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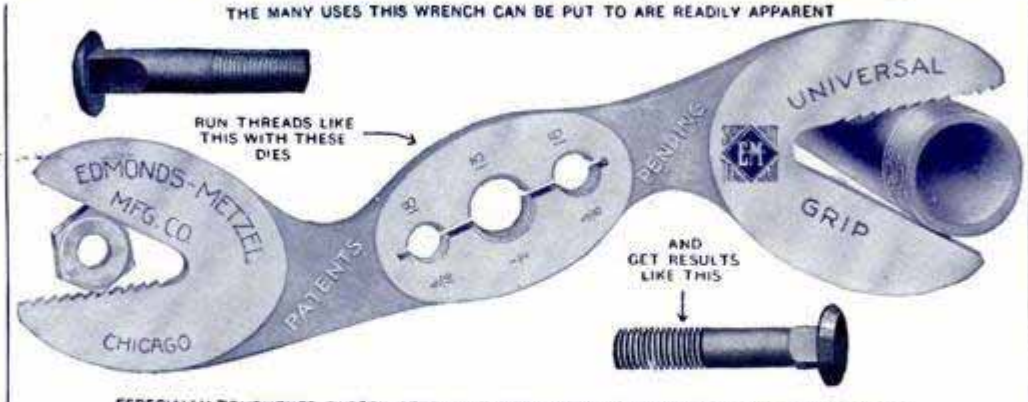

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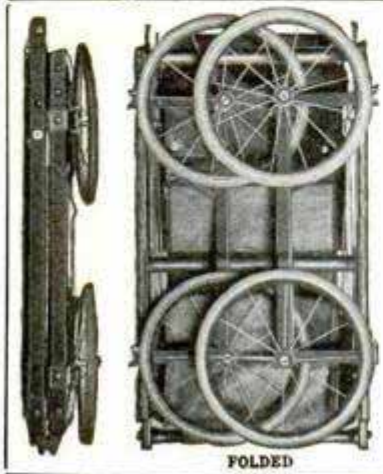

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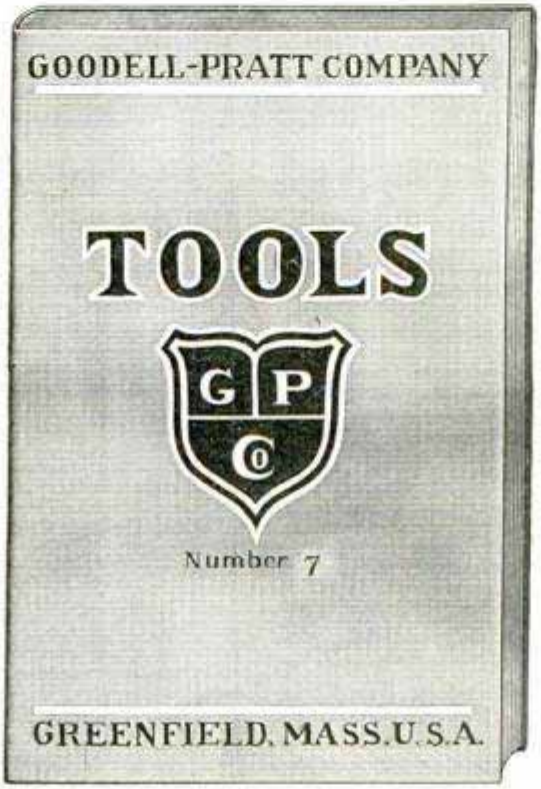

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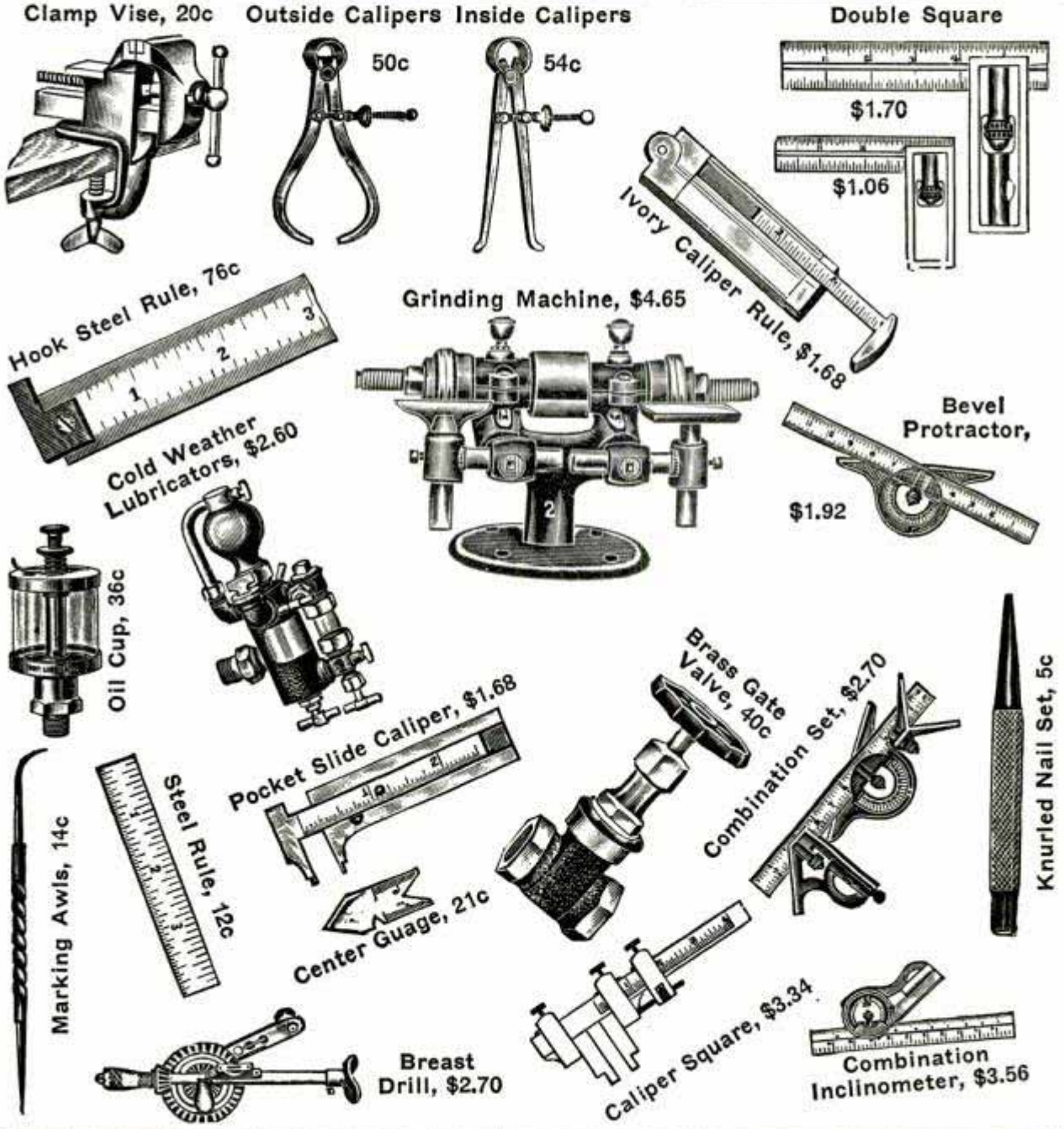

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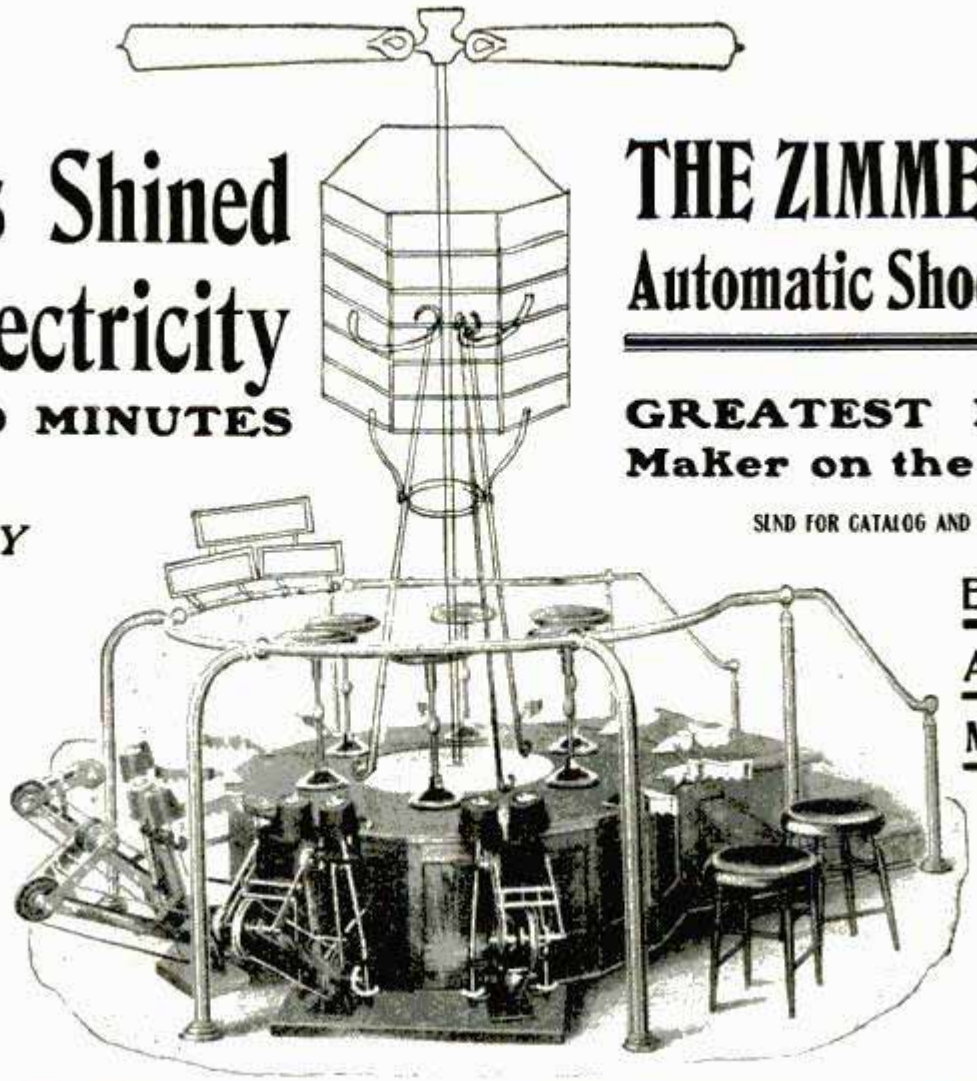

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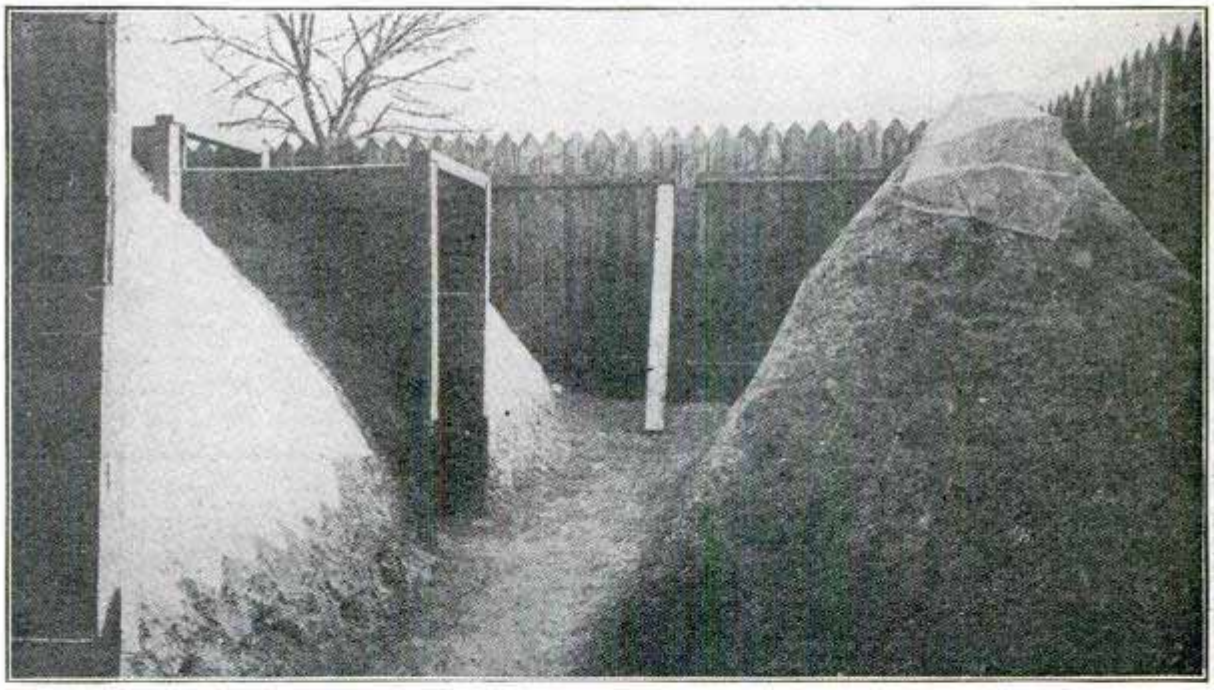
POPULAR MECHANICS

Vol. 7. No. 4. CHICAGO, APRIL, 1905. 10 Cents a copy. $1.00 a year

Examining Bombs by X-Rays

Perilous Occupation Uses Science to Save Life-Experts Work in Underground Rooms

Not alone as a means of examining the interior anatomy of man is the X-ray a life saver; it is now employed to show what is inside the most dangerous and deadly bombs. On the continent of Europe the police department of all the large cities has one or more experts whose hazardous business it is to open and examine the bombs which are from time to time sent to members of the royal families and high officials.



Entrance to Underground Chamber

These infernal machines are of all descriptions, some being designed to explode by any sudden jar, others operated by clockwork mechanism which if not interrupted will cause an explosion at a pre-determined moment; while still others are inclosed in the most innocent looking packages made to resemble a book, for instance, and so constructed as to explode when the package is opened. These are the most dreaded, for it is not easy to hurl a contact bomb without being seen; and the intended victim may as likely as not be elsewhere when the clockwork machine is due to explode; but the package sent by mail or express will do its work weeks and even months after it has been closed and delivered.

The bomb experts are among the highest paid members of the force, and their identity and work is guarded with great secrecy. When one of them pays the penalty with his life the event is often never known outside of a few trusted officials of the department.

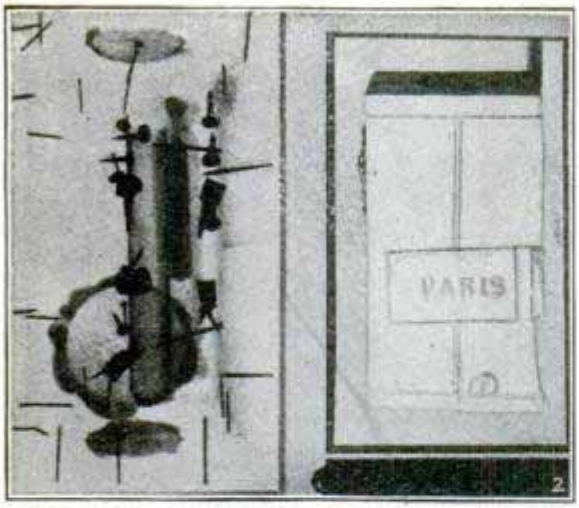


Fig. 1—Interior of Infernal Machine containing bomb sent by mail to Russian Ambassador. Paris, as revealed by the X-ray. Short black lines are nails with which the box was made. Fig. 2—Photograph of exterior of Box.

The invention of the X-ray was a boon to the bomb expert. By its aid he is able to look into the most cleverly constructed infernal machine without even tearing off the wrapper inclosing the package. The illustrations show the deadly contents of two examples. One is a bomb, the other an infernal machine. The first will explode by shock, the other upon the opening of the lid of the box which was sent by mail.

The expert's work is done in a remote, carefully guarded place, and within casemates. No one except the guard is allowed to approach, and the casemate is deeply imbedded in earth to reduce the damage from a possible explosion as much as possible. Every time the expert enters to examine some new device he has no assurance he will ever come out alive and whole; he may be blown to atoms any moment. It is desirable, however, to open and examine these engines of death, because in that way clues are often discovered which connect one case with another.

On January 30 a bomb, in a grey paper package, was discovered near the residence of Prince Troubetzkoi, military attaché of the Russian embassy in Paris. The same day a similar bomb exploded in the Avenue

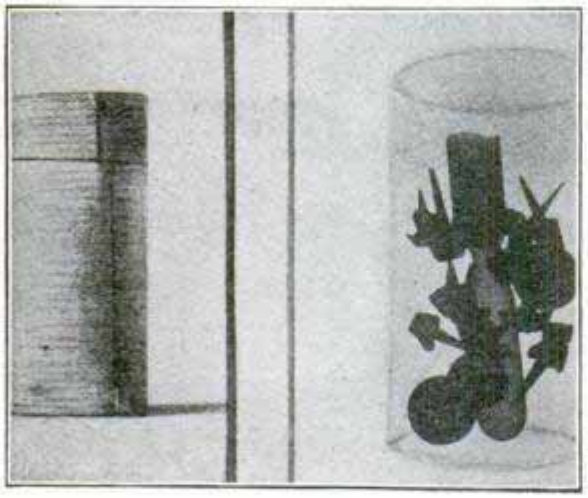
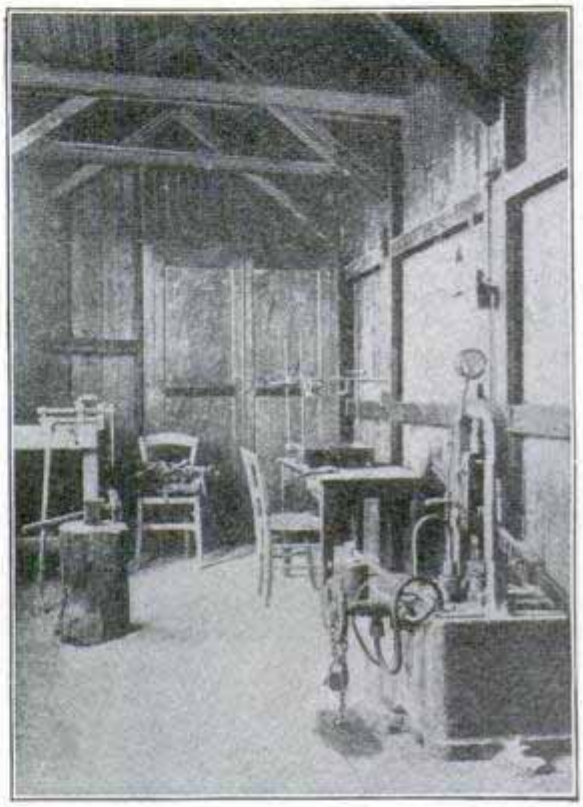


Fig. 1—Photograph of Concussion Bomb. Fig. 2—X-ray picture of contents. Note large stick of Dynamite, large shot, nails and sharp fragments of iron. Very Deadly.



Interior of Underground Workshop Where Bombs Are Examined

de la Republique, and injured several people. The bomb discovered by Prince Troubetzkoi was examined by the authorities, who found that it was filled with nails of various sizes, buckshot, cartridges, and fragments of iron. The other bomb, which was similar in construction, hurled its contents to a distance of thirty yards.

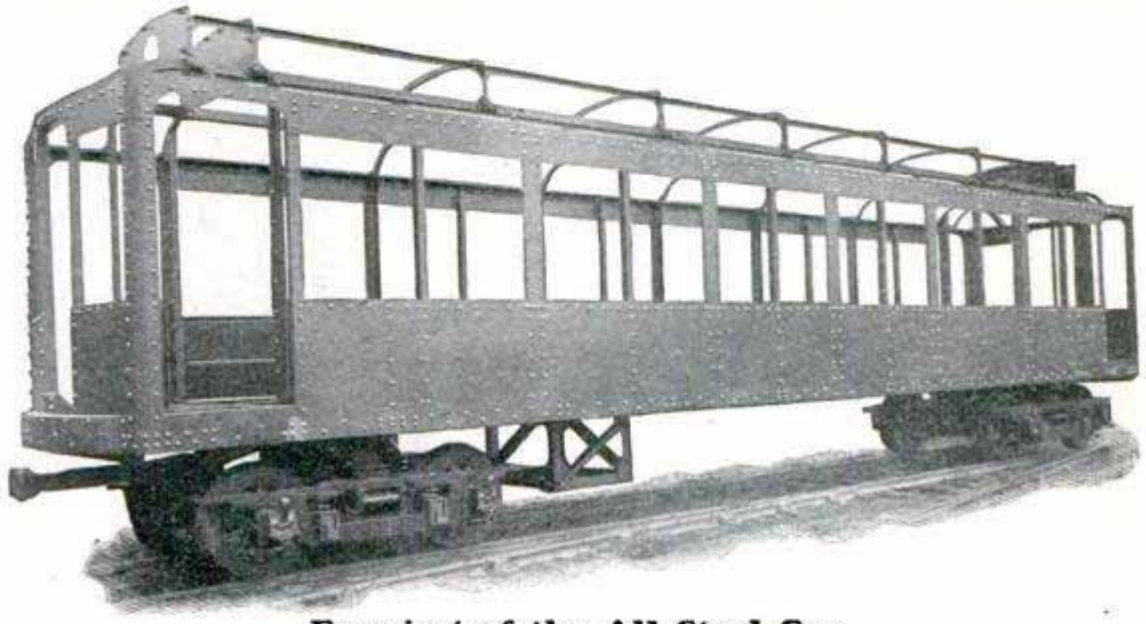
WIRELESS MESSAGE PASSES THROUGH MANY TEMPERATURES.

A wireless telegraph message was recently sent from Chicago to Key West, Fla. The message had to pass through many temperatures and varied weather conditions in the trip from the Lake Michigan locality to the Gulf Stream city, but the apparatus worked perfectly.

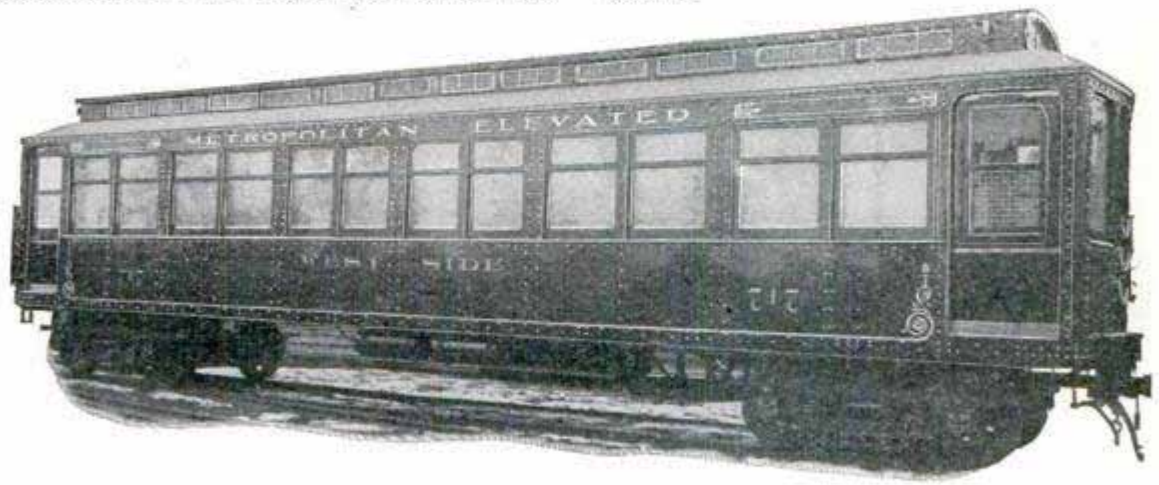
All-Steel Cars as Light as Wooden Ones

The great objection to the all-steel car as urged by many builders has been on the score of weight. Prominent engineers, however, declared that this objection was only a temporary one and that in a short time an all-steel car would be designed for a construction as light as the old wooden cars.

The Metropolitan Elevated Railway Company, of Chicago, has recently put into service an all-steel car but little heavier than the wooden ones of the same pattern, that is 48,000 lb. without motors. The sides of this car from the window sills down to the bottom of the side sills are covered with ¼-in. steel plate, continuous from end to end of the car. This plate is riveted to a 6-in. channel-bar, which forms the side sill at the bottom, and to an angle iron at the top, so as to form a plate girder along each side of the car. The cross sills are 6-in. I-beams. On these cross sills rests the sheet steel bottom, which is of 3-16-in. sheet steel in the center of the car between the bolsters, and 5-16-in. from the bolsters to the ends of the car. On the interior ¼-in. stiffening plates or braces, which are covered by the backs of the seats, are used. Between posts on the inside of the car, wood furring faced with steel is placed. The roof is of wood, covered with canvas, as usual in car construction. The seat frames are of pressed steel. On top of the steel bottom is first a layer of mineral wool and upon this, wooden flooring. The only wood used in the entire construction is the flooring, the roof, the window sills and frames and a few minor details.



Framing of the All-Steel Car



Courtesy of the American Car & Foundry Co.

All-Steel Car Complete

THE ONE-MAN RANGE FINDER.

The establishment of the correct range is one of the important things where any fighting is to be done. The old-fashioned

Fig. 1--The Old Way

way is shown in Fig. 1, where two officers are endeavoring to get the range of the summit of the distant hill from the bluff above the river. By measuring the angles at the ends of the base line they will be able to calculate what would otherwise be a very difficult range to estimate.

The new way—the Jap way—for the enterprising Japs have found it out, requires only one man, and he can work in safety behind a tree if one happens to be handy. The instrument can be used in a horizontal or

Fig. 2--The New Way

vertical position. At each end of the tube is an object glass which reflects the view to the middle of the tube where there is an eye-piece. The calculation is made in very much the same way as by the older method.

The International Commission awarded England $375,000 in settlement of the North Sea incident in which the Russian fleet fired on English fishing boats.

BALLOON BEATS FAST BOAT

The aeronauts Faure (left) and Latham (right) ascended in their balloon at a quarter before seven on the evening of February 11 and the wind being favorable crossed the English Channel and landed safely at one o'clock the next morning. The ascent

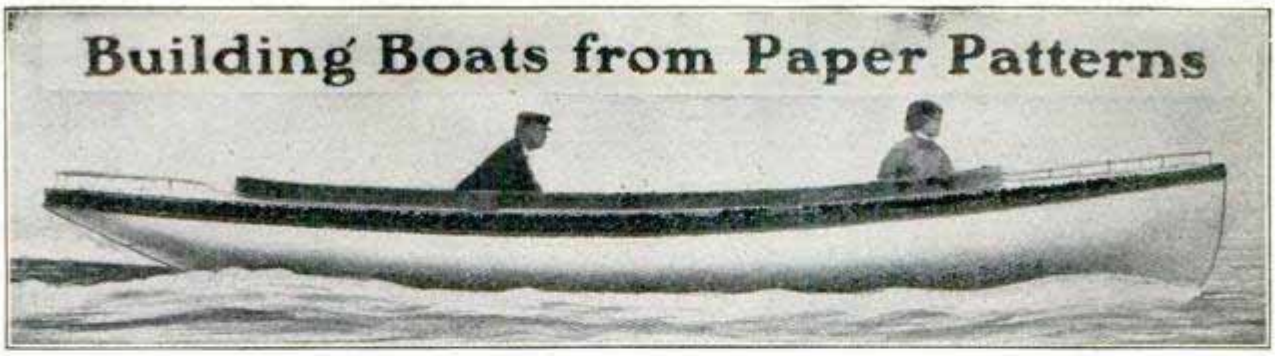
After the Voyage

was from the Crystal Palace, London, and the landing at St. Denis, Paris. The time made beat the fastest boat-train by three-quarters of an hour.

WIRELESS TELEGRAPHY FOR THE POPULACE.

In England anyone can go to a telegraph office and send a telegram to friends or other persons at sea on a transatlantic liner at a cost of only 13 cents per word, all telegrams, however, to amount to at least $1.60. The postoffice recently completed negotiations with the Marconi International Marine Communication Company by which communication between all telegraph offices and the wireless telegraph stations on the coast was established. The patronage will consist chiefly of business messages.

Building Boats from Paper Patterns



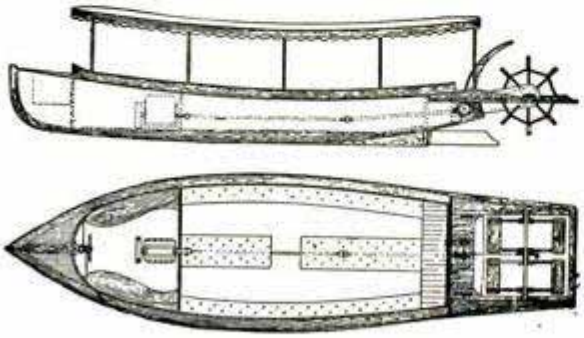
Easier to Build a Boat Than to Make a Suit of Clothes

By C. C. Brooks, President Brooks Boat Mfg. Co.

In the days when your mother made your clothes what would she have done without the paper pattern? What the paper pattern is to the housewife cutting out a dress or garment, the paper boat patterns are to the

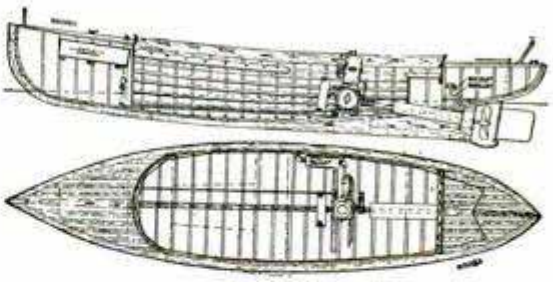
inexperienced builder. In fact the average young man will now experience much less difficulty in constructing a 20-ft. launch than in making himself a suit of clothes. From printed directions you select certain kinds of wood of suitable size, lay the pattern on, draw the lines and go ahead with saw and chisel. No difficult calculations, and guessing at curved lines, with vexatious blunders and doing it over a second time.

Economy of time and labor for builders of small boats, whether the builder is an amateur workman or one regularly engaged in the business is gained by the use of the paper pattern system. These patterns are printed the exact size of every piece of

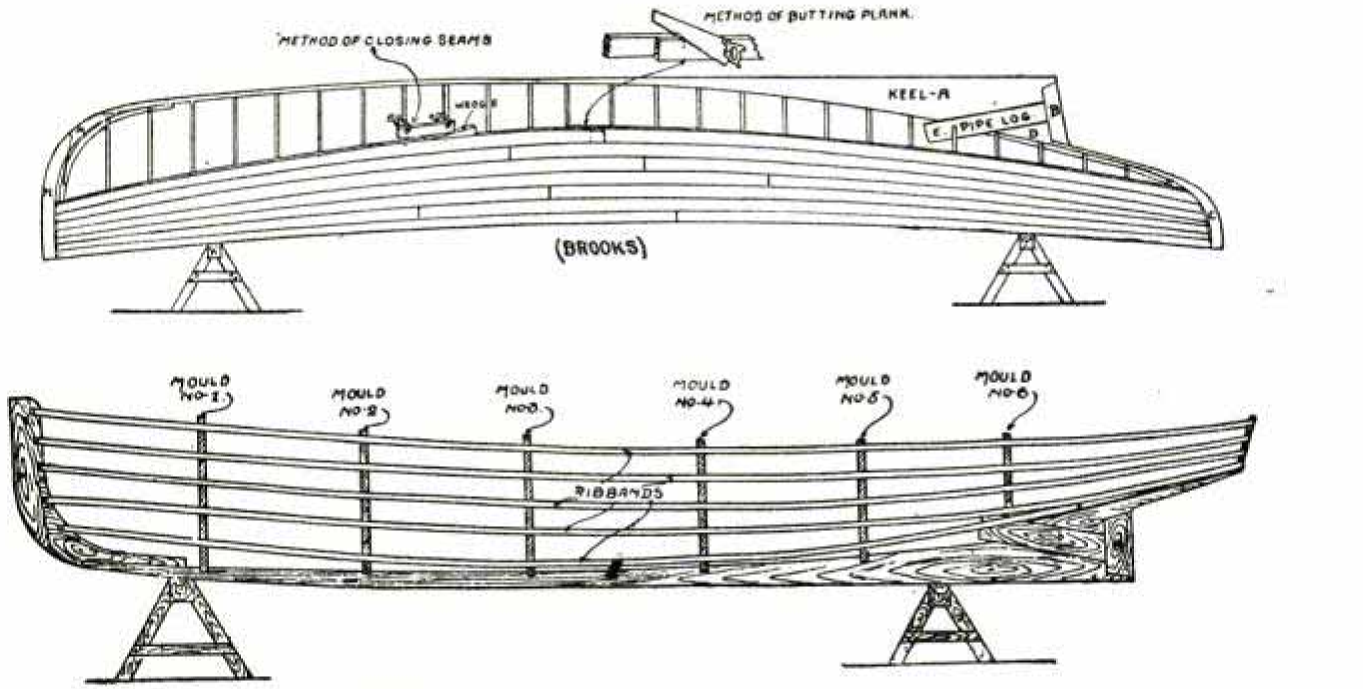


timber entering into the construction of a boat from the keel pieces and the molds to the last streak of planking and all the little details required to complete the craft, inside and out.

They are printed for every style of pleasure craft from a canoe to a cruising launch and come as a pleasing surprise to those who have given up cherished projects of building their own boats after considering the time and skill required to lay down the lines of a proposed craft on the shop floor and take off from them, by tedious measurements, the shapes of molds, planking, etc. This work is, in fact, almost out of the question except to one skilled in boat building and the inexperienced man who undertakes the job usually either throws it up in disgust or comes out with a craft of such ugly proportions as to make it a laughing stock among his nautical friends. But with



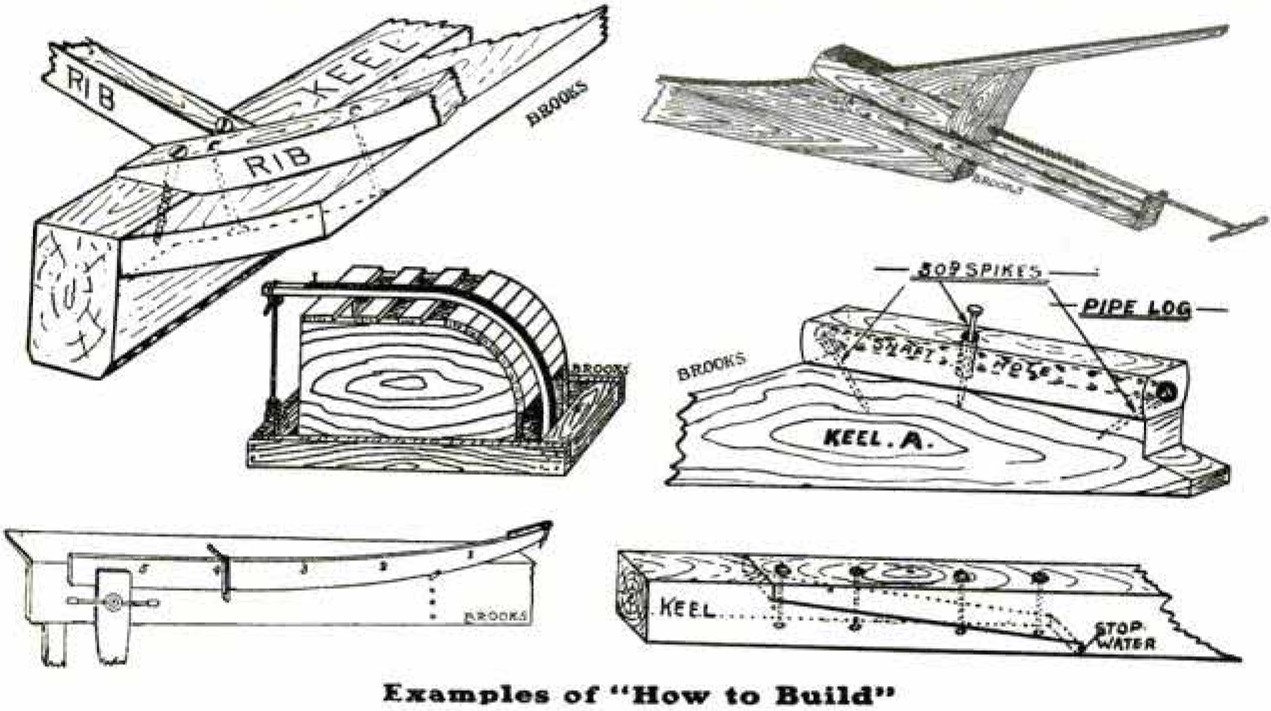
the paper patterns all the preliminary work is done for him. All he has to do is to cut out his timber as directed and fit it together and he produces duplicates of boats built by skillful craftsmen on lines which are known to combine beauty, speed and safety. In using the patterns their lines are transferred to the necessary timber or planking by tacking the pattern in place, punching awl holes along the lines, close together where the curves are sharp and farther



Two Stages of Construction--Motor Launch

apart where the lines are straight or nearly so; the patterns are then removed, nails driven lightly into each awl hole and then by bending thin, flexible strips of wood up to the nails the lines can be marked out on the timber exactly as they appear in the pattern. In building a boat the keel, stem and stern pieces, which form the backbone of the craft, are usually constructed of oak and vary in number and shape according to whether the craft is of the popular torpedo stern design, a variation of the same known as the compromise stern, or the older styles of transom and fantail sterns. Fig. 1 shows the shape of these pieces in a transom stern boat and Fig. 2 shows the keel put together, molds in place and rib-bands fastened on, ready for bending the ribs into place. In Fig. 3 is shown a detail of construction which the inexperienced builder might leave out. This is the use of stop-waters in the joints in the keel. These joints are difficult to calk in the usual manner, but are made water-tight after fastening together by boring holes through the joints and driving in soft pine plugs freshly covered with white lead.

The matter of steaming and bending ribs and planking is often thought to be troublesome but it is really a simple affair. The



Examples of "How to Build"

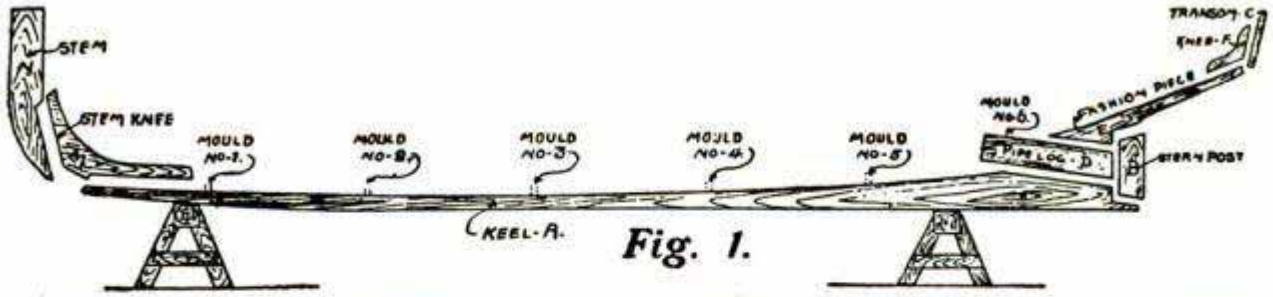


Fig. 1.

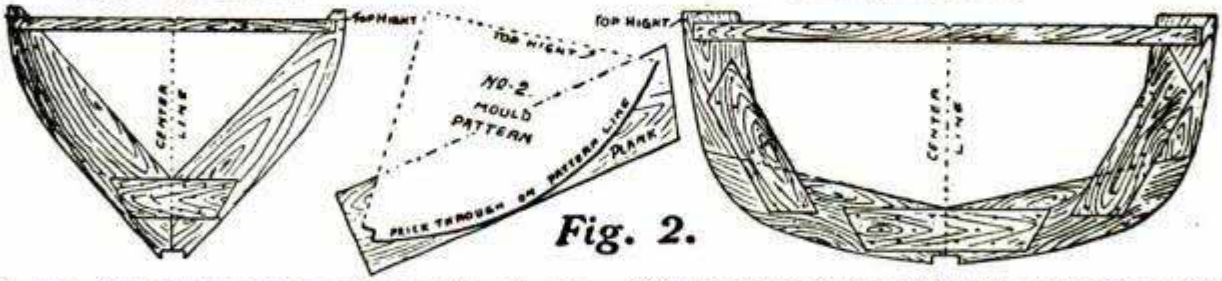


Fig. 2.

ribs are frequently the only parts of the boat which require steaming and a steam box can easily be constructed which will take its supply of steam from a tea-kettle or the necessary pliability can be obtained by soaking the timber in hot water. This also applies to the planking, when steaming is required, as it is only at the ends that steaming has to be resorted to to secure the needed pliability.

In building rowboats and the smaller

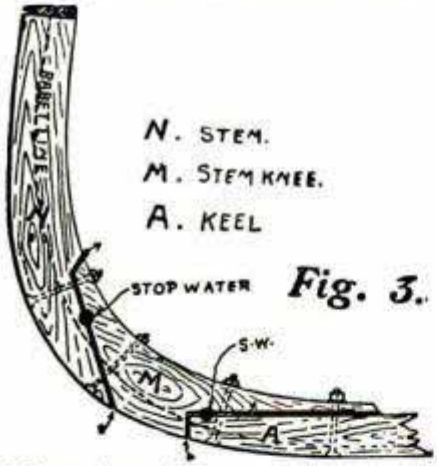
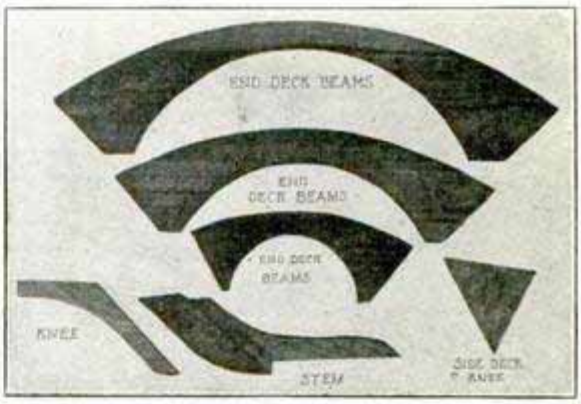


Fig. 3.

sizes of launches there are two methods of fastening the planking; clinker or lap seam, and carvel, or smooth seam. The former is preferable as it gives added strength to the boat, but with the heavier planking of the larger craft this method cannot be followed. With printed instructions on how to proceed, and the use of patterns, almost any person, who has any knack in the use of tools, can build a serviceable and sightly craft from a canoe to a launch. The satisfaction of sailing your own boat, and the experience of making it, open up a new and intensely pleasurable line of work to the thousands who find their best recreation in "making something with their hands."

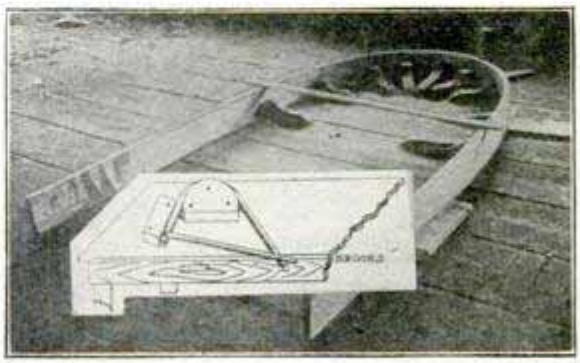
DEAD BLACK STAIN FOR HARD OR SOFT WOODS.

Apply one coat of hot logwood solution and allow it to dry, then apply a second coat. When the second coat is dry, apply



"Sawed from Patterns"

a solution of acetate of iron, made by dissolving iron filings in hot vinegar or in acetic acid. This has a chemical action on the logwood, says the Manual Training Magazine, and turns it black. Let it dry and finish by rubbing in a little raw linseed oil or finish with wax.



Examples in Bending

Woman Makes Iron on the Stage.

Dazzling experiments in the new science of alumino-thermics have been conducted by a lady on the English stage recently, says the Illustrated London News. This science was explained in the March issue of Popular Mechanics and the apparatus and principle is just the same as in thermit welding. The woman pours thermit (iron oxide and aluminum powder) and barium superoxide into her crucible and ignites the barium superoxide. A blinding incandescence results and in 30 seconds a lump of iron is formed. The temperature of the molten mass is very high. The experiments in their order are as follows:

1. The iron is made in a small crucible and falls from it through 12 in. of water and burns a hole in an iron plate at the bottom. Temperature 5,200 degrees Fahr.
2. Temperature of 5,200 degrees Fahr. generated in a hat.
3. Molten iron from the crucible pierces a 2-in. iron plate.
4. A hole with clean edges bored through an iron plate by the molten metal.
5. Making iron for a horse shoe in 10 seconds.
6. An ingot of the iron beaten into a horse shoe in a few seconds by the lady performer.

Rolled Steel Car Wheels

Latest Process One of Great Importance to Railroads and the Public

"As the mighty oak had its origin in the small acorn, so the great railroad systems of to-day rest upon the stability of the flange of a car wheel.

"Upon this small section of metal, about 1 1-4 inches square, depend the lives of the millions of passengers and the value of merchandise of incalculable price. Passengers amid the comforts and luxuries of our modern service hardly realize the vital importance of this piece of metal; but engineers and railroad managers do, and they have been directing their best endeavors to this most vital element of railroad equipment."—Vauclain.

The passenger about to start on a 4,000-mile journey across the United States is attracted by the ponderous size of the locomotive which is to draw his train, and by the luxurious and substantial appearance of the palace sleeping and dining cars in which he is to live for the succeeding five days. But not one in a thousand gives a thought to the character and strength of the wheels which are to carry him through mountains, across deserts and over slender bridges hundreds of feet above seething torrents. And yet throughout all the long journey, from noon to midnight, there is not a moment of the time the train is in motion that a terrible accident is not possible should the tiny flange on any one of the hundred wheels under the train crack and break. The traveler almost never thinks of this, but railroad operators do constantly, and so careful and far-reaching is the construction and inspection of car wheels that this greatest possibility of danger is reduced to a cause so seldom occurring as to constitute a really marvelous fact.

In the first days of railway cars the wheels were made of wooden spokes and rims covered with a thin strap of iron. With heavier cars and faster trains the cast iron wheel came into general use; and a continued increase in speed and load resulted in the chilled-iron wheel, a distinctly American product, and the wheel is now in use all over the land. The infrequency of accident caused by the failure of this wheel is sufficient evidence of its excellence.

The chilled-wheel (only the flange and that portion which comes in contact with the rail—the tread of the wheel—is chilled and hardened), however, is beginning to be taxed to its utmost on account of the big 50-ton cars which the railroads are now ordering. To safely carry these great loads a demand exists for wheels with stronger flanges and longer wearing qualities. The weak point in the present wheel is the brittleness of the flange, and the tendency of the wheel to heat when the brakes are applied. This has led to the production of a rolled-steel car wheel, the entire wheel being rolled from a single piece of steel.

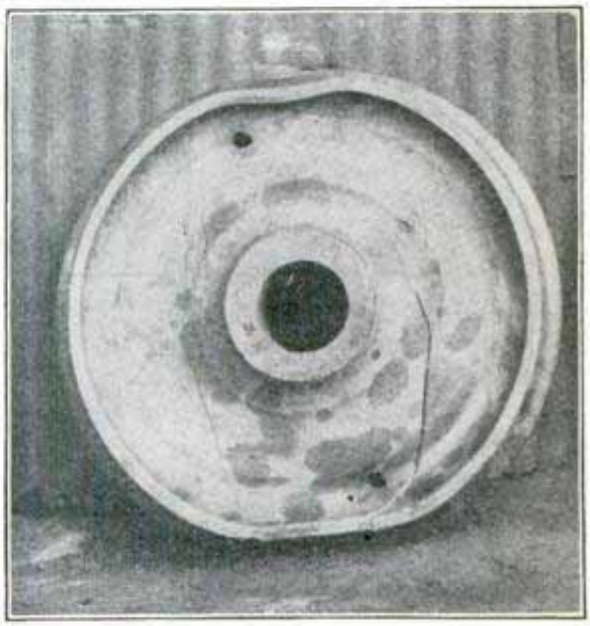


Fig. 3.--After the Drop Test

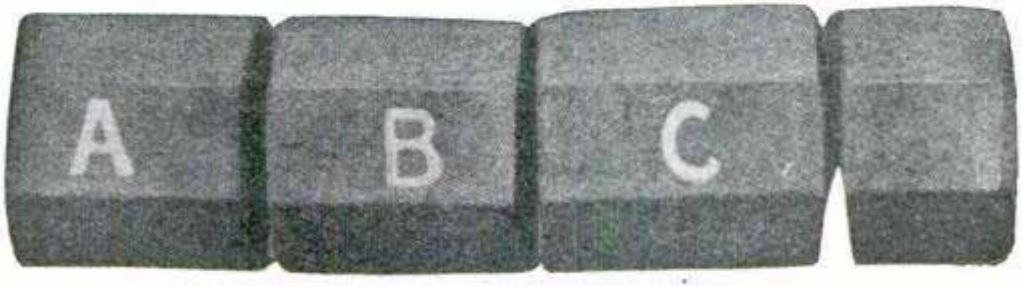


Fig. 1.--Steel Ingot for Three Wheels

In an address before the Franklin Institute Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works, describes how the new wheel is made. A steel ingot is first divided into sections, as shown in A, B, C, in Fig. 1. Each section weighs about 700 pounds. The section is brought to a white heat in a furnace, from which at the proper moment, it is removed by an almost human

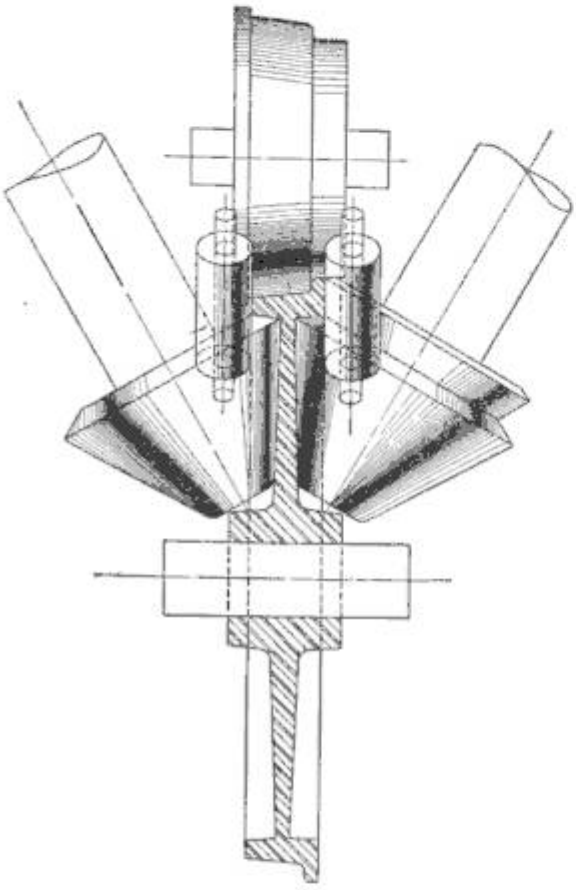


Fig. 2. Diagram of Rolls

mechanical device called the "mechanical man." This machine reaches into the furnace, picks up the section or "blank," carries it to a huge 5,000-ton hydraulic press and deposits it there. There it receives the form of a car wheel, but on emerging from the press is conveyed to the rolls, where it is subjected to enormous pressure and revolved at a high rate of speed, emerging a perfect wheel. When cool the hub is bored out and the wheel is ready for the severest service.

In order to determine the strength of the rolled steel wheel, some interesting tests were made. One test was to support the wheel horizontally upon a ring underneath the face of the tread and allowing a weight of 2,240 lbs. to fall upon it. It took thirteen blows to break a 36-in. wheel, eight of the blows being from a height of 30 ft. Another wheel was tested in running position, and striking with a weight of 2,240 lbs., it took seventeen blows, nine of them being from 25 ft., to fracture the wheel from rim to hub. Fig. 3 shows the wheel after the test just described.

A solid rolled-steel wheel has a first cost of $58.80, with a scrap value of $8.75, a life of 350,000 miles, or a cost of $1.43 per 10,000 miles.

The chilled-iron wheel has a first cost of $19.40 with a scrap value of $5.80, a life of 80,000 miles, or a cost of $1.70 per 10,000 miles.

PROF. LOEB'S EXPERIMENT.

Prof. Jaques Loeb, of the Leland Stanford University, has performed a wonderful experiment, the result of several years' effort toward the creation of life. He has not, however, as the earlier newspaper accounts stated, actually caused a new life. He has taken the female eggs of the sea urchin and by chemical means fertilized the eggs and hatched them. But he has made nothing complete as yet. Without the eggs he could have done nothing. If the eggs even had been ground to powder, he could not at present have taken that crushed mass and hatched out a sea urchin. His experiment is intensely interesting; his result quite surprising; but without the mother sea urchin all the mysteries of a wonderful laboratory are powerless. In the matter of creation no one has as yet successfully improved upon the first chapter of Genesis.

THE ART OF NAIL DRIVING

Theories are very good in their place, remarked the late F. J. Holloway, but they would not teach one how to drive a nail. Nothing but practice will do that, and even practice without thought will not accomplish it, says Locomotive Engineering.

You must have both combined. When you drive a nail in a board, what do you do? Do you trust to luck that the swinging hammer above your head shall come down in the right place? Do you concentrate your thoughts on the hammer circling in the air? No. You concentrate your thoughts and eyes square on the head of the nail you want to hit, and no matter where your hammer is or what curves it describes in the air, if your intense thought is on the spot where the blow should fall, there it will fall. If your thoughts wabble and are uncertain you will miss the nail or drive it sidewise.

HOW HOT WATER CIRCULATES

Excerpts from address of J. S. Brennan before the American Society of Heating and Ventilating Engineers at New York

The first cause of circulation of water in a hot water heating system by the force of gravity is that the water becomes compact as it cools off, and it therefore outweighs the warmer and lighter water and pushes it to the top of the apparatus. Hot water will move only when there is a heavier and cooler body of water to displace it and force it upward by means of its superior weight.

The drawing force which propels the water in the risers and radiators is proportional to the difference in the mean temperature of the ascending and descending parts of the apparatus, and does not depend upon the actual quantity of water contained in those opposing parts of a system with a given difference in temperature; it is also proportional to the vertical height of the circuit. For example, in a circuit or riser 50 feet high the motive force would be twice as large as in one only 25 feet high.

The force of the circulation through radi-

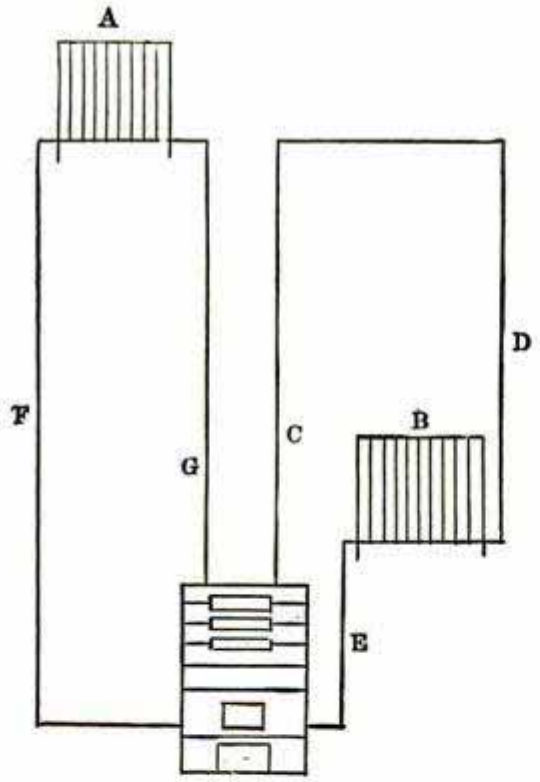


Fig. 1. Hot Water Heat

ators with a given fall of temperature depends mostly upon the height of the return pipe, and is independent of the height of the riser pipe. Take for example, in Fig. 1, a radiator on the fourth floor, A, or 50 feet high, another radiator on the first floor, B, or 10 feet high, with both feed or riser pipes the same height. The circulation through the radiator on the fourth floor will be about three times as great as through the radiator on the first floor, notwithstanding the fact that the supply columns of both radiators are of equal height, because the return F is about three times as high as the returns E of the radiators on the first floor. The temperatures of the pipes C and D are nearly the same, consequently the water in D simply balances an equal height of pipe C, and fails to supply any force for circulation. The force for circulation in this cir-

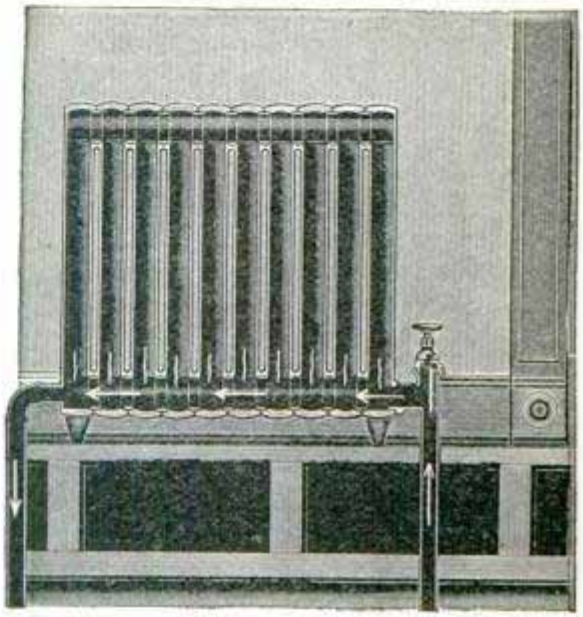


Fig. 2. Poor Heat

cuit therefore depends upon the preponderance of the weight of water in the return pipe E over the weight of that below the level of the radiator B.

Fig. 2 is a fair illustration of a radiator with the usual style connections. The force of the circulation through the radiator depends upon the height of the return column. The return pipe having a strong pull on the radiator the current is along the lines indicated by the arrows, and the water in the radiator has but little circulation to it. The water rushes through the lower portion rapidly and the top of the radiator will be nearly cold while the lower part is hot. This gives poor heating results.

Fig. 3 shows an improved connection to increase and improve the circulation in a hot water heating system, which has been successfully used by the writer on a great many hot water heating systems. The direction in which the arrows point shows the actual current within the radiator. The hot

water must pass directly to the top, dropping to the bottom as it cools off, returning to the return pipe. The circulation is positive and by actual tests 6 degrees hotter than

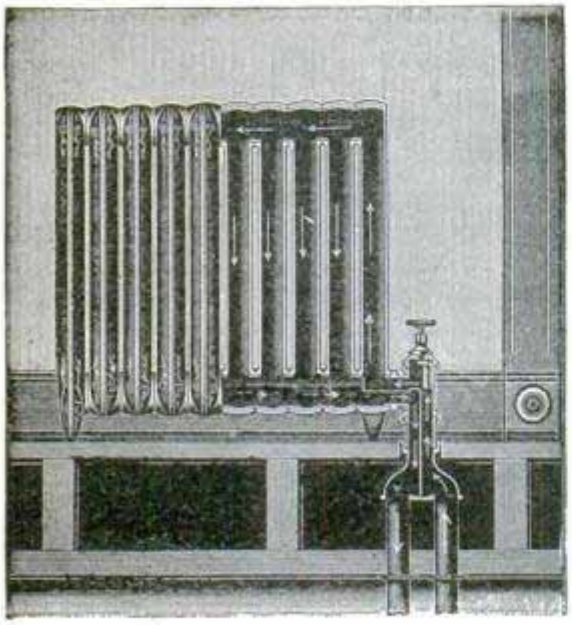


Fig. 3. Good Heat

the circulation the old way, and, furthermore, the entire surface of the radiator is heated.

FRAZIL ICE.

Did you ever hear of frazil ice? It is better known in Canada than in the United States, and forms under conditions quite similar to those which produce anchor ice. Many people think the two terms mean the same, but Professor Barnes of Magill University says there is a difference. The Toronto Engineers' Club defines frazil ice as "water at a temperature just ready to freeze, but prevented from so doing by motion; the action of freezing taking place when the degree of motion was lowered." "This is," Professor Barnes says, "contrary to all the known laws of ice formation. Motion is one of the essentials to the starting or production of the ice crystal of which frazil is but an example, the fineness of the crystal being determined by the "degrees of motion." The whole question of the formation of frazil and anchor ice hinges on open water conditions, agitation, admixture and temperature of air, and to a certain extent on the clearness of the water and sky. The same physical laws governing the change from the liquid to the solid state, which are known in the laboratory, are operating on a large scale in our Canadian water-ways, and everywhere we witness the tremendous struggle going on in nature between ice and water. When such minute temperature conditions as a hundredth of a degree determine the immense formation of ice crystals in places too turbulent for surface ice to form, and render the effects of the ice disastrous to engineering works, we certainly witness a wonderful spectacle of the delicate poising of the forces of nature."

Anchor ice gathers in vast quantities at the intakes of water works and water power plants, and chokes the passage to an extent which entirely shuts off the flow of the water. In Chicago the water supply comes from cribs buried two, three and four miles out in the lake. During February and early March crews of men were kept working night and day removing the anchor ice from the intakes. The work is so exposed and exhausting that fifteen minutes at a time is the limit of endurance.

DIVER'S INSULATED HELMET FOR ELECTRIC EELS

The story of the strength of the shock produced by an able-bodied electric eel has been taken by many people with a liberal degree of allowance. The submarine diver, however, who has to work in waters where the frisky eel is inclined to be friendly tells quite another tale. In proof of the shocking story a concern in New York, which makes diving suits for the Navy Department, announces the completion of an insulated helmet. The Marine Journal says:

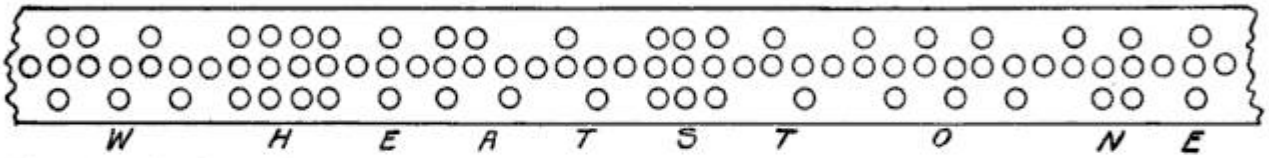
They recently made an insulated helmet which was to be used where electric eels were rather numerous, as the electric shock which these eels are able to deliver to a diver is strong enough to make him insensible when it is transmitted to him through any exposed metal part of his armor, and for this reason it is unsafe to use an apparatus unless perfect insulation can be insured. Although this insulating was a very difficult matter, the experience of this old establishment in making divers' outfits enabled them to do it so that the diver could be guaranteed perfect immunity from this annoyance.

PASTE FOR MOUNTING PHOTOS.

A good mounting paste is made as follows: Mix well together 3 oz. dextrine, ½ oz. sugar, and 4 oz. water; heat until thoroughly dissolved and let cool. Then add 50 minims carbolic acid. A drachm of glycerine may be substituted for the sugar with excellent results.

Telegraphing Direct From London to Persia

4,000 Miles Over Rivers, Mountains and Deserts



Four hundred words per minute by telegraph from Liverpool, Manchester, or London direct to Teheran, Persia, are sent by the use of the system spelled in telegraphic language, Fig. 1, on a punched paper ribbon.

It is by this long telegraph line that London keeps in touch with its Government in India. Teheran, in Persia, is the terminal station of the direct line, the messages from there being sent over various lines and cables.

To understand the working of the Wheatstone system, suppose a clerk in the London office receives a message from Teheran. He seats himself before an instrument called a perforator, which has three keys. The number of holes punched by each of these keys, one, two and three, are shown in Fig. 2. The first represents a space, the second a dot, and the third a dash. Using these keys the clerk writes the message on a paper ribbon which looks, when ready to send, like Fig. 1. The ribbon containing the message is passed to the sending clerk, who, by means of clock-work, feeds it rapidly into the transmitter, a toothed wheel catching in the middle line of holes. Pins on moving levers drop through the punched holes as they come along, making contact alternately with the positive and negative poles of a battery. A receiving instrument has on it an inked disk. As the current flows in one direction the disk touches the paper and draws a line representing a space, dot or dash, until a current in the opposite direction lifts the disk. These currents are just what are produced by the contact through the punched paper in the transmitter at the sending station.

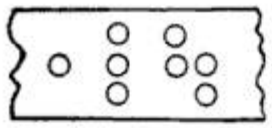


Fig. 2.

At every relay station a Wheatstone receiving apparatus is in circuit, and the clerk is able to see how the signals are leaving his station by starting the instrument and looking at his slip. If the signals registered are imperfect, and the station preceding him reports that they left him 'O. K." he knows that if the line is in good electrical condition, his regulation is at fault. By this means there is a check kept upon the work during the whole period of transmission.

One clerk can send messages as fast as several can punch them. A single ribbon can be used several times to send the same message to different places. So much for the system.

The line discussed starts at London, runs to the German coast, thence to the Russian frontier, thence to Warsaw, and Odessa, through the Steppes, Crimea, northeast of the Black Sea, through the mountains and forests to Tiflis then south over the deserts to Persia's old capital Tabriz, thence to Teheran.

Great difficulty attended the construction, and every year gangs of men are required to keep the line clear through the forests. Falling trees and flocks of wild geese sometimes interrupt communication, but the greatest trouble is the severe hoar frost, called "reifeis." This collects on the wires, sometimes forming a sheet of ice from one wire to the other, and when swinging is set up by the wind, wires are broken and the iron posts bent over. Many remedies have been tried with a view to prevent this trouble. At first the binding wire used to attach the wires to the insulators was strengthened, but it was found that this caused even greater difficulty. It was better that the wires should break away from the insulators than that the whole line should be destroyed. Later a large number of posts was added, and it was found that this additional strength materially improved matters, although interruptions still occurred. In Persia the insulators offer a fine mark for the rifles of the wandering tribes.

This long line is only kept in good order by having a series of control stations along its entire length from the Russian frontier to Teheran; in a country where the line is particularly liable to disturbance, these control stations are 20 to 25 miles apart, and when a fault occurs the controllers of the two stations between which the fault is located are immediately ordered out to remove it. Interruptions are restricted by this means

to short intervals unless the line for some distance is completely wrecked by "reifeis," and this has occurred on more than one occasion.

This line was first worked by the Morse system, but so much time was lost in retransmitting the message that the Wheatstone automatic method was tried between Teheran and Odessa in 1897. It was so satisfactory that one after another of the retransmission stations were cut out and the new system installed.

It was not long before relay apparatus was introduced in the London office. Messages to and from Manchester and Liverpool were then exchanged by those places direct with Teheran, a distance of 4,000 miles, with 11 automatic relay staions.

Not only has the time of transmission been reduced, one may say, almost to a minimum, but traffic is not affected nearly to the same extent as under the old system by short interruptions; messages continue to be punched up during these intervals, and are put through in large batches at great speed as soon as communication is restored.

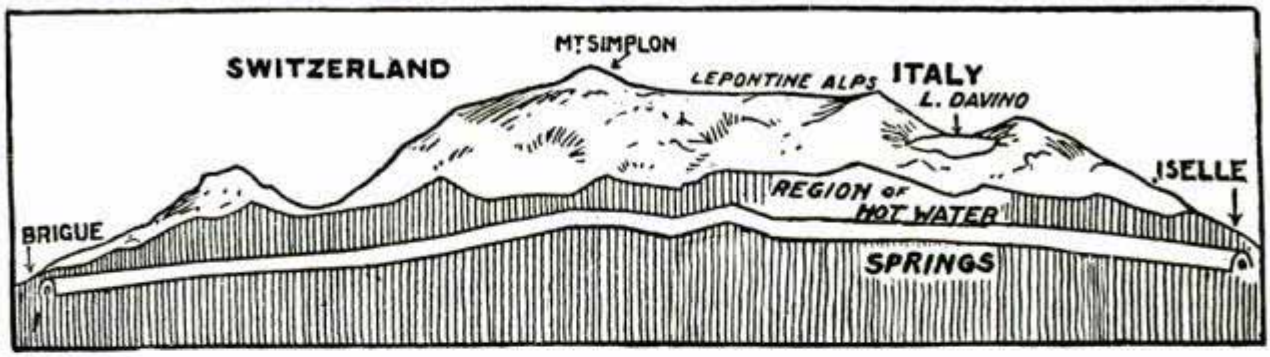
MARCONI.

The above portrait is the latest picture of Marconi, who is shortly to be married to the Hon. Beatrice O'Brien, a member of an aristocratic Irish family which has a history of 400 years.

Guglielmo Marconi was born in Bologna, April 25th, 1875. He was educated in Leghorn, under Professor Rosa, and, subsequently, at the University of Bologna, in which city were carried out the first experiments in connection with his system of wireless telegraphy. Marconi's invention was successfully tested in England between Penarth and Weston, and later by the Italian Ministry of Marine at Spezia. Wireless telegraphic communications were established between France and England in 1899; two years later he was enabled to transmit signals across the Atlantic Ocean from Poldhu, Cornwall, to St. John's Newfoundland. In 1902, Mr. Marconi's system was installed on board the Italian crusier Carlo Alberto, and during her voyage from England to Russia, he received messages from Cornwall and transmitted them to the Tsar and the King of Italy at Kronstadt. Later on, in December of the same year, he was able to announce the establishment of his system of wireless telegraphy between Canada and England. This was followed, a few weeks later, by the transmission of a message from the President of the United States to the King of England, inaugurating wireless connection between Cape Cod and Cornwall.

TO ACCELERATE SPEED OF SHIPS.

Prof. Carlo del Lungo, demonstrator in physics at the Royal Lycee of Spezzia, has invented and patented, both in Italy and in England, a device for pneumatically lubricating the hulls of ships. Professor Lungo, it is stated, pumps air into the water surrounding ships, thereby diminishing the density of the water, and it is held that the effect of pumped air is analogous to the lubrication of machinery by oil.



Longest Tunnel in the World Completed

Ten Thousand Laborers Worked Night and Day--Care of Workmen--International Bearing

The boring of the Simplon tunnel, the greatest tunnel engineering feat of the age, was completed on February 24, when the two gangs of workmen, Swiss and Italian, who had been working towards each other for a period of six and one-half years, joined hands through the small gap which assured the ultimate success of the enterprise.

The Simplon tunnel is 12¼ miles long, the longest of the four tunnels now piercing the Alps and, in proportion to its length, was constructed in less time than either of the others. The tunnel extends from Brigue, Switzerland, to Iselle, Italy, and its purpose is to enable the Jura-Simplon railway from Geneva up the Rhone valley to connect with the Italian road from Milan at Iselle, and so afford an all-rail route from Geneva to Milan, and also shorten the distance from Milan to Calais. The commercial advantage thus afforded Switzerland, Germany and Italy is obvious. France, too, will be benefited. When the St. Gothard tunnel was opened she lost much of the international traffic that had theretofore passed over her railways. The Simplon tunnel will restore a portion of this to her.

Work on the Simplon tunnel started simultaneously from the Swiss and Italian sides in August of 1898, 10,000 Italian workmen in all being employed, 4,000 at Brigue, Switzerland, and 6,000 at Iselle, Italy. The men were not all employed at the same time, however, but the work was kept up night and day by 8-hour shifts. The tunnel consists of two distinct bores, 56 feet apart, center to center. At the middle, for a space of 420 yards, the two become one tunnel to make room for sidings and cross-over tracks. The two tunnels are connected by transverse galleries every 650 feet. At first only the eastern tunnel will be used for a single track railway, the smaller or auxiliary tunnel acting as a ventilating shaft, until such time as the receipts of the first tunnel shall be sufficient to warrant its enlargement to the normal section for a single track. The main tunnel is 19 feet wide and 19.3 feet high, the auxiliary tunnel is 6.5 feet wide and 10 feet high. This mode of construction has been of great advantage. The auxiliary bore was always kept ahead of the main gallery, and tracks were laid in the transverse galleries so that material from the forward headings could be removed without passing the men behind. The altitude is lower than in any other Alpine tunnel, being only 2,310 feet above sea level. This is the

Swiss Entrance and Tunnel Machine Shops

reason for the greater length which the engineers decided was preferable to so great a

Hot Spring

death from the pestilential atmosphere. At the Simplon, large dressing halls are pro-

The Deluge

gradient, which has been a drawback in the other tunnels.

From the first, the construction work proceeded against many and unexpected obstacles. The high temperatures of the rock, at times as high as 130 degrees F., was a constant menace to the health of the laborers; on the Italian side numerous streams of water were tapped, most of these were small, but again the water would be of considerable volume and flood the workings. Hot springs, some discharging 750 gallons per minute, were continually breaking in, and it was necessary to work around them. The tool which most facilitated the work is known as the Brandt drill. This drill is 3 inches in diameter and rotates slowly, being kept at its work by hydraulic pressure of 1,500 pounds to the square inch, or 10 tons on the cutting faces of the drill. The waste water is discharged along the axis of the drill, keeping the tool cool and washing out the rock cut away. By means of this drill the galleries on the Swiss side were advanced 20 feet or more daily.

At each end of the tunnel a permanent ventilating plant, consisting of two 200-hp. turbines running at 400 revolutions per minute and driving two huge fans 12.3 feet in diameter, are installed. These plants at either end supply a maximum of 106,000 cubic feet of air per minute at a pressure of 10 inches of water per minute. The tunnel portals are closed by sail cloth curtains operated by electric motors. The fans may be used to draw out gases as well as for forcing fresh air into the tunnel.

During construction there have been fewer accidents to laborers than in any other of the great tunnels. The St. Gothard tunnel dealt death to 400 laborers, who were attacked by miner's worms and breathed

vided at either entrance, and the temperature is the same as within the tunnels. The men pass in through boarded platforms and remain for a half hour until they are gradually cooled off. The great danger is the liability of contracting pneumonia by sudden changes of temperature. In these dressing halls there are baths, hot and cold douches, and usually the work garments are laid aside there and fresh raiment donned.

The lodgings provided for workmen are perfectly sanitary, the food is of the very best in quality and the cost is nominal. There are also well equipped hospitals. Within the tunnel the tracks are laid on one side to afford room for pedestrians and the trains are run by schedule and protected by signals. Thus has the loss of life been minimized. The men were provided with 58,000 cubic feet of air per minute.

The cost of the great tunnel complete will approximate $15,054,000.

ELEVATORS FOR STEAMSHIP ENGINEERS.

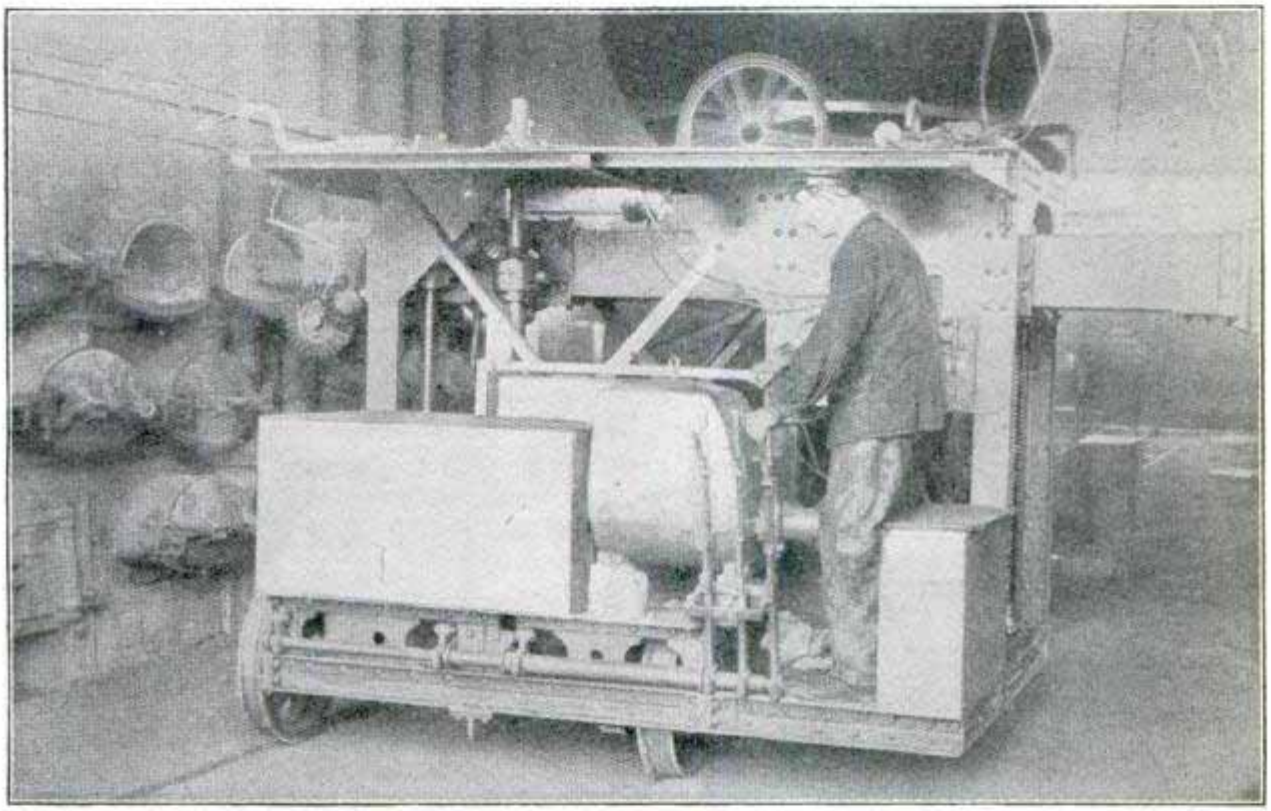
The steamship engineer carries great responsibility, and so much depends on him that any device that will facilitate his movements about the ship or aid him in his work is well worth installing. The American Shipbuilder suggests the need of elevators for the personal convenience of engineers in descending or ascending the 30 or 40 feet to and from the engine room. The means of descent is ordinarily a slippery iron stair case where a firm grip, steady nerves and a sure foot are required to make it in safety. The ascent exhausts any man to a degree. The elevator would cost little as there is always plenty of steam or electricity at hand and plenty of room to spare. No elevator boy would be required as any engineer could operate the elevator himself.

ELECTRIC COAL SHOVEL.

The filling of the retorts for making coal gas is hard and unhealthy work. The removal of the coke is even more so, for in addition to the heat there are deadly gases escaping which fill the lungs of the workers.

Electricity and mechanics have joined in providing a remedy. By means of a most ingenious machine one man now does the work of twenty. A trolley car line is constructed to run in front of and close to the retorts. When a retort is ready to fill the car is moved into position and the operator pulls a lever. Instantly a stream of coal is shot into the oven depositing at the farther end, which is usually 20 feet from the door. As the retort fills the lever is moved, reducing the velocity with which the coal is thrown and thus depositing it nearer and nearer the front until the oven is filled.

The operation has required just 10 seconds, during which 900 lbs. of coal has been uniformly distributed. One 12-hp. and one 18-hp. motor have done the work. The door is then closed and sealed, and the nozzle of the distributing tube is raised, lowered or moved along to the next oven, as the case may be. All the operations of the charging car are controlled by one man using three levers.



Filling Retorts with the Electric Shovel

FIRE ENGINE THAT DOES THINGS.

Remarkable English Machine Which Propels Itself, Pumps Air and Water, Makes Electric Light and Has a Telephone.

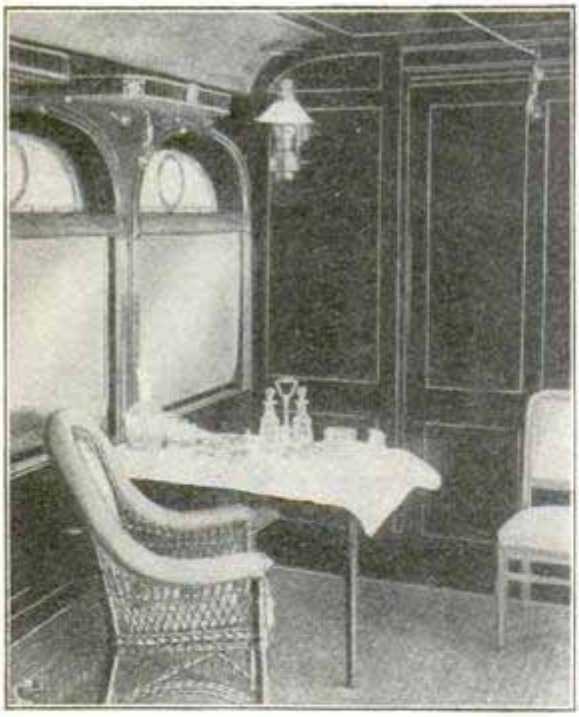
The most wonderful and cosmopolitan fire engine in the world has recently been put in service in Manchester, England. In the first place horses are discarded, and by a new and simple system of gearing the steamer propels itself at a higher rate of speed than previously attained by any self-propeller. Fire engines that run with their own power are not unusual, but this machine is a real power plant. An air pump is connected by gearing with the crank shaft of the engine, which furnishes air through a flexible metallic hose to firemen working in dense smoke, or placed where they are subject to gas or fumes of acids or other chemicals. This flexible hose is connected with a protective helmet worn by the fireman, which is made of heavy leather, extending down over the shoulders and supplied with an opening for the eyes and part of the face. The air enters at the back of the helmet and flows around the face, passing out of this opening, keeping the eyes and nose free from smoke. The helmet contains a telephone receiver and transmitter whereby

communication can be maintained with the officer at the fire engine, and by means of a switchboard, if necessary, with a chief official. The engine has a small dynamo, located over the front wheels, and connected with the fly-wheel by means of a belt. This furnishes a current for eight 32-candle power incandescent lamps through a flexible cable, so that, provided with a hand lamp, a fireman can penetrate dark and smoky apartments, where it is necessary often to cut off gas or oil supply. The entire equipment, including the protective helmets for the firemen, is stowed in the forward part of the fire engine, which is of the usual English pattern, and adds comparatively little to its weight.

DINING CARS ON TROLLEY ROADS.

Cooking Done in an Electric Kitchen

What is said to be the first regular dining car service on trolley roads is now in operation on the interurban line from Dayton, O., to Indianapolis. The trains are known as the inter-state limited. The kitchen is equipped with all the latest electric cooking utensils, and when the cook builds a fire in his stove he turns a button instead of splitting kindling.



Trolley Dining Car

The Street Railway Journal says the time table is arranged so that people will take advantage of the buffet service and to make close connections with limited cars on other roads. The cars stop only at stations in the larger towns, and a passenger is required to purchase a seat check before entering the car. Sales of seats are telephoned ahead and seats are reserved, and sales never exceed the seating capacity of the car. The interurban lines have a more direct route between the terminals than the competing steam lines, and the running time is nearly as good. Including the excess of 50 cents for the through run, or 25 cents between points on any one or two roads, the fare is considerably cheaper. The buffet service is claimed to be the first in regular service on an interurban road. The menu follows closely that used on regular Pullman buffet cars, and the prices are very reasonable.

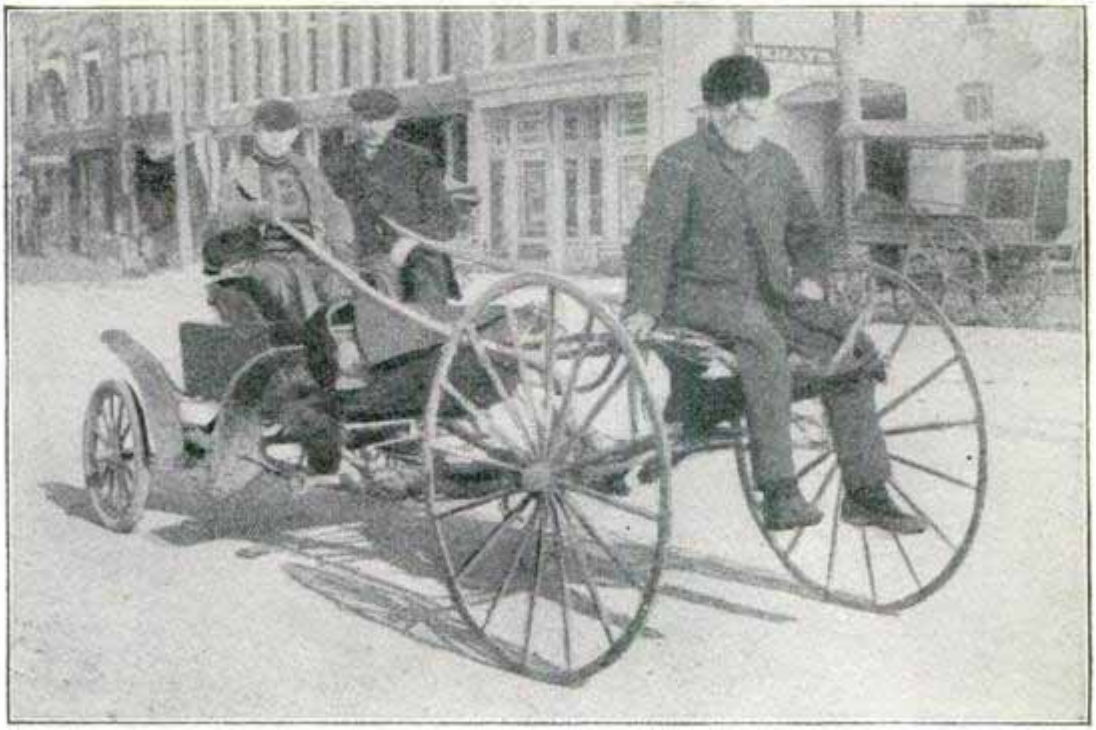
WARMING BOOTH FOR FIREMEN.

The men in city fire departments are great sufferers from cold each winter. The more severe the weather the larger the number of fires. A newspaper man in Pennsylvania has devised a portable warming booth which consists of a collapsible frame of iron pipe over which a canvas cover is drawn. Steam from the fire engine is passed through the pipe frame warming the booth which will accommodate three men standing at a time.

SUPPLIES CAPTURED AT PORT ARTHUR.

The Japan Times, Tokio, February 11th, gives a list of supplies which were found in Port Arthur, and which became the property of the Japanese with the surrender. Shells, 82,670; rifle cartridges, 2,266,800; powder, 30 tons. The amount of the food supplies will cause surprise, and included 1,422,000 lbs. of flour; 4,400 lbs. of barley; 176,000 lbs. of crushed wheat, 2,970 lbs. of rice; 30,800 lbs. of mealie meal or maize; 132,000 lbs. of biscuit; 77,000 lbs. of corned beef, 770,000 lbs of salt; 44,000 lbs. of sugar; 1,375,000 lbs. of beans; 1,900 horses in fine condition, and 50,000 roubles in cash. In the naval depot were 500 tons of biscuits; 250 tons of new flour—brought one month before by the "King Arthur"—400 tons of flour of earlier import; 40 tons of sugar; two tons of butter; some barrels of salt beef; 75,000 tons of Cardiff coal, 15,000 tons of briquette coal; and 55,000 tons of Japanese coal. There was an almost inexhaustible store of vodka, beer, champagne and other wines—"too great a store," was the significant comment of a Russian admiral. Tobacco, cigars and cigarettes were in abundance. No private stores were commandeered.

CART FOR STEERING GEAR



Steering Disabled Auto with Sulky Shafts

When he ran into a fence at the bottom of a long hill, and smashed both front wheels and the steering gear, a man in Salina, Kansas, made a valuable discovery. He borrowed a two-wheeled cart of a near-by farmer. Then, says the Automobile Review, taking two long hedge poles he ran them over the rear axle and under the front axle and then over the axle of the cart. This raised the front of the machine off the ground and he had the shafts of the cart to guide with. The progress he made was not quite so fast as he had been making, but he got home all right. The farmer had a ride to town.

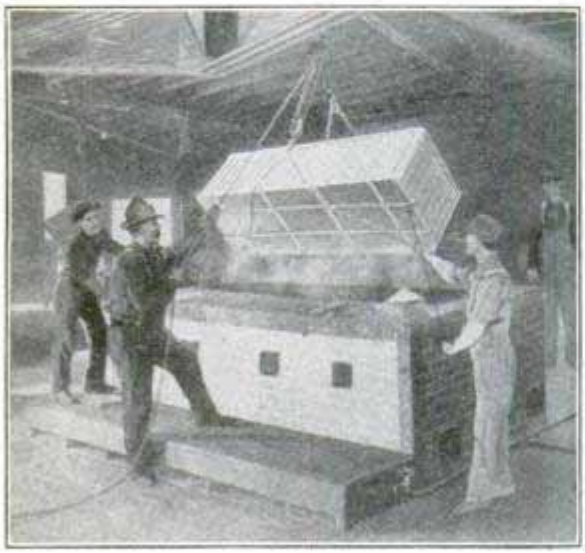
Gun Camera Photographs Tarpon

Kodak fiends love to tell of a "good shot," but here is a real genuine "shooter." The device was made specially to order and as shown in the illustration consists of a camera carried on a gun barrel. The apparatus was made for the special purpose of photographing tarpon when leaping in the air and the March number of Outing, from which the illustration is taken, contains several remarkable pictures taken with this camera. The gun arrangement permits instant and accurate sight; a touch of the trigger and the picture is taken. The barrel is sighted as in firing a shot gun.

Gun Camera for Photographing Moving Birds and Fish

EVERLASTING STEEL BURIAL CASKETS.

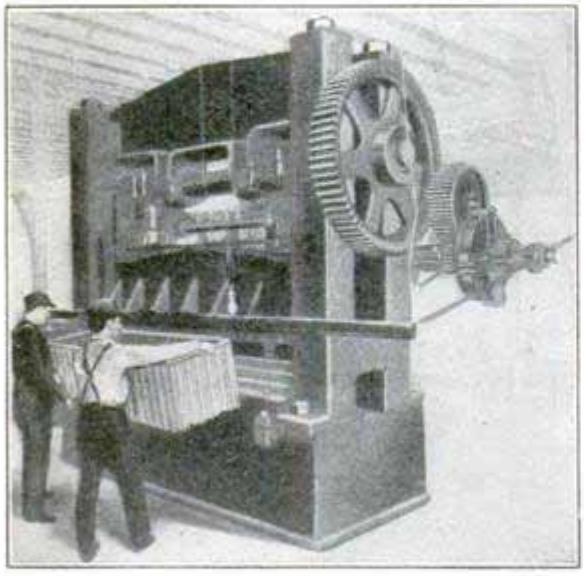
Steel burial caskets are now made which are absolutely air and water tight, and which are practically indestructible from the elements to which they are exposed. The



Removing from Galvanizing Kettle

method of construction is simple but involves the use of enormously heavy machinery.

A sheet of heavy steel is placed in a ponderous press 16 ft. long and which weighs 40 tons. Here the metal is subjected to a hydraulic pressure of 100 tons. When it has been shaped the casket is submerged in a great kettle holding 30 tons of molten metal, where it is galvanized. After galvanizing the finishing work consists in producing the effect of natural oak, white enamel or whatever tint or finish is desired.



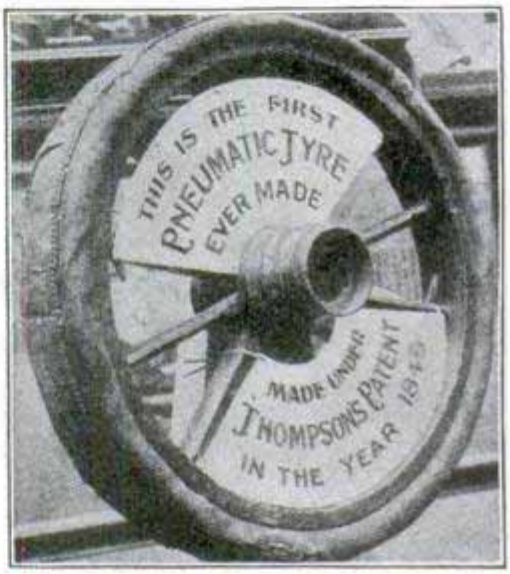
The 40-Ton Press

The steel case is intended to contain the wooden casket, and is made in sizes from 38 in. long, weighing 48 lbs., up to 89 in., weighing 195 lbs.

A railroad in Georgia is painting all its locomotives and tenders a brilliant red. As red is the universal danger signal it will be particularly unsafe to be run over by one of these "ruby rushers."

PNEUMATIC TIRES IN 1845.

Pneumatic tires are by no means the modern invention we would suppose. At the recent motor car show in London there was



displayed the first pneumatic tire ever made. The illustration gives an excellent idea of its appearance and construction.

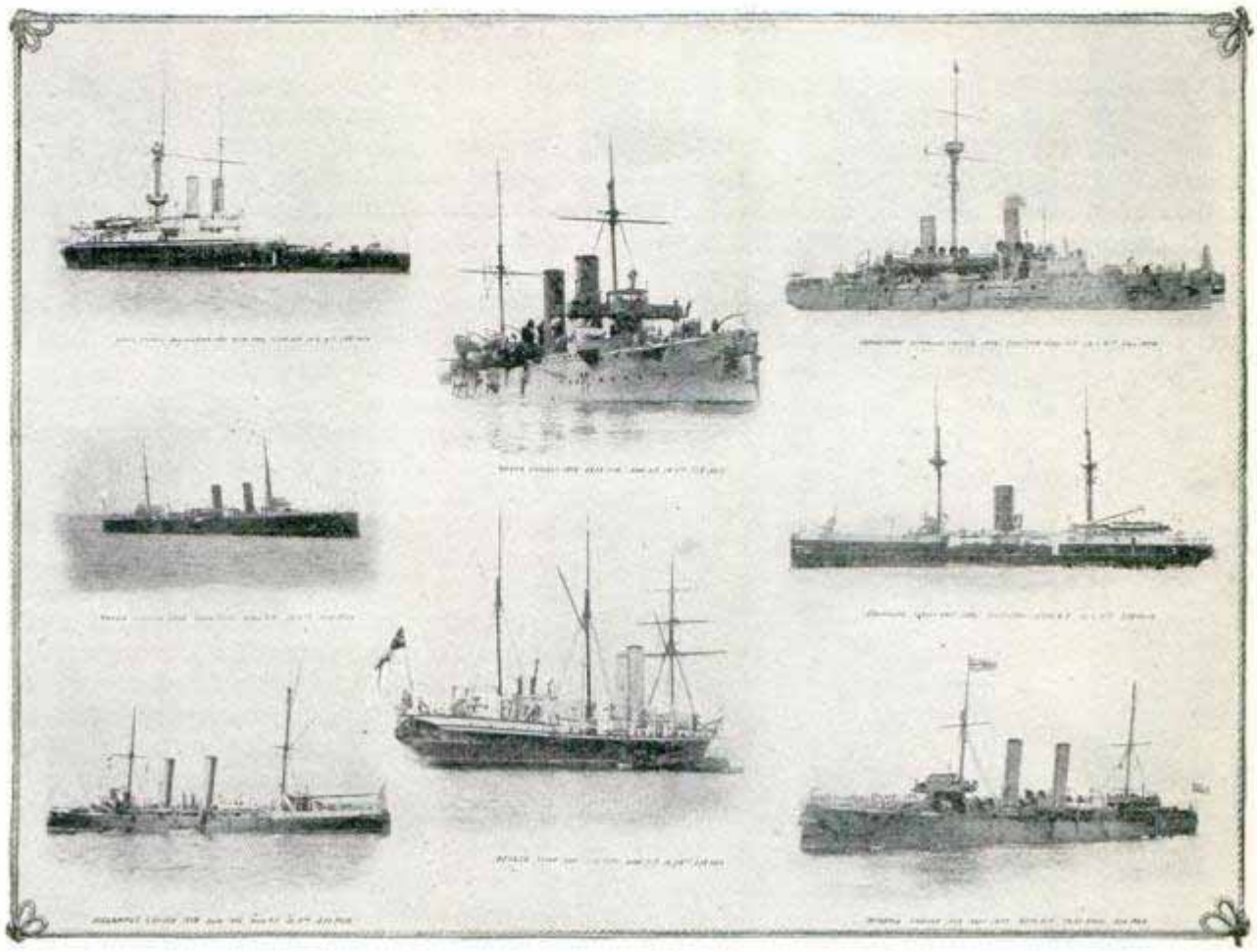
WHAT DOES THE EARTH WEIGH?

The scientists are doing great things out in California. While Prof. Loeb is hatching out fatherless sea urchins another has finished weighing the earth. He says:

Under standard gravity a cubic foot of earth weighs about five and a half times as much as a cubic foot of water. A cubic mile of earth then weighs 25,649,300,000 tons. The volume of the earth is 259,880,000,000 cubic miles. The weight of the world without its atmosphere is 6,666,250,000,000,000,000,000 tons. If we add to this the weight of the atmosphere given above we get a grand total—6,666,255,819,600,000,000,000 tons."

No wonder Atlas became round-shouldered!

Ordered to the Scrap Heap



The illustrations show a few types of war vessels of which England has ordered several score to the scrap pile. All these boats will be replaced by the most modern naval engines of war obtainable, and $200,000,000 a year will be spent in improving her navy.

MODERN MACHINERY AT THE VATICAN.

The Vatican at Rome, rich in antiquities, is soon to receive a number of innovations in the way of modern machinery. The Pope has ordered that the Vatican observatory be equipped with wireless telegraphy, two linotype machines be installed in the Vatican and a huge dynamo in the Church of St. Peter's for illuminating that magnificent structure. There is also some talk of installing an electric elevator for carrying visitors to the dome of the church. Besides these, Pius X has ordered two of the latest type automobiles for personal use in the Vatican gardens.

A new Atlantic cable will be laid during the coming summer. The cable will be of high speed and the latest improved type.

ASSEMBLING MACHINERY BY PHONE.

Machinery experts can locate many troubles in a machine by the unnatural sound it makes. Recently a Canadian firm had some difficulty with a machine of Boston manufacture which they had tried to install themselves. Finally, in despair they called up the Boston firm over the 'phone and were directed to run their telephone wires into the room where the machine was so that an expert, who was at hand, could determine by the noise it made what was the trouble. The expert directed the Canadian people just where the receiver of the telephone should be placed and in a few seconds more he had told them what was the trouble, and how to remedy it. The change occupied but a few moments and in a short time everything was running smoothly.

Modern Methods in Tea Manufacture

Germs From Coolies' Feet Are No Longer Distilled in the Beverage--110 Pound Chest Packed in Two Minutes

The manufacture of tea in the Orient, once carried on by the hand and foot labor of coolies, has undergone remarkable changes in the past few years by the introduction of western methods and machinery which have reduced the time and labor required in tea manufacture to a minimum.

The machinery is operated by native laborers and the bustling scene on a large, well-equipped tea estate in India or Japan is unusual in the extreme for a country where the climate naturally induces languor and the desire of ease.

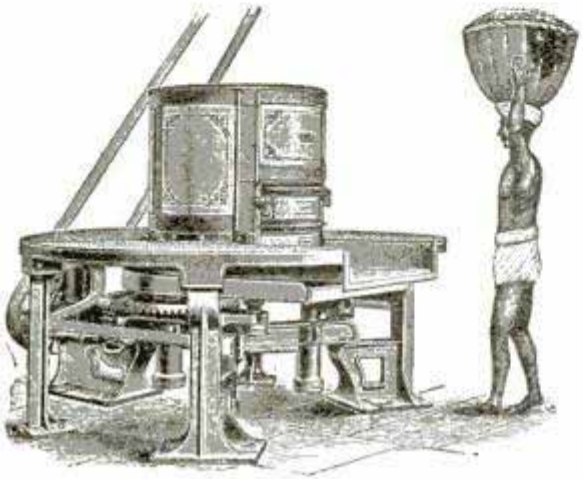


Fig. 1—Rolling Machine

The leaves of the tea-plant, plucked by native laborers and in a crisp and brittle condition are brought to the factory in baskets. Here they are carefully weighed and then spread out on shelves or racks in what are called withering lofts. These buildings are about 175 ft. long, 35 ft. wide and have six or eight lofts where the tea is spread. The sides of the loft are open; the floors are of timber. In the withering lofts the tea is reduced to a limp state, the volume of air in the loft being controlled by fans which direct the current over the spread leaf. This withering is accomplished, no matter what the climatic condition, in from 12 to 16 hours. Without the fans, it would require from 48 to 60 hours, or even longer, says Page's Weekly.

When the leaf is limp enough to take a twist without breaking, it is removed to a rolling machine (Fig. 1), where its cells are broken up before the fermenting process. The rolling machine consists of a hopper in which are fitted "ploughs," and is mounted on a table. It has a capacity for from 300 lb. to 350 lb. of withered leaf. By a movement of the table a strong lateral pressure is exerted and causes a boiling motion in the center of the mass of leaf and so gives it an equal and well-twisted rolling, also keeping it cool throughout.

From the rolling machine the wet roll is passed through a rotary seive which breaks up any compacted masses of leaf and separates the finer tea from the coarser, so that the different classes may be fermented separately. The finest qualities ferment fastest and are dried off as soon as sufficiently fermented.

One of the most important processes of the whole manufacture is the drying of the leaf after fermentation. Two types of drying machines of from 40 to 350 lbs. capacity are manufactured for this purpose. What is known as the "downdraft" drying machine is shown in Fig. 2. The wet roll is spread on trays which are inserted in the drying chamber through the bottom trap port and which, as the drying progresses, are gradually raised by a system of levers until they are opposite the top tray port, when they are withdrawn, the tea being fully dried. The hot air for drying is produced in the stove and drawn down through the trays by means of a centrifugal fan. A coolie operates the apparatus.

The other type of drying machine, shown

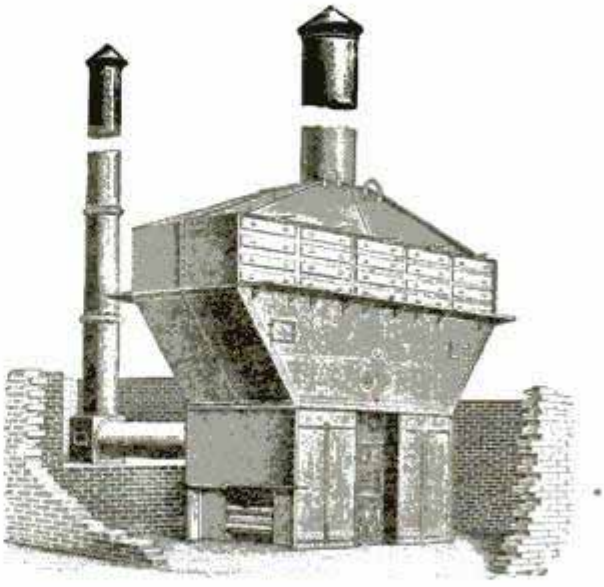


Fig. 3—Updraft Drying Machine

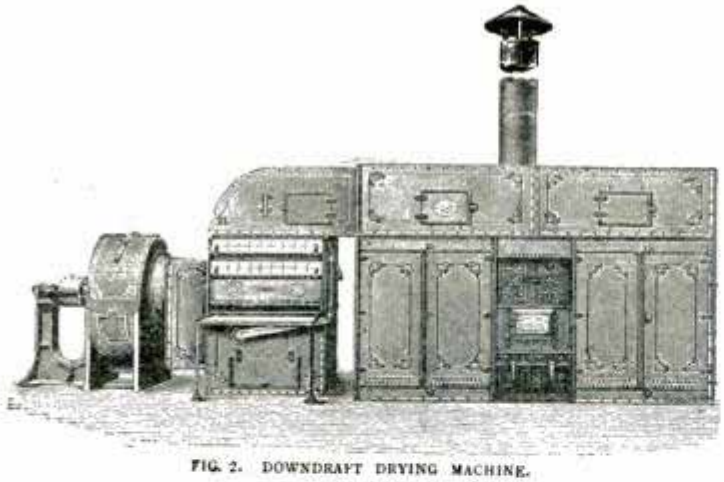


FIG. 2. DOWNDRAFT DRYING MACHINE.

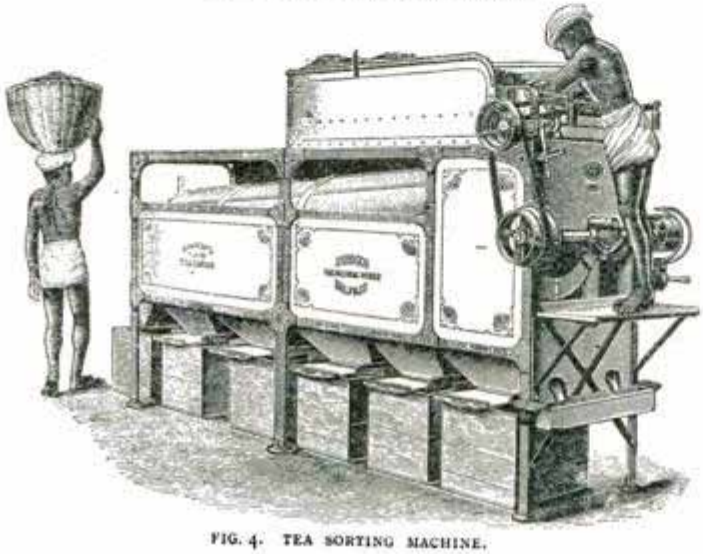


FIG. 4. TEA SORTING MACHINE.

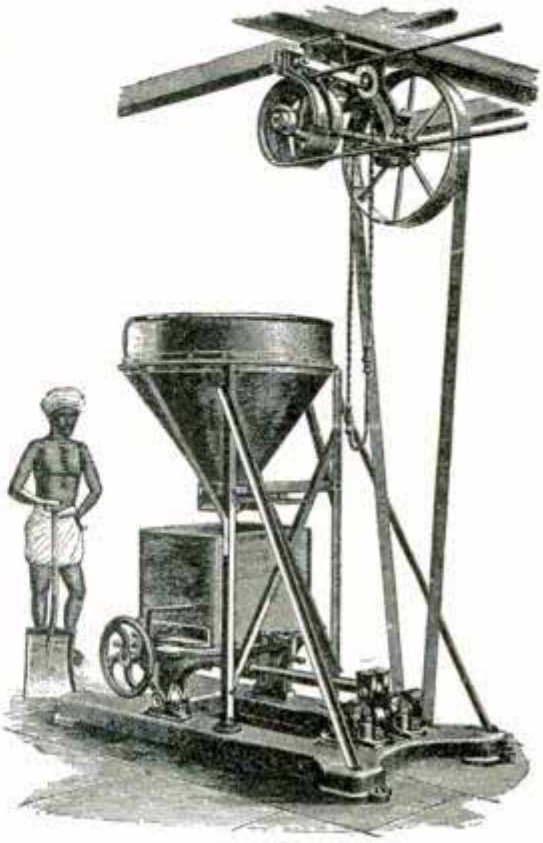


FIG. 5. TEA PACKER.

in Fig. 3, is called the "updraft," and works with a self-acting upward current of heated air which passes through the tiers of trays in the drying-chamber where the leaf is spread. The air passes either into the factory or into the chimney, as desired. The capacity is for 350 lb. of fully dried tea per hour and the operation requires but one attendant, for the dried tea is discharged automatically at the close of the process. Any kind of fuel is used in the stoves with the driers, from wood to oil fuel.

The last process is the sorting, grading and packing of the tea. A sorting and grading machine is shown in Fig. 4 and a packing machine in Fig. 5. Of old the packing was effected by coolies trampling the tea into chutes with their bare feet. In using the packing machine, the chests are clamped in a vibrating table, which makes about 2,000 vibrations per minute, and so causes all the particles of tea to settle down closely in the chest. A 110-lb. chest of tea is packed in this manner in about two minutes.

INSTALLING GASOLINE ENGINE IN SMALL BOAT.

A reader requests instructions for properly installing a gasoline engine in a small boat. Inasmuch as there is quite a difference in the construction of the many excellent gasoline marine engines it is impractical to give details which will answer in each case; what would be advisable in one might be very undesirable in others. The better way is, having made your selection of the engine, to follow the directions which each engine builder furnishes with his machine. These instructions are usually very explicit.

The general rule, however, calls for anchoring the engine securely and setting it as low in the boat as possible. The engine should receive sufficient pitch of course to bring the screw propeller well under water, although the stern will naturally draw down into the water somewhat when the engine is running.

THE OIL COMBAT IN KANSAS.

The controversy between the people of Kansas and the Standard Oil grew out of the sudden advance in freight rates on crude oil for which the Standard is blamed. Crude oil which was selling at $1.38 per barrel was thus reduced to 70 cents per barrel. The Standard was practically the only purchaser. Hundreds of wells had been sunk owing to the attractive price. When the producers rebelled, the Standard retaliated by

"How Careless"

refusing to buy at any price. Complaint was also made that the Standard was charging the public 20 cents a gallon for refined oil, or $10.50 per barrel, whereas the oil plus the cost of refining is claimed not to exceed $2 per barrel.

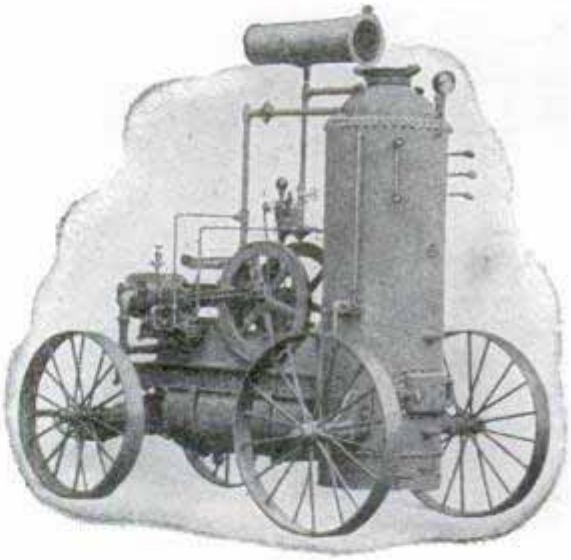
The legislature then passed a bill entitled "A Bill to Provide Labor for Convicts," under which money was appropriated for the erection of oil refineries owned, controlled and operated by the state. The constitutionality of the bill has been questioned; the courts will probably have to decide that point. The purpose of the state refineries is to afford an equalizing influence which will remove the present condition of monopoly. Some other states desiring to make an expression of sentiment have voted loans to Kansas to aid in the work and several other oil states are agitating the question of state refineries.

The Kansas legislature deny that the act is socialistic in spirit; but merely done for self preservation. The cartoon entitled "How Careless" is from the Chicago Chronicle and shows the housewife "Kansas" lighting a fire in the stove with paper "Socialism" and pouring "State Oil" on the flames.

PORTABLE AIR-COMPRESSING OUTFIT.

Portable power plants are increasing both in number and favor as for many jobs nothing could be of greater convenience. Last month we described a portable electric power plant complete in itself, while this month it is a portable air compressor outfit, which may be carried from one location to another and used for the operation of drills, chipping and riveting tools, sand-blasting and similar purposes.

The outfit is entirely self-contained, as the boiler, compressed air receiver, air compressor, and circulating pump for cooling the air-cylinder jackets are all mounted on one truck. For riveting hammers the compressor is proportioned to deliver air at about 100 pounds pressure per square inch, while for sand blasting and stone tools, air is supplied at 70 pounds pressure. The receiver permits the storing of air so that a much larger number of tools may be operated than otherwise, since it is only occasionally that all tools are in operation at the same time. The pressure of the air is maintained by a pressure governor, while the compressor is prohibited from running away, in case of a



Portable Air Compressor Outfit

break on the air line, by a fly-ball speed governor, the two governors being so combined that they operate upon a common throttle valve. The compressor engine exhausts into the stack, thus increasing the draught. The air compressor cylinder walls are jacketed and are supplied with cooling water by a small duplex pump.

Four-Cylinder Balanced Compound Locomotives.

The first locomotive of the four-cylinder balanced compound, ten-wheel type was built in January, 1902, for the Plant System of Railroads, as the 20,000th built by the Baldwin Locomotive Works, after seventy years of operation. Since then the improvements have been numerous and our illustrations show the construction and arrangement of the cylinders of a simple compound locomotive of large size.

A compound engine is one in which the same steam is made to do work in more than one cylinder. In large marine engines the "expansion" is carried through three or four cylinders. Such engines are called triple expansion or quadruple expansion. The high pressure cylinder, or the one which first receives the steam from the boiler is the smaller, and each successive expansion cylinder is larger than the one from which it receives its steam. In locomotive work the "simple compound" type is used, consisting of one high pressure and one low pressure cylinder on each side. The main features of the engine on which the compound described is installed are as follows: Total weight of engine, 176,510 pounds; tender, 109,490 pounds; tank capacity, 7,000 gallons; working pressure of boiler, 200 pounds; fuel, soft coal; total heating surface, 2,793 square feet, covering 341 15-foot 2-inch steel fire-tubes, and including 128 square feet in fire-box; grate area, 27 square feet; weight on driving wheels, 127,010 pounds.

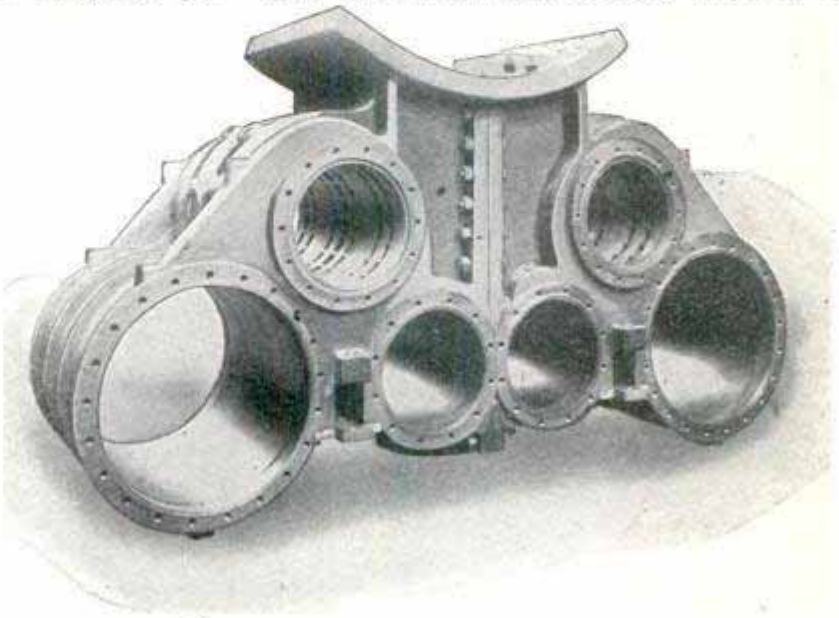


Fig. 1. Cylinder Saddle

Fig. 2. Piston Type Valve

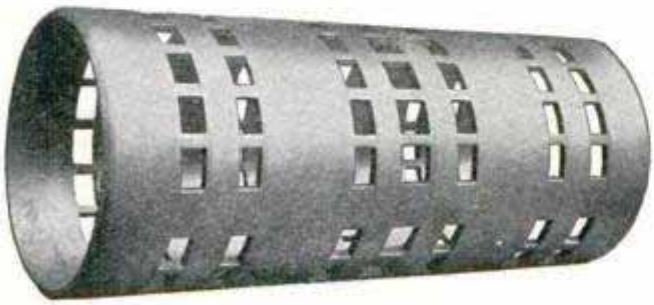


Fig. 3. Valve Bushing

The low-pressure cylinders are placed outside the engine frames, and connected to the driving wheels by crank pins, while at the same level inside are the high pressure cylinders with a crank-driving, axle connection.

The cylinder saddle, Fig. 1, is cast in two parts, then bolted together. Each part has a high and low pressure cylinder with steam admission controlled by one valve. The Stephenson valve motion is used as in single cylinder engines, and the piston type valve, Fig. 2, slides in a bushing, Fig. 3, forced into the cylinder saddle. Only one reverse lever in the cab is required.

Fig. 4 shows steam entering the H. P.

cylinder at the crank end, and the exhaust at the other port passing to the valve cavity which acts as a receiver, while the valve edges control the admission to the L. P. cylinder. Low pressure exhaust passes under the front and back cavities in the valve. The starting valve connects the two live steam ports of the H. P. cylinder to allow the steam to pass over the piston.

The moving parts of the H. P. cylinder are going in one direction while those of the L. P. cylinder move in the opposite direction. Similar speed and weight of parts in each keep a balance. Two pistons on each side of the locomotive, traveling in opposite directions, make strains equal and prevent "nosing."

One illustration shows the damage done to rails by an ordinary Atlantic type unbalanced locomotive running 80 miles an hour over swampy land. A more compact foundation prevented the inner rail from looking like the outer one.

Totalling the advantages of a balanced compound locomotive over simple engines, we have: a saving in coal and water of 20 to 25 per cent per indicated horsepower; less steam used, hence higher boiler efficiency; lighter stack exhaust with more complete, slower combustion; higher boiler pressure and dryer steam; greater range of expansion, divided between the two cylinders; higher temperature of cylinders and consequent less cylinder condensation; cost of repair same as in simple engines.

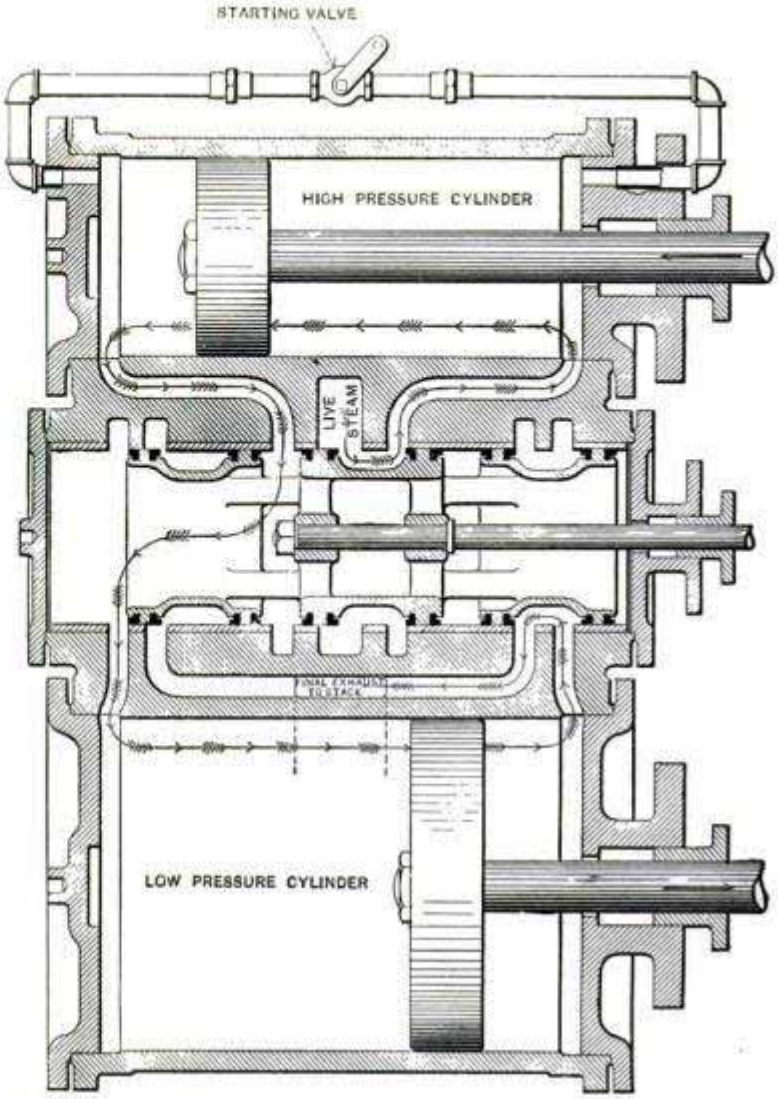
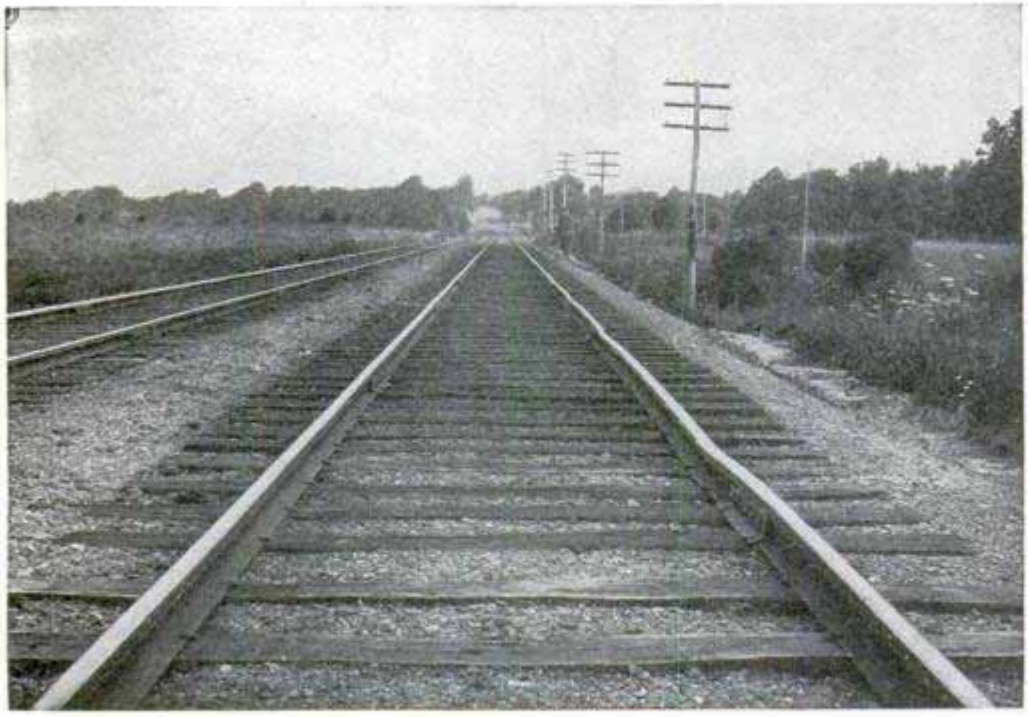


Fig. 4. Steam Distribution in Balanced Compound Cylinders

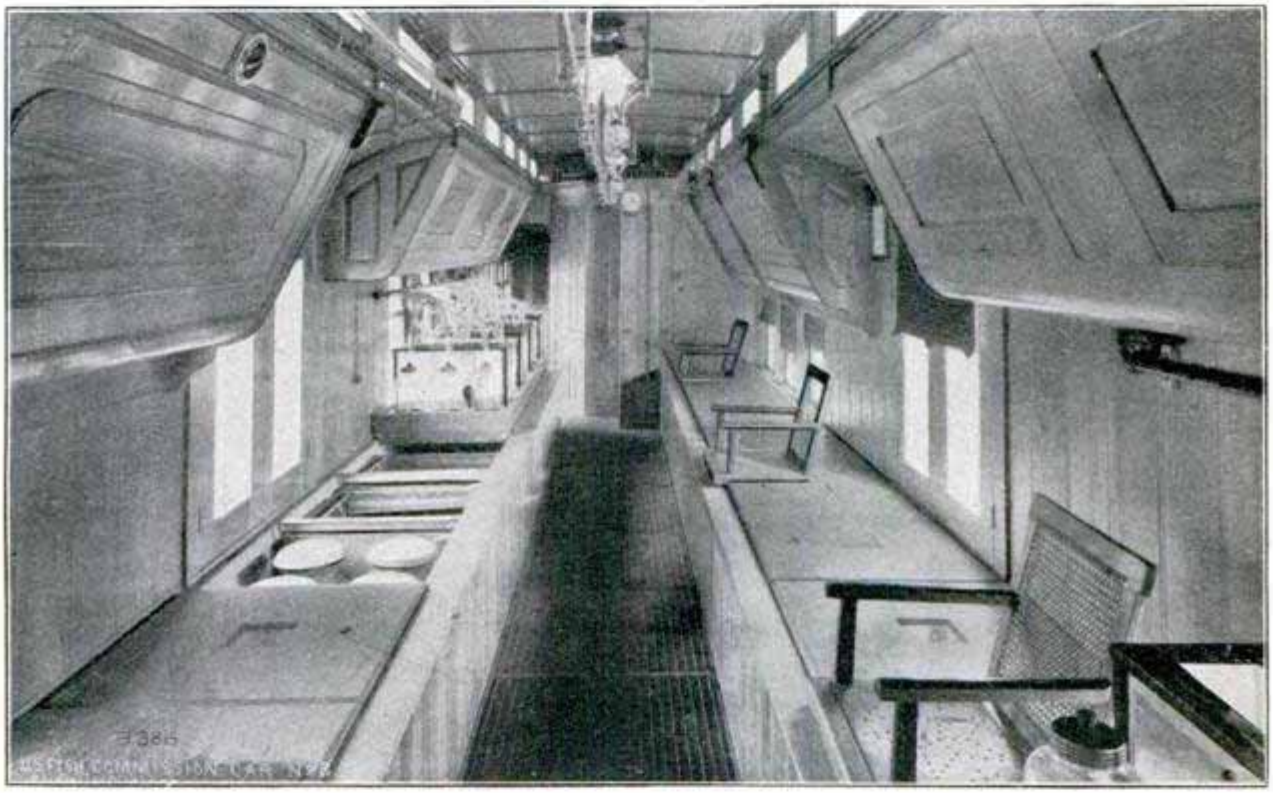


Rail Depression Caused by Imperfectly Balanced Locomotive

Hatching Fish by Millions

How Uncle Sam Transports and Distributes Fish Eggs and Fish by Land and Sea--Reasons for Fish Culture--Government Hatcheries.

In no other country is fish-culture conducted on so scientific a basis as in the United States. The first hatchery in this country was established at Caledonia, N. Y., in 1868, and as early as 1883, Prof. Huxley, at the International Fish Conference held in London, said that no nation comprehended dealing with fish so scientifically as we. Every year millions of fish are hatched at



U. S. Fish Commission Car No. 3, Showing Shipping Tanks.

our government hatcheries and the young fish distributed all over the country, to our lakes and rivers. Not only that, but millions are sent abroad, to every part of the globe, and the care of fish and eggs in transport is so well understood that they are sent thousands of miles without material loss.

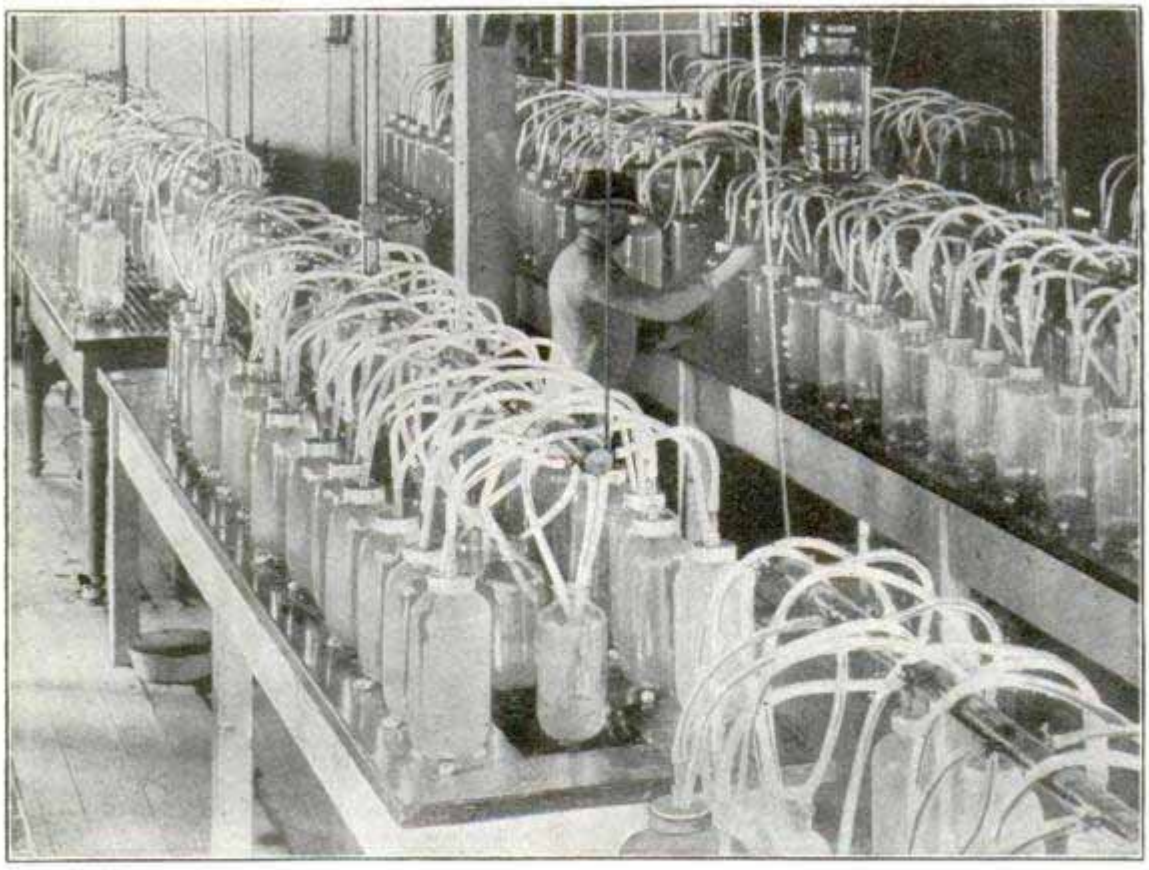
To appreciate the full value of this work, one must know something of the conditions surrounding eggs and young fish hatched in the natural place and way. Fish are extremely prolific and the number of eggs left in a stream would mount into many millions. Salmon produce 1,000 eggs to each pound of weight, shad 50,000 in all, herring 25,000, trout from 200 to 3,000, according to weight and size. Left alone perhaps one in a thousand of these eggs would be hatched. Many decay, thousands are not vitalized, some are covered with sediment and die from suffocation and great numbers are devoured, for all fish are fond of spawn. But even should the eggs lodge in a favorable place, as just where a spring bubbles up and they are continually agitated by the waters, the first few days of each tiny creature's life is fraught with peril. Nature has provided him with a nursing bottle larger than himself, which, while it nourishes him, is a great encumbrance and makes him unable to protect himself and the chances are that he will be devoured by the larger fry before he has had time to absorb the yolk sac. In the spring this yolk sac is absorbed in a few days, but in the fall it takes from 30 to 40 days. This is due to difference in temperature of the water.

When the eggs are collected and hatched under artificial conditions much of this loss is prevented, ofttimes for millions of eggs the loss being no more than two per cent. Government hatcheries are situated all over the country. Different species sometimes

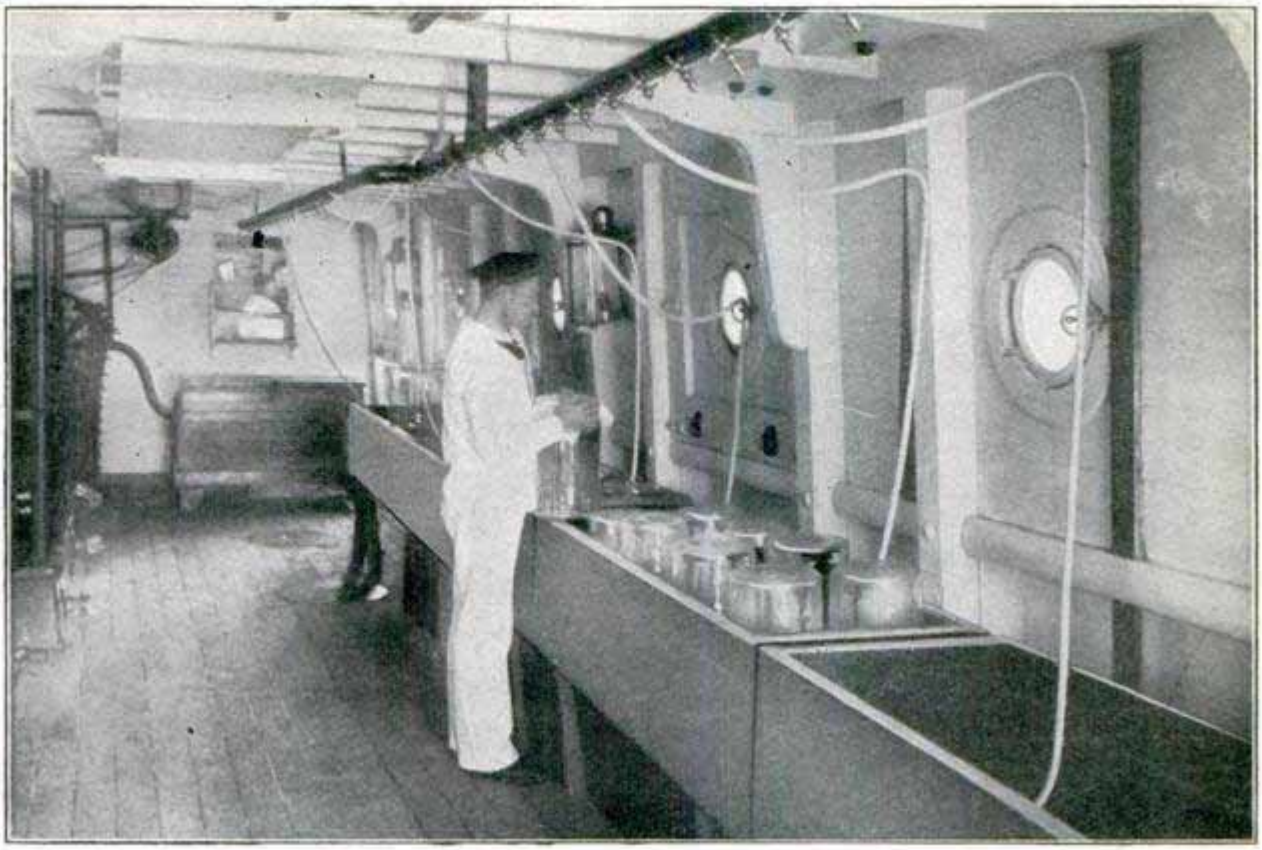
require different treatment, but a hatchery usually includes the same apparatus. The Spearfish station in South Dakota, for instance, is a frame building 32x62 ft., heated by steam, and including an office, reception room, boiler room and two bedrooms above for use of attendants. The hatching apuaratus comprises 32 troughs 13 ft. long by 12¾ in. wide. These are fitted with shallow trays for the eggs and are capable of handling 1,000,000 eggs. Water supply is brought by gravity from springs. There are also twelve rearing ponds 100 ft. by 8 ft.; three spawning ponds 120 ft. by 20 ft., and two spawning ponds 84 ft. by 20 ft., all 3 ft. deep: three stock ponds aggregate 15,000 sq. ft. and there is an ice house 20 ft. by 14 ft. This is a typical hatchery, though many are on a larger scale and have more accessories.

The salmon hatcheries on some of our western rivers represent one of our great industries. Retaining racks, 190 ft. long and resting on six piers 28 ft. apart made by bolting timbers together in the form of a triangle with the long angle upstream and the spaces filled with stone, are used. These have a number of traps which allow the fish to pass upstream but not return. The fish are dipped from the trap with soft net bags and assorted according to sex and condition. They are placed in wooden pens 12 ft. by 4 ft. and having grated sides and floors. They are then taken to the spawnhouse where the eggs are stripped into tin pans, washed and vitalized and placed on shelves to stay until they can be taken to the hatchery. Each fish after undergoing this operation is weighed and measured and any unusual fact about it is recorded also. Buckets with capacity for about 50,000 eggs are used for carrying the eggs to the hatchery and they are carried with extreme care. At the hatchery the eggs are measured into shallow baskets by dippers holding 1,800 each. The water in the troughs is kept in circulation and the eggs are picked over every other day. The fifth day they are left until they can be handled. At a temperature of 50 deg. F. this will be about 15 days. When the eye spots appear the eggs are packed in shipping cases, with layers of carefully prepared moss, free from all insects and fungi, for transportation.

The great quantities of white fish eggs and shad eggs to be handled made some device for hatching on a larger scale imperative for these species. Consequently automatic hatching jars were introduced for the purpose. These are cylindrical glass vessels of



Hatching Shad and White Fish on a Large Scale.



Hatchery on a Fish Commission Vessel

7 qts. capacity with hemispherical bottoms and supported by three glass legs. The top receives a screw cap closed by a metallic disk having two ⅝-in. holes, one in the center for admitting a glass tube introducing water into the jar, and the other at equal distances from the center and the edge of the metal plate, for the glass tube carrying waste water. The central tube is connected by a ½-in. rubber tubing with the pet cock which regulates the water supply. The opening is arranged so it is sealed hermetically.

When ready for work the jar is washed and filled with fresh water and a shallow tin funnel with perforated rim inserted just so the water stands as high in the throat of the funnel as possible. The eggs are then poured in by dipperfuls, 8,000 to 10,000 eggs per jar. The jar is closed in a manner which expels all air from the feed tube. A boiling motion is established in the mass of eggs and all dead eggs remain on top where they are easily accessible. By this means many more eggs can be hatched than where necessary to handle them, "feather" them over for dead eggs, etc.

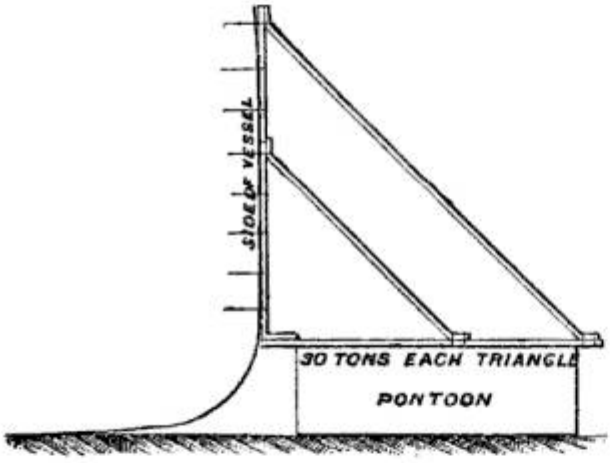
The government has provided vessels both for inland and coastal waters in connection with the work of the Fish Commission and besides these has cars specially fitted for transportation and distribution of eggs and fish. Fish Commission Car No. 3 is representative of this part of the work. This car is 60 ft. long (interior dimension), 9½ ft. wide and 13 ft. 8 in. high. It has two large doors in the center from roof to floor to facilitate loading and unloading and is finished in ash. It contains an office at one end and an ice box of 1½ tons capacity and a pressure tank of 500 gallons. At the other end is the boiler room and kitchen. The boiler room is equipped with a 5 hp. boiler, a circulating water pump and air and feed pump. The tanks and cans for transporting fish are carried in two compartments along the side of the car between the office and boiler room. These compartments are 30 ft. long and 3 ft. wide and 25 in. deep. The hatching outfits carried are eight lead-lined boxes 6 in. high with six automatic hatching jars in each, three on each side of an aquarium. These are lifted out in the daytime and wedged in trays on top of the compartments. At night they are put back to allow the four berths above them to be lowered. There are chairs, also that can be raised and lowered and for dining a table is placed in the aisle. Under the car between the trucks is a reservoir tank holding 600 gallons of water. The water is pumped from this into the pressure tank near the

office, passes from the pressure tank to the fish cars and tanks and back again to reservoir.

These cars travel thousands of miles every year, carrying millions of fish into the districts where there is a demand for them or where the waters need replenishing. The work thus done is of incalculable benefit both to the fish industry and to the people in keeping them supplied with an important food product.

PONTOON METHOD OF RAISING SUNKEN VESSELS.

Where conditions admit of its use the pontoon is one of the easiest and quickest methods of raising a sunken ship. The pontoons consist of strong steel tanks, which are ranged along both sides of the hull, and allowed to fill with water and sink. As they sink they are drawn in under the hull and



End View of Section

divers go down and fasten the pontoons together. Chains and hawsers are also passed around the hull to hold the pontoons in place and braces are also placed. Pontoons of about 25 tons lifting capacity each are most easily handled, but larger ones of 100 tons capacity each are placed amidships.

Powerful compressors are then set at work which empty the pontoons of water by filling them with air. When the hull is floated it can be towed to a dry dock or beached where permanent repairs can be made. The illustration shows the pontoons employed in raising a small vessel of only 1,070 tons. If there are holes in the hull they are first closed if possible. These patches are made in various ways, frequently with strong oak planking, which is held in place by strong bolts.

ENGLISH COAL FIELDS.

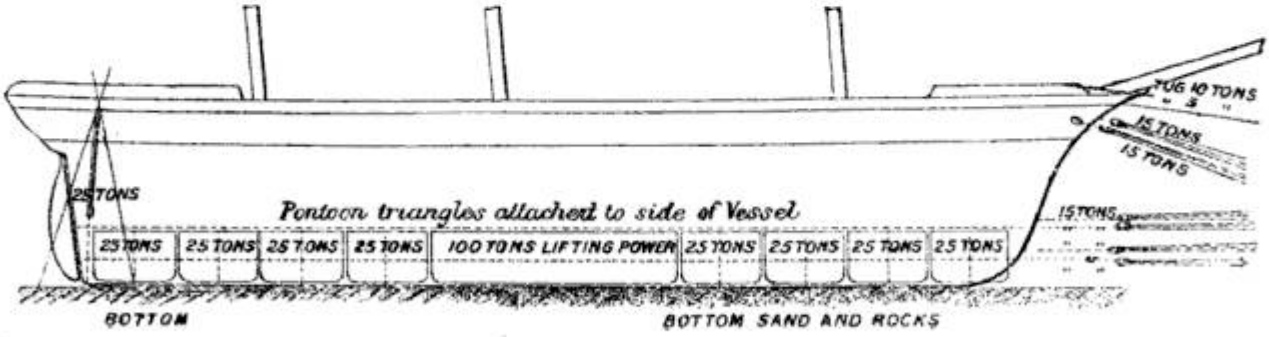
Latest Examination Gives 435 Years Before Fields Will Be Exhausted

The English coal commission has completed a long and very thorough examination of its coal fields, and reports that the supply will last 435 years. This is based on the expectation that mining can be carried on to depths of 4,000 feet. The amount in round numbers is 140,000 million tons, of which 4,000 million tons is in Wales.

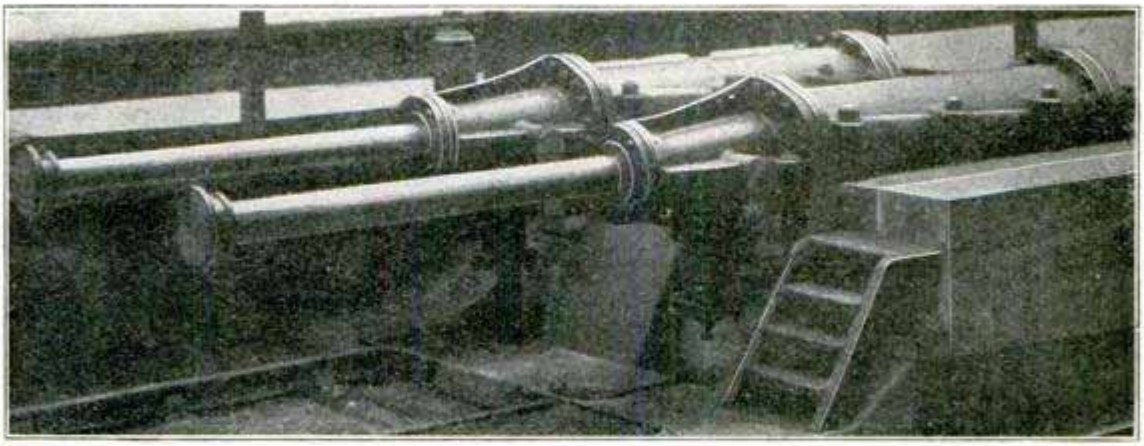
The present domestic heating system is most extravagant, the houses being warmed by means of open grates, which involves a yearly waste of 16,000,000 tons, which go up the chimneys in heat and soot. In this connection the regulation of the London Fire Department regarding chimneys burning out is interesting. When a chimney burns out the Department responds, and the unfortunate householder has a fine of $25 to pay for his carelessness.

BICYCLE POPULAR IN DENMARK.

In no country is the bicycle so generally popular as in Denmark, where all classes use it for pleasure and business on the 4,000 miles of almost perfect roadways. The government has taken off the mail coaches and is using automobiles, and small launches are found in abundance on sound, lakes and fiords.



Stop Trains With Water



"A train of 400 tons moving 10 miles an hour was successfully stopped"

The formidable contrivances shown in the cut are not a pair of torpedo guns; they are "hydraulic buffers," which are being used experimentally on the Caledonian Railway, Scotland. When an incoming train strikes the piston rods the pistons are forced into the cylinders, which are filled with water. The blow opens a valve which allows the water to pass out at a rate which acts as a yielding cushion to the train. The pistons have a travel of seven feet, says the American Inventor, and in a test a train of 400 tons moving at 10 miles an hour was successfully stopped.

WIND PRESSURE ON HIGH BUILDINGS.

Did you ever stand on the roof of an 18-story building when a great wind was blowing, or even on a building of lesser height? Doubtless you will recall your feelings on that occasion. How the huge structure seemed to sway back and forth bearing you, a mere atom, with it. Thousands of unutterable thoughts surged through your mind in that brief space and some were great and noble, and all were vast. But at last, even though you were strong of nerve and could look down from the giddy height without a tremor, that sense of swaying, imagined or unimagined, threatening every instant to pitch you into the abysm of space, unmanned and sent you reeling back into safety.

The sense of swaying is not imagined. Tall buildings do sway and how much they sway has been measured exactly, the distance of the sway varying with the height of the structure and the velocity of the wind. Scientific "wind-bracing" of the present time goes far to prevent this swaying and a building 200 ft. high withstands the force of a hurricane dashing against it with a force of 30 lb. on every square foot of its surface, swaying out of perpendicular probably no more than a quarter of an inch.

Mathematics, the precise calculations of the mind which allow no "abouts" or "almosts," make possible the scientific construction of the slender shafts of steel cages which tower aloft in our great cities. Were it not for these careful computations of wind force and of the necessary resistance beginning at the upper stories and transmitted downward until it is distributed to every member of the steel frame and the whole strength from foundation to roof brought proportionately into play for the common defense, these buildings would soon be a mass of wreckage. The principle of this resistance is the same as a man's shoulder resists a push, the force of the push being distributed to every muscle and down to his feet, enabling him by the resistance of his whole body to stand firm.

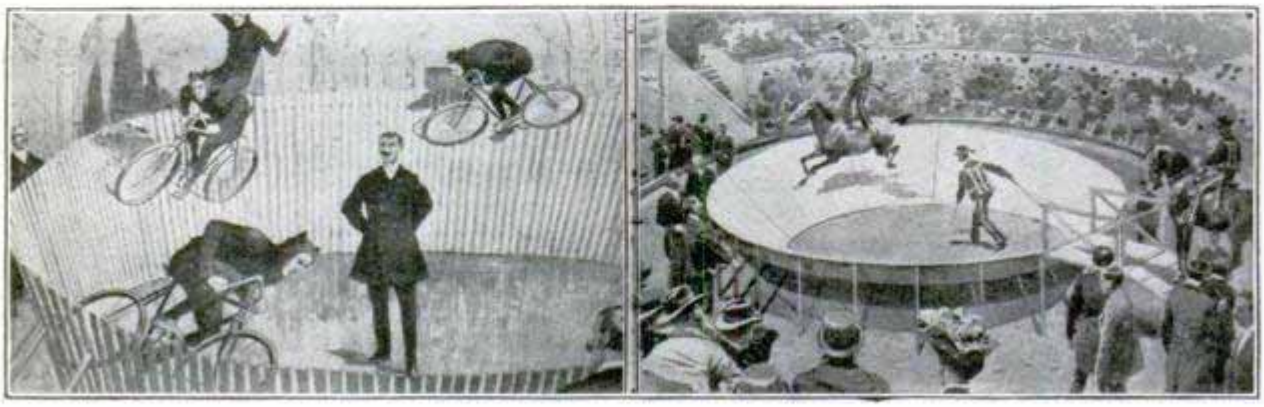
LEAD-LINED PIPE PROOF AGAINST SULPHURIC ACID.

A jet of steam was introduced into a pipe carrying fumes from boiling sulphuric acid to a stack. It was thought the steam would condense the fumes, but instead it absorbed them and formed sulphuric acid which destroyed the heavy iron pipe in a few hours. A lead-lined pipe substituted for the corroded one was proof aginst the acid.

MANY RISK LIVES TO ENTERTAIN.

That the public is best entertained by feats that involve great hazard to the performers is an old form of barbarism in a new guise. The rule that "the greater the hazard, the keener the interest," holds true in every case and works both ways.

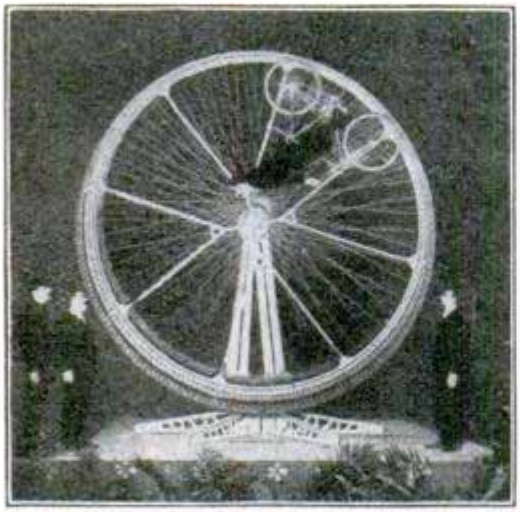
The day of the gladiator, of the fierce combat between man and beast, or beast and beast has long since passed in most countries; the day of the prize-ring is rapidly waning, but an even more exciting form of amusement has taken the place of these. Anyone who has frequented the pleasure resorts of our cities cannot but have noticed the increasing number of mechanical devices by which the people are invited to race with death, or to watch others risk their lives. It is true that the lesser risks only are permitted the sensation-loving citizen and that the apparatus is made as "safe" as engineers can make it, but in every instance it is the hazard—the spice of danger—that baits the interest of the people.



Two Very Perilous Amusement Feats

In England recently an inquest was held over a jockey who suffered a fatal accident while "circling the circ" in Loudon's great Coliseum. "Circling the circ" is done either on horseback or on a bicycle, and is extremely dangerous, as the rider depends on the speed to keep him in place on the sloping sides of the circle and is always riding at an angle. At the inquest mentioned, the chief of the general staff of the Coliseum said that there was always an element of danger in such scenes. A few accidents more or less can only be expected. The revolving stage is dangerous to performers.

The French are carrying dangerous amusement feats to the extreme. One of the latest introduced in that country is called the "gyroscope." The gyroscope is a 13-foot wheel revolving around a horizontal and a vertical axis simultaneously. A bicycle track is on the inner rim of the wheel, and the trick cyclist mounted on his bicycle enters the track at a furious rate and so sets the gyroscope going. All at once he blocks his bicycle wheels, while the huge wheel carries him up to quite a height. He repeats this performance several times until he is finally carried around with the wheel for six or seven revolutions.



The "Gyroscope"

GOLD FROM SEA WATER.

London town for the past month has been considerably agitated by the brave assertion that a process for extracting gold from sea water at an expense of no more than $50 for every $500 value of gold produced has at last been perfected. The same idea was mocked at a few years ago and most people supposed it had been wholly abandoned, but the assertions have at least received enough support to send the prices of the shares of stock up much higher than originally.

STAGE DRAGON CONTROLLED BY A TELEPHONE.

In the opera "Siegfried" a dragon is an important feature of the entertainment, says a New York publication. This opera was rendered at the Metropolitan Opera House here recently, says the American Telephone Journal. The insides of the dragon, which is made of canvas and papier-mache, consist of two small boys, who are supposed to guide the beast's movements in accordance with the music. They are rarely equal to doing that correctly, even after rehearsal. The performance the other night is said to have been given without a single stage rehearsal, as no time could be found for the preparation of the opera. It was, therefore, more than ever necessary to have the occupants of "Der Wurm's" inside kept up to their business. The stage manager decided to install a telephone in the beast. It connected with the opera house switchboard. On one end was Herr Greder, the stage manager, and at the other were two receivers strapped to the heads of the two boys, who received momentarily directions as to what they should do. The dragon under the circumstances covered himself with credit.

SUBSTITUTE FOR TIRES.

An elastic wheel for automobiles, composed wholly of steel, is a recent French invention. It is reported to have successfully passed severe tests and to have met all requirements. The illustration shows its construction. The rim is coated with a band of rubber, which the Automobile Review says "does not increase to any extent the elasticity of the springs and is intended solely to lessen the noise of the running car."

All-Steel Wheel

A NEW GAS METER.

A small, inexpensive, and accurate gas meter, easily placed, is a new English invention. It is called a "rotary meter" and works on the principle of a windmill. The gas operating on a set of blades turns a shaft, which transmits its motion to gear wheels, and they to a dial read as in the ordinary meter. The parts run with the least possible friction, and, there being no leather bellows or water, the gas pressure does not affect its working. It is invaluable where the gas is dusty, being easily replaced by a clean one. Its low cost enables a consumer to place one on each separate gas apparatus in the house, and thus determine how much gas is being used for various purposes. The one illustrated is three inches in diameter and three inches high, and is in place to measure gas supplying a fire.

Rotary Gas Meter

Corks boiled for some time in melted parrafin are thus rendered impervious to air, acids and alkalies. Keep the cork beneath the surface of the paraffin, and heat and allow to cool a number of times.

THE TANTALUM LAMP.

The tantalum electric lamp is a new type of incandescent lamp, and receives its name from the metal of which the filament is composed. Tantalum, though comparatively little known, exists in considerable quantities and its cost in the raw state is not great. When drawn into wire it is somewhat darker than platinum, and has a hardness about equal to that of mild steel but with greater tensile strength. The filaments are not easily broken in shipment of the lamps, and have a much higher resistance than the carbon now generally used in incandescent lamps. The life of a tantalum lamp is believed to be much greater than one of carbon, and to yield a better light. Owing to the peculiar lacing of the filaments, the tantalum lamp may burn through several times before becoming useless. Often a light tap on the lamp will bring a broken filament in contact with its neighbor. A peculiarity of tantalum is that its resistance increases with increased temperature while carbon diminishes in resistance with heat. The Electrical Review sums up the main points as follows:

1. The tantalum lamp has a filament made of a metallic conductor and burns at once on being connected without any previous heating.

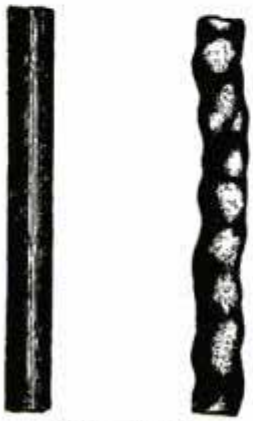
2. The light-giving wire is prepared by melting in a vacuum and drawing; it is tough even in the cold state, and can therefore be coiled and fixed in the lamp when cold.

3. A relatively great length of wire can be placed in a simple manner within a bulb of ordinary dimensions.

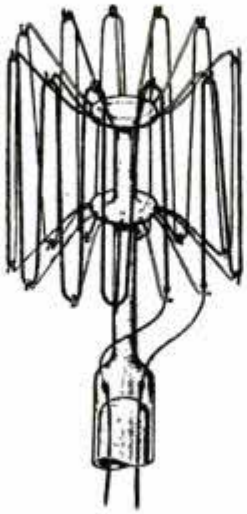
4. Tantalum ore exists in considerable quantities and can be easily procured.

5. Similar principles of treatment can be adhibited to other metals of a very high melting point.

The lamps are at present being made only in Berlin.



Filament Before and After 1000 Hours' Service.

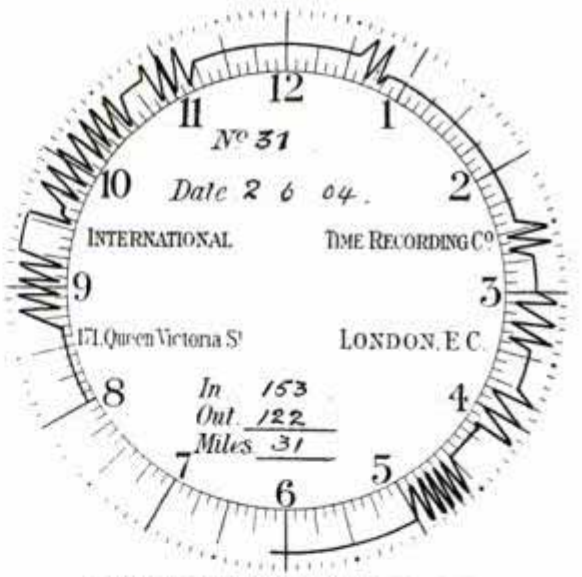


Filament Frame of New Lamp.

AUTOMATIC JOURNEY RECORDER.

The journey recorder is an automatic instrument which can be attached to a motor vehicle and produces a record of the day's work of the vehicle showing when it was in motion and how long the stoppages were.

A paper dial marked with the hours of the day is rotated by a clock, and a pencil,



RECORD OF THE DAY'S JOURNEY OF A VAN.

READING: Started out at 8.40 a.m.; travelled 12 miles with 2 short stoppages, till 10.35; standing from 10.35 till 10.50; travelled 3 miles, till 11.15; standing, 11.15 till 12.35; standing, for dinner, from 12.50 to 2.25 (too long); travelled 14 miles, with 3 stops, and reached home at 5 p.m.: the last 6 miles were done in 30 minutes, which is too fast, considering the length of the journey.

actuated by the wheel of the vehicle, draws a short line for each mile travelled; on the completion of the mile the pencil is returned and the mile recorded. When the vehicle is standing the pencil marks a concentric line. The gear for actuating the pencil is very simple, being a scroll fixed on the nave of the wheel, and gearing into a star wheel attached to the axle or spring, and by a flexible shaft inside a protecting tube, transmitting the motion to the recording mechanism.

SHOP NOTES

HOW TO STRAIGHTEN SHAFTING.

If it is not convenient to remove the shaft to be straightened, it may be straightened while in place by the method shown in Fig. 1. Have enough weight on the end of the

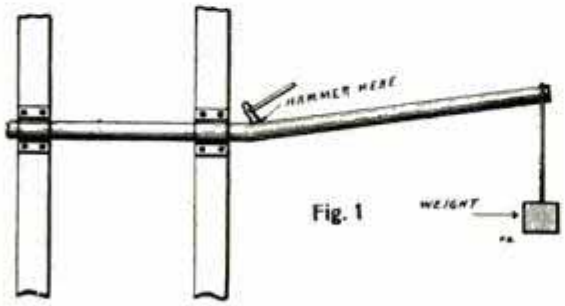


Fig. 1

shaft to cause considerable strain, and pound lightly on the top of the shaft.

In Fig. 2 is shown another method. Hang the shaft to be straightened by the ends, the bow being up, and pound on the under side with a light hammer. The light taps swedge the iron, says the American Miller,

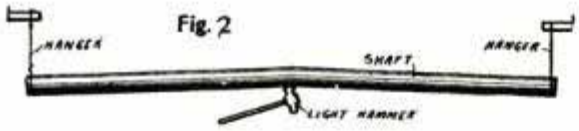


Fig. 2

and cause it to be straightened. Use a straight edge to true the shaft by.

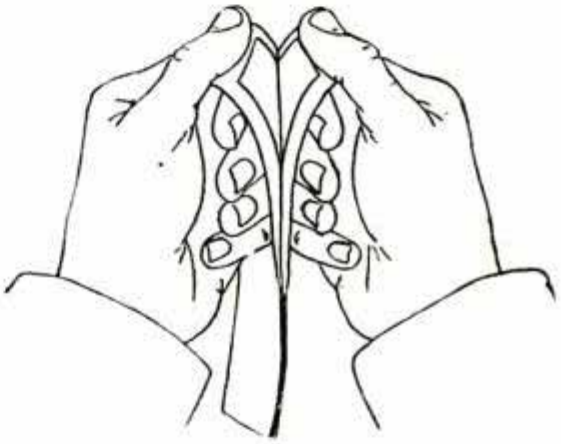
LAYING A DRAIN ACROSS A MARSH.

In drain laying, when a soft place is reached in a marsh or in seepy land, if stone or gravel cannot be procured the place should be treated as shown in the sketch, says Brick. The place when dried out is liable to sink, but by bridging it as shown, by driving down short 6-in. boards about 2 feet apart until solid ground is reached, truing up the tops of these boards and nailing on a 6-in. board to grade on which to lay the tile, the difficulty may be overcome.

HOW TO SPLIT PAPER.

When drawings or engravings are printed on both sides of a sheet of paper and it is desired to file them separately, the paper may be split very satisfactorily and without injury to the drawings, says a correspondent of the American Machinist.

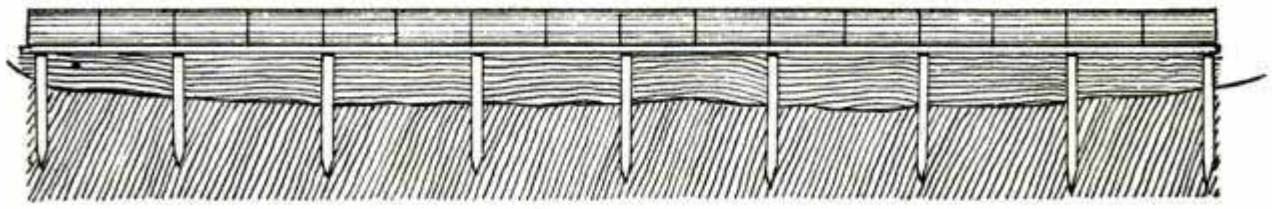
Have ready two pieces of cotton cloth, an inch or two larger than the paper to be split, some flour paste and some warm water. Cover the paper with a thin coating of the paste, dampen one piece of cloth and place on the paste side of the paper; smooth it out and so remove any air that


Splitting Paper

may be under the cloth. Treat the other side of the paper in the same manner and allow the whole to become thoroughly dry.

When dry, separate two corresponding corners of the paper, as shown in the sketch, and gently pull apart. Paper will adhere to each cloth and they must then be allowed to soak in water in order to remove. Handle carefully till dry.

To make enough mortar to plaster 100 sq. yds. use 8 bu. of good lime, 16 bu. of sand and 1 bu. of hair.


Laying a Drain Through Marshy Land

THE MEASUREMENT OF VACUUM.

The importance of knowing just the pressure in the condenser has led to much discussion as to how it should be determined.

Fig. 1 shows one method, using the principle of the barometer, in which the mercury column is pushed up by atmospheric pressure until its weight, plus the pressure

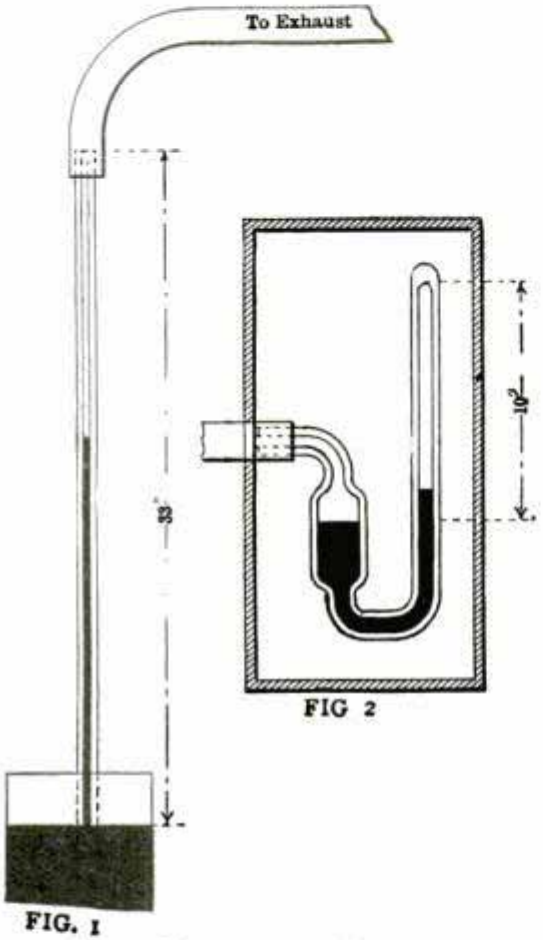


FIG. 1

The Measurement of Vacuum

FIG 2

in the condenser, equals the atmospheric pressure on the mercury in the dish. Suppose this column is 25 in. high and the barometer reads 30 in. The pressure in the condenser is equal to 5 in. of mercury. But two readings were necessary to get it. Besides this, a higher barometer reading; that is, greater atmospheric pressure, which would, of course, push the mercury up, would seem to show a better vacuum in the condenser, when in reality this vacuum was probably made less by the increased atmospheric pressure.

The best instrument is one that will: (1) show the actual pressure in the condenser, independent of the pressure of the atmosphere; (2) it must be accurate at all times.

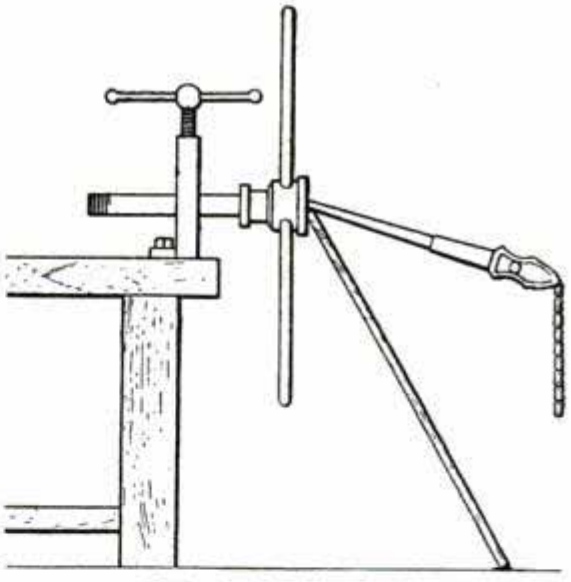
Take a glass tube, made and connected as in Fig. 2, with a vacuum above the mercury in the closed end. The difference in height of the mercury in the arms of the U tube will show quite well the actual pressure in the condenser. If the mercury rises 5 in. in the tube it means that the pressure on the exhaust side of the piston is the same in effect as if the piston were lifting a layer of mercury 5 inches thick. In a 10-inch piston this would mean a constant load of about 193 pounds at its back. This helps us to understand a 25-inch vacuum and how a still lower pressure cylinder can get work out of this exhaust steam.

The instrument in Fig. 2 is neat and cheap, and the arm at the right need be only 10 inches in length. By its use we may speak of 5 inches back pressure instead of a 25-inch vacuum.

HOW TO START A PIPE DIE.

It is possible to start the ordinary plain 2-in. pipe die on anything, save rotten pipe, by the following method, says a correspondent of the Engineer.

Take a board 6 or 8 in. longer than is necessary to reach the center of the pipe when standing on end, and with one end of



Method of Holding Stock

a bar or the handle of chain tongs in the pipe, incline the board so that the upper end comes about flush with the pipe, as shown in the sketch. Bear down on the bar, which will press the boards against the stock and so hold it firmly in position and squarely against the end of the pipe.

If you have a good kink for this department, send it in. We can use rough sketches of any size, if accompanied by brief explanations.

COLLECTING SPILLED MERCURY.

Mercury spilled on floor or table is hard to collect, as it separates into small globules which roll away at the slightest touch. A simple method of collecting it is to make a wet ring around it by means of a wash bottle or a glass, and then gather it up on a card scoop or in an envelope. The mercury cannot readily cross the wet ring.—Technics, London.

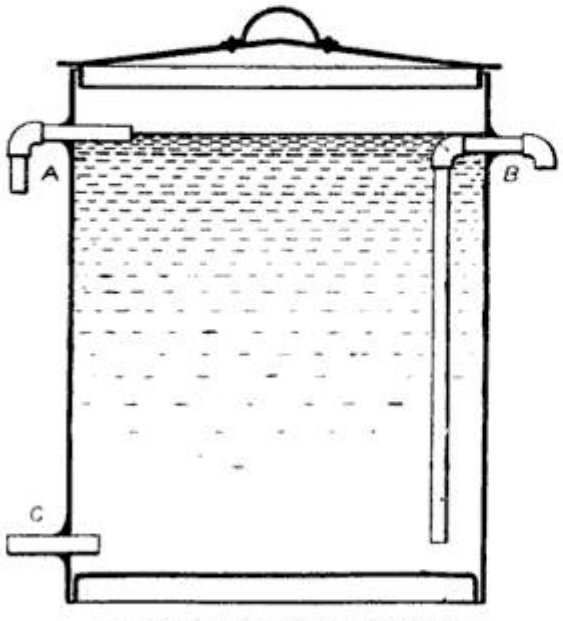
HOW TO RECUT OLD FILES AND RASPS.

Dissolve 4 oz. saleratus in 1 qt. water and boil the files in the solution for a half hour. Remove the files, wash and try them. Then to 1 qt. of water slowly add 4 oz. sulphuric acid. Immerse the files in this preparation and let stand from six to twelve hours, according to the fineness or coarseness of the files. Earthen vessels only should be used for the acid preparation. Bottle the liquid and it may be used again; but be careful in handling it, as it is poisonous.—Contributed by F. H. Olson, Loomis, Neb.

A SIMPLE OIL SEPARATOR.

For separating oil from water before filtering the oil, the apparatus shown in the accompanying sketch is efficient and can be made at home, says a correspondent of the Engineer.

A gallon oil can is used for the tank, and the pipe, C, is connected to the drip from the engine. Through this pipe, C, the oil and water enter until the liquid in the can is on a level with the pipe, A, through which the light oil floats off, while the water runs out at B, which is ¼ in. lower than A, so that the water cannot reach A. In starting the separator, to prevent any water getting into pipe B, it is well to pour enough water into the can to cover the bottom of pipe B.

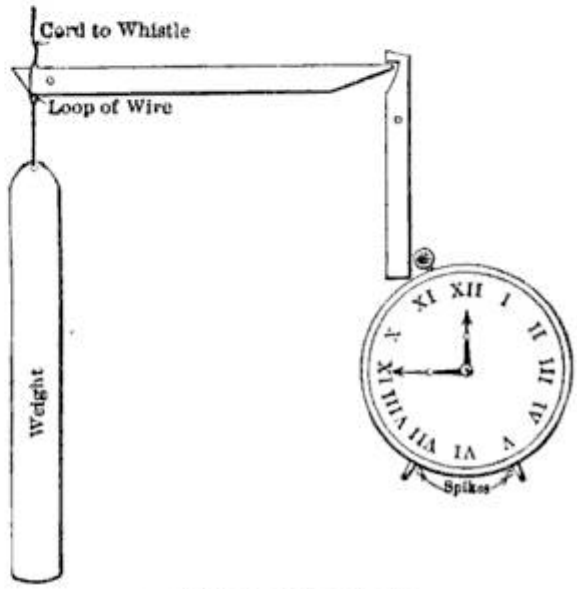


Sectional View of Oil Separator

HOW TO MAKE A TIME ALARM.

A time alarm which will blow a whistle at the time it is set for is very easily rigged up as shown in the sketch.

A weight is attached to the whistle cord and hung up by a loop of wire on a trigger working loosely on a nail. The other end of this trigger is set under the hook of another loose trigger. An alarm clock having the bell removed is set against the wall by means of spikes on which the legs rest. The clock is near enough to the second trigger so that when the alarm rings the hammer will strike the trigger and release the weight, which falls with a jerk and so blows the whistle. A little slack in the cord running to the whistle will cause the weight to fall with a jerk.



A Simple Time Alarm

HOW TO CLEAN PAINT KETTLES.

Add half a pound of caustic soda to two gallons of water, and boil the kettles in the solution. The caustic acid may again be used for the same purpose several times, or may be used for cleaning paint from woodwork, says the Master Painter.

A good furniture oil is composed of 1 pt. boiled linseed oil, 4 oz. yellow wax melted and colored with alkanet root.

SET SCREW POINTS.

In obtaining a point on set screws which are to be used on threaded collars, the method shown in the sketch is excellent, as it entirely stops annoyance with soft metal points.

To procure the points is a very simple matter. In Figs. 1 and 2 is shown part of

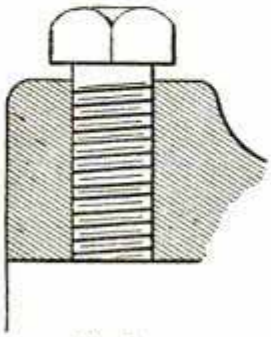


Fig. 1

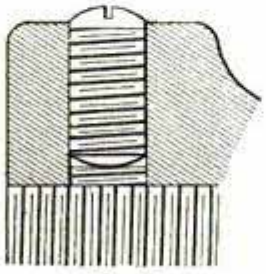


Fig. 2

an adjusting ring for the blades of an adjustable reamer. Rough bore the hole, leaving enough stock so it can easily be rechucked and finished; drill and tap the hole for a set screw and screw a wrought-iron cap bolt in the tapped hole, as in Fig. 1. With a hand die cut the extreme end of the cap bolt small enough to be a "sloppy" fit in the tap hole, this being done to insure enough lateral play in the end to be used as the "point," so that the set screw will force it tightly upon the male thread which the adjusting ring is to fit. Rechuck the ring and bore and cut the thread in it in the usual way. This being done screw the cap bolt out of the hole, and cut off a piece, as shown at Fig. 2, with two or three threads of the original cap bolt on it and the same thread in the end as the adjusting ring. Caseharden the wrought-iron "point" so made and screw in to the adjusting ring (see Fig. 2) until it is in the same position it was in when the internal thread was cut in its end.

Points properly casehardened, says a correspondent of the American Machinist, will not expand under the ordinary pressure of the set screw and cannot mar the threads they grip.

DARK GREEN PAINT FOR VEHICLE GEAR.

When painting the gear of a vehicle dark green add a little chrome yellow, or chrome green, if preferred, to the black for the first coat, and for the second coat add the same to black rubbing varnish.—John L. Whiting & Sons' Book, "What Else to Do."

BAND SAWS AND HOW THEY ARE MADE.

The very best steel obtainable, combining qualities of toughness, elasticity and edge-holding is used for band saws. The saws are rolled from large pieces of the steel until of the right thickness (the standard is 14-gage) and are then left for grinding and polishing.

Band saws are heated for tempering in large furnaces 75 to 100 ft. long. When at the right heat they are taken out and plunged into a long trough filled with whale oil, and when cold the teeth are punched by an automatic machine. If, when tested for its temper, it is either too soft or too hard, it must be retempered.

The blade usually comes out badly twisted after tempering, says the Wood-Worker. Some are long-face twists and some cross-face twists, then comes the cross-line twist, which runs the entire length of the saw. Sometimes part of the saw will have long-face twists and part cross-face twists. All twists are taken out of blade with the cross-peln hammer, and tension put in with the round-face hammer to the amount desired. Tension levels are used that are made on a circle, so as to have the tension even throughout the saw.

The blade is then ground between two large grindstones running opposite directions from one another. Great care is taken in grinding to keep the stones true so as to grind the saw alike on both sides. Should one stone become hollow-faced and the other remain square, you would find the saw blade to be ground level on one side and rounding on the other. It would be impossible to level such a saw alike on both sides.

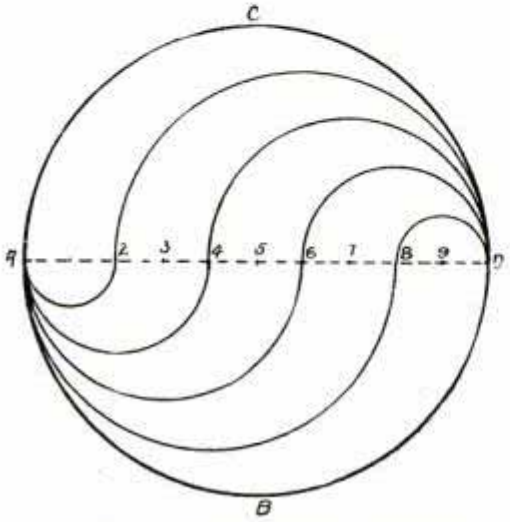
After being ground, saws are polished and brazed together, but are always hammered and tensioned before they are put together.

TO FINISH SPRUCE.

Wet the surface of the spruce with dilute sulphuric acid and allow it to dry. Hold over a heated stove until the whole surface is as black as charcoal, then with a stiff scrubbing brush, remove all the charcoal that will come off. Oil the surface with linseed oil and beeswax. This treatment brings out the harder grain in black and gives the rest a brownish tone. This finish is used in Japanese work, says the Manual Training Magazine.

TO DIVIDE A CIRCLE INTO ANY NUMBER OF PARTS OF EQUAL AREA.

Let ABCD be the circle, to be divided into five parts of equal area. Divide the diameter, AD, into a number of equal parts twice as great as the number of parts desired in the circle—in this case, five. Number the points as shown. From 1 as a center, draw



Dividing a Circle into Parts of Equal Area

a half-circle through A and 2 on one side of AD, and from 6 as a center, strike a half-circle through 2 and D, on the opposite side of AD. In the same way, taking as centers 2 and 7, 3 and 8, and 4 and 9, the remaining half-circles are drawn, giving the required equal areas.

OIL THAT COLD WILL NOT AFFECT.

It is often difficult to keep machinery properly oiled in cold weather, as the oil freezes in the oil holes and the cups, and the oil upon the ways of the lathe and planer becomes stiff, causing the machines to work hard. A good oil for winter use is made by mixing graphite with cylinder oil until in a thick or pasty consistency, and then adding kerosene until it flows freely. This oil will not become stiff at 14 degrees below zero, and is valuable to those operating machinery outside or in cold shops.—Contributed by Paul S. Baker, Muscatine, Iowa.

Concrete which is well-proportioned will safely withstand a crushing strength of 50 tons per square foot, it is said. Most American cities limit it to 16 tons per square foot, however, in their building laws.

CEMENT FOR LEAKS IN IRON PIPE.

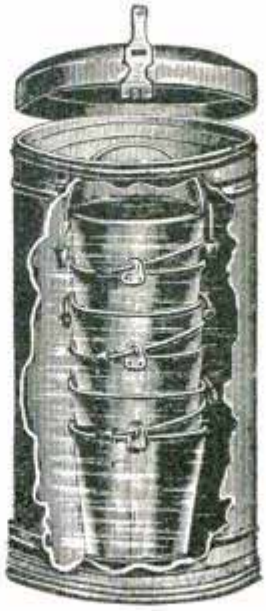
A cement for closing leaks in iron pipe consists of coarsely powdered iron borings, 5 lbs.; powdered sal ammoniac, 2 oz.; sulphur, 1 oz., and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed it sets more firmly without the sulphur. It must be used as soon as mixed, says the Mechanical Engineer.

TO MAKE GAS ENGINES NOISELESS.

To make a gas engine noiseless, the following simple device can be introduced by anyone at a small expense, says an English journal: A pipe split for a distance of about 80 inches is attached to the end of the exhaust, with the split end upward. Beginning at the lower end of the cut, which may best be made by a saw, dividing the pipe into two halves, the slotted opening is widened out toward the top until it has a width equal to the diameter of the pipe. The puff of the exhaust spreads out like a fan, and the discharge into the open air takes place gradually. The effect produced is said to be remarkable, but it depends somewhat on the flare of the tube.

SAFETY FIRE BUCKET TANK.

The fire bucket is a constant temptation to the workman who happens to need a pail and can't find one handy. The fire buckets to be of use when really needed must be in handy places. If they are set around on the floor they are either in the way or soon disappear. If hung up on nails or hooks or placed on shelves they dry out and are often found empty and ready to fall to pieces when the fire comes. An Eastern concern has conceived a practical soiution of the fire pail problem by using a galvanized iron tank partly filled with water in which the pails are kept. A lid to the tank keeps out dirt and prevents evaporation.



FLANGED WHEELS.

Faulty Systems and How They Could Be Improved

The flanged wheel, undoubtedly, is very destructive in its effect upon a belt. Some manufacturers of belting state in their contracts that the radial flanges often used to keep belts on pulleys shall be dispensed with. The flanges are used oftentimes simply to overcome some imperfection in the alignment of the wheels or shafts. Again they are employed to guide the belt correctly on a wheel which is of too small diameter, too wide or too narrow, or in which the belt system itself is defective, and the belt cannot be kept in proper line.

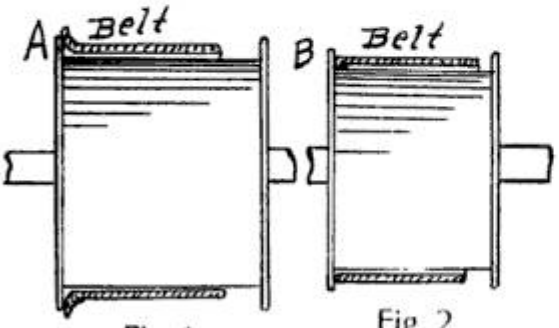


Fig. 1

Fig. 2

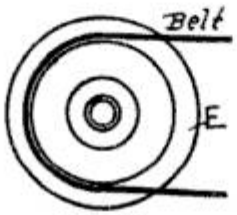


Fig. 3

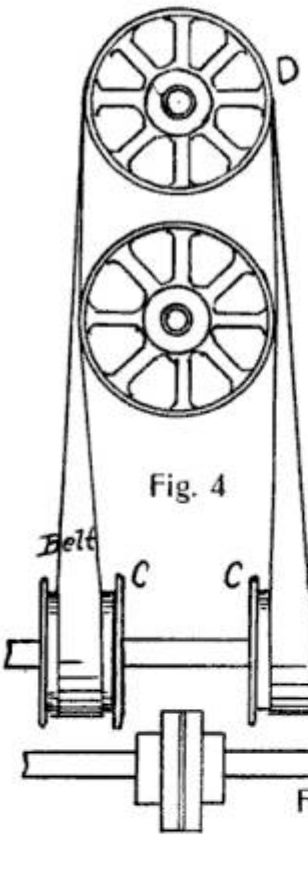


Fig. 4

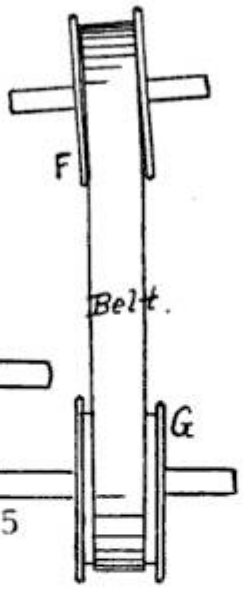


Fig. 5

There are several reasons why the shoulders or flanges of wheels are often seen in use, even in these days of apparently perfected power and transmission. Of course the effect upon the leather, rubber or canvas belt of the flanges is to tear and wear the edges in a short time—sometimes in a very few weeks after the belt is installed. In the cuts are shown some illustrations of defective systems of flanged wheels that came to notice recently.

The wheel system shown in Fig. 1 was found in use in a flour mill. There had been considerable trouble in keeping a certain belt in line on some overhead shaft wheels, and in order to overcome certain other defects a wheel was put on with the flanges as shown. The result was that the belt stayed on the wheels, but it constantly rubbed against the flange, as at A, resulting in ruining that edge of the belt in a short time. Some overhauling was done, and the belt was caused to run within the flanges, but still it rubbed against the side of the flange, as at B, Fig. 2. In course of time the edge of the belt was wrecked and a new belt had to be put on. The error in the flange system of deflecting the course of a belt is that the flange has to deflect the belt after the belt has already taken its grip on the wheel. The way to deflect a belt on a wheel is to exert the pressure upon it sidewise to the right or left, so that it will pass to the wheel spirally. This is done by applying the pressure before the belt gets hold on the wheel surface. The flange cannot do this. Fig. 3 shows the belt passing to the wheel, contacting with the flange E. There are occasions on which the flanges happen to come right, and the belt takes its course without danger of being worn by frictional contact with the wheel guides. But this is rare. Usually the flanges create trouble, more or less.

A system of right-angle drive was fitted up in a machine shop, as in Fig. 4, with the flanged wheels C, C. Many have used this form of drive, and usually made the belt stay on the wheels without the use of flanges on any of the pulleys. Sometimes when the system is installed and apparently complete, it is found necessary to turn the belt in the opposite direction, causing the belt to run off. Then the flanged wheels are clapped on. The driving pulley in this system is marked D. The pulleys C, C, turn in opposite directions on the shaft, and therefore need to be on independent sleeves, with a collar on each side of each sleeve.

This system is sometimes used instead of the half-cross method. The belt, however, has to be twice the length than for the direct driving. With proper setting the system can be run readily without flanged wheels.

In another establishment a belt was apparently laboring along between the flanges of a wheel, as at F, Fig. 5, and the floor and parts of machinery just below were liberally sprinkled with the grindings of the costly leather belt, chafed from the edges by the flanges. An inspection quickly determined the cause. The shaft carrying the wheel, F, was quite a distance out of line. The pulley, without its flanges, was unable to retain the belt on. Therefore, rather than re-adjust the shaft, a pulley was keyed on with flanges. The flanges kept the belt on, but the effect upon the belt was beginning to tell, and no doubt by this time the belt is upon the waste pile of the shop. A little re-adjusting of the shaft, making the parallel alignment true, would have overcome the defect at once and for good. The driving pulley of the system, G, was likewise flanged. The half-crossed belt running upon flanged wheels with disastrous results to the belting was found also in a number of cases. Some of the highest grades of belting were receiving unjust treatment from these flanges.

In the half-crossed system, heavy belts of narrow width are of course the best. Fortunately, the heavy, narrow belt is not so readily torn and worn by the flanges. Often the tough little double belt will run for a long time, grinding against the flanges, before signs of wear are observed. But even the double belts, tough raw-hide belts, and belts made specially to resist wear and tear, cannot stand the cutting, breaking, grinding, chafing flanges indefinitely. The cone pulley is, in one respect, a form of flanged wheel, for the reason that one side of the wheel in use must always be provided with a higher shoulder than the other side. Yet it is very seldom that the change or the cone pulleys destroy belting. As the flange or shoulder exists on one side only in each instance, it is possible to adjust the system so that the belt will always run so as to clear the shoulder. In the cone wheels the faces are made flat or parallel, as a rule. In special cases, however, convexing is advised. Such faces are also made with recesses, but so slight that the fact is scarcely felt by the belt. It is the abuse of the cone wheel that causes trouble with the belts. The one-cone wheel system, adjusted in the manner shown in Fig. 6, was found in a wood-working establishment. The outer pulley surfaces of each wheel at both sides were flanged at H and I. The shaft carrying the lower cone was out of true, and, to further add to the complications, a shifter was in use at J, manipulated by the lever and rod K. The belt was constantly abrading against the flange, and gave signs of

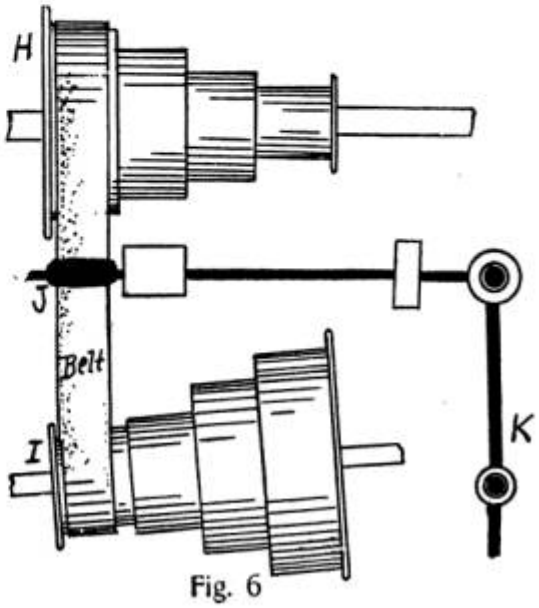


Fig. 6

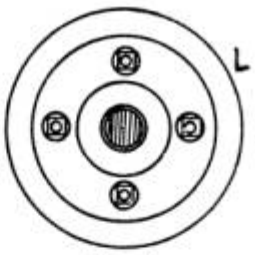


Fig. 7

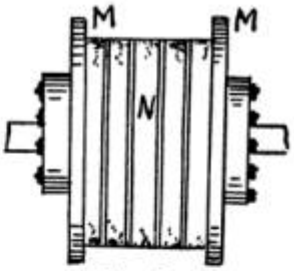


Fig. 8

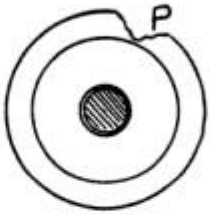


Fig. 9

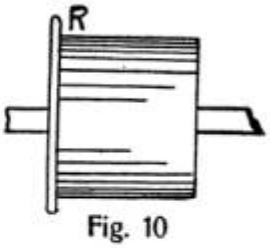


Fig. 10

breaking and tearing. The edges were scraped badly. When asked why the shafts were not properly lined so as to overcome the trouble, the response was that they did not have time to fix it. Belting is an expensive proposition. It will pay to take the time.

As to building up wheels with flanges, this ought not to be encouraged. Yet there are occasions in which it is perfectly proper

to use the flanged wheel. It is wrong only when some one claps on a flanged pulley to keep a belt in line when the belt runs untrue because of defective adjustments of the shafts or wheels, or the belt unions are unevenly closed and the belt wabbles as a result.

In Fig. 7 is a drawing of a home-made flange. The flange proper is L, and is part of the side which may be adjusted to the interior disks, so as to form the flanged wheel of the pattern shown in Fig. 8. The flanges are marked M, M. The disks are of wood, turned from hard stock, to right size at the nearest wood-working shop. The disks are bored through for the bolts of the flanges, and quite a substantial flanged wheel results.

Fig. 9 is a sample of what we often see. It is a piece broken out of the flange of a wheel. This fracture makes a rough place, and unless a remedy is sought the sharp, ragged edge will cut and ruin the belt. Broken pieces are sometimes riveted back in place. Fig. 10 is a sketch of the one-flange wheel. The flange is marked R. This type of wheel may be found in service in some places.—"Traveling Machinist."

RAISING A HEAVY TIMBER WITHOUT TACKLE.

A heavy stick of green timber 12 in. x 14 in. and 48 ft. long was raised to a height of 7 ft. 6 in. in fifteen minutes without the use of tackle by C. J. Case of Troy, Pa., and one assistant. The timber was raised as shown in the sketch, by see-sawing it and building up a crib of blocks beneath it. Each time one end of the timber went up a new block was placed, the work proceeding in this manner until the desired height was attained.

WEDGE FOR HAMMER AND TOOL HANDLES.

An English tool maker has put on the market a metal wedge for securing heads of hammers and other similar tools. A malleable iron wedge is provided with a short traverse slot at its thicker end. This wedge is driven into the shaft of the hammer, and a staple is then driven in astride the slot, its ends opening out as shown in the accompanying illustration, thus preventing the wedge from coming loose.

ROOFING PAINTS MADE OF GAS TAR.

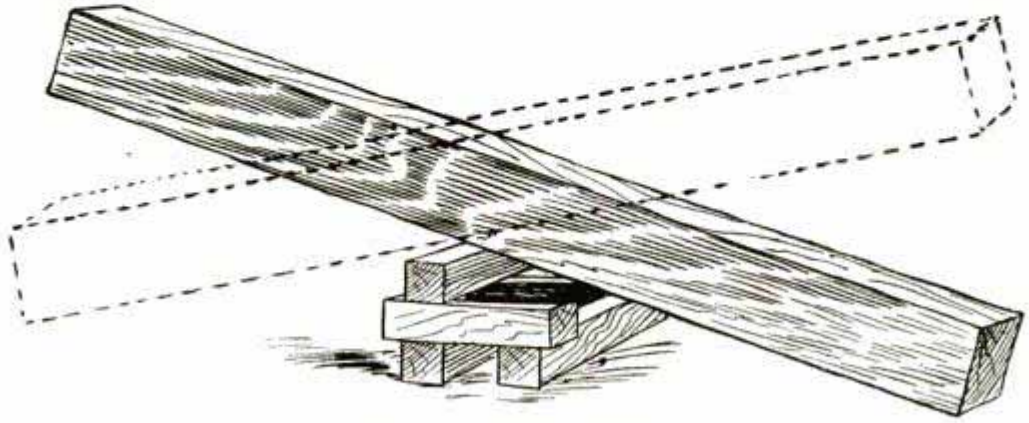
The following recipe is one of the very best for a roofing paint made of gas tar:

Take 30 lbs. each of coal tar pitch and cheap asphaltum; melt and boil slowly over a slow fire for five hours; add 8 gals. boiled linseed oil, and then add slowly 10 lbs. each of red lead and litharge. Boil three hours longer. Take from fire and thin, while still warm, with enough turpentine or benzine to make it work freely.

This is, however, a rather expensive paint and also considerable trouble to compound. A much simpler and at the same time reliable paint may be made as follows:

Take 3 gal. liquor coal tar and mix with it 1 gal. benzine asphaltum varnish, which may be thinned with either turpentine or benzine to working consistency.

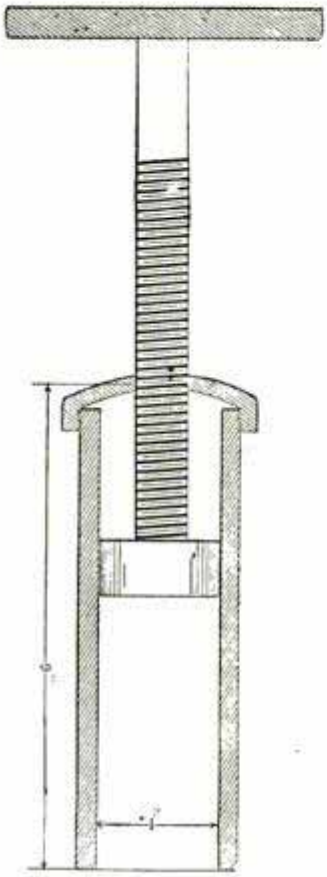
An excellent flux for copper, tin or arsenic is powdered flint glass.



Raising a Heavy Timber

COMPOUND FOR USE ON COMMUTATORS.

A good compound for use on commutators which will prevent them from sparking or cutting and will keep them in good shape, is made as follows:



Two parts of the best paraffine wax melted and allowed to come to a slow boil, into which is stirred one part of baking soda. Stir for two minutes and add one part of the best and finest graphite. Keep stirring and let remain over the fire for three minutes. Pour into mold.

Any sort of a mold may be used. The one shown in the sketch is used by a correspondent of Power, and molds a stick 9 in. long and 1 in. in diameter. Cut up into sticks 4½ in. long and wrap separately in tinfoil until needed. Treat commutator lightly once in awhile.

ANOTHER METHOD OF USING SANDPAPER.

Fold the sandpaper three-ply. Face a piece of common rubber of suitable size and an inch in thickness. Place the sandpaper on the work, and upon this the rubber, and begin work.—Contributed by C. L. Truesdale, Sharpsville, Pa.

HARD SOLDER FOR SILVER.

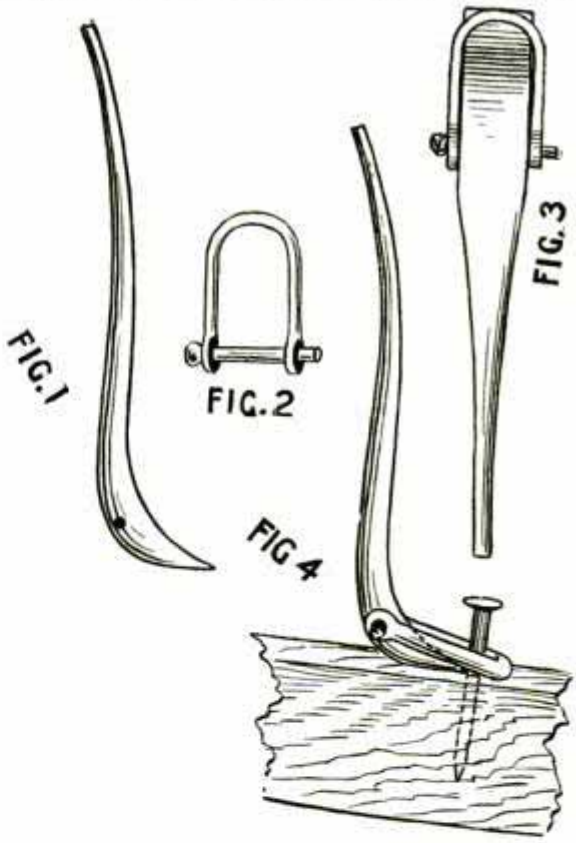
Equal parts of silver and brass make a good, hard solder for silver, which will fuse much easier, however, by the addition of 1-16 part of zinc.

In soldering either silver or gold it is well to draw the solder into a wire, or to flatten between rollers and then cut into small bits, which may be used as required. To perform the work first join the parts to be soldered together with fine, soft wire. Have ready some finely powdered borax, well moistened with water, into which dip a camel's hair brush, and touch the joint to be soldered, placing a little solder on the joint. Apply a large piece of charcoal to the joint, and then with a blowpipe and lamp blow upon it through the flame until the solder melts.

To cleanse the article after the soldering has been done heat it red hot and let it cool. Then boil it in alum water contained in an earthen vessel. The cleansing will be perfect.

A GOOD SPIKE PULLER.

The spike puller here illustrated is made of a 2½-ft. steel bar in the form shown at Fig. 1, and has a clevis made as shown in Fig. 2, and measuring at the side 3 in., and at the ends 1¼ in. The method of attaching the clevis to the steel bar by means of a pin is shown at Fig. 3, while Fig. 4 shows the position of the tool in use. This is an

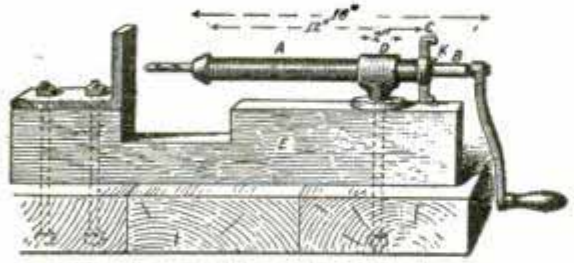


excellent tool for the purpose, and will pull rusty spikes as well as new ones.—Contributed by C. J. Case, Troy, Pa.

The best varnish for iron is a thin coat of red lead, laid on and allowed to dry, then one or two coats more added. Allow each coat to dry before applying another.

HANDY DRILL FOR ALL-AROUND WORK.

A drill which is handy for all-around work is made of a piece of one-inch gas pipe, A, 12 in. long and cut eight threads to the inch. At the end it is flattened for a key, K, which holds the feed handle at B.

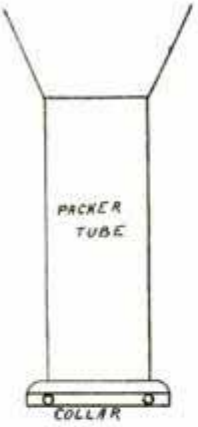


A Handy Drill

A piece of 1-in. iron 16 in. long, headed and drilled, is used for the drill spindle. If desired the hole may be made square by heating and punching with a square punch. To avoid twisting of the spindle, the part, D, is 2 in. long through the threaded part. The block, E, is of hardwood, 4x4 and 24 in. long, both block and drill being bolted down solidly to the bench. A correspondent of the Blacksmith and Wheelwright says the drill is easily and cheaply made.

TO MAKE A HANDY BAG OR SACK HOLDER.

A simple, cheap, easily changed device for holding sacks and bags filled from a tube is described in the American Miller: Take a piece of good, sound plank 1½ or 2 in. thick and 14 in. square. Draw a circle in center of plank the size of the lower end of the tube; draw another 1½ in. larger than the first and saw out as marked. A blacksmith can put on a band of ⅞x3-16-in. iron, to prevent splitting. Have the band placed even with the lower side and round off the upper edge. Drill three ⅛-in. holes through band and wood, and equal distances apart, and three corresponding holes in bottom of tube. This collar will fit a 48-in. tube. Three 2-in. buggy tire bolts and nuts will hold collar on tube.

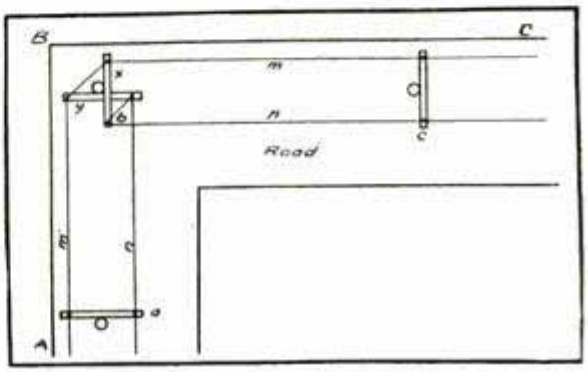


A 13-in. collar is best for 100-lb. sacks, and a 14-in. collar for 140-lb. sacks, outside diameter.

BEST WAY OF TURNING A CORNER IN TELEPHONE CONSTRUCTION.

In constructing rural telephone lines a little practical foresight will greatly reduce expenses. Our illustration shows a method of turning a corner, which, says the Telephone Journal, is the very best.

A, B and C represent the turn in the road and b represents the corner pole. Upon b two crossarms are mounted at right angles, x and y, so that y is parallel to a, and x to c. The wires M and N and m' and n' are run in the usual manner and dead ended at the knobs at the crossarms at b.



Turning a Corner

Insulated wire, which renders the possibility of crosses from any cause almost impossible, should be used to cross connect the lines. This construction reduces the cost, does away with more than one guy wire and gives the best efficiency attainable.

HEAVY FLOATING BODIES TRAVEL FASTER THAN THE CURRENT?

Referring to the article on "Speed of Floating Boats in Flowing River," which appeared in the February issue of Popular Mechanics, B. F. Curtis of Cheney, Wash., makes the assertion that heavy floating bodies travel faster than the current, and cites us to an experience of his own in proof of his assertion. Mr. Curtis says:

"I at one time came down a swift river in a boat and caught up with a raft of saw logs. I stopped rowing to eat my dinner, and the raft of logs left me 200 yds. behind in thirty minutes. I had to row hard to catch up with the raft, and when I reached it, I tied my boat to it and made better speed. This proves that heavy floating bodies travel faster than the current."

INSULATING STEAM DOMES AND PIPING WITH HAIR FELT.

Where a high pressure is carried and there is considerable heat radiation it is economical to cover steam domes and piping with non-conducting insulating material. A correspondent of Power tells how he covered two steam domes and a large amount of 2-in. piping with hair felt. The domes in question were 4 ft. 6 in. high by 4 ft. wide, and to cover them one would proceed as follows:

Around each dome fit asbestos board ¼ in. thick and wire it on securely. Cut 16 pieces of wood 1¼ in. square, 4 ft. 6 in. long, and each having three slots cut in them (Fig. 2) 4 in. long and ⅝ in. deep. Set eight of these pieces at equal distances around each dome in a vertical position with slots toward the asbestos board (Fig. 1). Wire these in place also, and then put on another layer of ¼ in. asbestos board. Wrap this with strong twine, to hold it in place, and then wrap on hair felt, a layer 1½ in. thick. Wind on twine to hold this secure and, keeping the surface smooth, cover the hair felt with asbestos paper, and finally cover the whole with canvas properly sewed and painted. Treat the top of the dome in the same manner, except that the asbestos should be cut by a paper templet made to fit the safety valve, main stop and 2-in. connection, and radial strips of wood should be used instead of vertical pieces. Fasten these to the vertical strips with wire nails. Fig. 3 shows a sectional view of the covering. With this covering the hand can feel no heat when the boilers are under steam, the temperature of the boiler room will be reduced and made more comfortable, and fuel expense will be lessened.

Cover piping in the usual manner, except in applying the asbestos paper. Cut this into strips wide enough to go around the pipe, wet it and wrap around the pipes. It will not need twine to hold it if put on while wet. Cover the asbestos paper with hair felt and then another layer of asbestos paper to give a smooth surface, and finally the neat covering of canvas.

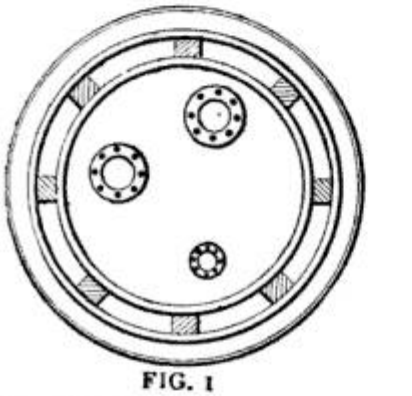


FIG. 1

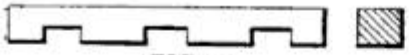


FIG. 2

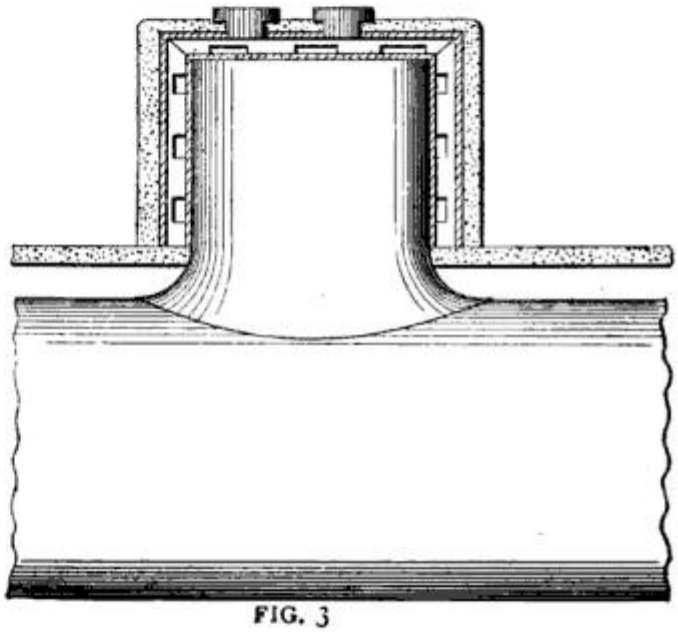


FIG. 3

Covering a Boiler Dome With Hair Felt

To remove ink stains from ivory use repeatedly a solution of quadroxalate of potash in water.

HOW TO FIND THE NORTH AND SOUTH POLES OF A DYNAMO.

While the dynamo is in service, bring the north-seeker end of a compass needle near each of the poles. Those that attract this end are north poles and those repelling it are south poles.

HOW TO TEMPER SPRING STEEL.

Heat to a cherry red and plunge into cold water. This will harden it; clean with emery cloth. To draw the temper, place in clean hot sand until the colors run to blue. Then place in cold water. Repeat the sand process if still too hard.

FIRST THINGS TO DO IN CASE OF BURNS, OR SCALDS.

Three classes are generally recognized:

1. Simple reddening of the skin.
2. Accompanied with the formation of blisters.
3. Charring of the skin and ulceration of all degrees up to complete destruction of the part.

Burns of the second and third degree, especially when covering large areas, require immediate medical attendance. In severe burns there is liability to shocks and prostration. The general directions for treatment of such a case would be to transport the patient to a place of safety, then remove clothing by cutting away with a knife or scissors. If the clothing sticks, do not pull it off, cut around it and wet it with water or oil, promptly exclude air by covering the wounded or injured surface.

As the pain attending a burn is very intense, care should be taken not to expose too large a portion of the surface to the air at any one time, and to cover as quickly as possible with something that will exclude the air. This should be done the moment the covering is removed. When the burn is extensive, expose and dress a small portion of the burn at a time.

Never hold the burn to the heat, but warm moist cloths are sometimes grateful, especially if wet with a warm solution of baking soda (bicarbonate).

When a person's clothing catches fire, make him lie down immediately or throw him down if necessary. Wrap him quickly in a blanket, cloak or shawl, preferably some woolen material, and smother the fire by pressing and patting upon the burning points from the outside. Have water ready, and in removing the wrapping pour the water over the burning point.

Serious degrees of shocks usually follow such burns. In cases of severe shock it is heroic treatment to lay the person on a sheet and lower him, clothes and all, into a bath tub full of water, moderately warm. This will relieve the pain and shock.

It is best in these cases not to attempt any dressing of the burns, simply to cover them with a layer of gauze, then a layer of lint, over this a layer of absorbent cotten, outside the whole a sheet or blanket, and await the arrival of the physician, or transport the patient to a hospital.

In slight burns or scalds, put a teaspoonful of baking soda in a pint of boiling water; stir well; in this dip a piece of lint and carefully cover the burns and scalded places; cover this with absorbent cotton, and finally wrap with the triangular or roller bandage.

In more severe cases, saturate lint with perfectly fresh salad oil, olive oil, sweet oil, vaseline or petrolatum. In the absence of these, the white of an egg may be used. A very common practice is to apply carron oil (equal parts of raw linseed oil and lime water). In absence of oils, dust the burned part with starch, flour or toilet powder or if nothing else is available use moist earth or clay. Cover the whole with a layer of lint, over this a layer of absorbent cotton, and finally wrap with a triangular bandage.

Burns from caustic lye, strong ammonia and similar substances, should be first thoroughly flooded with water and then with vinegar, and subsequently treated as if burned by fire. Burns from acid, vitriol, etc., should be first flooded with water and then washed with a solution of baking soda or lime water. If nothing else is available, take chalk, tooth powder or a portion of mortar from the wall, crush it and stir it up with water and apply on lint to counteract the acid. After washing, treat as a burn by fire.

Use a weak solution of washing or baking soda in the case of drinking an acid. For other burns of the inside of the mouth or throat caused by drinking hot fluids or swallowing chemicals, apply oil or the white of an egg, by drinking, or pouring from a spoon. In the case of caustic potash, ammonia and the like rinse the mouth and throat with weak vinegar. If a fragment of lime gets into the eye, don't try to take it out but flush with water and bathe it with diluted vinegar or with lemon juice, a teaspoonful of either to a cup of warm water.

In cases of frost-bite, carry the patient to a closed room without a fire, undress carefully, and rub the frozen parts, or the whole body with snow or bits of ice, otherwise put patient in cold bath, keeping up a vigorous rubbing of the surface affected; warm coffee or tea may be given as a stimulant. If the person has ceased breathing, use methods of artificial respiration. As the patient revives, carry him to a room slightly warmer, and cover loosely with a blanket. Afterward rub with a cloth wet with warm water, whiskey, or with diluted alcohol.

Treat cases of sunburn as mild scalds, covering with a weak solution of baking soda, oils, vaseline, or with white of an egg, then with lint and bandage.

When users of wood furnaces experience difficulty with creosote dripping from the smokepipe, the simplest remedy is to reverse the lap of the pipe, so the condensation will drip into the furnace.

HOW TO SOFTEN IVORY.

Into 1 qt. of vinegar slice ½ lb. of mandrake. In this immerse the ivory and let it stand 48 hours in a warm place. At the end of that time it will be possible to bend the ivory into any form desired.

AN EASY RULE FOR CIRCUMFERENCES.

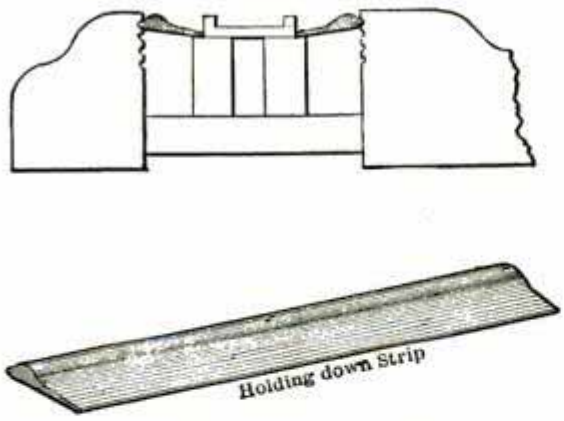
The rule that 11-14 of the diameter equal ¼ of the circumference is close enough for any business calculation, and will often save much figuring.—Contributed by C. J. Case, Troy, Pa.

TO REMOVE STAINS FROM MARBLE.

Take two parts of soda, one of pumice and one of finely powdered chalk. Sift through a fine sieve and mix into a paste with water. Rub this composition all over the marble and the stain will be removed. Wash it with soap and water, and a beautiful bright polish will be produced.

HOLDING DOWN WORK IN SHAPER AND PLANER VISE.

Strips, such as shown in the sketch, afford a simple means of holding down work in shaper or planer vise. Small, half-round grooves are planed 1-16 in. wide in the faces of both jaws of the chuck, and the round



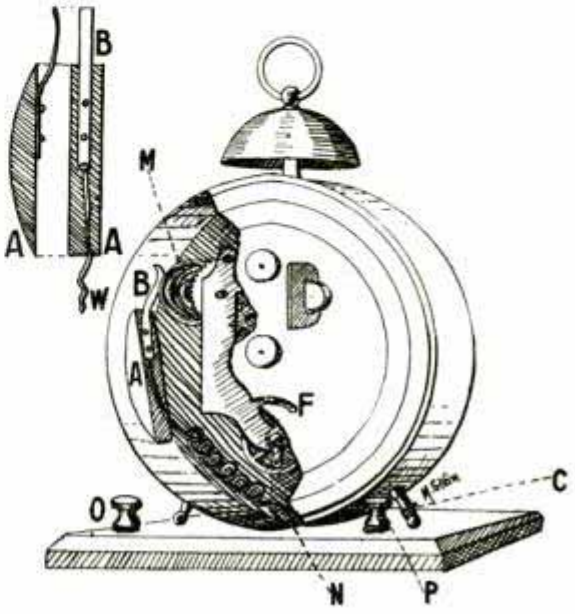
Holding Down Work in Shaper and Planer Vise

edges of the strips, if made to fit, will not kick up, says a correspondent of the American Machinist. The grooves are so small that they do not injure work held directly against the faces of the jaws. The strips can be placed so as to accommodate different heights of parallels and different thicknesses of work.

TO CONVERT AN ALARM CLOCK INTO AN ELECTRIC ALARM.

An ordinary alarm clock may be converted into a very satisfactory and efficient electric alarm by the method here illustrated:

The device consists of a segment of wood, A, having its radius equal to that of the



An Electric Alarm

interior of the clock, so as to fit snugly against it. To this segment the brass spring, B, is attached by two brads, and to this spring the insulated wire, W, is soldered. The segment of wood is then glued to the interior of the clock in such a position that when the alarm spring, M, unwinds it will press against the brass spring, B. A small hole, N, is made in the bottom of the clock, through which the wire, W, is passed. Care must be taken to insulate the brass spring, B, and the wire, W, from the rest of the clock. The clock is then mounted upon a suitable base, and the wire, W, is passed beneath this and attached to the binding post, O. A wire from the binding post, P, is passed through a hole in the base and wound about one leg of the clock at C. An electric bell and a dry cell are attached in series with the clock by the two binding posts, and the alarm is wound up. As the spring, B, and wire, W, are insulated from the rest of the clock no circuit is formed; but when the alarm goes off the spring, M, unwinds and forms a contact at B, thus completing the circuit.—Contributed by Milton F. Stein, Chicago.

Shellac may be bleached by exposing in thin threads to the atmosphere.

WITH PINS, STRING AND COMPASSES.

Take a string and make a loop one inch long. Stick pins at the points D and D', Fig. 1. Put the loop over the pins, and, with a sharp pencil catch the loop and run the

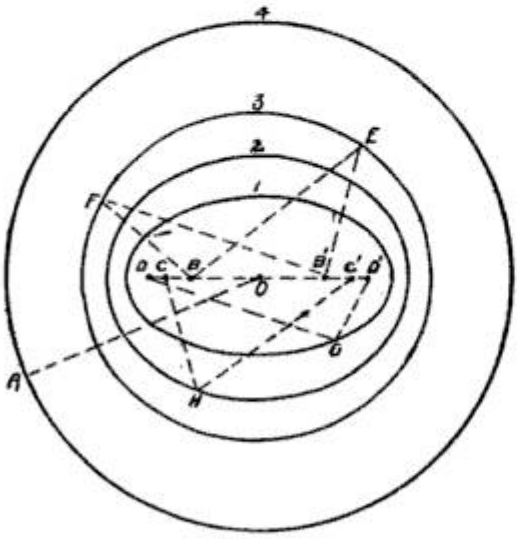


Fig. 1 With Pins, String and Compasses

pencil along it. Ellipse 1 is drawn. Use the same loop, putting pins at the points, C and C', and draw ellipse 2. With pins at B and B' curve 3 is made. Placing the string over a pin at the center, O, we get with radius OA, curve 4, a circle. The points B and B' and C and C', etc., are called foci of their respective ellipses. This work depends upon the law that the sum of the distances of any point on the curve from the foci is always the same; for example, taking curve 3, BF plus FB', is the same length as BE plus EB'.

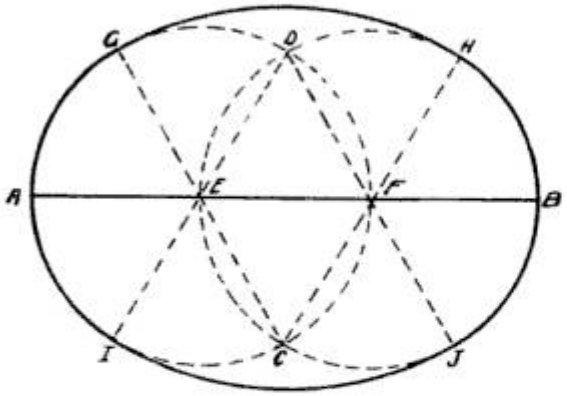


Fig. 2. With Pins, String and Compasses

To draw a curve (ellipse) like Fig. 2, when the length, AB, is known, proceed as follows: Divide the line (axis), AB, into three equal parts by points E and F. From E and F as centers, and a length equal to one-third AB, draw the circles IFG and HJE. Through G and D, where the two circles intersect, draw CG, CH, DI and DJ. From C as a center, strike the curve GH, and from D as a center draw the curve IJ. AGH—BJI is the required curve or ellipse.—Contributed by C. L. Truesdale, Sharpsville, Pa.

HOW THE STEAM TURBINE OPERATES.

Usually the explanation of the operation of a steam turbine is "written so you can't understand it;" the following, condensed from the Engineer, London, is a clear and simple explanation of a complicated question:

We take the Laval turbine as the simplest type of the machine. In it steam, as is well known, is allowed to blow against vanes on the rim of a wheel. These vanes are cupped in order that the steam recoiling from the wheel may return, so to speak, on itself. Very little thought is required to show that if the curve of the cup is of the proper shape, and the tangential velocity of the cup—that is to say, the speed with which it moves away from the jet—is half that of the jet, the steam will leave it without any velocity whatever, and the whole of the energy in the jet will have been transferred to the wheel. Now, at this point the circumstance that steam is an elastic fluid comes in to cause mental confusion. It is hard to credit the statement that an elastic fluid can really leave anything with which it has been in contact without velocity. The fact which our readers must get into their heads is that in the Laval turbine the working steam is not an elastic fluid, and has no pressure. To make this clear, let us suppose a Laval wheel of 100 horsepower using 20 lbs. of steam per horse per hour, that is to say, 2,000 lbs.; and per minute, leaving out fractions which we do not want, 33 lbs.; and per second a little over half a pound of steam. Now, the steam issuing from the boiler has a pressure of, say, 150 lbs., but it is permitted to escape through a diverging nozzle, and the pressure is all expended in imparting velocity to the steam. Let us divest ourselves of all ordinary concepts about steam, and fancy that it ceases to be a fluid exerting pressure and becomes a torrent of very fine shot projected at a velocity of about 5,000 ft. per second, or nearly twice that of a rifle bullet, against the vanes of the turbine. We have no longer an elastic fluid to deal with; we have half-a-pound of something which may be regarded as solid—at least, in the sense that the water in a Pelton wheel is solid—moving at the

enormous velocity we have stated. The work done by the steam entering the nozzle is entirely expended in pushing the molecules away in front of it through the nozzle and out at the other end. Each group of molecules, in a sense, acts the part of the charge of powder in a rifle to make those in front of it fly faster. To put the facts in another way, the result is just the same as though a stream of fine sand fell into a steam jet. The jet would impart its energy to the sand, and if the sand were directed into the vanes of a Laval turbine it would cause its rotation. Instead of sand we utilize the molecules of the steam. With these facts before us, we see why the velocity of the rotating wheel of the Laval turbine must be so high. It has to attain a speed of about 2,500 ft. per second, or over 1,700 miles an hour, in order that the whole of the energy may be transferred to the wheel. It will be understood that, as far as the wheel is concerned, the steam has ceased to be an elastic fluid. It may be considered in the light of a shower of fine projectiles impinging on the vanes at an enormous velocity. Hence the revolutions of even as much as 30,000 per minute, in the smaller turbine.

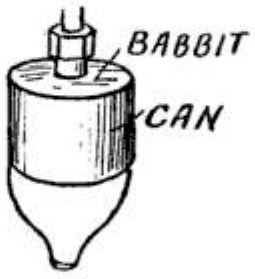
The same effect takes place in the Parsons type of turbine, but the action is masked by the absence of the diverging nozzle. Divergence takes place inside the wheel casing, the steam expanding from step to step downwards. Quoting from Mr. W. F. Durand, an American engineer, we may say that, in turbines of the Parsons type, "the steam rushes from the steam supply to the condenser through the annular space between the wall of a long cylindrical casing and the contained rotor, increasing the cross-sectional area from the entering to the delivery end. This annular space thus constitutes in effect a gigantic nozzle within which the steam is continually undergoing transformation as it passes from one end to the other;" that is to say, it ceases by degrees to be an elastic fluid and becomes instead a furious torrent of molecules.

It is not necessary here to refer in any detail to the precise way in which the flying molecules of steam transfer their motion to the vanes. The major difficulty met with by those who want to understand the steam turbine is how a free elastic fluid can transfer its energy to a rotating wheel. The only way out of the difficulty is to say that the steam is not an elastic fluid, but a current of flying molecules—none the less molecules capable of mechanical action because they are small almost past the possibility of conception.

The initial perplexity in thinking about the steam turbine lies no doubt in clearly seeing how pressure—potential energy, to use what is little better than scientific jargon—can disappear and turn up in another form as kinetic energy. But when we dive a little below the surface it will be seen that, according to received theory, pressure itself is nothing more than the result of the impact of flying molecules—in fact, the whole energy stored in any volume of steam or other gas is always essentially kinetic. To pursue this branch of the subject would, however, lead us away from the purpose which we had in view in writing this article. Many more patents will no doubt be taken out, but in so far as these refer to principle, and not to detail, the inventor will do well to keep the facts constantly in mind. The steam must be worked in such a way that while its molecules will always tend to move in right lines, they will give up their energy in the form of centrifugal effort, or recoil, according to the type of turbine in which they act. The ruling principle is always that we have a molecule, or a pound, or a ton, of steam, moving like a bullet at a velocity of 5,000 ft. per second, and we want to take all that motion out of it, transferring it to the rotating wheel. It is not, perhaps, easy at first to master the idea that steam can ever cease to be an elastic fluid exerting pressure in all directions; but once the facts are grasped, the whole theory of the action of the steam turbine becomes intelligible.

REPAIRING THE LUBRICATOR.

A lubricator which had frozen and cracked in two places and would not hold after having been fixed by the tinner a number of times was finally disposed of by a correspondent of the American Miller in the following manner:

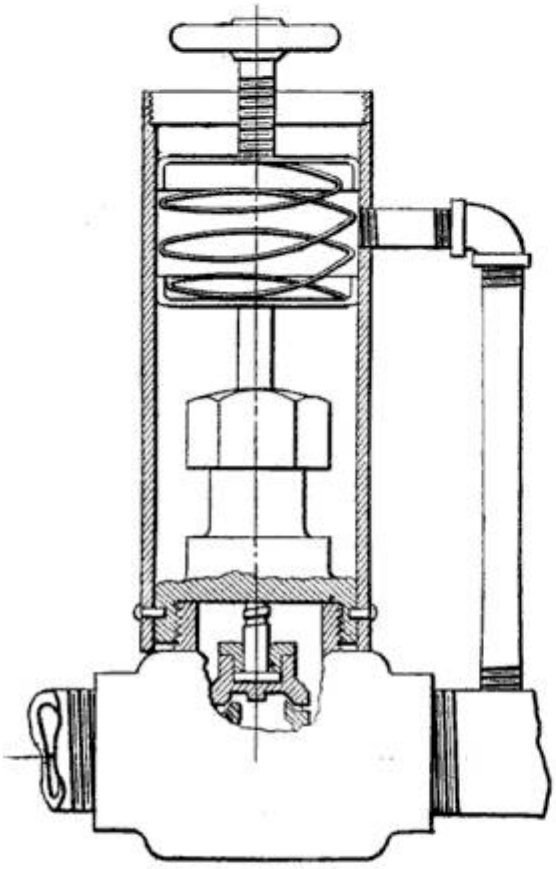


A tin can, cut in half, just fitted the bulb or condenser. On top of this was poured babbitt. The arrangement, it is said, does not make a stylish appearance, but is O. K., and does not leak.

HOW TO MAKE A REDUCING VALVE.

To make the reducing valve shown here take a globe valve and file the stem so it will slide easily in the bonnet. File the base of the bonnet so a piece of brass pipe 6 in. long can be pinned on it. The body is thus formed, and it is now necessary for it to be steam-tight.

Fasten an iron washer on the valve stem-



Reducing Valve

top, and on top of the iron washer fasten a leather cup washer. Place a spring on top of this and on the spring place a piece of sheet metal for the adjusting screw to rest on. A valve wheel fastened on a piece of steel, as shown, will serve for this. Just above the cup-washer make a connection with the outlet of the valve and the body; this balances the pressure. A correspondent of Power says he has used such a valve on both steam and water with good results.

HOW TO MAKE BLUE OR ANTIQUE COPPER SCREWS.

Stand any bright screws on the heads on top of a stove; put a little oil on them; cover and heat until they are the color desired. The color will not rub off.—Contributed by C. J. Case, Troy, Pa.

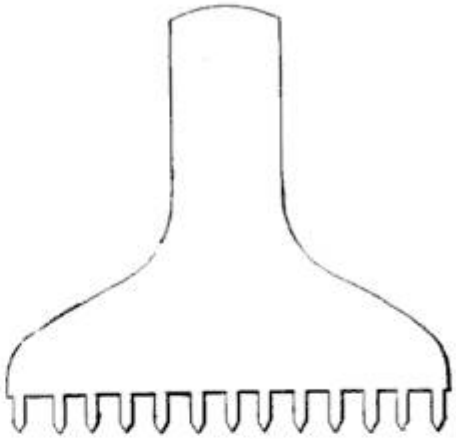
TO CLEAN MARBLE.

Mix up a quantity of the strongest soap-lees and quicklime to the consistency of milk; lay it on the stone for 24 hours; clean it and it will appear as new. To further improve, rub with fine putty powder and olive oil.

HOW TO COVER A BUGGY DASH.

For this job a tool made of a piece of plow steel and like the one shown in the sketch will be necessary. Lay the frame of the dash on the leather and mark along it with a lead pencil the places where the stitching is to be done. Allow 3-16 in. on the inside of the stitching for drawing, but none on the outside of the frame, where the marking should be exactly at the edge of the frame.

When through marking remove the frame, place the points of the tool on the pencil mark, and strike the two with a hammer, making 10 or 12 perforations at a time. In this manner go over all the pencil marks, placing an outside tooth of the tool in the last hole made each time the tool is lifted, as a guide.



Tool For Covering Dashboard

If both sides are to be covered with leather, says the Blacksmith and Wheelwright, tack the two pieces together before starting and punch both at the same time. If one side is of duck make holes in the duck with needles while stitching, drawing tightly all the while, and your dash will look like machine work, if the job has been carefully done.

ETCHING ON STEEL.

For etching names, dates or designs on steel use iodine, 2 parts; potassium iodide, 5 parts; water, 40 parts.

MECHANICS FOR YOUNG AMERICA

BOY'S HAND-POWER AUTO.

The picture shows what a nine-year-old boy at Oakland, Cal., constructed. His name is Earl Clifford. He took a coaster wagon and by means of a bamboo lever placed vertically and operating a short horizontally

working wooden "driving rod," connected to an iron crank fastened to one rear wheel, succeeded in producing a machine that makes quite good speed. The illustration shows the arrangement, which any bright boy can make with a few tools. Earl made this wagon motor without any suggestions or assistance from anyone.

HOW TO MAKE A PAIR OF DUMB-BELLS.

Any boy can make a pair of dumb-bells for himself and a lifting weight, also, which will do quite as well as any he could purchase, providing he does his work carefully.

First procure two large tin cans, such as fruit is often canned in, and cut the ends out of each. Shape four round pieces of wood just large enough to fit tightly in the ends of the cans and then cut a hole in the center of each piece of wood as shown in Fig. 1. Procure, also, a hardwood bar the length of the ordinary dumb-bell—a length of old broom handle will do very well.

For filling the cans mix one part of cement with two parts of sand and add water until it is soft, but still has a degree of firmness. Pack this closely into the cans and insert the wooden disks into the ends of the cans. Insert the hardwood bar through the holes in the inside disks so that it runs clear through the center of each can of cement, and joins the cans with a proper

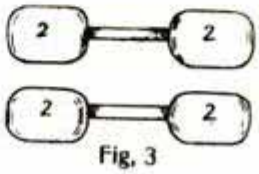


Fig. 3


Fig. 4

length of rod between (Fig. 2.) It is well to first string the two inner disks on the bar and then drive a few nails through each end of it before pushing into the cement, to give it a grip. The disks are then pushed along the rod to fit into the open end of each can. Put a wedge in each end of the can to hold the bar in place. The other dumb-bell is made in the same manner.

At this stage let the bells stand for five days or until the cement is perfectly dry, then remove bits of wood and tin until only the cement is left. Cement dumb-bells may be filed into shape as in Fig. 3, and painted, also, if desired.

Fig. 4 shows a lifting weight made of cement. Its construction is very simple. The cement is packed into a wooden mould previously prepared and an iron rod with a ring is thrust in at the top. When the cement is dry the wooden mould is removed.


Fig. 1

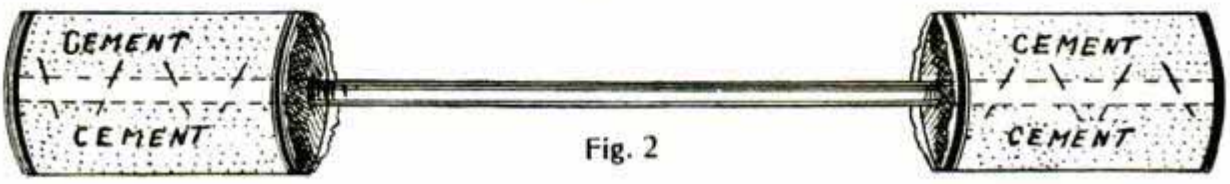


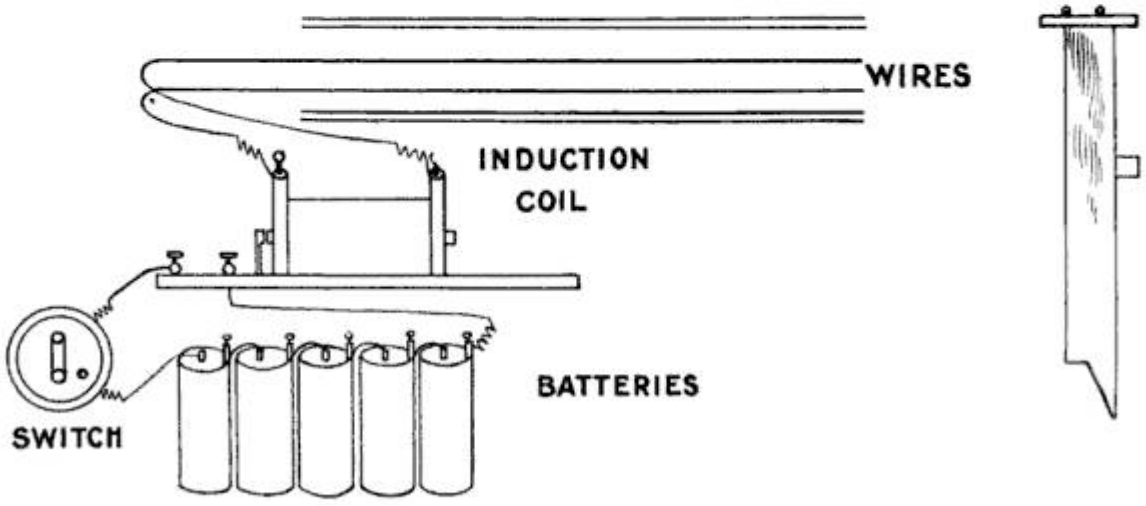
Fig. 2

HOW TO RID YOUR YARD OF CATS.

The following is a description of a device I built at my home in Brooklyn, which not only gave us relief from the nightly feline concerts but also furnished much amusement to my friends.

I first ran two bare copper wires along the top of the fence about one inch apart, fastening them down with small staples, care being taken that they did not touch. To the ends of these wires I fastened ordinary insulated bell wire, running them to the house and connecting them to the upper binding posts of an induction coil; I then ran a wire from the lower binding post of my coil through the batteries back to the other lower binding post of coil, breaking the circuit by putting in an ordinary switch. The more batteries used, the stronger the current. The switch should always be left open as it uses up the current very rapidly.

When "tabby" is well on the wires I close the switch and she goes the length of the fence in bounds, often coming back to see what the trouble is, thus receiving another shock.—Contributed by Charles L. Pultz, 554 9th St., Brooklyn.



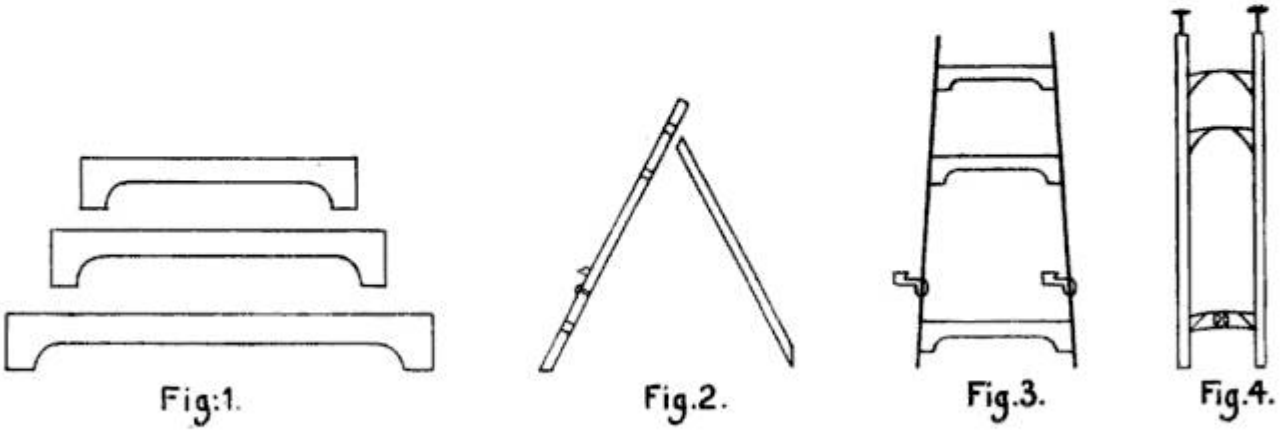
Electric Apparatus for Driving Away Cats

HOW TO MAKE AN EASEL.

A strong and substantial easel may be made at home with very little expense and no great difficulty.

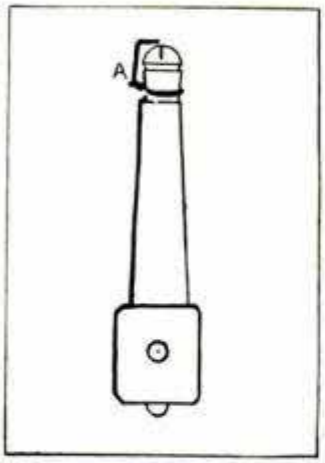
Smooth down with a plane, four pieces of pine, 4 ft. long, 4 in. wide and 1 in. thick, until suitable for legs. Make three crosspieces, Fig. 1, and join the legs with them as shown in Fig. 2. With an auger bore a hole in each leg about 3 in. from the bottom, and fit into each a little peg, Fig. 2, for the picture to rest on. The peg should be of hardwood so it will not break.

Cut the handle from an old broom, measure off the right length, and put a hinge on one end. Fasten this leg on the second crosspiece, thus forming a support for the two front legs, Fig. 3. The easel may be finished according to the individual taste. It may be sandpapered and stained and varnished, or painted in some pretty tint, or, if preferred, may be enameled.—Contributed by G. J. Tress, Emsworth, Pa.



Making an Easel

TO LIGHT A GASLIGHT WITHOUT MATCHES.



It is probably well known that if you rub your feet briskly over a carpet on a dry, cold day and then touch any metallic object with your finger it will emit a small spark. The following amusing experiment may be done on the same principle:

Take any small piece of wire about two inches long and twist it around a gas-burner as shown at A in the sketch. Have the tip of the burner about an eighth of an inch below the end of the wire. The wire must be just far enough away from the center of the burner to keep it out of the flame, or else it will melt.

Now get a friend to turn on the gas when you are ready for it. Go around the room once or twice rubbing your feet along the carpet. When you come around to the gaslight touch the point of the wire and if the gas is turned on, the light will flare right up as if it had been lit with a match.

This experiment cannot be done on a damp day or without shoes, and works best in cold weather.—Contributed by E. H. Klipstein.

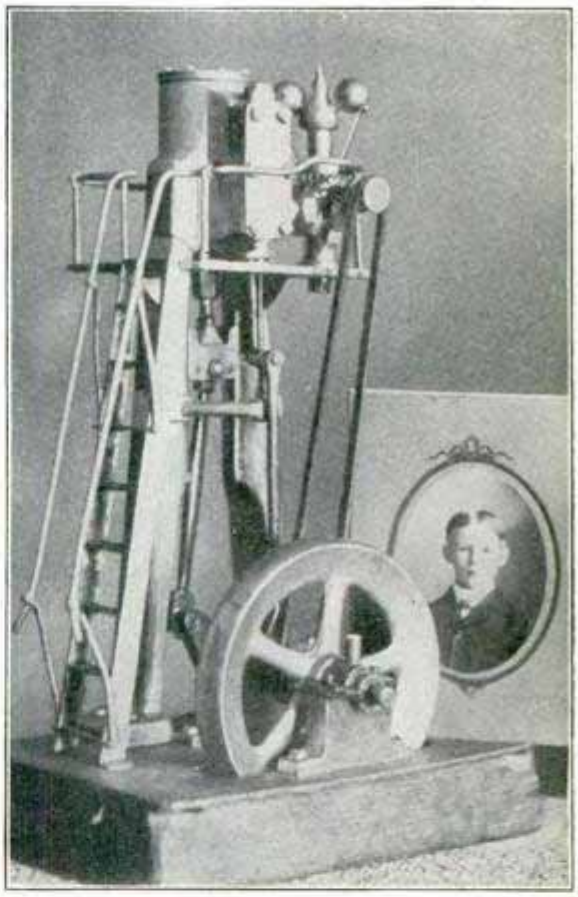
MECHANICAL RABBITS FOR TARGET PRACTICE.

The latest thing in target practice is a mechanical rabbit which jumps and runs like the real thing. These targets are being used in the shooting schools in England. The Sporting Goods Dealer says: Along the ground is laid a sort of miniature toboggan railway, and the rabbit is sent flying across it by the force of a spring. Of course the rabbit hops up and down, in the manner of a real galloping bunny. What makes the matter more confusing is that there are three such targets, and the sportsman never knows which rabbit the operator, who releases them by means of cords, will start first, but must be ready to take his shot when and where it offers. Another good contrivance is the snipe-throwing catapult, from which is discharged a tin plate, whitened and shaped like a snipe, which describes erratic curves in the air simulating very well the tricky flight of the real snipe.

ENGINE BUILT BY A BOY.

That a boy, and not a large one at that, can master the difficulties of engine building which would puzzle many a man, is proved in the following illustration. This engine was entirely constructed by Alfred E. Sharpe, of Elkhart, Iowa.

The youthful engine builder is only 14 years old and he was nearly a year working on it. Many of the parts had to be made over several times before he succeeded in getting them just right. The engine stands 16 in. high, and develops ½ hp., and runs



Engine Built by 14-Year-Old Boy

smoothly and without noise. He frequently belts it to his mother's sewing machine. The supporting part of the engine is made of babbitt, the cylinder of brass, and the rods and other parts of steel or iron.

A steel chimney 230 ft. high and 8 ft. in diameter has just been completed and will be erected in Mexico.

CANADIAN LIGHT SHIPS—DIAPHONES. A NEW TYPE OF FOG ALARM.

In an address before the Canadian Society of Civil Engineers, the president, Col. W. P. Anderson, said:

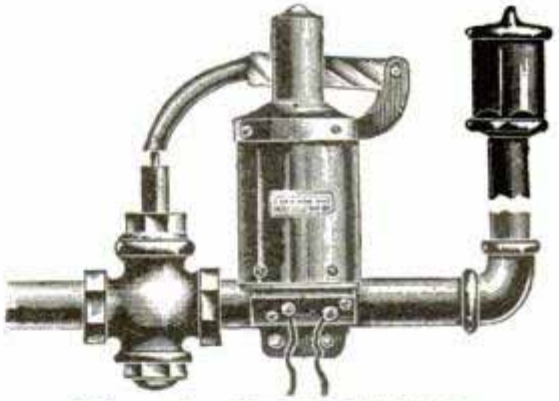
"A modern lightship, such as those lately moored off Anticosti, and off Lurcher shoal, in the Bay of Fundy, is a perfect battery of ingenious mechanisms. From the electric lights at her mast heads, automatically occulted by clockwork making and breaking the current produced by a dynamo in the engine room, to her moorings, connected with powerful automatic buffers and steam windlasses to relieve the strain on her bows, she is full of interesting machinery. She is self-propelling, provided with a powerful fog alarm, a submarine bell, and a Marconi telegraph instrument. For the design of these latest vessels we are indebted to the United States Lighthouse Board, whose plans were adopted under the conviction that its long experience with lightships in the open Atlantic was too valuable to be ignored.

"The first Canadian fog alarms were steam whistles. About 1873 reed horns were substituted, from motives of economy, a very simple and fairly effective arrangement, patented in Canada, being adopted. In these machines the lifting of a pistol in a steam cylinder compressed air in a large cylinder immediately above, and forced it through the horn, so that the length of blast was regulated by the stroke of the steam piston. One of these horns has been heard 26 miles under favorable conditions. They were not, however, considered first rate fog alarms, and when larger grants became available, syrens of the Scotch and English types were adopted as the most powerful sound producers obtainable. A first-class English syren at Belleisle is operated by air compressed half a mile from the syren house, the power being obtained from a Pelton wheel run by water led from the lakes on the hills of the island. This installation has run successfully for many years, the cost of maintenance being a mere trifle.

"The Government is now substituting diaphones for all the types of instruments previously used for fog alarms. These instruments are claimed to give a very penetrating sound. They have the advantage over the syren that they can be kept at a constant pitch, and if the Canadian patentees succeed in producing perfect resonance they will doubtless prove superior in sound-carrying capacity to any signal yet invented. They are run by compressed air, and we are installing oil engines to operate them, because it is frequently difficult to obtain sufficient fresh water for steam engines at our fog alarm stations. The sound is produced by the free vibration in a slotted cylinder of a very light slotted piston, the air being admitted in rear of the piston, and escaping through the slots, which are alternately opened and closed sufficiently fast to produce a pure musical note.

ELECTRICALLY OPERATED STEAM WHISTLE.

Push the button and blow the whistle, is the latest one on the button. Such a device is now on the market, and the whistle may be blown from as many places in the office and factory as there are buttons established. The wiring system is simple, being similar to that for operating a call bell or buzzer close at hand. The whistle may be placed either indoors or outdoors, and any required distance from the operating key. The standard type of whistle for all ordinary pressures



Electric-Steam Whistle

of steam is shown in the illustration. Any voltage of direct or alternating current may be provided for in the winding of the actuating solenoid. The device will operate any whistle up to three inches in diameter at 150 pounds pressure. If provided with a larger valve it will operate a six-inch whistle at the same pressure. A recently developed use for this apparatus is in connection with private branch telephone exchanges. It enables the operator to reach parties whose duties require their presence in many places remote from the office. Any number of different signals may be arranged, so as to reach as many different men. If a call comes in for any particular man, the operator presses the whistle key the requisite number of times, thus givng the signal on the whistle for that particular man.

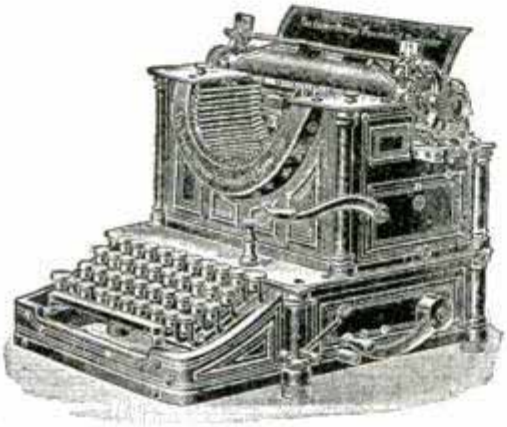
SAYS CONCRETE PAVING POOR.

"Concrete does not make a desirable pavement," writes W. I. Blair, of Terre Haute. He has made a careful study of its qualities and comments on the mention of concrete paving in our March issue, as follows:

"The concrete very readily wears and affords a very uncomfortable condition when the street is dry and almost as bad a condition when wet, affording a surface of sticky, disagreeable mud."

TELEGRAPH TRANSMITTING TYPEWRITER.

This is a typewriter, which when connected to the line as the Morse sending key is connected, will when the letters of the keyboard are touched, transmit the Morse



Telegraph Typewriter

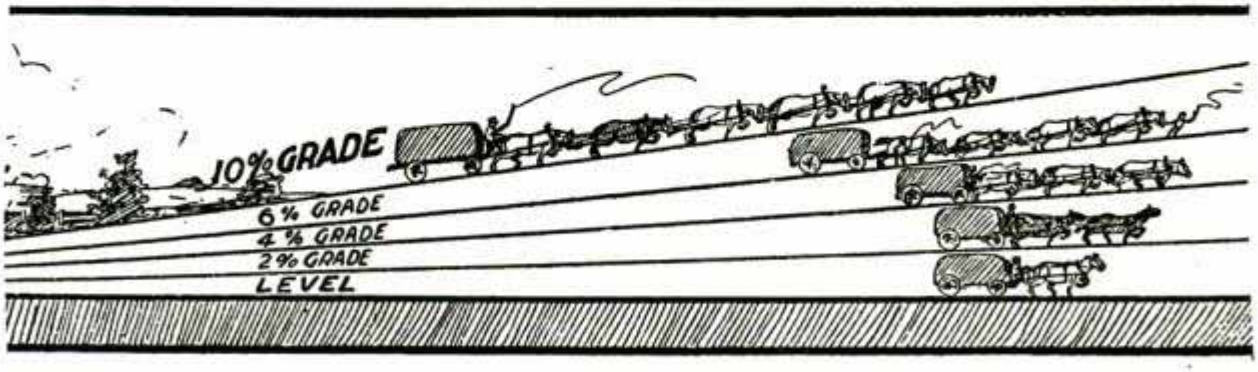
characters of the letter touched. One depression of a letter on the keyboard faithfully produces the proper dots, dashes and spaces of the desired letter. For instance take the letter H, which in the Morse alphabet consists of four dots and three spaces, and requires eight muscular movements; with the typewriter transmitter, a single depression of the key "H" is sufficient to put the entire Morse "H" on the wire. The typewriter transmitter not only enables greater and long continued speed, but removes the cause of that ever-dreaded "telegrapher's cramp." Any but a skilled telegrapher, however, would make poor headway in sending a message, as the operator must allow for the long letters and not strike the keys regularly as in ordinary typewriting. For receiving messages the operator reads by ear from the sounder and transcribes the same as in an ordinary typewriter.

HAULING UP HILL IS COSTLY.

Why railroads spend great sums in order to reduce a small hill to level grade and why the hauling of machinery over mountain wagon roads is so expensive is graphically illustrated in a sketch from a Government road report.

It will be seen that what one horse can pull on a level requires two horses to draw when a hill rising two feet to 100 is reached; requires three horses to draw when a hill rising four feet to the 100 is reached; four horses when a rise of six feet to the 100 is encountered and requires six horses to draw when a hill rising ten feet to 100 stands in the road. The enormous excess cost of hauling on these roads, over roads on a level, is, therefore, apparent: The legal rate in many sections is 3 to 4 per cent maximum, beyond which a grade is not allowed to go. Grades of even this steepness are the exception, roads being kept to 1 or 1½ per cent as far as possible. By the most ordinary surveying the roads of any section outside of mountain districts can be brought to reasonable grades. The government and all other authorities urge sections using these "primitive paths" to correct them by proper surveying.

General Roy Stone, of the government service, said several years ago of what he calls the "hill tax": "The people have paid this tax for 100 years and yet they wonder why they are poor." It is apparent that it is the duty of the thinking people to bring about a revolution in the system of public highways.



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Mr. E. W. Pratt, author of the portion on Locomotive Engineering, is master mechanic of one of the large railroads, and has made the locomotive his life-study.

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3. What are the general qualities of steam?
4. Is heat a body?
5. What general qualities are due to a body?
6. What do you understand by the word: aggregate?
7. What are the general qualities of heat?
8. Are we able to transfer light into heat?
9. Would heat be developed by compression of aeriform bodies?
10. Can you give me examples showing that mechanical motion causes sensible heat?
11. What do you understand by combustion of a body?
12. What other causes of sensible heat do you know?
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DISCIPLINE WAS PRESERVED.

In the early days army posts were of great importance in suppressing Indian uprisings, clearing out gangs of highway robbers, etc. Accordingly, each post was kept in a constant readiness for call to active service and strict discipline was always preserved. The manner in which it was sometimes maintained, however, as in the following instance, might give cause for a hearty laugh.

Captain Troxell, of the Seventeenth Infantry, an Irishman and a strict disciplinarian, had considerable trouble with certain members of his company who, being Hibernians from different counties, were disposed to quarrel over-much among themselves.

Once when Captain Troxell was officer of the day the sergeant of the guard, a strapping Irishman, who himself disapproved these frequent fights as being subversive of discipline and disgraceful to the company, approached the captain with the customary salute and said:

"Officer of the day, sir, I have the honor to report that Private Murphy of your company, a prisoner in the post guard-house, struck at me with a pickax handle."

Captain Troxell returned the salute and merely said, "All right."

A few minutes later the sergeant of the guard presented himself again and, after saluting, said: "Officer of the day, sir, I have the honor to report that Private Murphy, a prisoner in the post guard-house, struck at me with a pickax handle."

Once more the captain returned the salute and said: "All right."

The sergeant of the guard stood at attention for a moment, then deferentially said:

"But, sir, officer of the day, is it all right for a prisoner in the post guard-house to strike at the sergeant of the guard with a pickax handle?"

"It is," answered the captain, "if the sergeant of the guard is fool enough to let him."

Ten minutes later the sergeant returned and saluted.

"Officer of the day, sir," he said, in his gravest voice, "I have the honor to report that Private Murphy of your company, a prisoner in the post guard-house, desires to go to the hospital on sick report, sir."

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Specialists who know how.

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THE BEST RAZOR MADE AT ANY PRICE.

Hand forged from the finest razor steel in the world. Made and tempered by experts, ground by hand, ⅝ inch blade with double shoulder, set ready for use. Fully warranted. We guarantee satisfaction. If the razor we send you is not right **EVERY WAY,** we replace it until you are completely satisfied. A trial will convince you. Don't pay $3 to $5 for a razor no better or not as good.

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WE RESTORE SIGHT!

GLASSES RENDER DEFECTIVE VISION CHRONIC.

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THE IDEAL COMPANY, 239 BROADWAY, NEW YORK.

HOW HE KEPT AFLOAT.

"Nothing like presence of mind in the face of great danger," grimly remarked the man who had fallen from the excursion boat and had been rescued without difficulty. "I'll bet there were more than ten life-preservers hurled at me by as many idiots, but, thank heaven, I had sense enough not to grab any of them."

DEER EARS ON WOLF'S HEAD.

A Wisconsin paper tells of the means two wily Indians took to secure the bounty on wolves several times over on the same hide. The paper says:

"Bill Davis and Jim Swallows, Indians, living in the town of Freemont, have developed a get-rich-quick scheme, and have town chairmen in this section guessing as to what a wolf scalp is and what is not. The bounty paid on wolves is $10, the law providing that the town chairman is to remove the ears from the scalp to prevent further bounty being paid on the same wolf. This fact suggested to the Indians that they could patch ears upon a mutilated scalp there would be nothing to prevent them from going to some other town chairman and collecting another bounty. They re-eared the wolf by sewing the tip end of deer ears to the head and the scheme worked several times before detection occurred."

PANAMA SEA LEVEL CANAL.

The engineering committee of the Panama Canal Commission, consisting of Commissioners Davis, Parsons and Burr, has made the highly important recommendation of a plan for a sea-level canal, with a bottom width of 150 feet and a minimum depth of water of 35 feet and with twin tidal locks 1,000 feet long and 100 feet wide. The total estimated cost of the canal on this increased basis is $230,500,000. The committee estimates that a sea-level canal can be completed within 10 or 12 years.

RUN OF THE MANIFEST.

A short "Toot-toot" from the engine flute,
And a "High Ball" from the rear,
The switch is set by an old time yet,
And the block for the main line clear.
There's a bird-like trill from the triple's bill,
As the shoes from the tread drop free;
A creak and a clank from the draw-bar shank,
In the crunch of the coil to the key;

A short quick bark, a flash in the dark,
From the mouth 'twixt scoop and tray;
A trembling slip—a sand bound grip,
And the "High Ball's" under way.
Thru the bustling yard, where the earth is jarred
By the dip of the giant's careen,
And the searchlights wink to the clinkity-clink,
As they flash from red to green.

From the pop valve twined, in the cutting wind,
Fly streamers of hissing white,
Like ribbons of pearl, in the swish and swirl,
Or a ghost in a frolic of night.
A mile ahead there's a twinkling red,
And the distant echoes mock
The long clear note from the whistle's throat,
As it calls for the interlock.

Then presto—click, like a magic trick,
And the crimson flashes white,
In the wizard's power, from the signal tower,
As it snaps the de rail tight.
There's a swish and sway thru the right of way,
And the jar of the wheel truck's leap,
As the red caboose tears the gravel loose,
In the draught of its swing and sweep.

While the grass bends low in the undertow,
And its tendrils twist and strain
To join the crowd, of the atomic cloud,
In pursuit of the speeding train.
A crash and roar—in the tunnel's bore—
The speed of a cannon ball—
While the cinders hail thru the stifling gale,
That recoils from the rocky wall.

Then out of the mouth and away to the South,
Where the Mississippi flows,
And a queenly craft with her wheel abaft,
The softest signal blows—
Coo-oo Coo-oo, as if to woo
Swift Mercury from his route,
But his winged heels mock her appeals,
With the roar of a scornful flout.

A click-clack-clack a click-clack-clack,
On, on to the busy mart,
A roll and pitch o'er frog and switch,
Up close to the throbbing heart,
Then a grinding sound where the wheels turn 'round,
And the brakes are tightly pressed,
While the bell's loud chime, rings in on time
The run of the Manifest.

—R. R. Trainman's Journal.

FISH PONDS UNDER HOTEL.

The finest hotel in Philadelphia has ponds for the breeding and growth of diamond-back terrapin established three stories under the structure. Five thousand fish valued at $30,000 are said to be in the ponds, and every fish was carefully selected. It will be many years before this stock can be drawn upon, but in time it is believed the high class supply will more than pay.

SAWING WOOD WITH A GASOLINE ENGINE.

A small gasoline engine may be used with great economy for sawing wood, and on many farms a portable outfit is used for the purpose. A correspondent of Farm Implement News tells of results accomplished with such an outfit.

A 6-hp. engine with a 36-in. saw mounted on a small hand truck was used, and ignition was accomplished by a magneto with governing pulley, started without a battery, though an 8-cell battery is kept for emergencies. For cooling the engine a small water tank containing from 10 to 15 gal. of water with a small circulating pump was used. In an all-day's run this water is not changed, but it is drained out at night to prevent freezing.

With this outfit, in six and one-half hours' run, 40 cords of pole wood, 128 cu. ft. to the cord, were cut in 16-in. lengths. The outfit was moved twice as the poles were in three piles.

With the same rig in five hours' time, 15 cords of cordwood were cut in 16-in. lengths, and 16 loads of pole wood, amounting to about 14 cords, in 16-in. lengths. Two men go with the rig and change off feeding every 15 minutes. From five to six gallons of gasoline are used in an all-day run.

RENOVATING CAMERA BELLOWS.

For stopping leaks in camera bellows the popular and simplest method is to paste over them a piece of black court plaster, or even black paper, but that is hardly available for leaks in the corners. A varnish that is easily worked into them may be made as follows: In a strong solution of shellac in alcohol rub up sufficient lamp black, and, to give it the necessary flexibility, a trace of soap, says the Keystone. This should be well rubbed up with a spatula on a slab or plate of glass and applied with a suitable brush.

TIPPED THE TELEPHONE OPERATOR FIFTY-SEVEN DOLLARS.

A telephone operator from "up state," as they phrase it in New York City, came down on a little visit and tells this story of how and why she came.

"The other day," she says, "a stranger came into the telephone exchange of my little city and asked for the long-distance connection with New York. He walked into the booth at 10:30 and took out his watch. He talked a while and then waited a while, then talked more and waited more and again talked and waited. It was a long wait and I grew uneasy. The man was a stranger to me, and I had no certainty that he could pay the bill. I quietly called up the town marshal and asked him to be near by in case of trouble. The man was still in the booth, watch in hand and alternately talking and waiting. Finally he rang off and came out.

" 'Well,' said he, pulling out a roll of bills, 'I make it an hour and fifty-eight minutes. That will make a big hole in a $100 bill, won't it?'

"His time was correct, but his toll bill was smaller than he had thought it. It was $43. He handed me a $100 bill, bidding me keep the change.

" 'But the change is bigger than the charge,' I exclaimed.

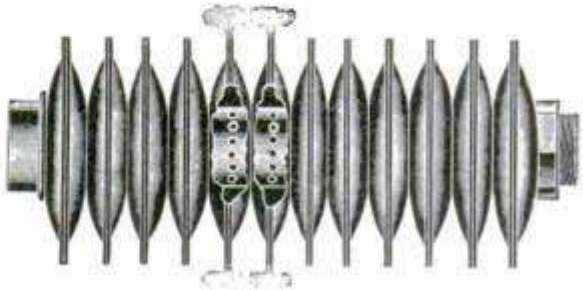
" 'That's all right,' he said; 'I made $10,000 by that talk and you are welcome to a share of it.'

"He walked out of the office," continued the girl, "and I don't know to this day who he was or how he made that $10,000, but I took my $57 tip and came to New York to spend it."

Speaking of long-distance telephoning, it is not unusual in New York for a wire to be "plugged," as it is called technically, for a day at a time by some big house or law firm, when an important matter is under negotiation. There are several wires to Chicago, for instance, and frequently one of them is at the sole disposal of one talker for hours at a time.

New Mechanical Devices

GAS ENGINE MUFFLER—The new muffler is composed of twenty-four opposed disks on the end of the exhaust pipe. At twelve regular intervals, as shown in the illustration, the exhaust pipe is bored with several small holes opening in to the chamber between the opposed disks. The gas escapes from between the outer edges of these



disks in a thin stream. By test this form of muffler is found to be noiseless, and as the total outlet at the point of escapement is so many times larger than the bore of the exhaust there is no back pressure.

OYSTER PANS.—A metal case containing several

trays or pans, for delivering oysters on the half-shell to customers. Each tray holds two dozen.

LLOYD'S HYGRODEIK—An indicating instrument which shows by means of a pointer on a dial the amount of moisture in the air of room, office or store. The use of steam heat in office buildings and apartments has been attended with more or less discomfort to the occupants, and in many cases has been productive of ill health, while furniture has cracked and warped from a lack of suitable moisture in the air. When the indication shows the air is dry beyond a normal point, water in pans or other receptacles should be provided for evaporation.

GASOLINE WATER HEATER for kitchen boilers, intended to furnish a heater independent of kitchen range or heating furnace. The tank is incased in asbestos to prevent heating the room. Gasoline is the fuel used and is burned in a new and specially constructed burner which automatically reduces the size of the flame when the water reaches a certain temperature.

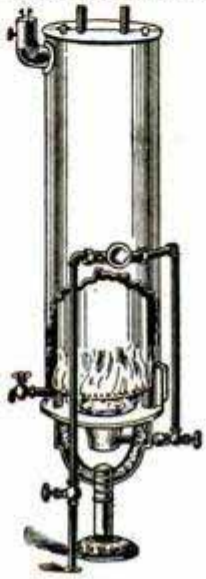
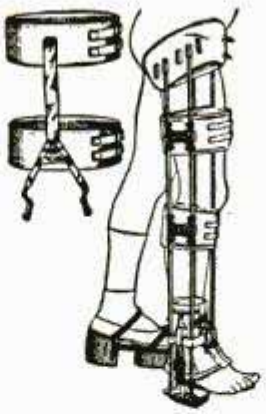


Fig. 1.—Burner Used in Connection with Kitchen Range Boiler Connected with Thermostatic Valve.

Fig. 2.—Burner Using Gasoline as a Fuel.

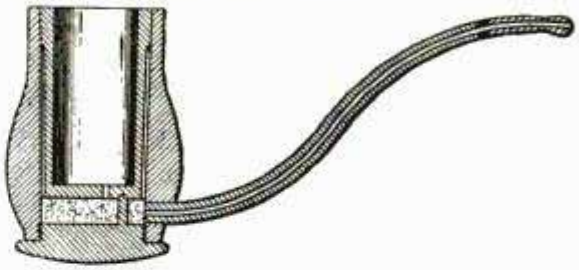
ELECTRIC TYPEWRITER—And now an electric typewriter; not one in name only, but actually operated by electric power. Current is obtained by attaching a flexible cord to any lamp socket. The slightest touch on the keys instantly strikes the letter wih a uniform blow. The makers claim much greater speed and vastly less fatigue for the machine. The carriage is returned to the right by touching a key and another key shifts the paper for a new line.

NEW AMBULATORY SPLINT—Taylor in the Journal of the American Medical Association describes his ambulatory splint, which he has used successfully in the treatment of fractures of the thigh and leg. It consists of four rods, two placed on each lateral aspect of the leg, which are adjustable as to position and length and can be fitted to either limb. At the hip and ankle are placed pneumatic pads which can be either tightened or loosened at will with an ordinary bicycle pump. The ankle pad is secured over a Levis splint and tightly laced, then the strap and the heel extension are buckled on either side, to make any traction unnecessary, even for hip fractures. A fourth pad is placed just below the knee. It secures the Levis splint and helps to retain the limb from any side play. It is not necessary to do much bandaging, as the pads hold the parts perfectly in apposition.



COMBINATION POCKET KNIFE—This useful tool combines the following in one; Pocket knife; leather punch, swedging awl; wire cutter; wire pliers; Alligator wrench; hoof hook; screw driver, and a screw bit. The various tools fold into the handle in such a way as not to make the knife unhandy or inconvenient to carry in the pocket.

DRY SMOKING PIPE—This shows a pipe invented by Mr. William J. Felton and recently patented through our Patent Bureau. It is so constructed that the smoke before reaching the stem must pass through an absorbent in a chamber at the bottom of the pipe, then up one side of the bowl, half around it and down the other side before reaching the stem. The smoke is not only filtered but is



subjected to the heat of the inner bowl which also has a tendency to purify it. Any moisture from the mouth of the smoker cannot get into the bowl which contains the tobacco. The danger from cancer in the use of a pipe of this kind is entirely eliminated.

This pipe costs but little more to make than a common pipe Mr Felton desires to sell his patent or have a manufacturer handle his pipe on a royalty. Address care Popular Mechanics Patent Bureau, Journal Bldg., Chicago, Ill.

What Happened.—"Do you know what happened to Lot's wife when she turned her face and looked behind?" asked the Sunday school teacher. "Well, if she was gettin' off a street car, I know," said observing Tommie.—Yonkers Statesman.

Last Opportunity TO SECURE

$1,200 a Year for Life

By Small Monthly Payments

This will be the last chance you will ever have to join this investment which has been so popular with the readers of this magazine that all the shares have been now taken except the final allotment.

Remember, there are only 6,000 shares all together in this Company, and when these are gone the sale must be permanently closed. Series A, B, C, D, E, F and G have been closed, and Series H, the **LAST AND FINAL ONE,** which we are now offering, will at the present rate of sale be quickly taken.

Every series of these shares has been over-subscribed, and the number of shares in the final series is so limited that many people will necessarily be disappointed. We reserve the right to pro-rate or to reject applications when over-subscribed.

If you have been procrastinating—if you have been putting it off "until to-morrow," or "until next week," it behooves you now to

SECURE YOUR SHARES AT ONCE

The Mutual Rubber Production Company is divided into only 6,000 shares, each one representing an undivided interest equivalent to an acre in our great commercial rubber orchard. These 6,000 acres are in Southern Mexico—the finest rubber land in all the world. In this orchard we are changing the production of crude rubber from the uncertain method heretofore employed—that of reckless and destructive tapping by improvident natives—to the most solid and permanent basis known to modern scientific forestry, and under Anglo-Saxon supervision. No industry ever underwent so radical a development as we are now engaged in, without making immensely wealthy all those interested in the change. The enormous fortunes made in the past, by gathering crude rubber from virgin trees scattered here and there in the tropical jungle are as nothing compared to the sure and permanent incomes to be derived from this new industry.

No large cash down payment is required to secure these shares, as they are paid for in small monthly installments, as the work of development progresses. For $20, as the first monthly payment, you can secure five shares. Then you pay $20 a month for 23 more months, then $10 a month for a limited period, until you have paid $1,500, the full price for five shares ($300 each in the present series). But, meantime, you will have received dividends amounting to $1,050, or $210 per share, so that the actual net cost of the five shares in this remarkably safe and profitable investment will be only $450 of your own money, or $90 per share. Then, from the maturity period onward, your five shares, or acres, will yield you or your heirs $1,200 a year for more years than you can possibly live.

Early dividends are provided by "tapping to death" 400 of the 600 trees we originally plant to each acre, and the 200 trees remaining for permanent yield will produce every year at least two pounds of rubber each, at a net profit of 60 cents a pound. These statistics are vouched for by the Government reports of the United States and Great Britain—the most reliable sources of information in the world.

This means, on your five-share investment, a permanent and certain income of $1,200 a year, or $2,400 a year on 10 shares. Or better still, 25 shares will yield you $6,000 a year. A single share can be secured on the same advantageous basis.

No such opportunity as this to secure a permanent annual income has ever before been offered to people of moderate means.

Our Final Offer--Your Last Opportunity

If you do not promptly take advantage of this remarkable final offer, you will be too late to share the profits enjoyed by the hundreds of fortunate shareholders scattered throughout the country. Probably some one of them is your good friend or acquaintance.

Every possible safeguard surrounds this investment. The State Street Trust Co. of Boston holds the title to our property in Mexico as trustee. We agree to deposit with them the money paid in for shares, and we file with them sworn statements as to the development of the property. This company also acts as registrar of our stock. You are fully protected from loss in case of death or in case of lapse of payment, and we grant you a suspension of payments for 90 days any time you may wish. Furthermore, we agree to loan you money on your shares.

We can prove to you that the five shares in this investment, paid for in small monthly installments, will bring you **an average return of twenty-five per cent. on your money during the period of payment,** and will then bring you **$100 a month for more than a lifetime.** This opens the door for yourself, not to wealth, but to what is far better, a competency for future years, when perhaps you will not be able to earn it. Payments of $4.00 per month the first two years and smaller payments thereafer will secure you one share.

Our literature explains our plan fully and concisely, and proves every statement. We will **hurry it to you immediately** on request, thus assuring you a possibility of securing shares before it is too late. This is absolutely the last call. The large demand for Mutual Rubber shares has made this final announcement necessary.

Mutual Rubber Production Company

91 Milk Street, Boston, Mass.

THE ORIGIN OF THE "TIP."

A long time ago, at the entrance to one of the old English taverns, there was placed a box with a slit in it bearing the initials "T. I. P." These little letters spelling the word "Tip," were meant to stand for the words, "To Insure Promptness," and the visitors to the tavern began to drop in their coins to secure greater activity on the part of the waiters.

While the word "tip" is of comparatively modern origin, the practice has existed throughout the world for centuries.

HOW WESTINGHOUSE SOLVED IT.

Here is an incident illustrating how business problems pursue the inventor of the air brake, says The World's Work:

A few years ago a game of whist was progressing smoothly, when, after one of the deals, Mr. Westinghouse did not pick up the cards, but kept drawing on a piece of paper before him. The others watched him curiously, remarked that they were ready to proceed, and then waited, unable to understand why he should pay no attention to them.

Suddenly, with a flash of triumph in his eye and exultation in his voice, he cried out, "Brown, I've got that natural-gas meter fixed—here it is: it cannot fail to work successfully," and picking up his cards he asked, "Whose turn is it to play?"

THE SMALLEST MOTOR IN THE WORLD.

The smallest electric motor in the world is described by the Street Railway Review as being built by a watchmaker, whose work has trained him to handle delicate machinery. It was made with all the exquisite care required in making a motor that moves with all the regularity of a big machine, and yet is so small that its owner wears it as a scarf pin. Viewed from a little distance the article has the appearance of a very valuable and rather a curiously designed pin. It is only when standing near to it that its nature can be discovered. The first thing to attract attention is the buzzing of the machine, which by means of a current obtained from a small battery carried in the vest pocket, is kept in operation at a high rate of speed with a noise like a bee buzzing.

HOW TO RESIGN.

"Going to resign, are you?" said the superintendent to an indignant person who had been pouring his grief into his ears. "Can't stand it another minute, eh? Put up with it as long as you could, and now you're going to throw up your job and tell your chief what you think of him? Yes, I know. Last straw and all that sort of thing? Uh-huh.

"Did you ever see my set of rules for resigning? I framed them up years ago when I was in the newspaper business, and I have used them ever since. I have resigned often since then, always in the way prescribed by these rules. Perhaps they will be of service to you. Here they are:

"Rule 1. After receiving the last straw don't do anything for two hours. Above all, don't write anything.

"Rule 2. At the expiration of two hours, write your resignation, and make it as hot as you can. Relieve your feelings and say everything you have been penning up in your breast. Scorch the scoundrel.

"Rule 3. Then go home.

"Rule 4. The next morning, immediately upon arising, read over your resignation, and tear it up.

"Rule 5. Go to work at the usual hour.

"Take a copy of them," concluded the superintendent, "and you will find that they are absolutely essential to any man who expects to resign frequently and still continue to rise in the world."

CHEWED OFF ELECTRIC WIRES TO MINES.

A notable instance of Japanese determination is related by a Japanese writer in Success. In the present war with Russia some Jap soldiers had to crawl quite a distance under the glare of the fire works and searchlights of the enemy. They passed the first nettings of barbed wire successfully and were approaching the second, when they came upon many mines and pitfalls. The mines had to be disposed of. They were found to be electric mines and the conductors were unburied. Four conductors were cut. These were wrapped in rubber coating and within the coating were 24 small wires. The soldiers had no scissors. Time was pressing, so they fell upon the wires with their teeth and chewed them off. The men were so excited during the work that they never realized that many of their teeth were broken by this hard usage.

Some of the figures for seemingly trivial things which are included in railway supplies reach amazing proportions. For instance, the patrons of one large railway system chewed $11,500 worth of gum in the past year. That is, 1,150,000 pieces were taken from slot machines in the 400 railway stations of the system. This same system used 26,000 brooms last year, 400,000 pen points, 50 bbl. of ink, 3,000 lb. rubber bands, 15 carloads printed blanks and enough lead pencils to make a string 25 miles long.

THE BOY KNEW HOW.

One of the side rods of the engine broke as a train was running down a grade, on a new railroad in southern Kansas, says the American Thresherman. When the train was stopped at the foot of the grade, the good cylinder was "on center" and after the broken side had been uncoupled it was impossible to start the engine.

The engineer, the conductor and the passengers took turns trying to devise a way to start it. At last a farmer's boy crawled through a barb-wire fence, and came over to make a suggestion.

"Why don't you let 'er go kerchunk?" he asked.

"What?" demanded the conductor, not grasping the idea.

"Why, let 'er go kerchunk. Unhitch the last car and shove 'er up the grade a-ways. Then let 'er come down kerchunk against the train. That'll bump 'er along some."

The railroad men smiled contemptuously, but the passengers sided with the boy, so at last it was decided to try his scheme. All hands turned to and pushed the car a little way up the hill. Then it was sent with increasing speed back against the train, which it struck with the foreseen "kerchunk." The "kerchunk" did the work. The engine was bumped off center, the engineer gave it enough steam to keep it slowly moving, the passengers scrambled aboard, and the one-legged outfit limped away on its journey.

A few days ago a 16-hp. automobile was suddenly driven up the marble steps of the clubhouse of the Mercantile Club of Philadelphia and was as suddenly backed down, before the indignant members could interfere. The performance was the result of a wager and the driver collected the $1,500 stakes and hastily left the scene.

THE NORSK NIGHTINGALE.

Ve ban crowded up in cabin,
  Not a soul ban saying vord,
It ban storming gude and plenty
  And ay tank nobody stirred.
It ban awful teng in venter
  Tu be out in little ship—
Ven der ban big vend, ay tal yu,
  Yu ant feeling wery flip.

Val, ve all ban feeling seasick,
  Some ban scared, and saying prayers;
"Ve ban lost!" the captain tal us,
  As he falling down the stairs.
Dis har captain's little daughter
  She ant scared, ay tal yu dat;
She yust laugh, and tal her father,
  "Yu ban talking tru yure hat!"

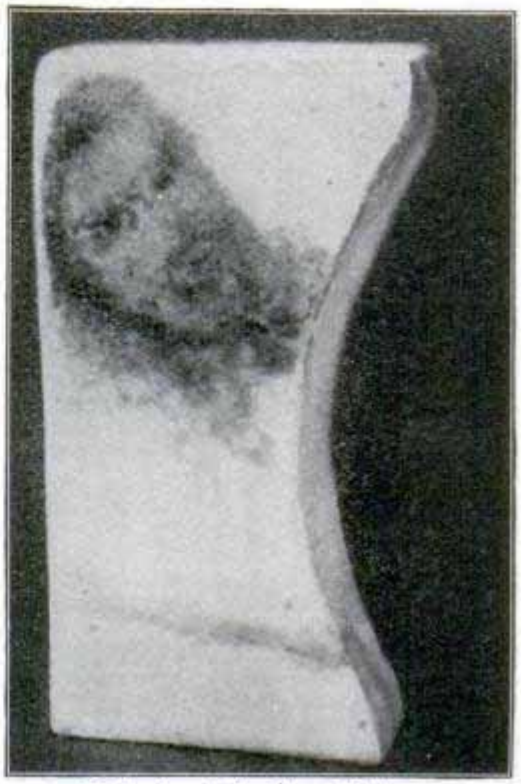
"Vat yu say?" her father tal her,
  "Ay tenk yu ban purty rude!
Ef yu ant stop getting sassy
  Ay skol spank yu purty gude!"
But his daughter ant ban nervous,
  No, sir, she yust standing pat,
And vonce more she tal her father,
  "Yu ban talking tru yure hat!"

Then she tal him "ay ban reading
  Book vich Missus Eddy write,
And she say ef ve believing,
  Ve skol coming out all right.
So ay yust believe dis schooner
  Ant ban going to senk at all,
Ay ban stuck on dis har Science—
  Ay ant fraid for any squall!"

Purty sune dis har old vend storm
  It stop blowing, and next day
Ship skol coming into harbor
  So ve ant ban drowned, yu say.
Ay ant know ef Missus Eddy
  Tal dis schooner not to senk,
But ef vind had yust kept blowing,
  Dar ban hal to pay, ay tank!

MYSTERIOUS PICTURE ON WHETSTONE.

A mechanic at Dayton, O., on Easter morning last, while whetting his knife on a stone chanced to look out of the window for a minute or two. When he again glanced at the stone his astonishment knew no bounds, for there on what a few moments before was a perfectly plain stone, was



Mysterious Whetstone Picture

the figure of a face, in which many who have seen it recognize a likeness of the Christ. Mr. Starry, the owner of the stone, is a man of standing in his community and his statement is fully accepted. The stone has been examined by several thousand people. The face does not fade, neither has it become more distinct. It is a most curious and remarkable incident.

CEMENT FENCE POSTS IN GREATER DEMAND.

The number of firms manufacturing cement fence posts has increased considerably in the past year and the manufacture of these posts is one of the coming industries of the United States. Most of the posts, while different in construction, are the same in principle, the cement post being reinforced with strips of iron or wire embedded in it with loops of wire or other means of attaching the fence wires.

The posts do not deteriorate in the earth, are not affected by frost and may be fire-swept without harm. For this latter reason they are coming more and more into demand by railways for fencing in right-of-ways and on western farm lands where prairie fires are annual events.

ENTIRE FAMILY LIKE "POP."

Your appellation, "Popular Mechanics," is certainly the most appropriate one you could have adopted, if I can judge from our home, where it is the most sought after paper that we get among a great many. I have three boys, 16, 10 and 3 years old respectively, and when the paper comes there is a regular fight, which usually ends in the youngster getting the paper first, as his efforts are so demonstrative and lasting that to get rest the paper is turned over to him. Sometimes there is a compromise, in that he will share it a little to get information. Ships and railroads or automobiles are his hobby. Kindly excuse the digression.—Wm. J. Ruff, Quincy, Ill.

The Bradley Polytechnic Institute, Peoria, Ill., has added two new courses: one to prepare teachers of Manual Training, the other to fit teachers to instruct in Domestic Science.

"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.

FOR SALE OR TRADE—2½ h. p. engine, new, upright; 2 h. p. engine, horizontal, new; 4 h. p. marine engine, new; 2 ignition dynamos; 25-light dynamo; 4 h. p. charging plant. Will accept in exchange light automobile runabout, gasoline or electric. A. H. Arp, Moline, Ill.

TO EXCHANGE—One new 12 h. p. Gasoline engine, complete, for second hand automobile. Address, Box 1107, Joliet, Ill.

WANTED—Second hand automobile in good condition. Write W. B. Reynolds, Reynoldsville, Pa.

BLACKSMITHS.

Be a Master Mechanic and expert steel worker 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.

BUSINESS CHANCES.

ESTABLISHED and profitable manufacturing business on Pacific coast requires services of good office man with $25,000 to enlarge business; no agents. Address 803 Popular Mechanics.

$4,000 STOCK of watches, clocks, jewelry, stationery, chinaware, glassware, notions, etc. Bench work, $50 per month. Christmas sales, $1,500 to $1,800. Brick store, 25x60. Rent, $15. Established 1880. S. Rhodes, Ulysses, Neb.

REPAIR SHOP for sale; building and tools; repairing bicycles, guns, sewing machines, typewriters, etc.; large trade. For particulars write Lock Box 65, Toledo, Iowa.

SPLENDID opening. Live, growing railroad town, rich farming country; leading store, fine fixtures; stock about $3,700; must sell for cash. Best location; good repair trade. Must sell at once—have government appointment. C. V. Bates, Huron, S. Dak.

$1 INVESTED in our coal mine today will be worth $5 in a year; bank references. Write Bitimlous Mining Co., 540 Andrus Bldg., Minneapolis, Minn.

ENGINES.

FOR SALE—¼-H. P. steam engine and ½-H. P. water tube boiler, complete, with gasoline burner and injector, $30. Leroy Hogeboom, 28 Eldridge St., Binghamton, N. Y.

FOR SALE—One 3½ horsepower air cooler Mobile gasoline engine, with accessories; good as new; $45.00, or will exchange for transmission gear for 1¼-inch shaft. C. Warren Patton, Jacksboro, Texas.

FOR SALE—3 h. p. bicycle engine, $35.00; 1¼ h. p., $20.00; 3 h. p. marine, $75.00; new 15 ft. 2 h. p. launch, 4 cycle engine, $140; second hand front axle and wheels, $12.00. W. Hoffman Motor Works, 1253 N. Halsted St., Chicago.

FOR SALE—Engines, 18-hp. Garr & Scott, 16-hp. and 12-hp. Port Huron, 16-hp. and 14-hp. Case, 10-hp. Advance, 10-hp. Russell, Avery & Case separators, Western, Marseilles, Port Huron and Ottawa shellers. Inquire Martin J. Alleman, R. No. 20, Peru, Ill.

FOR SALE—3-hp. gas engine and one steam engine, 3x5 inch cylinder. Chas. Archibald, East Palestine, Ohio.

LAUNCHES.

LAUNCHES—If interested don't fail to get folder, etc., of the best 20 ft. 5-hp. launches on the market. Also knocked down frames for parties desiring to build their own boat. F. P. Neumeister, Rockford, Ill.

FOR SALE—8 h. p., fast and seaworthy, twin-screw cabin gasoline cruising launch; length, 28 ft. 6 ins. by 8 ft. beam. Price, $600. Photos and full description by mail. Harry Hann, Maurice River, N. J.

MISCELLANEOUS.

FOR SALE—300 assorted Strawberry, or 100 assorted Raspberry and Blackberry plants, $1.00. John A Nelson, Craig, Neb.

EMPLOYES and Watchmen's Recorders, for recording arrival and departure of employes, and the night watchman's trips. Illustrated catalogues free. R. E. Kimball & Company, 274 Wabash Ave., Chicago.

BICYCLE RIDERS! Punctures cost money, but not with my single tube band tool. Tool and bands for 6 punctures for 15c. Address C. Crone, 2265 Union St., Toledo, O.

FOR TRADE—Complete threshing rig for stock or western land. Guy Ross, Alexandria, Neb.

WANTED—Full particulars of meritorious articles suitable for mail order business, and circulars with our imprint for distribution among agents. Agents Supply Co., Detroit, Mich.

FOR SALE—Patent No. 779,625, Corn-Chopping Machine. Jones, Marquard & Jaedicke, Hanover, Kan.

WANTED—One second-hand small power air compressor in fair condition; must be cheap for cash. The York Automobile Garage, York Village, Me.

EDISON Triple Spring Triumph Phonograph. cheap. Address Albert A. Haehnlen, San Jose, Cal.

FOR SALE—Complete course in mechanics in International Correspondence Schools; cost $76; will sell for $35. Investigate this. Box 124, Buena Vista, Colo.

CLARINET, snare drum, bass drum, steel hunting and sailing boat that you can't sink. Want cash or what have you. Box 300, Pleasant Prairie, Wis.

ELECTRIC flash lights, 95c; electric bell outfits, $1; electric motors, $1; annunciator, 6 indications, $3; telephone and telephone parts, telegraph instruments and all kinds of induction coils. J. A. Shannon, 40 W. Upton St., Chicago, Ill.

LET ME ASSIST you with that machine you are thinking about. Frank Pavlik, Winnetka, Ill.

FOR SALE—Mechanical drawing course (International Correspondence School); cost $53; will sell reasonable. Address G. B. Price, 903 Oswego St., Syracuse, N. Y.

AUTOMOBILE parts to exchange for Edison phonograph or typewriter. A. P. C., 10 S. Wall St., Columbus, O.

OUR NOVELTIE CATALOGUE is just out. Write for it now. Smith Bros., 363 West Van Buren St., Chicago, Ill.

CASH, OR WILL EXCHANGE for kodak or guns, complete lessons "Metal Mining," International Correspondence Schools; cost $65. Lessons on "Cyanide Process;" cost $15. Blow pipe outfit; cost $15. Complete drawing outfit; cost $10. Address "Mining Engineer," care Popular Mechanics.

BRAINS FOR SALE—Do you want a prospectus written and illustrated for your new company or syndicate? Do you want one that will command attention and sell shares? Do you need a catalogue or booklet that will not be thrown in the waste basket? If so write to Expert, care of Popular Machanics, Journal building, Chicago.

CAMERA FOR SALE—Vive camera, 3¼x3½ in., in good condition, $3. C. L. S., Popular Mechanics.

MISCELLANEOUS.—(Continued)

ADVERTISING COURSE FOR SALE—Full course of lessons from the foremost school in the country. Price $10. C. L. S., Popular Mechanics.

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

THE FRACTOMETER will instantly solve all problems in addition or subtraction of fractions and their decimal equivalents. Every person has need for this wonderful invention, especially Draftsmen, Engineers and Mechanics. Price 50c postpaid, or given free with a year's subscription to Popular Mechanics at $1 per year. Popular Mechanics, Journal Bldg., Chicago, Ill.

MONEY IN PIGEONS—Squabs are raised in one month; bring big prices; eager market; money makers for boys and girls. We supply breeders. Particulars free. W. H. Guest, Russellville, Ark. Box 115.

YES, WE HAVE IT—Electrical supplies and novelties of every description, for the student, amateur, workman. Write us. Modern Electric Company, Muncie, Ind.

DEATH is said to be pleasant when it takes place by drowning; however, we do not believe you want to die that way. "How to Swim" is the book that will teach you how to swim. Contains 100 illustrations; sent postpaid for $1. 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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BINDERS—Will hold Popular Mechanics 12 issues. Sent postpaid on receipt of 50 cents. Address Popular Mechanics.

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WONDERFUL RESULTS from your Phonograph by using "TIZ-IT", because IT IS IT.

WANTED—Ten light second hand dynamo in fair condition; must be cheap for cash. Warren F. Blaisdell, York Village, Me.

POSITIONS WANTED.

POSITION WANTED—To work in gasoline or electric engine works. I am well experienced with electricity. A 8, Care Popular Mechanics.

WANTED—Position as engineer or foreman with some manufacturing company; ten years' experience. O. J. Moon, Martinsville, O.

PATENTS FOR SALE.

We have clients who desire to sell all or part interests in the following new patents:—These inventions are practical and salable things, in most cases suitable for a mail order business, but the inventors are not in position to market same. They offer excellent opportunities to parties having small capital who wish to start or extend a manufacturing business.

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AN ELECTRIC WHIP, designed for use in place of the ordinary horse-whip. Gives animals a gentle shock, or a severe one if balky or lazy. Will cure balkiest horses. Is highly recommended, cannot be stolen, and will last a life time, so is cheaper than common whips.

CIGAR CUTTER AND MATCH IGNITOR to carry in vest pocket or on key ring. Can be made in nickel finish for 1½c, and is suitable for advertising device. Will retail for ten cents.

PIPE which can be cheaply manufactured, and frees tobacco from nicotine. Is neat and practical, and can be sold in competition with common pipes.

CUFF-BUTTON which holds the cuff in coat-sleeve. Is cheap to make, easy to apply, and nothing to get out of order.

BACHELORS' button, needle and thread holder. Every traveling man and college boy should have one. Sold by the best stores at 10c. A fine thing for mail order business.

CARD TABLE having counting device attached, thus avoiding paper, pencil or slate. No chance to cheat or make mistakes in counting with this table. Suitable for manufacturer of tables or other furniture.

For full particulars address Patent Sales Department, Popular Mechanics, Journal Bldg., Chicago, Ill.

WATCH PERFORMS MANY FUNCTIONS.

A Paris watchmaker has just completed the most complicated watch ever made. It tells time in hours, moments and seconds and by days, months and years, also, making the necessary changes for leap year automatically. It indicates the lunar phases, the seasons, the soltices, and equinoxes, the hours for sunrise and sunset and gives the time of 125 cities of the world. In the inner case are the celestial maps of two hemispheres which move at the rate of 256 seconds a day, and 650 golden dots represent stars up to the fourth magnitude, showing their exact location.

The watch also contains a striker, a barometer, a hydrometer, a thermometer and altimeter for altitudes up to 15,000 feet, a compass and all the features of a repeating chronometer. The watchmaker worked in spare moments for seven years upon the watch. In size it is said to be little larger than the ordinary timepiece. Its parts number 975 and involve 24 mechanical movements. It is regulated without opening the works.

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THE FIRST STEP

If you have made an invention and contemplate applying for a patent, the first point is to learn whether your idea is new and patentable. Do not depend on the fact that you or your friends have never seen anything of the kind. Send us a pencil drawing, showing plainly your invention, and write out a description of its construction and operation, as well as you can. If you have a model, send it instead of the drawing. We will compare your sketch or model with all patents issued in the United States for inventions resembling yours, and for inventions in which similar mechanical constructions or principles are used. If a patent is found for an invention exactly like or closely resembling your idea, we will send you a copy of such a patent. If nothing is discovered to prevent getting a patent for your invention we will so advise you.

The charge for this service, unless otherwise agreed upon by special arrangement, is five dollars. This examination is an important step in connection with every patent application and requires great care and skill. An incompetent attorney may overlook a patent which closely resembles or completely anticipates your invention, or he may not know where to look. A dishonest attorney will purposely fail to find an anticipating patent in order that he may get the fee for preparing the application. The inventor is the loser in either case.

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We will place a Wing Piano in any home in the United States on trial, without asking for any advance payment or deposit. We pay the freight and all other charges in advance. There is nothing to be paid either before the piano is sent or when it is received. If the piano is not satisfactory after 20 days' trial in your home, we take it back entirely at our expense. You pay us nothing, and are under no more obligation to keep the piano than if you were examining it at our factory. There can be absolutely no risk or expense to you.

Do not imagine that it is impossible for us to do as we say. Our system is so perfect that we can without any trouble deliver a piano in the smallest town in any part of the United States just as easily as we can in New York City, and with absolutely no trouble or annoyance to you, and without anything being paid in advance or on arrival either for freight or any other expense. We take old pianos and organs in exchange.

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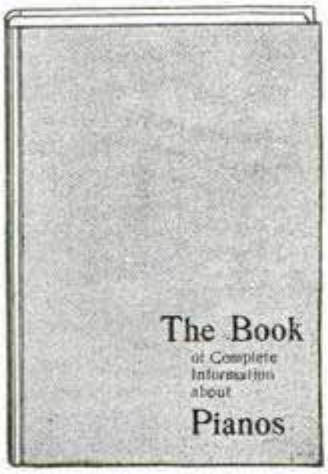

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A book—not a catalogue—that gives you all the information possessed by experts. It tells about the different materials used in the different parts of a piano; the way the different parts are put together, what causes pianos to get out of order and in fact is a complete encyclopedia. It makes the selection of a piano easy. If read carefully, it will make you a judge of tone, action, workmanship and finish. It tells you how to test a piano and how to tell good from bad. It is absolutely the only book of its kind ever published. It contains 156 large pages and hundreds of illustrations, all devoted to piano construction. Its name is "The Book of Complete Information About Pianos." We send it free to anyone wishing to buy a piano. All you have to do is to send us your name and address.

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1868——37th YEAR——1905

Want a First Class Typewriter?

Need Not Cost
You One Cent

CERTAINLY THE GREATEST OFFER EVER MADE

Do you want a nice typewriting machine? Not a toy, or something that is more bother than it is worth, but a really first class, practical, workable, usable, satisfactory outfit.

We have closed a deal direct with the manufacturers, who have taken into consideration the big advertisement we are giving them, and thus we have secured a price that enables us to give our readers an advantage they could not possibly get in any other way.

We are to use 3,500 of these machines within twelve months. That is another reason why we are making an offer which we believe can easily be worked out by everyone by whom this offer is read. The Odell typewriter has until recently been selling at $20. The factory having been greatly enlarged it is now possible to produce them in large quantities at a lower cost than ever before. The makers guarantee it against any flaw in material or defect in workmanship or manufacture.

It possesses all the latest improvements.
Prints direct from type.
Has superior manifold facilities, makes clear copies, and cuts perfect stencils for mimeographs, neostyle and other duplicating machines using wax paper.
Maintains perfect alignment.
Is simply constructed; has about 75 parts, other machines having 800 or more parts. Thus it requires little attention and will not readily get out of order.
No trouble to keep clean.
Short common words of four letters are more rapidly written than on other machines.
No ribbon necessary. One bottle of ink, which is furnished with machine, lasts almost a year.
Does all kinds of work including tabulating, etc.
Writing always in full view of operator
Easy to learn. Comes in 7 languages.
Is durable because all parts are made of metal, except ink roller and rubber platen.
It has no frail bearings and runs free and easy.
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Built on the principle of the printing press. Can be carried in your satchel.
Has independent action of platen for interlineations, corrections or writing on ruled lines, etc. Fulfills all requirements. Regular Retail Price is $7.50.

DIRECTIONS—Full instructions for operating and taking care of the machine, for making letter press copies, cutting stencils, and manifolding are sent with each machine.

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BOOK REVIEWS.

QUESTIONS AND ANSWERS. By G. E. Collingwood. Pocket size; illustrated; cloth. Price $1.00, postpaid. Train Dispatchers' Bulletin, Toledo, Ohio.

This handy little book exhausts in questions and answers the Standard Code of train rules and the rulings of the American Railway Association. It will be especially valuable to trainmen preparing for examination, and is a good book for reference on the subject.

FERRIC AND HELIOGRAPHIC PROCESSES. By Geo. E. Brown, F. I. C. Cloth; 130 pages, with six specimen prints; 12 mo. Price $1.00 postpaid. Tennant and Ward, New York.

All who have to do with reproduction by blueprint or kindred processes will find this little manual a convenient handbook. The work is so simple and yet so exhaustive that it is adapted to the needs of amateur, architect, draftsman or engineer who has occasion to reproduce his drawings by this method.

JOHNSON'S HANDY MANUAL FOR PLUMBERS AND STEAM FITTERS. By John W. Johnson. Cloth; 150 pages. Illustrated. No price quoted. John W. Johnson, Chicago.

This little book is replete with practical information for plumbers and steam fitters, and contains many valuable tables. It is written in a plain simple style and arranged in an excellent manner for reference purposes.

CATALOGS RECEIVED.

A neat little booklet issued by the Clayton Air Compressor Works, New York, is entitled "Compressed Facts About Compressed Air" and treats of the economical features of compressed air installations, and the uses compressed air may be put to.

"As the Photographer Saw Us," is the title of an attractive catalog issued by the Guarantee Electric Co. of Chicago, and containing illustrations of their plant for manufacturing dynamos and motors. One view shows the largest collection of motors and generators in the United States.

THE "DEEPEST DEEP."

The "deepest deep" in the world, writes Geo. W. Richards, Ex. Ch. Elect., U. S. N., was sounded while the U. S. S. "Nero" was surveying the bottom of the Pacific ocean for our cable to the Philippines. The enormous depth of 37,600 feet, over five miles, was obtained. This deep is located between Honolulu, H. I., and the Island of Guam, which is about the middle of the Pacific.

We Paid $100,000

For Liquozone, Yet We Give You a 50c Bottle Free.

We paid $100,000 for the American rights to Liquozone; the highest price ever paid for similar rights on any scientific discovery. We did this after testing the product for two years, through physicians and hospitals, in this country and others. We cured all kinds of germ diseases with it—thousands of the most difficult cases obtainable. We proved that in germ troubles it always accomplishes what medicine cannot do. Now we ask you to try it—try it at our expense. Test it as we did; see what it does. Then you will use it always, as we do, and as millions of others do. You will use it, not only to get well, but to keep well. And it will save nearly all of your sickness.

Kills Inside Germs.

Liquozone is not made by compounding drugs, *nor is there alcohol in it.* Its virtues are derived solely from gas—largely oxygen gas—by a process requiring immense apparatus and 14 days' time. This process has, for more than 20 years, been the constant subject of scientific and chemical research.

The result is a liquid that does what oxygen does. It is a nerve food and blood food—the most helpful thing in the world to you. Its effects are exhilarating, vitalizing, purifying. Yet it is a germicide so certain that we publish on every bottle an offer of $1,000 for a disease germ that it cannot kill. The reason is that germs are vegetables; and Liquozone—like an excess of oxygen—is deadly to vegetal matter.

There lies the great value of Liquozone. It is the only way known to kill germs in the body without killing the tissues, too. Any drug that kills germs is a poison, and it cannot be taken internally. Medicine is almost helpless in any germ disease. It is this fact that gives Liquozone its worth to humanity. And that worth is so great that we have spent over one million dollars to supply the first bottle free to each sick one we learned of.

Germ Diseases.

These are the known germ diseases. All that medicine can do for these troubles is to help Nature overcome the germs, and such results are indirect and uncertain. Liquozone attacks the germs, wherever they are. And when the germs which cause a disease are destroyed, the disease must end, and forever. That is inevitable.

Asthma
Abscess—Anaemia
Bronchitis
Blood Poison
Bright's Disease
Bowel Troubles
Coughs—Colds
Consumption
Colic—Croup
Constipation
Catarrh—Cancer
Dysentery—Diarrhea
Dandruff—Dropsy
Dyspepsia
Eczema—Erysipelas
Fevers—Gall Stones
Goitre—Gout
Hay Fever—Influenza
Kidney Diseases
La Grippe
Leucorrhea
Liver Troubles
Malaria—Neuralgia
Many Heart Troubles
Piles—Pneumonia
Pleurisy—Quinsy
Rheumatism
Scrofula
Skin Diseases
Stomach Troubles
Throat Troubles
Tuberculosis
Tumors—Ulcers
Varicocele
Women's Diseases

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 we will pay the druggist ourselves for it. This is our free gift, made to convince you; to show you what Liquozone is, and what it can do. In justice to yourself, please, accept it to-day, for it places you under no obligation whatever.

Liquozone costs 50c. and $1.

CUT OUT THIS COUPON

for this offer may not appear again. Fill out the blanks 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.

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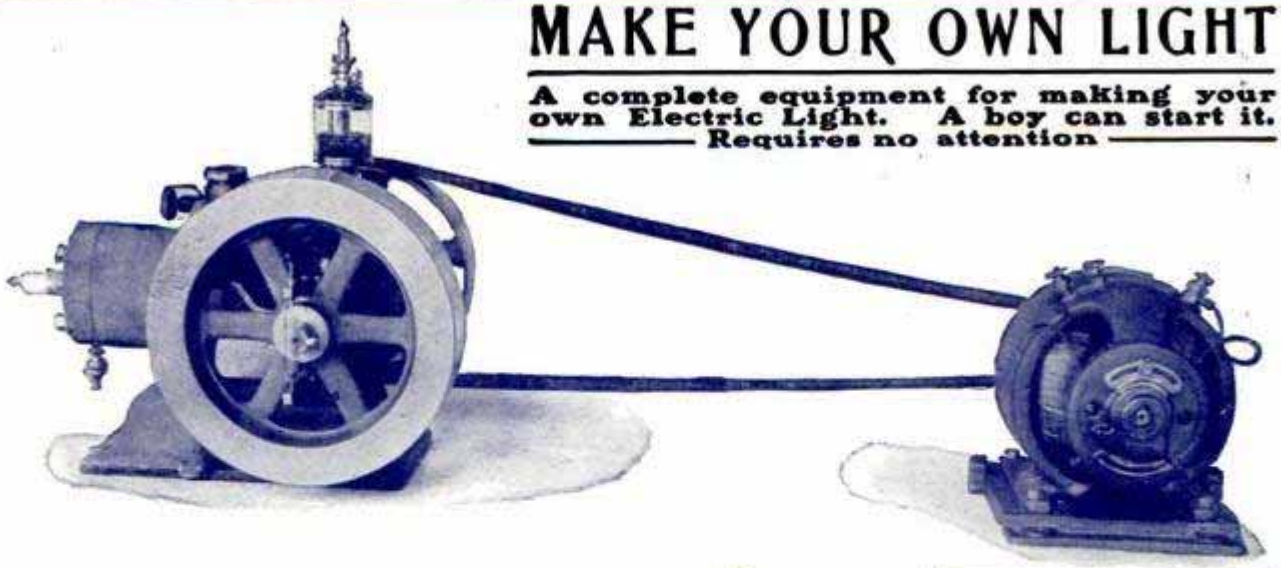
763 Give full address—write plainly.

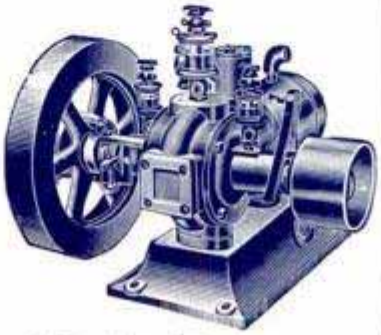
Any physician or hospital not yet using Liquozone will be gladly supplied for a test.

MAKE YOUR OWN LIGHT

A complete equipment for making your own Electric Light. A boy can start it.
Requires no attention



¾-h. p. Gasoline Engine, 6 Light Generator, 200 feet Covered Wire, 36 feet Lamp Cord, 6 16-Candle Power Lamps, 6 Sockets, 6 Rosettes, 6 Porcelain Tubes, 50 Porcelain Knobs, 2 feet Cir. Loom, 1 Switch Fuse, Solder and Tape. The above complete and perfect outfit is offered at a price so low you cannot afford to burn oil. Send for descriptive circulars.



The most Perfect Small Engine Ever Built.....

STRONG DURABLE
SIMPLE POWERFUL

Mounted on solid wood base. All connections made and ready to run.

JUNIOR ENGINE WORKS, • 907, 160 Washington Street, - Chicago

Dear Sir:—Would you be open for an investment which will yield, with reasonable assurance, from 50 per cent to 100 per cent each year?

It will average 75 per cent—which means 6¼ per cent a month.

When I say investment, please understand that I do not mean a gambling proposition, such as stocks and grain speculation, or horse-race betting, nor anything which requires you to buy what you do not want, or sell what you have not got.

I REFER TO A STRAIGHT INDUSTRIAL PROPOSITION, which has for its commodity products produced by nature, and in turn manufactured into commercial necessities, for which the demand always exceeds the supply.

As a representative business man, I fully realize the annoyance of receiving unsolicited literature and advertising matter of unknown propositions.

Therefore, before placing before you, in full detail, the venture I refer to, I ask your consent, and for that purpose I attach this coupon, which explains itself. If agreeable, and you are open for a proposition which will produce all that I claim, kindly sign and mail it.

THIS COSTS YOU NOTHING BUT THE POSTAGE, AND PUTS YOU UNDER NO OBLIGATION.

In closing, permit me to say, that the men at the head of the corporation which I represent are men of great wealth and undisputed commercial integrity.

There is not a single questionable feature in the entire plan.

May I hope to hear from you by return mail?

Very sincerely,

L. C. WELTON, 59 Clark St., Chicago.

COUPON

Dear Sir:—You may send to my address full details of the proposition you refer to. I will carefully consider the matter, and, if interested, will write you further. This with the distinct understanding that I am under no obligations.

Name ..... Postoffice .....

County ..... Street and No. .....

Date .....1904. State.....