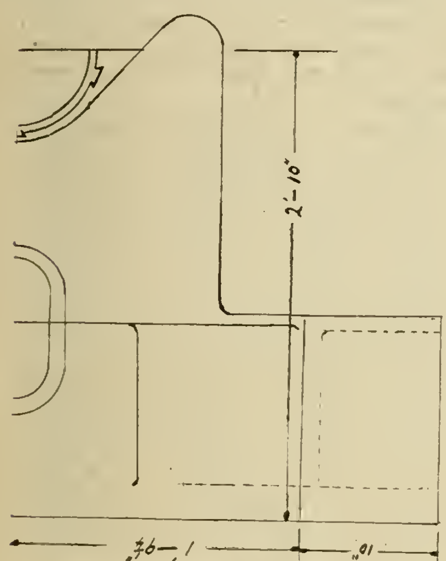


FIG. 3 ANOTHER VIEW OF SAME.

row cores to their precise position. Analyzing the three methods above briefly outlined, that marked "A" is ahead of the other two from the aspect of cost, and also as regards quality of finished product, the cost of core-making being brought as low as is consistent with safety, scales or cuts while pouring being specially noticeable by their absence.

The core-making does not need any special description, having no peculiarities, cast iron grids being used in the main cores as shown, loose hooks or an extra heavy pair of prods in each grating seeming to hoist the cores around by, and a liberal allowance of cinders being rammed up in each main core to facilitate drying and venting, particular care being taken in the case of the lower main core that the vent from the coke communicates directly with the holes above referred to, leading down to the cinder bed, for if you have any obstruction in this instance, look out for a pyrotechnic display, with the usual lamentations to follow.

The core boxes for the main or inside

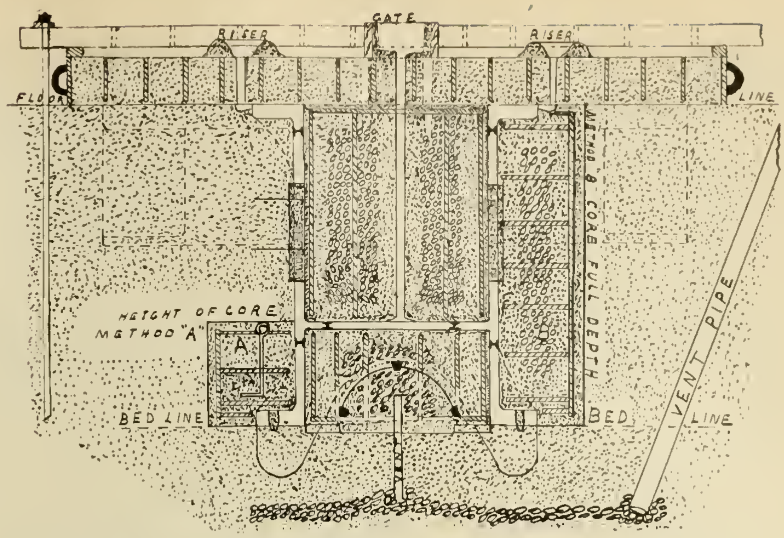


FIG. 4—SHOWING SECTION OF ASSEMBLED MOULD FOR MARINE THRUST BEARING BLOCK.

spaces are best and cheapest made of skeleton type, open top and bottom, screwed up in four pieces, the fillets being easily cut away and rounded when finishing the cores, no trouble being experienced by this method if good, strong, straight core plates are used, or if you ram them up on the flat face of the oven car, but if you try to carry these and similar cores, weighing perhaps fifteen hundred pounds each, about the shop in a green condition, on plates three-eighths or half an inch thick, you are going to make the long-suffering coremaker wonder what he did in his youth to deserve being sentenced to such a trade.

Needless to say, a high-grade metal is essential, both on account of the strength required, and amount of machinery on the job, the following analysis being eminently suitable:

Silicon Per cent.	Sulphur Per cent.	Phosphorus Per cent.	Manganese Per cent.
1.50 to 1.75	Under 0.10	0.30 to 0.60	0.60 to 1.00

A cursory examination of the foregoing analysis will show that the use of charcoal iron or a considerable steel scrap content, preferably the latter, in the charges, is necessary to obtain the results and staying power needed, as is also a high pouring temperature, with rapid filling of the mold, the latter to avoid the risk of cold sheets, however faint or apparently harmless they may appear, the chance of a broken thrust block in a heavy sea, with the propellers out of the water, and "cutting wind" half the time at high speed, with the consequent sudden check and strain at every immersion, being by no means imaginary.

THE MISSING ONE

We recognize many
Of the old bar fixtures
All camouflaged up
As soda fountains,
But the old bar-flies
Seem to have passed on.

Arkansas "Gazette."

A WELL PLEASED SUBSCRIBER

In a communication which we received from Mr. Wm. Ruckhaberle, of Owen Sound, were the following sentiments which we know he will forgive us for repeating:

"I have been a subscriber to the CANADIAN FOUNDRYMAN for several years and have to state that since there is a foundryman on the job as editor, it is a real enjoyment to read it, and it is getting better all the time. I have to thank the editor for putting in that article on "Health's Law About the Foundry," and one entitled "Making the Foundry More Attractive." They were certainly good, but I think for the sake of us molders, it would not hurt if you would put in articles again and again on these most interesting points."

Mr. Ruckhaberle is a molder, and, as he states, he reads the CANADIAN FOUNDRYMAN and appreciates our efforts to induce foundrymen to make their foundries as pleasant as possible for the men. Our desire is that foundrymen will see the point and realize that molders are not hard to satisfy if an attempt is made in that direction, and that if labor-saving equipment is contemplated, see that it is of the kind that saves the labor of the man. Once the foundry is brought up to a standard where the men are not working in an exhausted condition, due to foul gases, dust, smoke, dampness draughts, etc., there will be little trouble in reconciling them to the use of other modern devices which must come in the march of progress.

Casting Drop Hammer Bases in Small Foundries

How Chunky Piece Can be Made in Green Sand Mold by Taking Proper Precaution and Using Cores Where Green Sand is Not Deemed Safe

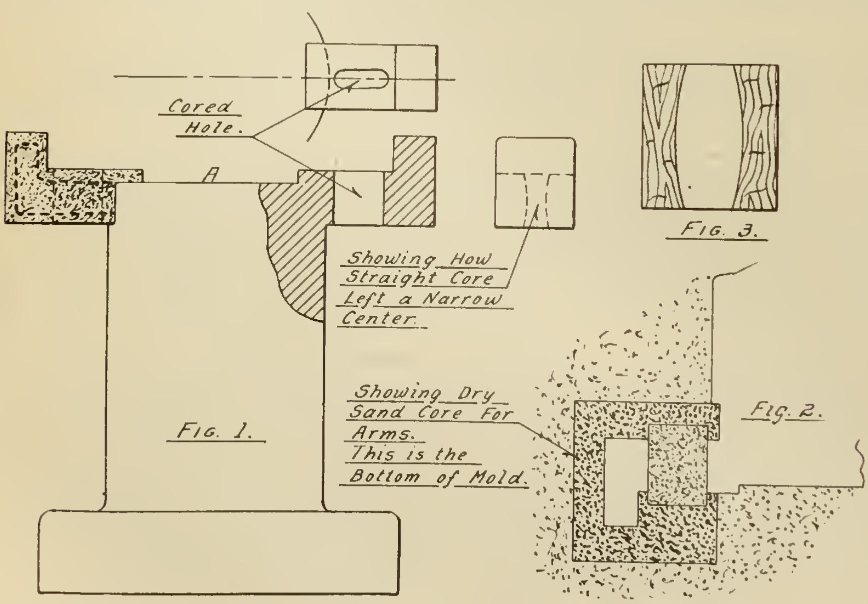
By DONALD A. HAMPSON

WE made a number of drops for a nearby forging shop and the foundry work on the beds, or bases, called for a little out-of-the-ordinary work, for us at least. These bases were as shown in Fig. 1. They weighed 2,200 lbs. just as we took them out of the sand. Larger foundries would undoubtedly have made them in loam, but we didn't do any of that class of work, so had to turn them out by jobbing foundry methods.

The face A of the castings was planed off to receive the shoe or bolster holding the dies, and as it had to be "clean," the castings were molded with this face down. The flange around the end of the base then came in the cope and the impurities naturally collected in this region, where they did no harm. As the shrinkage would leave a hole toward the centre, we added a temporary cone-shaped piece to the pattern, forming a head from which the shrinkage could draw ("sinkage," one of the men called it). Some of the castings came out flat and some with a swell toward the middle, which was acceptable to the customer.

Molded in this way, the two arms (on what is the top of the base as used) come at the bottom and there the walls of the mold must sustain the full pressure of the mass of iron above them and the securing of the molten metal as it is poured and is "churned" during the pourings. It was foreseen that the green sand mold would fail at this point, consequently a change was made. The pattern was altered by prying loose the arms. Then we made a dry sand core of the arm by making a core around the detached arm, as shown by Fig. 2. When baked, these cores were placed in the mold, lined up with marks on the pattern, and the sand rammed up. The castings turned out satisfactory in every case—it is doubtful if loam molded ones would have been any better or any cheaper.

When the first two hammers were being assembled, it was discovered that the cored slots through the arms were tight on the bolts which must pass through the slots. A checking up of the core box showed that it was a quarter of an inch larger than the size of the bolts; the core maker was a careful man; hence the conclusion was that the core was eaten away by the iron in motion during pouring. To offset this the core box was hollowed out, as in Fig. 3, taking a sixteenth from a side in the middle (where the castings were the tightest) and rounding to nothing at the edge. This also was the correct move, as was proven by subsequent castings which gave no trouble in the shop.



DIFFERENT VIEWS OF PATTERN AND CORES FOR HAMMER BASE.

Letters To The Editor

Dear Sir:—We are making cast-iron ingots, 2 ft. 6 in. long, 10 in. wide, with a core hole 3¾ inches. We are casting them on the side, and about three inches from both ends they form a groove about a 16th to an 8th of an inch right around, as if the core bulged out. It is something we don't understand. The mould is poured with good soft iron. The core is held down by its own prints; why should those grooves come in the castings? We have no trouble with the vent, and then we have made the same casting 5 ft. long, poured it on end and put in 2 iron links to hold the casting by and when they were shaken out it was found that some times they had cracked so much that if we poured oil on it, it would come right through. Now can you tell me what the trouble is? The foreman claims that the links had something to do with it. Of course, those were poured with hard iron, but why did some crack and not the others? Sometimes they were kept in 4 or 5 hours, and then it was found that they were cracked.

Answer.—I would attribute your first trouble to the temperature of the metal more than to anything else, and in the case of the upright ones to the links. I take it that these ingots are what might be called sleeves or pipes, ten inches in diameter and about three inches thick. With good fluid metal there should be no trouble in getting a sound casting, either from hard or soft iron. Very dull iron doesn't make a sound casting. In the case of the upright ones, if the links are fastened to the cope they will have to hold up the weight of the casting as it will contract considerably, above a half an inch, and the top being seamed, the bottom would be raised from its support and hang to the links, and being still soft might give way.

How Iron Behaves

A few examples of what iron will do will undoubtedly be of interest.

In Fig. 1 will be seen a sleeve such as we have just described. I have had the best of success with this kind of casting by raising one end above the other about two inches and gating from the lower end and placing a feeding head on the upper end. I have seen such pieces act just as described above when poured on the level with dull iron.

In Fig. 2 is a similar casting with the staples cast in the top, said staples secured to the flask as shown at C, by having eye hooks suspended from a rod and wedged to the top of the cope. As the metal contracts when cooling, the top being fastened causes the bottom to be lifted, leaving a space as shown at A, and throwing all the weight on to the staples, leaving it liable to give way at the point B.

In Fig. 3 is a standard well pump casting about an eighth of an inch in thickness, with a heavy ring at A and another at B. A is to be tapped for pipe connection, while B is tapped for stuffing box.

I was once employed at a place where pumps were made and I have seen whole heats of them checked at A, but not at B, leaving a nasty ragged crack around the pump, as shown at A. This did no harm as it was only on the outside, but it looked bad. It would not go clean

FIG. 1—POURING SLEEVE WITH ONE END RAISED.

through, and if it did, the pipe being screwed in would plug it, but as I have said, it looked bad. This was caused by this spot staying fluid after the rest was set, and as the light part tried to contract the spout and the flange prevented contraction, causing it to separate as shown. The metal immediately against the core would be sufficiently set to hold and would stretch enough

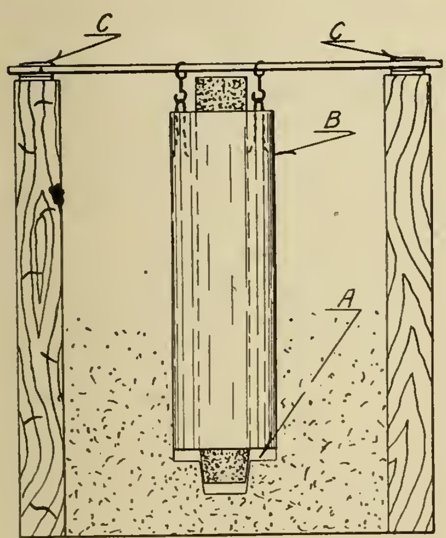


FIG. 2—SLEEVE MOULDED ON END WITH STAPLES TO BE CAST IN.

without checking. The part B had no such strain, and being close to the end also helped to cool it quicker. If the metal had been right it would have been less likely to check. The metal used was pure pig iron analyzing 3.25 silicon, and had not the strength to hold itself together. About 40 per cent. scrap mixed through it would have overcome all the difficulty. In this particular plant money was wasted on pig iron, and an attempt was made to save it on the

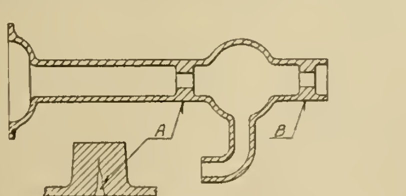


FIG. 3—CASTING WHICH HAD DEFECT AT A.

coke, with the result that the castings were made under the most unfavorable conditions. The pump handles used to break when putting them in the wheelbarrow, and the ones which escaped this generally met their finish in the rumbler.

In Fig. 4 is a job I worked on when an apprentice. Artesian wells were a great hobby in our district, and this was a cast iron pipe six feet long and about 8 inches in diameter, with one end drawn in to fit a two-inch pipe. The idea was to let the pump cylinder down into it. The core arbor was made to fit it as shown and was well covered with prickers and vent holes. We used to sweep the core up in green sand and had the best of success, but a great many of them used to crack at the point mark-

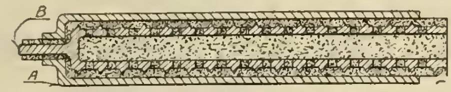


FIG. 4—CASTING WHICH CRACKED AT "A."

ed A, on account of the casting contracting against the arbor. I never knew of one cracking lengthwise, although the arbor was almost as big as the pipe, but the end would crack about half way around. If the arbor had been driven with a sledge from the point B about the time the casting was set, this could have been avoided, but nobody seemed to think of it at that time.

Fig. 5 is a section of jacketed kettle with heavy connection between, as shown at A. This heavy spot used to stay melted until all the rest was set, and would then pull apart, with the result that when bored to connect the kettle to an outlet pipe the water jacket was also connected. This was a case where a better kettle could have been made bottom up, so that this spot could have been fed. I overcame it by making a casting of the proper size and shape and putting it into the mould,, not as a chill, but as a part of the casting. It might not seem like a mechanical way of

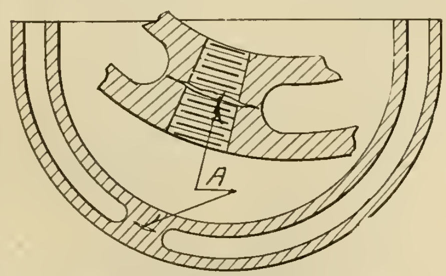


FIG. 5—SHOWING CHECK IN BOTTOM OF JACKETED KETTLE.

doing, but the result was perfect. The melted metal adhered to this chunk and made a perfect front, and it was this chunk which we bored out.

In conclusion let me say that my experience has taught me that to make clean, sound castings the iron requires to be melted hot enough to throw off its impurities, and incidentally, melted fast enough to prevent picking up sulphur; and while I do not say to pour it white hot, I would rather pour it too hot than too dull. For such work as I have shown I would use iron running about 2 per cent. silicon, which will make a cleaner, stronger and closer grained casting than a higher silicon iron, and at the same time will be nice and soft if properly melted. For the pieces Figs. 1 and 2, even less silicon would do. There are a great many more castings lost through bad melting than through bad moulding. I have poured work which had to be perfect with iron which hadn't the remotest chance of making a perfect casting. Yet the foreman would say the gate was the trouble. If the iron is right, the gate is of very secondary consideration, and if the iron is not right it is a mistake to waste the mould on it, no matter what kind of a gate is used.

THOR HAS ROUSING SALES MEETING

The Independent Pneumatic Tool Company, general offices No. 600 West Jackson Boulevard, Chicago, has just completed a very succesful sales meeting, at which branch managers and representatives from the north, south, east, west and Canada were in attendance.

The meeting was in charge of Vice-President and General Sales Manager R. S. Cooper, other officials of the company in charge being: John D. Hurley, president; F. W. Buchanan, secretary; Adolph Anderson, assistant to president; F. B. Hamerly, works manager; Axel Levedahl, consulting engineer, and R. A. Norling, C.D.

The men spent a whole day at the factory with the mechanical departments and many ways and means of improving Thor tools and Thor service to customers were devised.

All were very enthusiastic about the future outlook, and Vice-President and General Sales Manager Cooper states that he has no doubt but what things will be humming away merrily in a month or two at the same swift pace they moved during war times.

A RATHER "NUTTY" EPISODE

William Fehrman, manager of a local ten-cent store, hired Miss Lily White, graduate of an efficiency school, to assist in inventorying.

"Lily had had little experience, but a lot of enthusiasm. So down to the basement Bill marched the new clerk.

"Everything in the place had to be counted, Fehrman said, with a sweep of his hand, and he added that the number of articles must be put down on paper.

"Two days later Bill asked his assistant what had become of the new girl. The assistant didn't know, so Fehrman started a search. He found her in a far corner of the basement where there were several barrels of peanuts.

"She was starting on the second barrel.

"'There were 17,982 peanuts in the first barrel, Mr. Fehrman,' said the industrious young woman."—Exchange.

Making Steel in Canada

The Open Hearth and Bessemer Processes Are Described in This the Last Portion of the Series. The Acid Open Hearth and the Basic Open Hearth Processes Are Discussed in Detail

In the early days of the iron and steel industry the product of the blast furnace known as pig iron, was converted by means of a puddling furnace into wrought iron. The furnace in which this conversion took place is shown in Fig. 1. In most cases it was fired by coal, although in some progressive plants gas was used.

The iron made in these furnaces was made as the result of very severe physical exertion on the part of the workman—the quality of the material depended upon both the workman's mental and physical powers. The furnace held five or six hundred pounds of metal, this metal was subjected to the influence of the heat and air from blowers until it reached a semi-liquid condition, and then by means of an iron rod, called a fettling bar, the operator worked up balls of semi-plastic material, weighing about one hundred pounds each. The balls were removed and taken either to a hammer, or a set of rolls, and worked into bars. They were known as puddle bars, and formed the basis of all other rolled and forged materials. The theory at the back of the puddling furnace is a little hard to understand, but the impurities were removed by oxidization, and the working of the material in the bath exposed all portions to the action of the flame, and resulted in a material tough and fibrous. The drawback, of course, was that only small quantities could be made at a time, and that a dependable analysis was hard to obtain.

This product, as mentioned before, was known as iron. Steel was made by taking selected pieces of iron, packing them in a crucible along with certain materials high in carbon, and bringing the whole to a soaking heat for a certain period. This produced a material that could be used for the purpose of making cutting tools, knives, etc.

After the discovery in year 1856, by Sir Henry Bessemer, that steel could be made in larger quantities, definitions have changed, and steel can now be defined as "Purified pig iron, which has been cast while in a molten state, and in which the carbon and other impurities present in the original pig iron have been reduced to such a point that the ingot cast is capable of being forged, or rolled into blooms, slabs, billets or bars."

To-day we have four (4) main branches of the iron family:

Cast iron, which contains anything from two and one half (2½) to three and one half (3½) per cent. carbon, and is the product of the blast furnace without any refining, except remelting.

Steel which has been defined above, and for usual commercial purposes, such as structural steel bars, etc., has a carbon content of from .20 to .50 per cent. carbon.

Steel castings, or cast steel, which is a material very much the same as the steel mentioned above, except that it is cast into a mould, and intricate and massive shapes obtained, which cannot be manufactured by rolling.

Tool steel and alloys steel made by melting either in an electric or a crucible furnace, selected portions of bar steel with special chemical ingredients to obtain an extremely hard material capable of cutting and working other steels.

All the above are known as ferrous materials, ferrum being the Latin name for iron, and they are thus distinguished from the non-ferrous materials having copper, etc., as a base.

We have already mentioned Sir Henry Bessemer, who in year 1856 made known what was then called the method of making steel without fuel. The apparatus he used is that known as the Bessemer convertor. Roughly, the process consists of placing a quantity of molten iron in a vessel; air is then introduced at the bottom and blown through the bath of metal. The rapid combustion that ensues eliminates carbon and other impurities, and the working of the bath secures a thoroughly mixed material.

The shape of the vessel is very peculiar. It is suspended by trunnions between two high "A" frames, the air entering through one of the trunnions and being carried down to the wind box at the bottom. The wind box contains the bottom section in which are a number of small holes, ⅜ to ⅝ inch. in diameter, through which the air is forced into the molten metal. The bottom portion is made removable and special facilities are usually provided to enable bottoms to be changed without loss of time; their average life is from twelve to twenty operations, or blows, as they are termed. The other trunnion is used for attaching the necessary gearing for rotating the vessel, and the peculiar shape of the nose-piece is to enable the molten metal to be poured in when the vessel is laying in a horizontal position. The vessel is lined with firebrick, laid with great care, a lining may last from six hundred to one thousand blows.

The actual time to blow a charge of metal is about twenty minutes, but charging and pouring consume, perhaps, another thirty minutes, so that one blow per hour is all that can be counted on. Modern convertors usually have a capacity of from fifteen to twenty tons.

The metal is brought from the blast furnace in the hot metal ladle. The ladle is lifted up and the contents either poured direct, or by means of runners into the convertor, the blast is then turned on and the vessel turned to the vertical position. After blowing, the vessel is again rotated and the contents are poured into other ladles, and from this thence into ingot moulds. The blast is supplied by a blowing engine, or turbine, and has a pressure of from twenty to twenty-five pounds per square inch.

This invention of Sir Henry Bessemer marked an epoch in the history of steel making, for by it large quantities of steel could be produced at a time, but owing to the rapidity of the process the analysis of the material was not completely under control. It is quite true that practically all the carbon could be removed, and carbon in one form or another added in certain weights to give the desired results, but the other ingredients, such as manganese, silica, sulphur and phosphorus were not under complete control, and Bessemer steel lacked the uniformity that afterwards came to be desired, so a process known as "The Open Hearth Process" was perfected by Sir William Siemens about the year 1861. Fig. 2 shows a cross-section of an open hearth furnace, and before proceeding further we should become acquainted with the particular parts:

Furnace Proper. Note the heavy steel binding, and the manner in which the furnace can be rotated in order to pour the metal, and skim off the slag.

The Port Ends. The lower opening is for the gas, and the upper opening for the air. Combustion, of course, does not take place until the two intermingle in the furnace.

The Checkers. A mass of brickwork arranged with openings somewhat similar to the checker-work in a blast furnace stove. One checker is for heating the gas, and the other for heating the air.

The Stack, which provides the draft for pulling the gas through the furnace.

The Gas Inlet Valve.

The Air Inlet Valve.

Now, follow a complete cycle of operations, the gas and air come in through their respective valves, which are so set as to enable them to pass along the flues, through the checkers, up through the ports and into the furnace; they mingle and ignite, pass over the bath of metal in the furnace, out through the ports on the opposite end of furnace, down through the checkers, giving up their heat as they pass to the brickwork, through suitable openings in the gas and air valve into the flue and out of the stack. After operating in this manner for, say, twenty minutes, the valves are reversed and the gas and

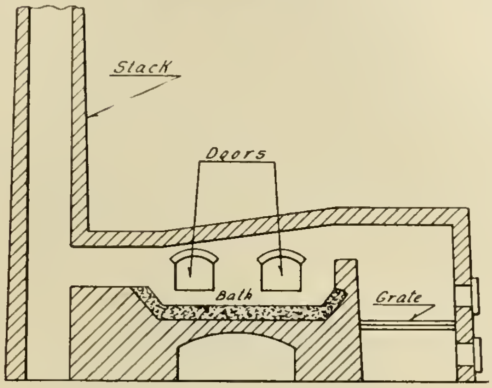


FIG. 1—PUDDLING FURNACE.

air take exactly the opposite path. When a furnace gets properly into operations, the air is pre-heated to a temperature of about one thousand degrees by the heated brickwork of the checkers. This process of obtaining heat from the waste gases is known as the regenerative process.

Not all furnaces are made of the tilting type. Many are stationary, and have a tap hole opened very much the same as a blast furnace. The brickwork forming the end of the ports is contained in a cage and made removable, so if the end of, what might be termed, the blow pipe becomes burned away, it can be replaced without stopping operations for a lengthy period.

Steel made by this process is, of course, known as open hearth steel, and the usual period to refine a charge of metal is from ten to twelve hours. At any time samples may be taken and analyzed, so that the metal is under complete control of the melter. Capacity of the furnaces varies from ty-five to one hundred tons.

There are two distinct open hearth processes: the acid open hearth process and the basic open hearth process. The furnaces, port ends, checkers, etc., are the same for both processes, except for a difference in the material forming the furnace bottom lining.

The different processes are to suit ores of varying qualities. Let us review the impurities in the raw materials:

1.—Carbon—which settles the class and strength of the steel.

2.—Silicon—desirable in correct proportions.

3.—Manganese—desirable in correct proportions.

4.—Sulphur—produces red shortness.

5.—Phosphorus—produces cold shortness.

The acid process takes care of low phosphorus and sulphur ores, while the basic process takes care of high phosphorus and high sulphur ores.

The Acid Process

The acid process aims at reducing to allowable limits the following impurities in the steel:

1—Carbon.
2—Silicon.
3—Manganese.

The sulphur and phosphorus is not eliminated, so the total furnace charge must not contain more of these constituents than is desired in the finished heat.

The process is one of oxidation, or burning, the carbon in the steel is oxidized to carbon monoxide, which further changes to carbon dioxide and passes off as a gas. The silicon and manganese are oxidized and form the slag that floats on top of the bath of metal and protects it.

The Basic Process

The basic process aims at reducing to allowable limits:

1—Carbon.
2—Silicon.
3—Manganese.

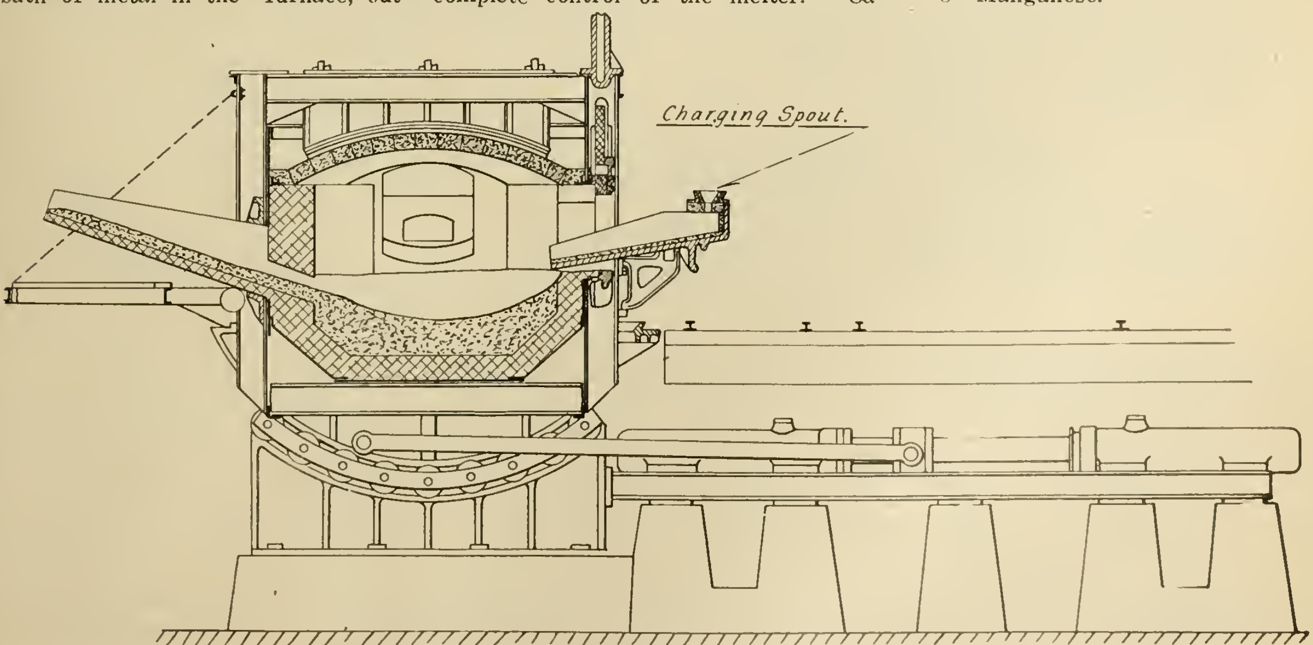


FIG. 2—CROSS SECTION OF 25-TON FURNACE.

4.—Sulphur.
5.—Phosphorus.

The first three items are removed in the manner described in the acid process, while the sulphur and phosphorus are removed by the addition of lime, which forms a slag to absorb them.

The charge of a furnace consists of hot metal, scrap and lime. The metal is poured in by means of a charging spout. The lime and scrap are charged by means of a charging machine.

This machine picks up a steel box full of scrap or lime, takes it to one of the furnace doors, pushes the box into the furnace, turns it over, dumping the contents and then withdraws.

When the heat is ready, samples having been taken and quick analysis made to determine the pouring, the ladle is placed before the furnace, the melter takes his position and with a signal orders the huge furnace to be slowly rotated, the silver stream of liquid steel breaks away from the bath, rushes along the pouring spout and plunges into the ladle.

The analysis of the metal is known, and the melter also knows what class of steel is desired, swift calculation is made and carbon in the shape of powdered coke, or coal added to correct; also manganese in various forms.

The ladle fills, the slag overflows and is caught in a pit or another ladle, then the crane hoists the 75 or 90-ton load and places the ladle over the waiting row of ingot moulds, the opening at the bottom is opened and the steel flows out and fills the moulds.

The moulds are all on cars, and after cooling are taken to the stripping crane, where the mould is lifted off and the ingot is then ready for the mills.

Before passing on there are one or two details deserving attention. A feature in the reversing valve is that the direction of the gas is reversed and the path of the waste gases altered by the one movement.

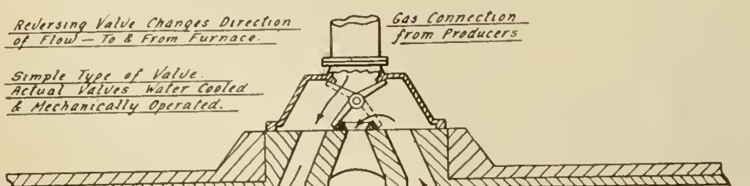


FIG. 3—GAS REVERSING VALE.

The pouring nozzle in the ladle, Fig. 4, which enables the metal to be poured from the bottom of ladle into the moulds.

In some plants the metal from the blast furnaces is taken first to a mixer, which acts as a reservoir and secures uniformity of product.

The usual fuel for open hearth furnaces is producer gas, made from bituminous coal, but coke oven gas and tar are sometimes used.

The gas producer is an apparatus for producing combustible gas by the incomplete combustion of solid fuel.

When the producer is in operation, the layer of ashes extend to a height of about three feet above the ash-pan, or to such a point that the top layer of ashes is kept opposite the sight-holes in the producer shell. The central blast tuyere is, therefore, surrounded by ash and protected from the heat.

A horizontal layer of incandescent coal from 2 ft. to 3 ft. thick commences at the level of the sight-holes. At this point the red-hot carbon, coming in contact with air and steam which have been superheated by passing through the glowing ashes, seizes the oxygen from both and is transformed into carbonic acid (CO_2), at the same time liberating the hydrogen from the steam. The carbonic acid passing upward seizes another atom of carbon from the hot fuel, forming carbonic oxide (or carbon monoxide CO), while part of the hydrogen from the steam will also unite with the glowing carbon, forming marsh gas (CH_4) or other hydrocarbons. In the upper layers of the coal a somewhat lower temperature prevails, but even at the surface of the fuel the heat is sufficient to liberate the rich volatile gases which are found in varying percentages in all bituminous coals.

To melt a ton of steel takes about eight hundred pounds (800 lbs.) of coal, each pound of coal makes about sixty (60)) cubic feet of gas (at 60° F.)

The great advantage of gas as a fuel lies in the fact that a low grade of coal can be used, that coal and ashes can be mechanically handled, and the gas and air heated before combustion takes place.

We have now followed the iron ore from its hiding place in the depths of the earth through the blast furnace where the major portion of its impurities are purged away, through the open hearth furnace where the refining is carried still further, and we now have ingots of steel weighing from three thousand (3,000) to eight thousand (8,000) pounds each. Before rolling, these ingots have to be heated in either a soaking pit furnace or a continuous heating furnace. They are then rolled, first in a mill, called a Blooming Mill, which reduces them from ingots of, say, sixteen inches (16 ins.) square to blooms 6 ins. x 6 ins. square. These blooms are then re-heated and rolled into billets, and the billets in turn rolled to the various bars required.

In the cast of steel plates, the ingots are cast in the form of a slab and worked between plain rolls until the desired size and length is obtained. Large structural members as "H" beams and "I" beams are rolled from an ingot

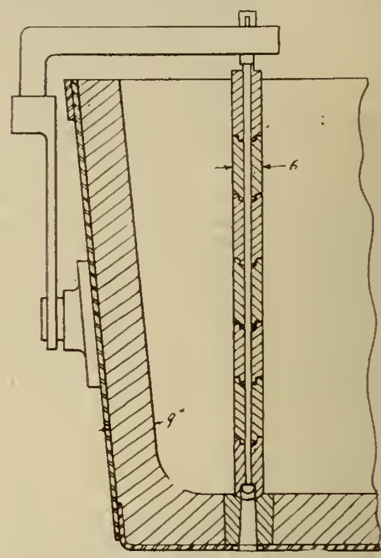


FIG. 4—SECTION OF A PRODUCER.

cast roughly to the contours of the beam.

The original mills with simple stands of rolls and the bars had to be placed between them and lifted from one pass to the other by man-power. Modern mills are provided with tables of all descriptions to eliminate this hand work and secure immense outputs.

CHARCOAL IRON

Charcoal iron is just the same as any other iron, because, as we have often pointed out, all iron is the same. The main characteristic of charcoal iron is that it is low in silicon. Iron, as we have said, is always the same, but the different brands of iron are the result of different metaloids which are associated with the pure iron, making strong or brittle, white or gray. In melting iron, it absorbs carbon from the fuel. It also absorbs sulphur. The sulphur tends to set the carbon, which is to say, it causes more of the carbon to be in the combined state. Silicon on the contrary tends to counteract the effect of the sulphur and free the carbon, but both sulphur and silicon are weakeners, and iron high in these two foreign substances will not be strong. If an iron can be produced which is low in sulphur it can stand to be low in silicon also, and still be soft and at the same time stronger than ordinary iron. This is where charcoal iron excels. Charcoal has not the sulphur in it and the iron consequently does not absorb it, thus charcoal iron can contain about 1 per cent. of silicon and be soft. Charcoal is not easily procured these times, but if an imitation can be produced with the proper silicon and sulphur content, all well and good. Sulphur tends to increase shrinkage, while silicon tends to prevent. Iron low in both makes good car wheel iron because it chills hard on the rim without shrinking unduly, causing cracks or strains.

BUSINESS BRIEFS

James Feasy, foundry superintendent for the Rustin & Hornsby Co., Limited, Lincoln, England, visited the foundries of Toronto before returning from his trip to the Philadelphia convention.

The Taylor & Forbes Co., of Guelph, are contemplating a considerable addition to their foundry.

The Standard Foundry Company, Buffalo, N.Y., have plans drawn for a foundry 80x140 feet.

The Packard Motor Car Co. of Detroit have awarded the contract for the erection of a foundry to be added to their plant.

Jenkins Brothers, Limited, 103 St. Remi street, Montreal, P.Q., have work under way on the construction of their new foundry.

H. Hooper, of Parry Sound, is building a foundry and equipping it with a thoroughly modern cupola and other equipment.

BRANTFORD, A LIVE INDUSTRIAL CENTRE

As a hustling and bustling manufacturing centre there is probably no city in Canada which has anything on Brantford. Foundries predominate, but intermixed with the foundry business is a little bit of everything else. Look where you will and you will see piles of brick and lumber, or a trench being dug for the foundation of a factory of some kind.

The foundry business which most concerns us, is in a fairly busy way in Brantford.

The Waterous Engine Works, while able to fill all orders, have recently taken on additional men in order to keep up to the increased volume of orders coming their way.

The Cockshutt Plow Co. have been busy right along, but are fairly well caught up with their work, but are not reducing their staff.

The Verity Plow Co. is still very busy and is taking on moulders.

The American Radiator Co. is running a full house and finding lots of business.

The Wm. Buck Stove Co. is working to the limit, running every floor, as well as emptying their huge store houses.

The Goold, Shapley and Muir Co. are busy on windmills, but not so busy on some of their other lines.

The flu is commencing to show itself again this fall, but in a considerably modified form. We have not yet learned which brand it is that we are having this time. Last season we had three different kinds, at least three different germs were working on the job. All the germs seem to have graduated from the same school, but go by different names. One is Pfeiffer's bacillus, another is pneumococci, while the third one is streptococci.

OBITUARY

It is with feelings of regret that we are called upon to chonicle the death of one of Canada's leading foundrymen in the person of Mr. James Thomson, who passed away at Hamilton on the evening of October 5 last. Mr. Thomson, who was president and managing director of the Gartshore-Thomson Pipe and Foundry Co., Ltd., Hamilton, Ont., was born at Cargill, Scotland, on the 17th of March, 1847. At the age of four he came with his parents to Canada and settled in Dundas, where he spent his school days, and ultimately served his apprenticeship as a molder at the Gartshore Foundry, which was then located in that town. In 1870, when the Canada

THE LATE JAMES THOMSON.

Iron Foundry & Pipe Works was built in Hamilton by Thomas Cowie & Co., he moved to that city and took a position as a molder, and later on as foundry foreman.

When in 1896 the Gartshore-Thomson Pipe & Foundry Co., Ltd., was formed and took over the business, Mr. Thomson was chosen as vice-president and managing director. In 1905 he was elected president and managing director, which position he held until his death.

Mr. Thomson was of pleasing personality and made many friends, by whom he will be greatly missed. Although a thorough business man, he was always an ardent friend and an admirer of honest sport, and was well known in curling and bowling circles.

"Financial hobo" is the name which is now attached to the man who used to be known as a promoter, and the definition given for the same is: "A man who sells nothing for something to a customer who thinks he is getting something for nothing."

CATALOGUES

The Stow Manufacturing Co., Inc., Binghamton, N.Y., have handed us their catalogue of appliances manufactured by them, including portable electric tools, electric motors and special machines; also the Stow flexible shafting. The book is well illustrated and shows how the motor can be carried about to whatever place it is required to do grinding, making it possible by the use of the flexible shaft to grind ponderous castings with the same ease as grinding small castings on an emery wheel. The portable motor and the flexible shaft can be used for grinding, drilling, tapping, or for running a power screwdriver, or cleaning castings with revolving scratch brush.

The Pangborn Corporation, Hagerstown, Md., have just issued a beautifully illustrated catalogue, describing their line of sand-blast and allied equipment, which covers everything which could be covered in this line. The illustrations include a veritable portrait gallery of their office and executive staff, as well as many views of their plant, showing the systematic manner in which the every detail of the operation of manufacturing is carried on, from the office on down to the finished article. The catalogue is well worth asking for.

The W. S. Rockwell Co., 50 Church St., New York, have issued a very useful steel heat-treatment chart, on which is given valuable data to anyone interested in this subject. We are informed that they will forward one of these charts to those interested upon request.

J. H. Williams & Co., makers of superior drop-forgings and drop-forged tools, with works at Brooklyn and Buffalo, N.Y., have just issued a catalogue, 4 by 6 inches, 160 pages, fully illustrating and describing their standard stock specialties. These include several lines of new goods, viz.: "Agrippa" turning-tool holders, set-screw pattern; "Agrippa" boring-tool posts; "Vulcan" forged-cutter tool holders, and several new assortments or sets of drop-forged wrenches.

The book contains, also, a description of the drop-forging process in very simple, non-technical style for the benefit of those not conversant with its details.

In Ohio a negro was arrested on a charge of horse theft and was duly indicted and brought to trial. When his day in court came he was taken before the judge and the prosecuting attorney solemnly read the charge in the indictment to him.

Then the prosecuting attorney put the question: "Are you guilty or not guilty?"

The negro rolled uneasily in his chair. "Well, boss," he finally said, "ain't dat the very thing we're about to try to find out?"—N. Y. Truth Seeker.

The Pattern Makers' Section: Making a Core Box

Being Second Instalment on This Interesting Subject by an Eminent English Pattern Maker in the "Foundry Trade Journal," London, England

By JOSEPH HORNER

CORE-BOX work, which includes curved and cylindrical sections, is more costly to produce than that in which the sections are rectangular. If cylindrical portions are straight, they can be finished with round planes of suitable radii; but if curved in plan, the whole of the shaping is thrown upon the gouges. A good deal of this is now performed in the larger shops by rotary cutters in pattern-makers' machines.

When an absolutely straight cylindrical section is departed from, the sections have to be worked in detail. In a comparatively plain box like Fig. 1, the halves being fitted with dowells and clamped with dogs, the circle for the diameter A are struck on both ends and worked right through with planes. Before planing, the circle for B is struck, to be cut inwards afterwards with a paring gouge, guided by lines on the joint faces, and checked with a template.

D and C follow, the guiding lines being on the joint faces only; firmer and carver's gouges being used. The templates are of semi-circular shape, or a set-square is employed, guided by the edges in the joint faces.

For the box in Fig. 2 a similar pro-

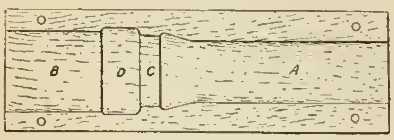


Fig. 1.

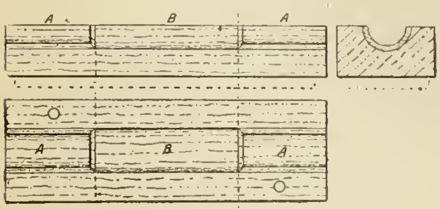


Fig. 2.

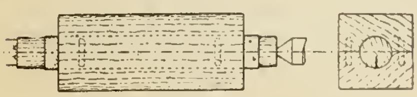


Fig. 3.

cedure may be adopted. The portions A may be planed right through parallel in the first place, and then B cut, using firmer-gouges. Since the bevel of the cutting edge, which is on the outside of the gouge, is the face in contact with the work, it possesses no guidance similar to that possessed by a paring gouge. A straight-edge is therefore used for longitudinal check in conjunction with a template or a set-square for circular truth. Another method is that illustrated. The box is planed parallel through to the large diameter B, and the pieces A are fitted within. These can be turned outside in the lathe, inserted, and worked with paring gouges

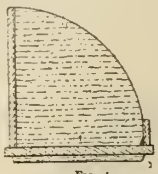


Fig. 4.

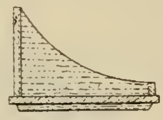


Fig. 5.

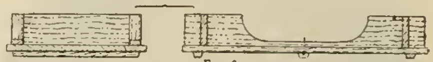


Fig. 6.

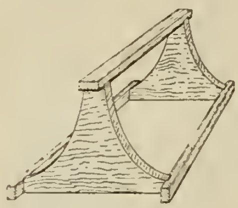


Fig. 7

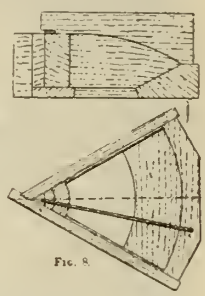


Fig. 8.

and planes. This method is accurate, and has an advantage from the point of view of alterations, since with the same recesses A, can be made smaller or larger as desired.

Another way to make such a box, and those of which it is typical, is to prepare it in three pieces, jointed as indicated by the dotted lines in Fig. 2, and unite them with a long broad batten screwed on the back of each half-box, shown dotted in the figure. Then B can be planed as readily as A. The batten is screwed on before any portion is worked. The box is marked out, the batten removed, the parts separated, and worked and then united permanently. This general method is applicable to boxes that are much more complicated than this, and which occur in the valve-chambers of pumps and in automobile cylinders. Jointing the sections where differences in dimensions occur, as well as those in shapes, saves a deal of scooping out with outside firmer gouges.

A large group of boxes which are curved in plan is typified by those used

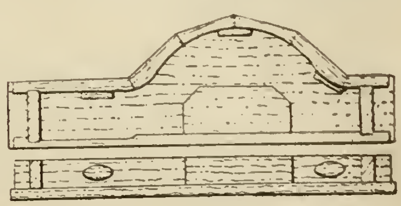


Fig. 9.

for socketed-bend pipes. This is almost wholly work for the outside firmer gouge, and templates must be used working from the lines marked in the joint face. But these are simple by comparison with some where the section frequently changes, and where the shapes in plan may include irregular curves and tapering dimensions. It is then often impossible or unwise to make joints to build up the box at each change of section. Extra care must be taken, as the metal in the casting is thinner. For example, if metal is intended to be only 3-16 in. or ¼ in. thick, error in cutting too deeply would thin it more seriously than if the thickness were ½ or ¾ in. In such cases, with castings of complicated shapes which are standardized, it is common practice to take specimen castings in lead, tin, or white-metal mixture, and saw them through in different directions to check the thicknesses, and alter the core-boxes where required. The permanent core-box is then frequently cast to avoid the risk of a wooden core-box going out of truth. In some cases cores are rammed in the patterns of metal, as in some light pipe-bends.

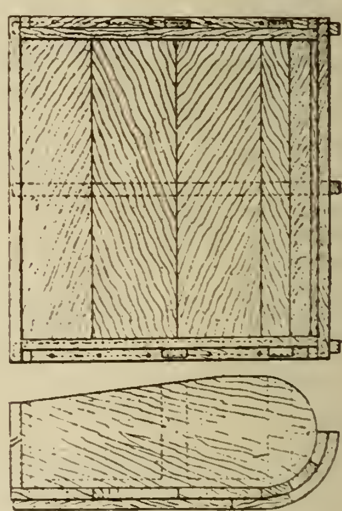


Fig. 10.

Whenever possible radii are inserted, or edges bevelled where sections of different diameters meet. But many such parts are facings for brass seatings and for valves which must be flat. A little taper must nevertheless be imparted to these for delivery of the core similar in amount to that given to patterns for corresponding depths, leaving it to the machinist to face them truly.

Box halves of the shapes now being considered are prevented by means of dowells from being shifted during ramming. There is some risk, if wooden dowells are used, of the box edges losing their coincidence by the wearing and working loose of the dowells in their holes. For this reason those of brass or malleable cast-iron are to be preferred. Halves are held during ramming with clamps of wood or iron.

To remove the marks of the planes or the gouges from cylindrical boxes a rubber is used, Fig. 3, ran between the lathe centres, with the halves of the box held closed over it with the hands. A strip of glasspaper is inserted in a saw-kerf cut along the rubber and encircles it. The box must be traversed to and

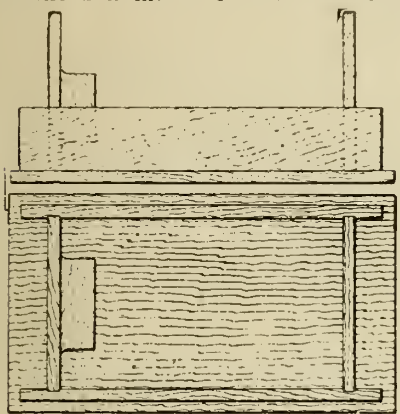


Fig. 11.

fro slightly over the revolving rubber to prevent the formation of grooves.

A considerable amount of work, timber and time are saved in many core-boxes by the application of the method of strickling to the formation of curved outlines, instead of cutting those outlines in timber. In some of these cases the box frame is a mere skeleton. Thus, in Figs. 4 and 5, instead of forming the curved portions in blocks of wood, the ends only are cut to the curves required, and a strickle worked along the edges imparts the shapes to the cores. Such boxes can be made in one-fourth the time that would be occupied in shaping the curves in timber, and are just as accurate. The principle has many applications.

In Fig. 6 the deep concavity is formed by strickling in preference to fitting a thick block to the shape. The frame lies on a bottom board. Not because the face of the board is necessary, but in order to afford support to the weak box sides. Fig. 7 shows a box having two ends curved to guide the strickle. To block up such curves would entail a useless expenditure of timber and time. In Fig. 8 the sides of the box have the top edges cut to the curve of the arms of a bevel wheel made in cores, the teeth being moulded by machine. A strickle worked round and set against a register on the boss-piece imparts the curve to the top face of the core. In Fig. 9 the curved portion is shown as formed with blocks, and the box frame is laid on a bottom board. Here the reason for abandoning the strickle is to have timber to which may be attached the three prints. Alternatively, the curved edge might be strickled, in which case the prints would have to be carried on strips of wood dowelled on the box edges. Fig. 10 shows a box for the main core of a condenser. Here a portion of the curved end is made up with block-

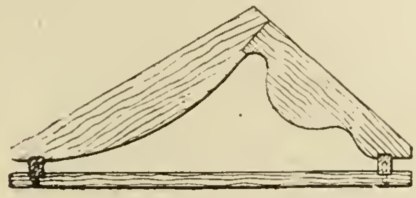


Fig. 12.

ing to afford support to the sand, but the other moiety is strickled.

Fig. 11 is an illustration of the box for a hooded cylinder. The ends provide the curve for the hood, along which a straight strickle is worked. A bottom board is convenient to keep the frame true. It is often necessary, as when guide-blocks for the cross head are required. Fig. 12 is the core-box for the crank-shaft bearing in one type of engine bed. The box may be made as shown, or alternatively it may have two sides with edges cut to the curves to be strickled. Fig. 13 shows a box for the exhaust port and chamber for a low-pressure cylinder. The curve of the ends on which the strickle is worked gives the metal thickness in the cylinder body. The general construction is indicated by the shaded timber.

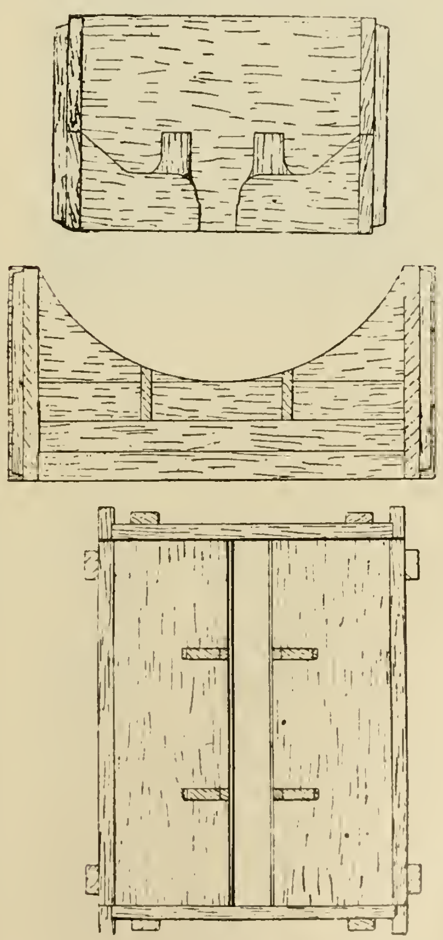


Fig. 13.

CAN YOU GET PAST YOUR FOREMAN?

From "The Sphinx Talks," the house organ of Miller, Franklin, Basset & Co., of 347 Madison Avenue, New York City, we clip the following editorial, which should be of exceptional value to those who are employed at foundry work as well as workmen in every kind of industry. It is written by Mr. Basset, who is himself a member of the company and is aimed at the executives of manufacturing concerns, and if heeded, might be the means of averting many unpleasant misunderstandings between the manager and the men. Following is the article:

"Do you know what your workmen call you?

" 'The Boss.'

"And what they call the department foreman?

" 'The straw-boss.'

"That's quite a sidelight upon how they regard foremen—as one with a mere resemblance to the real thing, without being of the real substance—men of straw!

"Ask an ex-private of the A.E.F. who it was he swore to kill just after getting his discharge, and he will tell you, 'The top sergeant.'

"For the commissioned officers over him, it's a safe guess he has little but good to say. His captain looked out for his welfare and treated him well, for it's usually an attribute of those accustomed to giving orders—to ruling, if you will —to give reasonable orders, to be reasonable and approachable. They have learned to give orders in a way and a tone which is inoffensive.

"It's the non-commissioned officers, those but lately raised above the run of men, who are least considerate of their late equals.

"They seem to feel that to be obeyed they must give orders in an overbearing offensive way. They are not sure enough of the newly-achieved authority to assume that obedience will follow an order.

"What is true of an army is true in a factory. A foreman comes from the ranks of workmen and fears usually that Tom and Bill, with whom of late he fraternized, will not take orders kindly from their old pal. So to add effectiveness the new foreman removes himself from familiar contact with them, wears a forbidding frown, and adds a bit too much tone of authority to his orders. Perhaps there is, too, just a little desire to 'rub it in.'

"Whatever the mental processes may be, it is certain that between the stockholders of an enterprise and the men in the shop the foremen provide the greatest barrier. In fact at this point there is both a barrier to be overcome and a gap to be jumped.

"Strange to say, but little effort is made to close up that gap and to lower the barrier. Owners hold conferences as a matter of course with superintendents. They in turn commonly hold 'foremen's meetings,' at which they, with considerable success pass their ideas along and find out what the foremen think their men are thinking.

"But the foremen seldom unbend to their subordinates. So, for lack of the contact between men and foremen, the policy of the owners seldom get to those who can make or break the business.

"How often have owners seen conditions clearly for the first time, when visited by a committee of striking workers!

"It is partly a realization of this fact —a subconscious realization of it I believe—which has led a few clear-seeing owners to organize their plants under a form of industrial democracy.

"Some have gone so far as to give the men a say in the management of the plant—while giving the foremen no say. Others have the workmen elect from their own number a 'house of representatives,' while the foremen elect a 'senate.' Either way is good.

"The point is that workman representation gives the men an opportunity to jump the gap, to climb over that barrier between themselves and the management —and so to get their ideas, needs and viewpoint to the owners, with no danger of being stopped by petty foremen.

"With the assurance that they can speak freely without hurting themselves, the men offer many suggestions that improve production and reduce costs. The trouble has been in the past that their suggestions have often not been welcomed by the foremen and the only way the workmen could get the ear of the management was through the foremen.

"You may feel that it is not yet safe to give the workmen a chance to help you manage. Perhaps you don't believe they have much to offer. But you certainly must wish your men could know how decent a chap it is they are working for.

"So, if you don't want to put in a plan of Industrial Democracy, you can at least let the men elect committees to confer with you—thus jumping the foremen barrier.

"Foremen cannot be eliminated. Direct supervision is needed and foremen must give it. They must also be teachers and sometimes disciplinarians, but they should never be barriers.

"A manufacturing business should not be a steeplechase course. It should be a smooth track with no obstacles between the men and the manager."—W. R. Basset.

LOAM MOULDING

SOME few months ago we had some articles on loam moulding, but dropped the subject for some unknown reason. Now that the winter months are drawing near and the moulder will sit tight around the fireside after his evening meal is over, we will try and interest him in this oldest, yet most interesting, branch of the moulder's art. When I say art, I mean it, because moulding, in any of its branches, is more of an art than a trade, and loam moulding is, will I say? nothing but an art. The artist or sculptor who can model his subject in clay would find loam moulding but very little different. Supposing he wished to make the bust of a man, for instance, he would take his block of stone and cut it to the proper likeness, or he will take plastic clay and fashion it into the proper form. Now, supposing he had intended to make a cast bust, he would take this same plastic clay and fashion it, not in the shape of his desired model, but plain on the outside and with an opening of the proper design on its inside. This has been done by making the model in wax after which the clay is placed against the wax. When the clay work is done the wax can be melted out, leaving the opening of the proper shape to pour any material into, thus forming the desired cast. If he had not made the wax model he could have worked directly on the interior of the mould, in which case he would require the same artistic skill as in forming the model. This is exactly what a loam moulder has to do from an artist's standpoint, but he has other things to consider, which require equally as much skill. He must guard against strain, due to the pressure of melted iron, and he must also bear in mind that wherever there is fire there will be gas of some kind, and the gas must either get away, or else it will remain and occupy space. For this reason the clay which is used must be porous, so that the gas can escape, and it must be thoroughly dried, so that steam will not be added to the gas. These are in the main the principles on which loam moulding is based. A loam mould could be made entirely of loam, or it can be made by plastering the loam onto the inside of a casing, or a hole can be dug in the ground and the loam can be built against the wall of this pit, but the cheapest and best method to be followed in the general run of cases is to have a foundation plate of iron, onto which a brick wall is built to conform with the desired shape of the mould, but slightly bigger, so as to admit of plastering it with the loam mixture and shaping it to the exact measurements required. Thus, if a brick enclosure of any size or shape is built and plastered on the inside, and metal poured into this plastered enclosure, the casting will be of the same shape as the enclosure, provided that the gas got away and the plaster remained on the wall. Suppose we wish to make a roller or drum, 30 inches in diameter. If we have the spindle and steps which would be used in doing green sand work, we plumb up the spindle and attach a sweep board so as to make the mould exactly 30 inches + the shrinkage, which would be about a quarter inch, or slightly more. We would then build the brickwork a good half inch all round bigger than the sweep. The bricks of which the wall is built should be soft building brick, not fire brick. The mud in which the bricks are laid is just gangway dirt mixed with water. This makes a porous wall, through which the gas will easily escape. The loam mixture is now spread on by hand and swept to shape with the spindle sweep, after which it is slicked to a finish, blackwashed and dried. Now, this is just a crude rudientary lesson on loam work. In next few issues of CANADIAN FOUNDRYMAN we will describe and illustrate some interesting work in loam, by British loam moulders, who know their business. Loam moulding is not practised in Canada to anything like the etxent that it should be, and it is to be hoped that our readers will interest themselves in these articles, as many jobs can be done in loam to better advantage than by any other means.

BOOZE VS. COFFEE

To all appearances the booze question is a thing of the past. By a vote of the people of the province it has been decided that we do not need strong drink. After quite a long spell of enforced temperance it has been decided by the majority of the people that we had not suffered any hardships which would balance up to the hardships which had been caused through intemperance, and while it may be a breach of a man's personal liberty, it is evidently the will of the people as a body. Now that we can not get it, we will have to break ourselves of the habit of wanting it and see what we can find as a substitute. Of course, to the rank and file of the foundry workers, it does not count, because the expression "Drunken molder" was long ago an extinct or defunct expression, as far as actual facts are concerned. As a matter of positive fact, a whisky-drinking molder was an exceptionally scarce article, and if a molder, after a hard day's work, took a glass of beer, he did so to quench his thirst and revive his strength, but not with a view to becoming intoxicated. However, there are other things which can be used as substitutes, and among these we might mention coffee. Coffee has a history dating back as far as whisky. Perhaps it will be better appreciated if better understood.

The ordinary coffee plant is a native of Abyssinia, and as such was used as a beverage, both in the wild and cultivated state, from time immemorial. It was carried into Arabia about the beginning of the fifteenth century. From Arabia it was carried to all parts of the Mohammedan world by the Mecca pilgrims, who found in it a happy substitute for the alcoholic beverages forbidden by the Koran. The first authentic mention of it by a European was by a German physician and traveler, on his return from a tour through Syria in 1573. It was brought to Venice by a physician in 1591. It is referred to in 1621 by Burton in his "Anatomy of Melancholy," as follows: "The Turks have a drink called coffee, so named from a berry black as soot and as bitter, which they sip hot because they find by experience that that kind of drink, so used, helpeth digestion and promoteth alacrity."

Audible Electric Signals in Industrial Plants

An Extract From a Paper Presented Before the Rochester, N.Y., Section of the American Institute of Electrical Engineers, Also Before the Erie Section of the Same Organization

By V. KARAPETOFF, Professor of Electrical Engineering, Cornell University, Ithaca, N.Y.

NO industrial plant of any magnitude may be considered fully efficient unless means are provided for promptly locating any important employee, no matter where he may be within the plant. A private telephone system, however extensive, serves this purpose only as long as the needed man is at his desk, but as soon as he leaves his desk the problem of locating him becomes a hit or miss proposition. On the other hand, a superintendent, a foreman, a millwright, a repair man, etc., is ordinarily useful only in so far as he can freely move about the shop without the fear that someone of importance may need him. Thus, within the last few years, under the tremendous impetus of the pressure for an enormous increase in the production of munitions of war, audible electric signals have been introduced into many industrial plants.

Such an electric signal is usually similar in construction to the familiar electric "horn" used on automobiles. It consists of a diaphragm with an anvil at its centre. A toothed wheel driven by a small electric motor strikes the anvil many times a second and causes it to vibrate vigorously. These vibrations produce the well-known warning tone, which carries over a considerable distance. The device is provided with a projector or horn, the shape of which depends on whether it is desired to scatter the sound, to intensify it in horizontal direction, or to deflect it downward. Such motor driven signals are now made much more powerful than automobile horns, and are wound for 110 or 220 volts, direct or alternating current, so that they can be connected to a lighting or power circuit, and do not require a separate low-voltage battery.

With such electric audible signals scattered throughout the plant, it becomes an easy matter to locate instantly any person to whom a code number has been assigned. For example, when the manager wishes to speak to one of the assistant superintendents, who may be anywhere in the plant, he simply tells the telephone operator to sound this particular man's call. As soon as this assistant superintendent hears his call, he comes to the nearest telephone, whereupon the operator connects him with the manager.

It would be rather inconvenient for the telephone operator to sound various calls by hand; therefore a special code-calling automatic instrument has been developed for this purpose. The operator merely sets the desired person's code number on a dial and pulls a lever, a contact making mechanism is thereby set in motion which closes the electric circuit and operates the code signals throughout the plant the required number of times (usually three times) and then stops automatically.

In noisy and in open places, or in large factory lofts, the electric horns mentioned above constitute the most suitable type of signal. In offices they may be replaced by less loud electric gongs, bells, buzzers, air whistles or incandescent lamps. In some cases two separate circuits are run from the code-calling mechanism, one circuit for ordinary calls, the other for fire alarm gongs, or for some other special purpose. Sometimes two allied plants are operated side by side with a separate staff in each. Then the same code combinations can be assigned in both plants, but the horns in one or the other plant will sound according to which of the two circuits is closed.

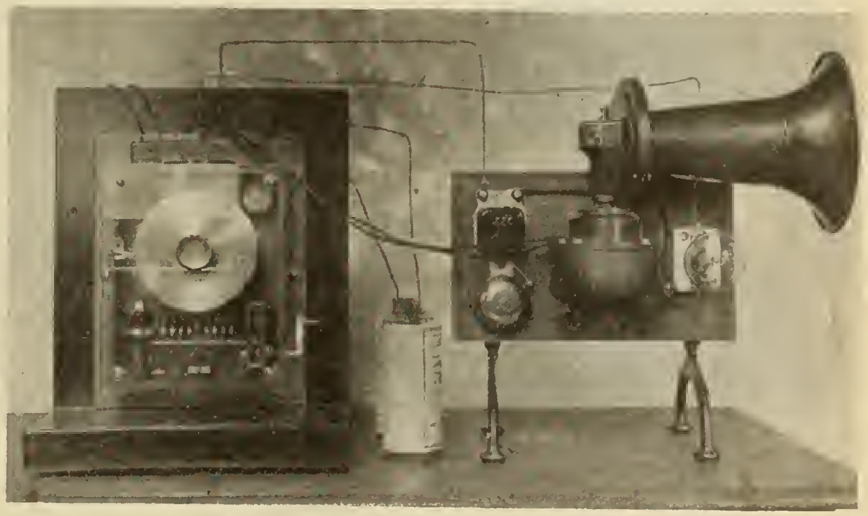


FIG. 1—KLAXOCATOR, ACTUATING AN ELECTRIC HORN, A BELL AND AN ELECTRIC LAMP.

A further application of loud electric horns in industrial plants is for extensions to telephone bells. The ordinary telephone ringer is not loud enough in many shops when the foreman is away from his desk. In this case a relay is connected in parallel with or in place of the telephone ringer, and when it is actuated it closes a secondary circuit which causes an electric horn to sound. This call should be a single blast to distinguish it from code calls.

Audible electric signal systems are also used in various plants as warning signals on cranes and hoists, also to call a shifting locomotive, to indicate the beginning or the end of a certain operation, or for other local purposes. Like in the case of any convenience, once such an electric system has been installed, the superintendent, the foreman, and even the operatives themselves will find new uses for it.

Editor's Note:—At Fig. 1 is shown one of these code-calling instruments. The name given this instrument is that of Klaxocator, and the signals which it actuates are an electric horn, a bell and an electric lamp.

LOWERING A HEAVY STEEL PLATE

By H. J.

An interesting engineering operation is reported concerning the lowering of a heavy steel plate at the gas works of the Consolidated Gas, Electric Light, and Power Company of Baltimore, Md. The plate, which is to form the bottom of the tank containing the new gas-holder, is 219 feet in diameter, and weighs 234 tons. It was delivered in the form of ⅝ in. sheets of steel plate averaging 12 feet by 6 feet. These plates, supported on wooden troughs, were riveted together until the circle at the bottom of the tank was completed. To lower this huge plate, 150 giant jackscrews were inserted at regular intervals throughout its area. The wooden supports were then removed. A man at each of the handles of the jackscrew awaited the signal to turn; a signal-man at the centre of the plate struck a piece of steel with a hammer, and at each stroke the 150 men made a half turn on the 150 jackscrews. The work of lowering was accomplished in 32 minutes.

ACID-PROOF CEMENT FOR PIPE FITTINGS

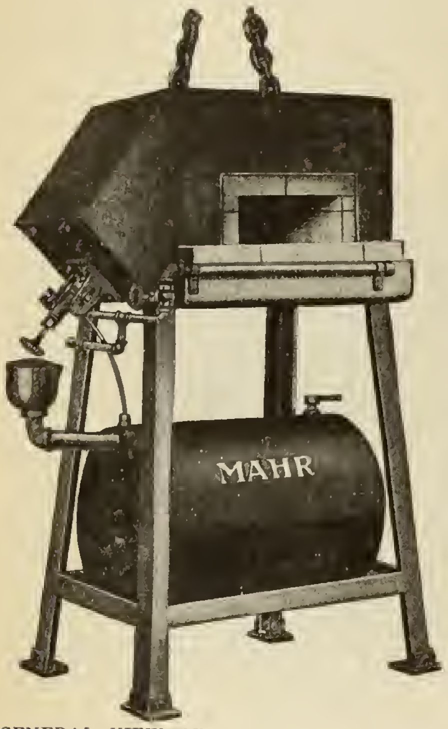
An excellent cement for packing the joints of piping or vessels containing strong acid solutions is made by mixing equal parts of asbestos fibre, linseed oil, and white lead. For weak acids the cement can be cheapened by the addition of clay.

Description of a Mahr Calorizor and Furnace

Oil Burning Furnaces For Forging and Heat Treating Purposes Are Rapidly Becoming the Usual Installation in the Industrial Plant of To-day. This Describes One Such Furnace

By J. H. RODGERS, Associate Editor Canadian Machinery

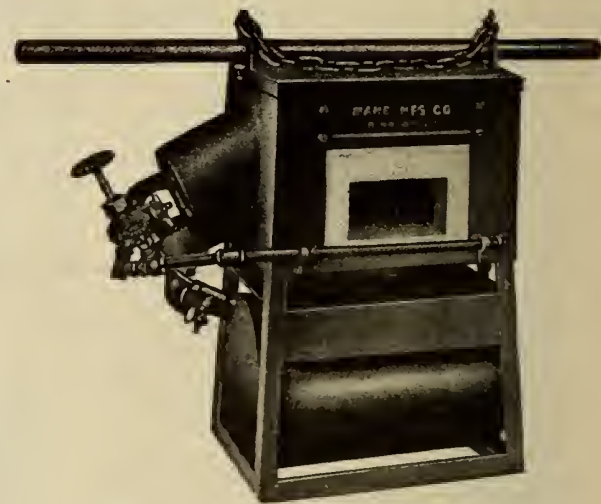
THE oil-burning furnace, for forging and heat treating purposes, is rapidly becoming a very essential feature of present industrial enterprise. The necessity of scientific application of heat in the treatment of shell forgings, to conform to definite specifications relative to the manufacture of munitions, has demonstrated the advantages that could be derived from a better knowledge of this branch of engineering practice. The acceleration of efficiency in the construction of furnaces during the war, was amply illustrated in the improved designs that were in successful operation at the close of active shell production. Experience, coupled with the study that has since been given to this all important unit, the oil-fired furnace, has enabled engineers to make further progress along these lines, and faulty design is gradually being eliminated and being replaced by improvements that will eventually establish the extreme economic value of this particular type of furnace.



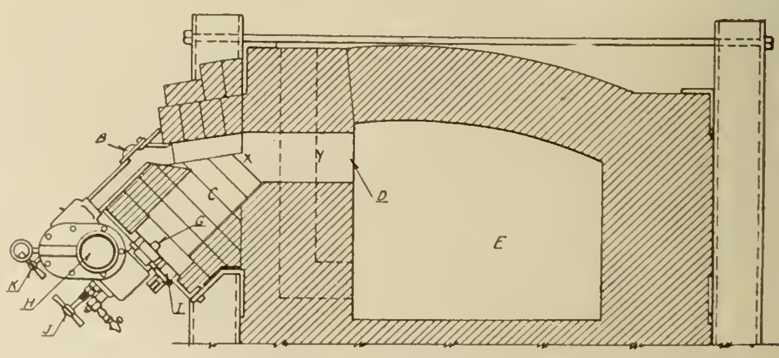
GENERAL VIEW OF THE MAHR FURNACE.

In many styles of furnaces the actual heating chamber, in which the parts are subjected to the heat treatment, is likewise utilized as the combustion chamber, and the inevitable presence of oxygen necessary for combustion, invariably results in oxidizing the metal in the furnace. This has always been a serious factor in the process of heat treatment of steel or other metals, and unless extreme care is exercised, the resultant effect of oxidization is frequently costly and inconvenient.

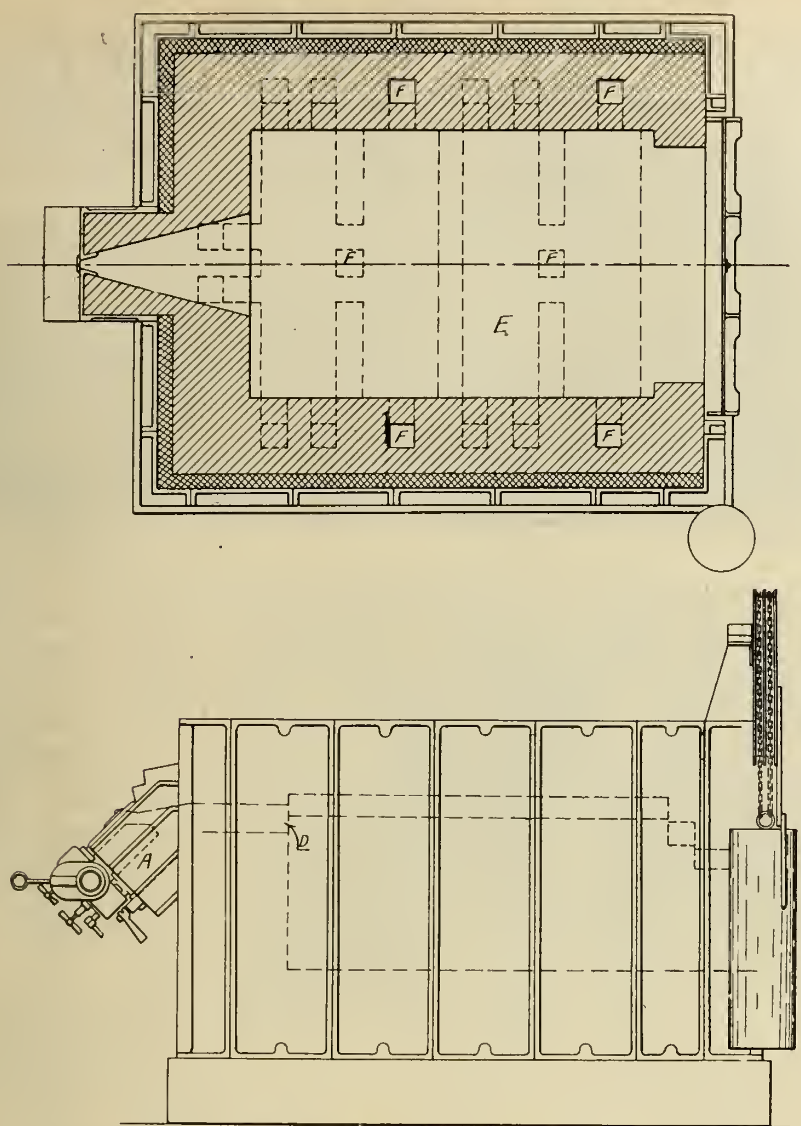
Realizing that a high efficiency furnace must be one in which the oxygen in the fuel mixture would be entirely consumed before coming in contact with the work in the furnace, the Mahr Manufacturing Co. of Minneapolis, Minn., have perfected a design of furnace in which the above requirements have been met. Apart from the method of carrying off the waste gases, the general design of the furnace proper differs little from those of other makes, but it is the design and construction of the burner and the combustion chamber that gives to the furnace its individuality and economic value.


A TYPE OF FURNACE OF LOWER CONSTRUCTION.

It will be seen from the illustrations that the calorizor A is attached to the outside wall of the furnace in such a position that the opening D into the furnace is located near the roof of the heating chamber E. This permits of a swirling movement of the gases as they distribute to all sections of the heating chamber. Even after the gases have done their initial work, the surplus heat is still further utilized by a special arrangement of the outlet flues F, F, etc., as these circle the fire chamber, through the brickwork, before passing to the atmosphere—a decided improvement over the old method, where the waste gases passed directly through the roof.

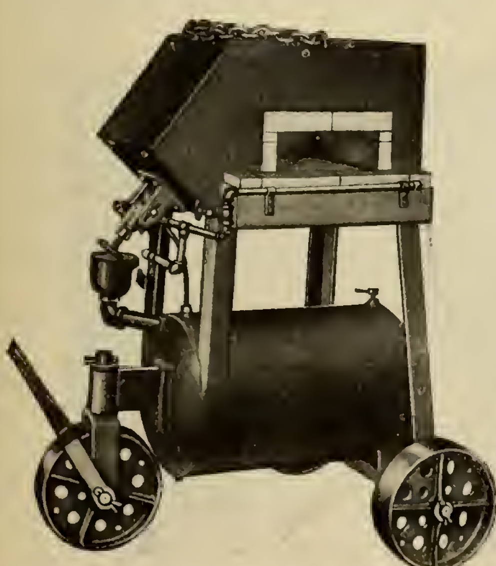

SECTIONAL VIEW THROUGH THE FURNACE.

A brief description of the action of the calorizor may be given as follows: . The oil enters the combustion chamber through the oil nozzle G, and is atomized by the main air supply entering at H and passing into the combustion chamber around the oil nozzle. The atomized oil, having been lighted through the lighting hole I, receives a further supply of air through the lower air valve J. The effect of the due adjustment of these valves is to carry the flaming gas up to the point X, where it is met with an additional supply of air entering through the upper air valve K, this second current of air completing the combustion at the point approximately marked Y, at the same time giving the hot gases, so produced, the necessary velocity to carry them across, and circulate through the heat chamber. In the lower duct, between the oil nozzle G and the point X, the atomization and the combustion should be carried well forward, but the supply of air should not be so great as to draw the flame entirely away from the lighting hole pocket. The peep hole is shown at



PLAN AND ELEVATION OF THE MAHR CALORIYOR AND FURNACE.

B. If the above directions are closely adhered to it is claimed that but a short tongue of flame, at most, will find its way into the heating chamber, and the gases therein will be so free of oxygen that no oxidization of the metal will take place. The even distribution of the heat is aided by the fan-shaped calorizor duct, where it enters the furnace. The action of the calorizor is similar to that of the carburetor on an automobile, where the latter is fitted with independent air valves. For satisfactory operation of these calorizors it is only necessary to have an air pressure of about 8 ounces, supplied by means of a blower. In general, the Mahr calorizors are uniform in size, but in the smaller furnaces and portable forges the calorizor is built into the furnace frame, while for the large furnaces the calorizor is a separate unit and can be located as desired. These furnaces are made in various types and sizes, including rivet, flue welding, forging, annealing and hardening types of every description. The James Buckley Company, of Montreal, are the exclusive Canadian agents.



A PORTABLE OUTFIT

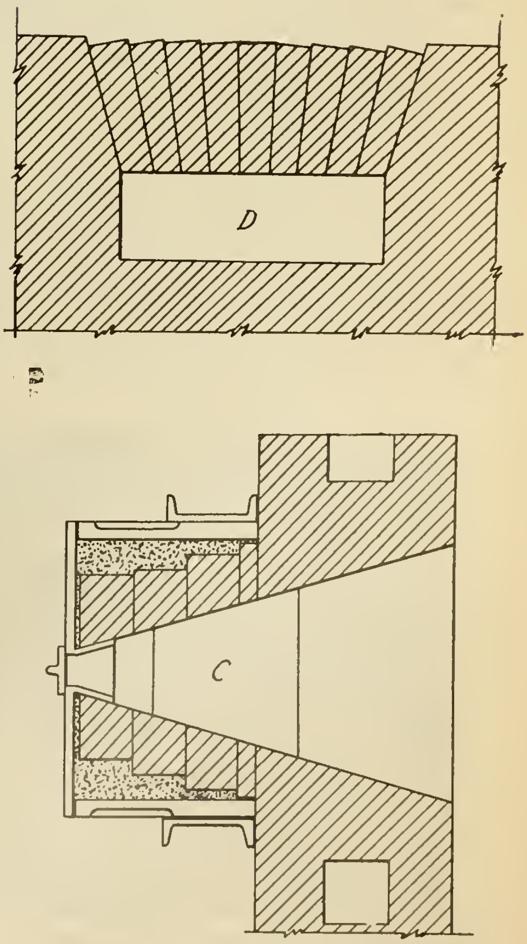
EXTENDING FOUNDRY

The Perfect Machinery Co., Galt, Ont., is extending its foundry building to double its present size to cope with the greatly increased demand for their machine tools.

Nova Scotia Output Increases.—The Nova Scotia Steel & Coal Company show an increased production for the month of October. The total was 56,507 tons. This is an increase of over 4,000 tons over September. The output for each colliery is as follows: Princess, 15,320; Florence, 21,913; Scotia, 8,184; and Jubilee, 11,507 tons. The output for the whole Dominion for the month of October was 280,000 tons.

Bull's Metal and Melloid Co., Ltd., Yoker, near Glasgow, Scotland, Admiralty contractors, are distributing their circular describing the lines which they produce, which includes "Melloid" bars, tubes, etc. Bull's white metal "B" for lining crank, thrust and funnel bearings. The circular also shows illustration of the company's plant, which includes a foundry where castings are made from the metals which they produce, which includes propeller wheels, etc.

Building Foundry. — Burnett and Crampton, Rigaud, Que., are planning a new foundry capable of turning out 250 tons of castings a month. They will install molding machines and equipment of the most modern type for producing machinery castings, mill and mining equipment and general castings.



DETAILS OF REFRACTORY CONSTRUCTION.

Handling the Product by "Trucktractor"

A Very Novel Adoption of a Tractor and Truck Combination is Herein Described. Moving Freight Cars, Trailers or Other Vehicles Becomes Part of Its Day's Work, or It Can be Used Independently if Desired

By HARRISON JENKINS

A VERY interesting adoption of the tractor and truck combination as suited to shop conditions is shown in the various illustrations throughout this article.

The Clark Tructractor Co. of Chicago, Ill., are the makers of this type of truck, and Fig. 1 shows a separate view of the apparatus.

These trucks have proven themselves to be great labor savers, and well adapted for use in the machine shop and foundry. Such firms as the Hyatt Roller Bearing Co., Clark Equipment Co., Stewart Motor Truck Co., Barney-Floyd Co., Ohio Steel Foundries, National Malleable Casting Co., Jeffery Mfg. Co., and others, have found this truck a wonderful time saver.

Its flexibility is a big feature, as it can turn on a very short radius (see Fig. 2), which is a decided advantage in many cases. The design is such that the truck body is built so close to the ground, and is so powerful that it can be used for every purpose from carrying a full ton load of shavings from the lathe, foundry sand, red hot forgings or castings, finished or unfinished parts from one machine to another or between plants. It will operate on rough roads as well as on factory floors. It will plow through snow or mud, through foundry sand, or on oil-sodden floors.

It is built and put together by efficient and highly experienced workmen, under the supervision of high-class engineers, and made to stand up under the most severe industrial service.

Some of the tasks it has been performing for the past year and a half are as follows: Moving freight cars, heavily loaded trailers, and carrying loads up to a ton and a half constantly—day after day—without breakage or mechanical troubles. The fact that it operates on 8 gallons of gasoline, ordinary working day, makes it a most economical machine.

FIG. 1.—GENERAL APPEARANCE OF THE TRUCK.

Its ability to run 24 hours a day without being laid up for recharging and its economical operation, coupled with the lack of breakage, makes this machine an exceptionally efficient and satisfactory one for commercial purposes.

The fact of its having nine and one-half inches of ground clearance and an abundance of power, makes it possible to manipulate on rough ground, foundry floors, factory yards and bad roads. Sand and mud do not prevent this machine from successfully and quickly performing its duties under all weather and factory conditions.

Its great range of speed (from ½ of a mile of 15 miles per hour) permits the Clark tructractor to creep through congested places and around sharp corners, deliver its load exactly in the place desired, without danger to machinery or employees, and to run at high speed through open places and in the traffic of roads and city streets.

One of the machines was recently driven from Buchanan, Michigan, to Chicago, Illinois. This machine was stopped at several of the large industrial plants on the way and most interesting demonstrations were held. It covered a distance of 143 miles in one

FIG. 3.—USED IN CONJUNCTION WITH THE TRAILER.

FIG. 2.—TURNING IN A SHORT RADIUS.

FIG. 4.—USING THIS TYPE OF TRUCK IN THE FOUNDRY.

day and arrived in Chicago in first-class condition, ready to begin regular routine work in one of the well-known institutions.

The fact that this machine is built entirely of metal and that its centre of gravity is very low, makes it a most satisfactory one for foundry and forge shop use. Extreme changes in temperature do not affect its operation. Hot castings and forgings can be carried from one section of the plant to the other—quickly and without damage to the machine. It thus speeds up production, prevents congestion and increases the efficiency of these plants. It has a surprising drawbar pull and is capable of moving loaded freight cars without straining any of its parts. Heavy trailers are transported from one part of the plant to another at high or low speeds, ranging from ½ mile per hour to 15 miles per hour.

The truck is very simple to drive and operators soon become efficient and dart in and out of narrow doorways, here and there among the machines, into the sand blast rooms, about the foundry and along the highways, carrying material from department to department—from foundry to the shipping platform or station.

It has a carrying capacity of one and a half tons, and is supplied with either platform, cargo or dump body.

Other information desired will be given on request by the makers of this truck.

A Detail Study of the Manufacture of Silica

A Complete Description of Its Analysis, Density, Porosity, Temperature, Etc., Are Contained Herein. To Those Interested in Such a Subject, This Article Should be of Keen Interest

By M. E.

THE manufacture of silica products employed in the Martin or similar furnaces is carried out with compact siliceous rocks, suitably ground, about 2 per cent. of slaked lime being then added, with sometimes a little clay or ground bauxite, and the whole is worked up into a body which can be moulded directly in metal moulds or by means of a machine press which gives sharp angles; it is not necessary to employ a powerful pressure. The pieces are afterwards dried, then carried to as high a temperature as possible in the kiln. The silica products met with in commerce can be arranged in three broad categories: (1) Those which include large grains; (2) those which include medium grains; (3) those which include small grains. These grains of rock, large or small, are all surrounded by a fine mass made by the mixture of finely ground lime and silica, forming a kind of cement adhering to the grains of rock.

Analysis of silica products can be made by two processes; either by the quantitative analysis of each of its elements, or by estimation in the state of sulphates of the elements of other than silica. In this last process, which is rapid but imperfect, the lime, alumina, etc., are treated all together, without paying attention to their proportions, but it is indispensable to know the quantity of alumina contained in these products, for, if it is in excess, it brings about a lowering of the softening and fusion points.

Physical studies of silica products comprise observations on changes of volume, density, porosity, and mechanical resistance under the influence of high temperatures. For this purpose tests are carried out: (a) On products such as proceed from factories; (b) on the same products submitted to 1,710 deg. C. for an hour or two, or to 1,650 degs. C. for the time necessary for their complete expansion.

The tests on products made by the trade include determination of density, porosity and resistance to crushing at ordinary temperature.

Density.—Apparent density and absolute density are measured; the measure of this last provides a first indication on the thermal conditions in which the product was burned. The density of quartz is about 2.66; under the action of heat, when it attains its total increase in volume the density is about 2.32. Quartzites present analogous results. The density of flint varies between 2.60 and 2.62; after burning at a high temperature this density is no more than 2.22. If, for example, this absolute density is not above 2.45 to 2.50, it is certain that the burning has neither been high enough nor long enough; if this density is below 2.40 and tends to approach 2.35, their burning can be considered satisfactory. Silica products based on compact flint present smaller absolute density, which should approach 2.25 and tend towards 2.22.

Porosity.—Porosity is determined by finding the weight of water which the very dry siliceous product absorbs during a stay of twenty-four hours in water. Porosity depends on several factors, and particularly on the nature of the rock, the size of the grains, the composition of the cement, etc. Certain bricks have a porosity of 8 per cent.; others have higher porosities, sometimes reaching 20 per cent. This porosity should increase when the products are heated to 1,710 degs. C., if they are of good quality, too great a porosity facilitates absorption of slags in the Martin furnace, and accelerates wear of the bricks.

Resistance to Crushing at Ordinary Temperatures

The resistance to crushing is very important. In Martin furnaces, and especially in the arches, the part of the products which is in contact with the gases in combustion increases in volume, the arches swell, and pressure—often very high—results in different directions. Just at the periods of tapping or of changing the furnaces there are great variations of temperature which bring about contractions or expansions. During these operations the bricks should resist changes of pressure without being crushed or cracked. The resistance to crushing at ordinary temperature is measured by the process adopted by the Conservatoire National des Arts et Metiers, where half bricks are operated on. This resistance depends on the quality of the grains of the rock, and the quality of the cement which surrounds then: it is greater when the porosity of the products is small. According to the physical properties of the products the resistance to crushing varies from 120 to 500 kilog. per sw. cm.

It is preferable to proceed with these tests on whole bricks which have been heated to 1,710 degs. This operation is performed in a Bigot and Bodin recuperating furnace. If the condition of the pieces permit, their expansion, density, porosity and resistance, to crushing tain only 85 per cent. of silica and 15 per cent. of foreign matters, are as re- when cold and at 1,500 degs. are then determined. When taken from the recuperating furnace, if the pieces have been clearly softened and deformed, or have melted, they are of inferior quality and are not suitable for use in the Martin furnaces. Where they have resisted without either melting or being deformed three principal cases occur: (1) As the temperature is raised, the siliceous grains increase in volume and porosity. The cement which surrounds them is partially vitrified, contracts, and resists (without cracking) the expansion of the silica grains. Experience proves that the porosity of these products decreases in proportion as they are taken to higher temperatures, and that the best silica products present this peculiarity; (2) creased, their porosity has increased, and it more finely and not use large grains. In the case of Souvigny quartzite, which expands 10 per cent. and a quartzite American sandstone which expands 15 per cent., the volume of a cube of the first with side 10 becomes 1,331, at 1,710 degs., and a similar cube of the second becomes 1,520; the volume of the first gas increased 33.10 per cent., and that of the second 32 per cent. In order to obtain an equal increase of volume it would be necessary to crush the American sandstone finer than the Souvigny quartzite; (3) porosity, after heating to 1,710 degs., has slightly increased, resistance to crushing at ordinary temperature has perceptibly decreased, and resistance to crushing at 1,500 degs. has become null.

Careful examination shows that the grains of siliceous rock have become friable, the chief material employed being such as falls into powder at 1,710 degs. The porosity of these grains has increased considerably; the cement has preserved its consistency and has not cracked, but when a trial is made for resistance to crushing at 1,500 degs. the cement softens, and the grains no longer having any cohesion, the products crush under slight pressure. The quality of these products is defective; it is like those which are made with a mixture of rocks of good quality and rocks of which have become exhausted at high temperature.

The study of silica products with the microscope shows that tridymite is formed rather rapidly in the presence of lime at high temperature—this formation being much slower in the parts of rock grains which are not in contact with the lime.

It is rather difficult to state precise rules on the subject on account of the variety of the principal materials. The principal qualities required of silica products: (1) Refractoriness as high as possible and above 1,710 degs; (2) increase of volume as small as possible; (3) crushing resistance as high as possible when hot and at ordinary temperature; (4) small porosity. Attention should also be drawn to two particular points, the grinding the rock and the burning of the products.

The existing practice is to use heavy vertical mills. The ground material is afterwards sifted in order to separate over-large grains, which are reground. The apparatus used in the sifting room allows no separation of very fine elements, fine, medium, and coarse. Vertical mills destroy part of the angles and the ground material is never of constant composition because it remains for a longer or shorter time in contact with the grinder, or because the pieces of rock to be crushed offer very variable resistances to crushing. It is certain that manufacturers will be induced, sooner or later, to make use of processes analogous to those used in the abrasives industry—crushing the rock, grinding in cylinders, a sifting which allows classification of the grains and separation of the fine dust constituting the basis of the cement which serves as agglomerant. These processes give grains with sharp edges. They allow exact determination of the proportions of grains of different sizes separated by the sifting rooms. Manufacturers will thus have the possibility of making products with angular grains, of constant composition as regards grain size, and including a known proportion of fine.

These products are burned at as high a temperature as possible, viz., about 1,600 degs., at which temperature a few hours' firing suffices in order to obtain a good result. At present most manufacturers use intermittent kilns, which only permit temperatures of about 1,400 degs. to be contained in the middle; it is necessary then to maintain the products at this temperature for long hours in order to obtain a transformation and a partial expansion of the silica; a considerable expenditure of fuel and a magnified duration of the burning result. In some of these kilns the setting in, the burning, the cooling, and the drawing from the kiln, require about three weeks.

As a result of repeated trials made in a tunnel kiln between 1,500 degs. and 1,550 degs., the duration of a good burning according to the tonnage to be produced per twenty-four hours, varies from four to five days from the moment the products enter into the tunnel until the moment they go out of it.

The examination of a number of bricks taken from open hearth furnaces shows the influence of density and porosity on crushing resistances; they give valuable indications as to the condition of the bricks in the furnaces and the essential principles which should be conserved in the management of these furnaces. It also demonstrates two very plain facts, contrary to the opinions generally approved at present, viz: (1) It is admitted that silica products are only of good quality if they include 94 to 95 per cent. of silica. But the experiments show that the grey parts of the bricks which contain only 85 per cent. of silica and 15 per cent. of foreign matter are as refractory as products with 95 per cent. of silica and that thanks to their feeble porosity they are far superior as regards crushing resistance at all temperatures; (2) It is equally admitted that an excess of lime and of iron oxide is detrimental in silica products, and that it is only necessary to exceed the proportion of 3 to 4 per cent. for these two elements combined. But in the grey part of the bricks the proportion of these two elements varies from 10 to 14 per cent.

The following table recapitulates some of the physical tests which have been made in the course of these studies:

(a) Brick of good quality.
(b) Brick which cracks at high temperature.
(c) Brick made with rocks friable at high temperature.
(d) Brick from a Martin furnace, unattacked part.
(e) Brick from a Martin furnace, brown part.
(f) Brick from a Martin furnace, grey part.

	A	B	C	D	E	F
Fusion points	1,750°	1,730°	1,730°	1,730°	1,710°	1.730°
Linear expansion at 1.710°, per cent.	1.60	5.90	4.00	2.50	....	....
Porosity (water absorbed), per cent.	12.00	9.5	10	10.5	2.1	0.3
Porosity after heating at 1,710°, per cent.	9.7	16.10	12	9	....	....
Crushing resistance at ordinary temperature	121	480	160	166	1,115	1,415
Crushing resistance at ordinary temperature after heating at 1,710°	...	nil	52	...	....	....
Crushing resistance at 1,500° after heating at 1,710°	77	nil	nil	37	52	138

The crushing resistance is expressed as kilogms. per sq. cm.

Under the title "Division of Labor on the P.R.R.," a New York financial journal prints the following:—"Mulcahey, who is a 'pick-handler' (wheel-tapper) on the railway, is supposed to be visiting his stock-broker with whom he has done considerable business 'since the Director-General took over operation of the railroads.'

"Having in mind Mulcahey's advanced age and rapidly-failing strength, his broker remarked:—

"'Mul, you're getting pretty old and feeble, aren't you, to be bending over and hammering wheels all day?'

"'Shure, me hearin' is still good.' replied Mul.

"'Your hearing? What's that to do with hammering wheels?'

"'Uncle Sam (i.e., the Government) showed 'em how to run the railroads. I've got a helper now to do the hammerin.'

"'What do you do?'

"'I do the listenin',' answered Mul. —North Eastern Railway Magazine.

State of Mind of the Foreigner in this Land

SOME of the members of the committee investigating conditions in the steel mills of United States seemed to be surprised that they should find notices to the foreign employees printed in five different languages.

The surprise should not have been at such a thing, but at the members of the committee, public men, supposedly in touch with what is happening in their country, being ignorant of this condition.

This particular condition is not exclusively the property of the United States. Its duplicate can be found in several lines in Canada.

For years it has been a hard matter to call attention to the real foreign problem. When it was brought up by labor interests the cry was raised that labor wanted to shut them out to keep the price of labor at a higher mark. And it might be added right here that if the only aim of bringing foreigners to this country is to bring them here to compete with our own labor, and force down the standard of living, then the time is ripe to slam the national front door in a mighty emphatic manner.

On this page we show a reproduction of a picture that was found in several places in the homes of foreigners employed in the U. S. steel mills. It is the conception that some of the foreigners have of the way they are being treated and exploited under the capitalist system.

Look at the thing, and then imagine the state of mind of the ignorant foreigner who has been brought up in such an atmosphere.

Look at the thing and you can see there the passions and the hatred that the agitator calls into play when he wants to sand-bag industrial life on this continent.

For the purpose of this article, CANADIAN MACHINERY eliminates the international boundary between Canada and United States, for the very good reason that their problems in dealing with the foreigner are our problems. The history of the strikes of 1919 prove that beyond the chance of successful contradiction.

The talk of Americanization and Canadianization in relation to these people is folly unless we are prepared to realize that they can make or break our national happiness and prosperity.

On election day in Toronto, in the foreign districts, one could see these men in hundreds after hundreds, pouring into the polling booths, voting on what manner of laws we shall have in this land.

Do they fully understand the things about which they vote?

They do not.

Have they any good idea of what the things they vote for mean to the land?

None at all.

Do they understand or appreciate what a prohibitory law has worked for Ontario in the way of the reduction of crime, and the increased bank deposits of hundreds of people?

No, they do not. Nor do they care a whit. They were out, every man jack of them, voting for the repeal of the O.T.A.

The skilful politician makes all sorts of appeals to their fancies and their prejudices, and their votes are counted to kill the expression of opinion of men and women whose every interest is tied up in the development of this Canada of ours.

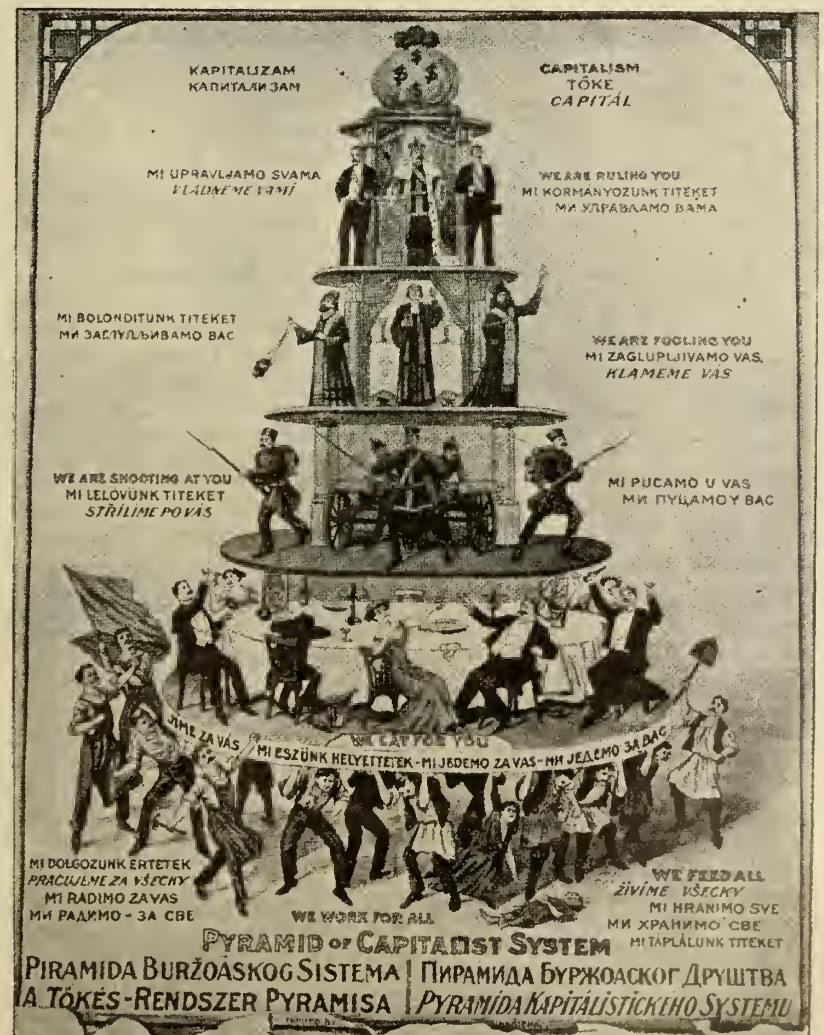
But to return to the picture on this page. Is it possible to make a good Canadian or a good American out of a man who is cherishing the thought that the system of Government, the church, the militia are all framed and brought into existence for the sole purpose of becoming a millstone around his neck, to grind him down and to keep him down?

The only answer to such a query is a plain and emphatic NO!

The man who has this picture burned into his mind will look upon almost every move that is made for his betterment as a move on the part of the capitalist class to further draw the cord around him. He cannot be approached as a man with an open mind. The agitator keeps this picture before him. He has been doing it for years in Canada and he has been doing it for years in United Sates. And all the while he has been more or less unmolested in his damnable occupation.

That same doctrine has been shouted up and down the coal mining areas of Western Canada for years. Men from the Old Country — not foreigners — have been the leaders in the movement in many cases. It has

(Cont. on page 335)



HOW THE AGITATOR WORKS ON THE FOREIGN MIND

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1887)

JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President.
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF
A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449. Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: G. E. Pearson. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 9s. 4d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address, giving both old and new.

Vol. X. Toronto, November, 1919 No. 11

CONTENTS

The First-class Mechanic

IS he born or made, or is he the product of birth and education combined? The above question seems to be one that has been debated for hundreds of years, perhaps for thousands of years, and still it is a very live question. There are some who contend that the good workman is born for a good workman, while there are others again who contend that he is the product of skillful training. Without doubt, birth has much to do with it, but training certainly is needed and no mechanic can do justice to himself or to his company unless he has had all the training necessary. Without the training he is very much like the untrained soldiers.

However, let us see what Cicero said, and we all acknowledge that Cicero was probably one of the brightest and ablest thinkers that the world has ever produced.

Cicero said: "I admit that there have been many men of excellent mind and ability, and that these men, because of their genius have existed through themselves alone. I also grant that natural talent without education has counted more for praise and glory than education without natural talent. But I maintain this: when some methodical instruction and training is added to excellent natural talent, then is the true ideal of perfection wont to exist.

The good workman or even the poor workman who desires to improve himself, will see from this that while an occasional man is born a genius and can succeed without education, the bulk of human beings are better citizens if they add to their natural talent the experiences which other equally as gifted men have had. He will also agree that to gain knowledge direct from others is a slow process compared with reading it from a book or trade paper. If a man is already a good workman it is folly to say that he can not grasp a new idea from a paper equally as well as seeing the operation performed.

Learning To Read

IT is a melancholy circumstance that very few people seem to know how to grasp what they read in a paper. It is no difficulty to read what we already understand and be able to follow each point as we come to it, but to start on an article dealing with something of which we are absolutely ignorant, it is a more difficult matter to follow it. However, if we understand the English language and will banish other thoughts from our minds, it is an easy enough matter to follow any subject. Take for instance, the matter of steel foundry or malleable iron foundry work. We may be thoroughly conversant with gray iron foundry practice, but when we see these other branches of the business we pass over them as though they were foreign to us, yet every foundryman should study these most interesting subjects, and he will be surprised how easy it is to master and how convenient it will be to have the knowledge thus gained.

No amount of knowledge will ever hurt any of us, and it behooves every man who intends to get all there is in life to get all the information which is available.

A Wrong Viewpoint

Mechanics frequently look at trade journals and if nothing happens to be in evidence which deals directly with the work they have in mind they do not see anything to be gained by reading it, overlooking the fact that increased knowledge puts them in a better position to face the problems which will be confronting them through life. There are innumerable molders, foremen, and superintendents, who are holding what would appear to be good positions, but they can never tell what a moment may bring forth and it might be handy to understand what had formerly looked to them like an inferior line of work. We have, in our time, met good, heavy machinery molders, who fell down on a plow point job, not that he felt above it, but because he could not make it.

Our New Local Legislature

Considerable attention will be drawn to our new Government, which is expected to take over the reigns of power on the 14th of this month. There is no reason why they cannot handle the management of affairs equally as well as any of the former party Governments. There is no doubt but they will, but we want them to go further and surpass any former party. The Farmers and the Labor organizations have always felt that they were sidetracked for the benefit of more influential parties, and now that they have things in their hands, it is to be hoped that they will have the hearty support of all parties in their efforts to legislate in a manner which will be fair to all.

Wages and Living Expenses

THE cartoon, if we may be privileged to call it by this name, which is shown herewith, is a fair sample of what the wage-earner of to-day is up against. There is no class of citizen who tries harder to avoid strife than the honest working man, but when he sees the cost of living continually beyond his reach, what is he to do but try harder than ever to catch up to it? But the harder he tries the more determined it is to keep ahead of him, with the result that he goes on strike and perhaps goes to extremes in some cases. But surely there is some means of stopping the tail until the mouth can catch up. We can not always see eye to eye with the striker that the fault rests with his employer. It is not always possible for him to yield on all the points advanced by the working man, as he is also up against the high cost of living problem. Howbeit the working man is the one who is hit the hardest by the high prices of commodities and he must get redress from some source and the demand on his employer seems to be his only opportunity

The impression has prevailed all along that the farmer was the man who was not doing too bad out of the high prices. They produce the things most needed by the working man, but now that the farmer and the working man are combined and are going to expose the guilty ones, we trust that they will meet with success, and that they will devise means whereby the cost of living can be reduced without reducing the working man's means of meeting it. Mr. Drury, our newly-elected Premier, seems to think that the time is near at hand when wages will come down, and, of course, he thinks other prices will come down with them, but if he intends to keep peace within the fold of the Farmer-Labor combine he will have to use his every effort to see that the price of farm produce to the consumer is reduced first. If it is the idle, non-producing middleman who is getting the unearned rake-off then we want him attended to.

THIS is the season of the year when green men go north to the deer country with loaded guns. A few days later we read that his will has been probated and that he was well thought of in the community in general.

* * *

AN order may go forth to vaccinate all the folks in Toronto. Although the war is over it's just another call "to arms."

* * *

IT'S a caution how many loafers and hangers-on imagine that their presence is quite essential to the firm's success.

The Need For Apprentices

CANADA needs mechanics if she is going to succeed as an industrial and manufacturing country. Canada needs shops that will teach the apprentice something worth while rather than turn him out as a handy man or a specialist on Operation No. 4 or Operation No. 10, as the time card may call it.

There are tool rooms and there are drafting rooms that do not want to be "bothered with" apprentices. The one big demand of the institution is for production. The in a short time is the big consideration, and in such an atmosphere it is an easy matter for the apprentice to become "handy" in some particular capacity and stay right there.

If your shop has nothing to offer an apprentice, be honest enough to say so.

You can turn out a mechanic—a rare man nowadays—a machinist, or a specialist. The boy who comes to your shop to learn a trade is entitled to know, all things being equal, what he has a chance of becoming. If only a specialist on some speed production idea, tell him so, in order that he may not waste three or four years of his time on it.

It is short-sighted policy, taking the mechanical field as a whole, to be too busy to "bother with" apprentices. If Canadian firms are going to turn out a product that will stand up in competition with the world, then we must have more and better mechanics. We must aim to bring mechanical excellence, knowledge and practice to such a degree that we can design and build precision tools as good as any on the market.

The shop that is too busy to "bother with" apprentices, but is willing to reach over and steal the finished product by means of a few extra dollars per week has a knot-hole conception of the duty it owes to the industrial fabric of Canada as a whole.

THE MIND OF THE FOREIGNER

(Continued from page 333)

been possible for the last twenty years to hear the doctrine of capitalistic exploitation preached openly in its most vicious form, with nothing done to meet the campaign.

The politicians wanted the votes of those men wherever they could get them, and they were not going to do anything that should alienate this support.

The strikes of foreigners this year may work out for lasting good if they have the effect of making the men in charge of affairs in this country and United States get seriously to work to find out what is back of it all, and what must be done in the way of corrective propaganda.

There must be something more than mere opposition to the agitator. There must be something that will cut the ground from under his feet. Rooting out the agitator is of little use in itself, as it simply places the halo of martyrdom on his miserable head, and leaves room for another to follow in his wake.

Foreigners who are in this country have a good chance to reach a better plane of living than was ever possible for them in the land they left. In return, all that is asked is that they mind their own business and cease trying to apply Marxian nonsense to a field where conditions do not call for it. Industry has a perfect right to insist that in return for decent working and living conditions, for the absence of the sweatshop, that it be placed in a position where it can go ahead with reasonable and definite assurance that it is not going to be sand-bagged and gassed at the say-so of the agitator, whose pockets bulge with teachings of anarchy, and the easy pickings he extracts from the hard-earned surplus of his victims.

THE average man does not love war. But there would be quite a heap of folks ready to sign on if General Reduction started operations hereabouts.

* * *

ALTHOUGH the farmers rule Ontario, Old Man Hicost lingers in our midst.

The Continued Supremacy of Cast Iron

By DONALD H. HAMPSON

WE hear a great deal these days about new metals and alloys, and we very nearly get the idea that the big five (cast iron, wrought iron, brass, bronze, and steel) of our fathers' days have been superseded. Twenty-five years ago, the metallurgist and the chemist and the mixers of metals had not come to the front with the bewildering variety that is offered to-day. From the reading of magazine articles and advertisements and from association with automobiles, the lay public has picked up considerable general information about materials—information which leads them to believe that every metal part that is worth while must be made of "alloys or special metals." And this is true to a lesser degree with many men in the mechanical branches—due largely to nicely worded statements of enthusiastic salesmen.

But to a greater extent than is realized at first thought, one of the "superseded" metals holds its own, in fact, is making new friends all the time. That metal is cast iron. Plain, ordinary grey iron—the cheapest of all the metals and the most adaptable. If you want a section only one-sixteenth thick or if you want a part that weighs twenty tons you can make it of cast iron and know pretty well beforehand that you can get it anywhere, any time, and that it will be just what you want.

"The bigger they come, the harder they fall," is a truism of the prize ring and it applies quite nicely to some of the vaunted substitutes for cast iron.

Take the aluminum piston for automobile engines, for example. It was going to revolutionize the business, but how many men who are in the class that has to look after their own cars will buy another car with aluminum pistons? There's an occasional exception, but it is back to the good old cast iron piston for theirs next time. Sold under various trade names, these men have found that the slight gain in weight and higher engine speed were accompanied by a loss of power unless the engine was over-hot and that the cylinder walls were saved at the expense of the pistons. Aside from the necessary sloppy fit in the bore, the wrist pins have a disagreeable habit of wearing or working loose so much sooner. It is back to the cast iron piston and a little slower speeded engine for these men who have tried.

The die casting gave poor old grey iron quite a shove to the wall. But recently, there has been a marked tendency to return to the sand cast product, especially for parts that are subject to any wear or pressure. Of course the iron casting does not begin to have the appearance of the accuracy that the die casting does. It is the permanentness of cast iron and its superior wearing quality that make it a more value than mere shape in the beginning.

Aluminum and die cast products made deep inroads in the printing business a few years ago when the market was flooded with the white metal "furniture" and plate mounting bases; these pieces were originally of wood or lead, but as the art progressed and modern machinery came in, cast iron replaced these two—to be followed by the die cast parts, that could be made of the required accuracy at a far lesser cost than cast iron. Actual usage throughout a period of years, however, showed that the white metal changed its size under printing pressures almost as easily as had the lead and that the boasted "stronger than cast iron" could not be realized. One supply house states that they would be half a million ahead to-day if they had left the other alone and stuck to the cast iron.

It is frequently stated that cast iron makes a good bearing surface for any shaft from the slowly revolving one up to a saw mandrel, yet we do not see many such because the average builder is wedded to the use of some bearing material. Two cases showing how good it is will be noted.

There are in a certain shop sixteen 2 in. milling machine spindles made of ordinary soft steel and running directly in cast iron of the headstock. These were made in 1902-1903 and were intended for using the carbon steel cutters of that day. With the general introduction of high speed steel, the machines were speeded up and as the steel bettered, more speeding up was done to keep the steel working right up to the "book speed." Just plain oil hole lubrication and ordinary operators—and not a case of refitting in all that time, though the work must always be "plus or minus, not over 0.000½ in." And the writer made and fitted a quantity of ¾ in. cast iron bearings over eleven years ago for which the factory has never had an enquiry for replacements in spite of the fact that the shafts in them run at 14,000 R. P. M.

Then there is the case of the car wheel. At one time we were led to believe that the paper wheel was going to open up an era of silent, smooth running calculated to please the elect. Yet there are none of those paper wheels in use to-day and there are millions of the old-fashioned cast iron wheels rolling along smoothly and with a satisfactory degree of silence. Even the steel wheel has not made such deep inroads in the iron wheel business—not even when you can get cast iron chilled wheels that will do 80,000 miles or more and at a first cost of four cents a pound, even in these days of high prices.

Every factory has to use shafting, including pulleys and hangers. These latter items were once made exclusively of cast iron but the last two decades have witnessed the advent of pressed steel hangers and pulleys—parts which certainly are modern, light, neat, and almost indestructible. Yet if one circulates among the actual users of these products, there is found an undercurrent of reaction; one man tells you that a cast iron pulley or hanger "stays there" after it is made; another complains about the cast iron parts that are riveted or bolted in the steel structure and work loose; another machinist invites you to look at the "round" steel pulley he has in the lathe for boring, adding that if he took a cut ever it to make it round it would cut through at two points; and still another man beckons you to the scales to compare the weight of the steel product with well designed cast iron pulleys and hangers, pointing out triumphantly that the difference is hardly over five per cent.

In some automobiles we find gear cases of cast iron. The mechanic delights to work on such a car because he knows that the case isn't warped or sprung, that unless it has been cracked it is as accurate as on the day it was machined, that a touch with a hammer or a slip of a wrench will not bruise a surface to the point of inaccuracy that may escape the less trained eye of his helper.

All the metals used as substitutes for cast iron have their places—and the business could not get along now without them—but the selling talk that a competitor uses cast iron "because it is cheap, we use gold aluminum alloy" does not go as it once did and it seldom goes for re-orders. Grey iron has come out of the woods triumphant because it retains its size and shape, because it is one of the best wearing substances known, and because it can be given any reasonable form and at a cost that is not prohibitive.

Among the recent electro-therapeutical devices introduced to the public is an electric brush which, instead of being supplied current from a battery in the usual fashion, contains its own source of power. Leaving aside the therapeutical qualities of the electric brush, the present device is of immediate interest because of its electrical features. It contains a small generator which is capable of delivering currents of infinitesimal amperage, but at potentials of from 50 to 200 volts. The generator is driven by pressing a lever beside the handle, which lever operates through a chain of gears.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

QUESTIONS AND ANSWERS

Question.—A few months ago the firm I am employed by purchased a quantity of patented nickel salts. I prepared a solution from the salts according to instructions received from the manufacturer of the chemical, and as I could not obtain the results which my employer expected, we had a sample of the salts analyzed, the chemist's report being as follows: Nickel sulphate, 27.58 per cent.; magnesium sulphate, 2.75 per cent.; ammonium chloride, 18.00 per cent.; boric acid, 10.00; moisture, 41.10 per cent. I cannot get good deposits from this solution when operated at the speed recommended by the manufacturer; the deposit either cracks or is pitted. It does not burn black, and therefore gives no indication of excessive rate of deposition. Please let me know if it would not be quite practical to prepare a rapid solution of better composition from other chemicals? Anything with reference to the above will be appreciated.

Answer.—In one sense of the word the chemical composition of a plating solution is of little consequence—what they will actually do is what counts. A comparison of four or five salts, including the brand you have, shows that they all contain approximately 2 oz. of metallic nickel per gallon of solution, while a solution made from your salts and tested contained much more, and if it had been made up to the full amount of chemicals per gallon would no doubt have exceeded 3 oz. per gallon.

The statement made by some manufacturers of prepared salts to the effect that some fabulous amount of nickel can be deposited by the use of their salts is more or less erroneous. We find by actual experiment that the amount of nickel deposited by these solutions when operated in series with a given quantity of current working in all of them, is not sufficiently different to merit claims of superiority for any one brand of salt. If the specific resistance can have anything to do with the successful operation of a nickel solution, we would say that your solution would require something like two and one-half times the voltage to get same current through it as could be sent through some simple dense solutions. The specific resistance in the solution you have is in the neighborhood of 100 ohms. In a Chinisol solution it is about 64 to 65. Perels is a very high resistant solution also, it being about 60 ohms. Concord has 45 ohms. as compared with an ordinary double nickel salt solution of 47 ohms, while Capstone solution has a specific resistance of only about 35 to 37 ohms. From the resistance of these solutions you can, by ohms. alone, compute the carrying capacity and voltage required to do certain work. These figures, together with certain fundamental facts relative to electro plating, form the basis of a very interesting study of high-power nickel solutions. No doubt these different prepared nickel salts have some merit for quick, bright work and may prove quite satisfactory, but when they are used at same speed for plating heavy polished castings, like stove work, the average plater finds that they start off and give more or less satisfactory deposits for a short period of time and then balk, various symptoms of trouble appear and finally the solution becomes operative only at greatly reduced speed, owing to change in density and character of deposits. Pitting and cracking are principal defects in deposits. Furthermore, the tendency of all these deposits is to curl. If you will make up a solution of several different kinds of nickel salts and put electrodes in each and let the cathodes be of thin metal, you will find that the richer the solution, the more will the deposit have a tendency to distort the cathode. That is to say—a heavy deposit placed on a piece of ordinary sheet tin will, in the course of three or four hours plating by ordinary current used in commercial work, cause the tin to bend in nearly a half circle, showing that the tension is very great. This is with reference to a nickel solution of normal acidity. There are only a few things that happen in a nickel plating solution that are not revealed by a chemical analysis.

> **AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.**
>
> **Officers for 1919-1920.**
>
> President—Mr. John A. Magill, 591 St. Clarens Ave., Toronto.
>
> Vice-President—Mr. T. G. O'Keefe, 147 Dupont St., Toronto.
>
> Secretary-Treasurer—Mr. O. Holtham, 328 Carlton Street, Toronto.
>
> **PLACE AND DATES OF MEETING**
>
> The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

While the formula you furnish shows nickel sulphate, we are rather inclined to believe it is nickel chloride and ammonium sulphate. The reason for this opinion may be obtained from a simple experiment, which I will describe in order that you may try it. If you will take 10 cubic centimeters of the nickel solution and add to it 15 to 20 cubic centimetres of pure grain alcohol, the alcohol will dehydrate the nickel salts, causing them to settle to the bottom of the test tube or beaker. With the salt you are using this precipitated salt has the characteristic yellowish green color of nickel chloride, while known sulphate nickel salts precipitate vivid emerald green crystals, characteristic of the single and double sulphates of nickel. A dense solution may be safely employed for your purpose, but we would not waste time and money on the prepared salts. Secure good chemicals and prepare your own solution. Make it simple, use it with reason, give it extra attention until you are satisfied it is trustworthy, and you will gain in knowledge, and the output will be of less doubtful quality than you will obtain from the more expensive solution. Keep the acidity very low, or operate the solution neutral.

* * *

Question.—We have been using cold rolled steel in the manufacture of our product during the past two years, previous to that we used sheet brass. For some months past we have received complaints with reference to the nickel plated portions of the steel rusting. Our method of plating is as follows: Electro clean, rinse, immerse in muriatic acid solution, rinse, copper strike in cyanide solution about 30 seconds, rinse, nickel plate one hour. The nickel is buffed on cotton wheels and the japanning of other portions follows. Do you consider our method correct, or can you suggest a line of procedure which would produce better results than we are getting. We wish to continue using steel, but we must stop the rusting if possible.

Answer.—Your method does not impress us as being in harmony with your desires. When an electro plate is produced for the purpose of protection to steel, this fact must be kept prominently in mind by the operator at every stage in the process of preparing the work, as well as in plating. See that the articles are placed on suitable holders or hooks in such a manner as to allow uniform deposition of metal over the entire surface. This is a very important point in the preparatory stage. The electrolytic cleaning method is quite correct if you are using a solution which does not corrode the surface of the steel when a direct current is employed. Do not use reverse current on steel unless every possible precaution is used to avoid corrosion or remove the effects if it accidently occurs. If an acid dip is absolutely essential before coppering, neutralize the acid left in the pores of the metal after immersion by strong cyanide solution. Your method of using muriatic acid dip is incorrect. The operation of acid dipping at this point is useless and actually harmful in more than one respect. Eliminate the muriatic dip entirely. We could devote a whole page to the subject of acid dips for steel and explain why muriatic acid used as you have used it is conducive to poor results in the production of protective coatings. With a fair grade of cold rolled steel an acid dip before coppering should not be required. Electro-clean the steel, rinse in clean, cold, running water; place the work in a cyanide solution of about 5 degreesBeaume density for at least 3 minutes; arrange crocks or small tanks to facilitate this 'soak," or transfer the work directly from the cleaner to the copper. Before adopting the latter method it would be good policy to determine the nature of the cleaning solution. Some cleaning solutions are not chemically fit to be introduced into a cyanide copper solution even in very small quantities. At any rate, get your clean steel into the copper solution with the pores of the metal free from any trace of acid. Now instead of allowing 30 seconds for a copper flash or film to form, permit the steel to remain at least 3 minutes and receive an appreciable "strike" at least. If the copper bath is properly managed you can easily run each batch 5 min. and obtain a fine-grained, smooth, pink deposit of copper, which will be of some value as a protective undercoating; rinse in two waters and place in the nickel bath. If a double salt solution is used for nickeling, a one-hour deposit is not sufficient, as your maximum current density would not exceed 5 amperes per square foot in a cold solution, and we venture to say you have not operated at this density. To produce a heavy deposit, give the work at least 2 or 2½ hours at the highest current density possible without injury to the deposit. If you are using a single salt nickel solution and have the proper concentration, good conductivity and ample effective anode surface, we would say a 1-hour deposit should prove satisfactory for ordinary purposes. If, however, your product is subjected to the action of atmospheric changes out of doors, we would advise longer treatment in the nickel solution. In brief, we would suggest that you see that the steel is free from rust in any form before it enters the cleaning solution; study each step in the process of cleaning, dipping, coppering and nickeling, and satisfy yourself that no unnecessary plunges are made. Bearing in mind at all times that "rust begets rust," and a simple green film, which is scarcely perceptible to the naked eye, will eventually develop under cover of copper and nickel until it becomes a disfiguring blemish upon an otherwise perfect product. The deposition of zinc, instead of copper, would be even more efficient, but would entail considerable expense in altering your system. This may be considered as your last resort. But try the above first.

Question.—I am not an experienced plater, have had no training and try to learn by observation and reading, as well as by practice. The foreman of the shop where I am employed has been sick for several weeks, I am doing the best I can during his absence. We used to use carbonate of copper, which was soft, like paste, and it dissolved easily. We have some dry carbonate now and I have failed to get it dissolved. Please tell me what to do. Kindly send letter.

Answer.—You certainly deserve credit for having the gumption to get ahead. Young men nowadays seem to care for little else than the almighty dollar. It is indeed refreshing to hear from one who has an inclination to learn something with reference to his work. To dissolve the dry copper carbonate easily, proceed in the following manner: Secure a stoneware crock, large enough to hold the quantity of solution you wish to make for stock purposes; also get a piece of cheesecloth, large enough to cover inside of crock and allow at least six inches of cheesecloth to remain over edge of crock. Place the copper carbonate in this cloth-lined crock and add just enough strong cyanide solution to make a paste when mixed thoroughly with the carbonate. Use a small wooden paddle to mix the mass and carefully crush all lumps. Considerable heat will be generated by the mixing, but no harm will result. When the carbonate is reduced to a dark brown or black mass, gather the ends of the cheesecloth which are over the top of crock in a manner such as to form a bag containing the mass of plastic copper salt. Fill the crock two-thirds full of strong cyanide solution and suspend the bag so that the pasty mass is partially beneath the surface of the solution. The paste will dissolve with no further attention other than an occasional stirring of the solution. If you wish the solution for immediate use, stir vigorously and allow to settle. Use clear solution only for replenishing copper solution. Add a little more cyanide to portion left in crock and use same as at first. After one or two trials you will be able to dissolve large quantities of the dry carbonate in very few minutes in this manner.

Question.—The plating plant where I am employed has recently been moved, and in doing so the nickel solution was placed in barrels. When tanks were filled at new plant the solution was emptied into them without straining. It was very dirty. I added 3 oz. of muriatic acid, but there was little improvement. The metal we nickel plate is brass. We plate it 30 min. After moving solution the deposit appeared good for 15 minutes, but, at the end of 30 minutes I could rub it all off. A little oil from shafting dropped in the solution. Blue-black patches came out on the nickel. What should I do? Please oblige by publishing soon.

Answer.—We trust the experience you have had with the nickel solution in question will cause you to respect your nickel solutions more highly in future. A nickel solution, if of any value as a plating bath, must be handled and cared for with some degree of intelligence or it will not yield even moderately good deposits. We cannot attempt to say where the damage actually occurred, as it is obvious that your methods were doubtful throughout the whole proceedings. It is probable that the nickel solution was seriously contaminated by use of unclean barrels. The addition of 3 oz. of muriatic acid would increase the bad effects, even though the bath consisted of several gallons. You do not state volume of bath and we cannot imagine its size. When moving a nickel solution, use clean vessels, and don't expect good results if you neglect to do so. Boiling would be the first remedy to try. If a heavy brown foam resulted we would skim it off and continue boiling until no skum formed; neutralize and place in tank; electrolyze for several hours with strongest available current. Use very small cathode and plenty of anodes. Oil from shafting should have no bearing on results if immediately removed from surface of solution.

Question.—Recently we have noticed small black spots on our finished stove castings. These spots develop during the operation of buffing the nickel plate. Can you advise us as to whether the spots are due to the iron or a fault in the plating process?

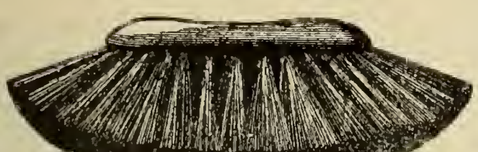
Answer.—There are several things which might cause the small black spots on the finished casting. As you do not mention the method employed in preparing the castings for plating, or the manner of operating the plating bath, we can not reply as explicitly as would be possible otherwise. If the nickel is deposited directly upon the iron, the spots may be caused by hard spots in the castings, which the polishing wheel failed to remove, these spots being a skin of oxide do not allow an adherent deposit to form and the removal of the deposit will reveal the oxide or cause of the blemish. Blow holes just below the surface, from which a pin hole leads, will hold enough pickling solution, cleaning solution or cyanide to produce a black spot. Small pin holes from slag or oxide will frequently remain unnoticed until piece is plated, and then appear as a black spot; the nickel magnifies the defect. A porous casting is very liable to produce the spots unless properly pickled or sand-blasted, and thoroughly cleaned and rinsed when being prepared for plating. If the castings are copper plated in a hot cyanide solution before nickeling, the cyanide may cause a stain to form about the holes after plating, unless removed by repeated rinsing in hot and cold water used alternately so as to contract and expand the metal, and thus expel the solution. Or they may be immersed in a very dilute solution of sulphuric acid and water and finally dried by aid of strong, hot soap solution. The nickel solution should not cause the spots unless unreasonably alkaline.

Foundry Facings

You Can't Afford to Pay a Cent Too Much

WHEN you buy direct from the manufacturer, the profits which would in the ordinary course of events go to the middleman, are retained in your pocket.

Hamilton products are Made-in-Canada and sold direct to their consumer.



Moulders' Soft Brushes as above are made from the best quality pure Russian bristle, four inches in length, wire drawn. The block is in two pieces, glued and screwed together.

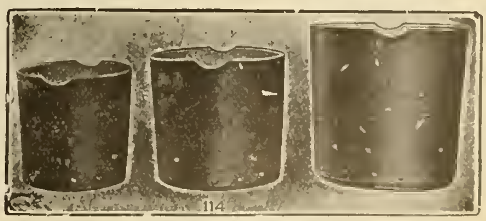
Service

Quality

Satisfaction

Here are Some of Our Lines:

XXX Ceylon
XX Ceylon
No. 206 Ceylon
Climax Silver Lead
Imperial Plumbago
Climax Stove Plate Facing
Faultless Blacking
Climax Core Wash
Mineral Facing
Pipe Blacking
Seacoal
Climax Partine
Climax Black Core Compound
Climax Grey Core Compound
Climax Yellow Core Compound
Climax Brass Flux
Bell's Core Gum
Graphite Boiler Compound



These Foundry Ladles are flat bottom riveted steel bowls with forged lips and vent holes.

The Hamilton Facing Mills Co.

LIMITED

HAMILTON, ONT., CANADA

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	38 40
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 25

METALS

		Gross
Aluminum	$33 00	$35 00
Antimony	10 00	10 50
Copper, electrolytic	24 50	26 00
Copper, casting	24 50	25 00
Lead	7 75	7 00
Silver, per oz.	....	0 98
Mercury		....
Tin	....	58 00
Zinc	10 00	10 00

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$15 00	$13 75
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper, wire	18 00	18 00
No. 1 mach. comp'n.	16 50	16 75
New brass cuttings	13 00	10 75
No. 1 brass turnings	9 00	9 00
Light brass	7 50	7 00
Medium brass	9 00	7 75
Heavy melting steel	13 50	13 50
Boiler plate	13 50	11 00
Axles, wrought iron	20 00	20 00
Rails	14 50	13 50
No. 1 machine cast iron	21 00	18 00
Malleable scrap	15 00	17 00
Pipes, wrought	10 00	5 00
Car wheels, iron	20 00	20 00
Steel axles	20 00	20 00
Mach. shop turnings	6 00	6 00
Cast borings	7 00	8 00
Stove plate	15 00	13 00
Scrap zinc	6 00	6 00
Heavy lead	5 00	5 25
Tea lead	3 75	3 50
Aluminum	18 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00

Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.

B

1/4 in.	$13 00
5-16 in.	11 00
3/8 in.	10 00
7-16 in.	9 30
1/2 in.	10 15
9-16 in.	10 00
5/8 in.	11 75
7/8 in.	11 75
1 inch	10 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 50
Linseed oil, boiled, single bbls.	2 92
Linseed oil, raw, single bbls.	2 90
Plaster of Paris, per bbl.	4 ..
Sandpaper, B. & A. list plus	43
Emery cloth list plus	3..
Borax, crystal	0 14
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 25
Sheets, black, No. 10	5 15	5 25
Canada plates, dull, 52 sheets	8 50	7 10
Apollo brand, 10¾ oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's est. No. 28	....	....
Premier, No. 28 U.S.	....	7 75
Premier, 10¾ oz.	....	8 05
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/4 in.	$16 75
3-16 in.	15 40
1/4 in.	11 20
5-16 in.	11 50
3/8 in.	10 50
7-16 in.	9 30
1/2 in.	10 50
5/8 in.	10 00
3/4 in.	9 70

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list; cast iron fittings, 15% off list; malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24½c lb.; class C, black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60%

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.04
Acid, hydrofluoric	.30
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride, lump	.22
Ammonium, chlor., granular	.18
Ammonium, hydrosulphuret	.50
Ammonium, sulphate	.30
Caustic soda	.10
Copper, carbonate, anhy.	.41
Arsenic, white	.14
Copper, sulphate	.16
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.16
Nickel sulphate	.18½
Potassium carbonate	.60
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.18
Sodium carbonate crystals	.06
Sodium cyanide, 129-130%	.38
Sodium cyanide, 98-100%	.55
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.)	6.00
Tin chloride	1.75
Zinc chloride	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$4 00
Polishing wheels, bullneck	2 25
Pumice, ground	0 06
Emery composition	0 08
Tripoli composition	0 09
Rouge, powder	0 45
Rouge, silver	0 50
Crocus composition	0 12

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base ½ in. to 1 in rd.	0 34
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, ¼-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19½
Palacine	22½
Machine oil, per gal.	36
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39½
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil	10¼

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27½
Delta Files	20
Nicholson	32½
P.H. and Imperial	50
Globe	50
Vulcan	60
Disston	40

CANNOT SECURE ENOUGH MATERIAL

Shipments of Steel Are Away Off and the Demand is Growing Very Keen

TORONTO.—The coal strike on top of the steel strike in United States is causing certain industries on this side of the line to stop and think where it is all leading. There can be no question about the fact that the number of serious strikes across the border has a very unsettling influence on business in the Dominion, especially in lines where the finished product here depends on the raw product that comes from some point in United States.

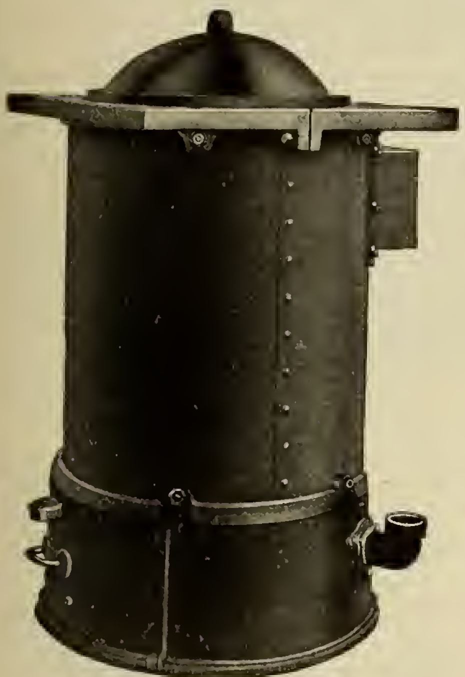
Deliveries Are Slow

Agencies in Canada which are handling American lines are losing sales in many cases because they are not able to get deliveries that will satisfy their customers.

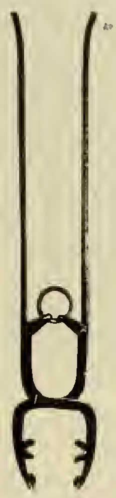
There is still a tendency on the part of many firms to trade in their used equipment, and the exchange of goods in this way tends to keep quite a quantity of material in the used machinery market. One Toronto firm has been placing in its warehouse a quantity of used ma-

Brass Foundry Equipment

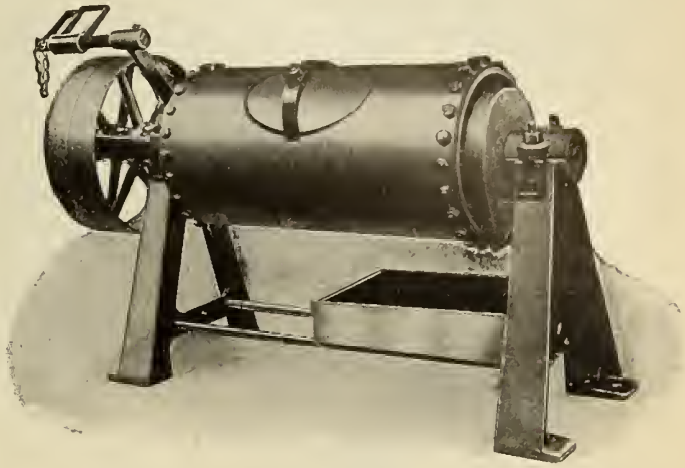
We are prepared to give complete estimates on the above. If interested, write us for prices and particulars.



The above are supplied in different sizes for forced or natural draft.



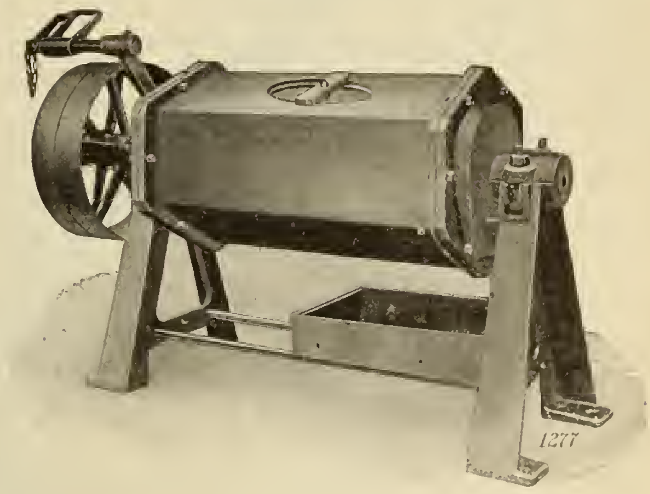
Crucible Tongs of all sizes.



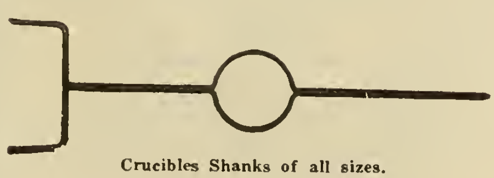
Tumblers for wet or dry milling. Made in two sizes.

The celebrated Morgan English Crucibles carried in all sizes.

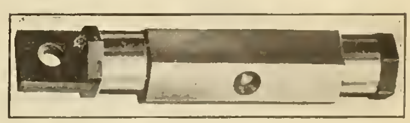
Pick-up Tongs.



Wet or dry in two sizes same as above.



Crucibles Shanks of all sizes.



Branford Vibrators.

We are also distributors of "Branford" Vibrators and Accessories.

The Dominion Foundry Supply Co., Limited

"Everything for the Foundry"

MONTREAL QUEBEC — TORONTO ONTARIO — WINNIPEG MANITOBA chines that have been rebuilt at a factory outside the city. There has been quite a steady work in this line for some months past, in fact, much of it has been under way since the clearing out of the shell shops.

Shipments Are Very Slow

"We are at our wits' end to know what to do," was the response that CANADIAN MACHINERY received on asking one Toronto warehouse what shipments were coming through from the strike area of United States. "We thought we were having tough skidding last week, but this week is worse many times over. It is now over 17 days since we have had a shipment of sheets or plates in our warehouse, and orders that were booked to go direct to our customers are faring very little better. Last week we thought we were fortunate because we received a good sized shipment of boiler tubes, but on looking through them we find that the mills that shipped to us were away off on standards, and that most of the material we received were lengths and sizes they had in stock. The ability to ship the much-wanted sizes would have been proof to us that they were operating at something like fifty or sixty per cent. capacity, but it looks as though they were off entirely."

It is hard to convince some of the consumers in this district that production is up to sixty or seventy per cent., as is claimed in many of the reports that are reaching here from the strike district. Seconds in sheets are being bought up eagerly, the buyer apparently being willing to make the best he can of what may be in the shipment.

One Ontario manufacturer, who conducts a nice business in one of the manufacturing towns of the province, has just returned from a trip through the Canadian West, booking tractor business for spring delivery. On his return he found that he had orders for between 75 and 100 machines, so he immediately started to visit the warehouses and agents with a view to securing a supply of material, only to find out that he could get no promises of delivery, let alone any ready material that could be sent along as a starter.

The prices quoted on another page of CANADIAN MACHINERY this week have not been changed because business is being booked at old prices, but there can be no doubt that the prices we give are purely nominal. It is well known that premiums are being paid in many

Sad, But True

There was a man who fancied
That by driving good and fast
He'd get his car across the track
Before the train came past.
He'd miss the engine by an inch,
And make the train hands sore;
There was a man who fancied this—
There isn't any more.

There was a wise old trainman,
Expert at coupling cars,
He used his feet to push in place
The knuckles and drawbars.
He did it thus for many years,
And thought it was great fun;
He had two feet to push them with,
He now has only one.

Bill Jones on the repair track,
Imagined he could do
A moment's work beneath a car
Without the flag so blue.
Well, yes—he did it many times,
In spite of rule and warning;
One day an engine bumped the car—
Bill's wife is now in mourning.

Between the rails of the northward track
Mike smoked his pipe of clay,
As "55" with time freight south
Sped noisily on her way.
'Twould take four steps to clear both tracks,
These steps Mike did not take,
Then Number 2 approached unheard,
Result—"An Irish Wake."

cases, depending on the urgency of the business.

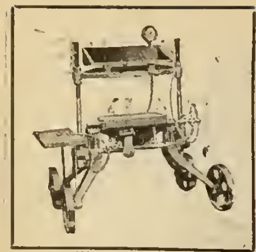
As a general thing it can be stated that the large steel companies across the line, headed probably by the Steel Corporation, are adhering to old prices, and as the last report of the corporations showed very large earnings, there seems to be good reason to suppose that prices will not go up, although it must be admitted that the scarcity of material now is tending to make them unusually firm.

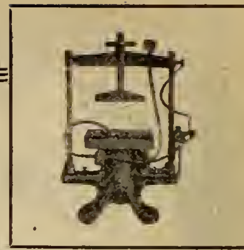
The Scrap Market

Industrial uncertainty, strikes, and all the other things that are parading across the business stage at present, have acted as a road roller to the scrap metal market. It is a hard matter to size up the situation at all. There is only a small volume of business moving. Sellers do not want to take the prices that are being offered by the dealers at present, while on the other hand buyers, watching the trend of the market, are under the impression that prices are due to slump.

It did look for a few days as though the whites were due for a better period, and it was felt that there might be some increase in these, but for the present they are dull and stagnant.

In reference to the prices of metals, it is well worth noting that cast iron and stove plate, when spoken of in tons, mean net tons in Ontario, and gross in Montreal.





DAVENPORT

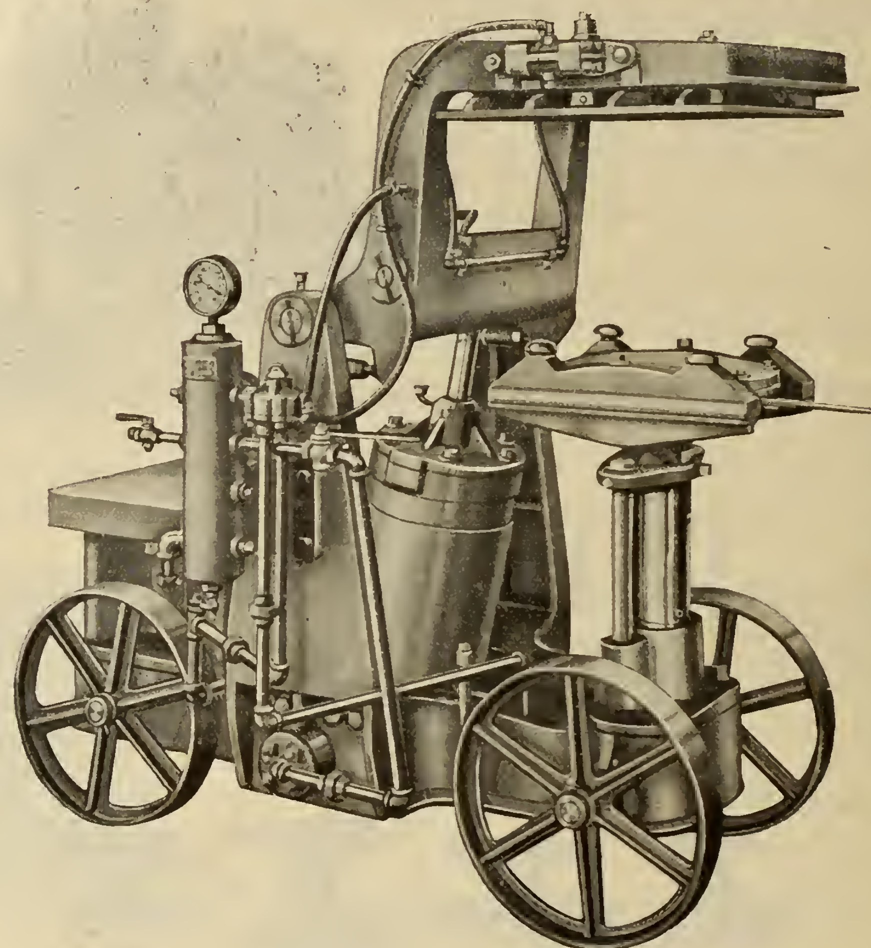
JOLT-ROCK-OVER-DRAW MACHINES

Stationary and Portable

CAPACITIES RANGING FROM 750 TO 6000 POUNDS

Simple to Operate

Durable in Construction



Fast in Production

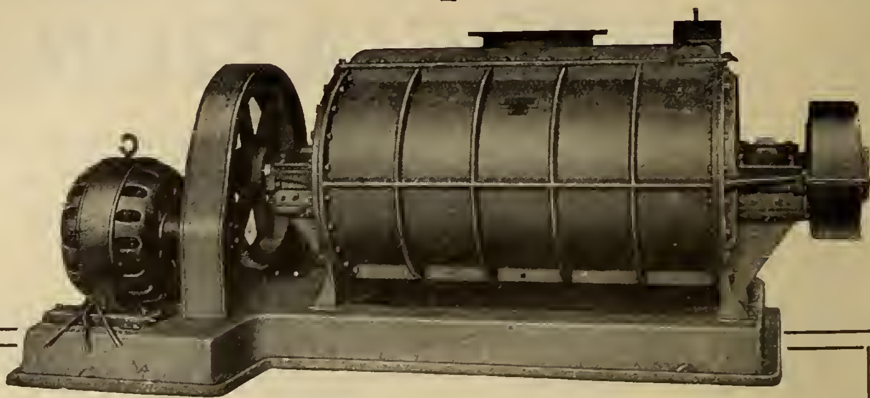
Manufactures of all sizes of

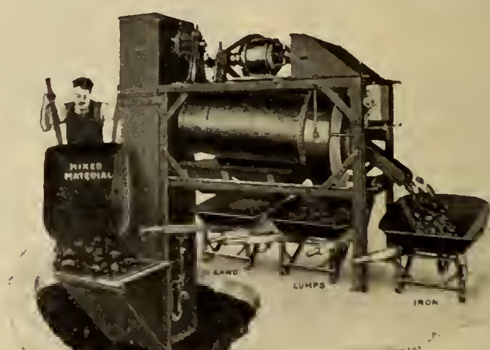
PLAIN JOLTS, CORE JOLTS, JOLT STRIPPERS, POWER SQUEEZERS, JOLT SQUEEZERS

Davenport Machine & Foundry Co.

Davenport, Iowa

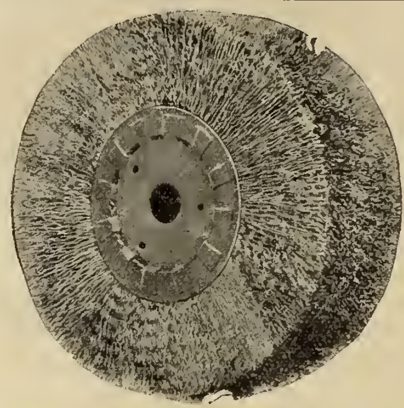
Send for Catalogue





"SAMSON" Wire Wheel Brush Sections

Each Section a Brush in itself



Can be quickly mounted on a Shaft or Spindle

No Hub or Holder Required

Metal disc centre punched to fit any size spindle.

A convenient and practical method of building a wheel any desired width of face.

Especially recommended for removing scales from hot forgings, axes, shovels and tools; for cleaning brass castings, sheet brass and copper.

A trial order will convince you "Samson" scratch wheels are the most efficient and economical brushes on the market to-day.

Write for catalog and complete information

The Manufacturers Brush Co., Cleveland, Ohio

19 Warren Street, New York

A Complete Heating Plant For Foundries

This furnace is a complete portable hot air blast heating and ventilating system ready for operation—requiring small space only.

Equals 100 Salamanders—
Less trouble and fuel than one—
The Blower does it

Designed for factory and industrial buildings requiring heating and ventilating at the smallest possible cost.

Mechanical Hot Blast Heater

Will burn any kind of coal, coke, oil or gas. Made for belt drive or with direct-connected motors. They are decidedly economical in operation—simple in construction—nothing to wear out or get out of order.

For drying purposes it is especially recommended for drying clay products, asbestos, magnesia, cereals and all other products dried by warm air up to a temperature of 400 degrees F.

ROBERT GORDON, Inc.

OFFICE AND FACTORY, 622 WEST MONROE ST., CHICAGO, ILL.

CANADIAN AGENTS, E. J. WOODISON CO., LIMITED, TORONTO, MONTREAL

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRESTERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GATES
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
Clark, Chas. J., Chicago.

BLAST METERS
Clark, Chas. J., Chicago.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison Co., E. J., Toronto.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Lindsay Chaplet & Mfg. Co., Philadelphia.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CONVERTER BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison Co., E. J., Toronto.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Roots Co., P. H. & F. M., Connersville, Ind.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.
Magnetic Mfg. Co., Milwaukee, Wis.
Woodison Co., E. J., Toronto.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Hyde & Sons, Montreal, Que.
Woodison Co., E. J., Toronto.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

FURNACE BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Black Donald Graphite Co., Calabogie, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Hartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison Co., E. J., Toronto.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.

MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co., Cleveland, O.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACE BLOWERS
Roots Co., P. H. & F. M., Connersville, Ind.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Magnetic Mfg. Co., Milwaukee, Wis.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Woodison Co., E. J., Toronto.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, Ohio.
Woodison Co., E. J., Toronto.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MAGNETIC; STANDARD AND SPECIAL
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia
Woodison, E. J., Co., Toronto, Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison Co., E. J., Toronto.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corporation, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD
TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Pressed Steel Co., Muskegon, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison Co., E. J., Toronto.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIND GATES
Roots Co., P. H. & F. M., Connersville, Ind.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

VOL. X. PUBLICATION OFFICE, TORONTO, DECEMBER, 1919 No. 12.

Assures Best Cupola Results

Saves Material

Saves Labor

Solves Molding Troubles

Kawin Service

Reduces Losses-Increases Output

Saves You 100% Over and Above Its Cost

When you decide to adopt Kawin Service you are given "gilt-edge security" of satisfactory results—for Kawin guarantees to save you at least 100 per cent. over and above its cost.

We could not afford to offer such a guarantee as this if we did not know from experience what we can do. Foundries in all parts of Canada and United States are numbered among our clients and they are profiting by our help.

In 1903 we had one service station—now we have five. This gives a fair indication of the general demand for our service.

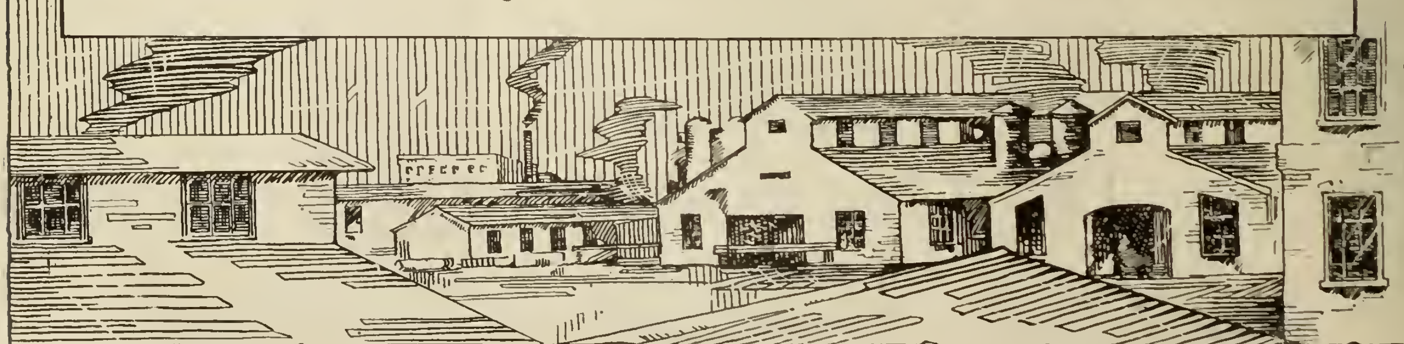
Put your cupola, mixing, moulding, and other foundry difficulties in our hands. We can save you money and increase your profits. Write for particulars now.

Charles C. Kawin Company, Limited

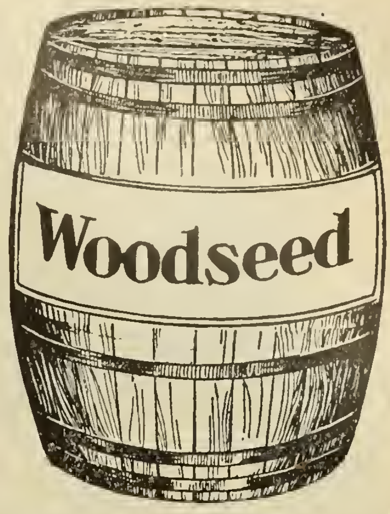
CHEMISTS, FOUNDRY ENGINEERS, METALLURGISTS

307 KENT BUILDING, TORONTO

Dayton, Ohio Chicago, Ill. Buffalo, N.Y. San Francisco, Cal.



WOODSEED
Liquid
CORE COMPOUND



Another PURELY CANADIAN product manufactured in our Toronto plant.

WOODSEED is always lower in price than Linseed Oil.

WOODSEED will bind as much sand as Linseed, and at the same ratio will produce as good a Core.

WOODSEED is always uniform. We do not change the formula to meet the Linseed Oil market.

ORDER TRIAL BARREL NOW!

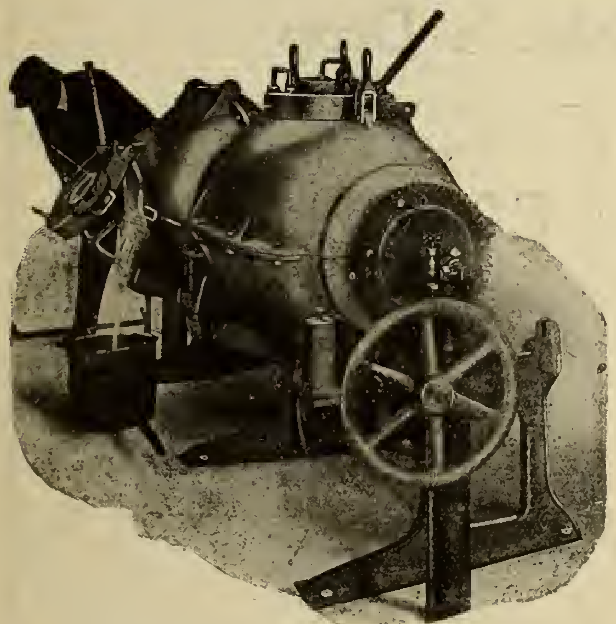
E. J. Woodison Company, Limited
TORONTO

Buy the best! It's cheapest in the long run

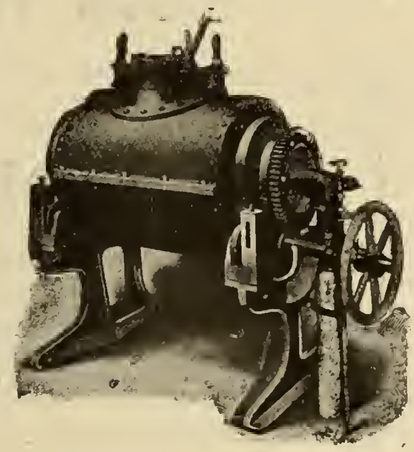
The Monarch Way

of Melting Metal is the Most PROFITABLE WAY

LABOR is the big factor in cost. It is the most profitable when given proper appliances to work with. It is the most wasteful when given inadequate facilities. It's the machine that sets the pace, not the man. If its productive pace is low, low will be the profits; if high, high will be the profits. In many foundry plants facilities are just productive enough to carry overhead and pay the boss an ordinary salary, while in some they are productive enough to pay the boss a handsome salary and leave a nice margin of profits. It is the latter plants that are using the MONARCH MELTING FURNACE type of facilities. MONARCH furnaces not only cut the labor costs, they ensure better melts and consequently better castings.



Monarch Double Chamber Melting Furnace

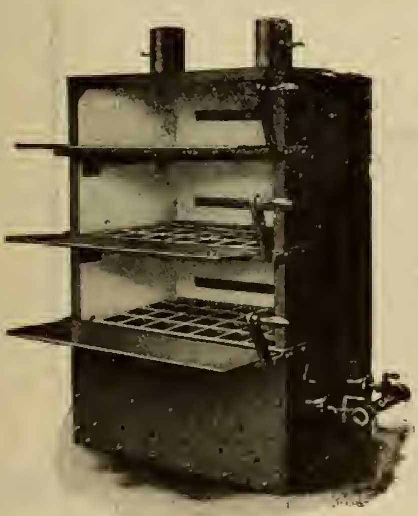


Monarch Rockwell Single Chamber Furnace—"Simplex"

The MONARCH is made in two designs as herewith illustrated. One is a single chamber furnace, the other a double chamber.

Monarch Rockwell, Double Chamber Melting Furnace requires no crucibles. Burns oil or gas. Melts almost twice as much metal as any other furnace without additional cost for fuel, because it utilizes all the heat from its one burner. While melting in one chamber exhaust heat brings the metal in the other chamber to the melting point.

"Simplex"—Monarch Rockwell Single Chamber Melting Furnace—Built on the same lines as the Double-chamber Furnace, but without its continuous heating capacity. Still the fastest and best fuel economizer of its kind.



Monarch "ARUNDEL" Drop Front Core Oven—Any Fuel

Monarch Core Ovens

The MONARCH line of Core ovens will meet all your requirements. Right up-to-date in design and built by hand labor. We have the "ACME" overhead trolley, the "ARUNDEL" drop front ready for immediate shipment—all sizes.

We specialize exclusively in equipment for the brass and iron foundries.

The Monarch Engineering & Manufacturing Company

1207 American Bldg., BALTIMORE, Md., U.S.A.

Shops at Curtis Bay, Md.

HOLLAND PRODUCTS

GOOD PRODUCTS ONLY

Use Holland Products and Your Costs Will Take a Drop

HOLLAND

CORE OIL

Specially constructed gas fired kettles with pyrometer attached for accurate heat regulation always assure uniformity of Holland Core Oil. Order it by the barrel or tank car and save money—the most economical and satisfactory oil you can buy.

HI-BINDER

CORE FLOUR

Hundreds of barrel-lot customers and numerous car-lot customers prove that our Hi-Binder Core Flour is "delivering the goods." Cheaper than flour and the only substitute that is better! Try a barrel and watch results—this is the best test.

HOLLAND CORE ROSIN

A perfectly satisfactory substitute for rosin but much lower in price. Try it.

HOLLAND PARTING

Our mills are the most modern type and you can depend upon the uniformity of every ounce of Holland Parting.

Holland products are specially made to reduce costs and at the same time improve the quality of the work. Get the "Holland Habit" and save money by ordering Holland Core Oils, Match Oil, Linseed Oil, Hi-Binder Dry Core Compounds, Hi-Binder Dry and Green Sand Facing for Steel, Hi-Binder Core Paste, Parting.

Canadian Agents:

The Dominion Foundry Supply Co., Limited

TORONTO *"Everything for the Foundry"* MONTREAL

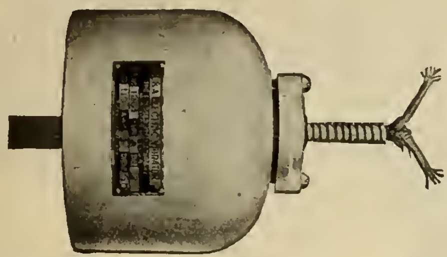
HOLLAND CORE OIL COMPANY

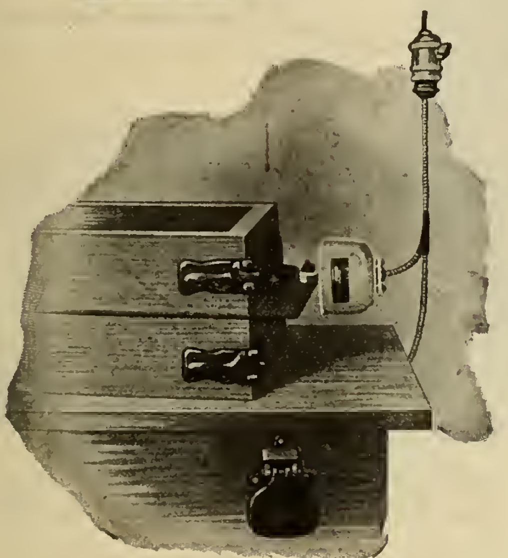
4600 West Huron Street

CHICAGO

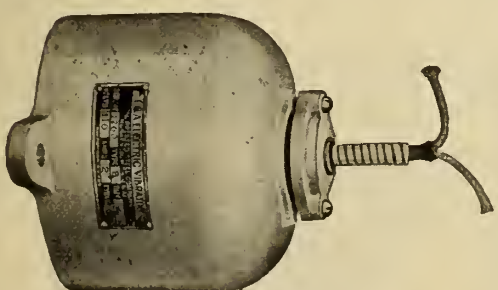
HOLLAND PRODUCTS
GOOD PRODUCTS ONLY

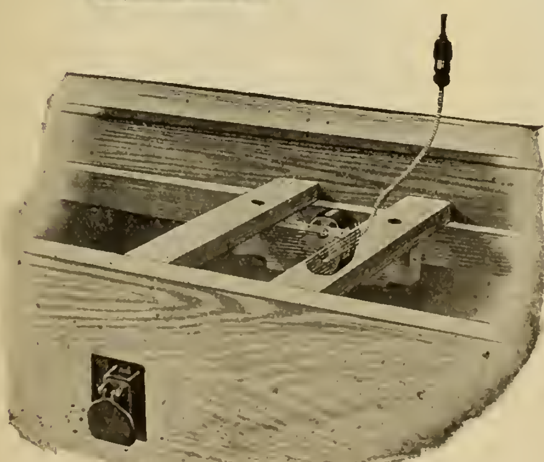
HOLLAND PRODUCTS
GOOD PRODUCTS ONLY





Style "A" quickly and easily attached to match or pattern plates





Crucibles of Quality

UNIFORM

Service and Durability
Ensure Economy.

Tilting Furnace
CRUCIBLES
Our Specialty.

Catalogue on request

A TRIAL WILL CONVINCE YOU.

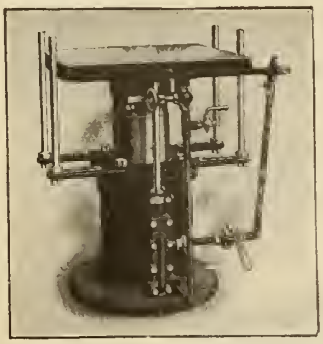
Jonathan Bartley Crucible Co.

TRENTON, N. J., U. S. A.

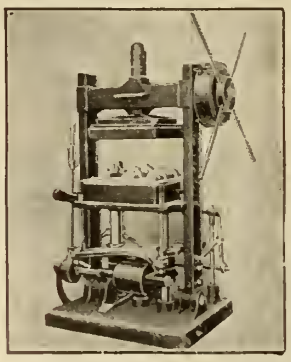
Canadian representative H. T. Meldrum 14 St. John St., Montreal, Canada.

British Moulding Machines

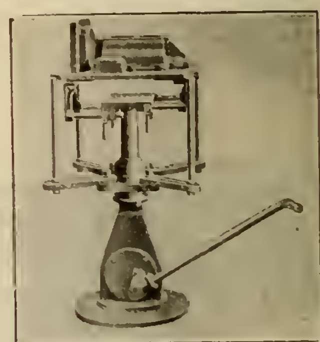
AND FOUNDRY EQUIPMENT



The JARR RAM (Pneumatic).
The Machine with a Perfect Lift.



The HEAD RAM.
Most powerful Hand Machine made.



The HAND RAM.
Adjustable to any size box.

The most efficient Machines, built to stand rough usage

Write for Catalogue to

BRITANNIA FOUNDRY COMPANY

COVENTRY, ENGLAND

Diamond Master Flask

Diamond Steel Jacket

DIAMOND

In Diamond Master Flasks the accepted principles of snap flask building have been developed and enlarged and the weak and faulty conditions overcome. Master Flasks are light in weight, easy to handle, accurate and very durable.

Their convenience and accuracy will result in a larger and better production.

Diamond Steel Slip Jackets are made to fit any make of flask, straight or tempered, and of any thickness of metal desired up to 8 gauge. Far more serviceable than cast iron or wooden jackets—they can neither break nor burn.

We also manufacture a complete line of foundry accessories, Wedges, Clamps, Varnish Cans, Pattern Benches, Core Boxes, Rapping Plates, etc.

Sold in Canada by

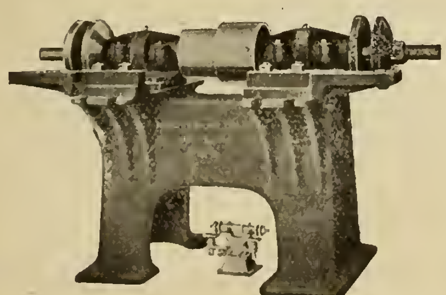
DOMINION FOUNDRY SUPPLY CO.
WHITEHEAD BROTHERS COMPANY
E. J. WOODISON COMPANY
FREDERICK B. STEVENS
HAMILTON FACING MILLS CO., LTD.

If interested, write any of these jobbers or to us direct.

DIAMOND CLAMP & FLASK CO.
38-40 N. 14 St. RICHMOND, INDIANA

Ford-Smith Grinders

FOR EVERY CLASS OF WORK



MILLING MACHINES
SPECIAL MACHINERY
MOTOR DRIVEN GRINDERS
DISC GRINDERS
FLOOR GRINDERS
WET TOOL GRINDERS
BENCH GRINDERS
POLISHING MACHINES
BUFFING MACHINES
SWING GRINDERS

Manufactured by

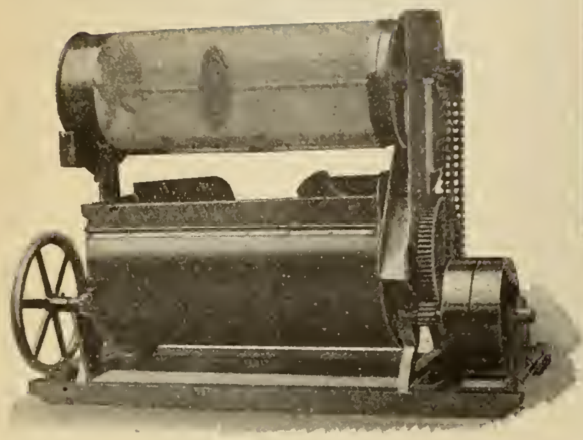
The Ford-Smith Machine Company, Limited
HAMILTON CANADA

CRUCIBLES

DOMINION CRUCIBLE CO.
LIMITED
ST. JOHNS, QUE.

HAMILTON FACING MILLS CO. LIMITED
HAMILTON, ONT.

SOLE CANADIAN DISTRIBUTORS



BLYSTONE
SAND MIXER

Strong
and
Durable

Simplest
Mixer
Made

50

MAKES
50
PER CENT
CUT
in
MIXING
COSTS

The "BLYSTONE"

The Foundry Owner's Best Friend These Days of High Production Costs

In these days of labor shortage and high cost of production manufacturers must figure out ways of doing more work by machinery than ever before. FOUNDRYMEN—THINK OF THE SAVING YOU CAN MAKE WITH A BLYSTONE SAND MIXER! You can cut your mixing costs 50% if you will let the BLYSTONE take the place of the hand-and-shovel method.

Time required for mixing is reduced 60%; and 25% to 30% less core oil and other binders are required.

Think of what the BLYSTONE means to you in your multiplicity of manufacturing problems. Can you afford to be without it?

Over 1,000 foundries in Canada and United States are now using the BLYSTONE for mixing Core Sand and Facings. Right now we are selling more machines than ever before—foundrymen need it to decrease labor costs, to increase production, to make a fair profit.

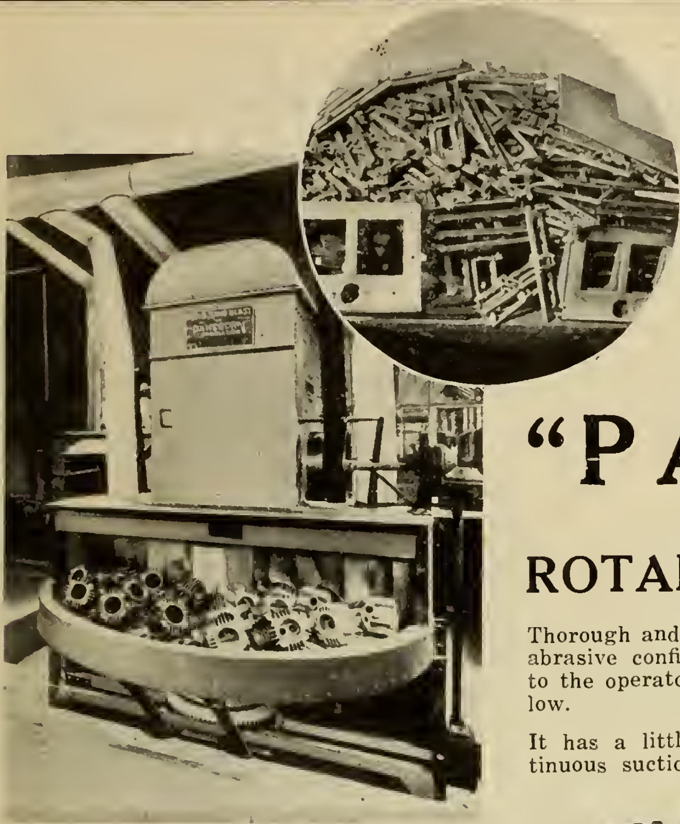
WRITE FOR ATTRACTIVE TRIAL OFFER

Representatives at all principal points:

BALTIMORE	J. W. Paxson Co.	NEW YORK	Wonham, Bates & Goode, Inc.
BIRMINGHAM	Hill & Griffith Co.	PHILADELPHIA	J. W. Paxson Co.
BUFFALO	E. J. Woodison Co.	PITTSBURGH	J. S. McCormick Co.
CHICAGO	Scully-Jones & Co.	SAN FRANCISCO, CAL.	Ditty Brothers
CINCINNATI	Hill & Griffith Co.	SEATTLE, WASH.	Ditty Brothers
CLEVELAND	E. J. Woodison Co.	TORONTO	E. B. Fleury
DETROIT	E. J. Woodison Co.		(1609 Queen St. W., Phone Park 6700)

BLYSTONE MANUFACTURING CO.

1119 Ironton Street - Cambridge Springs, Pa.



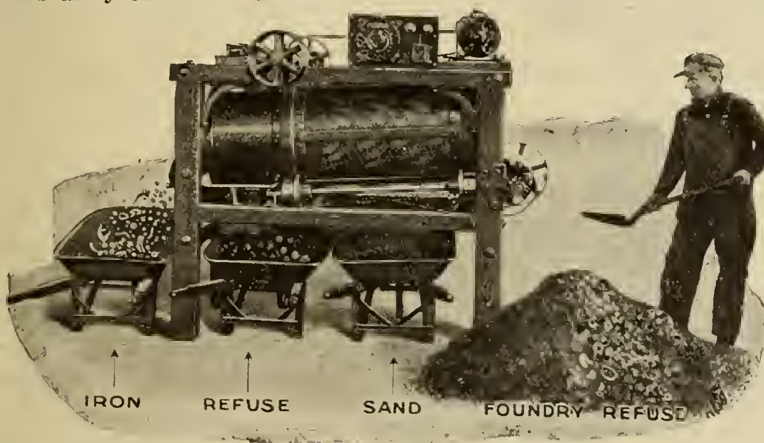
You Will Save Money

With This Machine in Your Foundry

Don't let iron chippings, gaggers, risers, runouts, grindings, filings, broken tools and scrap metal find their way to the scrap heap, then finally to the dump! This material is valuable. It represents real money when you put the DINGS MAGNETIC SEPARATOR on the job in your foundry.

The DINGS share of usefulness doesn't stop there, either. IT'S A SAND SAVER, TOO. Think of this machine as a cost-cutter. Can you afford to be without it?

Handles anything you can put on a shovel. One man operates it. Power cost is very light. Over 2,500 in use—why not join this army of contented users?



DINGS

Magnetic Separator

Should be thoroughly known to every foundryman—write for full description to-day.

DINGS MAGNETIC SEPARATOR CO.

800 Smith Street

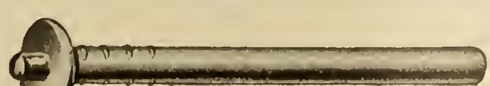
MILWAUKEE - WISCONSIN

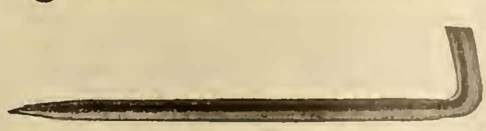
Lindsay Chaplets

Lindsay Chaplet & Mfg. Co.

911 Harrison Building

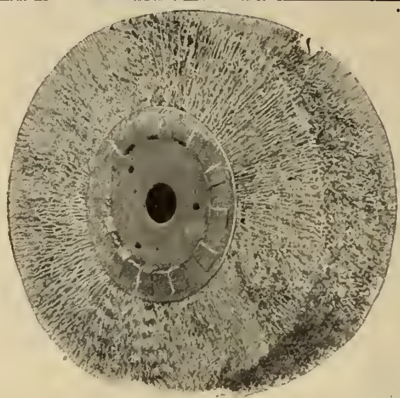
Philadelphia Pennsylvania





"SAMSON" Wire Wheel Brush Sections

Each Section a Brush in itself



Can be quickly mounted on a Shaft or Spindle

No Hub or Holder Required

Metal disc centre punched to fit any size spindle.
A convenient and practical method of building a wheel any desired width of face.
Especially recommended for removing scales from hot forgings, axes, shovels and tools; for cleaning brass castings, sheet brass and copper.
A trial order will convince you "Samson" scratch wheels are the most efficient and economical brushes on the market to-day.

Write for catalog and complete information

The Manufacturers Brush Co., Cleveland, Ohio
19 Warren Street, New York

A Complete Heating Plant For Foundries

This furnace is a complete portable hot air blast heating and ventilating system ready for operation—requiring small space only.

Equals 100 Salamanders—
Less trouble and fuel than one—
The Blower does it

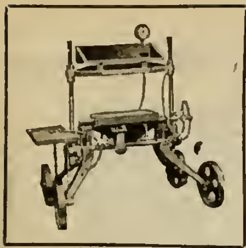
Designed for factory and industrial buildings requiring heating and ventilating at the smallest possible cost.

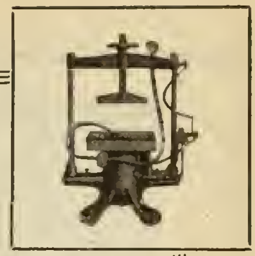
Mechanical Hot Blast Heater

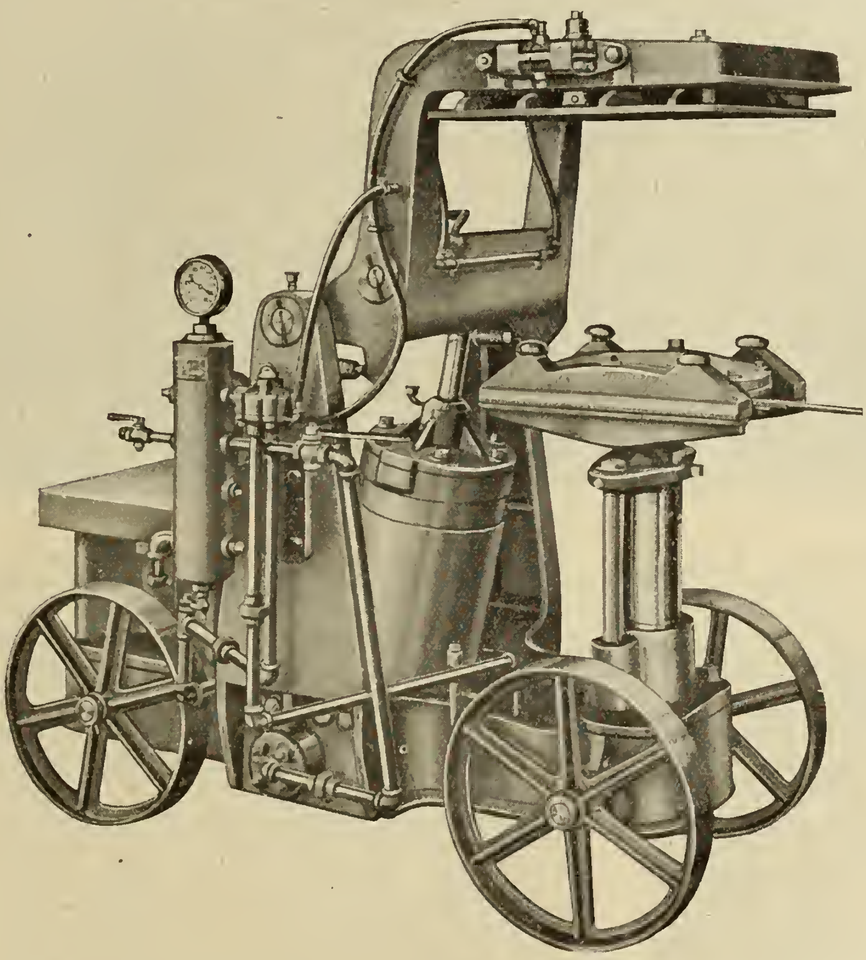
Will burn any kind of coal, coke, oil or gas. Made for belt drive or with direct-connected motors. They are decidedly economical in operation—simple in construction—nothing to wear out or get out of order.

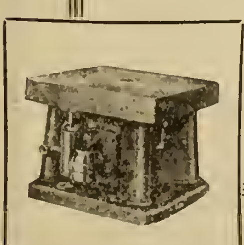
For drying purposes it is especially recommended for drying clay products, asbestos, magnesia, cereals and all other products dried by warm air up to a temperature of 400 degrees F.

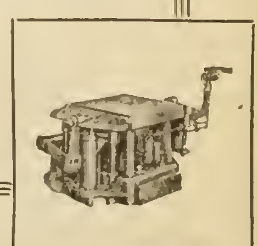
ROBERT GORDON, Inc.
OFFICE AND FACTORY, 622 WEST MONROE ST., CHICAGO, ILL.
CANADIAN AGENTS, E. J. WOODISON CO., LIMITED, TORONTO, MONTREAL











CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909 Published Monthly

An Interesting Casting, Made in a Loam Mould

Previous to the War These Castings Were All Imported From Germany, But Canadians Are Now Producing Them of a Superior Quality

By F. H. BELL

IN the accompanying illustration will be seen an interesting piece of casting which was moulded and cast at the foundry of Miller Brothers & Sons, of Montreal, Canada. It is one of an order which this company filled for the C. H. Catelli Co., Ltd., manufacturers of macaroni, and is used in the process of the manufacture of this staple article of food. It is to all intents and purposes a kettle as far as the eye of a foundryman can discern, but it requires to be of this particular design in order to answer the purpose for which it is intended. Its outside design can be seen in the picture, while an inside view presents a plain bottom, nine feet in diameter and straight parallel sides four feet high. It is 2¼ inches thick and weighs approximately 13,000 lbs. While its general appearance is such that it might not at first appear to present any very great difficulty in the way of moulding it, nevertheless, presents some very interesting features which cannot fail to be of interest to any intelligent foundryman. The mould in which this casting was made might properly be designated a combination mould, being partly done in sand and partly in loam, but it was essentially a loam mould.

In beginning the mould a perforated plate similar to the one shown in Fig. 2 is levelled up on blocks as shown in Fig. 7. This plate must be heavy and rigid enough to bear up the weight of the mould and the casting when poured. The spindle is plumbed up through a hole in the centre of this plate and the sweep board, Fig. 3, is secured at the proper distance from the spindle. The design of this sweep board will be seen to be such that it will make the straight upright side; also the flange, the level top and the tapered guide. The 8-inch brick wall shown to the left of Fig. 7, and which constitutes the outside of the mould, is now built on this plate about ⅝ of an inch clear of the sweep, and loam to this thickness is spread on and swept to the shape of the sweep.

Moulding Sand For the Bottom

The wall being done, a sufficient thickness of sand is rammed on to the bottom to admit of the ribs being bedded in. This sand bed is struck off level, after which the ribs are bedded in level with the sand and withdrawn and the bottom finished as in any green sand mould. The facing sand used in the bottom would contain a binder so that it could be skin dried. This bottom would, of course, be well vented to the bottom plate with a fine wire, and the sand along the ribs will be well nailed to the main body of the sand. All vent holes will be rubbed over and the entire surface made smooth and black washed. This will require to be dried sufficiently to form a good crust. After the drying process is completed and the ashes and loose dirt are blown out this portion of the mould is practically done.

AN INTERESTING CASTING MADE IN A COMBINATION LOAM AND DRY-SAND MOLD.

Making of the Core

The making of the inside and cover is equally as interesting. This is done entirely with brick and loam. A pricker plate similar to Fig. 4 is cast in open sand with 3 staples equally divided for distance on the back and about a foot from the edge. This plate must be heavy enough to bear up the weight of the core, being about 2 inches thick, and perforated with small holes and well provided with prickers about 2½ inches long to secure the loam. This plate is the foundation on which the core is built and will form a part of the core itself. It will therefore require to be about an inch smaller all around in order to permit of the shrinkage in the casting of the kettle. Before starting to build the core this plate has to be turned over with the prickers uppermost, and the loam surface swept on. To do this the plate requires to have a hole in the centre, through which the spindle projects. The plate is blocked up level and the spindle the bottom, the core is slicked and black washed and put in the oven and dried, which completes this portion of the core.

Making the Cover

The next move is to make the cover. This is done in a similar manner to making the bottom of the core. A ring is made and loamed the same as was done These bars or slats, as they might be called, are used as backing to wedge the brickwork to, instead of ramming the finished mould into a pit.

The pouring of this mould is done by means of pop gates. As will be seen on the cover plate, Fig. 6, there are 24 holes in a circle corresponding to the diameter of the casting. The location of

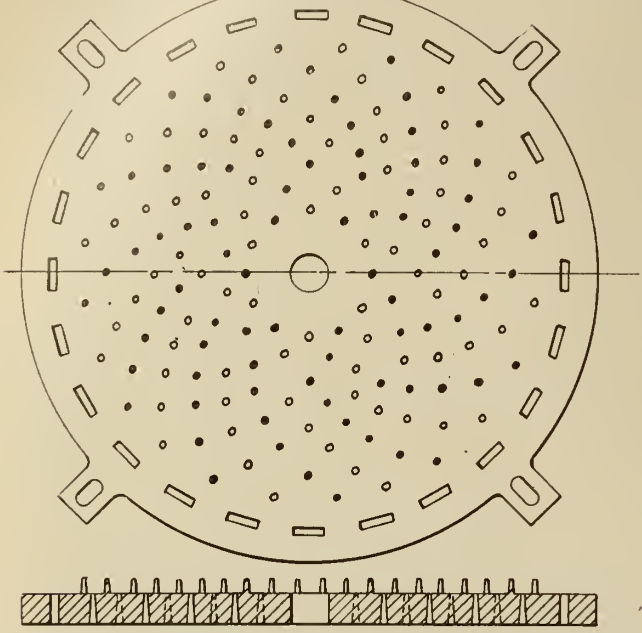


FIG. 2—SHOWING FOUNDATION PLATE ON WHICH THE MOLD IS BUILT—THIS PLATE ALSO PERFORMS AN IMPORTANT DUTY IN THE BINDING OF THE MOLD.

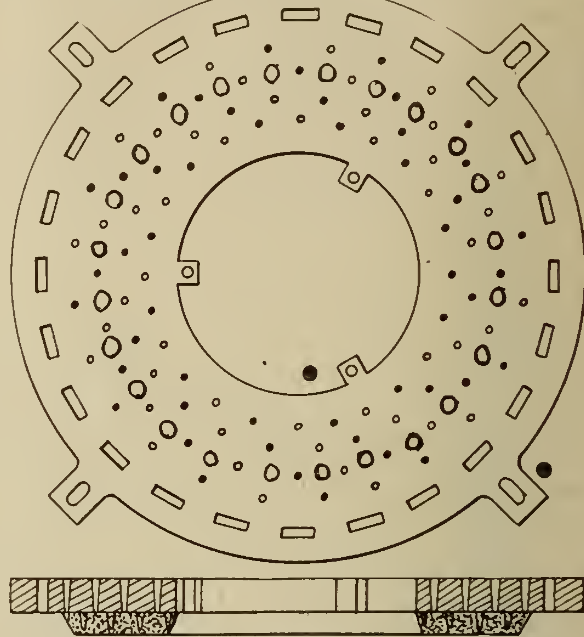


FIG. 6—COVER PLATE, ALSO FORMING A MAJOR DUTY IN HOLDING THE MOLD.

is plumbed to a right angle with the plate and a straight sweep is used. Before putting on the loam, the prickers are clay washed. The loam is spread on by hand and struck off with the sweep, after which the sweep and spindle are removed and the surface is slicked and black washed and this much of the core is put in the oven and dried, after which it is turned over and levelled up and the spindle put in place and the brick wall of the core is built up to the sweep, which is the reverse to the former one and appears as in Fig. 5. The top of this wall is loamed and swept off level, the lower sweep arm being placed at proper height, and after removing the spindle and sweep and plugging up the hole in with the bottom plate, giving it the appearance of Fig. 6. This is turned over and placed on top of the core and secured by hook bolts, making it as though all swept up in one piece. In placing the two parts together it is necessary to have them carefully measured so as to have the core exactly in the centre of the cover. The whole thing is now lifted up and lowered down into the mould. The taper on the cover corresponding to the taper in the mould insures perfect alignment and even thickness to the casting. The mould is now bolted together by means of bolts connecting the lugs on the bottom plate to those on the top. Upright bars 1¼ x 3 inches are stood in the slots shown in the plates. gate is shown in Fig. 7. Gate pins are placed in these before loaming the plate. The 24 gates are connected on the top of the mould by a pouring basin and this basin is flooded with metal when pouring. The metal drops into the ring shown on the illustration, and falling, as it does, on all sides simultaneously or at the same time, it cushions itself and remains where it fell without giving the mould an opportunity to cut. All succeeding metal falls into this and flows through the mould, making a sure run of it. By making a number of duplicate castings, the same mould does for them all by retouching it where required. A casting of this size will shrink slightly over an inch and will free itself

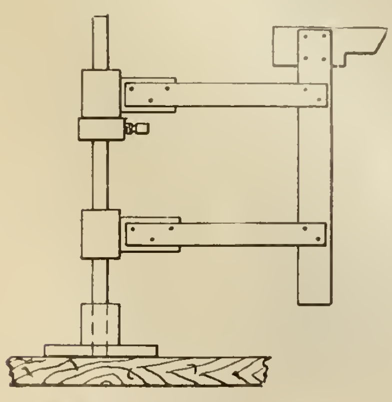


FIG. 3 SHOWING SPINDLE AND SWEEP ARRANGED FOR SWEEPING THE OUTSIDE WALL OF THE MOLD.

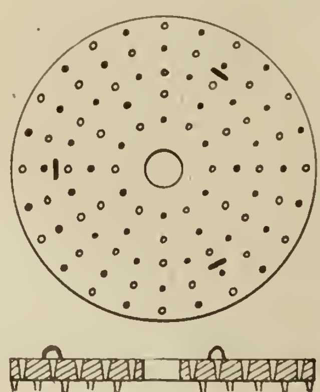


FIG. 4—TOP AND CROSS-SECTION VIEW OF PLATE ON WHICH CORE IS BUILT

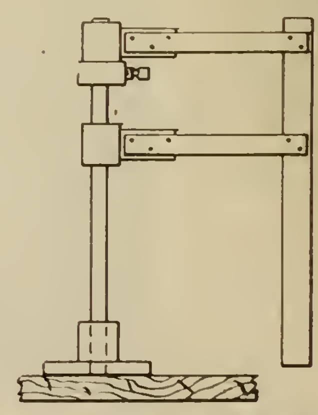


FIG. 5—SPINDLE AND SWEEP FOR SWEEPING CORE TO PROPER SIZE AND HEIGHT.

from the outside. The inside will, of course, be just the reverse and will require to have an upright row of soft loam bricks built into it to crush under the shrinking pressure and prevent the casting from cracking. This part will have to be built anew each time. When the casting is removed from the mould the spindle and sweep are put into place and sufficient loam spread on to repair the damages and the mould is black washed and dried and proceeded with as in the case of a new mould. The sand bottom will, of course, have to be tempered and done over each time. In making the first one the brick and loam would require to be dried before the sand bottom was made or else the heat required to dry it would be too great for the bottom.

Mr. Donaldson, the foundry manager, who is standing beside the casting, Fig. 1, and under whose personal supervision the work was done, is particularly proud of these castings on account of their general appearance, if nothing else, although they were perfect in every respect. The casting as it was photographed is just as it was taken from the sand, and as will be seen it is almost perfectly clean. The foundry in which this work was done, was formerly operated by the late P. Amesse, but was recently taken over by Miller Brothers & Sons, who for generations back have operated a machine shop, etc., and purchased their castings from this foundry. Mr. Donaldson, who was placed in charge of this department, is, needless to say, a thorough foundryman, and is showing the foundrymen of Germany that their services are no longer required in this particular field.

It never was necessary to import these castings from Germany or from anywhere else, but if it had not been for the war Germany would undoubtedly have been still supplying these goods to Canadians.

In the chocolate factories, of which there are quite a few in Canada, large kettles of a somewhat different design from this, but right in the line of good Canadian foundry practice, are used, but strangely enough it never occurred to the Canadian chocolate manufacturer or the Canadian macaroni manufacturer to leave his order with a Canadian foundryman, and it evidently never occurred very seriously to the Canadian foundryman to go after the order.

Characteristic of the Canadian people, they seem to have great esteem for anything which bears the name of "imported." The people of Germany never seemed to be that way. On the contrary they took pride in letting the world know that their goods were "Made in Germany," and if Canadians were anxious to have an imported article, the German was equally as anxious to accommodate them, and if the German foundryman should ever push himself into this field again we must not blame him. Our foundrymen have demonstrated that they can produce the goods, and now it is up to Canadians to be proud of our institutions and not be ashamed to say that it was "Made in Canada" when speaking of a chocolate boiler or a macaroni kettle.

ONE THING BRINGS ON ANOTHER

A reader of the CANADIAN FOUNDRYMAN submits the following: In the October issue was an article entitled: "Peculiarities of Melted Iron," which brought to my mind a condition which exists in most foundries. What I refer to is the pouring of pipe jobs. Pipes of all sizes are usually moulded on their side and gated on one side. As the iron enters it runs down below the core and comes up to opposite side at the same that that it comes up the side next to the gate. The metal on the opposite side of the core forms a sort of a scum on its surface, and all iron which enters and goes to that side simply forces this scummed surface higher up, but does not break it. The metal on the side next to the gate does not act particularly different, although it might be kept a little more lively. When the iron has raised to a sufficient height to cover the core these two scummy surfaces flow towards each other, and ultimately come together, but it is quite frequent that they do not knit properly together. The top of a pipe poured this way is quite often unsound and the foreman usually attributes it to the core being too hard or the core wash not being of the proper constituency. It is not an uncommon sight to see the entire top surface full of holes and flaws with cold-shuts. This is often blamed onto hard ramming of the cope, whereas it is really all in the pouring. I was never particularly attached to pop-gating, for the reason that the metal splashes all over when it strikes the top of the core, and besides it is apt to cut the core, but apart from this it is a safe way to get a solid top on the casting. For work which is not too big I have had success by gating on top of the core print and cutting the gate lengthwise into the pipe. This has all the advantages of pop gating and goes away with the splashing, but for large work it is apt to strike heavy on the mould below the parting where it begins to curve inward.

To start a gate at each side of the core print and join them on top of the mould with a pouring basin has the effect of preventing any scum from forming during the first stages of pouring, and if the opposite end from the gate is raised slightly as has been already pointed out in this periodical, it is probably as safe a way as any to make the ordinary run of pipe castings, as the iron does not flow over the top of the core all at the same time, but fills one end and works its way to the other covering the core and making a solid and sound casting as it goes along.

Never crawl under a hanging mould or even put a hand under it to do repair work unless some support is first put under it or something which it can fall onto and which is of sufficient height to prevent personal injury to the workman. Don't take any chances as chains have been known to break and this one is just as likely to break as any other. "Safety First" is a wise motto.

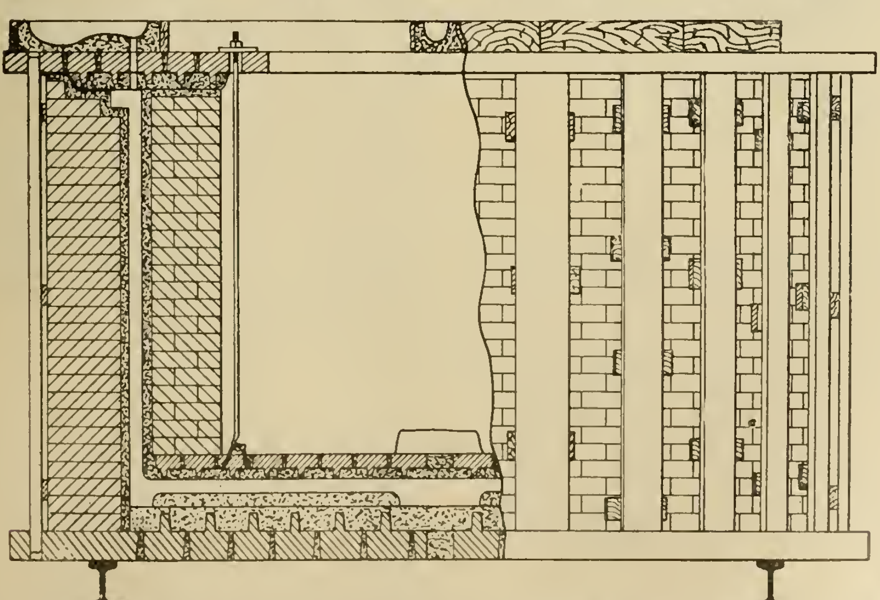


FIG. 7—LEFT SHOWS SECTION OF INSIDE OF MOLD AND CORE—RIGHT SHOWS OUTSIDE APPEARANCE, WITH UPRIGHT SLATS WEDGED TO BRICKWORK TO PREVENT SPREADING

BELT CEMENT

In mending belting in a foundry or wherever belts are exposed to steam, it is not advisable to use glue. The steam will dissolve it and the joint will soon break. The only adhesive that will hold under these conditions is a pyroxylin cement, which being waterproof, will withstand the steam and moisture indefinitely.

There once was a man named Costello,
Who was a most stingy old fellow;
To church he once went, donated a cent,
And brought home a fine silk umbrello.

"Genius is the power to take a hint."—Markham.

"An institution is the lengthening shadow of one man."—Emerson.

Loam-Moulding a Small Five-Way Flanged Pipe

Loam-Moulding is the Oldest Branch of the Moulders' Art, and it Still Has Advantages Which Are Indispensable

From the "Foundry Trade Journal," By C. THOMAS

IN the ordinary course of pipe founding, the top branch of a five-way pipe, such as illustrated in Figs. 1 and 2, would be made by means of a loose core and a core with a small radius placed on the main body-core.

In the particular case discussed in these notes the radius desired at the junction of the top branch is very large, and it is absolutely necessary that the bore of the pipe should be perfectly smooth. Moulding in the ordinary way could not be followed, as this would result in the formation of a bad place where the loose core joined the main body of the pipe.

Figure 3 illustrates a method of overcoming this difficulty. A plate, as shown in Fig. 3, is first cast of a suitable length and width to allow the pipe pattern to be strickled on in loam. The centre of the branch on the top of the pipe is then marked on the plate. The brackets 2, having been already cast the same width as the plate and 3 in. or 4 in. higher than the face of the flange of the branch, are carefully set equi-distant from the centre of the branch marked on the plate, and also exactly at right-angles to the plate. These brackets are held in position by means of cramps. A strickle 3 is screwed to a guide strip C. This guide strip has two notches, by means of which it is centred between the brackets. The skeleton iron to carry the core is made with long, straight prods to carry the top branch. The body core is strickled with the usual strickle as far as the angles, and these are made, using a quarter strickle worked off the plate. The angles or radius of the top branch are left until the whole core is dry, when they are made, using a template on the centre lines of the branches. The remainder is worked in by hand. The top branch core is formed on the main core by using the strickle with the guide-strip, on either side of the brackets. The core is "thicknessed" in the usual way, with the exception of the branch, and this is left without thickening. When preparing the pattern for the flanges, it is advisable to work from the centre branch, so that any slight error in setting the guide brackets may be corrected. The thickness of the branch is obtained by means of a few strips of wood cut the correct thickness and length for the flange to rest on. These are fastened to the branch core by means of a few sprigs and the remainder filled in with sand or loam. The length of the strips is obtained by measurement from the dead-plate on which the pattern is placed to prepare it for the flanges.

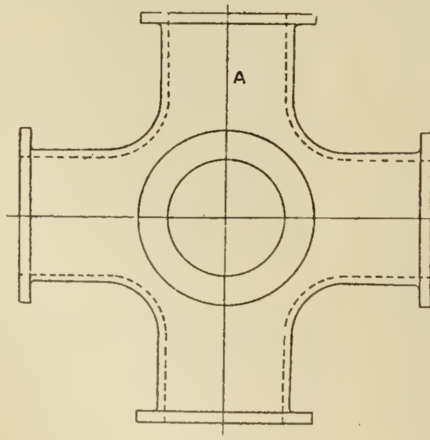


Fig. 1.

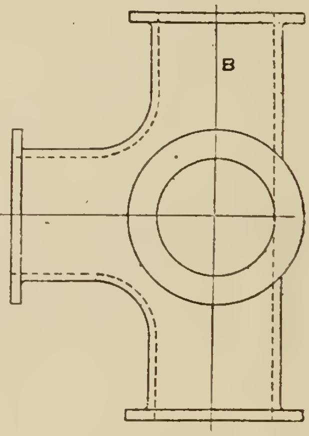


Fig. 2.

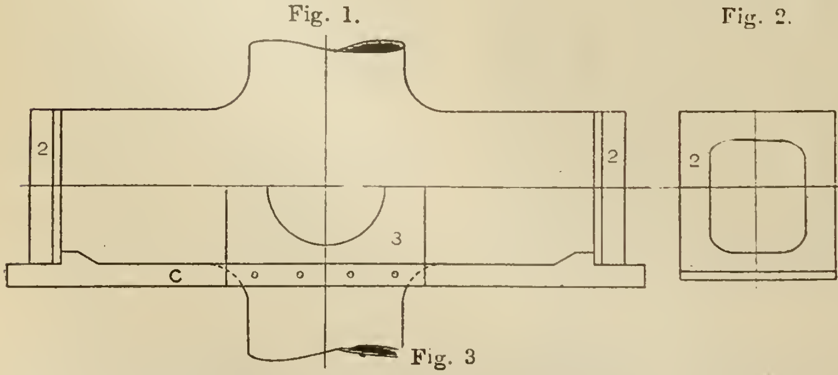


Fig. 3

FIGS. 1 AND 2 SHOW VIEWS OF CASTING.
FIG. 3 SHOWS IMPROVED METHOD OF MAKING IT.

CENTRIFUGAL STEEL PIPE MAKING

National Steel Corporation, Limited, of Toronto, Have Tried Out New System With Marked Success

The National Iron Corporation, Limited, Cherry Street, Toronto, manufacturers of steel pipe, have been trying out a new method of casting iron pipe and part of their operations are being devoted to the turning out of machinery, which, it is predicted, will some day come into universal use in the making of steel piping. The firm have already shipped one of the machines to France and a representative of a Japanese firm of manufacturers is with the company now receiving instruction in the progress with a view to introducing it into his plant in Japan.

The method was devised by a French engineer and it is being commercially undertaken both in Canada and the United States, the claim being that it will revolutionize the pipe making industry by reason of the fact that it produces a stronger pipe and one that will not burst under a high pressure. Of course before it can come into general use in this country it will be necessary for the Canadian Society of Civil Engineers to alter the standard.

In the method employed, a rotary, water-cooled cylindrical mould receives the molten metal, no sand being used. The iron, at very high temperature, is poured through the funnel into a trough, which is immediately introduced into a revolving mould and turned over. Centrifugal force distributes the metal evenly, and as graduated ladles are used, there is no waste. The finished pipe is withdrawn a few seconds after the iron is poured, coming out lengthwise quite easily. The walls of the pipe so cast are remarkably thin and uniform, and tests indicate greater strength and closer texture than result from the ordinary casting in sand. Many experiments in centrifugal casting of iron pipe have previously been tried but did not prove commercially practical. The success of the system is attributed to a cold mould and the instant withdrawal of the pipe which hardens as soon as poured.

After the peace treaty had been signed by Germany's representatives in the Hall of Mirrors at Versailles the Eiffel Tower wireless station sent broadcast the message "Fermez les portes" ("Shut the doors"). The phrase, as many will understand, was suggested by the fact that when peace was declared in ancient Rome the doors or gate of the Temple of Janus were closed.

Molding Cup and Saucer for Christmas Present

An Interesting Yet Difficult Mould to Make, Showing Ideas Which Are Useful in Other Kinds of Castings

MOULDING CUP AND SAUCER

THE views which I am showing here, while looking childish, are not by any means as childish as they might at first appear. While the subject I have chosen is perhaps about as useless as anything could possibly be, I thought it would be in keeping with the Christmas spirit which is pervading the air at this joyous season, to illustrate something which would be of interest to the younger generation and at the same time demonstrate what is really a difficult line of moulding.

Moulding is moulding anyway, and if the moulder gets his information on a job like this he can use the knowledge to good advantage on any job where these particular features of the trade appear.

To make a tea cup and saucer in one piece would be a simple operation if the cup did not have any handle, but to make the cup with a handle and also

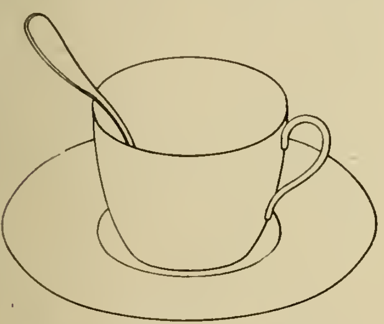


FIG. 1—CUP, SAUCER AND SPOON, CAST IN ONE PIECE.

have a teaspoon in the cup, as shown in Fig. 1, makes the moulding of it a more complicated undertaking, and as I have already said, if the moulder can do it he can do lots of useful jobs which are similarly complicated.

Now to get down to the work in hand. First put down a flat follow board on which to start the mould, remembering that a three-parted flask will be required. What will ultimately be the cope will be put down first. The saucer will first be placed on the board and the flask placed as shown in Fig. 2. After ramming this part and bedding on the board and rolling it over, the parting is made, as in the bottom point of Fig. 3, and the cup is put in place and the chute part of the mould rammed up. The spoon is put in place and the sand tucked under it. The parting is now cut as on the upper point of Fig. 3 with the handle left

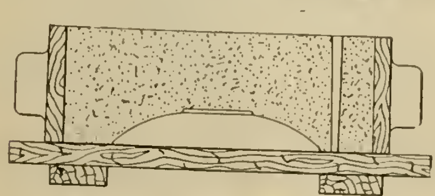


FIG. 2 STARTING THE MOLD.

entirely exposed. The space to one side of the handle is now filled in and an upright parting made, splitting the line of the centre of the handle, after which the remaining portion is made up around the handle. This is smoothed off level

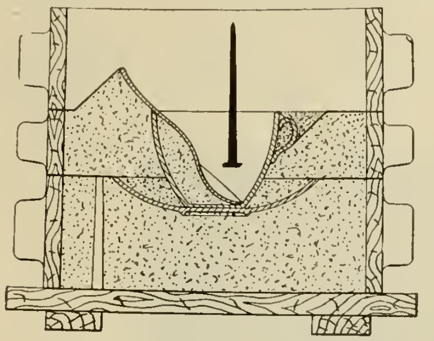


FIG. 3—MOLD READY TO HAVE DRAG RAMMED UP.

and the third part of the mould is rammed up. A large spike or a soldier rammed into it to anchor the inside to the main body of the sand. After well venting it it is now lifted off and the spoon lifted away. If it is feared that the spoon will not run on account of being too thin it can be scraped away at the underside where it will not show, but leaving the upper or face side of the spoon as it is. A little thin paste is now put on the end where the parting is and the mould closed. The paste holds the two sections of the inside together, and it would now be possible to lift it off again as shown in Fig. 5, and remove the cup, but I prefer to bed the board on and roll it over, leaving it as shown in Fig. 6, after which the cope is lifted off and the saucer is removed. The check is next lifted off, leaving the handle of the cup bedded into the sand, which had

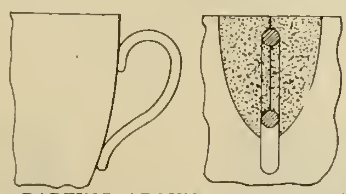


FIG. 4—PARTING AROUND THE HANDLE AND THROUGH THE CENTRE OF HANDLE.

previously been tucked around it with the parting up the middle. The cup is then slightly turned around so as to move the sand at the handle in order to admit of lifting away the cup, when the sand forming the handle wil be pressed back into place with the fingers and the cheek and cope put into place again.

If it was desired to lift the inside as shown in Fig. 6 the cup would be turned slightly to relieve the handle, the same as the other way, and the cup removed and the mould closed up and rolled over; the cope lifted off and the saucer removed; the gate cut and the cope returned. Either way works all right, but which ever way it is moulded, it is always gated and poured as in Fig. 6, or else pop gated in the centre.

PIG IRON TRADE

The price of pig iron of all grades is going steadily upwards. In an already strong market, the prospect of curtailment by lack of coal acted as a further strengthener. Following are reports from various U. S. centres:

PITTSBURGH.—The foundry iron market has been quiet lately, but this is due to the furnaces being pretty well booked up for next year, first half. There has been great activity in basic, 40,000 tons of this grade having been sold. The basic prices are $33 valley and Bessemer at $34.

NEW YORK.—The demand for pig iron is strong and furnaces have sold up at least half their capacity for the first half. This condition is reflected in the rising prices. Eastern Pennsylvania

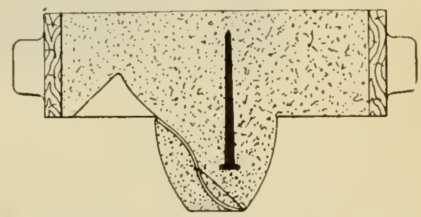


FIG. 5—INSIDE LIFTED OUT AFTER SPOON WAS REMOVED. PASTES BROUGHT UP THE PIECE.

foundry, 2.25 to 2.75 silicon, first half delivery, has sold at $37 and $38 furnace, and 2.75 to 3.25 silicon at $39 to $41 furnace.

CHICAGO.—Producers are practically out of the market, thus applying to both Northern and Southern furnaces. Melters would be glad to place contracts almost regardless of cost. A small tonnage from a Virginia furnace is being offered in the Chicago district at $36 furnace, with a $5 freight rate, and full manganese differentials.

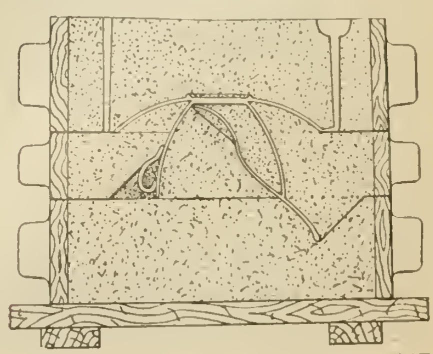


FIG. 6—CROSS-SECTION OF MOLD WHEN COMPLETED.

Electrically Heated Metal Pattern Plates

This Article Refers to Pattern Plates Which Are Used on Molding Machines. The Electric Burner Taking the Place of the Gas Burner Sometimes Used

THE production of clean, smooth castings from molds made with metal patterns depends upon there being no sticking of molding sand to the patterns when they are removed from the sand. There is a tendency for moisture to collect on the cold metal pattern from the moist sand, or for the cold plate to "sweat," during which process moisture collects on it. When this moisture collects, the sand sticks to the pattern being removed from the mold, and the mold acquires a rough surface, so that when the metal is poured, the casting will have a rough surface. This pattern will now have a rough surface, due to the adhering sand, so that when the next mold is made, it will have a rough surface unless the pattern is cleaned off and dried. This trouble is experienced summer and winter.

The collection of moisture can be prevented by heating the pattern. The heat applied, however, must not be so great as to cause the sand in the mold to dry, as it would then crumble away and again the casting would have a rough surface. Furthermore, the heat must be applied in such a way that the pattern can be conveniently changed when desired.

The usual method of heating is by means of a gas flame left burning in the space underneath the pattern within the frame work of the molding machine. It is difficult to keep the flame low enough so that it will not heat the pattern too much. A larger flame than necessary is, therefore, employed at some distance from the surface of application. This makes an inefficient arrangement, as most of the heat is dissipated into the surrounding space. The surrounding air becomes contaminated by the gas fumes, and in summer there is the further discomfort due to the heating of the surrounding air.

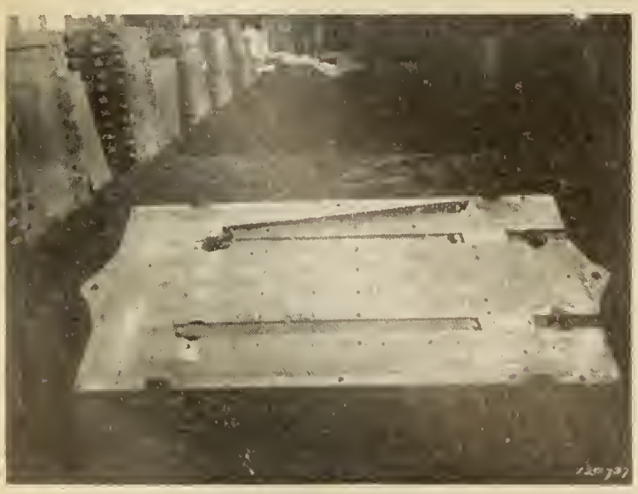
BOTTOM FACE OF TABLE, SHOWING ELECTRIC LEADS.

Difficulty is experienced due to variation of gas pressure, so that at one time the pattern is too hot and at another too cold. When the pattern gets too hot, it is necessary to cut off the gas, and when it has cooled down, relight and readjust the gas. In some sections, there is a scarcity of gas.

A much more convenient method of heating is by the use of electric heaters as shown in the photographs. Two steel-clad heaters are shown mounted in the space immediately below the metal pattern plate, within the framework of the molding machine. In order to use as little heat as possible, they are located just below the thickest pattern used. They are attached to simply supporting angles attached to the frame of the machine. It is obvious, then, that any pattern of any thickness and of any size within the capacity of the machine may be attached to or removed from the molding machine without being interfered with by the heaters, and without disturbing the heaters whatever. To conserve heat, an asbestos insulating plate is placed just below the heaters, to prevent loss of heat due to radiation downward from the heaters. The entire installation is made in such a way as not to interfere in any way with the usual operation of the machine, including the mechanical vibrator, and without any modification of the machine other than to drill and tap small holes for attaching the mounting angles.

As stated above, the heaters are of the steel-clad type. For the molding machine shown, taking a pattern plate 16 in. x 11 in. x 2 in., there are two heaters, each 13 in. long x 2¼ in. wide x ¼ in. thick overall. They consist of slotted ribbon resistors of high resistance, temperature-resisting alloy insulated in mica troughs, the whole being encased in a heavy sheet steel cas-

Continued on page 349



HOW ELECTRIC HEATER IS ARRANGED.

MOLD BEING MADE, WIRE NO INCONVENIENCE.

Making a Large Pulley From a Small Pattern

Also a Few Other Ideas Which Can be Utilized in Moulding From the Old-Fashioned Pulley Ring and Spider

WE will suppose for convenience in figuring that we have a pulley ring with six inch face and twenty inches in diameter and we wish to make a casting with the same width of face but an inch bigger in diameter. We will also presume that the casting is to be half an inch thick.

Before describing the method of moulding, it might be as well to first describe the system of moulding to be followed if the pattern were of the proper diameter, after which we will describe how to get the additional inch. In order to do odd jobs such as this it is required that we be equipped with the old-fashioned pulley ring with loose arms and loose hubs on the arms, also anchor to fit down between the arms to lift the portion of the inside which is above the arms. Along with this we should have a three-part flask with the cheek of the same depth as the pattern, viz., six inches, also a bottom board. The cheek may be rammed on a smooth board and rolled over, but nothing much is gained by it, so we will ram the drag up on the bottom board and strike it off level, after which, place the pulley pattern right side up, which is to say, with the thick side uppermost. Bed the arms into the proper place and make parting, both at arms and outside at bottom. After putting the anchor in place by means of screws which project high enough to reach above the top of the cope and which are left in for the time being; the cheek is put on and the sand rammed up level with the top of the cheek, inside and outside of the pattern and another parting cut. The cope is now rammed up, after which the screws are withdrawn from the anchor and the cope lifted off. The ring part of the pattern is now drawn and the cope returned. The screws are now replaced and secured with wedges, and the cope again lifted off, bringing the anchor and its part of the inside with it.

This, to my notion, is better than lifting the anchor separately as it insures making the mould true to the pattern, providing the flask is tight and it also gives an opportunity to roll the inside over to finish it. The cheek is now lifted off and the finishing and blackening attended to when the cheek is replaced and the core set and the cope closed on. The gate can be on the hub, or, if so desired it may be gated at two or more places around the outside. This, as we have shown, makes the pulley of the same size as the pattern, less the shrinkage. To make the pulley an inch larger, strips of wood half an inch thick and six inches long are placed around the pattern and the mould proceeded with as before up to the time of closing where we left off before. The screws would now be withdrawn and the cope lifted off again. Waste will now be put into the arms to keep the sand out, and sand rammed into the space from which the ring had been drawn, thus making the inside the size that the outside had been. The strips are now drawn and the cheek lifted off and finished as before. The arms are now located and the sand scraped away so as to allow the waste to be withdrawn and the ends of arms properly finished. It will be seen that the mould is now one inch bigger both inside and outside than it was. This method can be adopted, no matter how much bigger it is required to make the casting, only that for a larger pulley to be made from the same pattern the strips would have to be of sufficient thickness to make up the required diameter, and these would have to be removed and thin ones put in their place when the time came to build up the inside. This method of lifting the anchor is not necessary, as the anchor can be lifted out separately if so wished, providing it has guide pegs on the bottom. In some respects it might be of advantage to do so, although I prefer the way described. If it is desired to make a wider face the same system is practised by having the strips of wood long enough to make the proper face, and after ramming the sand around the outside and bedding the arms in the proper place to properly centre, and driving the anchor into place, the pattern is drawn up to the top of the strips, when balance of the sand is rammed around the outside and the parting made. The mould will now be proceeded with as usual. This same method can also be used if a casting is required to be smaller than the pattern by placing strips on the inside and filling on to the rim in order to make it smaller.

Another lesson on pulley moulding from these old patterns, and one which might be of interest, is to make the mould without the use of an anchor. Supposing we wish to make the casting of the same dimensions as the pattern but have no anchor, it is just about as easy to make it by placing the pattern on a smooth board with the thin side up and ramming the cheek with the cope side up. Ram the inside just as carefully as before with the arms and hub properly placed. Cut the parting inside and outside, and put on the parting sand, after which ram up the cope, securing it with soldiers and gaggers. When the cope is done, clamp up and roll over and make smooth parting at the other joint. Next, put bars in the drag and ram it full of sand and lift it off. The ring part, as will be remembered, has the thick edge this way and can be drawn out, after which the barred drag is closed on again, the bottom board is rubbed on and the whole thing clamped and rolled back. The cope can now be lifted off bringing the upper portion of the inside with it without any trouble as there is the thickness of the pattern to play on. The arms are now drawn and the mould finished. The cheek can be lifted or not as is thought advisable, but by lifting it away a better opportunity is offered to properly finish and blacken the mould.

In case a pulley is to be made and it is considered necessary to have an anchor and none is available, a very good makeshift can be improvised by nailing four boards together in the form of a drag or slip jacket and fastening the screws to it. This wooden frame makes a support for the sand and a backing for the gaggers, which will be used to lift the sand. After the parting it cut and the parting sand put on, some facing sand should be riddled on to the arms, and after clay washing the wooden frame it is put in place and gaggered just the same as gaggering a cope with bars hanging down. The parting is made straight across and a flat cope rammed up and lifted off. The ring is drawn and this wooden anchor can be either fastened to the cope to lift it or it can be lifted separately, which latter way would be better in this case as it might not be safe to try rolling it over.

THE OVERHEAD TROLLEY IN THE FOUNDRY

There are few modern improvements in the foundry which are a greater convenience than the overhead trolley. If properly laid out the tracks can be made to connect every part of the gangway with the rumbling room, the scratch benches, the cupola elevator and even the machine shop. If the gangway is filled with castings in the morning and it is desired to rumble the castings which are at the far end first, the trolley carrying a platform can be shoved to the required position and loaded and delivered to the rumbler. Or castings can be picked out at different parts of the gangway instead of sorting them over in the rumbling room. With a barrow it is customary to dump the castings in front of the rumblers and then sort them over and pick out what is wanted for each machine; with the trolley and platform each class of work is selected with ease and put on the platform and shoved to the rumbler, where it is put right in without any further handling. Defective castings and sprues can be shoved out to the scrap pile without bothering about the right of way on the floor or gangway.

The same trolley system is used for conveying ladles of melted metal or for flasks or anything which comes in the line of the track.

Practical Hints for the Brass Founder

BRONZES FOR HIGH PRESSURE AND FOR PROPELLER

Question.—Please give me the necessary information. I have found great trouble in locating mixture to stand 4,000 to 5,000 lbs. pressure. Please state alloy that will stand test of 5,000 lbs. pressure, also percentage it contains. Also a good propeller phosphorus bronze which would be of great value to me.

Answer:—Success in bronze casting is more the result of proper melting than in the formula of the alloy, although the alloy is of importance. A good alloy consists of 88 per cent. copper, 10 per cent. tin, and 2 per cent. zinc. If the copper is melted just sufficient to dissolve the zinc and tin it is hot enough. The tin is introduced next, and lastly the zinc, which acts as a deoxidizer. If properly stirred and taken from the furnace and poured as soon as it is hot enough to not stick to the stirring rod it should make a sound casting which will stand the desired test.

In melting, always keep the metal covered with charcoal dust or something which will protect it from the air.

Phosphor Bronze

Phosphor bronze is practically the same thing with the zinc omitted and phosphorus substituted, although phosphorous is seldom used in excess of 1 per cent. Phosphorus and zinc in the same mixture is not to be recommended as the one tends to counteract the effects of the other.

Propeller Wheels

Propellor wheels are usually made of Muntz metal or manganese bronze. Muntz metal consists of 60 per cent. copper and 40 per cent. zinc. If we add 1 pound of manganese to about 300 lbs. of this alloy we have what is commonly known as manganese bronze. Manganese can be bought from the supply houses in the form of manganese copper, and can be introduced into the alloy in this manner, much handier than trying to use the metal itself.

If facilities are at hand for melting and mixing the different metals an excellent manganese bronze can be made as follows: Copper 57.20, zinc 40.14, tin 1.18, lead 0.02, iron 1.38, aluminum 1.25.

Study in Mixing

Considerable study is required in mixing different metals because one is liable to injure another. Every brass founder knows what a curse the least speck of iron is in a brass casting, yet if he only studied how to use it, iron is not a curse. It is not the iron but it is the carbon which is contained in the iron which does the injury. If aluminum is introduced into the mass it will absorb the carbon and carry it to the surface, leaving the soft iron to mix perfectly into the alloy. Herein lies another cause for worry as every brass expert knows that a mixture containing aluminum is porous. But if the proper amount of aluminum is used it will all be absorbed in the carbon and will no longer affect the alloy.

Characteristics of Zinc

Another metal to be watched is zinc. This metal acts entirely different in copper-manganese from what it does in copper-tin mixtures. A few features in connection with manganese will no doubt be of interest and will be introduced to the reader in the succeeding article.

MANGANESE BRONZE

Pure metallic manganese exerts a very marked bleaching action upon copper. 18½ per cent. manganese in the copper alloy being sufficient for a white color. Twenty to thirty per cent. manganese may be added to copper without impairing its ductility, although doubling its strength. Alloys of copper and manganese oxidize badly, while the addition of zinc, to a copper-manganese alloy instead of deoxidizing it as would be the case with copper and tin, acts the very reverse and fills the casting with pits. If 1¼ per cent. aluminum is added to a manganese-copper alloy it serves as a deoxidizer and the alloy may be cast readily, producing perfect castings. Manganese bronze, as ordinarily understood, however, contains very little manganese, usually less than 1 per cent. It has a tensile strength of approximately 60,000 lbs., and is used principally for casting propeller blades, as it does not corrode by coming in contact with the sea water.

OBSERVATIONS ON A TYPICAL BEARING METAL

By Miss Hilda E. Fry and W. Rosenhain

The observations described in this paper embody the results of an investigation into the effects of pouring conditions on the microstructure and hardness of a white bearing metal of the composition, copper 4.4 per cent., tin 86.8 per cent., antimony 8.8 per cent. The results show that the method of casting such an alloy influences the microstructure to a marked degree, and that by varying the temperature of pouring and the type of mould great variations in grain-size can be produced. Further, not only does slow cooling result in a coarse structure and rapid cooling in a fine-grained structure, but the relative temperatures of the molten metal and the mould have a pronounced influence on the uniformity of grain from side to side of the casting.

The tables of Brinell numbers for this alloy indicate that, though the chill-cast ingots are generally harder than the sand-cast, there are no very great differences in hardness to correspond to the differences in casting conditions. A remarkable feature is the fact that hammering of the ingots results in appreciable softening, which is more pronounced if the cold work is followed by a light annealing treatment.

Tin, the metal used as a hardener in brass mixtures, is used as a softener in white metals. By repeated remeltings the tin content is lowered by oxidation, resulting in a concentration of the antimony and copper. The alloy thus would tend in time to become harder, to prevent which new tin is added to soften it. Heyn and Bauer have published some figures obtained with a bearing metal of somewhat similar composition which illustrate this point:

	Percentage Once Melted	Percentage Five Times Melted	Difference due to Four Meltings
Tin	86.43	85.86	— 0.57
Antimony	8.76	8.58	— 0.18
Copper	4.51	5.33	+ 0.82

The necessary additions of antimony and copper in the manufacture of new metal are made by means of a "hardener," the composition of one such alloy being tin 80 per cent., antimony 15 per cent., copper 3-4 per cent.

In the manufacture of such a material, sweepings, scrap, etc., may be melted in a small air furnace under a covering of "pearl ash," and to this melt the antimony and copper are added, the alloy is thoroughly stirred and cast into pigs.

BRASS FOUNDRY SAND

Although the difficulties arising from the use of unsuitable moulding sands in the casting of non-ferrous metals and alloys are not so acute as those similarly concerned with steel, the former carries with it problems peculiarly its own. The investigation of moulding-sands in works' laboratories is urged, and the methods of testing and standardizing such sands are indicated. The use and significance of chemical, mechanical and mineral analyses are emphasized, and it is found that in sands used for non-ferrous work the chemical analysis (or texture) rises to the position of prime importance. Methods of graphical representation of the results of analyses are illustrated.

The bond of moulding-sands may be natural or artificial, or at times both. The natural bond is either hydrated iron oxide or clay, and in order that the bonding power should be a maximum the clay or other material should be evenly distributed round the quartz grains. Hence the importance of the proper mixing and milling of moulding-sands.

The Gating of Non-Ferrous Metal Castings

For the Benefit of the Founder Who Does Not Know the Meaning of Non-Ferrous, Would Say That it Means Any Metal Containing No Iron. Usually Meant to Indicate Brass of Some Kind

GOOD non-ferrous gating consists in the logical construction and placement of those circulating media by which metal either associates with its mould or exercises control over its casting product. Good gates, therefore, are instruments of control and media of transmission. This dual consideration is vital to gating results.

By trend of lead, gates admit a threefold classification, those leading to, those leading from and those coursing independent of the mould. Briefly they might be termed, gates of ingress, gates of egress and gates of independent lead. Exercising widely different functions, each type of gate thus classified must be studied and constructed accordingly.

The term gate, as commonly used, is broad and general, indicating part, parcel and whole of these instrumental media. Practice is common to designate all parts compositely—a gate—and just as prevalent to refer to each part separately as such. For distinguishing purposes individual terms such as sprue, head, riser, etc., frequently are applied, though the tendency is neither universal in scope nor uniform in term selection. Therefore it is apparent that a well-defined and universally-accepted nomenclature of its gates has been one of the overlooked items of scientific effort along non-ferrous foundry lines.

Various Gates Defined

In the absence of such, and to avoid present confusion, this discussion will adhere to the general term and use qualifying words to designate the particular gate or part of gate referred to. By such method the following gates appear briefly defined:

Pouring Gate.—Vertical ingress gate, descending the mould to the first abrupt change of direction and including a funnel-shaped top.

Pressure Gate.—Sections of pouring gate above the highest point of the mould metal.

Drop Gate.—Vertical ingress gate used to step metal downward.

Button Gate.—Bowl-shaped basin underlying vertical gate to protect sand against the impact of the falling metal —a shock absorber.

Connecting Gate.—Horizontal gate joining the bottom of one vertical gate to the top of another.

Delivery Gate.—Mould attaching ingress gate.

Runner Gate.—Main intermediate between vertical and delivery gates.

Riser Gate.—Vertical egress gate, functioned to pass off surface metal dross and relieve the mould of sudden applications of force generated by the pressure gate and intensified by momentum of metal.

Skim Gate.—Either egress or gate of independent lead, mechanically constructed and positioned to trap dirt and dross and exempt mould metal therefrom.

Feed Gate.—Ingress gate, furnishing some part of the mould a higher temperature or greater bulk of metal than that reaching it through regular channels.

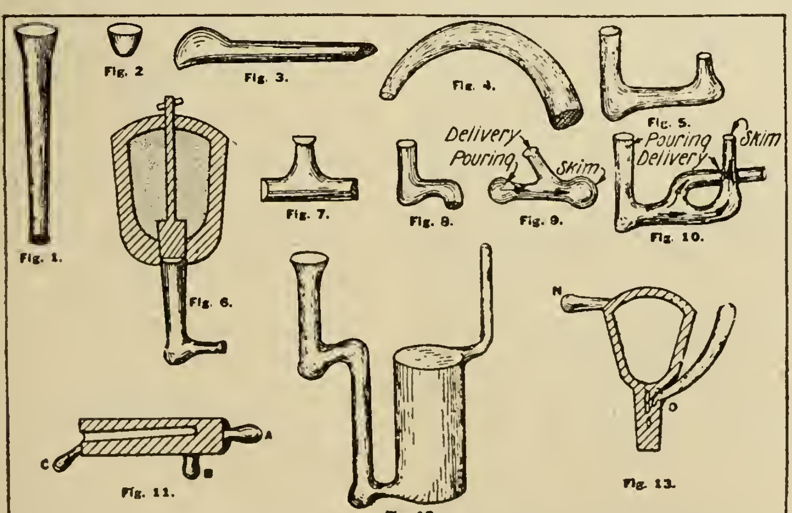


FIG. 1—POURING GATE. FIG. 2—BUTTON GATE. FIG. 3 RUNNER GATE. FIG. 4—HORN GATE. FIG. 5—U-GATE. FIG. 6—DROP-POURING GATE. FIG. 7—HORIZONTAL DELIVERY GATE. FIG. 8—CONNECTING GATE. FIG. 9—SKIM GATE. FIG. 10—SKIM GATE MADE BY A CORE. FIG. 11—A BURNS THE CORE END; B DISPLACES AND BURNS; C STRIKES AT AN ANGLE AND AT POINT MAXIMUM CORE SUPPORT. FIG. 12—A 6 x 14-INCH BRASS PIN, GATED AND POURED FROM THE BOTTOM. FIG. 13—N SUPERINDUCES A DRAW IN THE HEAVY LOWER SECTION WHICH THE HORN GATE AT O OVERCOMES.

Horn Gate.—Gate resembling a horn. A sand hole delivery gate leading to some advantageous point in the mould not otherwise accessible.

U-Gate.—Modified form of horn gate realized through the use of dry sand cores and sub-surface in position.

Drop-Pouring Gate.—Method of getting metal into a mould with maximum speed and cleanliness. The plan of enlarging gate head cavity to hold all metal required to fill mould and gates, fitting a stopper core in the bottom of the cavity, filling cavity with metal and suddenly lifting the core.

Bottom Gate.—Delivery gate attaching at or near the bottom of the mould.

Pop Gate.—Vertical gate attaching direct to the casting. Mainly illogical in non-ferrous practice.

Flow-off Gate.—Egress gate permitting excess metal to course through a mould or some part of a mould for some specific purpose.

Overflow Gate.—One taking care of excess metal furnished by a flow-off gate that terminates in the atmosphere.

Representative of non-ferrous practice in general and conservatively responsive to their designating terms as noted, the foregoing gates will be thus referred to in this discusssion, their implied sense, as briefly delineated, attaching.

Effect of Gating Practice on Casting Status

That a non-ferrous gate exercises a tremendous influence over its casting status, independent of its mere capacity to transmit metal, is a fact far removed from debatable ground. Responsible to principle, that influence applies under all conditions of demand and wholly independent of class or type of work with fidelity to that principle. Operating on these broad bases, a gate can be so constructed as to menace any casting it will run. There is scarcely a class of non-ferrous work, light, medium or heavy, which cannot be injured by improperly gating.

A careful study of the various gates shown in the illustration should give any careful thinking moulder a good idea of which would be most suited to the job in hand.

A Georgian from the mountains came to town with a load of produce to exchange for groceries. As he neared the city he saw a sign: "Speed Limit 15 Miles an Hour." Prodding his oxen with a stick, he muttered: "By golly, I don't believe we can make it."

Core Making from the Engineer's Point of View

Core Making as a Trade Will Be Much More of a Credit Once the Core Room Receives the Attention Which it Should

INEFFICIENT handling of raw material and product increases the cost of production. Even in small plants much can be done to systematize the delivery of core sand to the benches and do away with the necessity of skilled workers leaving their benches in order to get sand and do mixing.

Crowded gangways, littered with core plates, riddles, boards and other trash, go far toward making for inefficient delivery of materials.

Keep the Gangways Clear

Rows of benches ranged back to back with sufficient space for a gangway between them will allow the free passage of laborers with their wheelbarrows of sand, rods, etc., to pass without disturbing the coremakers, or the cores setting on stands by the core benches.

Note: Placing the sand in boxes on skids handled by an elevating truck to place it within easy reach of the coremaker is a still better plan.

Benches with a hopper at the back permit of a larger volume of sand being left on the bench at one time, without its being in the way of the worker or without having him disturbed when it is being delivered to his bench.

Use Elevating Trucks

The core room should be arranged to permit the flow of work to progress in a systematic manner. The coremakers should place their finished plates of cores on racks adapted to use with an elevating truck. This type of truck furnishes the means for a continuous use of large truck ovens.

The use of rack trucks on stationary tracks prevents the oven being used while the cores are being loaded into the rack and when they are being removed. The continuous use of the ovens is an important factor where trucks are the means for holding the cores in the oven. Where ovens have to stand idle while their truck racks are being loaded and unloaded, just twice as much oven equipment as is required is being used.

Make Continuous Use of the Ovens

When using steel racks in connection with these elevating trucks as many trucks as can be utilized are on hand. Some are placed at the core benches and are being loaded, while another set can be in the oven with baking cores, with a third set with baked cores being unloaded at the assembly benches. Where these racks can be placed back of the coremaker's bench they will produce best results.

Big Saving in Time

In a foundry studied by the writer the time wasted by the coremakers when taking each plate to the oven amounted to more than an average of two minutes per plate. This two minute loss on each plate could have been reduced to a six-minute loss on 40 plates by using the portable rack.

Other sources of economy will be found in the careful study of core binders. Linseed oil, flour and rosin have long been considered as the only reliable binders, but research has brought out substitutes which can be used to advantage, with considerable economy. Coal tar is one of the best binders, but is an awkward material to mix through the sand. When mixed it makes a core which has practically no blow to it. Coal tar is the main material in dry black core compounds. Lack of knowledge frequently causes foundrymen to condemn it because it makes a core which is harder after the casting is poured than before. If just sufficient black compound is used and then baked with a very hot fire, it makes a core which will burn out under the heat of the melted iron. The main thing in using black compounds is to have an oven which can be heated very hot.

Another kind of binder which can be used to advantage is the sticky liquid binder made from the refuse of the sugar mills and sold under various names. For convenience we will call it glucose, although it is only a byproduct of glucose. It can be used in place of molasses wherever molasses have been used. It can be mixed with flour, oil or the black binder previously spoken of. In fact it can be used in a lot of ways which will surprise the foundryman. Unlike flour it can be used to good advantage with moulding sand or with sand containing some moulding sand. If the moulding sand is not strong enough to hold up, it must be remembered that sand and clay are the chief constituents of moulding sand, and it is quite in order to use thin clay wash in the mixture, but if so desired a small amount of flour may be used. In making oil cores it is often possible to use some of this material and economize in oil. It is certainly advisable that the core room receive as much attention as any other part of the plant and good returns will be the reward.

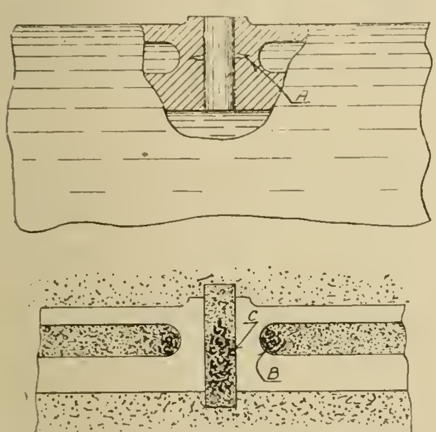
Chills and Chilling Cores

INTERNAL strain in an ill-proportioned casting is always a source of annoyance, and frequently of considerable monetary loss, particularly when the casting requires to stand hydraulic or other pressure, and is found to be porous. A casting does not require to be open grained like a sponge in order to allow water to be forced through it. On the contrary, a casting such as an engine cylinder will bore out and appear to be a perfectly clean, sound casting, free from any trace of defect and yet on being put to the test will be found porous with water sweating through it on all sides. This is generally attributed to a bad mixture of iron, which, of course, frequently is the true cause, but it is not always convenient to arrive at a mixture which has all the characteristics required. It is a well-known fact that iron which is suited for one class of work is not well suited for another. It is also well known that iron has to be poured at different temperatures for different jobs, and with all this added to the uneven thickness and ill-shaped designs of certain castings it makes an extremely difficult problem to solve.

Chills

Chills can be used to good advantage on some occasions to set the heavy sections and close the grain on at least the surface of the section before the lighter parts have a chance to draw on it, thus making it sound on the surface, if not in the interior, and if properly chilled it should make the interior of the heavy section much sounder than would otherwise have been. If the reader will give a little reflection on the effects of a chill and the reason for the same, he will more easily comprehend its value. Iron is a rapid absorbent of heat while sand or clay is slow, and iron cools quickly, while to use technical terms, iron is a conductor of heat, while sand is a bad conductor. Every moulder knows how long it takes for hot parting sand to cool sufficiently to allow him to put his hand into it, and every core maker knows how long it takes to get a core heated to the centre; so it will be seen that heat moves slowly in this material and melted metal poured into a sand mould retains its heat for a long time because the sand refuses to absorb it, and as a consequence, it changes its chemical combination while slowly cooling, and the parts which are thin contain the smallest amount of heat will cool first and will draw metal from the heavier part to overcome the shortage due to contraction, and when the heavier part comes to cool it has nothing to draw from and simply pulls itself apart. Now if it were possible to have the heavy section cool at the same time as the lighter part, this would be overcome to some extent, although not entirely. It would not provide against contraction, but it would prevent the loss due to the lighter part bleeding the heavier part. Now herein lies the secret of the chill. If a heavy piece of iron is placed in the mould in such a manner that it will come in contact with the heavy section of the casting the metal when poured will set at this particular spot before that which is poured in the lighter part, for the reason that the heat which is contained in this part will be instantly absorbed by the piece of iron just spoken of, and which is commonly known as a chill. This chilling process, not only hastens the cooling, thus preventing the uneven strain, but it holds the carbon in combination, making the grain finer and closer and of course harder. Now, there are places where a chill would do splendid work, but unfortunately cannot be used. As an example, we will cite the cylinder of a gasoline engine.

A gasoline cylinder is of more importance than a steam cylinder, because a steam cylinder, while it should be perfect, will work if it is not, but a gasoline cylinder must be capable of holding a vacuum or it is no use. And the water jacket must be water-tight or it is no use. Now we will consider the design of a cylinder with a water jacket, a section of which will be shown in the illus-



SECTION OF GASOLINE CYLINDER WITH UNEVEN THICKNESS.

tration. The cylinder proper has to be heavy like a cannon to stand the shock of the explosion of gasoline or gas, while the water jacket is light, having only to hold the cooling water. In addition to these extremes are spots like the one shown where the thin jacket is connected to the heavy part by a still bulkier chunk in form of a boss, which projects out beyond the jacket and, also in through the water space and joining onto the cylinder proper.

The metal used on this class of work must be close, low-silicon iron in order to make a smooth bore and take a good anti-friction polish and at the same time be free from leaks. Iron of this description can be expected to shrink out of shape without much encouragement and as there is poor chance to use the feeding rod, it is difficult to prevent it from drawing at the point marked. If a chill could be worked in at this point it would be a great advantage, but as will be seen, such cannot be, as there would be no chance to get it out, and if put in with a view to leaving, it would tend to crack the jacket, so the next best is to chill it by means of the core.

A Chilling Core

This can be done by mixing iron borings through the sand of which the core is made. To do this use equal parts of silica sand or any good, clean, sharp sand and cast iron borings and mix with the same binder which is used for ordinary sand cores. The jacket core will, of course, be made of the same sand as always, with the exception of the part where it comes in contact with the section to be chilled. This will have the iron mixture for an inch or a little better. The core through the boss could also be made from this mixture, as it being only half iron will only be half as effective in hardening the casting and will not make it hard enough to cause any trouble in making, and it will make enough better casting to repay for any extra work which will be caused through the metal being to a certain extent harder. This mixture works the same as any other and the binder burns out, leaving the iron core free to fall out just the same as any other burned core when the casting is being cleaned. It allows the casting to contract properly, and at the same time chills it enough to make the grain of the iron close and free from leaks or pores.

ELECTRICALLY HEATED METAL PATTERN PARTS

(Continued from page 344)

ing. There is a mounting lug on each end with holes punched in for mounting the heaters. The heater terminals are mounted on one end of the heater casing and are protected by a substantial terminal cover. The two heaters used on each machine have a total rating of only 300 watts, and operate on 110 volts. The heaters are permanently connected together electrically, and connection is made to a wall receptacle convenient to the machine by means of a flexible heater cord, having a separable attachment plug on the end.

Because of the small space in a vertical direction occupied by the heaters, there is ample room for them in the somewhat restricted space available; and due to the flexible heater cord, it is possible for the pattern support to be raised or lowered, the heaters moving as an integral part of it.

The advantages of this heater over gas are obvious. When it is desired to heat the pattern plate, it is not necessary to hunt for a match, operate valves, burn the fingers, or adjust valves until the correct degree of heat is obtained. Instead, it is only necessary to plug into a wall receptacle and give no further thought to the matter, since but one degree of heat, and that the correct one, can be obtained. If for any reason, such as the machine standing idle, the pattern plate should be overheated, it is not necessary to operate any valves, such as shutting off the gas, until the temperature becomes right and then relight and re-adjust the valves. Instead, it is only necessary to pull the plug from the wall receptacle and leave the heater disconnected until the temperature becomes right, and then plug it in again. Furthermore, no trouble is experienced from variation of gas pressure, and a steady, uniform heat is obtained.

DEATH OF HENRY CLAY FRICK

Henry Clay Frick, founder of the great H. C. Frick Coke Company of Connellsville, Penn., died in New York on Tuesday morning, December 2, at the age of 69 years. Of late years Mr. Frick has been chiefly identified as a steel magnate, but his real fame is bound up in the celebrated "Frick" Connellsville coke. Frick's coke was at one time considered indispensable in the foundries of U.S. and Canada. When the United States Steel Corporation commonly known as the Billion Dollar Steel Trust, was formed in 1901, H. E. Frick was one of the directors, and the coke business which he controlled was absorbed by the corporation, and the output was shortly afterwards taken off the market as foundry coke and all used in the manufacture of steel.

The H. C. Frick Coke Co. produced more coke than any other institution of its kind in the world, and H. C. Frick accumulated wealth at a phenomenal rate, yet with all his personal ambitions he had one boast which he advertised to the limit, and in which he defied contradiction, viz.: "That he paid the biggest wages for unskilled labor of any institution in the world."

OPENING MORE OFFICES

The Booth Electric Furnace Co., whose incorporation was announced in these columns a few weeks ago, has opened up the following district offices in connection with the sale of electric furnaces for melting steel, iron and nonferrous metals.

For New York and New England, Edward B. Stott & Company, Flatiron Building, New York City, with Mr. E. F. Tweedy, secretary of the company, directly in charge; for Eastern Pennsylvania, New Jersey, Maryland, Delaware, and Southern Atlantic Coast States, Northern Engineering Company, 306 Chestnut Street, Philadelphia, with Mr. F. W. Doran in charge; for Northeastern Ohio, Western Pennsylvania and Western New York State, Mr. Chas. L. Foster, formerly sales manager of the Electric Furnace Company, of Alliance, Ohio, with offices at 879 The Arcade, Cleveland, Ohio.

In connection with these district offices, a complete staff of engineers and metallurgists will be maintained, so that the needs of customers can be promptly met and adequately taken care of.

Further announcements will be made of the opening of other district offices, arrangements for which are being completed.

Observations on Making and Marking Core-boxes

This Article, Bearing Upon Standard Work, Will Follow Nicely After Those in October and November Issues. It Emphasizes a Number of Points Which, Though of Equal Importance, Are Quite Often Overlooked

By JOHN A. McEWAN

THE following article, with special bearing upon standard work, will come in very nicely after that one on page 292 of the October issue.

It emphasizes a number of points, which, though of equal importance, are quite often overlooked.

1. The more loose parts there are in a

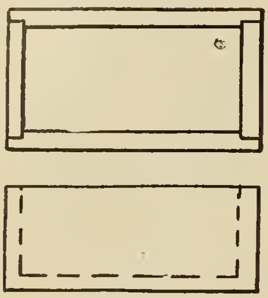


Fig. 1

core-box, the greater the danger of some of them going astray; so, if it will serve the purpose by using a box with draft on all sides, then there is no need for making it loose at the opposite corners and pinned to the bottom board. Figures 1 and 2 will serve to illustrate.

2. Before starting to make a core-box, try and arrange so that there will be no overhanging sand. Figure 3, at A, shows a lug which is formed on the base of a casting by placing a core against the pattern when ramming the drag. One pattern-maker made the core-box as shown in Figure 4, and another man made it as shown in Figure 5, which is not nearly as good, although he had been shown one similar to Fig. 4. The fact is, there is quite a difference between simply looking at a thing.

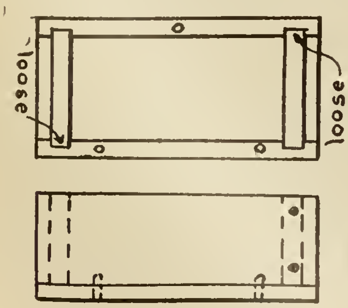


Fig. 2

and really seeing it. To see means to have an impression made on the mind, so evidently the man I speak of merely looked, but did not see.

3. If the core-box has quite a number of loose pieces, or if the pieces go in different places at different times, mark each piece and each position, and then mark the necessary information on the outside of the box. A few minutes spent by the pattern-maker will mean a larger saving of time in the foundry and possibly may avoid some spoiled castings, but in any case, it will make the core-maker's path easier.

4. On large core-boxes, in addition to lettering each piece in each box, if there are a number of boxes, it is well to number each one, and stamp the box number on each loose piece. We also mark on

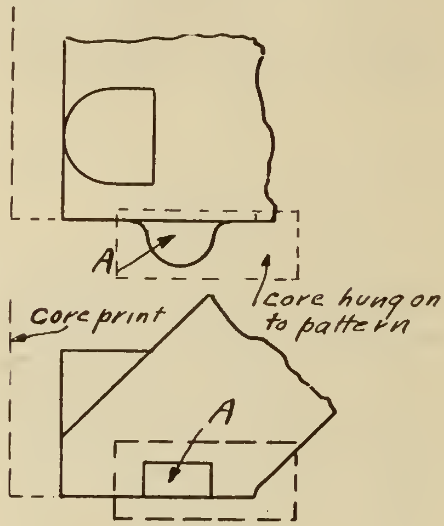


Fig. 3

the core-box which of them is the cope core and which the drag core, so that the core-maker will know how to put the lifting hooks. Here is a sample of marking on a box:

Box 1, No. 646-2.
Drag core 1 off.
With pieces A, B, C, D, E.
Cope core, 1 off.
With pieces F G, H, J, K.

When the same pieces go in different places we do like this:

Drag core
1 off, with pc. A at A, B at B, C at C.
Cope core
1 off with pc. A at D, B at E, C at F.

The above remarks may not seem very important, but to anyone who has had to put together a complicated core-box when there was no means of telling whether some pieces were missing or not, this practice of marking each piece will appeal, for it is a great satisfaction to first get together all the pieces that are enumerated on the outside of the box, and then the work of assembling will be comparatively easy.

5. How often it happens, that the pattern-maker makes a one cast job, rushes it into the foundry, verbally explains to the boss moulder or core-maker how the core-box is to be manipulated, and possibly at that particular moment the man

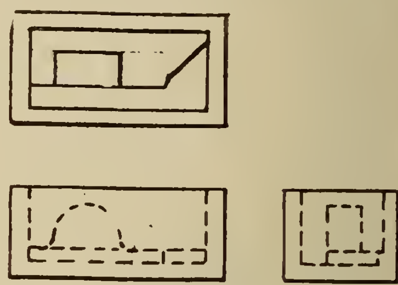


Fig. 4

addressed may be bothered about some other thing, which diverts his attention, and when he finds time to make the core, what he was told has slipped his mind. How much better it would have been if the instructions had even been only pencilled on the core-box.

6. Whenever the necessity arises for the use of a bedding frame on the top of a core-box, it is usually much better to make it a part of the core-box and not a separate part, for, as a rule, separate frames are not so easily kept track of. This matter is quite generally overlooked by the pattern-maker. Just a short time ago we received a couple of new patterns and core-boxes from

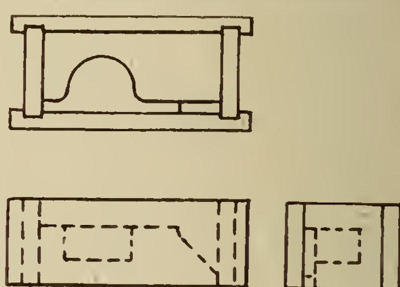


Fig. 5

outside and each core-box had a loose piece pinned on top, but no provision had been made for supporting this projecting piece of core while rolling the box over. If these boxes had gone into the moulding shop as they were, the core-maker would have needed to hunt all through his pile of frames and very likely nothing suitable would be found.

since one side of each core-box was curved and the other two sides ran to a point.

7. In order to save the core-maker the trouble of cleaning out the corners of a core-box where loose pieces drop in, it is best to bevel the edges and corners of all loose pieces and also to provide means of withdrawing them, putting a small hole in small pieces and a draw-plate in heavier parts.

MOLDERS AND PATTERN MAKERS WORKING IN HARMONY

THE little story in the September issue of Canadian FOUNDRYMAN entitled "The Kilkenny Cats Brought Up-to-Date," was well prepared and brought out some admirable sentiments. The idea of molders and pattern makers working in harmony instead of trying to shift the blame for personal carelessness on to the other's shoulders, was indeed a proper spirit in which to work.

The story was certainly interesting, and it recalled a little circumstance in my own career which, if I were as capable a writer, would perhaps be equally as interesting and beneficial.

However, if I cannot do justice to the subject I will do as near justice as my ability will permit.

Some fifteen years ago I was employed as a molder in a fairly large manufacturing plant, and in this same establishment was a pattern maker, whom I held in very high esteem. I considered him a first-class mechanic, and still look upon him in that light. Our frequent transactions with each other in our daily work were always of such a nature that we became what might be termed, personal friends. In time we both left that place, he launching into business on his own hook, and I taking a position in a jobbing foundry. This brought us into even closer contact with each other, because on frequent occasions I was called upon to mold patterns from his establishment, and sometimes the core box would not measure up the same as the pattern, and I would always give him warning before it was too late, thereby saving trouble. I say I always gave him warning, and so I did up to a certain date on which I did not see it myself until it had gone too far.

There was an order that came to the foundry to make a casting which was similar to a lathe bed with the headstock cast on to it. In fact this is exactly what it was, only that instead of an ordinary turning lathe it was for threading pipe, but it was very similar in appearance. It had to be made bottom up and bedded in the floor. The headstock had sleeves projecting from it to make bearings for the spindle and back gear shaft. Any molder who has ever made machine tool castings will know what I mean. The headstock reached down into the floor about the length of my arm, and at the bottom were these sleeves, no less than eight in number, some of them four inches in length and some one inch. These pieces had to be loose-doweled to the main pattern until they were tucked in, after which the dowels were withdrawn. After drawing out the main pattern these pieces would have to be secured with nails and then drawn in; a peach of a job in such a place. I could not have my arm and my eye there at the same time, so I had to work by feel.

However, I got it finished and poured on the third day, and when the casting was taken to the machine shop it was found that whoever had made the pattern had made a mistake, and things did not line up properly, and accordingly, before making any more it was taken to my old friend the pattern-maker to be altered. He took off the headstock and put a piece under it to make it higher and then deliberately turned it around and screwed it on backwards, and when it came back to be molded I, not being a machinist, didn't know that it was wrong, and put it in the sand again, and had it just about finished when I noticed that it was different from the first one. I noticed this on account of the different position I had to get myself into in order to draw out these little pieces. I called the manager's attention to it and suggested that he call up the machine shop man and be sure. And sure enough, when he came and looked it over he said: "Of course it is all wrong, but go on and finish it, and I will make the pattern-maker pay for it. I had no authority to say what would be done, but after his departure I made the suggestion to the manager that if he would provide me with a boy to hold the lamp I would come back after hours and bed the patterns in as they should be and donate my services free on account of the pattern-maker being a friend of mine, as I did not want to see him soaked for a hundred or so. When the boss saw my attitude he volunteered his services, and between the two of us we had the change made by eleven o'clock that night and we got a good casting. I didn't even suggest a cigar for my trouble, being only too pleased to be able to undo the mischief for my good friend, and knowing that if he had been similarly circumstanced he would have been equally as well pleased to do the same for me.

Years rolled by after this little episode. His business flourished and he accumulated property, while I groveled along from bad to worse, until finally I threw up the foundry work and launched into a little enterprise of my own, but of course along the line of foundry and pattern shop necessities, and incidentally appealed to this successful business man to patronize my business to the extent of one dollar; not to help me exactly but to secure a dollar's worth of real value in his business. He sized things up in about the hundredth part of a second and decided that he could not see his way to squander a dollar on my proposition. I urged him all I could, but all to no purpose. I did not hint that he owed me anything. Had I thought that he did I would have presented my bill at the time, but I thought that he might look upon it in the same spirit that I had done in the past, but not so.

To sum it all up, my good-natured way and my working nights without pay puts me in the category of "suckers," while his way puts him in the class of successful, shrewd, business men.

Still, for all that, I have no regrets; I am not sorry for any good turn I ever did to a brother man, and while my life has not been a financial success, I feel that nobody's finger can point at me. I guess that molding makes a fellow an easy mark. A molder is supposed to do everything in his power for others and not expect anything for himself.

Air Conditioning in Industrial Plants

The Following Article Shows What is Being Accomplished in Many Industries. Why Not Have Pure Air in the Foundry?

AIR conditioning is becoming recognized as a subject of increasing importance by those who are interested in atmospheric conditions in factories, mills, laboratories, bakeries, tanneries, and the like, because the proper conditioning of air not only aids manufacturing processes, but gives employees the proper air to breathe.

The possibilities of overcoming unhealthy air conditions are multitudinous. Among the most pronounced examples are chemical laboratories, bakeries, confectionery factories, film manufacturers, laboratories, lithography and printing plants, textile mills of all classes, and hide and leather establishments. The possibilities, however, of conditioning air are by no means confined to the industries just enumerated. Wherever there is "sick" air there is a remedy.

To be more explicit about the application of air conditioning systems, a few specific examples may be considered. For instance, in dye houses where no air conditioning system is installed the amount of fog or steam may be so great that a light will not show through it more than thirty inches away. The drip from the roof in such a room is a nuisance and the drops of water collecting on the roof soon causes decay and deterioration. Furthermore, in a number of chemical industries, the materials used are highly hydroscopic, that is, they readily absorb moisture. This is true in the manufacture of gelatine products and explosives, where it is imperative that constant comparatively low temperatures and constant low moisture content be maintained. In other processes, those which involve oxidation, it is necessary that constant atmospheric conditions be maintained in order that the oxidation may be regular and rapid. This occurs especially in processes which involve the use of varnishes and paints.

Air conditioning is also a prime factor in the regulation of conditions in laboratories or manufacturing plants where very delicate tests are made. Balances which weigh to the 5th or 6th decimal place are affected by variations in atmospheric conditions. It is evident, by eliminating these variations, that tests, no matter how far apart, can be accurately compared.

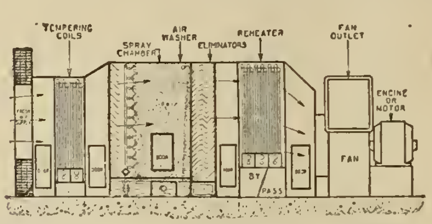
In candy and chocolate factories, cool, dry air is an absolute requirement. If hard candy is kept in moist air for even a short period before being drapped or hermetically sealed, the product loses its transparent color and resolves again into the appearance of granulated sugar, also the moisture makes the candy sticky and any particles broken off in the process of manufacture become affected in the same way. Automatic machinery is gummed up and eventually the whole factory must be closed down, due to the fact that the machines cannot be run. If, however, moisture is taken out of the air and it is kept at a comparatively low temperature, the candy remains indefinitely as it was originally made and the particles are as so much dust which may be collected by a vacuum cleaner, as it will be a dry sandlike powder. Chocolate candy, which is made in warm, moist rooms, assumes the familiar gray color due to the working of the cocoa oils. In this industry, too, uniform low temperatures and low moisture content are prime necessities.

It is found that in the baking industry a high humidity at a proper temperature maintained throughout the year will insure the baker standardized time for the rising of the dough. This is most essential where all baking and handling is done by machinery, and thousands of customers wait each day for their fresh bread. The relief of a baker whose dough is ready for baking every day at the same hour can readily be imagined. The profit that results from having the bread ready at a specified time each day as compared to losses resulting from irregularity in deliveries, makes an air conditioning installation a paying investment.

Manufacturers and users of photographic films are being greatly helped by the proper conditioning of air. Films are made by a gelatine process and are therefore not only hydro-scopic, but are soft and melt in warm humid air and must be dried at a low temperature and low humidity. Without manufactured air conditions, the film manufacturer must depend upon favorable natural weather to produce films. Frequent forced shutdowns result because the weather is too hot or too damp. With artificially controlled atmospheric conditions, manufacturers of moving picture films, photographic paper, and dry plates can operate 365 days in the year.

Successful lithographing and color printing where more than one color is used is dependent on air conditions. One of the most important points in work of this kind is the registering of the various colors, so that they blend with each other. Everyone has seen pictures where this registering was not perfect. This results almost entirely from the expansion and contraction of the paper due to variations in moisture content in the printing room.

In the textile, paper, chemical and drug, and meat industries, the maintenance of constant moisture content is a



STURTEVANT SYSTEM OF AIR CONDITIONING

great factor of profit or loss. In these industries the manufacturers must protect their materials against loss of weight by loss of moisture. If textile fabrics, for instance, are allowed to become dry and are sold in the dry state, the manufacturer will lose a startling amount of money in a year. With cotton and wool at present prices, one cannot buy the raw material with 12 per cent. moisture in the case of wool and sell finished cloth with 4 or 5 per cent. without taking a loss that would more than pay for an air conditioning installation.

Furthermore, in the textile industry, silk, cotton, and wool, static electricity is a source of constant worry to the factory superintendent especially in winter. As the fibres pass over the machines, friction develops which causes the fibres to repel each other, so that a close spun thread or yarn with the fibres lying parallel does not result, producing thereby a product of inferior strength and resulting at the same time in the formation of a great deal of "fluff" or "fly." This "fly" floats around the room and is breathed by the operators. The way to overcome this condition is to add enough moisture to the air to make it a favorable conductor of electricity, so that as soon as a static change is formed in the product, it is drawn off and dissipated. Further, if enough moisture is present, the particles of "fluff" absorb moisture, become heavy and settle to the floor where they may be readily swept up.

The subject of air conditioning covers such a large field that an article of this size is entirely inadequate to give many examples of its possibilities. It has been studied and apparatus has been manufactured by the B. F. Sturtevant Co. of Boston, Mass., and Galt, Ont., who, for many years, have been the leaders in the manufacture of air moving apparatus. Together with the manufacturing of air conditioning apparatus by this company, the engineering organization of W. L. Fleisher, Inc., 31 Union Square West, New York City, provides a staff of experts in this branch of engineering, which will diagnose industrial atmospheric conditions and recommend the correct solution to the problem and is prepared to undertake the design and installation of complete air conditioning systems.

REMELTING CHILLED CASTINGS

In the October issue of CANADIAN FOUNDRYMAN was an article on the remelting of chilled castings, in which an effort was made to prove that the rim of a chilled car wheel would make just as soft castings as the hub. I certainly can not agree with the argument, as I always use chilled rims for hard castings and use the hub for ordinary work. I must have more convincing arguments before I will change my mind. Can you give me any real grounds for accepting the new theory?

Answer.—The article was just a contribution, based on a foundryman's experiences, coupled with his knowledge of the mysteries of chemistry; but I am prepared to vouch for the correctness of his contention, and will endeavour to put it in as plain a light as possible, hoping that the explanation will be of benefit to foundrymen who have not gone deeply into the subject.

As we have frequently pointed out, and as most every one knows, iron is an extremely ductile metal, which may be forged and hammered, or rolled, into very thin plates, ribbons or bars. Such bars may be bent double while cold, or tied into bow knots. But this is not the iron of commerce. Iron, such as is used in foundry work, contains, in addition to pure iron, carbon, silicon, manganese, sulphur and phosphorous. Each one of these metaloids has an effect on the others, and according to the proportions of these different impurities, as they are sometimes termed, will depend the grade of the metal; but for the subject under discussion we will only require to deal with carbon and silicon, as these are the ones which will be effected by the action of the chill. Supposing we have an iron containing 1 per cent. silicon and 3½ per cent. carbon, with the sulphur and phosphorus low, as they would have to be for car wheels, this metal, if poured in a sand mold, will make a casting which will be soft enough for machinery castings, and will analyse about 1 per cent. combined carbon and 2¼ per cent. graphitic carbon; but it must be understood that all the carbon is in the combined state when the metal is melted, and if any means could be devised to drive all the heat out of it at once, the casting would contain 3½ per cent. combined carbon and would be very hard, while on the contrary, if the heat could be held into the molten mass for sufficient time, the carbon would all be released and the casting would contain 3½ per cent. graphitic carbon. But, as neither of these extremes is adopted, it depends on what length of time has been consumed in cooling, how much of the carbon has become free.

As we have already stated, the silicon content has something to do with regulating the combined carbon. In fact, it has a lot to do with the total carbon. A metal high in silicon will be low in carbon, and particularly low in combined carbon, and will be influenced very little by being cast on a chill; but an iron of the analysis spoken of in this article, will readily yield to the influence of the chill. The heat will be rapidly absorbed by the chill, and the combined carbon will remain in combination, but no other chemical change takes place. The total carbon and the silicon are in exactly the same proportion that they would have been had the casting cooled slowly, and when remelted it returns to exactly where it would have been had it not been chilled.

A point usually overlooked, is that the silicon content becomes less every time the iron is melted, and the carbon automatically regulates itself to the silicon; the less silicon the more carbon, and vice versa.

Another point is, that iron which is kept melted for some time tends to anneal itself, which simply means that some of the carbon burns out and some of the silicon goes to the surface, so that, as a matter of fact, the hub of a car wheel would be slightly lower in both carbon and silicon than what the rim is, and when remelted it will, as a consequence, absorb more carbon from the fuel than what the rim will, and castings made from it will be, to a certain degree, harder than those made from the chilled rim.

This may not look plausible, but it is nevertheless true, It can be figured out in theory, and is easily proved out in practice.

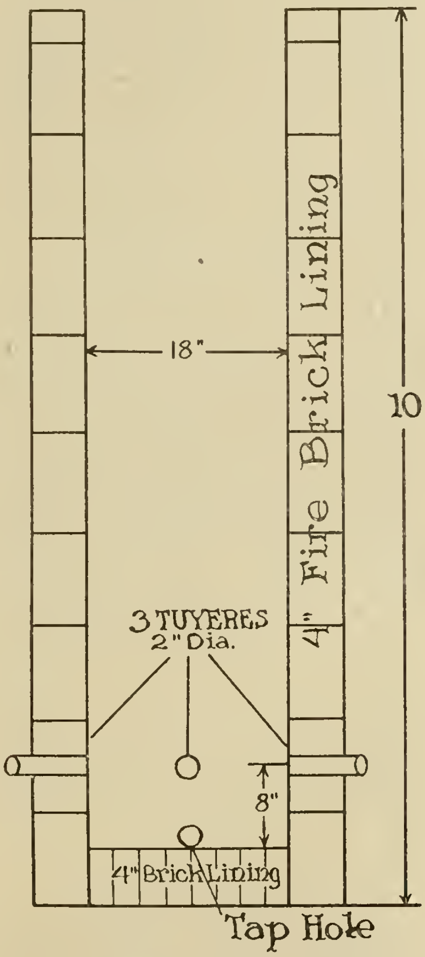
BUILDING—MANAGING A CUPOLA

A foundryman about to open up a foundry for the manufacture of small castings, has asked for information regarding the construction and management of the cupola which he proposes to build. As his question involves practically the entire field of cupola practice, it will probably be as well to include in addition to the answer to his questions a few points of general interest in operating cupolas of all sizes. Following is the question:

Question.—Will you please give me your opinion of cupola I want to build? Drawing enclosed. Have I got the tuyeres the right height (8 inches from the hearth) Will you also give me method of charging and time of blast? And shall I need a slag hole? If so, will you give me the position on drawing? Also please tell me how much iron I can get at one cast.

Answer.—An 18-inch cupola is rather small unless it is to be used in making bedstead castings or similar work where continuous melting is required, in which case a slag spout would be required, but to use a slag spout on so small a cupola requires very careful watching and would not be advisable in a jobbing foundry.

In placing the slag spout on any cupola it requires to be high enough above the bed to allow the required amount of melted iron to accumulate in the basin without running out of the slag spout, and low enough below the tuyeres to prevent the cold blast from striking the slag; so it will be seen that it requires fairly high tuyeres to admit of a slag spout. 8 inches above the top hole is abundantly high, in fact, higher than they should be for rapid melting. The closer you can have your tuyeres to the bottom the better the melting will be,



PLAN OF CUPOLA. NOTE LOCATION AND DIMENSIONS OF TUYERES.

but with such a small diameter care must be taken to allow enough space in the basin for the iron to gather between taps.

As regards the size of your tuyeres they are far too small. It is not blast that is required in melting, and if the proper amount of air could be admitted without causing a blast pressure it would be all the better. About 20 per cent. of the area of the cupola is as small as can be recommended for the total tuyere area and if calculations are taken from 18-inch diameter it will give an area of approximately 255 square inches. 20 per cent. of this will be 51 sq. inches of area to the 3 tuyeres, or 17 sq. inches for each tuyere. Three tuyeres 2¼ inches high and 8 inches wide would make the required tuyere area and would bring the blast down lower than a square or round tuyere.

In operating a cupola it is necessary to have a bed of coke of sufficient height to melt the iron. This bed must be maintained at the same height throughout the heat, for the reason that the iron is melted within a limited space known as the melting point or melting zone. The melting point is the highest point in a cupola at which iron is melted properly, and the melting zone is the space between the highest and lowest points at which iron is melted properly. Iron may be melted to a limited extent above or below these points, but it is not properly melted and the resultant castings will be inferior. The melting zone extends across the cupola above the tuyeres, and is from 6 to 8 inches in depth. Its exact location is determined by the volume of blast and the nature of the fuel used in melting. A large volume of blast gives a high melting point, and a small volume a low melting point. A soft, combustible fuel gives a high melting point, and a hard fuel a low melting point, the blast being equal in volume with both fuels.

To do good melting the melting zone must be discovered and a sufficient quantity of coke placed on the bed to bring the top of it up to the melting point. This will be from 18 to 22 inches, but as we have said the melting point will vary according to the volume of blast and nature of the fuel, and in order to locate the exact position of the melting zone it is advisable to charge on an abundance of coke, and no matter how high up the coke is in the cupola there will be one place where it is the hottest and this place will show on the line of the furnace, and any coke which was above this point will be practically wasted, as the iron will not melt properly until the coke is burned down to this point. After the first heat the melter will be governed by the lining. Wherever the lining is burned the most is where the hottest fire was, and where the iron will melt the best. In all future heats the first charge or bed, as it is commonly known, should be at this point after kindling is burned out. The coke should be charged by weight, and on top of the coke bed can be charged about three times its weight in iron. This will be found to be about the weight of iron which can be melted while the coke is being burned down to the bottom of the zone. If enough coke is placed on top of the first charge of iron to raise it to a height of about six inches, this will settle down onto the coke bed and bring it up to its original height when the first charge of iron is melted. On top of this 6-inch charge of coke which was, of course, weighed as well as measured, but not more than ten times its weight of iron preferably 7 or 8 times the weight of coke to begin with, and if it shows more iron could have been melted, keep adding until the maximum is reached. This should not take many days. An 18-inch cupola could not be expected to melt much over 12 cwt. and deliver first-class metal, but with care it might go as high as 20 cwt. by drawing the slag over the side of the spout.

THE HOT BLAST CUPOLA

In the last issue of CANADIAN FOUNDRYMAN we showed a small hot-blast cupola built by James Higham of Owen Sound, and the writer of the article suggested that the principles involved in this small furnace could be adopted to good advantage in larger furnaces. Now comes a communication from Mr. Higham to the effect that they have one in the shop over which he has charge and that it is actually doing very good service as an auxiliary furnace. This cupola is considerably larger than the one shown last month, but still it is quite diminutive as compared with the ordinary run of foundry cupolas of to-day. It is 19 inches in diameter inside of the brick lining and is 7 feet 6 inches in height above the sand bed and 12 inches from the sand bed to the bottom of the tuyeres.

Mr. Higham says of this cupola: "It is a very useful and handy furnace, melting 3,000 lbs. of iron quite comfortably and with no fear of bunging up. We have melted 4,500 pounds in it. So much in hot blast's favor, which speaks for itself of the advantages of its use. At the present time the subject of fuel saving ought to command attention from foundrymen, and this style of furnace has some advantages from this point of view. During the month of October this furnace was put into commission on several occasions. A record of the last four heats is as follows:

Date	Iron Melted	Coke burned
Oct. 21	2650 lbs.	350 lbs.
Oct. 23	2400 lbs.	350 lbs.
Oct. 25	2100 lbs.	330 lbs.
Oct. 28	2100 lbs.	330 lbs.
Total	9250 lbs.	1360 lbs.

"From these figures it will be seen that the proportion of core to iron is as 1 to 7 or thereabouts, and in the first heat it is slightly in excess of this. When we consider that this is an exceptionally small cupola for general foundry use and that these heats were small, even for the size of the cupola, it must be conceded that it is economical melting.

"It must always be remembered that a lot of coke is required to make up the first heat and in taking off a small heat this makes a bad showing as the bed is always the same, no matter how big the heat is, and if additional charges had been added to these heats the melting ratio of iron to coke would have far exceeded these figures. But we are getting away from the main feature of the furnace. The blast in passing through the hot chamber may not have time to be heated to a terrific heat, but it is heated to some extent and the slag which is always running down the walls of the cupola and over the tuyeres is not chilled as it would be if coming in contact with the cold blast. As a consequence the tuyeres are kept open and the proper amount of air delivered to the fuel throughout the heat."

SATISFIED INQUIRER

Editor CANADIAN FOUNDRYMAN:

"Very many thanks for your prompt and very intelligent answer re Building Cupola. It helped me out fine, and cupola works fine, except some of my castings are chilled and cold shot. Will you let me know the trouble through the CANADIAN FOUNDRYMAN? Also can I use all scrap in melting, or must I use new iron with it? I have done lots of moulding but have never taken the trouble to learn anything about the melting end."

Answer.—If you are sure that the cold shots are not due to damp sand or hard ramming in the mould, they can only be attributed to the iron being dull or improperly poured. Cold shots are caused from so many different sources that it is difficult to say, without seeing the job just which one would be the cause. Iron poured over a large surface will be cold shot even with the best of metal unless poured very rapidly.

A new lining in a cupola never works as good the first heat as it does afterwards, but if the iron continues to run dull it will require more fire.

Scrap iron is never as soft as the pig from which it was made, for the reason that melting burns out the silicon and also increases the carbon and the sulphur. The faster melting you do the less carbon and sulphur will be picked up from the fuel and the less silicon will be burned out. From this you will see that it would be a difficult matter to get as soft castings from scrap as you would get from new iron, although with real good scrap the castings should be all right for ordinary chunky castings. If you will study carefully the working of your cupola ou will find that your best iron will be after you have poured about three or four hundredweight of metal, so the best thing to do is to put your best scrap at this part of the heat and then pour your best work when this iron comes down: you will soon learn to know the best iron when you see it in the ladle.

CATALOGUES

The W. W. Sly Manufacturing Co., Cleveland, Ohio, have just issued a neat booklet describing the goods which they manufacture, which includes steel tumbling mills, cinder mills, rosin mills, sand blast equipment, dust arresters, exhaust fans, cupolas, core ovens core sand reclaimers, etc. The pages are full of pithy sayings as well as valuable suggestions and it is a handy book of reference. The last page describes their latest design of cupola tuyere, and is a little story in itself.

CANADIAN FOUNDRYMAN is in receipt of the latest catalogue of the **McLean-Carter Open Hearth Furnace**, manufactured by the McLean-Carter Furnace Co., of Milwaukee, Wis. The book is profusely illustrated, showing different details of construction. Samples of work done in steel are also shown. In addition many valuable formulas are given, together with much valuable information to steel melters, included in which is a description of the various fuels used in melting steel and the effects of each fuel on the resultant casting. It is an interesting catalogue and should be in the hands of every foundryman who is interesting in steel casting.

Frederic B. Stevens, Windsor, Ont., manufacturers of foundry facings, supplies, equipment and fire brick, buffing compositions, polishers' and platers' supplies and equipment, have just handed us their latest catalogue, No. 2271, containing 768 6x9 pages. The book is a handsome cloth-bound volume, and is entitled "Red Book No. 1." It is profusely illustrated, and contains everything used in the foundry, either for iron, steel or non-ferrous metals, galvanizing, plating, etc., and would be a handy book of reference for anyone in the foundry business.

Dr. Kirk's System of Foundry Practice is the title of the Doctor's latest pamphlet, which he has just handed us. It treats of general foundry practice, including cupola management, metallurgy of foundry irons, dry sand cores, semi-steel, cupola steel, malleable iron, steel malleables, etc., and is full of useful information on those subjects. Core making, which is the most neglected branch of foundry work, is given particularly valuable consideration; but all points are well explained. Dr. Kirk's address is 938 North Tenth Street, Philadelphia, Pa.

The Blaw-Knox Company, P.O. Box 915, Pittsburg, Pa., have just handed to the trade their latest folder, describing their various styles of clam-shell buckets for handling sand, etc. Different views are given, showing the different classes of work it can be adapted to. The different details of the bucket mechanism are also described.

A HINT FROM FORD

The Ford Motor Company is perhaps the first to work out a practical system of grouping its employees at the street car stops and training them to enter the cars in a systematic and orderly manner, thus increasing greatly the rate of loading and reducing to a minimum the number of accidents caused by carelessness in boarding the cars. This system, together with the staggered hour method of dismissing employees at the end of their day's work, makes it possible for the street railway company to handle about 20,000 employees in two hours without interfering perceptibly with its normal schedule.

The Hillis & Sons Co., of Halifax, Nova Scotia, are preparing plans for the erection of a foundry in that city.

The Western Steel & Foundries Co., a subsidiary of the Dominion Wheel & Foundries, Ltd., are preparing for the immediate erection of a foundry at St. Boniface, Manitoba.

A Summary of the Mineral Production in Canada

This Article Covers the Preliminary Figures for 1918, Mentioning the Various Metals, Such as Copper, Gold, Silver, Platinum, Nickel, Iron, Steel, etc., and Where These Metals Were Mined

"THE usefulness of statistical data on mineral production," says the preliminary report for 1918 of the Canadian Department of Mines, "is greatly increased by the promptness with which the records can be presented to the interested public. "Acting on this principle, estimates, based on the periodical returns made to the various war boards organized by the Government, were put together at the end of the year. These estimates, further revised and supplemented, have now been issued as a preliminary report—"still subject to revision." The department, in this way, has secured prompt presentation of the broad results of mineral production.

The total value of the metal and mineral production of Canada in 1918 was 210,204,970 dols., an increase of 20,558,149 dols., or 10.8 per cent. on the values for 1917. In comparison with 1913, there was an increase of 44.3 per cent. Though much of this increase in values is due to higher prices, "it is satisfactory to note that, out of about forty-five items or products no less than eighteen products have reached their highest production in actual quantity during 1918 or 1917." Cement, stone, bricks, and other building materials fell off by about one-half, but the war demand led to large increases in metals, various non-metals and fuels. Half the total increase in value, as compared with 1917, was due to the higher prices obtained for coal, and a considerable proportion of the balance to higher prices of silver, cobalt and asbestos. Metal production in 1918, valued at 113,563,111 dols., increased by 7,107,964 dols., or 6.7 per cent. The metals—cobalt, copper, lead, molybdenum, nickel and zinc—all increased in quantity. Gold and silver slightly declined. Non-metallic production, valued at 96,641,859 dols., increased by 13,450,185 dols., or 16.2 per cent. Most of these non-metallic products—except clay and stone quarry materials—increased in quantity.

Copper production in 1918, which amounted to 118,415,829 lb., increased by 8.4 per cent. in quantity but decreased by 1.8 per cent. in value. The high mark of 117 million lb. in 1916 was passed. The average price of copper in 1918 was 24.628 cents per lb., against 27.180 cents in 1917. Of the total production 92,769,167 lb. were contained in blister copper and in matte produced in Canada, and 25,646,662 lb. estimated as recovered from ores exported. Ontario's output of 47,047,801 lb. increased by 9.7 per cent. in quantity, and the British Columbia production of 62,858,628 lb. increased about 9 per cent. in quantity. The total amount exported was 60,536 tons (of 2,000 lb.) against 59,961 tons in 1917.

Gold and Silver

Gold declined slightly in quantity. The amount was 710,526 fine ozs., as compared with 738,831 fine ounces in 1917. Ontario produced 411,270 ounces, or about 57.8 per cent. of the total production of Canada. British Columbia yielded 187,069 ounces, as against 133,742 ounces in 1917, an increase of about 40 per cent., due to increased activity at the Rossland Mines and to the entry of the Belmont Surf Inlet Mines. The Yukon gold output fell by 42 per cent. to 102,382 ounces, and was much below the average for the past ten years. Gold exports were valued at 10,040,813 dols., as against 15,929,051 dols.

The production of silver is estimated at 21,284,607 fine ounces, valued at 20,597,540 dols., as compared with 22,221,274 fine ounces, valued at 18,091,895 dols., in 1917. The decrease in quantity was 4.2 per cent., but the increase in value 13.8 per cent. Ontario's output of 17,109,389 ounces was 80.4 per cent. of Canada's silver production. Most of this silver came from the ores of Cobalt and the adjoining districts. In 1917 Ontario produced 19,301,835 ounces, British Columbia produced 3,965,828 ounces against 2,655,994 ounces in 1917, an increase of 49.3 per cent. in quantity and of 77.5 per cent. in value. The average price of silver for the year was 96.772 cents per ounce.

Platinum

The recorded production of platinum was 39 crude ounces (25 fine ounces), valued at 2,560 dols., as against 57 crude ounces, valued at 3,823 dols., in 1917. This was all obtained from Similkameen district of British Columbia. A definite record of the total recovery of the metals of the platinum group has not been obtained. The most important sources of the metals are the nickel-copper areas of the Sudbury district, Ontario, which are refined at Port Colborne, Ont., in the United States and in Wales. On the basis of the reports from the Canadian Copper Co., the total matte shipments in 1918 would contain, among other precious metals, 8,677 ounces of platinum and 13,016 ounces of palladium. The United States Government in June last fixed the price of platinum at 105 dols. per ounce.

Nickel

The amount of nickel produced in 1918 was 92,076,034 lb., valued at 36,830,414 dols., as against 84,330,280 lb., valued at 33,732,112 dols., in 1917. As usual, the nickel was chiefly derived from the Sudbury district, Ontario. The new refinery at Port Colborne started operations on 1st July last. The nickel-copper matte yielded by the smelters in the Sudbury district amounted to 86,773 tons (2,000 lb.), containing 45,670 tons of nickel and 23,472 tons of copper. The smelters of the silver cobalt-nickel ores of the Cobalt district reported a production of 243,186 lb. of metallic nickel and 962,309 lb. of nickel salts; the corresponding figures for 1917 were 265,896 lb. of metallic nickel and 657,549 lb. of nickel salts. The exports were 1,710,800 lb. of fine nickel, at 41.3 cents per lb., and 85,767,700 lb. of nickel in ore, matte, etc., valued at 12.3 cents per lb.

Lead and Zinc

Lead amounting to 43,846,260 lb. was produced in 1918, as against 32,576,281 lb. in 1917. There was an increase of 34 per cent. in quantity, and of 12 per cent. in value. The average prices in Montreal for the two years were 9.25 cents per lb. in 1918 and 11.137 cents in 1917. The exports were: lead in ores, concentrates, etc., 22,684,100 lb. against 13,410,400 lb. in 1917, and pig lead, 7,461,700 lb., against 1,004,500 lb.

Previous to 1916, all zinc ores mined in Canada were exported for both smelting and refining, but during the last three years much of the ore raised has been treated in Canada. The total production of zinc in 1918 was 33,663,690 lb., valued at 2,746,620 dols. (8.159 cents per lb.), as compared with 29,668,764 lb., valued at 2,640,817 dols. (8.901 cents per lb. in 1917. British Columbia yielded 31,011,164 lb. and Quebec 2,652,526 lb. The refined zinc produced in Canada from native ores was 12,278 tons (2,000 lb.), in 1918, against 9,985 tons in 1917 and 2,974 tons in 1916.

Iron and Steel

Iron ores showed a further falling off in 1918, being 206,820 short tons (2,000 lb.), valued at 863,186 dols., as compared with 215,302 tons, valued at 758,621 dols., in 1917. Most of the ore, 197,637 tons, was raised in Ontario. The quantity of ore charged to blast furnaces in 1918 was 2,242,337 tons, of which 96,745 tons were domestic and 2,145,592 tons imported—Newfoundland and "Lake ore."

Pig-iron production was 1,194,000 short tons (2,000 lb.), valued at 33 million dols., as compared with 1,170,840 tons, valued at 25 million dols., in 1917. Of the total production 1,163,520 short tons were made in blast furnaces and 30,425 tons in electric furnaces from scrap steel, chiefly shell turnings. In 1917 the blast furnace output was 1,156,789 tons, and the electric furnace production was 13,691 tons. In Ontario the blast furnace pig iron made was 748,258 tons, as against 684,642 tons in 1917, and was the largest amount made in this province. Nova Scotian blast furnaces made 415,870 tons, against 472,147 tons in 1917, and, with the exception of the year 1914, was the smallest production in this province since 1911. The grades of pig-iron last year were: Basic 966,409 tons; Bessemer, 15,415 tons; foundry and malleable, 181,696 tons; and electric furnace low phosphorus iron, 30,425 tons. The export of pig-iron in 1918 was 2,130 tons, and the imports 67,396 tons.

Provisional estimates of steel ingots and direct steel castings put the quantity as 1,893,000 short tons for 1918, of which 1,820,000 tons were ingots. In 1917, the production was 1,745,734 short tons, of which 1,691,291 tons were ingots. Electric furnaces produced in 1918 about 120,000 tons of steel, as against 50,467 tons in 1917, 19,639 tons in 1916, and 5.625 tons in 1915.

Coal and Coke

Although Canada has very large undeveloped reserves of coal, especially in the Prairie Provinces, the Dominion still imports the greater part of the coal consumed. The total production of marketable coal in 1918 was 14,979,213 short tons (2,000 lb.), valued at $55,752,671, and, except for the output of 1913, was the largest quantity raised in any one year from Canadian mines. In 1917, 14,046,759 tons were produced, valued at $43,199,831. The 1918 output shows an increase of 6.64 per cent. in quantity and of 29.06 per cent. in value. Most of the coal—11,154,251 tons—was bituminous. One mine in Alberta yielded 115,405 tons of anthracite; the remainder, 3,331,216 tons, was lignite. Alberta was the biggest producer, and increased its 1917 figures by 1,205,496 tons, or 25.45 per cent. British Columbia increased by 134,703 tons, or 5.53 per cent., but Nova Scotia fell off by 474,289 tons, or 7.5 per cent., and yielded less than in 1913 by 2,127,271 tons, or 27 per cent. The total exports of coal entered for consumption were 21,678,587 tons, valued at $71,650,584, as against 20,857,460 tons in 1917, valued at $70,562,357. Bituminous coal increased, while anthracite fell off. The consumption of coal in 1918 was 34,840,605 tons, as compared with 33,123,735 tons.

The output of oven coke was 1,234,347 short tons made from 1,945,475 tons of coal, of which 1,348,232 tons was domestic and 597,243 tons imported. The average was 0.634 tons of coke per ton of coal. In 1917 the output was 1,231,865 tons of coke from 1,928,923 tons of coal, or an average of 0.639. The estimated consumption of oven coke was 2,363,270 tons in 1918, against 2,192,373 tons in 1917. The by-product recovery ovens, which dealt with 71.2 per cent. of the coke production, yielded 10.525 tons of ammonium sulphate and 7,697,435 gallons of tar.

Petroleum

A slight increase in Canada's petroleum output has been seen during the past two years. This has been due to the development of the new Mosa field in the county of Middlesex, Ontario. From all sources 304,741 barrels (10,665,935 Imperial gallons) were produced, valued at $866,544, as against 213,852 barrels (7,484,120 Imperial gallons), valued at $542,239 in 1917. This was the largest output since 1910. A bounty of 1½ cents per gallon is paid on the marketed amount of crude oil from Canadian fields. Ontario's production was 288,692 barrels, or 10,104,220 Imperial gallons. Complete returns of the oil refineries have not yet been received, but in 1917 nine refineries used 199,256,799 gallons of crude oil, of which 190,822,740 gallons were imported and 8,434,059 gallons obtained from Canadian wells. The total quantity of petroleum oils, crude and refined, imported into Canada in 1918 was 420,728,933 gallons, as compared with 379,148,006 gallons in 1917.

Other Metals and Minerals

It is estimated that the molybdenite content of ores and concentrates shipped was 377,850 lb. in 1918, as against 288,705 lb. in 1917. Quebec produced about 88 per cent.

Some six tons of tungsten ore were received for treatment at the ore-testing laboratories of the Mines Branch.

The production in 1918 of arsenious oxide was 2,483 tons and of arsenic in concentrates, 1,015 tons. This compares with 2,656 tons of arsenious oxide and 280 tons of arsenic in 1917.

During the past four years the production of asbestos has largely increased, the prices in 1918 being from three to four times those of 1914. The total output was 143,456 tons (crude and mill stock), against 141,743 tons in 1917. The average price of crude was $671.35 per ton, against $510.47, and that of mill stock $46.87, against $34.08—the whole production was yielded by the Province of Quebec.

The total shipments of chromite ore and concentrates in 1918 were 21,994 short tons, valued at $39.40 per ton, against 23,712 tons, at $24.54 per ton in 1917. The total content of Cr_2O_3 was 8,526 tons, against 8,472 tons. Thus the slightly reduced output of 1918 exceeded that of 1917 in chrome content and in total value. A feature of the year was the entry of British Columbia as a producer of chrome ore. The bulk of the quantity raised came, as before, from the Eastern Townships, Province of Quebec.

Fluorspar increased substantially, the principal production from Madoc, Ontario, being supplemented by recently opened deposits in the Yale district, British Columbia. The total amount was 7,362 tons, valued at $135,712, as compared with 4,249 tons, valued at $68,756 in 1917. Canadian steel companies use from 10,000 ton 15,000 tons per annum.

In spite of the strong war demand the output of graphite fell off. The total product was 3,051 tons, valued at $270,054, as compared with 3,714 tons, valued at $402,892 in 1917. Ontario yielded 2,934 tons.

The production of magnesite—obtained entirely from Argenteuil County, Quebec—also declined from 58.090 tons in 1917 to 39,365 tons in 1918. The price, however, advanced so much that the 1918 production was valued at $1,016,765, against $728,275 in 1917.

The output of pyrites declined from 416,649 tons in 1918 to 413,698 tons in 1917. The total sulphur content in 1918 was, however, 157,311 tons (an average of 38 per cent.), against 155,163 tons (an average of 37.2 per cent.), in 1917. Canada consumed 85,951 tons of pyrites last year, and the balance of 327,747 tons was exported to the United States.

For the first time since 1907 the quantity of salt sold from Canadian wells showed a decline. The sales in 1918 were 131,727 tons, valued at $1,285,039, as compared with 138,909 tons, valued at $1,047,792 in 1917. There was a decline in quantity of 5 per cent. and an increase in value of 22.6 per cent. The Canadian product was, as usual, entirely from the saltfield of Southern Ontario. A deposit of rock salt is being opened up in the neighborhood of Malabash, Cumberland County, Nova Scotia. This is the first known discovery of rock salt in the Maritime Provinces, and the first deposit in Canada to be discovered at a depth sufficiently shallow to enable it to be won economically by actual mining.

PAINTING CORRUGATED STEEL

The corrugated steel used for airplane hangars in this country and overseas was painted before shipment. Owing to the large quantity of steel, it was out of the question to do this work by hand, and machines could not be used on account of the corrugations. For this reason, a spray system of painting was employed. First, the sheets were coated with red lead before being corrugated, and after that they received a coating of green on one side and grey on the other side, applied by means of a jet 14 inches wide.

DOINGS IN THE MONTREAL FOUNDRIES

Montreal as a foundry centre undoubtedly stands prominent as far as Canadian plants are concerned. This not only applies to the number of foundries but to the size of some of them. Nearly every line of work is represented here but particularly noticeable are the numerous jobbing foundries which are prepared to do heavy contract work. Every foundry appears to be well supplied with work unless it might be the single exception of the locomotive business, which is not very brisk of late. Marine work, structural work, electrical machinery, and in fact almost every class of foundry work is in a reasonably brisk condition.

Eagle Smelting and Refining Works, Limited, 41-45 Prince street, Montreal, have given us some very interesting literature relating to their line of manufacture, which consists of babbitt metal, solder, type metal and white metals of all kinds; also brass and bronze castings.

The Prince of Wales inspected the Algoma Steel Co. works at Sault Ste. Marie, Canada, on Sept. 4.

Research Work on Malleable Iron

Being the Result of Four Years of Research Work for the American Malleable Casting Association

By ENRIIQUE TOUCEDA

IT is the writer's belief that three factors mainly operated to darken the vision of many of the manufacturers regarding the value of research work. The first is fundamental. Stated brutally, it is ignorance as to its possibilities. Following this regrettable fact is their obsession to the thought that the prime and essential requisite for success lies in the advertisement, with oftentimes the accent on the last four words. The third factor has reference to the extent to which research has been discredited through the employment for that purpose of men not qualified through temperament, proper training or resourcefulness, to undertake such work—the square peg in the round hole, the neophyte, and at times the quack. While the revelations born of the world's war have in large measure done much to open the drowsy eyes of the manufacturer, it is nevertheless certain that hard and diligent work still remains to be done before the majority will be aroused from their lethargy.

Condition of the Industry Prior to Research

2. Prior to the time four years ago that research work was undertaken in the interests of the American Malleable Castings' Association, the industry was in a more or less chaotic condition. There had been at least three years of serious business depression, ruinous competition as a consequence had been running its insensate course, but back of and beyond all this, was the damning accusation of the engineer, that the material, except in the case of a limited number of concerns, was not only lacking in dependability, but of low strength when dependable. In railway-car fabrication particularly, the number of malleable-iron castings used had dwindled from a very large quantity per car, to an almost insignificant number, consisting mainly of unimportant details. Malleable cast iron was rapidly being replaced by the steel casting, and in other directions as well, the latter was encroaching on the legitimate field of the former, and incidentally placing it in an exaggeratedly false position, for the reason that when substitutions were made the patterns were redesigned and made much heavier to accommodate the less-fluid casting properties of that metal. When a steel casting failed, the attitude taken by the engineer was that the maker did not understand his business, that he was incompetent. If, on the other hand, the broken casting proved to be made of malleable iron, the assumption in that case was not that the maker was incompetent, but that the material, per se, was unsuitable for the part. Under those rather distressing circumstances it was not strange that the malleable-iron founder stopped, looked and listened. He began to awaken to the fact that recklessly he had been traveling a perilous course for a great many years, unmindful, too, of the frequent flashing of the danger signals. He was finally begining to experience deep misgivings as to the future welfare of his industry.

3. It may prove of interest and pertinent at this point to make some remarks in connection with the literature of the art at this particular period. Aside from a few fragmentary articles, there existed none that contained any real information of value to the metallurgist who sought knowledge in this field, while much of it was replete with gross misinformation. It consisted for the most part of what might be called metallurgical platitudes, information at the finger ends of any well-informed metallurgist. Some very prolific writers on the subject of black-heart malleable iron can certainly be accused of considerable recklessness, which is about the mildest form in which this statement can be made, for even the most superficial chemical or metallographical investigation could have demonstrated the falsity of many of their statements. In this way many fallacies had been handed down from one writer to another and accepted as true by those who lacked the time, opportunity or equipment to investigate for themselves.

4. Actually, there exist but few facts that have been solved to date in connection with the metallurgy of malleable iron that could not through careful investigation be ascertained by any competent and resourceful iron and steel metallurgist, well equipped for such a purpose. It is true that there are quite a number of baffling problems that have not yet been solved and that need solution, but in the main the strictly metallurgy part is now well understood.

5. Some conscientious writers, on the other hand, have expended considerable energy, have carried through many painstaking investigations and furnished abundant data as proof for their statements, and still, as the author will endeavor to make perfectly clear further on, their experiments have failed to prove helpful to the manufacturer of black-heart malleable iron, due in almost every case to one fundamental mistake. Other authors have applied to this product conclusions drawn from experiments made on white-heart malleable iron, such as used on the other side.

Formation of the Association

6. Among the various manufacturers of malleable-iron castings, at the time referred to, were some twenty-five who were progressive enough to understand the benefits that accompany co-operation, and that one might better have an intimate friend with whom to compete than an enemy. These had formed an association that had been in existence some ten years or more. The association had as its objectives the exchange of ideas in the direction of business economy, improved works practice, the study of proposed foundry and factory enactments, the securing of more favorable insurance rates, the study of problems relating to cost, labor, housing and sanitation, and finally the forming of friendships that are the natural outcome of frequent and close personal contact. It is to these men largely that credit should be given for the renaissance of the industry. They decided to enlarge their field of action and, irrespective of cost, determined to go the full road along the lines of metallurgical research. They determined as well that every statement made as to progress would be conservative and accompanied by data that would be incontrovertible, which course they have followed to the letter.

7. The preliminary part of this paper will be descriptive of the steps that were taken to bring system out of chaos, the second will deal with some metallurgical details of the malleable-iron process, and the third with the fallacies that have been handed down in the manner already indicated. The first step taken towards systematization was to make a hasty survey, papers were written by the consulting engineer in connection with matters deemed of most importance at the time to the membership, and in these recommendations were made as to suggested improvements in work practice generally. These papers were sent to the secretary, who had them printed in uniform bulletin form for distribution. In these bulletins to date a very wide field has been covered, as they contain quite complete details in regard to physical properties and tests, the metallurgy of the process, air-furnace and annealing-oven constructon and practice, combustion, special investigations of difficulties encountered from time to time by the various members, and other matters too numerous to mention.

Method of Physical Testing

8. When the research work was started, it was found that by far the majority of the members had no system of testing the quality of their product, aside from the twisting and bending of a casting, in order to ascertain its ductility, or the bending over of test lugs attached to castings. Consequently there was no way in which could be compared the quality of product of one member with that of another. To be candid, there was available no information of value that could be given to an engineer who might be seeking information of this character. Mr. Benjamin Walker, who at the time was vice-president and

general manager of the Erie Malleable Iron Company, of Erie, Pa., a number of years previous to this, had devised for the purpose of testing the quality and uniformity of his product, what he called a test wedge. The wedge was 6 in. long by 1 in. wide, tapering from ½ in. at its base to 1-16 in. at its other end. His practice was to distribute a series of these wedges throughout the annealing oven, and at the conclusion of the anneal subject them to test—accomplished by holding the butt end of a wedge in a narrow-jawed tongs, placing it upright on an anvil, and striking its top end with a 6 or 8 lb. sledge. In this manner the thin end of the wedge would gradually curl up under these repeated blows, and it is apparent that the more blows the wedge would stand before fracture. the shorter would be the butt left in the jaws. The shortness of this butt he considered was a measure of the metal's ductility.

9. It was decided that an attempt would be made to standardize this test for adoption by the association. With this end in view a machine (Fig. 1) was so designed that a weight of 21 lb., when raised to a height of 3.33 ft. above the top of the wedge, when placed in position for test on the anvil of the machine, would be automatically tripped to deliver a fairly constant blow on the thin end of the wedge. The blows were counted, and for convenience the number delivered before rupture took place, was recorded as the *blow efficiency* (assumed to be a measure of ductility) was measured and expressed in terms of *butt efficiency*. These were arbitrary terms, understood by the members, and intended for their use only. It will be noted that the test is one of great severity, for the reason that the first blow must be borne by a section but slightly larger than 1 in. by 1-16 in., and equals, expresesd in pounds of static pressure, over 1,350 lbs. As the wedge curls and consequently shortens, subsequent blows obviously are delivered through a slightly greater distance, while, as the wedge must he held in such a position that it will he hit squarely and not upset when struck, it is evident that the blow must be delivered on the highest point of the curl. As this point is quite some distance away from the centre of the section that resists the blow, it is obvious that the effect of the blow is augmented by the horizontal distance of this point from the centre of that section whose bending moment is the greatest. Twenty blows has arbitrarily been chosen to correspond to a blow efficiency of 100 per cent., but at the present time we have numerous members whose wedges invariably test better than 30 blows. When a wedge fails to break at 30 blows without fracture it is thrown aside, as it is obviously a waste of time to investigate it further.

10. It was decided that tensile-test bars should be cast by all of the members, and further that they be required to send to the consulting engineer one tensile-test bar and one test wedge from some one heat of each day's run. This made possible the ascertainment. not only of the quality of each member's product, but furnished data through which a comparison could be made of the quality of the product of the membership as a whole. Equally important, it also served as a direct and positive measure of the progress that ensued from month to month. The dimensions of the tensile-test bar are similar exactly to that contained in the American Society for Testing Materials specification for malleable cast iron. It is a round bar 12 in. long. The ends that go in the grips are each 3 in. long by ¾ in. in diameter,

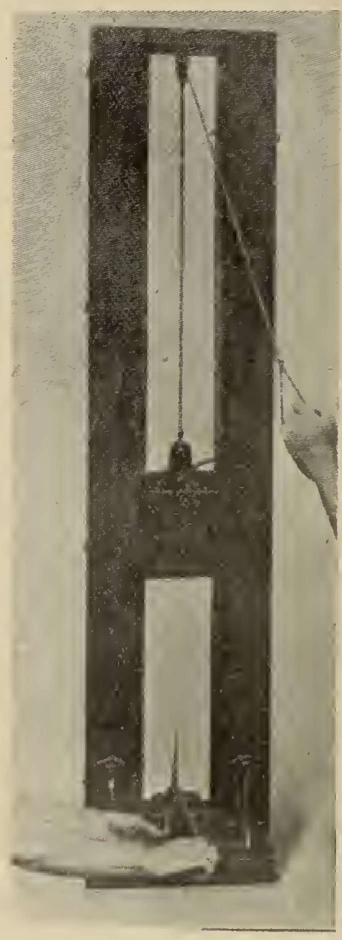


FIG. 1—SHOWING MACHINE FOR TESTING. MALLEABLE WEDGE.

and gradually taper in a distance of 1 in. to the reduced section, which is ⅝ in. in diameter and 4 in. long. At the end of each month a report is made of the result of the test. This report is promptly printed and distributed in the form of a bulletin. For convenience, and in order that the situation can be easily analyzed, the results are classified and tabulated as follows:

Per cent. of bars having an ultimate strength lower than	40,000 lb.
Per cent. of bars having an ultimate strength falling between	40,000 and 42,000 lb.
	42,000 and 44,000 lb.
	44,000 and 46,000 lb.
	46,000 and 48,000 lb.
	48,000 and 50,000 lb.
	50,000 and 52,000 lb.
Per cent. of bars having an ultimate strength over	52,000 lb.

The average elongation of each class is recorded under the figures for ultimate strength in that class. Accompanying the foregoing, but not reproduced here, is a tabulated record of the results of each member's work. The members are classified into those who make railway work, and those who do not. To the former is assigned a letter, and to the latter a number. Through this procedure each member can identify his record but not that of any other member, as all of the identification marks are known only to the consulting engineer.

11. In this manner it is possible to learn just how each member is progressing, and if it is considered by the Research Committee that his progress has not been as rapid as it should have been, the consulting engineer is requested to pay him a visit with the object of aiding him more quickly to better his condition.

Average Physical Properties Prior to Research

12. It is pertinent at this point to present in as fair and impartial a manner as possible a comparison of the physical properties of malleable iron manufactured within the past few years with that made in the period prior to 1913. Before entering into this matter the writer wishes to go on record as stating that any data in connection with the ultimate strength of malleable iron is valueless as far as serving to show its real worth unless accompanied by information regarding the ductility of the metal as measured by the elongation. If one knows how, there is no difficulty whatever in uniformly making a metal of 85,000 lb. ultimate strength, provided ductility be sacrificed down to what would be represented by a 5 per cent. elongation. Further on the structure of such material is shown. In the past there have been occasional records of tests that have run somewhat similar to these figures, and such tests have been quoted by others in different articles, but in the light of present practice this is not considered good malleable iron unless it is to be used for special purposes where ductility is not of consequence and a high ultimate strength is imperative. When such high ultimates were obtained it must obviously have been by accident rather than design, because if 5 per cent. elongation was a rather high average at the time, it follows that it would have been accompanied hy a high ultimate strength had it been known how to obtain it. There are still stronger reasons for making this statement. For many years the writer has had an unusual opportunity to learn either at first hand or on good authority what character of product most of the concerns made. and aside from one concern who had always enjoyed an enviable reputation for the uniformity and exellence of its product and another very large company whose plants were very painstaking in their methods of manufacture. the ordinary run of malleable iron was undoubtedly inferior. The record of tests made in this laboratory during the period mentioned do not exceed three hundred. They do. however represent the product of many different concerns. As some of the bars were of square section. some rectangular, and

others round, it is plain that no uniformity existed in their dimensions. The latter vary anywhere from ½ to 1 in. in diameter, while the former for the most part are 1 in. square and 1 in. by ½ in. The great majority of these tests show that the ultimate strength was under 39,000 lb. per sq. in., while the elongations were for most part under 3.5 per cent. There are instances of fairly high strength, slightly over 48,000 lb., while the highest elongations ran 7 per cent. in 4 in.

13. It happens that the writer has a record of tests made in 1911 on bars made by seven concerns that were deemed at the time to be unquestionably among the very best producers of malleable iron castings. These founders were each asked to make 20 of the very best bars they could produce for test, 10 to be 1 in. in diameter, and 10 to be ½ in. in diameter. In these tests the average ultimate strength of the 70 bars of 1 in. diameter is 39,882 lb., and the average elongation exactly 5 per cent. The lowest ultimate is 31,990 lb. and the highest 45,560 lb., the lowest elongation 1.7 and the highest 9.8 per cent. In the ½ in. bars, the average ultimate is 41,693 lb., and the average elongation is 5.5 per cent. The lowest ultimate is 33,600 lb., and the highest 47,430 lb., lowest elongation 1.2 and highest 6.3 per cent. Inasmuch as each of these seven concerns were informed that what was wanted was 20 test bars that would represent the very best product they could make, and inasmuch as these manufacturers were considered among the best of the producers, it would appear that the writer is warranted in assuming that the foregoing tests would represent a high rather than a low average.

14. Table 1 is reproduced from Dr. H. M. Howe's book, "The Metallography of Steel and Cast Iron," pages 96 and 97. In the first series of this table there is a very good bar, though the writer is inclined to doubt the accuracy of the figures under the elastic limit column. In the second there is a bar, slightly better than the other. The one with 8.2 per cent. elongation is also good. The second series furnishes a guide as to what was deemed to be unusually good malleable iron several years ago.

Fallacious Theories of Malleable Iron

15. In Hatfield's "Cast Iron in the Light of Recent Research, 1912," page 213, is a table containing the result of 14 tensile tests of bars 1 in. by ⅝ in. in section. The bars run very uniformly and the material, while of low strength, is ductile. The latter should certainly be expected in bars that are but ⅜ in. thick. The lowest ultimate strength is 38,820 lb. and the highest 45,700 lb., the lowest elongation 10 per cent. and the highest 15.3 per cent. Under this table appears the following: "If attempts are made to increase the maximum stress obtained from such iron, the elongation would appear to have to be sacrificed, and to a considerable degree. In illustration of this the following records are given":

Maximum stress tons per sq. in.	Elongation, per cent. in 2 in.	Reduction of area, per cent.
18.9	12	9
21.1	13	8
24.0	9	8
26.5	7	5
27.8	5.5	3.5
29.0	5.0	4.2
34.3	3.0	2.5

16. Under this table the following words appear: "The cause of the increase in tonnage is the retention of increasing proportions of combined carbon. This combined carbon stiffens the material and incidentally reduces its ductility." The writer believes that he was the first to prove and furnish indisputable evidence as to the falsity of the statement that the ductility of malleable iron decreased as its ultimate strength increased. While Hatfield is correct in assuming that the ultimate strength is increased and the ductility decreased with an increase in combined carbon, the statements indicate clearly that he was, at the time at least, not familiar with the manner in which malleable iron can be obtained having the characteristics of high strength accompanied by high ductility. It can be stated that in normal malleable iron as made to-day the higher the strength the higher will be the ductility, and in this particular this metal is unique. In a paper read by Dr. Richard Moldenke, before the American Foundrymen's Association in 1903 can be found these words: "The tensile strength of malleable castings should run between 42,000 and 47,000 lb. per sq. in.; castings showing only 35,000 lb. are serviceable for ordinary work. It is *not advisable to run beyond* 54,000 lb. per sq. in. *for the resilience is reduced*, and one of the valuable properties of the malleable casting impaired. The elongation of a piece of good malleable will lie between 2½ and 5½ per cent." In the "Mechanical Engineers' Handbook," edited by Prof. Lionel S. Marks and published as late as 1916 appears the following by the same author: "These castings *should not be machined*, as the interior is not as strong as the metal at and near the surface. Tensile strength 35,000 to 48,000 lb. per sq. in. European malleable cast iron, made by a somewhat different process, is not as sensitive to machining; the castings, which are thin only, are practically decarbonized in the annealing process, whereas in the American blackheart malleable iron only the skin is decarbonized, the metal adjacent for about ¼ in. partially so, and the central portions contain the full carbon percentage of the original hard white casting." The writer has italicized certain parts of the matter quoted in order to devote, if possible, a little attention to these parts later on. It is believed that the foregoing fairly sets forth the state of affairs as to physical properties during the period mentioned.

17. Let us see what improvements have been made within recent years, that is, since the research work was started for the association. We will not select the best month's record but will reproduce in part the very last report sent to the members, that is, the record for March, 1919.

18. Table 2 covers the physical tests for ultimate strength and elongation on bars received during the month of March, 1919. It would be impossible, almost, to consider the figures in this record and fail to note that as the tensile strength increases so does the elongation. These monthly records have been kept in this manner for four years or over, and there is no exception to this rule. It will be noted that only 0.40 per cent. of the total bars received tested under 40,000 lb. per sq. in. As a matter of fact, only 10.54 per cent. were under 46,000 lb., while 44.06 per cent. stood over 52,000 lb., with an average elongation of 14.67 per cent. The best individual record showed an average of 59,681 lb. ultimate and 21.47 per cent. elongation. The worst was 39,942 lb. ultimate and 4.20 per cent. elongation. The latter record belongs to a member who but very recently joined the association.

Limits of ultimate strength.	Per cent. of bars	Per cent. elongation
Under 40,000 lb.	0.40	4.50
Between 40,000 and 42,000 lb.	0.88	6.86
Between 42,000 and 44,000 lb.	2.79	7.67
Between 44,000 and 46,000 lb.	6.47	8.13
Between 46,000 and 48,000 lb.	10.29	9.50
Between 48,000 and 50,000 lb.	17.16	10.09
Between 50,000 and 52,000 lb.	17.95	11.55
Over 52,000 lb.	44.06	14.67

(To be continued)

TABLE 1. PROPERTIES OF MALLEABLE CAST IRON (H. M. HOWE)

		Tensile strength, lb. per sq. in.	Yield point, lb. per sq in.	Elongation per cent.	Elongation inches	Contraction of area, per cent.
Malleable castings. Standard Properties.						
E. Schoemann. Open-hearth furnace		44,230	......	3.9	....	.....
		48,640	......	4.5	....	.....
W. P. Putman		39,638	28,326	7.03	2	10.51
		50,849	41,792	10.15	....	20.92
Kent, Master Car Builders' Association, 1891. Size of specimen	1.52 × 0.25 in.	34,700	21,100	2.0	4	.....
	2.0 × 0.78 in.	25,100	15,400	1.5	4	.....
	1.54 × 0.88 in.	33,600	19,300	1.5	4	.....
	1.52 × 1.54 in.	28,200	......	1.5	4	.....
Kent		32,000	......	2.0	4	.....
Touceda. Avg. strength of commercial		41,000	......	.....	....	.....
Malleable castings. Unusually good properties.						
C. H. Gale		60,000	......	.....	....	.....
		70,000	......	.....	....	.....
H. R. Stanford, average of	3 tests 13/16 in. diam.	55,100	......	5.2	....	5.5
	3 tests 13/16 in. diam.	64,500	......	2.8	....	1.3
	2 tests 13/16 in. diam.	69,100	......	4.0	....	2.6
	2 tests 13/16 in. diam.	56,700	......	8.2	....	8.4
	3 tests 13/16 in. diam.	51,600	......	7.0	....	7.7
	42 tests 13/16 in. diam.	49,810	......	6.61	....	6.23
S. B. Chadsey		45,810	......	6.25	4	.....
		55,230	......	10.55	....	.....

On the Move! Once Common Among Moulders

The Moulders of To-day Have Little Idea of What the Moulder's Life Represented Forty-five or Fifty Years Ago, and the Following Story Will Be of Interest

By JOHN WODESIDE

"THE bluebirds now begin to sing. The restless moulder's on the wing," is an old couplet connected with the trade. It was not spring which tempted me to turn my face to the East, for the autumn months were close when I left the little shop in Tara; but I decided to go where shops were more plentiful, and a moulder could get a lift without having to go and holler up the machine shop; though, indeed, in after years in my far-distant Butte City, experience I had been forced to go out on the street and constrain the passerby to give the needed assistance.

Anyhow, I landed in Toronto just in time for the Ontario Rifle Association matches, and after a hurried, but fruitless search of the shops for work, I despatched a letter to Bob Strong, an old-time neighbor of my school days, now, fortunately for me, occupying the place of foreman in the old Hall Works foundry in Oshawa, just a few miles down the line from Toronto; and then went in for the matches, as I was a devotee of the rifle, but I failed to make expenses. This being my first experience in a large city, I was fortunate in obtaining lodgings in the Union Hotel, right under the big illuminated clock of the Union Station tower, which proved a great comfort to me when roaming the streets, night or day, and guided my footsteps to my humble roost.

However, Strong showed up, all right, and gave me a place amongst his husky gang of 30 moulders at Oshawa. The old shop had been reopened as an agricultural works to manufacture the Champion reaper and mower, and although it was a great relief to get onto a steady job, let no man imagine that an agricultural foundry is a haven of rest.

The wages were $1.75 per day of ten hours, and six days per week, and as board and lodging were only $2.50 to $2.75 per week, we still were able to dress fairly; in fact the dandy of the gang, J. Mitchell, came out in high hat, patent leathers and kid gloves. But after the lonely months in the village shop this life offered more fun than my school days. The day's work was heavy, but time flew to some jest, some practical joke, or a season of song by Billy Bull, who possessed a voice which, taken in time, might have spared his back many a weary day, and never had a gang a more sympathetic friend than Bob Strong. It was not a good place for loafers or slackers, but we got all the help which a good word and a ready joke often bring. And what a gang he had, from his big Scotch assistant foreman, Alex. McLean, Billy Hare, Dick Ensor, the James brothers, who, along with Tom Robinson, were lost in the great steamship disaster off the B. C. coast a year later. Jimmy Glass (Toughened Glass), the melodious Billy Bull, an ex-British soldier, and the dandy John Mitchell, down to George, the stout Dutchman, and little "Snaps," who was slain a year or two later, in a moulders' strike in distant Troy, N.Y.

But the bad days of "the panic" were upon us, business seemed unsettled, finances were disturbed, and a storm was coming that swept away our happy gang, and scattered us over the continent.

In the summer of 1875 the Masson works was opened in Oshawa, also an agricultural work, and the first thing the new firm tried was to pull wages down to $1.50 per day. We had a good union, between the Hall Works and the malleable iron foundry over in the east end, so we put up a fight, picketed the railway station and proclaimed a strike situation. We held out fairly well, having some trouble to keep casuals moving along at the station, until an old-timer came in by a back trail, on foot, and got started in the new shop, nor could we root him out; so when toward winter the Hall Works shut down, we gave in, and a few took refuge in the new shop, at the reduced wages; while the rest of us, unable to get a square-up of wages in arrears, hung around and lived in hopes, which did not always prove beneficial to the boarding houses. Having a few dollars to invest in a railroad ticket, I took my old Enfield rifle, and a few packages of ammunition, and started out northward on a deer hunt, which landed me away back in the old lumbering town of Coboconk, where I soon discovered that there would be more profit in chopping cordwood than in pursuit of the elusive venison carrier. So I made the acquaintance of old Capt. Courson, who was in charge of a settlement, mainly French-Canadians, which Gooderham & Worts of Toronto were placing in bush farms, large tracts of which they had taken up for speculation years before. Now, they gave the farmer a good chance to pay for his farm by buying from him all the cordwood he could cut and haul to the station. I stacked my rifle and bought an axe at the company store, which flourished under the care of the old captain.

The timber was mostly maple, of a goodly girth and free splitting; 50 cents per cord was the price for cutting and splitting it. The teams took it out and piled it for us in separate ranks. Two cords was a pretty good day's work after my hands got broke in. Board in a Frenchman's farm house, new and poorly furnished, cost somewhere about half the dollar per day that the two cords brought. Of course, we had some in our party of six choppers who could sometimes go three cords, but for a regular day's work, two cords sufficed for me. The winter was very favorable to us shorn lambs, for it was one of the mildest on record, with only enough snow to allow the sleighs to run, so it went easy on extra clothing, and there was a prospect of even getting ahead enough to buy a railroad ticket for home if the call came. It was a jolly little camp that of the French settler, Joe Chaquet, for at night, Joe, in his quaint English, told long stories, or sang his habitant songs, while Jim McGinnis lent an Irish flavor with his old ballads, or went across the border with "the Bonnie Scotch laddie, who wears the bonnet so blue." I could put in a part in reading the news of the day, as I could capture a paper from old Cap.'s store. But there was one of the crowd whose tales of adventure influenced my future course somewhat. Rufe Barracrae, who had roamed through the wild West for years and finally stranded back near home, told us tales of the new gold country opening up in Dakota, the famous Black Hills, as yet fiercely contested for by the warlike Sioux Indians, but of which he had got a glimpse while acting as Government mule skinner on the troubled border lands. Our continent seems to produce a gold rush each ten years pretty regularly. The first in my lifetime was the California excitement of '49; next came the B.C. rush to the Cariboo in '59, which was partly responsible for the scattering of our family, and the probable changing of my life, for the life of a hired boy on the old farms, run mainly by ox power, was not conducive to enthusiasm for the agricultural profession, in fact the only tool on the farm that I had a warm regard for was the axe, my present means of acquiring wealth, or, at least, a sustenance when once again thrown into the old familiar surroundings. And now this Black Hill excitement might date from '69, when prospectors tried to penetrate the Indian reservation, but so fierce was the opposition to the greedy gold seekers that many a scalp dried in the Sioux tepees, and although the U. S. Government tried to move them, they made but slow work. But Rufe's tales opened up a world of adventure which appealed to me in later days.

To be continued

The Portable Electric Oven and its Uses

An Article Describing the Uses of These Ovens, Together With Interesting Photographs of the Same

By B.S.B.

IT is a well-known fact that many concerns have small pieces of work completed in different parts of their factory which have to be dried, japanned or enamelled before going on to the next stage of manufacture or assembly. Where production is small these pieces are usually taken to a special department, treated and then put back into the cycle of manufacture. This necessitates extra carting and hauling, loss of time, and is inconvenient. In other words, it is not an efficient or scientific method of handling the work.

Fig. 1 shows a portable electrically heated oven used for drying fibre and japanning small parts at the Philadelphia Switch Factory, Philadelphia, Pa.

The oven is 1 ft. 6 in. wide, 1 ft. 6 in. high and 5 ft. long, with a heating chamber 10 in. high underneath the floor of the oven. General Electric heaters totalling 4.72 kw. are installed in this heating chamber, and are controlled by means of snap switches, Figure 2, so that four heats are obtainable, drawing 4.72, 3.94, 3.37 and 2.95 kw. respectively. The heating equipment, in this case, is designed for operation on a direct current circuit at 250 volts.

Fibre strips are dried in the oven at a temperature ranging from 200° to 250° F. By means of the snap switches it is possible, after the work has been brought up to the desired temperature, to provide just enough heat to take care of the losses due to radiation and ventilation, the oven, therefore, requiring little attention. (However, automatic temperature control, in most cases, is desirable, as it gives a more positive and flexible temperature regulation.)

For fibre drying the electric oven is the best. If the temperature rises too high, as is liable to be the case in a gas, steam or oil heated oven, the fibre becomes dry and brittle and is hard to work with. Electrically generated heat with the consequent close control of temperature provide ideal working conditions.

This oven is provided with ventilation, so that it is adaptable to japan baking and enamelling. It is sometimes used for impregnating small coils with waterproofing and insulating material.

The portability of this oven has time and again proved to be a great convenience and saving. One man can easily push it around from one room to another, and elevators make it equally useful on any floor in the building.

It is, of course, conceivable that gas, oil or steam could be used to heat this oven, but it is not practical. The difference between connecting up gas or steam pipes, carrying tanks of oil and compressed air along with the oven and merely connecting up the oven by means of a set of electric wires is obvious.

The coal strike effects are apparent in some districts, while others are untouched. Prices are higher in some cases. Following are reports from various centres:

CHICAGO.—Although a number of plants have had to close down, due to a shortage of coal, the scrap market remains strong. Foundry grades retain their strength and No. 1 wrought is a good feature. Railroad offerings amount to about 6,500 tons.

BOSTON.—There has been a general advance in the New England district, and the past month has been the best month for business of the year. Re-rolling rails have sold at $27 shipping point. Heavy melting steel will bring $17 if of good quality. Wrought pipe is at $18, and No. 1 machinery is $34.50 delivered.

NEW YORK.—There has not been much trading, but several grades have advanced. Heavy melting steel is at $18 to $18.50 f.o.b. New York. There is considerable buying by brokers, but not much selling.

PHILADELPHIA.—Heavy melting steel is strong in this district. Some heavy tonnages have been sold at $24.50 delivered, and one lot of 5,000 tons was sold at $22.50 delivered.

FRONT VIEW OF PORTABLE FIBRE DRYING OVEN.

REAR VIEW OF PORTABLE FIBRE DRYING OVEN.

Henry Ford's View on a Very Vital Question

In the issue of the Dearborn INDEPENDENT, *on "Mr. Ford's Page," which appears this week, is the following article. It discusses the amount of profit in a day's wage. How much does it cost a man to produce a day's work?*

How much profit does a workman reap from his day's labor? How much ought he to reap? Does a "good living" come under the head of profit, or is it properly a part of the cost ofproducing a day's labor? How far can human energies be measured and human values standardized in order that the cost of a day's labor may be standardized?

Questions like these occur in one period or another of every man's thought about a system of economics which shall be more solidly based than any which serves us now.

But a more than academic interest attaches to these questions, for they are the real, even if unspoken, basis for much of the irritation and confusion which exists in the industrial world today.

The workingman is beginning to understand that he is in business. His raw material is human energy. His product is a day's work. All other business men seek a profit above cost of production, why should not he?

The difficulty thus far has been in making out the cost sheet. How much does it cost to produce a day's work?—that is the question for which there seems to be no satisfactory basic answer.

It is perhaps possible accurately to determine—albeit with considerable interference with the day's work itself—how much energy the day's work takes out of a man. But it is not at all possible to accurately determine how much it will require to put back that energy into him against the next day's demands. Nor is it possible to determine how much of that expended energy you will never be able to put back at all—because a "sinking fund" for the replacement of the body and vital strength of a worker has never been invented.

It is possible, however, to consider these later problems in a lump and provide for them under a form of old-age pensions; but even so, we have not thus attended to the question of profit which each day's labor ought to yield in order to take care of all of life's overhead, all physical losses, and the inevitable deterioration which falls upon all earthly things.

Moreover, there are questions having to do with the pre-productive period, which would have to be solved. Here is the man, let us say, ready to begin his service to society by turning out days' work throughout his life. How much did it cost to rear and educate him to his present age and usefulness? And how can that be figured as part of the cost of the energy he puts forth as he works to-day? Now, if it were the case of a machine, you would know what to charge. The machine cost a certain sum; it wears out at a given rate; it would cost such-and-such an amount to replace. It is a simple matter to figure the actual cost of the machine and its productive work, and add the profit.

Can we do that with men? Rather, can men do that for themselves, so that selling a day's work they will have as intelligent an idea of the cost of that day's work and the profit it ought to bring, as any manufacturer ought to have of his product?

> THIS article discusses the amount of profit in a day's wage. How much does it cost a man, in strength, money and ability, to produce a day's labor? How much profit ought he to receive on that outlay? How can basic figures be obtained on these matters?

The problem becomes more complicated when you consider the man in all his aspects. For he is more than a workman who spends a certain number of hours at his work in the shop every day.

If he were only himself, the cost of his maintenance and the profit he ought to have would be a simple matter. But he is more than himself. He is a citizen, contributing by his cultivation and interest to the welfare of the city. He is probably a householder, living under conditions which represent more than mere maintenance, in that they represent the graces of social life. More than that, he is probably a father with more or less numerous progeny, all of whom must subsist and be reared to usefulness on what he is able to earn.

Now, it is obvious that to regard the man alone, refusing to reckon with the home and the family in the background, is to arrive at a series of facts which are misleading and which alone can never suffice even for a temporary solution of the questions that concern us.

How are you going to figure the contribution of the home to the day's work of the man? You are paying the man for his work, but how much does that work owe to his home? How much to his position as a citizen? How much to his position as the provider of a family? The man does the work in the shop, but his wife does the work of the home, and the shop must pay them both: on what system of figuring is the home going to find its place on the cost sheets of the day's work? It finds its place there already in a sort of haphazard way. If a man cannot support himself, his wife, his children, his habitation, his position in society—why, he doesn't stay at the job, that's all. It isn't a matter of cost and profit to him; it is the matter of a "living."

Is a man's own livelihood the "cost"? And is his ability to have a home and a family the "profit"?

Is the profit on a day's work to be computed on a cash basis only measured by the amount a man has left over after his own and family's wants are all supplied?

Is the livelihood of five or six persons beside those of the actual worker to be charged up to "profit"?

Or, are all these relationships to be considered strictly under head of "cost," and the profit to be computed entirely outside of them? That is, after having supported himself and family, clothed them, housed them, educated them, given them the privileges incident to their standard of living, ought there to be provision made for still something more in the way of savings profit, and all properly chargeable to the day's work? These are questions which call for accurate observation and computation.

Perhaps there is no one item connected with our economic life that would surprise us more than a knowledge of just what excess burdens the day's work actually carries.

It carries all the worker's obligations outside the shop; it carries all that is necessary in the way of service and management inside the shop. The day's productive work is the most valuable mine of wealth that has ever been opened.

Certainly it cannot be made to carry less than all the worker's outside obligation. And certainly it ought to be made to take care of the worker's sunset days when labor is no longer possible to him, and should be no longer necessary. And if it is made to do these, industry will have to be adjusted to a schedule of production, distribution and reward which will stop the leaks toward the pockets of men who do not assist production in any way, and turn all streams for the benefit of those who do. In order to create a system which shall be as independent of the good-will of benevolent employers as of the ill-will of selfish ones, we shall have to find a basis in the actual facts of life itself.

It costs just as much physical

(Continued on page 48)

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

The MacLean Publishing Company
LIMITED
(ESTABLISHED 1887)

JOHN BAYNE MACLEAN - - - - - - - President
H. T. HUNTER - - - - - - - - Vice-President.
H. V. TYRRELL - - - - - - - - General Manager

PUBLISHERS OF
A Monthly Technical Journal devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager.
A. R. KENNEDY, Managing Editor. F. H. BELL, Editor.

OFFICES

CANADA—Montreal: Southam Building, 128 Bleury St., Telephone Main 1004. Toronto: 143-153 University Ave., Telephone Main 7324. Winnipeg: 1103 Union Trust Bldg., Telephone Main 3449 Vancouver: Roy A. Hunter, 39 Tenth Avenue West. Eastern Representative: G. E. Pearson. Ontario Representative: S. S. Moore. Toronto and Hamilton Representative: W. E. G. Macdonald.

UNITED STATES—New York: A. R. Lowe, 111 Broadway, New York, Telephone 8971 Rector. Chicago: A. H. Byrne, 1401 Lytton Bldg., 14 E. Jackson Street, Phone Harrison 9133. Boston: C. L. Morton, Room 734, Old South Bldg., Telephone Main 1024.

GREAT BRITAIN—London: The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C.; E. J. Dodd, Director, Telephone Central 11960. Cable Address: Atabek, London, England.

SUBSCRIPTION RATE

Canada, $1.00; United States, $1.50; Great Britain, Australia and other colonies, 9s. 4d., per year; other countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor by telling us. We should be notified at once of any change in address, giving both old and new.

Vol. X. Toronto, December, 1919 No. 12

CONTENTS

A Merry Christmas and a Happy New Year

'TWILL be but a few short days now ere the festive season is upon us, with its greetings of joy and good cheer; and ere we again appear before our readers it will have gone for another year, and we will have journeyed on into the year of grace 1920. We, therefore, take this early opportunity of extending to our many readers our most heartfelt wishes for a Merry, Merry Christmas and a twice Happy New Year.

We also take this opportunity at the close of a most successful year to thank all of our numerous patrons for their hearty support and encouragement.

It is a great comfort to the editor of a paper to receive letters of congratulation from satisfied readers. In this respect we have been greatly comforted during the past year.

It is also gratifying to be able to announce to our readers that our circulation is now considerably more than double what it was a year ago, and we hope that by honest effort on our part, and the generous co-operation of our appreciative subscribers to considerably augment our present list during the ensuing year.

Our desire is not only to enroll every foundryman and every man who is in any way interested in foundry work, but to satisfy them and secure them as permanent subscribers. We like to feel that everyone who is now on our list is pleased with himself for being there. We invite criticism, however, and also suggestions. If any shortcomings are in evidence we want them pointed out. In fact, we want every subscriber to feel that he is a party to its success and that this only Canadian foundry publication will hold its own with any on the globe.

Again thanking you all and wishing you the fullest measure of good things for the holidays, we bid you "good-bye" for this old year and will look forward with pleasant anticipations to the coming year's labor.

Moulders' Health and Comfort

SOME months ago we published an article relative to the health and comfort of workmen, and how they are looked after in Ontario's statutes, which was received with considerable satisfaction by the workmen in general, but was at the same time looked upon with a certain amount of suspicion, on the grounds that the employers had more pull than the men and that nothing could be done to enforce the law. This, coupled with the commonly expressed view of the average moulder, that the Manufacturers' Association was a powerful organization which would do everything in its power to make life miserable for the moulder for the sake of getting back at him, has prompted me to explain to the best of my ability that the moulders have a very exaggerated conception of the feelings which the employers have towards them.

In the first place the Manufacturers' Association is very little interested about moulders. The only organization which really counts for much in this respect is the American Foundrymen's Association, which includes practically every foundryman in the United States and Canada. And this organization is doing everything in its power to enact laws for the betterment of the men who are employed in their foundries. The self-imposed laws which this organization adopted unanimously at its convention in Boston two years ago are far more drastic than any Government would care to enact, and it speaks for itself that the employers are wide awake to the fact that everything in their power must be done to keep the men from turning their backs on the foundry. There is certainly no desire to get back at anyone. The desire is to keep the men together and contented, and keep the foundries in operation. This interesting paper entitled, "American Foundrymen's Association Safety and Sanitation Code," will be published in full in the January issue of CANADIAN FOUNDRYMAN.

Favors Six-hour Work Day

LORD LEVERHULME, head of the great soap business of Lever Brothers, at Port Sunlight, England, with a branch in Toronto, and who is recognized as the greatest employer of labor in the world, is visiting Canada for the purpose of inspecting the Toronto plant and for other purposes of interest to himself. Lord Leverhulme is a staunch advocate of increased production, but he believes in getting it out of the machinery and not out of the men.

A machine will work long hours, but it is not necessary to keep the same operator any longer than six hours per day. In this he has a good argument, and the same argument holds good in the foundry. Machinery does not drive the man off the market, as the average moulder seems to think, neither does it increase his labors. As proof of this, Lever Bros. employ more men than any other individual concern in the world, and are prepared to reduce the hours of labor and employ more men profitably, by increasing the efficiency of the machine.

If machinery can be made to reduce the cost, it automatically increases the demand and gives increased employment to the operators of the machines.

Keeping in With the Men

ON several occasions we have published articles treating on the subject of making the shop more attractive, and have received some very flattering comments from both workmen and employers on the suggestions advanced by our contributors. One employer expressed himself as exceptionally well pleased and urged us to continue in the good work, assuring us that if we kept in right with the workmen we would be sure to keep in with the employer, because what was good for the men was good for the boss. This was certainly very encouraging, and we confidently believe that most of the employers are anxious to make their surroundings as pleasant as possible for the men, but as regards keeping in right with the men, we have always been in right with the men, and will always do our part to win the boss over if he is careless regarding his men. We are always glad to receive letters from either employer or employee, with suggestions along the line of making the foundry more attractive. Last month we published what we considered to be an exceptionally-written article from an employer in New York City, in which he advanced the argument that frequently the employer is in total ignorance of the dissatisfied state of mind amongst his men on account of the obstinacy and bullheadedness of the foreman, and that the first intimation that things are not going right is when he sees a deputation of striking workmen coming into the office, and that the foreman whom he thought was a mediator between the employer and the men was in reality a barrier. If there are any foundry foremen in this class we hope they will see their error and cease from it. But a foreman's lot is not an ytoo rosy, and we would advise that the men be not too hasty in over-riding the foreman in their eagerness to get to the real head of the concern.

The Foundry Foreman

THE foundry foreman, as we have just hinted, does not always have the pleasant road to travel, and if he is inclined to be approachable there are men who will take advantage of him. But, on the other hand, there are foremen who delight in doing annoying things for no other reason than that their authority permits them to do so. There is certainly room for all hands to make a net set of resolutions on New Year's Day.

The Strike Situation

SPEAKING about the strike makes one think about the peace treaty. The delegates, or plenipotentiaries, or whatever they may be called, work all the year 'round in their endeavor to make a settlement which will be satisfactory, and when it is presented to the other fellow it does not suit and has to be taken back and remodelled. After all we put up with from Germany it does not look just right to humor them very much, but still it is considered wise to yield on some points rather than have further trouble. Now, about the strike. There is not a particle of common sense in having foundries standing idle and lots of work to be had; moulders working in strange towns and foundrymen buying their castings from outside foundries, all for right-down cussedness. There is lots of work to be done, and there is no need for these foundries standing idle. Why don't some strong-minded organization get after both bunches and bump their heads together and jar up their grey matter, and get these foundries in operation?

It is claimed that the best method of utilizing the peat resources of Canada efficiently would be by gasifying it in gas producers, as in this system the valuable by-products contained in the fuel could be recovered. The combined nitrogen of the peat can be economically secured in the form of ammonium sulphate, and the valuable fertilizer, with the peat ash containing potash and phosphoric acid, could be restored to the land from which the peat has been taken. Peat tar is a source of refined pitch and tar, candle wax, lubricating and burning oils, and powerful disinfectants greatly exceeding carbolic acid in germicidal strength. The valuable by-products of methyl, alcohol, acetone, pyridine bases and crude acetic acid, can be recovered from the aqueous distillate from the producer.

AN evangelist who was conducting nightly services announced that on the following evening he would speak on the subject of "Liars." He advised his hearers to read in advance the seventeenth chapter of Mark. The next night he arose and said: "I am going to preach on 'Liars' to-night and I would like to know how many read the chapter I suggested." A hundred hands were upraised. "Now," he said, "you are the very persons I want to talk to—there isn't any seventeenth chapter of Mark."—Boston *Transcript*.

Hoch the Kaiser

By JOHN WOODSIDE

The Kaiser saws wood to keep up his morale,
Which after the war was inclined to go stale.
The sword, he once wore, as befitting his station;
But his bucksaw fits better for a steady vocation.
The cords he cuts daily have not been reported,
Whether he splits it, and piles it, of timber assorted.
Does he set, and file up his own good saw blade,
And spit on his hands when the day's start is made?
We'd like those small items of the homely day's work
Of the man, who in "meaness," outrivalled the Turk.
Of small oaks, or poplar he cuts daily his "whack,"
I'd condemn him to hickory, or hard tamarac.
He cuts souvenirs freely for brothers and sisters,
But I never have heard that he raised any blisters.
After all they have suffered thru' his breaking the laws,
There are thousands who treasure the blocks that he saws,
And would hold him as sacred against "degradation,"
Such as might be his fate if tried by the nations.
If the court of the nations can't attend to his case,
We'll subscribe for a biplane, his name to erase.
No signs of repentence in him or his nation
For deeds of the foulest since earth's first creation.
You'll find, though he saws in his quiet Dutch home,
While lamenting his thwarted ambition,
The song he sings low, to each stroke of his saw,
Is "The Great Anglo Race to Perdition."

Thomas in Detroit "News."

Why did they civilize us when we were happy?

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, etc., Used in the Plating and Polishing Industry.

Questions Answered

Question.—The nickel solution which I wrote you about some time ago has not worked correctly yet. I had the solution analyzed, and it contains nearly one ounce of zinc per gallon and some copper. It's a mystery to me how these metals got in the nickel solution. I have tried to remove it by putting iron bars in the solution over night, but it does not collect the copper very fast. Could you tell me of a better way, one which will act quickly? The tank holds 200 gallons.

Answer.—In your former letter, you state that you added 3 oz. of muriatic acid to the nickel solution. Are you sure you did not add chloride of zinc solution, thinking it was the pure acid? Such things have happened. If you have allowed pieces of brass to remain at the bottom of the tank for any length of time, the solution would become contaminated with both zinc and copper, especially if the piece were in contact with the positive side of the electrical circuit. Possibly you used galvanized iron pails when moving the solution; if so, the solution became contaminated as a result.

The use of clean, bright, sheet steel as you have used iron bars, has been known to remove some copper from an acidulated nickel solution; but, the process is slow and requires frequent cleaning or changing of the steel sheets to prove of value. We have no knowledge of zinc being removed in same manner. If, as you state, the solution actually contains 1 oz. of metallic zinc per gallon, we have serious doubts as to the possibility of restoring the nickel solution to a useful condition. If you wish to experiment a little with it, try the following:

Add about 25 oz. of C. P. sulphuric acid and 25 pounds of common table salt to the 200 gallons of solution, heat the solution to 100 degrees Fahr., and replace in tank; then turn on current as strong as possible, using a cathode of about 36 square inch area; allow current to flow through bath in this manner for several hours; repeat same process every day (except addition of chemicals) for several days; then neutralize the solution by use of nickel carbonate, and operate carefully for few hours on small loads. The metals may thus be rendered harmless to the deposits. If this method fails to restore the solution, we would discard it as useless. The removal of metals foreign to a certain electro-plating solution is usually a task which does not prove either practical or economical in industrial plants operating solutions of large volume. It is, therefore, necessary that every precaution should be taken to avoid the introduction of these foreign substances. We do not advise discarding a solution of any kind if its value warrants a reasonable attempt to save it. The conditions under which you have to work would have a great bearing on what might be possible. Judging from your letter, we would not imagine your chances for success, in this case, were very hopeful.

Question.—Would you publish in the CANADIAN FOUNDRYMAN the best way to dissolve zinc and copper carbonates, both the dry and plastic forms, and oblige?

Answer.—The use to which the dissolved carbonate is intended would naturally determine the proper solvent. If the zinc or copper carbonate is to be used in a brass plating solution, the proper solvent is sodium cyanide. Make a strong solution of the cyanide by dissolving same in luke-warm water; add the plastic carbonate gradually until sufficient is dissolved. The dry carbonate is a little more difficult to dissolve, but, if moistened with the cyanide solution and mixed into paste before addition of full volume of solution, the operation is simple. Proceed in same manner as when preparing a cup of cocoa from the dry cocoa powder. You will find detailed explanation on page 338 of November issue of the CANADIAN FOUNDRYMAN.

A very rapid method which may be used in case of urgent need, is to place a quantity of the carbonate in a stoneware vessel, add cold water, add cyanide in lump or powdered form, and stir the liquid vigorously until complete solution is effected. Do not fill vessel more than one-third full, as heat is quickly generated and the volume of solution increases suddenly. Add cyanide until clear solution is obtained. If the carbonate is required for purposes other than cyanide plating baths, such solvents as hydrochloric or sulphuric acid could be employed. These latter solvents would merely convert the zinc or copper carbonate into either a chloride or sulphate of the metal, and, as these salts may be obtained cheaply, we assume that the cyanide is the solvent required. Do not add the carbonate directly to the plating bath. Dissolve in solution contained in separate vessel. By making a stock solution and keeping well covered, no delay is caused when additions are needed. Cyanide solutions containing undissolved carbonate are turbid black or white, according to nature of metal; clear liquid indicates complete solution of the carbonates.

Question.—One of our products includes a steel ball cup which is casehardened. The face of the cup is polished and thinner at the centre than at the outer circumference. These cups frequently crack, the crack appearing on face side and usually found after the cup is plated; the cup is then useless. Can you inform us why the cups should crack during the plating process?

Answer.—It is quite possible that the crack and is caused by being ground too rapidly. The heat generated suddenly may do the damage. Even when water is allowed to flow over the work during grinding operation, cracking is liable to occur unless care is observed, sudden expansion and contraction being responsible. The fault is not in the use of water, but in forcing the grinding beyond the proper cutting limit of the wheel. The cracks thus caused may be but very fine and are enlarged during preparations for plating, as by dipping from boiling solution to cold or warm acid or water. Assure yourself that the cups are in perfect condition when received in the plating room, by a careful examination with a magnifying glass after cleaning in only warm solution. If found to be sound, the cracking is probably caused by dipping from a hot to a cooler bath, or vice-versa. If you are using a sulphuric acid dip, the trouble may be caused by plunging the hot cups in it. If such is the case the cleaning operations should be performed in cooler dips to avoid extremes of heat and cold in dipping. Surround the dips with running water by placing crocks on bricks built up in cold water tank. Hot cyanide copper solutions operated with excessive amount of free cyanide will also cause fine cracks to develop in their hard steel cathodes. In this case avoid extremely high temperature in bath and reduce the amount of free cyanide by adding either carbonate of copper or copper cyanide.

Question.—We are anxious to obtain information relative to tinning grey iron castings, the dipping process particularly. We would also appreciate your

---

AMERICAN ELECTRO-PLATERS' SOCIETY, TORONTO BRANCH.

Officers for 1919-1920.

President—Mr. John A. Magill, 591 St. Clarens Ave., Toronto.

Vice-President—Mr. T. G. O'Keefe, 147 Dupont St., Toronto.

Secretary-Treasurer—Mr. O. Holtham, 328 Carlton Street, Toronto.

PLACE AND DATES OF MEETING

The Occident Hall, corner Queen and Bathurst Streets, Second Thursday of each month, at 8 P.M.

advice regarding the best solution for cleaning the castings before they are tinned.

Answer.—The preliminary treatment of grey iron castings differs slightly from the preliminary treatment given wrought iron before tinning, owing to the uncombined carbon or graphite in the former, and on which the flux has no action. The pickle usually consists of a 10 per cent. solution of hydrofluoric acid, and the duration of pickling varies from five minutes to thirty minutes, according to the condition of the casting's surface. The acid is kept in a lead-lined or wooden tank, lead-lined container is the safest. After pickling, the castings are tumbled, if size and shape will permit, in order to obtain a bright, clean surface. A wet tumble using a 10 per cent. solution of soda ash may be used. This treatment also neutralizes the acid in the pores of the castings. Large castings may be sand-blasted after pickling, or the castings may be tumbled and pickled in one operation by use of steel or iron tumbler equipped with a safety valve, or two valves, one on each end. The solution used for this treatment consists of 2 gallons of muriatic acid to every 100 gallons of water used; to this is added about 2 pounds of salammoniac. A quantity of tumbling stars should be used with large castings to facilitate uniform cleaning. When tumbling operation is completed, the castings should be quickly transferred to cold water. Small castings may be handled in iron wire baskets or strung on wires. Large castings are handled singly by means of hooks or tongs. They are immersed in strong caustic soda to remove any grease. When clean, remove and rinse in clean, cold, running water. The castings are next dipped for a few seconds in a solution of 5 gal. muriatic acid and 100 gal. water. They are now ready for the flux. The flux is composed of a saturated solution of muriate of zinc to each gallon of which 5 pounds of salammoniac should be added. The muriate of zinc is made by dissolving metallic zinc in muriatic acid until no more will dissolve. The tin used should be of best quality procurable. The addition of lead causes the surface of finished work to tarnish quickly. Before beginning the actual operation of tinning, cover the surface of the molten tin with a quantity of the zinc flux to a depth of about ¼ inch; to this add a little sal ammoniac. Dip the castings in the flux and then immerse in the molten tin and keep submerged until they acquire sufficient heat and become completely coated with tin. They are then removed and the excess of tin is thrown off by a quick motion. If baskets are used for small work, the articles should be shaken while in the bath to expose all portions to the molten metal. When immersing the castings in the molten tin, care should be observed to avoid excessive boiling or splashing. The coating obtained in this operation being rough, a second tinning is necessary to produce a smooth surface with lustre.

From the first kettle the castings should be transferred to the second bath, which may be maintained at a slightly lower temperature than the first. The surface of the second bath should be covered with pure tallow to a depth of from ½ inch to 2 inches. Some operators use 1 pound of palm oil and 5 pounds of tallow. There are substitutes which have been used during the war, but, we believe you will now find it possible to obtain tallow at a reasonable figure. This coating of oil acts as a flux and prevents oxidization, it also gives a more uniform surface and makes the tin run freely. When the casting has had time to heat and the tin has completely covered the surface, it is removed and quickly shaken to remove the excess tin and may either be allowed to cool in the air or directly immersed in a coal oil bath, kept cool by being surrounded by cold running water. Remove and wash in clean boiling water, and dry as usual. On very high-grade work, 3 and sometimes 4 tinning baths are used to produce an extra heavy coating, each bath necessarily being maintained at a slightly lower temperature than the one preceding it.

Question.—We wish to secure a formula for a black finish on chisels, wrenches, pliers and various other tools which we manufacture. These tools are polished, but are not plated, and the finish must be quite durable and not easily affected by the atmosphere or contact with the hands.

Answer.—We believe the following will serve your purpose. If a darker shade is desired than one immersion produces, redip the articles until proper color is obtained:

Bichloride of mercury, 2 oz.; copper chloride, 1 oz; bismuth chloride, 1 oz.; hydrochloric acid, 6 oz.; denatured alcohol, 5 oz.; water to make one gallon.

Question.—We have read the article, "A study in colors," which recently appeared in CANADIAN FOUNDRYMAN, but failed to find reference to a finish which is of special interest to us. We refer to the mildew effect which is produced on brass and copper. The finish has a greenish color and resembles green mould or mildew. Can you favor us with the formula?

Answer.—The finish you have reference to is a peculiar type of antique finish, which is used for den fixtures and similar products. It is produced on brass by boiling the articles in a solution of equal weights of nitrate of iron and hyposulphite of soda in 8 times their weight of water until of proper tint; then wash thoroughly, dry and lacquer, or use 2 parts water and 1 part iron chloride in same manner for antique green. To produce the antique surface on copper, dissolve 5 parts each of sodium chloride potassium bitartrate and copper acetate in 50 parts of acetic acid of medium strength, or 100 parts of white wine vinegar and a little water. When mixed well, cover the copper article with the paste and allow to hang in a warm, moist air for at least 24 hours; then go over the surface with a waxed brush. If high lights are present relieve with a wheel or by hand and touch up with chrome yellow or any any other suitable color. By applying ammonia to the article, with a brush, a blue color is given the original green, or by using carbonate of ammonia the color is deepened.

Question.—We would like to obtain a formula for a nickel solution suitable for nickeling small pins, tacks, and wire articles. The final finish must be bright and we do not find it practical to employ a rotating machine for this work. Therefore, we now seek a formula for producing a bright plate, which will suffice without subsequent operations. Can it be done?

Answer.—To obtain a bright nickel finish on small wire articles, such as you mention without any burnishing treatment during deposition, or subsequently it will be necessary to employ a brightening agent, such are always retarding agents also. This bath would be of little value as a plating bath for general run of work, but will answer your purposes splendidly. For each gallon of solution dissolve the following chemicals in water. Double nickel sulphate, 12 oz; single nickel sulphate, 5 oz.; ammonium chloride, 3 oz.; boric acid, 5 oz.; use only 1½ volts and as large volume of current as possible without burning the deposit. We do not understand why you find it impractical to use a rotating machine. A cylinder with canvas sides would serve the purpose. Some of the largest manufacturers of this kind of goods use mechanical devices for plating. The rate of deposition would be increased, labor costs reduced, finish uniform from day to day, floor space and solution required for given amount of work would be less. We are confident you will eevntually adopt the mechanical method and if we can assist you further, let us know.

Question.—I am getting into trouble by my method of using nickel anodes. The superintendent differs with me and insists on his opinion being recognized by me as best. Please state whether a slime on the nickel anode is harmful or not. Would you advise keeping anodes free from slime by frequent cleaning?

Answer.—The accumulation of any foreign substance upon the surface of nickel anodes is not only a direct hindrance to the passage of the electric current, but an indirect disadvantage in an attempt to obtain perfect deposits, especially where large cathode surfaces are presented in a horizontal position. Now, metallic substances are always poor conductors, the slime is nothing more or less than the refuse of anodes and solution and should be removed, not only from the anode, but from the solution as well. Nickel anodes are particularly susceptible to the formation of thick sponge-like slime, and nickel solutions are often doped to remedy irregularities, which are really caused by the thick coating of slime. The anodes need not be subjected to rough treatment when being cleaned, and once in 2 or 3 months is often enough for general purposes. The cleaning can easily be overdone, and when inexperienced help are required to do this work they should be carefully instructed, and the work supervised closely to prevent useless waste of nickel. No tools are necessary, merely the hands. Scraping is wrong procedure. Leave some loose carbon, rinse in cold water and replace in tank. If solution contains floating particles of iron oxide, filter the solution. Nearer neutral the solution, quicker the slime will form.

Question.—As we have undertaken to fill a large contract for brass-plated auto engine parts, we are very much interested in best and cheapest method of making brass anodes. What is the best mixture for our plating needs? We want a fine yellow brass. Any suggestions you may offer will be appreciated.

Answer.—For your requirements we would advise the regulation brass mixture of copper, 66 per cent., and zinc, 34 per cent. Use the purest metal obtainable. A 3 to 1 mixture is sometimes used and the color regulated in the bath, but the 2 to 1 mixture is the one generally employed for good work. Copper anodes and zinc anodes 2 to 1 may be used instead of the brass anode. We prefer the latter method, the bath requires less attention than when using brass anodes, the upkeep is small, color very easily controlled, and deposition may be made rapidly and the fouling of anodes is lessened if bath is kept well balanced.

Question.—As I have no plating machine I am obliged to plate very small pieces on trays. The nickel solution which I have used for the work has gone wrong. The pieces being plated acquire a dirty color, sort of a black, and the deposit is very slight. The solution registers 7 degrees on the hydrometer, and we have the tank well lined with good nickel anodes. Voltage is from 2½ to 3½ volts. What shall I do with this solution?

Answer.—We are of the opinion that your solution is low in conducting powers, and possibly deficient in metal. Test with litmus paper. If not alkaline, add 2 to 3 oz. of some good conducting salts, say, sodium chloride, magnesium sulphate, or ammonium chloride. If alkaline, add 5 oz. sulphuric acid per 100 gallons of solution; operate for two or three days and if the improvement is marked, test again and act accordingly. Single nickel salts only should be used to maintain the metallic strength of the solution and it is possible you may need to add acid occasionally as well, depending on how hard you work the solution. It would be advisable to increase the voltage at this tank if you can do so, 5 volts would not be too strong; keep the contacts throughout the circuit clean and perfect; use as high amperage as possible; inspect the anodes often as the use of trays is very severe on nickel anodes. You may find some of the anodes have worn off before the solution and decreased your anode surface to such an extent that the bath has become depleted of metal quickly. If you use the solution principally for tray plating, we would suggest that you increase the actual Be. density to at least 10 degrees by adding single nickel salts. Conducting salts will be required to be added occasionally. Keep acidity stronger than in the nickel solutions used for regular work, which is plated on wires or holders.

Question.—I am using a "sour" copper solution made from copper sulphate and sulphuric acid. The deposit flakes off and is extremely brittle. How can I improve it?

Answer.—The solution needs acid, add 2 oz. sulphuric acid to each gallon of the bath and turn on current, with cathode in solution. Operate for few hours before employing for regular work. When an acid copper solution is deficient in acid a sub-oxide of copper is deposited along with the copper and a non-adherent, dark, brittle plate is result. When once the solution is acidulated correctly, the addition of acid is not frequently required. The metallic content of the bath should be maintained by the addition of copper sulphate.

Question.—We have an enameling dip of about 150 gallons of black baking enamel. In replenishing this dip, one of the workmen inadvertently used a funnel which had previously been used for oil at the storeroom. Considerable oil has been introduced into the enamel in this manner. At present the enamel is quite useless. The valve of the dip is such as to cause us concern, as we do not wish to discard it. Is it possible to save it by any method practical in a manufacturing plant?

Answer.—Procure from your supply house about 5 gallons of benzole. Pour the benzole into the enamel and stir the mass thoroughly for several minutes. Cover the tank with something which will prevent any foreign matter getting into it, but allow a free circulation of air beneath the cover. The cover may rest on four blocks. Allow the dip to remain undisturbed for about three or four days. Then remove the extraneous matter from the surface and the dip is ready for use again. We would suggest that you keep your supply of enamel in or near the department, or at least use funnels kept for your purpose only. The benzole may cost you more than you feel is reasonable, but is really cheaper than the enamel, which you may save by its use.

Question.—We have some aluminum castings which must be given a satin finish and be clean and free from stains. How can we do this work at low cost for supplies, and quickly?

Answer.—A matte or dead white surface, such as you require, may be produced on aluminum castings by dipping in a hot cleaning solution, which contains considerable caustics, for 2 or 3 seconds. Then rinse in cold running water and immerse in undiluted nitric acid. A momentary immersion in the nitric acid is sufficient, agitate during the plunge. Try a small casting a few times until you get the proper time. The caustic solution forms an oxide over the aluminum and the acid removes the oxide, leaving a clean, white surface, free from stains. When properly cleaned, wash in clean cold water and pass through clean boiling water, and dry without touching with the hands to avoid finger stains. Portions of the casting may then be polished by protecting the matte finish during the operation.

Chas. Trawford, of Trawford and Company, chain manufacturers, of Walsall, England, has been in Canada during the past month, visiting their Canadian agents, Thos. Moore and Sons, of 224 Lemoine St., Montreal, with the object of studying the field here for the purpose of developing trade in this country.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products

PIG IRON.

Grey forge, Pittsburgh	$27 15
Lake Superior, charcoal, Chicago	34 60
Standard low phos., Philadelphia	38 40
Bessemer, Pittsburgh	29 35
Basic, Valley furnace	25 75
Toronto price	$32 75 to $35 75

FINISHED IRON AND STEEL

Iron bars, base	$4.25
Steel bars, base	4 25
Steel bars, 2 in. larger, base	5 50
Small shapes, base	4 25

METALS

		Gross
Aluminum	$33 00	$35 00
Antimony	10 00	10 50
Copper, electrolytic	24 50	26 00
Copper, casting	24 50	25 00
Lead	7 75	7 00
Silver, per oz.	....	0 98
Mercury		.....
Tin	....	58 00
Zinc	10 00	10 00

Prices per 100 lbs.

OLD MATERIAL

Dealers' Buying Prices

	Montreal	Toronto
Copper, light	$15 00	$13 75
Copper, crucible	18 00	18 00
Copper, heavy	18 00	18 00
Copper, wire	18 00	18 00
No. 1 mach. comp'n.	16 50	16 75
New brass cuttings	13 00	10 75
No. 1 brass turnings	9 00	9 00
Light brass	7 50	7 00
Medium brass	9 00	7 75
Heavy melting steel	13 50	13 50
Boiler plate	13 50	11 00
Axles, wrought iron	20 00	20 00
Rails	14 50	13 50
No. 1 machine cast iron	21 00	18 00
Malleable scrap	15 00	17 00
Pipes, wrought	10 00	5 00
Car wheels, iron	20 00	20 00
Steel axles	20 00	20 00
Mach. shop turnings	6 00	6 00
Cast borings	7 00	8 00
Stove plate	15 00	13 00
Scrap zinc	6 00	6 00
Heavy lead	5 00	5 25
Tea lead	3 75	3 50
Aluminum	18 00	18 00

COKE AND COAL

Solvay foundry coke	.....
Connelsville foundry coke	.....
Steam lump coal	.....
Best slack	.....

Net ton f.o.b. Toronto

BILLETS.

	Per gross ton
Bessemer billets	$38 50
Open-hearth billets	38 50
O.H. sheet bars	42 00
Forging billets	51 00
Wire rods	52 00

Government prices.
F.o.b. Pittsburgh.

PROOF COIL CHAIN.
B

1/4 in.	$13 00
5-16 in.	11 00
3/8 in.	10 00
7-16 in.	9 30
1/2 in.	10 15
9-16 in.	10 00
5/8 in.	11 75
7/8 in.	11 75
1 inch	10 65
Extra for B.B. Chain	1 20
Extra for B.B.B. Chain	1 80

MISCELLANEOUS.

Solder, strictly	0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 38
Putty, 100-lb. drum	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English, per lb.	0 35
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls.	1 50
Linseed oil, boiled, single bbls.	2 92
Linseed oil, raw, single bbls.	2 90
Plaster of Paris, per bbl	
Sandpaper, B. & A. list plus	43
Emery cloth list plus	3[illegible]
Borax, crystal	0 14
Sal Soda	0 03 1/2
Sulphur, rolls	0 05
Sulphur, commercial	0 04 1/2
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 25
Sheets, black, No. 10	5 15	5 25
Canada plates, dull, 52 sheets	8 50	7 10
Apollo brand, 10 3/4 oz. galvanized	....	....
Queen's Head, 28 B.W.G.	....	....
Fleur-de-Lis, 28 B.W.G.	....	....
Gorbal's est, No. 28	....	....
Premier, No. 28 U.S.	....	7 75
Premier, 10 3/4 oz.	....	8 05
Zinc sheets	20 00	20 00

ELECTRIC WELD COIL CHAIN B.B.

1/8 in.	$16 75
3-16 in.	15 40
1/4 in.	14 20
5-16 in.	11 50
3/8 in.	10 50
7-16 in.	9 30
1/2 in.	10 50
5/8 in.	10 00
3/4 in.	9 70

Prices per 100 lbs.

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list class B and C, net list: cast iron fittings, 15% off list; malleable bushings, 25 and 7 1/2%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings: class B, black, 24 1/2c lb.; class C, black, 15 3/4c lb.; galvanized, class B, 34c lb.; class C, 24 1/2c lb. F.o.b. Toronto.

ANODES.

Nickel	$0.58 to $0.65
Copper	0.38 to 0.45
Tin	.70 to .70
Zinc	0.18 to 0.18

Prices per lb.

NAILS AND SPIKES.

Wire nails	$4.70
Cut nails	4 75
Miscellaneous wire nails	60 c

PLATING CHEMICALS.

Acid, boracic	$ .25
Acid, hydrochloric	.04
Acid, hydrofluoric	.30
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride, lump	.22
Ammonium, chlor., granular	.18
Ammonium, hydrosulphuret.	.50
Ammonium, sulphate	.30
Caustic soda	10
Copper, carbonate, anhy	.41
Arsenic, white	.14
Copper, sulphate	.16
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.16
Nickel sulphate	.18 1/2
Potassium carbonate	.60
Silver nitrate (per oz.)	1 20
Sodium bisulphite	.18
Sodium carbonate crystals	.06
Sodium cyanide, 129-130%	.38
Sodium cyanide, 98-100%	.55
Sodium phosphate	.18
Sodium hyposulphite (per 100 lbs.	6.00
Tin chloride	1.75
Zinc chloride	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated.

BELTING, NO. 1 OAK TANNED.

Extra heavy, single and double	30%
Standard	30-10%
Cut leather lacing, No. 1	2.20
Leather in sides	1.75

PLATING SUPPLIES.

Polishing wheels, felt, per lb.	$4 00
Polishing wheels, bullneck	2 25
Pumice, ground	0 06
Emery composition	0 08
Tripoli composition	0 09
Rouge, powder	0 45
Rouge, silver	0 50
Crocus composition	0 12

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, 1/2 to 2 in.	42 50	43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6x4 base	45 00	44 00

BRASS PRODUCTS.

Brass rods, base 1/2 in. to 1 in rd.	0 34
Brass sheets, 24 gauge and heavier, base	0 42
Brass tubing, seamless	0 [illegible]
Copper tubing, seamless	0 [illegible]

ROPE AND PACKINGS.

Plumbers' oakum, per lb.	.10
Packing square braided	.38
Packing, No. 1 Italian	.44
Packing, No. 2 Italian	.36
Pure Manila rope	.37
British Manila rope	.31
New Zealand Hemp	.31
Transmission rope, Manila	.43
Drilling cables, Manila	.39
Cotton Rope, 1/4-in. and up	.74

OILS AND COMPOUNDS.

Royalite, per gal., bulk	19 1/2
Palacine	22 1/2
Machine oil, per gal.	36
Black oil, per gal.	16
Cylinder oil, Capital	52
Cylinder oil, Acme	39 1/2
Standard cutting compound, per lb.	06
Lard oil, per gal.	2 60
Union thread cutting oil antiseptic	88
Acme cutting oil, antiseptic	37 1/2
Imperial quenching oil	39 1/2
Petroleum fuel oil	10 1/4

FILES AND RASPS.

	Per Cent.
Great Western, American	50
Kearney & Foot, Arcade	50
J. Barton Smith, Eagle	50
McClelland, Globe	50
Whitman & Barnes	50
Black Diamond	27 1/2
Delta Files	20
Nicholson	32 1/2
P.H. and Imperial	[illegible]
Globe	50
Vulcan	50
Disston	40

TENDENCY NOW IS MUCH HIGHER

And U. S. Mills Are Not Anxious to Take on Much Business for 1920 Delivery

TORONTO.—Prices have crowded into the centre of the stage as far as the machine tool and iron and steel market is concerned. There may be some price lists that still exist as absolute, but they are becoming more infrequent, and the tendency seems to be to withdraw all quotations, and give prices on request for actual delivery. This is not a very satisfactory way of doing business for either the consumers or the dealers, but it is about the best that can be done now.

The Machine Tool Market

The market for wood working machinery is just as uncertain as in the metal working lines. There are cases where makers of machinery have made advances as high as twenty per cent., which, in this country, would be worth thirty per cent. on account of duty and exchange. Metal working machines are more firm in regard to advances, and few have been made during recent weeks. It amounts to practically the same thing, however, as many builders refuse to quote any price at all for future deliveries. As far as can be seen they are willing to accept business for future shipment, but only on the understanding that price shall be that which is prevailing at the time of delivery.

This is being reflected in the used machinery trade. One dealer informed CANADIAN FOUNDRYMAN that instructions had been sent out to hold up all prices quoted on used equipment, as there would likely be a revision in the near future.

Cutting Prices Now?

Some of the salesmen handling certain lines of high-speed goods complain that prices are being cut below where they can make any money in the business. It is hard to explain why, but it is a fact that U.S. concerns are now paying net list for high-speed cutters, while in Canada the price is ten off. This has been the prevailing price for some time, but just recently quite a lot of buying has been done at ten and ten off. The jobber complains that he can do nothing at this price. Of course, it is all right for the concerns using the cutters, as they are getting a close price, and they know it. English firms are getting in shipments of high-speed once more. Prior to the war the high-speed steel market in this country was largely in the hands of the British makers, but during the time of the war, owing to the need for material at home, and the inability to get shipments through, the business passed largely into the hands of American firms. It is evident that British makers are out now to get a slice of that market back again, as they are putting in their high-speed goods in some cases at a price which is ten per cent. better than the local quotations.

The Market For Steel

As far as the jobbers are concerned, price lists appear to have ceased to exist. They may still be in existence for the guidance of buyers, but for actual transactions in sheets, plate, tube, etc., they have passed out for the time being. Figures that are quoted elsewhere in CANADIAN FOUNDRYMAN in these lines are simply nominal. When a house has nothing to offer in the way of sheets or plate it might as well quote ten dollars as one dollar.

Bar mills in this country have gone up $7 per ton in the last three weeks. United States mills, according to Canadians who have been over the ground recently, are not in good shape, or at least they are not taking on business. It looks very much as though some of the mills were looking for better prices in the spring, and are not inclined to book up at present quotations. It may be that they even expect prices to mount rapidly when the spring rush comes, as it surely must come.

Here is the way one Canadian buyer sized the situation up for CANADIAN FOUNDRYMAN: "It looks to me as though the mills in United States had profited by the lessons they learned during the war. At that time they booked away ahead, and piled up enormous tonnages. The result was that they were kept busy grinding away on this stuff at a set price, while other mills with not such great bookings were at liberty to go out and take on business that was pressing for delivery and therefore willing to pay a higher price. As one of the U. S. men stated the case a few days ago: 'We do not propose to be caught as we were during the war. Then we were so filled up on soup there was no room for turkey when they passed it to the mills. This time we are going easy on the soup and we are going to sit up when the turkey comes.' Which is another way of saying that they intend to roll easily for the present and when the higher prices become common they will roll seriously."

The independents are acting pretty much together at present taking their lead from the Corporation. The Corporation is becoming pretty well booked ahead and will not promise anything in the way of deliveries, although adhering to the prices of March 21. It is figured out now that the independents realize that urgent buyers will be in the market and prices are liable to soar in proportion to the urgency of each separate case.

The mills at the Soo of the Algoma Steel Corporation are busy now, having a lot of business on their books, especially in the merchant bar mill. The demand is very strong for small bars, reinforcing bars, structurals, the Soo mill now rolling up to 15 in. in the latter.

The Non-Ferrous Markets

Coppers are showing a little more strength, but the market is crowded with material, owing to the manner in which United States exchange is working against business being done in that country. It might also be mentioned that speculators who had bought some time ago in the hope of a rise in the copper market are having a merry time trying to hang on in hopes of a better chance for them turning up in the near future.

Scrap Not Active

Coppers in the scrap market are weak, with little demand either way from dealers to users or from pickers to dealers. The steel and iron section is stronger and holding well at the advanced prices that were marked up last week.

HENRY FORD'S VIEW

(Continued from page 362)

strength to turn out a day's work when wheat is $1 a bushel, as when wheat is $2.50 a bushel. Eggs may be 12 cents a dozen or 90 cents a dozen—it makes no difference in the units of energy a man uses in a productive day's work.

One would think that the real basis of value would be the cost of transmuting human energy into articles of trade and commerce. But no; that most honest of all human activities is made subject to the speculative shrewdness of men who can produce false shortages of food and other commodities, and thus excite anxiety of demand in society.

It is not in industry that the trouble lies, but in those regions beyond, where men lie in wait to seize the fruits of industry and create false scarcities for the sake of arousing an anxious demand for things which normally are, and ought to be, accessible to all who engage in daily productive pursuits.

We must begin with the land; we must continue with the day's labor; and we must keep so close, so jealously close to both these fundamentals that we shall be suspicious and fearful of all that robs the land of men, and robs labor of its primal importance in material life.

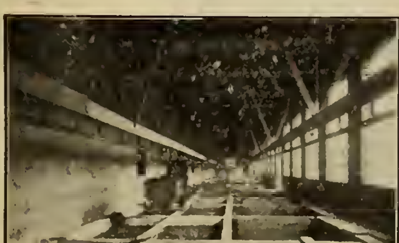
We shall think out, and try out, and establish more enduring economic systems as we go on about our work, than we shall ever be able to do sitting idle with our heads in our hands trying to "think" a new world system out of our brains.

The day's work is the hub around which the whole wheel of earth-life swings. It must be kept central, both in our thinking and our action. Any system that shunts the day's work off to one side as unimportant, is riding to a fall.

Mechanics Go To States.—The officials of the Metal Trades and Building Trades Unions are seriously worried by the growing shortage of men, due to so many of them going across the border. A good many men who went there during the strike here have failed to return. More are going now, being attracted by the high rate of wages.

Will Stop Export.—An official of the Canadian Railway Board speaking recently said that even if the coal strike was settled there was little chance of any coal reaching Canada during December. Railways are already using wood fuel for their stationary boilers, and have reduced their passenger service, and there is no doubt that a serious curtailment of freight trains will ensue.

Have An Elevated Railway In Your Plant



When New York could not find room for all her traffic on street level she carried it overhead.

Land is too valuable in these days for floor space to be wasted. The passages in your factory have all the traffic they can accommodate.

Why not use the space on the ceiling?

By using an overhead conveyor you will save congestion on the floor. The men can handle bigger loads at a time, without risk of blocking the passages.

Every factory or warehouse is a miniature New York! There is more traffic to be accommodated than floor space will comfortably handle! An overhead conveyor will relieve the congestion and utilize space that is going to waste.

BT TIME SAVER

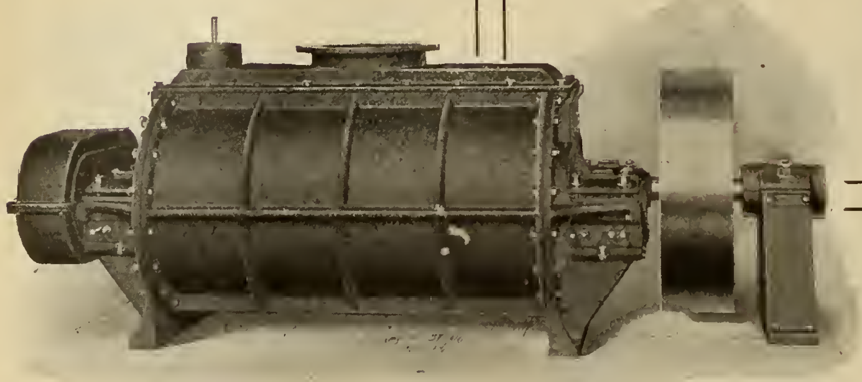
BT Overhead Conveyors

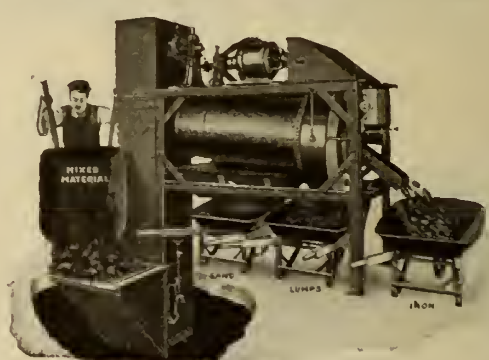
BT TIME SAVER

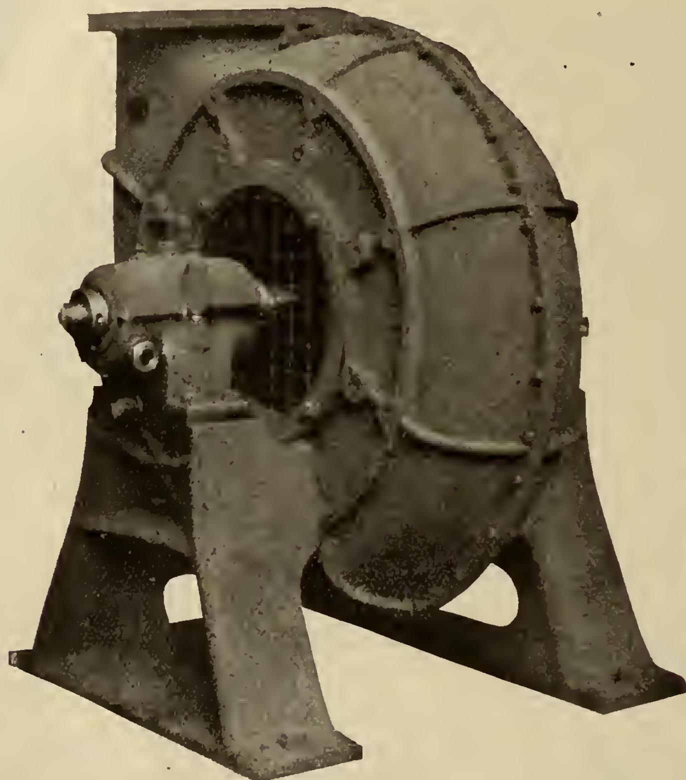
All kinds of buildings throughout the Dominion have been fitted with BT Conveyors, from small garages and machine shops to big steel plants and factories. We have track, hangers, switches and the necessary fittings for any building. From big bars of steel to loads of leather scrap, we have designed carriers to convey products of all kinds. Complete information is yours for the asking. It will be a pleasure to go into the matter with you and help you to decide how to arange a conveyor outfit for your plant. A card will bring full details, without obligation to you, of course.

BEATTY BROS., LIMITED Head Office: Fergus, Ont.

Branches at: Winnipeg, Man., Edmonton, Alta., Montreal, Que., St. John, N.B.







Planing Mill Fan

No. 2 Vacuum Cleaner

Sturtevant
(TRADE MARK)

SYSTEMS

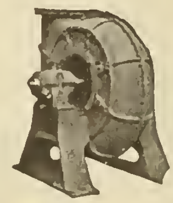
Autoforce Ventilator

Steam Turbine

Electric Propeller Fan

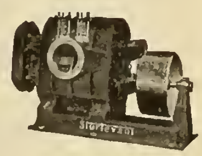
Sturtevant
(TRADE MARK)

STEEL PRESSURE BLOWERS



Medium Pressure Blower

Low Pressure Blower

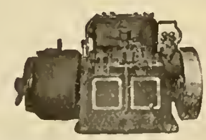


High Pressure Blower

For All Purposes

THO designed originally for supplying air to cupolas and forges Sturtevant steel pressure blowers are now used for all purposes where pressures up to 16 ounces to the square inch are to be maintained; and where air is to be forced for long distances. Regularly built with horizontal discharge but can be readily made for down blast or up blast. Built in all sizes and may be belt, motor, engine, or turbine driven. Operating and upkeep cost is remarkably low as proven by actual performance in many long term (30 years and more) installations. Design and construction are typically Sturtevant—supreme! Blast wheel is made of refined steel and galvanized to prevent rust. Wheels are accurately balanced and run smoothly when driven at high speed. Bearings are each cast in one piece and are lined with highly durable non-heating white metal. Write for catalogue.

Volume Blower and Exhauster



Gasolene Generating Set

B. F. STURTEVANT COMPANY of Canada, Ltd.

Factory and Main Office
Galt, Ontario

Sales Office: Toronto,
Montreal, Winnipeg

Turbo-Blower

Direct Current Motor

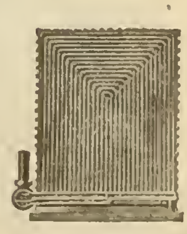
Type H Air Washer

Fuel Economizers

Sturtevant
(TRADE MARK)

PRODUCTS

VS-7 Steam Engine



Heater

Foundry Thor Tools

Thor Pneumatic Floor Rammer.

A perfectly balanced, one-hand machine. Operator does not have to "carry" it along in both hands, but simply guides with left hand.

Thor Portable Air Grinder No. 72.

Four hundred and sixteen foundries bought Thor Pneumatic Tools last year. Including Thor Tools sold for other purposes, 67,322 Thor Tools were sold during the year 1918.

Let us tell you how you can save time, money and labor in your Foundry.

Thor Chipping Hammer

SAND RAMMERS

Size	TYPE	Piston Diam. and Stroke	Speed Per Min.
Nos. 40-R or 40-C	Bench Rammer	1" x 4"	800
Nos. 45-R or 45-C	Floor Rammer	1" x 4"	800
Nos. 50-R or 50-C	Floor Rammer	1¼" x 5"	750

Nos. 40-R, 45-R, and 50-R are equipped with Butt. Nos. 40-C, 45-C and 50-C are equipped with Pein. Specify type wanted.

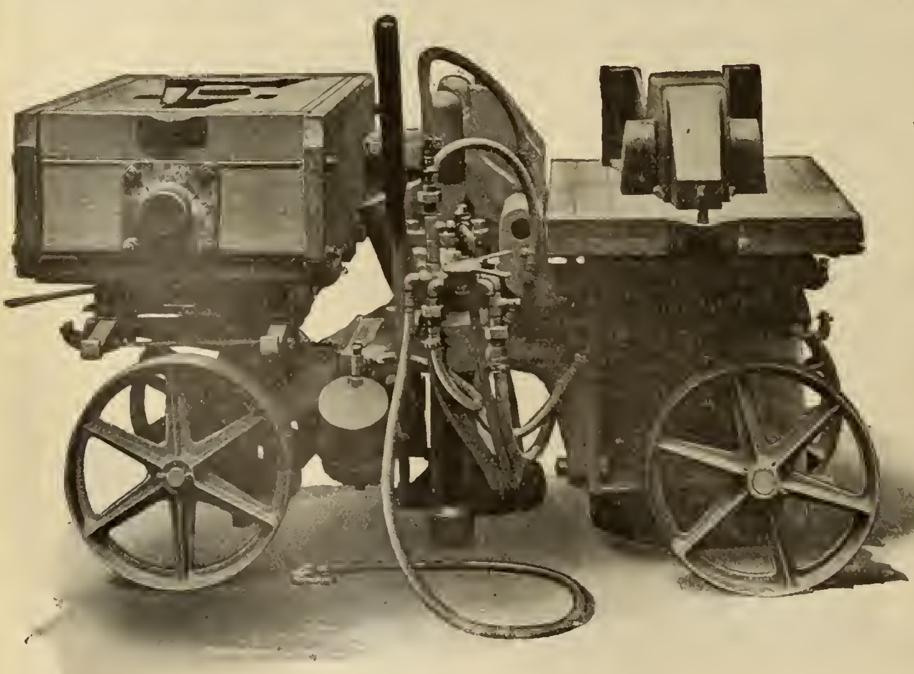
INDEPENDENT PNEUMATIC TOOL COMPANY

General Offices: 600 West Jackson Blvd., CHICAGO, U.S.A.

CANADIAN OFFICES: 334 St. James St., MONTREAL; 32 Front St., TORONTO; 123 Bannatyne Ave. E., WINNIPEG; 1142 Homer St., VANCOUVER

TABOR

PORTABLE COMBINATION SHOCKLESS JARRING ROLL-OVER AND PATTERN DRAWING MOULDING MACHINE



A distinctive Tabor achievement, being a combination of two exclusive Tabor features: the Shockless Jarring Machine and the Roll-Over Straight Draw Machine. Eliminates all ramming time and is suited to a wide variety of work. Send for Bulletin M-S-H.

Tabor Mfg. Co.

PHILADELPHIA, PA.
U. S. A.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE MATERIALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto, Ont.

AIR COMPRESSORS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

AIR JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

ALBANY SAND
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

ALLOYS
Stevens, Frederic B., Detroit, Mich.

ANALYSIS
Hersey Co., Ltd., Milton, Montreal, Que.

ANODES, BRASS, COPPER, NICKEL, ZINC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

ARRI TERS, DUST
Pangborn Corporation, Hagerstown, Md.

BARRELS, TUMBLING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BARRELS, SANDBLAST
A. C. Leslie & Co., Ltd., Montreal, Que.
Pangborn Corporation, Hagerstown, Md.

BINDERS, SAND
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

BOILER GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GATES
Roots Co., P. H. & F. M., Connersville, Ind.

BLAST GAUGES—CUPOLA
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.
Clark, Chas. J., Chicago.

BLAST METERS
Clark, Chas. J., Chicago.

BRAKE SHOES, WHEEL TRUEING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRICKS, RUBBING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, FOUNDRY AND CORE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Manufacturers' Brush Co., Cleveland, Ohio.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BRUSHES, ALL KINDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Manufacturers' Brush Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

BUFFING AND POLISHING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BUFFS AND BUFFING AND POLISHING COMPOSITIONS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

BURNERS, CORE OVEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CABINETS, SANDBLAST
Frederic B. Stevens, Detroit, Michigan.

CARBON BLACKING
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison Co., E. J., Toronto.

CARS, CORE OVEN AND FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CASTINGS, NICKEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
W. W. Wells, Toronto.

CHAPLETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Chaplet & Mfg. Co., Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Lindsay Chaplet & Mfg. Co., Philadelphia.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CHARCOAL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CHEMISTS—SEE METALLURGISTS

CHEMICALS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

CINDER MILLS
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Ind.
Frederic B. Stevens, Detroit, Michigan.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

CLAY LINED CRUCIBLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

CONVERTER BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

CORE BINDERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Holland Core Oil Co., Chicago, Ill.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE BOXES (STEEL AND WOOD)
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

CORE BOX MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

CORE COMPOUNDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Holland Core Oil Co., Chicago, Ill.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CORE JOLTS
Davenport Mach. & Fdry. Co., Davenport, Iowa.

CORE MACHINES, HAMMER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd. Toronto, Ont.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

CORE-MAKING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J. Co., Toronto, Ont.

CORE OILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Holland Core Oil Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE OVENS—SEE OVENS

CORE WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Joseph Dixon Crucible Co., Jersey City, N.J.
Obermayer & Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

CORE REDUCERS
National Engineering Co., Chicago, Ill.

CORE WAX
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison Co., E. J., Toronto.

COMBINATION JOLT ROLLOVER AND PATTERN DRAWING MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.

COUPLINGS, PLAIN, FLEXIBLE AND CUT OFF
Independent Pneumatic Tool Co., Chicago, Ill.

CRANES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

CRUCIBLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

CRUCIBLES, RESERVOIR, TILTING FURNACE, BOTTOM POUR, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLAS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLAST GAUGES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA BLOWERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Roots Co., P. H. & F. M., Connersville, Ind.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA LININGS BLOCKS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

CUPOLA TWYERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

CYANIDE OF POTASSIUM.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

DIPPERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Gautier, J. H., & Co., Jersey City, N.J.
Hyde & Sons, Ltd., Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

DRILLS, ELECTRIC AND PORTABLE
Independent Pneumatic Tool Co., Chicago, Ill.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING OVENS FOR CORES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Cleveland Nickel Works, Cleveland.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Eng'r'g Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

DUST ARRESTERS AND EXHAUSTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison Co., E. J., Toronto.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST EXHAUSTER, ANISTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DYNAMOS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Welle, Toronto.
Woodison, E. J., Co., Toronto, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

ELEVATORS, HYDRAULIC, PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY STANDS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

EMERY WHEELS—SEE WHEELS

FACINGS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FANS, EXHAUST
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FERRO-ALLOYS
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Que.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Que.

FILLERS (METALLIC)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FILLETS, LEATHER AND WOODEN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

FIRE BRICK AND CLAY
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Gautier, J. H., & Co., Jersey City, N.J.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FIRE CEMENT
Frederic B. Stevens, Detroit, Michigan.

FIRE SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FLASKS, SNAP, ETC.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Ind.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Obermayer Co., S., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY COKE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY MIXERS
National Engineering Co., Chicago, Ill.

FOUNDRY PARTING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY EQUIPMENT
Frederic B. Stevens, Detroit, Michigan.
Magnetic Mfg. Co., Milwaukee, Wis.
Woodison Co., E. J., Toronto.

FOUNDRY FACINGS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY PRACTICE
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.

FOUNDRY GRAVEL
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton,
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

FOUNDRY SUPPLIES
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Obermayer Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

FURNACE LINING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Hyde & Sons, Montreal, Que.
Woodison Co., E. J., Toronto.

FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

FURNACES, BRASS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton,
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

FURNACE BLOWERS, ROTARY
Roots Co., P. H. & F. M., Connersville, Ind.

ASBESTOS, DUCK AND LEATHER GLOVES
Frederic B. Stevens, Detroit, Michigan.

GOGGLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

GRAPHITE GREASE
Pettinos, George F., Philadelphia, Pa.

GRAPHITE, ANTI-FLUX BRAZING
Can. Hanson & Van Winkle Co., Toronto, Ont.

GRAPHITE PRODUCTS
Black Donald Graphite Co., Calabogie, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Jonathan Bartley Crucible Co., Trenton, N.J.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

GRINDERS
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.

GRINDERS, DISC, BENCH, SWING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

GRINDERS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC, HAND TOOL POST, FLOOR AND BENCH.
Independent Pneumatic Tool Co., Chicago, Ill.

GRINDERS, RESIN
Frederic B. Stevens, Detroit, Michigan.
W. W. Sly Mfg. Co., Cleveland, Ohio.

GRIT, ANGULAR
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

GRIT, STEEL
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

HAMMERS, CHIPPING
Independent Pneumatic Tool Co., Chicago, Ill.

HAMMERS, CHIPPING, CAULKING PNEUMATIC HOSE
Independent Pneumatic Tool Co., Chicago, Ill.

HELMETS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

HOISTING AND CONVEYING MACHINERY, ELECTRIC AND PNEUMATIC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Ltd., Walkerville, Ont.

HOISTS, CHAIN AND PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.

HOISTS, HAND, TROLLEY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Northern Crane Works, Walkerville.
Woodison, E. J., Co., Toronto, Ont.

IRON CEMENTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hyde & Sons, Montreal, Que.
Stevens, Frederic B., Detroit, Mich.
Woodison Co., E. J., Toronto.

IRON FILLER
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

IRON SAND
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

JOLT ROCKOVERS
American Molding Mach. Co., Terre-Haute, Ind.

JOLT MACHINES AND SQUEEZERS
American Molding Mach. Co., Terre-Haute, Ind.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Grimes Molding Machine Co., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

JOLT STRIPPERS
American Molding Mach. Co., Terre-Haute, Ind.
Davenport Mach. & Fdry. Co., Davenport, Iowa.

KAOLIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

LADLES, FOUNDRY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Walkerville.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

LADLE HEATERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Woodison, E. J., Co., Toronto, Ont.

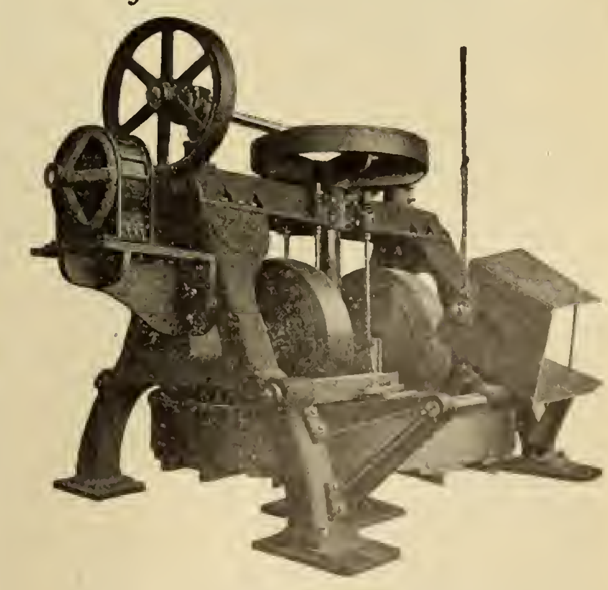
LEGGINGS
Frederic B. Stevens, Detroit, Michigan.

LADLE STOPPERS, LADLE NOZZLES, AND SLEEVES (GRAPHITE)
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

LINSEED OIL, CORE
Obermayer & Co., S., Chicago, Ill.

LUBRICATING GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MAGNETIC SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Magnetic Mfg. Co., Milwaukee, Wis.



MELTING POTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

METALLURGISTS
Charles C. Kawin Co., Toronto.
Hersey Co., Ltd., Milton, Montreal, Que.
McLain's System, Inc., Milwaukee, Wis.
Toronto Testing Laboratories, Toronto.

MILLING MACHINES
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

MICA SCHIST
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.

MINING AND QUARRYING MACHINERY
Blystone Mfg Co., Cambridge Springs, Pa.
Can. Hanson & Van Winkle Co., Toronto, Ont.
National Engineering Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

MITTENS
Frederic B. Stevens, Detroit, Michigan.

MIXERS
National Engineering Co., Chicago, Ill.

MOLDERS' TOOLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

MOLDING MACHINES
Britannia Foundry Co., Coventry, Eng.
Can. Hanson & Van Winkle Co., Toronto, Ont.
The Cleveland Osborn Mfg. Co., Cleveland, O.
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Grimes Molding Machine Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

MOLDING SAND—SEE SAND
Frederic B. Stevens, Detroit, Michigan.

MOLDING SIFTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

NOZZLES, SAND BLAST
Frederic B. Stevens, Detroit, Michigan.

NORTH RIVER SAND
Pettinos, George F., Philadelphia, Pa.

OVENS FOR CORE-BAKING AND DRYING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer Co., S., Chicago, Ill.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

OIL AND GAS FURNACE BLOWERS
Roots Co., P. H. & F. M., Connersville, Ind.

PANS, WET AND DRY
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.

PARTING COMPOUNDS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

PATTERN SHOP EQUIPMENT.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PATTERN WAX
United Compound Co., Buffalo, N.Y.

PATTERNS
Frederic B. Stevens, Detroit, Michigan.
Montreal Pattern Works

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.

PHOSPHORIZERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

PLUMBAGO
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

PLATING AND POLISHING SUPPLIES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells Toronto.
Woodison, E. J., Co., Toronto, Ont.

POWER JOLT SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

POWER SQUEEZERS
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.

PROTECTIVE WEARING APPAREL
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

PULLEYS, MAGNETIC

RAMMING PLATES AND MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Magnetic Mfg. Co., Milwaukee, Wis.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

RETORTS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Jonathan Bartley Crucible Co., Trenton, N.J.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Obermayer Co., S., Chicago, Ill.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., New York, N.Y.
Woodison, E. J., Co., Toronto, Ont.

RIDDLES, ELECTRIC
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

RESIN
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

RIVETERS, PNEUMATIC, HYDRAULIC HAMMER, COMPRESSION
Independent Pneumatic Tool Co., Chicago, Ill.

ROLLOVER MACHINES
Davenport Mach. & Fdry. Co., Davenport, Iowa.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

ROUGE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

SAND
United States Silica Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND MILLS
Frost Mfg. Co., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Woodison Co., E. J., Toronto.

SANDBLAST ABRASIVES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST ACCESSORIES
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SANDBLAST EQUIPMENT
Pangborn Corporation, Hagerstown, Md.
Woodison Co., E. J., Toronto.

SAND BLAST MACHINERY
National Engineering Co., Chicago, Ill.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
United States Silica Co., Chicago, Ill.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST GRIT AND SHOT
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND BLAST SAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Pettinos, George F., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

SANDBLAST SUPPLIES AND ACCESSORIES
Pangborn Corporation, Hagerstown, Md.
Frederic B. Stevens, Detroit, Michigan.

SAND BLAST SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND CONVEYING MACHINERY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SAND BLAST MACHINERY, BARRELS,
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Frost Mfg. Co., Chicago, Ill.
Sly, W. W., Mfg. Co., The, Cleveland, O.
Woodison, E. J., Co., Toronto, Ont.

SANDBLAST MATERIAL
Frederic B. Stevens, Detroit, Michigan.

SAND-MIXING MACHINERY
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.
Frost Mfg. Co., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, Ohio.
Woodison Co., E. J., Toronto.

SAND MILLS
Frederic B. Stevens, Detroit, Michigan.
National Engineering Co., Chicago, Ill.

SAND MOLDING
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

SAND RIDDLES
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SAND SIFTERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

SAND SIFTERS, HAND
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SEPARATORS
Ding's Magnetic Separator Co., Milwaukee, Wis.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.

SEPARATORS, MAGNETIC; STANDARD AND SPECIAL
Magnetic Mfg. Co., Milwaukee, Wis.

SEPARATORS, MOISTENERS, OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SEA COAL
Obermayer & Co., S., Chicago, Ill.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SHOT
Frederic B. Stevens, Detroit, Michigan.
Globe Steel Co., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison Co., E. J., Toronto.

SHOVELS
Frederic B. Stevens, Detroit, Michigan.
Obermayer & Co., S., Chicago, Ill.
Woodison Co., E. J., Toronto.

SIEVES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SILICA WASH
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SILICA ROCK, GROUND AND PULVERIZED
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

SKIMMERS, GRAPHITE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

SLIP JACKETS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK BOTTOM PLATES
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP FLASK TRIMMINGS
Diamond Clamp & Flask Co., Richmond, Ind.

SNAP MOLD JACKET
Diamond Clamp & Flask Co., Richmond, Ind.

SMALL ANGLES
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Woodison, E. J., Co., Toronto, Ont.

SOAPSTONE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Pettinos, George F., Philadelphia, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPELTER BOWLS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Joseph Dixon Crucible Co., Jersey City, Pa.
Woodison, E. J., Co., Toronto, Ont.

SPRAYERS
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Frederic B. Stevens, Detroit, Michigan.
Woodison Co., E. J., Toronto.

SPRUE CUTTERS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

SQUEEZER MOLDING MACHINES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto. Ont.

SQUEEZERS, POWER AND HAND
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

STEEL, CRUSHED
Frederic B. Stevens, Detroit, Michigan.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

STEEL GRIT
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.
Woodison, E. J., Co., Toronto. Ont.

SWING
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.

SWING GRINDERS
Frederic B. Stevens, Detroit. Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison Co., E. J., Toronto.

STEEL BANDS
Diamond Clamp & Flask Co., Richmond, Ind.
Woodison Co., E. J., Toronto.

STEEL BARS, ALL KINDS
A. C. Leslie & Co., Ltd., Montreal, Que.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

STEEL PLATES
Pangborn Corpora..on, Hagerstown, Md.
A. C. Leslie & Co., Limited, Montreal, Que.

STEEL RAILS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

STIRRERS, GRAPHITE
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Joseph Dixon Crucible Co., Jersey City, N.J.
Woodison, E. J., Co., Toronto, Ont.

STONES, RUBBING AND OIL
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Can. Hart Wheels, Hamilton, Ont.

TANKS, OIL AND WATER
Frederic B. Stevens, Detroit, Michigan.

TALC
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Frederic B. Stevens, Detroit, Michigan.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
Woodison, E. J., Co., Toronto, Ont.

TESTS OF MATERIALS
Hersey Co., Ltd., Milton, Montreal, Que.

TEEMING CRUCIBLES AND FUNNELS
Can. Hanson & Van Winkle Co., Toronto, Ont.

TOOLS, PNEUMATIC
Independent Pneumatic Tool Co., Chicago, Ill.
Keller Pneumatic Tool Co., Chicago, Ill.

TONGS, SHAKE OFF
Diamond Clamp & Flask Co., Richmond, Ind.

TRACK, OVERHEAD
TROLLEYS AND TROLLEY SYSTEMS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Woodison, E. J., Co., Toronto, Ont.

TRIPOLI
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

TRUCKS, DRYER AND FACTORY
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

TURNTABLES
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Northern Crane Works, Walkerville.

Stevens, Frederic B., Detroit, Mich.
Woodison, E. J., Co., Toronto, Ont.

VENT WAX
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Hyde & Sons, Montreal, Que.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

VIBRATORS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Pressed Steel Co., Muskegon, Mich.
Tabor Mfg. Co., Philadelphia.
Woodison, E. J., Co., Toronto, Ont.

WALL CHANNELS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELBARROWS
Frederic B. Stevens, Detroit, Michigan.
Hyde & Sons, Montreal, Que.
Woodison Co., E. J., Toronto.

WHEELS, GRINDING
Can. Hanson & Van Winkle Co., Toronto Ont.
Can. Hart Wheels, Hamilton, Ont.
Frederic B. Stevens, Detroit, Michigan.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

WHEELS, POLISHING, ABRASIVE
Can. Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Mach. Co., Ltd., The, Hamilton, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
Woodison, E. J., Co., Toronto, Ont.

WIND GATES
Roots Co., P. H. & F. M., Connersville, Ind.

WIRE WHEELS
Can. Hanson & Van Winkle Co., Toronto, Ont.
Dominion Fdry. Supply Co., Ltd., Toronto, Ont.
Hamilton Facing Mill Co., Hamilton, Ont.
Stevens, Frederic B., Detroit, Mich.
W. W. Wells, Toronto.
Woodison, E. J., Co., Toronto, Ont.

WIRE, WIRE RODS AND NAILS
Frederic B. Stevens, Detroit, Michigan.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Steel Co. of Canada, Hamilton, Ont.
Woodison, E. J., Co., Toronto, Ont.

INDEX TO ADVERTISERS