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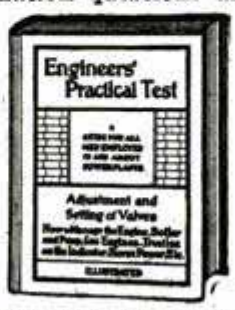

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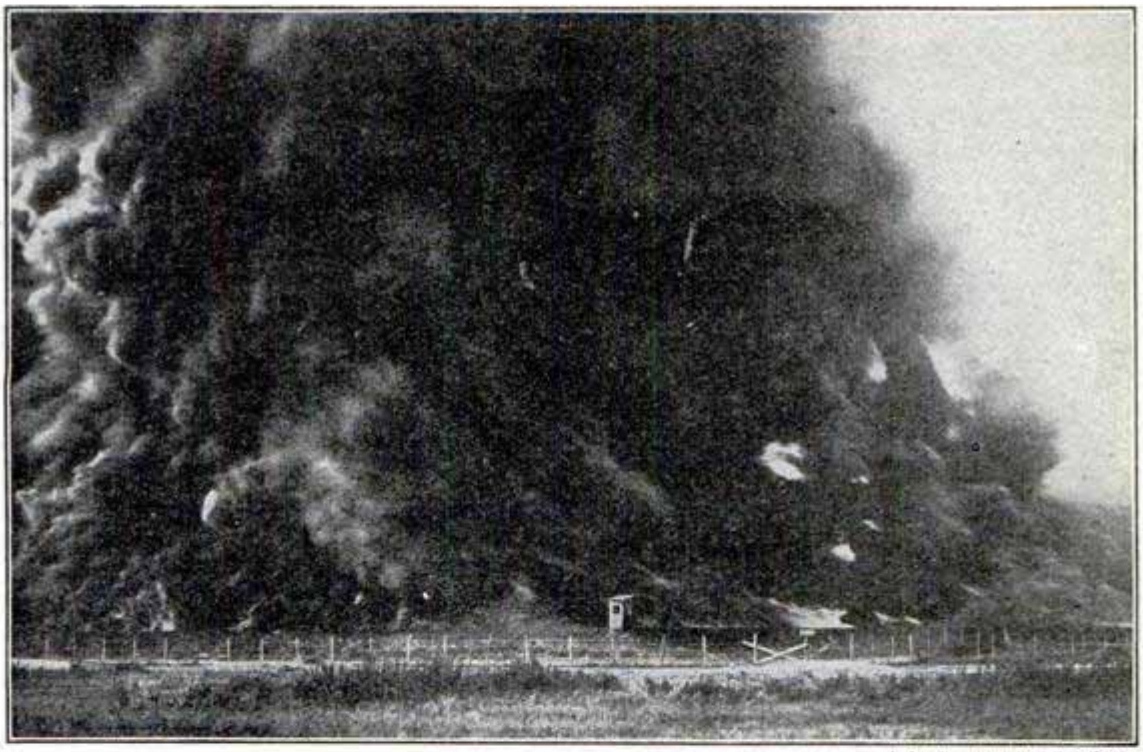
POPULAR MECHANICS

Vol. 7. No. 11. CHICAGO, NOVEMBER, 1905. 10 Cents a copy. $1.00 a year.

A SEA OF FIRE

Great Conflagration Covers Four Square Miles and Consumes 2,250,000 Barrels of Oil--Workmen's Families Flee in Terror--Lives Lost, Homes Destroyed



L. L. Allen, Phot., Humble, Texas.

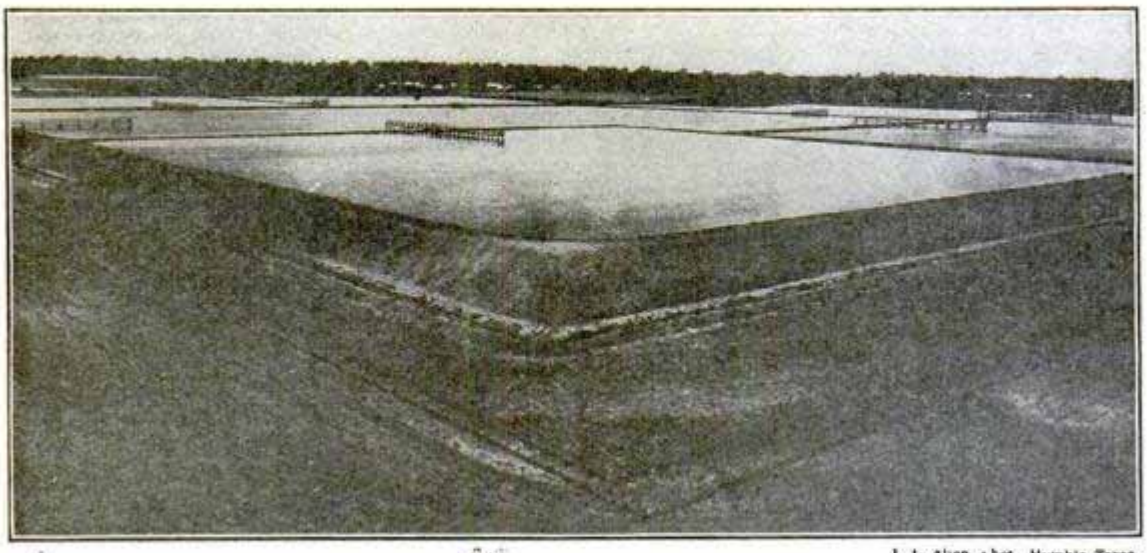
The Conflagration at Its Height

A sea of fire that surged its burning waves over its brim and swept into that awful holocaust the bodies of men and beasts and the lowly dwelling places of many workmen wrought fearful havoc at Humble, Texas, a new oil field 16 miles from Houston, recently. The disaster occurred at four o'clock on a Sunday afternoon, a time when people were resting quietly in their homes. A bolt of lightning struck an earthen oil reservoir and set fire to the oil it contained.

Two hundred men and 75 mules were put to work at throwing up an earthen embankment to keep the fire within bounds, when suddenly the oil boiled over and the fire spread to other tanks. Fifty mules were burned to death and that some men perished is certain. The people at the oil field abode in tents and these frail structures were ready prey for the flames. Men, women and children, half clad, fled in terror.

At its height the fire covered an area of

four square miles and in all 2,250,000 barrels of oil were consumed. Placing the value at 25 cents per barrel, the total loss in oil alone was $562,500. It required several days' work to get the fire under control. The fight was carried on amid great danger.



L. L. Allen, a hot., Humble, Texas.

The Oil Tanks Before the Fire

AIR SHIP IN CHICAGO

Knabenshue and his air ship have come and gone. The demonstration was disappointing, for the flights were few and not nearly as successful as at New York or Columbus. The reason given was that the air currents from the lake made operations dangerous, and as the navigator refused to go up when the wind exceeded 12 miles an hour, which it did nearly every day for two weeks, few opportunities were afforded. Several short flights were successful so far as returning and landing within a few feet of starting point, and one flight of two miles and return was made.

The air ship consists of a 62-ft. gas bag with a capacity of 7,000 cu. ft. of gas, and weighing 65 lbs. From the bag is suspended a bamboo framework 38 ft. long which, with the 10-hp. gasoline engine weighs 200 lbs. The "propeller" is two-bladed, 16 ft. in diameter and pulls the ship along, being placed in front. The propeller revolves at 180 r. p. m., being geared down from an engine speed of 2,160 r. p. m. When the engine stops during a flight the operator makes no effort to start it, but descends.

That we are a long way from any commercial travel in air ships is clearly indicated in Mr. Knabenshue's statement:

"I do not believe that air ships will ever be made practicable for aerial navigation for the public. I consider that out of the question. They are of service in time of war, where one can sail over the enemy's camp and return and report his position and strength."

TELEPHONE BEATS CYCLONE--SAVES LIVES

That the telephone is responsible for the saving of the lives of an entire family near Clyde, Minn., is an undisputed fact. It was at the farm of Frank H. Sanders, where he and his wife and six weeks old baby, his mother and his father-in-law were seated at the supper table, says the American Telephone Journal.

They knew that a storm was approaching, but thought it would amount to nothing more than the average summer thunder storm. Suddenly the telephone rang long and loudly, and Mr. Sanders answered. The call was from his neighbor, A. McConchie, who told him that a funnel-shaped cloud had formed over toward the south and was then driving directly for the Sanders place. Mr. Sanders called the family, and picking up the baby he dashed out of the house, followed by the others. They sought refuge in a clump of willows a few rods away. Hardly had they reached the trees, where they held on for life, when the cyclone struck the house and in a minute the large brick structure was in ruins.

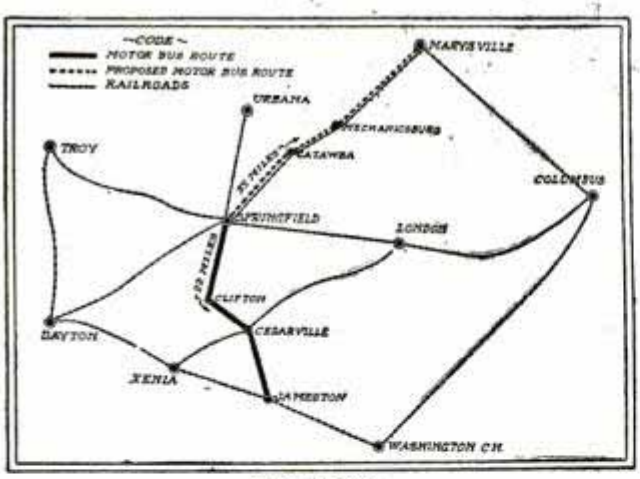
No member of the family was injured beyond a few bruises from flying debris.

INTERURBAN AUTO LINE

The Motor Car Enters the Field Against the Trolley Car--First Line is 22 Miles Long in Ohio--Results Encouraging thus Far.

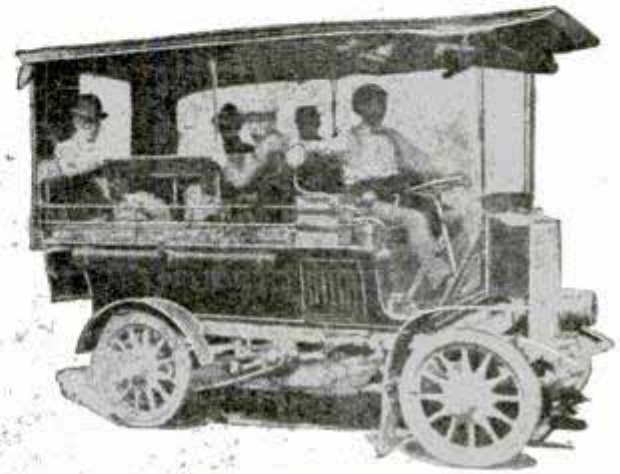
An interurban auto line is now in operation in Ohio, a state already a network of interurban trolley lines. To what extent the new system may affect further construction of electric lines remains to be seen. Such undertakings seem particularly well adapted for use on exclusively summer lines, such as connecting lakes with railroad stations. The saving over the cost of track construction and power houses is very great, and the motor buses cost no more, and usually less than electric cars.

The line referred to connects Springfield, O., with Jamestown, 22 miles distant, passing through two other towns on the route, with a combined city population of 42,500 people. The roads are fairly good, but the motor line offers to pay $100 per mile per year toward the maintenance and improvement of the roads, if the local authorities will do the same. Two cars are already in service (with one in reserve), making the run of 22 miles in 1 hr. 45 min. A rate of



The Route

2½ cents per mile is charged, or 50 cents for the through trip. The Motor Age says. "From Present running the cost of operation can be fairly well calculated. In a round trip of 44 miles 4½ to 5 gallons of gasoline are consumed and 2½ pints of lubricating oil. The former costs 10½ cents per gallon and the latter 50 cents per gallon, making the expense for each round trip 57 cents. The operator is paid 25 cents an hour and as 2 hours are required for the round trip an extra $1 must be added, making the actual operating expenses for a round trip for each machine, $1.67. Four and a half such trips are made each day, so that the daily expense is $7.51, and the yearly cost



One of the Vehicles

amounts to $2,253. The company is allowing 2 cents per car mile for repair and depreciation. The two machines make together 220 miles each day or 66,000 miles per year, 300 days, so that the yearly repair allowance amounts to $1,320, which, taken with the annual fuel bill, gives a grand total of $3.573.

"The three machines cost $6,600, an extra sum of $1,000 was spent in fixing up a garage and repair shop, and $1,000 was spent on highway repair. On this investment 5 per cent interest must be placed, which adds $430 to the total of $3,573 already reached, making in all $4,003 expenses for the first year.

"Where are the receipts to cover this expenditure to come from and what will the company have as a revenue at the end of the year? Supposing that only one passenger was carried throughout the entire year, the receipts therefrom, at 2½ cents per mile, would be 2½ cents taken 66,000 times which gives $1,650. Two passengers carried all of the time would be an annual revenue of $3,300 and four passengers would yield yearly receipts of $6,600. Take from this sum the operating expenses, $4,003, and there remains $1,597 as a dividend on the $20,000

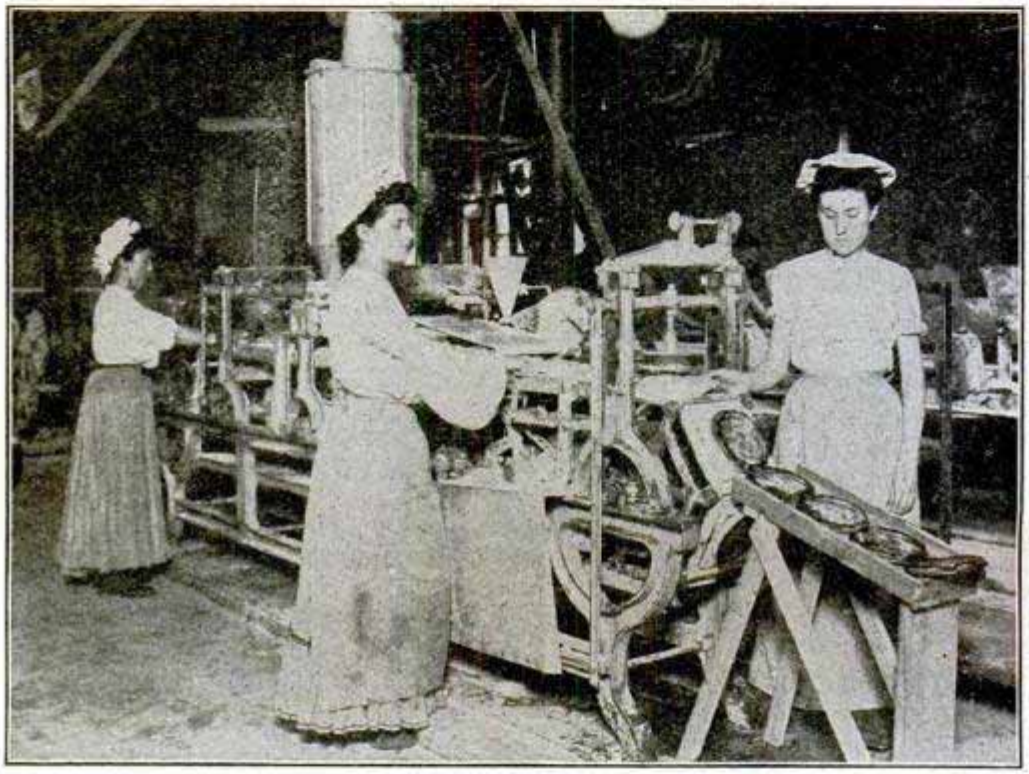
paid-up stock. A 5 per cent dividend on the $20,000 stock would only amount to $1,000, so there remains a margin of $597 for some things that are sure to lighten the coffers of the concern."

The cars will accommodate 14 passengers each; an 18-hp. gasoline engine furnishes power for an average speed of 15 miles an hour. Arrangements are being made to extend the service 35 miles to Marysville. The experience of this line will be watched with great interest.

THE GAS ENGINEER

In his annual address to the Pacific Coast Gas Association its president refers to the promising future to young men in gas engineering. While the title is at present a self-conferred one, the near future will recognize it as distinctively as electrical engineering. A course in mechanical engineering is essential as a foundation.

Of the future of the gas engine he said: "The great future universal success of the gas engine is dependent on some form of cheap, though effective, power gas, all kinds of which are now being experimented with, and all forms of fuels are being tested, including coals, coke, charcoal, petroleum, oils, hydro-carbon residues, volatile hydro-carbons, wood, peat, hay, straw, leaves, rushes, reeds, moss, sawdust, shavings and dried sewage. All kinds of combustibles are economically usable in one manner or another, and the time is probably not far distant when an enormous amount of our power will be derived through the medium of the gas engine from fuels we now allow to go to waste."



Turns out Pies Ready for the Market

MACHINE MAKES 300 PIES AN HOUR

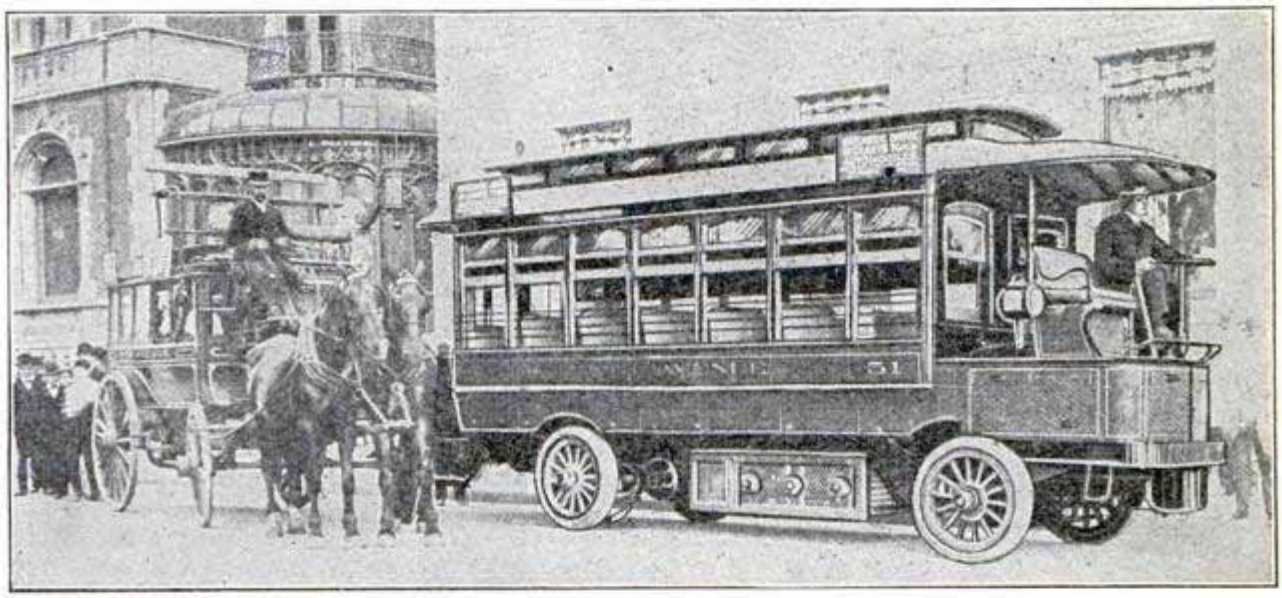
Three hundred pies every hour is what the new pie machine is doing. For people with whom pies do not agree, this is something fearful to contemplate, but to the small boy the announcement is next to a circus or the millennium. The dough is mixed in a special machine and fed into the pie machine which cuts out both top and bottom crusts, lifts the plates, drops the filling into place, lays the covers, trims and finishes the pie ready to be placed in the oven. Only three attendants are required, and the machine will operate as long as the proprietor furnishes the dough. The filling is prepared separately and poured into a large receptacle which lets down just the right amount as each pie form passes along.

As an experiment, 5,000 boxes of choicest peaches were put in cold storage in California. It is hoped to market them at Christmas.

GASOLINE-ELECTRIC 'BUS FOR NEW YORK

Unusual Combination of Powers in the Test Vehicles

An electric street car without any trolley or track, and running on pneumatic tires, is a brief description of the gasoline-electric motor car, the first of its kind to be operated in a large city in America. It is unlikely that the newcomer will seriously compete with street cars, although the body has been built at one of the largest street car plants in this country, and the electrical machinery by one of the large builders of street car motors. The car or 'bus is on trial and making regular trips on Fifth avenue between Washington Square and 88th street. Passengers are carried at a fare of 10 cents each, and with a saving over the horse-drawn buses of 10 minutes.



"An Electric Street Car Without Trolley or Track"

The car has no upper deck and deserves no special description. Entrance is entirely by one side at the rear, and a narrow aisle divides the two rows of cross seats, accommodating two passengers each, or 28 in all.

The power, however, is an interesting combination of a gas engine, an electric generator and motors, with storage batteries as auxiliary power to start and for lighting. The power combination is not altogether new in principle, having been employed more than 10 years ago, by Wm. Patton, of Chicago, as power for cars on track, at a time when gas engines were much less efficient than now.

Beneath the driver's seat is the prime power producer, a vertical 4-cylinder gasoline engine of 40 h. p., direct connected to an electric generator of 45 h. p. Two electric motors are placed beneath the car, convenient to the rear wheels, and driving them by means of a sprocket chain. Twenty cells of storage battery, which must be charged once daily, are also carried beneath the car and supply current to start the generator, which in starting sets the gasoline engine at work. The generator does not restore any power to the batteries. This is a change from previous operations in which the gas engine has run continuously, and was supposed to contribute to the battery any surplus electrical power generated, such as while going down hill when more power is produced than used. The batteries also furnish the light, both for interior, headlights and rear signal lamps. No standing passengers are allowed.

Should the experiment prove a mechanical and financial success, it is the intention to entirely replace the Fifth avenue stages with the new cars.

On January 1 of this year there were 537,105 miles of railroad in the world, of which 270,386 are in America; 187,776 in Europe; 46,592 in Asia; 15,649 in Africa and 16,702 in Australasia.

FILTERED BREATH FOR MINERS

Filtering the exhaled breath, so that a little store of oxygen may be used again and again as the medium for expelling from the lungs the carbon dioxide and vapor of water produced there, is the means by

How the Apparatus is Worn

which, in the future, rescue parties will be enabled to carry on their work for an hour at a time in the deadly atmosphere of mines where explosions have occurred.

The ingenious device by which this is accomplished is the invention of two scientists of the Polytechnical University of Vienna. The apparatus comprises three boxes containing the same amount of sodium-potassium peroxide supported in a frame provided with a hose, a mouthpiece and a bag in the form of a jacket. The boxes are inclosed in an insulated covering of braided pasteboard.

To use, the boxes are placed in the frame so that the sheet lead plates with which they are sealed come in contact with perforated crowns of the frame. The hose-connecting joint is placed upward and the bag-connecting joint downward. The jacket is put on the body and the supporting frame hung about the neck and locked in position by means of a leather waistband. All the joints are screwed tight. The bag is then filled with 8 qt. of oxygen, either by means of an oxygen producer and filling tube provided with the apparatus, or by pumping it in from a supply. The mouthpiece is then inserted between the lips and teeth and a nose clamp is adjusted.

The sodium-potassium peroxide, assisted by the filters, absorbs the carbon dioxide and vapor of water from the exhaled breath. Breathing takes place simultaneously through two boxes and the third may be switched on when these are exhausted, which is made known by a high resistance offered to breathing. With this apparatus, a man can breathe for a period of 90 minutes, allowing 60 minutes for work and 30 minutes for retreat from the locality.

The apparatus may be cleansed and recharged, and may be kept in reserve for emergencies for years with only an occasional inspection.

RATTLESNAKE STOPS AN AUTO

Two enthusiastic automobilists who are crossing the continent relate in the Automobile, their experiences in crossing the plains. In some districts the rattlers were so numerous that sleeping on the ground was impossible. On one occasion they ran into a mass of rattlers sleeping in the sun, several of whom were thrown into the air. One

Snake Stopped this Auto

fell on the canvas covering of the tonneau, but fortunately slid off without doing any harm. One of the wheels was less fortunate, for a big fellow fanged the tire and in a short time it went flat. The car is making a transcontinental trip, New York to San Francisco.

BIG STREAMS TO FIGHT FIRES

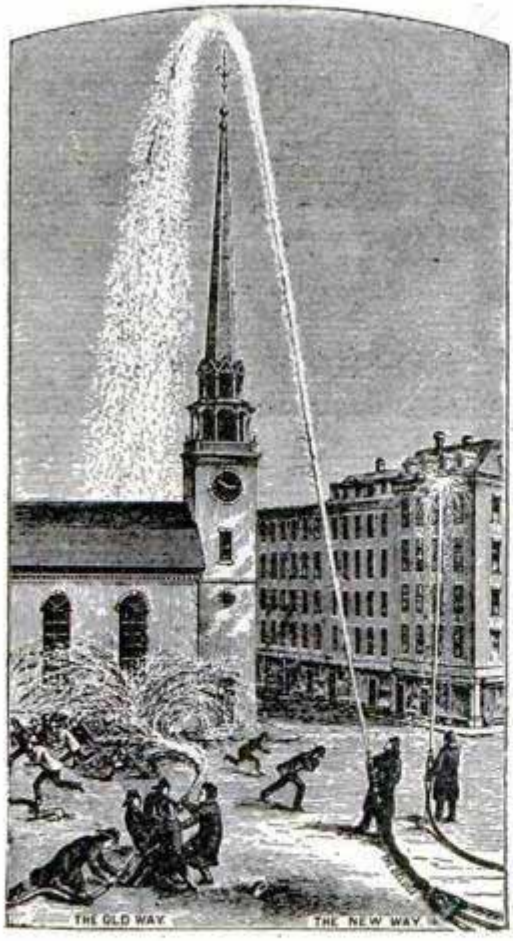
Recent Invention Enables Firemen to Throw 2 1-2-inch Stream Over 300 Feet

For a full half century there had been practically no change in the manner of handling fire streams. Then a man with a mechanical turn of mind studied the subject and produced a device which has made it possible to hurl a stream of water 2½ in. in diameter at the nozzle, a distance of 400 ft. And what is much more remarkable a little girl 10 years of age can direct the stream without assistance from anyone.

If "a little knowledge is a dangerous thing," even more so is a small stream of water on a big fire. Under proper conditions the water, instead of putting out the fire, only serves to make it burn more fiercely. At 212 degrees the water is converted into steam, and at 1,470 degrees the steam is converted into its natural gases, oxygen and hydrogen. Hydrogen is considered, when burned separately, the hottest of all known gases, and when mixed with three-sevenths of its volume of air, explodes, and in its incandescent state burns at such an intense heat as to melt almost any known substance; wrought iron melts at 2,900 degrees, a temperature often reached in fires.

Courtesy Samuel Eastman Co.

"A Child Can Direct the Stream"



Two Ways of Fighting a Fire

Some years ago larger streams than had previously been possible were secured by the use of siamese couplings, in which two or more small streams from engines or hydrants were brought together in the coupling and emerged from the farther end in a large, powerful stream. Standpipes are operated on this plan, and with two or more powerful fire engines to furnish the water will pour a small river into an eighth story. But only the larger cities can afford standpipe outfits.

Even where the siamese is in use the handling of the big stream is something calling for strength and nerve. The chief reason heretofore why large streams have not been used has been the difficulty and danger of controlling them at the nozzle.

The recoil, or pull back, of all nozzle pipes is in exact proportion to the size of discharge. A 1-in. nozzle under a pressure of 100 lb. requires the best efforts of two strong men in directing. Increase the size

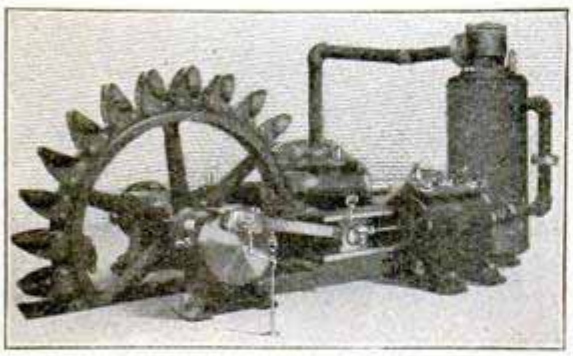
Nozzle a Child Can Control

to 1⅛ in. and it requires the third man; to 1¼ in. and it calls for the fourth man. As the space at the pipe is limited only about three men can work to advantage, and this is why all fire companies practically stop with 1 and 1⅛-in. streams, the same sizes that were formerly used on hand engines.

The latest improvement—it might almost be called a discovery—is in the construction of a nozzle which can be adjusted from the smallest stream to one of 3 in. without shutting down, and which, instead of requiring several strong men to control, almost stands alone. So easy is it to control a child can, with perfect safety, direct the great deluge of water which would knock a man down 100 ft. distant. Horizontal streams have been thown a distance of 350 ft and vertical streams repeatedly to a height of 200 ft.

WATER COMPRESSES AIR

Wind and water are so frequently mentioned in connection with mining stocks, that it is interesting to find one instance where the use of these two great forces in nature are an actual asset. A gold mining company in British Columbia uses com-

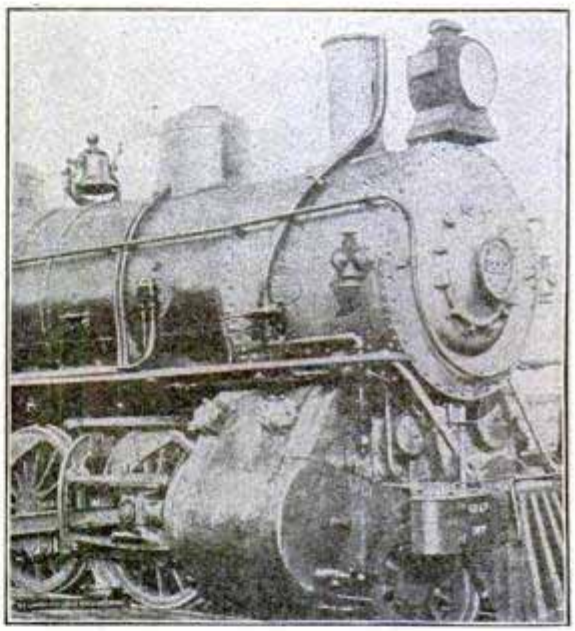


Water-Wheel Air Compressor

pressed air for hoisting and drilling, and the compression is secured by means of a water wheel. The wheel develops 90 h. p. under a head of 170 ft.

VARIABLE EXHAUST FOR LOCOMOTIVES

This device is intended to lessen the tremendous draft in a locomotive without interfering with its steaming qualities, and is known as the Wheaton variable exhaust. At certain times and under certain conditions the exhaust escapes through a separate pipe outside the stack, with sufficient force to maintain the necessary fire to steam properly. The illustration shows the attachment on a Chicago Great Western engine. Locomotive Engineering says: "The apparatus acts with the action of the reverse lever and the pressure of the exhaust in the stack is directly dependent upon the relative position of the reverse lever upon



Engine Showing the Variable Exhaust

the quadrant. If the reverse lever is at the end of the quadrant the separate exhaust is at its greatest opening, and this opening is gradually reduced as the lever is hooked up to running position. At this point the valve is closed."

TURBINE BATTLESHIP FOR BRITISH NAVY

The British navy is to have an 18,000-ton turbine battleship, the first of its kind to be built. The vessel will have four sets of turbines mounted on four shafts and operating ahead turbines. Each shaft will be equipped with ahead turbines for high and low pressures and with astern turbines, also. Water-tube boilers will be used and the ship is designed for a speed of 21 knots.

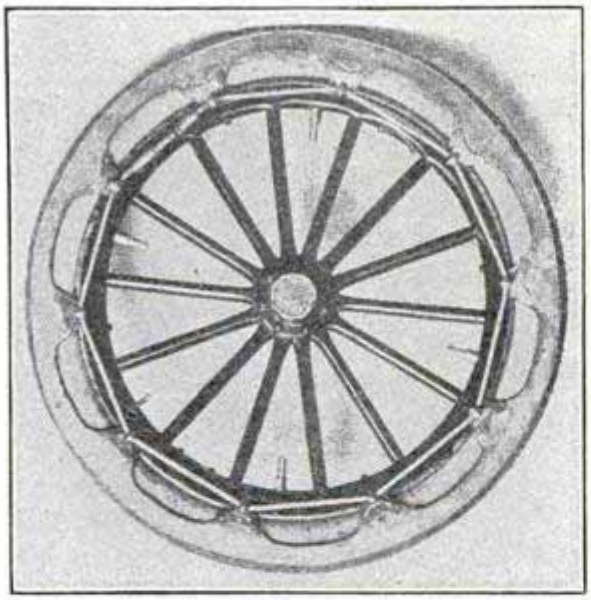
A SAWDUST HILL

Old Mother Nature's rock-ribbed eminences have a promising rival in a huge pile of sawdust that has been accumulating for several years at Cheboygan, Wis. The hill covers 14 acres of ground, is 1,080 ft. long, 875 ft. wide, ranges from 20 to 50 ft. in height, and is composed almost entirely of white and Norway pine sawdust.

The mill that produced this enormous amount of sawdust was run by water power and so had no way of disposing of the waste, says Wood Craft. The village prohibited the company burning it on account of the smoke, and they were not permitted to dump it into the river. The sawdust is rotting a little at the bottom. Chemists have examined it at times with a view to extracting its chemicals (its only value), but nothing has been done in this regard.

RUBBER TIRE PROTECTOR

The protector is made of rubber with a corrugated tread ¾ in. thick; on each side are 10 ears, projecting toward the center of the wheel, and to each ear is riveted a metal hook. A steel cable passes around and engages with each hook, and the two ends are joined by a turnbuckle,

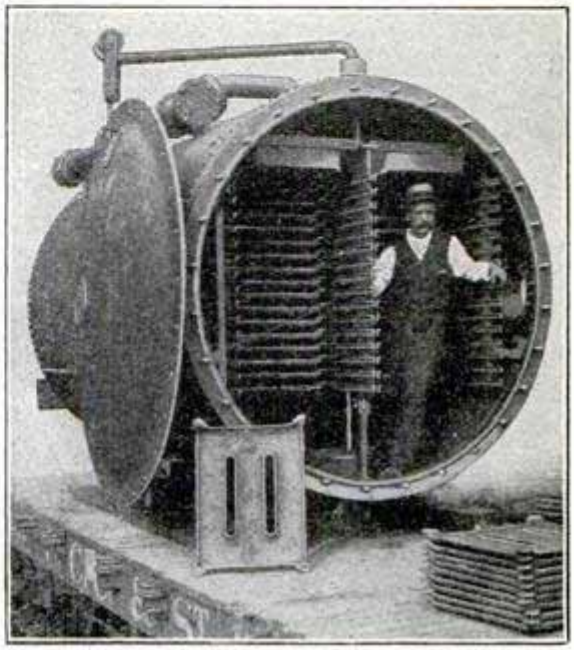


Tire Protector

the tightening of which draws the protector down on the tire as closely as may be necessary. The cable is ¼ in. in diameter. The device is put in place when the tire is deflated, and after inflating the tire, the protector is pulled down with the turnbuckles.

SIXTEEN THOUSAND HORSEPOWER FEED WATER HEATER

One of the largest feed water heaters ever built was recently installed in a Philadelphia power house. The heater is 90 in. in diameter and 15 ft. long overall. All its working parts and the bottom are made of cast iron, and as this material is found to



Courtesy The Hoppes Mfg. Co.

Mammoth Feed Water Heater

be less corrosive in certain waters than steel plate, it is used in all parts coming in contact with the water. To save weight the shell above the water line is made of steel plate. The lime-catching surface in the heater is 2,010 sq. ft., the pans being multiple trough-shaped pattern; by the use of this form of pans the water is made to flow over the sides and through the slots and to follow along the underside of the pans in a thin film so that the steam comes in direct contact with it, even when the pans are coated with lime or other solids. Owing to the large amount of lime-catching surface and the settling chambers provided by the troughs, no filter is required.

A large oil eliminator is provided at the rear end of the heater and the feed water is regulated by means of a float in an outside box.

The front head of the heater is removed and swings to one side by means of a crane provided for the purpose, opening up the entire end of the heater so that the pans may be removed for cleaning, and as lime and other solids form only on the pans, this work may be done entirely on the outside.

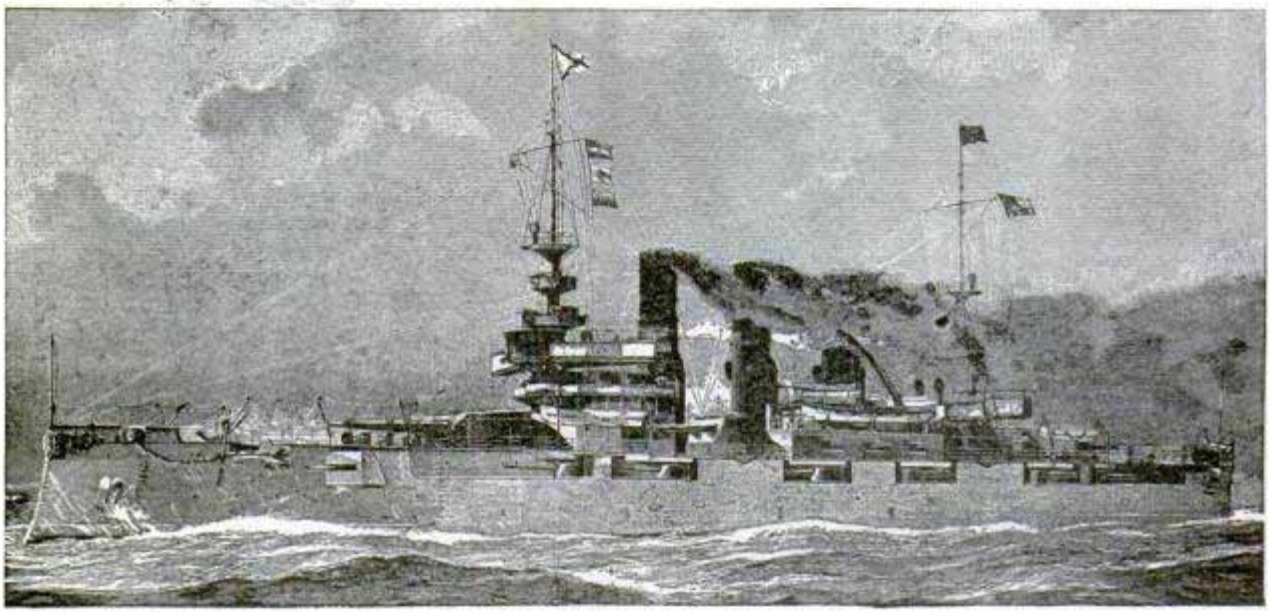
BATTLESHIP "NEW HAMPSHIRE"

The new United States battleship "New Hampshire," now in course of construction, will be of 16,000 tons displacement and equipped with the heaviest armor and most powerful armament for a vessel of her class. Her dimensions are: Length on load waterline, 450 ft.; extreme breadth at load waterline, 76 ft. 10 in.; mean draught to bottom of keel, 24 ft. 6 in. She will be of 16,500 horsepower, and her trial speed is placed at 18 knots. She will carry a complement of 860 officers, seamen and marines.

The fighting equipment of the vessel will comprise: Four 12-in. breech-loading rifles, eight 8-in. and twelve 7-in.; twenty 3-in. 14-pounder rapid fire guns, twelve 3-pounder semi-automatic guns, four 1-pounder semi-automatic guns, two 3-in. field pieces, two machine guns and two automatic guns. She will also carry four submerged torpedo tubes for the discharge of the largest and latest type of 21-in. automobile torpedoes. The hull protection will consist of a complete belt of waterline armor, 9 ft. 3 in. wide, having a uniform maximum thickness throughout a range of 285 ft. amidships, gradually tapering thence to 4 in. at the bow and the stern.

The ship will be driven by twin screws, actuated by triple-expansion engines of the four-cylinder type, capable of developing 16,500 indicated horsepower when making 120 revolutions a minute under an impulse of steam at a pressure of 250 lb. to the square inch. The engines will be placed in separate water-tight compartments. Steam will be supplied by twelve water-tube boilers at a working pressure of 265 lb. They will have not less than 1,100 sq. ft. of grate surface, and not less than 46,750 sq. ft. of heating surface. The three smoke stacks will be each 100 ft. high above the base line.

The vessel will have an evaporating plant capable of turning out 16,500 gal. of fresh water daily, and distilling apparatus capable of condensing 16,500 gal. daily. There will also be a dense-air refrigerating plant and an electric-generating plant. An electric dish-washing machine, an electric dough-kneading machine, a steam bakery and a steam laundry will be among the modern features. Wireless apparatus will be provided, also. The hygienic facilities throughout will be of the best. The cost of the battleship will be $4,400,000.



U. S. Battleship "New Hampshire"

MINERALS IN THE PHILIPPINES

The Philippines are rich in precious metals. A report just issued by the Department of the Interior tells of gold, silver, copper, platinum, iron, coal and petroleum. Stamp mills and cyanide plants have been erected by enterprising Americans, and other improvements are under way.

Cement and concrete are poor conductors of electricity. Even when re-inforced with steel it is believed to be as immune from lightning as ordinary buildings.

MODERN MANUFACTURE OF VENEERS

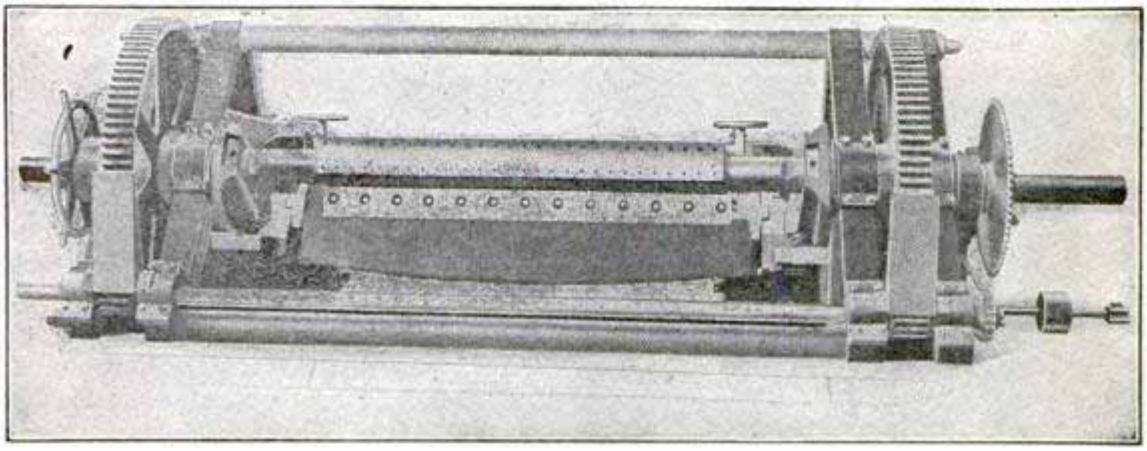
Rich Effects Obtained--Scarcely a Square Inch of Waste--Methods of Cutting and Drying--Used for Fine Work

Veneer is no longer a term of deception, for to-day the finest doors, pianos, furniture, floors and sleeping cars are veneered. The province of the veneer machine is to make a single log of mahogany, for instance, cover as much space as otherwise twenty logs would be required to do. The work of converting the solid log into a long strip no thicker than pasteboard, and which can be rolled up like carpet, is an interesting one.

The process by which huge logs or "flitches," ranging in value up to $5,000 apiece, are reduced to thin sheets sufficient to constitute thousands of square feet of surfacing, with hardly a square inch of waste, is of unique importance in this age. The time has passed when man may reap the forests with a wanton hand. His improvidence has brought upon him its penalty—enforced economy—which is alike his recompense, affording him, in forestry, a healthful science for his brain and a wholesome labor for his body.

Veneers are manufactured in two ways, by sawing and by cutting with knives. Sawed veneers are so expensive, however, that the demand for them is small. Nearly the thickness of the veneer is lost in saw-kerf and, on an average, a saw can make only five cuts before refiling is necessary, an operation requiring two and one-half hours. Where the wood is very gritty only one cut can be made before refiling the saw. Flitches often remain on the saw three weeks before all sawn up. The only advantage of the sawed veneer is that longer stock can be used in the sawing machine than in the slicing machine.

It is the knife-cut veneer, however, that has brought the industry to its present enormous proportions. This method of manufacture is so practical and so economical that the demand for the product is greatly in excess of the supply. Furniture manufacturers use millions of feet of fine veneers every month; car builders use fancy veneers for ceiling and finishing; banks,



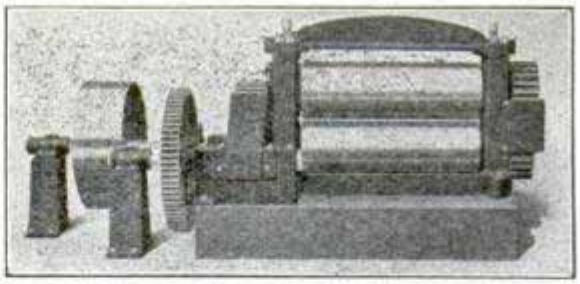
Veneer Cutter With Stay-Log Attachment for Cutting Fine Veneers

Veneer Cutting Knife

offices, hotels, stores, churches, public buildings and homes use this finish, and beside these finer uses there are the basket, box and fruit package business and the veneer barrel manufacture, all large consumers. A single veneer cutting machine of one make on the market will cut the material for 100,000 barrel staves in ten hours, and still the demand exceeds the supply. Any kind of lumber will make good cut veneers, even crooked logs not worth sawing, and all our native timbers can be worked in any thickness up to the practical limit of about ½ in.

The Log Trolley

In preparing a log or flitch for cutting, it is first sawed up in lengths suitable for the machine to handle, its surfaces freed of bark, and it is then either steamed or boiled in a vat. Logs can be cut cold, but better results are obtained by heating, which softens the wood, renders it flexible, drives out the sap so that less time is required for drying, and overcomes any disposition to check or split. Boiling is preferable to steaming, as the heating is evener throughout and the logs remain in cutting condition for several hours, whereas after steaming they must be cut immediately, for, once cool, they become brash and hard and can never be put in good cutting condition again. From the boiling vat the log is

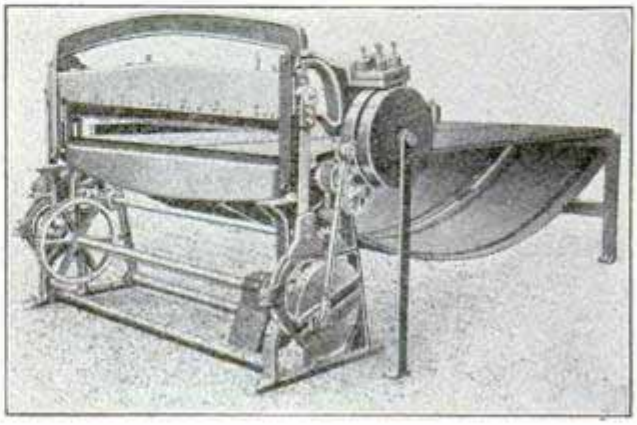


Wringer for Soft Wood Veneers

carried to the veneer cutter by a log trolley, consisting of an I-beam track provided with a carriage and a chain hand hoist for raising and lowering the log.

The rotary cutting machine has an A-frame, giving it a broad floor base; the log is held in the machine by dogging spindles, operated either by hand or power. The knife is attached to a head block and is firmly clamped between heavy castings, which cover both its sides up to the necessary clearance from log and stock. Its pitch can be changed instantly to suit the wood being cut by merely shifting a lever. This is very important, as timber varies in its characteristics as to grain, structure, hardness, density, etc., so that no rule can be made for setting the knife. Practical machines up to 10 ft. in length are built along these lines.

Veneers cut from figured woods, such as mahogany, walnut, ash, curly birch, cedar and quartered oak bring the highest prices. For cutting these fine woods the machine is furnished with a stay-log device, consisting of an arm or offset chuck for each spindle connected by a heavy cast iron bar incapable of spring under any knife pressure, with ¾-in. holes, drilled in its face at intervals of every 3 in., to which the flitch is securely bolted by special lag screws. Suppose quartered oak is to be cut. The



Veneer Clipper

log is first sawed into quarters and then a small piece is cut from each outer corner of each quarter to accommodate the chucks of the stay-log attachment. Then along the side of the flitch ⅝-in. holes to correspond with the holes in the stay-log are bored. The flitch is then bolted to the stay-log and the machine is ready to set in motion. Each revolution brings the face of the flitch in contact with the knife, cutting any desired thickness and producing the proper quartered effect. Any length of knife up to 120 in. may be used in such a machine, while the weight of these machines ranges from 20,000 to 52,000 lb.

The veneer comes from the veneer machine in continuous sheets, and its quality and purpose determine its future treatment. Usually it is divided into widths by one of the several types of veneer clippers. From the clipping machine the neat piles of material are conveyed to the drier. For soft wood veneers, usually a mechanical wringer is provided which extracts from 25 to 50 per cent of moisture from the stock, reducing the cost of drying.

The modern drying machine consists of a series of iron rollers incased in an iron box of the length and breadth required for the stock. The iron rolls are geared to and driven by a shaft running the full length of the box. The shaft is driven by an independent engine. A hot-blast fan driven by an engine is used in connection. The veneer is fed in at one end of the drier by a boy and comes out at the other dry, flat, free of checks, wrinkles or splits and with its surface partially polished, and is then ready to ship. The drier can be instantly adjusted to dry any kind or thickness of veneer and two boys can handle it. Poplar veneers 1/30 in. thick can be dried perfectly in 15 minutes.

With this perfected process of manufacture and the growing scarcity of lumber, the veneer industry is becoming so profitable that many sawmill owners all over the country are adding a veneer cutting department, realizing that, while there will always be the natural demand for sawed lumber, the uses for thin lumber are daily increasing.

The Drying Machine

TO KEEP SHEEP IN A FIELD

Here's a kink for the farmer whose sheep persist in jumping fences. Dr. Matthews, of Blue Mound, Ill., was annoyed in this way and had tried several means of preventing it, all without success.

One day he noted that each sheep would walk up to the fence, step backwards a few steps, then make a run for the fence and jump over it. The doctor sharpened one end of a stick 3 ft. long and lashed it by the other end to the underside of the sheep's tail, then turned the animal loose.

The sheep walked toward the fence as usual, measuring its height with great precision, but when it backed off for the spring the sharp end of the stick was pushed into the ground and the discomfited sheep turned in a line parallel with the fence and with a shake of the head and a little snort gave up the performance of the feat. In this way all the sheep were broken.—Contributed by John Trainer, Girard, Ill.

HOW BINDER TWINE HAPPENED

The first reaping machines brought out by McCormick bound the sheaves with fine wire, a method both neat and economical, but one that was followed by disastrous results. Flour mill after flour mill was destroyed by fire and investigation showed that bits of broken wire getting into the mill-stones with the wheat was the cause. This difficulty was overcome by a Yankee who proposed drawing the wire from the wheat by means of a magnet.

A little later horses and cattle all over the country died from a strange disease, which post-mortem examinations revealed was caused by swallowing wire with their fodder. The magnet would not work in this case and so John Good, a rope worker, produced a loosely-spun yarn made of coarse fiber as a substitute for the wire binding. $12,000,000 worth of binder twine is made and sold in this country in a single year.

DISCOVERS SECRET OF NORTH POLE

Simple, Economical, Mechanical Process Freezes 60° Below Zero--Expected to Revolutionize Cold Storage and Ice Manufacture--Produces the Dry, Cold Air Found in High Altitudes--Remarkable Curative Powers for Tuberculosis and all Fevers--Can be Piped Into Houses Like Gas

It was a sultry day in August in a Southern city; men were dropping in the streets by scores, overcome by the terrible heat. The clang of gongs was incessant, as the never-ending stream of ambulances sought the entrance of a great building. Patient after patient went in on stretchers through the swinging doors. If you should follow one of these senseless, dying bodies you would see it laid out on a wheeled stretcher, and rapidly pushed onto an elevator, which quickly reaches the upper floor. In another instant the patient is rolling along a hallway, passing through several tight fitting doors which automatically open and close.

You enter a small room without openings, save for the door and a ventilator. The walls, ceiling and floor are of spotless white tile. The only objects you notice are an enormous thermometer, the cluster of incandescent lamps in the ceiling, and a small table on which stand a few partly filled bottles.

Outside, on the street, 30 seconds before you were in a suffocating atmosphere with the mercury marking 105 in the shade. Here the air is like that on a snow clad mountain peak, cool, clear, absolutely dry, and fairly sparkling with vitality. You glance at the big thermometer, and look a second time before you realize its red column really stands at 50°. You return to the patient. The nurses already have him in hand, his clothes are stripped off, and there he lies, an inert, unconscious mass of flesh whose life hangs by a very slender thread. One of the internes has already taken his place near the thermometer. His hand is on a valve controlling a 2-inch pipe which projects a few inches from the wall.

The head physician has finished his hurried examination. Without raising his head he softly gives the command—"40 degrees."

The interne opens the valve slightly; a rushing sound follows; his eyes are riveted on the big thermometer, which has already commenced to fall. Down, down, steadily down goes the red streak until it marks 40 degrees.

"Forty," calls the interne, and his breath shows white in evidence.

The physician still bends over the patient, one hand on his pulse. He gives the order—"30."

The valve opens a little more; down goes the red line, steadily falling, until the interne reports "30."

The physician has an anxious look. For the first time he raises his head to remark:

"Slowly to zero."

Again the valve opens wider, while in response the red line drops, drops, passing 25°, 20°, 15°. To all appearances the patient is dead. Not until the temperature is within 2° of zero does he show the slightest sign of life. Then a faint change is noted in the face, the whole body seems to absorb the vitalizing ozone; a moment later it gives a little quiver, the first indication of returning muscular action. Slowly, almost imperceptibly at first, the chest shows a slight movement, gradually becoming more pronounced and regular, until at last with a full strong breath the lungs fill to their utmost—the patient dreamily opens his eyes—his life has been saved.

"That was a close one," the physician remarks to his assistants. "He was 107.5, but he is down to 101 now. Put him in the 50° ward." And the patient is wheeled out while the operating room is made ready for the next "emergency."

Today the foregoing treatment does not exist. Less than a year hence, it will doubtless cause no more wonder than other great discoveries, and like the X-ray and wireless telegraph, pass out of the realm of mystery into the practical, commonplace condition of every day commercialism.

The following account of what gives every assurance of being one of the most remarkable discoveries and inventions of recent years—for it partakes of both—is here given publicity for the first time. And this article has been held back several months in order that time might demonstrate any failure of the process. A plant which has now been in actual, practical, successful operation for several months leaves no doubt in the minds of all who have witnessed the demonstration that a discovery has been

made, the importance of which is so far-reaching, commercially and therapeutically, as to entitle it to rank high among the mechanical accomplishments of the century.

For years inventors and scientists have labored, and millions of money have been spent, in the hitherto fruitless attempt to produce the dry, cold air of the Arctics and snow-clad mountains, in such quantities and at a cost which takes the production out of the experimental laboratory and sets it firmly among practical, commercial undertakings. For the past ten months, in a quiet out-of-the-way place, a man of practical mechanical ideas, not a scientist, has actually been doing what so many in America and Europe have attempted, viz., producing unlimited quantities, as desired, of either moist or absolutely dry air at extremely low temperatures, and at a cost which cannot fail to cause a sensation.

It is a purely mechanical process, in which no chemicals whatever are employed. Compared with present processes it is very much cheaper to install, and its operation is so simple that skilled labor is unnecessary.

A temperature of 30° below zero is as easily obtained as 6° above. No one knows as yet what is the extreme limit of cold, as all thermometers so far obtainable in making the tests have frozen and burst at 30° below zero: 60° below is considered well within reasonable bounds. Our readers will be more interested in what is done rather than in a detailed account of how; the operation may briefly be stated as a purely mechanical one, in which the power may be furnished by steam or gas engines, water wheels, or electric motors, as most convenient.

The results are two-fold:

First. The manufacture of ice for all commercial purposes; and,

Second. The use of the cold air not consumed in the ice-making, for cold storage purposes. Used in this way it is a by-product which would otherwise go to waste, and can be delivered in either a moist or dry state.

The plant costs less to install than any of the systems at present in use, and the expense of operating is very much less.

It is estimated that $25,000 will cover the entire expense of installing a plant, including buildings, necessary to provide all the ice used and the cold storage rooms required by a city of 25,000 people. Ice is made in one-half the time required by present artificial methods, and with the great advantage of dispensing with expensive, dangerous chemicals. Hence a plant of given horsepower, say 100 hp., will produce twice the tonnage of an ammonia plant of 100 hp.

If cold storage, or cold air, and not ice, is desired, that can economically be produced. There has developed thus far no apparent reason why the cold, dry air, at any temperature desired, cannot be delivered to residences, stores, hotels, etc., in identically the same way that gas and water are now delivered. When a city is piped for the cold air, ice will no longer be required in the house, and instead the cold dry air will be allowed to escape into the present icebox or refrigerators by opening a valve, just as one turns on gas in the parlor. If the weather is unusually hot, the valve can be opened a little more; in cooler or cold weather the supply may be decreased or turned off entirely. Bedrooms, or sick rooms, can be kept cold by running a rubber pipe extension if the house is not piped for the cold air. A remarkable feature in the cold room experiments has been that the operators and others have repeatedly gone into the cold room where the temperature was at zero, while in the shade outside it was around 90°, when they were perspiring at every pore and so far none have taken a cold. The explanation is in the absolute dryness of the air. This has convinced several prominent medical experts who have witnessed the demonstration that the cold, dry air process will be the successful treatment for tuberculosis and pneumonia, as well as typhoid, scarlet, yellow and other fevers and diseases.

A tuberculosis specialist recently announced the plan of taking a colony of patients to Greenland, that they might breathe the cold, dry air of the Northland. The remarkable health of Arctic explorers, in spite of manifold hardships and terrible exposures, is well known. There is no reason now why special sanitariums should not provide the same cold, dry, bracing air of Northern latitutes right at home, where the patients can breathe it continually, at temperatures suited to each case, while living in rooms flooded with sunshine. In typhoid, for instance, a rising fever could be gradually checked and reduced by lowering the temperature of the room without resorting to the shock of the ice bath. Local application can also be made wherever desired by means of an air-spray nozzle, and for many operations a jet of the cold air will produce and maintain a local anæsthesia regardless

of heart condition, and insuring a bloodless operation.

Notwithstanding the fascination of the new process in its possibilities from a medical standpoint, the original object and main purpose was the economical production of ice in large quantities for commercial purposes. Natural ice lasts longer, and gives out more cold than artificial ice for the reason that the natural ice is frozen at a lower temperature than is usually employed in ice plants. Obviously what has not been put in is not there to take out. Artificial ice is usually made at about 30°. Under present methods extremely low temperatures are practically impossible, and are obtained only at an increased ratio of cost. It is a good deal like speed in a boat. If 1,000 h. p. will drive at 15 miles an hour, 2,000 h. p. will not be sufficient to make 30 miles. The new cold process, however, is less affected in this respect, and low temperatures are not only easily obtained, but at only slightly increased effort. Ice is therefore made in one-half the time of present methods, and is harder, and contains more cold.

The process is equally available for the small plant which a butcher can install in his retail market, to the larger one for the largest hotel, or the big commercial plant capable of turning out several hundred tons per day. A plant can be installed in a single box car, and the cold air piped through an entire freight train, just as the air for operating the brakes is already piped. With such an installation a fruit train, for instance, can run from Los Angeles to Boston, across deserts during the hottest weather, with a variation in temperature of not to exceed two degrees in any car during the entire trip. For packing houses and other establishments requiring large cold storage facilities the new system is calculated to effect a saving of thousands of dollars annually, while the convenience and safety due to the absence of all chemicals is scarcely less important.

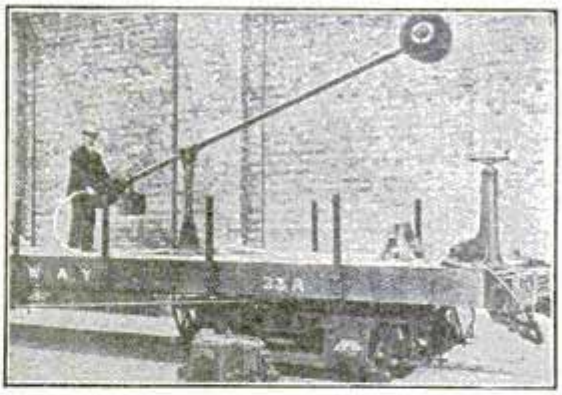
The combination of first making ice and then using the by-product dry cold air for supplying cold storage warehouses is something which cannot be done with the ammonia process, but is practical under the new system. One example will illustrate the power of the mechanical process. A cold storage room 15 ft. square and 10 ft. high was built where it was exposed on all sides to the full effect of the sun. The walls consisted only of one thickness of inch matched flooring. It was little more than a pine box. This repeated filling with the dry cold air had shrunk the boards until in many places the tongue had drawn from the groove, leaving cracks through which one could see. The thermometer stood at 91° in the shade outside when the party of visitors entered and the door was shut. The cold air pipe, 2 in. diameter, was opened. Fifteen seconds was the extreme limit anyone could hold his hand in the chilling blast. In five minutes the thermometer had fallen to zero. The representative of a big packing company remarked as he witnessed the tests. "With 200 h. p. I could freeze an entire city of 100,000 inhabitants."

What will greatly surprise engineers is the small amount of power required. A temperature of 30° below zero is produced and maintained in commercial quantities, with a 40 h. p. water turbine, at the plant in which the tests have been made. The ice is of finest quality and has found ready sale.

A large demonstrating plant in one of the largest cities will shortly be completed, when the works will be thrown open to the public for inspection.

COMPRESSED AIR TUNNEL SWEEPER

For cleaning the dirty walls of its tunnels, the District Railway Company of London is using a new mechanical brush or sweeper mounted upon an electrically propelled car.



Sweeping a Tunnel

The sweeper is mounted on a swivel and is operated by compressed air. It consists of a series of brushes which revolve at great speed against the roof and sides of the tunnels and dislodge all the dirt accumulated there. The "sweep" can turn the brush in any direction he desires. The truck is provided with two air-pumps which compress the air to a pressure of 200 lb. to the inch.

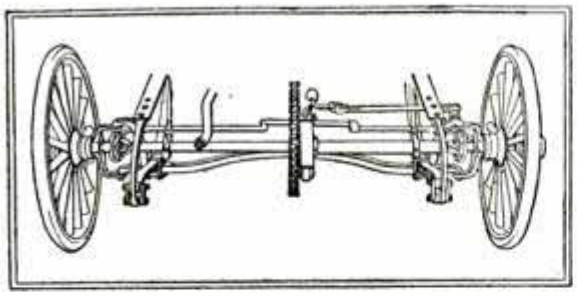
THE "BEDBUG" SPECIAL

Probably the only train in the world of its kind and name is now going over the main line and branches of the Union Pacific. It is equipped with all modern appliances for exterminating bugs and insects of all kinds, and will fumigate all the section houses on the system. Steam from the engine is carried to the car where it is mixed with poisons or disinfectants according to requirements, and the building sprayed inside and out by means of hose and suitable nozzles.

FRONT WHEEL AUTO DRIVE

A number of manufacturers are bringing out machines in which the front wheels only are the drivers. One of these we illustrate. The Motor Age thus describes its operation:

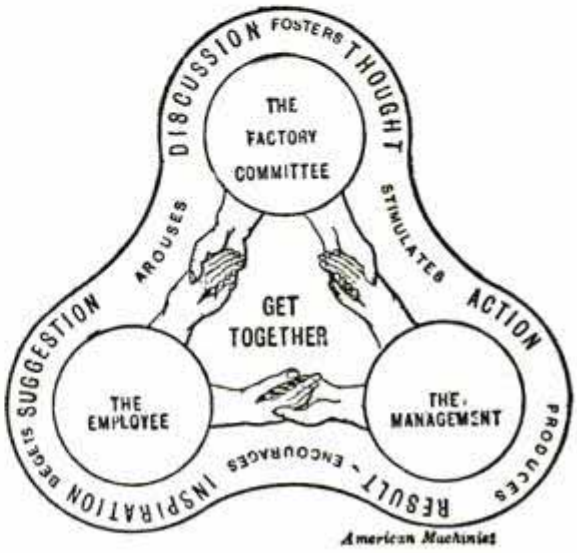
The principle of driving the front wheels is by placing a universal joint between the steering knuckles and the outer ends of the drive shafts and by placing a stationary axle a few inches beneath the drive shafts and carrying the shafts on it. The driving shaft is divided at the center where a differential and sprocket for single-chain drive are carried. The drive shafts with their inner ends carrying the differential gears revolve in a casing attached to the stationary axle, leaving the driving shafts free of



any load carrying, the only strain remaining on them being that of driving the wheels. The steering knuckles take the form of a short sleeve or ring on the part of the drive shafts outside of the universal joints, being that part to which the wheels are rigidly attached. From the bottom and top of this sleeve extend short curved arms pivoted on other arms on the ends of the stationary part of the axle. At the rear side of the sleeve carrying the knuckle is an arm connected with the connecting rod between the two knuckles and which is connected with the base of the inclined steering column for turning the wheels.

THE GET TOGETHER IDEA

An extremely suggestive article with experiences of the writer, Mr. H. F. J. Porter, appears in the American Machinist. He advocates a closer relationship between owners and managers of a works and the superintendents, foremen and employes. He says: "To bring about these conditions, a



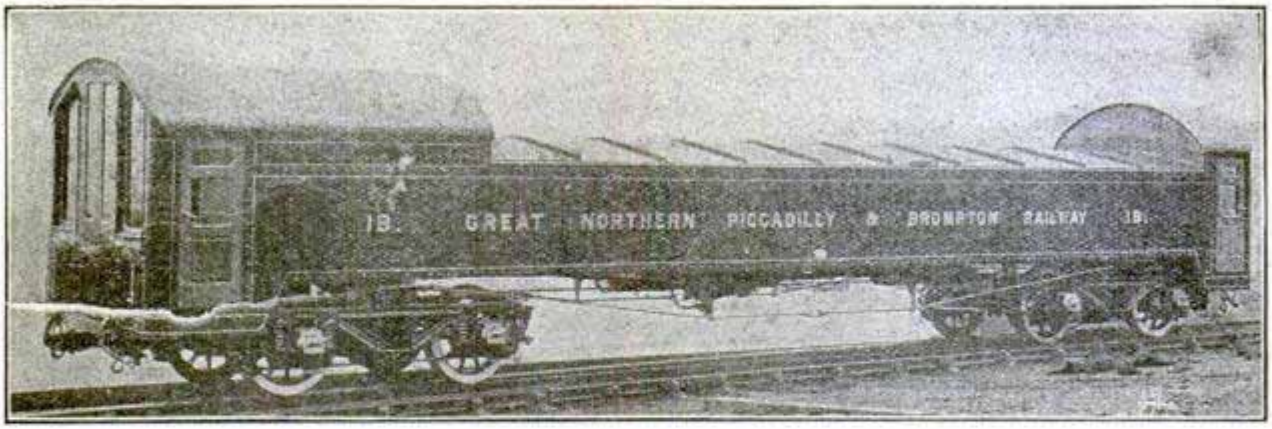
Factory Banner

meeting of all the employes of the company was called to take place one day at noon, and there I announced the desire of the company to change its policy of management to one in which all the employes should have a voice. The employes were requested to elect a factory committee, with representatives from the office, the selling organization, the factory operatives and the foremen. Of this committee the superintendent, representing the management, would be permanent chairman, while the term of service of each of the other members would be six months, so arranged that one member would retire and a new one take his place every month. This committee would act in a recommendatory manner to the management on all matters which would come automatically to it through a suggestion system.

Then follows the details of how these suggestions are made, referred and acted upon.

The employes adopted the motto "Get together," and framed a banner emblematic of the principles involved in that policy. This is shown in the accompanying sketch, and an outline of it they wore as a badge of membership in the organization.

STORAGE BATTERY LOCOMOTIVE



The Underground Electric Railways Co., London, has constructed two steel storage battery locomotives, 50 ft. long. A cab for the motorman is placed at each end. The battery compartment holds 80 chloride cells weighing 36 tons; the car complete weighing 55 tons. The Locomotive Magazine, London, says: "These locomotives will be employed on goods traffic, and it is expected the number will soon be increased."

SIMPLE STEAM GRADER

This grader is the invention of a railroad builder in the state of Washington; its operation which is extremely simple will be understood from the illustration. The scraper, which is a sort of steel box with a cutting edge at the sides and bottom, is 7 ft. wide, 8 ft. long, and 36 in. deep. The knives are 10 in. wide and 7 ft. 6 in. long. A 7-ft. scraper will hold 3 yds. A crew of five men is sufficient. The scraper is returned to starting point by reversing the donkey engine, which reverses the movement of the endless cable to which the scraper is attached. The Railway Review says: "The longest haul should not be over 1,500 ft., and under ordinary circumstances 3 minutes is ample time for a haul of 800 ft. to 1,000 ft."

About 75 of these machines are now in operation throughout the country. Two of them have been sent to Nome, Alaska, to be used in bringing out beach sand which lies under water, and could not be worked otherwise on account of the movement of the tide. It has also proved a success in taking ballast from a river bed through which water was flowing, so that the ballast could not be gotten in any other way.

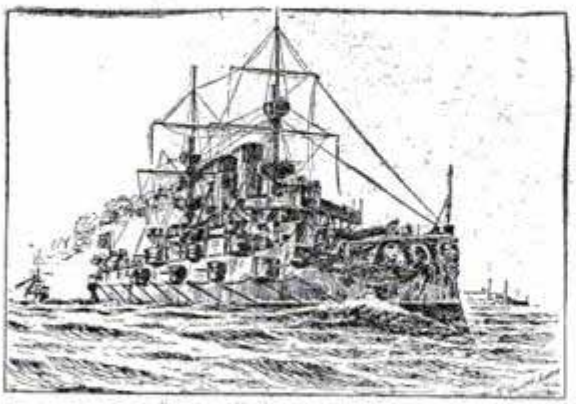
FORTY-TWO STORY HOTEL PLANNED

A New York architect is at work drawing plans for a proposed hotel to contain 42 stories. The building would be 500 ft. high, making it the tallest in the world, and would accommodate 2,200 guests. A roof garden on the top and an immense swimming tank in the basement are included among its essentially modern features.

"About 75 of These Machines are Now in Operation."

THE "MIKASA" DISASTER

After passing in safety through all the dangers which surrounded the Port Arthur blockade for months, and also escaping serious injury in the great sea battle which



The "Mikasa"

closed the war, Admiral Togo's flagship, the "Mikasa," was destroyed by fire and explosion in the home harbor of Sasebo on September 11. About midnight fire was discovered at the base of the mainmast, and in less than an hour spread to the after magazine, which exploded. The ship sank in shallow water and will be raised.

Naval engineers say the ship could have been saved had the sea-cocks been opened and the vessel submerged. Probably the extent of the fire was not realized by those on board. The fire was caused by electric wires. The ship was 400 ft. long; 75½ ft. beam; drew 27 ft.; had displacement of 15,200 tons; 16,400 h. p.; speed 18.6 knots; was built in England in 1902.

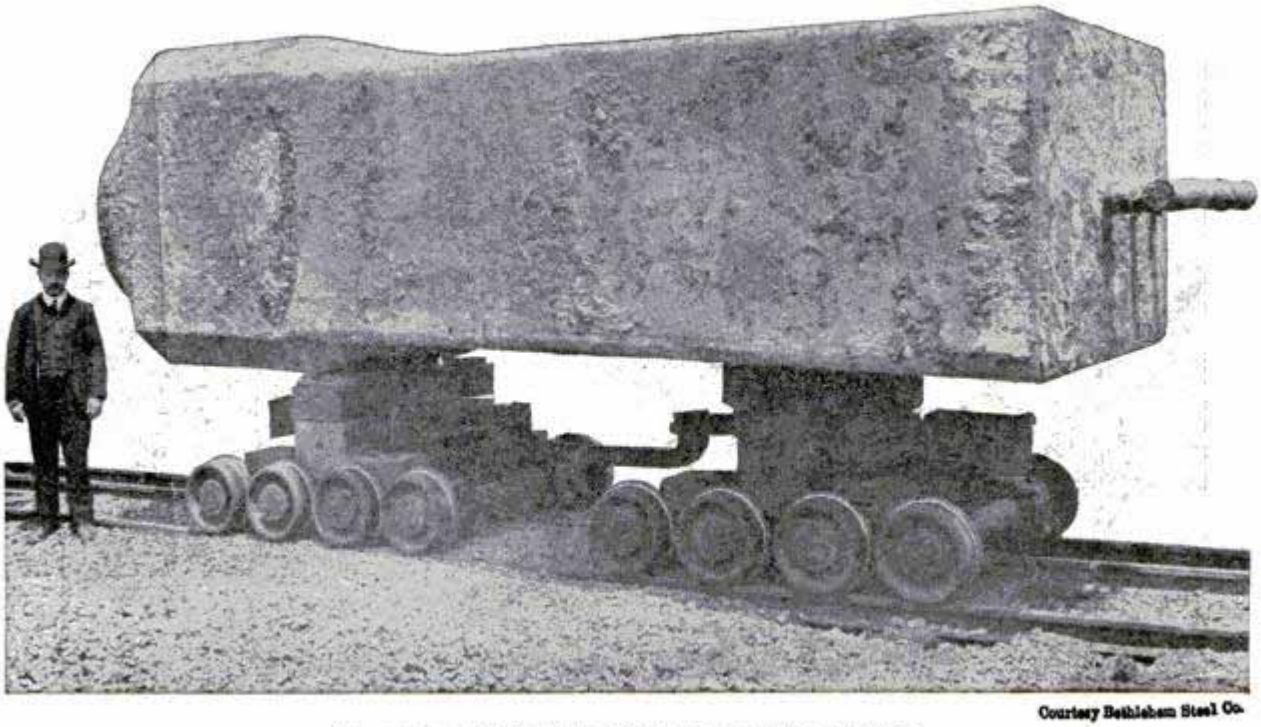
TELEPHONES FOR LOST ALPINE TRAVELERS

On various parts of the famous St. Bernard Pass in the Alps the monks have erected huts for the benefit of lost travelers. Each hut is numbered and connected with the hospice by telephone. The lost traveler telephones to the monastery the number of the hut he has reached. The number is repeated to one of the trained dogs kept at the monastery and the dog immediately sets forth for the hut.

CRANKSHAFT INGOT WEIGHED 126 TONS

A single ingot of open-hearth steel, weighing 126 tons, was used to form the big crankshaft for one of the engines of a California gas engine electric station installation. The crankshaft is a ninety-degree double-throw, 38 in. in diameter, and will support a fly-wheel weighing 130,000-lb.

The engines of the installation will be the largest ever built. Each will indicate 5,333 hp., the capacity required to drive a 4,000 kilowatt generator with which they will be direct connected. The nearest approach to these engines are two at Hastings, Va., each of 4,500 horsepower capacity.

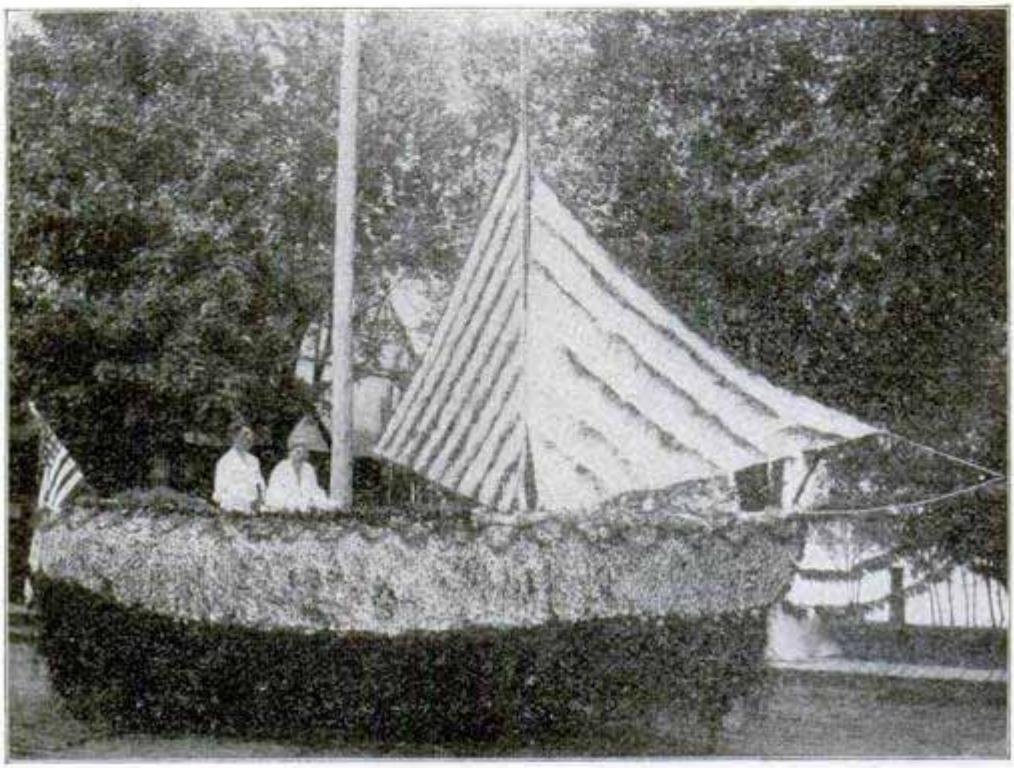


Courtesy Bethlehem Steel Co.

Open Hearth Steel Ingot Weighing 300,700 Lbs.

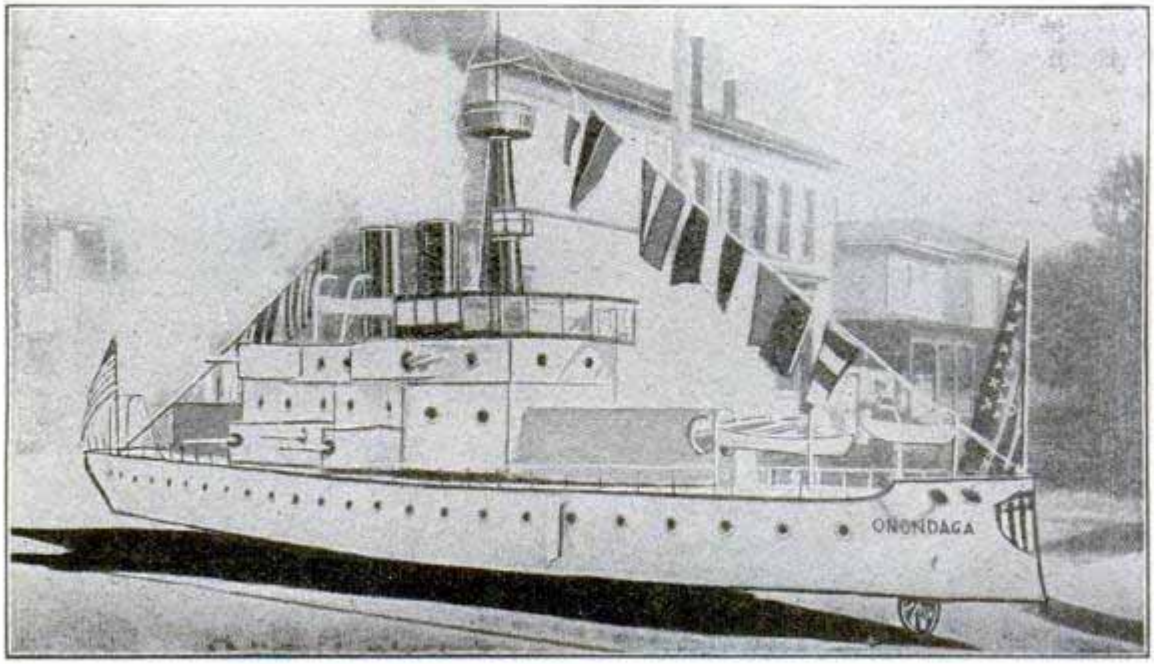
PRIZE AUTOMOBILE DECORATION

In a floral parade at Oconomowoc, Wis., recently, in which there were forty-five entries the prize was given the owner of the automobile shown in the illustration. The motor wagon was given the form of a sail boat. The Florist's Review says: "Thousands of Shasta daisies and pansies were used with trimmings of asparagus."



Prize Automobile Decoration

Still more effective was the float which took the prize in a parade at Syracuse, N. Y. A miniature battleship, well proportioned and faithful in its details even to the small boats, presented a very realistic appearance. In order to support the bow and stern a single wheel was placed under each end; the forward wheel being steered from



Prize Battleship Float

the cabin. As the ship moved along the street with smoke pouring from its stacks, it presented a very business-like appearance.

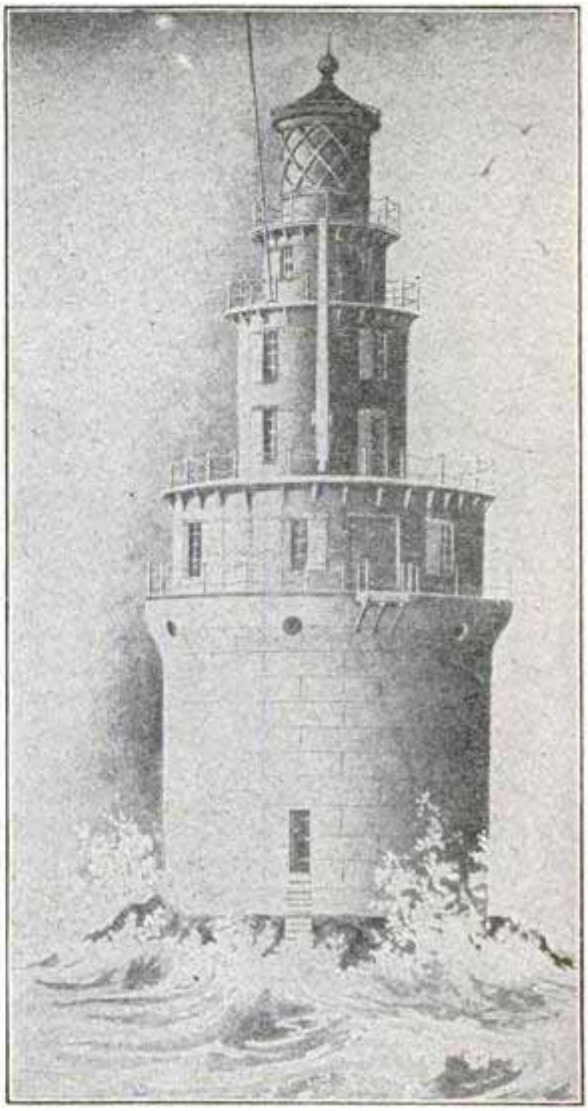
LIGHT STATION CONSTRUCTED ON TERRIBLE "MILE ROCK"

One of the most difficult and dangerous engineering feats recorded in lighthouse construction has been the erection of the new light station on the famous "Mile Rock," located just outside of the Golden Gate—San Francisco Harbor. This station has just been finished, after more than a year's work, at a cost to the government of more than $100,000.

For the past half century, Mile Rock has been a standing menace to all vessels entering, or departing from, the Bay of San Francisco. The rock stands three-eighths of a mile off the southern shore of the entrance, and just one mile eastward from a line drawn from North Head across to the Cliff House beach. As the rock was too large to blow up, the government finally determined to beacon it. The very liberal appropriation of $100,000 was made in view of the fact that the difficulties of building this particular station were great, and the perils extreme.

At mean tide the sharp and ragged rock jutted only 16 ft. above the surface of the heaving waters. At very high tide the points were entirely submerged. It was a mere rocky pivot exposed to the full force and fury of open sea, winds, and sweeping tidal currents. Only 1,000 sq. ft. could be found on the rock after the rough edges were leveled off—around the ragged sides; and for the foundation but 704 sq. ft. were secured for the base.

Over and around these ragged pinnacles was constructed a huge steel cylinder 42 ft. high, elliptical in shape, 40 ft. long, and 25 ft. wide in the broadest place. This great cylinder-base was composed of steel plates 2 ft. and 10 in. wide, and ¾ in. thick, very strongly riveted together—boiler fashion. All the inside space was filled with concrete—nearly of pure cement. The point and sides of the rock jutted upward, and, uniting with the hardened cement, formed so many powerful and massive braces to hold the cylinder foundation impregnably firm against the fury of gales and seas. Over 1,200 barrels of cement were required to form the



The Beacon on Mile Rock

foundation, and 60 tons of steel plates were used. Above the foundation was erected the main tower—rising 50 ft., and requiring 92 tons additional steel. The total height of the station above mean sea level is 92 ft.

All the work was done by sailors under the personal supervision of an engineer; for so great and constant were the perils of operating on the wave-swept rock that no regular landsmen could be found hardy enough to undertake the task. The materials were all carried out on a little steam tender, and landed amid the greatest difficulties and dangers. Necessarily, the work progressed very tardily. It is a remarkable fact that no lives were lost, and no serious accidents occurred during the building of this navigation beacon. For many years the beaconing of this rocky pinnacle was deemed impossible, even by engineers. Its accomplishment must be recorded as a

wonderful piece of marine engineering. It is an ocean monument to those who planned and were courageous enough to carry the work forward to completion.

The top of the tower is surmounted by a third-order light. In the base the storage of provisions and fresh water are provided for. The fog signal machinery occupies the first story of the steel tower; the second is used by the keepers as a kitchen; the living and sleeping apartments are in the third story, and the fourth is the watch room. Surmounting the tower is the lens lantern, 12 ft. high and 10 ft. in diameter. The stories are graduated from 11 ft. 6 in. to 7 ft. 10 in. in height. The entrance to the lighthouse is through a door 10 ft. above the rock. Landing steps lead down into the water. Winding steps of cement lead up to the storeroom. The fog horn is operated by means of compressed air obtained by a 20-hp. oil engine operating the air compressors.

This machinery, together with an engine for operating the derrick, which is used to hoist supplies landed at the station, is packed within the lower story of the steel superstructure. Communication with the shore is maintained by means of a cable so that the keepers can be in constant touch by telephone with their superiors.

Engineers claim that the foundation can successfully defy the combined forces of seas, winds and tides. Some four years ago the large steamship "Rio de Janeiro," coming from the Orient with 200 passengers and a very valuable cargo, attempted to enter the harbor during a dark and foggy night. The vessel ran on a rock, and inside of 40 minutes went down. More than two-thirds of the passengers were lost, and the vessel also. There is every reason to believe that the ill-fated steamer struck on Mile Rock.

WHY POPCORN POPS

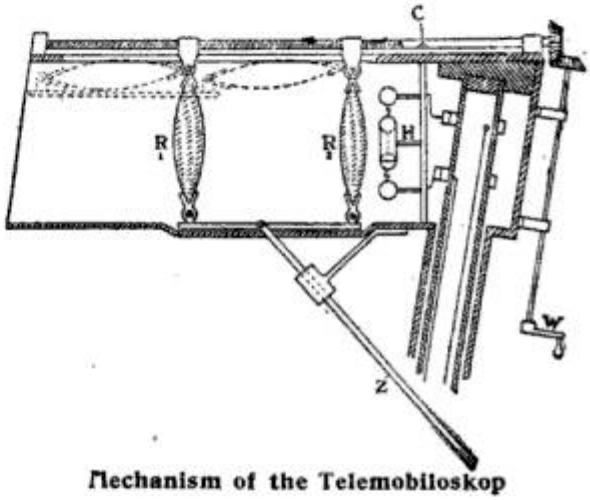
Volatilization of the oil contained in the kernel, upon being heated, is given by the Department of Agriculture as the reason why popcorn pops. Popcorn differs from field corn in that it has a larger proportion of corneous element and a greater per cent of oil. The outer portion of the kernel of field corn is more porous than it is in popcorn, also, and the oil escapes as it volatilizes. The great pressure exerted by the volatilized oil in popcorn causes a sudden explosion and the kernel turns wrong side out.

THE TELEMOBILOSKOP

Locates Vessels in Foggy Weather, Reducing Danger of Collision.

The telemobiloskop is a new nautical instrument which enables the pilot of one vessel to locate the nearness of another vessel in a fog, even though no signals are given. The instrument is operated by electricity, which all large ships now have means of producing, and sends out sparks which form electrical waves. The electrical waves travel along the surface of the ocean until they strike a metal part of another ship, whence they are reflected back to their source, and are caught by a receiver, similar to those used in wireless telegraphy operation.

The illustration shows the mechanism of the apparatus. Axle C is the carrier which is adjusted so that it always remains in the



Mechanism of the Telemobiloskop

same vertical position. A large projecting box, moved by a machine, turns around this axle. The box stands on a high elevation, the mast perhaps, and slants toward the water. The inductorium of the sparks is at H. Two lenses, R, inside the box shape the electrical waves into a cylindrical body so that they travel compactly.

The receiver is placed over the box and is separated from it by a metal plate so that it can take only returning waves. The exact distance to another vessel is ascertained by turning lenses R by means of handles W and Z so as to get the strongest reflection from metal parts of the other vessel, which the loudness of the indicator marks out.

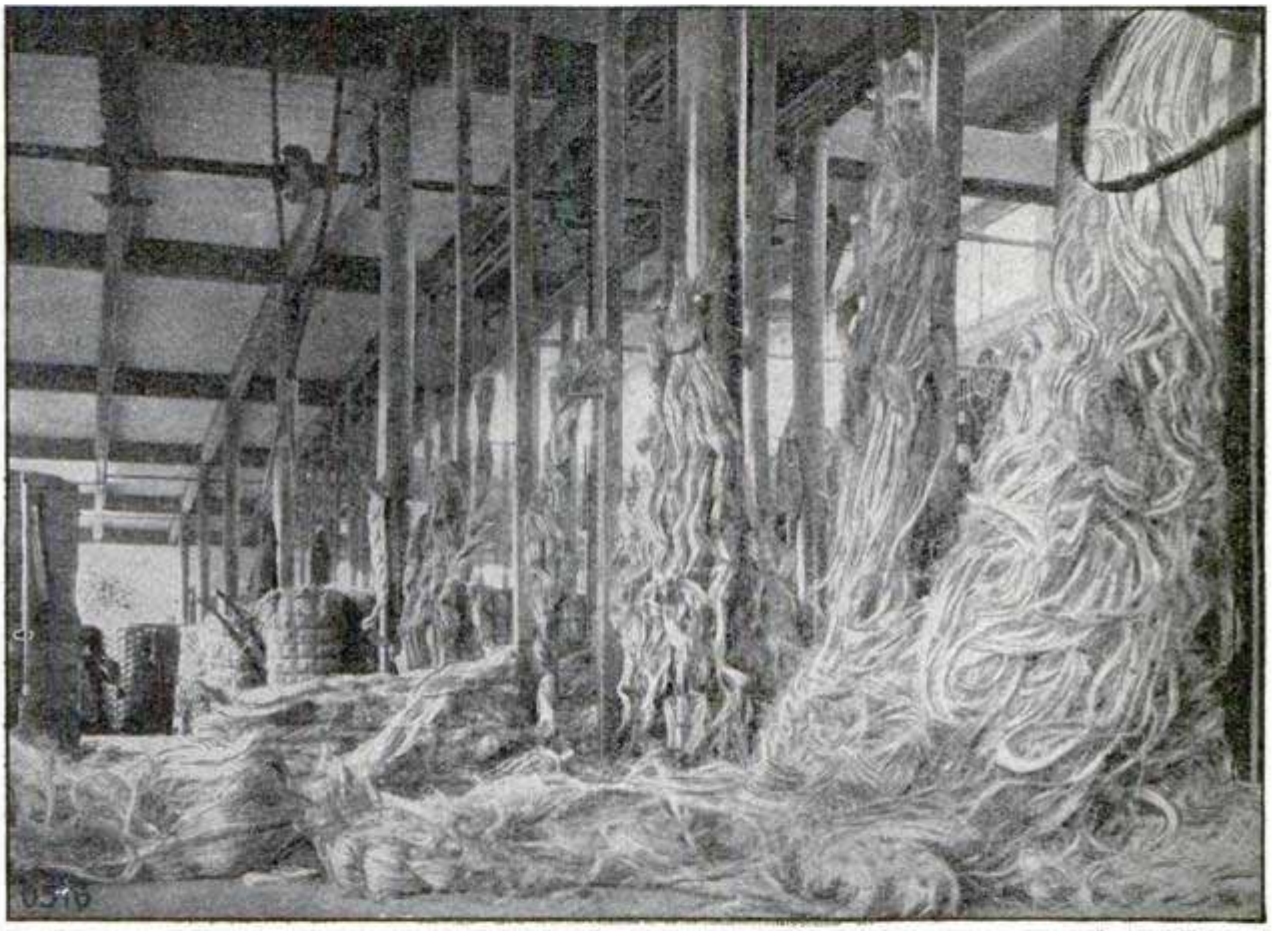
Oregon fir is destined to supplant Norway pine as a durable building material. Government tests have lately established its superiority.

HOW MANILA ROPE IS MADE

Pound for Pound as Strong as Steel--Old Method of Manufacture -- Putting in Couplings--Table of Technical Terms

No longer ago than 1881 it was stated as a notable fact that at the government rope walk at Boston ropes 170 fathoms (1,020 feet) long could be turned out. The primitive method of rope manufacture that had been in use for 3,500 years was still employed there. While other industries were being developed by the introduction of machinery and the application of power the manufacture of rope remained a hand process. The rope walk at these plants consisted of an enclosure often more than 1,000 feet long; the machinery was a wheel with a series of hooks on it placed at one end of the walk. The workman wrapped a bunch of the hemp fibre around his waist, attached some of the fibres to the hooks and while an assistant turned the wheel, he walked slowly backward, drawing out the proper number of fibres with one hand, compressing them with the other, twisting them into yarn as he went. The yarn thus spun was twisted into strands and the strands into rope, horsepower being employed in the last operation.

It was when one of the first Atlantic cables broke in mid-ocean and a rope 2,000 fathoms (12,000 feet) long was required for grappling that the possibilities of machinery in this connection were first exploited.



Courtesy C. W. Hunt Co.

Opening Bales of Manila Fibre

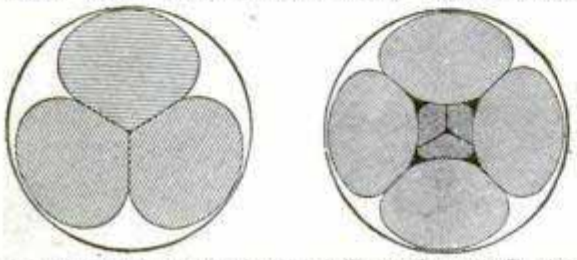
Up to this time the longest rope manufactured was less than 200 fathoms long. Then John Good, a young workman in a rope walk, offered to build machinery from his own designs and with it turn out a rope of sufficient length for the purpose. The bold enterprise was carried out successfully, but it was not until 20 years later that the use of machinery became general and to this day a cordage works is called a "rope walk."

In the modern manufacture of rope the bales of hemp (manila hemp being the strongest material used for rope) are opened and the fibre shaken apart lightly and

placed in layers which are sprinkled lightly with kerosene oil. Animal oil would effect spontaneous combustion, but kerosene oil does not heat the fibre. The bales of hemp weigh about 270 lb. and hanks of fibre 10 ft. 7 in. long have been received, though the ordinary run is less than 8 ft.

The hemp is first passed over revolving cylinders having sharp steel teeth. This process is called "scutching" and its purpose is to straighten the hemp and remove the coir, dirt or foreign matter of any nature. It is then combed into a continuous ribbon or sliver by passing through breakers, after which it goes through spreading and drawing machines and comes out straight, even and ready to be wound on spindles and be spun.

The spinning machine operates two spindles which move at 1,500 revolutions per minute and twists the fibre right-handed



Cross Section of Three and Four-Strand Ropes

into yarn. The yarn is about ⅛ in. in diameter and from 20 to 80 yarns are twisted in the opposite direction or "left hand" to form a strand. This is done by a machine called a "former," which has a circular iron disk at the center of which is erected a perpendicular shaft with a "head" or die at its end. Several bobbins full of yarn, the number being determined by the size the strand is to be, are spaced around the edge of the disk and the free end of each yarn is carried to the die, where they are twisted left hand by the revolving of the disk. As fast as twisted the strand is wound off on a drum. Thus the length of the rope is not limited as in the old method. The strands, three or four, are twisted in the same way into rope, only in the opposite direction or right hand.

The process may be thus briefly described, but in the actual manufacture, a deal of expert knowledge is involved. There is a wide difference in the qualities of manila fibre and the material must be selected for the use to which the rope is to be put. Then there is the question of internal wear, easily illustrated by untwisting an old rope and noting the powdered fibre that drops out. Manufacturers use different means of preventing this. One firm lubricates the fibres with plumbago mixed with sufficient tallow to hold it in position. The tallow makes the rope partly water-proof and the lubricant fills up the hollows and uneven places until all the threads are lubricated. Then again the question of strains caused by twisting fibres, yarn and strands always in opposite direction to the preceding twist must be considered as the strains must be carefully balanced. A four-strand rope is more durable than a three-strand as it comes nearer forming a circle. A table of terms relating to cordage is given below:

TECHNICAL WORDS RELATING TO CORDAGE.

YARN.	Fibres twisted together.
MARLINE.	Two yarns twisted together.
THREAD.	Two or more small yarns twisted together.
STRING.	The same as a thread but made of slightly larger yarns.
STRAND.	Three or more large yarns twisted together.
CORD.	Several threads twisted together.
ROPE.	Several strands twisted together.
HAWSER.	A large three-strand rope.
CABLE.	Three hawsers twisted left-handed together.
SHROUD-LAID.	A rope of four strands with a heart.
HAUL.	To pull on a rope.
TAUT.	Drawn tight or strained.
BIGHT.	A loop in the rope.
FALL.	The rope in a hoisting tackle.
KNOT.	A loop or fastening with a rope.
HITCH.	Attaching a rope to an object.
BEND.	Attaching two ropes together or to an object.
TACKLE.	An assemblage of ropes and blocks.
	A rope is:
LAID.	By twisting strands together in making a rope.
SPLICED.	By joining to another rope by interweaving the strands.
WHIPPED.	By winding yarn or small stuff around the end.
SERVED.	When wound continuously with yarn or small stuff.
PARCELED.	By wrapping it with canvas.
SEIZED.	By binding two parts together by a yarn or small stuff.
PAYED.	When painted, tarred, or greased, to resist wet.

The transmission of power by manila ropes has within recent years been demonstrated practical. It has been found that the rope is capable of transmitting large amounts of power, will run in any direction, is smooth and quiet running, there is absence of electrical disturbance, its use is economical in first cost and in maintenance and accurate alignment of sheaves is unnecessary. The coupling system of mounting ropes on pulleys is considered better than the band or tension pulley systems though the first cost of couplings is high. Figs. 1, 2, 3, 4 show how ropes are spliced, and Figs. 5 and 6 show the method of splicing in a coupling.

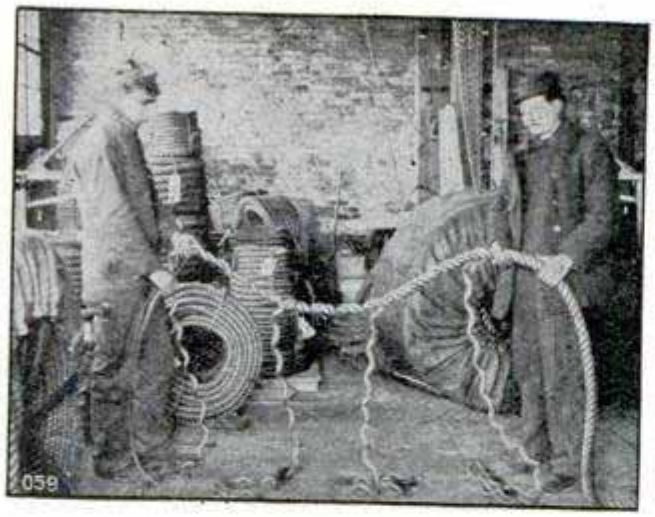


Fig. 1. Unlaying the Strands

Fig. 2. Butting the Ropes Together

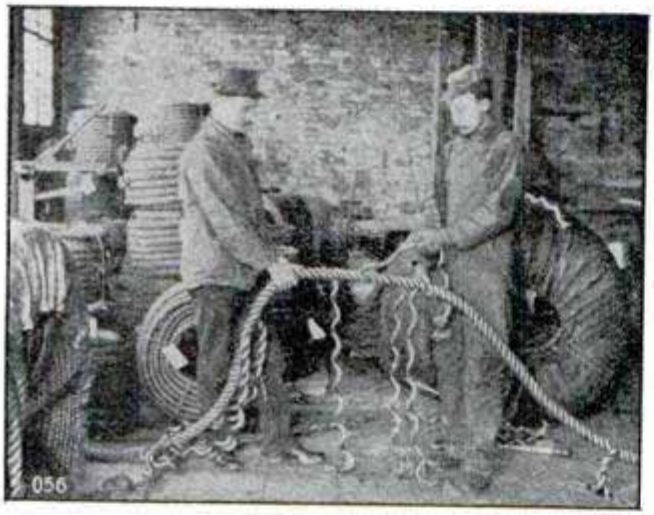


Fig. 3. Laying the Strands in Position

Fig. 4. Tucking in the Ends

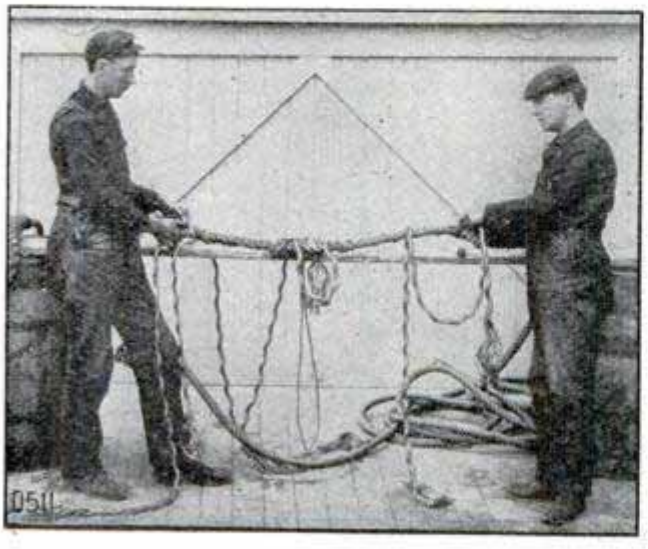
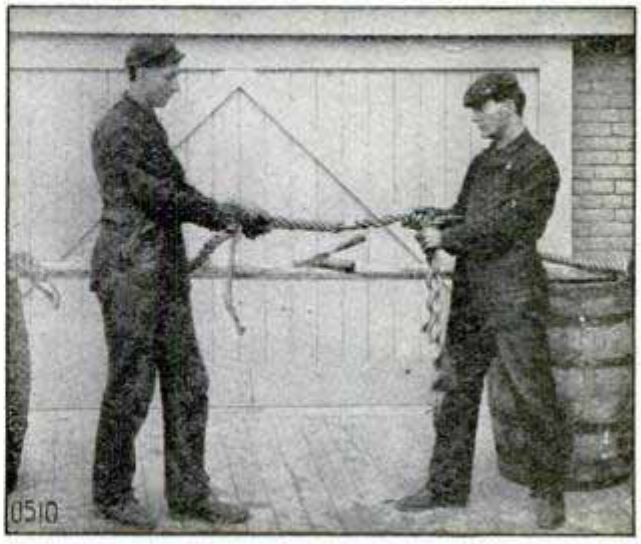


Fig. 5.

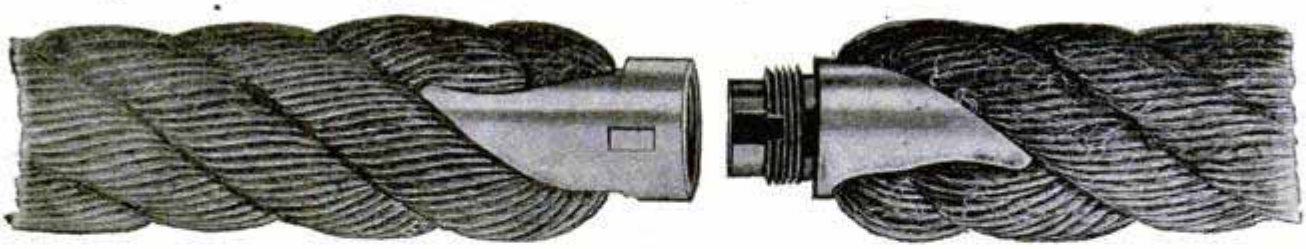


Courtesy C. W. Hunt Co.

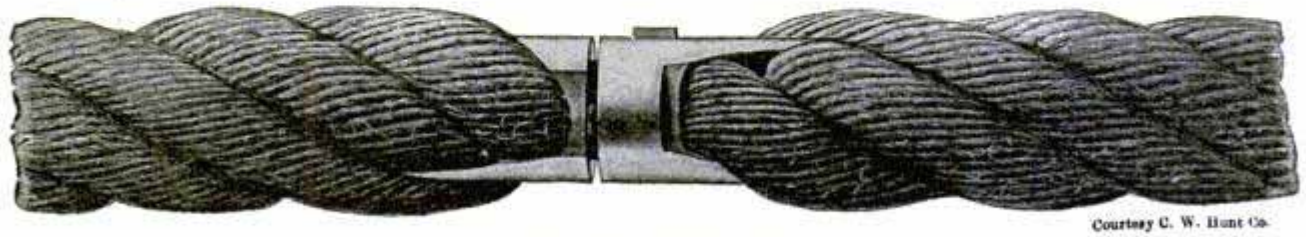
Fig. 6.

Splicing in a Coupling

Manila rope, pound for pound, is as strong as steel. A bar of rolled steel 1 in. square and 1 ft. long weighs 3.33 lb. and has a breaking strength of 64,000 lb. A 1-in. manila rope weighs 0.34 lb. per lineal foot and has a breaking strength of 7,160 lb. Deduced from this, the strength of a rope equal in weight to the bar of steel 1 in. square is (7100x3.33)-:-0.34=69,000 lb. Comparing rope with leather belting, it is found that a manila rope 1 in. in diameter is equal in driving power to a double leather belt 2⅝ in. wide, each running at the same speed.



Coupling Spliced in the Rope Ready to be Put on the Drive



Courtesy C. W. Hunt Co.

Coupling Ready for Use

A knot and a splice in rope are always its weak points and in all installations where rope plays an important part these points should be in the hands of one who understands the matter thoroughly.

USE OF ACETYLENE IN FRANCE

14,500 Tons of Carbide Used in One Year

The use of acetylene in France is decidedly on the increase. There are now 40,000 installations for various purposes in use in that country and 112 towns, having a population up to 5,000, where it is used for municipal lighting.

"In the six years from 1896 to 1902," says Engineering (London), "there were no less than 2,350 patents dealing with the production and utilization of acetylene granted in France." The government places installations of this kind, where the capacity of the gasometer does not exceed 35.3 cubic feet, in the third class of risks, and the rather stringent laws in regard to them are not strictly enforced, as there have been so few accidents from them. Insurance companies charge no extra premium because acetylene is used, provided that the gas producers and the store of carbide are placed outside the insured buildings. Where they are placed inside, a carefully ventilated room is fitted up for the purpose and the carbide must be kept in a metallic chest in a dry place. Insurance premiums are much higher in these instances, consequently the latter arrangement is not often employed

In the towns where acetylene is used for lighting, the pipes are mostly of lead, diminishing in diameter from 3.14 inches at the gas generator by stages to 0.51 inch at private dwellings and street lights. Street lamps usually contain but one burner. They are very troublesome to clean and recharge. Gas is sold to a municipality at 57 cents per 1,000 cubic feet and to private consumers at 67 cents per 1,000 cubic feet.

The consumption of carbide in France for 1902-3 was 14,500 tons. Figures for a later period could not be obtained. Aside from lighting purposes, acetylene is being used for miners' lamps, oxi-acetylenic blowpipes yielding a temperature of about 5,432 degrees Fahr., soldering irons of many varieties, several types of stoves and other appliances.

In Germany the increase in acetylene installations is even more marked. The price to consumers is less than in France, and where it is installed two houses out of every eleven take the gas, and each house piped averages 8½ burners. There are about 8,000 installations of all capacities in active operation in Germany at the present time.

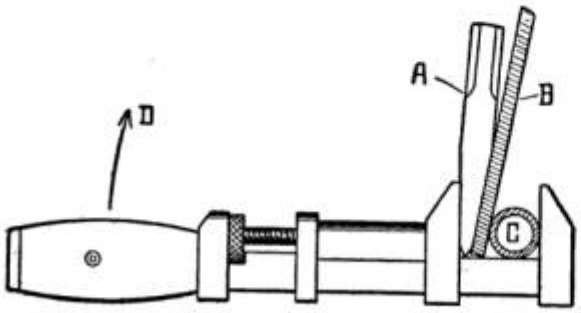
All the articles appearing in this department are reprinted in book form at the end of each year.

SHOP NOTES

Contributions to this department are invited. If you have worked out a good idea or know of one, please send it in.

SUBSTITUTE FOR PIPE WRENCH

The hot water front was to be removed from my stove, but I had no pipe wrench. I had a 12-in. monkey wrench, a cold chisel



Substitute for Pipe Wrench

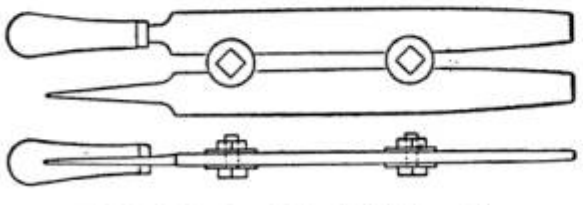
and a flat file, however, and the sketch shows how the job was done. A indicates the chisel, B the flat file, C the pipe and D shows the direction of pull. It took all the power I could exert on the wrench to start the pipes, but it did the work.—Contributed by W. L. Dines, Jr., 74 Mason street, Worcester, Mass.

TO TEST TURPENTINE

To test the purity of turpentine drop a small quantity on a piece of white paper and expose to the air. No trace will be left if the turpentine is pure; but if it contains oil or other foreign matter, the paper will be greasy.

SUBSTITUTE FOR AN OFFSET FILE HANDLE

Take two files and bolt them together, one on top of the other with suitable small bolts. Two ¼-in. or ⅜-in. bolts with nuts



Substitute for Offset File Handle

and two washers each will do nicely. This makes a simple and convenient substitute for an offset file handle.—Contributed by M. M. Frickling, Southern Railway Shops, Columbia, S. C.

HOME-MADE STEAM WHISTLE

This whistle may be made from whatever materials one may have on hand and so the dimensions may vary with the requirements.

Take a piece of pipe, say, ¾ in. for the whistle stem and 3½-in. pipe for the bell and base. Put a thread on the stem long enough to reach through the whistle base and make connection. Mark the stem flush with the top of the whistle base and cut a thread on

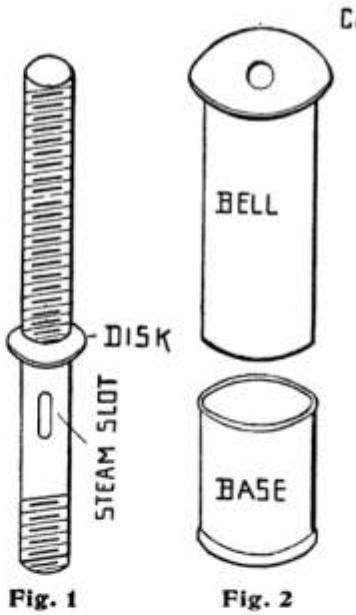


Fig. 1

Fig. 2

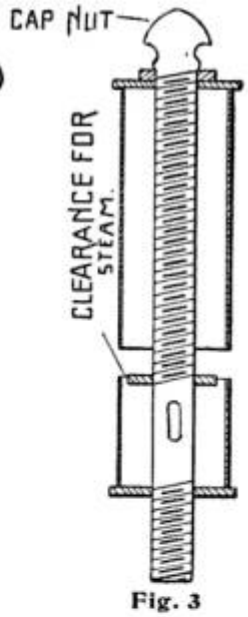


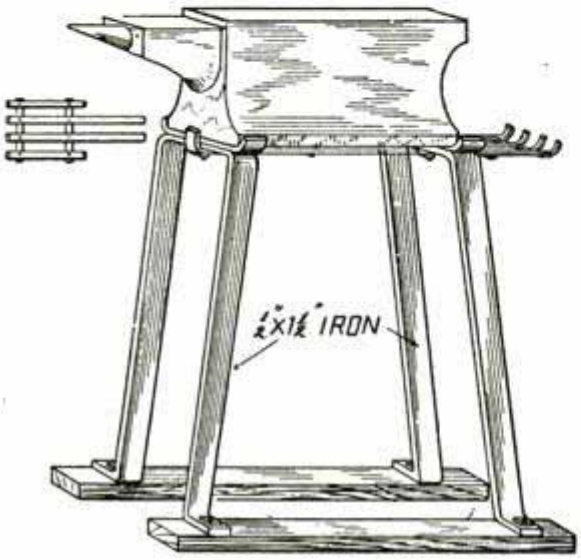
Fig. 3

that end all the way down to the mark, in order to get the disk down just flush with the top of the base, and leave a clearance of about 1/32 in. between the walls of the whistle base and the disk. Cut holes in this stem just below the disk for steam. Now screw on the bell, which should be tapped the same size as the stem, until it comes over the opening in the base. Then screw on a cap nut and you have a pretty good whistle.—Contributed by L. C. Haskine, 366 6th street, Laramie City, Wyoming.

IMPROVED HOME-MADE ANVIL BLOCK

The anvil block shown in the sketch is made of 1½x½-in. iron, which is about ordinary wagon tire—something that most blacksmiths have on hand. The feet are bolted to 2x4's, which may be nailed or otherwise fastened to the floor.

The advantage of using such a block is



Home-Made Anvil Block.

that it is not in the way when bending a long piece of iron. With a wooden block one cannot make a square bend in a piece of iron that comes down over the block, unless the block is small, and especially one cannot make the bend over the center of the anvil. With the iron block the work comes between the legs of the block.

The shelves on the block can be removed when in the way and are handy for holding tools. Underneath the anvil there is room for scraps of iron and tools that are used very often. A sledge may be used on the anvil without affecting the block.—Contributed by B. W. Woldridge, Hickory, Mo.

HOW TO DEMAGNETIZE A SAW

One of our readers asks how to demagnetize a saw. He laid a saw on the floor of an electric car and next day when filing the saw, found that it was so highly magnetized that he was obliged to brush the filings off constantly.

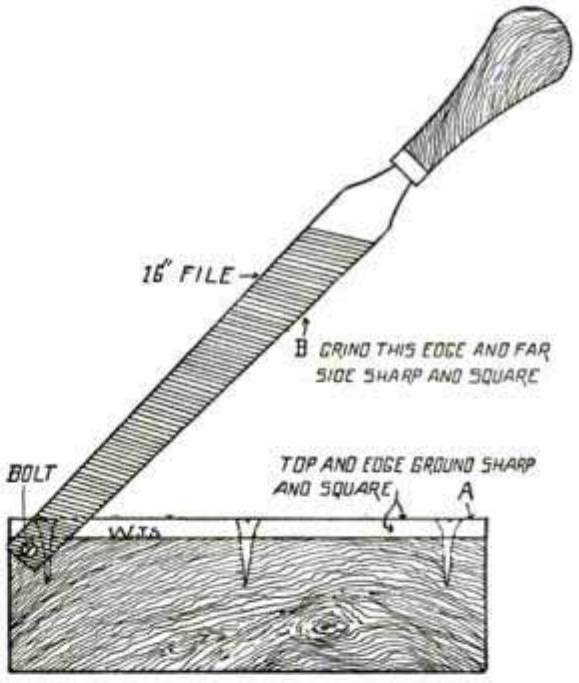
One way is to let the saw fall a few times on the floor. If this does not work, try the following plan: Attach a string to the saw and twist the string. Hold the saw over the place where it was magnetized while the electric car is in motion, or over any other dynamo. Then walk slowly away from the field of the dynamo or motor (which is sometimes a distance of six or ten feet), allowing the string to untwist and rotating the saw.

CHEAP SHEARS FOR CUTTING TIN

The materials required for this device are two old 16-in. files, a small bolt, a block of wood and a couple of screws.

Cut one of the files to the length you wish the knife (A in the sketch) to be and grind one side and one edge sharp and square. Drill holes in the top for fastening the knife to the block of wood, using the screws.

Grind the top and an edge of the other file (B) sharp and square. Drill a hole in the end of the file and one in the end of the block and mount the file with a bolt. These



Shears for Cutting Sheet Metal

shears are handy for cutting tin, sheet iron, etc.—Contributed by W. J. Slattery, Emsworth, Pa.

CAPACITY OF A HOPPER

Multiply, in inches, the length by the breadth and multiply this product by one-third the depth. Divide by 2,150.4 and the answer will be the number of bushels the hopper will hold.

TROUBLE ALARM FOR GAS LIGHTING SYSTEM

In response to the request in our July issue for a trouble alarm plan for a gas lighting system a number of our readers have favored us with replies and diagrams.

Figure 1 is submitted by Geo. W. Bentley, Chicago, and shows the right wiring for Mr. Williams's system as it now stands.

Figure 2 is a system of wiring recommended by W. J. Slattery, of Emsworth, Pa.

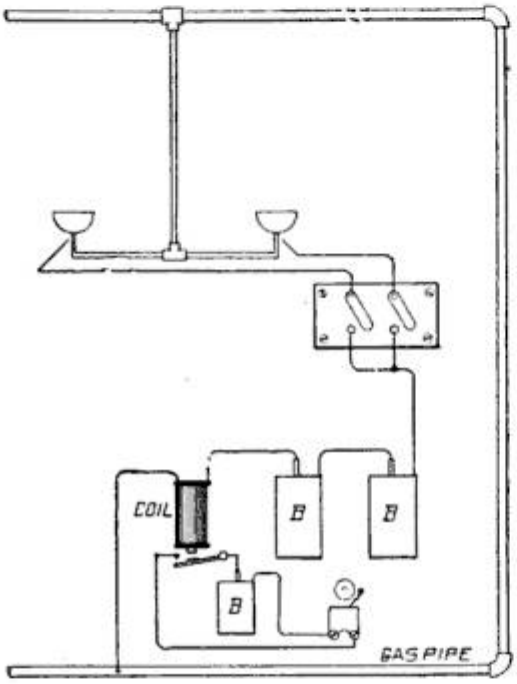


Fig. 1

A is the spark coil; B is a soft iron armature suspended in front of the coil about ¼ in. from the iron core of the spark coil; C is a regulating screw and binding post, such as is used to regulate induction coils. In case of ground the soft iron armature and the soft iron core of the spark coil will contact, closing the circuit at D and ringing the alarm. Harry W. Krug sent in a plan essentially the same as Fig. 2, and says:

"The bell will ring for a second every time the gas is lighted or extinguished. If the same battery is used for the five lights it is best to use marked or tagged wires so that a ground can be located. Each wire should also be provided with a separate switch. When the bell begins to ring, open one switch after another. The one last opened before the bell ceases to ring is the grounded circuit."

Figure 3 is sent us by J. M. Berger, 717 9th street, N. W. Washington, D. C. A soft iron armature is pivoted on one end of the spark coil (see A in sketch) and one wire of the alarm circuit is connected with it. The other wire is connected at B. In case of a ground the core of the spark coil attracts the armature and closes the circuit at B. Mr. Berger says:

"It is a very good plan, when you are going to use a large number of burners in a house, to run a separate wire to the battery for the pendant circuits and also for the automatics. That is, make a separate circuit for each floor and a circuit for the automatics on each floor to the battery wherever it may be placed, then connect them to switches. This will be found a very good arrangement and costs but a trifle more. When a ground occurs with a system arranged in this manner it is only necessary to open the switches in succession until the circuit that is in trouble is reached. This switch should be left open and the fault traced while the rest of the lighting system is left in full working order."

The installation submitted by J. H. Eddleman, Philadelphia, Pa., corrects the faults in Mr. Williams' system. He says: "Mr. Williams has his spark going through his bell. If he will ground wire A with gas pipe and connect wire B with wire between sparking coils and batteries his bell will give an alarm whenever there is a short circuit or ground any place along his system. I use six wet batteries." The arrangement is shown at Fig. 4.

In a diagram submitted by A. M. Larson, Minneapolis, Minn., the wiring of the lighting circuits remain the same as in Mr. Williams' plan. At A, Fig. 5, however, an arma-

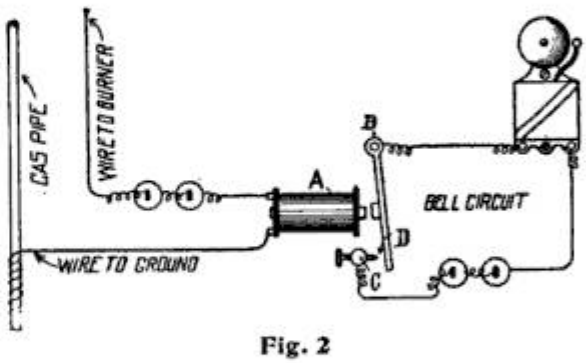


Fig. 2

ture lever, kept away from the end of the spark coil by means of a small spring of sufficient strength, is introduced. This lever is connected to one terminal of an independent bell circuit, the other terminal is

connected to a small metal point to the right of the lever. When a switch is closed, completing one of the lighting circuits, the gas is turned on and lighted, and in the meantime the current passing through the coil has made a strong magnet of the core, which, acting upon the lever, draws it until it touches the metal tip, thus completing

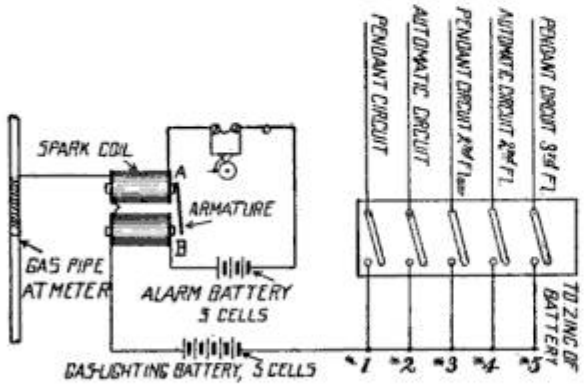


Fig. 3

the outside bell circuit. As the lighting switch is usually operated by making two or three quick connections, if the system is working properly, each switch, when thus operated, will cause the bell to make these same short rings. A short circuit would cause continuous ringing. A break in the line would be indicated by no action in the bell whatever. With this plan the electric door bell of the house could be used as the alarm, or, if desired, a cut out switch could be introduced and use it merely as a test, whenever desired.

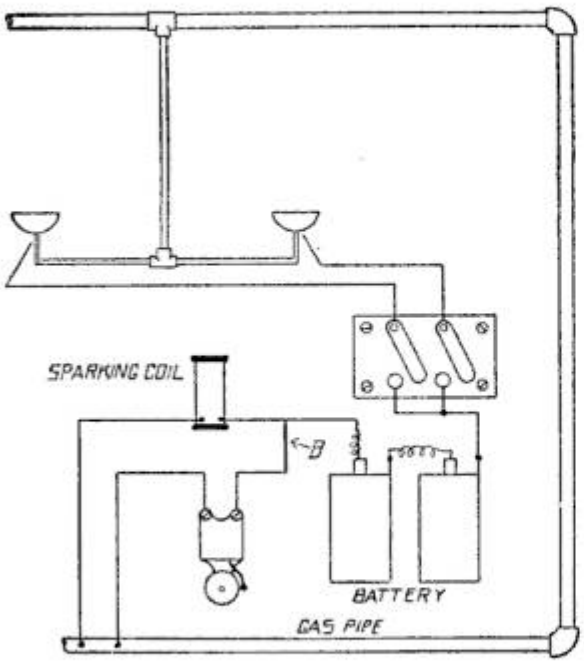


Fig. 4

Figure 6 shows plan of wiring as suggested by Geo. S. Barnet, Chicago, the principle being the same as in Fig. 5. Mr. Barnet suggests putting the bell in the basement, or other out-of-the-way place, as it taps every time the gas is lighted.

"Providing the resistance in the sparking coil is greater than the resistance of the bell, there is no excuse for Mr. Williams' system failing to work," writes D. D. Morin, Chicago. "If the resistance of the coil is lower than that of the bell, it can easily be seen that the greater part of the current will flow through the coil and to the ground, thus leaving very little, if any, to pass through the bell.

"The reason the alarm failed to work after a time, must have been that the batteries had become exhausted by ringing for some time without his knowledge. I would suggest that he put a two-point switch between the coil and line that comes from the lighter, so as to cut out the coil entirely, thus giving the bell the full benefit of the current. Of course, the switch must be put on the coil before he attempts to light the gas. Referring to Fig. 7, when the switch is on at A, the coil is in position to be used; when on at B, the alarm bell is in position. If the switch plan is not convenient, he might replace the bell with a 'drop,' so that when the lighter becomes grounded or short circuited, the 'drop' will fall and thus close a local circuit having a closed circuit battery in it, so the bell can ring for some time without injuring itself or the other circuit. Referring to Fig. 8, switch No. 1, when on C, is used on the coil; when on D, is used to throw the drop. Switch No. 2 is used to stop the bell from ringing when the drop contacts at A."

W. S. Hodill, East Liverpool, Ohio, repeats D. D. Morin's statement in regard to resistance, and suggests merely adding another battery so that more current will pass by way of the bell.

L. J. Voorhees, Sayre, Pa., says it is uneconomical to divide the current in this way, and recommends putting in a switch as shown in Fig. 9. In this plan when there is a short circuit in the line A, B or main circuit for lights, it magnetizes the core of coil C, causing the steel spring D to come in contact with point E, causing a circuit through battery and bell without interfering with the main circuit in any way.

In Fig. 10 the connections of automatic

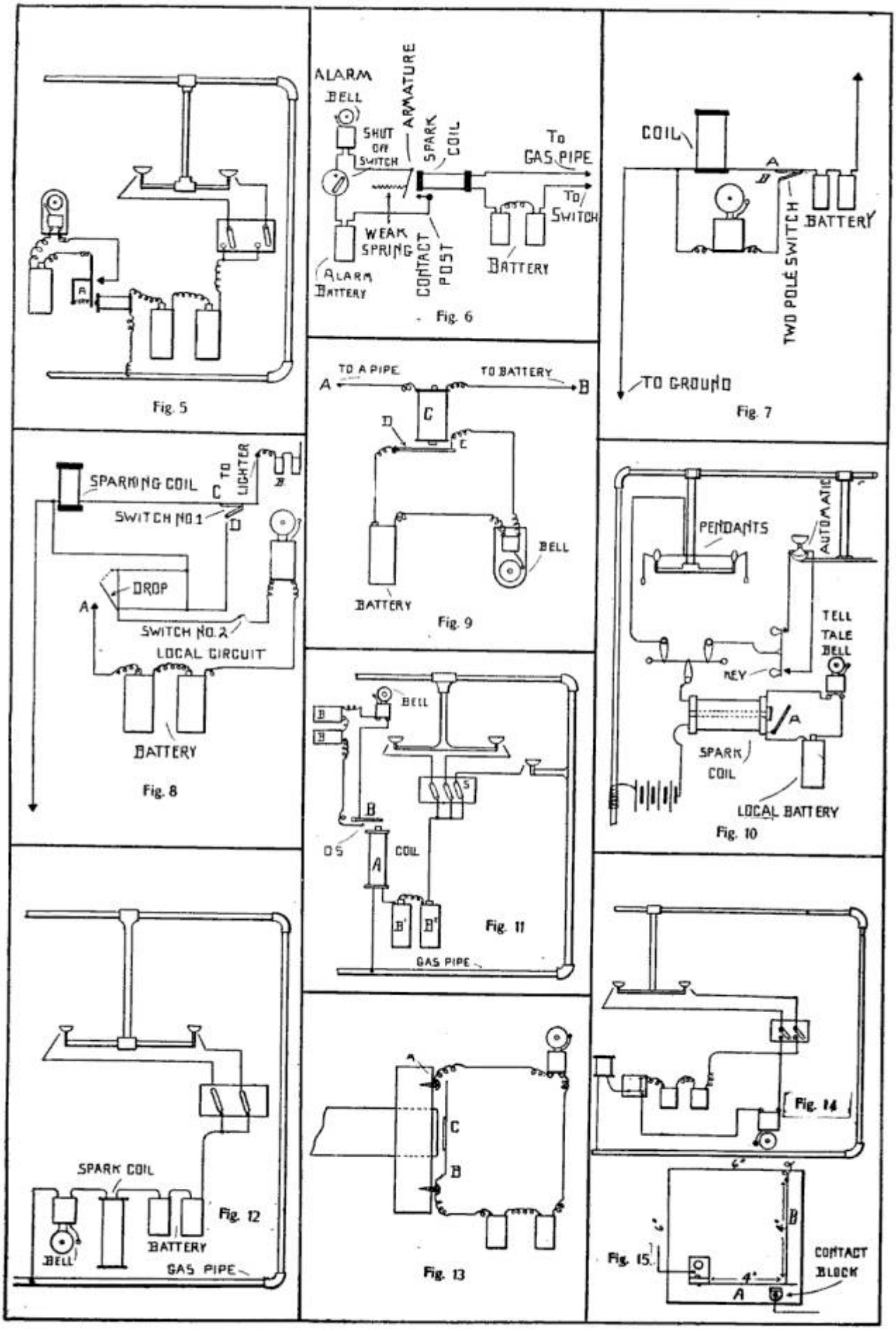


Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

and pendant burners, also the tell-tale bell on a separate circuit, is shown. The armature, A, is pivoted to the end of the spark coil and held a short distance away from the magnet core, either by means of a spring or by gravity, in such position as to be attracted by the magnet core when the circuit is closed, thus closing the local circuit. This will show a heavy ground or a short circuit, writes Wm. Lachman, Chicago, but a slight leakage, which is a drain on the life of the battery, must be found with the aid of a galvanometer or magneto.

In Fig. 11, plan submitted by Wm. T. Hall, Chicago, A represents a spark coil, with the end of one wire grounded to gas pipe, while the other end passes to terminal of battery cells, and thence to switches, S. A lead of wire is then run to each gas jet in service, and the gas can be lighted by operating pendant. For detecting ground and short circuits, B is a spring with a soft iron at one end and fastened at the other. O S is a second spring made fast at one end. The terminals of two cells of batteries with a bell in series is connected to the springs as shown in the diagram. When short circuits or grounds occur, the iron core of the spark coil will become magnetized, thereby attracting B, which, in turn, will contact with O S. This closes the circuit and causes the tell-tale bell to ring. Trouble can be located by opening switches.

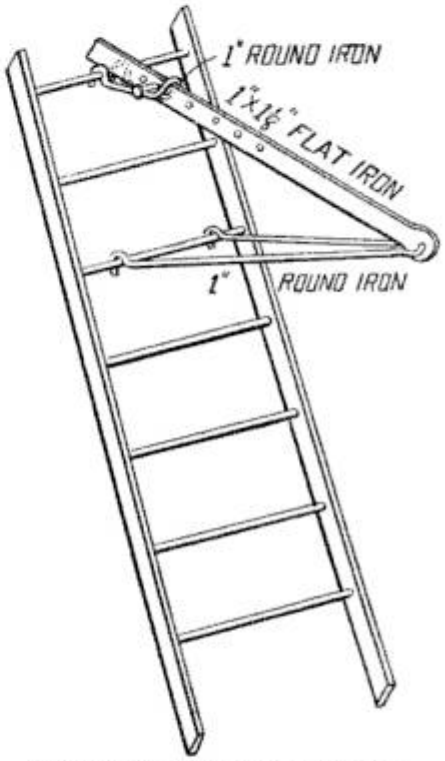
In Fig. 12 the bell is in series with the lighter spark coil and batteries. The plan is suggested by J. S. Gibbs, Dallas, Texas.

Henry H. Peebles, of Cleveland, Ohio, sends us Fig. 13, and says: "Make a relay on end of spark coil and connect in series with a bell and battery. Contact, in case of trouble on the line, will be at H. The spark coil to be connected up in the usual manner."

W. J. Barber, North Adams, Mass., comments on Mr. Williams' system as follows: "The alarm resistance wire should be of suitable size to operate upon the circuit in question. If of high resistance, or very long, or very fine wire, resistance wire should be fine also. In Fig. 15 the contact arrangement is shown. A is a spring tending to touch the contact block and B should be iron wire about 22 or 24 B. & S. gauge. (For wiring plan, see Fig. 14.) The idea is to let all the current that goes to lighter or burners traverse the spring and resistance wire, so that if it is on long enough to heat the same, it will expand and allow the spring to touch the contact of the bell circuit. The time element is governed by the size of the wire, longer wire being slower to respond. The alarm can be gauged to sound in from 10 seconds to two minutes after ground or short circuit.

SCAFFOLD BRACKET FOR A LADDER

A good scaffold bracket for a ladder is shown in the accompanying illustration. It is made of 1x⅛-in. flat iron and 1-in. round iron. The key-holes at A are for adjusting



Scaffold Bracket for a Ladder

the slant of the ladder. The bracket may be used on the inside of the ladder for low work, or on the outside for high work.—Contributed by G. B. Hiskey, Berlin, Nevada.

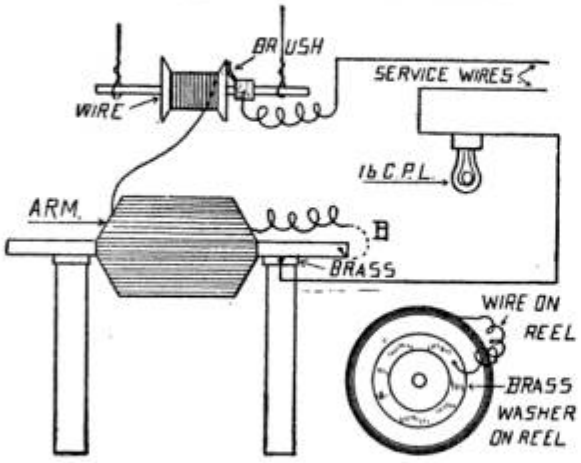
TO DRIVE FLIES FROM THE HOUSE

During the fall flies are often a greater nuisance than at any other time of the year. A good way to rid the house of them is to saturate small cloths with oil of sassafras and lay them in windows and doors. The flies will soon leave.—Contributed by B. F. Lamb, Minier, Ill.

The Department of Agriculture are experimenting with the cold storage preservation of seeds which, if kept in a warm place, are subject to attack from insects which hatch eggs among the seeds.

TO DETECT GROUNDS AND SHORTS

The outfit illustrated herewith is useful for detecting grounds and shorts in armature and field winding and saves the extra work of testing every now and then.



Ground Detecting Device

When there is a ground the 16 candle-power light is turned on. Shorts may be found by connecting wire B to the brass box as indicated by the dotted lines. If there is any amount of wire on the reel, the light will burn dimly and when a short is made in the winding the lamp will burn brighter.—Contributed by B. R. Van Valkenburg, 2212 E. Lake Ave., Seattle, Wash.

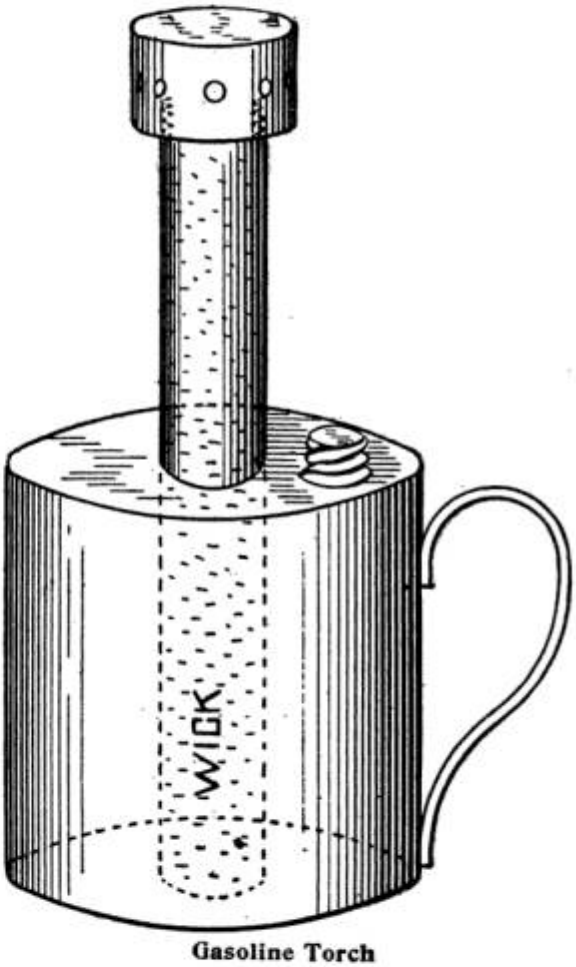
A METHOD OF CLEANING RUSTY PIPE

At the annual meeting of the Pacific Coast Gas Association, in San Francisco, in July, an interesting experience on the cleaning of rusty pipe was described. Some plain and steel tubing for use in high pressure lines came from the factory to the point of shipment on flat cars, and in consequence was badly rusted before it could be gotten under cover. Cleaning machines not being immediately available, a part was cleaned by hand and efficient tools proved a serious problem. Coarse and fine files were not much of a success, because they would not clean out pitted spots and irregularities in the surface of the pipe without removing valuable metal. Emery cloth and sandpaper did not last long enough to make a showing. Steel wire casting brushes proved quite efficient, coarse brushes being used to loosen the larger pieces of scale and rust and fine brushes to work into the pits and clean the dust off. Soft red brick, such as would be used only for filling, and furnace slag were found excellent, the fine particles working into the pitted spots and irregularities as they broke off. The dust left can best be removed by a fine wire brush, leaving the surface of the pipe clean and bright, ready for receiving the paint.

HOME-MADE GASOLINE TORCH

Procure an old tin can, pint size, with a screw top, for holding the gasoline. Punch a hole in the center of the top and insert a piece of ¼ in. gas pipe to within ⅛ in. of the bottom of the can, letting the pipe extend out of the can 4 or 5 in., soldering it in position. Screw a common cap on top of the pipe and drill eight or ten holes around the cap. Fill the pipe with wicking or asbestos.

When ready to light the burner, heat the can on the top and hot gas will flow from the holes. When lighted it will burn as steadily and brightly as gas light. This is a handy torch for use around the shop or outside, as it takes a very strong wind to blow it out.—Contributed by Thiede.

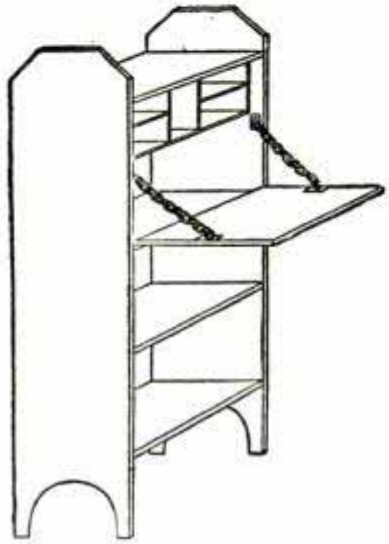


Gasoline Torch

HOW TO MAKE YOURSELF A DESK

In constructing this desk care must be taken in particular to always have the pieces of wood of exactly the right dimensions and cut with square angles. Further than this the work presents no difficulties to one of average ability. Oak is the most suitable wood for the purpose, though white wood makes a nice desk also, says the Engineering World.

Make the side pieces 50 in. long, 12 in.



Home-Made Desk

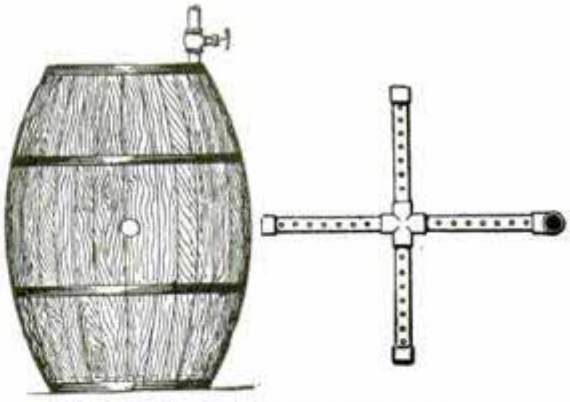
wide and ⅞ in. thick, with curved openings 6 in. high and 8 in. wide at the bottom. Send the sides to the mill to have the pieces cut out, sending a drawing showing what you want done, also. Make the bevel at the top 45° or 3 in. each way. Cut the four cross-pieces from ⅞-in. material 24½ in. long, two of them 12 in. wide for the top and bottom and two 11½ in. wide for the middle. In the top and bottom pieces cut ¾-in. rabbets on the back inner edge for the backing, which should be of ½ in. matched stock. Cut grooves ¼ in. deep in the side pieces to receive the cross-pieces. Place the top piece 5 in. from the top of the side pieces, the second cross-piece place 14⅛ in. lower, the third 12⅜ in. lower yet and the bottom piece 10 inches lower than the third piece and 8½ in. above the floor.

Make the partitions for the pigeon holes of ⅜-in. material 10 in. wide, two pieces being 23¼ in. long, two 9 in. long, two 6¾ in. long and two 6 in. long. Nail the two end pieces to the ends of the cross-pieces, then nail the two vertical pieces in place, first nailing to them the ends of the two short shelves. Nail the other ends of the short shelves through the end pieces. Attach this frame to the desk by screws put through from the inside. When the backing is on, further support the frame by a ½-in. square strip screwed to the backing. The backing should be in 36½-in. lengths and may be nailed on with small nails.

Make the drop-leaf from two pieces glued up, 24 in. long by 14⅛ in. wide. Fit a cleat 2 in. wide and ⅜ in. thick at each end to corresponding rabbets cut on the upper side. After fitting and gluing the cleats keep the shelf in clamps until the glue is dry. Attach the shelf to the desk with ornamental T hinges of brass or black iron and put on side chains as shown. Fit a lock to the outer edge and to the inside upper corners of the case glue stop blocks to hold the leaf flush when desk is closed.

WASHING WASTE

Though waste is cheap, in a plant where economy in all branches is practiced, a good method of cleaning it for second use will not be scorned. Save the waste as it is used, allowing it to accumulate in a receptable provided for it. When sufficient is on hand fit up an old barrel with a heating



Waste-Washing Apparatus

coil, says a correspondent of the Engineer's Review, fill it half full of water and, using sal-soda or soap, boil the waste until it is clean. When dry it will be as good as new.

"A wooden floor laid over hollow tile or concrete with not more than ½-in. space between the wood and concrete, burns very slowly, and would have but little effect in feeding a fire."—Kidder.

AN INEXPENSIVE JACK

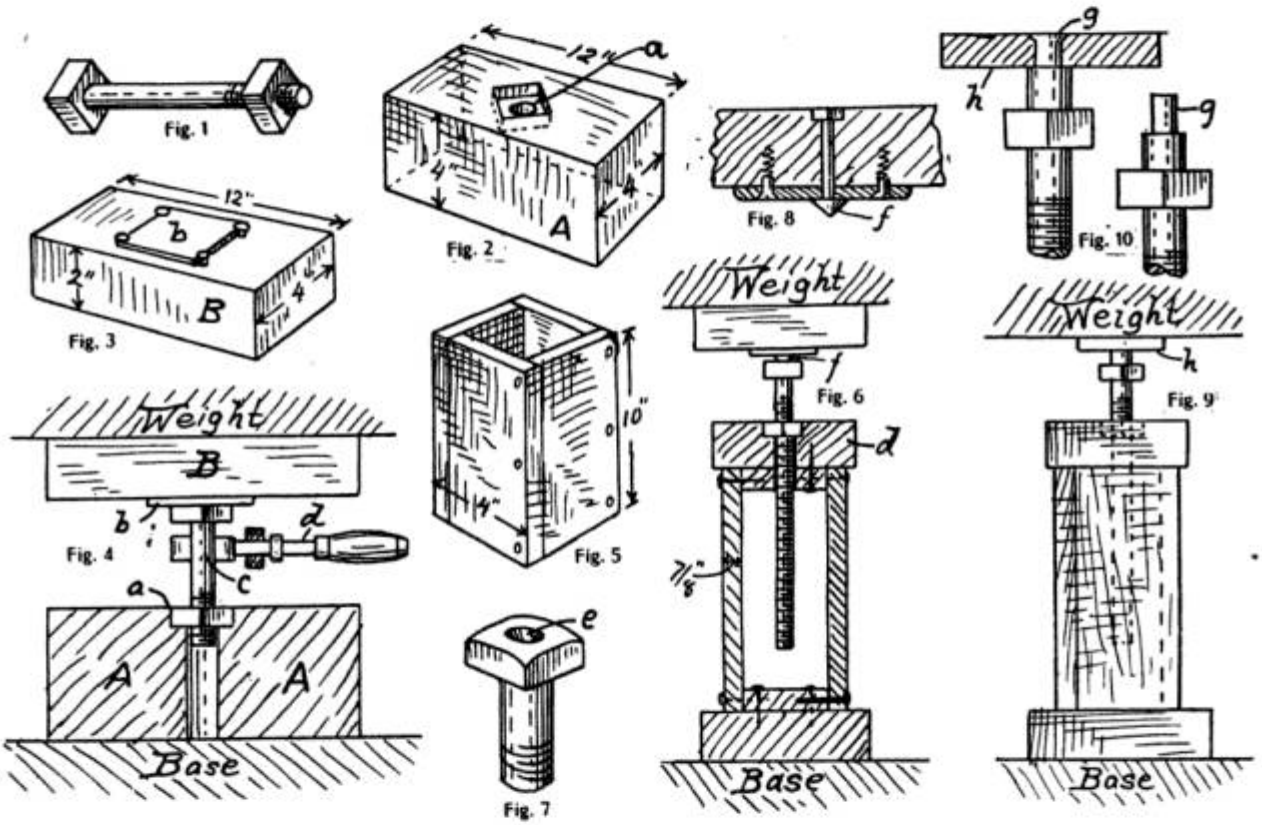
A jack suitable to meet with an emergency may be constructed at a cost of three cents, as follows:

Take an ordinary machine bolt (Fig. 1) any size and length that will bear the weight to be lifted or let down—say, ½ to ¾ in. diameter by 4 in. to 10 in. long. Get a block 4x4x12 in. and bore a hole about ⅛ in. larger in diameter than the bolt through the center; also cut a mortise the size of the nut as at a, Fig. 2. The mortise is to keep the nut from turning.

Get another block about 2x4x12 in. and on one side in the center fasten a plate (b, Fig. 3) ⅛ to ¼ in. thick and 2 to 4 in. square or round. If there are not holes drilled in the plate, fasten it to the block by driving in four or five nails at its edge and allowing the heads of the nails to hook over the edge of the plate.

When blocks A and B are ready, place block A on the base or foundation, setting the bolt and nut in the hole and the mortise, the head of the bolt being up, and put block B with plate b on the head of the bolt on the underside of the weight. (See Fig. 4.) Fit a pipe wrench (d) around the stem of the bolt (c) and proceed to tighten or release as the case requires.

An ordinary bolt is only threaded an inch or so at the point end, therefore only a short lift or release can be made at a time. To raise or lower more than the thread will allow, two jacks of similar construction would hasten matters, using one until the thread is exhausted, then setting the other and using its limit of thread; then setting the first jack again, and so on until the weight is adjusted as required. If only one jack is used it will be necessary to block up for each adjustment. If a long lift or lowering is desired and a tap and die are handy, it would be well to thread the bolt to within an inch or so of its head; this will give a longer movement of bolt. A jack of this description will lift a very heavy load; the writer has one in use that is made out of a machine bolt ¾ in. in diameter and 3½ in. long that cost 3 cents, and which lifts one corner of a house.



A jack for general use can be made at small cost, as follows: Get a machine bolt ¾ to 1 in. in diameter and 10 to 12 in. long. Have it threaded to within one or two inches of the head and make a countersick (e, Fig. 7) in the head of the bolt. Make a square box (Fig. 5) out of ⅞-in. strong, light timber and fasten a block about 2 in. thick by 4 to 5 in. square (d, Fig. 6) at the top of the box. In the center of this block cut a

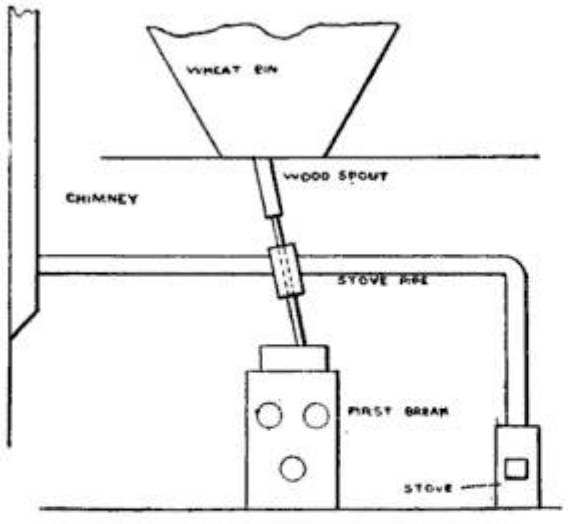
mortise for a nut, as at a, Fig. 2. At the bottom fasten a pasteboard 2 in. thick and 6 in. square. Prepare a block as at B, Fig. 3, fastening the plate in this case with countersunk screws and a bolt with a sharp-pointed head (f, Fig. 8) in the center. This bolt is to set in countersink in head of bolt at e, Fig 6.

A better and more substantial way is to make a screw with a permanent swivel plate, as follows: Have the bolt forged for the purpose. (See Figs. 9 and 10.) Have the square head set about an inch below the point end, then turn down the point end (g) about half its diameter for a distance ⅛ in. longer than the thickness of the swivel plate h. Plate h should be ¼ to ½ in. thick and about 3 to 4 in. square with a hole bored in the center of the same size as pin g and slightly countersunk on one side to make swivel, taking the place of block B, Fig. 3, thus making a cheap and handy jack.—Contributed by C. N. Leonard, 1319 Barth avenue, Indianapolis, Ind.

HOME-MADE WHEAT HEATER FOR A MILL

For the country mill where steam is not used a home-made wheat heater will be found serviceable. The American Miller describes such an installation.

Cut a hole in the middle of a stove pipe

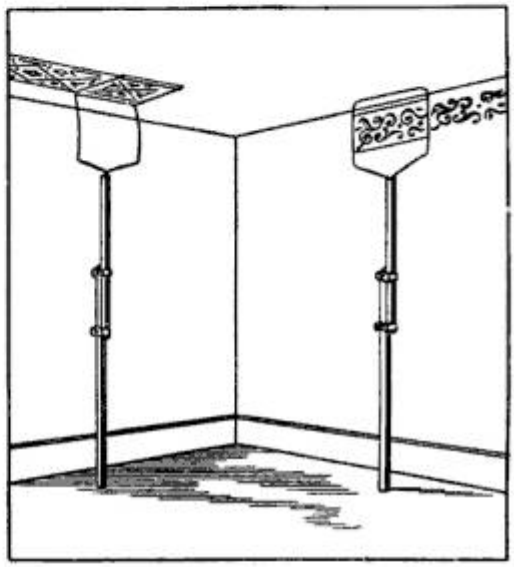


Home-Made Wheat Heater

and join two half links of pipe on each side. Cover the ends of the short pieces with sheet iron, making an opening in each large enough to admit a 2-in. gas pipe. Run the gas pipe from the wooden spout at the wheat bin, through the hot air chamber so made to the rolls. The stove pipe, of course, runs from stove to chimney. Keep up a good fire in the stove and the wheat as it moves through the gas pipe will be put in good condition for grinding.

CONVENIENT STENCIL HOLDER

For applying stencil decorations a new stencil holder, a recent invention, will be found convenient. The device holds the stencil in working position against either a

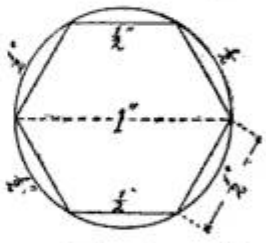


Stencil Holder

side wall or a ceiling while the pattern is being reproduced upon the surface against which it rests. The holder is adjustable to any height within its limit and is also collapsible, making it convenient for transportation from one job to another.

TO DRESS UP A HEXAGON

Turn the work round in the lathe, caliper the diameter and file a flat on round equal to one-half the diameter. File the next side of the hexagon in the same way, and let the edge of this flat just reach the edge of the first flat. Proceed in this way until the eight sides are filed. If carefully done the work will come out exactly as shown in the sketch.—Contributed by F. A. Sustins, Stevens Point, Wis.



Life subscriptions to Popular Mechanics, $10, or, sent five years for $3.

TO FIREPROOF PAPER

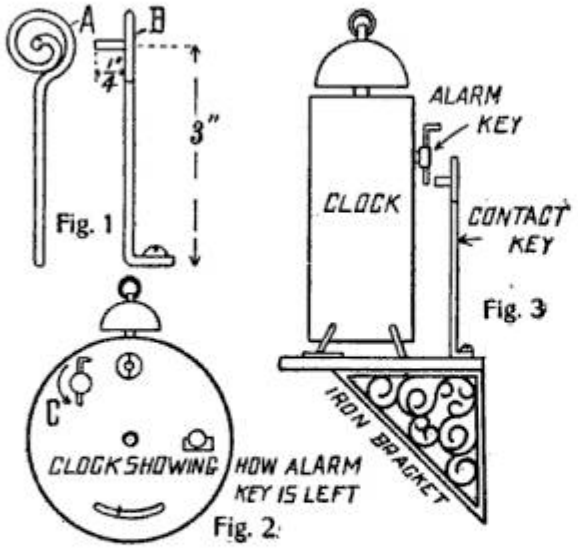
By immersing paper (plain, printed or written on) in a strong solution of alum water and then drying it, the paper will be made fireproof. Some paper, however, requires several immersions and must be immersed and dried until saturated. Test by holding saturated paper in the flame of a lighted candle. Money can be fireproofed in this way.—Contributed by John Weldon, 433 Columbia St., Brooklyn, N. Y.

CONNECTING UP AN ALARM CLOCK TO RING AN ELECTRIC BELL

Construct a shelf 6 in. x 4 in. of any hardwood. Get a strip of thin brass 4 in. x ¼ in. Bore a small hole ¼ in. from each end to admit a small round-headed screw. Screw the brass strip 1¼ in. from the front edge and 1 in. from each side of the shelf.

When this is completed make a contact point out of a piece of No. 16 iron or copper wire about 4 in. long. Bend one end of this wire in the shape shown at A, Fig. 1, so that ¼ in. of the end at the center of the coils will project at right angles to them. Bend the other end of the wire so that it can be fastened to the shelf. Fasten this contact point 2 in. from the brass strip and 2¾ in. from the right hand side of the base. The distance from the center of the coiled part to the base should be 3 in. B, Fig. 1, shows a side view of this part.

Remove the alarm key from the clock, and

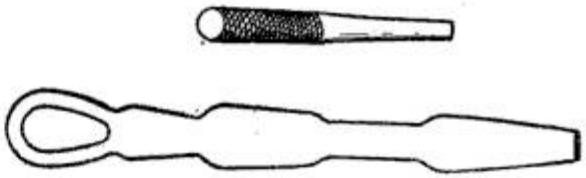


if it has square corners cut it so it may be bent in the shape shown at C, Fig. 2, if it is round fasten a piece of No. 16 wire, bent in the shape indicated at C, to it, using wires to hold it in place.

Connect one wire from the electric bell to one of the screws in the brass strip and connect the other wire to the contact point. Set the clock on the shelf with the front legs resting on the brass strip and so the contact point is a little to the right of the set key. The clock may be taken down to wind, and in winding the alarm only one turn is necessary. Leave the bent part of the key pointing upward so that when the alarm goes off the key will turn downward, striking the contact point and closing the circuit, remaining so until someone comes to move the clock, and stop the ringing. The advantage of this method is that there are no connections to loosen when the clock is taken down to wind.—Contributed by R. M. Taylor, Cincinnati, Ohio.

HOME-MADE SCREWDRIVER AND NAIL PUNCH

A good screwdriver can be made out of an old flat file about 8 in. long by grinding it smooth on both sides and on the edges



Home-Made Screwdriver and Punch

to the shape of a screwdriver. One of these screwdrivers after a year's use is as good as when first made.

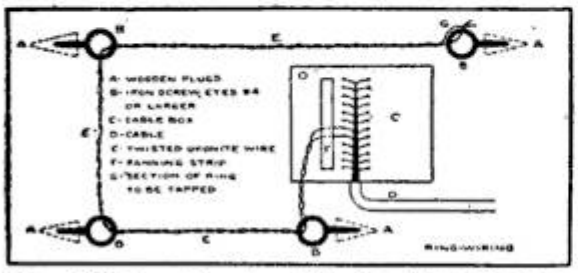
A nail punch may be made of an 8-in. rat-tail file by taking a piece 4 in. long out of the middle and grinding the point half smooth and leaving the other half as it is.—Contributed by Edgar Robertson, Castleton, N. Y.

LINSEED OIL AS FLUX IN TINNING ROOFS

Tin roofs need have absolutely no preparation previous to painting, if the tinsmith uses linseed oil for a flux. The oil is not quite as rapid as rosin or acid, but it leaves nothing objectionable to be dealt with afterwards. Acid will run into the seams and cause corrosion, while rosin is extremely hard to remove, especially from pits and irregularities in the surface.—Contributed by James H. Beebee, Rochester, N. Y.

RING WIRING AND DISTRIBUTION

Circuit distribution in closely built districts is a problem which differs largely from that encountered in suburban or rural localities. The most improved method utilizes a scheme called The Block, says the American Telephone Journal. In the center of blocks consisting of the area enclosed within four streets, terminal boxes are installed. From there the twisted pairs are run through rings fastened to fences or



Ring Wiring, Showing Details of Installation

walls, and in this manner distributed to the subscribers' stations. The cable leading to the terminal box is brought in underground and the box placed in a dry cellar to which access can be readily secured at all times. The supports employed for this method of distribution consist of iron screw eyes or rings not smaller than No. 4, and of sufficient size to allow all the present and prospective lines along any route to readily pass through them without binding. These supports should be covered with an insulating enamel which not only adds to the resistance of the line in damp weather, but also prevents to a large extent any chafing of the insulation when the wires are pulled in.

These rings are shown at B in the accompanying illustration. In placing them, if in brick or stone, the hole should be drilled and a wooden plug driven in to give a sufficiently strong holding point for the screw thread. Insulated rings should never be driven in, as by so doing, the enamel will be cracked off, destroying its insulating quality, and also forming a rough surface upon the ring which will wear away the insulation upon the wire. For turning corners, rings with angle irons in place of the screws should be employed. Where the line route is along fences no trouble will be experienced in screwing the eyes to the woodwork. At the final ring where the twisted pair leaves the run to enter a subscriber's premises, it should be tapped off as shown at G. This gives additional strength to the circuit and prevents the wires slipping.

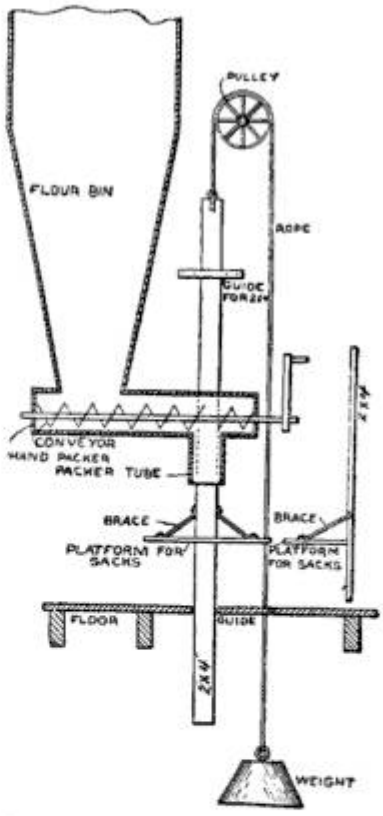
This method of distribution is sightly and affords excellent protection to the circuits in cases of storm, by holding them close to the building or fence, which acts as a shield against the wind.

SAND THE SECOND COAT OF PAINT

If the second coat of paint is well sanded with fine sand, it will not need to be painted again in twenty-five years, writes James H. Beebee, of Rochester, N. Y. Use seashore sand, well washed and freed from all impurities.

HAND-PACKER FOR SACKING FLOUR

The accompanying sketch shows a handy packer for sacking flour by hand. There is little to explain in the sketch, as anyone can see at a glance all that is required to make it. It can be put on any hand packer, says American Miller.



Hand Packer for Sacking Flour

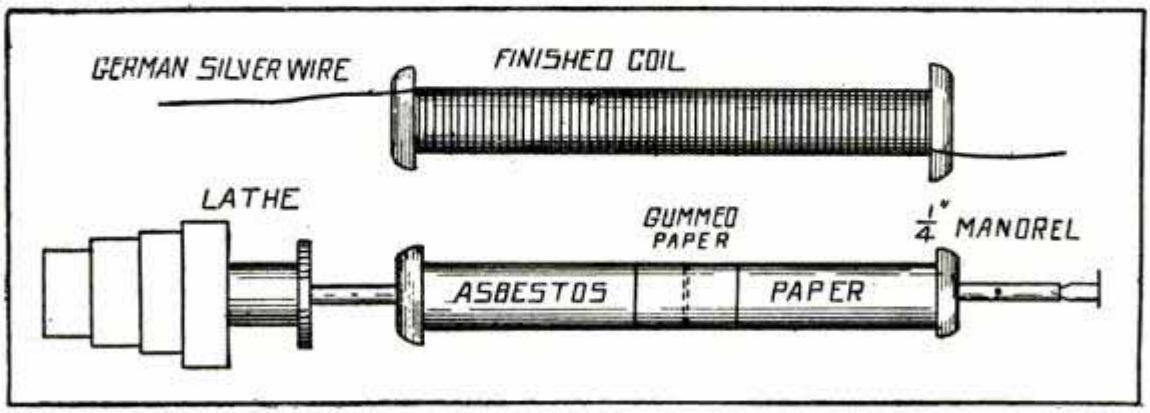
It can be made by anyone, and all that is required is a 2x4, a rope, rope pulley and weights to little more than counterbalance and draw up the sack platform.

METHOD OF WINDING COILS

In replacing some burnt-out coils in a controller I hit on the accompanying kink, writes O. N. Tait, electrician, Mountain View, California:

In a piece of ¼-in. iron 12 or 14 in. long drill two holes, one near each end. Over this rod slip two common bushings, such as are used to go through walls. Have the heads of the bushings away from each other, and use gummed paper to hold the ends together. Then with a piece of asbestos paper take one turn around the tubes, holding this in place with gummed paper also. Put the work in the lathe and wind on the wire its own width apart. Cut off the wire and put the other end in the other hole. Then take the work out of the lathe and place in a gas flame, turning it once, until the wire is red hot all over. Allow to cool slowly; by doing this the wire may finally be cut off without danger of its unwinding. When cold coat with shellac. Knot the ends of the wire and you will have a coil that is noncombustible and can easily be removed from the mandrel.

I have a set of these coils in a controller on a huge rotary press and they have given good service under hard usage.



Good Coil-Winding Method

TO FIND HOW MUCH GRAIN ANY BIN WILL HOLD

For finding how many bushels of grain any bin will hold try the short cut of multiplying the length, breadth and height in feet together and then multiply by 0.8. The result will be the number of bushels the bin will hold. This rule is shorter than the old rule, says the Grain Man's Guide, and is accurate.

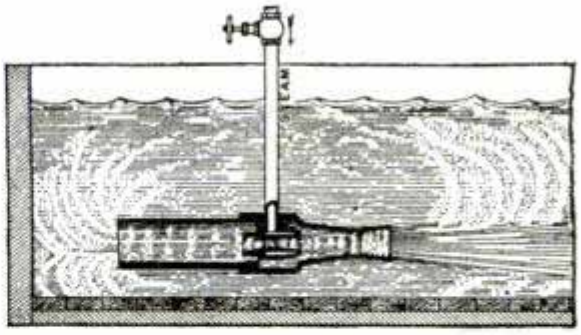
HOW TO PRESERVE POSTS

Wood can be made to last longer than iron if treated according to the following directions, writes Anthony Haselman, 80 Morton street, Newark, N. J.:

Into boiled linseed oil stir pulverized coal until the mixture is of the consistency of paint. Put a coat of this over the timber, and there is not a man living who will see it rot.

HOW TO HEAT LARGE BODIES OF WATER

Large volumes of water, such as contained in swimming tanks, etc., can be rapidly heated by means of the arrangement shown in the illustration. It consists of an ejector having space for steam around a central tube through which the water passes. The steam is turned on and rushes out of the concentric opening, drawing the water after it. One hundred gallons of water can be raised 50 degrees in three minutes in this way with only a ½-in. steam connection, and a 1½-in. water inlet, or in one minute with a 1-in. steam pipe and a 2½-in. water opening.

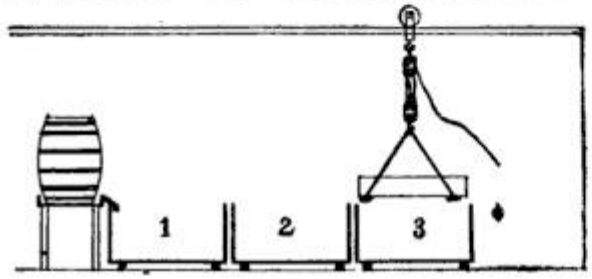


Heating Large Bodies of Water

HYDROFLUORIC ACID vs. SULPHURIC ACID FOR PICKLING CAST IRON

By F. W. Hobbs, Electroplater.

The use of hydrofluoric acid for pickling cast iron preparatory to polishing and plating marks a great stride in the reduction of cost and quality of work produced. The old method of pickling with sulphuric acid was very unsatisfactory at best; in spite of the various alkali baths used after pickling, the work nearly always behaved badly in the nickel path, owing to the acid remaining in the pores of the iron, and the result was a dark unsightly deposit, especially in the backgrounds or unpolished surfaces, and a contaminated solution. Suppose a plain surface is to be pickled: If the sand is burned in in patches, which is often the case, the acid must work its way under the



Apparatus for Pickling Castings

sand, dissolving the iron, thereby freeing the sand; at the same time the acid is going much deeper into the exposed places where there is no sand; result, an uneven surface requiring extra work to grind it even again.

Hydrofluoric acid has very little effect upon iron, but dissolves sand very freely and therein lies the secret of its superiority. Its use results in a smooth grey casting free from sand and scale, and one which, when rinsed and soaked for ten or fifteen minutes in lime water, will grind easily and come out of the nickel bath a perfect white, and the condition of the solution will not be affected in the least. After using hydrofluoric acid for two years, I can positively say that the use of sulphuric acid for pickling is simply a loss of time and material as compared to hydrofluoric. Hydrofluoric saves emery, glue, wheels, solution and time and produces a far better class of work than could be had by the use of sulphuric acid or no acid.

A convenient method of using the acid is shown in the accompanying sketch. At the left is a bench a trifle higher than top of the tanks. On this bench is a shallow lead tray large enough to permit the barrel of acid to be stood in it. A small lead pipe leads to the first tank, which should be lead-lined with seams burned, not soldered. This tank is to contain the acid, one part to fifteen parts of water. Tank No. 2 is for clear water, and Tank No. 3 for hot lime water. The lime water can best be heated by inserting a coil of steam pipe. Above the tank is a track with a set of small falls connected to a truck on the track. The cage or car is made of soft wood doweled together with wooden dowels and slung from falls by an iron strap sheathed in lead pipe. The cage is first loaded and lowered into tank No. 1, then raised, run along the track and lowered into No. 2, then up and along and into No. 3, then up and run back and lowered on to pieces of scantling placed across No. 2, where it may dry by the heat caused by the hot lime water. Have two or more heavy hoops made and rolled in hot lead, and when a barrel of acid is received, place the hoops on as a protection, should the acid find its way through the pitch lining and attack the slender hoops on the barrel. Put a strap on the barrel and raise it into the tray, then puncture the side near the lower head with a nail in such manner that when the acid runs out it will strike in the tray and be conducted to the tank by the small lead pipe. When the proper amount has been drawn off, stop up the puncture with a wooden plug. Should this leak a little or should the joints leak a little, the acid will be conveyed by way of tray and pipe to the tank so none will be lost. When the barrel is empty it may be lowered and the heavy hoops knocked off for use on the next barrel.

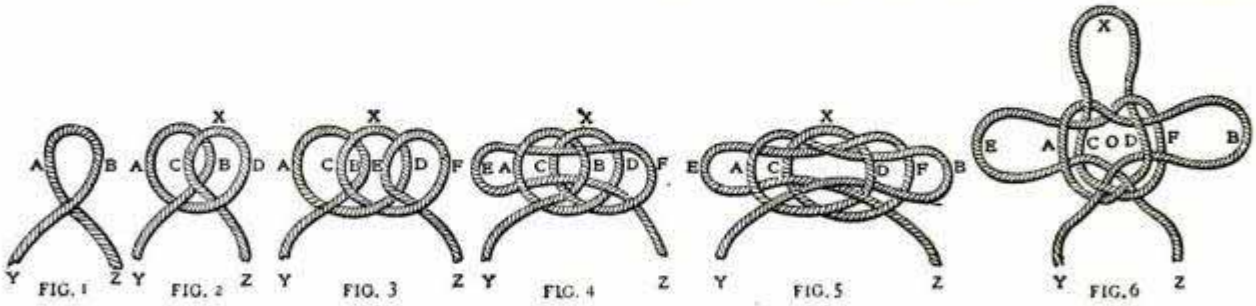
The acid is shipped in pitch-lined barrels or lead-lined carboys; the carboys soon become leaky, owing to rough usage in transportation and are expensive; therefore, I recommend that the barrels be used for transportation.

MADE A WASHER OF A KEY

While looking for a washer, which I failed to find, I ran across an old brass key with a round ring at the top and flattened at both sides. Using a cold chisel, hammer and file I cut the ring off, then filed it perfectly round. It worked like a charm for the water faucet.—Contributed by W. A. Perry, 74 Orange street, Brooklyn, N. Y.

HOW TO TIE A JURYMAST KNOT

This knot is also known as a masthead knot and a bottle hitch and is used at the top of a temporary derrick in place of a mast iron to fasten the guys to. A correspondent of the American Machinist tells how to tie the knot.

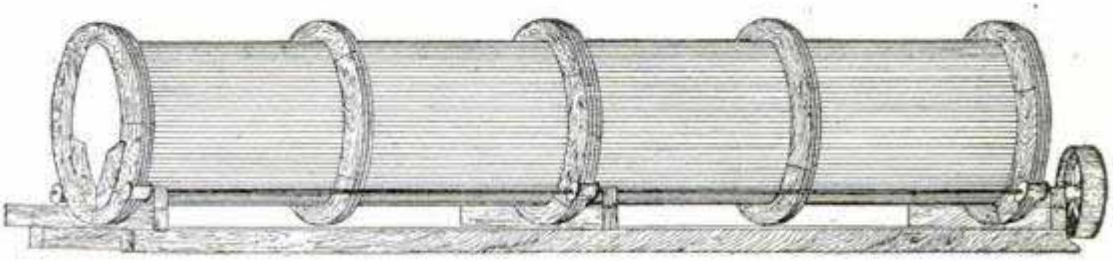


Take a piece of stout cord and hold it between the thumb and forefinger of each hand with a space of about 6 in. between the hands. Then twist the cord right-handed with the thumb and forefinger of the right hand only. This will throw up a "bight" like Fig. 1, with the part A under B. Grasp the loop thus formed between the thumb and forefinger of the left hand at the point where the two parts cross. Then move the thumb and forefinger of the right hand along the cord about 6 in., and throw up another "bight," laying it on top of the first one. You then have Fig. 2. Hold these two bights with the left thumb and forefinger, measure off another 6 in. and throw the last "bight." Place it on top of the last one made and you have Fig. 3. Take the part E in the last bight at Fig. 3 and—while holding the other parts in place—pass it under B, over C and under A. This makes Fig. 4. Then take B, Fig. 4, and pass it under D and over F. The result is Fig. 5. Then, while holding E in the left and B in the right hand, take hold of X with the teeth and pull it. The result will be Fig. 6. In practice the part O in Fig. 6 goes over the reduced part of the mast or derrick head. The forestay is made fast to X. The stays to E and B. Y and Z form the back stays. Any strain on the stays tightens up O. By pulling Y and Z in opposite directions the knot comes out. Every workman should know how to tie this knot.

PIPE-CLEANING MACHINE

A machine for freeing pipe of oil and rust preparatory to painting, consists of a wooden drum, 4 ft. in diameter and 22 ft. long, which is worked at about ten revolutions per minute, says the Journal of Electricity, Power and Gas. The pipe to be cleaned is placed in the drum and nearly covered with clean, sharp sand. Sand is added as required after the first charge.

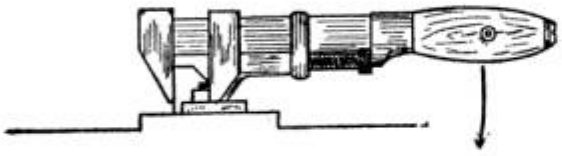
There is enough pipe for one time in the drum when the top piece drops and rolls over the other pipes, about one each turn, or so. If it drops too often, remove one piece at a time until right, or if it drops not at all, add pipe until it does. This method will clean the pipe bright inside and out. All the cost is for power to run the machine and help to handle the pipe.



Wooden Drum for Cleaning Pipe

REMOVING KEYS FROM VALVE STEMS AND SHAFTS

While adjusting a high duty pumping engine with Corliss valve motion, I frequently found it necessary to remove the



Removing a Key

keys from the valve stems. Most all keys are driven in to stay and it is no easy matter to start one without breaking off the head or bending the key, but by means of the following wrinkle I found it quite easy to remove most any key.

Place a monkey wrench on the head of the key as in the illustration, and drive a chisel or wedge between the head of the key and the stem, or the shaft, or whatever it may be. While driving, press against the handle of the wrench.

The wrench puts an even strain on the key and also keeps the wedge or chisel in place. Squirting kerosene oil around the key will also aid in extracting it. I learned this scheme in a machine shop where it was used to remove sprocket wheels keyed on the ends of shafts.—Contributed by John Weldon, 433 Columbia St., Brooklyn, N. Y.

SAID TO CURE FELON

A very simple cure for a felon is given in the Medical Visitor by Dr. Whitman. The doctor says that for the last fifteen years he has used egg to cure felon, and has yet to see a case it will not cure. The way to apply the egg is as follows:

Take a fresh egg and crack the shell at the larger end. Make a hole just large enough to admit the thumb or finger, whichever it may be, and force it into the egg as far as possible without rupturing the shell. Wipe off the egg which runs out and bind a handkerchief or soft cloth around the finger or thumb, leaving the egg on over night. This will generally cure in one application, but if not make another application.

White spots on polished furniture, caused by hot dishes or alcohol, may be removed by the use of spirits of camphor.

HOW A GAS ENGINE TALKS

To the experienced man the gas engine has a language of its own which the man who runs it must at all times understand, says Gas Power. If he cannot do this then his experiences with the engine are going to be varied, but they won't be pleasant. When the engine is right and is, in consequence of being so, doing what is right, the only sound it emits are such as are made up from the clicking of the valves, the inhalation of the air and the exhaust. When the usual sounds are well understood, any unusual ones will be promptly noticed and their cause located and removed. The trained ear is probably a better trouble detector than the eye. The best way to become acquainted with the natural sounds is to first operate or run the engine for a time, say from a half to an hour, free; without a load.

It will be noticed that under no load, besides driving itself, if it is a hit-and-miss governor engine, it will produce an inhalation sound followed immediately by a loud exhaust report. If the governor is the least bit off or sluggish a second or third of this pair of sounds may follow in quick succession. But usually the first is followed by an intermission, which is made up of a series of suction sounds at the end of the exhaust pipe, if the governor serves to hold up the exhaust valve when no impulse is needed. These suction or blowing sounds are due to the inhalation and expulsion of the air through the exhaust pipe, at each movement of the piston, so long as the governor holds up the exhaust valve. The moment this valve is released a loud suction or inhalation sound is again heard at the mouth of the receiving pipe, followed immediately by the loud report at the end of the exhaust pipe, which pair of sounds is the result of taking into and igniting the charge within the cylinder and exhausting the burnt gases under the pressure that remains in the cylinder at the time the exhaust valve opens.

Now, if the inhalation sound at the receiving pipe is heard and the loud exhaust report does not follow, the operator knows at once that the charge taken during the inhalation was not ignited or exploded. He knows there is a natural sound missing which signifies an abnormal condition. He reasons, if the charge isn't exploded, why not? Did the gasoline fail to get into the air current in sufficient quantity to make

the proper mixture? or did it overcharge the air? or was the mixture right and did the battery fail to make a spark? or if proper mixture and spark were both present, is there a leak of sufficient gravity through the valve or around the piston, by the packing rings, to allow practically all of the charge to escape before the spark is made?

The absence of a natural sound production will often point out an abnormal condition as readily as the presence of an unnatural one will. A careful operator notices all of these things. None of them escapes his ears so long as he is within hearing distance of his engine. To him the absence of one natural sound is the letter that misspells the two words, successful operation, consequently the importance of being able to detect the absence of the natural sounds. To know them is the only sure way to notice their absence.

The frequency of the exhaust reports increase as the engine is put under a load. And the heavier the load the more frequent the reports, until a full load is reached. A trained operator can be away across the country and within hearing distance of his engine, or rather the exhaust reports of it, and be able to say that the engine is running well and easily carrying its load, or that there is something wrong with it.

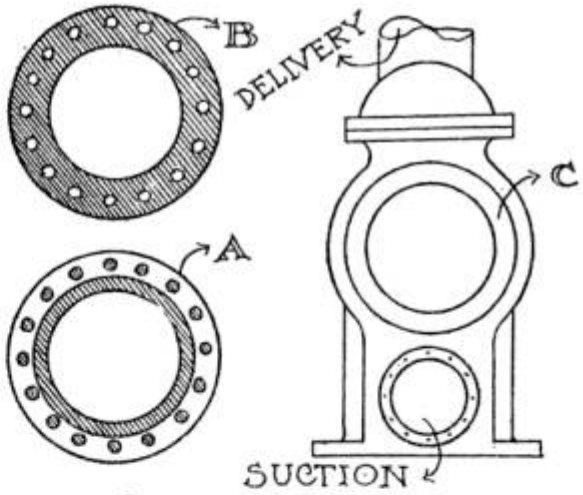
Now, one of the common expressions of discontent the engine makes is pounding in the cylinder; and this usually occurs when the engine is under a heavy load. The interior of the cylinder gets so hot that some burnt carbon or projecting point of iron becomes heated to the igniting point. This in connection with the heat generated by the compression pressure ignites the charge before the piston has completed its compression stroke. The result is a sudden conflict between the explosive and compression forces. This sudden collision of forces causes a heavy pound in the cylinder. A loose flywheel causes a thump, usually at every impulse the engine takes. Looseness at the wrist box causes a knock. A loose crosshead box usually causes a clatter. A knock once located around the connecting rod may be due to either the crosshead or wrist boxes being adjusted too tightly. One may be so tight as to lift and depress the other end at each revolution. Often a knock or clatter at the crosshead or wrist bearing may be cured by simply loosening up the bearing or box at the other end of the connecting rod from that where the knock is located.

A flywheel loose on the shaft sometimes makes a rubbing sound, caused by some part of the circumference of the rim of the wheel rubbing at each revolution against some object near the engine. There is a barking or coughing noise at times from the cylinder, due to escape of the explosive force past the piston rings. This seldom occurs unless rings are badly worn or poorly fitted to the piston. Sometimes gummy oil will cause rings to stick in their grooves. A blowing noise just in advance of the exhaust report at the mouth of the exhaust pipe indicates a leak at the exhaust valve.

GASKETS FOR CYLINDER HEADS

Cylinder head gaskets sometimes have a frayed or chewed appearance after being in use a short time, due to a breathing action or movement of the cylinder head outward, which action permits water to escape between the gasket and head.

If a gasket similar to the one shown at B in the illustration is made, treated to a



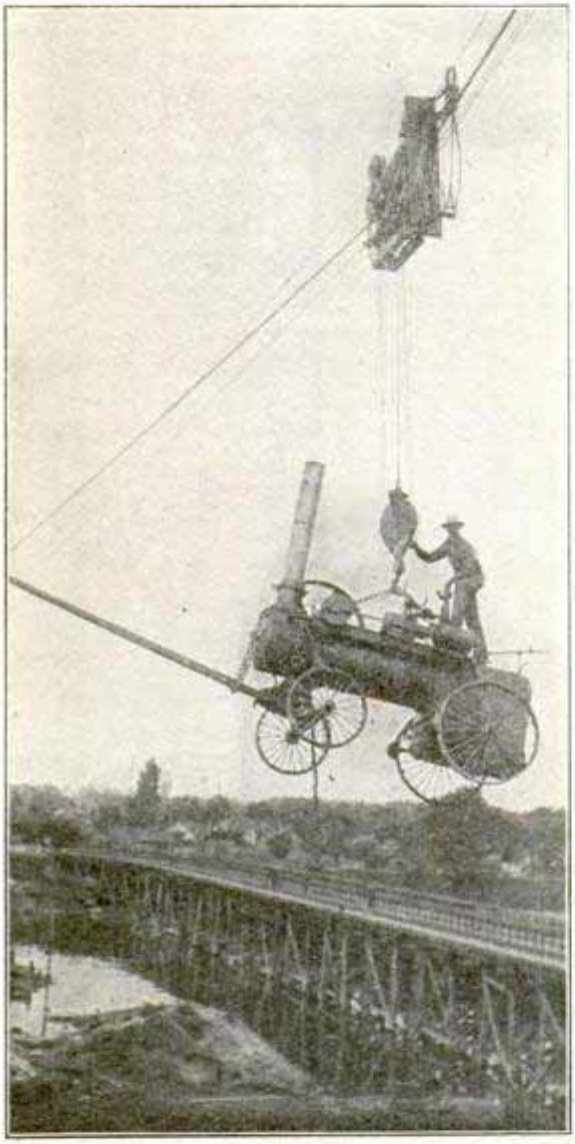
Gaskets for Cylinder Heads

coating of graphite and cylinder oil and inserted in place, a water-tight joint will result, says the National Engineer, even though the breathing action of the cylinder head continues. The method of applying the gasket is shown at A.

Varnish should not be thinned with turpentine, says the Master Painter. It reduces the gloss and if the turpentine has been adulterated with mineral oil injures the varnish.

ENGINES CROSS RIVER ON AERIAL TRAMWAY

During the construction of a new bridge over White river at Indianapolis recently, a daily spectacle, enjoyed by hundreds of people, was the transportation of material and machinery across the river on an aerial



"Frequently the Engineer Rode Across"

tramway. It was nothing unusual for the apparatus to pick up a large engine, hoist it high in the air and send it across to the other side on the suspended cable. Frequently the engineer rode across on the engine, although the great load traveled at a giddy height.

By using soap and water on an oilstone, as a substitute for oil, a smoother and finer edge can be given to knives and woodworking tools, writes John Weldon, of Brooklyn, N. Y.

DYNAMITE SHIP BLOCKS SUEZ CANAL

Explosion Hurls Wreckage 2,000 Feet in Air

The British steamer Chatham sank while passing through the Suez canal. Engineers declared it could not be raised, and as the vessel blocked the canal it was decided to blow her up with 90 tons of dynamite and blasting gelatin which formed part of the cargo.

Mines were placed in and around the hull, and fired through electric wires from a point five miles distant. At the expiration of 8 seconds water had reached a height of 2,000 ft., and wreckage continued to rise for 35 seconds. The canal was practically emptied of water for a length of 600 ft., and 500 ft. of one bank was destroyed. Thousands of dead fish were scattered in all directions.

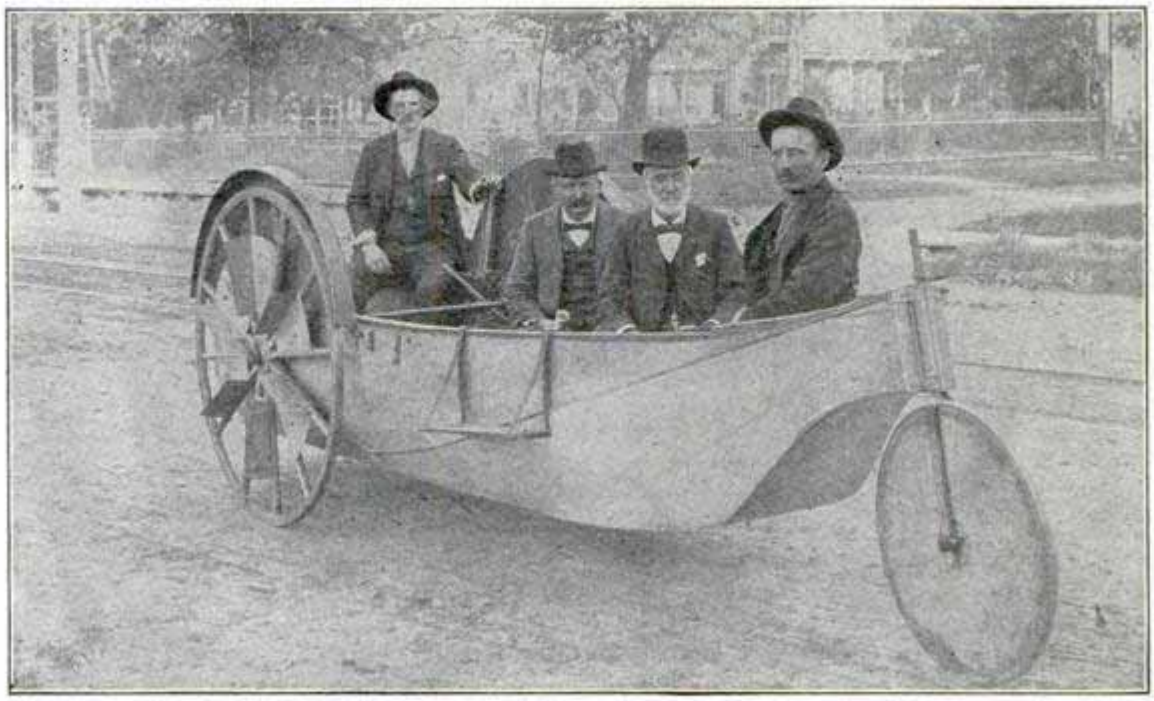
CODE TO DETERMINE LETTERS IN TELEPHONING

Have you ever tried to name a letter when using a telephone where the party at the other end cheerfully persisted in hearing your "B" as "T" or "D"? To remedy such difficulties and insure absolute accuracy J. H. Bailey, manager of a telegraph office, suggests a simple plan in telephony. He recommends a universal code which could be printed in all telephone directories, and be available for either local or long distance use. One word which cannot be confused with any other word in the code is selected to represent each letter, the word commencing with the letter it represents. The following code would be a good one.

Arthur	Nancy
Benjamin	Oliver
Charlie	Paul
David	Queen
Edward	Robert
Frank	Samuel
George	Thomas
Henry	Underwood
Isabel	Violet
John	William
Klondike	(X) for Cross Road
Lady	Yellow Dog
Mary	Zebra.

For train dispatching where accuracy is absolutely essential the code could be extended to indicate the numerals in the same manner as letters.

CRAFT THAT TRAVELS ON WATER, LAND, OR SEA



The Craft in Use on Land

The interesting craft shown in the illustration was constructed by T. Richmond, Jessup, Iowa. The power is a 3-cylinder gasoline engine. For use on land the machine is operated as shown. In the water a set of hinged paddles, which can be attached to the wheels, automatically open and close as the wheels revolve. For an ice boat spikes are fastened to the driving wheels and a runner placed under the forward wheel; two runners are also placed beneath the craft inside the driving wheels. Any of the three changes can be made in a few minutes.

GASOLINE-DRIVEN RIVER BOATS

Courtesy Fairbanks, Morse & Co.

"They Make 9 Miles an Hour Up the Mississippi"

For work on shallow water and against a swift current, flat-bottom stern-wheel boats, propelled by gasoline engines, are found to be swift and serviceable. The illustration shows three of these boats which ply between the shrimp fishing ground at Grand Isle, La., and the cannery of a New Orleans firm.

The boats are of 16 gross tons each, 60 ft. long, 15 ft. beam and 3½ ft. depth or hold. Each is equipped with a 30-hp., 3-cylinder vertical type special marine engine. The engines are set fore and aft and drive the stern wheel through a worm gear and sprocket wheels and chain. They make 9 miles an hour, upstream, against a 4-mile current in the Mississippi river, a good speed for a boat of this kind.

CHEMISTRY FOR MECHANICS

By M. G. KOPP

PART III

The following will be needed: 8 oz. of potassium chlorate ($KClO_3$), (10 cents); 8 oz. of manganese dioxide (MnO_2), (5 cents); a piece of sodium hydroxide; a hard glass test tube (10 cents); a Florence flask (½ liter, 15 cents); a two-holed rubber stopper to fit ½ l. flask (10 cents); another stopper but having one hole to fit hard glass test tube (10 cents).

DISTILLATION.

Distillation is the process of converting a liquid into vapor and then condensing the vapor to the liquid state. Water is purified by filtration or by distillation. Filtration serves merely to separate insoluble particles from a liquid, whereas distillation separates the soluble and insoluble particles from a liquid. When impure water is distilled all the substances more volatile than the water will appear in the first portions of the distillate; all much less volatile particles will remain behind in the retort or distilling flask as a "residue."

For example: place in a ½ liter Florence flask about a teaspoonful of salt (NaCl), sodium chloride; a small quantity of sand (SiO_2), silicon dioxide; and then half fill the flask with water (H_2O). Taste the liquid. By means of a rubber stopper, a tube (such as was bent in Part II, Fig. 5), ring stand, etc., arrange an apparatus as shown in Fig. 1. Heat the mixture in the flask to the boiling point. The heating should be done very slowly so as not to break the flask. When the liquid boils, steam, i. e., water vapor, will pass through the tube "a" and into the bottle "b," where it will condense into water and run into the dish "c." The bottle "b" can be a small preserve jar or the like and the dish "c" a common saucer. Taste the water in the dish. It has a "flat" taste but is free from the sand and does not taste salty. This water is called the distillate. The reason that the sand and salt did not pass over into the dish is that sand and salt are not volatile at the boiling point of water. If one filtered the solution in the flask the filtrate would not be free from the sodium chloride, since sodium chloride is soluble in water, so that to free the water from the sodium chloride it would have to be distilled. The reason that distilled water has a "flat" taste is due to the fact that all the gases present in natural water are boiled away. Distilled water can be made more palatable by either allowing air to bubble through it or by shaking it vigorously in a bottle open to the air.

CRYSTALLIZATION.

If a solid separates from a solution slowly, it will frequently be found to consist of regular masses called crystals. The more slowly crystallization takes place, the larger and more perfect will the crystals be. If the solution containing dissolved crystalline matter be boiled so as to leave a saturated solution (saturated with crystalline matter) and then cooled quickly, small, irregular crystals will be formed. When a substance separates from a solution, either through rapid cooling or the addition of some substance, small crystals or amorphous (non-crystalline) particles form. This substance is called a precipitate. In Part I when to a K_2SO_4 solution C_2H_5OH was added a white precipitate was formed.

In a test tube dissolve some $CuSo_4$. Boil the solution for several moments and allow to cool slowly. Notice crystals produced. Repeat above experiment, but cool quickly by allowing a stream of water to flow over tube. Notice size of crystals.

When two substances are dissolved in a liquid and the resulting solution allowed to crystallize, the two substances will crystallize separately. Crystals do not contain solids alone, but have a certain amount of water contained in them. Put a piece of $CuSO_4$ in a test tube and heat. The $CuSO_4$ turns white and water condenses near the top of the tube. This shows that $CuSo_4$ contains water of crystallization. Add a drop of water to the white substance in the tube. Notice effect.

Place a crystal (dry) of sodium carbonate (Na_2CO_3), which is common washing soda, on a piece of paper. Place a crystal of $CuSO_4$ on a similar piece of paper. Allow to stand for a day or two. The Na_2CO_3 will be found all crumbled up and the $CuSO_4$ unchanged. The Na_2CO_3 crumbled up

because it gave up its water of crystallization to the air. This process is known as "efflorescence." Place a small piece of sodium hydroxide (NaOH) in an evaporating dish and allow to stand for several hours. If the air is not too dry the NaOH will be found surrounded by a thick solution. NaOH on standing exposed to the air takes in moisture. This process is known as "deliquescence."

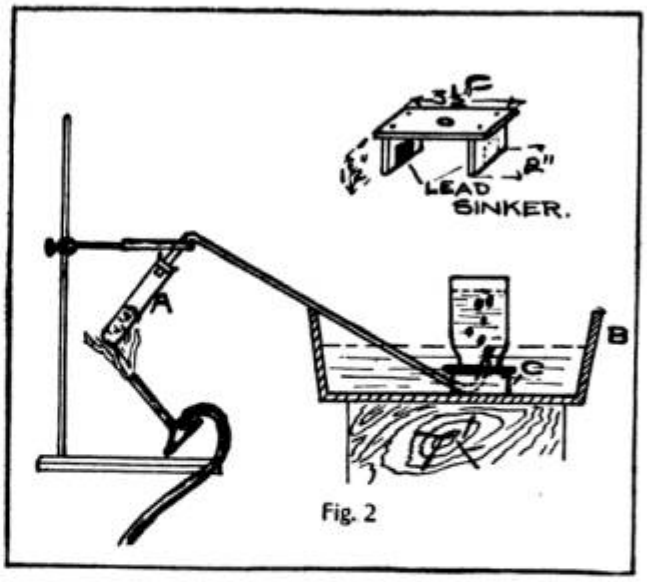


Fig. 2

HOW TO WRITE EQUATIONS.

When chemists wish to indicate certain compounds they write the compounds by placing the symbols of the elements, making up that compound, side by side. Thus, copper sulphate is written $CuSO_4$, which means that a compound of copper and sul-

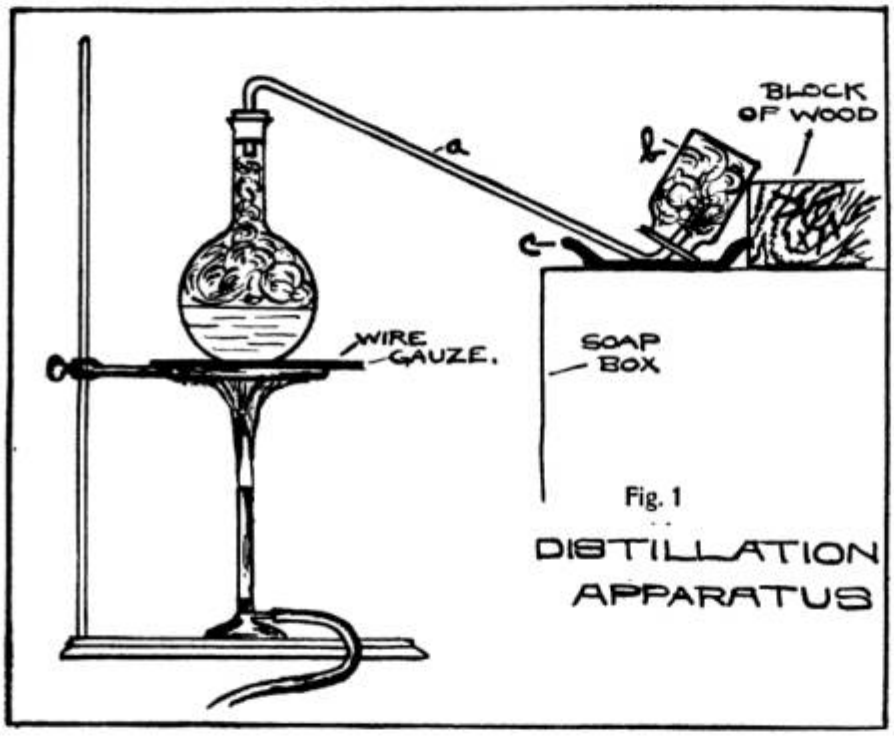
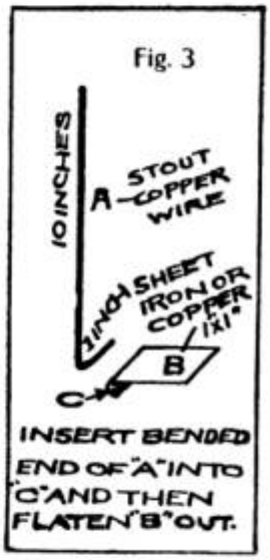


Fig. 1
DISTILLATION APPARATUS



phuric acid is referred to. To write the graphic representations of various compounds, which is known as formula writing, one must know what "valence" means. The power of the atoms to unite with different numbers of other atoms is called valence. An element such as chlorine, whose atom can hold only one atom of hydrogen, is said to be univalent. An element like oxygen, whose atom can hold two hydrogens, is said to be bivalent (valence of two); one like nitrogen, trivalent, and so on. Valence is not only the power of combination, but also the power of replacement. Thus the formula of potassium sulphate $\begin{matrix}K\\K\end{matrix}$—$SO_4$ (K_2SO_4) is derived from that of sul-

$\begin{matrix}H\\H\end{matrix}$

phuric acid—SO_4 (H_2SO_4), by replacing two hydrogen atoms by two of potassium, since the valence of potassium is one. In the case of zinc nitrate $\begin{matrix}NO_3\\NO_3\end{matrix}$Zn——one atom of zinc has replaced two hydrogen atoms in ($2HNO_3$), hence zinc is bivalent. Similarly, iron is trivalent in ferric phosphate, $FePO_4$; for the formula of phosphoric acid is H_3PO_4. Aluminum is also trivalent in aluminum sulphate, $Al_2(SO_4)_3$; for two aluminum atoms, each with a valence of three, replace six hydrogen atoms in $3H_2SO_4$. The valence of an element is represented by a Roman figure directly above and to the right of the

symbol of an element. In Part II, in the table of elements, the valencies are shown. A bivalent element, like oxygen, unites with two atoms of a univalent element, but with only one of another bivalent element. Thus, calcium chloride has the formula $CaCl_2$; but calcium oxide the formula CaO. When a bivalent element unites with a trivalent element, two atoms of the trivalent element generally require three of the bivalent one. Thus Al_2O_3 for aluminum oxide.

Knowing now how to write formulas, one can easily learn how to write "equations" representing a chemical change. Thus, take for example the reaction of H_2SO_4 on Zn. The equation is written thus:

$$H_2SO_4+Zn=ZnSO_4+H_2$$

and read, sulphuric acid plus two of zinc give zinc sulphate and two of hydrogen. The number of elements on one side of the equation must equal those on the other. In the above there are two hydrogens, one sulphur, four oxygen and one zinc on both sides of the equation. Since the valence of zinc is two it exactly replaces the hydrogen in the H_2SO_4. Take for example:

$$Zn+2HCl=ZnCl_2+H_2$$

Here there is only one replaceable hydrogen, so, since the valence of zinc is two, two HCl's must be taken. To become proficient in writing formulas and equations one must constantly practice writing out all kinds of reactions and compounds, bearing in mind to always have the equations equal in quantities on both sides, and that the correct number of replaceable elements be taken to satisfy the combining substance.

OXYGEN.

Symbol O. Valence 2. Discovered by Priestly in 1774.

In the free state oxygen occurs in the air, mechanically mixed with about four times its volume of nitrogen. In combination with other elements it is found in large quantities. It constitutes 44 to 48 per cent of the weight of the earth's crust, 88.89 per cent of water and about 23 per cent by weight of the air.

Heat a small quantity of mercuric oxide (HgO) in a test tube of hard glass. The oxygen is driven off while the mercury condenses on the sides of the tube. The equation representing the reaction is:

$$2HgO=2Hg+O_2$$

Light a small piece of wood, blow out the flame, and while the wood is still glowing plunge it quickly into the test tube. It immediately bursts into a flame of a very bright color. Notice how much quicker the stick burns in pure oxygen than in the air. Clean out the test tube as well as possible. If any Hg remains on the sides put a little HNO_3 into the tube and warm, when the Hg will dissolve. Clean out the tube well with H_2O and dry. Repeat the HgO experiment, using potassium chlorate ($KClO_3$) in place of HgO. On heating $KClO_3$ it melts, and at about 400° (Centigrade) decomposes with brisk effervescence, giving off oxygen and potassium chloride:

$$KClO_3=KCl+3O$$

Try glowing splinter experiment as above. Next arrange an apparatus as shown in Fig. 2, using a hard glass test tube (A).

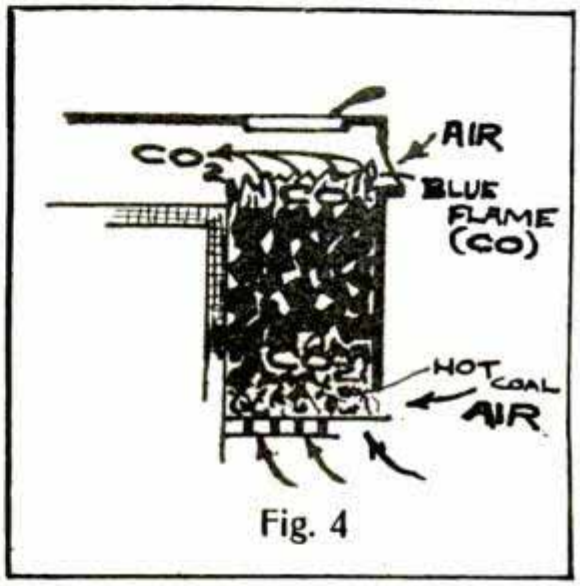


Fig. 4

Partly fill the test tube with $KClO_3$ and manganese dioxide (MnO_2), using one-third as much MnO_2 as $KClO_3$. Heat slowly and pass the evolved gas into a wide-mouth bottle or fruit jar, as shown in Fig. 2, having filled the jar with water and set in the tube (B) over the collector (C). When all the water is displaced slip a piece of cardboard, vaselined on one side, over the mouth of the jar, and then set upright on the bench; the vaselined cardboard prevents the gas from escaping. Collect three ½-pint jars full of gas. Into one jar plunge a red-hot iron wire. Into the other put burning sulphur. The sulphur is put on the spoon shown in Fig. 3, and then the spoon put into the flame of the burner. When the sulphur burns, the spoon with it on is put into the jar of oxygen. Into the third put a glowing piece of charcoal, or zinc and sulphur heated, by means of the holder shown

in Fig. 3. The $KClO_3$ and MnO_2 decomposes as follows:

(1) $2MnO_2+2KClO_3=2KMnO_4+Cl_2+O_2$

(2) $2KMnO_4=K_2MnO_4+MnO_2+O_2$

(3) $K_2MnO_4+Cl_2=2KCl+MnO_2+O_2$

MnO_2+KClO_3 decompose to form oxygen at about 200° Centigrade as compared with 400° with $KClO_3$ alone. From the above experiments it can readily be seen that oxygen is a colorless, odorless, tasteless gas. It is somewhat heavier than air and 16 times as heavy as hydrogen. It is condensed to a bright blue liquid at a temperature of 118° Cent. and 50 atmospheres pressure. As the above experiments show, oxygen is an energetic supporter of combustion. Oxygen is the power of life; without it we would die. It is the only part of the air that supports our life.

Fire or combustion is produced by the union of the fuel with atmospheric oxygen. Before a substance can unite with oxygen it must be heated to what is termed its kindling point; to produce flame, it must be changed into gas. A flame is burning gas. In a bunsen burner we have oxygen entering at the base, through the holes, into the burner where mixing with the gas it produces a non-luminous flame. On covering the holes and thus keeping out the oxygen, the flame is a smoky one, since the carbon and gases in the flame have not oxygen enough to heat them up. In the next part we will study more fully the bunsen burner under the title of "Flames."

Oxygen plays just as important a part in the operation of our coal stoves as it does in the flame of a bunsen burner. Referring to Figure 4, we have the air (oxygen) entering at the bottom of the fire and, uniting with the coal (carbon), forms CO_2 (carbon dioxide). As the CO_2 passes through the hot coals it is reduced to (CO) carbon monoxide (Di=2; mon=1). The CO burns at the top of the bed of coals into the familiar blue flame, uniting with the oxygen of the air above the coals to form CO_2 again:

$$2CO+O_2=2CO_2$$

In the next part we will take up flames, Centigrade and Fahrenheit thermometers, and hydrogen and its properties.

The first disaster at sea to be reported by wireless telegraph occurred on the vessel "Campania" when just off Nantucket, recently. An inrush of a terrific sea had seriously injured ten steerage passengers. Arrangements were made to give the vessel medical assistance when she arrived.

HOW A TELEGRAPH CABLE IS LANDED

The new Atlantic cable was successfully landed on the Irish coast, recently. The cable was handled by the cable ship "Cambria," of 1,954 tons gross register and able to carry 800 miles of deep sea cables.

When one of these heavy cables is to be landed, two light ropes are brought ashore by boat from the cable ship, which is anchored some distance out. One of these ropes is passed around a pulley firmly secured in the ground and is then spliced to the other rope. The ship, on being signaled, hauls on one end of the rope and so draws in to the shore a heavier rope attached to the other end. This passes around the pulley and is drawn back to the ship, drawing to the shore the cable which is attached to it. The cable passes over a number of barrels placed at regular intervals between the vessel and the shore. The illustration is by courtesy of Mr. A. Murray, of Waterville, Ireland.

H. P. Endean, Phot., Waterville, Ireland.

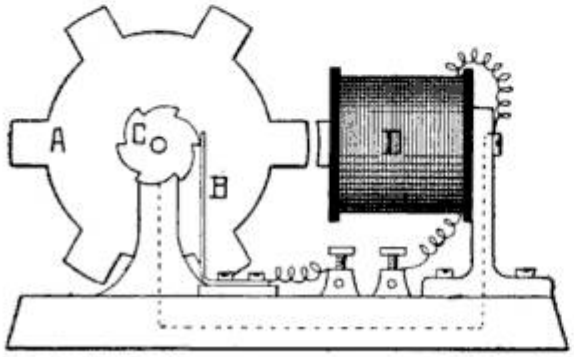
Landing the New Cable

MECHANICS FOR YOUNG AMERICA

ANOTHER ELECTRIC MOTOR

This form of electric motor is used largely in England in the form of an indicator. It is very easily made and if you have an old electro-magnet will cost about nothing.

A large soft-iron wheel is mounted on an axle with a pulley-wheel on one end



Electric Motor

and a circuit breaker on the other end. The teeth on the circuit-breaker must be the same number as on the soft-iron wheel.

The electro-magnet is mounted so that its core is level with the axle and in a line with the wheel. One wire from it is attached to one binding screw and the other end is grounded to the iron frame that supports it. This frame is connected to the frame supporting the wheel. A small brush presses on the circuit-breaker and is connected to the other binding screw.

In the diagram A represents the iron wheel; B, the brush; C, the circuit-breaker; D, the magnet. The wire conecting the two frames is shown by a dotted line.

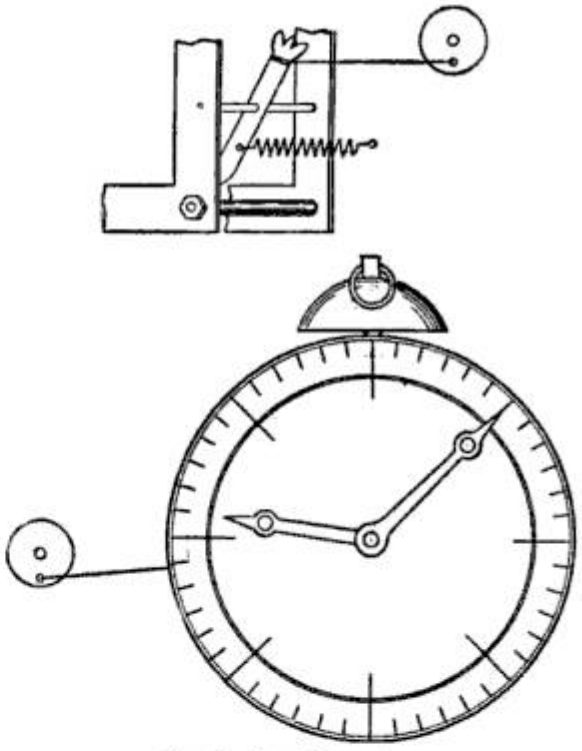
To start the motor, attach your battery to the screws and turn the wheel a little. The magnet attracts one of the teeth on the wheel, but as soon as it is parallel with the core of the magnet the circuit is broken and the momentum of the wheel brings another tooth to be attracted.

To reverse the motor reverse the connections and start the wheel the other way. Be sure that the frames are screwed down well or the motor will run jerkily and destroy the connections.—Contributed by F. Crawford Curry (14 years old), Brockville, Ontario, Canada.

USE FOR AN OLD CLOCK

Remove the hair spring of the clock, and fasten a spring to one end of the pawl and a small wire to the other end. Make a slit in the case of the clock opposite the pawl. Fasten the spring on the outside in any convenient way and pass the wire through the slit to an eccentric or other oscillating body.

To make the dial, paste a piece of paper over the old dial, pull the wire back and forth one hundred times, and make a mark where the minute hand stops. Using this for a unit divide up the whole dial. The hour hand has an inner circle of its own.



Revolution Recorder

Put the alarm hand at a little before twelve and wind the alarm. When the alarm is unwound the hour hand starts on a new trip. The clock I used was put on an amateur windmill and when the hour hand went around once 86,400 revolutions or jerks on the wire were made, while the minute hand recorded one-twelfth of this number, or 7,200. —Contributed by Richard H. Ranger, 19 W. 10th street, Indianapolis, Ind.

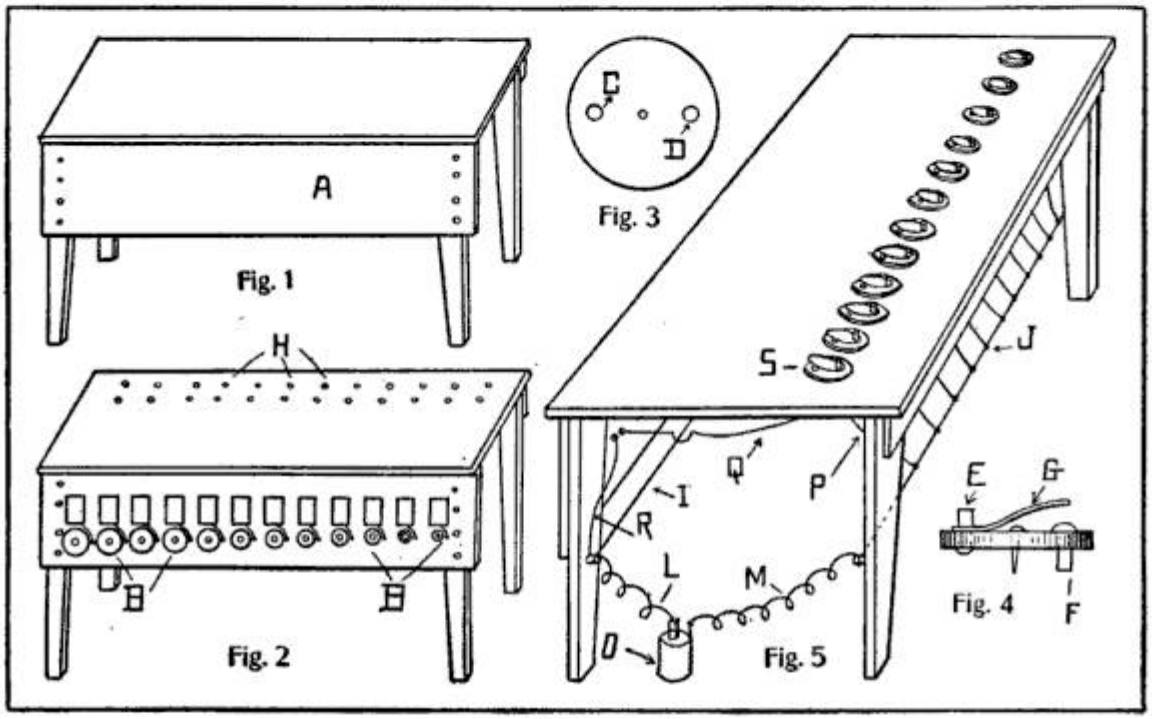
TO MAKE AN ELECTRIC PIANO

Make or buy a table about 3 ft. long and a foot or more wide, and about 2½ ft. high. Nail a board (A, Fig. 1) about 8 in. wide and of the same length as the table, to the table as shown in the illustration. Paint the table any color desired.

Purchase a dozen or so battery electric bells (they are cheaper if bought by the dozen) and screw them to the board. (See Fig. 2.) Arrange the bells in the scale as shown at B, Fig. 2. Bore two holes, near the posts of each bell for the wires to pass through.

Buttons for the bells may be purchased, but it is cheaper to make them in the following way: Take a piece of wood and cut it round, about 2½ in. in diameter and ¼ in. thick (Fig. 3) and bore two holes (C and D) through it. Then get two posts, about an inch long (battery posts will do) and put them through the holes as at Fig. 4. Cut out a piece of tin, ⅜ in. wide, punch a hole through it and put it under post E, Fig. 4, so that when it is pressed down, it will touch post F, Fig. 4. It may be either nailed or screwed down (G, Fig. 4).

Make two holes in the table for each button and its wires (H, Fig. 2). Nail or screw the buttons to the table as shown at Fig. 5 with the wires underneath. The connections are simple: I in Fig. 5 is a wire running from one end of the table to the other end, attached to a post at each end; J. is another wire attached in the same way; L is the carbon wire running from the batteries to I; M is the zinc wire running from the batteries to wire J; O indicates the batteries; P is a wire running from J to one post of a button; Q is another wire running from the other post of the button to one of the posts of the bell; R is a wire running from I to one post of the bell. When the button S is pressed, the bell will ring. Each button should be connected with its bell in the same way. One battery can be used with each bell if preferred.—Contributed by Vincent de Ybarrondo, 1148 W. 25th St., Los Angeles, Cal.



Details of Electric Piano

HOW TO MAKE A TELEGRAPH INSTRUMENT AND BUZZER

The only expenditure necessary in constructing this telegraph instrument is twenty-five cents for a dry cell battery, providing one has a few old materials on hand.

Procure a block of wood about 6 in. long and 3 in. wide and take the coils out of an old electric bell. If you have no bell, one may be had at the dealers for a small sum. Fasten these coils on the blocks at one end as shown in Fig. 1.

Cut a piece of tin 2 in. long and ½ in. wide and bend it so the end of the tin when fastened to the block will come just above the core of the coil. Cut another piece of tin 3 in. long and bend it as shown

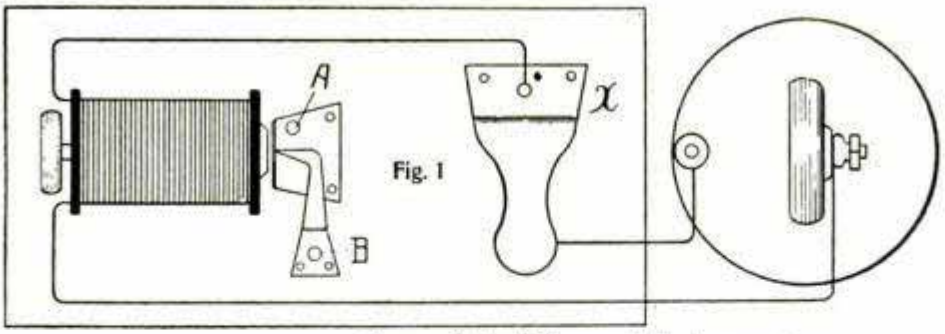


Fig. 1

Fig. 2

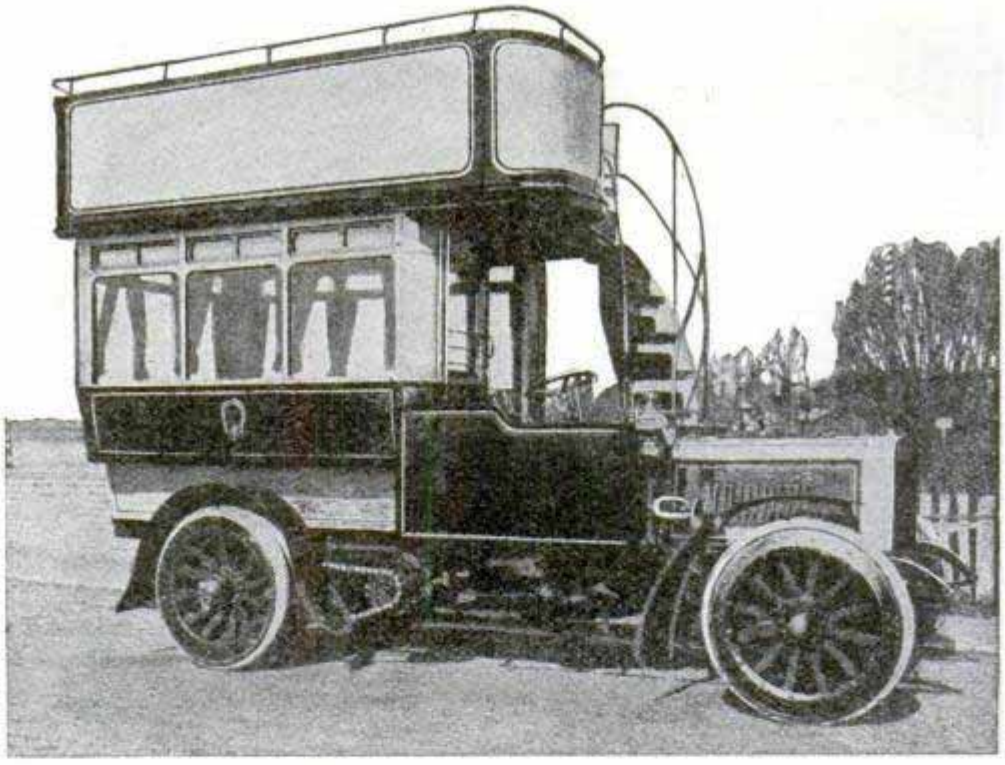
Home-Made Telegraph Instrument

at A, Fig. 2. Tack these two pieces of tin in front of the coils as shown in the illustration. This completes the receiver or sounder.

To make the key, cut out another piece of tin (X, Fig. 1) 4 in. long and bend it as shown. Before tacking it to the board, cut off the head of a nail and drive it in the board at a point where the loose end of the tin will cover it. Then tack the key to the board and connect the wires of the battery as in Fig. 1. Now, move the coils back and forth until the click sounds just the way you wish and you are ready to begin on the Morse code.

When tired of this instrument, connect the wire from the coils to the key to point A and the one connected at the point under the key to B, leaving the other wire as it is. By adjusting the coils the receiver will begin to vibrate rapidly, causing a buzzing sound.—Contributed by John R. McConnell.

ONE-MAN ENGLISH MOTOR BUS



"The Bus Seats 32 Persons"

One English firm has brought out a novelty in a motor omnibus the vehicle being entirely in charge of the driver. The entrance is at the front, the upper deck being reached by the usual winding stairway, hence all who enter or leave are seen by the driver who sits opposite one side of the entrance. The bus seats 32 passengers who place their fare in a box on boarding the car.

The omnibus has been well patronized from its first appearance.

Judge

Liquozone by What It Does. The First Bottle Is Free.

No testimonials are published on Liquozone. We prefer to buy the first bottle, and let the product itself prove its power. A simple test will do more to convince you than any argument or claims. We ask you to learn, at our expense, what this wonderful product means to you.

If you are sick, use Liquozone to get well, as millions have done. Learn what it does that other remedies have not accomplished. If you are well, use it to keep well; to ward off germ attacks and as an invigorant.

What Liquozone Is.

The virtues of Liquozone are derived solely from gases. The formula is sent to each user. The process of making requires large apparatus, and from 8 to 14 days' time. It is directed by chemists of the highest class. The object is to so fix and combine the gases as to carry into the system a powerful tonic-germicide.

Contact with Liquozone kills any form of disease germ, because germs are of vegetable origin. Yet to the body Liquozone is not only harmless, but helpful in the extreme. That is its main distinction. Common germicides are poison when taken internally. That is why medicine has been so helpless in a germ disease. Liquozone is exhilarating, vitalizing, purifying; yet no disease germ can exist in it.

We purchased the American rights to Liquozone after thousands of tests had been made with it. Its power had been proved, again and again, in the most difficult germ diseases. Then we offered to supply the first bottle free in every disease that required it. And over one million dollars have been spent to announce and fulfill this offer.

The result is that 11,000,000 bottles have been used, mostly in the past two years. Today there are countless cured ones, scattered everywhere, to tell what Liquozone has done.

But so many others need it that this offer is published still. In late years, science has traced scores of diseases to germ attacks. Old remedies do not apply to them. We wish to show those sick ones—at our cost—what Liquozone can do.

Where It Applies.

These are the diseases in which Liquozone has been most employed. In these it has earned its widest reputation. In all of these troubles we supply the first bottle free. And in all—no matter how difficult—we offer each user two months' further test without the risk of a penny.

Asthma	Fevers—Gall Stones
Abscess—Anaemia	Goitre—Gout
Bronchitis	Hay Fever—Influenza
Blood Poison	La Grippe
Bowel Troubles	Leucorrhea
Coughs—Colds	Malaria—Neuralgia
Consumption	Piles—Quinsy
Contagious Diseases	Rheumatism
Cancer—Catarrh	Scrofula
Dysentery—Diarrhea	Skin Diseases
Dyspepsia—Dandruff	Tuberculosis
Eczema—Erysipelas	Tumors—Ulcers

Throat Troubles.

Also most forms of the following:

Kidney Troubles	Liver Troubles
Stomach Troubles	Women's Diseases

Fever, inflammation or catarrh—impure or poisoned blood—usually indicate a germ attack.

In nervous debility Liquozone acts as a vitalizer, accomplishing remarkable results.

50c Bottle Free.

If you need Liquozone, and have never tried it, please send us this coupon. We will then mail you an order on a local druggist for a full-size bottle, and will pay the druggist ourselves for it. This is our free gift, made to convince you; to let the product itself show you what it can do. In justice to yourself, please accept it today, for it places you under no obligations whatever.

Liquozone costs 50c. and $1.

CUT OUT THIS COUPON.

Fill it out and mail it to The Liquozone Company, 458-464 Wabash Ave., Chicago.

My disease is.....

I have never tried Liquozone, but if you will supply me a 50c bottle free I will take it.

....

....

....

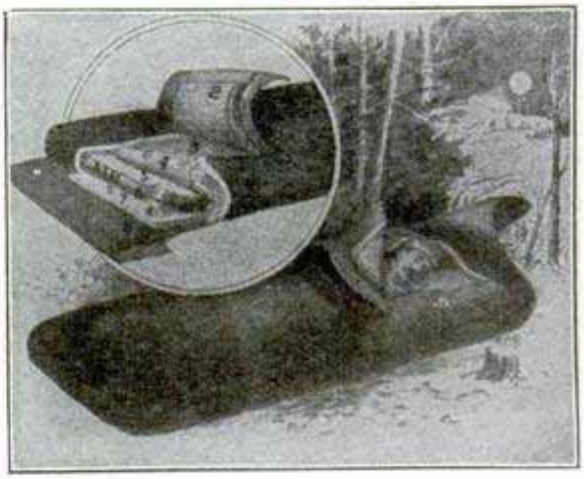
Give full address—write plainly.

M 341

Note that this offer applies to new users only. Any physician or hospital not yet using Liquozone will be gladly supplied for a test.

NEW MECHANICAL IDEAS

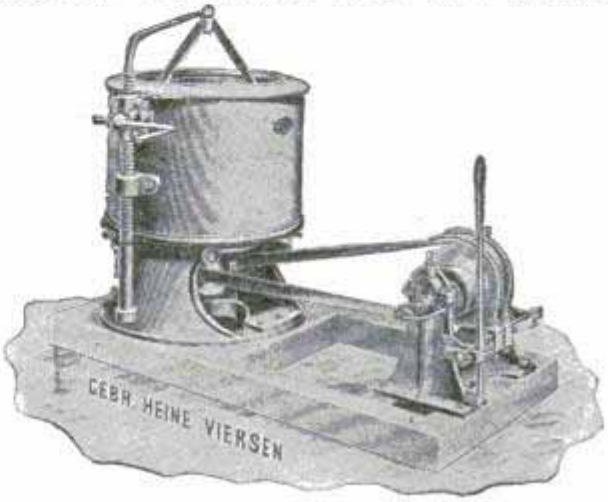
SLEEPING BAG.—A waterproof bag 6 ft. 3 in. long by 27 in. wide, containing an air mattress which inflates to a thickness of 3 in., leaving plenty of room for blankets. The pillow is also inflated and attachable. Extra pocket at the foot and warm pocket for the feet. Can be used on a bunk or in the open air upon the ground. The Sporting Goods Dealer says: "Where the covering goes over



Sleeping Bag

the shoulders there is a fullness of fifty-five inches which is gradually reduced to thirty-six inches at the foot. This affords ample room for a large man to wrap himself up in blankets and yet move around freely."

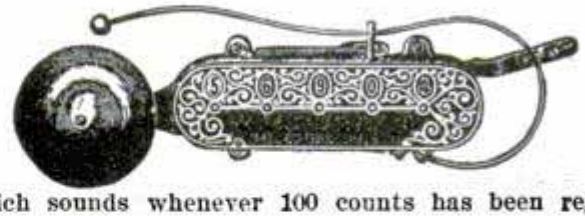
CENTRIFUGAL OIL FILLER.—A recent German invention, said to be very successful. Especially intended to remove oil from refuse matter, waste, etc. The mass is placed in a perforated



cylinder which revolves rapidly. Five minutes are sufficient to extract all the removable oil which is drained into a receptacle ready for use.

MANUFACTURING OPENING.—There is a growing young city in northern Nebraska with an inexhaustible supply of fine glass sand. The town is on a river which affords a water power capable of developing 4,000 h. p. Particulars can be had by addressing Industrial Dept., C. & N. W. Ry., Chicago.

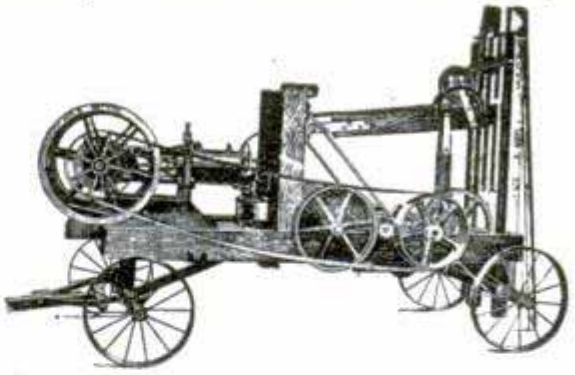
COUNTER ALARM.—The counter is not unlike those in general use, but has in addition a bell alarm



which sounds whenever 100 counts has been registered.

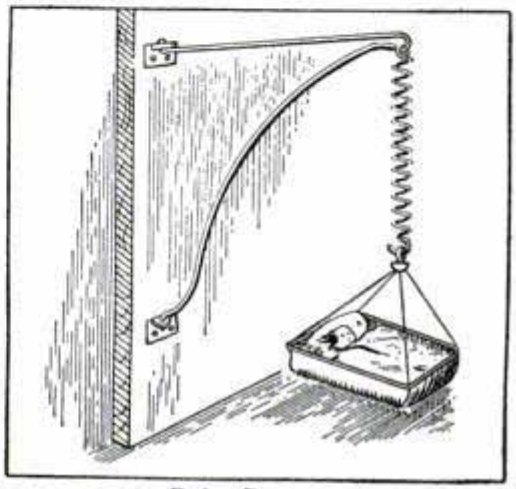
WIRELESS TELEGRAPHY.—Young electricians are taking great interest in constructing and experimenting with wireless telegraph instruments. Now that the most difficult parts of the apparatus can be procured ready made, for a few dimes each, the wireless fad will receive a great impetus.

GASOLINE WELL DRILLER.—This is a portable 6 h. p. machine which will drill to a depth of



600 ft. through rock. Is not self-propelling, but easily drawn by one team.

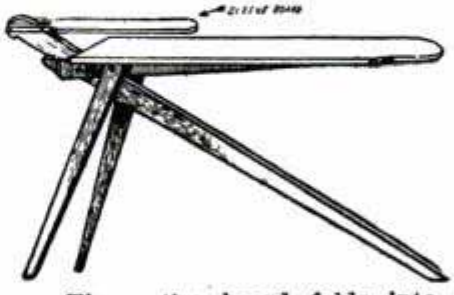
SELF-BOUNCER FOR BABIES.—For the mother whose baby demands someone's attention nearly all the time the self-bouncer will be a boon. The bouncer is in the form of a cradle and is suspended



Baby Bouncer

by means of rods on a spiral spring which is attached to a beam on braces at any convenient point. All that the cradle requires is a slight push—after that the spring will keep it in motion for a long while—or even the movements of the child's body are enough to start it and so lull him back to rest. The device can be detached and moved from room to room, the permanent fastenings for each place, however, being necessary.

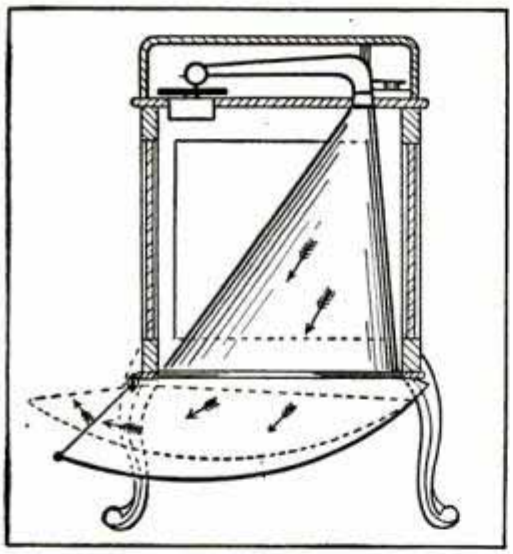
FOLDING IRONING TABLE.—A well finished board 14 by 52 in. supported by three legs at one end. The sleeve board swings out of the way when



not in use. The entire board folds into a small space, and is durable and strong.

"BOYLESS" BOWLING ALLEY.—A system in which no atendant is required to set up the pins and return the balls. The set-up is accomplished by pulling a lever, which restores all the pins, and the balls return by gravity.

HORN CABINET FOR TALKING MACHINES.—The horn of the talking machine is an awkward, but essential, part of the device. A new invention for stowing the horn out of sight and yet in nowise reducing its efficiency consists of a cabinet which supports the mechanical portions of the machine while the horn is inverted and hidden within the



Horn Cabinet for Talking Machine

cabinet. The mouth of the horn opens at the bottom of the cabinet and the volume of sound is diverted into the room by a deflector secured below and held between the legs of the cabinet.

AUTOMATIC TICKET AGENT.—An Italian engineer has perfected an arrangement which performs the duties of a ticket agent for any line to which it is adjusted automatically. Take, for instance, the Naples-Rome line, using 400 different tickets. The machine will manufacture on demand any one of these tickets, indicate its price; register the price in a total figure in the manner of a cash register; total separately the different items corresponding to the different tickets; number progressively the different tickets; keep account of number of tickets issued for each class and of the total number; duplicate the tickets on a continuous ribbon and stamp advertisements on the backs of the tickets. The machine is in charge of an employe, to whom the application for the ticket is made. The machine indicates the price; the money is handed to the employe, who turns a handle and the ticket is printed then and there, without any chance for fraud or dishonesty.

ALWAYS BE EXPLICIT

In the shop, as well as in the doctor's office, there is the constant necessity of being accurate. The story is told of a doctor who was visited by a young foreigner.

"The thing for you to do," the physician said, "is to drink hot water an hour before breakfast every morning."

"Write it down, doctor, so I won't forget it," said the patient.

Accordingly the physician wrote the directions down—namely, that the young man was to drink hot water an hour before breakfast every morning. The patient took his leave, and in a week he returned.

"Well, how are you feeling?" the physician asked.

"Worse, doctor, worse, if anything," was the reply.

"Ahem! Did you follow my advice and drink hot water an hour before breakfast?"

"I did my best, sir," said the young man, "but I couldn't keep it up more'n ten minutes at a stretch to save me."

INFORMATION GRATIS.

As a rule, engineers are anything but a frivolous class of men; but occasionally one comes across a black sheep. Recently a solemn-looking individual strolled into the refrigerating engine-room and asked Mr. Guppy, the light-hearted second, to give him a little information about his engines.

"Why, certainly," said Guppy, "those two brass knobs over there are called the jeremididlers, and that thing like a distorted mangle is the freezer. Now the jeremididler—so called because of its resemblance to a boiled owl—is really generating electricity flavored with red currents—you understand? Well, when we stir up the conflicting elements with a brass poker and an old clay pipe, the jeremididler is connected with the freezer, and, owing to the ammonia extracted from the pipe mixing with the electricity, it freezes the freezer so cold that we have to find out the temperature with a six-foot thermometer, and——"

"My word," said his questioner, "that's wonderful!" and he walked off.

"Hear me kidding the old chap?" said Mr. Guppy, with a wink, to the chief, who had been standing by. "He's as green as a new cheese."

"Yes, I've often thought so," said the chief quietly, "but he's the inspecting engineer for the company, all the same."—Am. Machinist.

HOW A PIPE LINE IS BUILT

R. M. Boyle, general manager of the Ajax Contracting Co., of Pittsburg, Pa., which has the contract for constructing the natural gas pipe line from Independence to Kansas City, Kan., writes in The Paint, Oil and Drug Review:

"We use Italian labor for digging the trench. These men are sheltered in tents and are cared for after the manner of soldiers. For the work of laying the pipe we employ Irish labor. These men get better wages and we board them in houses along the route.

"Building a pipe line is dangerous work. We go right through everything. The line is laid according to surveys, straight as the crow flies. It doesn't do to make many turns. If we go through a farmyard and there is a big, shady oak in the way, though it may be dear to the farmer's family, out comes the dynamite and the pipe line goes on. When we can't get a right-of-way through some man's land, we give a bond and go on. Sometimes the owner sits on the fence with a shot-gun. Then we arm one of our men, too, and he rides on the first wagon with the driver. Sometimes the farmer shoots and sometimes he doesn't. In any event the pipe line proceeds. Those Irishmen we employ form an army of 400 men and they are ready for anything that may come, if an attack is made in numbers."

BROTHER LIKES "POP."

One of our readers in Nebraska sends us a letter from his brother in Ohio, which says: "My Dear Brother:—Your esteemed favor of the 26th ult. came duly to hand, also the magazine Popular Mechanics. Why did you not tell me years ago about this magazine? I have had but little time to look it over, but every page is so interesting to me that I hasten to make remittance so that I can have it coming direct every month."

NEW BOOKS.

DIES AND DIE MAKING. By J. L. Lucas. Illustrated; 100 pages; cloth, $1.00. J. L. Lucas, Bridgeport, Conn.

Book intended for shop use. Gives the origin of dies and directions for making them in all their types. Well illustrated with diagrams. Practical and convenient.

THE MOTOR LAUNCH—HOW TO BUILD AND RUN. By W. P. Hartford. Illustrated; cloth; price, $1.00. W. P. Hartford, Cassville, Mo.

Tells how to build and operate a launch successfully. Is concise, free of technicalities and thoroughly practical. Explains in detail the operation of the gasoline engine, including the subjects of fuel, compression, cooling, muffling, lubrication, etc.

GEMS OF KNOWLEDGE FOR ENGINE AND TRAINMEN. By T. P. McCormick. Pocket size; morocco; price, 50 cents. T. P. McCormick, Waterloo, Ia.

This handy little book gives some valuable instructions to trainmen, exhausts the use of the air brake and the train air signal in a series of questions and answers and treats of breakdowns, telling just what to do in emergencies. It is written by a trainman.

PATTERN MAKING AND FOUNDRY PRACTICE. By L. H. Hand. Illustrated; 12mo.; over 200 pages; cloth, price, $1.00; full limp leather, price $1.50. Frederick J. Drake & Co., Chicago.

A book written by a practical mechanic for practical mechanics, out of the fund of his personal experience. Nearly every problem explained is taken from an actual pattern and the result is a work admirably adapted to the needs of the craft. The illustrations are numerous and helpful and the subject is handled in such a plain, straightforward manner that one cannot fail to understand.

ELECTRICIAN'S HANDY BOOK. By Prof. T. O'Connor-Sloane, A. M., E. M., Ph. D. Red leather; gold titles and edges; 768 pages; pocket book style; price, $3.50. The Norman W. Henley Publishing Co., New York.

This handsome volume covers in a practical manner the entire field of electricity, putting the information in such convenient form as to make it especially valuable as a reference book. The language is so clear that the work is adapted alike to the needs of the student, the practical worker and the expert electrician. Beginning with the first principles of the subject it carries the reader through the advanced branches. Illustrations are used wherever they can simplify the text, and altogether there are 610 specially made engravings. Above all the work is up-to-date and leaves nothing to be desired in the way of further explanation.

PRACTICAL GAS AND OIL ENGINE HAND BOOK. By L. Elliott Brookes. Illustrated; pocket size; over 200 pages; 16mo.; popular edition, cloth, price $1.00; edition de luxe, full limp leather, price $1.50. Frederick J. Drake & Co., Chicago.

A manual of useful information on the care, maintenance and repair of gas and oil engines, including stationary, portable, marine and automobile engines. Tells how to adjust, repair and test engines. Contains numerous rules, formulas and diagrams and over 50 illustrations. Practical information for owners, operators and all others having to do with gas and oil engines.

(Continued on page 1168.)

NEW BOOKS--Continued.

LOCOMOTIVE ENGINE RUNNING AND MANAGEMENT. By Angus Sinclair. Illustrated, 450 pages; cloth, $2.00. Railway and Locomotive Engineering. New York.

This work has been greatly enlarged and brought up-to-date. It shows how to manage a locomotive in running different kinds of trains with economy and dispatch; gives plain descriptions of valve-gear, injectors, brakes, lubricators and other locomotive attachments; treats of the economical use of fuel and steam, and presents valuable directions about the care, management and repair of locomotives and their connections. The information is plainly given and excellent illustrations further elucidate the text.

UP-TO-DATE ELECTRO-PLATING HAND BOOK. By James H. Weston. Pocket size, 4x6½; illustrated; over 200 pages; popular edition, full cloth, price $1.00; edition de luxe, full limp leather, price $1.50. Frederick J. Drake & Co., Chicago.

A manual of useful information for platers and others who wish to become acquainted with the practical art of the electro-deposition of metals and their alloys, including electro-deposition of metals, electro-deposition of alloys, electroplating dynamos, electroplating solutions, electroplating apparatus.

This book has been written to meet the requirements of platers desiring a practical and yet non-technical work on electroplating. The information given therein has been obtained from platers of practical experience, and the construction and operation of the different devices used in the electro-deposition of metals are fully described and illustrated.

While looking for "trouble," Home Telephone Company linemen ran into a swarm of bees housed in the cable box at the corner of East Maine and Vine streets, says the Batavia (N. Y.) News. There was a short but decisive battle, from which the linemen came off victorious and the buzzy family was broken up. In the box were found several pounds of honey, which the men enjoyed. The comb was not of beeswax, but of paraffine, which the bees had extracted from the cable cup within the box.

ADMIRAL DEWEY URGES BIG SHIPS

"As I have repeatedly said, the great lesson of the war in the far east is the necessity for bigger ships and big guns. In the battle between the fleets of Rojestvensky and Togo the damage was done by the big guns. The twelve inch guns of the Japanese ships did most of the damage, in my opinion. One Japanese officer said it was a battle of wireless telegraphy. By means of his scouts Togo knew long before he saw any of the Russians—when, in fact, they were a hundred miles away—the composition of Rojestvensky's fleet, the formation of the vessels, and the course they were steering.

"If your are going to fight as the Russians and Japanese did, at a range of three miles, anything under a twelve inch gun won't be of much use against armor. The eight inch gun is not effective."

GIRL A TELEPHONE "LINEMAN"

Grace Brennamen, the handsome 18-year-old daughter of the telephone superintendent at Lindsay, O., took her father's place while he was ill and help could not be secured. She donned a short skirt, put on a pair of climbers, and went up the poles and made the repairs as successfully as a regular lineman.

TO GAS ENGINE USERS.

to home it may consume we all kno a gasoline engine is a verry peculor little trick about the size of a lard can and as greesy orn the out side as a lard can is orn the en side

if you have one of this kind and have trouble with gaskets blowing out take a piece of copper about 1/16 or 3/32 of and inch thick and heat it. put en water to cool then cut your gasket and put it orn with thick oil and graduly tighten. if it blows out or leaks send for mee and i will eat it.

a lift orn and engine by

E. C. Freeman. Greenville. Texas.

It's the little things that count in the operation of a gasoline engine. A rusty wire, or one poorly connected; the least bit in life too much turn of a needle valve—or not quite turn enough. A little water in the bottom of the carburetter or generator. Any of these things will cause trouble, as will sometimes a sticking trembler where the jump spark is used. Engines have even been known to stop when the gasoline tank became empty. All easy to remedy, when found, but often hard to locate.—Gas Power.

SOLILOQUY OF AN ENGLISH DRUMMER

The September Journal of Gas and Sanitary Engineering, London, contains the following breezy monologue by its "Practical Man," who says:

Now don't, please!

It is really unseemly of you.

You ask me jovially, "How's trade?"

And you do not even remove your hat!

Pray speak softly and kindly of the "dear departed."

Trade! My good sir, there's isn't any!

Things are going from bad to worse.

They are. Plumbing—oh, my gracious! Plumbing!

Why look you, sir, I was told the other day by a traveler that the "cutting" was simply awful.

And as for booking orders, he'd been out a week and couldn't secure a single line.

And then the painting! Gracious, again! A traveler for one of the best varnish firms in the world makes the same complaint.

Only a more pitiful one. Yesterday, in a voice shaken with emotion, he told me he hadn't had an order for three weeks.

Going from bad to worse—what's the plural of worse? Worser! There you have it—that's trade.

The men are out in hundreds and the employers view with dismay the rapidly diminishing balance.

That is, if there ever was a balance. In many cases it must have been a fearfully attenuated one, I should think.

And to save the remnant what is done? "Substitutes" of every kind are used, and the most hateful and ruinous system of long credit offered and taken.

The season is here to

MAKE MONEY

Get started early.

$40 to $75 A WEEK

Can be made with one of these

Steam Peanut Roasters and Corn Poppers

S. DUNBAR & CO.
16-18 No. Desplaines St.
CHICAGO.

Catalog Free.

Nature's Coffee Pot

MAKES COFFEE A HARMLESS DRINK.

Do you want to own a coffee pot that will separate the pure extract from the bitter and poisonous matter of the coffee bean, leaving your cup of coffee as harmless as a glass of water? Think what this means to you. You can drink all the coffee you wish with none of the bad effects that is so common to coffee when made in the old fashioned pot.

We would like to tell you all about "Nature's Coffee Pot," its wonderful workings and the clever way it transposes coffee into a drink as healthy and harmless as water from a running stream.

"Nature's Coffee Pot" is a piece of art, it is made from the famous "Poillon Ware" with its many color tints of glaze. Sells for $2.00. Send us your address for further particulars.

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STANDARD Self-Filling Self-Cleaning **FOUNTAIN PEN**

No ink dropper. No smeared fingers. No twisted rubber No Complication

$178.90 earned in 32 days by retired business man in Ala.

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Our free lessons in successful salesmanship make experience unnecessary. We send all particulars and figures to prove above and many other records. Write today. **Energetic Agents and District Managers Wanted.**

STANDARD PEN CO., 1156 Baker Bldg., TOLEDO, O.

START A MONEY MAKING SCHEME OF YOUR OWN

And here is how it can be done. Let me ship you one of my **Electric Floss Machines** and you can immediately commence turning **SUGAR** into **DOLLARS**—here is the proof.

One pound of Sugar costing 5 cents will make 16 bags of Candy Floss; at 5 cents per bag you make 75 cents profit on every 5 cent investment—at this rate you can make your dollars earn you $12 each.

There is an opening in every Town and City of the United States for some enterprising Man or Woman to earn a good income by operating one or more of my Candy Floss Machines. Frequently as much as $90.00 a day has been made from one of these machines.

For further particulars, address,

SHAFFER CANDY MACHINE CO.
Suite 19, 245 Broadway, New York.

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66 Lake Street, Chicago

BURN AIR-IT'S CHEAP NO STOVE LIKE IT!

Consumes 395 Barrels of Air to one gallon of Kerosene. Penny fuel, burns like gas, hottest fire, won't explode, saves work and fuel bills. No coal, wood, dirt, ashes—no wick, no valves, easy operated, handsome, durable. **Grand cooker, baker,** quick work, cool kitchens. **15000 Harrison Wickless, Valveless Oil-Gas and Air Burners sold 1 month. AGENTS WANTED—$40 Weekly. Greatest MONEY MAKER.** Guaranteed, all sizes, sent anywhere, $8 up. Write, **FREE** proposition, 30 day trial offer.

World Mfg. Co., 5909 World Bl'd'g, Cincinnati, Ohio.

HINTS TO INVENTORS

After all, it is not so very hard to get rich. Fortunes offer themselves on every hand as rewards for a little ingenuity. For example, a machine is wanted that will open oysters, says the Saturday Evening Post. If you can make one that will do the work satisfactorily, it will render you independent for life.

Too difficult, you think? Take an easy one, then. How about a substitute for carpet—just a floor covering that will serve the same purpose at less cost. You can be a multi-millionaire before the year is out if you can solve that little problem.

There are, however, other things much easier. Perhaps, for example, you can contrive a simple and inexpensive tool that will cut ice without wasting it, taking the place of the wretched and extravagant ice-pick now in use. Why not try, anyway? There should be, one would think, the principle of the saw about it somewhere.

Here's another: an envelope that cannot be opened without detection is yet to be invented. Can you not solve the problem? As Colonel Sellers used to say, there's millions in it.

Can't you think of a way to fasten panes in windows without the use of putty? Puzzle that out, and you won't have to do any more work.

But we were speaking of envelopes. What is the matter with devising one that is suitable for carrying small articles through the mails? Nothing of the kind exists at present. Will you not step into the breach and while covering yourself with glory, fill your pockets with money?

Another thing that is much wanted in the world is a scrubbing machine. Invent one! If you do not, somebody else surely will, and then you will be sorry. Think what a boon such a contrivance would be to overworked housewives, and give your brain an extra hustle.

Most folks, especially women, cannot sharpen their own knives. They need some little machine that will enable them to get over the difficulty. Why not make one and patent it?

Typewriters make a dreadful noise. How can it be deadened, so that every business office may not resound with the unceasing rattle of the keys? Any one of the big companies that sell such writing machines would gladly pay $50,000 cash for a solution of that puzzle.

These are only a few of the inventions that remain to be thought out. Each one of them represents a fortune for somebody; and incidentally they serve to illustrate the fact that plenty of useful mechanical discoveries are yet to be made, and that there is no lack of opportunities for the rising generation of inventors to utilize.

BUOYANCY OF CAST IRON

Every founder who has noticed has seen, when he threw a piece of cold cast iron into a ladle of liquid iron, that the solid iron sank out of sight because each degree of heat that the liquid iron has absorbed has increased its bulk, says the Foundry. For equal bulks the cold iron is heavier and sinks. In a moment or two the iron, still solid but white hot, rises and floats on the surface, which is proof that it has expanded more than the melted iron and is lighter. The piece is rapidly becoming smaller and sinks to the surface as the last portion melts, showing that just at melting it is not as light as when it floated higher on the surface. We find that white iron does not float and that gray iron floats more above the surface as its silicon increases.

'TWAS WORK TOO

Prof. Nichol, the Cornell physicist, during the recitation of a freshman class in natural philosophy, observed a tall, lanky youth in a rear seat, his head in a recumbent position, his body in a languid poise, his eyes half closed and his legs extended far out in an adjacent aisle. He was either asleep or about to lose consciousness.

"Mr. Frazer," said the great scientist, "you may recite."

The freshman opened his eyes slowly. He did not change his somnolent poise.

"Mr. Fraser, what is work?"

"Everything is work," was the drawling reply.

"What! Everything is work?"

"Yes, sir."

"Then, I take it, you would like me and the class to believe that this desk is work?"

"Yes, sir," replied the youth wearily, "that desk is woodwork."—Cornell Widow.

EMERGENCY AUTO REPAIRS

The touring motorist is often in a position where he has only himself and the portable tool kit he carries to rely upon in case of accident of any kind. A correspondent of the Automobile relates some of his experiences in this line:

"It was not so very long ago that I was testing out a new car on an unspeakable road, when two deep ruts close together proved too much for the tubular front axle. The first rut bent it, and the second one broke it off short not far from the middle. In summing up the damages we found that though the steering pivots were slightly bent, they were still in working order, so we got to work to make a repair that would take us home. The nearest house, so far as we knew, was twenty-five miles away, so that we were thrown entirely on our own resources.

"The first thing we did was to make a hot fire of wood. In this we heated the two halves of the axle and took the kinks out as well as we could. Then we made four heavy hardwood splints and 'set' the broken axle as a surgeon would set a broken bone. We were lucky enough to have a roll of heavy wire in the tool box, and with this we bound the splints over the broken place, drawing the wire as tight as posible and using plenty of it. The finished job certainly looked anything but strong, but no one wanted to walk twenty-five miles, and we had to get home somehow, so we got into the car and started.

"I don't know how it happened that nothing else gave out, but that horrible piece of repairing took us home safely. To be sure, we crawled; the joint creaked and groaned and sagged; the front wheels assumed the wildest of angles and never pretended to be anywhere near parallel; but, handled with the tenderest care, the thing took us all the way. I think we went to bed when we got there."

Electric automobiles are used to haul canal boats in Belgium. When two boats meet the autos turn around and change boats.

SUNLIGHT AN INCENDIARY

Rays of sunlight focused on an inflammable article or substance, as for instance a light window curtain or hay, are frequently the cause of fires. This was clearly demonstrated by the experience of a tutor who was with his pupil and the boy's father at Mern, in the Tyrol.

The tutor called attention to the way in which the sunlight was focused on the table cloth by a full water carafe, saying that the heat was intense enough to be dangerous. The boy's father opposed the idea, and while the two were arguing it, the spot on the cloth darkened and burst into flame.

Not long ago a house at Saybrook, Conn., was fired by sunlight focused on a window curtain by a gold-fish globe, and undoubtedly there are many instances of the kind. A bubble in the glass used in a skylight may focus the rays so that a hay-barn or a house is fired.

PAINT SHOP FLOORS.

In the discusion of this subject at the recent annual convention of the Master Car and Locomotive Painters, a number of the members expressed a preference for vitrified brick floors for paint shops, says Railway Review. The principal objection to concrete floors was that they are dusty. Sweeping with brushes, the use of a mixture of coal oil and sawdust, and painting the floor were all recommended for overcoming this difficulty. It appeared also that the quality of the concrete has much to do with it. Mr. F. A. Weis, of the Central of New Jersey, stated that the cost of a concrete floor, for construction and maintenance, is less than that of asphalt or wood block. He considered concrete the best, "because, when properly installed, it will remain hard and smooth and the generation of dust therefrom will be very small; is absolutely fireproof; will absorb very little water, insuring against dampness; is easily kept clean, and in ordinary paint shop service requires practically no repairs."

The proportionate size of the expansion tank in relation to the radiating surface of a hot water heating system should be approximately one gallon for every 40 sq. ft. of radiation.

PEAT FOR LOCOMOTIVES

The Boston & Maine has experimented with peat for locomotive fuel, the peat being furnished by a company who are exploiting beds of this substance, occurring in Eastern Massachusetts. Attempts have been made to compress the peat by a rolling process, but the resulting briquets were not solid enough for locomotive use and broke up too readily. Their heating value is stated to be about 80 per cent of that of ordinary Pennsylvania bituminous coal. An attempt now is being made to coke the peat.

ELECTRIC POWER FOR THE FARMER

To furnish the farmers of its locality with electric power at annual rates, based on the extent of the service required, is the unique proposal of the Fort Wayne and Wabash Traction Company of Indiana. The company operates about 80 miles of interurban lines and thus is in good position to carry out its scheme. The plan is to furnish every land owner within one mile on either side of the company's tracks with an electrical outfit at cost. Much of the heavy work about the farm could be reduced in this way, as well as cutting down the amount of help required, and affording the farmer more of the luxuries enjoyed by city folk.

"Want" and "For Sale" Ads. 2 cents per word, payable in advance. Replies may be sent to a number, care Popular Mechanics, and will be forwarded promptly without extra charge.

"SHOP NOTES"—Paper covers 50 cents. Popular Mechanics.

AUTOMOBILES.

AUTOMOBILE SCHOOL.—Chicago School of Motoring; the original automobile school in Chicago. One hundred and eighty graduates the past year, to whom we refer upon request. Automobile owners, prospective buyers and young men wanting to become expert chauffeurs will save a great deal of money and a lot of worry by studying the mechanism, care and repair of gasoline automobiles, in our shop, where all parts are open so you can see how they are made, and how they operate. We give thorough and practical instruction. Competent chauffeurs supplied. Address, Chicago School of Motoring, Dept. B., 264 Michigan Ave., Chicago, Ill.

FOR SALE OR EXCHANGE—Automobile gear. Address C. C. H., 18 North Front St., Columbus, O.

FOR SALE OR EXCHANGE—4 h. p. automobile or boat 4 cycle gasoline engine. Address A. P. C., 18 North Front St., Columbus, O.

FOR SALE—8 h. p. 2 cylinder auto engine, $70; 5 h. p. 2 cylinder motorcycle engine; 8 h. p. transmission gear; igniting dynamo; spark coil; and one light automobile. All second hand. W. Hoffman Motor Works, 1253 N. Halsted St., Chicago.

WANTED—Motor cycle, kind, style and condition no object; also any motorcycle parts, new or second hand; will trade or pay cash. B. G. Raymond, St. Cloud, Minn.

FOR SALE—A JOB LOT.

	Each.		Each.
Bougie Herz Plugs...	1.00	Im. De Dion.....	$0.20
E. G. Bougie Plugs..	.50	Im. De Dion Porc. Cores	.10
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French Soot Proof Plugs	.75	Dow Mica Plugs.....	.65
Never Miss Plugs...	.75	Jewel Plugs	.90
		Battery Terminals..	.02½

A. M. Symonds, 901 N. Fairfield Ave., Chicago, Ill.

BUSINESS CHANCES.

FOR SALE—Eleven hundred and fifty acres pine timber. Double circular saw mill, twenty thousand capacity; cable feed, live rolls, gang edger, log turner and log haul, steel head blocks, shingle mill and planer. Good buildings, all new and modern. Big Bargain. For particulars apply to J. J. Patterson, Eagleville, Modoc Co., California.

ATTENTION—Mechanics, Salesmen, etc. We have an unusual and original plan and not at all one-sided, which we ask to present to you if you desire to begin a most profitable manufacturing business at your home or business place without other expense than materials from $25 to $50. Write Dept. M., The Cardinal Mfg. Co., Cleveland, O.

FOR SALE—Well equipped machine shop in state capital; a money maker; $2,500. Other business reason for selling. Schaefer Bros., Holmes St., Frankfort, Ky.

FOR SALE—Working interest in sawmill near Seattle, Washington. Openings for good mechanics who wish to locate permanently on the Pacific coast. Address S34, care Popular Mechanics.

FOR SALE—A grocery and crockery business catering to the best class of trade in a city of 3,500; sales, $27,000 yearly. Address 112, care Popular Mechanics.

FOR SALE CHEAP—Set of machinery and blacksmith tools, including 1 Kerkhart turning lathe, shafting and belting in good shape. 5 horse power engine, also boiler, emery stands, drill press, hammers, etc. Blacksmith tools complete with $100 worth of stock. Will sell for cash only. In town of 5,000 and the only machine shop. Good opening for the right man. Will also sell building. Write F. E. K., care Popular Mechanics.

BLACKSMITHS.

GOOD BLACKSMITHS ARE SCARCE AND BUT FEW LEARNING THE TRADE.

And the smith comes first of all professions or trades. The smith must make the tools first for all from the surgeon to the safe blower, by using Toy's Treatise on new steels explaining how to work them with 75 new methods for working all difficult jobs. Ten receipts for making your own compounds for welding different kinds of steel solid. Thermite welding fully explained; also two colored tool tempering charts; chart A explains all annealing and hardening; Chart B explains both scientific and plain tempering to a standard. All the above for $1.00. Valuable samples free. W. M. Toy, Sidney, Ohio.

EDUCATIONAL.

FOR SALE—I. C. S. electrical engineering course, 5 bound volumes. A bargain. Address R. R. B., 142 S. 4th St., Steubenville, Ohio.

WILL EXCHANGE—1-6 h. p. 110-volt motor and electrical engineer correspondence course, including 7 vol. brand new; for cash or motorcycle. No. 111, care Popular Mechanics.

FOR SALE—Complete course in mechanical drawing in Scranton School. Address Box 164, Edison, Ohio.

A NEW BOOK—Unpatented mechanical movements and devices, used in the make-up of gasoline engines and automobiles. With 28 sheets of blue prints showing details. S. M. Howell, Zanesville, Ohio.

WANTED—Second-hand correspondence course in mechanical engineering. Joseph N. Parker, Bedford City, Virginia.

IF THERE'S a book you need, and can't locate it, Popular Mechanics can.

A PRACTICAL BOOK, "Dies and Diemaking." Postpaid $1. J. L. Lucas, Bridgeport, Conn.

ANYONE WISHING TO SELL missing numbers of Horseless Age, 1905; Popular Mechanics, 1905; Power, 1903; Automobile, 1903; Motor World, 1904; Motor Age, 1903. Mrs. C. F. MacDermot, Hotel Wentworth, New Castle, N. H.

FOR SALE—Encyclopedia Applied Electricity, 5 volumes, new, $12.50. Also Blickensderfer Typewriter, in good condition, $12. Edwin Trube, Galveston, Texas.

FOR SALE

FOR SALE—Castings of emery grinder head and countershaft that you can build on a 9-in. lathe. Small steam engine and sewing machine motor castings. We make patterns from drawings. Blue prints of grinder and countershaft, 25 cents. Salineville Model & Machine Works, Salineville, O.

FOR SALE—Cheap—4x6 vertical engine; 2 steam pumps; 8 h. p. gasoline auto engine, good condition. Perry Bros., 467 W. Monroe St., Chicago.

FOR SALE—A Foyer Cylinder Letter Press in brand new condition. Will copy twenty letters per minute. Must dispose of it, owing to a change in office systems. Cost $25 new, will sell it for $12.50. Write quick or you may be late. Address 301, care Popular Mechanics.

FOR SALE PIANO—A new and elegant piano by one of the best builders in the country; never used; for sale at a great bargain. This is a very unusual offer. Best of reasons for selling. Address 225, care Popular Mechanics.

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FOR SALE OR TRADE—10 h. p. steam engine in good condition; one boiler feed pump. Will trade for a 4 to 8 h. p. gas or gasoline engine. Address M. A. Hyatt, Eaton, Ind.

FOR SALE—Gray & Co.'s Royal Silver Metal Plating Outfit, cost $16.50; never used; will sell for $10 Edwin Trube, Galveston, Texas.

FOR SALE—We have a lot of 1½ h. p. gasoline engines, set up on skids, complete with tanks, spark plug, coil, batteries, etc., which we are selling at $60 apiece; in order to make room for larger engine. Send for cut. Lennox Machinery Co., 10 S. Clinton St., Chicago.

FOR SALE—6x9 inch Victor hand-lever printing press, new rollers, excellent condition, $8. Address Robert J. Greer, North East, Pa.

FOR SALE—High-efficiency ½ h. p. dynamo-motor, cheap, with guarantee. 115 Popular Mechanics.

FOR SALE—A piano case organ, made of best quality black walnut; keys of ivory; bellows worn out. Wish to sell for the wood and ivory in it. O. Bashford, Poplar Grove, Ill.

FOR SALE OR EXCHANGE—No. 2 Duplex typewriter in good serviceable condition. Cost $100 new. Will trade for motor-cycle and pay difference. Chas. E. Thrasher, Nevada, Iowa.

FOR SALE—New automatic telegraph transmitter with 27 records. Address V. W. Bates, Shabbona Grove, Ill.

FOR SALE—One new 16-ft. Gasoline Launch, complete with engine, ready to run, $150. Send stamp for photo. Address 373, care Popular Mechanics.

FOR SALE—Wood-working machines, foot power, manufactured by Seneca Falls Mfg. Co., combination saw with boring, scroll-saw and moulding attachments; lathe, five-foot centers, mortiser with tenoning tool. Will sell cheap. Write Chas. H. Irish, Zion City, Ill.

HELP WANTED.

WANTED—Draughtsman wanted in British works of old-established engineering firm, to design main line and other locomotives, and best classes mining machinery, engines, pumps, etc. Must have sound theoretical training as well as practical experience with above mentioned work. Must be capable for ready and accurate calculations. Must have capacity to take charge. State experience fully—also age and salary expected. Address B. D., care "Railway Gazette," Queen Anne's Chambers, Westminster, London, S. W., England.

WANTED SALESMEN—The Tropical Oil Company, Cleveland, O., will arrange on salaried basis with lubricating oil salesmen for territory not covered; can also use on attractive commission proposition few good salesmen without previous experience in this line, which is easily learned. Communicate with us.

WANTED.

WANTED SITUATION—As superintendent or chief engineer, in some electric lighting or power plant, either direct or alternating current, or both. Preferably with some company that is willing to pay a salary in proportion to the increased efficiency given to the entire service, outside as well as inside the station. References exchanged. Open for engagement after 1st Nov. Address 117, care Popular Mechanics.

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WANTED—Pulverizing machine, porcelain lined, good, second hand. Give full particulars, maker's name, what it has been used for and how long. Address 118, Popular Mechanics.

MISCELLANEOUS.

MACHINISTS, CARPENTERS, MECHANICS—Are you looking for a handy, up-to-date tool? We have a brand new saw-clamp that will hold your saw steady. Guaranteed to please. Price, $1.25. Address 125, care Popular Mechanics.

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STEEL and BRASS STAMPS 6c (a letter); Wood Stamps, Seals, Plates, 50c; Embossing Dies, Presses, $4. Postal brings price circular. J. Kiola, engraver, 155 W. Madison St., Chicago, Ill.

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DISSOLVING STEREOPTICONS $105 outfit, $39; calcium light outfit, $15.50; slides, etc. Bargains. F. L. Smith, Amsterdam, New York.

NO. 30 HEAVY WINDOW SPRING, heavy nosing and strong springs with rubbing contact; can be arranged for open or closed circuit; size of plate ⅝x 3⅝ in., at 15c each; door springs; get our prices on other burglar alarm springs. Smith's Electric Supply House, 207 E. Van Buren St., Chicago, Ill.

WILL MANUFACTURE and place on the market any machine or device. Machinery, etc., to be designed or developed will receive my prompt and careful consideration. Let us figure on your work. Edward Lindmueller, Williamson Bldg., Cleveland, O.

WHEN YOU WANT anything and don't know where to get it, write Popular Mechanics.

WANTED—If you have anything in light metal manufacturing, job or experimental work, write me. Lowest prices. Schwabe & Son, 55 W. Washington St., Chicago.

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WANTED—Small metal specialties to manufacture. Expert die making. Press and screw machine work. Plating of all kinds. Prices right for quantities. John Oldfield, 937 W. 41st Court, Chicago.

MECHANICS, SHOPMEN, ETC., can have a regular, or side line manufacturing business at their home, or shop without other expense than materials which we furnish to manufacture Elastic Carbon Graphite paints. We instruct beginners free with first order for materials. Sales to merchants and consumers afford unusual profits. We want manufacturers where we have none, hence this unusual offer. Write Dept. M., The Cardinal Mfg. Co., Cleveland, O.

WILL CEMENT BOTTOM PROTECT WARSHIPS FROM TORPEDOES?

The English government has been experimenting with concrete to determine its efficiency as protection to ships from torpedo attack. An old gunboat was selected, and after removing all the machinery several tons of concrete were placed in the hold, arranged in layers. Three hundred pounds of guncotton were exploded beneath the hull. The results have not been given to the public.

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"I want to see a phonograph in Every American home."

The phonograph is Mr. Edison's greatest invention, and it has become his hobby. He has practically dropped all financial interest in his many other inventions, putting all his efforts to make the phonograph the model of perfection, until to-day Thomas G. Edison has made it possible for every American family to bring into their own home, without paying us one cent, the great invention on which he has spent many sleepless nights and thousands of dollars to perfect. It is his pride and pleasure—he wants you to hear it—he wants you to have a phonograph.

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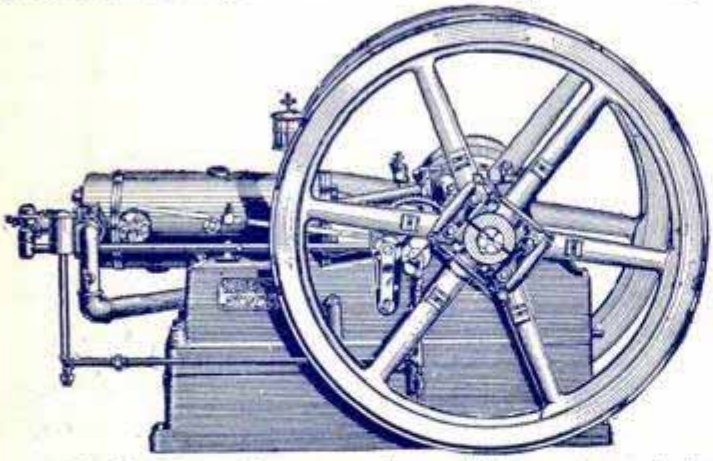

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