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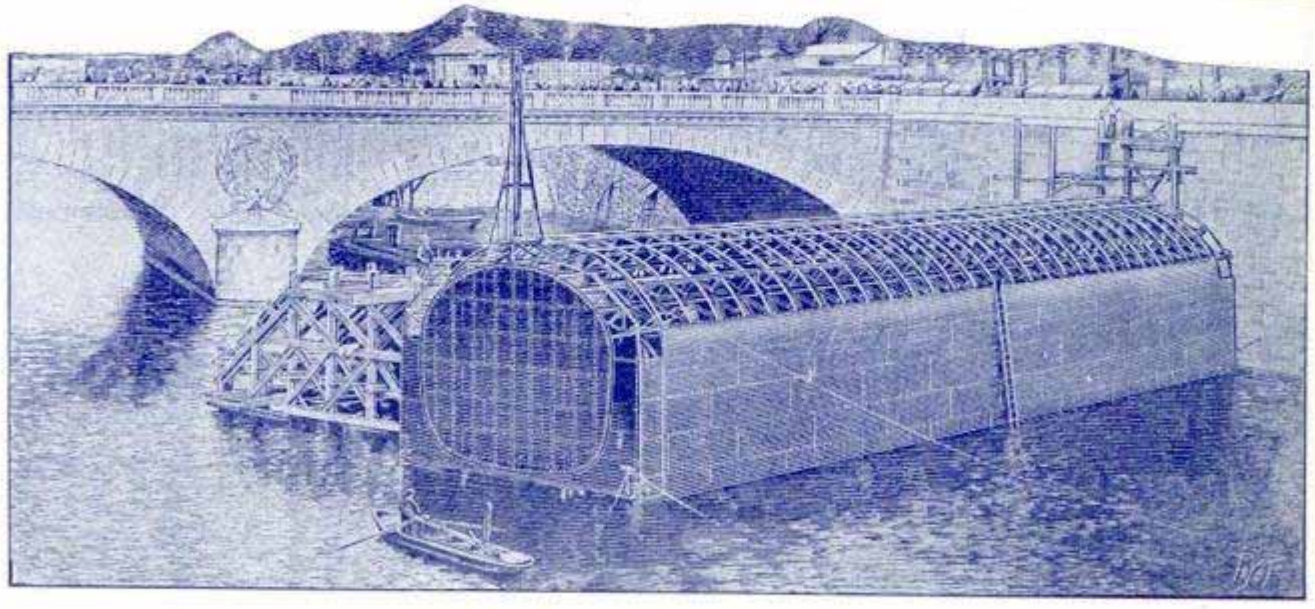

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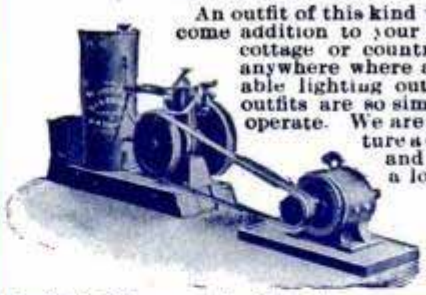

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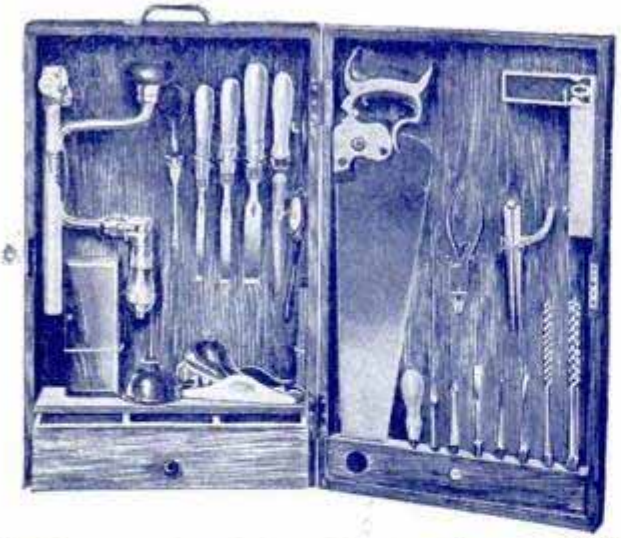

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CONTENTS.

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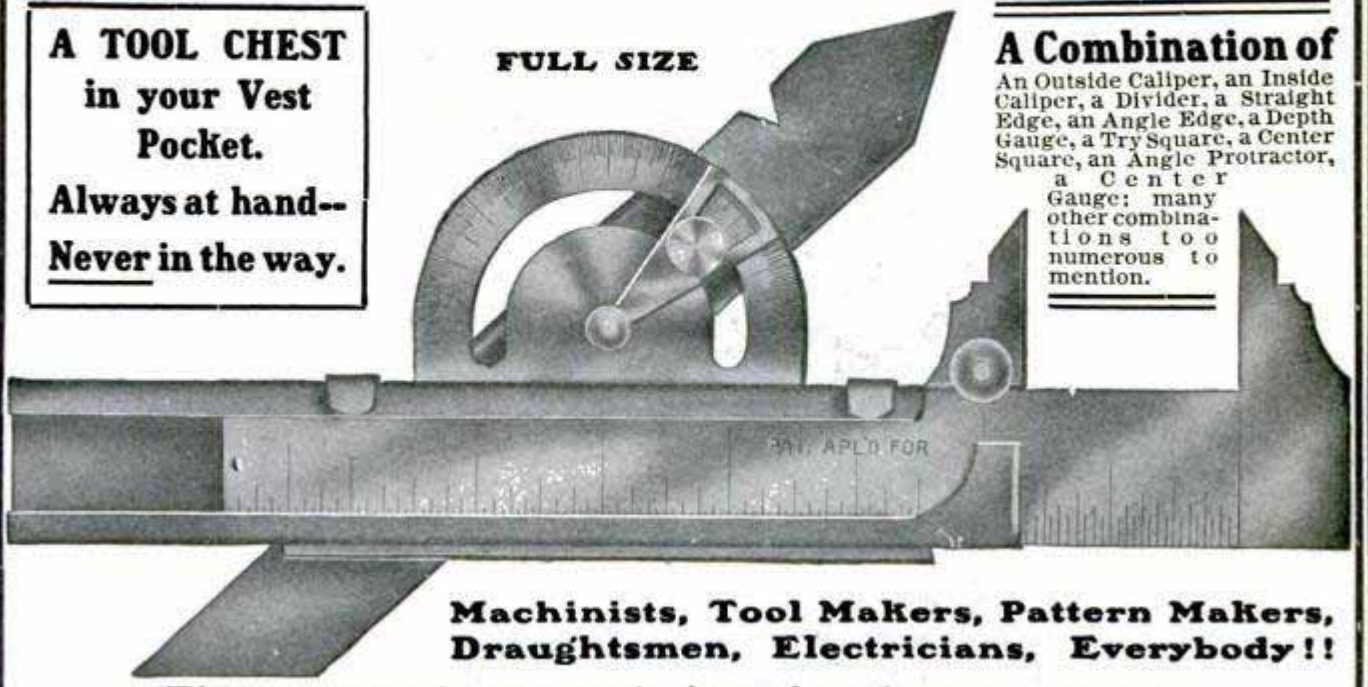

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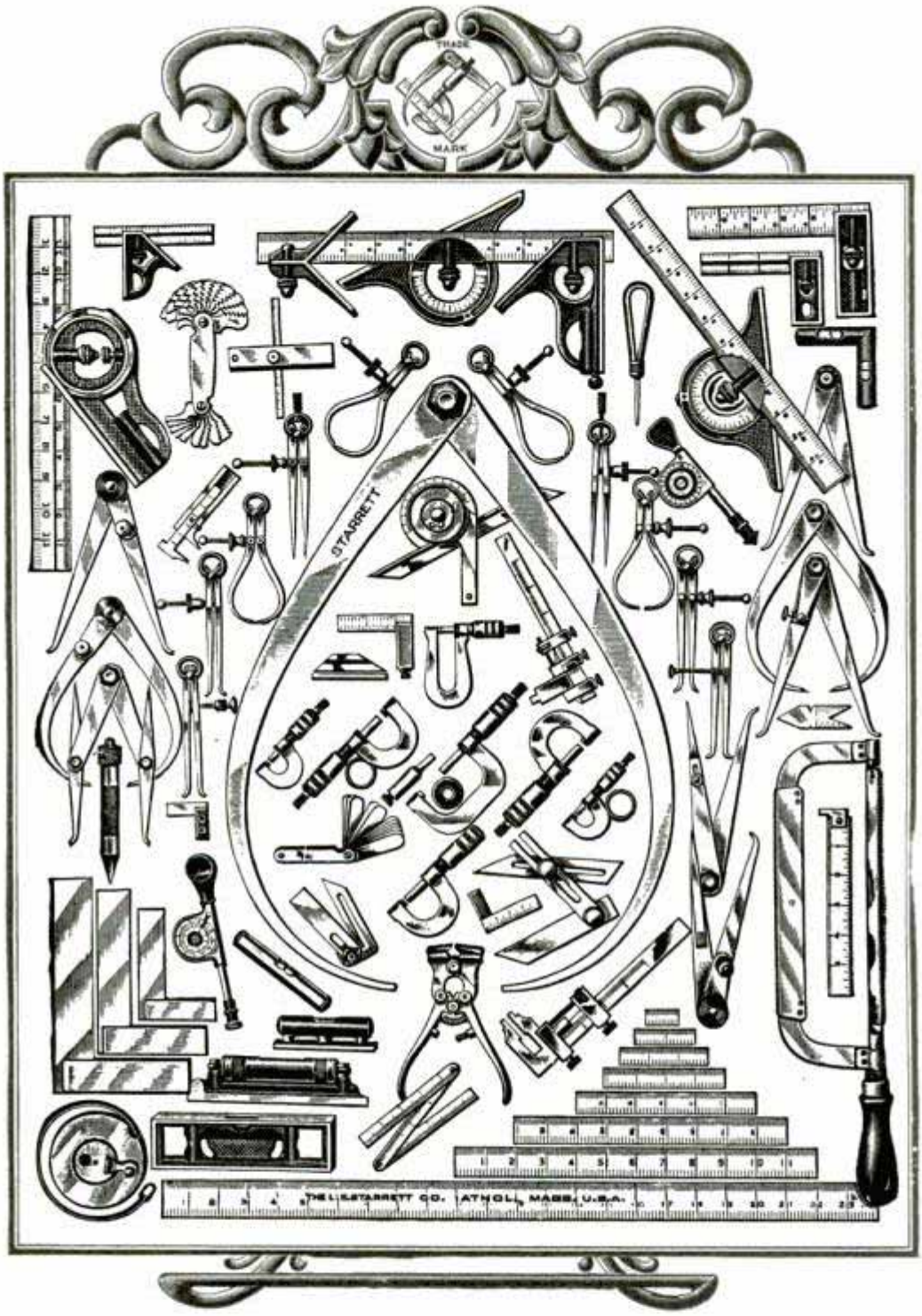

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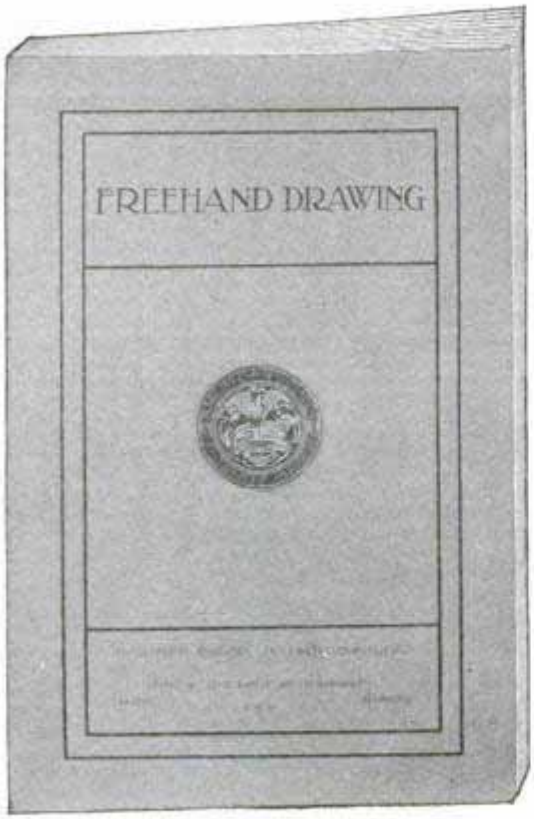

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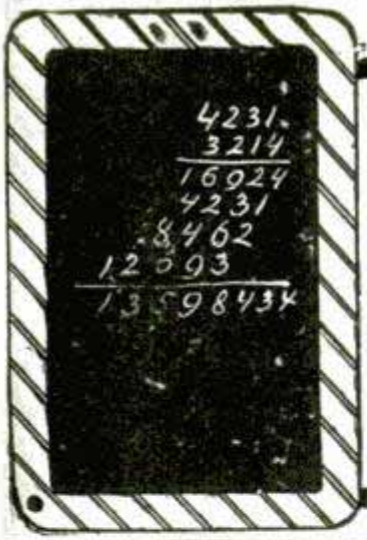

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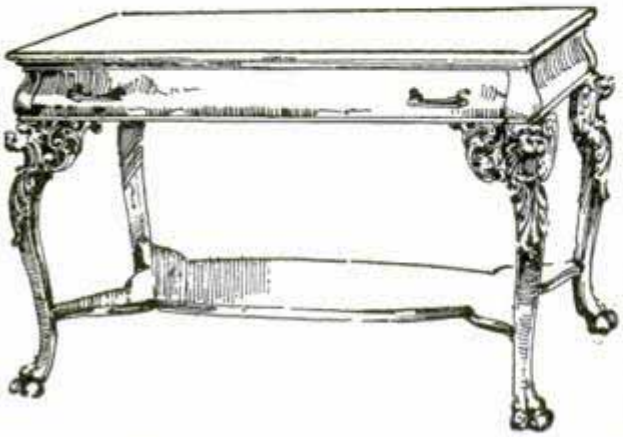

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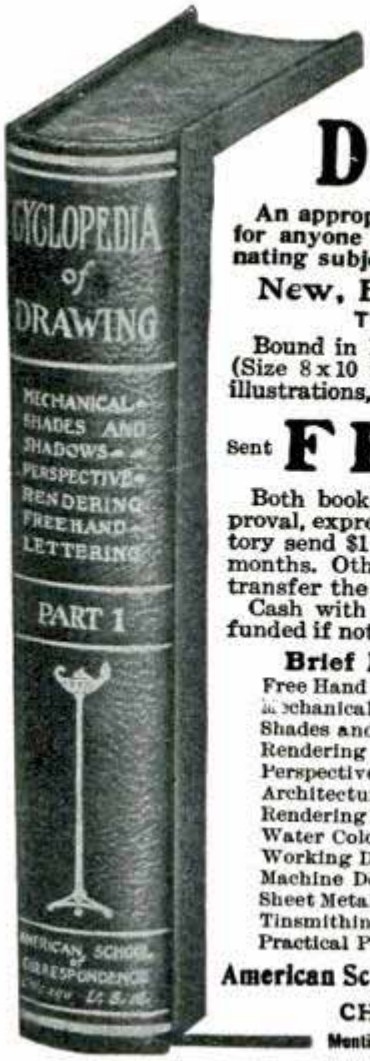

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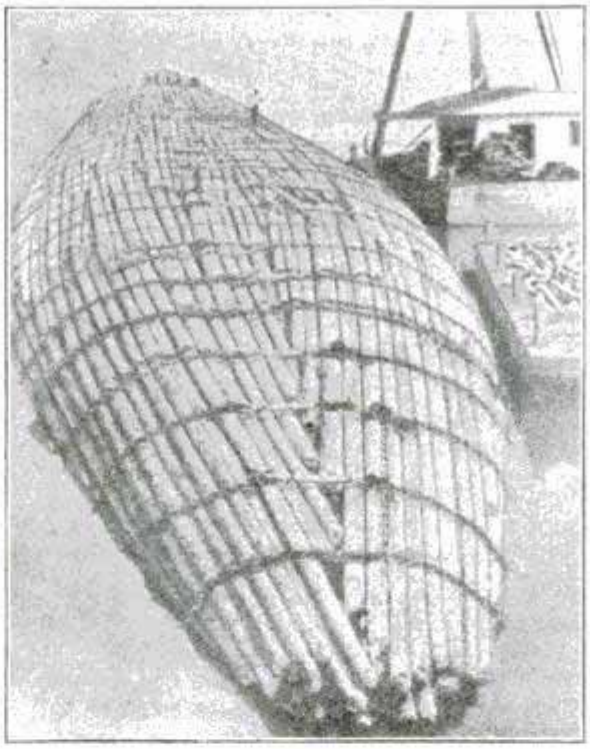
TO RAFT FROM THE COLUMBIA TO THE ORIENT

Ten Million Feet of Lumber -- Largest Ever Attempted -- 900 Feet in Length

The largest raft ever built will attempt the longest voyage ever made by a raft. Ten million feet of the finest Oregon timber, valued at $75,000, will leave the Columbia river for China. Monster logs from 100 to 200 ft. in length are being assembled in an exaggerated cigar shape, by means of a "cradle,"—a Canadian idea. The cradle looks like the skeleton framework of a great ship. The raft extends many feet under water and arches 10 ft. above. One hundred and fifty tons of mammoth chain binds the mass. One main chain extends from end to end; from this belt chains placed at frequent intervals extend clear around the raft.

When the raft is finished the cradle separates into two parts by the removal of key pins, and the parts are hauled out of the way. An immense manila hawser as large around as a man's body will serve as the tow rope. Two sea-going tugs will tow the raft, burning oil which will be supplied by an oil ship which will accompany the "fleet."



A 700-Foot Raft

Such a raft could be constructed nowhere else in the world, for in no other country can be found the giant trees and the necessary facilities for forming them into a raft. The illustration shows a 700-ft. raft which successfully made a trip from the Columbia river to San Francisco in ten days. Several previous attempts at ocean rafting have met with failure, the rafts going to pieces during a storm. The floating logs constitute a great danger to navigation, and float to great distances. Pieces of one Oregon raft were found months later thousands of miles away on the coasts of Hawaii and Mexico. Improvements and additional safeguards have since been made. The big raft is being constructed under the superintendence of Hugh R. Robertson, the father of ocean giant log rafting, and if this one safely makes the voyage of over 6,000 miles it is expected to net a profit of $50,000 or more.

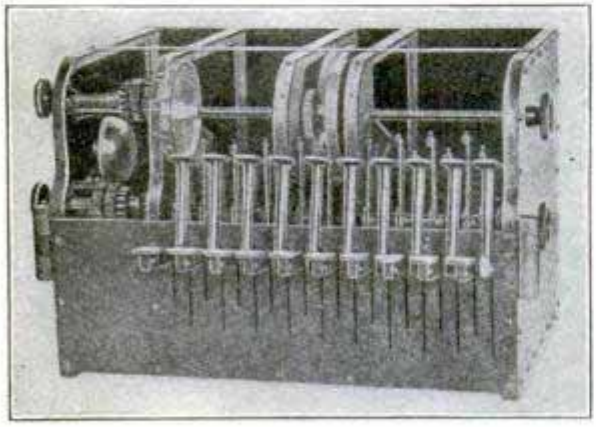
The logs composing the raft will be used for spars and piling. In hoisting them into the cradle, they are lifted one by one by a derrick operated by a hoisting engine, each log being left in the exact position it is to occupy on the long voyage. A daring logger rides every log on its seesaw course through the air, guiding its descent.

The enterprise is looked upon as venturesome in the extreme, though the builders are sanguine of success. The cost of building the raft is enormous, the cradle alone costing thousands of dollars.

NEW METHOD OF LOADING LOCOMOTIVES

Character of Load Determines Number of Cars in Train

A new method of determining what is a fair load for any of its freight locomotives, is being tried by the Illinois Central railroad. Tests have shown that a ton of light



Locomotive Tonnage Computer

loaded cars has almost double the drawbar pull of a ton of heavy cars. For instance, the Railway Age says, the "pull for a 10-ton car is given as 10.8 lbs. per ton, while for a 75-ton car it is 5.7 pounds per ton. This results in the condition that the engine may haul, say, 2,500 tons when in 35 cars, but if in 60 cars the same engine may haul but 2,000 tons, this figure being obtained by allowing an arbitrary of five tons additional per empty car. In addition to the feature of train resistance mentioned, the draw-bar pull also is affected by the make-up of the train, that is, with the heavily loaded cars at the rear the pull will be greater, and one trunk line, after tests, has placed the resistance at 10 per cent."

To estimate the load in a train, a machine something like a cash register has been constructed. The various keys register the draw-bar pull of the cars and various kinds of freight which is registered from the way bills. In this way a fair average load for the locomotive to be used is determined. There is a great difference in coal consumption between a train loaded moderately and extremely heavy trains.

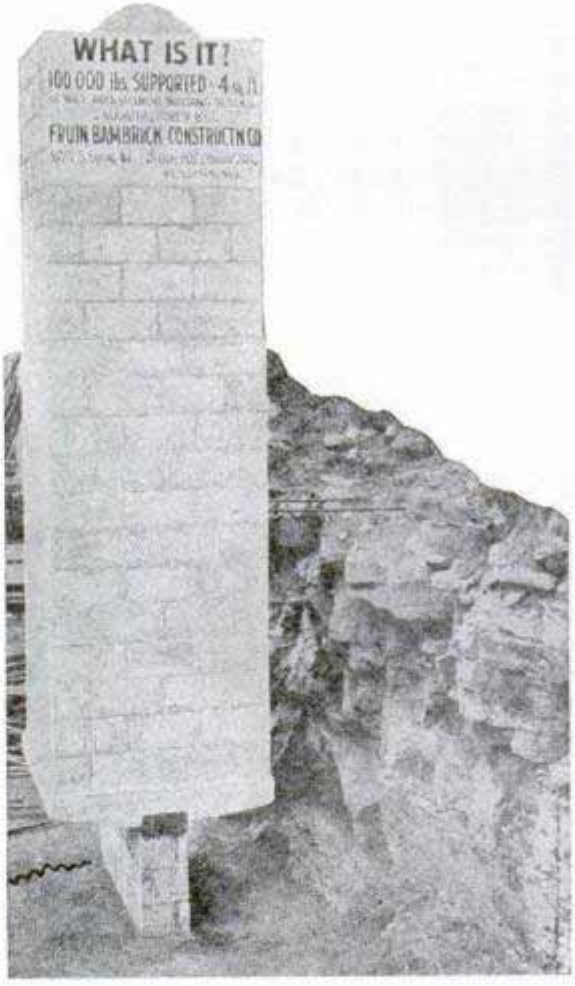
To supply props for coal, iron, gold, silver and other mines of this country, as the natural support is removed from their roofs, and for other mine purposes, requires 400,000,000 cubic feet of timber a year.

SHIPS' DECKS OF SAWDUST AND STEEL

Steel decks with a layer of a paste, made of sawdust and certain oils, laid upon them are being used as a substitute for wood decks on many ships. The layer of paste is about 1½ in. thick, is leveled and will take a polish if desired. This layer is somewhat elastic and adheres closely to the steel. It is watertight and durable. To repair, it is easy to cut the paste out and renew it, and the expense is small. The paste is manufactured and sold under several brands.

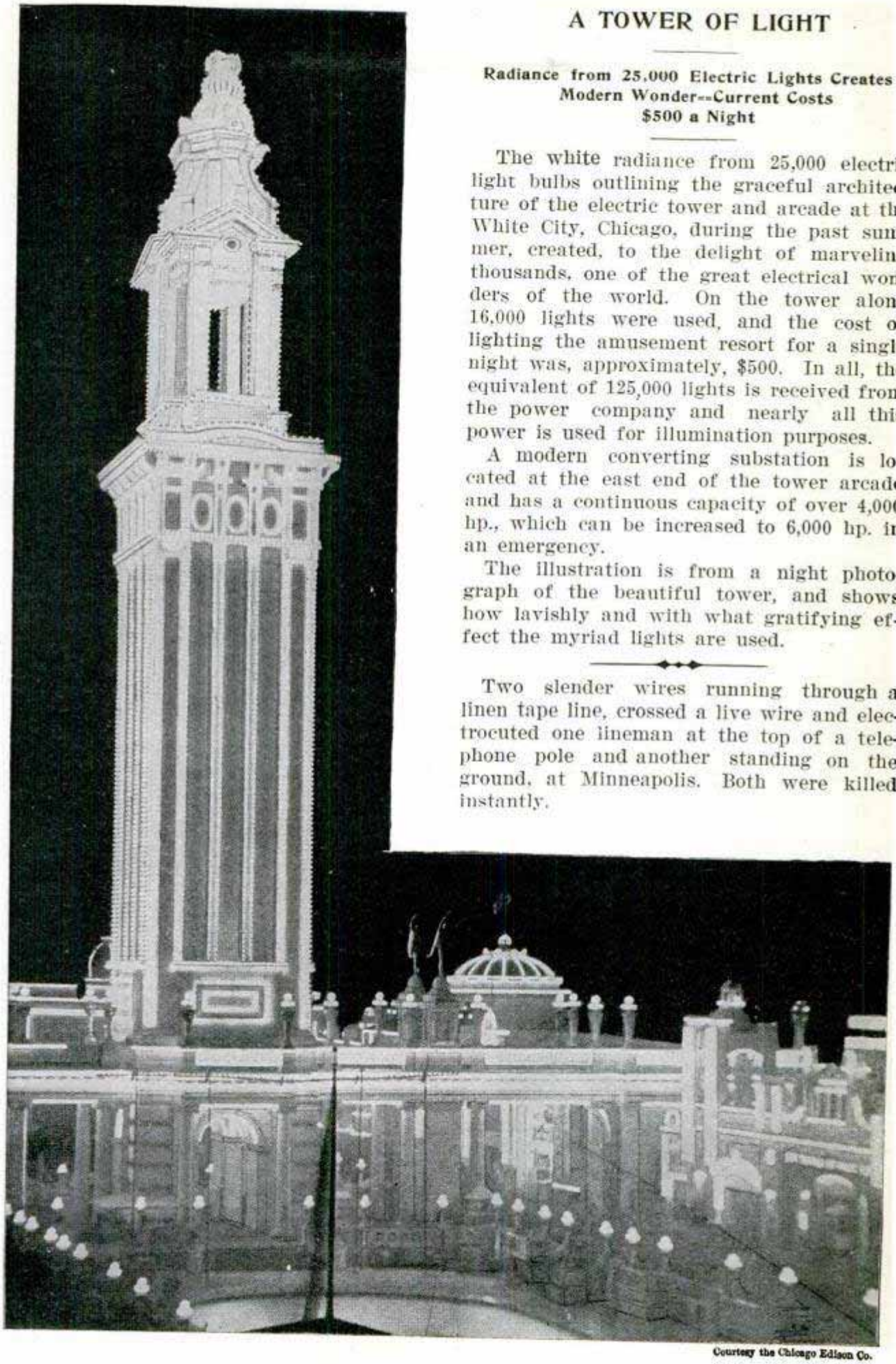
TWELVE-INCH HOLLOW BLOCK SUPPORTS 100,000 POUNDS

A unique demonstration of the surprising strength of concrete hollow block construction was made at St. Louis. A column 6 ft. square and 20 ft. high having an interior space 4 ft. square, was built of hollow block. The column is supported on a 12-



Strength of Concrete Hollow Block Construction

in. wall of hollow-block. The space within the column is filled with dry sand weighing 100,000 lbs.



A TOWER OF LIGHT

Radiance from 25,000 Electric Lights Creates a Modern Wonder--Current Costs $500 a Night

The white radiance from 25,000 electric light bulbs outlining the graceful architecture of the electric tower and arcade at the White City, Chicago, during the past summer, created, to the delight of marveling thousands, one of the great electrical wonders of the world. On the tower alone 16,000 lights were used, and the cost of lighting the amusement resort for a single night was, approximately, $500. In all, the equivalent of 125,000 lights is received from the power company and nearly all this power is used for illumination purposes.

A modern converting substation is located at the east end of the tower arcade and has a continuous capacity of over 4,000 hp., which can be increased to 6,000 hp. in an emergency.

The illustration is from a night photograph of the beautiful tower, and shows how lavishly and with what gratifying effect the myriad lights are used.

Two slender wires running through a linen tape line, crossed a live wire and electrocuted one lineman at the top of a telephone pole and another standing on the ground, at Minneapolis. Both were killed instantly.

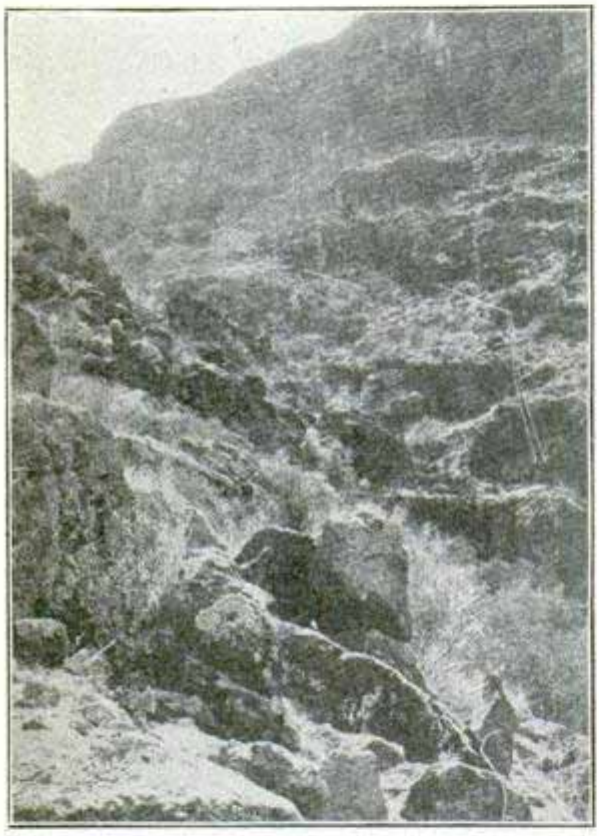
Courtesy the Chicago Edison Co.

TELEPHONE LINEMAN IN ARIZONA WHO "SHOT UP THE TROUBLE"

"I reckon I shot up that trouble some," was what "Slim" said when he returned to camp about nine o'clock one night.

The government long distance telephone line had just been completed under the most difficult engineering conditions from the Arizona Dam to Tonto Basin and Upper Dam, to connect the several construction camps. Geo. Bond Ellison, electrical engineer, relates the characteristic incident in the Journal of Electricity.

The line after completion was remarkably



Land of Rattlesnakes, Tarantulas and Scorpions

quiet and efficient in transmission and remained so for a week or ten days. At the end of that time the engineer rode into headquarters camp and was asked what had gone wrong? They could not get the Arizona Dam. There was an awful buzzing and rattling, and it had been so for twenty-four hours. It was O. K. on the Upper Dam section. The trouble was down the river; the engineer tested several times, and each time the rattling was seemingly louder. Finally the line rider was called in and told to hike down the trail and clear the trouble.

The line rider was known as "Slim," a long, lean Arizonian, preternaturally solemn, picturesque and characteristic in speech. In three or four hours the trouble cleared up and "Slim" was looked for to explain the cause. About nine o'clock that night "Slim" came gangling into the engineer's tent and folded himself up on a box and carefully rolled a cigarette; cocking his eye up at the engineer, he cautiously delivered himself.

"I reckon I shot up thet trouble some."

He was asked to explain.

"Wa-al, yu see, I hiked down the trail fer about twenty miles and didn't find nuthin', everything clear. Sa-ay, yu know where the line goes down in the holler at Fish Creek? I got round that pint of rock and looked down at thet pole. Yu know it's a transpersition! There was a big, red-eyed, long-horned steer just a bellerin' and pawin' up the ground all around and kinder lookin' up. I rid closter to get wise and dang my buttons! ef there wan't a six foot rattler, head end wound three times around one wire and tail end three times round t'other and the little ole rattlers stickin' right up. Wa-al, I jist naterally figgered it out this here way. that steer had caught Mr. Rattler and histed him up on the wires and was a waitin' fur him to fall off. Mr. Rattler was jest naterally scared plumb stiff and every time we took down the receiver and rung up we'd shoot the juice through him and he was hanging' there jist rattlin' like h—l for help!"

"Slim" went on to say that he was so impressed by the reptile's intelligence that he had killed the steer and turned the snake loose in the hills.

STEAM ROLLER SAVES COLD STORAGE

An accident to the boilers occurred in a large cold storage plant which could not be repaired under several days. The house was filled with perishable goods for which the cold storage company was responsible. The owners saw visions of thousands of dollars lost unless something could be done. The engineer finally thought of two steam rollers working on a road a few miles away. The rollers were secured, hurried to the plant, and steam connection made with the circulating pumps. By running the two boilers at their utmost capacity the temperature in the cold rooms was kept below the danger point and the contents were saved.

Index to Volume VII, January to December, inclusive, 1905, is now ready and will be mailed free on request.

BLASTING BY ELECTRICITY

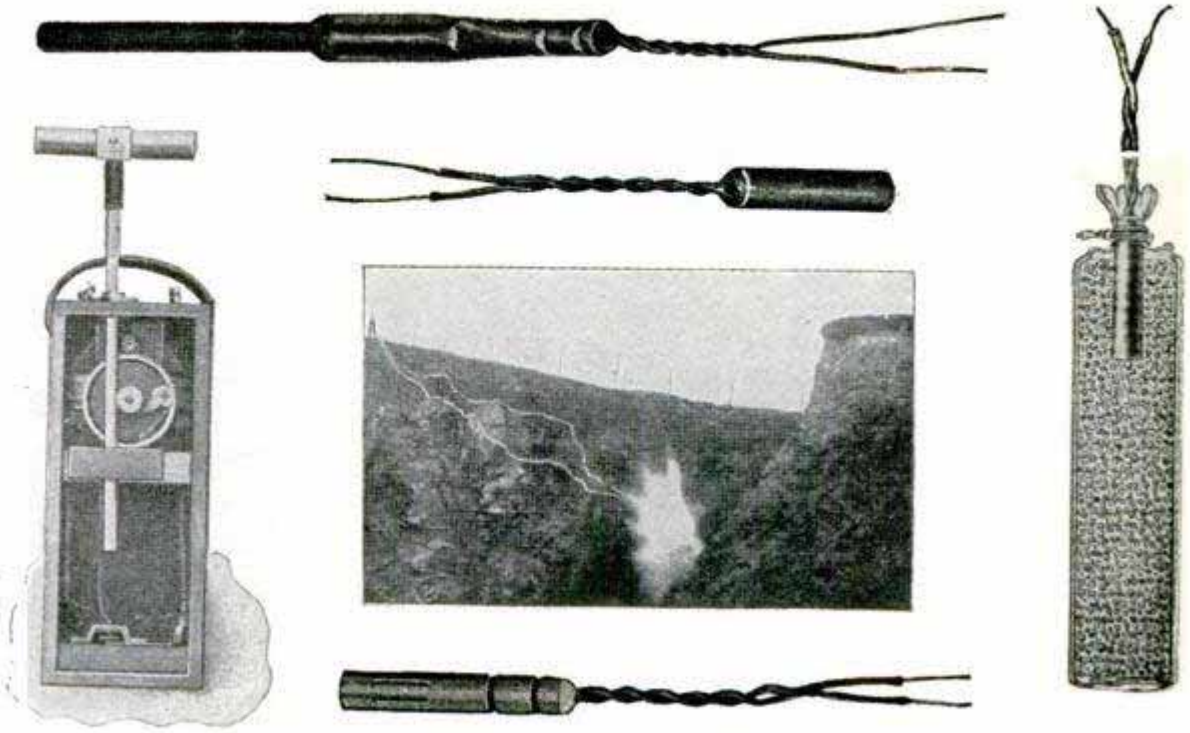
Once Perilous Work Now Perfectly Safe

The firing of a blast, whether a single charge containing a few pounds of black powder, or a series numbering scores and aggregating tons of dynamite and other powerful explosives, is now a matter of absolute certainty and precision, and need not involve the slightest risk if properly managed.

In the old days the firing of a blast was an exciting and dangerous event. When the charge had been carefully rammed down, and the mass of timbers piled on top, the workmen hurried to places of safety, leaving the most courageous one to light the piece of snaky fuse which extended out from beneath the pile. These fuses, even when made with great care, were very uncertain things. Frequently they burned with unexpected rapidity, causing an explosion before the blaster had time to escape. At other times they burned so slowly it was thought the fuse had gone out, and a second attempt to light it would be made just at the fatal moment.

Setting Off the Blast

Happily these accidents are now of rare occurrence, for an electrical exploder, which can be carried in the hand, two long wires, and the electric fuse have reduced the problem to a mathematical certainty. The electric fuse is a cartridge of paper or brass filled with powder into which two wires are carried, the ends being tipped with platinum and securely separated by a short gap. The wires are laid upon the ground to whatever distance safety demands, where, when all is ready, they are fastened to the two brass binding posts of the exploder. There are several types of exploders, but nearly all operate on the same principle. Within the exploder is a magneto which generates an electric current by the pushing down of the handle. At the instant the handle is lowered the current darts along the wires,



Details of the Electrical Exploder

and coming to the gap in the fuse jumps across, producing a spark or small arc, which ignites the explosive in the fuse, and this in turn fires the blast.

By using a larger number of wires, all connected to the same exploder, a large number of blasts can be fired at the same instant, or may be made to follow in regular succession. In this case time fuses for "delayed action" are employed, the length of the fuse determining the interval before explosion. The one operation of the exploder works them all, the time fuse being lighted in this event instead of the charge direct.

The expense of an outfit is not great; the fuses ranging from two cents to fifteen cents each, according to size and strength; while the exploders cost from $15 for a 6-hole exploder up to $50 for a 50-hole instrument. Small exploders are also made capable of firing up to four holes; these are worked by pulling a string and have been found most satisfactory.

PORTABLE SOUP TUREENS

Hot soup venders have taken the place of the ice-cream peddlers on the streets of London now that cold weather has come.

A Dish of Soup for Two Cents

The barrows that served for ice-cream in the summer have been turned into portable soup tureens. The soup is supplied by an association and is sold with bread at a penny (2 cents) a head.

COKE OVEN GAS TO LIGHT CHICAGO

The large portion of Chicago and suburban towns within a radius of twenty miles are to be lighted with gas from the great batteries of coke ovens now being built in the southern outskirts of the city. These ovens will cover fifty acres, and are considered the most extensive in the world outside of the Connellsville district in Pennsylvania.

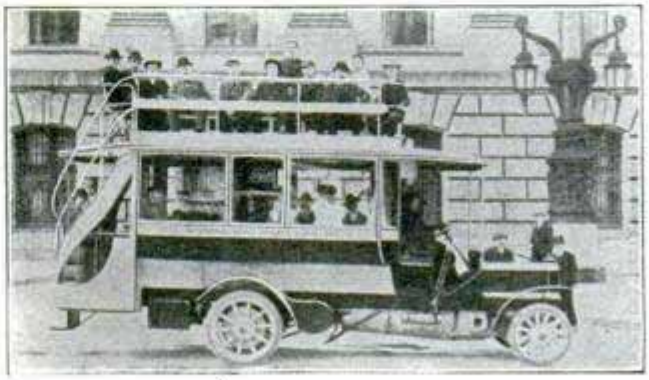
For years past thousands of millions of feet of gas have been pouring from coke ovens wherever operated, wasting an enormous amount of fuel value, and polluting the air. A process for receiving, piping and refining these waste gases has been devised and is expected to convert a hitherto waste of product into a superior article of illuminating and heating gas. If the experimental plant meets the expectation of the engineers, the largest gas plant in the world, to cost $3,000,000, will be erected.

DOUBLE PLATOON SYSTEM IN CHICAGO FIRE DEPARTMENT

The double platoon system is being tried with one engine company of the Chicago Fire Department. It involves twice the number of firemen at a station, one half of whom are off duty ten hours each day. The crew on watch are not allowed to go to bed as with the single platoon. The men do not seem to like the experiment thus far, and want to return to the former system. One of the difficulties is in changing the shift during the progress of a fire.

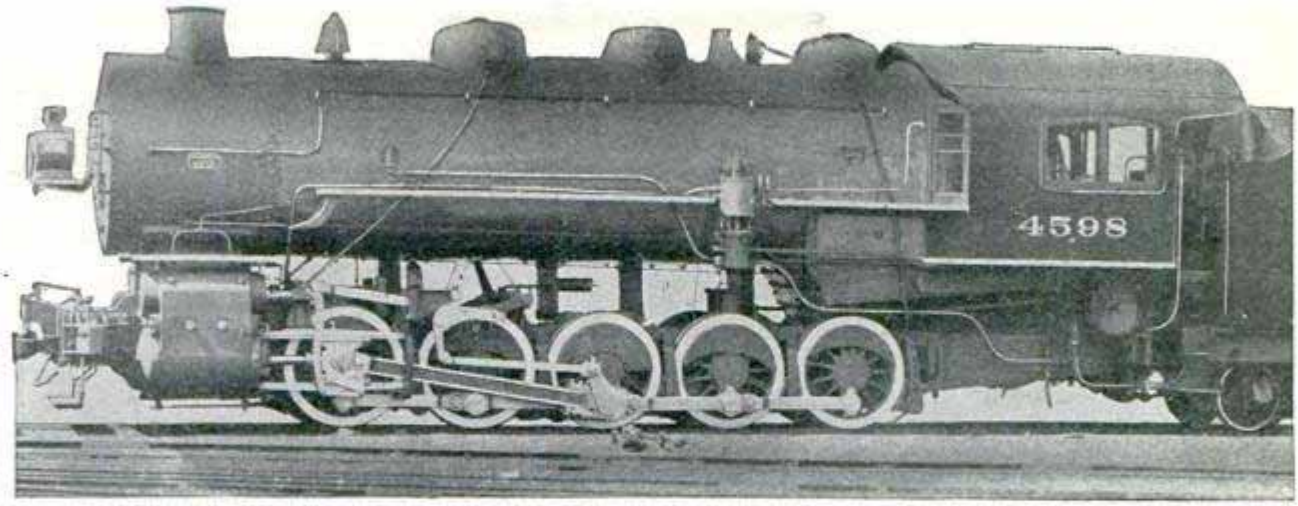
MOTOR BUS FOR BERLIN

A system of motor omnibuses has been put in operation in Berlin, a city where motor cars have long been used extensively. These cars are driven by a 24 h. p., gasoline motor, seat 16 passengers inside and 14 on top. Illustration by courtesy of the Motor Way.



Berlin Motor Bus

MOST POWERFUL LOCOMOTIVE IN THE WORLD

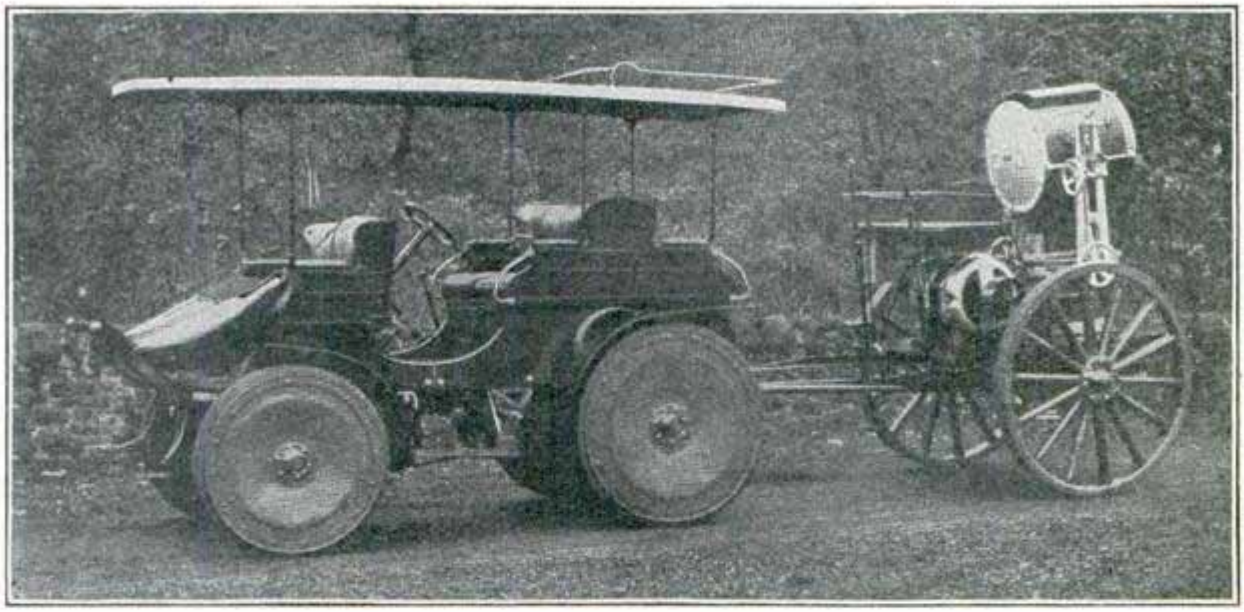


Courtesy American Locomotive Co.

Will a Larger One Ever Be Built?

The most powerful locomotive, and the heaviest switch engine in the world, was recently turned out by the Schenectady works of the American Locomotive Co., for the the Lake Shore R. R. It is what is known as a "Hump" engine, being used to haul heavy trains over summits in gravity switch yards. This powerful mass weighs 135 tons, without tender, all the weight resting on the ten drivers, which are 52 in. in diameter. The cylinders are 24 in. with 28-in. stroke. Other figures are: Diameter of boiler, 80 in.; steam pressure, 210 lbs.; 55 sq. ft. grate area: heating surface, tubes, 4,422 sq. ft.: fire box, 73 in. wide, 108 in. long: length engine and tender, 54½ ft.; weight of tender, loaded, 75 tons; tank capacity, 8,000 gal.

ARMY AUTOMOBILE SEARCHLIGHT



To Illuminate "Darkest Africa"

A traveling electric light plant is the machine illustrated. It was built in England for the army service and will be sent to Egypt. The car has a 20 h. p. motor, and specially wide wheels with metal sides to prevent sand getting between the spokes. The Automobile says: "The trailer is fitted with electric equipment of dynamos and searchlight, provision being made so that the dynamo can be driven from the car."

HOW DOES A GAS PRODUCER WORK?

By W. H. Patton, Gas Engineer, Chicago Branch Otto Gas Engine Works,

Producer gas is a gas made chiefly for power and heating, and takes the place of gasoline. The economy of producer gas will be better understood by a brief reference to the heat unit, commonly expressed as British Thermal Unit, and written B. T. U. A heat unit is that amount of fuel that is necessary to raise the temperature of one pound of water, say at 60 degrees Fahrenheit, one degree. Ordinary coal has a heating value, ranging from 10,000 to14,000 heat units per lb. The heating value of fuel required to develop one brake h. p. for one hour in a steam engine, varies from 16,000 degrees up to, and over, 100,000 degrees, governed by the character of engine, boilers, etc. The lowest consumption mentioned, is attained in but few instances, and then only with triple and quadruple expansion engines, and boilers perfectly free from scale inside, tubes thoroughly free from soot and boilers and pipes covered to prevent radiation of heat, not a practical every day proposition; while the gas engine is guaranteed to produce one brake h. p. for one hour on a consumption of fuel ranging from 9,000 to 12,000 heat units.

W. H. PATTON.

This is the condition to-day, which in the minds of leading engineers will in a few years eliminate the steam engine as a power factor. This condition has been reached in parts of Europe to a very considerable extent; for instance the Krupp Iron Works, of Germany, the largest iron works in the world, using some 68,000 h. p. are operated almost entirely with gas engines.

Articles of more or less length appearing in various periodicals of the day, containing statements of the wonderful economy, the absence of smoke, danger from fire and explosion, etc., with producer gas engines, have aroused an interest in the minds of the ordinary reader, especially in the minds of those mechanically inclined, as to what is a gas producer?

The ordinary stove of the base burning type, is a good illustration of the gas producer. Start a fire in it, fill the magazine at the top with coal, and after your fire gets to burning in good shape, tightly close the damper in the pipe, leading from the stove to the outer air, and if there are any leaky joints in your stove, you will have a first-class gas producer in active operation, right in your room.

However the gas producer for furnishing gas in your engine is a little more elaborate. By referring to the accompanying cut, it will be seen that a producer plant has the following parts; a producer or generator, smoke or vent pipe, evaporator, scrubber and gas receiver. The producer is an ordinary cylindrical stove, lined with fire brick in which the coal burns. The evaporator, containing water, is placed inside of the steel shell of the producer (see cut) in contact with the fire and generates steam which is conducted through a pipe and discharged beneath the grate, mixing with air as it is drawn up into the fire.

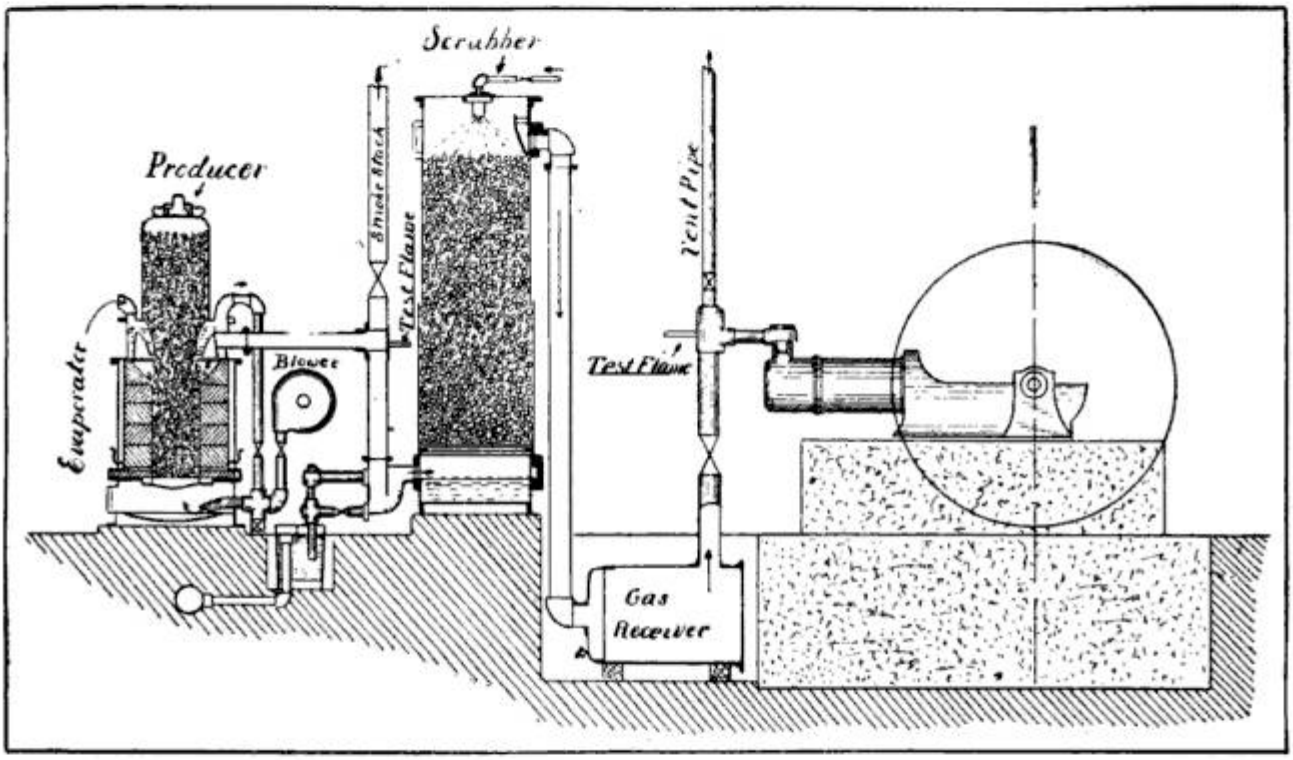
The heat of the fire decomposes this steam into its constituent parts of oxygen and hydrogen. The hydrogen increases the heating value of the fuel 20 to 25 heat units per foot. The gas made from the coal, has a heating value of about 120 heat units per foot. Thus it will be seen that the hydrogen raises the heat value in proportion, besides being a perfectly clean gas, and making the gas more combustible and quicker in its action.

The second large vessel is what is known as the scrubber. This is a boiler iron cylinder filled with coke. The gas from the producer enters this scrubber at the bottom, passing upward to the pipe leading to the gas receiver and engine.

At the top of this scrubber, a water pipe enters and water is sprayed on top of the coke, and runs down through the coke to the trap at the bottom. This accomplishes two purposes, namely, cooling the hot gas, and washing out the dust, ashes and other impurities, which are drawn through the producer, by the suction of the engine. The gas receiver is simply a small storage tank for gas.

Operation: Starting the producer is accomplished in the following way; a fire is kindled on the grate, in just the same

manner that you would start a fire in an ordinary anthracite base burner. The vent in the smoke stack is opened to the outer air. This is the same as the damper in the pipe of your stove. Your magazine is filled with coal, the blower is started, taking from 15 to 30 minutes the first time that the producer is started, and must be operated until the test flame will burn with a bright blue flame. When this condition is reached, the valve or damper (shown in the cut by a cross in the smoke stack) is closed, the blower is stopped and the valve, shown by a cross in the pipe over the gas receiver, is opened. The engine is then started when



Producer Gas Machine

the draft for the producer is furnished by the suction stroke of the engine.

When the engine is shut down for the night, open the valve or damper in the smoke pipe and the natural draft is sufficient to maintain a fire over night. When it is again desired to start the engine, 5 or 10 minutes blowing is sufficient to put the engine in condition, and again start the producer. The fuel used is anthracite pea coal, charcoal or coke, in this type of suction producer.

The question will naturally be asked, why not use soft coal which is cheaper? This can be done, but requires a much more elaborate installation of scrubbers, purifiers, etc., on account of the greater amount of impurities contained in this grade of fuel; besides requiring more care and time on the part of the attendant. As the suction producer requires only about one pound of hard coal per h. p. hour, when the engine is operating at full load, the very small saving in the cost of soft coal fuel would not pay for the extra expense of a soft coal producer, installing and operating the additional purifiers for engine units of less than 500 to 1,000 h. p.

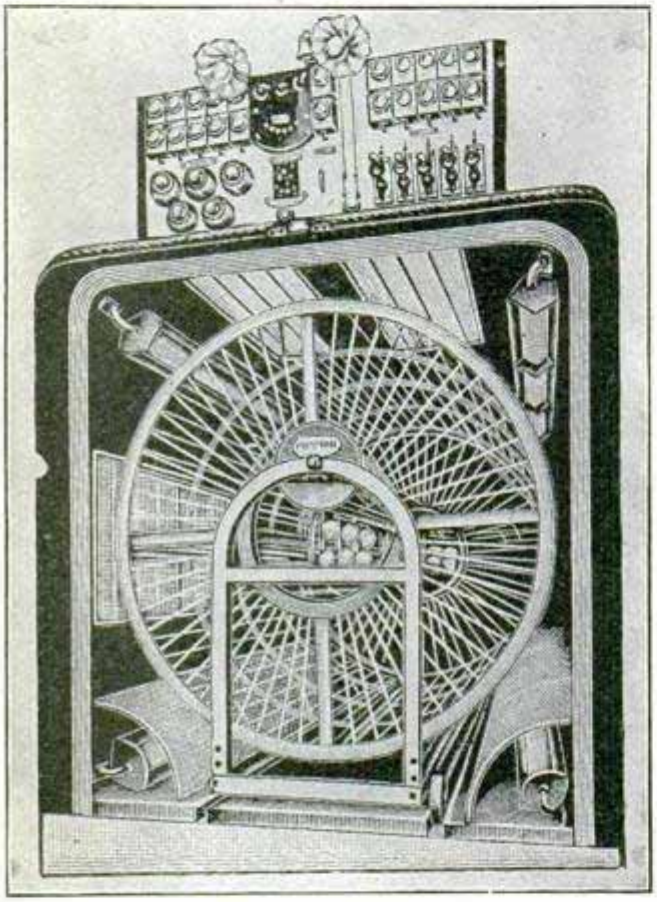
The utility of the producer gas system ranges from units of a few horse power up to the largest gas engines built, and include stationary and marine engines. In fact, great success has already been attained in operating large boats in Germany driven by gas engines, using producer gas.

As an instance of the great economy of the system, I might cite a case here in Chicago which has been in daily successful operation for six months past. The power was a 30 h. p. gasoline engine running on gasoline at a cost of $4.50 per day for fuel. As more power was needed, it was decided to use a gas engine of 60 h. p., and install a producer. The cost for fuel for gas now made by the producer from hard coal has averaged only 70 cents per day for a 9-hour day of the 60 h. p. engine.

The big Hamburg-American liner "Amerika" was dry-docked and had two coats of composition applied to her hull at Southampton, England, recently in the short space of 24 hours. Considering the area that had to be scrubbed and coated this was considered a great feat.

AN ELECTRICAL DISINFECTOR

Of all the varied uses to which electricity has been applied one of the most unique, as also the latest, is to disinfect beds, blankets, mattresses, carpets and other similar articles. The disinfector is a large metal chamber 6 ft. wide, 9 ft. long and 7 ft. high, which when closed is practically airtight. A steel cage, in five sections, is made to rotate by means of an electric motor. In each corner of the chamber extending its entire



Destroys All Disease Germs

length, and through the center are rows of electric lights of intense power. As the cage revolves its contents are treated to a light bath, and heated to a temperature of 300 deg. The impure air is drawn out at one end and fresh air admitted under control at the other. The Electrical Review, London, says:

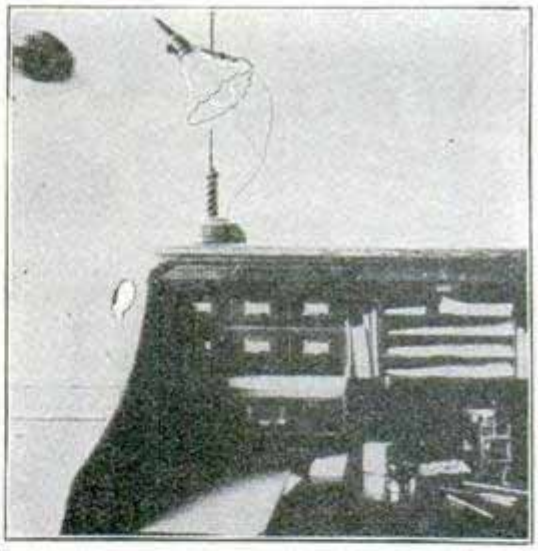
The electric disinfector is claimed to constitute one of the greatest advances in sanitary science and hygiene. The process has the effect of destroying completely, without use of steam or chemicals, the germs of disease, and thoroughly cleaning the articles which, under the process, are submitted to the simultaneous action of light and heat rays.

PROPER METHOD OF DESK LIGHTING

The proper method of desk lighting, according to J. R. Cravath, an illuminating engineer, is as shown in the illustration. He says:

"Badly arranged desk lighting is responsible for much trouble with eye-sight. The best method of desk lighting is to place the light high at the left-hand side of the desk. By equipping a lamp with a good reflector and pointing it at an angle of about 45 deg. to the right, a strong, fairly even illumination over the whole desk surface is obtained, and the glare of the regular reflector from the paper passes off in a direction to cause no annoyance.

"With a reflector, having a smooth white or polished reflecting surface, such as the ordinary green opal desk shade, polished aluminum or white enameled shades, lamps with bulbs frosted by the etching process should always be used to avoid the streaks which are always present in the light from

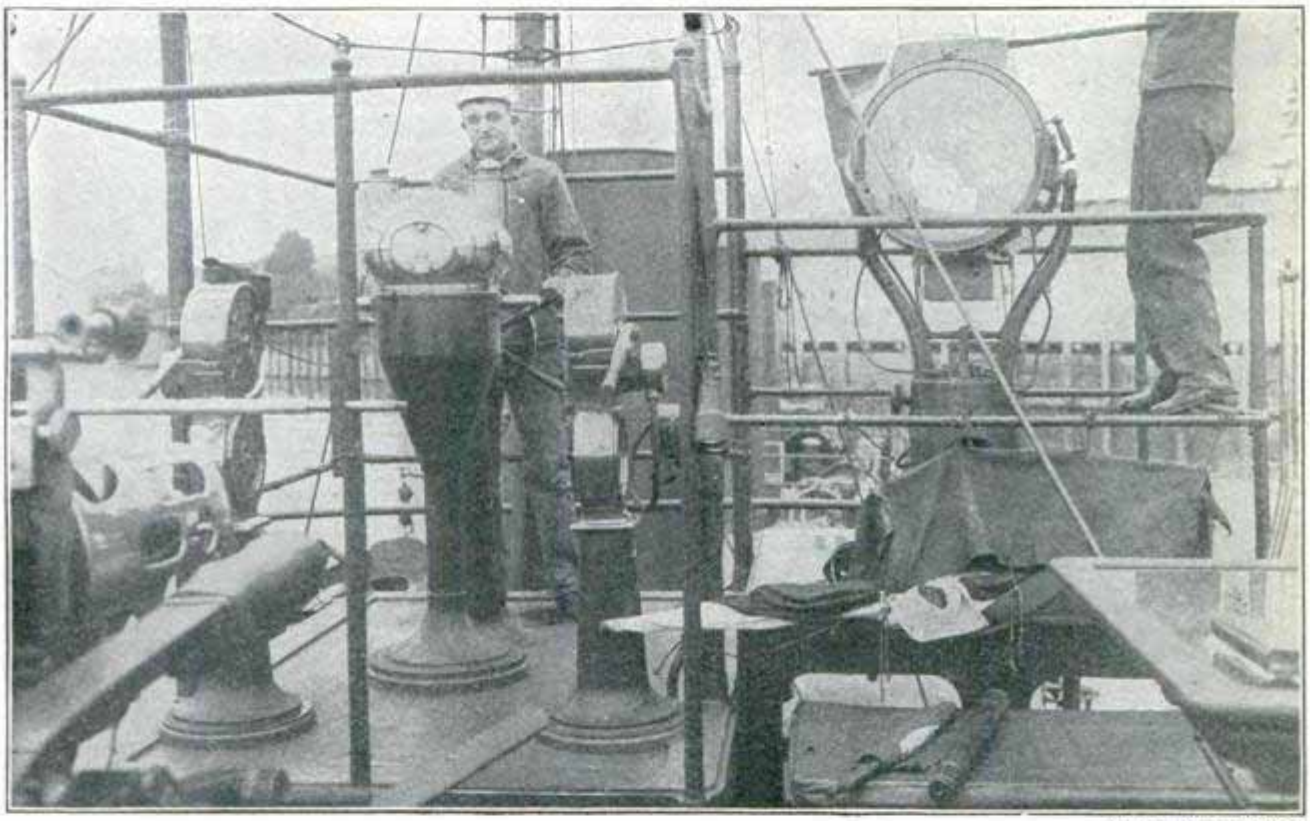


Desk Properly Lighted

clear bulb lamps with these shades. These streaks are largely eliminated by frosted aluminum, prismatic glass, fluted opal, or properly corrugated mirror type of reflectors."

THE BATTLESHIP vs. THE TORPEDO BOAT

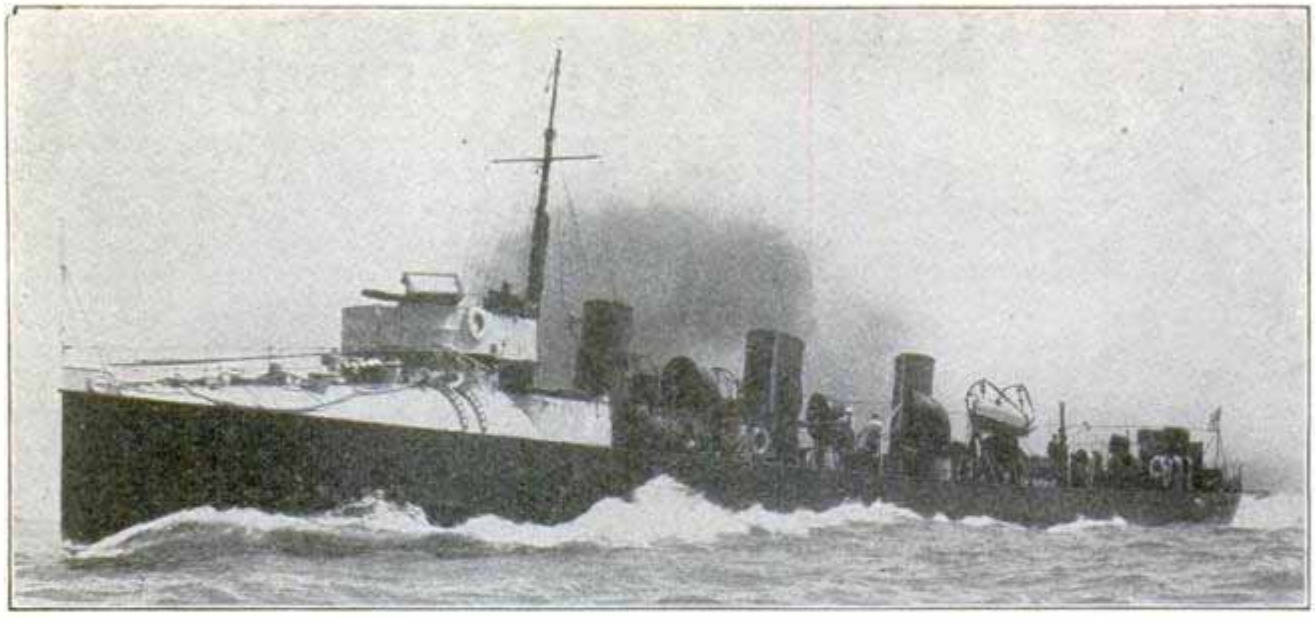
Shall the nation build battleships or torpedo boats to protect herself in the future? This is the leading problem in the minds of the greatest naval engineers of the world to-day, and while carefully worked out theories and circumscribed experiments will determine the question for each navy, the demonstration of superiority remains with the future. The past, including the Japanese-Russian war, has contributed little towards solving it. Deep-seated prejudice, priding itself, since naval warfare began in spectacular armadas in battle array, finds it hard to yield up its trust in the noble battleship; on the other hand, there is a voice rising from a million throats proclaiming her obsolete, and demanding that progress come to its own in the shape of torpedo boats.



Bridge of U. S. Torpedo Craft

Probably the best argument that has been advanced for the torpedo boat is one given by Hudson Maxim, who declares that 50 torpedo boats can be built at the cost of one battleship, and all manned with fewer men than one battleship would require, and therefore, if 50 torpedo boats were lost in destroying one battleship, the loss to both sides would be equal. In actual warfare, however, not more than an average of ten torpedo boats would be destroyed to a battleship, it is estimated.

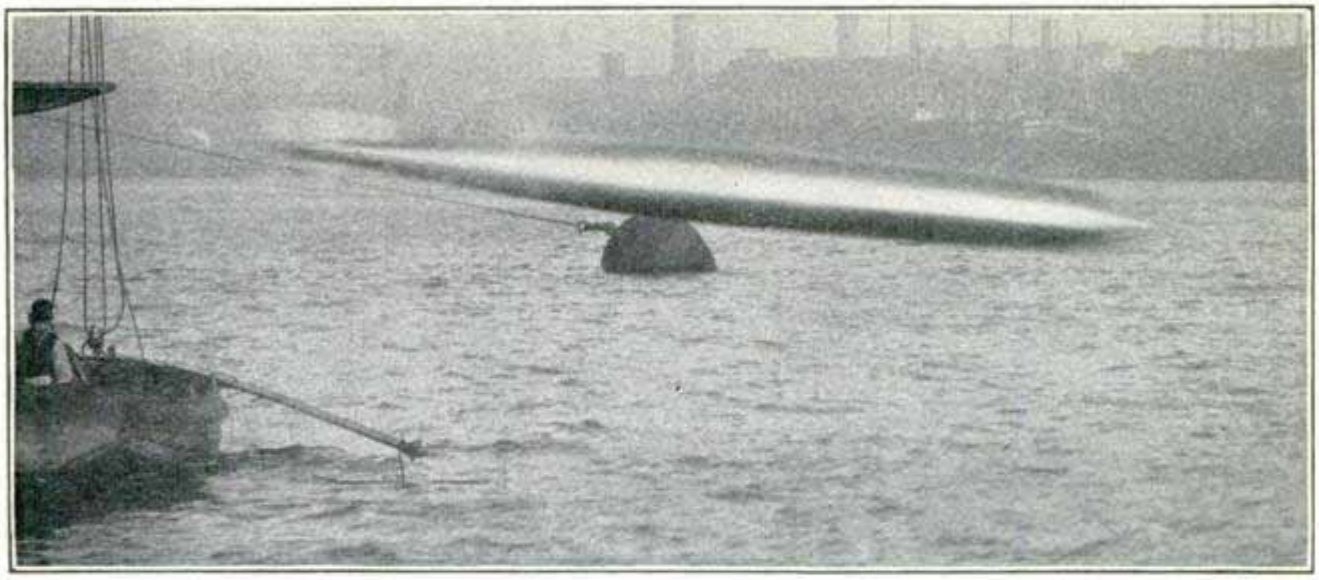
The torpedo boat carries no armament for her protection. What avail would it be before the steel-clad, fire-belching monster she goes forth to destroy. She is a frail little steel craft, crowded with big engines that cause her to quiver like a hunted deer and send her skimming over the waters at the rate of 35 miles an hour. Under cover of darkness or fog she goes forth and success or failure depends upon getting within firing range of her prey without being discovered. The little craft has two terrible betrayers which threaten her constantly: The powerful searchlights of the foe and the glow from her own funnels venting the smoke from her big engines. But if she succeeds in getting within 2,000 yards of the enemy without being detected and drawing a terrible rain of shell, the doom of the battleship is sealed—one effective torpedo is sufficient to sink her; and the wonderful automatic action of the torpedo is certain to be effective on impact within its range. Nearly every one knows the construction of the Whitehead torpedo. Its charge of gun-cotton



Torpedo-Boat Destroyer "Whiting," Traveling at Over 35 Miles an Hour, and Just About to Discharge Her Bow Torpedo at a Floating Target

at the head, its flask of highly compressed air furnishing power to its engines and motors, its balance-chamber with the wonderful mechanism keeping it just at the desired degree of submergence, operated by the pressure of the water through which the torpedo speeds, its machinery of locomotion in the compartment at the stern, its spinning propellers and the gyroscope which keeps it true to its course. A single torpedo costs from $1,500 to $3,000 and those used by the United States are in two lengths—12 and 17 ft. They are porpoise-shaped and their greatest diameter never exceeds 18 in. A torpedo weighs one-half ton. Torpedoes are sent out from the manufacturer in five sections, each section containing upwards of 2,000 separate pieces, such is the secrecy observed. The torpedo is aimed by means of an automatic "director" which acts according to the speed of the torpedo boat and of the target. The

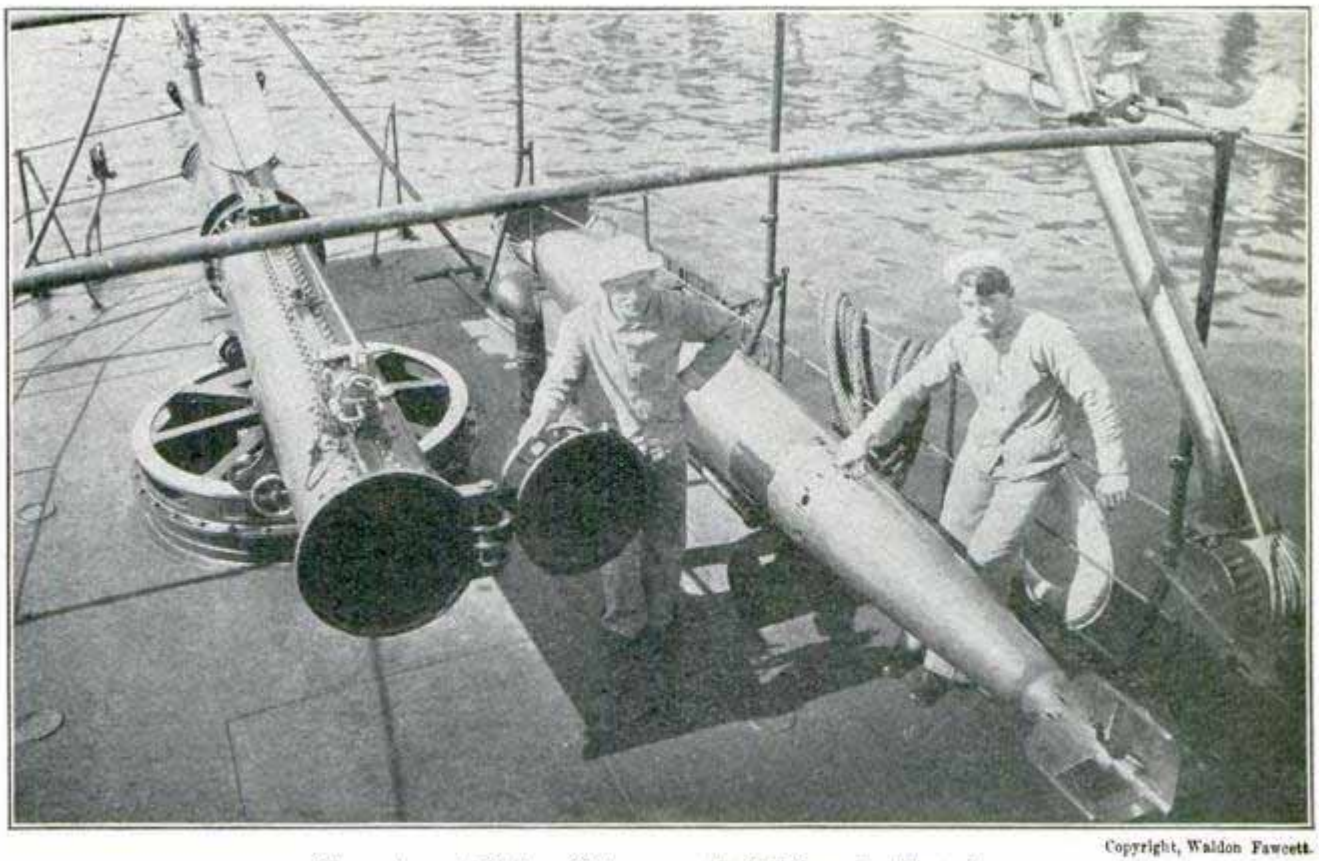
After Conning-Tower and Gun Platform on a U. S. Torpedo Boat



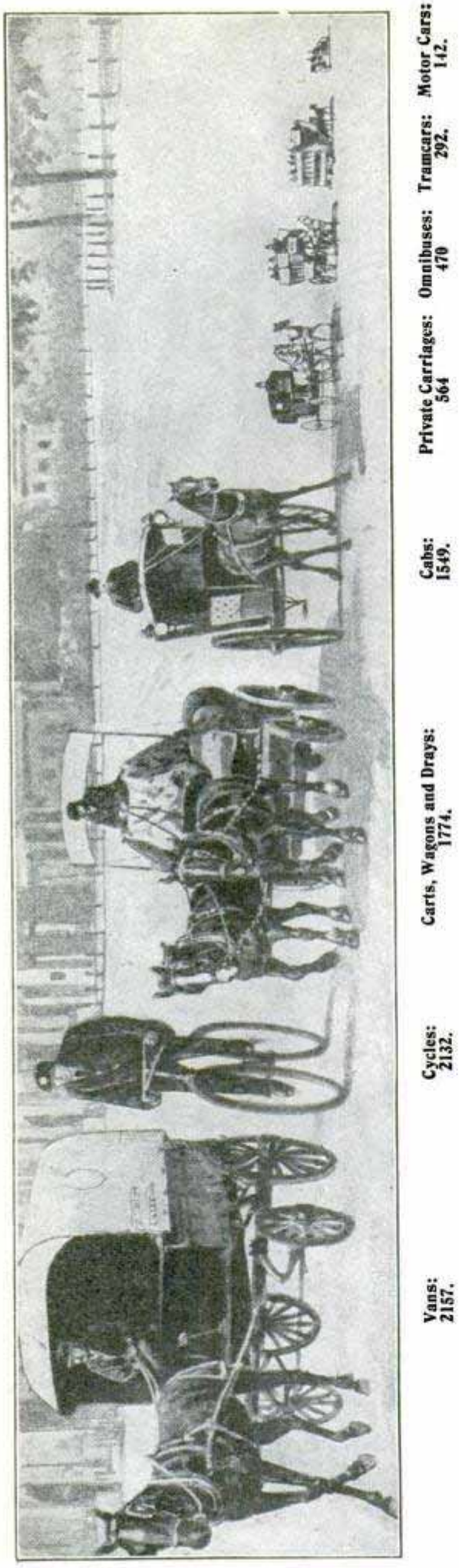
Remarkable Photograph of Torpedo in Flight

speed of vessels varies, however, and here enters the element of uncertainty. Cordite or gunpowder is used to fire the torpedo from its tube.

A torpedo-boat costs from $50,000 to $250,000, while our finest battleships cost upwards of $7,500,000 and the tendency is to increase the size and, consequently, the cost of the latter. The battleship has no safeguard against the torpedo which can tear a hole through the heaviest steel plating. If the battleship could be rendered torpedo-proof, then her supremacy would be established. Experiments in this line have been made. The fated "Petropavlovsk" had numerous cellular compartments, constructed to this intent, but when a torpedo tore a big hole in the hull the compartments on that side filled with water. Other methods have been tested without success and one great obstacle is that no nation is willing to sacrifice an expensive battleship to such tests. Thus the construction of the new battleships proceeds with an equipment of submerged torpedo tubes and the question remains unsettled. England, however, long-headed in affairs of this nature, is adding swarms of torpedo boats to her powerful array of battleships.



Torpedo and Firing Tube on a U. S. Torpedo Vessel



MOTOR CAR SAFEST VEHICLE IN LONDON

The operation of motor cars in London is found to cause fewer accidents than any of the several kinds of vehicles which use the streets of the great metropolis. There are, of course, a smaller number of motor cars than cabs, for instance, nevertheless the comparison is interesting. During the past year vans caused injuries in 2,157 cases while motor cars are at the bottom of the list with only 142 to their account. The comparison is graphically set forth in the illustration.

TELEPHONES IN THE MAINE FORESTS

The dense Maine forests in the vicinity of Moosehead lake, primeval in character, with trees of giant growth and for vast stretches showing no trace of man, are threaded with telephone wires and the thousands of messages that hum their way through the forests daily is sufficient testimony that the huntsman, the logger and the fire warden would now find these instruments indispensable to their lives there.

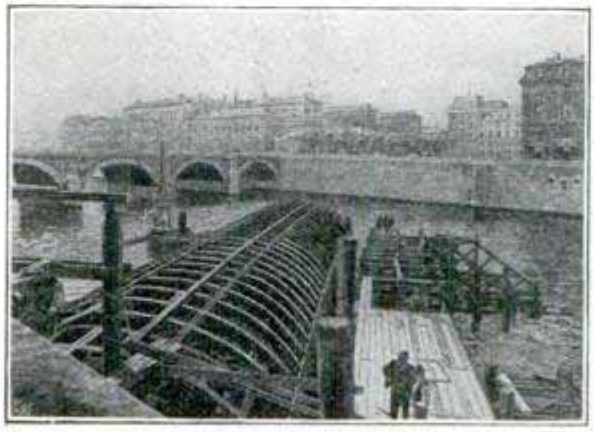
The huge trees form living telephone poles, and the porcelain insulators are placed on them but a little above man's reach, while despite the difficulties and the wild surroundings, the linemen make quick progress, stringing miles of wires in a week. The telephone is particularly useful along the west branch of the Penobscot river to the men driving logs. The river has a series of dams used both to hold the water in time of drought and to control the flood and a large crew of men is kept at these dams at all times. In driving logs down the river frequently they jam or pile up in passing over rough places in the stream. The man at the phone is watching alertly, and when the jam is a big one he telephones the crew at the dam above to close the gate and stop other logs from coming down stream until the jam is broken up. Dynamite is used to break up the jams, and when this is accomplished the telephone man tells the dam crew to open the dam again.

Before the installation of the telephone lines men were stationed along the stream at frequent intervals and shouted messages down the line. Fire wardens, also, find the telephone of great advantage. Powerful field glasses and range finders are used to locate the fires.

A PORTABLE TUNNEL

Built in Sections, Which Are Launched on the Seine Like Ships, Then Floated to Position and Sunk

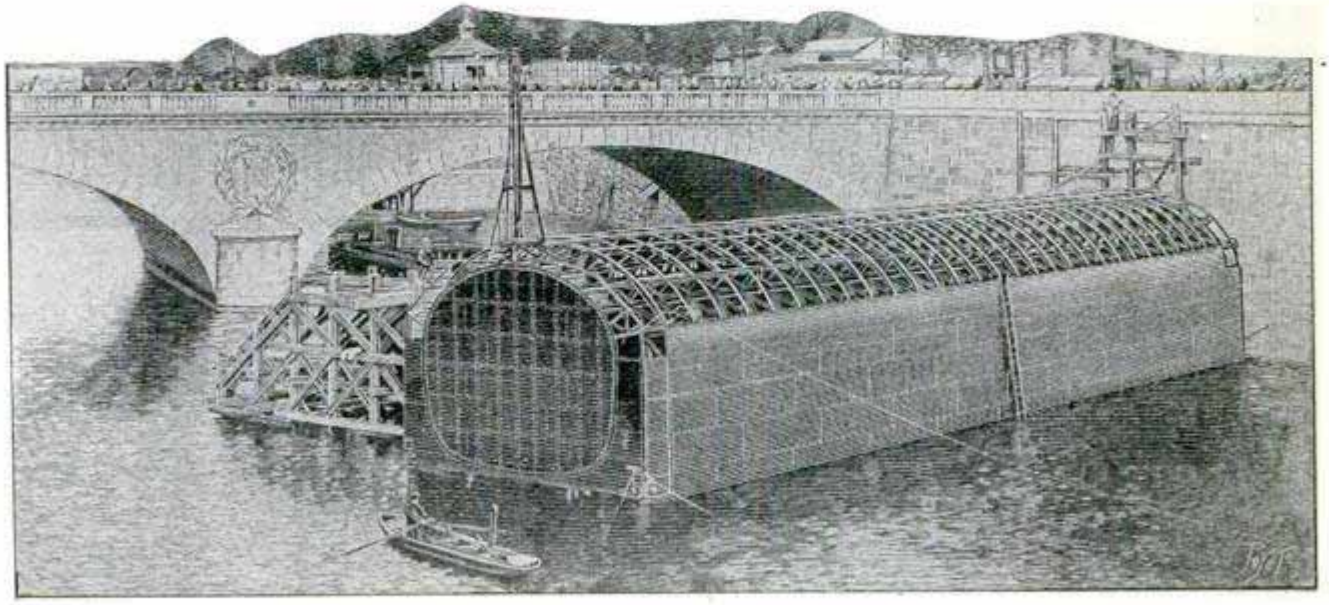
French engineers are at present engaged in building on dry land a huge double tunnel to cross under the Seine and accommodate the trains of line No. 4 of the Metropolitan underground railway of Paris, described in the July Popular Mechanics. This most notable departure in tunnel construction since the bore under the Harlem river in New York was made is rapidly approaching successful completion. The novel method of procedure was necessitated from the fact that the caissons which are to constitute the tunnel must not extend above the level of the river bed, in order not to impede navigation, and to build them in the position they were to occupy, at that depth, the work would have had to have been carried on from a platform built in the water, or else in a water-tight compartment with exceedingly strong walls. This was not practical, and so, through expediency, the tunnel was built on the banks of the Seine, a shallow harbor in Paris with a slight declivity suitable for launching being the spot selected for the special plant which stands beside a temporary pier.



Caisson in the Slip

The first of the caissons has been built and sunk. It is 115 ft. long, 29½ ft. high and 30 ft. wide; in the words of La Nature, "An immense metal box with a curved top." Until ready to launch the caisson remained open, then the ends were sealed, temporarily, and it was run out from the slip in which it had been built, on rails extending for a distance under the water and supported by trestle work. In order to make the distance the caisson must travel on rails as short as possible, the level of the Seine was raised 1.3 ft. on the day of the launching by a series of parallel dams down stream. The caisson, weighing approximately 280 tons, was controlled by powerful tackle as it moved along the greased slides. The descent into the water was gradual and without a jar until finally the huge steel structure floated lightly as a boat. It was then towed to the other side of the Seine and moored until the following day.

In moving the caisson to the place where it was to be sunk, great caution was required to keep its top from striking against



First Section of the Tunnel Launched on the Seine

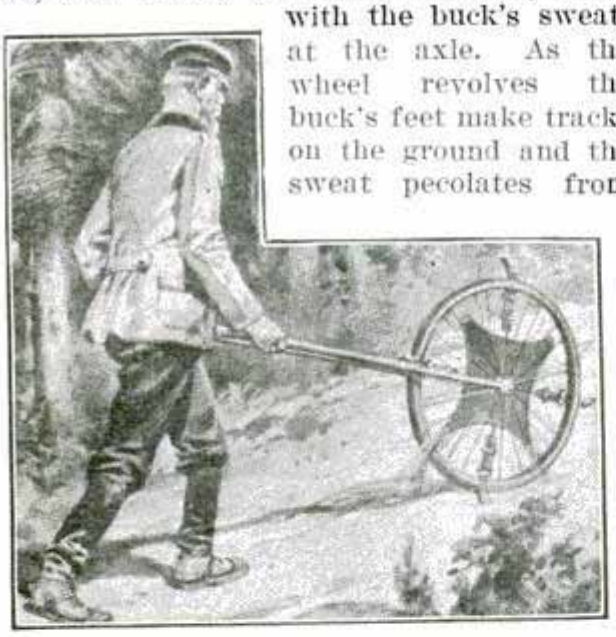
the arches of bridges. Also it was necessary to diminish the amount of air in it by forcing in water to act as ballast, and yet the amount of water must be carefully gauged, as the Seine is only about 10½ ft. deep at that point.

Arrived at its destination the caisson was moored along a palisade of piling placed obliquely to the course of the Seine and other piles were driven to form a palisade on the opposite side. Then the caisson was caused to descend and sunk into an excavation previously made. Later it will be lodged securely in place.

All the other caissons required to make the tunnel will be handled in this way and sunk end to end, then the temporary wall at the extremity of each will be removed and the remarkable portable bore will be complete.

ARTIFICIAL TRAILS FOR TRAINING HOUNDS

In England, where hunting is a popular sport, artificial trails are laid to train the pack to follow the scent. In laying the trail a unique contrivance is used. It consists of a wheel, on the rim of which are four buck's feet, and having a curious canister, filled with the buck's sweat, at the axle. As the wheel revolves the buck's feet make tracks on the ground and the sweat pecolates from



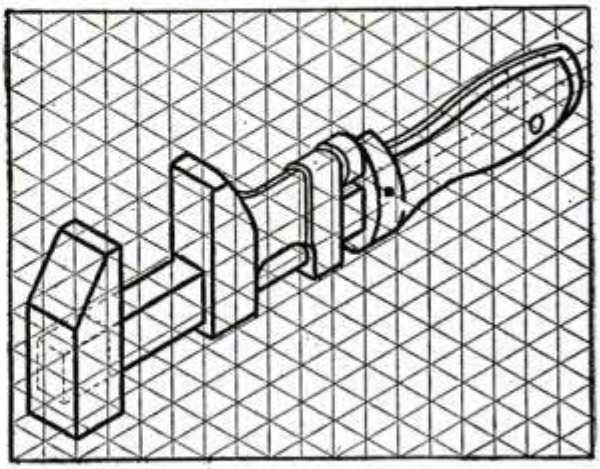
Laying the Trail

the canister, setting up an artificial scent, which the hounds follow readily. The illustration is by courtesy of the Illustrated London News.

A gas meter which was installed in London in 1859 is still in use. It ought to be an exemplary meter for it is in a church.

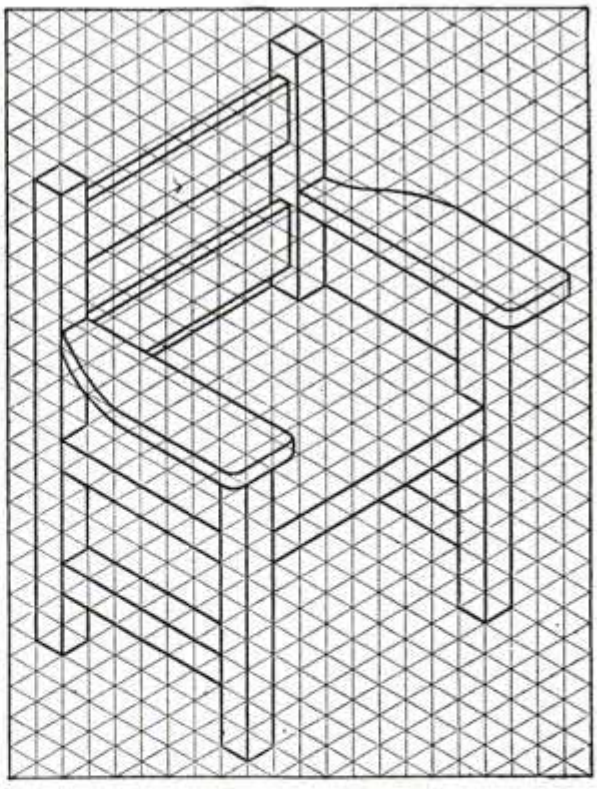
AN EASY METHOD OF DRAWING

A system of drawing which greatly assists and facilitates the work is fully described in an extremely interesting article in Wood Craft. The method involves the use of specially ruled paper, the lines, however, are not strong as shown in the cuts where



How a Wrench is Drawn

they appear heavy in order to be more easily understood. When the sheets are used for blue printing, the ruling scarcely shows. An examination of the illustrations will explain the plan. The prepared paper, which can be purchased ready for use, is ruled in



Easy to Draw

the three isometric directions, instead of being ruled in squares like the regular cross section paper.

WATER SUPPLY FOR COUNTRY BUILDINGS

A gas engine expert of national reputation remarked to the editor of this magazine recently that in a few years the windmill now found on almost every farm would disappear. He stated that the gas engine, which can be depended on to pump water and do other work, at the precise moment when the service is wanted would eventually replace the windmill.

In this connection, another evolution is worthy of note, and that is the reservoir for containing the water. Steel tanks placed in basements or underground are rapidly taking the place of the wooden tower-tanks. The reasons for this are concisely stated by Wm. Paul Gerhard, a recognized authority on country water supply. He says:

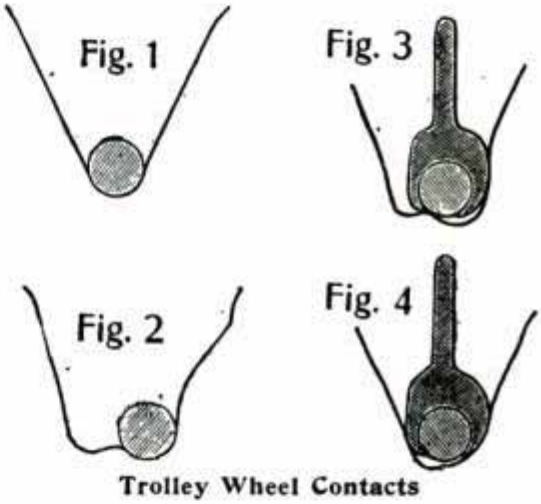
Exposed towers must suffer the deteriorating effects of the weather, and they also must be able to withstand heavy wind pressures. Wooden tanks when left standing empty and exposed to the sun become leaky; those intended for winter service should always be frost-proof in the best manner. Outside tanks are made of wrought iron or steel with riveted joints, and such tanks are nearly always round in section. They cost from 50 to 100 per cent more than wooden tanks without having superior advantages to offset the larger cost. The reasons why wooden tanks are more often used than steel tanks are that the latter are more difficult to erect, they give trouble by reason of sweating, and they rust soon if the outside paint is not constantly renewed. The objection to inside tanks is that their size must necessarily be limited, hence they provide an insufficient storage of water.

Pressure Tanks.—This system has many sanitary and constructive advantages, provides for an excellent fire protection, and does away with the use of fire engines. The water stored in the underground tanks is kept cool, remains pure, and cannot become contaminated as in the open tanks. Moreover, in the case of the underground source of supply, there is no exposure of the water to the sun's rays, hence there will be no annoying growth of algae. There is also no trouble from freezing of the water in the reservoir. In all cases where objection is raised to the appearance of an elevated tank, or to the heavy additional expense required to make it look well, this system is well adapted and worth investigation on the part of property owners.

FLASHING LIGHTS ON TROLLEY WIRES

The sight of a trolley car at night causing blinding flashes of white and blue lights along the trolley wire is one familiar to all our readers. These flashes occur at quite regular intervals and at the point where the wire is suspended. At those points, the wire is held by what is called a trolley ear, which partially encloses the wire. The wire is either clamped tightly or soldered to the ear to hold it in place.

When the groove of the trolley wheel becomes unevenly worn the wheel does not make a smooth even contact when passing under the ears, and the space between allows the current to jump across the small gap and in doing so becomes visible, forming an arc which appears as a flash because of so short duration. This explains why one car will



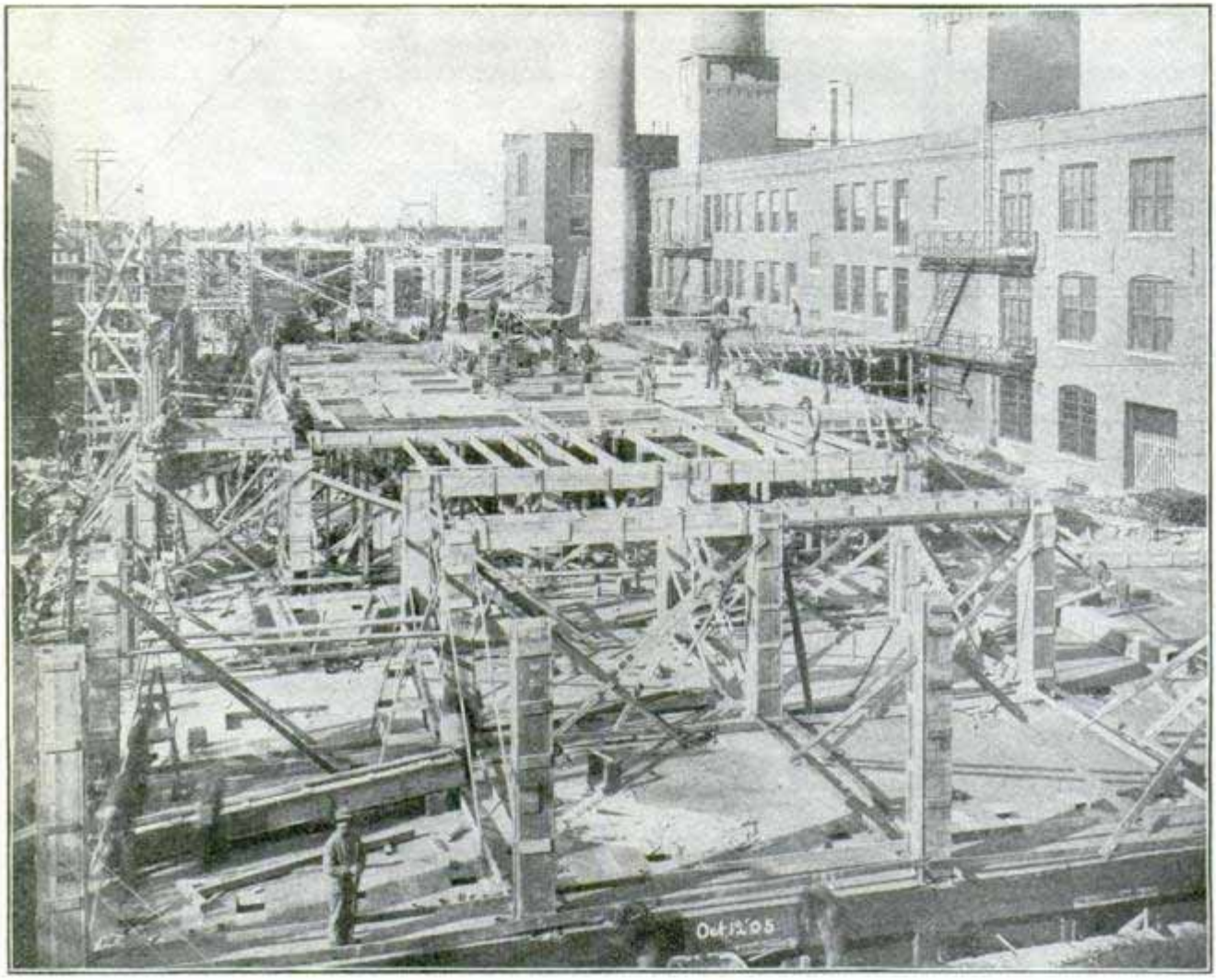
Trolley Wheel Contacts

flash the entire length of the line and the one following will emit no flash. The same result is also produced when a trolley ear becomes worn or bent so it does not evenly fit the groove, but the worn trolley wheel is the usual cause of the electrical display. Figs. 1 and 2 show a trolley wire fitting evenly into the groove of a trolley wheel. Figs. 3 and 4 show the uneven connection at trolley ears, due to the groove being worn.

An English lineman, H. Dudgeon, who has made a study of overhead construction says in the London Electrical Review:

"I found that the ears seemed to wear irrespective of the way they were suspended —either rigid, span or pull-off—but that the wear varied according to the gradient of the road, the number of cars using it, and the type of ear. On a level road, both ears on the same span wear alike, but on a hill those on the up line wear worst, and the steeper the hill, the more wear on the ears."

NOTABLE CONCRETE CONSTRUCTION AT DE-



As the Work Appeared on October 12,

The two views are of the same building showing the rapid progress made in less than two weeks. This structure is a three-story manufacturing building 103 ft. by 319 ft., built of reinforced concrete and tile—a construction at once fireproof and durable. Just how long buildings of this type will endure is not, of course, yet known, but concrete engineers claim for them a century or more unless torn down. The foundations are concrete, as also the basement floor and the supporting pillars and cross beams are of reinforced concrete. The partitions and roof are of tile. A shell of brick will be used for the exterior wall surface.

Work was commenced September 11, and the building was practically completed November 15.—Contributed by F. S. Cummings, Detroit.

Gas plants are being constructed in all parts of Japan.

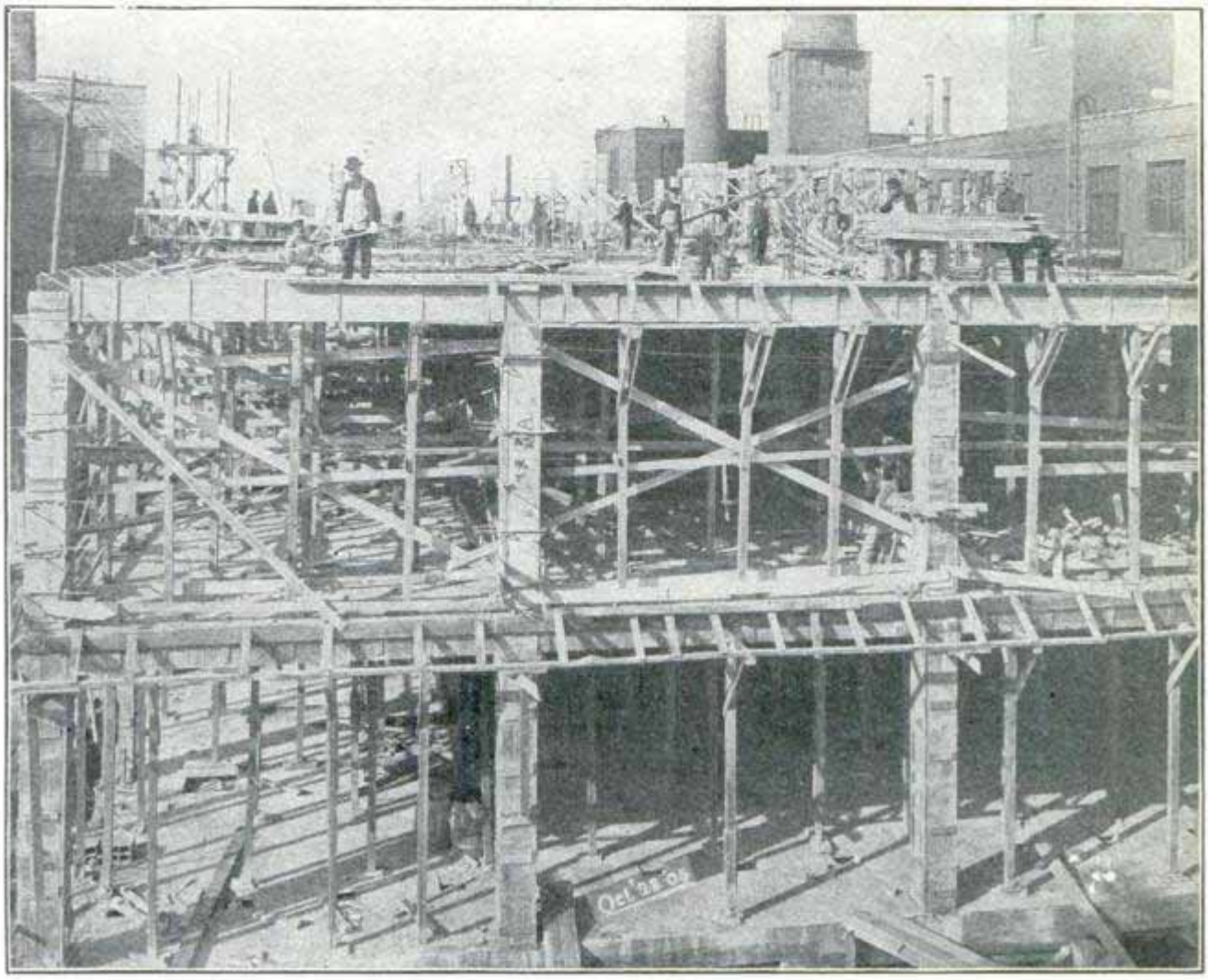
PANAMA CANAL CONSTRUCTION

By John Barnett.

Before I left Panama for the United States I noticed in the Panama Star & Herald, 13th August, another canal plan by Major Cassius E. Gillett proposing a 100-ft. level canal, costing probably $100,000,000. Much valuable time may be spent in considering the various propositions, but in the end the decision will be to build a sea level canal for the reason that it is the best and the cheapest in the long run, and should be 250 ft. wide to accommodate vessels of the near future.

It can be carried out in about seven years by using proper machinery and working 8-mile sections, or less, according to hills or rock to contend with. House the men and feed them, right at the point of work, with good substantial food at a fair price. Have

TROIT SHOWING PROGRESS MADE IN TEN DAYS



and as It Was on October 23

three gangs of men on each section working eight-hour shifts night and day.

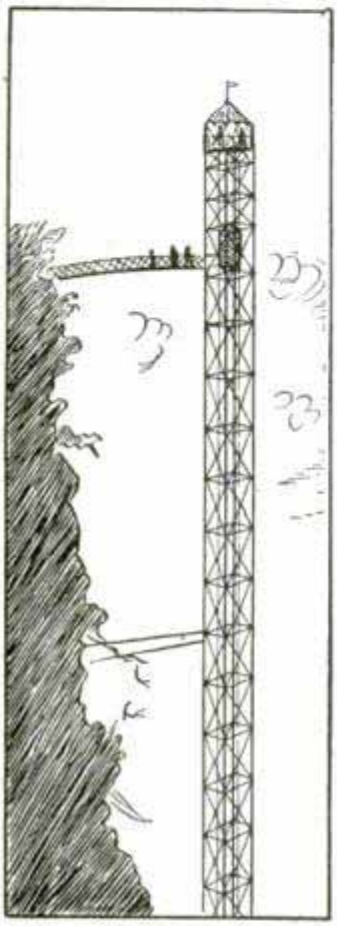
Dam the Chagress river and use the water to run turbines generating electricity to light the canal from one end to the other, also for operating power plants, etc. This dam can be arranged to allow an overflow of about one quarter more water than its natural flow in times of flood. Electric lights and power would also be useful after completion of canal—and all this at comparatively little expense. An electric railway parallel with canal would be valuable.

The entrance to the canal at each end should be 350 ft wide. Grade both sides of canal to an agreed level, then fill up all the back low-lying swamp land, etc., by using suction dredge pumps capable of handling 6,000 cubic yards of material per hour each. Have two in the canal at each end to follow up other excavators and grading canal to its proper depth as they go. After all the low and swamp lands are filled up, then have ready for use large, fast steam barges, that can be built to haul the dredging out to deep sea; these barges can be better handled than ordinary barges with steam tugs to haul them out and back; in fact, if properly built would do the work much quicker and after completion of canal could be easily altered for freight barges and I think would readily sell. By this method the canal could be finished and opened up for commerce by December, 1912, for we have the men, we have the will, and we have the money.

The tide level locks should be double or twin locks to accommodate vessels both ways, up and down, and should be 1,100 ft. long by 125 ft. wide, each, to accommodate vessels of the near future 1,000 ft. by 100 ft. beam. This class of vessel will make ocean passenger travel a luxury, and will be of advantage in handling freight.

ASCEND ALPS IN ELEVATOR

Persons not hardy enough to risk the rigors of Alpine climbing are now enabled to mount to the summit of the Hammet-Schwand mountain, 3,600 ft. above sea level, by means of the longest lift in the world, an elevator 600 ft. high.



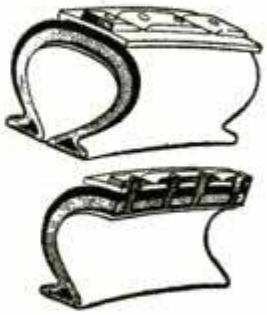
Alpine Lift

The elevator is located not far from Lucerne, and the tourist who wishes to ascend follows a picturesque road cut out of the side of the mountain and overhanging the lakes. In thirty minutes he arrives at a grotto in which the elevator shaft is hidden. The elevator is operated by electricity. The cage is 12 feet square and only seven passengers are carried each trip. For the first 213 ft. of the ascent the cage shoots up through a well of masonry, then suddenly emerges into the glare of day, still rising in its slender shaft of steel lattice work, through a distance of 387 ft. The ascent is made in three minutes. At the top the passengers land on an open gallery leading to the summit of the mountain, where the view is glorious.

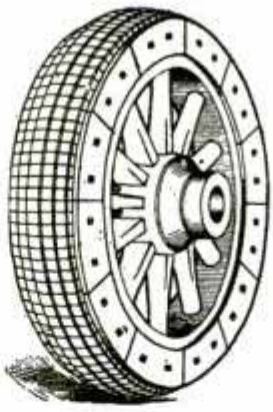
Two strong steel cables are used to lift the cage, and in case the electric power is interrupted it can be lowered by hand from within to the starting point. A steel ladder runs up the full height of the shaft.

PROTECTED TIRES AND WOOD WHEELS FOR MOTOR CARS

The enormous production of motor cars of all kinds, here and abroad, is making such a demand for rubber used in the tires, that some method of substitution or protection of the rubber tires is becoming an absolute necessity. Already manufacturers are using less and less pure rubber, because purchasers are unwilling to pay a price for tires which a genuine rubber tire must bring. And the application of power to large passenger and freight vehicles necessitates rubber tires of such large proportions as were undreamed of a few years ago. In all the arts requiring rubber there is a constantly increasing demand, which is causing a steady increase in the price of raw rubber.



Among the most recent ideas in tires the Motor Age cites a French invention by Herault which consists of a metal tread permanently united with the tire casing; outside the rubber tire is a heavy leather strip to which are fastened metal blocks, alternating square and oblong in shape, which are riveted through the tire casing. It is hoped the plan will prove successful.



For heavy vehicles an American company is making a wheel with the rim built up from sections of wood blocks which have been chemically treated. Any segment can easily be removed and replaced and the wheel costs less than one rubber-tired wheel, and is expected to last three times as long.

POPULAR CHEMISTRY

By Max D. Slimmer, M. A., Ph. D.

This department will appear regularly in the future and will contain talks on chemical subjects of general interest written in unscientific language "so that you can understand it." It is hoped that the readers of Popular Mechanics will assist us in making this section of the magazine as helpful as possible and with this end in view suggestions as to articles of interest or inquiries on chemical subjects will always be appreciated. In this connection its editor will be pleased to answer for our readers all questions that may be addressed to him, only stipulating that the answer must not require the expenditure on his part of any expense for analytical work or extended research. Address all inquiries with self-addressed and stamped envelope to Dr. Max D. Slimmer, 357 Dearborn Street, Chicago.

BOILER ROOM CHEMISTRY.

An understanding of simple chemistry can probably best be brought to readers of "Popular Mechanics" by selecting some subject of general interest to serve as an illustration of the various facts that will be treated in these talks. Probably, a study of economy in industrial operations, from the standpoint of the power plant, more nearly meets these requirements than any other subject one might select. In addition to being suitable for explaining many simple chemical phenomena, it is of vital interest to every one connected with any manufacturing enterprise, whether he be employer or employee. When we stop to consider that a saving of $5.00 a week can easily be effected, even in a small power plant, by the proper observance of the facts that will be set forth in these articles, and that this represents $250.00 per annum, or the gross earnings on an investment of $2,500.00, one can realize the importance of the subject of boiler room economy. No other item about the average industrial plant offers greater opportunities for saving, or yields more gratifying results.

The subject naturally divides itself into three parts. First, we must consider combustion, fuel and the conditions under which it should be used; secondly, the water supply, boiler compounds and methods of water treatment; and thirdly, a consideration of lubricating oils. A consideration of sources of power, other than steam, will not fall into the scope of these articles, as the chemistry involved is, for the most part, not such as can be untechnically made clear.

COMBUSTION.

The word combustion is, of course, familiar to every one, and we all know that, when a substance burns, as we ordinarily say, it gives off heat and light. Now, what really takes place when a substance burns? What do we mean when we say that we kindle a fire? If we take a candle, and light it, we notice that it grows shorter. We say it burns up. Now, take the burning candle, and place it under water. The flame goes out. Evidently, more than lighting is necessary to make a candle burn. Next, place the candle on a small wooden float on the surface of a bowl of water, and, after lighting it, cover it with a fruit jar, so that the sides of the jar are under the surface of the water. What happens? The candle becomes extinguished. In the same way, a candle set on the table, and covered with a tight fitting jar, goes out in a short time. The larger the jar, the longer the candle burns. In a word, the candle depends on something in the air for its ability to burn, and, in burning, this substance is used up.

Phosphorus is a substance which burns very much more easily than a candle, in fact, in order to keep it from burning spontaneously, it is necessary to keep it under water constantly. Let us then take a small piece of phosphorus, about as large as a pea and place it on a large cork. Place this cork on the surface of a dish of water, taking the greatest possible care to prevent the phosphorus coming in contact with our hands. The next step in the operation is to light the substance quickly and, with the greatest possible speed, cover the dish with a fruit jar. The phosphorus burns with a bright flame and the jar becomes filled with white fumes. After the vessel has cooled, we notice that the volume of gas within it has decreased and, if the operation has been carried out carefully, we will find that about one-fifth of the air has been used up. That part of the air which has been consumed is oxygen. The process which substances undergo, when they combine with the oxygen of the air, is called oxidation.

Oxidation is, perhaps, the most obvious, and commonest, chemical phenomenon. The process is taking place about us constantly. In many cases, such, for instance, as the rusting of iron, which is a true oxidation

process, it takes place at ordinary temperatures. Again, higher temperatures are necessary, before some substances will combine with oxygen. This change is often accompanied by the evolution of large quantities of heat. Every reaction which takes place rapidly, if it be accompanied by so great an evolution of heat as to produce incandescence, is termed combustion. In order to bring about the combustion of the substance to be burned, it is often necessary to raise its temperature considerably. This accomplished, further heating, from without, is not required.

The temperature at which combustion takes place is known as the kindling point, and it varies for various substances. For example, phosphorus ignites at very low temperatures. Upon this property its use for match heads depends. Matches are made by dipping wood first in pho phorus, and then in sulphur. The kindling points of the three substances, are, taking the lowest first, phosphorus, sulphur, and wood. The phosphorus ignites, and the heat evolved raises the sulphur to its kindling point. In turn, the sulphur ignites the wood, and this, once raised to its kindling point, burns steadily.

When phosphorus was burned in air, it underwent combustion, and consumed all the available oxygen, and the residue no longer supported combustion; that is, the phosphorus ceased to burn. On the other hand, when the candle burned, it behaved quite differently. The volume of air, in which the candle burned, was not appreciably diminished, although it had lost its power to support combustion. How can we explain this variance? Let us take a glass of water, and add a small piece of fresh lime. The lime crumbles, and the water becomes milky, and perhaps warm. If we let the glass stand quietly for some time the solution will become clear, and all the lime will settle to the bottom. Should we taste some of this "lime water," we should find that it tastes soapy. This alone shows us that this can not be simply water. To further convince ourselves of this fact, however, let us evaporate some of it. Upon evaporation, we find a slight solid residue. The water has dissolved some of the lime. For the present, we shall say no more about the subject of solution, but we shall treat of it fully, when we discuss the question of water-supply for boilers.

Let us now pour some of the lime water into a fruit jar and shake. Next, place a burning candle into a second fruit jar, put on the cover, and wait until the candle goes out. Now remove the candle, and pour some lime water into the jar, and shake. The lime water becomes turbid. As we found above, when we shook lime water and pure air together, no turbidity was noticed. It is obvious, then, that the cloudiness which we now observe, is due to the fact that the candle, when it burned, changed the character of the air. It contains some new substance. We ascertained this fact by the use of lime water. Any substance which makes known to us the presence of another substance, we call a reagent. Lime water, therefore, is a reagent for the substance that is formed when a candle burns.

Now let us take another portion of the lime water, and blow into it. We notice that the lime water again becomes turbid. Evidently, our breath contains the same substance that is produced when the candle burns. In other words our bodies must be burning, just as the candle burns, and the force exerted when we lift something, or walk, or do any other work, is in some way similar to the energy stored in the boiler. This substance which gives the reaction with lime water is known as carbon dioxide or carbonic acid gas. It is formed whenever carbon or carbon compounds burn.

When a candle burns carbon dioxide is not the only substance formed. If we were to hold a cold glass over the flame we should notice that the cold surface soon becomes covered with a dew and on careful examination we should find this to consist of pure water. Water is a compound of oxygen and hydrogen just as carbonic acid gas is a compound of oxygen and carbon. Such compounds of oxygen with other substances are known as oxides and are formed whenever any material burns. Up to this point we have become familiar with one gaseous oxide and a liquid. There are, however, many substances which give solid oxides on burning. Such substances do not lose weight on burning as does the candle or a piece of coal. A common example of a material which grows heavier on burning is ordinary iron. When iron burns it forms rust. Ordinarily iron does not combine with oxygen rapidly enough to produce incandescence. If, however, a piece of iron wire is ignited in a vessel containing pure oxygen it will burn with a bright white light and the iron oxide formed will be found to weigh almost one half as much again as the iron originally taken for the experiment.

(To be continued.)

BIG ORDERS FOR RAILROAD EQUIPMENT

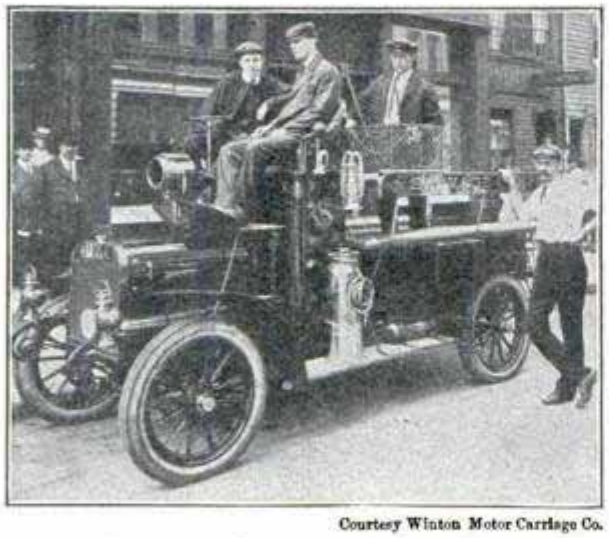
The present year promises to break all records in the construction of railroad equipment. The Railway Age compiles the following comparison of 41 weeks of 1905 with 1902, which was a record-breaker.

	41 Weeks	
	1902.	1905.
Freight cars	195,248	196,672
Passenger cars	3,459	2,297
Locomotives	4,665	4,131

It will be noted from the above table that orders for freight cars for the first 41 weeks of the current year are in excess of any previous year, while the contracts for passenger cars and locomotives, if continued at their present rate, will also exceed any previous record.

A MOTOR SALVAGE CAR

Next in importance to the fire-fighting apparatus in the preservation of property in our cities comes the salvage car. Every moment from the time the alarm is received until the salvage crew has saved all it can from the flames is of utmost importance. With this in mind, the more progressive cities have adopted the use of motor salvage cars, which enable the crew to arrive at the scene of the fire in the least time possible. Cincinnati, Ohio, is one of the cities thus equipped for effective service. Her salvage car consists of a touring car chassis rigged



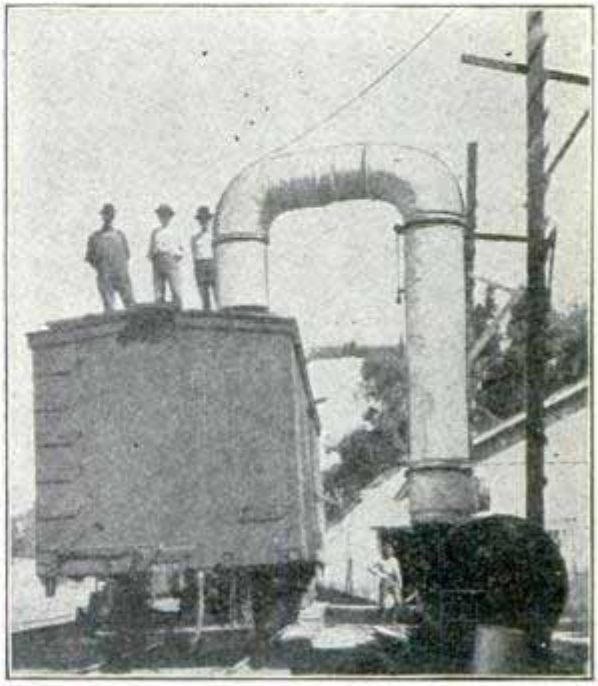
Courtesy Winton Motor Carriage Co.

Cincinnati's Motor Salvage Car

with a specially designed body, equipped with all the necessary apparatus and carrying a large crew.

NEW PROCESS FOR COOLING CARS

A new process for icing fruit cars is being tried in California. One icing is expected to last during the entire trip. The



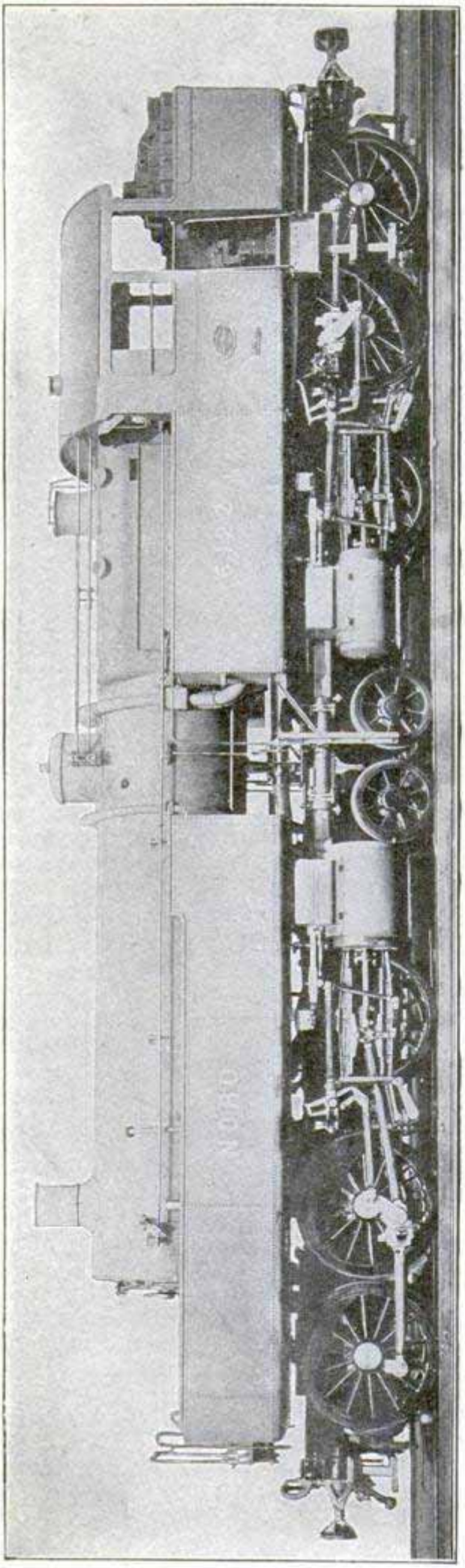
Forcing Cold Air into a Fruit Car

secret lies in exhausting all the warm air from the car and at the same time forcing a blast through the ice, with the result that in six hours all of the air in the car is reduced to freezing and the fruit thoroughly chilled.—Contributed by A. C. Wheelock, Sacramento, Cal.

TAX ON INDUSTRIAL ALCOHOL SHOULD BE REDUCED

Industrial alcohol, which is made from a variety of products such as potatoes, beets, corn, etc., has already demonstrated its fitness as a fuel power for motors, launches, automobiles and many other purposes. It seems to be the one available fuel capable of competing with gasoline, the price of which is constantly advancing. European countries have reduced or removed the tax on industrial alcohol; here the tax is 2,000 per cent of the cost of making. This tax should be either entirely removed, or, if necessary, to be taxed in order to control the manufacture, then let the tax be a nominal one and not prohibitive as at present.

Burnt linseed oil is that which has been boiled three times. It is darker than other oils and will not spread out on paper, and for this reason is used by litho printers.



French Compound Duplex Freight Locomotive, Nord Ry.

NOVEL FRENCH LOCOMOTIVE

Which May Revolutionize Present Designs--In Reality a Double Header With Only One Boiler and Crew, and No Tender

In order to avoid the use of two locomotives, or the cutting in two of heavy trains on certain divisions of the Nord Railway of France, the chief mechanical engineer, Mons. du Bosquet, has designed and built two machines which are the wonder of European railroad men.

The new type is in reality a double header, with only one boiler, one crew of two men, and no tender. There are two sets of six-coupled drivers with two pair of carrying wheels between. Drivers are 57¼ in. diameter; carrying wheels 33½ in. diameter. The locomotive is four-cylinder compound; the rear cylinders with diameter of 15¾ in. and 26¾ in. stroke, are high pressure. The low pressure cylinders which actuate the forward set of drivers are 24¾ in. diameter with 26¾ in. stroke. In starting or on grades both sets of cylinders can be worked high pressure. To increase the weight on the drivers four side tanks for water are built.

The steam passes from the boiler to a rotatable joint at the rear of the firebox—below the fire door and above the pivot of the rear set of wheels. From this rotary joint a separate steam pipe supplies steam to each of the high-pressure cylinders, a special system of knee-jointed pipes connecting the high-pressure cylinders with the low-pressure cylinders, while the utilization of the new type of intercepting and starting valve recently brought out on the Nord of France Railway permits of the starting of the two groups of engines as simple expansion engines. The ends of the two cross beams are provided with slides bearing on castings attached to the rear running gear frames, and by this means the rear set of wheels can turn in a horizontal plane round its pivot, but cannot move in any other direction as can the front set, which have a spherical pivot. Buffer springs are provided with a view to minimizing the transverse oscillations and the front set can thus adapt itself to the inequalities of the road, without in any degree affecting the suspended mass resting on the central girder. The Railway Review says: "In the course of some recent official trials, the engine illustrated herewith proved its ability to haul a load of nearly 900 tons, over a grade rising 1 in 80, at a

speed of 12 miles per hour, the engine passing with ease over curves of 231 ft. radius, whilst when it was traveling at a speed exceeding 43 miles per hour, the engines were perfectly steady.

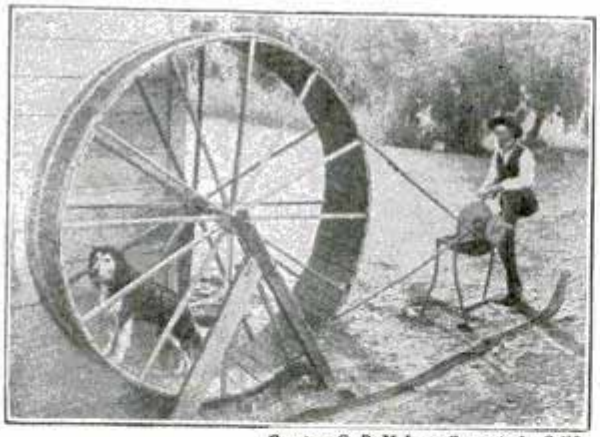
GREAT FACTORY OF CEMENT BLOCKS

The largest wagon factory in the world is now being erected at Moline, Ill., and will cover 15 acres. The building will be of cement blocks, with an estimated saving over brick of $24,000. The power throughout will be electricity.

A DOG MOTOR

A dog motor is in successful operation in California. This suggests an opportunity for some one with a fancy for figures to estimate the amount of useful power now running at large, serving no useful purpose, throughout the land.

The illustration leaves little description necessary as to the construction and operation of the motor which is connected by a rope drive to a grindstone. In this particular instance the dog enters into the work with evident pleasure, and makes no effort



Courtesy G. R. McLean, Carpentaria, Calif.

The Motor in Operation

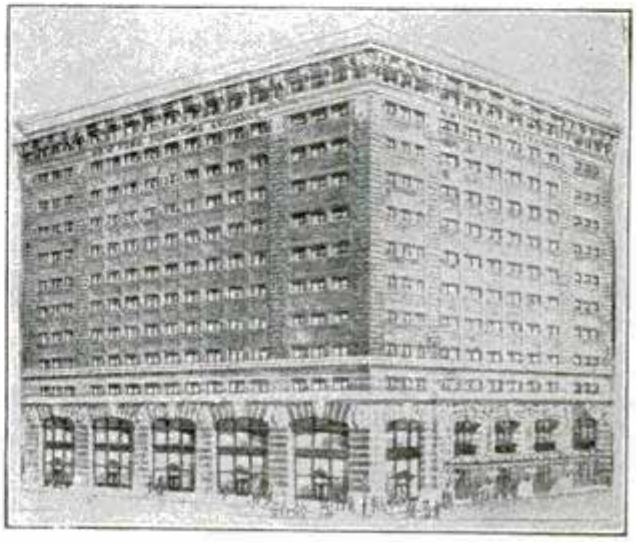
to escape. Where the service is less willing the wheel can be covered with wire netting to keep the power from escaping, and a small ratchet wheel and (mechanical) dog placed on the axle will insure movement in the right direction only.

In a test of submarine signaling conducted on the vessel "Lucania" in England recently, a signal bell on a lightship at the mouth of the Mersey was heard at a distance of nine and one-half knots. The vessel was under full steam at the time.

HOW FURNITURE IS MARKETED

Continuous Expositions of Ever-Changing Displays Fill Great Buildings

The American people spend considerably in excess of $100,000,000 every year for furniture. In this is included the modest furnishings for housekeeping in a single room and costing all told only $25 all the way up to the $100,000 order to furnish a mansion.



New York Furniture Exchange

Furniture is one of those things of which the traveling salesman cannot carry a full line of samples. And the styles are ever changing, with as many new novelties as a dry goods store. The retail dealer, therefore, has to come to the seller to select his stock. This has brought about during the past few years the establishment of great expositions, where manufacturers display and sell their goods.

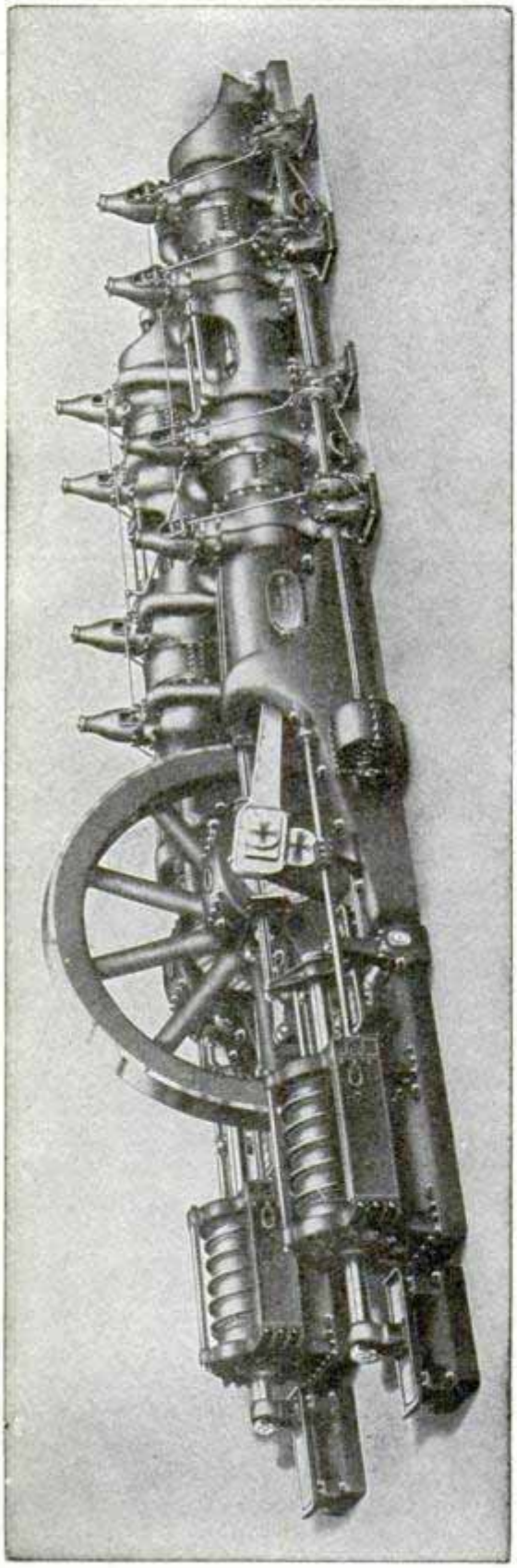
In New York and Chicago immense skyscrapers have been erected for this exclusive purpose, where everything manufactured in the furniture line is exhibited by the manufacturers. At first these expositions were held each spring and fall, but now they are made continuous throughout the year. The buildings are specially constructed as to light, even temperature, and fire protection.

In the fall before the furnace is started up for the winter, the registers all over the house should be closed and a good fire built to roast the germs and foreign matter that have collected in the pipes during the summer. This is recommended as wise precaution by Dr. Spalding of the Chicago health department, who says that these germs mingle with the atmosphere otherwise.

OPERATION OF THE LARGE GAS ENGINE

How a 3,500 h. p. Machine is Put in Motion

Only a few years ago a gas engine of 100 h. p. was something unusual; now single units of several thousand horsepower are in successful operation, and are constantly being increased in size. Brief extracts are here made from a paper by Arthur West, read before the American Street Railway Association.



Courtesy St. Ry. Review.

Twin Tandem Gas Engine of 3,500 H. P.

"One of the most important considerations in the design of large gas engines is the arrangement of the cylinders. In a single cylinder, single acting four-cycle engine an explosion takes place once in every two revolutions. In order, therefore, to get the same rotative effect as with a double acting steam cylinder, it is necessary to work four single acting cylinders on the shaft or two double acting gas cylinders tandem on one crank pin. With this arrangement four explosions are obtained in two revolutions, or an explosion every 180 degrees of crank angle. In case of a misfire or premature ignition due to bad gas, the crank can only move one-half a turn before another explosion takes place. In a single cylinder single acting engine the crank must move two whole turns before the next explosion, while with two single acting cylinders opposed to each other or one double acting cylinder the crank may be required to move one and one-half turns before the next explosion."

American gas engines are great improvements over the European types in being much more simple, especially in the valve gear. Efficiency varies with the different kinds of gas used. In the engine illustrated blast furnace gas will be used, making inspection of the interior of the cylinders once in two months desirable. Provision is made for this examination through openings of easy access.

"The four-cycle engine has, of course, to draw in its own mixture of air and gas and compress the same, and its functions, therefore, combine those of a pump, a compressor and a motor. It is the pumping and compressing work which causes the mechanical efficiency of the gas engine to be somewhat lower than that of a steam engine. The actual friction of the working parts need be no greater than with a well constructed corliss engine. . . . There is an impression rather prevalent that a gas engine is uncertain and hard to start. A properly designed engine, supplied with fairly decent gas, can be started as easily as a steam engine. Large Westinghouse horizontal gas engines are started by means of compressed air, the only operations required being, (1) open the main gas valve; (2) close the igniter circuit; (3) open one compressed air valve, similar in construction to

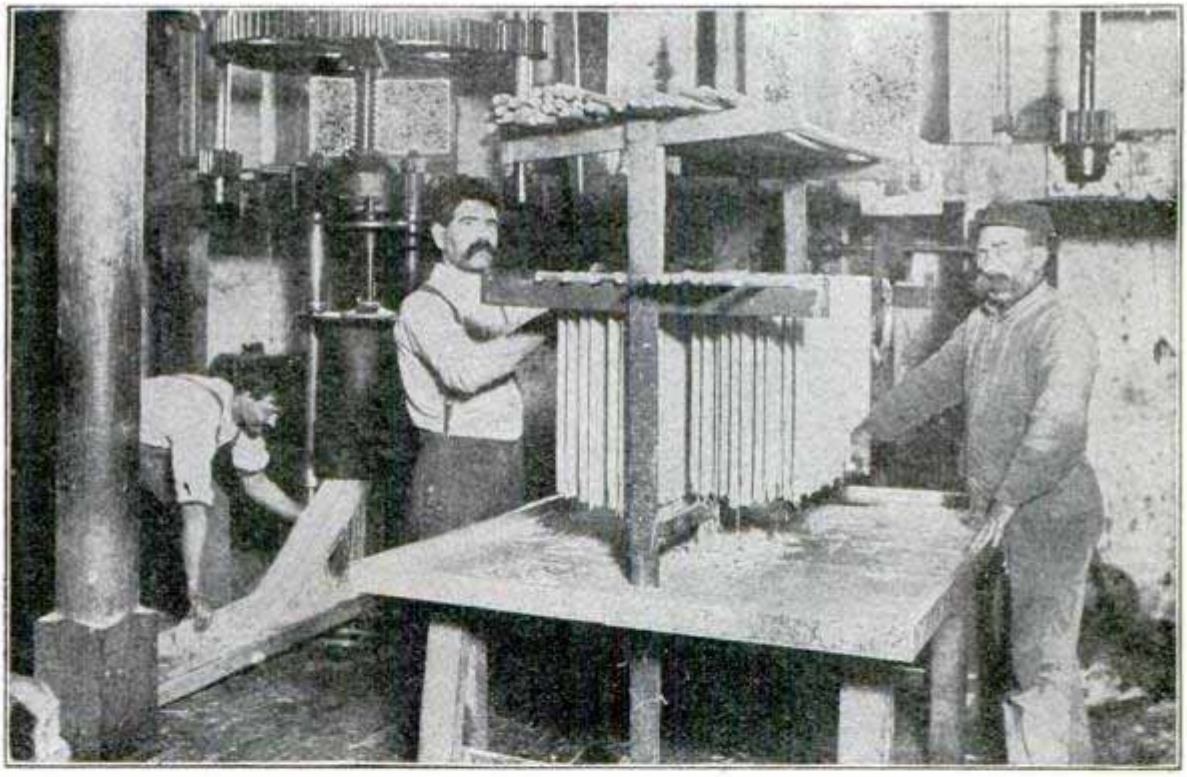
an engine throttle. The compressed air puts the engine in motion, which draws the charge into the cylinders and compresses the same, after which the first explosion takes place. Compressed air is shut off and the engine is in full operation. We find no more difficulty in starting our gas engines than a steam engine of comparative size. I desire to lay stress on this point, as one of the stock arguments against the gas engine is that it is difficult to get into operation."

The engine illustrated is one of two twin tandem furnace gas blowing engines. For electric work a generator would be direct connected and the air cylinders omitted.

HOW MACARONI IS MADE

Italy no longer has a corner on the macaroni-making industry. Right here in the United States there have sprung up within recent years a number of large factories to supply the rapidly increasing American demand. In Italy macaroni is regarded as the national food, and when first introduced into the United States it was for the purpose of supplying the Italian residents of this country. Gradually, however, others, including the Yankee, came to like it, whereupon the industry was given added impetus. France and Great Britain likewise learned from the Italian how to make macaroni and the industry, especially in France, is now carried on upon quite an extensive scale.

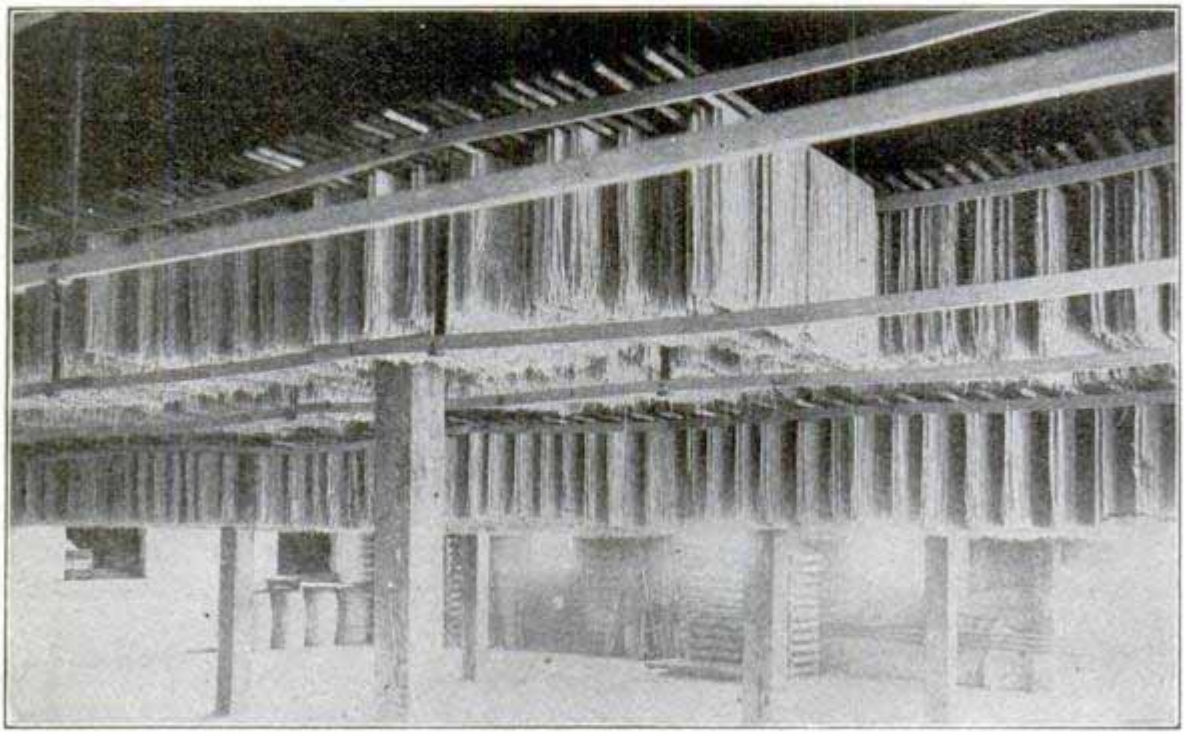
The American manufacture of macaroni is distinguished, as might be expected, by the introduction of different forms of labor-saving machinery. In Naples and Genoa, in the early days of the industry, macaroni comprised mere lumps of paste squeezed and dried. The word "macaroni" is derived from a Latin word which means "to crush." It is a paste food, obtained by mixing flour and hot water and kneading the dough. As in modern breadmaking in this country, both the mixing and kneading are done by machinery. Revolving machinery operated in large vats mixes the flour and water. Once in the shape of dough it is worked over upon a flat surface by a system of mechanical weights, which also revolve, and which, in addition to crushing the dough, are so equipped that it is at all times kept within bounds and moving in the proper channels.



Making Macaroni: Pressing and Trimming Operations

After being kneaded the dough is cut up into large chunks and dropped into big baskets and carried to the macaroni presses.

Into the top of double-cylinder presses it goes, from which it comes out at the bottom in the long hollow tubes, so familiar to the users of macaroni. This shape is given to the product by its passage through the dies of the press and the difference in the shape of these dies is responsible for the various forms of paste foods which are made in a macaroni factory. Some shapes do not have the hollow centers because of their smaller size. The object of the hollow center in the regulation sized macaroni is that it will cook better in this form.



"The Seasoning Requires About Ten Days"

As the product comes from the presses it is cut off in the desired lengths by an attendant upon the machines, who, in turn, throws these lengths across a stick. After these lengths have been properly distributed on the stick, he places it upon a rack where the macaroni is cut and trimmed, as shown in one of the photographs. It is now ready to go to the next room where great fans are at work which dry the product, after which it is ready for the seasoning process. The seasoning takes place in a large airy room and requires about ten days. The long lengths of macaroni, thrown across sticks and hanging up by the thousands in this room, present a very novel sight.

When properly seasoned the macaroni goes to the inspecting and packing departments.

Boxing and Shipping Room

POWER FOR LONDON

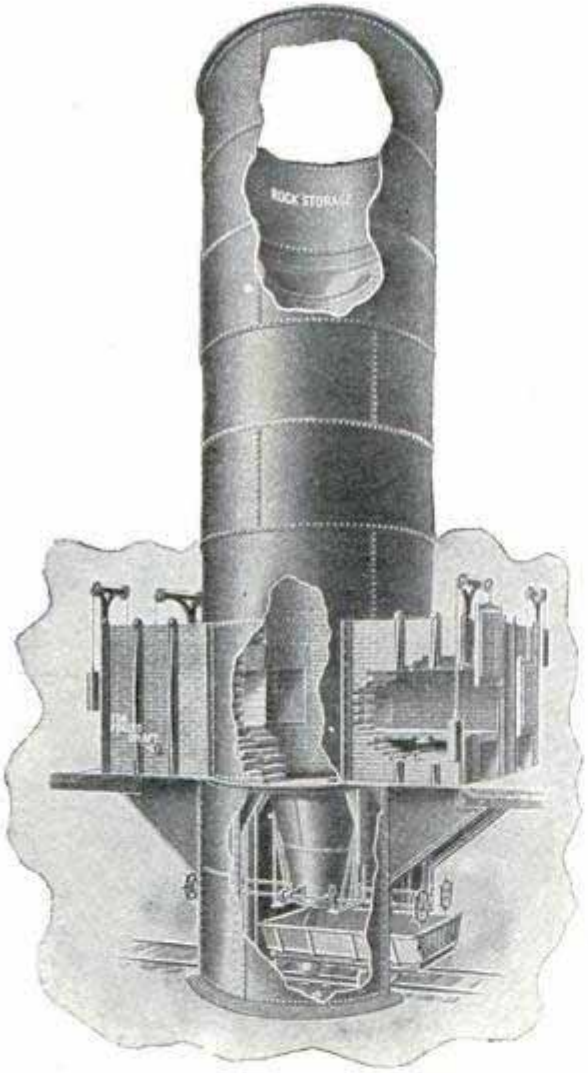
More than half a million horse power is required for the factories and workshops in the city of London. At the present time less than 5 per cent of this power is supplied by electric means. An effort is being made to produce in enormous quantities electric power for transmission and use throughout the city, thus doing away with the general consumption of coal with its attendant smoke, gas and ashes. It is proposed to erect several generating stations in the outskirts, thus removing the objectionable features from the city proper.

MODERN MANUFACTURE OF LIME

The crude but useful lime kilns, built of some refractory stone or brick on a hillside, are rapidly giving place to the steel kilns, which can be kept in continuous operation day and night.

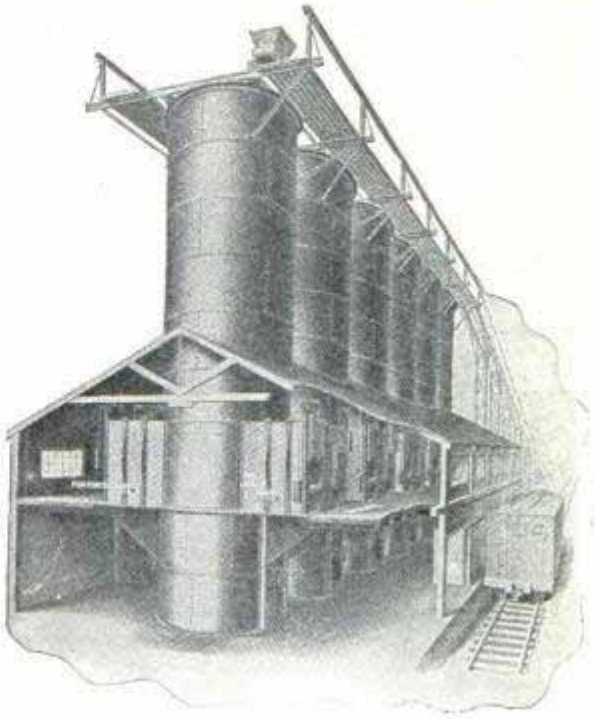
The "ready made" kiln consists of a heavy cast iron bed plate from which rises the steel cylinder, 11 ft. in diameter and 50 ft. high. The interior is heavily lined with fire brick to within 10 ft. of the top. The furnaces, four in number, are 10 ft. from the base, and below the grate bars is the coaling cone, which is filled at intervals by opening the grates and allowing the hot lime to fall through. The lime cools sufficiently in the cone to load into barrels or cars. A forced draft, as in a foundry cupola, insures a steady and intense heat.

The fuel, which may be either coal or wood, and the limestone is carried to the top in small cars on an inclined track, and constantly dumped into the kiln.



Single Kiln--Sectional View

It is the custom now to erect these kilns in batteries. Each kiln will weigh about 22 tons and the fire brick to line it 7 tons more. The lining is 2½ ft. in thickness. One pound of coal will produce from four to five pounds of lime. Lime is made faster with wood, but costs more. The capacity of a single modern kiln is from 100 to 140 lbs. each 24 hours, and cost from $1,500 up.



Battery of Kilns

SOUTHERN YELLOW PINE

The yellow pine is, commercially, the most important of the southern pines. Long leaf pine is always yellow pine, but not all yellow pine is long leaf. When manufactured it is known as long leaf, Georgia, hard, and southern pine. Its supply is not confined to Georgia, although that state first made it known in the general market; it is found from southern Virginia, down through the Carolinas and Georgia into Florida, and in Louisiana and East Texas. The long leaf is not found to any extent more than 150 miles from salt water. The Southern Lumber Review says:

Tests made by the United States government show that the long-leaf is the superior to the other in strength, elasticity and hardness, and of higher fuel value. If greater weight is an element of value, the long-leaf pine likewise has that quality. Long-leaf yellow pine is the strongest of the American pines. It is uniformly free from defects. The wood is even grained, and takes a high polish.

RUSSIAN OIL TANK CARS

The recent uprising with attendant revolution and burning of millions of dollars' worth of oil and oil refineries at Baku, Russia, has attracted unusual attention to this great Russian industry.

Oil Tank Cars of the Russian Government Railway

The tank cars of the government railway in which the oil is shipped overland—the major part being sent by water—are about one-half the size of tank cars used in this country. Each car has a built-up extension, as shown in the illustration, and is carried on four wheels.

GARDEN OVER ELECTRIC PLANT

A duke, residing in London, had a beautiful garden on a certain spot where an electric company decided it must establish a substation. The duke would not give up his garden and the company had to have its station. The difficulty was overcome by excavating the garden, building the station in a basement, and restoring the garden just as it was before on the roof of the electric plant. Trees, flowers and plants adorn the grounds, in the midst of which plays a beautiful fountain, while beneath whirling transformers noiselessly but ceaselessly perform their work.

MOTOR CYCLE FASTEST VEHICLE

In the recent Paris races the motor cycle carried off the honors for speed. The 12-horsepower Peugeot ridden by Cissac covered the mile standing start in 53 1-5 seconds, or 3-5 of a second faster than the time made by Clifford Earp in the six-cylinder 80-horsepower Napier. Averaged, Peugeot made the fastest time in all the six events in which they started.

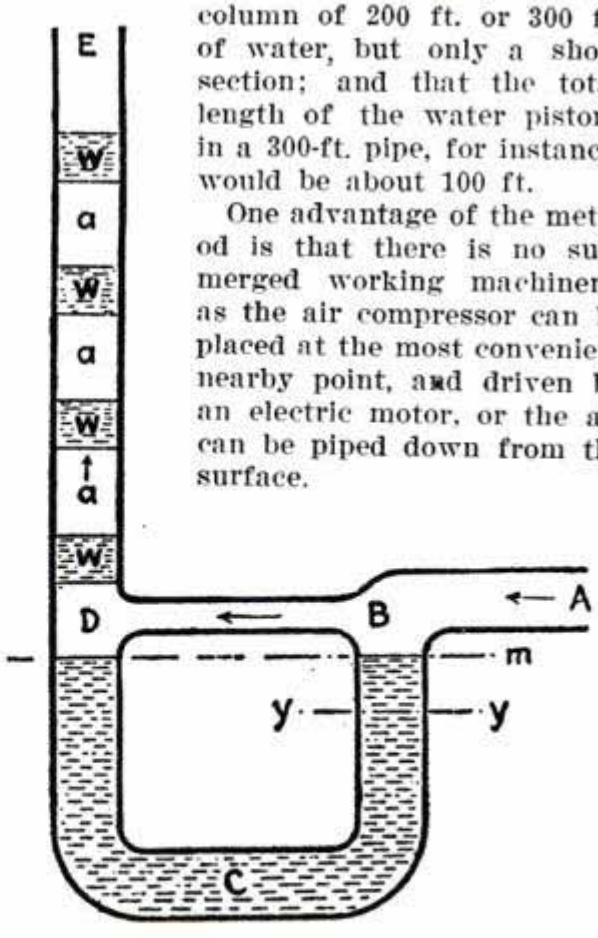
INGENIOUS AIR-LIFT PUMP

An air-lift pump which is creditably reported to be in successful operation in several places, is one more practical illustration of actually doing what the books have said could not be done. In fact, the Patent Office declared the pump non-operative until a demonstration proved the contrary.

A pressure of 40 lb. per square inch will lift a column of water in a pipe 92 ft. With the system in question using a 1½-in. air pipe and a 4-in. discharge pipe, water was lifted 210 ft. with 30 lb. pressure, delivering 220 gal. per minute. In the cut "a" represents pistons of air and "w" pistons of water; "C" is the U-shaped well, and "A" the air supply. The friction of the air in passing from "B" to "D," while small, is yet sufficient to make the pressure at "D" less than at "B," with the result that at regular intervals the column of water at "B" falls to the level "y-y" and rises correspondingly at "D," where it is carried upward in the ascending pipe.

It should be remembered that the compressed air is at no time lifting a solid column of 200 ft. or 300 ft. of water, but only a short section; and that the total length of the water pistons in a 300-ft. pipe, for instance, would be about 100 ft.

One advantage of the method is that there is no submerged working machinery, as the air compressor can be placed at the most convenient nearby point, and driven by an electric motor, or the air can be piped down from the surface.



Air-Lift Pump

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

SHOP NOTES

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

CHINESE METHOD OF MAKING OIL SKINS OR SLICKERS

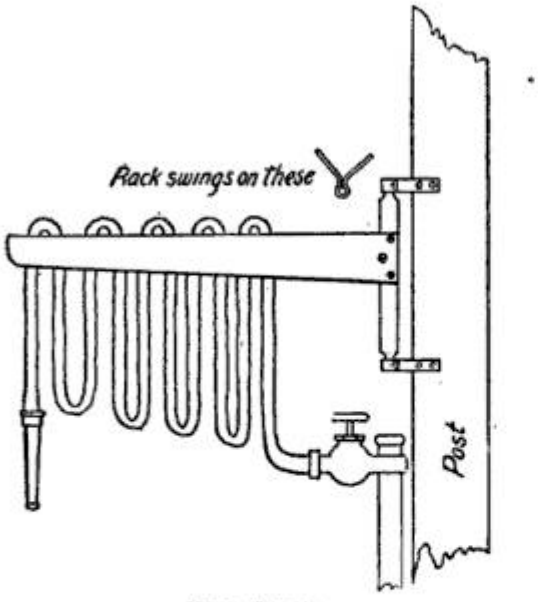
What is called oil skins and souwesters is called slickers in civil life, and have a disagreeable habit of sticking together when put away in dry, warm weather, which spoils them and makes them less waterproof.

The following simple formula makes them waterproof and when thoroughly dry, you can roll them up and put weights on them and they will come apart without sticking:

To one quart of pure raw linseed oil add two fresh eggs, well beaten, and mix. Apply with a rag or brush, let dry and give a second coat.—Contributed by John Rhodes of the U. S. S. Denver.

SWINGING RACK FOR HOSE

A hose rack that will swing in any direction the hose is pulled and may be placed near the ceiling and out of the way, provided the nozzle hangs within easy reach, is

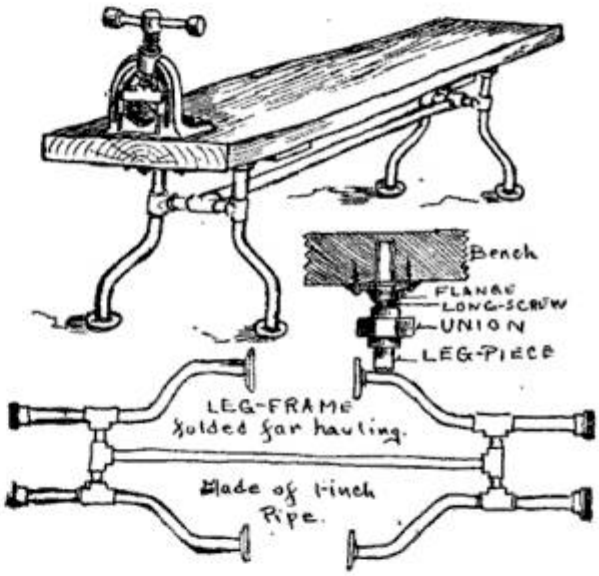


Hose Rack

shown in the illustration. This rack can be made by anyone, declares the Woodworker, and at trifling cost. It consists of a swinging double bracket 3 ft. long and with the sides far enough apart to allow the hose to pass freely between. It is provided with arms of 7x¾-in. half-round sticks, smooth on top, over which the hose is looped. When the hose is wanted, merely grasp the nozzle and walk away and it will come off readily.

PORTABLE WORK BENCH FOR PLUMBERS

The portable work bench shown in the illustration is described by a correspondent of the Metal Worker as being especially

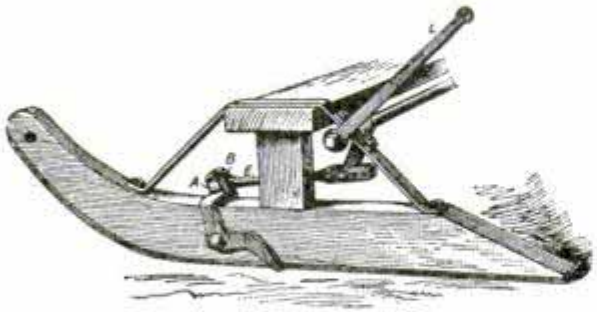


Plumbers' Portable Work Bench

convenient for plumbers. The top of the bench is made of 2½-in. poplar, 15 in. wide and 6½ ft. long. Four long screw nipples, with the collar half of four unions on the short threads, are screwed up into holes bored, as shown, through floor flanges which are screwed to the under side of the top. To set up the bench the standards are twisted upright and the top placed and the collars of the unions screwed down with the hand. No braces of any type are necessary in general work up to 1¼-in. pipe. For benches to be used regularly on 1½ and 2-in. pipe some form of brace easily applied and leaving the bench still of the quick knockdown type would be an improvement. For starting occasional threads on large pipe the thrust strain can be taken care of with a piece of plank in the frame.

HOW TO MAKE A SLED BRAKE

A sled brake like that shown in the sketch was used by a correspondent of the Blacksmith and Wheelwright to hold loads of 12,000 lb. in the mountains. To make it, proceed as follows:



Sled Brake Attached

Make a roller, R, the same as a double cam roller for a wagon brake, only heavier, 1½-in. round iron. Leave the end square for lever L to be held on with key. Make rods same as for a wagon brake, only make eye to connect with dogs A and B. To make the dogs take a piece of iron ⅝x3 in. and the length must depend on the width of the runner, but make the dog B on the inside of the runner about 12 in. long. Make a square turn at the middle. Draw the end down 3 in. from that turn and let it come at 45 degrees. Split the end and weld in a piece of steel. Sharpen so that it will be 1½ or 2 in. wide where it comes to the bottom of the shoe. The other dog, A, is made the same way, only it is long enough to turn over the runner at the top and meet the eye bar, E. They are connected to the runner with a ⅝ bolt, which must be put in so the snow will turn the nut on instead of off.

CAT HELPS ELECTRICIAN

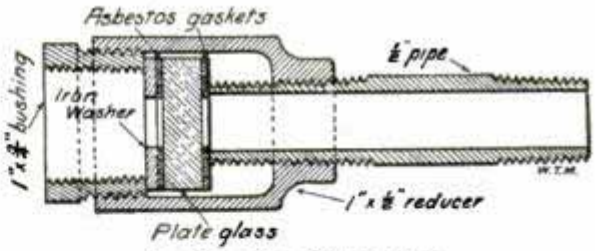
Last spring, when wiring a house for electric gas lighting, I had occasion to run a wire between a chamber floor and the ceiling to light the chandeliers in the rooms below. The gas fitters had taken up flooring in two places about 15 ft. apart, a greater distance than I could work the wire through. An interested spectator was a big yellow tom-cat, "Foxie" by name, and I concluded to impress him into the service, so I tied a chalk line around his body and pointed his nose down into the hole with directions to "scat," and he "scatted," being attracted by the light at the distant opening, where he brought the line out all right. I have since repeated the performance, and it will work every time, provided you can find the helper. If the cat is inclined to waste time under the floor, blow a little tobacco smoke into the opening where he started and he will hasten.—Contributed by Andrew Whiton, Hartford, Conn.

COMBUSTION SIGHT HOLE FOR TESTING A GAS ENGINE

A valuable device for testing engines is called a combustion sight hole and is adapted for use with make-and-break igniters. The Gas Engine tells how to make this device.

Screw a pipe nipple, ½-in. iron pipe size with a long thread on one end, into the cylinder head. On the thread of the nipple screw a 1x1½-in. reducer into the outer end of which screw a 1x¾-in. bushing, to be used as a stuffing box nut in holding a piece of thick plate glass in position at the end of a ½-in. nipple. Use asbestos gaskets to separate the glass from the nipple and the iron stuffing box washer. The distance of the glass from the inner side of the cylinder head should be several inches to prevent its becoming overheated and breaking, and its diameter should be so small that it does not touch the inside of the reducer.

This apparatus enables one to view the



Combustion Sight Hole

interior of a gas engine while the engine is in motion. For safety, do not put the eyes too close to the glass, but stand several feet away, though it is hardly probable that the glass will break. The cost of the device is under a dollar.

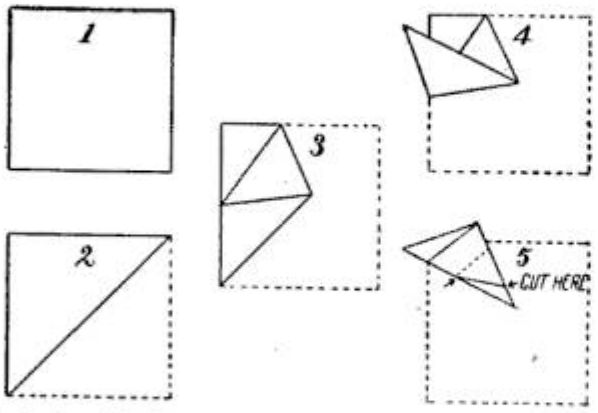
MIXING CEMENT

To make a cement block as hard as a rock and with no limit as to its lasting qualities, writes J. H. Johnston of Albion, Ind., proceed as follows:

Mix the cement in the usual manner and leave stand 12 hours; then break it up and mix again. Let stand for another 12 hours and remix and use.

TO CUT A FIVE-POINTED STAR

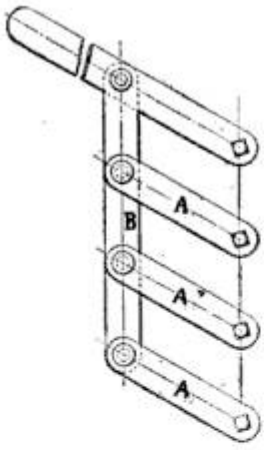
The accompanying diagrams show how a square of paper can be folded so that a five-pointed star can be cut with one clip. The



kink is old, but oftentimes useful.—Contributed by J. B. Dean, Reading, Mich.

LEVERS FOR TIGHTENING GIB-SCREWS ON MILLER KNEE

For tightening at once all the gib-screws locking the milling machine knee to the column the arangement of levers shown in the illustration works like a charm, says a correspondent of the American Machinist. The short levers, A, are all of the same length, have the same distance between holes and the position of the square holes with relation to the center line of lever is the same. Holes B are spaced to correspond with the spacing of the gib-screws.



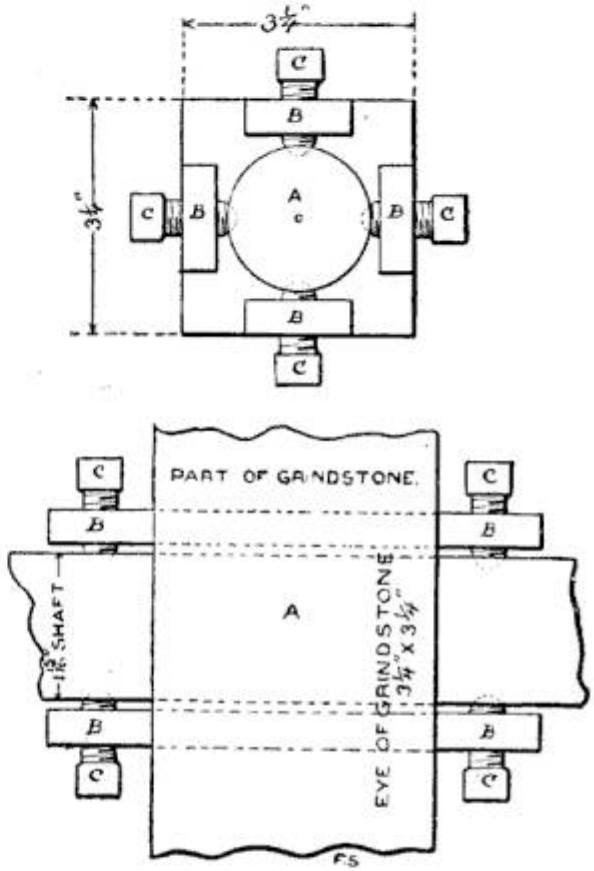
The gib-screws were all ground off at the ends when necessary, before assembling, so that when they were tight each would allow its lever, A, to stand at the angle shown. A movement downward from the position shown, and through an angle of about 60 degrees, is sufficient to loosen the knee.

There are two kinds of sizes, oil and water. Oil size makes an adhesive surface upon which the gold leaf must be laid immediately. Water size dries hard and when the gold is to be laid must first be brushed over with water. Oil sizes are used in decorating furniture. Water sizes are used for burnished gilding. Oil sizes do not harden sufficiently for this purpose.

GRINDSTONE FIXTURES

A set of grindstone fixtures like those shown in the illustration were made by a correspondent of the American Miller ten years ago and used for hanging a 600-lb. stone. The stone hangs as true today as when first hung.

The shaft, A, is a piece of 1⅛ about 3 ft. long and the hangers are four pieces of tire



Grindstone Fixtures

iron, 1½x1½, 7 ft. long, drilled and tapped ¾ in. from the end for set screws, which were made oval point to fit the countersink in the shaft. The eye of the stone was laid out and made 3¼ in. square with a cold chisel and the stone was then hung and turned up perfectly with set screws.

REGLUING BRIDGE OF A GUITAR

Having occasion some time ago to reglue the bridge of a fine guitar and not having suitable clamps, I removed the pegs from the guitar and replaced them with six binding screws, taken from the carbons of discarded dry batteries and left the instrument alone till the glue had had time to dry. This also allowed of immediate use of the guitar when necessary.—Contributed by Wallace S. Allen, Denver, Colo.

PATTERN SHOP CONVENIENCES

For transferring lines to irregular surfaces the vertical plumb or box square will be found convenient. This device is shown at Fig. 1 and is made of wood. The marker shown at the upper part of Fig. 1 and in dotted lines at the right-hand side consists of a straight piece of hardwood with a brad driven in the end and filed to a point, as at

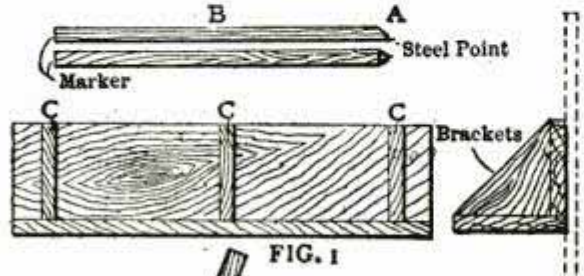


FIG. 1

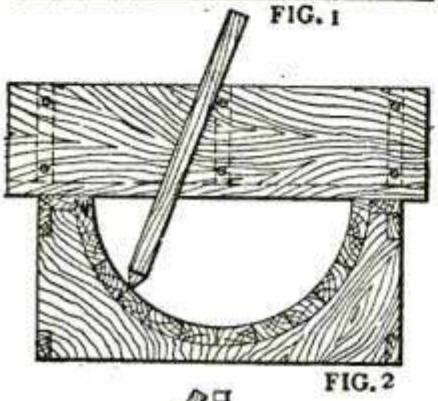


FIG. 2

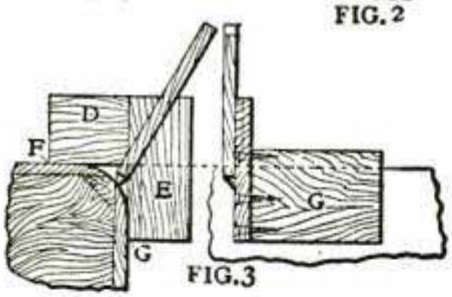


FIG. 3

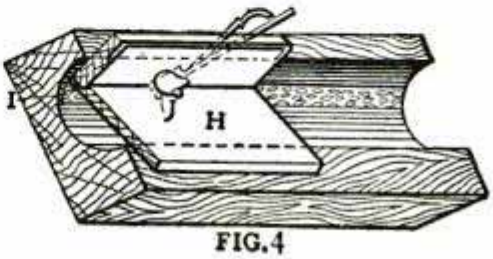


FIG. 4

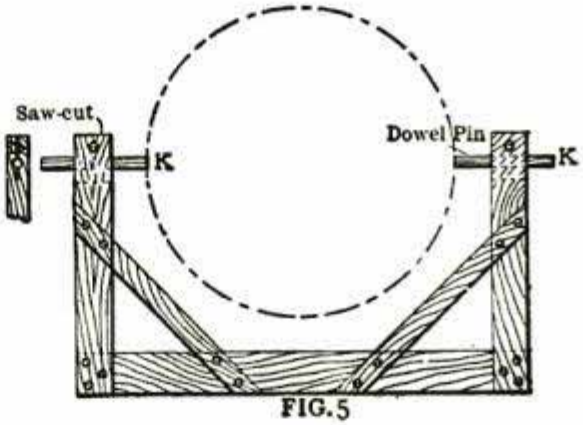


FIG. 5

A, or a metal plate let in flush with the face of the marker and filed to a point. The point should be in exact line with the face, B, says a correspondent of the American Machinist. Figure 2 shows how the device is used for drawing a line across a core box. It is also convenient for pipe connections, stove work, etc.

Another form of the device is shown at Fig. 3. The brackets on the device as shown at Fig. 1 exclude it from this class of work, but Fig. 3 receives its stiffening from the faces D and E. These are halved together and attached to face F and G as shown.

A method of converting a rabbet plane into a core-box plane is shown at Fig. 4. Wing H, which should be twice as wide as the body of the plane, is attached to the body by screws at a right angle to it, the face of the wing projecting slightly beyond the sole of the plane at I, so that it comes opposite the cutting edge of the bit. The wing is gouged out opposite the throat J of the plane to allow the shavings to clear themselves.

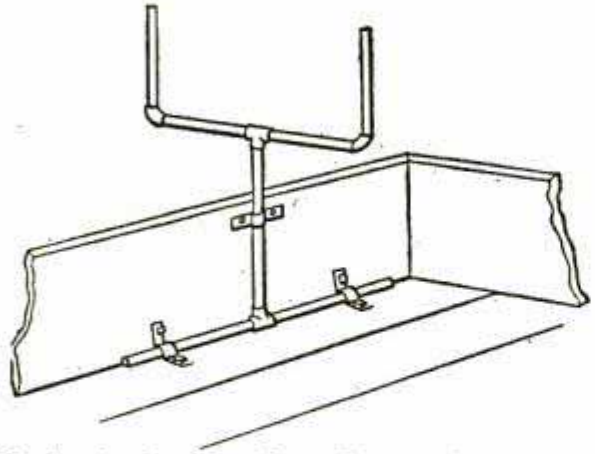
A pair of calipers for large work is shown at Fig. 5. They have a light wooden frame made of strips screwed together and are furnished with adjustable pins, K, made from ordinary dowel-pin stock.

TO CARRY LONG PIPE ON A DELIVERY WAGON

The job of carrying pieces of pipe 16 and 20 ft. long on a 10-ft. delivery wagon is one that often confronts the plumber or steamfitter. To make the pipe less unwieldy to transport a device like the one illustrated is recommended by a correspondent of the Metal Worker. It consists of a forked support to hold the pipe so that it can extend out over the horses' backs instead of trailing out at the rear.

A support is placed at the front and another at the rear of the wagon, the front one being a trifle higher than the other. Each is supported by a standard which is prevented from revolving by a piece of pipe extending lengthwise in the corner of the wagon. Three straps or pipe hangers,

carefully bolted to the wagon box, fasten the upright in place, in each case. If the supports are fastened to the stanadrds by a



Device for Carrying Long Pipe on Delivery Cart

union, they will be detachable in case bulky supplies are to be carried.

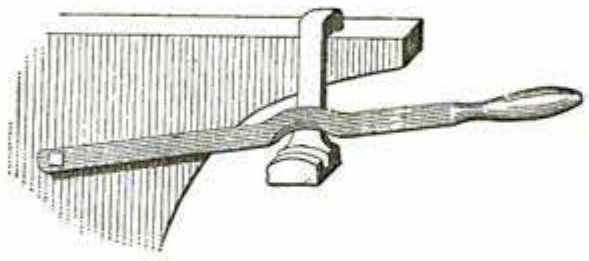
WAX VARNISH FOR MARBLE

Marble or statues exposed to the air may be preserved by applying a varnish made of 2 parts of wax in 8 parts of pure essence of turpentine. Apply the varnish hot, a thin, even coat, so that the lines of the figures will not be destroyed.

HOW TO MAKE RINGS AND PULLEY BLOCKS

Rings and pulley blocks were once called thimbles, and only a few smiths knew how to make them. The process is described by a correspondent of the Blacksmith and Wheelwright.

"Drill a ½-in. hole in your anvil and cut a thread in it for a set screw. Then make a hand lever and fasten it to the anvil with the set screw. Make a piece to fit in the



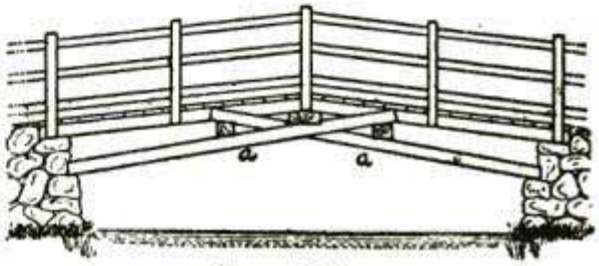
Making Rings and Pulley Blocks

anvil hole one inch square, and let it project over the anvil toward you. Fuller the end of it like a bottom swage. Make a loop the size you wish, get it hot, put it in the piece that is in the anvil, and bring your lever down on to it. Keep turning the hoop as it rounds it up, and you have a complete thimble in less time than it takes to tell you about it.

"For making open thimbles, we used to hammer our iron to a feather edge on both sides. We had a hardy made so that it would cut the ends the right shape. Then we put in a bottom swage and hollowed the thimble with the pein of the hammer. Then, holding it with a pair of narrow-bitted tongs, we turned the thimble over the anvil horn with the pein of the hammer."

BRIDGE FOR FARM USE

On a farm crossed by small streams which it is necessary to bridge, the form of bridge shown in the illustration will be found adaptable to almost any condition; and when it is built of good timber, says the Epitomist, forms a lasting and serviceable



Farm Bridge

structure. This bridge is especially valuable where a single log cannot be used as a stringer. Good timber of a size sufficient to sustain the weight the bridge must bear should be used for the stringers, a.

HOW TO SQUARE WINDOW SHADES

Window shades that are imperfectly squared will not roll up straight, and this is almost certainly the result where a square, of wood or metal, is used for the purpose.

The proper way to square a shade, directs Hartshorn's Roller, is to cut the cloth off the roll the right length, allowing for the bottom hem and for several turns around the roller when the shade is pulled all the way down. Then fold over the cloth, and bring the two outer edges together (Fig. 1). If the finished shade is to be narrower than the cloth, measure off one-half the width, top and bottom, using a rule, and put an awl through both thicknesses of cloth as close to the top and bottom as possible. If necessary make a slight short crease at the top and bottom of the shade. It is a good

plan to use two awls. Then spread the cloth out flat, carefully place a straight edge on prick marks A and B, Fig. 2, and with an ordinary shoe knife, very sharp, cut out the cloth. Cut also lines C to D, A to C, and B to D. Every corner will be

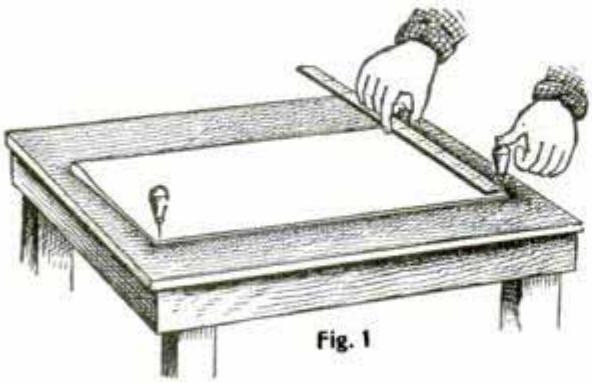


Fig. 1

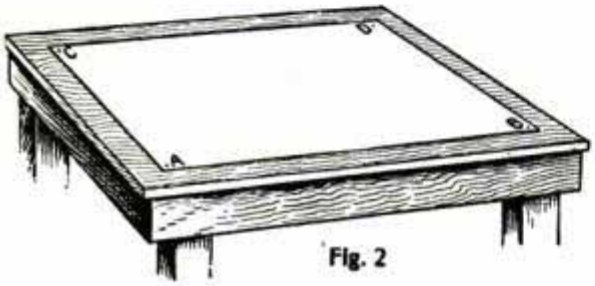


Fig. 2

Fig. 3

a perfect right angle. Fig. 3 shows how the edge of the knife should be ground, round and sharp. If the cloth is the right width for the curtain without cutting, only the top and the bottom need be squared. A number of shades may be cut down at one time.

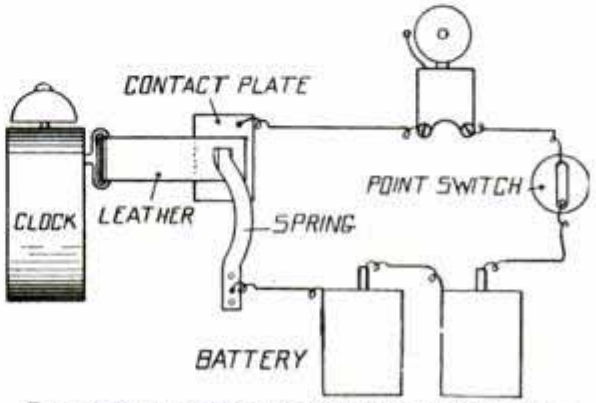
Never use shears for cutting shades, as they cut jagged edges and cause the cloth to ravel.

TO BROWN GUN BARRELS

Mix chloride of antimony to thin creamy consistence with olive oil. Heat the iron slightly, dress evenly upon its surface with the mixture and leave until the degree of browning desired is produced.

IMPROVED ELECTRIC ALARM

An improvement in the electric alarm attachment for an alarm clock described in our July number is suggested by Claude E. Harrison, of Clinton, Iowa, who says the



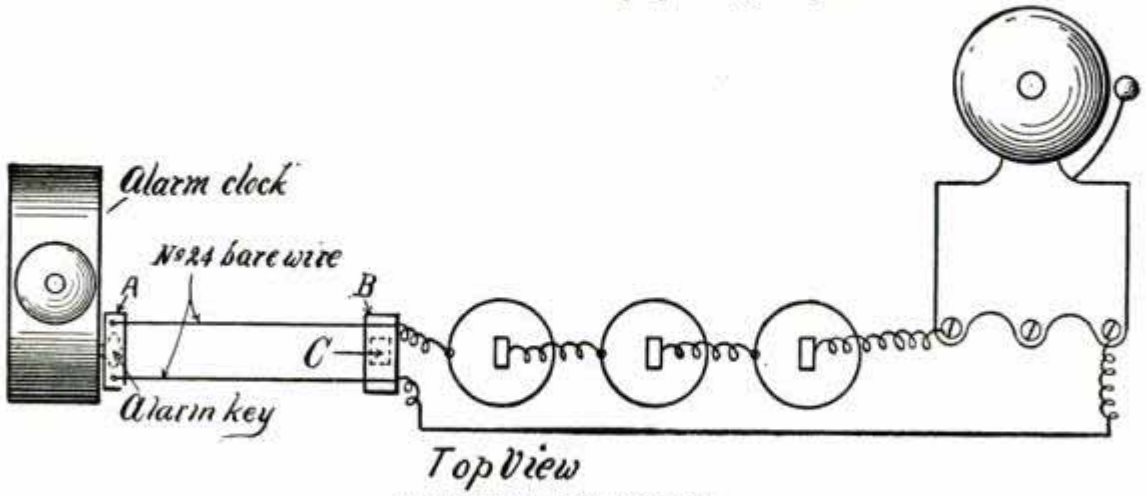
Proposed Improvement for Electric Alarm

No. 24 wires which twist together to close the circuit soon play out.

Instead of the No. 24 wires use a piece of leather ½ in. by 3 in. On one terminal of the circuit place a contact plate made of copper and on the other terminal put a piece of clock spring.

To set the alarm, place the leather between the plate and the spring. When the alarm rings the leather will be twisted from its position, thus closing the circuit and ringing the bell.

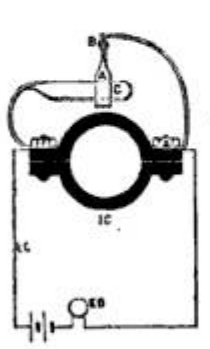
By placing a point switch in series with the circuit, the bell can be stopped without any trouble. During the day the clock can be used in any place desired.



Old Method, Using Wires

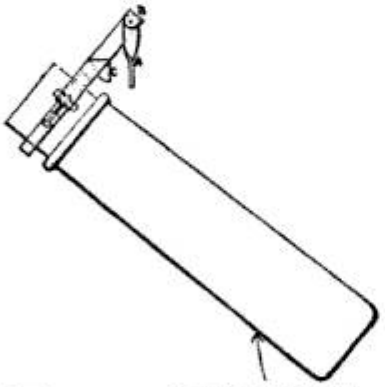
CIRCUIT-BREAKER ALARM

This is an English idea and can be constructed by any electrician at practically no expense. When the breaker opens from a short-circuit or overload the attendant may be engaged elsewhere and not hear the report. The plan was sent the London Electrical Review by R. N. Tweedy, who says:



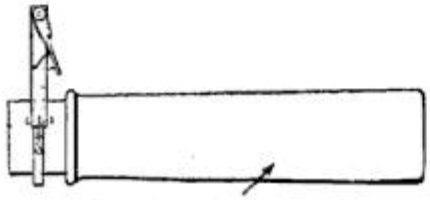
c, Insulating clamp; l. c, Local circuit; g b, Electric bell.

FIG. 1.



Circuit breaker handle, closed position.

FIG. 2.



Circuit breaker handle, open position.

FIG. 3.

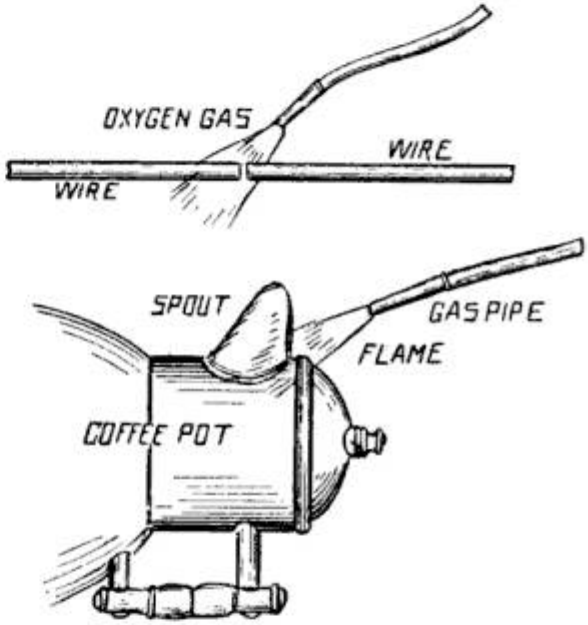
"It is hardly an exaggeration to say that no tools are required to manufacture the device. Certainly it can be made and fixed by the aid of a knife, a pair of pliers and a screw driver, and the cost per breaker is minute, especially if the switchboard attendants do the work, as they well may, while on duty. There can be no uncertainty about the action of the contact maker, for it depends on gravity alone; and the contact faces are always vertical, so that dust cannot cling sufficiently to insulate A from C when the breaker opens. As the current passing through the local circuit is infinitesimal, the pivoted joint, B, which is the only moving part, can be made so loose as to preclude the possibility of sticking, but to provide a still higher factor of certainty the contact maker, A, may be weighted.

It will be seen that the circuit-breaker must be kept in the closed position even when the feeder or generator is out of service, unless a switch is inserted in the local circuit of each breaker; but there is no practical objection to that, as there is always a switch in series with the breaker, and, so lohg as that is open, the feeder or generator will remain isolated. The interposition of a tumbler-switch to cut any breaker off the alarm bus-bars is to be deprecated, inasmuch as there is always a possibility of the attendant forgetting to close it when putting the circuit-breaker into service."

SOLDERING ALUMINUM

A reader who was at one time employed with a reduction company manufacturing aluminum wire, describes the soldering process used by the company.

The two ends of the wire were first heated by oxygen gas and then pressed together, as shown in Fig. 1. When cooled the wire would be smooth at the joint and appear as



Method of Soldering Aluminum

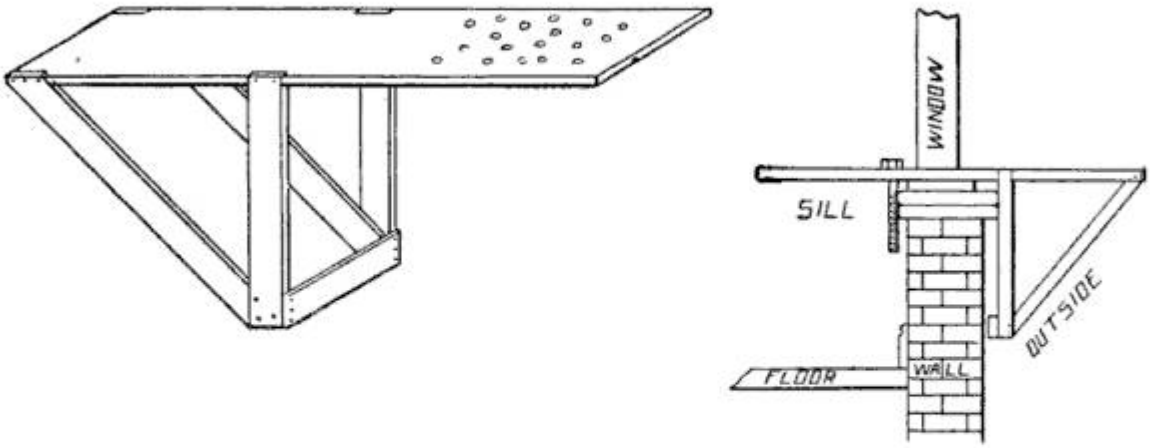
one piece. The same process was used in soldering the spouts on tea and coffee pots (Fig. 2)

TO CLEAN SLATE SWITCHBOARDS WHEN BURNED

First clean off with sand-paper; then give one coat of any good filler that will not carry current. When dry, putty up all uneven surfaces, using good, hard drying putty. Rub down with rock pumice stone, clean off and give one or two coats of color, give two coats of japan, varnish, after thoroughly dry, polish in the usual way. A good polish can be made from butter of antimony and raw oil.

Varnished paint may be cleaned by washing with a mixture of a pound of wheat bran boiled in a gallon of water.

HOW TO MAKE A WINDOW JACK



Window Jack for Painters

A window jack for painters' and window washers' use may be made of a plank 5 or 6 ft. long and 12 or 14 in. wide. The part which extends outside has legs or braces to brace against the wall. The inside part has holes drilled through at different intervals, say three rows and about 1 in. apart, to allow for different width sills.

To place, open the window and put the jack on the outside and put a bolt in the hole that comes nearest the sill on the inside. This makes a strong jack and one that a man can work on and feel safe. The bolt used should be about ⅝ in. and need only be slipped into the hole, as the weight on the outside causes the bolt to bear against the sill on the inside and holds the jack secure.—Contributed by Thiede.

HOW TO MAKE A CHEAP DIE AND STOCK

Make the die (Fig. 1) of tool steel 1½ in. wide, ⅜ in. thick and 4 in. long. Drill a ⅝-in. tap hole in the center of the plate, then tap it with a ⅝-20 thread tap. Drill a row of holes and saw them out to make a slot for adjusting the die which is done by means of a stave bolt (A), which passes through both sides of the slot. File three slots to form the cutting edges of the die and back off the starting side of the die by filing. Make three small holes (B B B) in the die for fastening it in the holders or stock.

The stock is shown in Fig. 2. Make it of a piece of tire iron 12 in. long, 1½ in. wide and ¼ in. thick. Put a ¾-in. hole in the center, as indicated, and tap three holes (B B B) for the stove bolts, which hold the

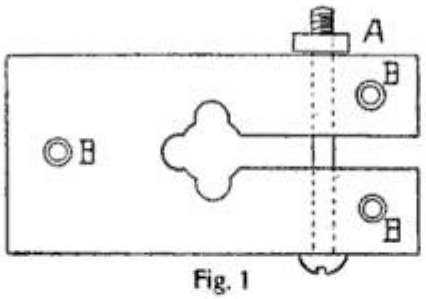


Fig. 1

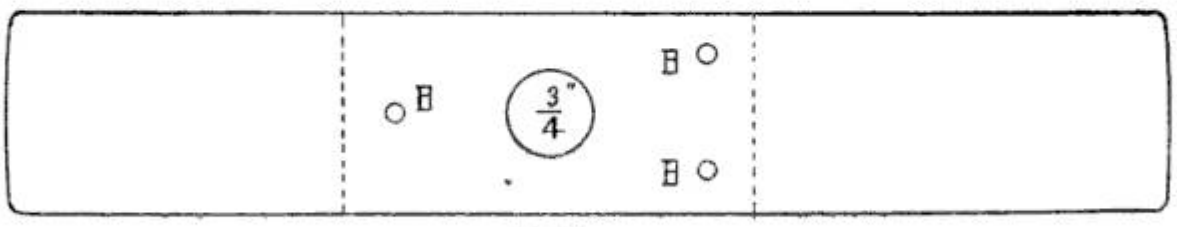


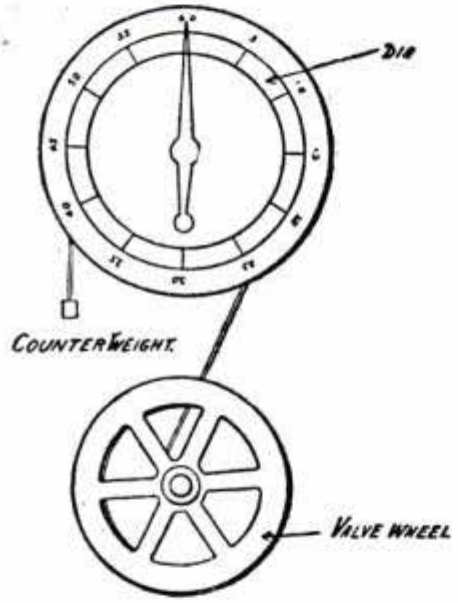
Fig. 2

die to the stock. Harden the die and draw its temper to a straw color and it will cut as clean a thread as one can wish.—Contributed by F. G. Emmelmann, Indianapolis, Ind.

TO FIND THE NUMBER OF TURNS A VALVE IS OPENED

A device for indicating the number of turns a valve is opened was described at the annual meeting of the Western Gas Association in Chicago recently. This device is shown in the sketch.

A cord is attached to the stem of the valve and thence runs over a small drum, around which it is wound several times. A small counterweight is hung on the free end of the cord. The drum communicates with an indicating hand, which registers on a dial



the number of turns that the valve is opened. When the valve is opened the stem turns and winds up the cord, turning the drum and moving the indicating hand.

CEMENT FOR TIGHT PIPE JOINTS

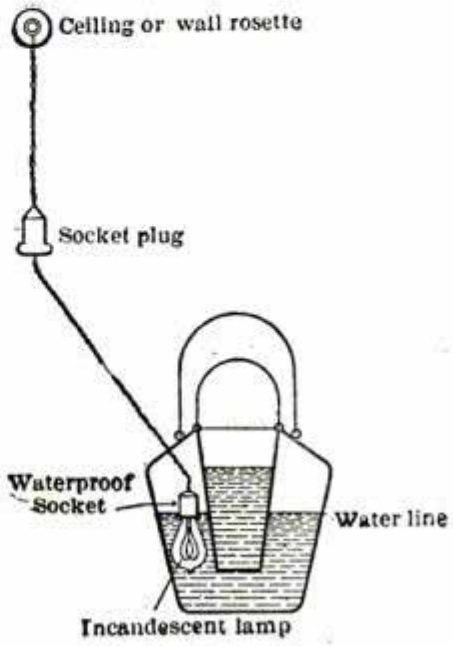
Powder and mix together 15 parts slaked lime, 30 parts graphite and 40 parts barium sulphate. To make a stiffer preparation, omit the lime.

CEMENT FOR WOOD VESSELS

Calcine and reduce to a fine powder, separately, lime-clay and oxide of iron. Mix them thoroughly and place in a closed vessel until ready to use. Before using mix with the necessary quantity of water.

HOW TO MAKE AN ELECTRIC GLUE HEATER

In the shop where electricity is used the electric glue heater is the simplest device of its kind. The illustration shows how it



Electric Glue Heater

is arranged. An incandescent lamp with a waterproof socket is suspended in the water in the kettle, and the joints between the glue pot and the kettle are made perfectly tight. A 32-candlepower lamp will boil the water in from two to four minutes, says a correspondent of Wood Craft, while six or eight candlepower will keep the kettle warm enough for constant use.

WAX FINISH FOR FLOORS

Slice 2 lb. of white wax thin and boil it with 2 oz. of pearlash in 2 qt. of water. Stir until the wax is melted and unites with the water. Apply with a brush and polish with old plush. Good for light service only.

TO SOFTEN OLD WHITEWASH

Wet the whitewash thoroughly with a wash made of 1 lb. of potash, dissolved in 10 qt. of water.

To clean tarnished zinc apply with a rag a mixture of 1 part sulphuric acid with 12 parts of water. Rinse the zinc with clear water.

FUEL ECONOMIZER FOR SAWMILL PLANT

In a small sawmill plant, consisting of a 25-hp. engine and boiler, where it was difficult to keep the steam up to the required pressure, a correspondent of Power fitted up and installed a fuel economizer and water heater that was a great improvement.

The fuel used was green slabs. The boiler was of the firebox type. The exhaust of the

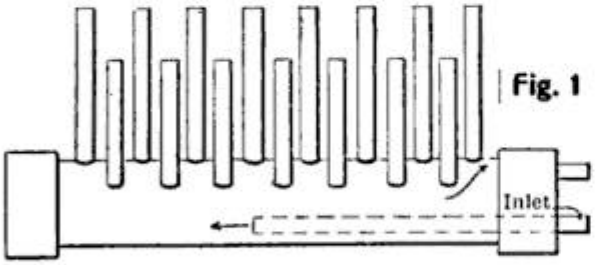


Fig. 1

engine was turned up the smokestack and the heavy draft kept the flues scoured out by means of pieces of bark it drew out through them.

It thus not being necessary to scrape the flues from the firebox end, the heater could be placed directly in front of the flues.

Fig. 1, shows a diagram of the heater. A piece of 6-in. pipe threaded at both ends was covered with two caps. Into this 6-in. pipe a number of ¾-in. pipes plugged at one end were screwed. These water tubes or quills were made short enough to lie below the water line when in position in the smoke-box of the boiler, as shown in Fig. 2. The quills were put in only on the top

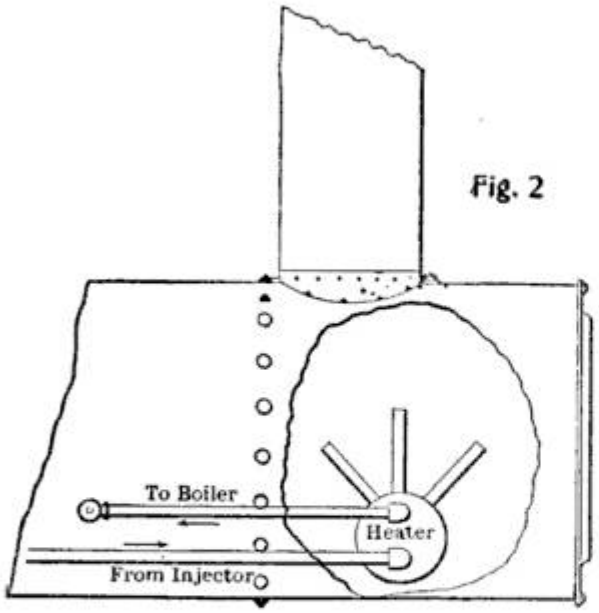


Fig. 2

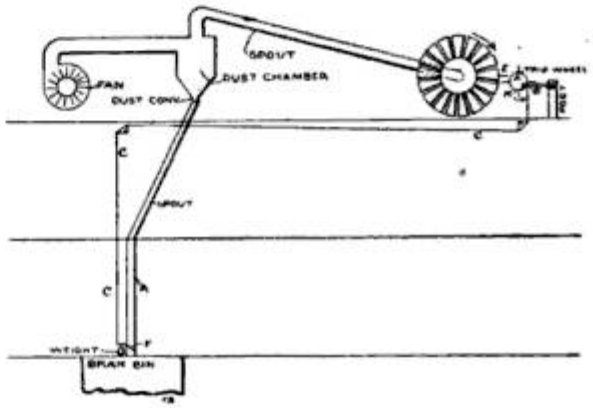
and sides, as shown, so that any sediment which might be in the water would not lodge in and scale them and cause them to burn out.

The heater absorbs a great deal of heat and the feed water is fed through it as it goes to the boiler. Ample water connections were used between the boiler and heater. The lower connection (delivery from the pump or injector) extends in about half way to insure circulation (see dotted lines in Fig. 1). The check and stop valve are on the delivery to the heater, but between the heater and the boiler no check valve was used, so that the heater has always a sufficient supply of water.

When after three years continuous service the heater was taken out of the boiler for inspection the quills were not scaled at all.

DUST COLLECTOR KINK

In a mill where the fan from the scourers blows into the dust chamber spout from chamber to bran bin, a great deal of dust was raised because there was so little stock



Kink for Dust Collector

running down the spout and so much air that it blew up through all other spouts leading to the bran bin. A correspondent of the American Miller tells how he remedied matters, as shown in the accompanying diagram.

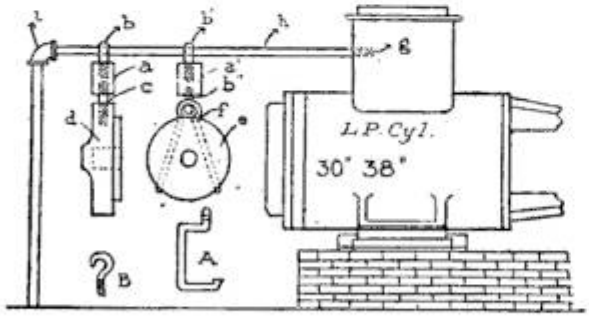
F is a valve in the spout, closed by means of a weight on the lever from F; C is a wire running to trip lever B; H is a small pin in trip wheel to raise lever B; E is a pin attached to the dust collector, which makes one revolution every five minutes. Four pins in the trip wheel, A, cause it to trip every 20 minutes, when valve F closes immediately, shuting off all air. Lever B is bolted loosely to the post or the wall and is just long enough to rise high enough to allow pin H to pass and lever B to drop back in place. It is checked from dropping too low by a small block fastened to the post and just below the lever.

The intervals between the action of the valve can be varied in duration by adding more pins to trip wheel A, or by using fewer pins.

INEXPENSIVE RIG FOR REMOVING CYLINDER HEAD AND PISTON

A simple and inexpensive rig for removing cylinder heads and pistons is shown in the sketch and may be made as follows:

At g there is a 1½-in. pipe plug put in the steam chest to allow for the removal of the L. P. valve stem for repairs. Remove this plug and into the hole screw a piece of 1½-in. extra heavy pipe about 4 ft. long.



To Remove Cylinder Heads

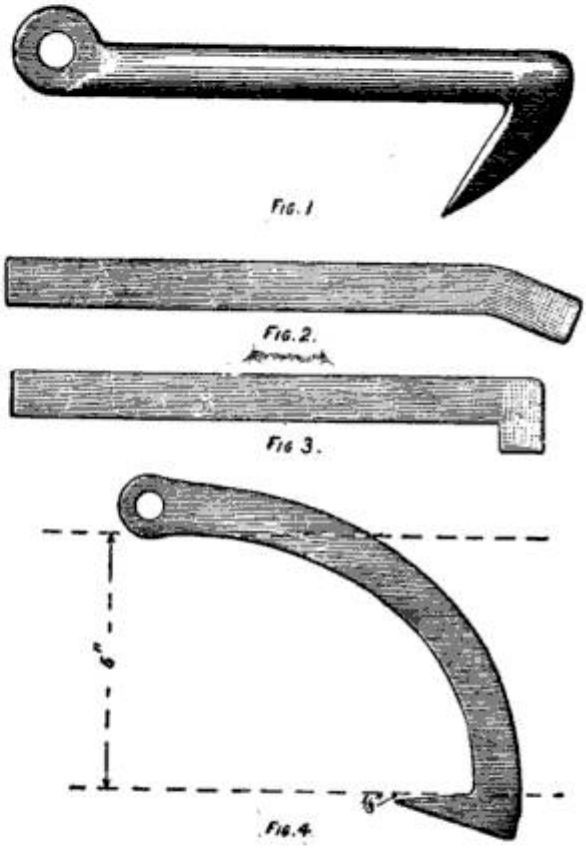
Put an ell on at i and screw a piece of common black pipe long enough to reach to the floor into the ell. Cut two pieces a and a′ each 4 in. long from a piece of 1½-in. shafting and drill a hole for a ⅞-in. standard machine thread through the center of each piece. Tap each of these pieces half way through with a left-hand thread tap and through the other half with a right-hand thread tap. Make the threaded hook, B, of ⅞-in. round iron, bent to fit the outside diameter of the pipe. Cut the hook with left-hand dies. Make hooks b, b′, b″ in the same way, except to thread b″ right hand. Make the bracket, f, supporting the piston head, e, of ⅞-in. round iron. A side view of the bracket is shown at A. Make the stud at c with a right-hand thread on either end; the blank space at c is for the grip of a pipe wrench. This device is recommended by a correspondent of the National Engineer.

HOW TO MEASURE CORN IN CRIB

This rule will apply to a crib of any kind. Two cubic feet of sound, dry corn in the ear will make a bushel shelled, says Grain Man's Guide. To get the quantity of shelled corn in a crib in the ear, measure the length, breadth and height of the crib, inside of the rail; multiply the length by the breadth and the product by the height; then divide the product by two, and you have the number of bushels in the crib.

FORGING GRAB HOOKS OR TWITCHING DOGS

In Fig. 1 is shown a grab hook made of a 1-in. bar of round iron. To make such a hook upset a lump 2 in. from the end of the bar, draw toward a point and bend square across the swell. Leave the front thick, but thin the outside of the point at the back. Cut off 10 in. inside the hook and punch a hole for the chain. This hook will not draw



out on a straight draft, says a correspondent of the Blacksmith and Wheelwright, but will come out easily by swinging away from the log and back.

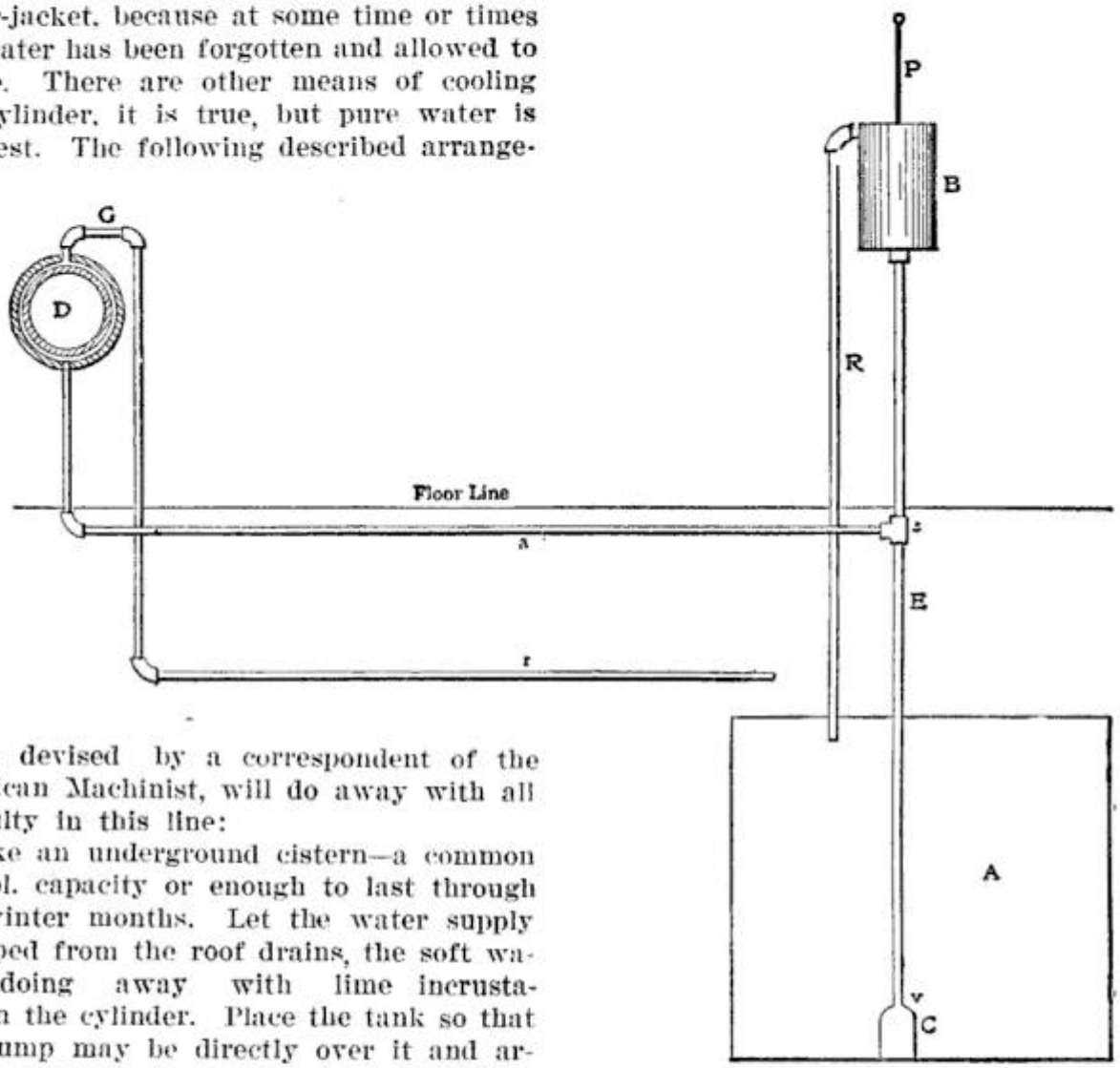
The other illustrations show how a peevey dog is made. Use ½x⅞x11-in. iron, heat it about 1¼ in. from the end to a good warm heat, but be careful not to burn. Bend slightly over the horn of the anvil, Fig. 2, then stand it on its hot end and hammer to the shape of Fig. 3. Draw to a point and in the other end punch the eye. Bend to the shape of Fig. 4, so the point will set ⅛ in. out from one of two parallel lines 5 in. apart when placed as shown in sketch. Use an anvil with a 5-in. face and in either of the dogs described do not allow a square corner to form in the throat, or the heads will break off.

NON-FREEZABLE COOLING WATER ARRANGEMENT FOR GASOLINE ENGINES

The water-cooled gasoline engine in use in a cold climate usually has a cracked water-jacket, because at some time or times the water has been forgotten and allowed to freeze. There are other means of cooling the cylinder, it is true, but pure water is the best. The following described arrangement, devised by a correspondent of the American Machinist, will do away with all difficulty in this line:

Make an underground cistern—a common 30 bbl. capacity or enough to last through the winter months. Let the water supply be piped from the roof drains, the soft water doing away with lime incrustation in the cylinder. Place the tank so that the pump may be directly over it and arrange with whatever modifications are required, as shown in the diagram. Place a common deep-well pump cylinder, C, at the bottom of the tank A, and carry a pipe up into the bottom of a reservoir, B, which should be placed about 2 ft. above the level of the top of the engine cylinder. Any kind of vessel that will hold 3 gallons or more will do for the reservoir. Run the pump rod, P, up through pipe E, and reservoir B, and attach it to any convenient mechanism for giving it the necessary reciprocating motion. At a point e in pipe E, preferably below the floor, insert a T and from it run pipe a to the bottom of the cylinder water-jacket. Carry the overflow taken from the top of the cylinder back to the tank by pipe r. At point v in pipe E drill a $\frac{1}{16}$-in. hole and leave it open at all times, so that when the pump stops the water will drain back.

The pump should in all cases be of ample capacity and should have a stop-cock at G, for gauging the flow, the surplus being returned to the tank by the overflow pipe R attached to B near the top. A cooling water temperature of 150 degrees as it leaves the cylinder indicates the highest degree of heat permissible in running gas or gasoline engines.



Cooling-Water Arrangement for Gasoline Engine

INK FOR LABELING

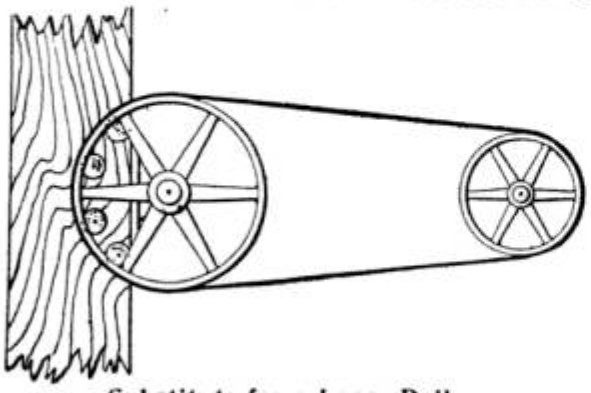
An ink that nothing will bleach is made by mixing pyrogallic acid and sulphate of iron in equal parts. Particularly useful for marking labels on bottles containing acids. Varnish the label after the ink is dry so that moisture will not affect it.

New oak may be made to look old by sponging with a strong hot solution of common soda in water. This will raise the grain which must be cut down with sandpaper.

LOOSE PULLEY SUBSTITUTE

For a belt that is not much used the appliance shown in the illustration will take the place of a loose pulley, says a correspondent of the Engineers' Review.

Small rollers are located near the flange



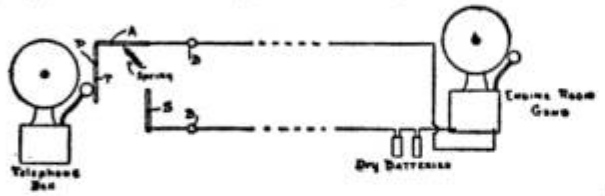
Substitute for a Loose Pulley

of the driving pulley. The top roller is even with the face of the pulley or nearly so, the other three are a little nearer the shaft and the lower one is still nearer the shaft. The belt may be handled by hand with this device, though for a large belt it is better to use a stick for removing it. The rollers may be fastened to a joist by log or wood screws on which they turn. The belt will not wear by friction when standing as in the case of a loose pulley.

GONG CONNECTIONS FOR TELEPHONES

For the noisy plant where the telephone bell cannot always be heard a simple gong signal will prove a great convenience.

Put the telephone in a quiet room adjoining the boiler room and connect it with the gong and two dry batteries in the boiler



Connecting a Telephone with a Gong

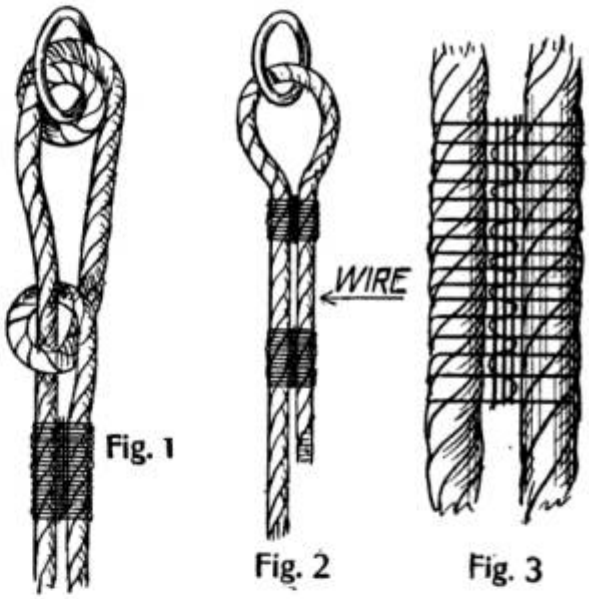
room, as indicated in the illustration. The dry batteries and the gong are connected in series to binding posts, B, B, says the Practical Engineer. T is a trigger pivoted at P, A is a piece of steel pivoted so that the spring can draw it down to touch the contact S. When the telephone bell rings, the clapper releases arm A, which contacts at S completing the circuit and causing the gong in the boiler room to ring. The trip must be reset after every call.

IMPROVED METHOD OF FASTENING A ROPE TO A RING

In regard to the method of fastening a rope to a ring, given in our September number, Harry de Joannis, of Chicago, says:

"The method illustrated in your article does not present, as stated, two thicknesses of rope to wear through, for, when the first thickness is worn through, it is worn through in such a way that the half-hitch holding it is insufficient to stand the strain. Not only this, but the seizing shown in the illustration should have two or three cross tightening strands, as shown in the sketch submitted herewith, to prevent the inevitable play of one rope upon the other.

"By the method I show, the rope takes a round turn through the ring and then is given a half hitch over the main rope and



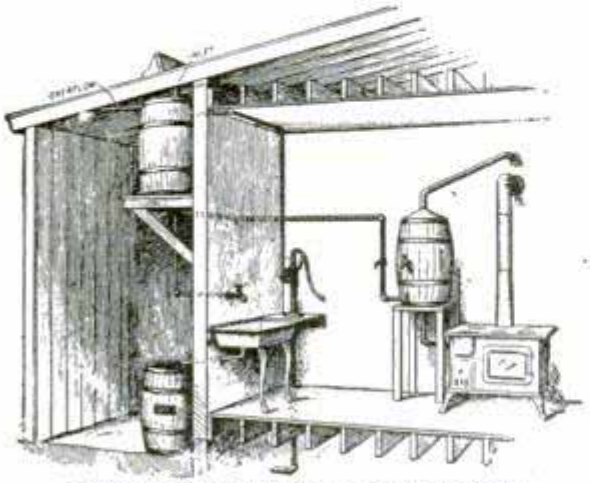
the end is fastened to the rope (Fig. 1), as in your illustration, with the addition of the strands above mentioned. The advantage I claim for this method of fastening is that the half-hitch takes a considerable portion of the strain and the round turn gives two wearing surfaces in the ring which can easily be examined at any time by pushing the half-hitch towards the ring and enlarging the round turn so that the inside surfaces of the rope are seen easily. If wire is used (Fig. 2), it should not be hammered flat nor is a round turn needed in the ring whatever. It should be laid around a split thimble and two seizings should be applied to it instead of one.

"In tightening seizings, the strands are woven in and out and then pulled tight and cut off short (Fig. 3)."

WATER SUPPLY SYSTEM FOR THE KITCHEN

In country towns where there is no water system a simple supply system for the kitchen will be found a great convenience.

Procure three barrels, one a very large



Hot and Cold Water Supply System

pork barrel. Mount the large barrel on a strong bracket outside the kitchen, in a shed if there be one, and make an inlet by which the soft water from the roof will flow into it. With a ½-in. pipe, an elbow and a bib for connections, run the water from this barrel to the kitchen sink and arrange for the overflow from the barrel to be run in another direction. Pipe the discharge from the sink to another barrel placed just below the supply barrel, but on the shed floor. The barrel can be wheeled away on a barrow or cart to empty in some suitable place.

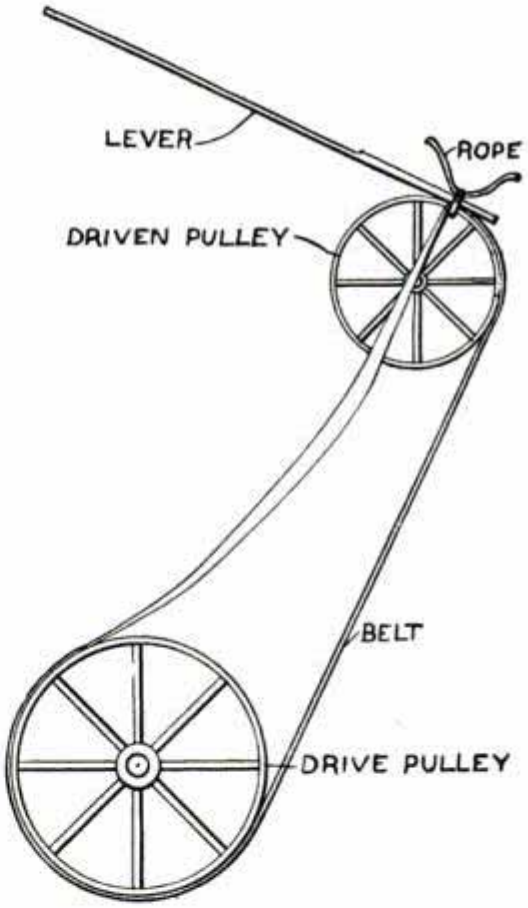
If the pump be one of the ordinary kind and out of doors, replace it with a force pump in the house at the sink and arrange it to connect with the supply barrel so that when there is no soft water the tank may be filled from the pump.

Place the third barrel on a strong bench back of the stove and lead a pipe from the supply tank to the barrel, connecting it at the bottom of the barrel. This pipe should be provided with a stop-cock to shut off the supply when the hot water barrel is full.

Make the water heater of ¼-in. pipe and install it in the stove. From the bottom of the hot water tank run a pipe to the heater. The return pipe from the heater connect into the side of the hot water tank about 10 in. above the bottom of the barrel. Make the connections by means of iron pipe with long threads cut on it and use jam nuts on both sides against asbestos washers soaked in red lead. Put the hot water service cock a few inches above the side connection so that the barrel can never be quite emptied. Make a cover of sheet metal in the form of a cone for the top of the barrel and lead a small pipe from the cone to the chimney to carry off any condensed steam. This system is recommended by a correspondent of the Metal Worker, who installed one that worked admirably.

PUTTING ON BELTS WHEN PLANT IS IDLE

Starting the mill up in order to put on belts is a source of extra expense which may be avoided by the means illustrated herewith. Place the belt on the driver pulley and run it as far as possible, says a correspondent of the American Miller. Then tie a rope around the belt and pulley behind the arm of the pulley. Put a lever in under



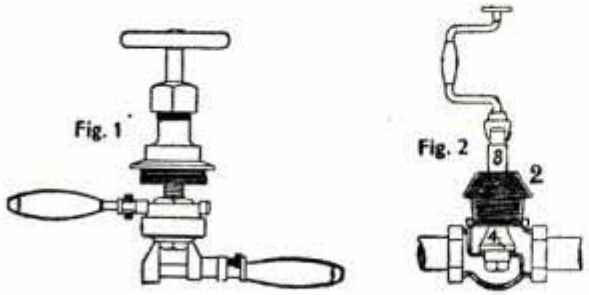
To Attach a Belt when Plant is Idle

the rope and on top of the belt and press down. With a long lever a greater weight can be exerted on the belt. The driver pulley will then turn the belt on readily.

REPAIRING A DISK VALVE

The following method of repairing a Jenkins disk valve is recommended by a correspondent of the Practical Engineer.

With a large monkey wrench unscrew the bonnet, giving it a quick, sharp pull to loosen the thread. A large wrench will not spring easily and round off the corners of the bonnet. If a valve has been in use



under steam pressure a long while, it may be necessary to apply a Stillson wrench. Remove marks made by the teeth of the wrench by filing carefully. Hold the disk-holder with one wrench and unscrew the nut with another, as shown in Fig. 1. If the disk and nut do not come out together soften the nut by holding it in a gas flame, after which it may be cut or pried out easily and a new one put in. Put a prick punch mark in the edge of the threads to prevent the nut from working off easily.

For repairing the seat of a Jenkins valve Fig. 2 shows a good plan. Remove the bonnet and screw in the bushing (2) to form a guide for the stem (3), on the lower end of which is a circular file (4). When this is turned by means of the brace it files the seat until all irregularities are removed, making it as good as new.

TO SOLDER AGATE WARE

A correspondent in the Metal Worker says holes in agate ware can be soldered, notwithstanding the general belief to the contrary. He says, take a chisel out of your side pocket, as I suppose you carry all your small tools with you, and give the old agate ware a crack or two and see what it does. Then take your file and rasp and give it a few strokes to brighten the metal, after which some cut acid should be put on and the whole can be readily soldered. The owner will say that you have botched his nice agate ware, but this is the best way to do the work.

BLUEPRINT CHEMICALS

For making blueprint paper prepare the following solutions: Citrate of iron and ammonia, 1⅞ oz., dissolved in 8 oz. of water and red prussiate of potash 1¼ oz. dissolved in 8 oz. of water. Keep the solutions in separate bottles until ready to use them. To use, measure equal quantities from each of the bottles and mix by shaking well. Keep the mixture away from white light, warns Machinery, applying it to the paper in a room illuminated with ruby light. Dry the paper in this room, also, and keep it in the dark until used. One ounce of the mixed chemical will cover 4 sq. ft. of paper.

TO FIND NUMBER OF TONS OF HAY

Rule—Multiply the length in yards by the height in yards, and that by the width in yards and divide the product by 15; the quotient will be the number of tons.

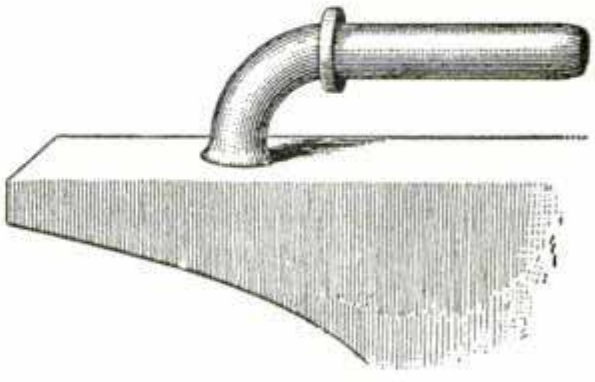
HOW TO TIP BOILER FLUES

Tipping boiler flues is a very simple matter if one just knows how to go about it. A

Tipping Boiler Flues

correspondent of the Blacksmith and Wheelwright recommends the following method:

Lap the flues one-half inch and take one heat and weld in the fire. Then straighten them up on the horn. Second heat in the



Straightening Boiler Flue on the Anvil

fire and weld on the horn. It will be hard to tell where the weld is and the flues will be as good as new.

MAKING FORCED FITS

To bore out a wheel and turn a shaft or other part to be driven or forced into the wheel by means of heavy blows or hydraulic pressure, is an operation of the most frequent occurrence in every machine shop and is of such utility as to be indispensable. The grip and solidity of a driven fit is something remarkable. Bolts and nuts will loosen, but no amount of vibration will affect the integrity of a well-made press fit. Systematic experimenters and mechanical writers have been somewhat neglectful of this subject, and considering its importance, the matter would seem to merit more attention. The data contained in this article came to the author by frequent experience in the every-day work of a machine shop, rather than from deliberate experiment. These conditions do not afford the same opportunity for accurate observation as would a carefully conducted test, but the figures obtained are sufficiently close to give satisfactory results.

The part to be driven must of course be slightly larger than the hole which receives it, but the difference is exceedingly small, and the first step is evidently to determine this amount correctly. The common practice is to gauge the oversize solely by the feel of the calipers, but the element of uncertainty in this method is very large.

In figuring the necessary allowance for any given case, the principal factor is the size of the job. To make a press fit of the greatest possible strength, there should be a difference in size of from two to three-thousandths of an inch for each inch of diameter. The required pressure in tons will be the allowance in thousandths multiplied by the diameter in inches and by one and a half. For example, a wheel is to be forced upon a 5-in. shaft, $5 \times .002 = .010$, which is the required allowance, and the required pressure will be $10 \times 5 \times 1\frac{1}{2} = 75$ (tons). On smaller pieces when the fit is required to be very heavy, the larger figure or .003 per inch of diameter may be used. Say the shaft is 2 in.: $2 \times .003 = 006$; .006 will be the allowance and the pressure will be $6 \times 2 \times 1\frac{1}{2} = 18$ (tons).

It will be apparent, however, upon a little reflection, that with pieces of very large size the necessary pressure would be very great indeed. For instance, a 15-in. crank-pin is to be pressed into its disk. By the rule, $.002 \times 15 = .030$; and $30 \times 15 \times 1\frac{1}{2} = 675$ (tons), the pressure. Very few shops, not even the largest establishments, are equipped with the means of obtaining such enormous pressures; and moreover, it is rarely necessary in large work to fit two parts together with such extreme tightness. An allowance of about .010 on the above pin would be sufficient and would bring the required pressure within more convenient limits.

It is also true that the driving allowance must in many cases be limited by the strain which the job will safely stand. The material and thickness of the metal which surrounds the hole, the length of the forced shaft, etc., these points are in some cases governing considerations. As a general thing, however, in ordinary cases when it is not necessary to go to extremes, the given rule of .002 per inch of diameter may be used on all work up to about 4 in. For larger pieces a total allowance of .008 to .010 is about right, regardless of size. About .007 will make a 40-ton fit on a 4-in. axle. When the required pressure is specified the necessary allowance may be found as follows: Divide the pressure in tons by one and a half times the diameter in inches. The quotient will be the required allowance in thousandths. Thus, a wheel is to be pressed upon a 4-in. shaft at 30 tons: $4 \times 1\frac{1}{2} = 6$ and $30 \div 6 = 5$; .005 is therefore the allowance.

For driving fits, a total allowance of .003 without regard to size is good practice with pieces larger than $1\frac{1}{2}$ in. For smaller pieces apply the first rule given for pressure fits.

A shrink fit is usually made in cases which require the greatest possible binding effect. The allowance may be somewhat greater than for a press fit. Some railway companies shrink their locomotive tires on at 1/64 in. per foot of diameter. Others use double this amount or 1/32 in. per foot. It is probable that about .003 in. per inch of diameter will secure the maximum effect in any case.

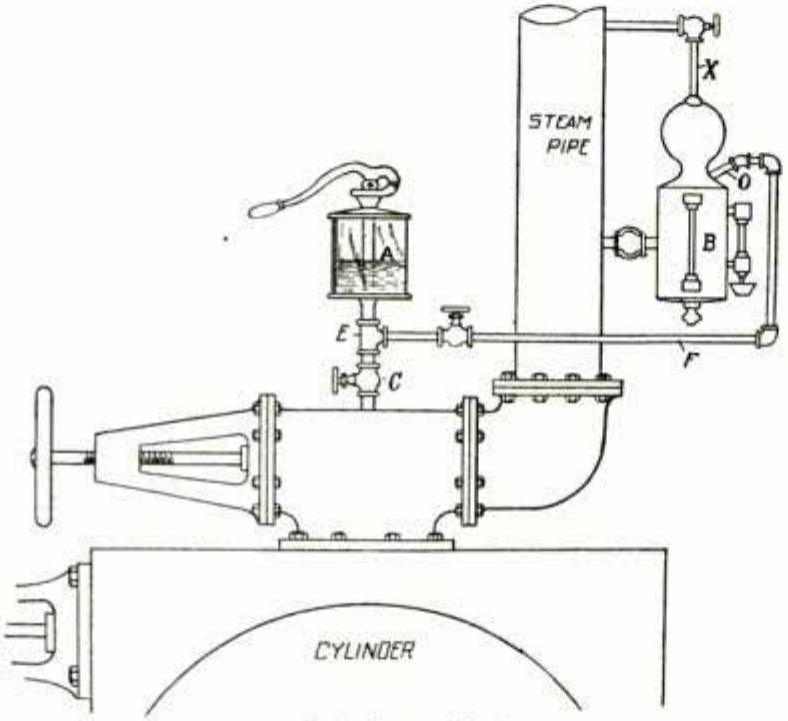
In making a press fit with an old wheel which has been previously pressed on and off, the foregoing rules do not apply. In this case the metal forming the circumference of the bore has been surface-hardened by the pressure to which it has been already submitted, and the force required to press the wheel on will be about double that required for new work, or, the forcing allowance may be reduced to one-half regular amount.—Contributed by S. M. Howell, Steubenville, Ohio.

A KINK FOR THE LUBRICATOR

The following kink may be old to some, but those having never tried it may use it with benefit.

Between the pump cup, A, and the throttle or steam-chest insert the valve C, and the tee E. In the ¼-in. pipe, F, insert valve, D. Pipe, F, taps the "fill-up" of lubricator B at O. Close valve C, open D and pump oil from A into lubricator. The condensed water is displaced by the incoming oil and rises through pipe X and is carried off into the steam pipe. Thus the draining of the lubricator is avoided.

In case of the failure of the lubricator and it is desired to oil cylinder by hand, close valve D, open C and pump oil direct to cylinder.—Contributed by Lee Boyer, Okmulgee, I. T.



Lubricator Kink

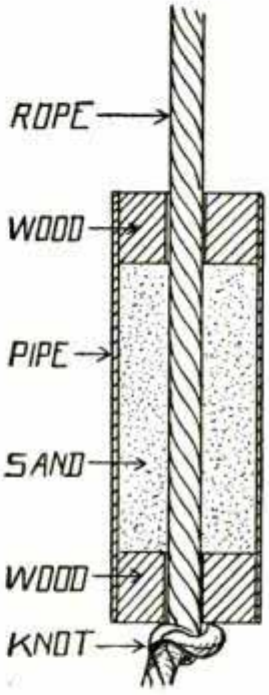
SIMPLE WAY TO FASTEN A ROPE TO A RING

Make an ample-sized loop by braiding the end of the rope into the rope. This may be done by passing the end of the rope, which should be untwisted, under every second strand, cutting a little out each time to make it taper. Then roll it on the floor with the foot and a neat job will result.

To attach to the ring simply pass the loop through the ring and slip the loose end of the rope through the loop. This gives two thicknesses of rope on the ring, is easy to put on and remove and as there is no knot, there is no loose end of rope to bother with.—Contributed by Paul McMichael, Hartstown, Pa.

COUNTERWEIGHT FOR DROP OR SLIDING DOORS

A cheap and good counterweight for drop or sliding doors or for tightener pulleys, may be made of a piece of 3-in., 4-in. or 5-in. gas pipe of any convenient length. Put a common cast-iron washer at one end, or a block of wood will do. Bore a hole through the wood and pass a rope through. Tie a knot in the end of the rope and put a block of wood corresponding to the first block at the other end of the pipe to hold the rope in the center of the pipe. If the weight is not heavy enough, fill the pipe with anything convenient, sand will do.—Contributed by F. A. Sustins, Stevens Point, Wis.

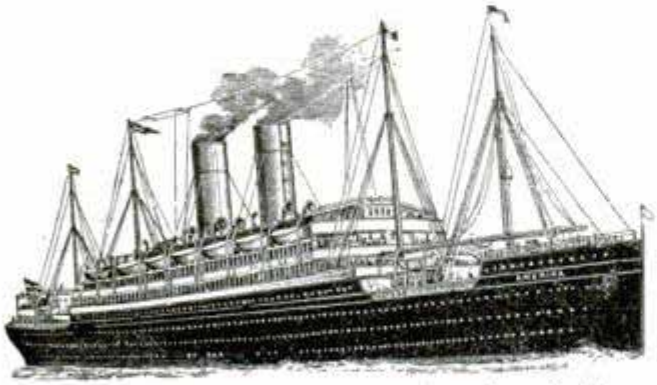


Counterweight

It is stated that an alloy consisting of 90 per cent copper, 6 per cent tin, and 4 per cent phosphor tin—containing 5 per cent phosphorus—has been found the best for castings for hydraulic purposes. The addition of two parts of lead makes the metal cut easier, but the castings are sounder and more uniform without it.

THE "AMERIKA"--AN ELECTRICAL STEAMSHIP

The "Amerika," the palatial steamship lately added to the Hamburg-American line, comes nearer being electrically equipped throughout than any other passenger steamer. Wherever feasible small motors are



An Electrical Ocean Palace; the "Amerika"

used to drive the machinery throughout the vessel, and in addition there are an electric elevator, electric call systems, a telephone exchange, with connections in all staterooms, electrically operated bulkhead doors (controlled from the bridge), a submarine signaling system, wireless telegraph apparatus, electric light, fans and baths. Electric ventilation is installed throughout and such minor details as boot-cleaning machines, barbers' brush machines, knife-cleaning machines, dough-mixers, etc., are all run by electricity.

The "Amerika" is a steel twin-screw vessel of a tonnage of 22,800. Her length is 670 ft.; beam, 74 ft.; depth, 52 ft. She has eight decks and her crew numbers 530, of whom 132 constitute the engine staff. Her speed is 20 knots.

PROFITABLE TREATMENT OF BLACK SAND

The placer gold miner has regarded black sand, from the earliest period in the history of the industry as an intolerable nuisance, interfering with the "clean up," and robbing him, despite all his care of an appreciable quantity of the finer gold in the operation of separating the precious metal from the dross collected in his sluices.

It has been reported, and never denied, that the foundations of the fortune of a California pioneer publisher, now dead, was laid from the gold which he patiently recovered from the black sand which he gathered from the miners of the camps in which he was located in '49. This he is said to have done by treating the sand with quicksilver in an old whisky barrel. However, he had few imitators, and most placer miners have been only too glad to get rid of the black sand that collected in their sluices in any way.

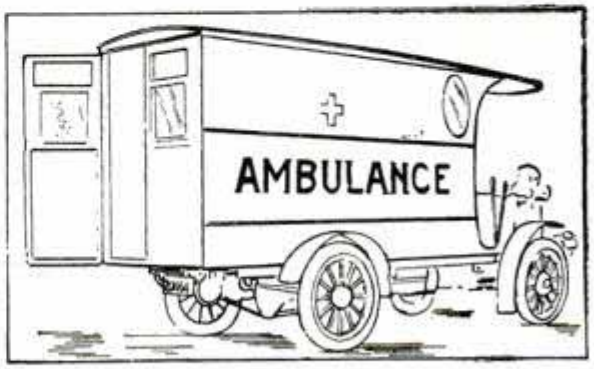
David T. Day, Chief of the United States Geological Survey, has recently made a series of examinations of black sand collected from various parts of the Pacific coast, with the view of ascertaining whether it possessed a commercial value.

The first discovery he made was that some black sands contained enough platinum to justify treatment for the recovery of that metal, which is now as valuable as refined gold. This has stimulated the search for platinum-bearing gold sands. Dr. Day's later discovery is that many of the Pacific coast black sand deposits contain a larger percentage of iron equal in quality to the Norwegian product.

In one experiment he obtained 683 pounds of iron from a ton of black sand. Whether these sands can be made profitable to mine and smelt must depend upon the volume of the deposits. Dr. Day claims to have discovered an economical method of treating them for the recovery of the metal. Just what it consists of, has not been made known yet. If crude petroleum can be used for smelting the ore, it will furnish a new market for the California output. Incidentally an existing industry would thus be materially helped through the development of a new one of equal importance.

MOTOR AMBULANCE

The use of the motor car for all purposes for which horse-drawn vehicles have been employed is steadily increasing. One of the latest, and best, is the motor car ambulance, which is now in operation in Syracuse and some other cities. The motor power enables the construction of large, heavy, easy riding vehicles, which can make twice the speed of horses. The ambulance illustrated



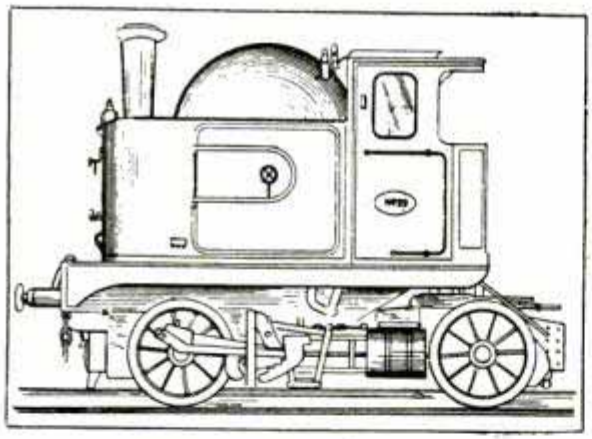
In Operation in Syracuse

has 16 h. p., weighs 2,700 lbs., and carries a large gong of peculiar sound, which readily distinguishes it from all other emergency vehicles.

The motor hearse is now the logical, and equally practical, sequence. When motor hearses were suggested two years ago, the idea was criticised as not in keeping with good taste. Such prejudice has rapidly waned, and the motor hearse will surely take its place in the near future.

A CURIOUS ENGLISH LOCOMOTIVE

English railways are devoting a good deal of attention to improving their suburban service. They are accomplishing this by means of a combined locomotive and passenger car, under one roof and operated by only three men; engineer, fireman and conductor. The power is a steam locomotive of unusual construction but which is not visible. A quick steaming vertical boiler is used, the fire-box of which is nearly round and made from one piece of pressed steel, with no seams or rivets exposed to the fire. The



Curious New Locomotive

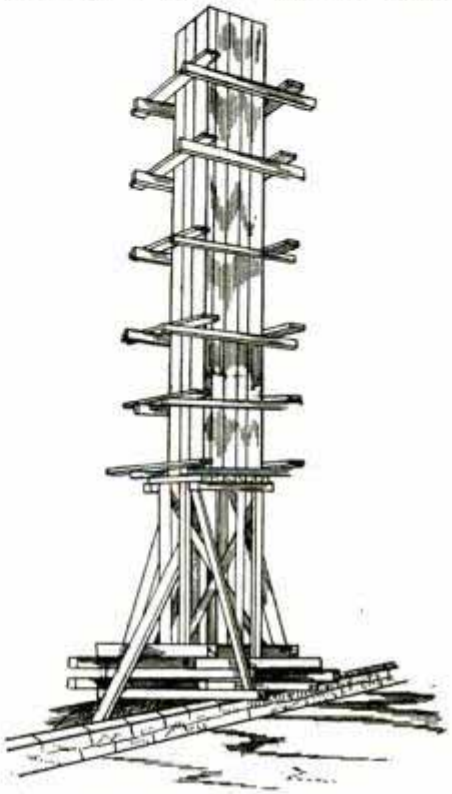
engineer can operate the car from either end; car seats 46 passengers. The Great North of Scotland Ry. Co. is using these cars.

BIG PAPER-MAKING MACHINE

What is believed to be the largest paper-making machine ever built has been finished in Edinburgh, and requires a special steamer for shipping it to Sweden, where it will be operated. The machine is 185 feet long, weighs 550 tons, and requires a 200-hp. engine to run it. Two sheets of paper, each 75 in. wide, will come through at a rate of 500 ft. per minute, or nearly 12 miles of paper an hour. The machine cost $73,000.

CONCRETE COLUMN TO BE TIPPED OVER TO FORM A DAM

At Victoria Park, on the Canadian shore of the Niagara river a remarkable dam is being built. It consists of a huge column of concrete 50 ft. high and 7 ft. 4 in. square supported on a trestle 20 ft. high. This



New Form of Dam Construction

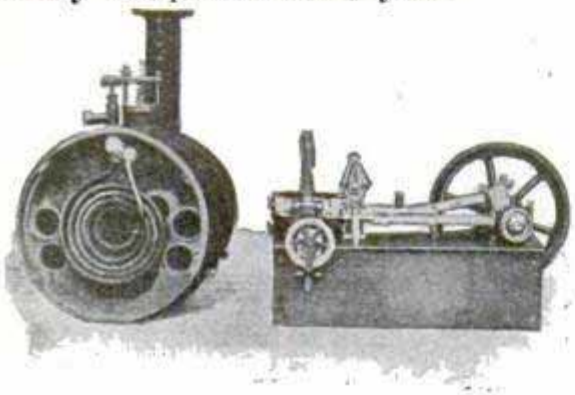
column is soon to be tipped over into the river to serve the purpose for which it was built, raising the water level at the intake there, which is the source of water supply for Niagara Falls, Ont., and for the Niagara Falls Park and River Railway Company.

Through the center of the concrete column runs a big chain of 800 lb. weight, and at intervals of 8 ft. in the column a wooden wedge a foot wide at the outside and tapering to 6 in. at the center is inserted. When the column is tipped over it will break at the points where these wedges are inserted and will be in six sections, held together by means of the chain through the center. The column weighs about 200 tons, and when prostrate will extend 20 in. above the river bank. An opening will be left between the dam and one river bank to carry away any ice that may be floated down-stream in front of the intake. The method of construction was recommended by Mr. Isham Randolph, consulting engineer of the Chicago Drainage Canal.

MECHANICS FOR YOUNG AMERICA

BUILDING AN ENGINE AND BOILER

A model engine and boiler were constructed by a correspondent of the Model Engineer out of what odd parts he could pick up at the junk store and the second-hand shop. The boy who tries his hand at building such an engine will find the work a source of both pleasure and profit that no ordinary occupation would yield.



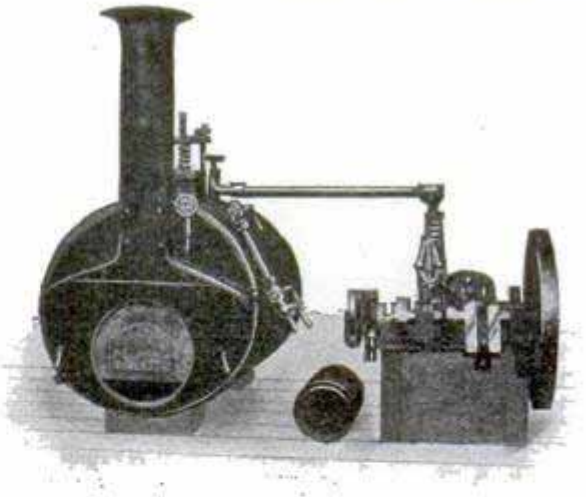
Model Engine and Boiler

The engine cylinder was bought at a second-hand shop. It was minus cover, steam chest and holding-down lugs; the steamways were but partially drilled out and one had a drill broken out. The builder had some chisels made and cut out the steamways oblong shape. Then he made patterns for the various missing parts of the cylinder and the remainder of the engine, and got castings in gunmetal. He also made all the studs, but bought the nuts.

The cylinder is lagged with felt and mahogany, fastened with two copper strips. The piston is packed with cotton. The guide-bars were cut from ⅜ steel plate; the cross-head is a steel forging; the connecting-rod is made from same pieces as guide-bars, but had ends forged; the big end of same is copied from a gas engine one. The crankshaft is built-up steel; the flywheel is iron with lead run into part of rim to balance crank; bearings are made of gunmetal; the eccentric is steel, and is made with a spigot; the strap is gunmetal recessed to fit spigot; the eccentric rod is cut from a steel plate. The base of the governors is gunmetal and forms a guide for valve-rod and bearings for vertical and horizontal shafts of governors. The balls were turned from brass rod, same piece as the oil cups were made from; the arms were made from horseshoe nails. The throttle valve was an old gas tap; the valve is so arranged if the governor belt breaks, or slips off pulley the steam is shut off the same as when governors are extended to their utmost; the engine is mounted on a ¼-in. brass plate, and the whole mounted on a hardwood box.

The donkey engine is intended to supply the boiler with water, which will pass through the feed heater, shown lying between the engine and boiler. This feed heater is made from an old beer pump. It contains seventeen ¼-in. brass tubes, 6 in. long inside. There are three baffle plates; the exhaust enters at the side at one end and goes out at the bottom at the other end; the position of feed heater is underneath bedplate, to which it is screwed inside of box.

The boiler is made of copper, 16 B. W. G.; the longitudinal seam is double riveted, the ends are single riveted. The furnace tube is brass, 14 B. W. G., and contains

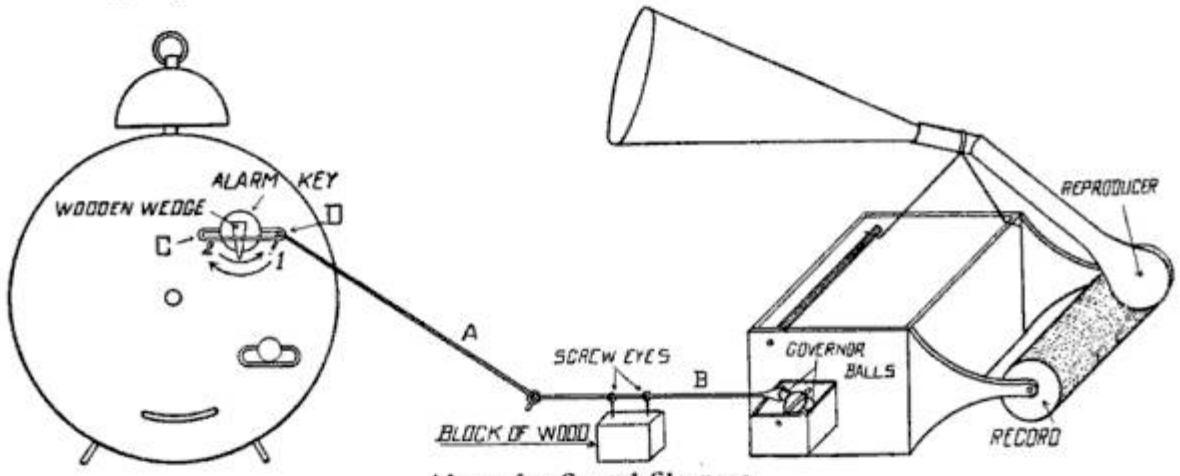


Engine and Boiler Connected

eighteen ⅜ water tubes. The six return tubes are brass, 1¼ in. diameter, 18 B. W. G.; the smokebox is sheet brass bolted to end of boiler; chimney is sheet copper with a brass top; rivets are ⅛ in. diameter and ½ in. pitch. All seams and joints are sweated with soft solder after being riveted and expanded. The water gage is ¼ in. diameter and is home-made. The back

pressure valve is made from a swing gas bracket, as is also the stop valve; the safety-valve is also made from scrap, except spring; the pressure gauge was bought.

The superheating coil is ⅜ in. diameter (copper), 6 ft. long; steam is led from dome inside of boiler. Boiler is covered with asbestos millboard, fastened with fourteen brass hoops. The furnace is fitted with fire-bars, and is adapted to burn coke or oil. Below is given particulars of the boiler and engine. Boiler: Length over all, 18 in.; length water space, 16 in.; diameter of water space, 10 in.; diameter of furnace tube, 5 in.; diameter of return tubes, 1¼ in. diameter of water tubes, ⅜ in.; diameter of safety valve, ⅞ in.; capacity of boiler to working level, 2½ gallons. Engine: Cylinder diameter, 1½ in.; cylinder stroke, 3 in.; crankshaft diameter, ¾ in.; bearings, diameter, ⅝ in.; bearings, length, ¾ in.; flywheel diameter, 8½ in.; weight of engine, 9 lb.



Alarm for Sound Sleepers

IMPROVED ALARM FOR A SOUND SLEEPER

This device is a combination of the ordinary alarm clock and a graphophone and is warranted to arouse the soundest of sleepers.

Insert a wooden wedge between the brass block of the alarm key and the ring of the key so that the ring will not drop down. Bend each end of a piece of wire 9 in. long up ¼ in. (A). Shape a wire (B) 3 in. long with an eye at one end and flattened at the other. Connect up these wires with the clock and the graphophone as illustrated, filing a notch in the governor balls to receive the flattened end of wire B. On wire B hang a wooden block by means of screws with eyes just large enough to fit over the wire easily.

When the correct distance between the clock and the graphophone is ascertained, make dents in the shelf for the clock legs so that it may always be placed in the right spot and so it will not slide around when the alarm goes off.

To operate the device, place a record on the mandrel, wind machine sufficiently to play the one record, then place the flattened end of wire B in the notch in the governor ball and release the starting lever so that the machine is free to start when the alarm key pulls wire B out of the notch. Turn the alarm key around one-half of one revolution in the direction of arrow 2 so the end of the key marked C will occupy the position now occupied by the end marked D. Hook wire A into the ring of the alarm key and the eye of wire B. When the alarm goes off the key will turn in the direction of arrow 1 and pull wires A and B, thus starting the graphophone.—Contributed by Chas. E. Frary, Norwalk, Ohio.

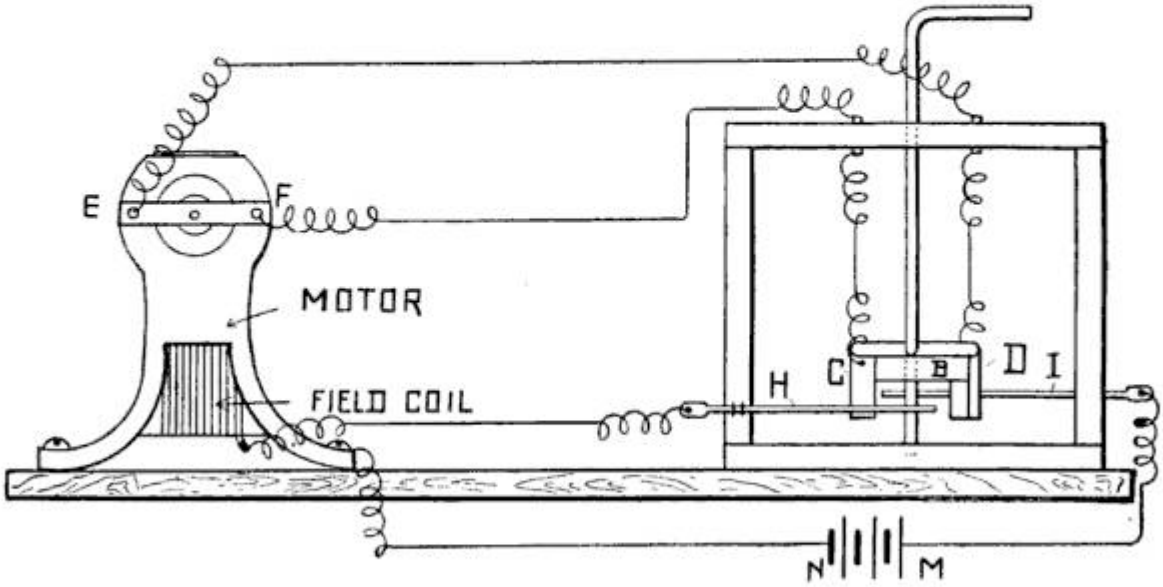
A SIMPLE REVERSE FOR A SMALL MOTOR

A simple and satisfactory reverse for small motors may be made as follows: Make the frame of the reverse as shown in the illustration of wood 1 in. wide. Cut out a wheel, B, about 1¼ in. diameter, and run a rod through it. To this wheel fasten two copper plates (C and D) at opposite sides. Connect C with F, and D with E. Make two brushes, H and I, by taking the insulation from some telephone wire; fasten the brushes as shown, so that they will not foul the wheel. Bend the brushes in a little, so they will make better contact with the copper plates. Then connect I with M and N with A.

By this arrangement the current is run from A through the field coil, from which it flows to brush H. Turn the wheel so that C and H are in contact; the current will

then flow to brush F and out at E. As E is connected with plate D and D with I the current is formed from I by connection with the batteries.

Turn the wheel so plate D is in contact with brush H, and plate C will be in contact with brush I. This sends the current to the other brush, E, and consequently causes the motor to reverse. If the directions are followed carefully the reverse is certain to be a success.—Contributed by G. Delaplaine Hall, Water Witch Club, Highland, N. J.



Reverse for Small Motor

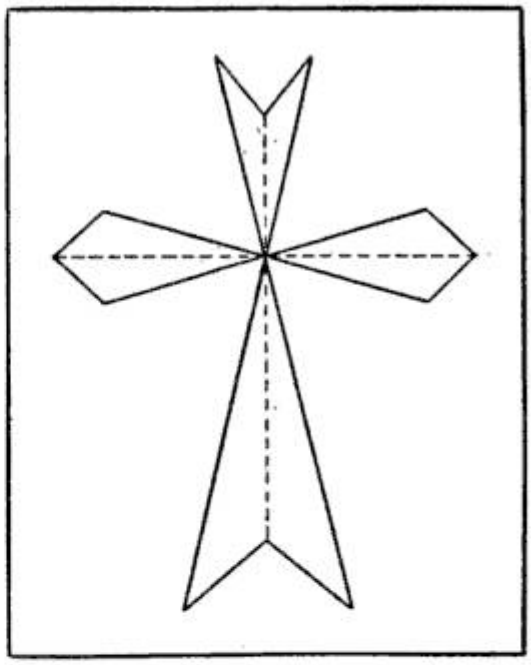
TO MEND PUNCTURED TIRES

Any boy can mend his own bicycle tires when punctured. All he requires is a teaspoon, a piece of rubber cut from an old inner tube (which will cost only a few cents), five cents worth of benzine and a small piece of sandpaper. It saves time to get all the materials together before beginning to repair the tire.

Make a gum for sticking the rubber together by cutting a piece of rubber ¼x¼ in. into small bits and pouring a little benzine over it. Put in a bottle and let stand five hours. To remove the tire from the wheel run the handle of the teaspoon around the rim under the tire and lift off the outer tube on the side; then pull the inner tube partly out and loosen it all around until you come to the valve. Knock the valve in and the inner tube will come out easily. To locate the puncture put the tire blown up in a basin of water and note where the bubbles rise. Dry the tube well with cloth and rub the leaking place and also the rubber for the patch with the sandpaper. Apply the gum freely to leak and patch and wait a minute till the benzine evaporates and the surfaces become sticky. Then press the patch firmly over the leak and leave to dry ten minutes. Put the tube in the covering, setting it well in the rim and inflate it.—Contributed by Willie Hare, Petrolea, Ont.

AN OPTICAL ILLUSION

Learn to train the eye to accuracy. In the accompanying illustration the horizontal dotted line appears shorter than the vertical



dotted line, when, in fact, they are of exactly the same length.

"I'm Well

Because of Liquozone," is a Tale Told Everywhere

In almost every hamlet—every neighborhood—there are living examples of what Liquozone can do. Wherever you are, you need not go far to find some one who has been helped by it.

Talk to some of those cured ones; perhaps your own friends are among them. Ask if they advise you to try Liquozone. Or let us buy you a bottle, and learn its power for yourself. If you need help, please don't wait longer; don't stay sick. Let us show to you—as we have to millions—what Liquozone can do.

What Liquozone Is

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

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

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

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

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

Where It Applies

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

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

Also most forms of the following:

Kidney Troubles	Liver Troubles
Stomach Troubles	Women's Diseases

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

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

50c. Bottle Free

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

Liquozone costs 50c and $1.

CUT OUT THIS COUPON

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

My disease is.....

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

.....

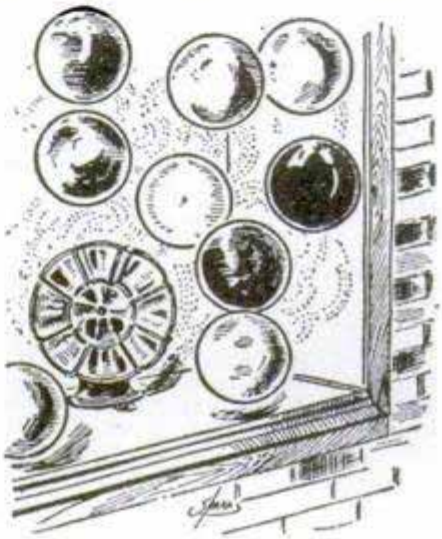
.....

.....

M341 Give full address—write plainly.

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

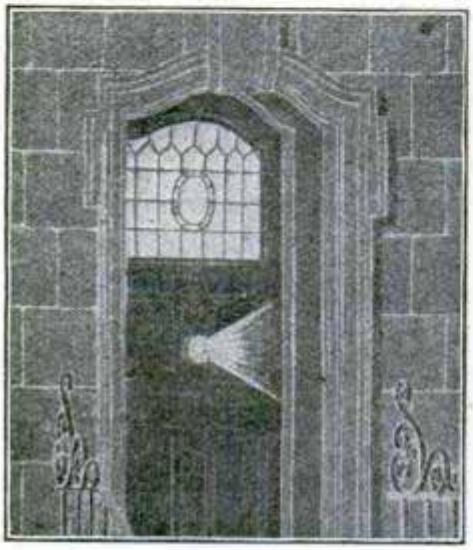
BALLOONS FOR SHOW WINDOWS.—Almost any moving thing, however simple in itself, will attract attention when placed in a store window. Print-



ers' Ink tells of a crowd that watched the antics of a dozen toy balloons placed loose in a show window and made to bounce and tumble in all directions by means of an electric fan.

In the center of the arched roof of All Saints' Church, Sedlitz, in Bohemia, hangs a chandelier constructed entirely of human bones. The church in which this remarkable object is suspended is decorated from the floor to the ceiling with the blanched bones of human bodies.

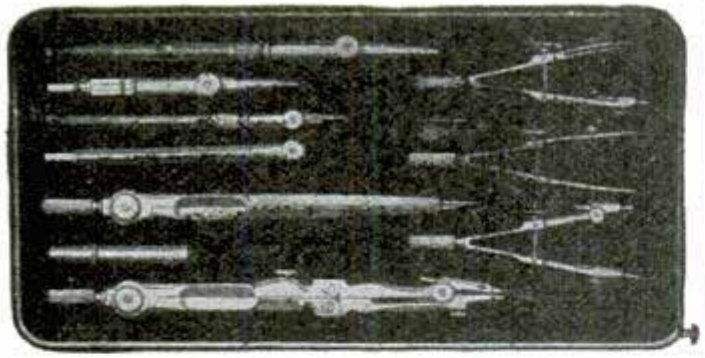
TRANSPARENT BELL PUSH.—A recent English invention so constructed that light from within the house shines through the bell-push making it



easy to locate the push at night. The idea seems to be an entirely new one and is said to meet with favor in London.

ELECTRICAL GARDEN PARTY.—What was probably the largest garden party ever given recently occurred under the auspices of the Men's Welfare League, an organization of employes of the Dayton, (O.) Cash Register Co. The electrical illuminations were unusually extensive for a single night's entertainment, and included the lighting and decorating of 400 acres. In putting in the apparatus there were used 59,347 feet of wire of various sizes, 33,898 candle power in incandescent lamps, 3,300 weather proof sockets, 1,850 receptacles, six gallons of lamp coloring and 50 pounds of tape. A dancing platform, 70 x 80 ft. was lighted by 280 eight-candle power and 140 four-candle power incandescent lamps. The main entrance was lighted with 350 four-candle power lamps. Eight large electric signs advertised refreshment booths within the grounds. There were 12 electric stereopticons in operation.

Twenty-five thousand lanterns from Japan and five thousand flower-lamps from Brussels were used in the decorations. Among the Japanese lanterns were thousands of celluloid globes, red, blue and yellow in color. These were hung together in great clusters, like bunches of grapes, and were swung from the limbs of trees. Two miles of hedges were illuminated.—Contributed by Ohio Press Bureau.



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Write for particulars about our new Mechanics Steel Tape Rule.

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TELLS in an instant "Which Way" your work is out. See? It is the size of a silver dollar and three-eighths thick. Nicely nickeled and polished. To introduce it, will mail one for 50 cents in stamps. Caliper Catalogue free.

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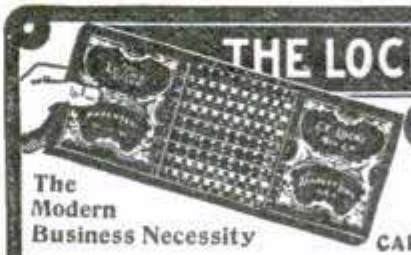

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Gents' Hunting Case, with Elgin or Waltham 7 Jewel Movement.

Same Movement in Silverine Case	$5.45
Ladies' Size, 20-Year Gold Filled Case, same grade movement	9.90
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Remit by P. O. or Express Money Order or Bank Draft payable to our order. Money refunded if goods are not satisfactory.

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All Year Tourist Rates and Homeseekers' Excursion Rates

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578 Miles Shortest 22 Hours Quickest

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Summer 63 deg., winter 53 deg. Fahr.

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All agents sell tickets via this route.
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OL16

CHIPS FROM THE "WOOD-WORKER."—A good engineer is frequently not properly appreciated till after a poorer one has his job, and then it's generally too late to do him any good.

Ten per cent more steam pressure can sometimes put a factory in shape to pay ten per cent more wages without increasing the cost of its product.

The best fireman is not necessarily the one that can burn the most fuel in the furnace in a given time. The purpose of a fireman is to make steam, not just to see how much fuel he can burn.

BORN OBSOLETE.—The new battle ship "Mississippi," launched recently, is pronounced "obsolete" already by the naval experts. This is no joke. They mean it. In reaching the "obsolete" class before she ever touched the water the "Mississippi" beats all records, ancient and modern. The ship's cost is about $7,000,000. The money is worse than "obsolete," apparently, but there's no help for it.—Springfield (Mass.) Republican.

LIFTING SUNKEN VESSELS BY COMPRESSED AIR

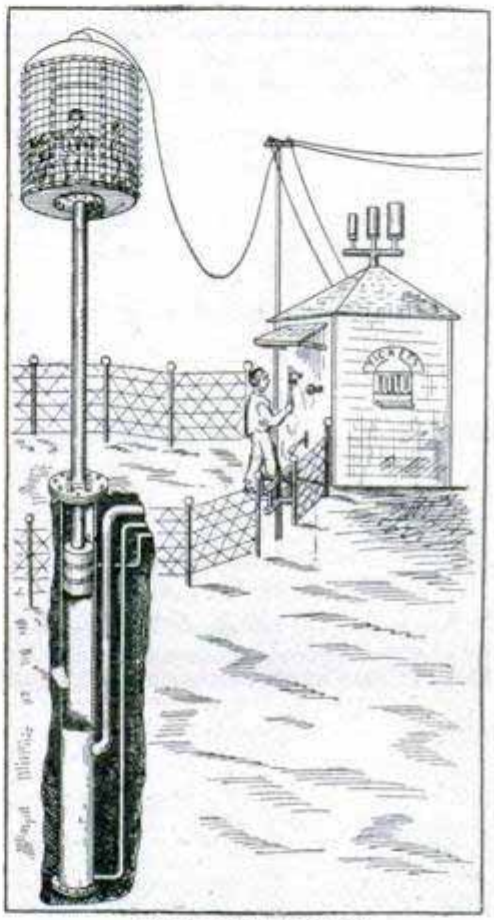
A wrecking apparatus for raising sunken vessels from the bottom of the sea, invented by Nicholas Ielpo and patented by the Italian government has been tested by the task of raising a barge loaded with building material which went to the bottom four years ago. The wrecking apparatus handled the barge easily and is declared a success.

The device consists of a series of elliptical chambers made of thick rubber and water proof canvas, which are filled with air compressed in the usual manner. Each chamber has a lifting power of 60 tons.

The battleship "Rhode Island" in her trial trip recently, made a speed of 19.33 knots an hour for one mile. The mean time for the twelve runs over the course was 18.93 knots an hour.

"DROP THE DROPS" THE LATEST AMUSEMENT DEVICE

Among the new amusement devices that will be put in use next summer is "Drop the Drops." This is a dropping machine, which will give the occupants the true falling sensation without the disastrous results which accompany most falls, so that they may live to tell their friends of it afterwards. The device consists of a circular car which holds fifteen or twenty passengers and is elevated in the air from 50 to 75 ft., and on reaching that height the air is automatically released and the car drops, and when about 20 ft. from the ground the piston begins to compress the air in the cylinder and

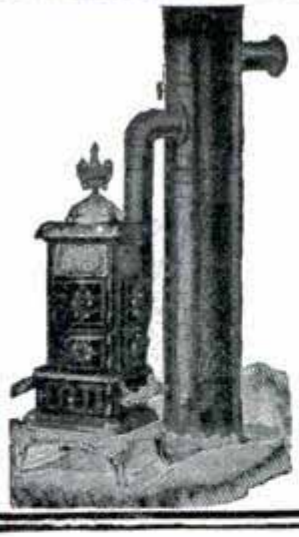


"Drop the Drops"

brings the car to a gradual stop about two or three feet from the ground, and on doing so the compressed air in the cylinder reacts and forces the car up again. This takes place three or four times until the car comes to a rest about ten feet from the ground and can be gradually lowered by allowing the air to escape and thereby allowing passengers to come to the ground safely, no worse for the unusual experience they have gone through. While the car is descending the escaping air blows the chime of whistles. This device is the invention of Chas. I. Matson, 614 N. Leavitt St., Chicago, Ill.

THE INVENTOR OF THE WATCH

Peter Heinlein, the inventor of the pocket watch, was persecuted for witchcraft in the days when he withdrew from his companions—in particular, his wife—to work on his invention. He was finally cast into prison, where the watch was perfected. Later he was tried for murder, but escaped by paying the family of his victim a large indemnity. He then retired to the convent of the Carmelites, where he continued manufacturing watches, giving the proceeds to the order. He died in 1546. At Nuremburg, the scene of his persecutions, a monument has been erected to him.



STERLING AIR HEATING RADIATOR

For Home, Store, Office, Factory, School, Church, Hall, Depot, Hotel, Etc.

Easily attached to any STOVE, RANGE or FURNACE using any kind of fuel. **Doubles the heating capacity or saves 50 per cent of fuel expense.** Insures warm floors, uniform temperature, **continuous circulation**, comfort and health. From 50 to 90 per cent of the heat usually escapes up the chimney and is utterly lost.

The Sterling Radiator saves and utilizes this heat. Can be used in adjoining room or in room above stove with excellent results. Constructed on scientific principles. Does not interfere with draught. Always satisfactory. Nothing like it. Neat. No other radiator that will admit of comparison. **Agents and dealers wanted. Write for full description and terms.**

STERLING AIR RADIATOR CO.

57 Wabash Ave., CHICAGO, ILL.

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SEE THAT BALL?

This New All-Metal-Ball-and-Socket-Swivel-Joint HORN CONNECTION will positively improve your PHONOGRAPH or GRAPHOPHONE. Fits all Edisons and new Columbias. **Price 50 C'ts Postpaid.** —KREILING & COMPANY— —Inventors and Sole M'f'rs.— 855 N. 40th Ave., CHICAGO.

A SPEED DIAL showing how fast your Phonograph runs given free, if you send us your name and address.

Iron Box Bell Sale

Our special sale on bells this month only. A 40c bell for 30c each. A 3-inch gong, well made, with German silver contacts. Will ring one cell of battery. If sent by mail 15c extra.

Smith Electrical Supply House
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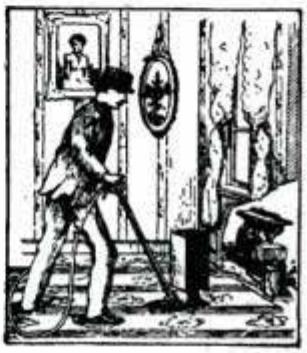
Clean House With Air



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We have complete outfits for residences of any size, summer homes, camps, hotels, schools, launches, yachts, etc. Every detail included; very best material; absolutely practical. So simple no electrician required. **Light all the time,** as storage battery included. **Gas, Gasoline or Steam** engines used give plenty of power for pumping water, sawing wood, refrigeration, etc. We would like to send every reader of Popular Mechanics who is likely to be interested our new 60-page Catalogue describing over 130 different outfits. Address

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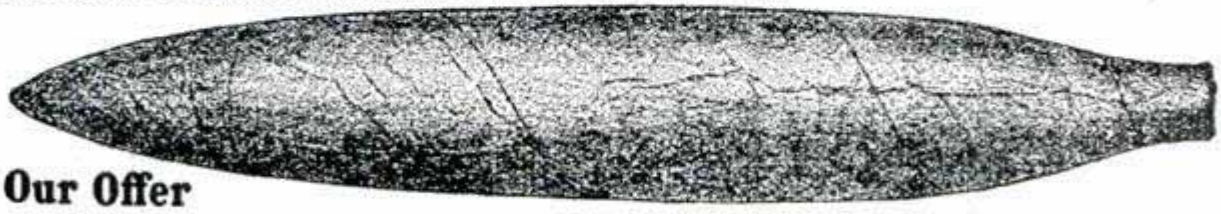
RICHARDSON ENGINEERING CO., Hartford, Conn.

WANTED Men and women to demonstrate and advertise. Salary **$3.00** per day. Expenses advanced. **Ideal Cutlery Co., Desk B, Chicago.**

AGENTS WANTED Sell 81 bottle Sarsaparilla for 35c; best seller; 200 per cent profit. Write today for terms. **F. R. Greene, 115 Lake St., Chicago**

PALMER HOUSE CIGARS

If you are a judge of cigars and know the delicate flavor of Genuine Havana, we want you to send for a hundred Palmer House Cigars. We are making this offer because we want every smoker in America to try this cigar. We want to prove to you that you have been paying too much for your cigars. You can save two thirds of your cigar money and have a better smoke than you have been paying 10 and 15 cents for over the counter. If you are a particular smoker and buy a cigar, not for what it costs but for its satisfaction and enjoyment, then you will become a permanent smoker of the **Palmer House.**



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$3.80

Our Offer

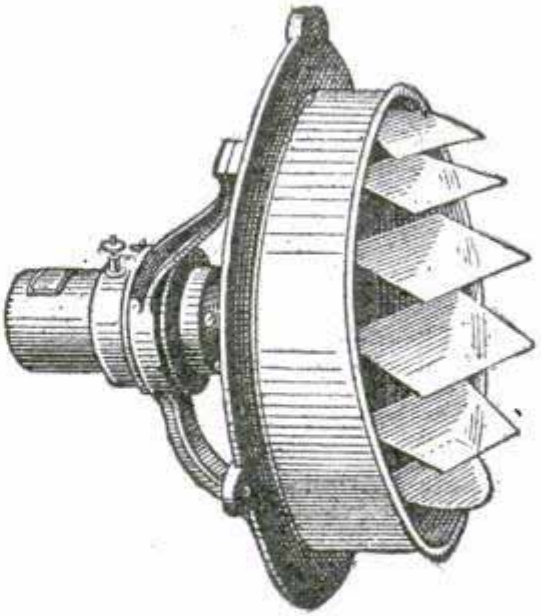
If you are a business or professional man, write us on your business paper or accompanied by your business card and we will send you express paid, **100 Palmer House Cigars.** *You can smoke* **10** *of them, if perfectly satisfactory, send* **$3.80.** *If not satisfactory return them at our expense. If not in business send* **$3.80,** *and we will send them to you express paid. If not satisfied after smoking* **10,** *you can return the balance at our expense and we will return your money without a word, or you can return C. O. D. to us.*

We simply want to give the cigars a chance to sell themselves. We could not do this unless they were made so good that the smoker will not only be pleased with them but will **come back** for more. We save you the wholesale and retail dealers' profit.

Palmer House Cigars are long filler, clear Havana. Londre shape cigars, The same size and shape as cut. The tobacco is rich and yields a smooth, mellow, delightful smoke. In ordering state whether you prefer strong, medium or mild cigars. Address,

PURITY CIGAR COMPANY, 92 Market Street, CHICAGO, IL L.

SELF CLOSING FAN.—A Berlin firm is making an electric exhaust fan which automatically opens when the fan starts and closes when the fan ceases



Automatic Closing Fan

to revolve. This prevents the entrance of cold wind and rain when the fan is idle.

THE BORING OF THE OX BOW TUNNEL in Idaho is one of the great engineering feats of the age, says the Scientific American. The Payette river at this point makes a loop, and by putting a tunnel through 1,200 feet, the river bed is left dry for two and a quarter miles. It is the intention to mine the river bed for gold. Experts have estimated its value at from $6,000,000 to $42,000,000. Ordinarily, the putting through of this tunnel would be a simple matter, but at 300 feet from the upper end and 250 feet from the lower, hot water was struck. The heat at first was from 95° to 105°, increasing as the work progressed to 132° at the hottest point. Different fans and blowers were experimented with to cool the air in the tunnel, but without success until William Flick, the superintendent of the work, thought of spraying the walls of the tunnel with water pumped from the river. Very simple pumping apparatus and common garden sprays were used with complete success. The tunnel is 28 feet wide and 9 feet high, and the flow of hot water amounted to 75 miner's inches. The cold water so cooled the hot water that it was caught in sumps and pumped out with common pumps.

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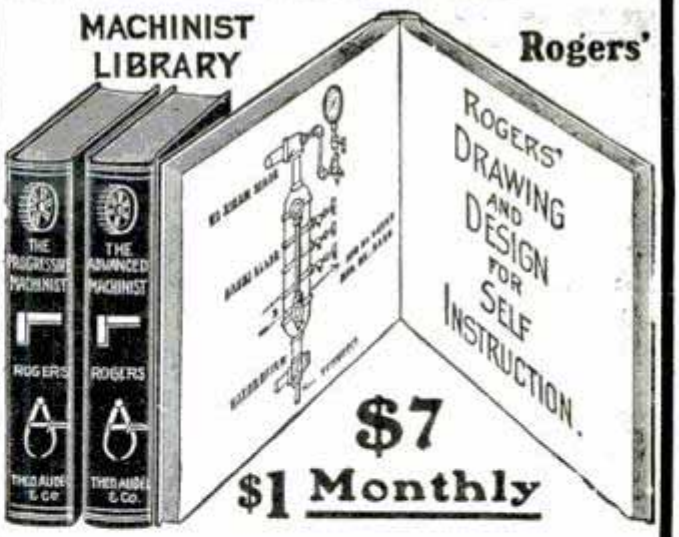

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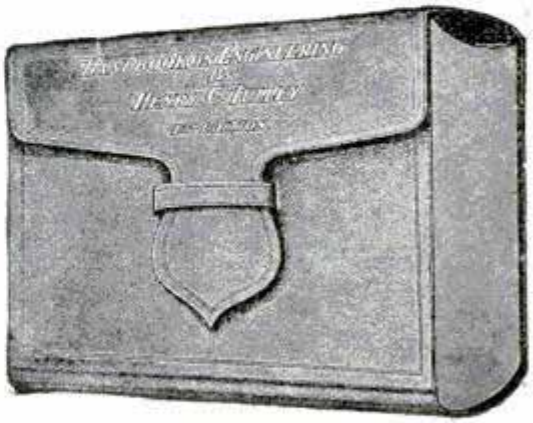

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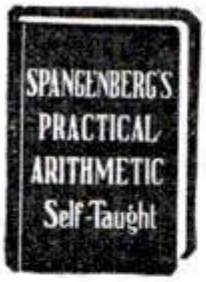

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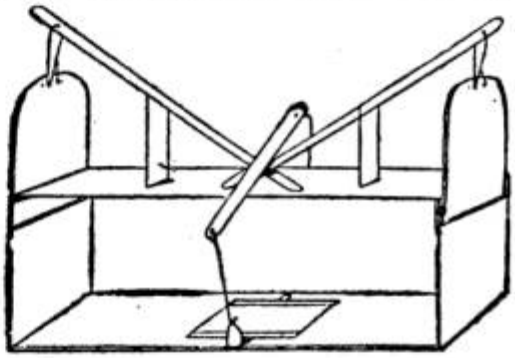

runs. These traps may be made of any required size, and some of the larger ones are constructed with a small wire cage suspended above the trip, in which a live bait can be put. An all metal trap of this type could be cheaply made, would weigh but little, and ought to serve well for many species of predatory animals.

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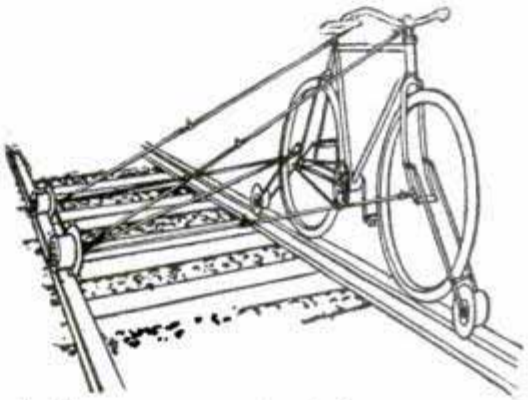
RAILROAD BICYCLE ATTACHMENT.—There have been several attachments for bicycles to enable their use on railroad tracks. This is one of the most recent and is said to be entirely successful



owing to the arrangement of the cross braces and the 4-wheel guides which permit a high speed without danger of jumping the track. Can be attached to any bicycle and does not materially increase its weight.

PRIZE FOR SAFETY PETROLEUM LAMP. The Great Grocery Exhibition, London, is offering for the fifth time a prize for a safety lamp using mineral oil. The lamp must not cost over 50 cents and must not be more dangerous than a common candle, regardless of any ignorance or carelessness.

NIGHT DIAL FOR TELEPHONES.—Where automatic telephones are used and the instrument is placed where the numbers cannot be read at night, it is proposed to use an illuminated dial. A small electric lamp is placed behind the dial so the light shines through, making plain each figure. A small battery, like a flash lamp, supplies current, which can be arranged to turn on by means of a switch or by taking down the receiver.

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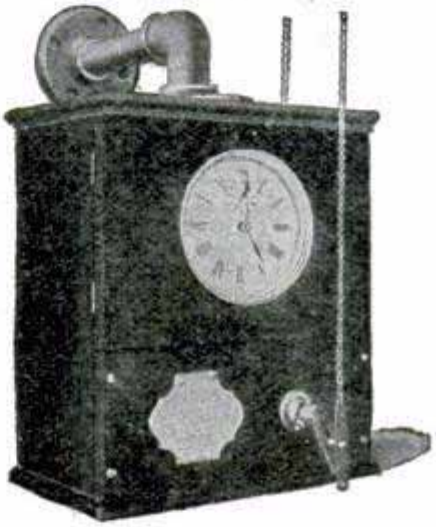

morning, and when that moment arrives your furnace will open up and go to work. We have frequently described home-made devices of this kind; this is the first one we have seen put on the market and the low price at which it is sold now places within the reach of everybody one of the greatest possible conveniences.

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AUTOMANIA.—A lunatic-asylum keeper in an eastern watering-place not far from Newport, R. I., was showing the regulation inquisitive visitor about the plant. A large room with about twenty cots was reached, but the place seemed empty.

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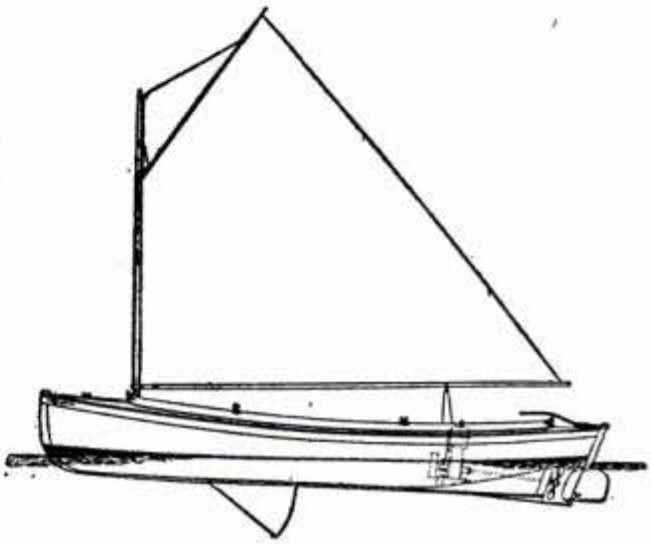

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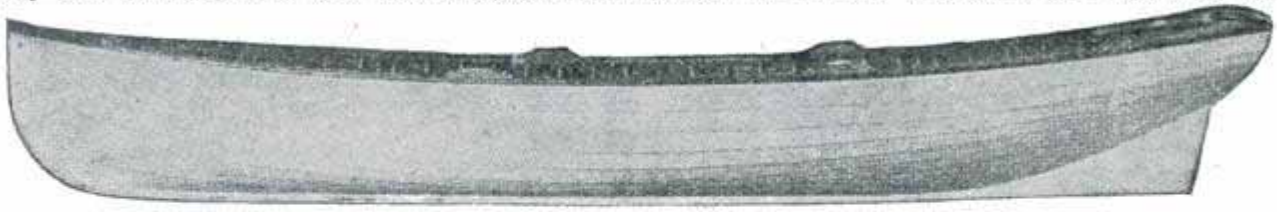

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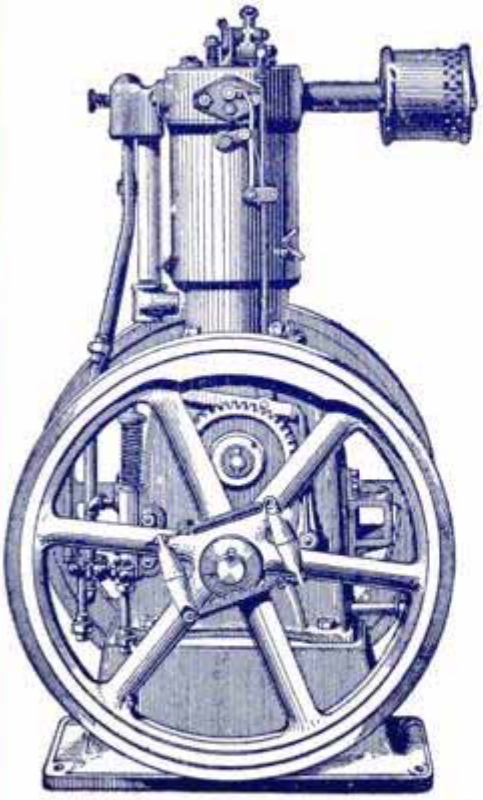

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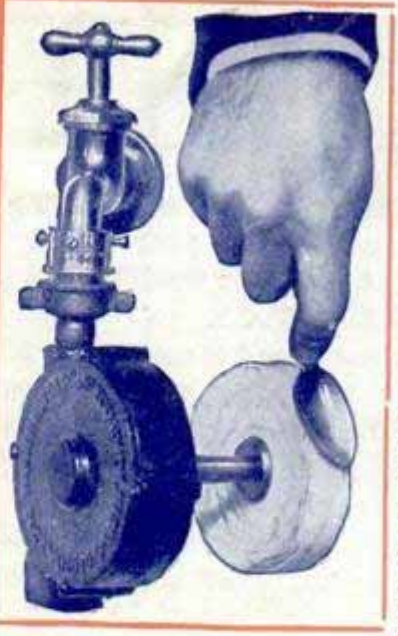

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