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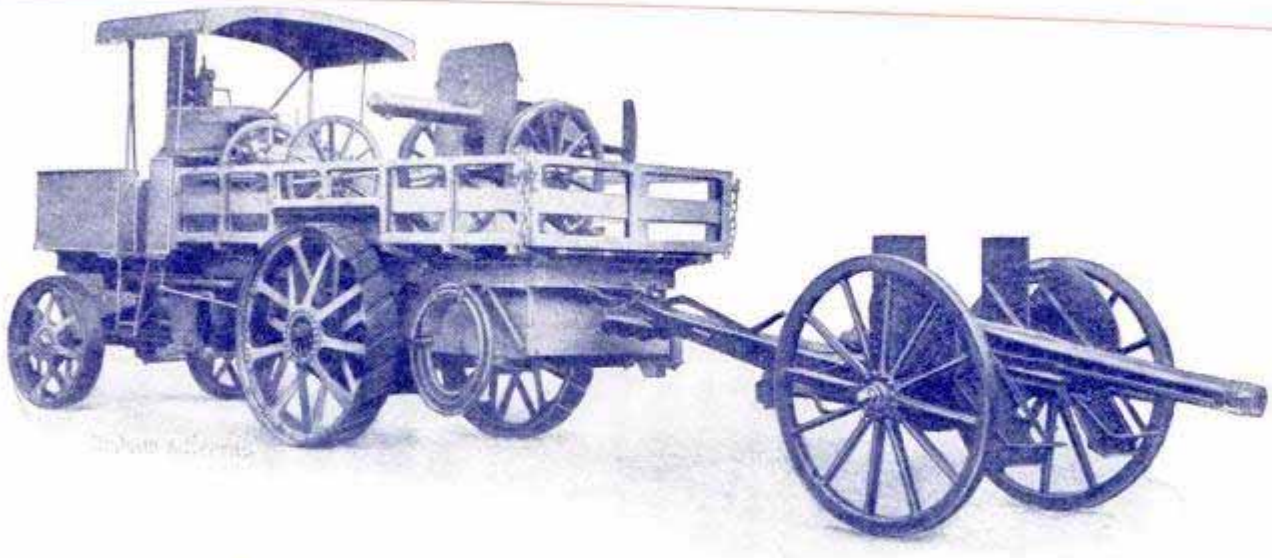
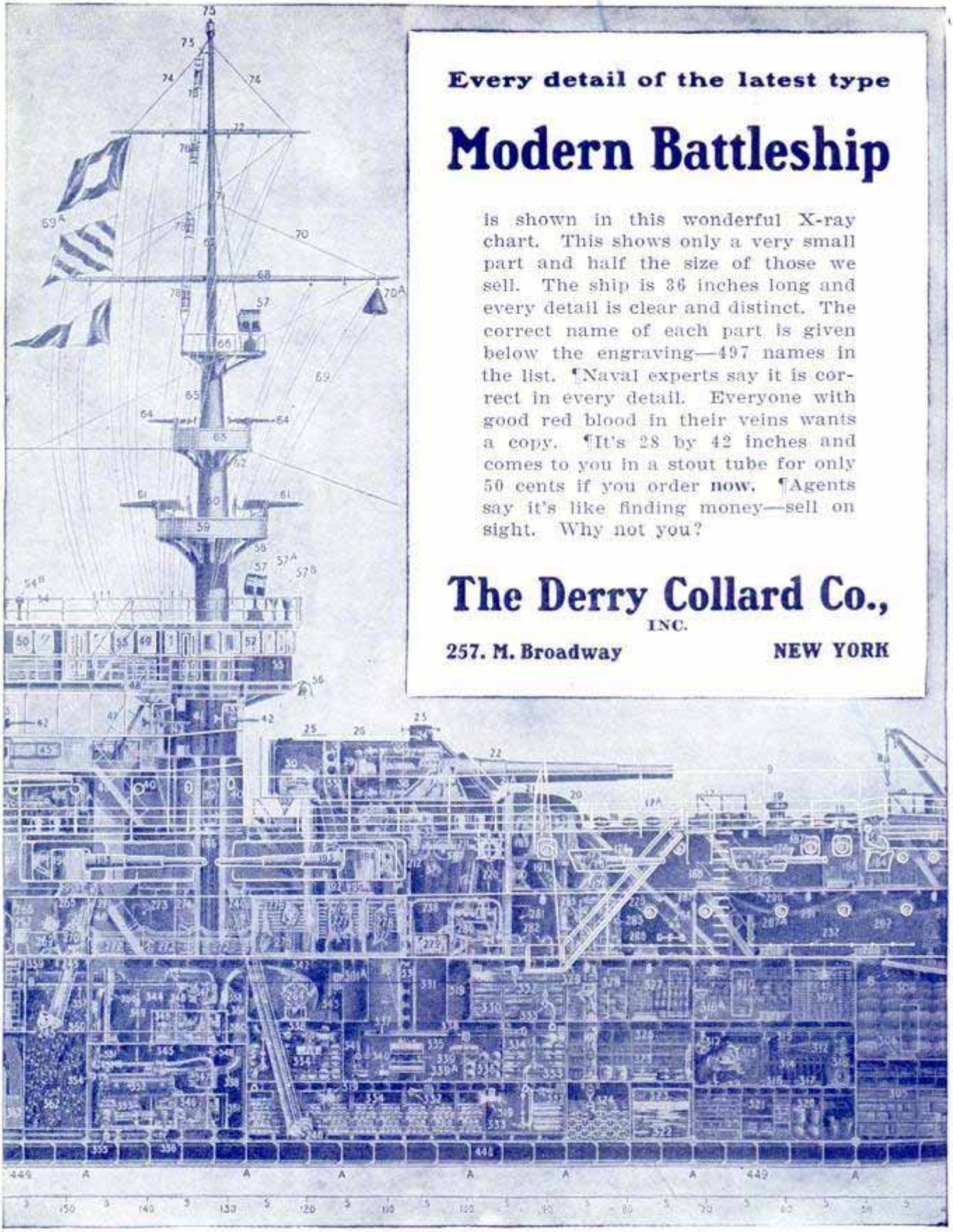


Latest English Artillery Transport—Page 219



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FEBRUARY, 1905

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POPULAR MECHANICS

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Electrifying a Big Bridge

Superstructure 300 Feet Long Covers Manhattan Terminal Where There Are Five Cross-Overs and Where An Immense Number of Cars Are Switched.

The electrifying of the new Williamsburg bridge connecting Manhattan and Brooklyn has recently been completed, and cars are now running over the structure.

The overhead work is of unusually heavy special construction, and at the Manhattan end of the bridge consists of special steel lattice girders, supported on steel poles and switching so many cars at the terminals.

Heavy mast-arms consisting of 2½-inch pipe, 18 feet long, are erected along both approaches to the bridge proper and extend over the double track. About 10,000 lineal feet of single troughing was used.

For the positive feeders there were erected overhead eight miles of 782,000 circular mils

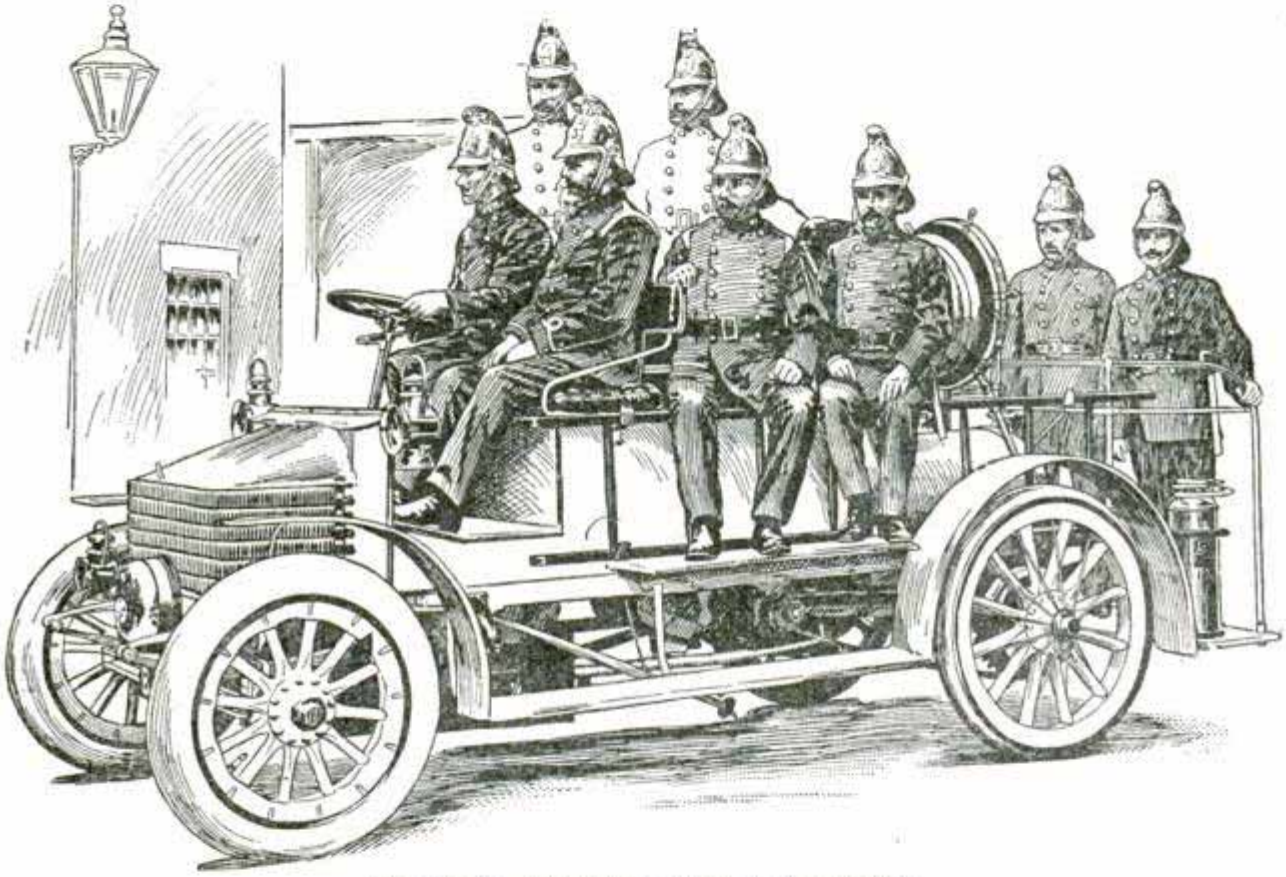
The New Williamsburg Bridge Connecting Manhattan and Brooklyn

by attachment to the permanent bridge structure; is 300 feet long, and covers the five cross-overs at the terminal. Special hardwood oak troughing was used, having attached bar iron fittings on which the trolley wheel operates. The contact bar, which is supported at frequent points by insulated hangers, is three-eighths inch by two and one-half inches. This construction is adapted to the large currents used for stranded weatherproof aluminum cables, and along the track for negative returns, seven miles, making a total of 15 miles. On the Brooklyn approach near the bridge tower a special steel frame switch house covered with corrugated iron has been built. From this point the overhead and track return feeders are extended. On the Brooklyn plaza, heavy steel poles support the overhead work.

Motor Fire Engines Popular in England

Motor fire engines are rapidly replacing the old horse-drawn machines wherever practicable in England. So far, in America motor cars are only used in this department for hauling chiefs and fire marshals to the scene of the fire, but in England the whole equipment is gradually being readapted to the new means of propulsion.

Gasoline motors are well adapted to the



English Firemen Ride in State

form of chemical fire engines shown in our illustration. The apparatus is mounted on heavy wheels, the rear ones having additional wire spokes and being shod with 3-inch solid buffer tires while the front ones are fitted with 3½-inch tires of another make. Exceptionally heavy springs are used.

The 24-horsepower engine is of the 4-cylinder horizontal pattern in ordinary practice. The speed gear is of dimensions which give strength for the heaviest work, the high speed gear being 25 miles an hour. Any steam generated by continued running on low gear passes through brass grids provided on the top of the watertank which is located between a double dash board. Beneath the driver's seat is placed the gasoline tank. There are two sets of powerful brakes fitted to the machine, cast-iron shoes, expanding into the inside of drums on the sprockets of the wheels, operated by the pedal lever and band brakes on drums of the wheel sprockets, operated by the side brake lever.

The car is controlled by a throttle valve regulating the supply of gas to the motor, operated by a lever on the steering pillar and an auxiliary throttle on the brake pedal.

The car weighs a ton and will carry 2,500 pounds of fire appratus. A step at the back accommodates a fireman and two chemical cylinders; brackets are arranged for carrying two 9-foot ladders and the mechanism of the whole apparatus is protected from dirt by a shield slung underneath the car.

FIRE HOSE FOR INDOOR USE.

Every large building (business house or dwelling) should have a reliable hose hung conveniently in reach for use in case of fire. Unlined linen hose is best for this purpose. This hose will leak when the water is first turned on, but will soon swell and stop the leaks. It should be tested out of doors every six months and thoroughly dried before replacing.

A JAPANESE MILITARY AIRSHIP IN USE.

The Japanese have made efficient and successful use of war balloons. The war balloons belonging to the 3rd Division of General Nogi's army were of great assistance in

Japanese Military Warship

reconnoitering the approaches to Port Arthur, the observer in the balloon having communication with the ground by telephone and from his high station directing the artillery fire.

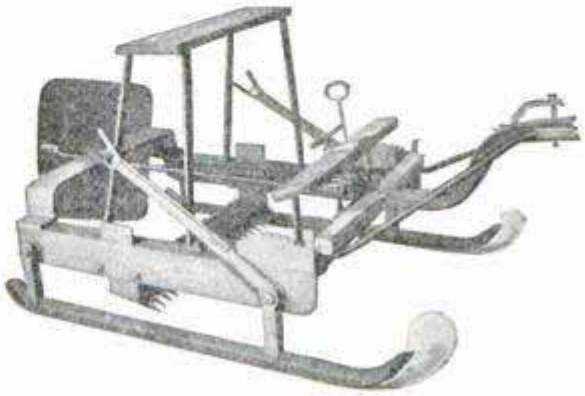
TRANSMITTING CRUDE OIL BY PIPE LINES.

Transmission of low gravity crude oil by pipe lines from the oil fields to the power market, so successfully effected in the east has not achieved the same result in the West. In Fresno county, California, a 6-inch pipe, 110 miles long is being laid for transmitting crude oil from the Coalinga oil fields to tidewater and thence by tank ships to San Francisco and other coast markets.

Such a pipe laid from Bakersfield, Cal., to Point Richmond, Cal., for conveying Kern county oil was at first supplied with eight pumping stations of 160-horsepower capacity. The oil pumped was delivered to the pipe line at from 500 to 600 pounds pressure per square inch in summer and up to 1,000 pounds pressure in the winter time. By this arrangement it was not possible to get the oil to Point Richmond in commercial quantities. Then seven more pumping stations were added and yet unsatisfactory results. It is now reported that fifteen more pumping stations are to be added, a station for each 10 miles. The venture was practically a failure.

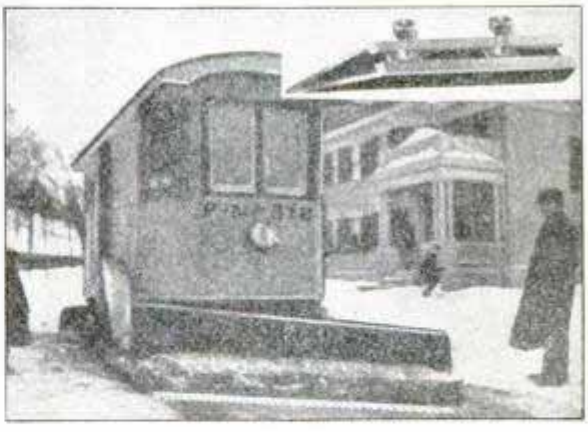
MACHINE TO LEVEL "HUMPS" IN TRACK.

Frequently during winter the snow and ice collects between the rails of street car tracks forming "humps." Sometimes the ice



Ice Planer for Street Work

ridges extend along the street between double tracks. To reduce these hard frozen masses of ice to the street level an eastern railway uses a row of cutting teeth fixed at intervals of 1¾ inches to an iron bar which is carried in front of the snow plows. The Street Railway Journal says the device is a success. The teeth are 6 by ¾ inches each. For other portions of the street not reached by the snow plow the row of teeth are car-



Knives Attached to Snow Plow

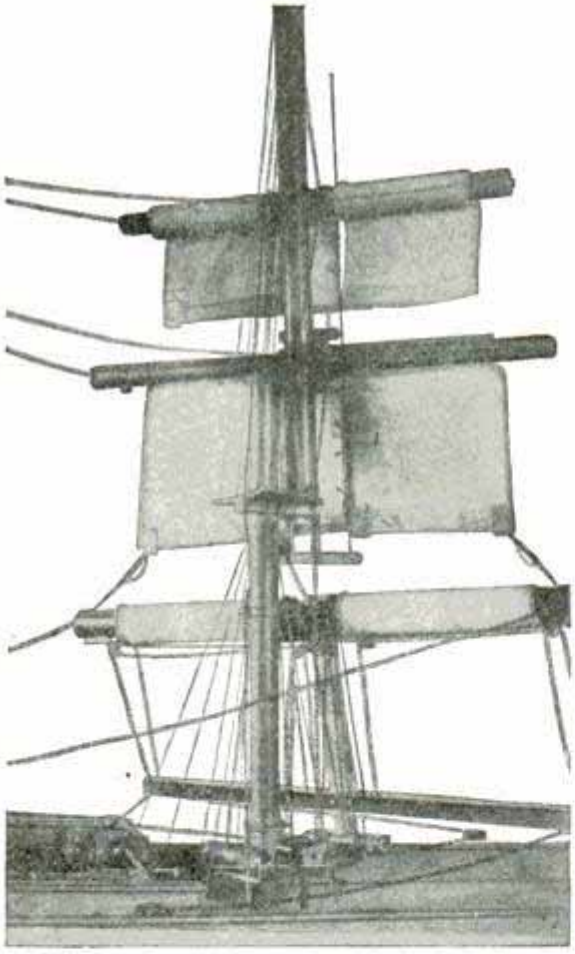
ried on a pair of runners and drawn by four horses. After being loosened the ice is shoveled up and carted away, or spread out evenly over the pavement.

"Shop Notes;" 1905 edition; 200 pages; numerous illustrations; 50 cents.

FURLING SAILS BY MACHINERY.

Jack Tar may no longer have to risk his life at dizzy heights, amid freezing blasts or lightning's play, while he tries to reef the upper sails. A retired sea captain, William Williams, has invented a system by which the sails can be raised or reefed from the deck, without the use of steam power. The plan of working the sails is on the principle of a roller curtain, except that steel ropes worked by hand winches on the deck take the place of curtain springs. The system is applicable only to square-rigged vessels.

Practically, Williams' device consists of a set of winches placed at the foot of each mast, whereby a single man by turning a crank can furl, unfurl or reef a sheet in one minute. To complete any three of these operations on the main yard, lower topsail yard, upper topsail yard, and lower and upper topsail yards, would require an able-bodied seaman but five minutes at the five winches.



The Hoisting Gear

These winches are so arranged as to take up their own slack by reversing cogs. The sails themselves work on sleeves that encircle the yards—the operation not being dissimilar to that of the common roller window curtain. By merely slipping a brake the sheets can be allowed to unfurl themselves by a system of counterbalancing weights. The gearing of the winches gives great leverage, for a pressure of 55 pounds on the crank can hoist 2,000 pounds up among the rigging. The yards can be braced, eased away, or hauled around before the wind by one seaman working a few minutes at a crank. The sails can be held to at any desired angle to the wind.

The system of winches before the mast corresponds to the present complicated tangle of halyards, and, besides saving more than half the labor, is invaluable in cases where the wind takes the vessel hard aback. It is almost impossible to furl sails by the old system under these conditions. The number of sailors can be reduced one-half. If the system fulfills the expectations of several large shipping interests in San Francisco, it is destined to revolutionize the life of seamen before the mast.

LENGTHENING THE LIFE OF TELEGRAPH AND TELEPHONE POLES.

A few years longer life for telegraph and telephone poles would mean an enormous save in American forests. With the increasing network of wires reaching out in every direction uniting the country like so many live nerves, the demands on our forests are something tremendous, and in a few more years must mean serious depletion of large trees. Two large corporations have united with this government to experiment with preservatives for poles. The life of the pole depends on a very small portion of its length, namely, in a standing pole, the section extending six or eight inches above and below the ground. This is called the breaking point, and in order to have a large margin against decay at this point much larger poles are used than are actually necessary to bear the strain imposed upon them.

The strain upon a pole is felt at the ground line. Decay also begins at the ground line, but does not extend far below because the supply of oxygen and heat decreases, nor far above because the moisture is not sufficient. Thus the only serious consideration is to find some antiseptic to protect this all-important section from fungus. In the experiments to be tried dead oil of coal tar will be forced through the butt of the pole and the creosote method will be used, but only for a distance of eight feet.

The usual treatment of poles in this country requires the use of an air-tight cylinder.

ICE-YACHTING—THRILLING SPORT ON NORTHERN LAKES.

Ice-yachting, both in this country and in Canada, has increased in popularity with the present season. In fact, some of the yachts have reached such proportions, with a corresponding increase in sail area that their speed has at times become a menace and several serious collisions have occurred.

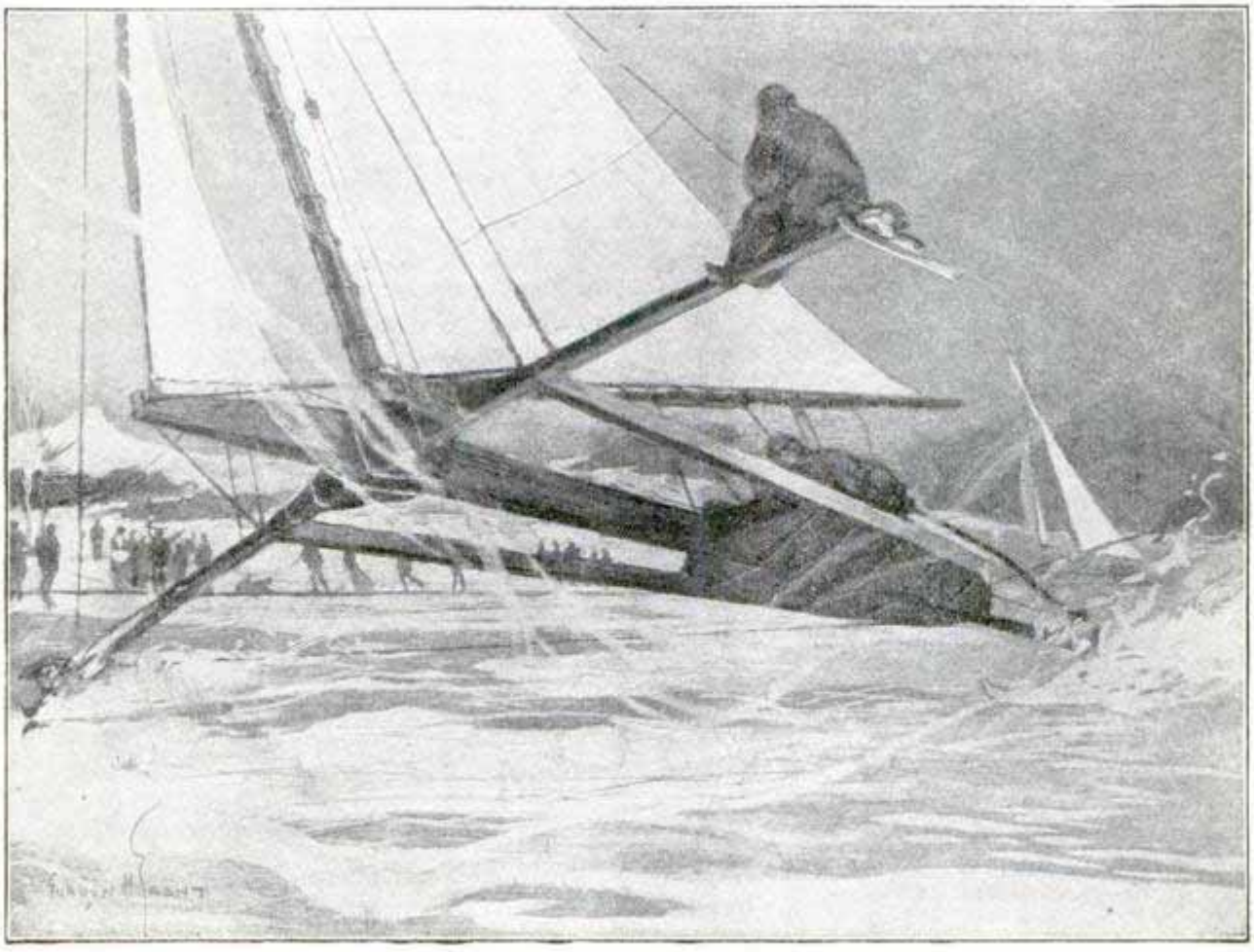
The hull portion of most of these yachts is very simple, consisting only of a center timber, running fore and aft, and the runner plank. The mast is stepped on the centerpiece, the forward part constitutes the bowsprit and the aft part carries the box and rudder part. The runners are attached to the runner plank which is a stout timber from 14 feet to 28 feet in length and tapering in thickness towards the ends.

The largest of these yachts weigh 3,000 pounds and have 1,000 square feet of sail area. Record time so far in the numerous races is a mile in two minutes and twenty-eight seconds.

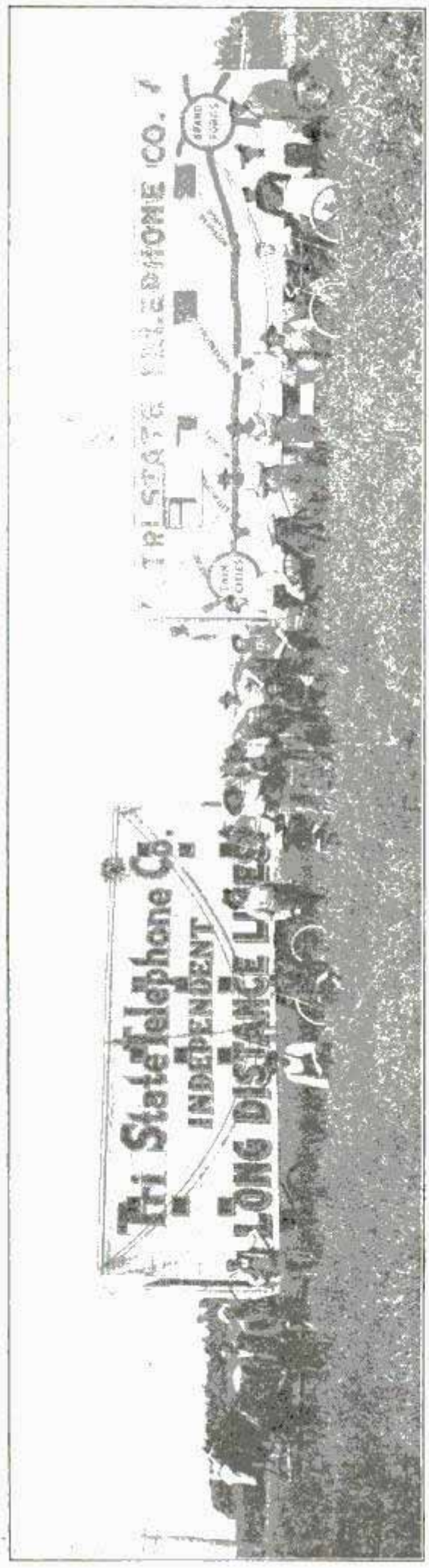
AUTO MAIL WAGONS IN PARIS.

The postal service in Paris has received fifteen new electric motor vans for transferring the mails between the main office, substations and railway depots. The cars have a speed of 25 miles an hour and weigh 2½ tons of which the storage batteries comprise 1,320 pounds. The Electrical Review says: "The batteries are charged daily between 12 and 2 p. m. and for this purpose a model charging station has been installed in the central postoffice building." The use of motor wagons for mail service is becoming general in Europe.

Electric Mail Wagon



"The Largest of these Yachts Weigh 3,000 Pounds."



Construction Wagons and Crew at Kerkhoven, Minn.

TRAVELING HOTELS FOR TELEPHONE CONSTRUCTION CREWS.

A northern telephone company in constructing lines through North Dakota and Minnesota met with some difficulty in securing board and lodging for its crews of workmen. Often the country is sparsely settled and the distance between lodgings and working points great.

To meet these conditions the construction wagons shown in our illustration were built. The wagons accommodate 16 men, one being used for a dining room and kitchen, the other as sleeping quarters. They are each 8 feet wide, 26 feet long and 7 feet high and mounted on low trucks with wide tires, giving a large bearing surface to the roadway so that the power required to draw them over soft tracks is reduced to a minimum.

The kitchen is 8 by 8 feet and located in the front end of the dining car, the rest of the space is used as a dining room.

In the sleeping wagon there are eight berths on each side arranged in tiers. On soft roads two teams are necessary for drawing each wagon, but over good roads only one team each is used. The wagons have proven a great convenience as the men are always on the ground for the work. Tents were formerly tried, but the wagons were an improvement.

Some large telephone companies are now using automobiles for repair work along lines, some have supplied motorcycles for this purpose and yet others have a good horse always in readiness. We are indebted to General-Superintendent L. D. Richardson for our illustration.

STEAM TURBINE'S CONTINUOUS RUN OF 3,962 HOURS.

One of the most remarkable runs ever made by a steam engine was completed when the 600-horsepower steam turbine in Machinery building was shut down on December 2, its work having been completed. This record of 3,962 hours continuous service breaks all steam turbine records. Piston engines have run for longer periods, but never under high speed; the turbine maintained a speed of 3,600 revolutions per minute, or 855,792,000 revolutions during the term. The work was to supply light and current for the exhibit of the electrical concern which built it, and the load varied 50 per cent. An examination of the turbine is said to have shown it in perfect condition after its long run, the tool marks on the bearings still showing plainly.

Living Trees for Wireless Telegraph Stations

Startling Discovery of Major Squier, U. S. A.--Already Successful on Short Distances--Great Possibilities.

Major George O. Squier of the Signal Corps, United States Army, has succeeded in sending and receiving wireless telegraph messages, using living eucalyptus trees in place of masts and towers. The branches and leaves served in place of the usual network of wires as antennæ.

Messages have already been transmitted by the new method between Ft. Mason and Yerba Buenna, a distance of three and three-quarters miles in a straight line.

It is certainly significant that Nature having provided unseen lines of communication in the ether should be found ready to still further supplement her bounty and furnish in leaf and branch and trunk those media which man has been erecting at great pains and expense.

The thought at once suggests the possibility of an hitherto undreamed of ease and multiplication of exchange of words between the dwellers in the rural districts, if every shade tree in the farmer's dooryard may become a speaking tube to friends and neighbors for miles around.

Major Squier has found that a good live tree is the best sending station for wireless. Also that a good live tree is the best receiving station. It requires only fifteen minutes for him to attach the necessary sending apparatus to the first tree. The mechanism that is affixed to the second, the receiving tree, can be so affixed in less time. It is so simple that it can be carried in a hand satchel.

Maj. Geo. O. Squier, U. S. A.

The perfection of the service rests upon the power of the instrument that emits the messages into the air and upon the delicacy of the detector that receives them.

Major Squier believes that trees will come into general use as wireless telegraph stations. In war times their utility would be of vast benefit to the army, the signal corps of which employed them.

In times of peace their value in furnishing facilities for telegraphing without wires and without the great expense attendant upon the apparatus now in use would commend them for some commercial purposes.

Major Squier is so convinced of the possibilities of the method that he has conducted elaborate experiments with the trees. He decided, as Fleming and other investigators had decided before him, that the general function of the vertical receiving wire used in wireless telegraphy is to unite electrically the earth and space, by which union a sufficient amount of the energy of the radiating waves is localized to operate a suitable receiving device.

It occurred to him that although it is sometimes impossible, and always troublesome and more or less expensive to get the proper wire, there are many available trees. He knew that much better results are obtained with the field telephone in wooded territory when the receiving wire is grounded by attaching it to an iron nail driven into a tree than when a conducting plate is buried.

It is possible to make a tree a telephone conductor even when this nail is driven into it thirty feet above the ground instead of a few inches, as is usually done.

Deciding that the tree, so useful in military telephony, was also of benefit in wireless telegraphy, Squier affixed a receiving instrument to one of General MacArthur's pet trees. This instrument he made by filling a small ebonite tube with the regular sized spherical carbon granules used in telephone transmitters.

He imbedded in them two steel needles as electrodes. These needles were close together at the central part of the tube. A head telephone was used to convey to the ear of the receiving operator the messages conveyed through the steel needles.

Yet, while the experiment showed that the electro-magnetic effects obtained were

sufficient to get signals, it was also shown that the tree had absorbed more electromagnetism than the instrument used. With the improved wave detector operated by electrical energy, which instrument Major Squier wants to get, the efficiency of the system of telegraphing with trees will be much improved.

Willow, pine, spruce and oak all make good receiving stations. They are useful for sending also. The power required for sending is secured from two small portable batteries of ten volts, each of which excites a large coil.

The "grounding" essential to sending is secured through the roots of the tree. A wire is attached to a nail driven into the root. The trunk of the tree supports the sending apparatus. The only electrical connection between the two is at the root of the tree.

Major Squier says:

"I have simply scratched the surface of this absorbingly interesting topic. I have experimented for only three months. Excellent results have been secured, and with better apparatus and more work I think we shall see that the possibilities of the subject are almost boundless.

"Naturally I am most interested in the military side. I want the United States army to get what benefit there is to be secured from my experiments. That is why I have applied for patents upon the system of using trees as stations for the wireless telegraph. One of my applications has been favorably acted upon. I have hope that the others will be. I have no idea of going into business, and I want the patents as much for the government's protection as for any other reason.

"The use to the army of trees as wireless stations is great. When a balloon is used to assist the wireless the enemy sees the balloon. Signal flags have been discarded because they revealed the signalers' whereabouts to the enemy. But a tree gives no sign that it is being employed as a signal station.

"Commercially the system has great possibilities.

"We have successfully telegraphed with trees as stations at every distance we have attempted. We have proved that the principle is workable. Now all that remains to be done is to get the best wave detectors and stronger power. The extension of the distances over which tree telegraphy is practical is only a matter of power.

"I see no reason that in the near future farmers, whose places are fortunately usually well provided with trees, cannot be able to communicate wirelessly for many miles.

"Anybody can see the importance of thus being able to get crop reports, weather bulletins and items of particular or general information.

"The cost of the instruments will be slight. Any system of wireless telegraphy can be used in connection with the trees. The limits of the discovery are so broad that no one company can corner the idea.

"But it is not only in space telegraphy that the trees are susceptible of great usefulness. My experiments have shown to me that the weather bureau and the department of forestry can get good results from a close study of the trees.

"The trees are not only helpful in that they conduct electricity to the earth, but they are good weather registers. Their field of usefulness in these directions has not as yet been thoroughly explored.

"In time we shall learn just what trees to plant about our homes that we may be safe from lightning. We shall also learn much of the weather of the future from the trees."

Extracts from Maj. Squier's Report.

The difficulty of transmitting electromagnetic waves over land as compared to that over seawater, has been well established, and this difficulty is attributed in a large measure to the general absorption of intervening hills, vegetation, buildings and conductors through which the wave trains must pass in reaching the receiving apparatus.

However closely we may approximate in theory to the actual mechanism of electromagnetic wave transmission, as used in wireless telegraph practice at present, it is now reasonably certain that both the earth itself and the space above the earth are essentially involved in the phenomena.

Repeated experiment has shown the importance of good earth connections for both the transmitting and receiving antennae, and several letters patent, such as those of Lodge, Muirhead, Fessenden and Stone, provide, in addition, for special conducting metallic nets or strips, at the foot of the antennae, extending therefrom to a distance of a quarter wave length or more, whereby the efficiency is increased.

The influence of the general condition of the earth around the foot of the antennae as to moisture, temperature and ingredients, has also been noted, and the effects of the capacity of the aerial itself, its height, and of elevated capacity areas placed at or near the end of the vertical wire, have been investigated in connection with the recent

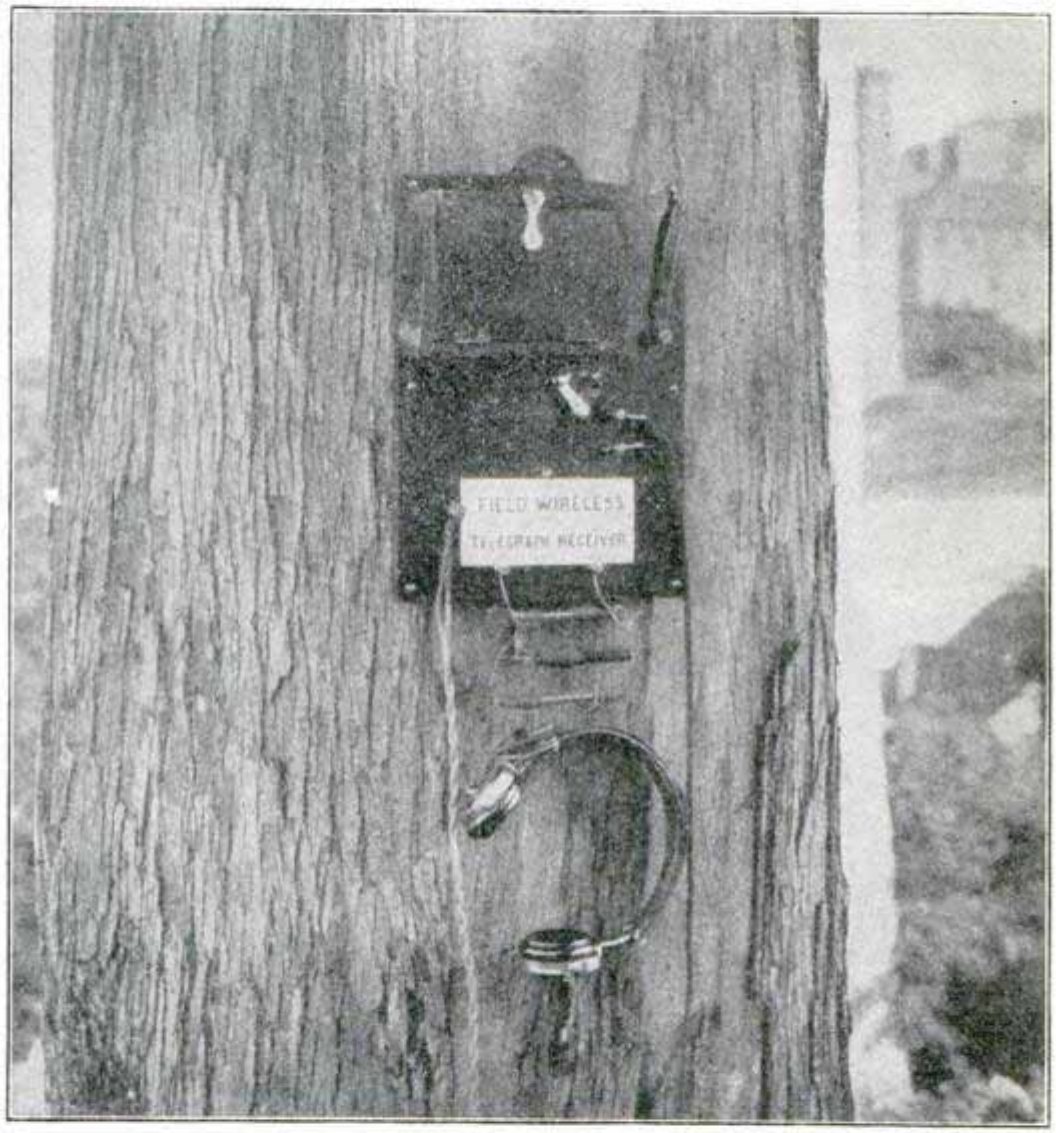
great advance in syntonized systems.

For best results, it has been observed in general that the vertical wire or net should be carefully insulated from all supporting poles, guys, or indeed any electrical conductor connected to the earth, the object being to form an open vertical receiving circuit, insulated in the air.

We may therefore, with advantage, as Fleming and others have done, regard the general function of the vertical receiving wire and its accessories as serving to unite electrically the earth and space effects above mentioned, by which, through the agency of one of the forms of wave detectors, a sufficient amount of the energy of the radiating waves is localized to operate a suitable receiving device.

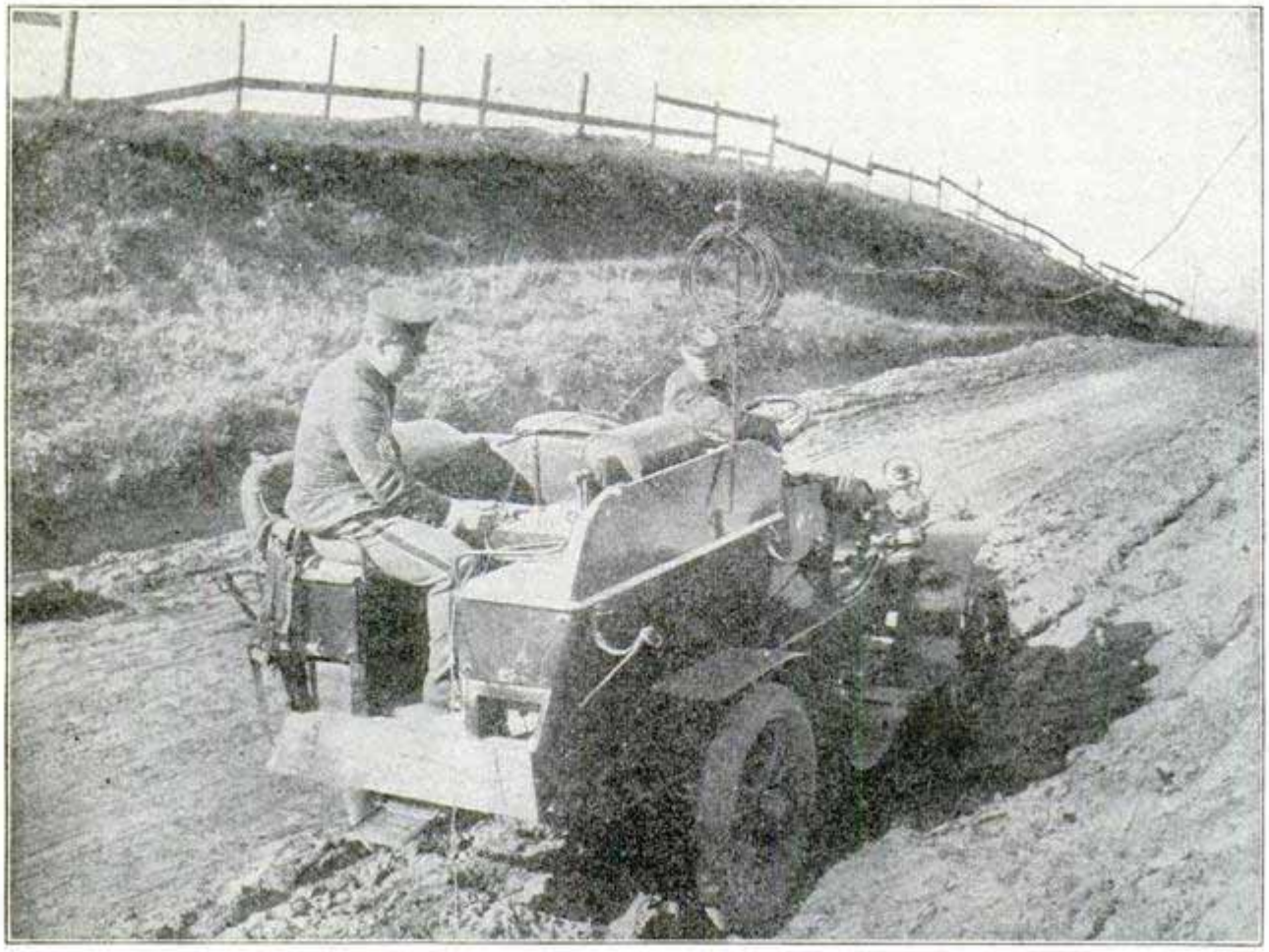
It was from a general survey of the above established facts regarding the receiving conditions for successful wireless transmission of intelligence, that the writer was led recently to consider how far these conditions may be fulfilled by growing vegetation, particularly in the form of high trees covered with green leaves.

My attention was first attracted by learning from Major General Arthur MacArthur, U. S. Army, of a successful experiment made in July, 1904, at the military maneuvers of the Department of the Columbia, at American Lake, Washington, by Lieutenant William M. Goodale, of the U. S. Signal Corps, in which he found that in laying rapid telephone lines in a wooded country, for the field exercises of the Army, a much better ground could be obtained by attaching the earth side of the instrument to an iron nail driven into the trunk of a tree or shrub, than by the ordinary and more laborious method of burying a conducting plate, or by driving an iron spike into the earth itself.



Wireless Telegraph Tree Station at Ft. Mason

It is found that the conductivity of a growing tree in a healthy state, for telephonic currents, is such that the earth contact nail need not be at the root of the tree, but may be carried to a height up the



Army Automobile Used in Tree Experiments

tree of 30 feet or more, and the telephone used from that elevation with satisfactory results. Indeed, experiment shows that good communication can be maintained from one tree top to another with the trunks of both trees in the circuit. When the operator holds the ground wire in the hand, and completes the circuit to earth by merely touching a live twig or leaf, the transmission of speech is good. This permits the military scout to use the vantage point of the tree elevation for observing the enemy, while being screened from view by its foliage, and at the same time to transmit by telephone to the distant station the information thus obtained.

In order to test other kinds of trees than those available at Fort Mason, California, a telegraph auto-car, recently purchased for the Signal Corps of the Army, was temporarily fitted with the necessary transmitting apparatus, and a tour made through Santa Clara and Alameda counties, California, installing and operating field sending and receiving stations at various points along the route.

The electric power required was in the form of two small portable storage batteries of ten volts each, which were used to excite a large Apps coil.

When a tree was used to support the sending aerial, the "earthing" was accomplished through the root system of the tree itself, by attaching a wire to one or more iron nails driven into its base. The tree stem was utilized to support the aerial, the only electrical connection therewith being at its base.

After a little practice two men, a sergeant and corporal of the Signal Corps, one a good lineman, and the other the chauffeur of the machine, who also acted as telegraph operator, could install a sending station in ten to fifteen minutes. A receiving station is even less trouble to install, since there is nothing to transport except what can be carried in the hands.

The experiments thus far have been mainly qualitative, and the apparatus used, of marked simplicity.

The transmitting apparatus at Fort Mason consists of a small Apps induction coil of about 4-in. spark, and a vertical antenna wire suspended from a 75-ft. pole situated on a bluff about 80 ft. above the sea level. This was one of the first wireless stations installed in the United States.

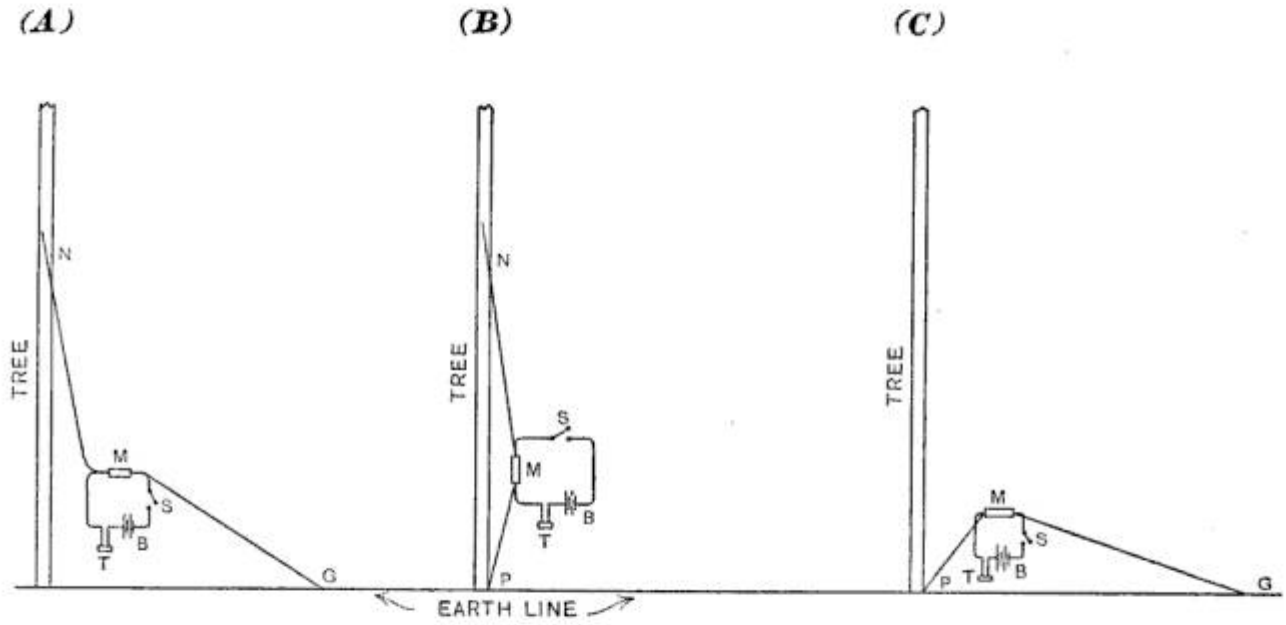
The detector used consists of a simple microphone made by partially filling a small ebonité tube with the regular sized spherical

carbon granules used in telephone transmitters, and by imbedding therein two steel needles as electrodes, so that they nearly touch each other at the central part of the tube.

In Fig. 1 are shown three typical arrangements of receiving circuits, which have been found efficient in practice. In this figure, a growing tree is represented by the double line.

In Fig. 1 (a), N represents a point of electric contact with the tree, made in any convenient manner, such as by driving an ordinary iron nail or pin into the tree, preferably through the outer, living part thereof.

The point G represents a conducting contact with the earth, made by driving a metallic pin therein. M is a microphone; T, a telephone; and B, a source of electro-



motive force. In Fig. 1 (b) and (c), the corresponding letters represent similar apparatus.

The first experiments tried were with an arrangement of circuits indicated in Fig. 1 (b).

The electrical contact with the tree at the point P, was made by driving a nail into the tree itself an inch or two above the earth line, so that the contact would be distinctly with the tree, and not with the earth. The whole apparatus used for these preliminary experiments was extremely simple, consisting of a few feet of flexible lamp cord, a microphone, with three small dry cells, and a head telephone receiver, suitably mounted on a small board about 10x12 inches.

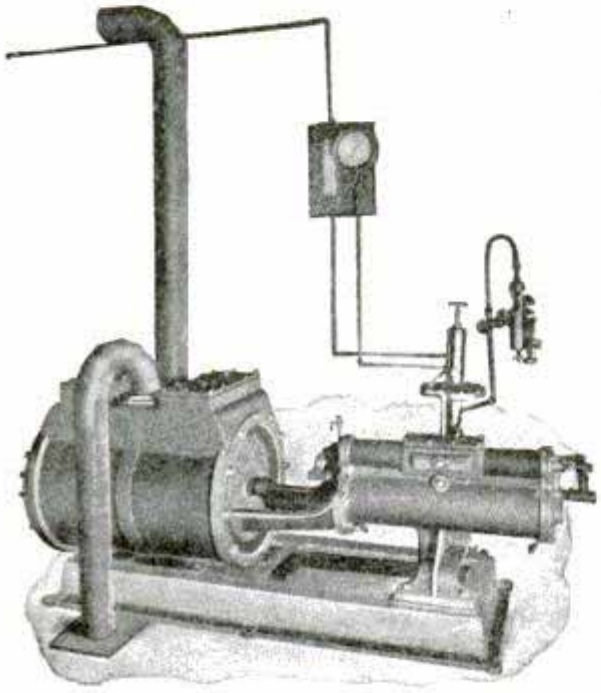
With the electrical contact at the point P remaining stationary, the upper point N was shifted up and down the tree, the effects being noted. In this experiment, the transmitting station remained unaltered as far as possible, sending a simple signal, such as the letter S. It was found that as soon as the distance PN became more than three or four feet, faint signals were heard, which in general increased in loudness with the distance between P and N, along the trunk or stem of the tree, up to the general region where the first branches began to diverge, beyond which a further increase could not be certainly noted.

In order to insure that the effects observed were actually due to electromagnetic waves from the tree itself, and not to the short antenna wire represented by MN, in (a) and (b), Fig. 1, a careful exploration of the tree was made, using lead-covered insulated wire for the connections PM and MN, the lead covering of this short antenna being carefully grounded, so that the actual wire used was incased throughout in an earth connected metallic conductor, which would effectually screen the electromagnetic waves from affecting the wire inside. With such a wire, with the point P remaining stationary, experiments were made, showing that as soon as the distance PN became more than about three feet for the particular distance and apparatus used, faint signals began to be heard. Upon removing the terminal an inch or two away from the tree, still keeping it at the same height above the earth, the signals disappeared entirely, returning again when electrical contact was restored. These effects increased in general, as the distance PN became greater.

Forty Minutes From Chicago to Milwaukee

Mail and Express to be Hurled Through a Pneumatic Tube at 120 Miles an Hour

From Chicago to Milwaukee in a straight line is 84½ miles. The fastest trains consume two hours in making the trip. It is now proposed to transmit mail and express matter between the two cities in 40 minutes. A pneumatic tube, 18 inches in diameter,



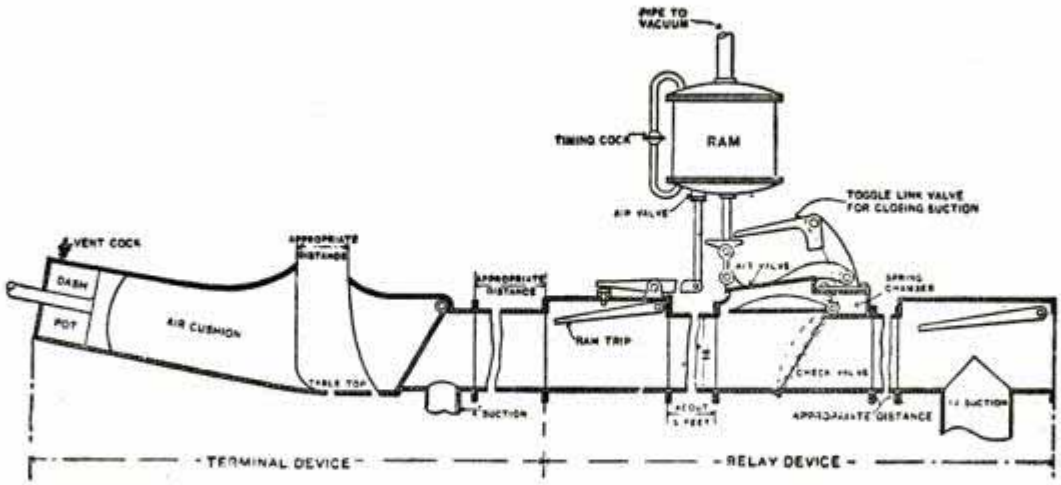
Vacuum Pump

conveying loads up to 500 pounds, is to be constructed; should it prove successful one more means of rapid communication will be available, and other large cities connected.

distant day. There are now in operation in the United States more than 300 tube plants accommodating 6,000 stations, requiring 3,600 horsepower, and operating at a cost of $36,000 per day. The longest of these is the plant serving the Chicago postoffice. This system is nine miles long, double tubed all the way. It connects various railway and postal stations of Chicago with the old postoffice building and has a capacity for carrying 3,000 letters per minute each way. Its cost was $650,000.

Until very recently, however, the practicability of tube systems connecting cities hundreds of miles apart was precluded by the enormous amount of power which would be required to operate such a system. It is now claimed that a new system has done away with this objection and that a line connecting Chicago and Milwaukee capable of carrying packages up to 500 pounds in weight is an assured enterprise.

The distance between Chicago and Milwaukee is 84.5 miles and the proposed system is to include pipes 18 inches in diameter for carriers conveying up to 500 pounds weight and a series of 3-inch tubes for special express messages and very small packages. From the main terminal at either city, connections with all the big factories, and other business houses could be installed and thus the service be made to include a large territory. The installation cost of such a plant would be $5,000,000, but it is a feature



Plan Section of Relay System

As yet no long-distance pneumatic tube systems are in operation but contracts for several are now pending and the work of installing them will be taken up at no very

of the system that the cost of operation and maintenance is so low that the company could make extraordinarily low rates, 500 pounds being carried for 15 cents. This is

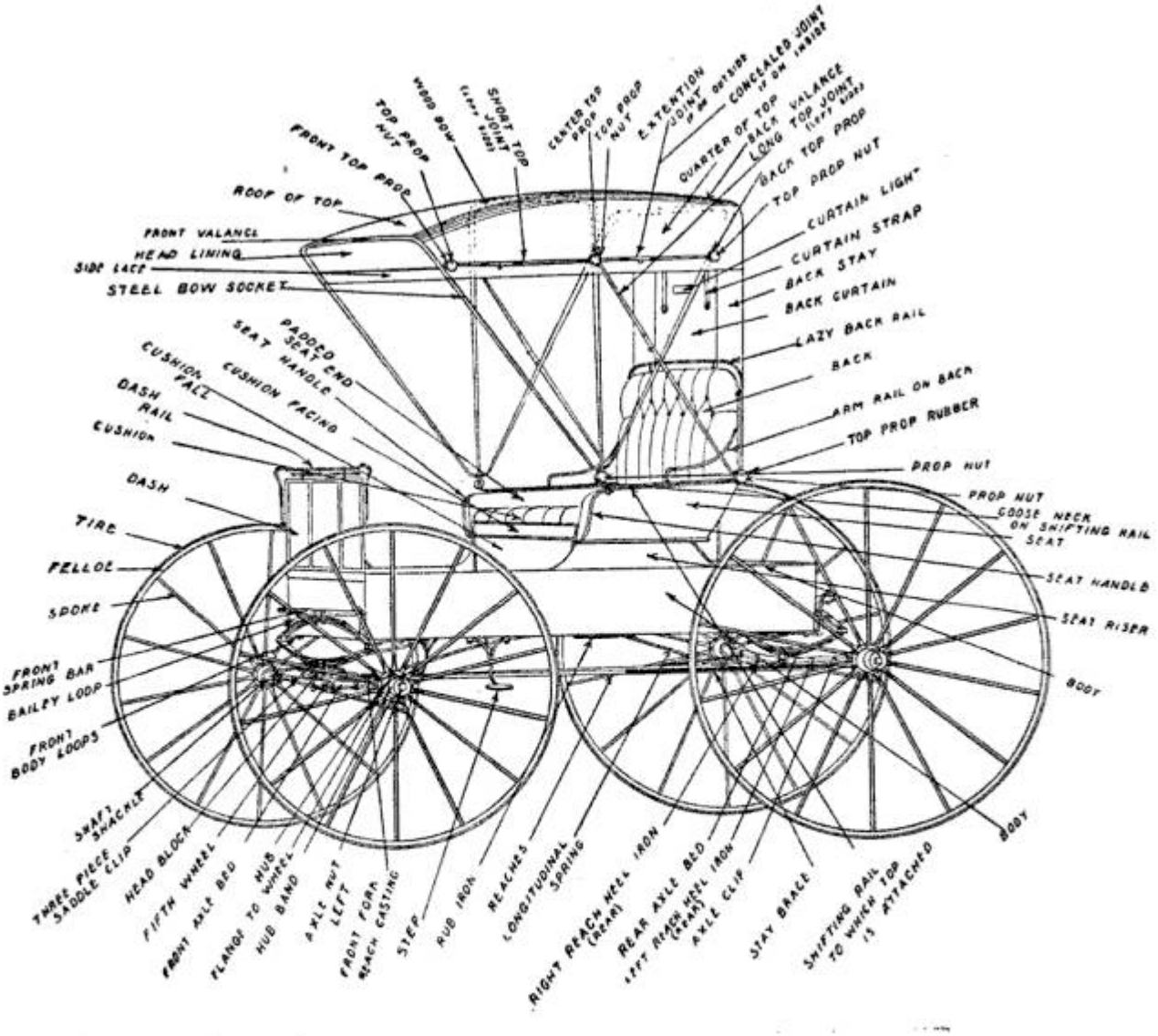
an astonishing fact when it is considered that the package would cover the distance in just 40 minutes.

The two important features of the plan are, (1) the fact that instead of the carrier being forced through the tubes by means of high pressure behind it, as in most systems, the air is partly exhausted in front of the carrier, and the carrier glides along sucked by the vacuum and seeking to demonstrate the old law expounded by Newton—"Nature abhors a vacuum"; (2) the system of relays dividing long pipe lines into sections of from two to three miles each, and each section operating wholly independent of the others. Automatically with the entrance of the carrier into a section power is cut off from the preceding section the instant the carrier leaves it. In this way the power required has been theoretically reduced to a minimum; and it remains for the constructed line to demonstrate the power required in actual practice.

The carriers do not travel on wheels or rollers, but are covered with block felt which is as hard as rock, and fastened with brass caps and screws. It is expected the felt will last several months. The carrier is very necessary to the safe conveyance of the contents. A few weeks ago by chance a leather pouch filled with mail fell into the tube at the Chicago postoffice and when the pouch arrived at the other end of the tube it was torn and riddled. This illustrates the tremendous power exerted by the air pressure.

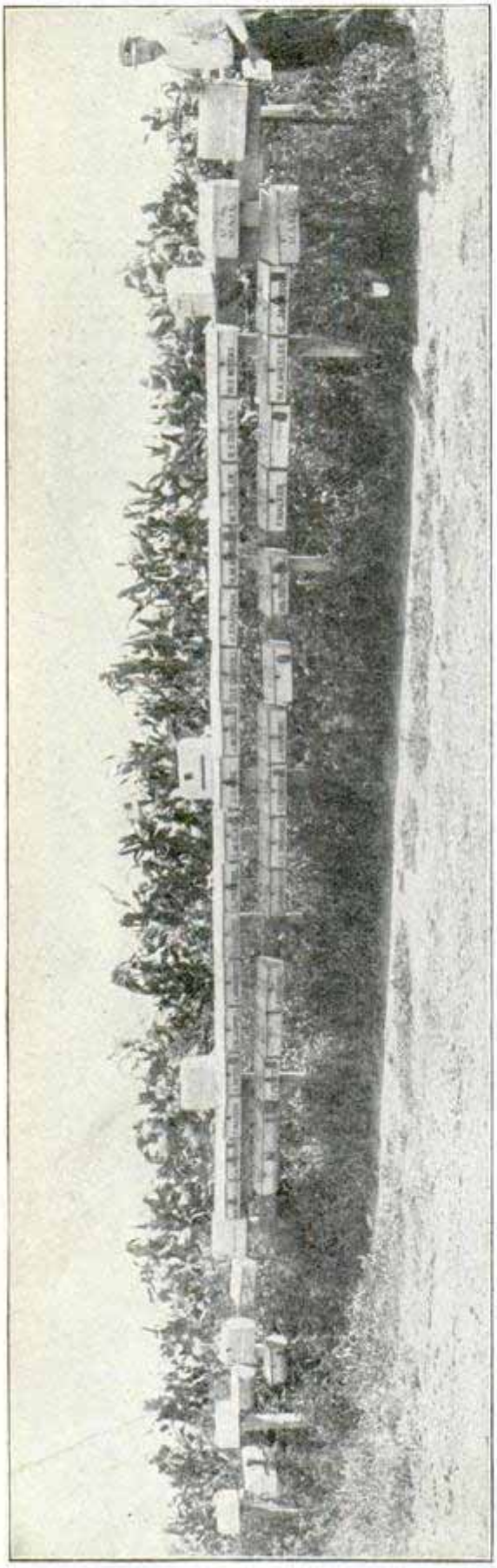
Pipe lines are intended to be placed underground where storms and other disturbing accidents cannot affect the service.

All the Parts of a Buggy



RURAL FREE DELIVERY.

Rural Free Delivery which corresponds to the free delivery system so long in force in cities, is now in operation in every state. Thirty thousand rural letter carriers make daily trips of from 20 to 30 miles each, serving from 100 to 150 farmers' families on each route. These carriers are required to furnish at their own expense, the "outfits" consisting of mail wagon, harness, horses, etc. Many are obliged to keep four or five horses on account of bad roads or hills. They are paid from $600 to $720 a year, according to length of route, but have to spend one-half their salary for horse feed and other running expenses. The mail wagons, which are miniature postoffices on wheels, cost from $60 to $75, besides the freight. These carriers perform nearly all the functions of a postmaster, selling stamps, registering letters and securing and cashing money orders. A farmer may thus in addition to receiving his mail every day in the year, except Sundays, send or cash money orders right at his front gate. Each "patron," as the farmers served are called, must provide a mail box, and place it on the fence, a post or tree in front of his residence. Thousands of patrons, however, are served who live long distances from the route, and hence at cross roads what is called a "nest of boxes" is often seen.



"Nest" of Mail Boxes on Rural Route No. 1, out of Fullerton, Neb.

The nest shown in the illustration contains 46 boxes, representing that many families some of whom live 10 miles away but who find it more convenient to get their mail in this way than to drive 15 or 20 miles to town.

The boxes may be locked, but seldom are, and in thousands of cases no locks are ever used. As the theft of mail from one of these boxes is severely punished by long terms in prison, such events are extremely rare. It is stated that there are now over 3,500,000 farmers' families being served by the rural free delivery, or a total population of more than 18,000,000 persons. The system is doing more to make farm life attractive to the young people than anything which has ever been done.

Several thousand additional carriers will be appointed during the present year, and the service is eventually expected to require 50,000 carriers. These carriers must pass an examination and give bonds for $500. Each carrier has a substitute who carries the mail when the regular carrier is sick.

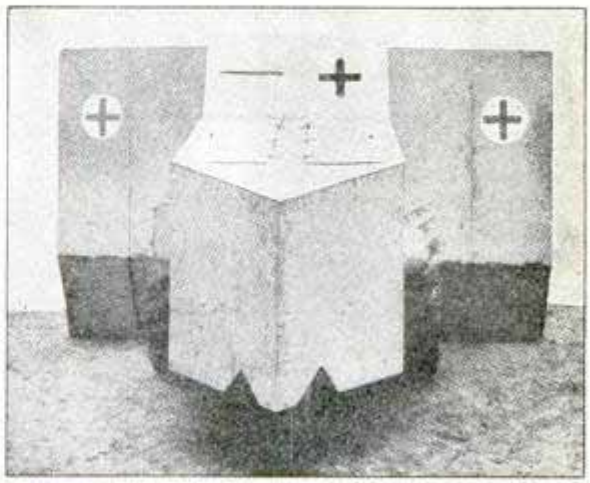
The rural carriers have only one or two holidays during the entire year, and must go out in all kinds of weather. They are the poorest paid employes in the government service.

The rural carrier has many thrilling experiences; at times he swims swollen rivers; rescues persons lost in snow storms; discovers and extinguishes fires where the family is away from home; and his arrival is the event of the day at the farm house.

BULLET-PROOF MILITARY MOTORS FOR RED CROSS SERVICE.

A bullet-proof military motor having shields of the Paliser design of special quality steel is an English invention which promises much toward reducing the terrors of warfare. The motors are designed for the use of officers and men in giving first aid to the wounded in the thick of a battle if necessary.

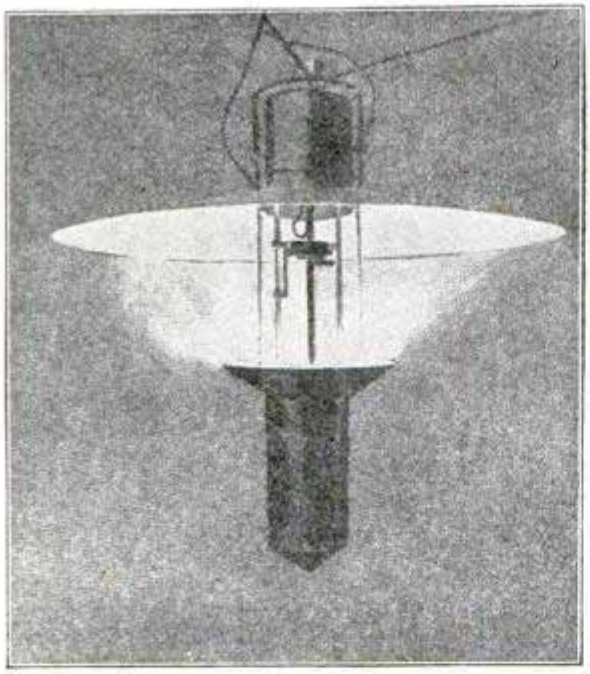
Used as a Shield



Front View of Motor

The motors have three wheels, and the bullet-proof shield may be extended wing fashion for protection. They carry such restoratives, bandages and emergency supplies as may be required for immediate use.

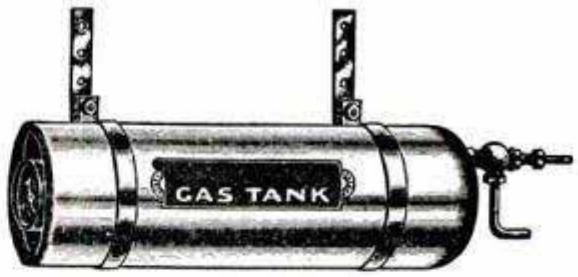
Mechanical appliances for army use are increasing. Portable ice-making machines and lamps for affording electric light without glass, by means of the motor, to a field hospital tent are among the important devices in this line. In the lamp the carbons are placed low, and the radiance thus thrown upward to the large shade, whence it is reflected, and so affords a shadowless, diffused light for surgical work.



Lamp for Operating at Night

GAS TANK FOR AUTOS AND LAUNCHES.

Acetylene is a popular light for automobiles and launches, and it is now possible to purchase the acetylene gas in small portable tanks, and avoid the generation of the gas. The tanks can be attached at any most convenient place about the machine or boat, and piped to burn as many lights as needed and where wanted.



When the tank runs low it is exchanged for another fully charged, with a supply to last from two to three months. Supply depots are located in all the large cities.

FIVE-YEAR SUBSCRIPTION OFFER.

In response to numerous requests we are now offering 5-year subscriptions to Popular Mechanics at $3.00. Persons availing themselves of this offer should keep us informed of all changes of address.

TIMING RACES AT THE FINEST TOBOGGAN RUN IN THE WORLD.

St. Moritz is a Switzerland village—one of the highest in the Engadine—having an altitude of 6,000 feet, and world-famous for its fine toboggan slide, the "Cresta." Here in March or April of each year gather tobogganing enthusiasts of many nationalties to compete in what might appropriately be called the "Derby" of this sport, though it is known as the "Grand National."

The toboggan course, with its high banks, forming sharp curves, and its steep gradient,

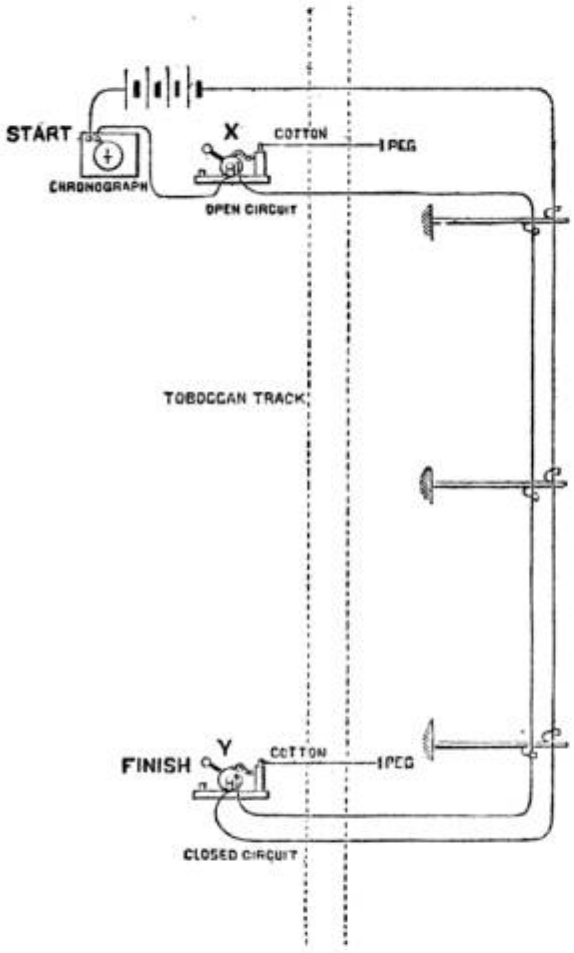


Fig. 1.

is much like other such courses, but is exceptionally well located. As only one toboggan can occupy the track at a time and the races are all decided on a time basis, a very interesting and accurate electric apparatus is used for this purpose. Alongside the course are set poles carrying four overhead wires, the two upper ones of which connect to a telephone at each end of the course, putting officials at those points in communication. At the starting point one overhead wire is connected through a battery of 10 cells to one terminal of a chronograph (see Fig. 1), and the other terminal of the chronograph is connected through a trigger switch X to the other overhead wire. The further ends of the overhead lines are connected at the finishing points to another trigger switch Y. Both switches, X and Y, are firmly fixed at the side of the course,

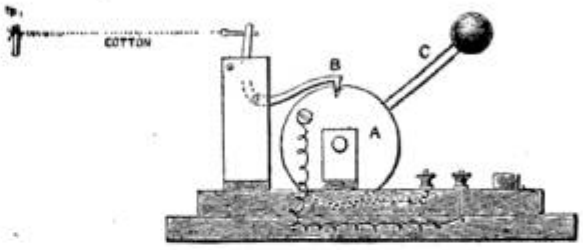


Fig. 2.

and have each a strong cotton line attached, with one end to the trigger of the switch; the line is stretched across the track about 2½ in. from the ground, and the other end is tied to a peg driven into the ground on the further side. The two switches are nearly identical. The Electrical Review, London, describes their mechanism as follows:

A circular wheel of brass, A, is mounted on bearings, and has a notch in its periphery in which the pawl, B, is placed when the trigger is set. To the wheel is fixed a radial arm, C, with heavy brass bob, which falls by gravity when the pawl is disengaged by the cotton being pulled. At the lower edge of the wheel, A, a piece of ebonite, D, is inserted in slightly different positions in the two switches (Fig. 3); also a metallic spring contact, E, is pressed against the under side of the edge of A.

As will be seen in Fig. 3, when the pawl is set in the notch in the two switches, the spring E in switch X will be pressing against the ebonite D and in switch Y, the spring E is making contact with the wheel A. Before the tobogganer starts, both switches are set with the pawls B in the notches of the wheel A and the cotton stretched from the trigger across the track at start and finishing points (Fig. 2). The signal is given and the tobogganer starts from a few yards behind the cotton; his toboggan striking the cotton, pulls and breaks it, disengaging the pawl; the arm,

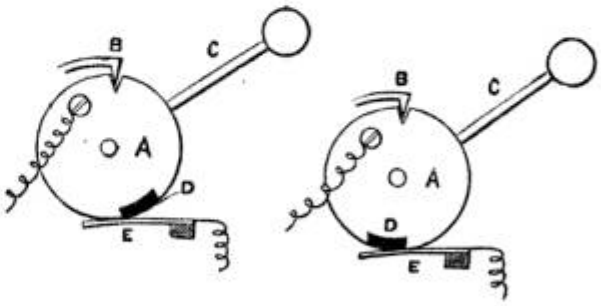


Fig. 3.

C, drops at switch X, closing the circuit, which allows the current to flow through the electro-magnet of the chronograph, the

armature releasing the clockwork, which immediately starts and continues until the cotton attached to switch Y is pulled and broken by the toboggan at the finish of the course, when the arm of switch Y falling breaks the circuit and stops the chronograph; the time is then noted, and the apparatus re-set for the next tobogganer. The chronograph has a stop for re-setting the hand at zero, one complete revolution of the hand representing 30 seconds and these being sub-divided into tenths.

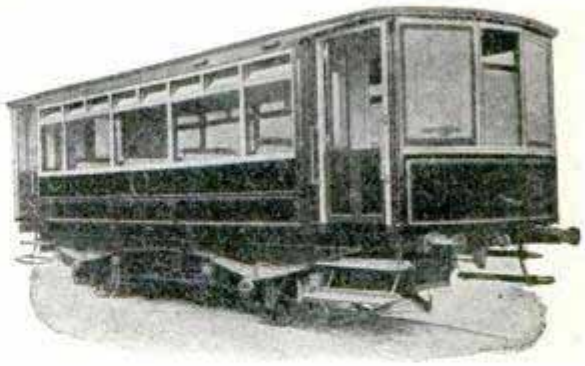
The Cresta is something over three-quarters of a mile in length, with a difference in elevation of 600 feet. The record time made so far is 61 6-10 seconds, an average rate of 60 miles an hour on the fastest parts.

GASOLINE MOTOR CAR FOR ENGLISH RAILWAYS.

The Great Northern Railway of England is experimenting with a gasoline motor car, which, if successful will be used in suburban work. The Electrical Review, London, says:

The motive power is generated by two engines, which, however, are not connected independently to the axles, although both axles are driven; under normal circumstances the engines drive on to a common longitudinal shaft, which is connected to the axles by beveled gearing. To overcome the difficulty of one axle over-running the other, owing to any possible inequality in the diameter of the wheels, a special form of differential gear is introduced, and combined with this special gear is the reversing mechanism. The engines are connected through independent clutches to a common change speed box, from which the power is transmitted, by means of the longitudinal driving shaft, to gear boxes suspended on each axle, and at this point the speed is reduced by means of single reduction gearing.

The engines are of the standard Daimler type, each capable of developing 36 H. P.



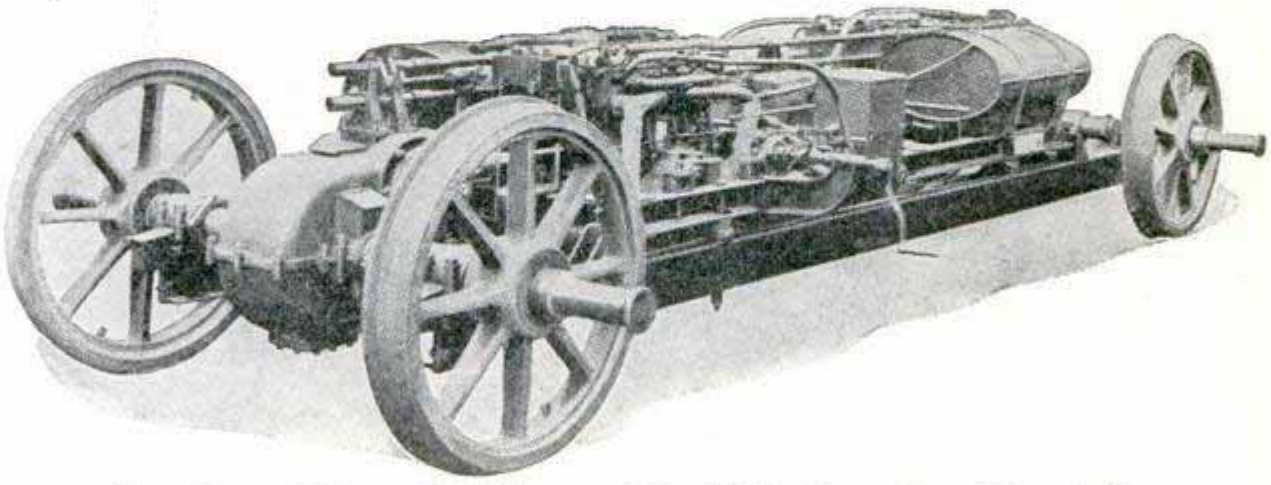
Gasoline Street Car

when running at full speed. A separate petrol tank is provided for each engine, and the combined capacity of these is sufficient for 400 car-miles.

The complete car weighs something under 16 tons, including its full complement of passengers, and although the normal speed for which it is designed is 30 miles per hour, it has on several occasions attained a speed considerably over 50 miles. The car is lighted by electricity obtained from storage batteries, which also supply energy for ignition purposes and for the magnetic clutches.

IRISHMAN SANG HIS OWN REQUIEM.

A merchant of Cork, who greatly admired his own magnificent barytone voice, sang his own funeral mass over his remains not long ago. This seemingly impossible feat was accomplished by means of a phonograph record prepared by the man in view of his death. The phonograph was placed on the coffin and the voice of the dead sang the mass. The record will be used for each anniversary mass.



Truck and Running Gear of English Ga soline Street Car

SMALLEST RESTAURANT IN THE WORLD.

What is claimed to be the smallest restaurant in the world is in operation at Butte, Mont. It is never closed; when the place was opened the owners threw away the key and the door has never since been locked. It is between two large buildings and is only 3 feet wide and 13½ feet long. Only four persons can be served at a time, and there is no standing room.

"Only Three Feet Wide."

About half of the 13 feet is taken up by the kitchen, which contains a small refrigerator, a gas range, a coffee urn and a coplete cupboard. The equipment is perfect in every respect, though in miniature.

Every inch of available space is utilized. The one table is 18 inches wide and 3½ feet long. There are four stationary chairs, which are in constant use.

The owners of this world's smallest restaurant are two chefs who run two 12-hour shifts. The two men do all the work. A great many visit the restaurant just out of mere curiosity.

Several railway systems are considering the installation of a wireless telegraph system for communication between moving trains and stations located at large cities.

HOW STEEPLE JACKS CLIMB TO DANGEROUS PLACES.

A steeple jack tells how he succeeds in climbing to apparently inaccessible places, and smiled as he remarked "It's easy—when you know how and have the nerve." All the same most people would rather look on from a safe distance than do the climbing. He says:

"I know of no reason why a painter of ordinary nerve and a clear head cannot climb a pole a mile high if he desires to, and the pole is that high. Very often we see a weather vane perched on the top of a rod anywhere from six to sixteen feet in length above a church spire. It is necessary to take the vane down in order to regild it.

"My way of doing it is this: Take an ordinary bos'n's chair, with a tail of sufficient length. Pass the tail around the spar or rod twice underneath its own part, then once around above, tucking the end under its own part, making what sailors call a rolling hitch. Place yourself in the chair, take in all the slack you can get, raising yourself as high as possible, jamming your hitch tight. Now take a strap of sufficient length (I do not mean a leather strap; I mean a piece of rope with both ends spliced together), pass it around your spar, one turn under and one turn over its own part, tucking the end under, making what is called a clove hitch. This is put on about the height of your knees, leaving the loops of your strap hanging down. Place a foot in each loop and raise yourself up; pushing the hitch on your bos'n's chair up as high as you can reach, jam it tight; sit firm in your chair and draw your feet up, strap and all, as high as you can; then raise up again, pushing your chair up as before, and thus proceed, hitchity-hitchity, Jack and the beanstalk fashion, until you get there.

"I have taken off and replaced church vanes in this way that were nine feet long, and weighed fifty pounds, and painted flagstaffs in the same manner. The bos'n's chair should be as snug to the hips as possible, in order to avoid all unnecessary play. In this way you are at your ease, and have your hands free to work with, obviating the necessity of hanging on with your eyebrows. Some years ago I saw a man make several attempts to shin a flagstaff about fifty feet high. When within a few feet of the top his strength would be exhausted and down he would come. With the chair and strap he could have remained there all day, and taken his dinner with him."

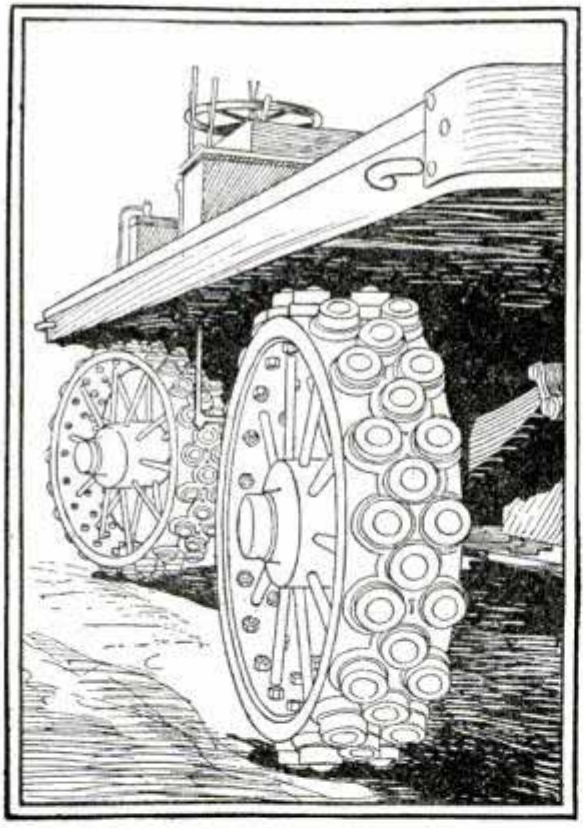
The chief danger is the possibility of a sudden faintness.

STEAM MOTOR WAGON FOR HAULING CANNON.

There has recently been built in England, for the government, several steam motor wagons, constructed especially for the transport of artillery. Provision is made for two pieces of artillery on the motor wagon, while several more can be hauled on their own wheels, behind. The illustration explains the method.

AUTO TIRE FOR HEAVY TRUCKS.

This tire is designed for motor trucks where the truck and load runs up into the tons. The accompanying illustration shows an Autraf tire on wheels designed for a 3-ton load each. They are of the cast rim and hub and wrought spoke type, common in farming and traction road engines, says Motor Age. The hubs are double and the spokes staggered. The rims are of 8-inch tread and 36-inch diameter. Sixty cups 3



Rims are 8-Inch Tread

inches wide and 1 inch deep, with one-half the depth projecting beyond and one-half recessed into the rim are fastened on their circumference. A rubber cylinder 2½ inches wide and about the same length, weighing 1 pound, is set in each cup and is held by a ¾-inch bolt, which passes through both rubber and wheel rim to the retaining nut. The rubber segments are readily reversible. The bolts have flat button heads, under which are washers nearly as wide as the rubber. These heads and washers take the road wear and make a flexible steel surface. It is said that the traction is effective. The empty machine used for a test readily shifts four loaded box cars, of an aggregate weight of 150 tons.

BLOWING GLASS BATHTUBS.

Interesting Process in Which Compressed Air Takes the Place of Man's Breath

Glass bathtubs are the recent production of a German inventor, who has succeeded in making them commercially possible. These new tubs are much inferior in appearance to the porcelain tubs so generally used, and in utility are nothing better, save in hospitals where medicated baths are oftimes given patients. The method of blowing them, however, is both unique and interesting.

A thick cast-iron plate having an opening the exact shape the glass tub is to be, having a removable frame resting on its margin and held in position by locking levers, is mounted on a hollow shaft which is journaled in bearings and arranged to rotate. The removable frame holds the outer edge of the glass within the cast-iron plate. Compressed air is used for blowing such a large piece and is forced into the molten glass by means of the hollow shaft and the perforated cast-iron plate. A bedplate supports the apparatus.

Sufficient molten glass is poured upon the iron plate from a ladle carried by a traveling crane. The glass spreads over the plate and under the frame, and rapidly cools at its outer edge. At this point plate, frame and glass are turned through a half circle so that the top frame is then underneath and the layer of hot, smooth glass hangs from the plate, supported by its chilled outer edge. The central part sinks uniformly, the bedplate being brought into contact to secure this result, and the bottom of the tub is formed. The bedplate, falling slightly, pulls the glass down and so forms the walls, and then through the shaft and cast-iron plate compressed air is skilfully introduced into the tub so as to give the walls whatever inclination desired. This done, the blast is turned off, the locking levers release the movable frame, and the tub, still hot, is rushed to the annealing oven, where it is carefully annealed, this operation being the most important of all.

LARGEST GAS ENGINE POWER PLANT IN THE WORLD.

Will Furnish Current for All the Street Cars in San Francisco

The electric street cars of San Francisco are to be propelled by power generated by the largest gas engine plant in the world. California already is world famous for notable feats of electrical engineering, and now adds one more laurel. The order has just been placed for the new gas engines, which will require several months to build.

There will be at the start three 4,000 kw. capacity, 3-phase, 13,200-volt, 25-cycle, 88-r. p. m. revolving field alternating current generators, to be driven by 5,400-horse-power gas engines. These generators are the largest in capacity in the world driven by gas engines.

HOW TO VENTILATE A SCHOOL ROOM.

The allotted time for contaminating the air in a school room where each pupil is allowed 130 cubic feet of space, is 8 min-

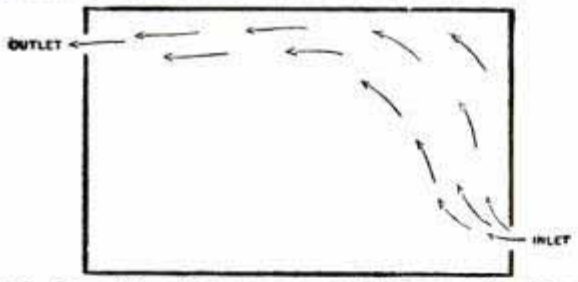


Fig. 1--Air Movement Due to Location of Registers

utes, according to R. C. Carpenter, a recognized authority. A contributor to the Metal Worker describes different systems of ventilation showing the movement of air currents. The system exemplified in Fig. 3, he says, works with admirable success in many of the metropolitan schools. He says:

"If the ventilating register is placed near the ceiling on the opposite side of the room, the movement of the air current will be that shown in Fig 1, none of the incoming air reaching the lower part of the room.

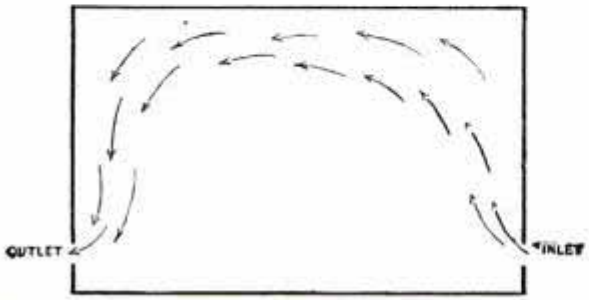


Fig. 2--Air Movement with Different Location of Registers

If the outlet is placed at the bottom of the opposite side of the room, the movement will be as shown in Fig. 2, the incoming air again missing the lower portion of the room, except where the air enters and leaves the room. Now if the register through which the air enters is placed

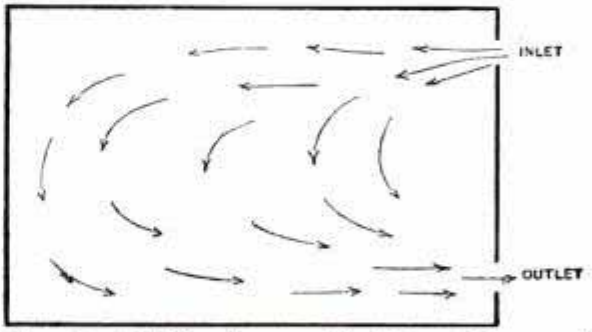
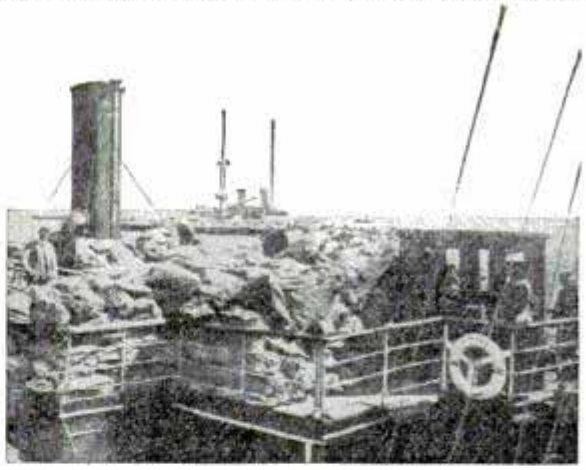


Fig. 3--Diffusion of Air Through Best Location of Registers

about 8 feet above the floor and the ventilating register at the floor on the same side of the room, the children sitting near the register will suffer no unpleasant effects from the incoming air, and the perfect circulation will take place as shown in Fig. 3."

BIG MAILS FOR EUROPE.

The holiday mails from this country to Europe were the largest ever carried. The mails are landed in tenders and the illustration shows one of them unloading from the



Christmas Mails

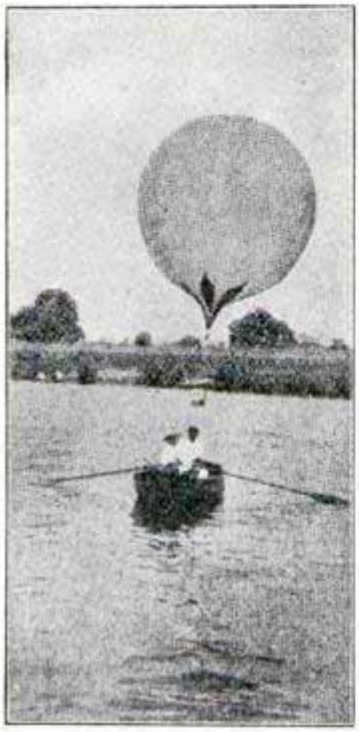
"Baltic." The load was so large the lower deck was piled full, and hundreds of sacks and bags were packed on the bridge. The Shipping World, London, says there was $3,000,000 in the registered letters alone.

Prussic acid is used in many localities in California for killing insects on fruit trees. One man's outfit for this work cost $10,000. Tents are placed around the trees and the fumes of the acid are liberated from a saucer at the roots of the tree.

Photographing From a Captive Balloon

Within the Reach of Every Photographer, Amateur or Professional--Expense no Longer an Obstacle.

It is quite possible to take photographs from a captive balloon so small that the experiment is robbed of almost all of its expense and the apparatus is convenient to its owner on any fair day he may wish to use it.



The balloon need not be of more than 500 cubic feet capacity (simply large enough to carry the camera and light attachments) and may be inflated by running a tube from the ordinary household gas meter to the balloon.

The balloon should be spherical in shape and made of some very light material of close texture. Light silk is one of the best materials for the purpose. Stitch the gores well together with strong, fine silk and coat the balloon with linseed oil varnish—a very thick coat. The neck of the balloon where

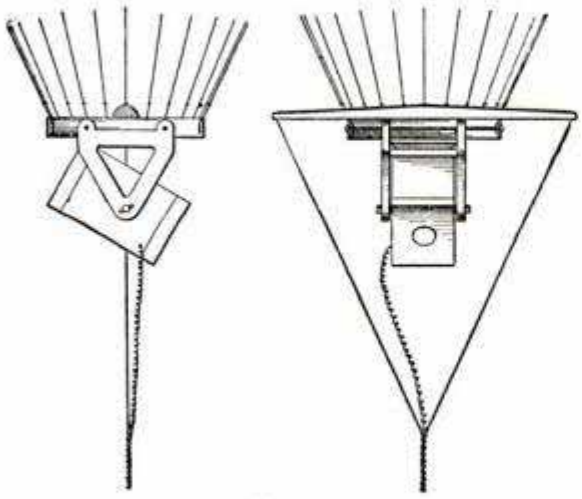


Fig. 1

the gas is entered is commonly left open. The purpose in this is that on ascending, as the pressure of the external air diminishes, the expansive force of the gas confined in the balloon greatly increases. For our purpose the balloon will not ascend to any great altitude, but were an ascent of several miles to be made, the expansive force of the gas would soon tear the silk envelope into shreds if there were not some means for a small amount of the gas to escape.

Over the silk envelope place a network of light, strong cords hanging down to the lower half of the envelope, and having cords or leading lines attached for fastening it to a hoop. A balloon of 500 cubic feet capacity can be inflated in about two hours.

For taking the photographs a camera of

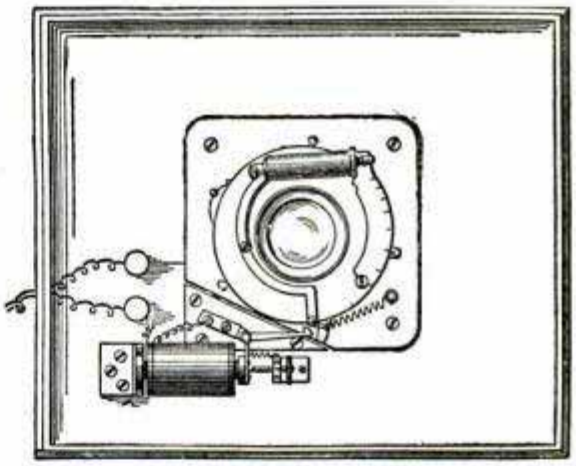


Fig. 2

box form with half-dark slides focused at infinity is most convenient. For attaching it to the balloon hoop use screw-clamped trunnions at its sides, mounted in triangular side frames, so that it can be set at any angle desired. This is clearly shown in Fig. 1. Fit to the lens of the camera a Bausch and Lomb shutter, as shown in Fig. 2, arranging a hook to hold it until it is time to remove the hook and release the shutter, this operation being performed by an electromagnet connected with a battery, which arrangement will be described further.

The length of the captive line may vary. Excellent photographs may be taken at an elevation of 150 feet and good ones at 500 feet. We would recommend the use of a long line, as there is a pleasure in experimenting with altitudes and comparing effects and results. The captive line should be

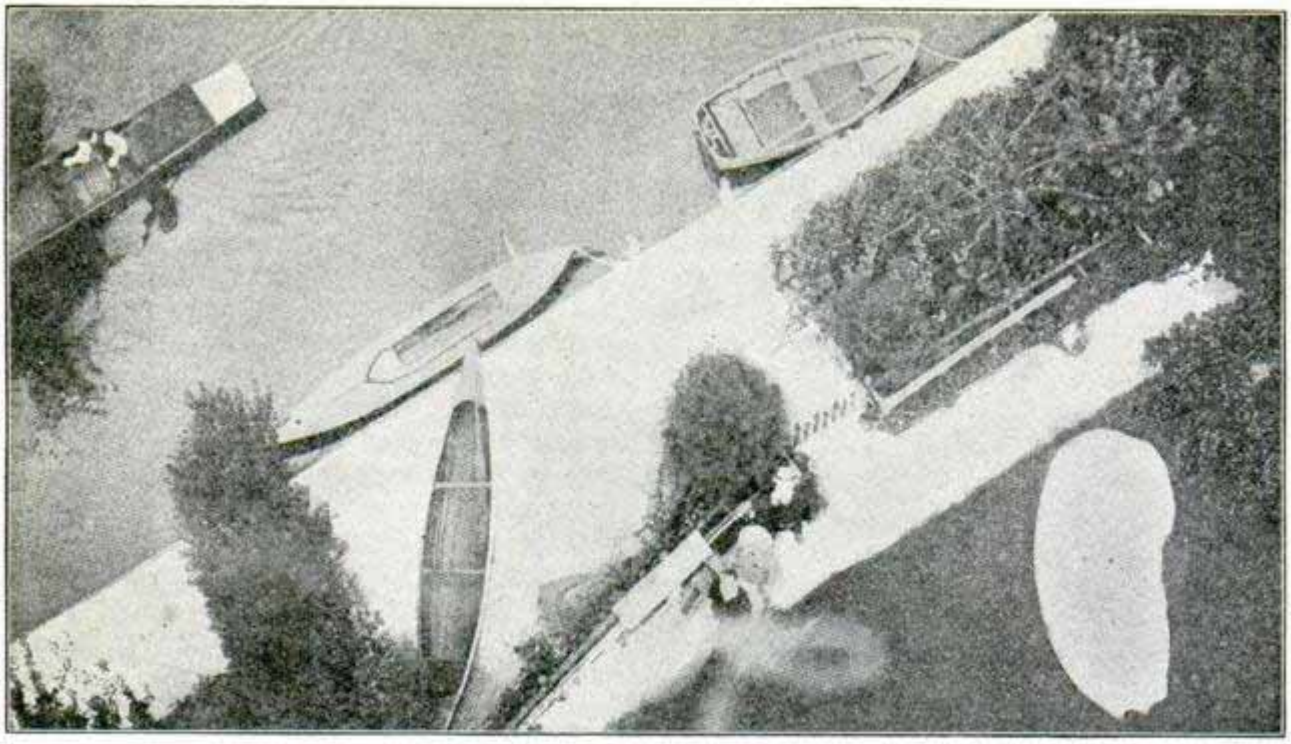


Fig. 3.—Broomwater Creek, England, Photographed at an Elevation of 160 Feet.

both light and strong and wound into a single cable with a double-strand flexible insulated conductor, such as is used in making telephone connections.

In Fig. 5 is shown a reel for winding and unwinding this three-strand cable. The reel runs on ball bearings and the inner ends of the two wires are connected with a plug terminal on the reel, so that a terminal battery may be connected at the moment the electric current is desired. The relation

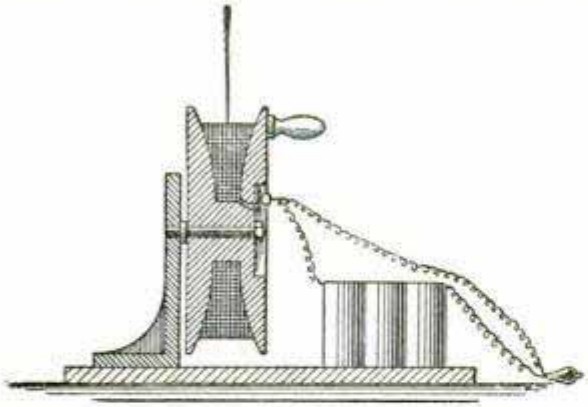


Fig. 5.

of the battery to the reel is also shown in Fig. 5. The battery has an electric switch for controlling the time of transmission of the current which releases the shutter covering the lens.

With this much of the apparatus prepared the rest is a matter of little time and trouble. Inflate your balloon, tie a string around its neck until you are ready to send it up, and tie bags of sand to the leading strings to hold it down, should there be any delay in proceedings. If the frame for the camera is ready, tie the leading strings to the hoop, being careful to tie them securely and at equal lengths. Insert the swing frame of the camera in the hoop, connecting it firmly by two long bolts. Pass the loose ends of the wires into the front partition of the camera and fasten them to the terminal screws of the electromagnet. Insert the dark slide and remove its front; set the shutter and adjust the hook for holding it in place.

If a true plan view is wanted, set the camera on its trunnions, with the lens pointing downwards. Release the reel and let the balloon carry the camera up—100 ft., 200 ft., or farther, according to your length of line and your wishes in regard to altitude. When it has ascended as far as desired apply a brake to the reel, insert the connection plug, press the button and send the current up the conductor, both that on the reel and that in the air, until it releases the shutter by means of the electromagnet lifting the hook and so effecting the exposure. The current may then be turned off and the balloon hauled down. To take another view, reset the shutter, change the plate and run the balloon up again. The captive balloon is held very steady by this method, whereas did the photographer himself ascend to take his views, the aerial craft would be susceptible to the least change in ballast. One aeronaut tells of sudden change in elevation of 20 or 30 feet

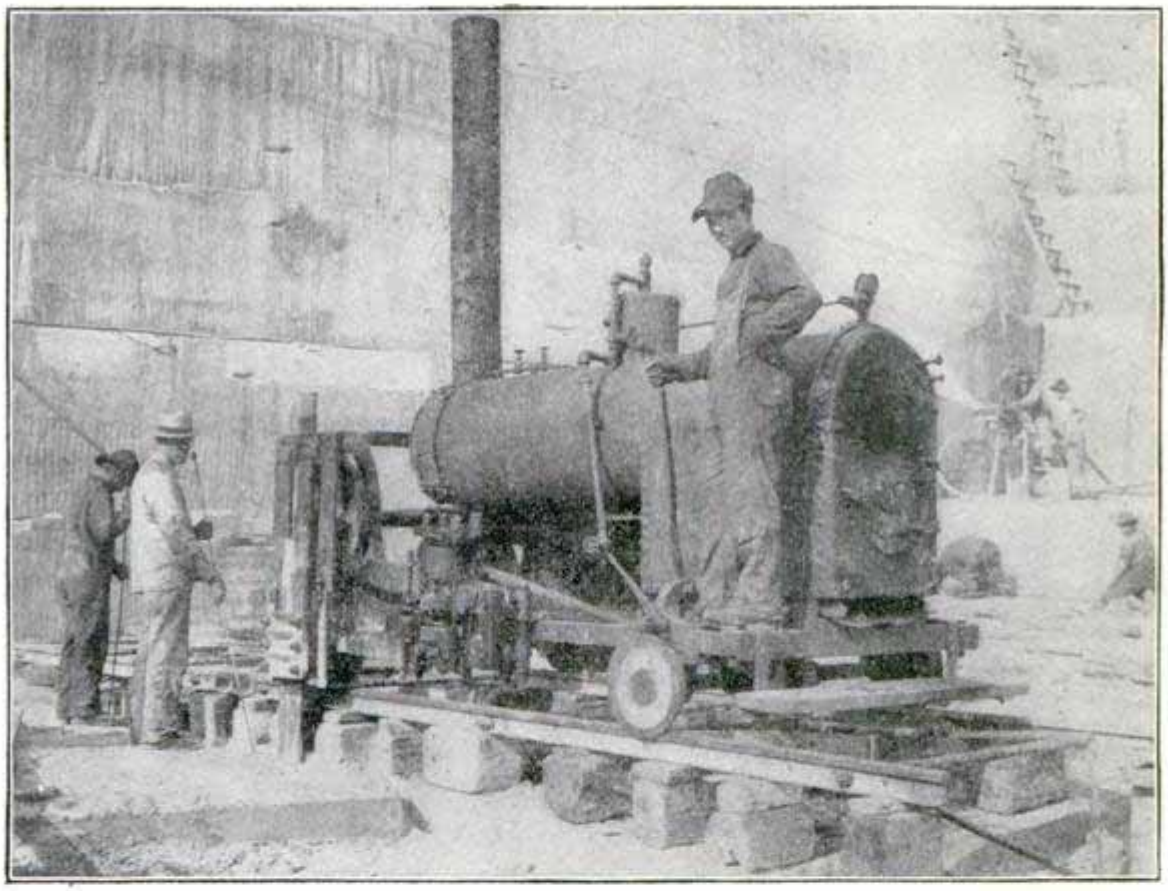
during a balloon voyage, due to his throwing out a chicken bone.

In Fig. 3 is shown a view of Broomwater creek, England, taken by a correspondent of Technics at an elevation of 160 feet. The three figures standing on the white path represent the operators of the captive balloon apparatus. On the seat is shown the reel and batteries. The white loop is caused by a portion of the captive line near the lens of the camera, a very common defect where the picture is taken vertically. The large white patch is the cover of a dinghy spread out on the grass to dry.

One of the great features, both of enjoyment and profit of captive balloon photography, is the complete control of the apparatus which may be maintained. Fig. 4 shows a balloon in an inflated state being carried down a river to the point where it is desired to take views. The balloon cannot be carried while inflated along crowded streets conveniently, but it is an easy matter to convey it by boat.

Naturally, it requires considerable experimenting to secure good results by this means. The balloon, the camera, conductors and connections must all be carefully adjusted, and probably readjusted, before the apparatus works entirely satisfactorily. But by this method captive balloon photography is quite within the realm of the possible for any photographer, amateur or professional, and will repay trying.

How Grindstones Are Quarried



Sawing Out the Rock

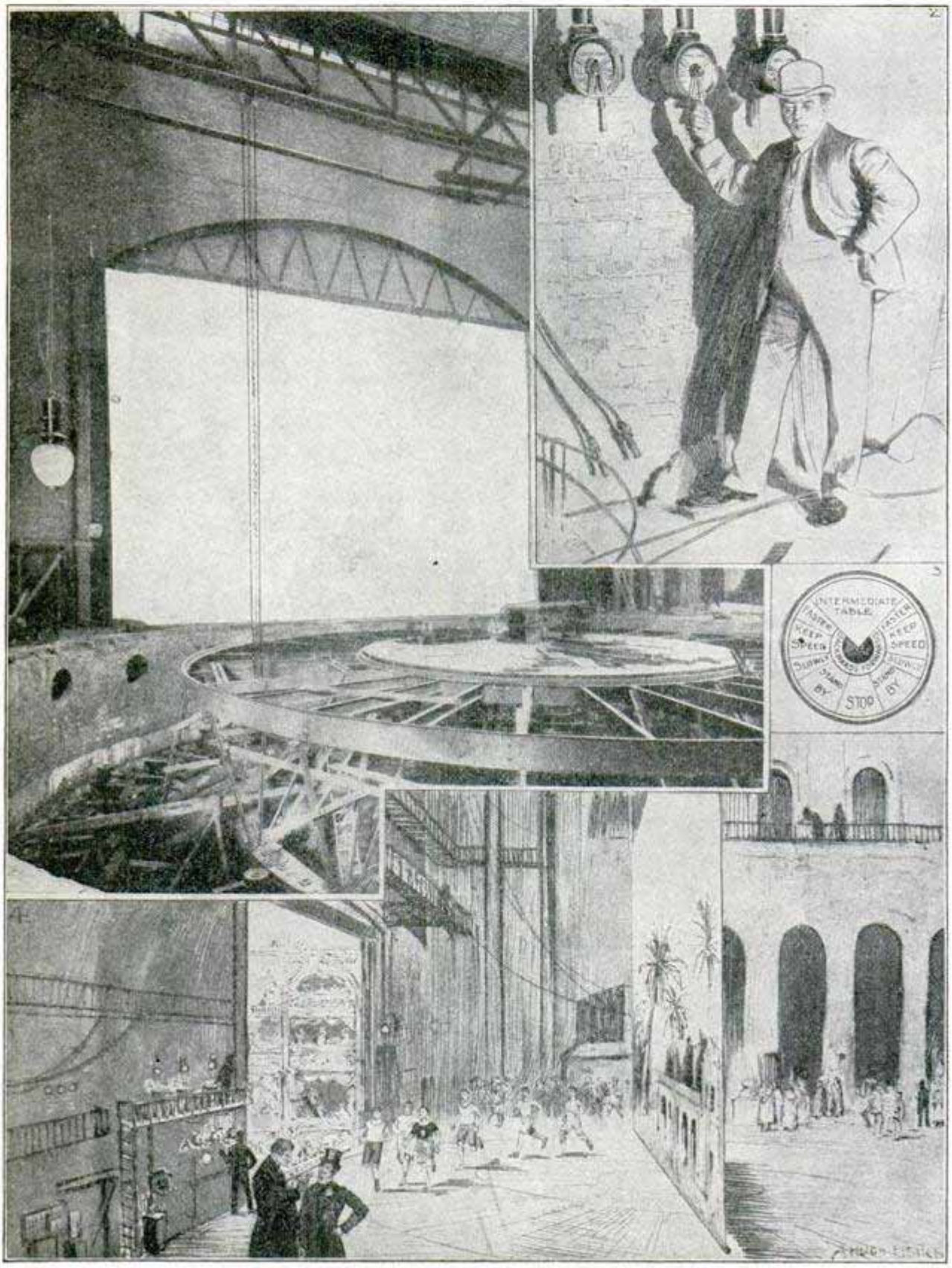
Recent reports of the United States geological survey state that there has been a decided increase in the grindstone production of the United States of late, due in great measure to the simultaneous increase in all kinds of manufacturing industries. The annual value of this product is close to $700,000, and the value of the annual imports of grindstones is about $75,000. The imports are mostly from England.

The American production of grindstones comes from Montana, Michigan, West Virginia, Wyoming and Ohio, the Buckeye state producing more than five times that of all the other states combined. The accompanying photograph illustrates the sawing of grindstones from the notable Ohio quarries with machinery. Holes are first bored and the saw works its way from one of these to another. Grindstones come from a particular stratum of the sandstone quarries, other strata in the same quarries being put to other uses. The grindstones are made into their round shape after they are taken from the quarry and are then ready for the market.

WONDERFUL REVOLVING STAGE.

A group of sprinters stripped for work, and running at full speed on the stage of a theater, but constantly in sight of the audience was the novel sight recently witnessed at the London Coliseum. That a man should run and not progress would be a paradox but for the fact that the runners were on a circular platform which was made to revolve as rapidly as they ran, and thus the performers did not pass from view. The mechanical arrangement is quite like that employed in the movable sidewalk.

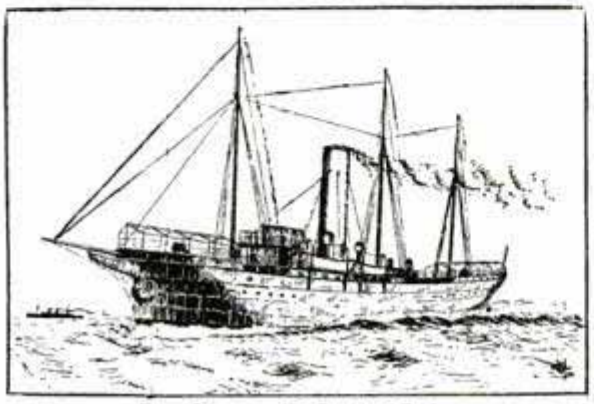
The construction consists of three concentric platforms which are revolved by means of fourteen small electric motors. In Fig. 4, at A, B, C and D is shown the



arrangement of the dials by which the speeds desired are telegraphed to the operator, who is located in the gallery above. One of the dials is shown in detail in Fig. 3 and in Fig. 2 the speed required is being telegraphed by means of a dial. A general view of the revolving stage arrangement is shown in Fig. 4, a foot-race being in progress on the revolving tables.

PILOT SHIP "FRASER" FOR CALCUTTA.

A new pilot ship, the "Fraser," has been built in England and is on her way to India, where she will be stationed at Calcutta. The ship is 281 feet long, 35 feet beam, and built



Indian Pilot Ship

to keep the sea in all weathers. Twin-screw propellers and ample boiler capacity enable a speed of 15 knots per hour over long distances.

ENGLISH SPRING WHEEL FOR AUTOS.

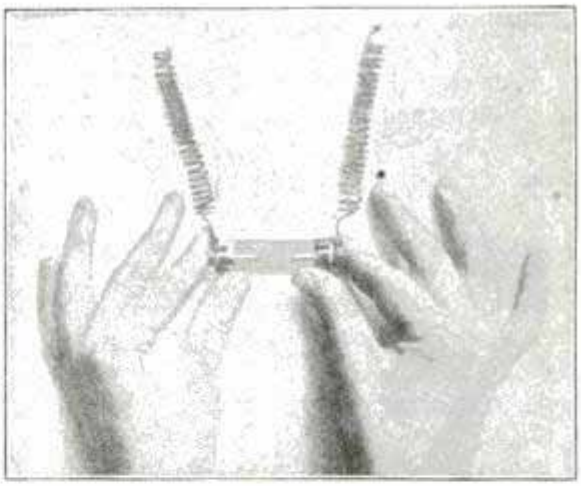
Spring wheels as a substitute for pneumatic tires are attracting attention in Eng-

Auto Spring Wheel

land as well as in this country. The invention illustrated has a pair of pointed star-shaped steel plates secured to each hub, and connected by a pin at each point of the star. Each pin carries a pair of triangular equalizing pieces between the plates, and a pair of triangular levers outside. Between the equalizing pieces are a pair of rollers, the rollers on adjacent triangles being connected by a series of plate-springs, the centers of which are attached to the star-plates by means of bolts passing freely through distance-pieces between the plates. Each bolt is also connected by pin joints to one pair of corners of the triangular levers already mentioned, the remaining pair of corners being jointed to the center of a pair of segments having rollers at the extremities which bear against the inner side of the rim of the wheel. It will be seen that any pressure on the rim of the wheel is transmitted from the plate-spring immediately opposite the point of application to the whole of the springs round the wheel by the agency of the equalizing pieces, and, further, that these springs are protected from any oblique strains by the triangular levers.

DEVICE TO INDICATE POLARITY OF ELECTRIC CURRENT.

A simple instrument is now procurable for determining the poles of a battery. A galvanometer is perfectly well adapted for the purpose, but is not very practical, says



Polarity Indicator

Scientific American. The trouble with pole paper and common blue-print paper is that both have to be moistened. A simple pole-tester, which can be had from any good electrical supply house, is shown in the illustration above. It consists of a glass tube closed at the two ends by a metal cap which is provided with a binding screw and a short internal metal rod. For the determination of polarity, the apparatus is put in circuit, and the liquid that it contains immediately becomes red at the negative pole. After the operation is finished, the tube is shaken to cause the color to disappear.

ONLY ENGINE OF ITS TYPE EVER BUILT.

A most unusual engine was recently installed on a scow in New York harbor, where it is operating a circular saw which cuts off piling at a depth of 30 ft. below the surface of the water. The saw is mounted on a vertical shaft and driven by

Courtesy of the Buffalo Forge Co.

Cuts Off Piling 30 Feet Beneath the Water

a 10-in. belt, which, from the peculiar construction of the engine has a quarter-turn in it.

The engine is the only one of its type ever constructed. It is of the enclosed type with a vertical shaft having two double-acting cylinders, made of close-grained charcoal iron, 10 in. in diameter with a 10-in. stroke. Steam is admitted by a single piston valve controlled by one governor located in the flywheel of the engine and supported on a steel plate attached to the arms of the wheel.

A thrust-bearing situated at the top of the shaft, directly under the flywheel, carries the weight of the main shaft, flywheel, governor and part of the connecting rods—a total of 1,750 lbs. distributed over 4,791 sq. in., a maximum pressure per square inch of 40 lbs.

The shoe of the crosshead, which is of the locomotive type, completely surrounds the guide-bar. The ratio of the length of the connecting rod to the stroke is a little over two.

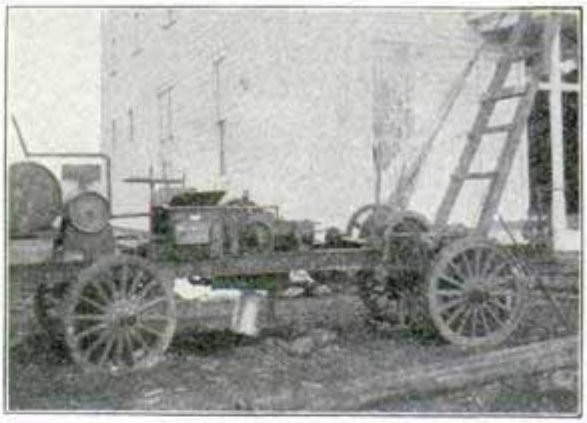
The engine is provided with a flywheel 5 ft. in diameter, and 13 in. in breadth, having a flange turned on one side. The crown of the wheel is only 5½ in. from the top of the wheel, so the belt tends to run above the flange and not wear its edge by contact with the flange.

One of the especial features of the engine is the lubricating system. All the oil is taken from a central reservoir and fed to the bearings by tubes, each tube having a sight-feed arrangement in connection.

A MOTOR WELL-BORING MACHINE.

A motor well-boring machine in which one gasoline engine is used both for propelling the apparatus from one place to another and for operating the boring machinery, also, is the invention of J. A. Yates, of Alturas, Cal.

The machine is adapted to speeds of one and one-half, three and six miles per hour. Because of the very bad roads to be traveled the rear wheels are fitted with steel tires 5 in. wide with ¾-in. "grousers" riveted on to give a grip where traction is poor. When the wheels cannot get grip enough to move the machine out of a bad place an 800-ft. steel cable is reeled out, secured to a tree or rock, and the motor thrown into gear with the cable drum, thus pulling the car out. The frame of the machine, constructed of steel of I-section with channel steel cross members, is very strong.



Motor Well-Boring Machine

Mr. Yates, in testing this novel apparatus, found it capable of climbing any hill having a road of any kind. The gasoline engine weighs 720 lbs., and the machine complete weighs 4,559 lbs.

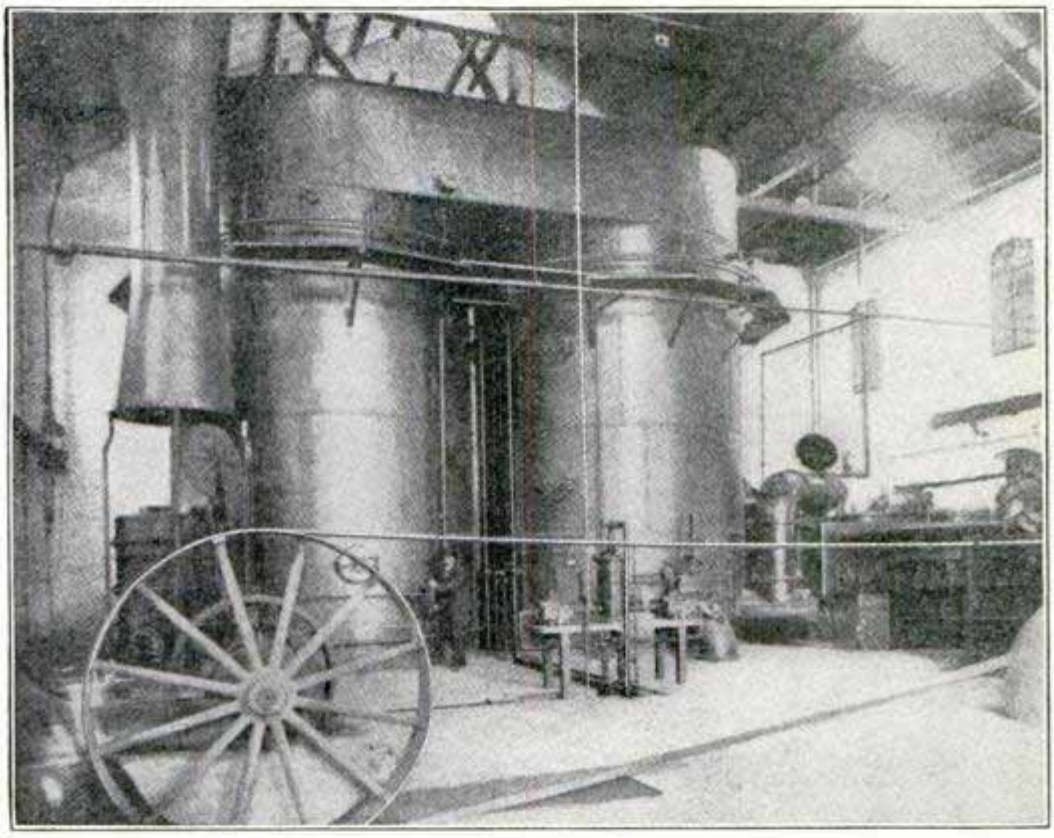
Largest Gas Generator Unit in the World

Produces 3,000,000 Cubic Feet of Gas Every 20 Hours--In Operation at Oakland, Cal.

What is believed to be the largest single unit illuminating gas generator in the world is producing 3,000,000 cubic feet of gas every 20 hours in Oakland, Cal.

The scarcity of coal and the abundance of oil has driven every coal gas plant but one in the state to the use of oil, and the former high price of gas has dropped to that prevailing in eastern states. The mammoth gas-from-oil generator is described in the Purifier.

The set comprises two steel shells, cylindrical in shape, sixteen feet in diameter and twenty-eight feet high, one being used as a generator, while the other is a superheater. These shells are connected at the top by a flue box, so arranged as to provide the largest possible opening for the flow of gas. Unlike other oil gas generators, this one contains no arches, and the oil is treated by heat radiated from checker brick and the walls of the lining, instead of by direct contact. The bottom portion of the generator is an open combustion chamber, drawn in at the top in a manner similar to the dome of a cupola, and while the inside diameter of the generator is eleven feet four inches, the neck piece at the top of the combustion chamber is drawn in to six feet. On the top of the corbel work, which forms the dome of the combustion chamber, there is a shelf nearly three feet wide encircling the generator, and on this shelf checker brick are laid to a point reaching the bottom of the flue connecting the two shells. The superheat is filled with checker brick, laid in the ordinary manner, with vertical flues of large area.



This Machine with One Man Produces 150,000 Cubic Feet of Gas Per Hour

The generator is connected by two 33-inch outlet pipes to a wash box provided with a seal and acting as a hydraulic main, and from this box the gas passes through a scrubber 12 feet by 30 feet, and two scrubbers 10 feet by 30 feet. The washing of the gas is done by means of sea water, as this gas does not seem to be as sensitive as coal gas for which fresh water must be used.

This machine which produces 150,000 cubic feet of gas per hour is handled by the labor of one man. There is no shoveling of coal and the most difficult work the gas maker does is to open and close a valve.

Fins for Propelling Submarines

Swims Like a Fish—Safety Chamber Permits Escape Should the Boat Sink.

Fins for propelling, impelling, directing and controlling submarine vessels is the essential feature of a new system of underwater navigation invented by a Mr. Middleton, of England. One of the important results accomplished by these fins is to enable the vessel to be navigated in three directions, instead of two, as in the case of the screw-propeller. That is, the submarine vessel equipped with the fins is able to be controlled in a vertical plane, instead of making alterations in its buoyancy to accomplish this end. This is most important, says the Illustrated London News, as the submarine vessel should be capable of moving in a vertical plane even better than in a horizontal plane.

The fins are driven by electric motors and the screw propeller provided, in addition to the fins, but its purpose is merely to simplify the mechanism for impressing the motion on the fins. The Middleton vessel, it is claimed, can be navigated and fought by the remarkably small crew of three men. Six men may be carried where a change of watch is required. The keyboard places all the parts under control of one officer, who by its manipulation may fire the guns, control the inclination of the fins, set the fin-motion going, reverse the electro-motor, control rudder motor, control the rudder, put pump in gear, control screw, and discharge topedoes. In Fig. 1, A and B show the fins flexed for raising the boat. A fin in detail is shown in Fig. 3. Fig. 1 shows the internal arrangement of a 300-ton submarine. The action of the fins is patterned after those of a fish, which by an almost imperceptible movement of its fins can place its body at any angle or poise.

Still another valuable feature of the Middleton boat is the automatic pump, which acts when the boat has descended to a depth that is dangerous, and which instantly changes the course of the vessel.

Another most interesting and novel feature of the craft is the safety chamber, by means

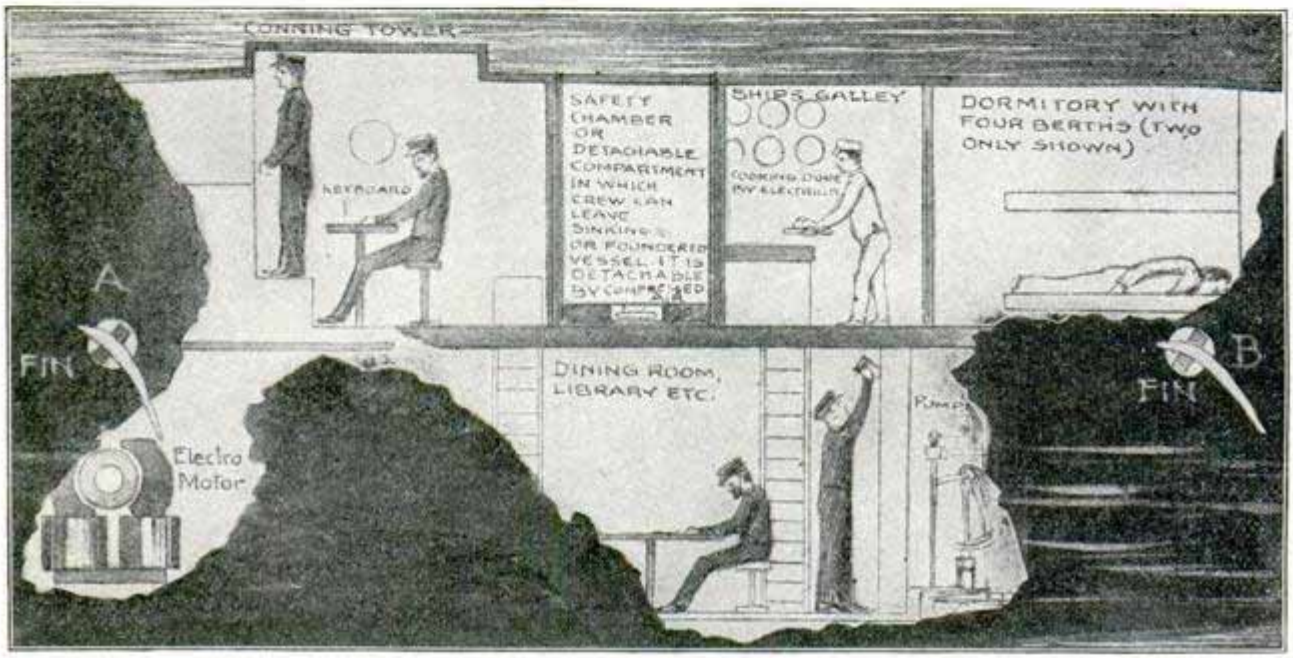
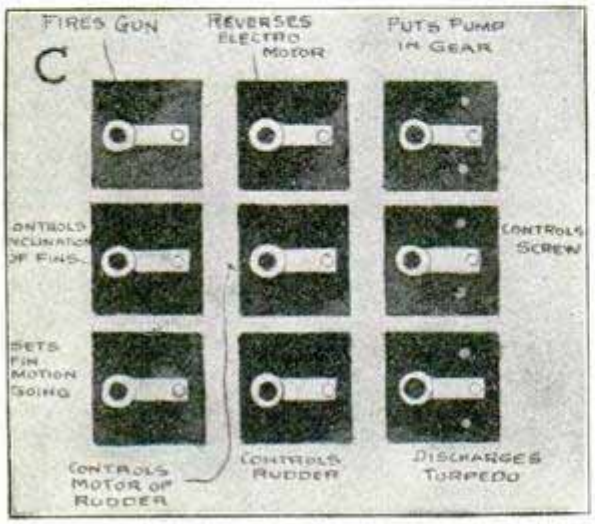


Fig. 1—Interior Showing Safety Chamber



Key Board which Does Things

of which the crew can be liberated and escape to the surface in case of accident to the submarine. Had this device been supplied in the ill-fated English submarine her crew could have escaped. The safety chamber is shown in the cut, and consists of a strong steel tank entered from the bottom. After the crew are in, the opening is closed and the tank released, rising quickly to the surface by its own buoyancy. On reaching the surface a cover can be removed from the top and the crew display distress signals.

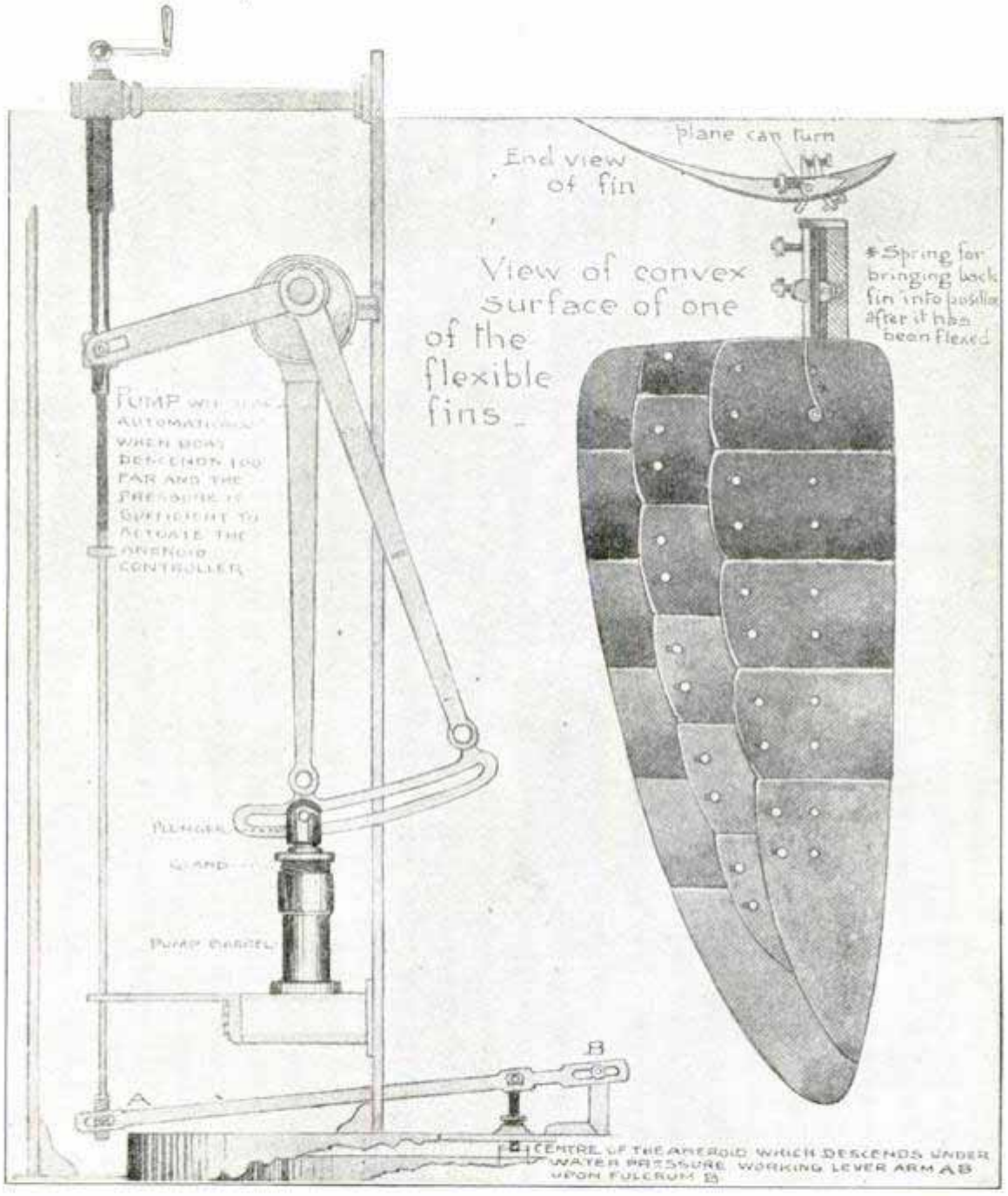


Fig. 3.—Detail of Fin: Pump Which Prevents Descent to Dangerous Depth.

GRADING COUNTRY ROADS WITH A TRACTION ENGINE.

In the vicinity of Durant, Ia., horses are used no more in grading the country roads, for it was found that a traction engine could draw two graders and take the place of 12 good horses, with an engineer to take care of the engine and one man to handle each road grader.

Does the Work of 12 Good Horses

The engine used was a double cylinder weighing about 20,000 pounds, having 6½-inch cylinder bore, 12-inch stroke, 200 revolutions per minute, and of about 125 pounds steam pressure. The graders are coupled to the tender, which is just behind the engine, and which carries a half-ton of coal and eight barrels of water. A team hauls an additional supply of water and coal enough to keep the machines going all day. The road graders do not follow the same track, but go side by side, one a little behind the other. The engine travels on the road about as fast as a team walks ordinarily.

MOSQUITO NETTING INSTEAD OF MEDICINE.

"I should have no fear of catching fever in the heart of a swamp if I had a proper sleeping place," declares Mr. A. W. Bayly, owner of the Gold Fields News, Barberton, Portuguese East Africa, and what Mr. Bayly considers a proper sleeping place is a place enclosed with mosquito netting or iron wire netting. To substantiate his statement Mr. Bayly relates personal experience.

After an absence he returned to his home to find that his eldest son had suffered from five successive attacks of malarial fever in one season, and he determined to try some preventive measures. The only gauze he could obtain at the place was a painted cotton fabric at 18 cents a square yard. With strips of old bamboo blind and small staples he fastened netting on the outside of all sash frames in such a manner that the windows could be opened readily. At French casements the gauze was fastened to the outside Venetian sun shutters; where there were no shutters it was fastened to the door or window frame itself. Outside doors were protected by light-framed porches. With a little care about closing doors or windows quickly the plan worked admirably. Mr. Bayly states that with this protection they have had no cases of fever for three years, though sometimes members of the family have been in unprotected houses for the night. There is only one species of mosquito—the Anopheles—which carries infection, and it only works at night and is innocuous during the daytime. It is sluggish and less industrious than the other species—the Culex—and therefore is not so apt to get in, but once in, its presence is not detected easily, for, unlike the Culex, it does not hum.

Later wire gauze was obtainable, but on the whole was not so satisfactory as the cotton gauze. The wire gauze has a nicer appearance and does not collect dust, as does the cotton, but the sea air causes it to oxidize and drop to pieces.

During some experiments as to the efficiency of this method, the camps of some railway construction gangs in Italy were protected with gauze and the men cautioned to be indoors between sunset and sunrise. An equal number were left unprotected, but dosed with quinine and other preventives. On the sections protected with screens the percentage of fever cases was but 5 per cent, while on the unprotected sections it was 95 per cent.

It is stated by United States Consul Hollis, Lourenco Marquez, Portuguese East Africa, that where wire netting, of English manufacture, has been used for this purpose, it is falling to pieces after a year's use, and that the only mosquito nettings that will stand the climate are the different galvanized and composition nettings made in the United States, and therefore firms in this country are receiving large orders.

Nikola Tesla has announced the invention of a "telautomatic" torpedo which, if adopted by the governments will stop the building of battleships and make forts needless. He says this new torpedo can be directed and submerged at will with a greater range than the largest gun; that its precision is unerring and its effect wholly destructive.

SUSPENSION BRIDGE FERRY AT NEWPORT.

An aerial ferry is being built at Newport, England, over the river Usk. Instead of a steel girder construction as in the bridge ferry at Duluth, described in Popular Mechanics last month, this one is hung from a suspension bridge consisting of sixteen steel cables each 2⅝ inches diameter. The span is 645 feet, and the towers 241 feet high are guyed by 32 steel ropes carried back 520 feet. The Shipping World says:

The platform carrying the traveling frame from which the car will be suspended will have two service foot-ways, and its total weight will be 539 tons. The traveling frame will be furnished with sixty cast steel wheels, carried in steel brackets secured to the longitudinal members of the frame, and will be 104 feet in length over all. The car will be attached to the traveling frame by thirty suspension ropes, which will be so fixed as to prevent any swaying motion during high winds. It will be divided into a central roadway space, and two roofed-in footways and a pilot house or motorman's cabin will be erected on one side to contain the controlling apparatus. The car will be 33 feet in length and 40 feet in width, and in itself will weigh 31¼ tons. It is designed for a proof load of 66 tons in addition to its own weight. The frame and car will be propelled by steel wire ropes wound on a drum worked by electric motors erected at one end of the bridge platform, the actual control being from the car itself. The rate of travel will be 10 feet per second.

OPENS WINDOWS WITH COMPRESSED AIR.

Opening and closing windows is the latest application of compressed air. An ordinary water motor or small electric motor in the basement does the compressing and the air is conducted through small pipes to one cylinder for each window. Two small valves control the action of the piston, one for raising, the other to lower the sash. The device moves noiselessly and is said to be inexpensive.

Save your Popular Mechanics each month, bind them at the end of the year and you will have a valuable book for reference at no extra expense.

GALVANIZING BY THE "SHERARDIZING" PROCESS.

New and Simple Method by Which Iron and Steel Are Protected from Corrosion.—Low Temperature Required.

Hitherto electro-zincing, or cold-galvanizing, and hot galvanizing have been the two methods used in coating iron and steel with zinc as a protection against corrosion. Both of these methods have great disadvantages. "Sherardizing," a new process lately employed for this purpose, combines the good points of the two other methods and further recommends itself on the quality of simplicity, the coating of zinc being applied at a temperature several hundred degrees lower than the melting point of zinc.

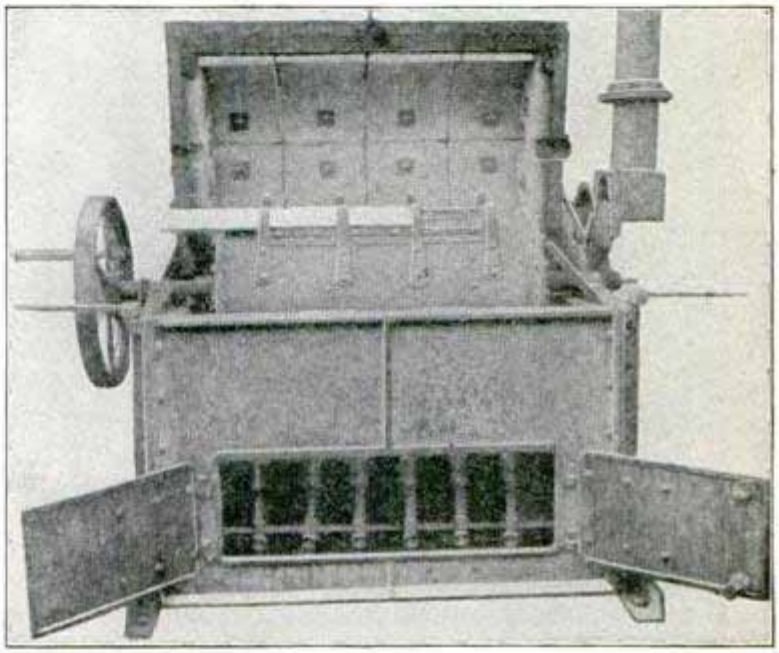


Fig. 1. Sherardizing Drum for Small Work.

Articles to be Sherardized are first freed of scale and oxide by dipping in an acid solution or by sandblasting. Zinc dust, obtained during the process of distilling zinc from its ores, is used for coating the metal. The zinc dust costs about $97 per ton. It cannot be smelted or reduced to a metallic form under ordinary conditions, even by very high temperatures, it is, therefore, especially adapted to a process of dry galvanizing as the zinc will not melt when the furnaces are overheated. Articles to be Sherardized are placed in airtight receptacles charged with zinc dust. The inside of the receptacle is coated with plumbago or black lead to prevent it becoming coated with zinc. Articles coated with grease take a better coating of zinc than those free from grease.

The type of furnace generally used for

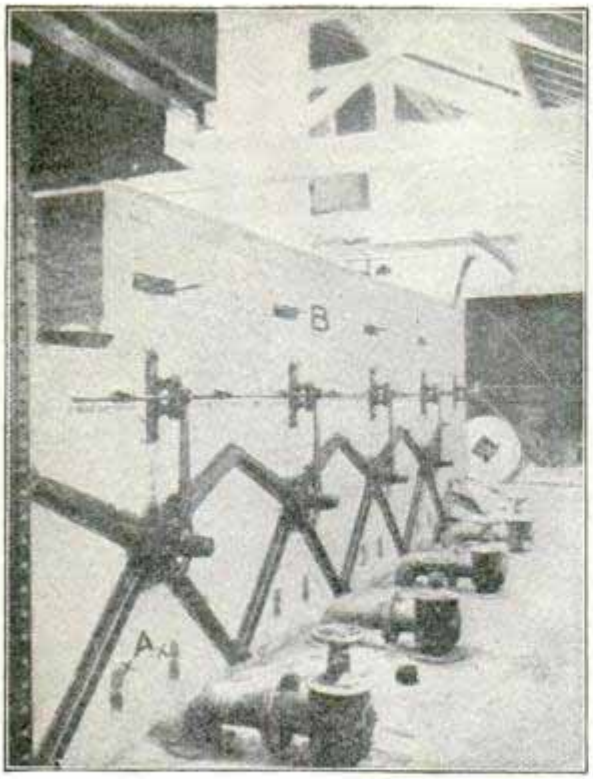


Fig. 2. Controlling Valves to Furnaces.

small work has a cylindrical closed iron chamber which is rotated on an axis. The chamber has a side door of iron, if to be used for small articles, such as bolts, small castings, nuts, etc., or an end door if for tubes and other oblong articles. The construction differs a little in these two cases, in order to insure the articles being turned over so they will receive a uniform coating. In such a furnace one of the trunnions is made hollow so that a pyrometer may be inserted to register the temperature. Bunsen gas burners are arranged below the furnace for heating the drum and the whole is enclosed in a cast-iron shell lined with fire-brick. The drum may be geared to rotate constantly, or may be turned intermittently by hand. (Fig. 1.)

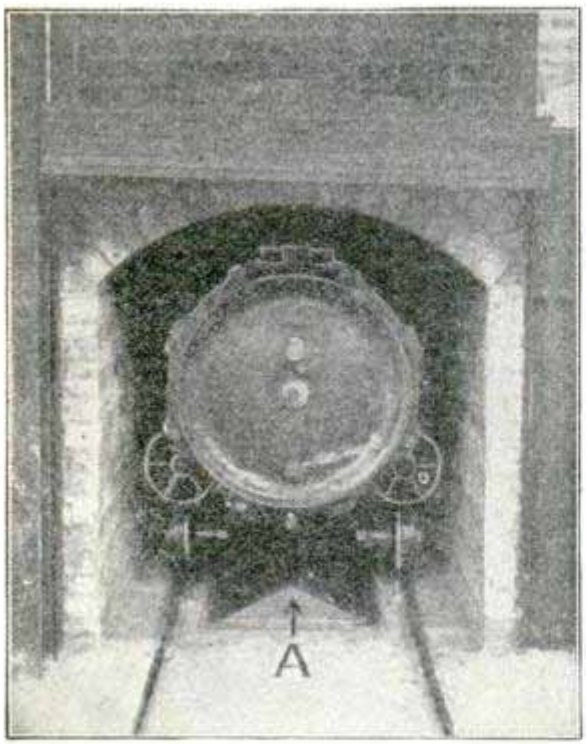


Fig. 3. Gas Burner and Drum.

In one big Sherardizing plant where four furnaces capable of taking drums 8 inches by 2 inches, with a capacity of two tons of material per charge, are in use, the furnaces are heated by gas led by iron pipes to the back of the furnaces. The supply is controlled by iron cocks and the gas is conducted through brick channels, having inlets (A, Fig. 2), through which the air is drawn. The gas is burnt through cast-iron burners (A, Fig. 3.)

To charge the drum it is placed on a truck, which is run on to a table (Fig. 4); one end is lowered by gearing and the zinc dust is charged into the tilted end from an upper floor through a chute (F, Fig. 5.) A drum being discharged over an iron grating which allows the zinc dust to fall into a chamber below, from which it is raised by a chain elevator is shown at G, Fig. 5. When charged with the zinc dust the drum is brought to a horizontal position, the air is exhausted and the truck run on tracks to the furnace; it is then lifted on to a furnace truck, which economizes heat. The drum is pushed into the furnace, the door is closed and the furnace heated to the temperature required, or from 500 degrees to 600 degrees F. When it has been in the furnace a sufficient length of time the door is raised and the drum and carriage drawn out into an open yard. Here it is allowed to cool until it can be easily handled.

Sherardizing forms a more lustrous and metallic coating than does cold galvanizing and a more uniform deposit than any other process.

"Articles can be Sherardized at a few hours' notice," says The Electrical Magazine, London, "starting all cold." The temperature required is so low that the minimum of fuel is consumed; the articles do not require so much cleansing as in other processes, making the labor less and the economy more.

To make a good blackboard paint moisten 4 oz. lampblack with alcohol; rub out with a spatula, and gradually add 1 qt. shellac. Stir in 3 oz. flour of pumice and 3 oz. pulverized rottenstone. Strain carefully; apply quickly and evenly; let stand two days and apply another coat.

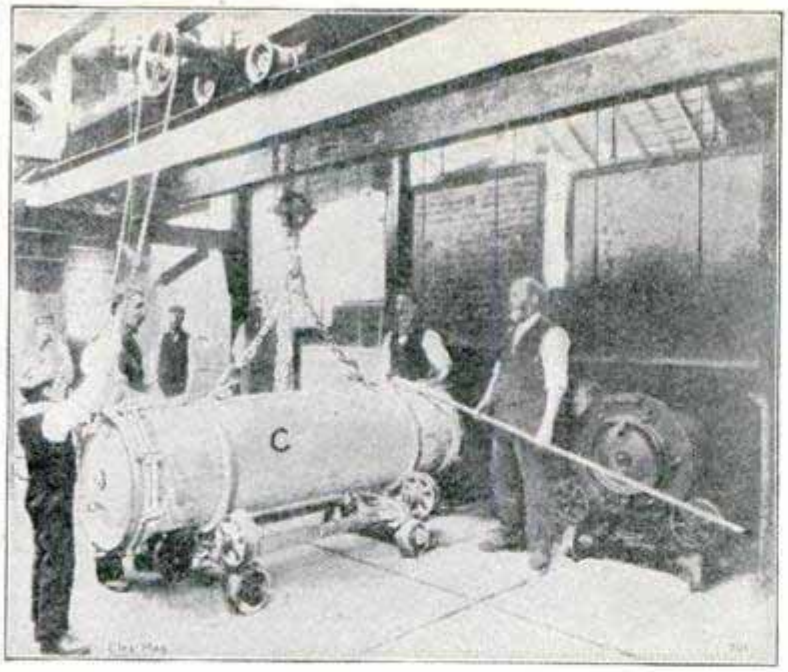


Fig. 4.—Placing Drum on the Table for Charging

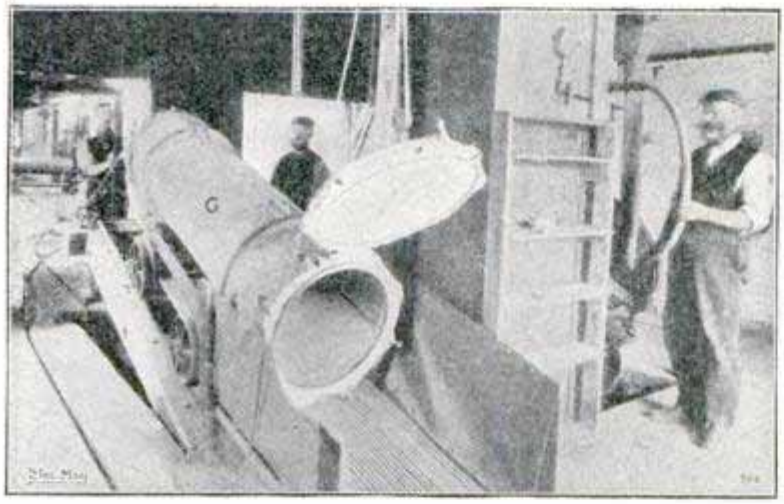


Fig. 5.—Drum in Position for Charging

OSTRICH RACING

When a dealer goes to an ostrich farm to buy a bird or two he selects the ones he wants by racing them. He chooses two or three he likes and these are ranged in line and shown a bunch of figs. Then the man with the figs goes a quarter of a mile away and the ostriches are started.

It is quite thrilling to see them with their long bony legs covering the ground at an amazing rate. The one who wins seems to enjoy his victory and if he is much ahead of the others eases up towards the last and reaches the goal at a walk, perhaps.

The dealer buys the winner, as the fastest is also the strongest.

NEW EXCURSION BOAT REGULATIONS RIGID.

New government regulations for excursion boats require that loose or compressed cork life preservers shall be abolished and the attaching of preservers to racks by wires, also. A preserver must be provided for every passenger and member of the crew.

All steamboats must be provided with fire buckets, barrels, axes and steam fire pumps capable of throwing a stream from two nozzles on each deck, at least fifty feet.

Taking Instantaneous Photographs By Electric Light.

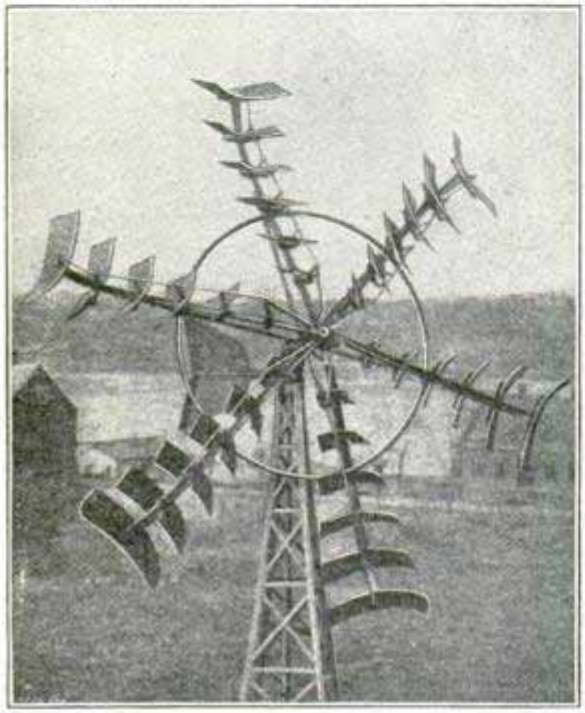
Instantaneous photographs may now be taken by electric light. A French photographer has devised an apparatus by which he can control perfectly the quality and amount of illumination and take photographs instantaneously at the moment of the subject's best pose.

A large parabolic reflector of aluminum has placed on its inner edge a series of incandescent lamps shaded with ground-glass screens. These light up the subject so that the photographer can secure the pose and determine the instant for the real exposure. An arc light with three carbons is in the center of the aluminum reflector, one carbon being fixed, the others movable.

To take a photograph, the subject is arranged, the sensitive plate exposed, and the instant the pose is best the photographer presses a rubber bulb which draws the two movable carbons across the fixed one, forming a brilliant arc. The movable carbons are drawn away from the fixed one by an electromagnet the moment the current passes through the lamp, thus extinguishing the arc. The time of exposure is about one-fiftieth second and the results are said to be most satisfactory.

CONICAL WIND MOTORS USED IN CONNECTION WITH STEAM ENGINES.

The Danish government, which has devoted more study to windmills than any other nation, announces the result of several years' experiments and declares in favor of the conical type of air motor. The experiments were conducted by Prof. La Cour, near the town of Ascov.

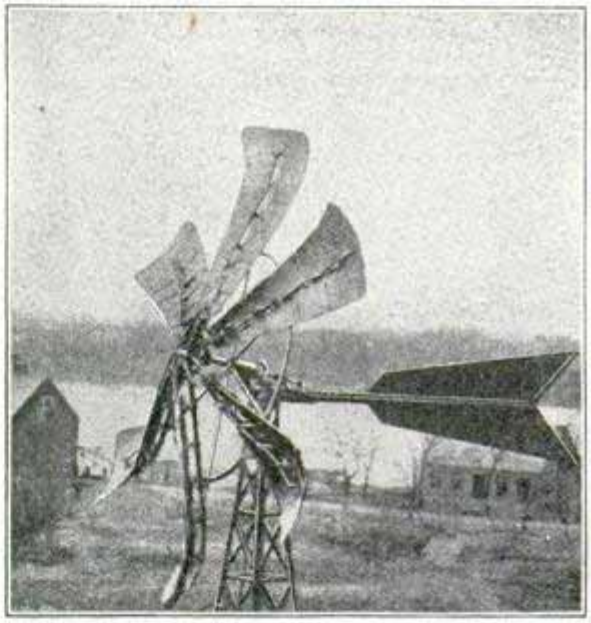


Conical Wind Motor with Wings Open

Some time ago a great storm shattered four of the 10 sails of a windmill, but the motor showed greater power than before. This fact showed that the ancient principle according to which the amount of power gained would be the higher the greater the surface, was false, and further experiments by Prof. La Cour go to bear out this conclusion.

The Electrical Review, London, says: That the wind acts on a perforated surface with a power much greater than in the case of an equal surface closed throughout, is borne out by the following experiment: Two plank fences of the same thickness and height, one of which had intervals between the planks, while the other was compact, were submitted to the action of the wind, when the open fence was thrown down, though the compact fence obviously opposed the greater surface to the wind. A further fact known in this connection is that perforated sails will work more satisfactorily than those free from any holes, and this has been utilized in a recent Italian invention.

Conical wind motors are in many cases used in the place of a steam engine. Pumps, wood and iron-working shops, and agricultural and milling plants may be operated by these wind motors, which do not require any appreciable amount of supervision; they may also be used for generating electricity. For the latter purpose, the firm of Theodor Reuter & Schumann, of Kiel, Germany, who are the manufacturers of the motors, have designed a very simple apparatus for regulating the speed of the gearing driven from the wind motor with absolute accuracy, as required by a dynamo. Another device enables a wind motor and a steam engine to work jointly on the same transmission, when the wind motor serves to relieve the steam engines, thus securing a considerable saving of coal. In the event of the intensity of the wind decreasing so that the wind motor cannot keep up to the speed of the



Conical Wind Motor with Wings Closed

steam engine, another device will throw it out automatically during the time of low wind intensity; the steam engine never has to turn the wind motor round.

ELECTRIC FANS IN WINTER.

Electric fans may be used to advantage even in winter. Placed in show windows they will prevent frost forming on the glass except in the very coldest weather, and when set upon a steam radiator they will drive the warm air to any part of the room desired.

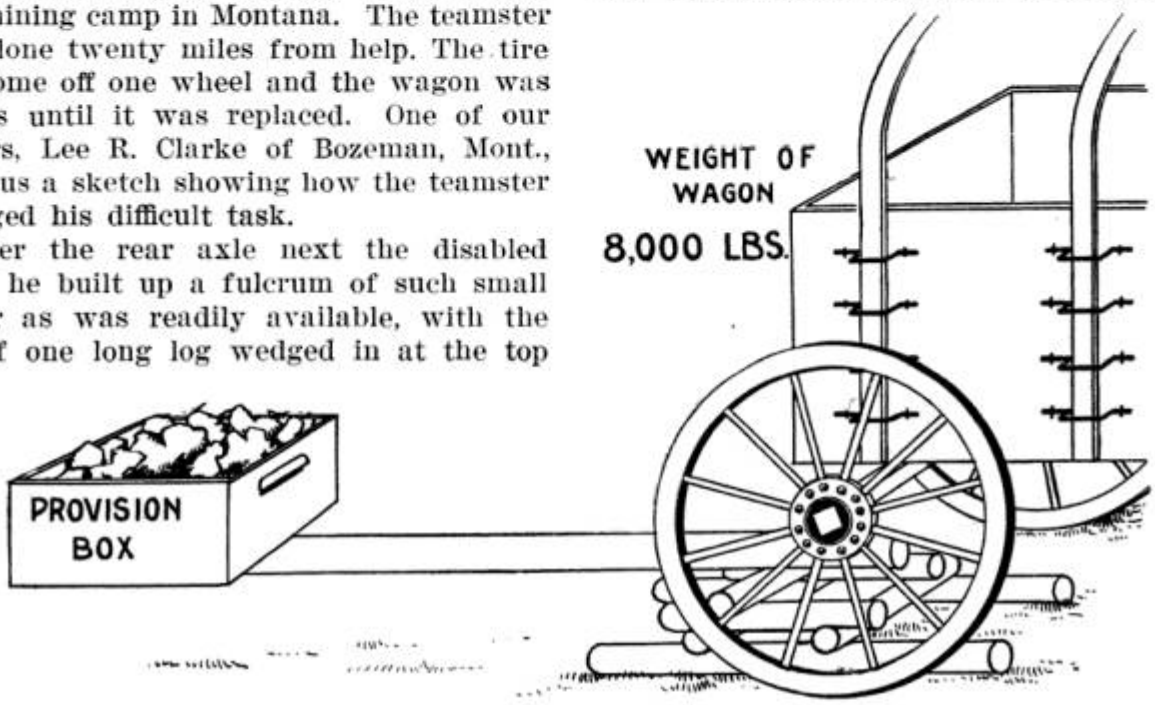
Flat steel scrapers are the best tools for removing polish from flat surfaces.

SHOP NOTES

REPAIRING A WAGON LOADED WITH 8,000 LBS. OF MACHINERY.

A wagon loaded with heavy machinery, wagon and load together weighing 8,000 lbs., broke down while on the way to the Crooke City mining camp in Montana. The teamster was alone twenty miles from help. The tire had come off one wheel and the wagon was useless until it was replaced. One of our readers, Lee R. Clarke of Bozeman, Mont., sends us a sketch showing how the teamster managed his difficult task.

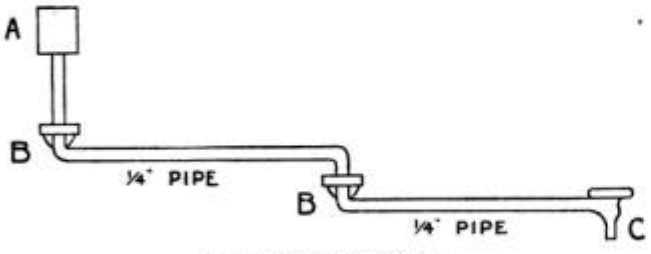
Under the rear axle next the disabled wheel he built up a fulcrum of such small timber as was readily available, with the end of one long log wedged in at the top next the axle to serve as a lever. At the other end of this log was fastened a provision box, and into this were piled rocks until the weight was sufficiently great to bear down the end of the pole on which it rested, and so lift the wagon resting on the other end, when the wheel was easily repaired.



Repairing a Loaded Wagon.

A HANDY SHOP LAMP.

A very handy shop lamp may be made in the manner shown in the sketch. A is the tank, B and B are union swivels, and C is the burner; ¼-in. pipe should be used.



A Handy Shop Lamp.

This lamp can be swung to any position, making it especially adapted to shop use.—Contributed by Roy Adams, Peotone, Ill.

WHAT TO DO IN CASE OF INSENSIBILITY OR UNCONSCIOUSNESS.

Concussion or stunning, caused by blows or falls upon the head or fall upon the feet, may cause mental confusion for a time, and may be accompanied by laceration of brain substances with hemorrhage and clot.

Alcoholic intoxication closely resembles apoplexy. Every doubtful case should be treated the same as cases of apoplexy until the attending physician has decided which is the condition.

In all cases, before the arrival of a physician, it is safe to secure quiet and rest by laying the person flat upon the back, with the head a little raised; heat may be applied to the body if it should appear cold. If there should be great heat of the surface, especially during very hot weather, cold may be applied to the body and head, or the body rubbed with ice. Use no whisky or wines.

The cautious inhaling of smelling salts or hartshorn, followed by some warm drink, may be permitted, provided there is a long wait before the arrival of the physician. But all this must be done with care, with the head lifted up so that the patient may drink more readily, for in this condition the liquids are liable to enter the lungs instead of the stomach, if poured in too rapidly.

ANOTHER PUMP-ROD FISHING DEVICE.

A description of another device for fishing broken pump rods is sent us by E. H. Harrison, of Dallas, Tex. He writes:

We have a well 1,230 ft. deep from which we have to pump our water, using a large lift pump. The rods are coupled together,

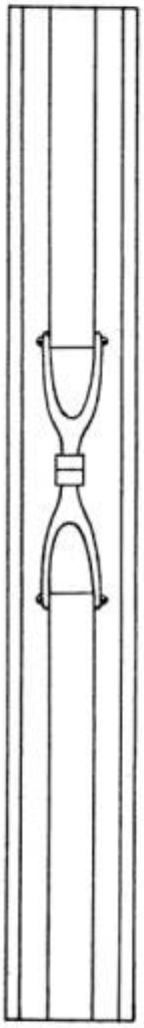


Fig. 1.

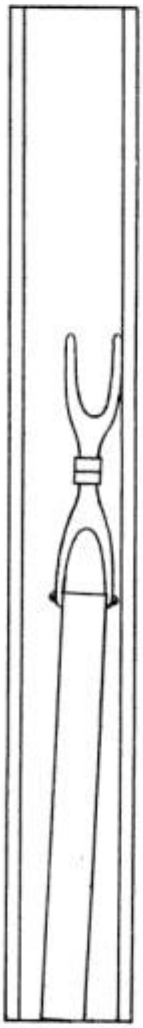


Fig. 3.

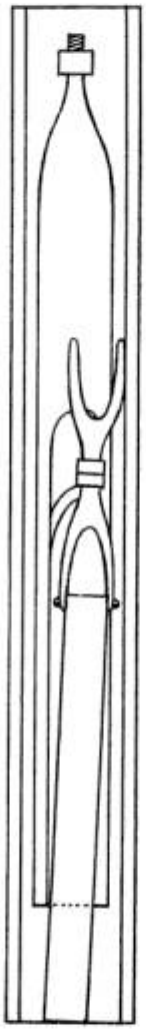


Fig. 5.

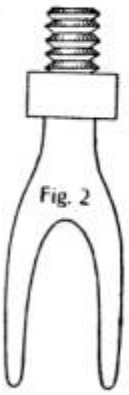


Fig. 2

with couplings as shown in Fig. 2, with the end of the rod put in the fork of the coupling and fastened there with brads, Fig. 1, and the couplings having male and female ends are screwed together.

Sometimes the rod pulls out of the fork leaving it in the shape shown at Fig. 3, with the fork against the side of the casing, making it very unhandy to get at. The cheapest and quickest method of fishing them out is as follows:

A fishing trap as in Fig. 4 is made, using 3-in. pipe, with a 2-in. slit about 4 ft. long in one side, with a steel dog on the opposite side to catch under the shoulder of the coupling. The slit in the pipe allows the fork to pass up the pipe far enough to allow the dog to catch under the shoulder of the coupling as in Fig. 5. Where the rod is broken the pipe without the slit is used.

BORING TENONS ON WAGON SPOKES.

Boring tenons on wagon spokes is a hard job where a common brace is used and one which requires a great deal of muscular power. Nearly every shop nowadays, however, is provided with an upright self-feed drill, which reduces the difficulties to a minimum.

To bore the tenons, make a small countersunk hole in the floor perfectly plumb under the drill shaft. Fit the spoke auger so it will run true and straight, put the wheel in place and proceed as though drilling a hole. The tenons will be perfectly straight and square with the wheel, every one alike, and the job done with no hard work.—Contributed by W. H. Raymond, New Sharon, Ia.

A GOOD CEMENT FOR CRACKED IRON POTS.

Knead 60 parts of clay and 10 parts of iron filings with linseed oil to make a thick paste. Add a little linseed oil just before applying and let it dry slowly. Will harden in two or three weeks.

OIL CEMENT FOR PORCELAIN.

Into 10 parts boiling linseed oil previously boiled stir 20 parts white lead and 12 white pipe clay. Knead the mass thoroughly. Let articles cemented stand several weeks to harden.

The height of a column of water in feet multiplied by .434 gives its pressure in pounds per square inch.

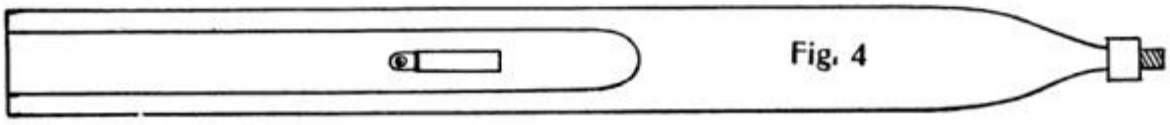


Fig. 4

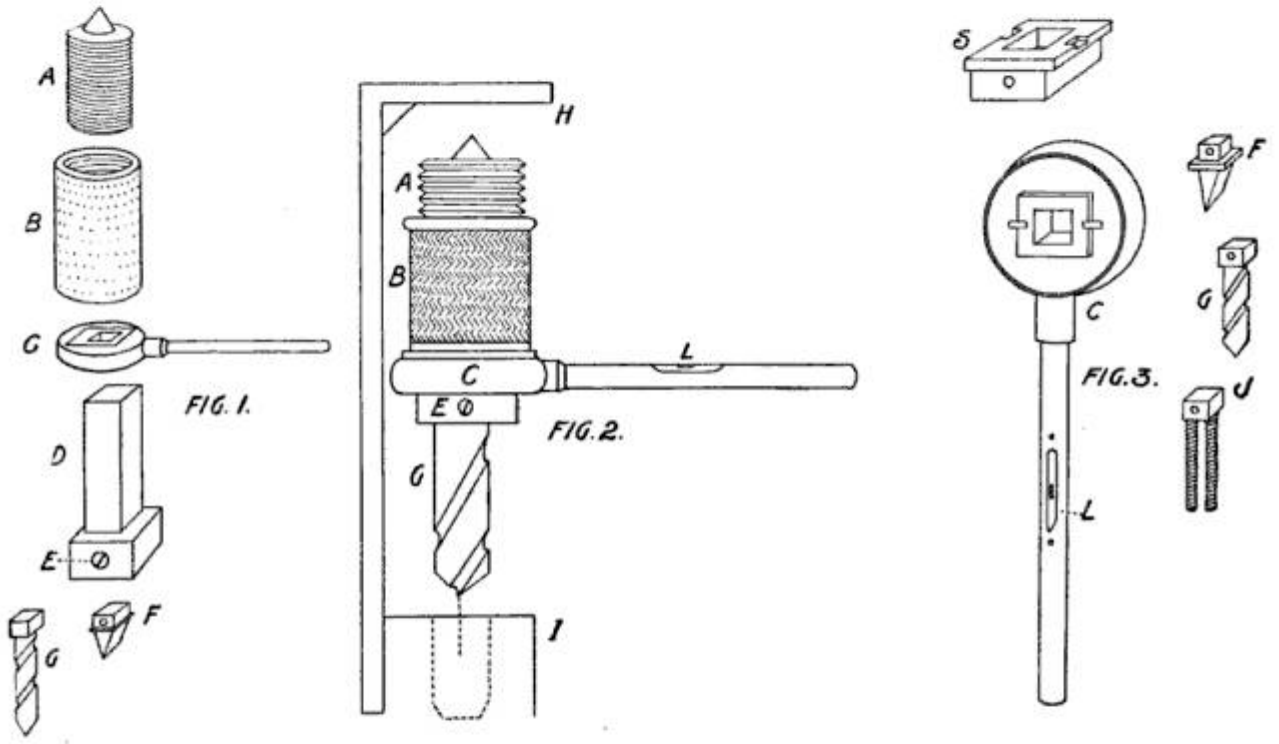
HOW TO BURN CHARCOAL.

First get good sound wood, black jack, black oak, elm, cedar, pine or walnut, and cut in four-foot sticks. Build a three-cornered pen out of wood eighteen inches across and about four feet high, says a writer in the Blacksmith and Wheelwright. Then begin to stack the wood on it and around the pen. Stack it close, and when you have a space large enough on top of the stacked wood, build the three-cornered pen higher. Then begin to stack short wood on its end until you can use long wood again, and so on. Then cover the wood with straw or hay about two inches deep. Have the straw even and as smooth as possible. Then begin to cover with dry dust and cover as thin with dirt as possible. Open a hole in the top of pit where the pen is and drop the pen full of chunks that are afire in order to start the pit to burning. Then make about five or eight holes at the bottom of the pit to give it air. Don't let it burn too fast. When it is well afire cover the top with short chunks, and straw and dirt; watch it closely. Punch a few small holes in the pit at the top to allow the smoke to come out. When the smoke is blue, stop the hole that the blue smoke is coming out of, and don't give it quite as much air at bottom through the air-holes.

As fast as the wood is burnt into coal next to the straw rake the straw out of the dirt and let the dirt to the coal, and when the whole pit is charred get the dry dust next to the coal and stop all the air-holes. The fire will then go out. Then draw out a little at a time and let the dirt still lay on the pit till it is all drawn. Coal is harder to burn under green dirt. It should burn about eight or ten days in a pit with one hundred bushels in it.

A HANDY RATCHET DRILL.

This handy ratchet drill is in six pieces and is shown in several combinations in Figs. 1, 2 and 3, in each of which the parts are correspondingly lettered as follows:



Handy Ratchet Drill.

A, feed screw; B, knurled feed; C, ratchet; D, chuck; E, set screw; F, screw driver bit; G, drill bit; H, rim of pulley; I, hub of pulley; L, level in handle of ratchet; S, bushing; J, tap.

The merit of this tool is in its great adaptability. Each piece fits snugly into its place. When used as a wrench or screw driver the tool may be used right or left-handed by turning the ratchet over. The handle may be taken out and used as a level; the bushings are in six sizes from ½ in. to 1 in.; screw driver bit, four sizes; tap, six sizes.

Such a tool made by a skilled workman from the proper materials would be a convenience hardly to be overestimated.—Contributed by Lee R. Clarke, Bozeman, Mont.

When an English journal tells about "petrol" it means gasoline; and "paraffin" is their way of saying kerosene, while spirits of wine means alcohol.

HOOKS AND POWER TRANSMISSION.

A Study of the Weak Points and Their Remedies

The employment of hooks for wires, cables and certain types of coupled belt ends in power and transmission is much more common than formerly. Hooks are very convenient for the purpose of unclasping the drive temporarily, and various designs of them are in use. The sketches herewith explain some of the points relating to their use. The hook shown in Fig. 1 is one of the usual type employed for joining any two ends of cable, endless chain system or belting arrangement in drives. The hook is found designed in several ways. Possibly the weakest type is that as exhibited, for the reason that there is a lack of ample bulk of metal at the point B where excessive strain occurs when the hook is drawn by the coupled parts. The hook circle at A may be properly described and a secure style of oval obtained for locking, but the shoulder portion at B, where the part is reduced in size, is fatal. To overcome this defect it is customary, therefore, to use hooks in drives in which the back of the hook at the point B is described in larger proportions by using a surplus of material, thus assuring great resisting power. Then, again, in many of the patterns of hooks in use in belt drives of smaller proportions, the simple line of wire seems in vogue, resulting in the describing of a hook circle like that shown in Fig. 2. This type of hook is faulty. The least undue strain in the cable system is likely to pull the hook open and perhaps fracture it, as at C. The hook in its original form is shown in Fig. 3. Its weak point is at D.

Hooks manufactured on the order shown in Fig. 4 may be found in practical service in rope and other descriptions of driving systems. This form of hook is made with a view of having strength in the back of the hook, but the shaft, F, is neglected. The result is that whenever any unusual strain exists, the chances are that the hook shaft will break off at this juncture and the combination be rendered non-effective. In order to avoid this trouble, many power and transmission engineers have the hooks made on the eye-plan, as shown in Fig. 5. Then when the draft of the coupling on G occurs, there is opportunity for the hook shafts to grip themselves, as each end is locked in with the nuts as shown. This makes quite a positive union. It is one that can be opened readily in case it is necessary to remove the link G. It is customary to wind these nuts with wire binding so as to make them pass through the wheel grooves if used in that form. Usually, however, the hooked ends are employed only on sprocket systems for elevating weights, where speed is slow and the opportunities for traveling of bulky parts ample. These styles of hooks may also be seen in use for supporting parts of the cable drives. The employment of guides, idlers, etc., all call for some kind of a supporting system, and often the journals are hung by means of hooks produced along the lines of the drawings. In the running

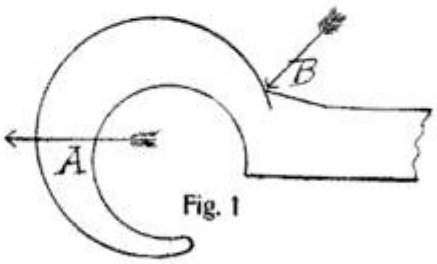


Fig. 1

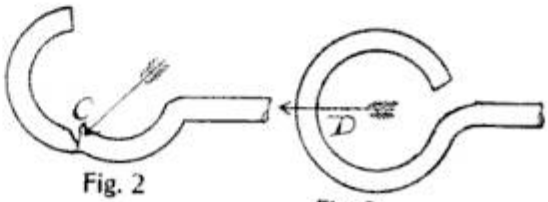


Fig. 2

Fig. 3

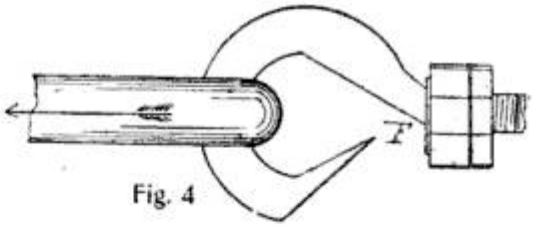


Fig. 4

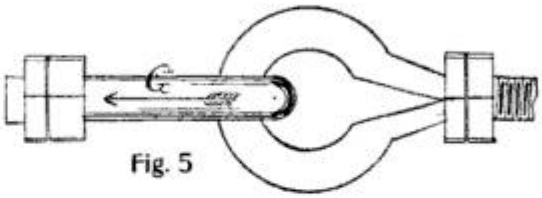


Fig. 5

system, however, it is desirable that the joints of all connections be as rounded and smooth as possible. Fig. 6 illustrates one style of connection for a drive in which coal is moved from point to point by a conveyor system. Where a joint occurs, the union is made by interlocking the split hook shaft into the formed or solid link or eye, and then the divided portions of the former were locked by binding with wire, as at H. These bindings serve to retain the sides securely and make quite a firm connection, so long as the wire lasts. It seems, however, that the wire needs constant attention, for as soon as it becomes worn and

weak it is liable to fracture, thus permitting the parts to open and releasing the union.

In most drives the socket system is preferred. The other forms are chiefly patched work, seen in miscellaneous shops, and used for slow drives under special conditions. The socket plan is next described. The caps may be made in halves, one side being arranged to lock with the other, as by the

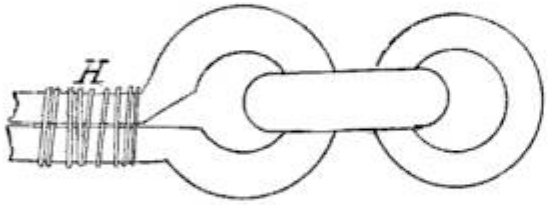


Fig. 6

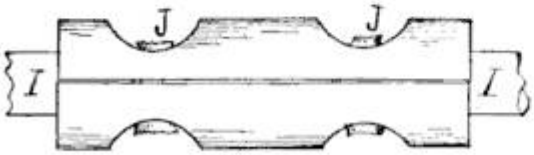


Fig. 7

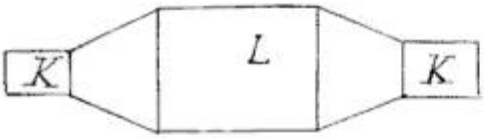


Fig. 8

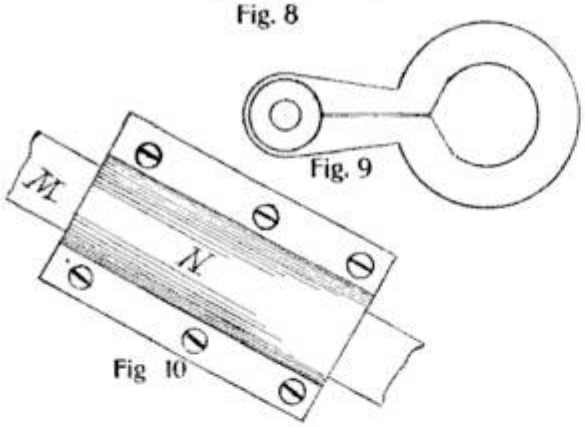


Fig. 9

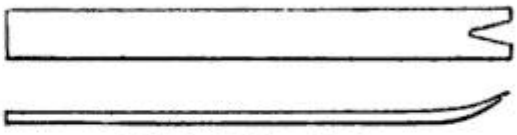
Fig 10

use of rivets, Fig. 7 at J, J, or by brazing into the stubs and locking with other devices. The sockets are often welded and bored for the rivets. Sometimes they are cast in molds. Some are iron and others brass or other metal. Copper is used now and then. The cable ends are inserted into the hollows, and as the inner sides of the parts are grooved around the circle, when the sides are tightly closed, there is a tendency to bite the cable of wire or rope quite securely, so that when a good joint is made, the cable ends remain intact under heavy strain. This manner of uniting the ends is useful for guide ropes or cables for wheel belt shifters when the shifter is up above one or two floors and a long shifter rope is needed. The ends of the cable inserted into the locking sides are marked I, I. In Fig. 8 is shown the socket which is cast like L with tapered ends. The parts K, K represent the cable placed within the shoulder coupling. The ends are introduced from either side and they meet in the center. Then the soft metal is compressed in a specially prepared apparatus and the roughened interior surfacing so securely bites the wire or rope that a very strong union results. The form of link for locking with a cable hook or corresponding part, shown in Fig. 9, is also in use. This style of locking eye is made by turning the ring on a stub and uniting the ends as shown. There is a chance left at the jointed ends to insert a bearing clasp by which union is made with any desired connection.

One also sees the common type of screw-fitted clasping sides, as in Fig. 10. This consists of two portions, each portion being shaped like box caps, and the caps are placed together and either united by means of screws or by bolts with nuts. Sometimes rivets are utilized and the rivets are headed up. The letter N designates one of the caps and M the inserted cable end. This is for uniting parts which do not pass in grooves.—Contributed by "R."

A TOOL FOR PULLING STAPLES.

Draw a piece of steel, an old rasp, or something of the same size, to the shape of a thin chisel. With a chisel cut a claw about 1½ in. long and shaped like the claw



Tool for Pulling Staples.

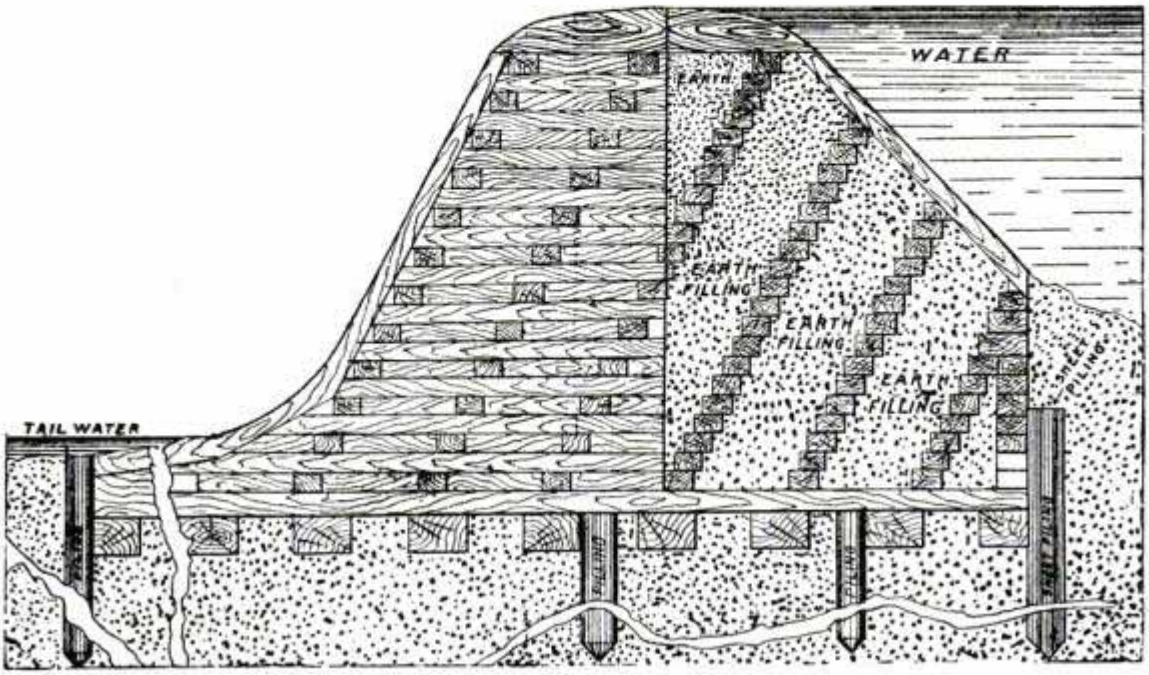
of a hammer. The bend of the claw is shown in the illustration. This is a good staple puller, says the Blacksmith and Wheelwright, but does not save the staples.

USES A POCKET MIRROR.

"In doing some kinds of work one is sometimes obliged to get down on his back to put in a screw or to see that everything is right," writes one of our readers, "for this purpose I often use a small pocket mirror having a handle and joint for turning it to any position."

EARTH AND TIMBER DAM ON SANDY FOUNDATION.

An earth and timber dam involving no special engineering problems and which is specially adapted for use on a sand foundation is shown in the cut. A writer in the American Miller says:



Construction of Dam on Sandy Foundation.

A peculiar feature of this dam lies in its circular construction and earth filling, making an earth dam, held together by timbers laid up, for all the world, like a laminated wheat bin. Each cell is 5 feet by 5 feet, and the earth is tamped in as the dam is raised a foot or two, a stream of water pouring into the cell during the operation.

It will be noticed that the cells are not perpendicular, but lean at an angle toward the upstream of the dam. This is intended to act as a brace to the structure and avoids getting the spikes too close together in the cross timbers. No attempt is made to have the planking on the upstream side watertight, but that on the downstream side is very carefully and strongly laid so that no water escapes and that it cannot be torn off by ice. The capillary action of the earth filling is depended on to keep the cell timbers wet and away from the air so they will not decay.

While this particular dam, which is 700 feet long and 19 feet high, cost about $80,000, others on the same principle, but differently located, need not cost much more, if any, than an ordinary timber dam. But it represents one of the best types of modern dam construction for sandy bottoms, and, if rightly put in, will stand for generations. In sections where timber is still plentiful, this principle can easily and profitably be applied to many different uses, such as wing walls and re-enforcements for waterways and race banks.

COMPRESSED AIR FOR CLEANING BOILER TUBES.

Compressed air works like a charm for cleaning boiler tubes, leaving them as clean as on the day they were put in. This is the verdict of a correspondent of the Engineer, who had formerly used steam hose for this purpose, but upon the installation in the plant of a large air compressor for pumping water, tried the compressed air method.

The air pressure was about 200 lbs. per square inch, and the rest of the apparatus consisted of a ¾-in. hose with a straight piece of ¾-in. pipe for the nozzle.

BLACK WATERPROOF DRESSING.

Mix together 7 lb. best black paint, ½ lb. powdered litharge, 1 pt. oak varnish, ½ pt. boiled linseed oil, ½ pt. thick boiled oil. Apply as ordinary paint. This dries sharp with a good gloss, says the Master Painter, and is durable and elastic. Especially good for railway and wagon covers, tarpaulin and such purposes.

The steam yacht "Arrow" has a record of 42 miles an hour—the fastest time ever made on water.

TOOL FOR CLOSING CAR DOORS.

Shippers, in particular, will appreciate the simple tool shown in our illustration. Many car doors made, apparently, to close by hydraulic power, refuse to work properly at the critical moment and cause any amount of annoyance and delay—then is the time when the tool is handy. Fig. 1 shows the two parts which any blacksmith can make. A is a piece of 1-in. drawn shafting, flattened at one end, making a rather prominent chisel-shaped hook on end C, which should be hardened, as some doors are iron-bound.

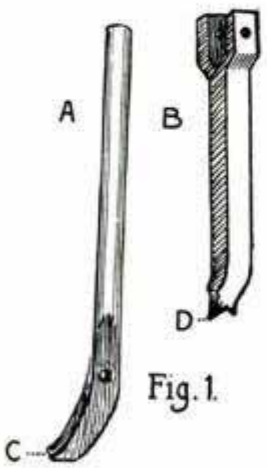


Fig. 1.

B is the leg or brace which must have a very sharp point on end D, with shoulders as shown to prevent burying too deeply in side of car. Fig. 2 shows the tool put together.

A (Fig. 1) is 3 ft. long; B is 2 in. Hole for bolt should be about 6 in. from end, or two or more holes can be bored. Fig. 3 shows how tool is used having a ratchet

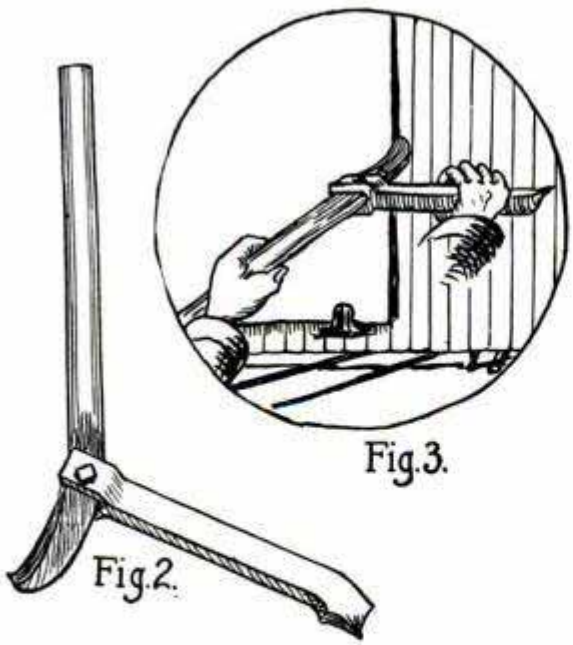


Fig. 3.

Fig. 2.

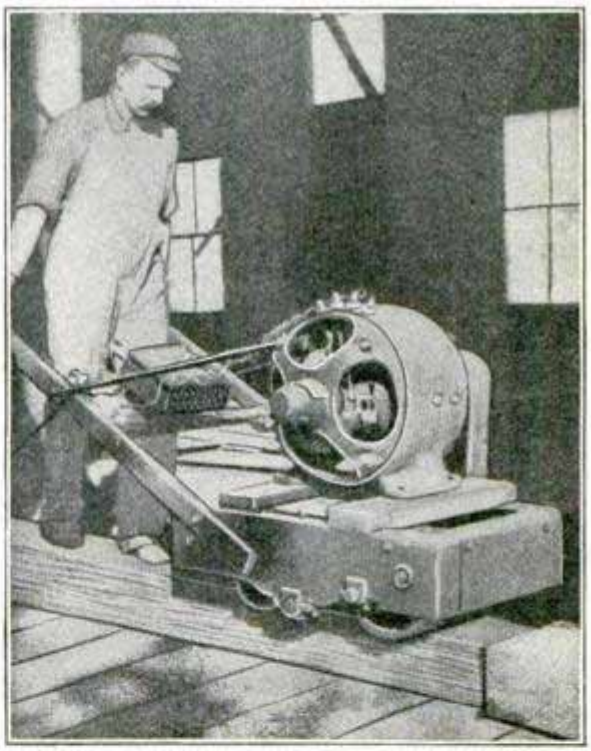
effect by working the bar back and forth and pressing leg firmly up against car.—Contributed by S. J. Hoag, Jonesville, Mich.

The diameter of a piston squared and multiplied by .7854 gives its area.

PORTABLE ELECTRIC PLANER.

An electric railway in California which had occasion to plane several hundred wooden trolley poles, and found it difficult and expensive to haul the poles to a mill, built a home-made portable electric planer as shown in the illustration.

It consisted of a planer head mounted on a substantial wooden truck and belt-driven by a 5-horsepower 500-volt direct-current General Electric motor. The rollers were made of two sections of 10-inch wrought-iron pipe, castings being fitted in the ends for the axle bearings. A pair of plow handles were used to push and guide the planer, the starting box for the motor being mounted between the handles, as shown. The entire outfit cost but $60 outside of the motor, which the company had in stock. The poles were 35 feet in length, with 8-inch tops, and it took about one minute to plane down one of the four sides of a pole. The poles were planed as they were unloaded from the cars, at the



Handy Portable Electric Planer

rate of six poles an hour. There was not only considerable saving in time, but also a great saving in expense, as it cost but ten cents per pole as against $1.15, the price estimated for doing it by hand.

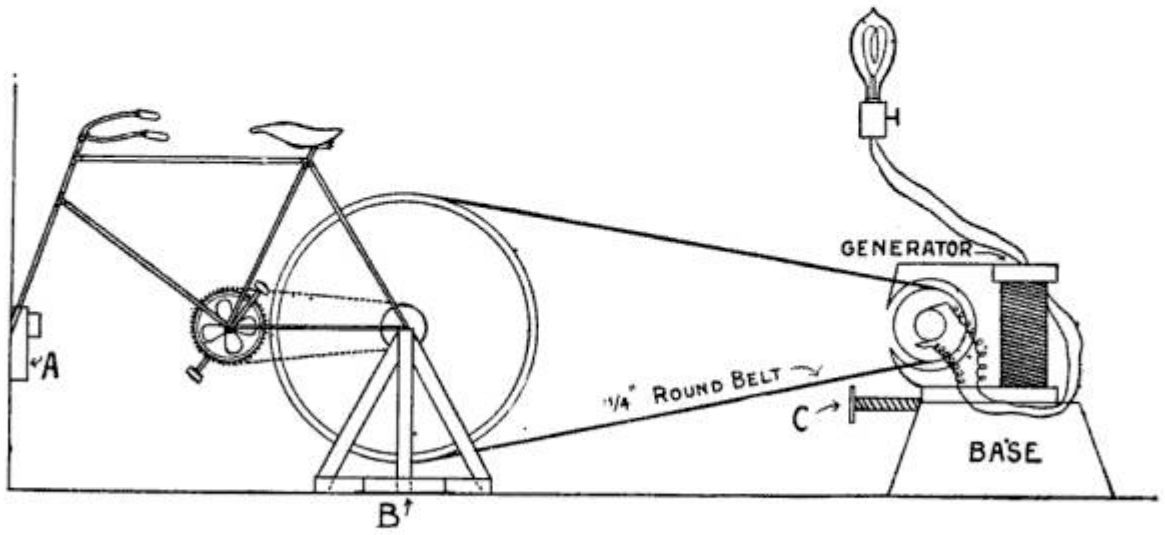
A good imitation mahogany stain consists of 1 part Venetian red and 2 parts yellow lead mixed with thin glue size and laid on with woolen cloth.

RUNNING A GENERATOR WITH A BICYCLE.

One of our readers, W. J. Slattery, of Emsworth, Pa., uses an old bicycle for running a small 10-volt generator; he says:

"The front forks of the wheel are securely braced to the wall and the back forks are then braced up so as to have the back wheel clear the floor about 3 in. The generator is set 5 or 6 ft. distant. To keep the belt tight a sliding brace can be made and worked by a screw.

"I have one of these rigged up and it is just the thing for charging small storage batteries, running small motor and for all experimental purposes where light power is required for a short time."

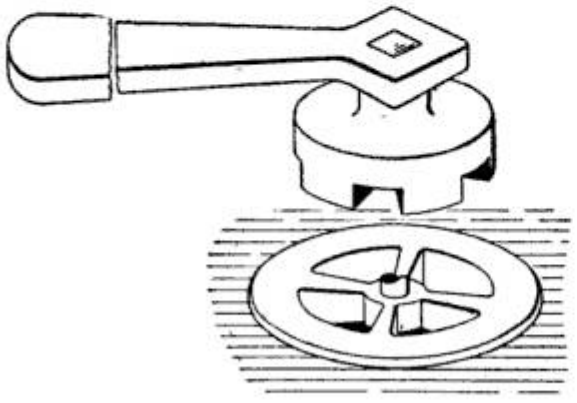


Running a 10-Volt Generator with a Bicycle

METHOD OF REMOVING BROKEN PUMP-VALVE SEAT.

A solid bar wrench fitted over the head of a valve wrench was the instrument used by a correspondent of the Engineer for taking out a valve seat in which the guard stem had been twisted off. As only one hand could be got into the chamber at a time it was impossible to drill or chip it out. The valve was in the suction chamber of a triple compound direct acting pump with 15 x 24 inch water plungers. The broken valve seat was in the lower left-hand corner and could not be pulled with a wrench.

The combination instrument, however, worked amazingly well.

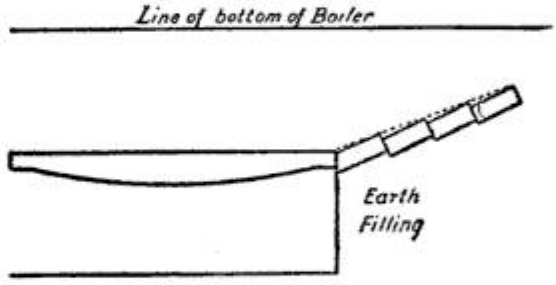


Solid Bar and Valve Wrenches

The machinist blocked up against the handle of the wrench with a 4 x 4 pine block, which extended through one of the hand-holes far enough so that he could put the cap of a jackscrew against the heavy brick wall. He then slowly turned the screw. In a few minutes he was rewarded with the loosening of the valve seat. Upon taking it out he drilled out the old guard stem and fitted another, and put the seat back in place again.

BRIDGEWALL FOR WOOD FUEL.

The accompanying sketch is used by a writer in the Wood-Worker to show how brick is placed on a bridgewall to prevent wood from dislodging it when firing.



For Wood Fuel

The front end of the brick, being below the back end of the row in front, prevents the ends being caught and loosened by passing wood over them.

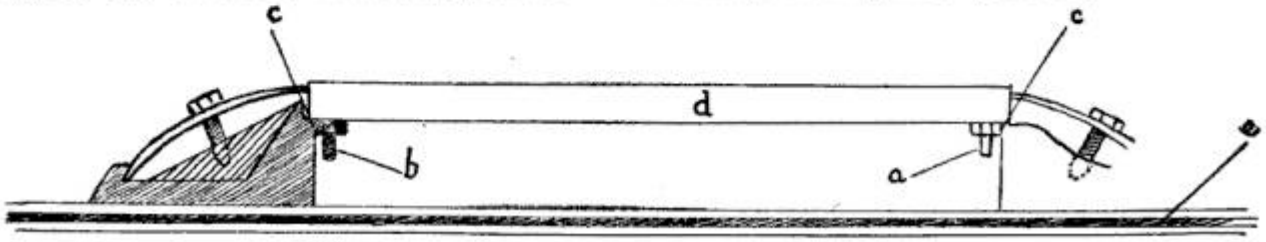
About twice a year evaporating tests, to determine the efficiency of the boiler, should be made. This does not require an expert.

A KINK FOR THE PLANER.

We have a considerable number of plates about 2 feet by 3 feet by ¾ inch to plane. A great many of them are warped so they will not lay flat on the four planer blocks we have and with these warped plates considerable time was lost in hunting sheet iron bushings, etc., to shim up with.

To remedy this I had four more blocks cast, just like the ones we had with the exception of a lug put on them at c. This lug was tapped for a ½-inch set screw which allows for enough adjustment to accommodate all warpage.

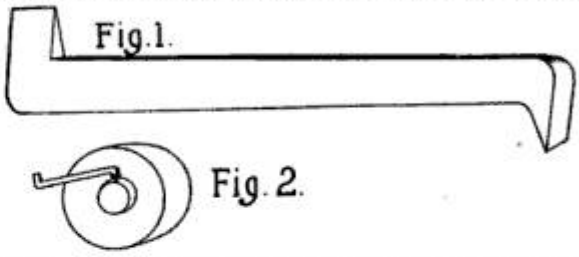
With this simple device the plate could be set up in half the time ordinarily used in shimming up with bushings. The bushings were a nuisance, also, for they frequently dropped out.—Norman, Muscatine, Iowa.



A Kink for the Planer.

SCREW DRIVER FOR SET SCREWS.

The accompanying illustration shows a handy form of screw driver for use on set



screws. Fig. 1 shows the shape of the tool, while Fig. 2 shows its position when in use. —Contributed by Lee R. Clarke, Bozeman, Mont.

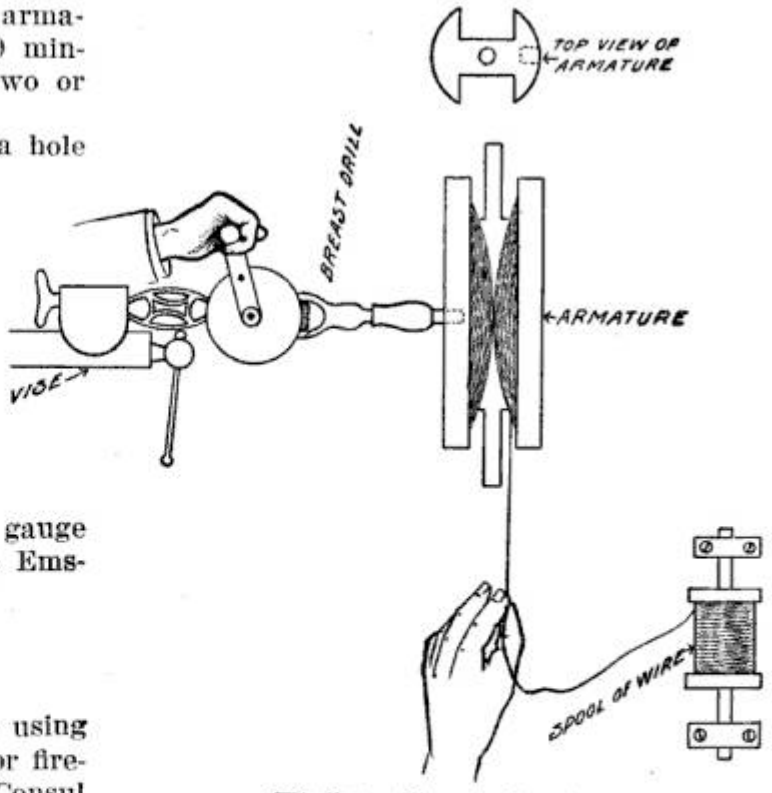
One cubic foot of steam is produced from one cubic inch of water evaporated under ordinary atmospheric pressure.

How to Wind a Magneto Armature.

By the following method a magneto armature may be wound in from 15 to 20 minutes, when by hand it would take two or three hours.

Usually the armature already has a hole tapped in it where it was fastened on the coil-winding machine in the factory, where it was first wound. At this hole hasten it on the chuck of a Miller's Falls breast drill with a piece of wood and then put in a vise as shown in sketch.

Put the reel of wire on a spindle so it will revolve as the wire is wound on the armature. Have a friend turn the drill while you guide the wire. Use No. 40 B & S gauge wire.—Contributed by W. J. Slattery, Emsworth, Pa.



Winding a Magneto Armature.

FIREPROOFING CLOTH.

Dyers at Manchester, England, are using titanic acid (the oxide of titanium) for fireproofing cloth, reports United States Consul Frank W. Mahin of Nottingham, England. Cloth treated with this acid was demonstrated to be non-inflammable. When touched with a lighted match the fire smoldered and went out. It is claimed that dyeing, boiling or washing will not remove the acid.

AUTOMATIC SHUT-OFF FOR A PRIVATE COAL BIN.

An automatic shut-off for a private coal bin will be found a great convenience and is one which may be easily constructed by any man or boy.

The bottom of the bin is constructed so as to convey the coal to the spout. When not in use the spout takes the position shown in Fig. 1. When coal is to be taken from the bin all one has to do is to press down the spout until the lever L (Fig. 2) drops and catches it by the pin P, which holds it down for the coal to run out.

The pail which catches the coal is placed on a stand which acts as a lever D. (Fig. 2). On the end of this lever is a weight, W, made in the form of a box so that when

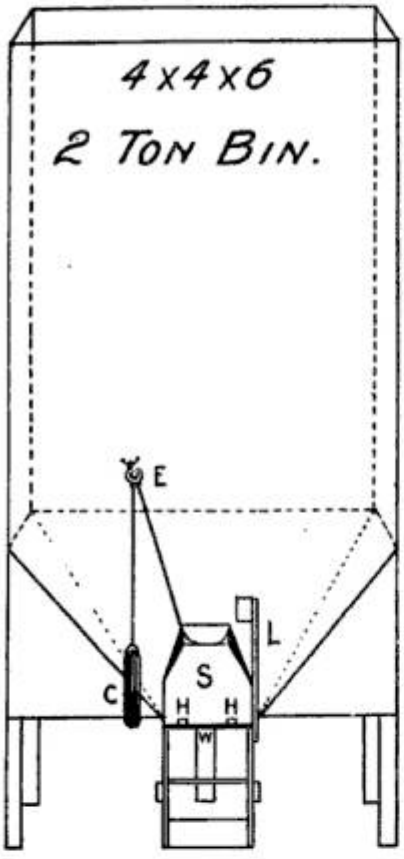


Fig. 1.
FRONT VIEW

a pail of larger capacity is to be filled the weight can be increased, or vice versa. When the pail is full of coal it over-balances the weight and causes the bar, F, to turn forward, thereby striking the lever and releasing the spout, which flies upward (impelled by the weight C, Fig. 2), and so shut off the coal.

The action of this coal bin is not only simple, but in all cases certain, unless clogged or otherwise out of order. This makes it very convenient for the person not

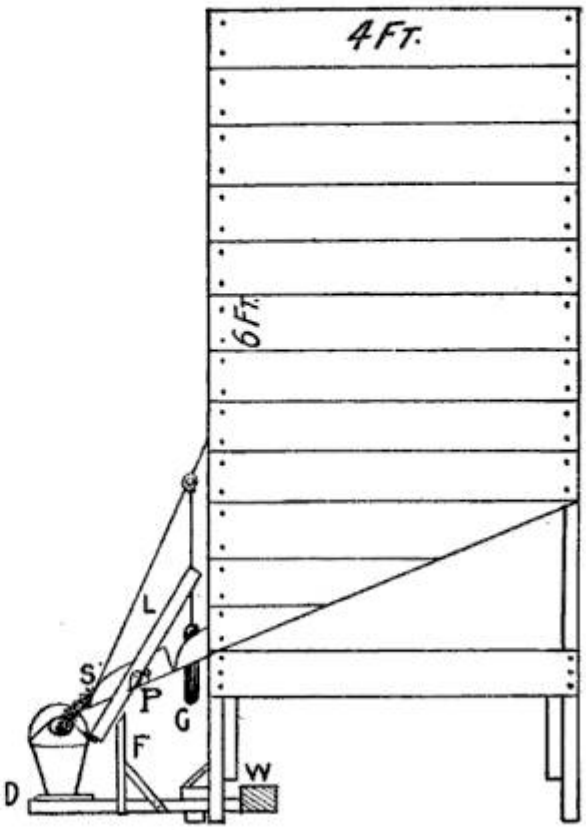


Fig. 2.
SIDE VIEW

desiring to use a fire shovel in zero weather. —Contributed by F. Blessin, Eldorado, Ia.

HOW TO MAKE A WOODEN AXLE.

Select a piece of wood of the proper size, find the center and draw a chalk line on all four sides the whole length, as at A, Fig. 1. The end view (Fig. 1) shows a gauge mark across it. If the wheels have an inch dish, measure 7-16 in. down from the horizontal line and 1-16 in. in front of the perpendicular line, stick dividers in the dot and strike a circle as large as the outer end of the journal is to be (end view, Fig.

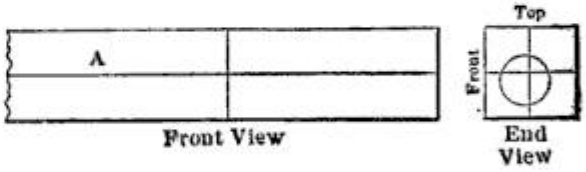


Fig. 1

1). With the square draw a line on all four sides of the circle and from these draw lines to the collar (B, Fig. 2.)

Draw a line, C, across the center of the circle, and from point to center line at the collar. D is the square of the center line of the arm. To get the collar squares, mark

out to one side from the center, reverse the square and get the line all around.

To cut the top and bottom off, strike the end all out and cut off the front and back

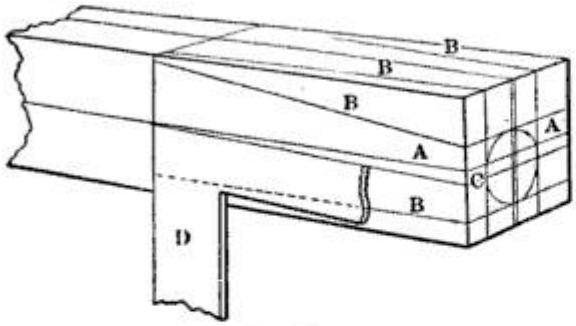


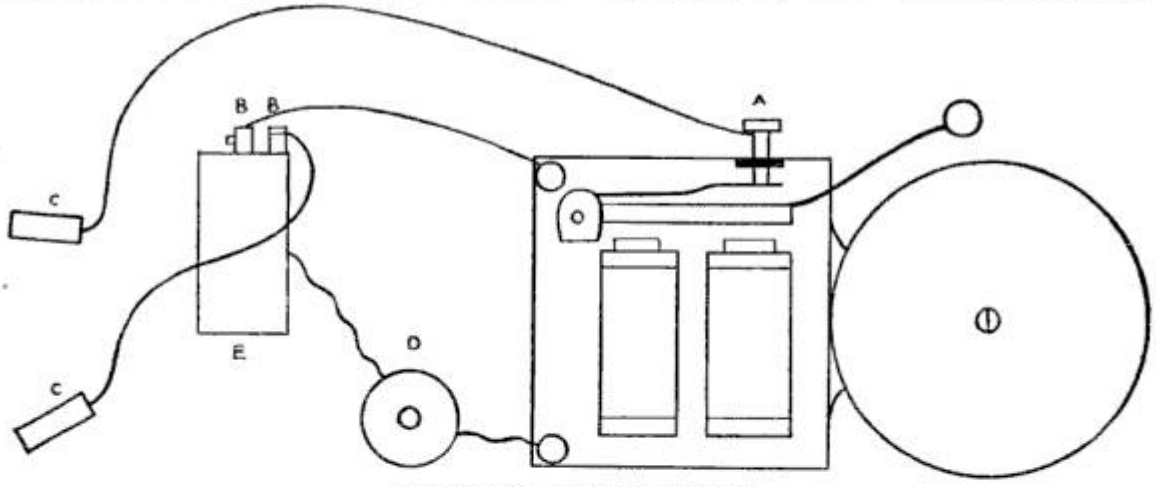
Fig. 2.

sides. The arm is then the right size and set right. Make it 8 in. square and round it up. A correspondent of the Blacksmith and Wheelwright, who describes this method, says he usually puts steel skeins on the bottom.

ANOTHER SHOCKING MACHINE.

The shocking machine shown in the sketch is very easy to rig up and will produce the same results as an expensive machine.

Take an ordinary bell outfit. Connect up the bell. Attach an extra wire to A, which is a regulating screw. To B on the battery attach another wire the same as to A. To the free end of these wires attach a small piece of iron. Grasp an iron in each



Home-Made Shocking Machine.

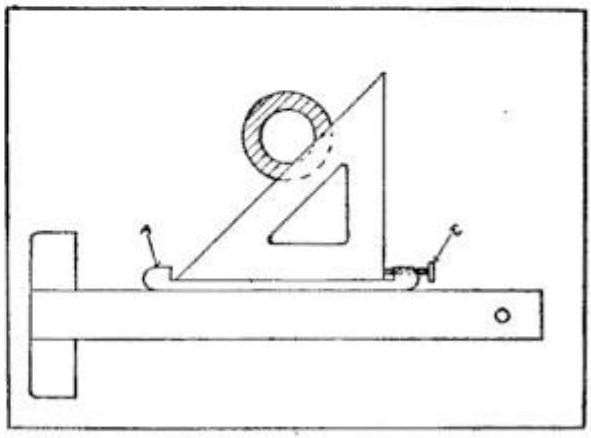
hand and have a friend turn on the bell. As the friend makes the connection you will receive a delightful shock. To intensify the shock, plunge C into a pan of water, grasp F in one hand and place the tips of the fingers of the free hand in the pan of water and proceed as before.—Contributed by Geo. Frye, 903 Vine St., San Jose, Cal.

Points in Diagram: A—Regulating screw. B—Set-screw on battery. C—Handle. D—Push-button. E—Battery. F—Same as C.

DEVICE FOR SECTION RULING.

The little contrivance here shown, I have found very convenient in section ruling, writes Signa L. Hatfield, of Wagoner, I. T.

Little explanation is needed. A is made of wood or other suitable material about ⅛ in. thick (I have used cigar-box material). The notch cut out is slightly (say ¼ in.) longer than the triangle which is to be used in it. Placing the device as



Device for Section Ruling.

shown in the sketch the spaces between lines may be made very regular. Draw a line along the triangle, and then holding the triangle stationary slide the device as far as it will go to the right, then slide the triangle until it strikes the adjusting screw, when it will be in position for making the next line. The adjusting screw, C, makes it possible to vary the space between lines. The head of this screw should be filed off on the sides until one dimension of the head is the same as the thickness of the wood.

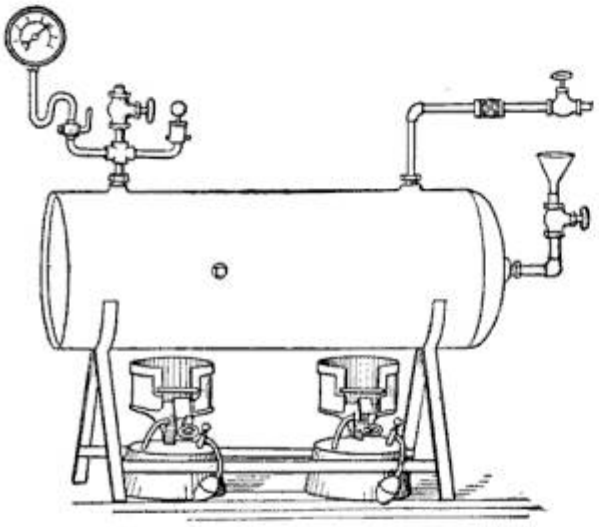
REMOVING VARNISH STAINS.

To remove resin, varnish or sealing-wax stains from fabrics, warm and apply strong methylated spirits. In rubbing the material apply the friction the way of the stuff, or a rough spot will be left.

THAWING UNDERGROUND FROZEN WATER SERVICE PIPES.

Thawing underground pipes is one of the plumber's hardest problems at this season when the pipe is sometimes frozen from the cellar wall to the main in the street and thus very difficult to get at. The machine shown in our illustration was devised by a correspondent of the Metal Worker just for this purpose, and will open any job on a straight line.

It consists of an ordinary 15-gal, expansion tank resting horizontally on legs made from the band iron taken from bundles of sheet iron. In one of the openings intended for the water gauge is a short nipple and a ½-inch cross. On one side of this cross



For Thawing Underground Service Pipes

is an ordinary steam gauge to register 35 lbs., and on the other side is an ordinary safety valve, set to blow off at 30 lbs., for safety. On the top of the cross is a nipple and a gate valve to let out the air when filling the boiler with water. In the other water gauge opening there is a ½-in. nipple and a ½ x ¼-in. reducing elbow, with a short nipple, and a swinging check valve, then another nipple and a ¼-in. gate valve. This is where the steam supply is taken from. In one end of the boiler is an elbow and a short nipple and a ½-in. gate valve with a tin funnel on the top to fill the boiler with water. The other openings are plugged.

To put this apparatus in operation put two pailfuls of water—hot, if possible—into the boiler, and with two good gasoline furnaces under the boiler run the steam up to 25-lb. pressure. On a ¾-in. service pipe use a coil of pure tin pipe for tubing, 75 ft. long, with a ¼-in. brass coupling soldered on one end to fasten about 10 ft. of ½-in. hose for steam. On the other end attach a union for connection to the ¼-in. valve on the boiler. Unroll 15 to 20 ft. from the other end of the tin pipe and push it in the service pipe until it strikes the ice. Then everything is ready for the steam to be turned on slowly, and soon the hot water and steam will be seen returning; but it is necessary to keep pushing the tubing into the pipe as fast as the ice melts, for if it is not kept well up to the ice it will not thaw, even if only 6 in. from the ice. In fact, it works decidedly better if it be kept against the ice in the pipe all the time. The tin tubing should have a ¼-in. opening, leaving plenty of space around it for steam and water to return.

A good round way stop or gate valve should be placed on the end of the pipe before starting, to avoid receiving a bath before it can be put on after the pipe is opened. When the water starts, have the helper pull the pipe out as quickly as possible and close the stop valve, when the job is completed without much trouble. If the water in the boiler gets low, which can be told by the steam suddenly dropping off, exhaust the steam in the boiler into a bucket of water and then empty the water into the boiler. This will warm the water that is to enter the boiler and aid in getting up steam again quickly. With this outfit its inventor has opened 86 ft. of ¾-in. service pipe in the ground in three hours' time without a helper, and the service seemed to be frozen solid.

When using it outside of a building three furnaces and a sheet iron jacket to keep off the wind may be used. This machine is cheap to rig up and successful in operation.

SPLIT NUTS IN DRIVING THREADED WORK.

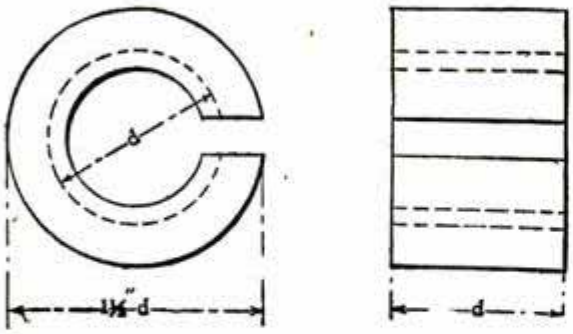
It is not good practice to use a nut with a saw slit in one side for threaded work, especially if it will not come off easily. If a cold chisel is driven in the slot to ease it, this soon results in a halved nut which is even more difficult to handle.

The split nut shown in the sketch is original with a correspondent of the American Machinist, who says he has used a set of 13 such, ¼ to 1 in., constantly for several years and finds them both cheap and effective.

They are made of cast steel, tapped to a full thread and turned concentric with the threaded hole. The length =d= the diameter of the tap, and the outside diameter of the nut = 1½ × d. After the slots are cut, the nuts are opened a trifle with a

chisel, to insure their being turned on freely by the fingers after hardening. It takes but a jiffy to spin them on. They are hardened in oil and given a spring temper by burning off the oil.

A common lathe dog or a 3-jawed chuck



Split Nut for Threaded Work

closes them on to a thread very firmly. A set takes up a space of 1 in. by 8¼ in. placed tandem, with the slots over a narrow upright strip of brass.

LIGHTING DEVICE FOR STONE CUTTERS AND OTHER CRAFTSMEN.

Portable electric lights are now used by many stone cutters who require good light for granite and marble lettering, says the Monumental News. As the work proceeds the light must be moved to many different positions and with the ordinary light it is

Portable Electric Light for Close Work

hard to keep the shadow from falling on the stone.

The light may be satisfactorily arranged, where electric lights are used, in the manner shown in the sketch. A wire guard protects the lamp against breaking and a strap is convenient for fastening it to the head. This arrangement causes the least bother and gives a light equal to the best daylight.

A good plumbers' cement consists of 1 part of black rosin melted, to which is added 2 parts of brickdust, finely powdered and thoroughly dried.

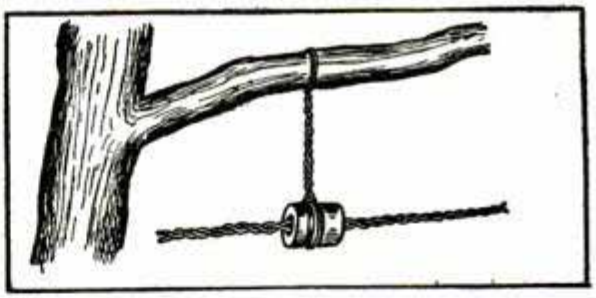
HOW TO BRONZE CAST IRON.

The Maschinenbauer describes the following process for imparting to common cast iron all the rich glow of bronze, without covering it with a metal or an alloy. Having thoroughly cleansed the surface and rubbed it down smooth, apply evenly a coat of vegetable oil, say sweet or olive oil, and heat the iron object, being careful that the temperature does not rise high enough to burn the oil. At the moment of decomposition of the oil the cast iron will absorb oxygen, and this forms upon the surface a brown oxide skin or film, which takes a fast hold and is so hard that it will admit of a high polish, thus bestowing upon the iron a striking resemblance to bronze.

SUSPENDING WIRES TO TREES.

In constructing telephone lines it is frequently desirable to suspend a wire to a tree. The American Telephone Journal gives the proper method of doing this.

The twisted wire is run through an insulator suspended from a limb as shown in



Insulated Suspension for Telephone Line

the sketch. If the wire were fastened directly to the tree the tree would sway with the wind and the wire might break. The insulator affords a flexible support which holds the wire in place without regard to the motion of the tree.

Often, when in need of a flat pulley, only a crown pulley will present itself. Now, we all know of several ways to crown a flat pulley, but when a friend of mine proceded to flatten a crown pulley (wood) with a rasp, the obvious simplicity of the thing almost killed father, says a correspondent of the American Machinist.

To make paint stick to tinware scratch the surface of the tin with a piece of rough pumice or sandpaper, apply a coat of thin shellac varnish and then paint of the desired color. This will prevent the paint from shelling off.

HOW TO MAKE YOUR CLOCK START FIRES FOR YOU.

BY WM. H. MATTHEWS.

You must have an eight-day clock or one which has an alarm that is wound from the outside of the clock.

Get an empty spool, A (Fig. 2); saw a groove in it on one end, B; attach a string, F, with a short piece of wire attached to the loose end, E. The string should be about 16 in. long.

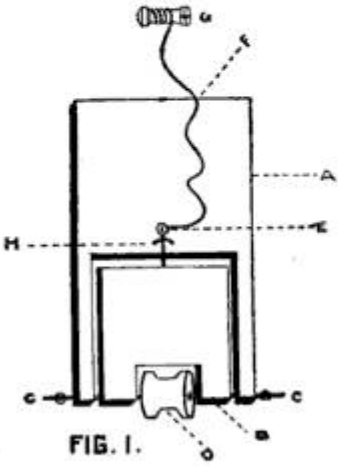


FIG. 1.

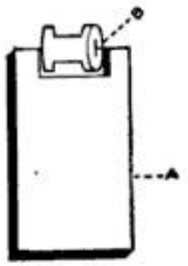


FIG. 3.

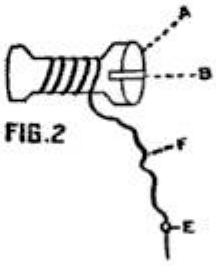


FIG. 2.

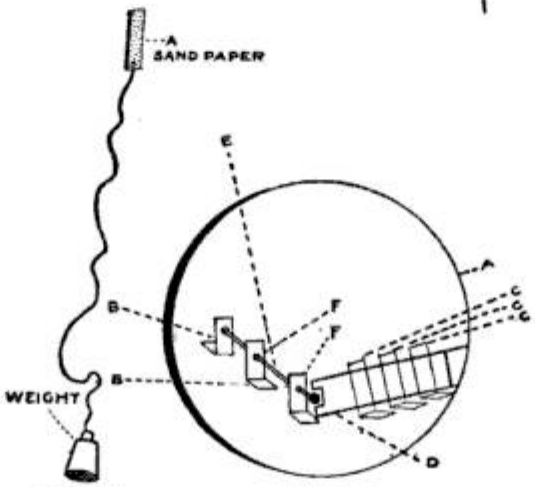


FIG. 5.
STRING WITH SAND PAPER ATTACHED AND WEIGHT ALSO

FIG. 4.

Get a piece of white pine about ½ in. thick, 6 in. wide and 16 in. long, A (Fig. 1); saw a piece out of one end of it as shown. The piece sawed out should be 4 in. by 5 in. Take the piece you sawed out and cut off about ¼ in. on one side and put it back from where it was taken; but before doing this, cut a small place in one end of this piece so that an empty spool can turn easily in it. (See D in Fig. 1.) Run a long wire, C, through the piece, A, and also through B, and the spool, D. This will make a trapdoor that will drop when the string F is wound on to spool, G, and the piece of wire, E, is withdrawn from under B when the alarm runs down. A close study of Fig. 1 will show you exactly how to make this part of the apparatus.

Take a heavy piece of wood, A (Fig. 3), and cut a piece out of one end and mount a spool in this place so it will turn easily (B, Fig. 3).

For the fire starting apparatus, procure a piece of tin; either a round or square piece will do. The top of a 10-pound lard bucket is just the thing. Fig. 4 shows how this is made. Take an old chisel and cut three pieces B, B, B. They must not be cut clear out of the tin but cut only on three sides. These pieces, B, B, B, must be bent upward to hold the match, E, They should be about 1½ in. high and about ½ in. wide. Make a hole in the two front pieces, B, B, large enough to let a match slip through easily. The last piece, B, should not have a hole in it. Take a piece of old rusty water bucket hoop about 6 or 8 in. long and cut a small notch in one end so that it will pass the head of the match, E. Then cut several (three will do) pieces of tin and bend them up, C, C, C, and over the spring and so mount it that it will press tolerably hard against the head of the match, E. All that now remains to be done is to take a piece of sandpaper about 1 in. wide and 4 or 5 in. long; tie a strong cord long enough to reach from the machine (Fig. 4) out to Fig. 3, which should be placed on the floor in front of fireplace and up to trapdoor, which is laid on the mantel with the clock placed on top of it. A weight should be attached to the other end of this cord. (See Fig. 3.) A small sack of sand is best for the weight.

Now to put the fire-starter in operation. At night before retiring let the fire burn down low. Cover the coals after raking them to the back of the fireplace. Put on your wood. Take your fire-starter (Fig. 4) and place a match, E, through holes F, F, with the head next to spring, D. Place the sandpaper, A (Fig. 5), between the match and the spring, D, with the paper projecting toward rear of fireplace. Put Fig. 4 between the fire-dogs and run the string attached to the sandpaper over spool, B (Fig. 3) and on up to trapdoor, B (Fig. 1). Insert wire, E (Fig. 1), under trapdoor, B, and lay the weight on trapdoor. Wind your alarm and push spool G (Fig. 1), on the thumbpiece that winds the alarm. Set your alarm for any hour, and when it rings the string will wind onto the spool and pull the wire from under trapdoor. The weight will fall and jerk the sandpaper from

between the match and spring and strike it, starting a fire. Be sure to have a notch in the spring so that it will pass the head of match, or it will put out the match when struck. Lay something that is easily burned close to the head of match to start the fire. Excelsior and paper are both good.

This is a good thing for a lazy man and costs nothing to make. I used such an apparatus several winters, and it is nice to have a warm fire to get up by. If you do not wish to attach it to your clock, run the string to your bed and pull it and start the fire yourself.

HOW TO MAKE AN AUTOMATIC FURNACE TENDER.

It is a simple matter to make a device which will open the furnace dampers at any desired hour day or night. It is particularly desirable for use in early morning in order that the house may be warm before getting-up time. The instructions are by a correspondent of the Metal Worker.

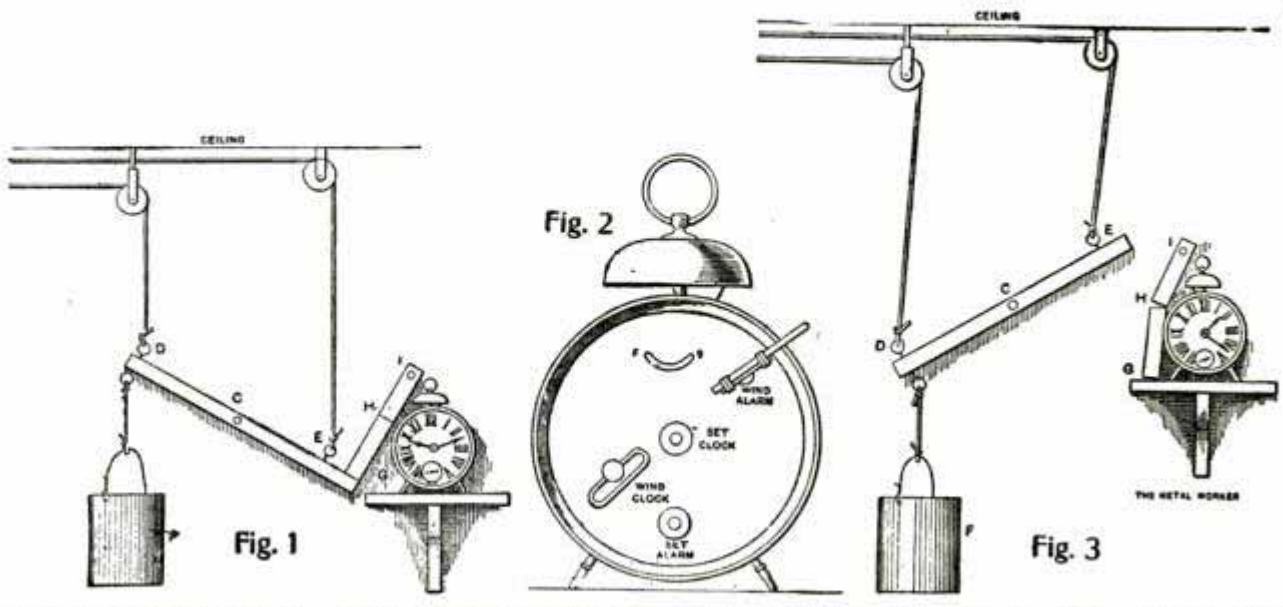
Most furnaces have two draft doors, a check draft at the back and a draft door, or lid, in front. When the furnace is checked the door in front is closed and the rear draft is open, allowing air from the cellar to go into the chimney without passing through the furnace. When the furnace is burning the rear draft is closed and the front one open, forcing the air to go through the grate to reach the chimney. The simple device illustrated will permit the draft to be shut off as desired, while a common alarm clock will close the check draft and open the front draft at any hour desired. Pulleys must be screwed into the ceiling, as shown in Fig. 1. Fine rope leads from the check draft to the end of the lever E and from the front draft to the end D. A hard wood stick 12 in. long is shown by D, C, E working loosely on a screw, C, driven into the wall or other convenient support. F is a weight, consisting of an empty tomato can, into which coal can be put until it is just heavy enough to operate the drafts.

To check the furnace the end E is drawn down, as shown in Fig. 1, raising the check draft and allowing the front draft to close of its own weight. The end E is held down by a lever, G H I, hinged in the middle on the bottom side and fastened to the wall by a screw at I, on which it works loosely. The alarm clock, Fig. 2, is set to go off at any desired time and is placed on a shelf, so that when the alarm goes off the winding lever for the alarm, which has been lengthened by binding a piece of hard wood, strikes the hinged lever from below at H, bending it up so that it flies out of the way, releasing the end E of the solid lever. The weight F then falls, as in Fig. 3, opening the front draft and allowing the check draft to close of its own weight.

PACKING FLANGE JOINTS WITH ASBESTOS

For packing flange joints, a correspondent of the Engineer claims that thin sheet asbestos (wet) is far ahead of the best rubber, if a permanent joint is required, though a rubber gasket can be put on much more quickly and easily.

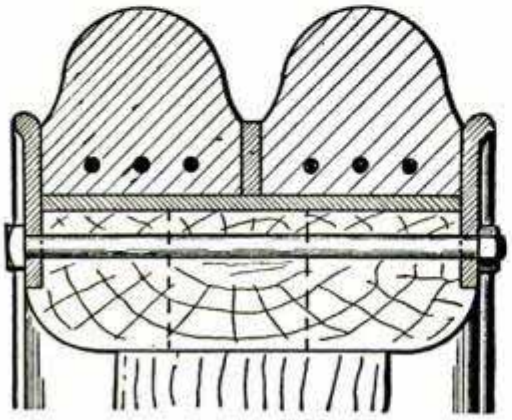
Great care is necessary in handling the wet asbestos, but if the joint is well made with very thin sheet asbestos and the flanges are in good condition, it will stand several hundred pounds pressure.



Automatic Furnace Tender. Fig. 1.—Furnace Drafts Checked and Regulator Set. Fig. 2.—Back of Alarm Clock. Fig. 3.—Furnace Drafts Open.

SOLID RUBBER TWIN TIRES FOR MOTOR OMNIBUSES.

Twin tires of solid rubber for the rear wheels of heavy motor omnibuses have gone a long way in solving the problem of the best tire for these vehicles. Twin tires were introduced a comparatively short time ago, but up-to-date have given general satisfaction. The tire consists of two solid rubber tires, placed side by side on one felloe; this gives four surfaces from which the rubber



Twin Tires for Motor Omnibuses.

can expand laterally, thus with the same amount of surface exposed to the load, it is more flexible than a single tire; it is also less liable to crack and is more durable as the average deformation is less for a given load.

Twin tires will not side-slip so readily as single tires and if one tire should pull out, in some types the tire is still temporarily serviceable. They are not suitable for front wheels, as they tend to make the steering difficult, but on the other hand they are not so necessary on the front wheels, as the weight on that axle is much less than on the rear axle. Merely wide tires in place of the two tires would not be practical, as they are liable to crack and are not resilient in that form.

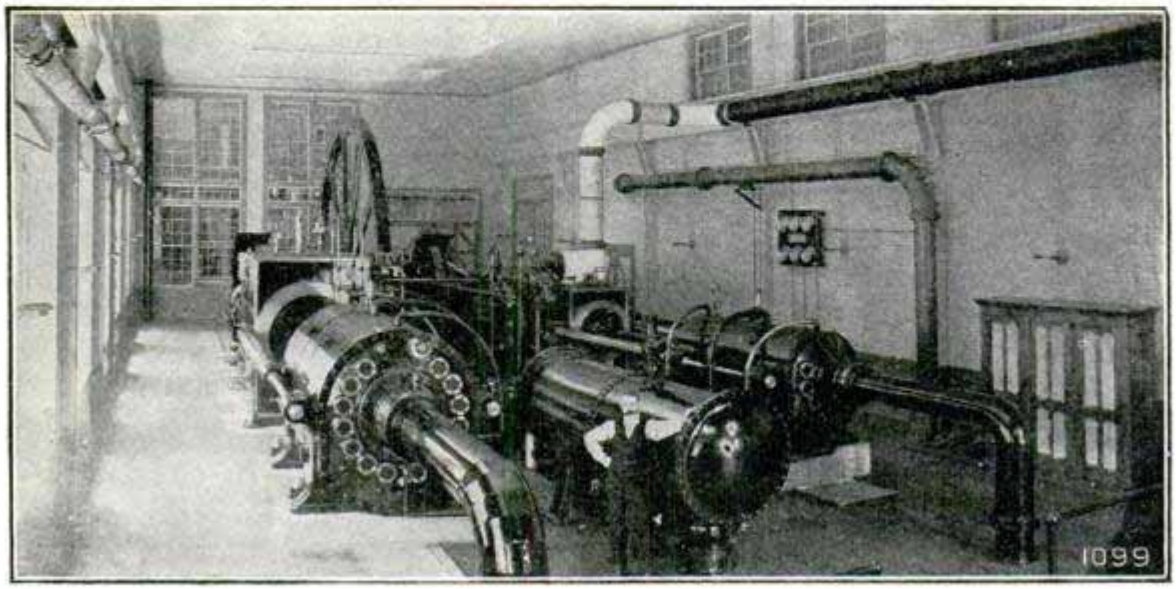
SHEET ZINC FOR ROOFING.

Zinc roofing in regard to its possibilities and economy is receiving considerable attention from contractors in this country, and zinc smelting plants are preparing to put lines of sheet zinc roofing materials on the market. At Iola, Kansas, a company has donated sheet zinc for the roof of the new Y. M. C. A. building soon to be erected there.

LARGEST AIR COMPRESSOR EVER BUILT.

The largest air compressor in the world is in operation at the power plant of the Homestake mine in South Dakota. It is a cross compound condensing two-stage Corliss machine, having a high pressure steam cylinder 32 inches in diameter with a 52¼-inch air cylinder and a low pressure steam cylinder 60 inches in diameter with a 32¼-inch air cylinder; the stroke is 72 inches.

At rated speed of 50 R. P. M. the free air capacity of the machine is 9,000 cubic feet per minute, this volume being sufficient under average conditions of mine work, to operate 125 rock drills. The steam pressure is about 130 pounds. Exhaust steam is received by a surface condenser in connection with a cooling tower. Both high and low pressure air cylinders are fitted with piston inlet valve and between these cylinders a horizontal intercooler is placed in the air circuit. The total weight of this huge compressor with its accessories is 300 tons. The output of the machine is used exclusively for operating machine drills in the underground workings of the mine.



This Air Compressor Operates 125 Rock Drills.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE WATER MOTORS.

To make the pattern of a water motor shown in Fig. 1, first get a disk constructed like A, about 20 in. in diameter. This disk can be cut out of sheet metal, or it may be made of pine wood, using common boards. The sheet metal will have to be cut at the tinsmith's. You can make the wood disk yourself if you mark out the shape on the boards in pencil and cut the material accordingly. After the disk is ready, the hub should be designed. This consists of the wooden wheel B. This wheel can be purchased ready made at a hardware or a general tool and machinery store. The wheel is grooved, about 5 in. in diameter, and of ample width to fit the shaft and carry the rope C. The wheel is fitted to the wood shaft with a key or screw. Next comes the application of the water wings or paddles. These are made of curved sheet metal of the design shown. They should be of sufficient width to receive the full blast of the jet of water from the nozzle or discharge pipe D. If the disk is of metal, the edge of the disk must be turned, so as to provide a shoulder to secure the paddles to either by soldering or by using little bolts passed through holes bored for the purpose. If there is a wooden disk used, the paddles are set-screwed to the rim direct. Thus we have the paddles in place, so that the discharge of water plays into each as it comes around the circuit as at E. Considerable speed can be developed with the common hose pipe. The power generated in this way is used for running sewing machines, fan wheels, dust wheels, etc. The entire affair fits in a boxed framework of wood, so that the water will be kept in. The water is drawn off through the base of the framework to the drain pipe. These devices may be seen in use for mechanical service in connection with running automatic contrivances in show windows.

The skeleton-like arrangement in Fig. 2 is made with the hub of small size as shown, to which the large wings or paddles are secured with set-screws. This hub is metal. It can be made by hack-sawing the same from a section of metal 3 to 4 in. in diameter and boring for the hole. Sometimes a common cart wheel hub can be used for the purpose. The wings have to be of wrought or other stiff metal, so that they will retain their form under the pressure of the water. These paddles are about 3 in. wide. Common 3-16 or ⅛-in. metal will answer the purpose. The wheel is set upon its shaft and the plan is made for the volume of water to fall upon the paddles from an outlet as at F. The water force contacts with the paddle at G, as shown. The shaft which carries the wheel also carries

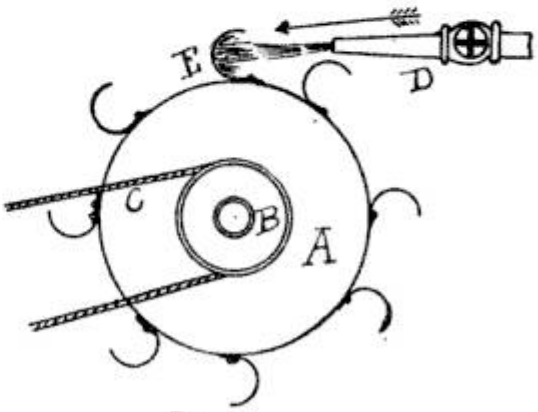


Fig. 1

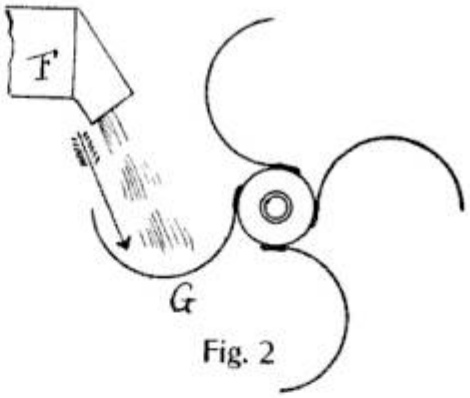


Fig. 2

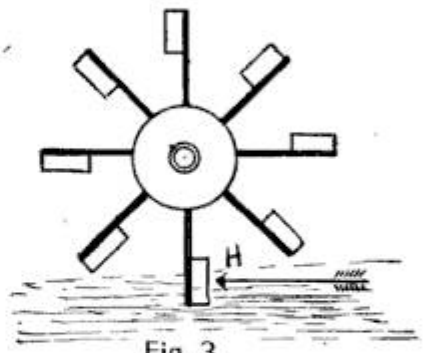


Fig. 3

the driving wheel, which is for a flat belt or round belt, as the case may be. It is quite easy to get from ½ to 3 hp. from these various types of home-made wheels.

The wheel in Fig. 3 is calculated for use in direct contact with the water. A running stream of water is selected and the wheel is adjusted on its shaft so as to drop

the lower portion of the wheel into the moving currents as shown. The water contacts with each box-paddle, as at H, in turn, and keeps the wheel revolving according to the velocity of the water. First we make the hub or center of two pieces of hardwood bolted together and protected with flanges on either side. The two pieces can be sawed from boards and fitted together with the hole for the shaft bored through. The hub is applied to the shaft. The spokes for the

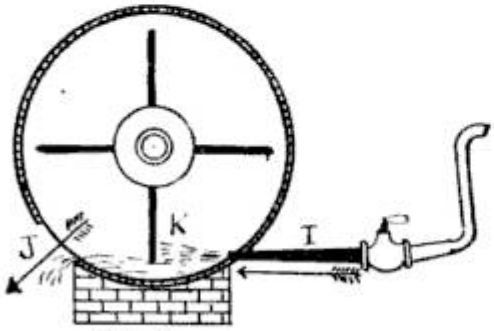


Fig. 4

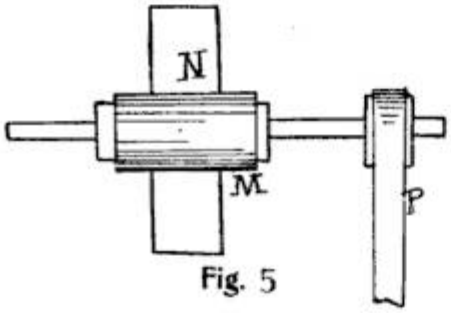


Fig. 5

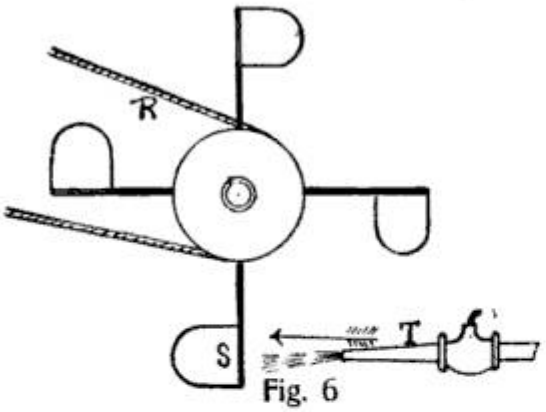


Fig. 6

paddle boxes are adjusted into holes bored around the circuit of the hub, same as spokes are fitted to the common wheel hub. Then the paddle boxes of tin or of wood are secured to the end of each spoke. These boxes are about 4 in. square with sides about 2 in. deep. Sometimes it is necessary to run the wheel within a case of sheet metal, as in Fig. 4. The case has an opening to let the water discharge in, as at I, and an opening to let the used water out, as at J. The case is usually set up on the brick masonry, as indicated. The affair is usually in the basement. The wheel is made with four plain paddles and the power is generated by the water striking the paddle, as at K. The hub is of wood, or as before, a discarded carriage or wagon wheel hub will do. The paddles are wooden, about 4 in. wide and 30 in. long. They are mortised into the hub.

Fig. 5 is another view of this wheel. The hub is marked M. The section of paddles shown is marked N. The shaft extends through the hub, and is secured to the hub with pins or a key. To one end of the shaft there is fixed the pulley for carrying the belt P. The journals for supporting the shaft are adjusted between the wheel center and the shaft ends. Several who have made this pattern of wheel have been able to get satisfaction from it. It is simple and is capable of generating quite a degree of power, which may be transmitted to some device through the agency of the belt P.

In Fig. 6 is shown another design, which can be constructed with materials usually easily collected. The hub is made first as in the case of the other wheels, and this may again be a common wheel hub, with the belt wheel fixed on the shaft adjoining it. Or in case that a wheel hub is not at hand, the hub can be made of a hardwood block, bored and rounded to suit the conditions. Then the spokes are inserted into holes made in the hub for the purpose. These spokes are of hardwood and a good way to get them is to secure spokes of an old carriage wheel. In fact, a good way to do is to get a wheel from a blacksmith or wheelwright and use it as it is, removing the rim, cutting the spokes to right length, and if necessary sawing off every other spoke. Or perhaps it will be necessary to saw off two of every three spokes. This gives you a very strong base to work with. The wheels can be bought for a very little money after they are cast to the junk heap. Many times they are given away. Thus if we were making the pattern of wheel in Fig. 6, all the spokes of the wheel would be sawed off except the four shown. To these spokes, at the ends, the bowl-shaped tins are fixed. They are fastened so that the spoke crosses direct over the front of the opening. Screws or rivets are used to make fast with. The water force is from the pipe T, and the discharge contacts with force against the bowl S, causing the wheel to revolve, bringing the next bowl in position, and so on. The rope belt is marked R, and is extended to the device to be driven.

A NOVEL BURGLAR ALARM.

Will Ring An Electric Bell, Flash An Electric Light, Shoot a Pistol Five Times and Call the Police

By W. H. Matthews.

A burglar alarm which will do all of these things may be made at small cost and with very little labor. Secure a piece of hard wood, a part of a tobacco box is best, about 8 or 10 in. square. Cut a round piece like Fig. 1 out of it and on one edge cut a notch as at C. Take a strip of hardwood about 1 in. thick, shape it like B, Fig. 1, and

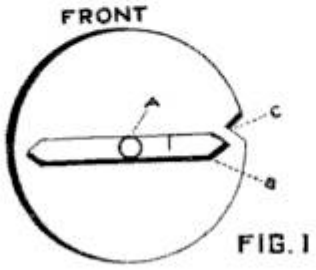


FIG. 1

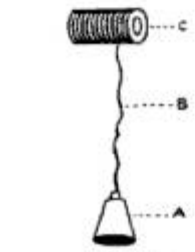


FIG. 3.

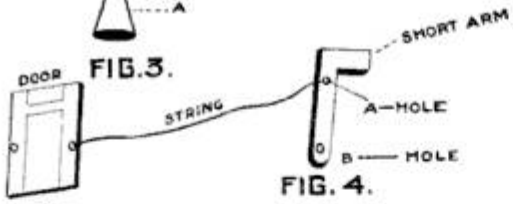


FIG. 4.

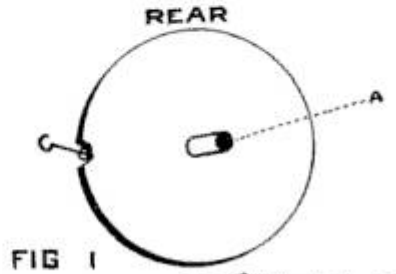


FIG 1

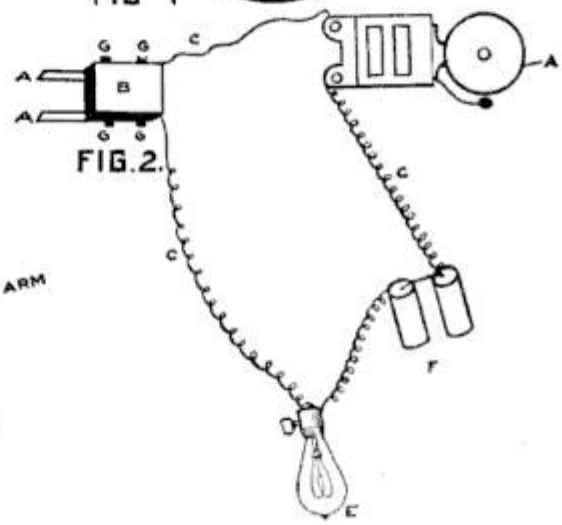


FIG. 2.

nail it securely to the round piece. At A make a hole large enough to run a 20-penny nail through.

Saw off 3 or 4 in. of the large end of an old baseball bat, make a hole through this also and nail it to the back of Fig. 1. The 20-penny nail should pass through the hole at A, through the hole in the bat and project far enough to drive into the wall. It should be fastened either to the wall in the room or the back hall.

Fig. 3 consists of a piece of ball bat, C, fastened to a strong cord, B, which has a weight, A, fastened to the other end. This is to be wound up on the piece of bat, C.

Shape a piece of wood like Fig 4, about 6 in. long. Make two holes A and B in it. The short arm of this piece is to project over the end of B, Fig. 1, and act as a trigger to keep the weight, A, Fig. 3, from dropping until wanted. The lower end of Fig. 4 is to be securely fastened to a piece of wood projecting from the wall so the short arm will slip over the end of B, Fig. 1. Now fasten a string in the hole, A, Fig. 4, and run the string to the doors and windows. You can run a dozen or more strings to the hole, A. The best way is to put a hook, or eye, in the door facing on one side of the door and a hook on the other side. Make a short hook out of a piece of hay wire and attach it to the end of the string. At night hook the end of string attached to trigger in eye on one side of door facing, draw it in front of door and put through the eye on other door facing. Leave the screen or other door unlocked and if any one attempts to go through the door he will put the machinery to work and get a "warm reception." The string should be about 2 ft. above the floor.

Remove the trigger guard from a double-acting cheap revolver, and fasten it so when the weight, A, runs down, the piece, B, Fig. 1, will strike the trigger and fire the pistol. BLANK cartridges ONLY should be used. They will prove effectual as the burglar will hardly stop to investigate.

Take a small block of wood, B, Fig. 2, and fasten two springs on it so that they will nearly touch. Fasten this block of wood so when the weight is wound up the springs will be in the notch, C, Fig. 1. When the weight falls the springs will be pressed together thus ringing the electric bell and furnishing an electric light. If you have no electric lights in the house, get a

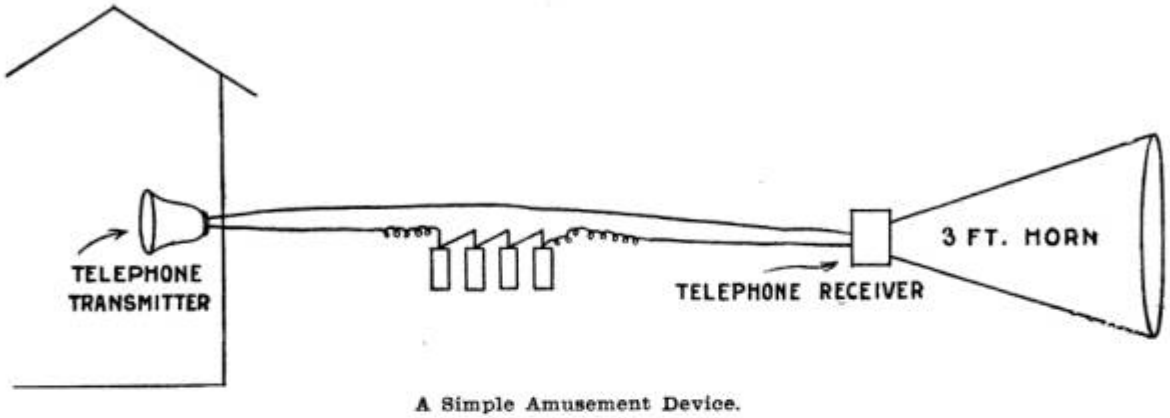
small electric hand lantern. The bell and light may both be connected on the same circuit. Fig. 2 shows how this is done: A, A, are the springs; B, block of wood; C, C, C, C, wires; D, bell; E, lamp; F, batteries; G, G, G, G, screws to which the wires are attached.

Now in addition, if you want to call the police, get a small, cheap phonograph and a record with, "Police," "Fire," "Murder," or anything else on it you wish. Make anything you please on it. Place it directly in front of your telephone transmitter and connect it with Fig. 1, and also connect the rereiver of the phone with Fig. 1, so that when the weight falls it will start the phonograph and at the same time will drop the receiver off its hook, consequently calling the police. Any one with a little ingenuity can connect the phonograph, and the receiver of the telephone so that when the weight falls they will do their part.

It will cost very little to make this and it will prove a sure protection. If you wish you can leave off calling the police, ringing the bell and flashing the light and only have it fire the pistol.

A MECHANICAL VENTRILOQUIST AND HOW TO MAKE IT.

An apparatus rigged up as shown in our illustration will afford any amount of amusement to the boy who cares to try it.



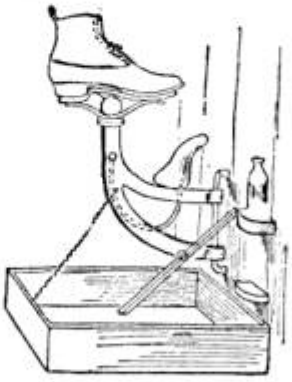
A Simple Amusement Device.

The materials required are a watch case telephone receiver, a transmitter, a large phonograph horn, about 200 ft. of No. 18 wire and three or four batteries.

Fasten the watch case receiver to the horn, being careful not to let it touch the diaphragm of the receiver. Run the line and attach the transmitter at its opposite end. When one talks into the transmitter a person 200 ft. distant from the receiver can plainly hear what is said. If the receiver and horn end is hidden in a clump of bushes near a road, people passing will be greatly puzzled at hearing a voice, seemingly out of uninhabited space.—Contributed by W. J. Slattery, Emsworth, Pa.

HOW TO MAKE A BOOT-BLACKING CABINET.

The boy or man who shines his own shoes will find a cabinet like the one shown in the sketch very handy.



This cabinet folds to the wall and projects only about 2 in. into the room. When dropped down a chain pulls the foot rest out into position and a hinged arm supports the box underneath to catch all dust which may drop from the shoe. A shoe form may be provided, also, for polishing shoes when not on the feet.

RENEWING DRY BATTERIES.

Dry batteries, if not too far gone, can be renewed by simply boring a small hole through the composition on top of each carbon and pouring some strong salt water or sal ammoniac solution into the holes. This kink is sent us by a reader who says that the process will make the battery nearly as good as new if it is not too far gone beforehand.

A GOOD IMITATION OAK SURFACE STAIN.

Mix equal parts of burnt umber and brown ocher with very thin glue size; lay on with soft woolen cloths and wipe dry after application. Be careful to have the colors well pulverized and strain the liquid before using.

In our "Mechanics for Young America" next month will appear among other things an article on "How to Make a Small Search Light," and "How to Make a Rabbit Trap." Both stories will give the young mechanic something interesting and practical to make.

SPEED OF FLOATING BOATS IN FLOWING RIVER

There is a very general belief that a boat can float down a smoothly flowing river at a speed exceeding that of the flowing water. In support of this belief, an argument somewhat like the following is often adduced:—

The river necessarily flows from a higher to a lower level, and therefore its surface is inclined in the direction of flow, says Technics, London. If we suppose the

FIG. 1.—WEIGHT SUPPORTED ON BOARD, WHICH SLIDES ON AN INCLINED PLANE.

boat to merely slide down the inclined plane formed by the surface of the river (the water being stationary), then it would acquire a definite velocity dependent on the friction between the boat and the plane. If, now, the water is supposed to move in the same direction as the boat, the relative motion between the two would be less, and therefore, the friction would be less and the final velocity of the boat greater. Fig. 1 represents a weight supported on a board which itself slides down an inclined plane. If there is no friction between the weight and the board or between the board and the plane, then the weight and the board will move together, the acceleration of one being exactly equal to that of the other; but if there is friction between the board and the plane, then the weight might move more quickly than the board. This argument appears very plausible, but it does not take into account the essential properties of the flow of water.

A section along the length of the river is represented in Fig. 2. If the cross-sectional

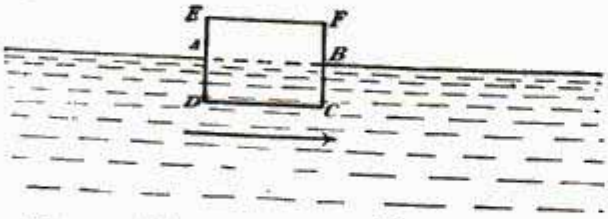
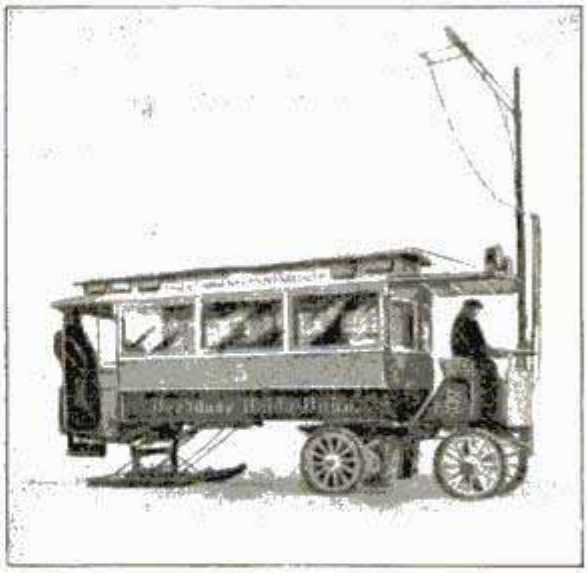


FIG. 2.—TO EXPLAIN THE EFFECT OF THE SURROUNDING WATER ON A BOX FLOATING DOWN A RIVER.

area of the river is everywhere uniform, it follows that the velocity of flow of the river will be the same at all points in its course; for if the flow through a given cross-section in a given time is not equal to the flow through any other cross-section in the same time, there would either be an accumulation or a progressive decrease of the water between the sections. Thus, if we take a rectangular parallelopiped of water represented in longitudinal sections by A B C D, Fig. 2, the water contained within this parallelopiped must move with a uniform velocity, and therefore must be acted upon by no resultant force. It is easily seen that the resultant force due to the action of the surrounding water on the parallelopiped will just serve to neutralize the downward pull of gravity. If we now replace the water within the parallelopiped A B C D by a solid with its upper surface flush with the surface of the river, the action of the surrounding water on this will be exactly the same as on the water originally contained in the parallelopiped. Therefore the solid will move exactly as the water did. If the solid floats only partly immersed, as at E F C D, its mass must still be exactly equal to the mass of water displaced, and therefore the action of the surrounding water will just neutralize the downward pull of gravity, and the body will still move at the same rate as the water. If by any chance it was set in motion with a greater velocity than the water, this velocity could not be maintained; the velocity of the body would quickly fall to that of the surrounding water.

TRACKLESS TROLLEY CAR SLED.

A traction novelty is the trackless trolley car sled which is in operation in Germany. The summer car is mounted on wheels and runs on the highway taking power from

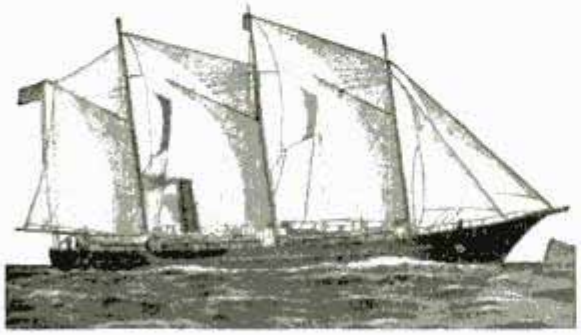


A Traction Novelty.

two overhead trolley wires; no rails are required. The winter car has wheels for drivers and one end is carried on runners. The car is heated with electric heaters and makes about 15 miles an hour.

COMMANDER PEARY'S NEW EXPLORING CRAFT.

When Commander Peary starts out on his search for the North Pole next June or July he will go forth with the most perfect equipment for the purpose possible. Experience has been the teacher and where the expedition was weak before, this time it will be strong. The ship now being constructed for this final dash is a marvel of strength fit to do battle with the mighty grinding, crushing ice floes it will encounter. It is a singular fact that to obtain the greatest strength and efficiency for this purpose wood, carefully selected white oak, and not steel was the material used.



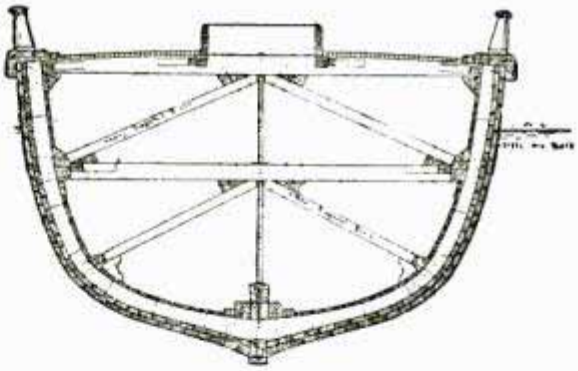
Peary's Vessel as it Will Appear When Completed.

The exploring craft is built to withstand heavy pressures acting upon her and is so shaped that the ice-pack pressing upon her below water will tend to lift her out of the water. By reference to the cross section the practicability of this construction is evident. Worked abreast of the plank sheer from stern to stern and securely fastened to the frames, plank sheer and waterway so that it is able to support the entire weight of the ship is a heavy white oak guard 8 inches by 20 inches. This is protected on the face and under-side by a heavy angle-bar of steel. Thus, by means of this guard strake is secured great longitudinal stiffness of the ship and the ship may be lifted out of the water by the upward pressure of the ice pack itself or by jacks placed upon the ice. The bow, the stern and the waterline will be armored to protect against the grinding of the ice.

In dimensions the vessel is: Length over all, 181 feet; beam, maximum, over guard-strake, 34 feet 2 inches; mean draft, 16 feet; full-load displacement, 1,500 tons. She will carry two deck houses, the forward one being portable and large enough to accommodate the great explorer, the scientific staff and officers of the ship for winter quarters when the ship has gone as far north as possible to force her. The ship will be heated by steam and lighted by both electricity and oil lamps. Concerning her motive power the Marine Journal says:

"The motive power will consist of a single, inverted, compound engine, driving a single 10-foot screw, and steam will be supplied by two water-tube boilers. Under forced draft, the engine will be able to develop 1,400 indicated horsepower, and under natural draft, 1,200 indicated horsepower. The bunker capacity is 700 tons of coal; and at starting, the vessel will carry a deck load, in bags, of 150 tons more. With this supply, at a 10-knot cruising speed, she should be able to do between four and five thousand knots. The vessel's rig is rather unusual, but is sufficient in spread of canvas to make her manageable under sail alone. The individual sails are designed to make it easy for a small crew to handle them. The foremast and the mizzenmast will be single sticks. A crow's nest will be carried on the maintopmast."

The vessel, carrying two years' supplies, will be forced as far north along the frigid shores of Grant Land as possible, and then



Cross Section of Commander Peary's New Ship.

the expedition will proceed with sledges. Matthew Henson, the colored man who so bravely stood by Peary through the perils of that other trip, will again accompany him. The Eskimos and sledge dogs, which will make up the rest of the party, will be most carefully chosen.

Nothing tending to make the expedition successful will be neglected, and the whole world is awaiting its developments. It is an astonishing fact that more is known about the poles of the planet Mars than is known about the conditions at the poles of our own world. The farthest point reached by Peary so far was 84° 17′ 27″ north, magnetic variations 99° west.

One $ Free-Just To Prove

I ask no deposit–no promise. There is nothing to pay, either now or later. The dollar bottle is free.

I want no reference—no security. The poor have the same opportunity as the rich. The very sick, the slightly ill, invalids of years, and men and women whose only trouble is an occasional "dull day"—to one and all I say "Merely write and ask." I will send you an order on your druggist. He will give you free, the full dollar package.

My offer is as broad as humanity itself. For sickness knows no distinction in its ravages. And the restless patient on a downy couch is no more welcome than the wasting sufferer who frets through the lagging hours in a dismal hovel.

I want EVERYone, EVERYwhere to test my remedy.

There is no mystery—no miracle. I can explain my treatment to you as easily as I can tell you why cold freezes water and why heat melts ice. Nor do I claim a discovery. For every detail of my treatment is based on truths so fundamental that none can deny them. And every ingredient of my medicine is as old as the hills it grows on. I simply applied the truths and combined the ingredients into a remedy that is practically certain. The paragraphs below will show you the reason why.

In eighty thousand communities—in more than a million homes—Dr. Shoop's Restorative is known. There are those all around you—your friends and neighbors, perhaps—whose suffering it has relieved. There is not a physician anywhere who dares tell you I am wrong in the new medical principles which I apply. And for six solid years my remedy has stood the severest test a medicine was ever put to—I have said "If it fails it is free"—and it has never failed where there was a possible chance for it to succeed.

But this mountain of evidence is of no avail to those who shut their eyes and doze away in doubt. For doubt is harder to overcome than disease. I cannot cure those who lack the faith to try.

So now I have made this offer., I disregard the evidence. I lay aside the fact that mine is the largest medical practice in the world, and come to you as a stranger. I ask you to believe not one word that I say till you have proven it for yourself. I offer to give you outright a full dollar's worth of Dr. Shoop's Restorative. No one else has ever tried so hard to remove every possible excuse for doubt. It is the utmost my unbounded confidence can suggest. It is open and frank and fair. It is the supreme test of my limitless belief.

Inside Nerves!

Only one out of every 98 has perfect health. Of the 97 sick ones, some are bed-ridden, some are half sick, and some are only dull and listless. But most of the sickness comes from a common cause. The nerves are weak. Not the nerves you ordinarily think about—not the nerves that govern your movements and your thoughts.

But the nerves that, unguided and unknown, night and day, keep your heart in motion—control your digestive apparatus—regulate your liver—operate your kidneys.

These are the nerves that wear out and break down.

It does no good to treat the ailing organ—the irregular heart—the disordered liver—the rebellious stomach—the deranged kidneys. They are not to blame. But go back to the nerves that control them. There you will find the seat of the trouble.

There is nothing new about this—nothing any physician would dispute. But it remained for Dr. Shoop to apply this knowledge—to put it to practical use. Dr. Shoop's Restorative is the result of a quarter century of endeavor along this very line. It does not dose the organ or deaden the pain—but it does go at once to the nerve—the inside nerve—the power nerve—and builds it up, and strengthens it and makes it well.

Many Ailments-One Cause

I have called these the inside nerves for simplicity's sake. Their usual name is the "sympathetic" nerves. Physicians call them by this name because each is in close sympathy with the others. The result is that when one branch is allowed to become impaired, the others weaken. That is why one kind of sickness leads into another. That is why cases become "complicated." For this delicate nerve is the most sensitive part of the human system.

Does this not explain to you some of the uncertainties of medicine—is it not a good reason to your mind why other kinds of treatment may have failed?

Don't you see that THIS is NEW in medicine? That this is NOT the mere patchwork of a stimulant—the mere soothing of a narcotic? Don't you see that it goes right to the root of the trouble and eradicates the cause?

But I do not ask you to take a single statement of mine—I do not ask you to believe a word I say until you have tried my medicine in your own home at my expense absolutely. Could I offer you a full dollar's worth free if there were any misrepresentation? Could I let you go to your druggist—whom you know—and pick out any bottle he has on his shelves of my medicine were it not UNIFORMLY helpful? Could I AFFORD to do this if I were not reasonably SURE that my medicine will help you?

Simply Write Me

The first free bottle may be enough to effect a cure—but I do not promise that. Nor do I fear a loss of possible profit if it does. For such a test will surely convince the cured one beyond doubt, or disbelief, that every word I say is true.

The offer is open to everyone, everywhere. But you must write ME for the free dollar bottle order. All druggists do not grant the test. I will then direct you to one that does. He will pass it down to you from his stock as freely as though your dollar laid before him. Write for the order today. The offer may not remain open. I will send you the book you ask for beside. It is free. It will help you to understand your case. What more can I do to convince you of my interest—of my sincerity?

For a free order for a full dollar bottle address Dr. Shoop, Box 3353 Racine Wis. State which book you want.

- Book 1 on Dyspepsia.
- Book 2 on the Heart.
- Book 3 on the Kidneys.
- Book 4 for Women.
- Book 5 for Men.
- Book 6 on Rheumatism.

Mild cases are often cured with one or two bottles. For sale at forty thousand drug stores.

Dr. Shoop's Restorative

FISHING BY TELEPHONE.

A Norwegian has invented a queer way of finding out where the fish are. A microphone, which is an instrument that will catch and transmit the least bit of sound, is lowered into the water from a fishing smack, and a wire from it leads to a telephone aboard the boat. Now, as the herring, codfish and mackerel schools number thousands and tens of thousands of fish, their passage through the water naturally causes a rushing sound, which can be heard by the fishermen at the telephone, and thus they are enabled to lower their nets at the right time and in the right place.

BALTIC FLEET VS. JAPANESE SQUADRON.

The Baltic fleet numbers altogether fifteen ships, and to oppose these the Japanese have thirty-three ships, exclusive of torpedo boats. The Russian guns number 703, the Japanese 941. The Russians have 54 sets of mining apparatus, the Japanese 125. The Russians have 14 sets of submarine mining apparatus, the Japanese 52, and, finally, officers and men of the Baltic fleet aggregate 8,521, as compared with 14,435 officers and men on the Japanese warships which they will have to meet.

OF COURSE ALWAYS TWO IRISHMEN.

Two Irishmen, who had not seen each other for a long time, met at a fair.

O'Brien: "Shure it's married I am, an' I've got a fine healthy boy, which the neighbours say is the very picter of me."

Malone: "Och, well, what's the harrum so long as the child's healthy?"—Tit-Bits.

Send for "Shop Notes," 1905 edition; 200 pages; 50 cents.

FIXING THE FURNACE.

When pa starts to fix the furnace all us children have to be
Just as quiet as if mother had a headache—or a tea;
First pa takes his coat and vest off, then you hear him cough and say,
"Pay to have it fixed? I should say not! Now, you children, run away;
Jobs like this I never shirk!"
(That's the way he starts to work.)

Mother smiles a sort of worried smile and shakes her head and sighs;
Then she takes us in the parlor, where to read aloud she tries;
But the racket pa is making drowns her voice and so she goes
On up-stairs to make the beds or mend some of our winter clothes.
From the cellar comes a noise
Like a dozen real bad boys!

After while his work is finished and pa comes up-stairs again;
Cut and bruised and black as any of those funny minstrel men,
Great big lump upon his forehead, thumbs all mashed, both eyes black,
Breathing like he'd run a foot race, hair filled full of dust and slack;
Limps and holds his sides and groans
Like he'd broken all his bones.

Mother meets him with witch hazel, bandages and salves and soap;
Says, "I'm awful sorry, Frederick; nothing's very bad, I hope?"
Pa just sits and chews his mustache, then he drags himself to bed;
Has to have the doctor come and patch his hands and back and head;
Has to pay for that—but still
Furnace man won't send a bill!

WHEN THE ENGINEER CRIED.

"Yes, indeed, we have some queer little incidents happen to us," said the fat engineer. "Queer thing happened to me about a year ago. You'd think it queer for a rough man like me to cry for ten minutes, and nobody hurt, either, wouldn't you? Well, I did, and I can almost cry every time I think of it.

"I was running along one afternoon pretty lively, when I approached a little village where the track cuts through the streets. I slacked up a little, but

(Continued on page 260.

(Continued from page 259.)

was still making good speed, when suddenly about twenty rods ahead of me a little girl not more than three years old toddled onto the track. You can't even imagine my feelings. There was no way to save her. It was impossible to stop, or even slack much, at that distance, as the train was heavy and the grade descending. In ten seconds it would have been all over, and after reversing and applying the brake I shut my eyes. I didn't want to see any more.

"As we slowed down my fireman stuck his head out of the cab window to see what I'd stopped for, when he laughed and shouted at me: 'Jim, look here!" I looked, and there was a big black Newfoundland dog holding the little girl in his mouth, leisurely walking toward the house where she evidently belonged. She was kicking and crying, so that I knew she wasn't hurt, and the dog had saved her. My fireman thought it funny and kept laughing, but I cried like a woman. I just couldn't help it. I had a little girl of my own at home."

EXPERIENCES OF A GASOLINE ENGINE EXPERT.

On arriving at my destination, after being called to doctor a gasoline engine which had been most thoroughly cussed as being the poorest gasoline engine on the market, because of its extreme peculiarity, in that it would run occasionally and stop most of the time, I found an engine of known merit and therefore had no hesitancy in tackling the job. The facts as given by the owner of the engine were true in all excepting that the engine was A-1 after the difficulty had been located, says the Grain Dealers' Journal.

As the pump would supply gasoline but part of the time it appeared as if it needed repacking or that the check valves needed attention. A wooden plug 1½ in. long and slightly tapering nearly as large in diameter as the pipe was located in the ¼-in. vertical gasoline supply pipe; this would float in the pipe when oil was being pumped into the cylinder, but before the pipe was thoroughly stopped the engine would have been supplied so that it would run for a short period. Since this plug was removed the engine has always given the very best of results.

On another occasion I found an engine running by alternating frequency, sometimes would run for quite a spell and then lay off until ready to start. I located the difficulty in the insulated copper wire. The copper wire inside of insulation had become parted, but the ends had scarcely spread apart, and the dangling wire would give to such an extent the circuit was open and sometimes it would be closed. The insulation covering this place was perfect.

We suggest that while the foregoing instances are peculiar and required the service of an expert, it has been our experience that little, if anything, has been wrong with engines that have been most harshly criticized. Good, hard common sense applied would have saved both time and expense to the owner of the machine.

THIS DIARY WAS GOOD READING.

There is a certain nine-year-old kid in this city who is keeping a diary. The book was given him last Christmas by a relative, and his father had forgotten all about it until he accidentally found the volume the other day. Curious to see what his small son had written in it, he opened the book and found that the diary had been faithfully kept. Here are a few of the entries:

"I am nine years old today. Looked in the glass, but wiskars ain't sproutin' yet."

"Sassed a boy. Got lickt."

"Pop borrid ten cents for car fair, that makes $1.15 he owes me. Wonder if He ever get it?"

"Jimmy ———— stole my ball. I lickt him for it."

"Ast Pop for some of my money and he give me a nickil. I want that doler."

"We feloes got up a baseball club today. Ime picher. If I had that doler 15 I could get a uniform."

"Pop got paid today and giv me my money."

"Mamma borrid a doler. Dum these people anyway. A feloe cant save nothin'."

"Ast Pop about banks. I want to put my money ware carfair aint so skarse."

"Got lickt again."

There was more of this, but "Pop" had read enough. As a result there was a conference, and now the arrangement is to pay five per cent a week interest, and settle every pay day. The kid got his "uniform."—Philadelphia Telegraph.

POSSIBILITIES OF INVENTION.

They've made a wireless telegraph,
  A horseless carriage, too,
And there's no way of telling what
  The mind of man can do.
We'll soon be eating henless eggs,
  And drinking cowless milk,
And wearing clothes of sheepless wool,
  Or mayhap wormless silk.

How would you like a treeless peach?
  Or a piece of hogless pork?
I'd be content if they'd invent
  A kind of workless work,
  Or mayhap, noiseless noise.
And I'm afraid if they keep on,
  They'll yet make dadless boys.

RATTLED THE WAITER.

There is a certain traveling man who devotes all his leisure time to the preparation of elaborate and solemn jokes. Nobody on earth is too august for him to tackle. He was in Pittsburg last summer, and one morning he went into a restaurant with his most dignified air, and proceeded to order breakfast.

"I want two eggs," said he to the waiter. "I want one fried on one side, and the other fried on the other."

The waiter nodded and withdrew. A little later he returned.

"Beg pardon, sir," he said, "but I am afraid I didn't quite catch your order. Would you mind repeating it?"

"Not at all," said the traveler, solemnly. "I want two eggs, one of them fried on one side and the other on the other."

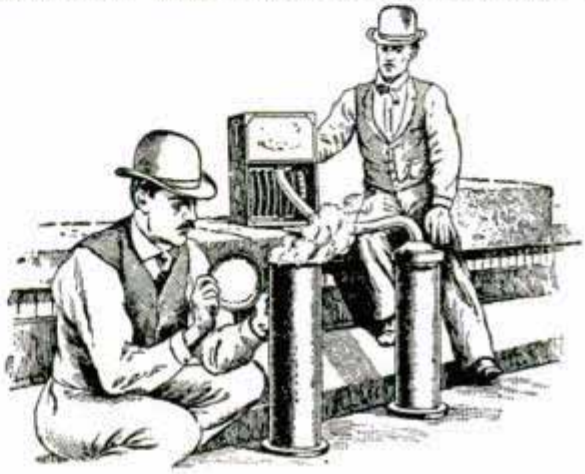
"Thank you, sir," said the waiter. "I thought that was what you said, but I wasn't quite sure, sir."

Five minutes later an apologetic waiter returned to the joker's elbow.

"I beg your pardon, sir," said he again, "but the cook and I have had some words. Would you mind having those eggs scrambled?"

TESTING HOUSE PIPES WITH SMOKE.

There are several methods of testing sanitary piping in a house, of which the use of oil of peppermint and smoke are most common. The smoke test shows the location of a leak by the escaping smoke. Some cities require the smoke test. The latest apparatus consists of a smoke generating chamber and a bellows. The smoke generating chamber is sealed by water, which not only provides a seal against the escape of smoke from the apparatus, but keeps the smoke chamber cool. In



Smoke Test for Pipes

this chamber oily waste, tar paper or other material adapted for producing a dense smoke is placed and set on fire. As soon as smoke is being properly generated a hose or pipe is connected with the smoke outlet and carried to one of the inlets or outlets of a plumbing system. Sometimes the hose taking the smoke from the machine is carried to the fresh air inlet, and the smoke is driven up through the building until every pipe connected with the drainage system is filled with dense smoke.

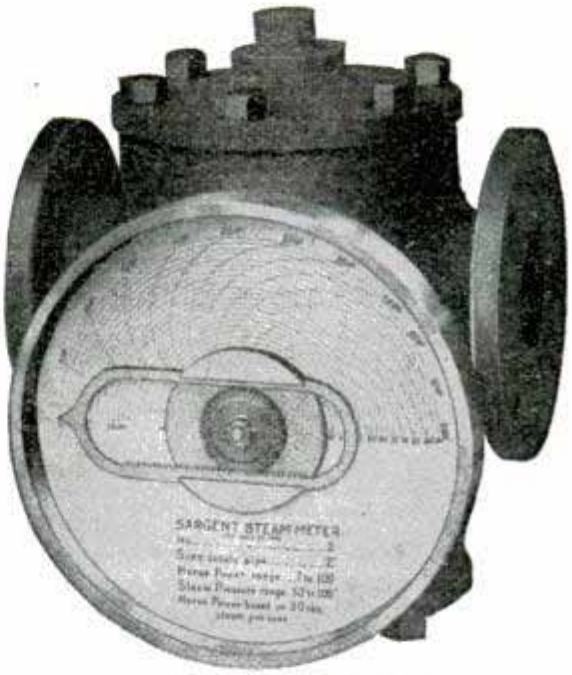
RESPONSIBILITY OF MOTORMEN.

"When people trust their lives in a railroad train," says W. S. Stone, Chief of the Brotherhood of Locomotive Engineers, "whether the motive power be steam or electricity, they are entitled to have a man in control of the power that whirls them at such great speed through the country who is a first-class man in every respect—in brains, in vigor and in responsibility of character."

Now that electric lines are running at 50 and 60 miles per hour, and already talking about higher speeds, the statement by Mr. Stone will commend itself to the public. While it is true that an electric car can ordinarily be brought to a stop in a much shorter space of time than a heavy passenger train, there are other emergencies which require that only experienced and competent men should be entrusted with the work.

A STEAM METER.

A meter for accurately measuring the flow of steam in a pipe is now on the market. It is said to do good work, although the price at present is rather high. The idea is to place the meter in the



Steam Meter

steam pipe next the boiler. By observing the position of the pointer at any time, the amount of horsepower or pounds of steam passing through the engine or heating system may be determined.

A FEW DON'TS.

Don't worry about the cost of a patent until you have found that the invention is new. (It costs $5.00 to find this out.)

Don't try to sell your invention until you can show that it is new and patentable. (If you haven't $5.00 worth of confidence in its novelty, you mustn't expect others to invest larger sums in it.)

Don't delay in applying for a patent after you have found that the invention is new and patentable. (Delays are especially dangerous in patent matters.)

Don't show your invention to anyone until after you have made an application for a caveat or a patent. (It is not safe.)

Don't imagine that your invention is worth a fortune and that others are worth nothing. (Most inventions are worth something; few have "millions in them.")

Don't employ a patent attorney who promises something for nothing. (Free service means worthless service, or worse.)

Don't try to get a patent for less than $65.00. (Most patents usually cost more.)

Don't expect to sell your invention or patent by simply showing a rough drawing of it. (Present it in the best shape possible.)

Don't get discouraged because one invention proves to be old or one patent is not salable. (If you can invent one thing, you can another. Patent rights are sold by the thousands and many fortunes made by them.)

PATENT OWNERSHIP.

One of two joint inventors cannot legally apply for a patent. They must both sign the papers. One of them can then assign all his rights in the invention or patent to the other, in which case the

patent will be owned by the one to whom the assignment is given.

Two persons cannot legally apply for a patent on an invention made by one of them. No one but the inventor has the right to sign the papers, except in case of his death, in which event the application must be signed by his duly appointed legal representative.

To make a joint invention both parties must actually invent or devise it, or contribute to the ideas involved in the device or machinery. If one person furnishes the ideas, and another makes a model embodying those ideas, the model maker is not an inventor, but simply exercises mechanical skill.

In the absence of a contract to that effect, an employer is not entitled to the patented invention of his employe, even where such invention was made in the time, and by the aid of the tools of the employer. If, however, the employe permits his employer to use the invention, or uses it himself in his employer's business, it will amount to a license to use it, which, however, cannot be transferred by the employer.

Where an employer conceives the invention, and is engaged in experimenting on it to perfect it, no suggestons from an employe not amounting to a complete invention in themselves, will constitute such employe a joint inventor.

If an employer desires to control the inventions of his employes he should so contract in writing. If an employe does not want to give his employer the right to use his inventions, he should not put the invention in use in his employer's business in the absence of a written contract covering all conditions.

Each owner of an undivided interest in a patent may use or sell, or license others to use the invention, without the consent of the other co-owners.

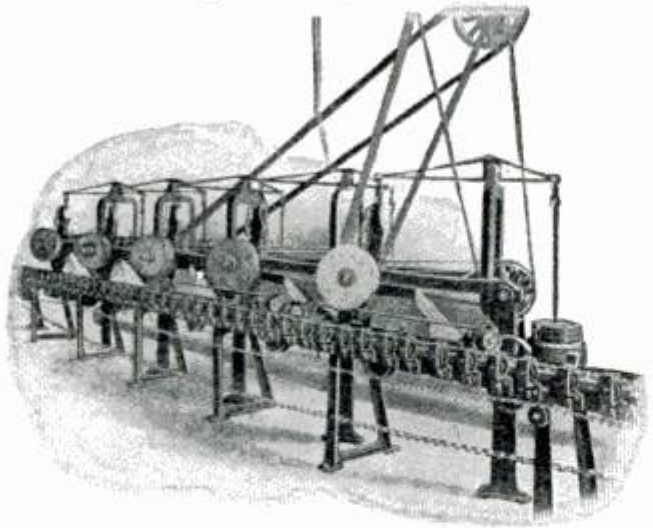
Where there are two or more owners of a patent, there should always be a partnership agreement between them as to the use of such patent, limiting and defining the rights of each co-owner.

MACHINE FOR POLISHING TUBING.

An automatic machine is now on the market for polishing brass tubes, such as are used in brass beds and ornamental furniture and fixture work. The Furniture Journal says:

As will be seen from the illustration, the tubing

revolves in its holders, and at the same time is carried in a horizontal direction, passing under all of the wheels of the machine at an angle of thirty degrees, as with hand work. In this way uniformity of work is assured, as every part of the surface comes under the wheels at the same pressure and at the same angle. The work is completed with one pass through the machine. A five-



Tube Polishing Machine

wheel machine has a capacity of twenty-five hundred feet per day, and can be adapted to work of any diameter and from two inches to eight feet in length. The machine can be operated by belt or other transmission, or by direct connection, and the speed of the carriage can be easily regulated.

ENGINEER RAN A BLAZING OIL-FUEL LOCOMOTIVE.

An engineer on an oil-burning locomotive of the Atchison, Topeka & Santa Fe Railway recently proved himself a hero when the locomotive caught fire while standing with its passenger train attached at San Bernardino, Cal. The tender contained 2,000 gallons of oil, and the cab was soon covered with flames and the danger of an explosion imminent. The engine had to be removed immediately. There was no yard engine available, so the engineer climbed back into the burning cab and ran the engine away where it could do no damage. The engineer suffered slight burns.


Prosperity in Kansas as cartooned by the artist of the Kansas City *Star*.

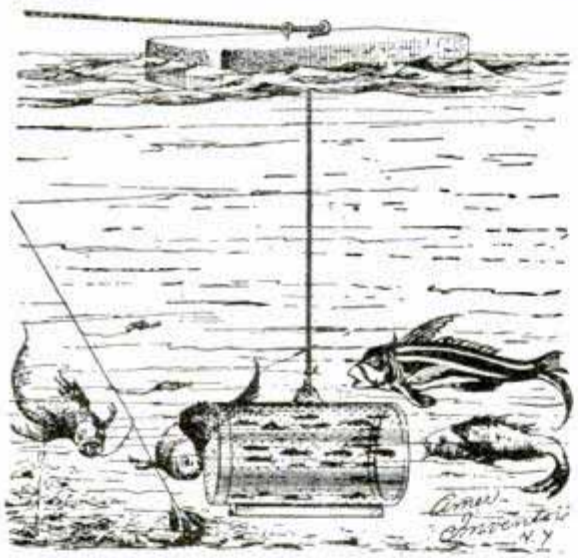
VALUE OF DETERMINATION.

Determination has quite as much as means of opportunity to do with giving one success. If a man is determined to do, he will be likely to do whether things favor or oppose him. If a man makes up his mind that, as things are, he cannot do what he ought to, or would like to do, he will not be likely to accomplish anything, however circumstances combine to help him. "Only Omnipotence can hinder a determined man," and Omnipotence will not oppose a determined man who is set in the right direction. It is not the opportunity that a man has, or the tools that are available to him, but it is the determination with which he pushes on against unfavorable circumstances, and with which he uses such fools as are available, that settles the question of how much he amounts to and what he accomplishes in life.

The total number of emigrants from England to the United States was less for 1904 than it was the year before, despite the cut rates which so alarmed the public. It was expected that these emigrants would be of the lowest character, but the actual facts is that the character of the emigrants has not materially changed.

SCHEME TO ATTRACT FISH.

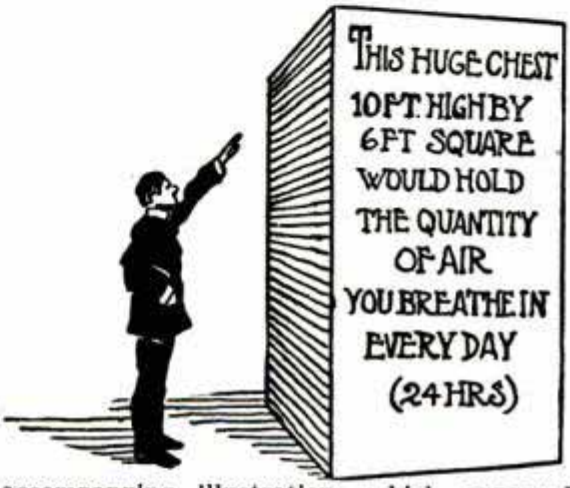
The duck hunter uses decoys to lure game within shooting distance, and why should not the fisherman do something to create a sensation? To have the fish come flocking around the boat is certainly much easier than rowing about in fruitless search.



A fish decoy is described in the American Inventor, on which a patent was recently granted. A glass bait holder, through which the water can pass to keep it fresh, is lowered from the boat. The apparent abundance of the bait is expected to draw larger fish to the spot.

THE AIR WE BREATHE.

The amount of air a person breathes in 24 hours is set forth in a very understandable manner in



the accompanying illustration, which appeared in the Boiler Magazine.

HOW IT FEELS TO FALL 137 FEET.

Workman Who Dropped from Brooklyn Bridge and Survived Tells Experience.

New York, Dec. 22.—Charles Somerfield, of New York, a riveter, fell 137 feet from the Brooklyn bridge into the river, and after swimming through the ice nearly to the shore was picked up by a tug.

He tells a remarkable story of his sensations during the long fall. Here is his story:

"The fall of 137 has not hurt me in the least. After I had made the first turn in the air the feeling was fine. The first thing I remember was seeing familiar things. It seemed as though hundreds of bright lights held by fairies in fancy dresses danced before my eyes.

"Besides the delightful sensations that I experienced every part of my past life was reveiwed by me.

"I remember that I wanted to make my peace with God and tried to murmur a prayer.

"My feet had barely struck the water when I started to swim, so I did not sink very deep.

"One thing that struck me as peculiar just before I reached the water was that I distinctly heard the cries of the women on the ferryboat. And, strange to say, my only thought was that if they didn't keep quiet I would sink.

"Altogether the best way I can describe my sensations is to say that I felt exactly like a man does after he has smoked opium.

"As to how I happened to fall, I was working on a platform underneath the roadway when I leaned over too far and the woodwork collapsed. As I fell I clutched one of the boards and shot down, dragging it with me. My legs and arms were wrapped about the board as I dropped through the air, turning over four times as I fell."

THE ENGINEER.

Geo. W. Scott.

Clad in overalls and happy,
(Neither willieboy nor chappy)
But good-natured, strong and sappy,
Listening with a well-trained ear.
Watching carefully his boilers,
Keeping tab upon his oilers,
Also bossing other toilers,
Is the man called engineer.

Feeling each and every bearing,
Keying up where they've been wearing,
When they're hot he'll do some swearing
With a voice that's strong and clear.
Splicing belts with rawhide laces,
Sounding boiler stays and braces,
Hardly ever plays the races,
Does the busy engineer.

He's been hailed as emblematic,
Of those termed aristocratic,
This, we think, not too emphatic,
For we hold him very dear.
Seldom owns a trap or horses,
Seldom figures in divorces,
Yet controlled are all the forces,
By the fearless engineer.

—National Engineer.

WHAT SHOULD THE YOUNG MECHANIC READ

This problem is confronting many a young mechanic. What periodical should he subscribe for? This problem is not always easily solved by the young themselves. It requires the good judgment of one who has had experience and who has with interest watched the daily work of the young mechanic about the shop. Looking over the long list of weekly and monthly papers published for the benefit of those engaged in mechanical work, we realize the necessity of good judgment based upon facts. When I say judgment based upon facts, I mean the faults of the young man and the points where knowledge is lacking, which are learned only by careful watching. We find that many of his faults are insignificant affairs requiring only a small amount of knowledge to correct. The problem is, what reading matter can be placed in his hands to give him this small amount of knowledge enabling him to correct his small mistakes, without trying to carry him to the top of the ladder of knowledge at one jerk. Most of the mechanical papers are published for the interest of the full-fledged mechanic. Small bits of information that would be knowledge to the young man are not considered worthy of space in their columns. Reading such papers the young man could form some idea of a huge piece of machinery by looking at the picture. When he reads the description of this great mass of machinery and finds that the figures necessary to describe the power, etc., require a formula using letters in place of the common numerals he learned at school, here at this point he loses interest in the article that had a very interesting beginning. He cannot read the figuring any more than he can read the inscription on the arch of Titus, built 70 A. D., and to him it is the same as the Phoenician alphabet is to the average man.

Now before passing our judgment upon such papers, let us consider the daily work of the apprentice. He is sent to the foundry, then a few hours in the machine shop, a few hours in the boiler shop and sheet iron shop. In fact, he is all over the place, outside and in, on the run all day because everybody wants him at once. He is called to help the foreman of the boiler shop a few minutes; in the meantime the foreman of the machine shop wants to know if the kid has gone to sleep some place. But the kid has no time to sleep, and, strange to say, he is expected to perform his duties with the same amount of knowledge as the journeyman. He is sent out to help raise a smokestack; his duty is to tend the ropes. Think of it! Where is a paper that would give him this simple but useful information how to tie a safe knot? How many experienced mechanics can tie a proper knot? How many mechanical papers would publish such a simple thing? Going a little deeper into the subject, if the standard mechanical papers do not publish such simple things, how is the apprentice going to learn the thousands of simple things he should know? The standard mechanical papers appear to the apprentice much as the famous puzzle, How Old is Ann? or Who wants Him First—the foreman of the foundry, boiler or machine shop? I have seen learned mechanics laugh and sneer at papers that publish the much needed but simple information. These same learned mechanics were wedded to a lathe or planer job when they were young and do not realize the thousands of simple things they do not know, even when these simple things are in print. They are not considered worthy of the notice of such men. If these learned mechanics, that laugh at simple things, were to lose the job they wedded when they were young, they

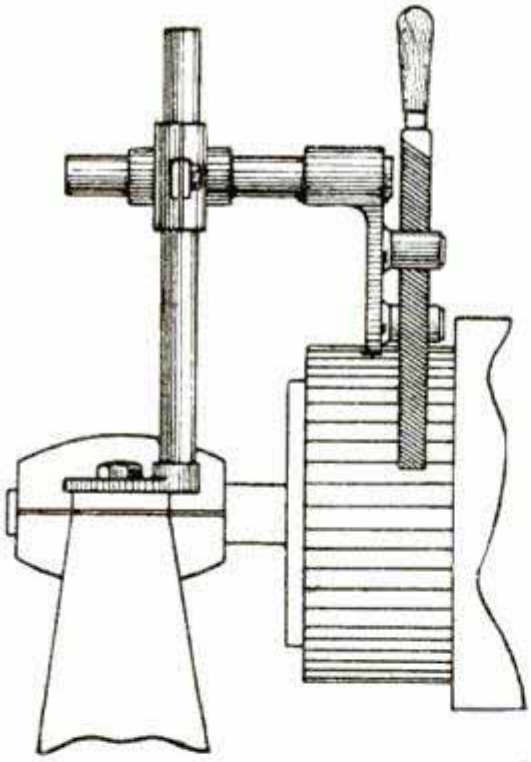
would find that they could not do the simple job of boring a hole in a log and bore it straight, or run a wheelbarrow and load it right. Simple things, too simple to learn, have caused the downfall of many a promising young man, and I dare say the loss of wealth.

Let us, dear reader, return to our story. We must teach our young mechanics the simple things first. In order to do this we must assist them in choosing a paper to read. You may ask, why is it necessary to read a paper to learn simple things; can not the learned men about the shop tell the young man what he wishes to know? Let us picture the young man seeking a little information. He cautiously approaches a wise-looking genius whose head has become bald from over study or his head is so crowded full of knowledge that the pressure therein has crowded the hair off. The young man asks him a simple question—he is told to "Go lay down and not be such a fool." The fact is, the bald headed genius did not know the answer to the simple question; he had been studying something of a higher nature which may benefit him some day if he lives long enough. The young man must read to learn. His paper must be one that teaches simple things as well as those of a higher order. Such a paper is good for both young and old.

PAUL S. BAKER, Muscatine, Ia.

FILING DEVICE FOR TRUING COMMUTATORS.

A new device for truing commutators consists of a standard which clamps to the motor or generator,



Device for Truing Commutators

and carries a horizontal bar holding a file. The bar is adjusted and the file is moved by hand.

HINTS TO INVENTORS.

There seems to be quite a demand for some simple, effective and not very expensive device for use on rural mail routes, by which the mail can be sent from the box in the road to the house. With something over 3,000,000 of these rural patrons each having a mail box, there would seem to be an inviting field for the right sort of an invention. At present there is nothing of the kind on the market, so far as we are able to learn.

"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"—Cloth $1, paper covers 50 cents. Popular Mechanics.

AUTOMOBILES.

ONE ORIENT MOTOR BUCKBOARD, latest model, used about three weeks, perfect condition. I have no longer use for an automobile. Price $125.00 f. o. b. Shreveport. R. C. Bradley, Shreveport, La.

AUTOMOBILE GEAR to exchange for anything useful; worth $150. A. P. C., 10 S. Wall St., Columbus, Ohio.

FOR EXCHANGE—A second hand automobile, 24 gasoline horse power touring car for 8 persons, finely finished; used but a short time and good as new. Want gasoline boat from 20 to 30 feet in exchange. House of David, Benton Harbor, Mich.

FOR SALE—One 16 h. p. Gaar-Scott traction engine with separator, weigher and wind stacker, new Parsons self-feeder and a number one Birdsell clover huller. The above machinery is all in good running order with belts and all fixtures. Call on or address Perry A. Friend, Burrows, Ind.

FOR SALE OR EXCHANGE—One 1¼ h. p. bike motor; would like foot power screw cutting lathe. Earl R. Person, No. 9 Arlington St., Leominster, Mass.

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.

FOR SALE—New 16 in. seamless steel shell boilers (copper flues), $55. Wm. Jones, Ravenna, Ohio.

FOR SALE.

FOR SALE—Incandescent battery lamps from 1¾ to 220 volts and candle power from ⅛ to 100; 40c each and base 10c. Discount given on dozen lots. Smith Bros.' Electric Supply House, 363 W. Van Buren St., Chicago.

FOR SALE—A specialty which pays manufacturer 100 per cent profit; can be made in almost any shop; patent has 14 years to run; will sell patent, dies, and a good trade already established. Owner is located on Pacific coast and does not wish to change residence. Address 769, care Popular Mechanics.

ONE MANDOLIN, one battery cigar lighter, one cash register, one cigar case, two pool tables, cues and balls. Want cash, Wyandotts, Houdans, Spanish, one horse power gasoline engine or what have you. J. D. McHenry, Dana, Ill.

SARATOGA SPRINGS, N. Y., 98 acres, 5 miles from this great summer resort, ½ mile to P. O., and trolley line. Price $1,500—owner lives in Massachusetts. Been in family 40 years. Title perfect. H. Van Ostrand, P. O. Box 475, Millbury, Mass.

FOR SALE—Complete laundry in growing town; coal cheap, water cheap, rent low, prices good; proprietor going into other business; guarantees purchaser to net 20 per cent on investment; price, $2,000; easy terms. Dr. Woodburn, Bremen, Ky.

FOR SALE—Steam laundry in town of 2,500 population. This is a bargain. Particulars given on application. W. D. Petrie, Lock Box 47, Gaylord, Mich.

FOR SALE—First-class hand laundry; splendid location; town of 2,000; no opposition. Address George Mulk, Cardington, O.

FOR SALE—A patent granted 1902, with dies, special cutters and a started business. Address No. A3 Popular Mechanics.

FOR SALE—Electrical scholarship, International Correspondence School, including six bound volumes. Cost $60. Make offer. Address A4, care Popular Mechanics.

SCIENTIFIC PATTERN WORK and patent office drawings, reasonable. Also rapid selling side lines for salesman calling on hardware and implement trade. Correspondence solicited. The Ashland Pattern Works, Ashland, O.

FOR SALE—Gray's electro plating outfit, set polishing tools and silver metal plater. Box 202, Columbus Grove, O.

FOR SALE—Cheap; a 6A Dahlmeyer lens. Address C. E. Ford, Madison, Wis.

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.

WANTED—MECHANICAL PARTNER—I have been engaged for the past year in manufacturing a machine for which there is a very large and growing demand. The work is such that I desire the co-operation of some bright experienced mechanic to join me. Only a few hundred dollars required; 200 per cent profit in the business. Address, 768, care Popular Mechanics.

FOR SALE—A controlling interest in a small manufacturing and jobbing machine shop in a growing city in southern Michigan. Well established business. A splendid chance for a young machinist ambitious to have a shop and business of his own. Address 999 Popular Mechanics.

FOR SALE—Machine shop; my half interest, bargain if taken soon. J. Tune, Fairbury, Ill.

My plant in N. Topeka, stock and fixtures, including gasoline engine air compressor and tools; reason for selling going into other business; will invoice about $2,800. W. J. Mattern, 522 Kansas Ave., North Topeka, Kan.

TO LIGHT MANUFACTURERS.

WANTED—Some manufacturer to make for me a new and greatly improved turpentine still. Avoids all danger from fire and produces from 15 to 25 per cent more than any other still. Several in use have proved its success. Have orders for all I can install in one year. No facilities here for manufacturing. A large, profitable field. Address A2, care Popular Mechanics.

HELP WANTED.

HELP WANTED to find something that can be manufactured in an up-to-date bicycle repair shop. Address A1, Popular Mechanics.

MISCELLANEOUS.

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.

MISCELLANEOUS.—(Continued)

THE IMPENDING CRISIS by Junious, Jr., a handsomely bound book treating on the attitude of Capital toward Labor. Regular price $2.50, but for a limited time we will send it postpaid on receipt of $1.00. No book of the century is so enlightening and warning to the people, sounded with patriotic purpose and with a view to arousing the torpid spirit of the masses to the fullest appreciation of the oppressions and crimes of this era. This great book not only exposes the follies and vices of the rich, but also the atrocious means employed by some to gain fortune.

A wonderful book for everybody to read. It will make you a better citizen. The price $1.00 is for a limited time only, and those persons who act promptly will have their names placed on our list and will receive our bargain sheets regularly. R. N. Hays, 195 State St., Chicago.

PRINTING—125 XXX white envelopes, 50 cents; 100 visiting or business cards, 35 cents, by mail postpaid. Other work equally low. Geo. L. Wade, Cherry Creek, N. Y.

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

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

One fine new Fox Milling Machine, with fifteen cutters, in perfect condition; cost $268, for $125 f. o. b. Shreveport. R. C. Bradley, 413 Market street, Shreveport, La.

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.

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—Every man to wear "Nancy Hanks" suspenders, warranted a year; they save your shoulders and buttons. Send your weight, Postpaid, 50 cts. Tibbetts, Putnam, Conn.

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

WANTED—Apparatus to burn or destroy roll tickets in large quantities. Address A5 care Popular Mechanics.

WANTED—Every man who shaves himself, to use the Honoco Paper Razor strop. This strop is made on scientific principles and is the ideal strop. No honing or grinding the razor. Guaranteed for one year. Send for description. By mail 75 cts. Hope Novelty Co., Bristol, R. I.

WE CAN TELL you where to get good bargains in all kinds of second hand machinery. Popular Mechanics.

BINDERS—Will hold Popular Mechanics 12 issues. Sent postpaid on receipt of 50 cents. Address Popular Mechanics.

IF YOU WISH to buy anything or have something manufactured and don't know where to get it, write Popular Mechanics, Journal Bldg., Chicago.

Five years subscription for three dollars. Popular Mechanics Co. make this offer. A great many people are taking advantage of it. It's open to you also.

HOW TO BRAZE CAST IRON. Send 25c to B. G. Raymond, Puyallup, Wash.

A MOVING-PICTURE MACHINE. 400-ft. moving picture film, a stereopticon, 150 slides, a 12x12 ft. screen, and a calcium light outfit, including gas tank and gas making apparatus. Used but very little. Cost $250. Will exchange for automobile, motorcycle or engine lathe. Address 295, care Popular Mechanics.

TO EXCHANGE—An A1 business lot on main street, less than ½ block from court house, for runabout gasoline automobile, 12 or 16 h. p. Must be in first class condition; property clear. Address Dr. O. H. Barthel, Pocahontas, Iowa.

ONE BUFFLOM spring and gear Bike wagon, gear with pneumatic wheels; in good condition; for price address M. W. Niederkorn, Farmington, Minn.

WILL BUY moving picture machine and films on payments; state price, terms and particulars. A 6, care Popular Mechanics.

TO TRADE—One 20 ohm telegraph instrument in good condition for small dynamo, from 2 to 6 lights capacity, of 6 candle power each. Address 838, care Popular Mechanics.

ENGINES.

BICYCLE engine, 2½ h. p. and complete outfit, $65. Chas. Gillivan, W. Jefferson, O.

FOR SALE—8 h. p. gasoline marine engine; complete outfit, almost new; jump spark. C. C. G., 620 Clinton St., Joliet, Ill.

ENGINES FOR SALE—High grade marine and automobile gasoline engines, 4 and 8 h. p., cheap. Houle Co., 580 East St., Holyoke, Mass.

PATENTS

PATENTS SECURED through Popular Mechanics Patent Bureau promptly. Charges reasonable. If you have a new idea or invention write us regarding it. We will answer promptly and fully without charge. Address Popular Mechanics Patent Bureau.

FARM PROPERTY.

FOR SALE—Illinois farm; 323 acres; black rich bottom land; clay subsoil; all can be plowed; no better corn land in the state; good buildings; fenced and crossed with Page woven wire; rural free delivery; long distance telephone; good gravel roads to city of 2,500 population. Home market for all farm products. Borden's Condensed Milk Factory. The price paid for milk for past six months, $4.50 per 100 lbs. Good school and creamery one-half mile from farm—6 miles northwest of Chicago. If sold quick will take $80 per acre. Part cash. Address, 766 Popular Mechanics.

RICH BLACK LAND

$3.00, $4.00 AND $5.00 PER ACRE.

These prices are made today; no telling what you will have to pay in 6 months from now. One crop will pay for your land and leave you a good balance in the bank. Write me at once if you want to know more about it. These are Bed Rock Prices, and are made to make some quick sales. Address N. L. Jackson, Belvidere, Ill.

BED ROCK PRICES.

MADE TO MAKE SOME QUICK SALES. SCOUR THE WHOLE UNITED STATES AND YOU WILL FIND NO SUCH BARGAIN IN FARM LANDS.

BLACK, RICH, SMOOTH Farm Land $3.00, $4.00, $5.00 Per Acre. Best wheat land in the United States; located near a good town, good schools, churches and market for your crops; 10 inches of snow in December insures big wheat crop and a big boom in prices. Only a little of this kind of land left and it is as sure to double in value as the west is sure to increase in population. There is less than 10,000 acres of this land. It will be cut up and sold in the next 30 days. Address N. L. Jackson, Belvidere, Ill.

BOOKS FOR SALE BY POPULAR MECHANICS.

AMUSEMENTS.

Comic Recitations and Readings, a new volume of funny recitations and readings, by Charles Walter Brown, A. M., 200 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Negro Minstrels, Stump Speeches and Black-Face Monologues, by Jack Haverly, a complete guide for amateurs for presenting a minstrel performance, 150 pages, paper covers, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Chas. K. Harris' Complete Songster, containing latest songs, 200 pages, paper covers, 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Announcement

WE beg to announce that on February 1st, 1905, the sale of the Treasury Stock of the North American Exploitation Company, heretofore offered at the special organization price of 25 cents per share, will be discontinued. We are pleased to say that we have disposed of the entire allotment offered at the above price. We are, however, authorized by the Company to fill all orders for the stock up to and including the above date at the same price to an aggregate of not to exceed 100,000 shares.

We reserve the right to return all subscriptions and remittances when the above extra allotment is subscribed for.

The next allotment, if any be made, will be offered at not less than 50 cents per share.

We advise prompt subscription in order to obtain the benefit of this special price.

We will be pleased to send full particulars of the enterprise and details of recent developments upon application.

——ADDRESS——

The Western Trust and Guaranty Co.
Fiscal Agents
New York Life Bldg., Chicago

CEMENT POSTS.

Any One Can Manufacture Them.

Any one can manufacture his own cement posts with a very little expense and have a wholly satisfactory post, declares T. A. Pottinger, of Peru, Ill.

"I learned," says Mr. Pottinger, "that the posts I have been paying 35 cents each for I can make at home for 10 cents each with cement at $1.90 per barrel (it can be had at $1.25 per barrel), and corner posts that cost $2.50, ready made, can be made at home for 16 cents each.

"There is no secret in making them. It requires only a simple mould, that anyone can make, and two staples, one inch apart, put in the posts while the cement is soft, for the wires to go between, and your post is made.

"A piece of wire the length of the height of the fence goes between the strand of fence wire and the staples; this secures the wires in their proper place. The post is simple and will last a lifetime. Of course, the staples must have a fish-hook turn to hold them in the cement. Each cement post requires four strands of wire, called cables, through it. These wires are of the utmost importance in protecting stock from lightning."

THE 20TH CENTURY FOREMAN.

By John Cherry, Kansas City, Mo., a graduate of American School of Correspondence in Mechanical Engineering.

Having experience, he knows his work and knows it well. He came up along the line of workmen and possesses thoroughness and fitness for the place. Competency was his aim and by work and study he attained it. Being a gentleman, he extends this respect to others and by so doing he has the good will of his men. His work in the shop is the work of direction and observation. He knows the working of every piece of machinery in the shop and he will have it do its work properly by personal observation or by one of his assistants. He takes time to acquaint himself with all the improved machinery of the latest invention that applies to his work; his mind is on his work and is stored full of new and useful thoughts of the advanced science and he applies them when and where needed. He is not found filing as he goes or with hammer and chisel cutting and clipping here or there. He is not a pupil of this class, but a pupil of the present and the future; drawing new ideas as new coins from the mint. His shop or factory will soon have a 20th Century move on it, too. The workmen will also catch the idea and not one will be so dull as not to fall into line, and honor and respect will be given to whom it is due.

The foreman will act with proper regard and care for those who work under his instruction. He exacts nothing but what is just and honorable and when the work is well done and finished on time, he is the manly man to say so. As it were, he is one of the arc lights of the factory. This new man knows how the work must be done and the responsibility rests on him. He must be a judge of the material used; if steel, iron or any other metal, he must know the quality by the latest tests. If wood, the kind of wood at a glance and whether the quality is suitable.

This new man is a specialist and is thoroughly up to date on the work before him. His mind is used to the field of thought and great business interests have found it out. The men of mental training are in the lead and will be henceforward. Competency is the watchword; it has gone forth in all lands and the men who are not qualified need not apply. What we have said applies to most all factory work. No hap-hazard work will do in anything or anywhere. A man must be competent and do his duty in the cotton mill, rolling mill, smelter or furnace. If a flouring mill grinds damaged wheat for any length of time, the mill goes into the hands of a receiver. If the new man has charge of such mill, he is a judge of wheat and knows the grades of flour. He knows the workings of every piece of machinery in the mill; knows the floe sheet and knows it is just right, too. The product of this mill will be of the right quality and quantity and financially it is a success. There will be neither dust explosions nor fires. Midnight oil and a technical education make the useful and successful man very early in life.

BLUE LIGHT AS AN ANESTHETIC.

Dentists may cease entirely to administer either ether or chloroform to relieve the patient of pain while having teeth extracted. Instead a new anesthetic may be administered through the eyes.

This new anesthetic is a discovery of Professor Redard of Geneva who, acting on the knowledge that colored light affects the nervous system, experimented with each color in turn until he found that when a patient is shut in a dark room and his eyes exposed to a blue light of 16 candle-power for three minutes he loses all sense of pain and yet retains consciousness.

SELLING PATENTS.

Assuming that your invention is new and useful, and that you have a good patent, or have applied for same, the following are the plans we recommend for disposing of the patent right under ordinary conditions:

1st. Have made a complete working model, or drawing of your invention in the best style you can afford. Show the model or drawings to your business acquaintances, and especially to those who are practical men and who are familiar with such inventions. Have them express in writing their opinions of your invention. Sell to these parties, if possible, a part interest in your patent with a view of securing their active co-operation in disposing of the entire patent to others who may be in better position to handle the article patented.

Have the invention "written up" in an interesting way and published in a paper which reaches the class likely to be interested in such inventions.

2nd. If you cannot sell your patent in your own city or locality, have made photographs of your model, or blue-prints of your drawings, and send them to manufacturers of such articles, with copies of the endorsements you have obtained for your invention, and ask the manufacturers to investigate the merits of the invention with a view of buying the patent right. Make your letters short and pointed, and use printed letter heads giving your name and address, the name, and an illustration of your invention. Do not claim extravagant things for it and do not ask a fabulous sum for the patent right. In fact, it is best not to name any price until you have interested the party.

If one man is not able or willing to put up all the money required, get others to join him. It is often easier to get ten men to invest $100.00 each than it is to get one man to invest $1,000.00.

3rd. If you cannot sell your patent by correspondence, take your patent and model and call on as many manufacturers in that line as you can, show them your model and point out the advantages of your invention. If they will not buy, but admit that the invention is good, ask them to put their opinions in writing so you can use them with the others.

4th. If you cannot afford to travel around to see manufacturers, send your model and a copy of your patent to some dealer in similar articles, who is located conveniently to the manufacturers, and offer him a liberal commission for making a sale of the patent for you.

5th. Offer to sell territorial rights for your invention rather than an undivided interest. It is better to sell the right for one or more states than to sell a one-tenth interest. If you cannot dispose of the right for a state, offer it for one or more counties at a proportionate price. Every such sale will help you in disposing of other territory.

6th. If you cannot make a sale by any of the foregoing means, the chances are that your invention lacks merit. If, however, you can command capital sufficient to manufacture the articles, do so, and place them on sale with appropriate circular and newspaper advertising, offering them preferably through a jobbing house in that line. If your invention is of a character that needs to be tested before it can be appreciated, have the test made in your own locality first if possible. Do not be discouraged if success does not immediately follow your efforts. On the other hand, do not spend time and energy on the invention against the advice and judgment of people who are in position to know more about such things than you are. Better abandon it and devote your energies to something else.

THE NORTH SEA TRAWLER.

What the London Standard Says of the Craft the Russian Warships Fired Into.

Cape Horn has a bad name with deep-sea sailors, and a Chinese typhoon, like a floating mine, is not a thing to be laughed at, but one would sooner face either in a tank steamer than knock about on the Yorkshire coast, as the steam trawlers do, in a northeast gale. The North Sea's yearly tribute in life and treasure to Neptune is appalling.

The casual observer sees nothing romantic about a steam trawler. She looks like a cross between a rat-trap and a tin kettle, dingy at that, with nothing but her strength to recommend her. Her decks are slimy; she has rusty plates and nets that at first sight would bring a blush to a fifth-rate rag shop. She slinks in and out of port like a vagrant of the sea, and makes night hideous with her wretched fog siren. Paint does not improve her. Freshly done, she resembles Hodge in a Court suit; a week later she is again in tatters. Her house-flag is as black as Capt. Kidd's, without the relieving white of the cross bones, and her masts and shrouds are positively furry with soot. She makes a wallowing bed in the mud as though she likes it, and only flies bunting when her owner dies. There is nothing of beauty in her, and her work is sweeping destruction. She receives none of the courtesies of the sea and pays none. She is base mechanical, and first cousin to a dredger. So might the artist say.

But the steam trawler belies her looks. She is a gallant sailor, every inch of her. That grimy smokestack is often white with salt, and her rags of rigging become beautiful in icicles. When the equinoctial gales cut proud liners short in their career; when those murderous sieves of Norwegian brigantines go down by dozens, and it seems impossible for anything built by man to live, the dingy trawler enacts a hero's part. When ocean monarchs—proud at other moments of their Royal Mail flag, or perchance of the blue pennant of the Naval Reserve—are belting away with their triple-expansions to keep bare head to sea; when full-rigged steel sailing ships—4,000 tons, class Extra A 1 at Lloyd's—dare only to show just the smallest pocket handkerchief of a head sail as they scud and race, and try to give the heel to the chasing sea, all too much concerned for their own safety to hear the signals of distress (the flag by day, the flare by night) that some foundering vessel shows—who is it risks the hundred-to-one chance of a capsize in a quick broadside turn to offer help? Ask in any of the shipwrecked mariners' homes up and down the coast, in any European language you like, and you will find it is that bit of a cockle-shell, the steam trawler.

The golden roll of heroism has no greater deeds of daring to show than those performed in every gale that blows by the crews of a North Sea trawler. Our own board of trade, the German Emperor, the king of Denmark, and of Norway and Sweden, by referring to their list of presentation binoculars, could tell of many. The greater number, however, of these heroic deeds are unrecorded. They form part of "the day's work."

ABSOLUTION.

It's a sleeping girl in a blazing room,
  And a bluecoat lad below.
But they cry, "You'll never do it, Mike!"
  And he—"I'll try, you know."
And the building swayed in the smoke and glare,
  And the ward was all aglow.

The ladder broke when it struck the wall,
  But Mike Kilrain hung there;
And he came again with the clinging child,
  And smothered her blazing hair—
The saved and savior framed in flame,
  While a glad cry rent the air.

And should we live for a hundred years
  There's some would see them still—
The big heart boy and the white-faced lass
  As they clung there on the sill;
But the windows vomit hell beneath,
  And it makes the heart blood chill.

"Hold quick the net; now boys, hold fast—
  Hold fast for Mike Kilrain!"
"Jump, Mike!" He throws the girl instead.
  She comes like a drop of grain.
"Hold high and fast!" "God bless ye, girl!
  Now, boys, hold fast again!"

Too late, too late! Stand back for life!
  Here's Mike with the crashing wall.
We tore his body from red-hot bricks,
  But he heeds no comrade's call.
The pride of No. 6 lay still,
  With the smoke for his funeral pall.

"You're late, good father; the lad is dead,
  We know you don't drive slow—
But I'm bold to say there's One above
  Who'll sponge his slate like snow,
And he's got his absolution now
  Where the brave, good firemen go."

—Western Fireman.

CATALOGS RECEIVED.

MORE STARRETT TOOLS. L. S. Starrett Co., Athol, Mass. This new catalogue is a supplement to catalogue 17, previously issued, and shows some of the most up-to-date mechanical devices designed for the convenience of men of various occupations. Several pages are devoted to new micrometers and micrometer cases.

INDUSTRIAL PEACE GUARANTEED, is the title of a neat pamphlet issued by the Citizens' Alliance of Joliet, Ill., and setting forth in engravings and text the merits and beauties of that city. The book also includes a map of the railway facilities of Joliet.

BOOK REVIEWS.

RIDER'S LITTLE ENGINEER. By Joseph B. Rider, C. E., South Norwalk, Conn. Pocket size, gold edges, morocco binding. Price $3.00. This handy little book contains engineering and other data relative to many subjects and also hundreds of instant answers for engineers, contractors or others in charge of or having to do with the designing, construction, operation or supervision of public or quasi-public works and structures or departments. It gives 229 valuable tables containing a wide range of information. Above all, the language is concise and simple, two essential qualities for a handbook designed for every-day use.

BEVEL GEAR TABLES. By Engstrom. Size, 5½x8 inches. Cloth. $1.00. The Derry-Collard Co., New York. A new book which does away with all the trigonometry and fancy figuring on bevel gears and makes it easy for anyone to lay them out or make them just right. There are 36 full-page tables that show every necessary dimension for all sizes or combinations you are apt to need. No puzzling, figuring or guessing. Gives placing distance, all the angles (including cutting angles) and the correct cutter to use. A copy of this prepares you for anything in the bevel gear line.

MODERN INDUSTRIAL PROGRESS. By C. H. Cochrane. Over 400 illustrations, 12mo., decorated cloth, $3.00 net; postage extra. J. B. Lippincott Company, Philadelphia. This book, as its name indicates, takes up in a plain, practicable manner the industrial progress of the last few years, especially in the fields of invention and mechanical construction. It would be impossible to exhaust the subject in a single volume, but the great things are all described in an entertaining manner. The book is profusely and beautifully illustrated with reproductions from photographs and drawings. Some of the subjects it treats are Wireless Telegraphy, the Conquest of the Air, Tools of Destruction, Great Canals and Tunnels, Bridges and many other kindred subjects.

TRAIN RULES AND TRAIN DISPATCHING. By Dalby. Over 220 pages; leather cover, $1.50. The Derry Collard Co., New York. Every railroad man and every boy who hopes to be a railroad man sometime will find this a handy book to carry. It gives the standard rules for both single and double track, shows all the signals, with colors wherever necessary, and has a list of towns where time changes, with a map showing the whole country. Then the rules are explained wherever there is any doubt about their meaning or where they are modified by different railroads.

WORLD'S FAIR TRANSPORTATION NUMBER of the Railway Review. Illustrated. Price, $1.00. The transportation exhibits at the Louisiana Purchase Exposition surpassed all previous exhibits of this character, in consequence the issue devoted to these exhibits surpasses anything of the kind previously published. The work typifies the progress of the world and will be both a valuable souvenir of the great Fair and a source of reliable information to whoever possesses a copy of it.

DESIGN AND CONSTRUCTION OF CENTRIFUGAL FANS. By J. H. Kinealy, M. Am. Soc. M. E. Illustrated from original drawings. Spon & Chamberlain, New York. This book is a comprehensive treatise on the subject of fan efficiencies and contains many formulas and tables.

MACHINE SHOP ARITHMETIC. By Colvin-Cheney. Size 4½ x 6 inches; 131 pages; cloth, 50 cents. The Derry Collard Co., New York. This is a book fully adapted to shop use. It takes up such calculations as are likely to come up in the shop, and shows how each step is taken. Shows how to make formulas as well as to use them. Takes up screw cutting in such a way that any thread can be calculated on any lathe. No hard and fast rules can do this. Tells about tap drills, pipe threads, weight of metals, metric system and many other things.

Popular Mechanics Book Department

We can furnish any book published. Books in the following list sent prepaid on receipt of price, or for the number of New Yearly Subscribers stated. The Sender of the club may include his own subscription in clubs of three or more.

ARCHITECTURE BUILDING, PAINTING, ETC.

Steel Square, Treatise of the Practical Uses of, by Fred T. Hodgson, Architect. New and up-to-date. Published May 1st, 1903. Do not mistake this edition for the one published over twenty years ago. This is the latest practical work on the Steel Square and its uses published. It is thorough, accurate, clear and easily understood. Confounding terms and phrases have been religiously avoided where possible, and everything in the book has been made so plain that a boy twelve years of age, possessing ordinary intelligence, can understand it from beginning to end. Cloth, 2 volumes, 560 pages, 500 illustrations, price $2.00. Given for 3 subscriptions.

Hodgson's Modern Estimator and Contractor's Guide, for pricing all builders' work, with many tables, rules and useful memoranda, by Fred T. Hodgson. This work contains a concise explanation of the various methods of estimating builders' work by the square, by the cubic foot, by rough quantities, by accurate quantities and other methods. The mason, the plasterer, the bricklayer, the carpenter, the excavator, the plumber and, in fact, the representative of every trade that has anything to do with building will find rules and methods given in this volume for estimating the cost of work he is tendering for. Cloth binding, 300 pages, 200 illustrations, price $1.50. Given for 3 subscriptions.

Modern Carpentry and Joinery, a practical manual for carpenters and woodworkers generally, by Fred T. Hodgson, Architect. A new, complete guide, containing hundreds of quick methods for performing work in carpentry, joining and general woodwork. Like all of Mr. Hodgson's works, it is written in a simple, every-day style, and does not bewilder the working-man with long mathematical formulas or abstract theories. The illustrations, of which there are many, are explanatory, so that any one who can read plain English will be able to understand them easily and to follow the work in hand without difficulty. Cloth binding, 256 pages, 230 illustrations, price $1.00. Given for 2 subscriptions.

Hodgson's New Hardwood Finishing, by Fred T. Hodgson. A practical treatise on wood finishing in all its branches, including tools and materials employed, preparation of surfaces, stains and staining, fillers and filling, shellacking, varnishes and varnishing, rubbing, polishing, French polishing, wax polishing, oil polishing, etc., etc. Also a full description of the woods employed in wood finishing, their treatment, and the finishing of floors. Cloth, 320 pages, 100 illustrations, price $1.00. Given for 2 subscriptions.

Radford's American Ideal Homes, containing 100 house plans, 200 illustrations, 250 pages, cloth, price $1.00. Given for 2 subscriptions.

American Ideal Homes, edited by Radford, illustrating 100 buildings with plans and perspective views, size 8 by 11, 108 pages, price $1.00. Given for 2 subscriptions.

Burnham's Practical House Builder, with plans and specifications, by H. E. Burnham, 100 illustrations, paper cover, price 25 cents; cloth cover, price 50 cents. Given for 1 subscription.

Estimating Frame and Brick Houses, by Fred T. Hodgson, 224 pages, with scale drawings and other illustrations, price $1.00. Given for 2 subscriptions.

Barn Plans and Out Buildings, for the construction of barns, etc., 256 illustrations, cloth, price $1.00. Given for 2 subscriptions.

Common Sense Stair Building and Handrailing, by Fred T. Hodgson, M. O. A. A. Handrailing—Showing three of the smallest methods known in the art, with complete instructions for laying out and working handrails suitable for any kind of stairs. Stair Building—Section four of the work, which covers upwards of 80 pages, is devoted to newel or platform stairs chiefly, and gives instructions for their building, planning and decoration. Cloth, 256 pages, 230 illustrations, price $1.00. Given for 2 subscriptions.

Builders' Architectural Drawing Self-Taught, by Fred T. Hodgson. This work is especially designed for carpenters and architects and other wood workers who desire to learn drawing at home, and who have not the means, time or opportunity for taking a regular course in school or college, or availing themselves of the offers made by one or other of the "Correspondence Schools." This valuable work contains over 300 pages printed from new large type on a superior quality of cream wove paper. Over 300 fine line engravings made especially for the work, each drawn to scale, 18 large double folding plates with full explanation for each. Also contains perspective views and floor plans of 50 low and medium priced houses. Cloth, price $2.00. Given for 3 subscriptions.

Hodgson's Low Cost American Homes, arranged and edited by Fred T. Hodgson, M. O. A. A. This book contains perspective views and floor plans of one hundred houses, churches, schoolhouses and barns, and is, without a doubt, the most practical work ever issued. The plans shown have been built from, and many of them duplicated many times over. All are practical, the creation of the well-known author, including many other architects throughout the United States and Canada. Cloth, 220 pages, 200 illustrations, price $1.00. Given for 2 subscriptions.

PAINTS AND PAINTING.

The Painters' Encyclopedia, containing definitions of all important words in the art of plain and artistic painting, with details of practice in coach, carriage, railway car, house, sign and ornamental painting, including graining, marbling, staining, varnishing, polishing, lettering, stenciling, gilding, bronzing, and valuable hints and helps in scene painting, porcelain painting, plain painting, distemper painting, and all work in which a brush, pencil or palette is used, by Franklin B. Gardner. Cloth, 426 pages, fully illustrated, price $1.50. Given for 2 subscriptions.

Practical Carriage and Wagon Painting, a treatise on the painting of carriages, wagons and sleighs, embracing full and explicit directions for executing all kinds of work, including painting factory work, lettering, scrolling, ornamenting, varnishing, etc., by M. C. Hillick. Cloth, 160 pages, fully illustrated, price $1.00. Given for 2 subscriptions.

The Signist, new, original, up-to-date. These designs have been prepared especially for this book by a master in each special line, all of which are replete with helpful suggestions of new and practical ideas, which the skilled mechanic or the beginner may amplify to almost an unlimited extent. In the preparation of this book no expense has been spared to produce a standard text-book of original art gems which shall adequately supply a long-felt want. Paper cover, price $1.50. Given for 3 subscriptions.

ENGINEERING.

The 20th Century Hand Book for Steam Engineers and Electricians, with questions and answers, by C. E. Swingle, M. E. This is the very latest and best book on engineering and electricity for the beginner, practical engineer or electrician published. It is written in a purely self-educational style, so that any one with but a limited education can understand it. Illustrated with hundreds of fine engravings, showing every working part of an engine or boiler, dynamo, etc., 600 pages, size 5x7, durably bound in full leather, pocket book style, red edges, price $2.50. Given for 4 subscriptions.

Farm Engines and How to Run Them—The Young Engineer's Guide, by James H. Stephenson and other expert engineers, fully illustrated with about seventy-five beautiful woodcuts, a complete instructor for the operator or amateur. This book was the only one out of several that was accepted by 17 state agricultural colleges as a text-book for use of students in farm machinery. 12mo, cloth, 224 pages, price $1.00. Given for 2 subscriptions.

Modern Air Brake Practice, Its Use and Abuse, by Frank H. Dukesmith. The new air-brake book. Invaluable to trainmen, engineers, firemen, conductors, electric motormen and mechanics. The latest and best 1904 edition. With questions and answers for locomotive engineers and electric motormen. While there have been many air-brake books written, we feel safe in saying that never before has the subject been treated in the same lucid, understandable manner in which our author has treated it in this new book. The book is fully indexed and cross-indexed, so that any subject can be turned to immediately, as desired. If you are already posted, you can become better posted. If you really want to know all that is worth knowing about air-brake practice send for this book. 12mo, cloth, 303 pages, hundreds of illustrations, price $1.50. Given for 3 subscriptions.

The Locomotive Up-to-Date. The greatest accumulation of new and practical matter ever published treating upon the construction and management of modern locomotives, both simple and compound, by Chas. McShane. Cloth, 736 pages, 380 illustrations, price $2.50. Given for 6 subscriptions.

The Practical Gas Engineer, by E. W. Longanecker, M. D. A manual of practical gas and gasoline engine knowledge, covering errors to be avoided in the construction of, and how to correct, operate and care for gas and gasoline engines. Every user of a gas engine needs this book. Simple, instructive and right up-to-date. Full of general information about the new and popular motive power, its economy and ease of management. 16mo, cloth, 150 pages, fully illustrated, price $1.00. Given for 2 subscriptions.

ELECTRICITY.

Modern Wiring Diagrams and Descriptions—New 1904 Edition, a handbook of practical diagrams and information for electrical workers, by Henry C. Horstmann and Victor H. Tousley, expert electricians. This grand little volume not only tells you how to do it, but it shows you. It shows you how to wire for call and alarm bells, for burglar and fire alarm; how to run bells from dynamo current; how to install and manage batteries; how to test batteries; how to test circuits; how to wire for annunciators, for telegraph and gas lighting; it tells how to locate "trouble" and "ring out" circuits; it tells about meters and transformers; it contains 30 diagrams of electric lighting circuits alone; it explains dynamos and motors, alternating and direct current; it gives ten diagrams of ground detectors alone; it gives "compensator" and storage battery installation; it gives simple and explicit explanation of the "Wheatstone" Bridge and its uses, as well as voltmeter and other testing; it gives a new and simple wiring table covering all voltages and all losses or distances. 16mo, 160 pages, 200 illustrations, full leather binding, round corners, red edges, size 4x6, pocket edition, price $1.50. Given for 3 subscriptions.

Electricity Made Simple, by Clark Caryl Haskins. Just the book for beginners and electrical workers whose opportunities for gaining information on the branches of electricity have been limited. A book devoid of technicalities. Simple, plain and understandable. There are many elementary books about electricity upon the market, but this is the first one presenting the matter in such shape that the layman may understand it and, at the same time, not written in a childish manner. For engineers, dynamo men, firemen, linemen, wiremen and learners. For study or reference. Cloth, 233 pages, 108 illustrations, price $1.00. Given for 2 subscriptions.

Dynamo Tending for Engineers, or, Electricity for Steam Engineers, by Henry C. Horstmann and Victor H. Tousley. It is with a view to assisting engineers and others to obtain such knowledge as will enable them to intelligently manage such electrical apparatus as will ordinarily come under their control that this book has been written. The authors have had the co-operation of the best authorities, each in his chosen field, and the information given is just such as a steam engineer should know. 12mo, cloth, 208 pages, 100 illustrations, price net $1.50. Given for 3 subscriptions.

Modern Electricity, by Henry and Hora. Not only the latest but one of the most elaborate and complete works on this subject. Includes latest achievements of scientific research, with explanation of modern inventions and appliances; 150 illustrations, two special wiring diagrams, free from technical phrases, cloth, price $1.00. Given for 2 subscriptions.

Easy Electrical Experiments and How to Make Them, by L. P. Dickinson. The book is an elementary handbook of lessons, experiments and inventions. It is a handbook for beginners, though it includes, as well, examples for the advanced students. Illustrated with hundreds of fine drawings; printed on a superior quality of paper. 12mo, cloth, 216 pages, 120 illustrations, price $1.00. Given for 2 subscriptions.

Practical Compend of Electricity (Vest Pocket Size). Electricity in all its branches and applications described in concise and practical manner. Includes directions for wiring and lighting of houses, estimates of cost, etc. 119 illustrations, vocabulary of common technical terms, leather, gilt lettering, price 50 cents. Given for 1 subscription.

The Motorman's Guide, by J. W. Gayetty. An invaluable instructor, illustrated. Full instructions about the care and running of cars. The latest and best published. Cloth, price 50 cents. Given for 1 subscription.

Practical Telephone Handbook and Guide to Telephonic Exchange, How to Construct and Maintain Telephone Lines, by T. S. Baldwin, M. A., illustrated. Containing chapters on The Use of the Telephone, Series and Bridging Phones, Line Construction, Materials to be Used, Locating and Correction of Faults in Instruments and Lines. This is the best book ever published on farm telephones. It is the only book ever issued which treats the subject exhaustively and comprehensively. It is of inestimable value to promoters of rural party lines, because it contains all of the arguments that are necessary to show the advantage of rural party lines. It also tells how such lines should be constructed and cared for. Cloth, 180 pages, fully illustrated, price $1.25. Given for 3 subscriptions.

Telegraphy Self-Taught, a complete manual of instruction, by Theodore A. Edison, M. A., instructor at American School of Telegraphy, illustrated. In this valuable volume will be found everything that is necessary to the study of telegraphy. Though telegraphy is essentially a matter of practice, it has been the aim of the author to present to those who aspire to master the art of telegraphy a book treating the subject in as concise and clear a manner as possible, without eliminating anything that is important, and without putting in things that are detrimental, and which would have a tendency to confuse. Cloth, 160 pages, fully illustrated, price $1.00. Given for 2 subscriptions.

The Handy Vest Pocket Electrical Dictionary, by Wm. L. Weber, M. E. Contains upward of 4,800 words, terms and phrases employed in the electrical profession, with their definitions given in the most concise, lucid and comprehensive manner. The book is of a convenient size for carrying in the vest pocket, being only 2⅝ inches by 5½ inches, and ¼ inch thick, 224 pages, illustrated, and bound in two different styles. Cloth, red edges, indexed, 25 cents; full leather, gold edges, indexed, 50 cents. Given for 1 subscription.

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