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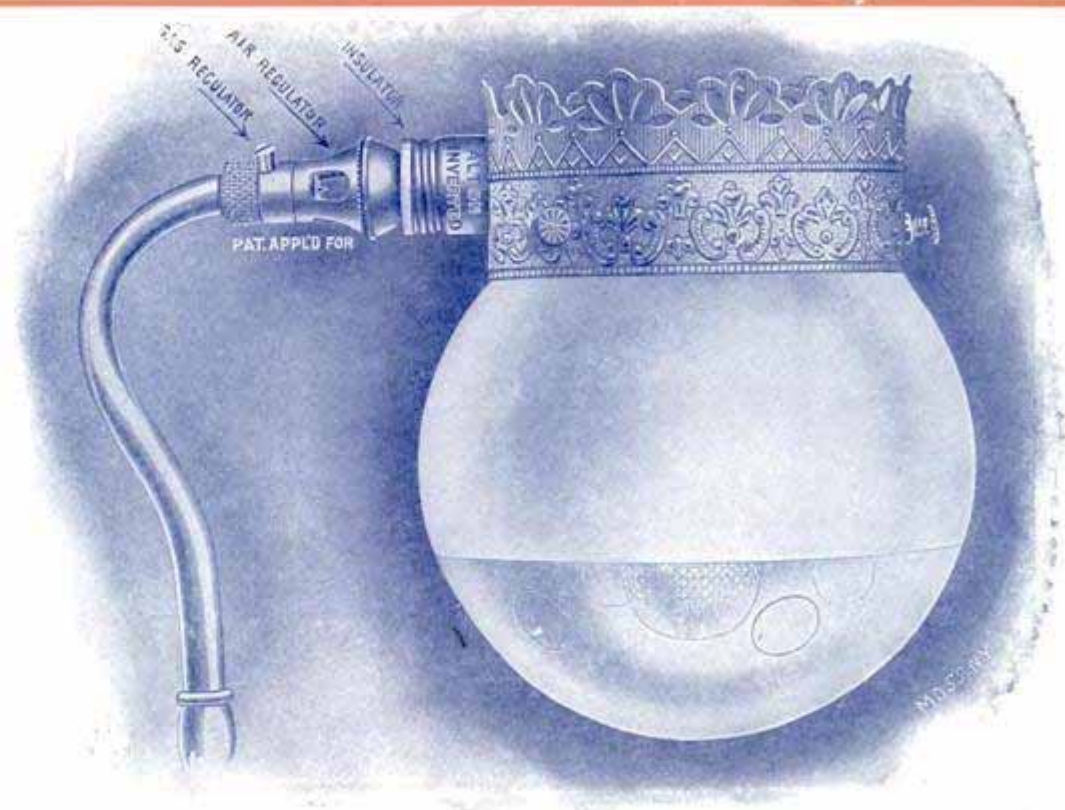
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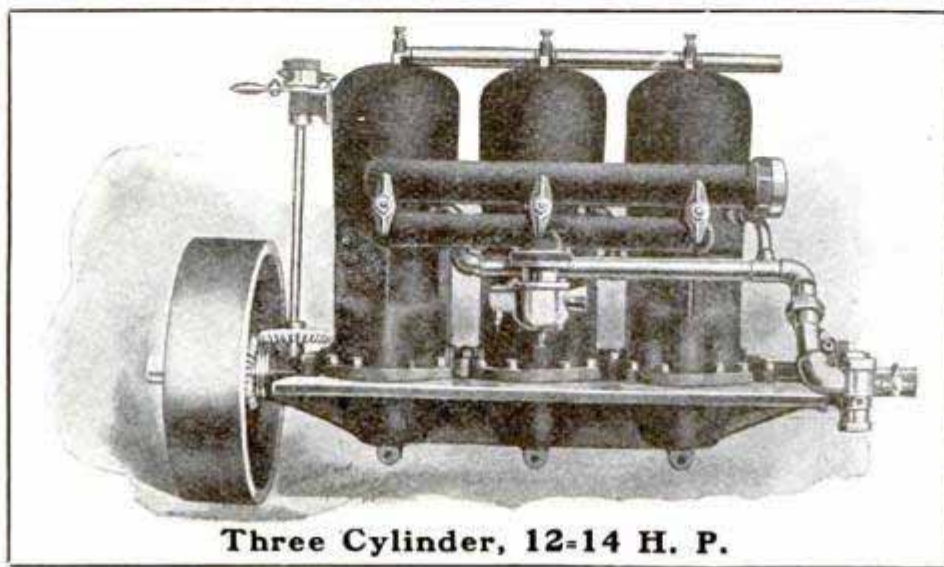
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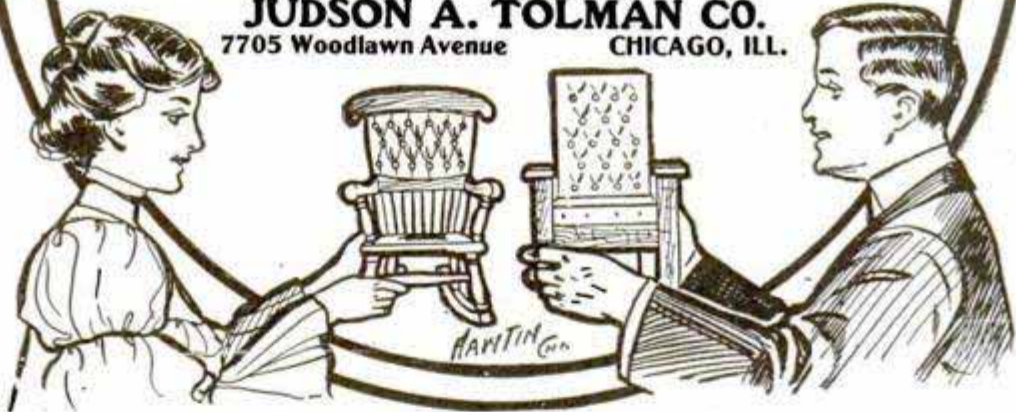
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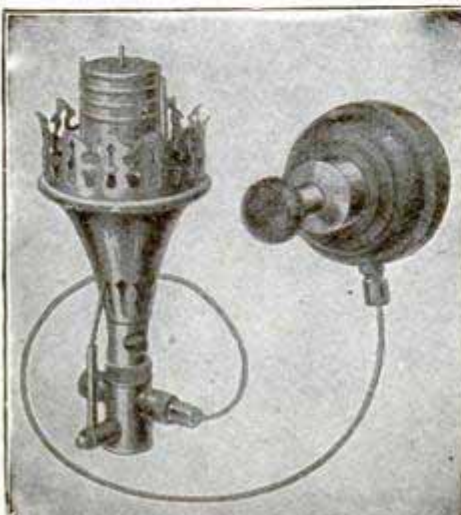
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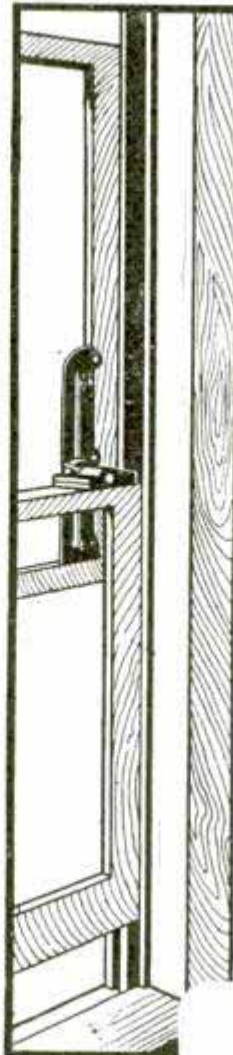
Bench 4½ ft. long, 32 inches high, 20 inches wide—fitted with a 13-inch glued up maple top 1½ inches thick, with 7-inch well for tools, fitted with two vices. Back board and tool rack as shown in illustration. Frame, glued up top, vices and tool rack all made of hard maple.

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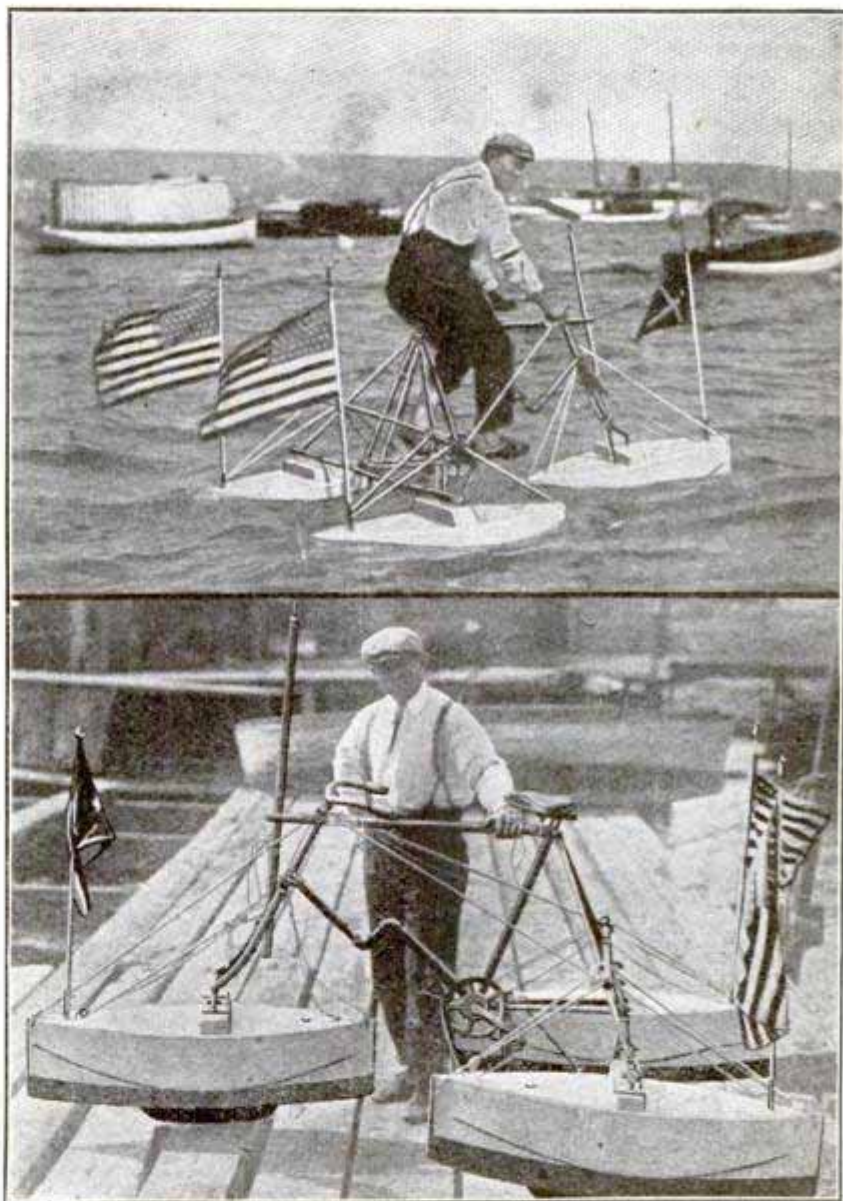
BICYCLE BOATING GREAT SPORT

These Machines Will be Seen in Large Numbers This Year

The bicycle boat which in one form and another has appeared at intervals during the past 10 years, seems likely to become quite popular next season. The ease with which a small gasoline motor can be adapted as the motive power, thus making a water "motorcycle," opens up a new type of outdoor sport which has great possibilities.

A recent bicycle boat built by a stage carpenter in New York is shown, and will prove suggestive to any of our readers who wish to build one for themselves. This machine is 8 ft. long, 5 ft. wide, is reversible, and weighs 60 lb. The propeller is a 10-in. wheel; 3-bladed. Provision is made for a small sail to be carried by a tube attached to the head of the frame. This boat will be equipped with power and exhibited at the sportsmen's show in New York.

The pontoons are of galvanized

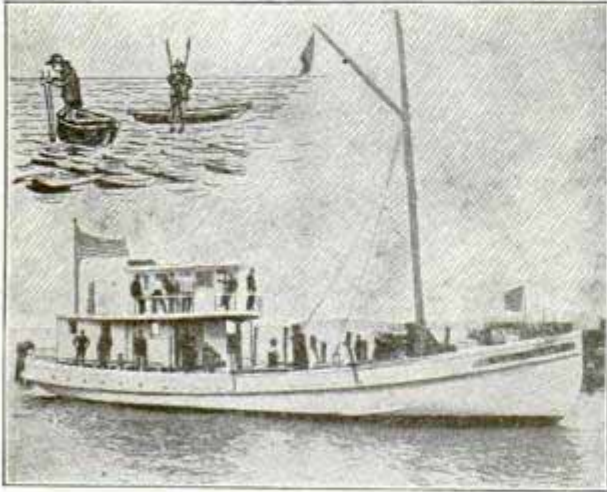


The Bicycle Boat is as Handy and Safe on Water as the Ordinary Bicycle is on Land. A Small Motor can be Easily Attached, Affording a Speed of 10 Miles an Hour.

iron which can be made at any tin-shop; those in the illustration are each 4 ft. long.

OYSTER FISHING BY MACHINERY

Instead of the tedious operation of manipulating the old-fashioned oyster tongs, which resemble two rakes hinged together, the shell-fish are now



The Old and New Way

brought up at the rate of 3,000 bu. a day by means of dredges. The modern oyster boat shown in the illustration is equipped with four dredges operated by a 100-hp. gasoline engine, which is also used for propelling the boat when not running the dredges. The boat has a carrying capacity of 3,500 bu. of oysters.

RAILROAD AUTOMOBILE TRIP

Chas. J. Glidden with his wife and party of friends are making the trip

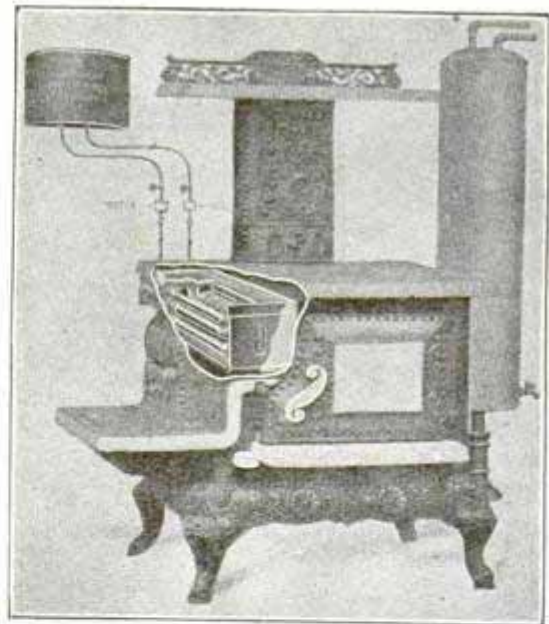


Auto Leaving Chicago

from Chicago to the City of Mexico on railroad tracks, his auto having been equipped with heavy flanged iron wheels. The machine will, of course, furnish its own power, and the car will run as the second section of a through passenger train under orders from the train dispatchers. Two years ago Mr. Glidden made the trip from Chicago to the Pacific coast in the same manner and found no difficulty in keeping up with the passenger train ahead. The steering gear is fastened, as the flanges guide the car.

OIL BURNER FOR RANGES

By means of a new device oil and water can be burned as fuel for cook stoves. The plan includes a tank divided into two compartments; one of which contains the oil, the other water. Small pipes lead to the burn-

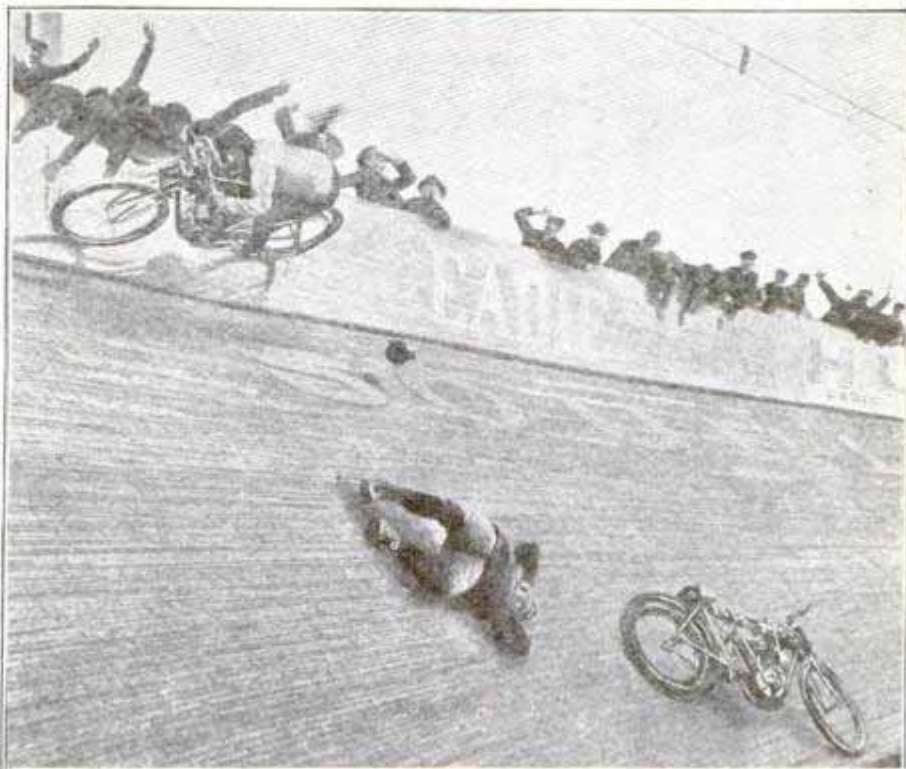


Oil-Water Burner

ers in the stove. The oil pipe is first opened quickly, heating the vaporizer in which the oil and water are converted into gases and mixed. An intense heat is produced which can be regulated as desired. The process is perfectly safe and can easily be applied to any stove.

MOTORCYCLE RIDES A WALL

A most remarkable demonstration was made on a race track in Paris where two motorcycles were running at 50 miles an hour. Owing to an accident to one of the machines its rider was thrown, and to avoid running over him, the other rider turned his machine so suddenly that it left the track and climbed the palisade. After running 100 ft. with the rider and machine in a position almost horizontal, the motorcycle ran off the palisade and literally rode on the breasts of the spectators, two of whom were killed and many seriously injured.



Motorcycle Rides on a Wall

POSTAGE RATE SHOULD BE REDUCED; NOT RAISED

Some personal interest, thought by many to be the express companies who would benefit several million dollars a year by the proposed change, has induced Congress to appoint a "postal commission" which is expected to report at the present session. The Postoffice Department, through Mr. Madden, recommends an increase from the present rate of 1 cent per pound on newspapers and magazines to 4 cents per pound. Not 10 per cent of the publishers could pay the new rate, which means there would be a big advance in all subscription prices,—and the people will have to pay the bill.

By a system of book-keeping which no business concern would tolerate, an apparent "deficit" is made each year, and it is proposed to make the publishers pay this. There is no actual deficit. The free matter carried for other branches of Government amounts each year (according to Postoffice Department's own figures) to more than the "deficit."

The 37,000 rural free delivery routes—which have reduced insanity among farmers 40 per cent in 10 years, and which are rapidly becoming self-sustaining—this rural delivery alone costs this year \$26,000,000, and represents a temporary loss of more than the alleged "deficit," but is worth to the nation twice its cost.

Canada carries its newspaper mail at $\frac{1}{4}$ cent per pound within 300 miles and at $\frac{1}{2}$ cent beyond that, and cleared \$490,000 last year.

The proposed raise in the price of the reading matter of the nation is an outrage on the people. It is to be hoped the "consideration of the question" will be forced to the root of the matter, which ought to result in an entire revolution in postal methods and administration.

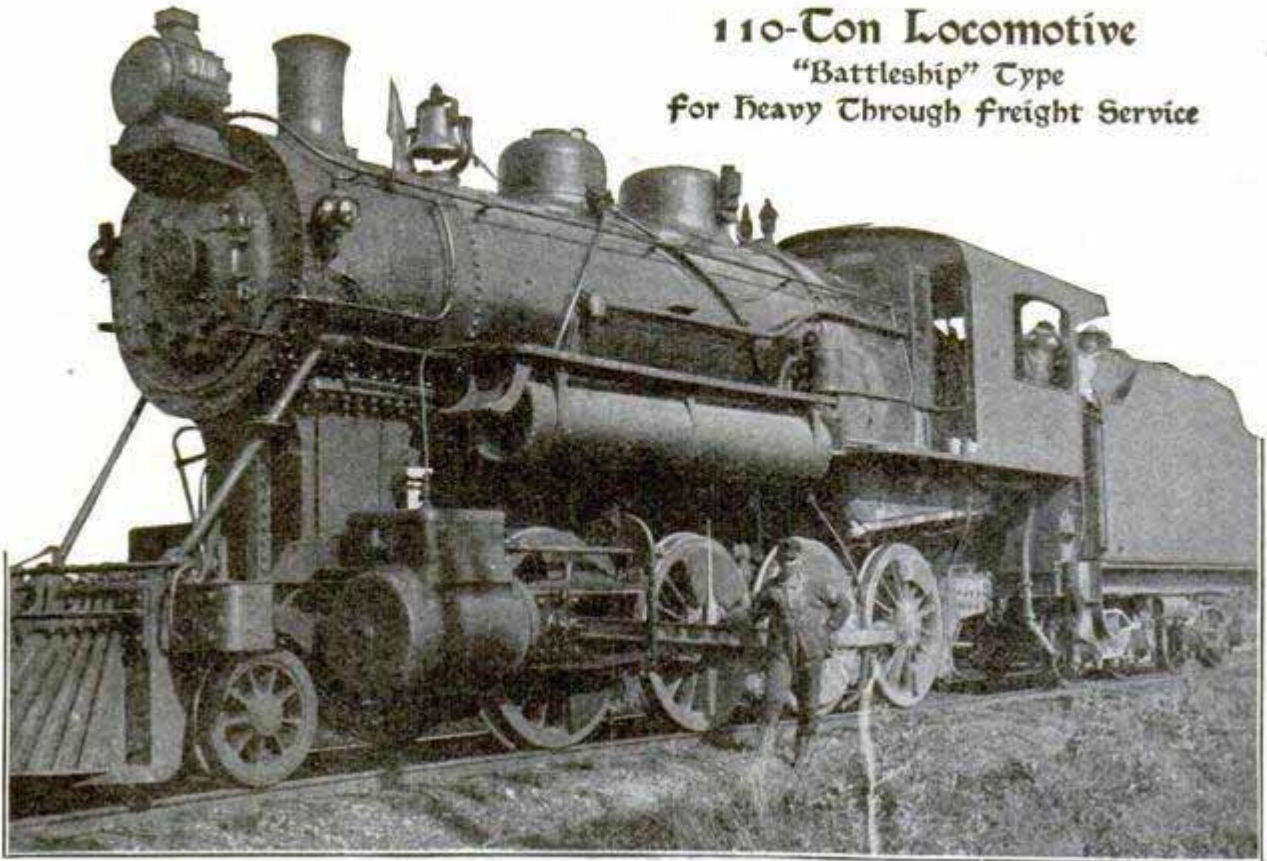
We are credibly informed that on a passenger train leaving Chicago every night there are two express cars for which the express company pays \$200 per trip. On the same train are two mail cars for which the Postal Department pays \$700 per trip for the same service and the same distance.

That there is no actual deficit under such conditions shows how profitable are the present rates of postage, and that instead of a raise there should be a decrease, both in the letter postage and newspaper rates.

The people do not ask for the change.

Then who does?

110-Ton Locomotive
 "Battleship" Type
 for Heavy Through freight Service



PASSING OF THE WOODEN FREIGHT CAR

**And the Wooden Passenger Coach Should Go
 With It**

The statement is made that owing to the scarcity and consequent high price of lumber, the wooden freight car being turned out at contract shops is greatly inferior in quality to those of a few years ago. The wood is full of sap and before the car really gets into service posts and boards show shrinkage. The *Railway Age* says:

"Even the paint on a modern box car is a fugitive mixture of mineral pigment and gasoline, slushed on with a wide brush and soon to evaporate and leave a dry powder to be washed off by the rain. The soft wood when left unprotected will more rapidly decay unless it receives a better covering at the home shop.

"The manager who considers the purchase of wooden cars, on account of a slender appropriation and the desire to have as large an equipment as possible, must reckon with the disadvantages above mentioned if he builds

for the future. The wooden car is constantly growing poorer in quality and the average life will be much less than that indicated by figures obtained from the cars in use prior to the age of steel."

The years of the wooden passenger car are likewise numbered. Hundreds of passenger cars are in service today which in a wreck would crush like eggshells and burn like tinder just as some of them did on November 12 on the Baltimore & Ohio railroad. While the collision was due to inexcusable carelessness, which the use of steel cars would not have prevented, no one will believe that the 100 or more victims who were pinned down by timbers and slowly roasted to death would have lost their lives in a modern steel car. There might have been some broken limbs, but a steel car never cremated anybody. Cities prohibit the use of bad boilers and stop the operation of dangerous passenger elevators, and in other proper ways protect the public, and it is not expecting too much that before a great while the Federal Government will make the penalties for using

rickety old passenger cars so severe that railway officials will not then risk their own liberty, nor the lives of the public as at present.

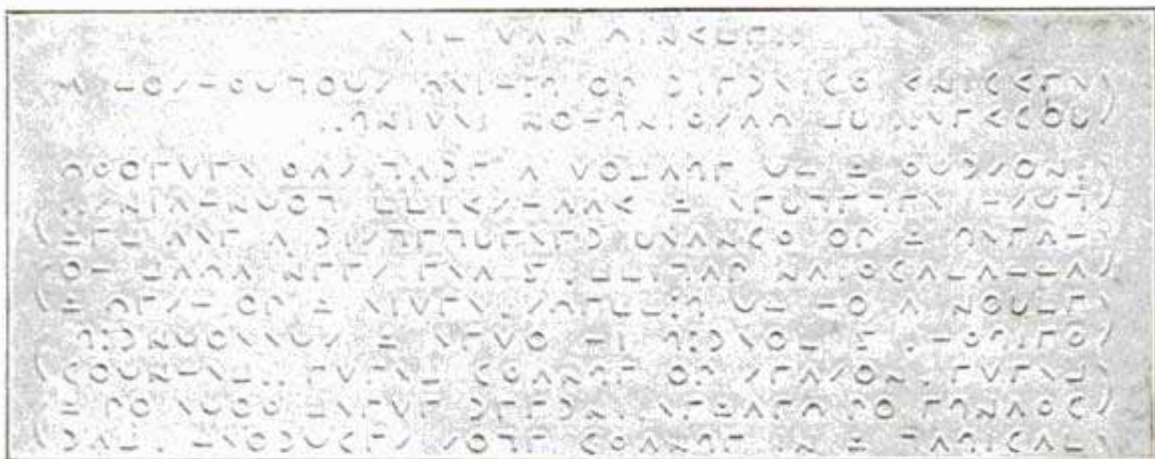
Certain trains on some of the better roads are now made up of cars in

which the coaches are nearly as safe as the heavy sleepers, but on occasion the best of them run out old traps that are ready to fall to pieces, and with some the offense is an hourly one every day in the year.

MAGAZINE FOR THE BLIND

Nearly 1,000 books, with editions which total 256,000 volumes, have been printed in raised letters for the blind by the Moon Society of London, established in 1847. The books include bibles, poetry, biography, history and text books, issued in 400 languages. The Moon Society has branch free circulating libraries in Great Britain and its possessions—which last year loaned 100,000 volumes—and in this country in New

York, with ink, a special embossing press is employed, a process necessarily somewhat slow and painstaking. The letters are $\frac{1}{4}$ in. high and raised about $\frac{1}{16}$ of an inch, with plenty of space between the lines, which instead of all reading from left to right, weave back and forth. All titles, and the first line of each article, and after that every other line reads from left to right: the other lines from right to left. The large parentheses at the



Reduced Reproduction of Part of Page of Moon's Magazine. Translation of First Three Lines Reads as Follows:

RIP VAN WINKLE . .
A POSTHUMOUS WRITING OF DIEDRICH KNICKER
. . GNIVRI NOTGNIHSAW YB REKCOB

York, Boston, Cincinnati, Chicago, Philadelphia, Washington and Sacramento.

Two years ago the late Dr. Wm. Moon, founder of the society, and himself blind for 70 years, started a monthly magazine for the blind, the pages being 11 in. by 13 in., with a table of contents on the front cover. This magazine is now conducted by his daughter, Miss Moon, and edited by his son, Dr. R. C. Moon of Philadelphia, Pa.

Instead of printing from the type

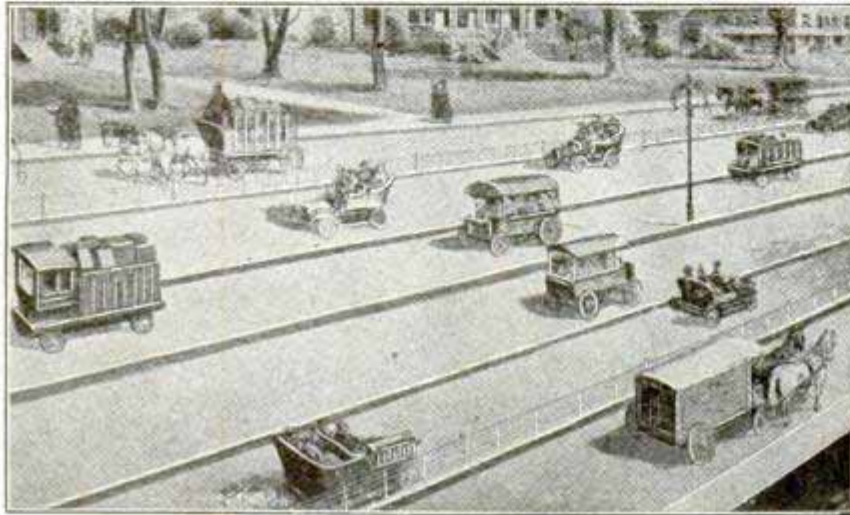
ends of lines guide the finger to the line below.

A similar monthly magazine will shortly be issued in this country, under the direction of Walter G. Holmes, of New York City, necessary funds having been donated by Mrs. Wm. Ziegler. The magazine will be sent free on request to any blind person who can read the raised letters. Those who cannot read will be sent free alphabets and instructions, from which they can quickly learn, if apt.

PROPOSED NEW CITY ROADWAY



Cross Section of Commercial Roadway



There Are Six Distinct Roads

LARGE CONSTRUCTIONS COST LIVES

The construction of any large engineering undertaking, such as tall buildings, large dams, railroads, etc., includes as one of the costs a definite loss of human lives. In other words when a big skyscraper is planned the engineers can reckon the number of lives it will probably cost while the building is yet on paper. During the past year in Chicago alone 34 workmen have been killed while engaged in erecting large buildings, and 113 more were seriously injured. Danger lurks all along the line, and the death-causes ranged from a bucket falling on a man at the bottom of a foundation caisson 100 ft. deep, to falls from the top of the same building to the street, a drop of from 200 ft. to 300 ft.

Eiffel, of tower fame, declares the average death loss is one life to each \$250,000 of cost of the construction.

A plan for a commercial highway is proposed along the lines shown in the illustration.

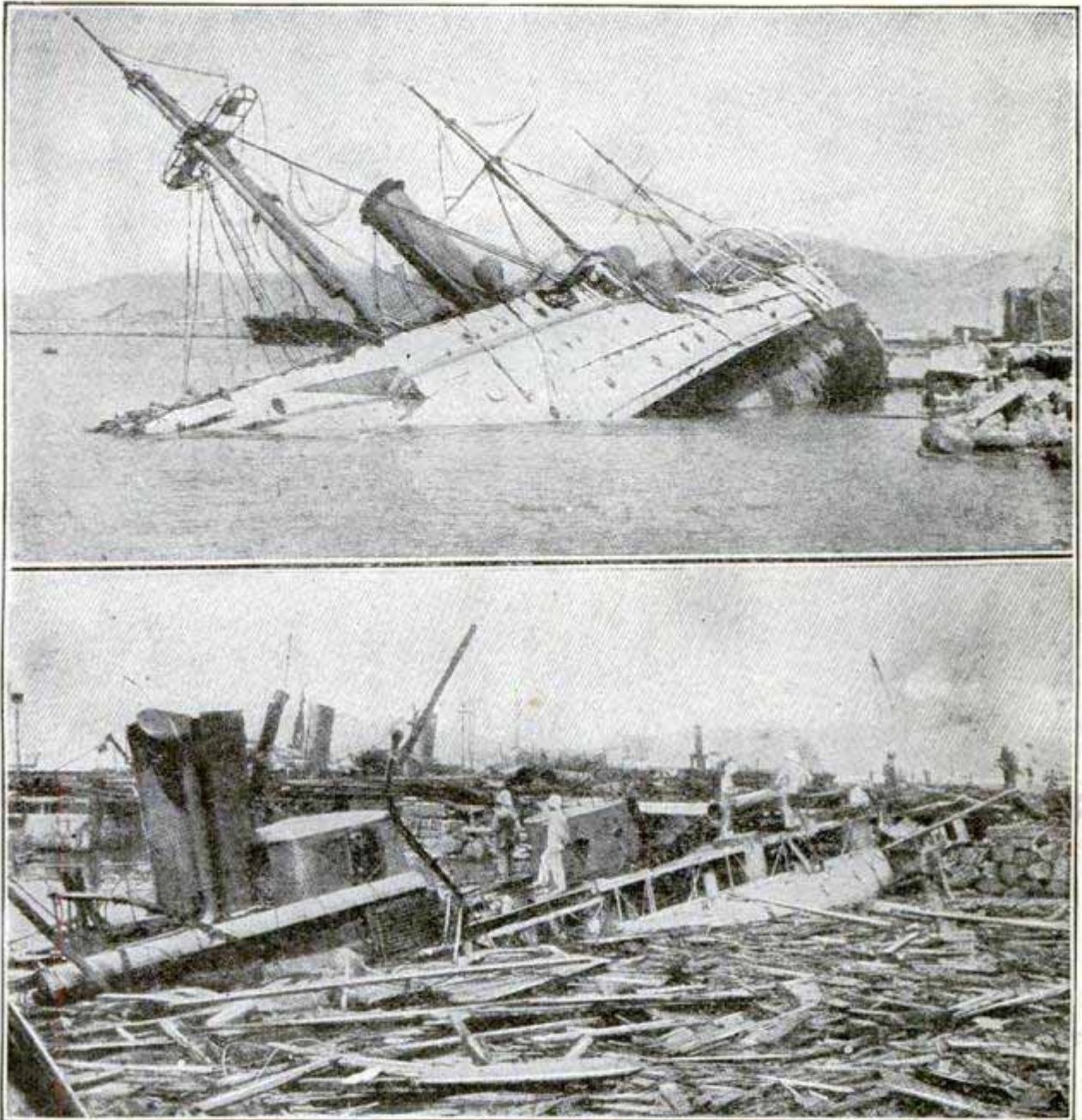
There are six distinct roadways; two for animal traffic, two for general auto traffic, and two for commercial auto-traffic. The three avenues on each side are for travel in one direction only, the other three for use in the opposite direction. Pedestrians use sidewalk on extreme outside.

Electric light poles to be placed in the middle, and each avenue separated from the next by a concrete curb. The extreme width of street is 120 ft. including footpaths. The design is copyrighted by H. D. and F. P. Layman.

SUBMARINE "LUTIN" RAISED

The ill-fated French submarine, "Lutin," which sank in 150 ft. of water, has been raised, and the bodies of the crew of fourteen, recovered. A floating dry dock was lowered below the water line, and the submarine attached by heavy chains. The dock was then raised by emptying her water-tanks, and dock and submarine towed into port.

An English inventor now offers a detachable compartment in which several persons could escape, if the submarine is fortunate enough to land on the bottom in such a position that the compartment can be released.



The great typhoon of September 18, 1906, at Hong Kong was remarkable as the only one on record which came without warning. Thousands of lives were lost, while the money loss ran into millions, says the Illustrated London News. The vessel at the top is the British vessel "Phoenix"; the other wreck shows the remains of the French destroyer "Fronde."

SAWED STEEL BAR WITH YARN

What the drop of water does to the hardest stone is only a circumstance to what a thread of yarn can accomplish. Major McClaughry, warden of the Federal prison at Ft. Leavenworth once found a prisoner who was supposed to be pounding stone, working away at one of the bars to an outside window. The man finally admitted what he was doing and was induced to give a demonstration.

A grating of the same description

was placed in his cell and a guard stationed over him to exact the proof of the statement. With the limestone dust and silicate from the stone pile, the yarn from his sock and a little water this man cut the Bessemer steel bar in eighteen working hours. With some fine emery, a chalk line, and two wooden handholds to save his fingers he made the other clean cut of the bar in five hours, proving the matter to the guard's satisfaction.

UTILITY OF THE TELEPHONE

Of all the applications of electricity the telephone is most used by the people. While the telegraph cannot now be spared, the masses use it only in



Jeweled Telephone Used by Queen of Spain

emergencies where the mails are too slow. The telephone is in the home and much of its service is commonplace, though useful. The latest phase is the discussion by the Roman Catholic clergy as to the propriety of employing the telephone for the reception of confessions where conditions prevent the member from coming in person to the priest.

New Fruit Paring Knife

The latest in a fruit knife for table use is a radical change from the time-



Cuts Very Fast

honored style. The improved form will cut twice as fast and twice as thin as an ordinary knife. It operates on the principle of a safety razor. For use in preparing vegetables and fruit for cooking it is said to be a great saver in both time and material.

CAPE TO CAIRO TELEGRAPH

The longest telegraph line in the world, the idea of the late Cecil Rhodes, lacks less than 1,000 miles of completion. The distance is 5,600 miles. Through jungles, across deserts, over vast chasms, in the face of the most difficult obstacles engineers have ever encountered, the work has been carried on for eight years. Part of the gap, about 400 miles, is through jungles where no white man has ever penetrated, and at present is acknowledged as too difficult to cross. The gap will be worked by wireless and

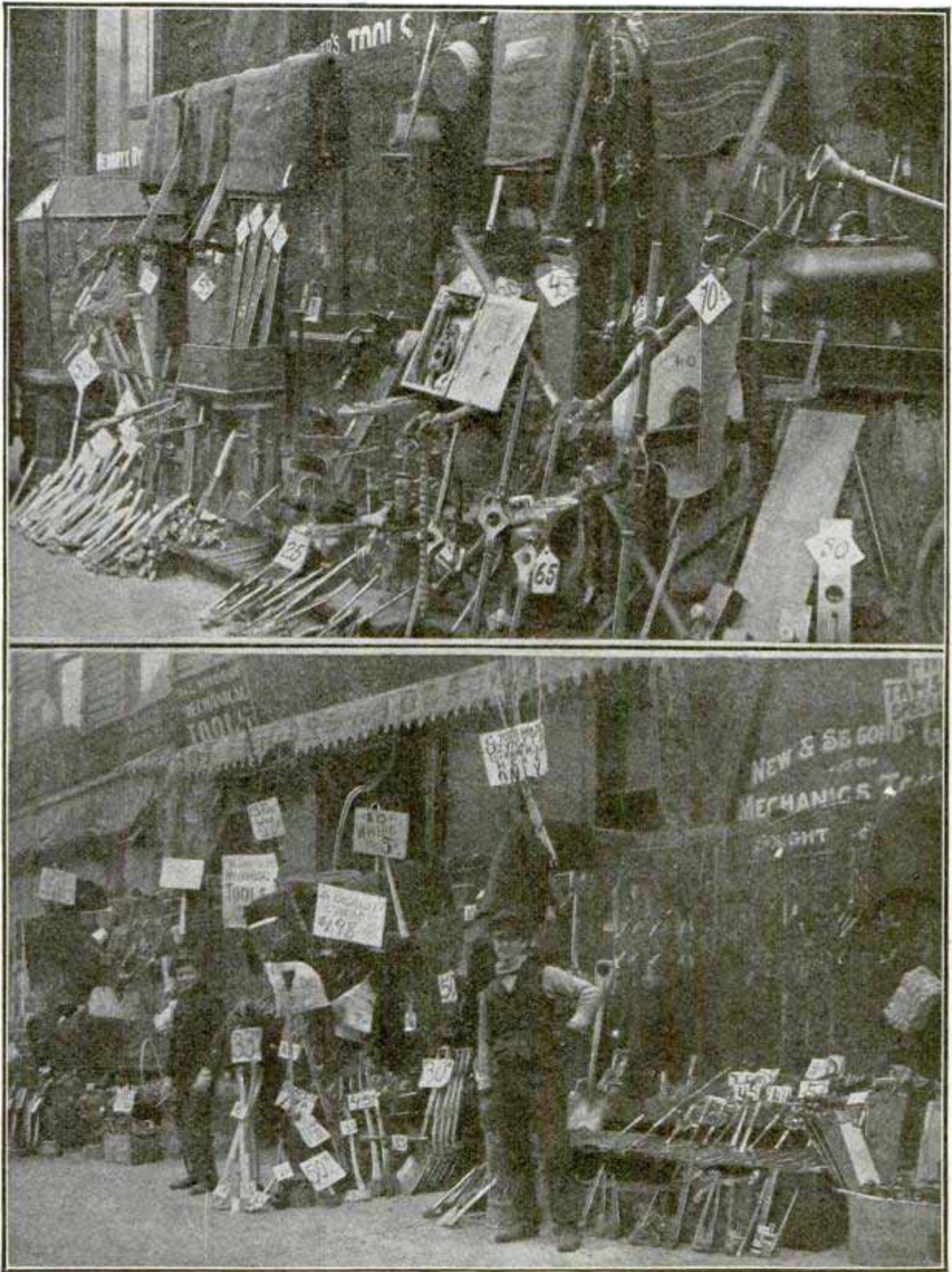


Building the Line

the rate over the entire line will be only 25 cents per word.

For hundreds of miles wooden poles were destroyed by insects and hollow iron poles weighing 160 lb. had to be substituted. Even these are frequently broken by elephants rubbing against them. Among some of the African tribes small pieces of wire pass for money which is another cause of trouble. Wild beasts, savages, serpents and pestilence have joined forces to hold back the enterprise, but each in turn has been overcome.

JUNK TOOL STORES



Second-Hand Tool Stores, Chicago

In every large city will be found one or more places where second-hand or junk tools are sold. Tools of all descriptions, adapted to every branch of mechanics, can be bought

at prices ranging from 1 cent up; a good sized paint brush brings 2 cents, a carpenter's hammer 5 cents, a pick or shovel 25 cents, a rip saw 10 cents, and so on. The average price is less

than one-tenth what the new article would cost at a hardware store, and often just as useful as a new one. Some of the stuff in the motley collec-



"A Paint Brush, 2 Cents"

tion comes from unredeemed pawns, some from junk dealers and a good deal from parties of whom "no questions are asked." Frequently quite valuable tools and instruments can be had for a mere song, as the most of the customers want the tools of ordinary use requiring less skill to handle.

INVALID'S MOTOR CHAIR

Invalids who are able to go out of doors, and who have the use of their hands, will be interested in the latest novelty, the motor chair.



Comfort and Ease of Operation

It is in reality a motor tricycle and is designed for the use of cripples or invalids who are not incapacitated

from taking care of the machine. Power and speed necessarily have been subordinated to the demands of comfort and from the side its appearance differs very slightly from that of the ordinary wheeled chair. Liberal sized pneumatic tires are used on the rear wheels, which are about 28 in. in diameter, but the steering wheel is of such diminutive size that any attempt to speed the machine would result disastrously. This wheel has a small solid rubber tire.

The motive power consists of a $4\frac{1}{2}$ -hp. air-cooled gas engine, mounted on the rear axle at an angle tilted backward from the vertical. Instead of driving directly to the axle or driving wheels, however, a variable speed gear, affording a range of 5 to 15 miles an hour, is interposed. A special form of foot brake acting directly on the motor shaft is provided.

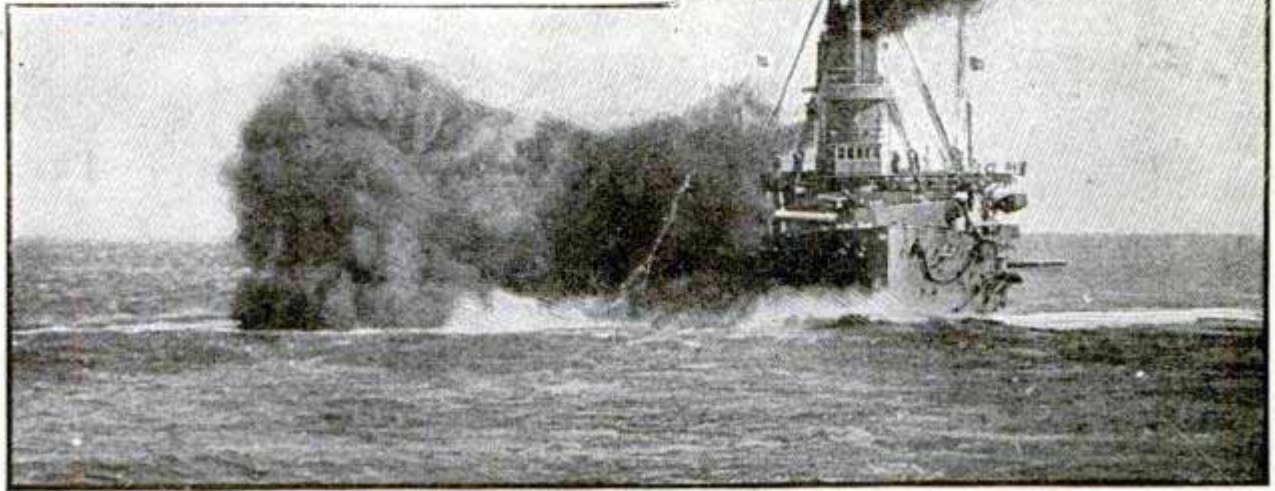
It is a French invention not yet on the American market. Some enterprising Yankee would doubtless do well with such a specialty. Just before the St. Louis exposition, a similar chair motor, only operated by storage battery, for carrying two passengers, was proposed and a few were constructed. We published a picture of the chair and several hundred inquiries were received indicating a surprising interest in the device. The company seeking the concession, however, failed to carry out its plans.

PAPER FROM EGYPTIAN PAPERUS

A London syndicate will have 100,000 tons of Egyptian papyrus plant ready to ship to its paper mills within the next six months. This revives an industry which has been extinct for over 1,000 years. A long search finally located a few plants in Palestine which were transplanted into Egypt and cultivated. The twentieth century seems to find frequent occasion to learn from the vast treasure house of knowledge of that remarkable people.

400,000-TON BROADSIDE**Most Terrific Discharge Ever Made**

The "Dreadnaught" has had her ultimate test and withstood the shock. The trial involved firing a broadside from the eight 12-in. guns, as pictured in the illustration. These guns are 53 ft. long; 42 men can stand

**Broadside by English Battleship "Cornwallis"**

shoulder to shoulder on one of them, from breech to muzzle. Each shell weighed 850 lb. and left the gun at a speed of 5 miles a second. Could this rate of travel be maintained the shell would travel from London to New York in 90 minutes, and go around the world in less than 13 hours.

The energy generated by these guns is estimated to be 50,000 tons for each gun, at the muzzle; or for the broadside of 8 pieces a total of 400,000 tons. The discharge caused the "Dreadnaught" to move sideways a distance greater than her own beam, and to list heavily, while the vacuum produced temporary cyclones around each gun.

A grand boulevard, 10 miles in length, leading from the gates of Paris to St. Germain, is planned to be constructed in Paris at a cost of \$2,000,000. There will be an electric railway under the avenue, a drive on one side, a motor car track on the other, two cycling tracks and two footpaths.

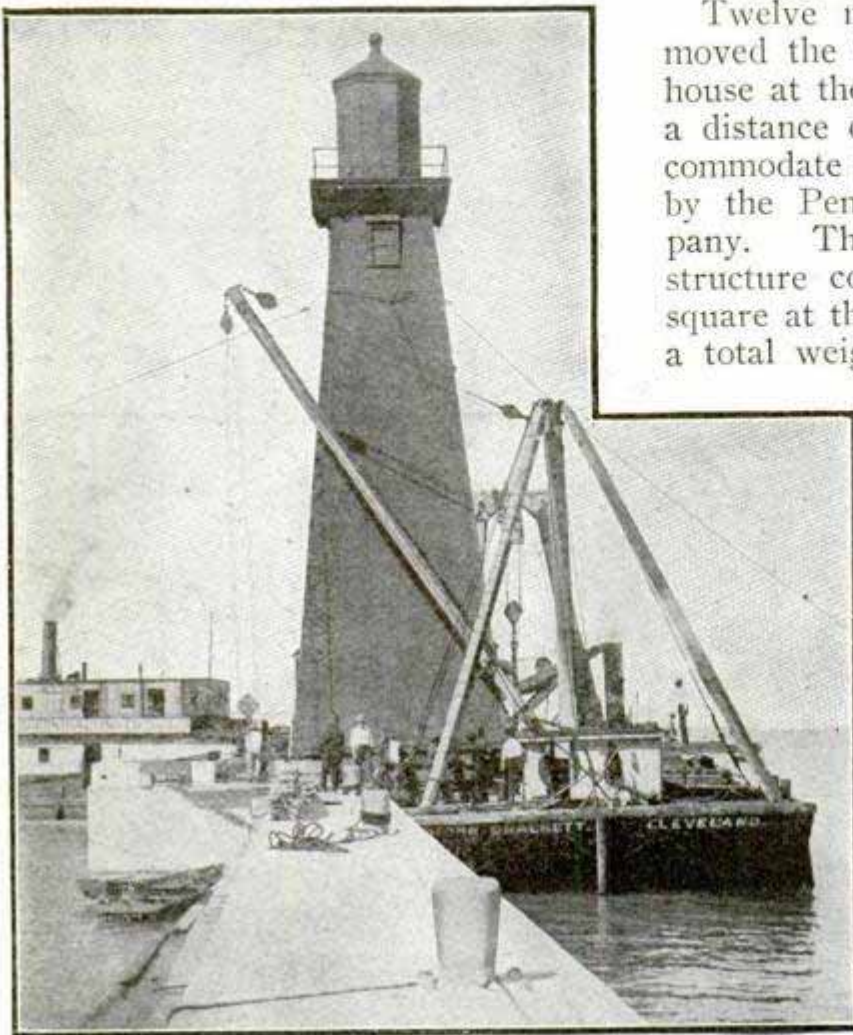
TELEPHONE OVER THE MISSOURI

Owing to the constantly changing bottom of the Missouri river a cable is not considered practical and the telephone wires connecting Council Bluffs and Omaha are suspended from a steel tower on each bank, 110 ft. high. These towers are built of galvanized iron and each will sustain a strain of 20 tons. The guy ropes are carried back 700 ft. and anchored to heavy concrete blocks.

ALCOHOL FIRE RISK SMALL

Very little fire risk is involved in the handling and use of denatured alcohol. The benzine used will be a hydrocarbon obtained either from petroleum or coal tar having a specific gravity of not less than 8.00 and a boiling point of not less than 150° C., and will be no more dangerous in point of fire risk than the alcohol itself.

MOVED TALL LIGHTHOUSE BY BOAT



Lighthouse Partly on Boat

CONDUITS FOR HIGH VOLTAGE TRANSMISSION

One of the problems which is engaging the study of electrical engineers is the solution of a suitable cable and conduit necessary for high voltage transmission. At present practically all the high voltage lines are carried in the air, involving very costly construction, as no chances must be taken on the lines going down in a storm. There are some transmission conduits in cities carrying voltages up to 10,000, it is true, but the 25,000 to 60,000 volt lines are still in the air, with serious losses from leakage. The Electrical Review says "the insulation thought to promise best for such cables is one consisting of cloth tape properly impregnated with some good compound."

Twelve men in four hours' time moved the 65-ft. 65-ton range lighthouse at the Ashtabula, Ohio, harbor a distance of 750 ft. recently, to accommodate improvements being made by the Pennsylvania Railroad Company. The lighthouse is a frame structure covered with metal, 18 ft. square at the base, 65 ft. high and of a total weight of 65 tons, and prior to moving it was not dismantled at all.

Jacks were placed under the building and, as it was raised, four guy ropes were used to steady it. After being suitably blocked up it was next placed on rollers and by alternately moving the building and loosening and tightening the guy ropes, it was soon deposited on a lighter which lay in the main river right next to the dock on which the range light stood. Whether the

towering structure could be held steadily on the moving vessel, or would overbalance and topple into the water, was an anxious question. Once on the lighter, however, it was slowly moved along to the new site on the end of a concrete pier. Then it was again blocked up and moved on rollers to place, uninjured in any respect.

UNITED STATES COPPER PRODUCTION

In 1845 all the copper produced in this country aggregated a scant 100 tons; for 1905 we produced over 901,000,000 lb.—one of the greatest industries in the world. Of this production China bought 80,000,000 lb. The Lake Superior mines yielded

25.5 per cent; Montana, 34.9 per cent, and Arizona 26.2 per cent. The Arizona production will surprise many of our readers.

The combined world's production of 1905 was 701,252 tons, of which North America furnished 502,822 tons.

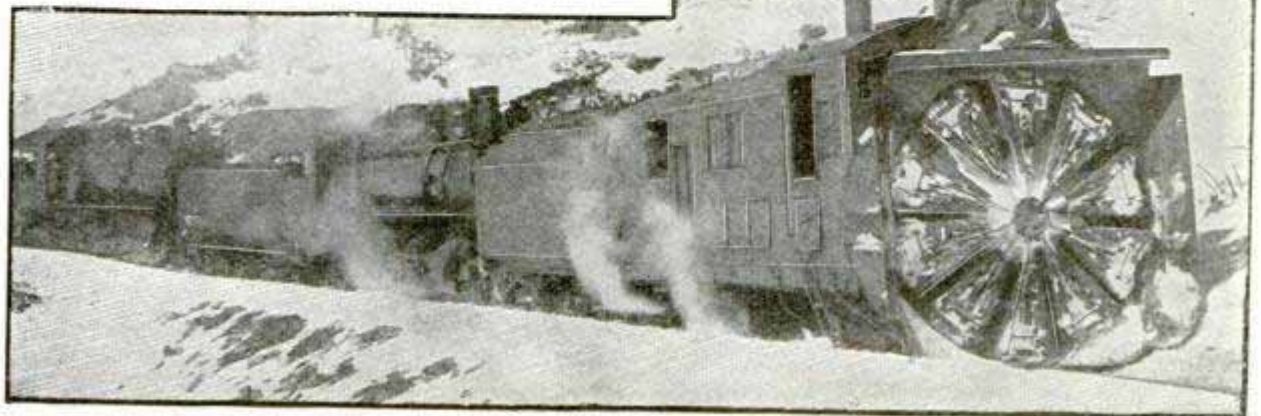
The United States output for 1906 is estimated to show an increase of 70,000,000 lb. over the preceding year.

The first ferry line to cross the open sea will be established on the Baltic between Germany and Sweden. The distance of 70 miles will be covered in four hours and the boats will carry an entire train.

THE ROTARY IS KING

This is the season when those railroads which cross the mountains in northern latitudes have their annual battle against snow. The invention of the rotary snow plow has reduced snow blockades from days to hours, and incidentally relieved the workmen of their hardest task of the entire year.

The rotary rapidly eats its way through a drift that formerly had to be cut out in blocks, being too hard to shovel. The power for driving the "fan" is carried in the same car, but motive power is supplied by a string of big locomotives which push it forward. The illustration shows one of the largest rotaries ever built, high up in the Rockies.



Resting After a Hard Run

TO DAM THE SUSQUEHANNA

A great army of workers, 2,500 of them, are working to throw the greatest dam in this country, and one of the largest in the world, across the swift waters of the Susquehanna river. The power station, which will use the water power, will at the time of its completion this year, be the largest generating station of its kind in the world, the output being 100,000 hp., which is greater than the big plant at Niagara.

Current at high tension will be transmitted to Baltimore, 40 miles away; Philadelphia, 60 miles; Wilmington, 45 miles; York, 25 miles, and Lancaster, 18 miles. The enterprise will cost \$10,000,000.

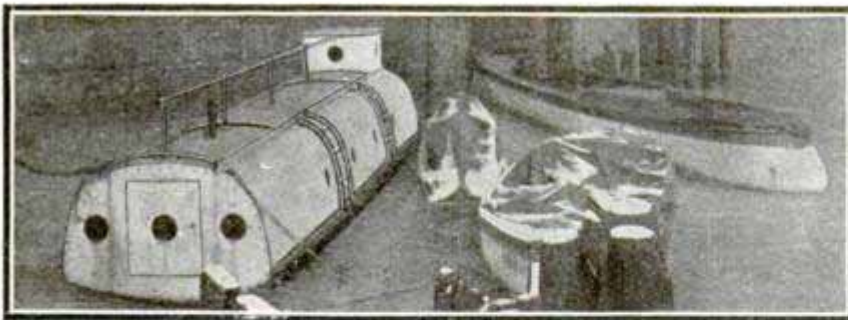
The dam will be 3,000 ft. long, from 40 ft. to 75 ft. high, and 68 ft. wide at the base. It will be one vast solid

block of concrete, of which 400,000 yds. will be used. The concrete is being manufactured at the work. A coffer dam already extends from one shore, laying bare a section of river bed which is being stripped to get down to solid work into which the dam will be anchored. In places the river is 60 ft. deep.

When completed, the dam will enlarge the river at that point to a lake 10 miles long, a mile wide, having an average depth of 30 ft. A good sized town has sprung into existence, with hotels, hospitals and stores.

NEW THEORY WHY WOOD WARPS

A new theory is advanced by hardwood experts as to why wood which has been carefully kiln-dried, often warps. It is now believed that when the sap is dried out various foreign substances other than turpentine, pitch, etc., remain in a more or less solid state; and when the wood is moistened these substances absorb water, and swelling, cause warping. A process is announced for removing



Built Entirely of Steel

the objectionable substances, the inventor claiming a piece of oak so treated can be soaked in water all night without swelling perceptibly.

Salton Sea, controlled at last by dams and soon to dry up, has changed the climate of its locality completely. What once was a desert is now a green country, refreshed by frequent rainfalls. The people are trying to have the sea preserved.

HOLDING DOWN A 40-STORY BUILDING

A 40-story building, such as is now erecting in New York, would seem to



be heavy enough to hold itself down, and so it would be but for the terrible wind pressure. To counteract this force great steel rods, $3\frac{1}{2}$ in. in diameter and sections of about 10 ft. each, are carried down 50 ft. into the cement foundations. The rods are anchored by plates and at the top converge in a single hollow column which extends to the top of the building. The foundations for a 40-story building are very costly, and twice as great as for a 20-story structure.

STEEL HOUSE BOAT

In a sheltered nook on the Chicago river, in the heart of the business section of the city, is anchored a new and novel type of house boat. The boat, which is the one at the left hand side of the illustration, is built entirely of steel, and the owner is a mechanic employed at a lighting plant fronting on the river. His spare time and money are put into the work of constructing the boat, the hull of which is now finished. The interior is being fitted up into several compartments, and is already occupied by the owner as a residence. Some day when the craft is finished he will float down to the Gulf of Mexico.

Experiments in Holland disclosed the fact that a parapet of sand backed by a wall of concrete increased the resistance to a shell about 20 per cent.

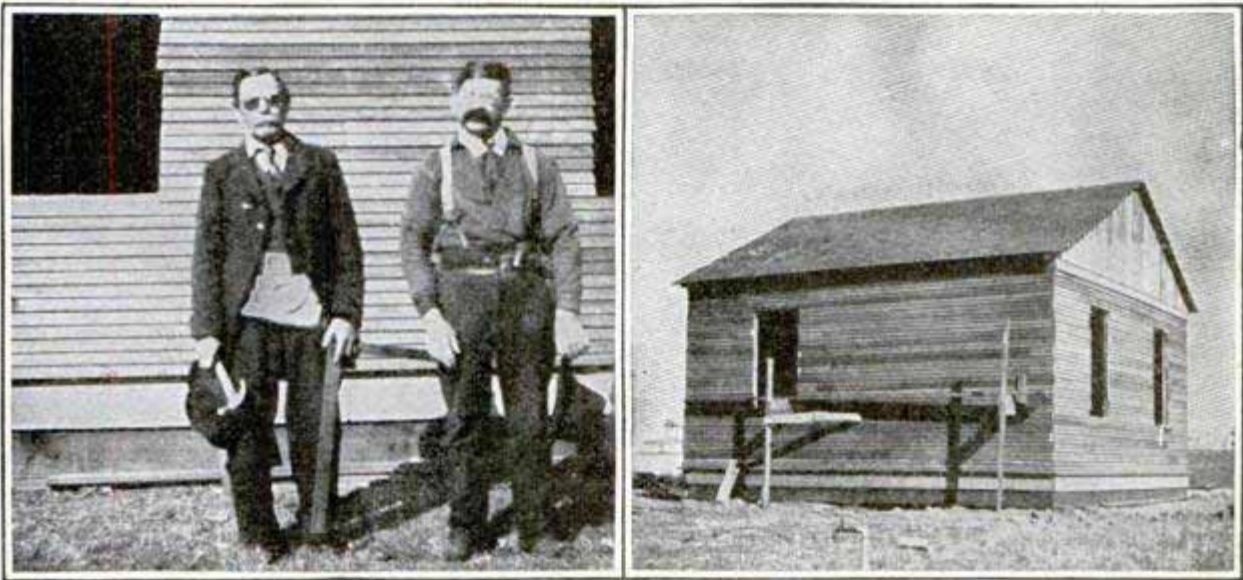
TWO BLIND MEN BUILD A HOUSE

Doing all the Carpenter Work Without Assistance

Two totally blind men have built a house for themselves at Berkeley, Cal., doing all the carpenter work themselves without any assistance whatever. The event is one of the most remarkable accomplishments in building. Neither of the men will ever see the sightly structure they have raised.

It is a coincidence that both these men are named Joseph—Joseph Brown and Joseph Martinez. The house is of the popular bungalow type, 1½

have closely followed the square and plumb—sawing accurately to the line and driving straight home every nail. Each angle is perfect; the vertical and horizontal parts of the building are very accurate—surprisingly so. How sightless workmen could accomplish such perfect mechanical results seems little short of marvelous. From day to day the work has been curiously watched by crowds including many



The Blind Builders and the House They are Building

stories high, and constructed entirely of wood. It is 18 ft. wide by 25 ft. long. As the builders are sightless, the work necessarily progressed slowly. From early morning until frequently long after sunset the two men toiled patiently at their task. The shades of night did not hinder the work, for noonday and midnight are equally dark to them, and out of the blackness came the song of the saw and the blows of hammer to passers-by, who heard but saw no workmen.

The bungalow presents a very neat and attractive appearance, all the work having been performed along strictly mechanical lines.

Though totally blind these builders

carpenters. The general work is pronounced as good as that performed by many builders who are blessed with perfect eyesight. These sightless workmen were not even afraid to climb the ladders when constructing the roof. In all the work the builders have received no assistance or suggestions.

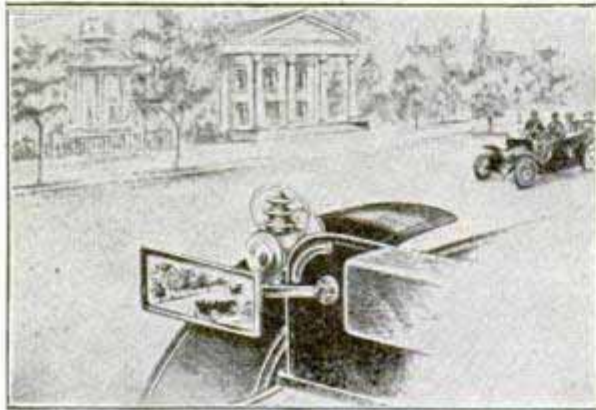
* * *

Brown and Martinez were not blind from their birth, but were deprived of their sight many years ago. They were door to door peddlars for many years, and managed in the course of time to accumulate snug sums of money that were wisely deposited in bank. At the time of the great fire

in San Francisco these men lost everything save their little bank accounts. Recently they pooled their holdings, purchased a small lot in Berkeley, and some lumber. They then set to work resolutely and have built themselves a house.

MIRROR FOR AUTOMOBILES

The latest accessory for the automobile is a small mirror set in a strong frame and suitably protected at the



"Looking Backward"

back, and placed where the driver can watch it. The mirror enables the occupants of a car to see what is coming from behind without turning the head.

CAR FOR INVALIDS

A car for the exclusive use of invalids and their attendants is a part of the regular equipment of the Hungarian State Railways, which are operated by the government. These cars were designed and built with a special view to comfort and privacy. The illustration from Locomotive, London, gives an idea of the interior of one of these compartments, of which there are several in a car. One room is equipped as a dispensary. Should a passenger be

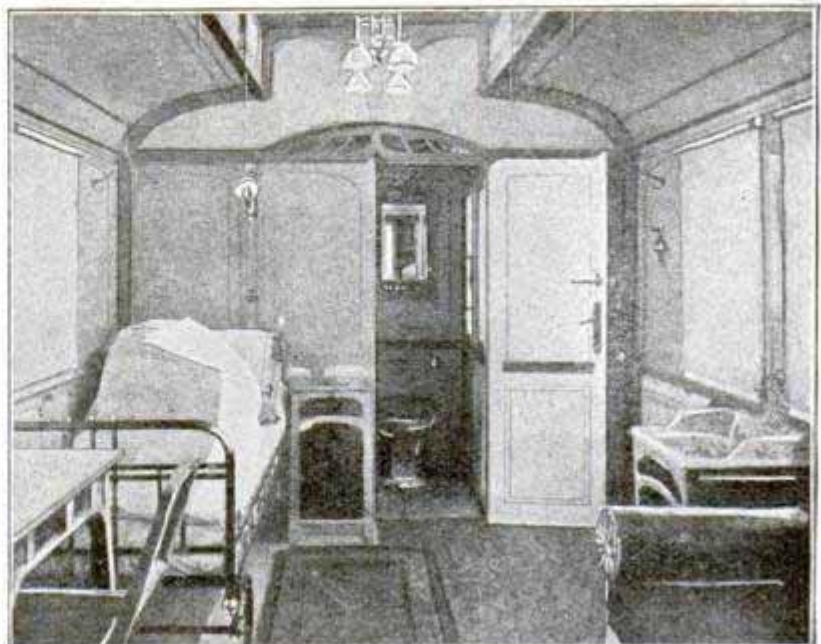
taken seriously ill while on the train he can be removed to the car and receive medical assistance without delay. Such a car, or at least a part of one car, would seem to be an improvement on our present overland trains.

WORKS TO SAVE STEEL FROM RUINS

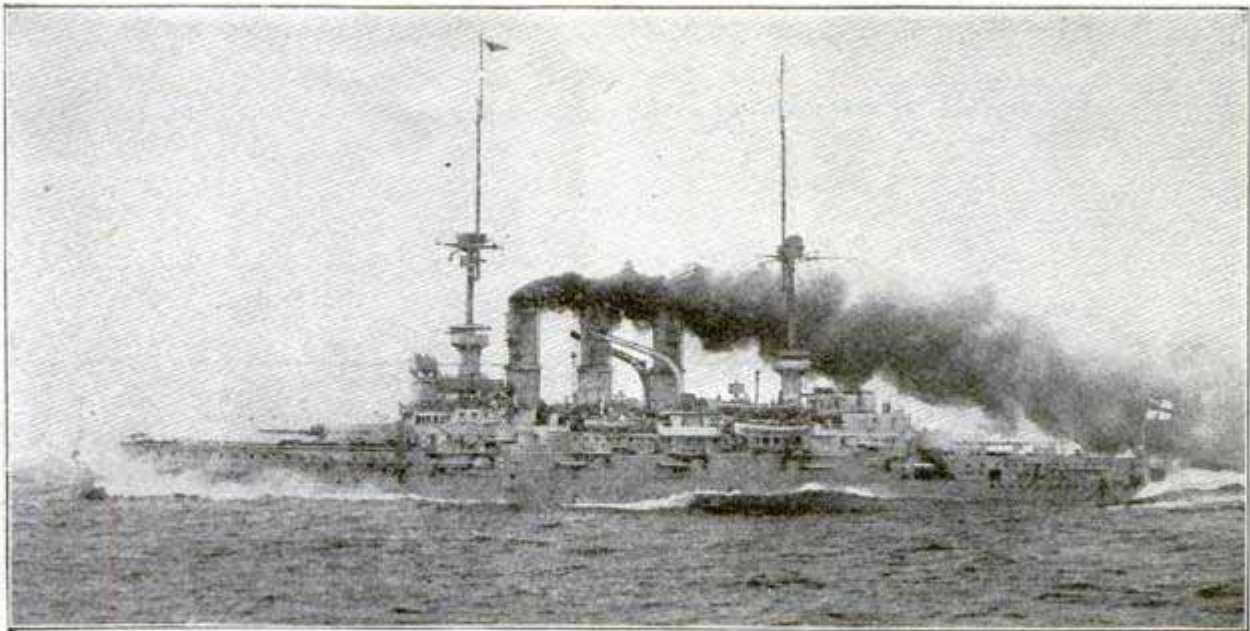
Sixty million pounds of iron and steel, taken from the ruins of San Francisco, are to be melted into ingots during the next two years and the recovery of this "junk" will mark the creation of a new industry. A great plant with enormous furnaces is being constructed on the Pacific Coast and a year's supply—50,000 tons—of the wrecked girders and beams is being laid in. About 1,000 men will be employed.

One of the difficult problems of San Francisco's reconstruction has been how to get rid of the twisted steel and iron skeletons that remained. The new industry solves the problem and opens up other possibilities for utilizing waste.

The fire loss in United States and Canada for October was \$13,872,000; for 10 months of 1906, \$414,460,000.



Compartment in Invalid's Car



GERMAN FIRST-CLASS BATTLESHIP "DEUTSCHLAND"; 13,200 tons; 16,890-I. H. P.; speed 18.85 knots. Armor Protection:—Water-line belt, 9.75-in. Krupp steel amidships tapering to 4-in. at ends; side above belt, 8-in.; main barbettes and turrets, 11-in.; casemates and battery, 6.75-in.; armored deck, 3-in. Armament:—Four 11-in. 40-cal. guns; fourteen 6.7-in. 40-cal.; twenty 24-pdr.; four 1-pdr.; and four machine guns. Six submerged torpedo tubes.—Courtesy Journal U. S. Artillery Association.

CUTTING STEEL BY MEANS OF HEAT

In most operations there are extremes to be avoided and a happy medium to be determined, if possible, and adopted, but in cutting steel with circular saws there seems to be no happy medium. If a saw is given a cutting speed of 20 to 25 ft. a minute it will cut the steel without any difficulty, or if the same saw is given a speed of 2 miles a minute it will also cut the steel successfully, but at an intermediate speed, such as 500 ft., it will not cut well at all.

In the first case, where the slow speed is used, the saw cuts the steel by taking off small shavings like any ordinary cutting tool, while with the high speed the steel becomes red hot and is practically torn through, but with the intermediate speed the friction is not sufficient to produce the necessary heat before the saw is broken.

In cutting large sections of steel, such as large I-beams and heavy shafting, a soft steel saw without teeth

is sometimes used. This revolves at a very high speed and is literally pushed through the metal, which becomes red hot. It is the common practice, however, to first make a number of nicks on the circumference with a cold chisel.

Another method of cutting steel, which has been used successfully for cutting pipe, was recently patented in this country by a Belgian engineer. The process consists in first heating the metal by means of an oxy-hydrogen flame and then cutting it by a small stream of oxygen gas, which unites with the steel and forms a fusible oxide; in this condition it flows freely from the cut.

The operation is made continuous by revolving the pipe and employing two jets; one containing oxygen and hydrogen and the other containing pure oxygen, which follows close in the path of the former. The oxy-hydrogen flame raises the metal to a red heat and the following stream of oxygen then makes the cut. It is said that the cut is fully as smooth as that made by a saw and is only 1/100 of an inch wide.

CEMENT HOUSES IN ONE PIECE

Walls, Floors, Partitions, Mantels and Roofs, All Cement

In a recent issue of this magazine Thomas A. Edison predicted the casting in molds with cement of a quite elaborate residence.

The plan has already been put into practice in the construction of 50 two-story cottages in Pittsburg, where the process is called the "monocast" system. The foundations, walls, floors, partitions and roof are all cement. The Cement Era says "floor, walls and ceilings are all in one piece; grates are built into every room, and mantels are molded in on the walls. Shelving and cabinets are built in and sinks, bath and wash tubs are made in the house better than can be bought at any plumber's; all of concrete."

The only wood is in the doors and window frames, and a local architect is already taking out patents on cement doors and window frames. The doors are no thicker than the ordinary wooden door, but little heavier, and are immune to kicks from the small boy.

The forms are made of cheap cull lumber and can be used over and over again.

STEEL DREDGES TO WORK THE YUKON

A mammoth dredge with capacity for handling 2,500 cu. yd. of material daily is now on its way into the Yukon territory. It will take the dredge 90 days to reach its destination and by the time it arrives its cost will approximate \$140,000. Manganese steel, which is to cast iron in strength as ten to one, has been used in the construction throughout and

the dredge is said to be a marvel.

A number of dredges are now in successful operation along the upper Yukon. The initial cost, because of the difficulties of transportation into the frozen north, is almost prohibitive, but once on the ground the machines rapidly pay for themselves.



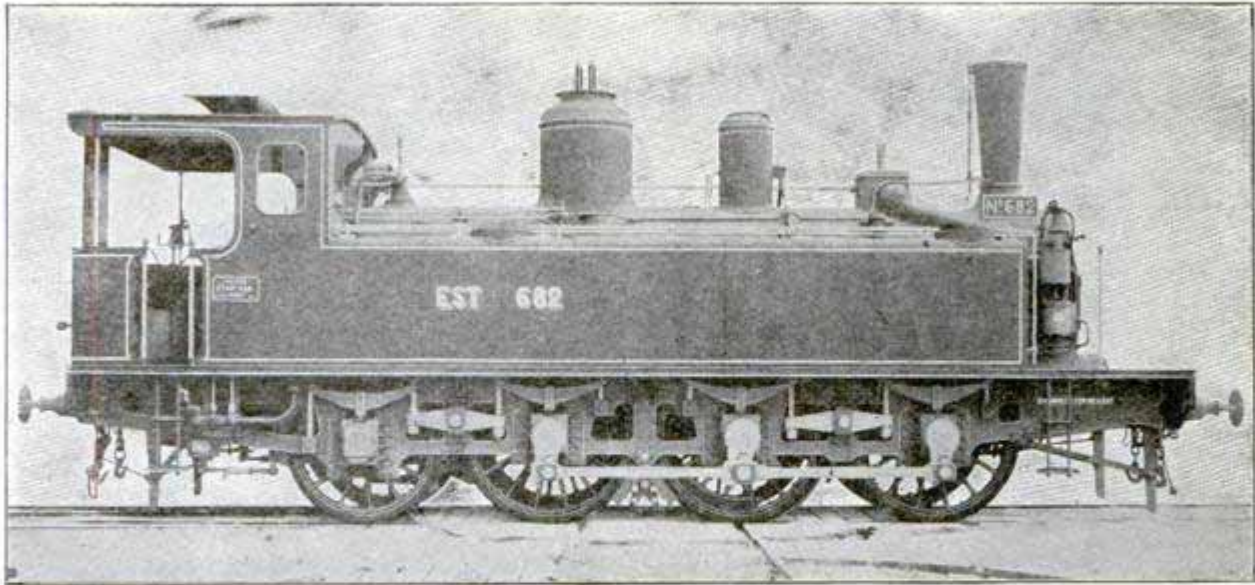
House Cast in One Piece

Cement is taking the place of adobe in many cities where adobe has been the building material for centuries.

TOO DAMP FOR THE DIVER



DIVER (who has just come to the surface and discovered that it is raining heavily): "Just pit ma head-piece on aga'n an' A'll get doon oot the wet!"—Black and White.



NOTABLE FOREIGN LOCOMOTIVES--Suburban Tank Locomotive, Eastern Railway of France. These engines work local trains on the lines out of Paris

ONLY HIGH EXPLOSIVES SUITABLE TO CHECK CONFLAGRATIONS

By P. H. Shaughnessy, Chief San Francisco Fire Department

Dynamite was used in great quantity to subdue the flames that swept over the city. In the hands of competent persons the explosive is a valuable auxiliary in fighting fire when other means fail. Our department gained valuable experience in the handling of dynamite, and I trust that other departments may profit by our observations. In the first place, dynamite should be stored in an isolated spot and under the control of the United States Army. It should never be brought into use until ordered by the chief of the fire department, and then it should be handled by trained men, preferably soldiers, commanded by competent officers. Great harm was done during the first days of the fire by the indiscriminate use of black powder. It developed that when black powder was exploded it threw off a combustion that ignited all woodwork with which it came in contact, thus starting additional fires. Giant powder, made of nitro-glycerine, was also used with the same results. On the third day of the con-

flagration 75 per cent dynamite, in stick form, was used with splendid results, as there was no combustion, and the buildings were leveled without danger. I would therefore recommend the use of stick dynamite, gun cotton or other truly high explosives that throw off no combustion, as the only means of checking a tremendous fire when water is not obtainable, as it levels a building to where you can deliver water to control the flames of such buildings of frame or brick of ordinary construction, containing wooden floor joints and wooden dividing partitions. I would not recommend dynamite to level buildings of "Class A," construction which are of the skeleton type, with steel frame and floors riveted at all junction points, for the reason that it would take an enormous quantity to level a building of that construction. I would further recommend that when dynamite is used that it should be exploded by electricity, as with the fuse system there is danger of not exploding when expected.



Courtesy Reliance Motor Co.

The Automobile Ballot Train

BALLOTS COLLECTED BY MOTOR TRUCKS

During a recent election in Detroit, Mich., the ballot boxes were collected from the various voting booths and carried to a central counting station by motor trucks. The city is divided into nine precincts, and in all eleven trucks were in service. Two collections were made, one at 2 o'clock and another at 8 o'clock. Each truck collected from four to eight boxes under charge of a precinct captain and delivery was quickly made, the longest time being an hour and forty minutes from the time the polls closed.

The year before ten patrol wagons and six trucks were used and the last of the boxes were not delivered until 11:30 p. m. The motor trucks run a total of 308 miles, with 310 stops, at an average speed of 16.7 miles an hour. They used 27 gal. gasoline and 9 gal. lubricating oil.

NATIONAL CONVENTION TO PROMOTE EXPORT TRADE

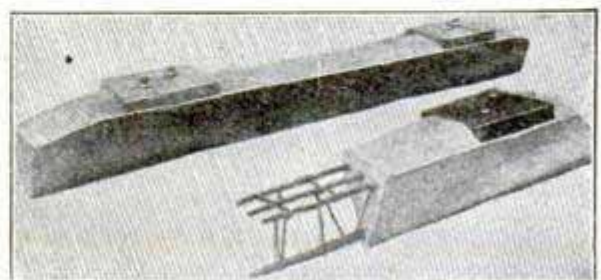
A national convention for the purpose of considering and devising measures for the enlargement of our foreign trade and to promote the demand abroad for the products of our farms, workshops and mines, will be held in the New Willard Hotel, Washington, D. C., beginning at 10:30 a. m., Monday, January 14, 1907. Secretary of State Root will deliver an

address. The movement is one in which every American who produces anything capable of export is vitally interested. For full details address F. S. Gardner, secretary, 203 Broadway, New York.

Four sailors of the gunboat "Du-buque" caught a devil fish weighing 3,600 lb. in Samana Bay, Santo Domingo, recently. The monster was harpooned, the struggle lasting four hours.

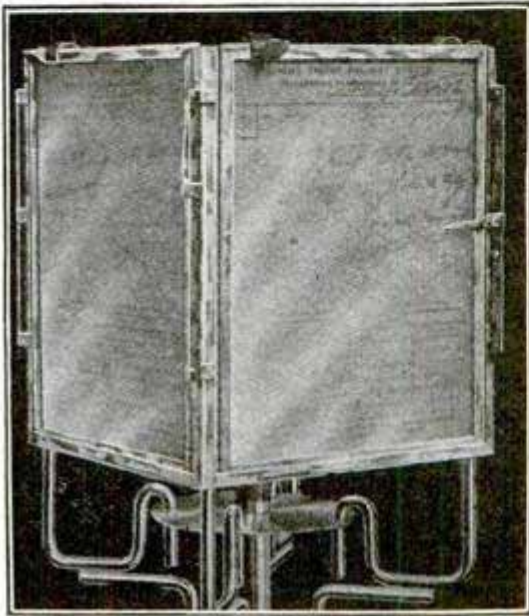
CONCRETE RAILWAY TIES

Reinforced concrete railroad ties which have been in service on a Texas road under very severe conditions are reported to have stood the test and to be in perfect condition. Three cars loaded with steel which were derailed by a broken brake beam passed over the ties, breaking the ends from three, but the track remained intact. The manager of the road pronounces the ties as nearly everlasting as any part of a railroad can be.

**Concrete Tie**

ENGINEER'S TRAIN ORDER LIGHT

The cab of a locomotive is the darkest place on the entire train at night. A tiny oil lamp throws a few rays of dim light on the water, steam and air gauges. A new device for engineers



Train Order Holder

is a frame for holding the train orders. The orders are placed flat between two pieces of glass which are then clamped in a frame and the frame

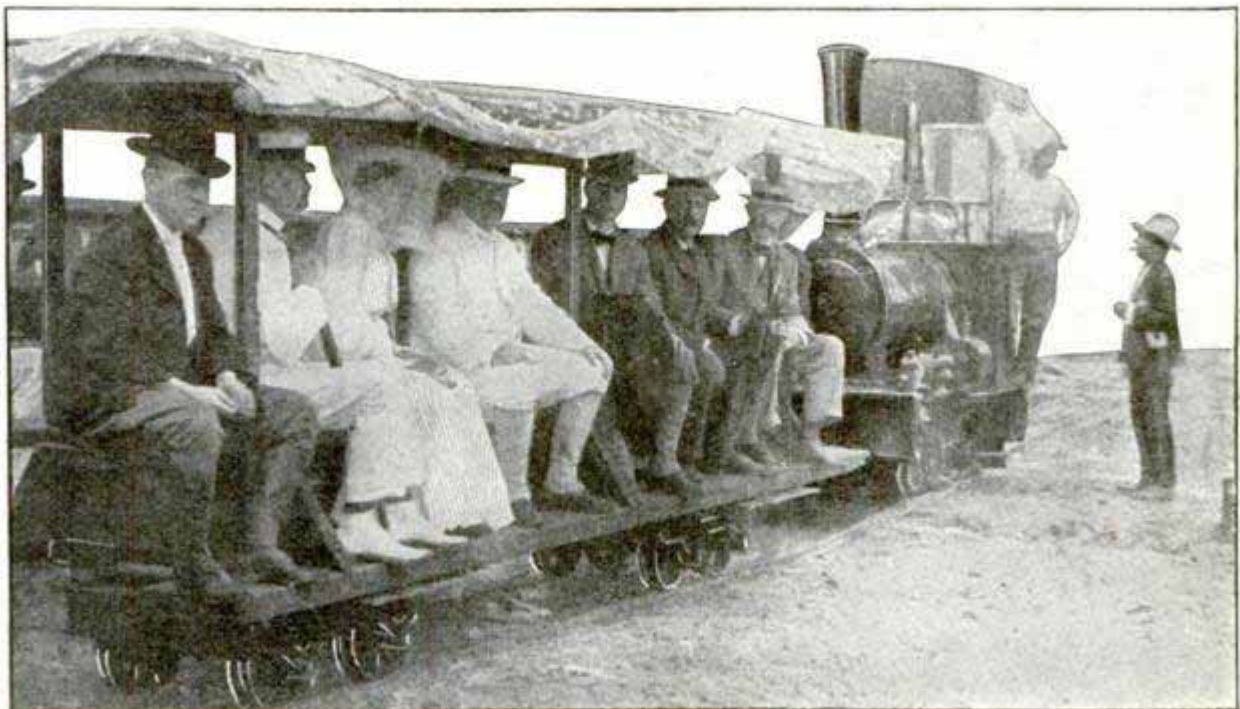
put in the 4-sided holder. Within a light shows through the order so it can be easily read whenever the engineer pulls a cord opening a shutter; at other times the lamp is masked.

LIGHT AFFECTS NIGHT WORKERS

The interesting statement is made that constructing engineers have found the quality of the light used in outdoor night work has a marked effect upon the workers. Acetylene is most like sunlight of any of the artificial lights and the claim is made that the men do more and better work with this illumination. The theory is that the workmen are in better spirits under stronger and more natural lights.

THE PRESIDENT IN PANAMA

The President's recent visit to Panama was one of the most practical and business like undertakings in the history of our executives. He will now be able to judge circumstances as they arise from personal acquaintance of the actual conditions on the big ditch which will be a great advantage. The inspection was evidently not a



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President Roosevelt and Mrs. Roosevelt, Chief Engineer Stevens, Shonts, Bishop and Engineer Holcombe on Narrow Gauge Railway Going to Mt. Hope Reservoir

case of an exhibition of selected choice portions, for the President went into unexpected places and laid out his own itinerary. The impression seems well founded that he was satisfied the work is being as well and as rapidly prosecuted as could be expected, and his visit to the works cannot fail to greatly stimulate both the operations and the workers. The newspapermen found abundant opportunity to indulge in prose and poetry over the event, and here is one of the best examples of the latter:



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On Launch "Bolivar"
Crossing at Pacific End of Canal

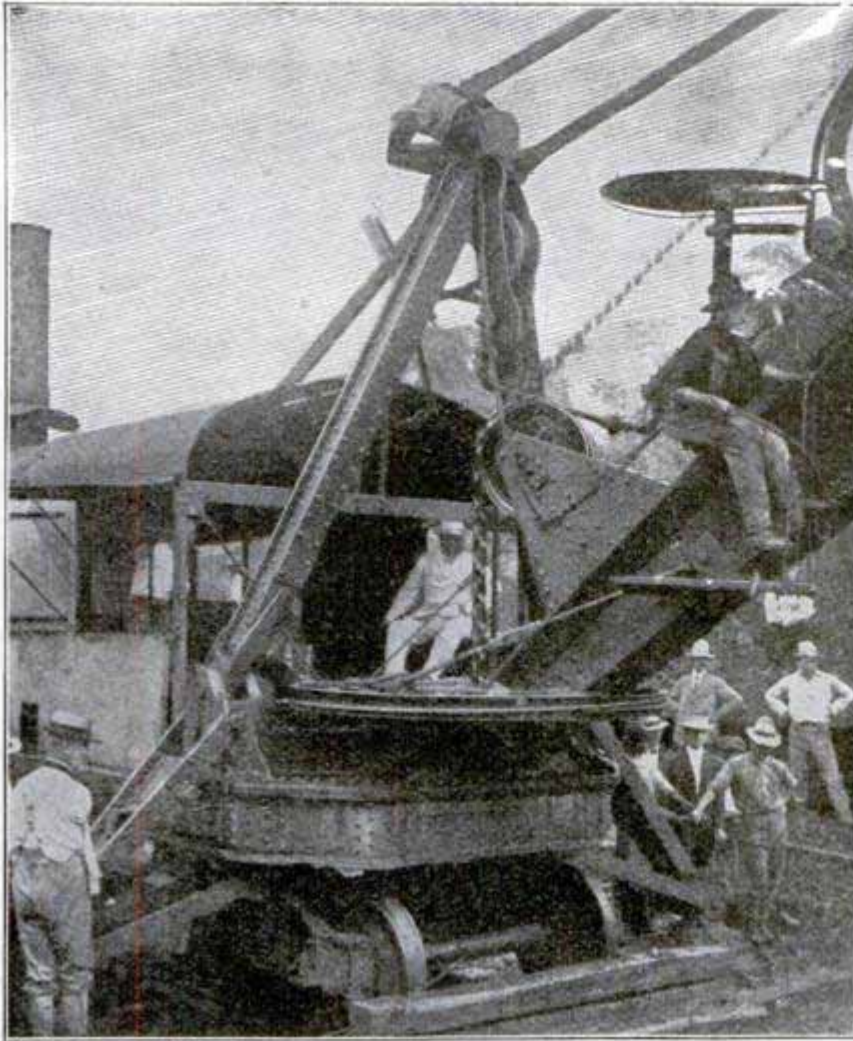
There was quiet over Colon,
There was peace in Panama,
(Where the role of "Sleeping Beauty"
Is performed with great éclat;)
All the dredges were reposing
With their noses in the dirt;
Every engineer was dozing
In his trousers and his shirt,
And the darky with the shovel
Sweetly slumbered in the mud
With his faithful mule beside him,
Gently chewing of its cud.
Poultney Bigelow was forgotten,
Brother Taft was far away;
All the Isthmus took its pleasure
In a dreamy holiday—
When along the throbbing wire
The electric message ran:
"He is coming! He is coming!
Better hustle while you can!"
Every dredge in sudden hunger
Took a double chew of soil;
Every engineer grew vocal
With the blasphemies of toil;
Every darky swung the shovel
Just as fast as he could pitch;
Every mule developed interest
In the progress of the ditch;
Every brush and broom in Colon
Set to work to clean the place;
Every mammy in Culebra
Scrubbed her pickaninny's face,
And the gravel fell in showers,
And the mud in yellow rain,
Till the atmosphere resembled
A political campaign;
Every industry and business
Took a mighty sudden spurt,
For when Teddy comes a-calling,
Then it's best to shovel dirt.

—New York Times.

FASHIONS IN CANNON

A naval expert says there seems to be fashions in the favorite type of guns, which recur at intervals just as styles in garments come and go and return again. The "Dreadnaught" is really a return tactically to the double-turreted "Monitor" type of our Civil War. The arsenals of Europe contain numerous gun relics a century or more old, the types of which are now reappearing in the armies and navies of the world, only in larger sizes than their ancient prototypes.

The Simplon tunnel is said to be in danger of collapse from the pressure of the 6,000-ft. mountain above it. A section of roof has fallen.



Copyright, Underwood & Underwood

President Running Steam Shovel at Pedro Miguel, Culebra Cut

FIRE PROTECTION FOR HIGH BUILDING

The 40-story building in New York has required some unusual measures for fire protection. It was decided to pipe the entire building with connection to a roof tank. The problem of pumping the water up 576 ft. was nothing new, but what to do with it when it came down was. The pressure from such a fall would make it impossible for the firemen to control the stream. Four tanks placed on four different levels and containing altogether 17,000 gal. were finally decided on.

At Hongay, Tonkin, is a hill 200 ft. high which is one solid block of coal. The 3,500 "miners" all work out of doors and get out 1,000 tons per day.

NON-INFLAMMABLE WOOD

All the wood to be used at the International Maritime Exposition at Bordeaux, next spring, will probably be treated with a solution of ammonium sulphate and other chemicals, which make the wood practically fireproof. In a recent test of the formula a huge pile of shavings, pine kindlings, and wood was set on fire, and in the blaze were thrown shavings and sticks of wood impregnated with this "ignifuge." When the fire had exhausted itself the impregnated shavings and wood were found to be simply blackened and charred; they gave out no flame. Paper and cotton fiber treated with the same solution when exposed to the flames were consumed very slowly without a blaze.

LOCOMOTIVE COAL BILL

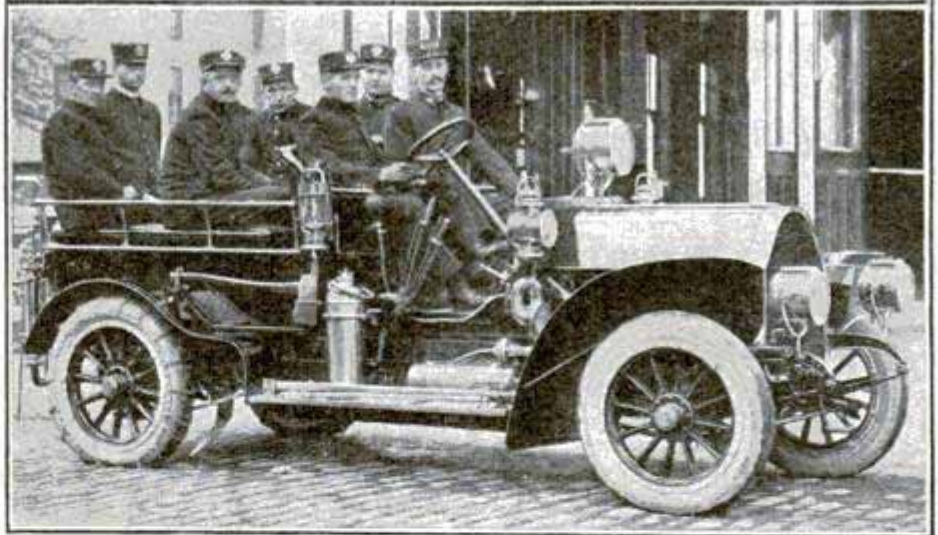
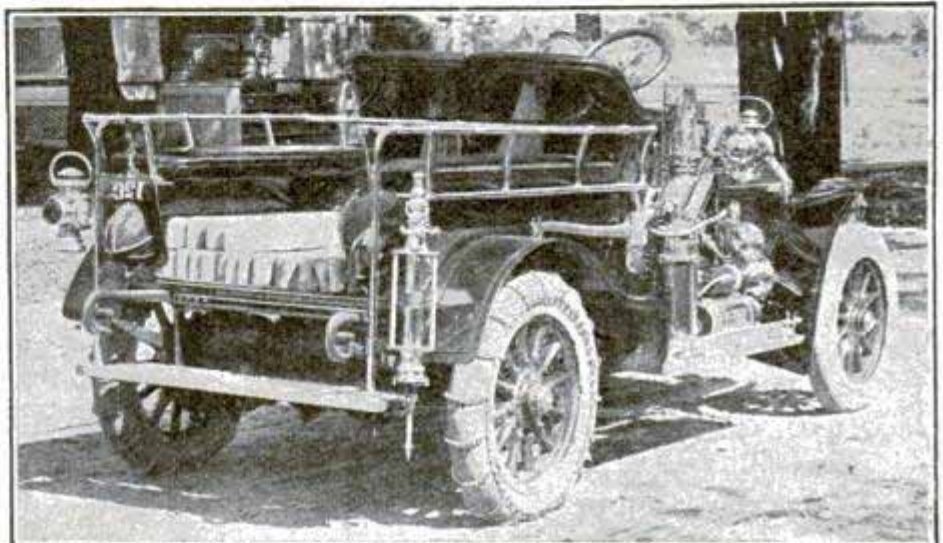
The amount of coal consumed by the railroads of the country is getting to be something immense. From the latest figures gathered (1904) it is shown that the 46,885 locomotives in this country burned that year 106,000,000 tons of coal, which cost \$159,000,000, or nearly 3,000 tons per year for the engines actually in service. Two of the roads running west out of Chicago each paid over \$5,000,000 that year for locomotive fuel. It is stated the big locomotives when actually working get more power out of a ton of coal than the smaller ones, but are more wasteful when standing idle. Still there is no danger of the coal supply giving out.

HIGH-SPEED EMERGENCY FIRE CAR

Instead of adding more men to each station of its fire department, as at first seemed necessary, Springfield, Mass., has established an entirely new department, consisting of a 40-hp. motor car and crew of eight men.

The fire car is located at the central station and answers every alarm, and often is able to extinguish the blaze before the engines arrive. The car carries such fire-fighting equipment as is suitable. On each side of the front seat is fitted a chemical tank, fastened by an easily detachable clamp. The axes are carried on the side of the body, and the hand spikes and crowbars on the running board. On the floor of the car is coiled 200 ft. of regulation hose, and at the rear on the right side the necessary nozzle. Snap fastenings are also provided for carrying the firemen's helmets, while hand lanterns are suspended and fastened to brackets by the side of the operator. The car is equipped with the regular side oil and tail lights, two gas headlights, and a gas searchlight fastened to the dash, the latter three being supplied by gas from a supply carried in a compressed form in a steel tank on the right side of the car. In addition to the hand horn a siren is also provided, which is operated electrically. Weed chains are used on both rear wheels, while just forward of the latter is provided a sand box

with two outlets, the outlets being controlled by the operator. This is rendered necessary from the fact that Springfield's streets are paved with wood blocks, and consequently when coated with mud are somewhat slippery. The eight men composing the crew were individually trained in the use of the car, so that each may be called an expert. It had been estimated that 20 more men were required in the force but the car with only eight men additional sufficed.



This Company Answers Every Alarm

At the Krupp works, and its ore and coal mines are employed 62,000 persons, of whom 5,000 are officials and clerks.

—♦♦♦—
The current of the Nile at the Assouan dam is so strong that a boulder weighing 60 tons has been dislodged from its bed and hurled against the masonry.

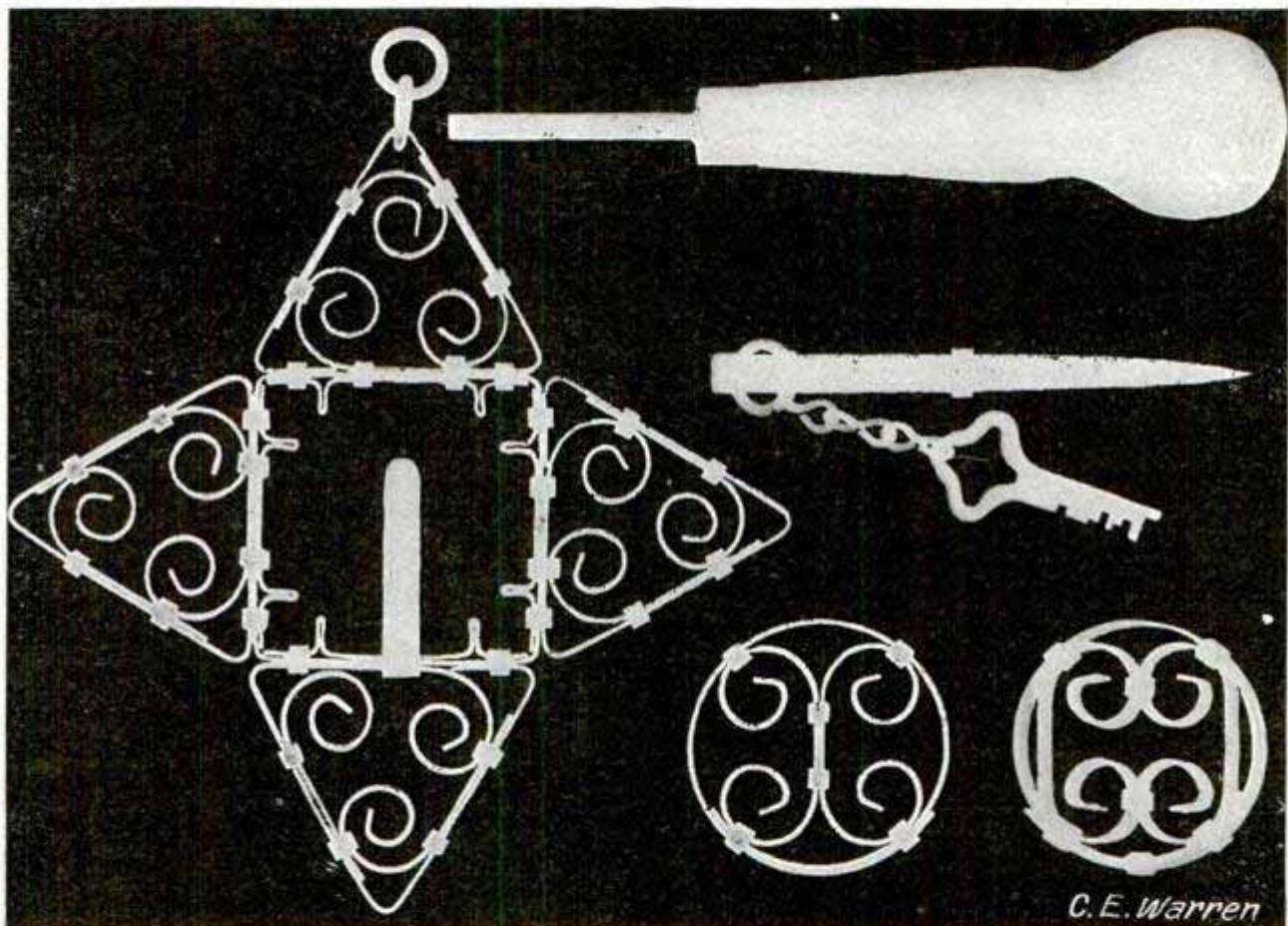
SHADOWGRAPHS AND HOW TO MAKE THEM

By Charles Everett Warren, M. D.

Casting about for a simple, easy, quick and accurate means of making a number of records of designs for bent iron patterns, I accidentally struck upon the following method of blueprinting, which is applicable to a number of purposes where an outline is desired:

correctly in relation to the plane of the board.

To obtain a perfectly clear outline, without shade, make a board with an arrangement for tilting it at any angle, a ball and socket joint being preferred, and drive a long, slim, steel wire nail near one end and perfectly perpendic-



Shadowgraphs Reduced One-Half Actual Size

If the object to be sun printed is simply laid on a board over a sheet of ferro-prussiate paper, sensitized side up and held in place by common pins pushed into the board through the paper, close to the object and standing vertically, it may be exposed to the direct sunlight and a print taken; but there will be an effect of more or less shade, since the eye cannot judge the angle of sunlight

ular to the surface. The shadow of the nail head will then indicate when the board is perpendicular to the sun's rays.

For paper I use heavy ledger stock. The sensitizing solution is as follows:

A. Ferricyanide of potassium	1/4 oz.
Water	1 1/2 oz.
B. Citrate of iron and ammonia	150 gr.
Water	1 1/2 oz.



Wine Glass and Bronze Statue--One-Half Size

Dissolve each separately and mix. If put in an amber colored bottle it will keep some time. But the paper should be used within a day or two after coating. For this reason prepare only sufficient for present use.

This is done in dim light, with a wad of cotton wool, spreading the solution evenly with long sweeps, the paper being laid on a board. It is then hung up in a dark place to dry. This, by the way, is an excellent formula for printing photos, if a fairly dense and vigorous negative is used, and may be of use for making post-cards if the stock is glazed; otherwise the solution will sink into the card.

Expose to bright sunlight until the paper not covered by object is a dull gray for deep blue or a bronze blue for light blue when developed. Develop in water, remembering that the full strength of color is developed by fairly long immersion. Rinse several times to insure perfect removal of all ferro-prussiate, or the print will not be permanent. Dry out the superfluous moisture by laying in an old newspaper and then remove to dry newspaper and dry under a weight.

If the slight print of the pin heads is objectionable, cut them off with cutting pliers after they are in place or use pliers to insert them. I have

found a thimble on the index finger a help, as it prevents sore fingers. Be sure to drive the pins firmly, and in a vertical position, close to the object to be held, as the board must be inclined and the weight may cause the object to fall off if it is not securely fastened.

The preparation of the object for exposure may be done in a dimly lighted room without causing any appreciable effect on the objective result. If the object does not have a flat side, but tends to tilt, put bits of cork of the right height under it or drive in a pin and cut off the head to leave it of sufficient height to act as a support.

This method was originally adopted to copy designs of scroll work made from $\frac{1}{4}$ -in. iron tape, but it has been found by experiment to be applicable for printing cylindrical and irregular objects of some thickness, such as tool handles and the like. Hence it is an easy and accurate method of getting template prints, which may be cut accurately to line.

Corrections in the blueprints or additional white lines or legends may be inserted by using a saturated solution of bicarbonate of soda as ink. If a little gum arabic is added to it it will flow better.

Line drawings may be made by printing and developing in the usual way. Line in all the parts desired with waterproof black ink and when dry immerse the print in a solution of bicarbonate of soda, and the blue ground will disappear, leaving a black line drawing on a white ground.

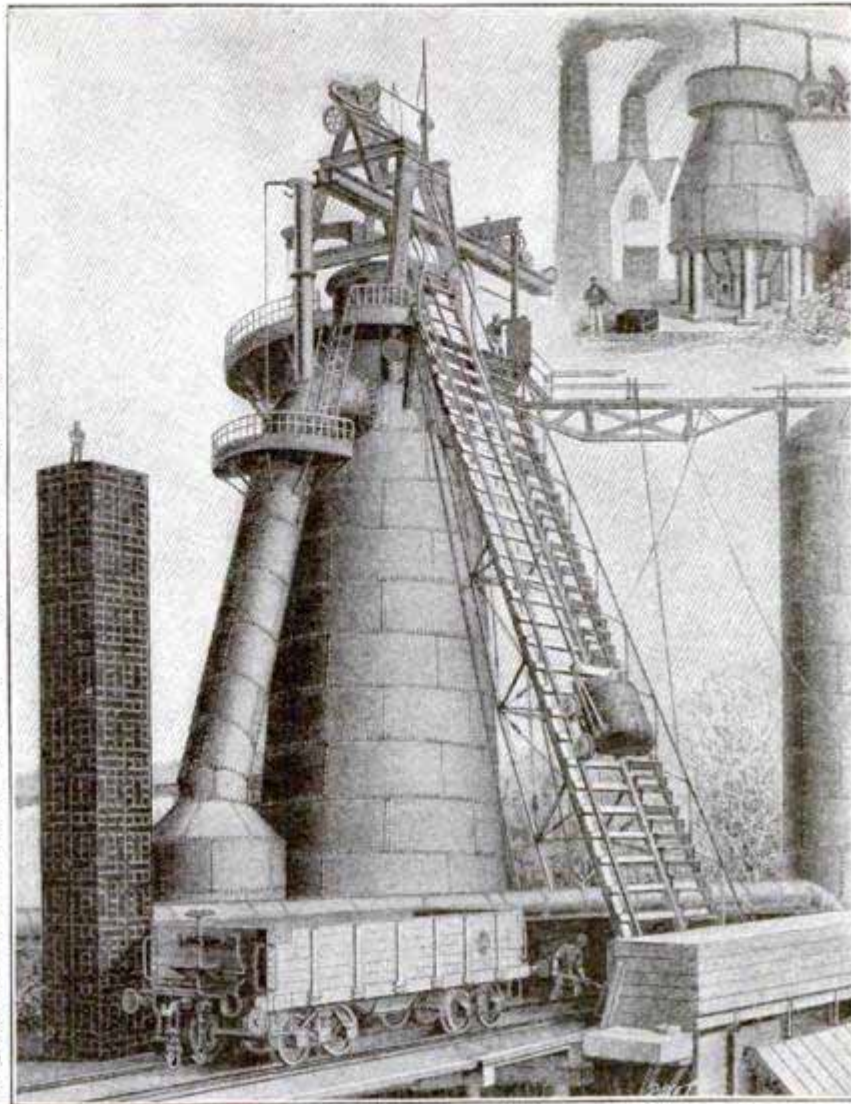
DIVER READS UNDER WATER

To test the qualities of a submarine electric light a diver at Aberdeen, Scotland, descended 20 ft. in muddy water taking a newspaper and the light down with him. While seated on an anchor at the bottom of the harbor he read aloud for ten minutes to the men above, the words being conveyed through the telephone in his helmet. The paper was held 18 in. from the lamp.

DEVELOPMENT OF THE FRENCH BLAST FURNACE

A French writer in *La Nature* reviews the progress of the iron industry in his country. Until within the past few years the old type furnace was generally employed, having a capacity of 6 to 10 tons production per day. Even now there are many of these small plants, limited to an output of 24 tons daily.

The artist has portrayed the small furnace with the man pointing to the small pile of pig iron, and also the modern French plant with an output of 700 tons per day, in which the product is represented by the tall square shaft on which a man is standing. In 1848 the French produced 500,000 tons of iron; last year, 5,000,000 tons.



Showing Growth of Iron Industry in France

CARD SHUFFLER



A machine which automatically shuffles a pack of cards in an instant, with the cards concealed from sight, and which changes the position of 99 out of every 100 cards, is the latest mechanical device for card players. It not only protects the cards from injury but gives an absolutely "square deal" shuffle.

The machine weighs 4 lb. and attaches in a moment to any table. It is about 12 in. high.

A FIRE-PROOF BRICK

A glass company at Monterey, Cal., reports the discovery of materials and a process of manufacture which produce a remarkable brick. The chief materials are magnesia and silica rock, which when ground and mixed with secret ingredients rapidly hardens in the air, and becomes a non-conductor of heat, cold and sound. A sample, 2 in. long, was exposed at one end to an intensely hot flame for 10 minutes and could then be held in the hand by taking hold of the other end. When subjected to a strong blow-pipe flame and suddenly plunged in cold water no injury was detected. It is said the cost of making is no greater than the ordinary clay brick.



SIGNAL BALLOONS

The illustration shows one of the signal balloons now in use in the German army. They are not intended for passengers but are sent up with signal flags and cones used in connection with a secret code.

ELECTRICAL DEVICE TO PREVENT SEASICKNESS

The terrors of a sea voyage, due to seasickness, are said to have been entirely overcome by a recent invention of Herr Paul Kappmeir. The accompanying illustration, from the American Inventor, shows a new electrical device as placed in position on the head of a patient suffering from seasickness.

The inventor of this device, after having made numerous experiments and exhaustive researches, came to the



The Electric Cap

conclusion that seasickness is caused by acute cerebral impression in combination with reflex irritation of certain nerves in the head, which results in a disordered circulation and an abnormal flow of blood from the head to the gastric regions.

In order to disprove the old theory that seasickness is caused by the contents of the stomach being continually washed against its walls, an experiment was tried in which a susceptible patient developed all the symptoms of seasickness while in a perfectly stationary position. This was accomplished by means of an optical illusion, the rolling motion of the boat being simulated by moving mirrors. Thus by visible impressions the feeling of equilibrium, in the same way as in the initial stage of seasickness, is disturbed in the reflex centers, but after a time, and also upon subsequent repetition by tolerance and habit, accommodation slowly begins, in the same manner that on ship-board the eye slowly accustoms itself to everything around it being in motion.

The electric cap consists of a compress, which produces both heat and pressure, thereby paralyzing the vasomotor nerves, which control the supply of blood to the head. This allows the normal amount of blood to flow to the head, thereby preventing the dizzy feeling and overcoming the distressing sensations in the stomach.

COAL MINING IN INDIA

India has upward of 35,000 square miles of coal fields. The coal is an excellent quality of bituminous and now retails at about \$3 per ton. At present mining is conducted in a very crude and unscientific manner, to remedy which the government has opened a college for training native engineers. Many women find employment in the mines.

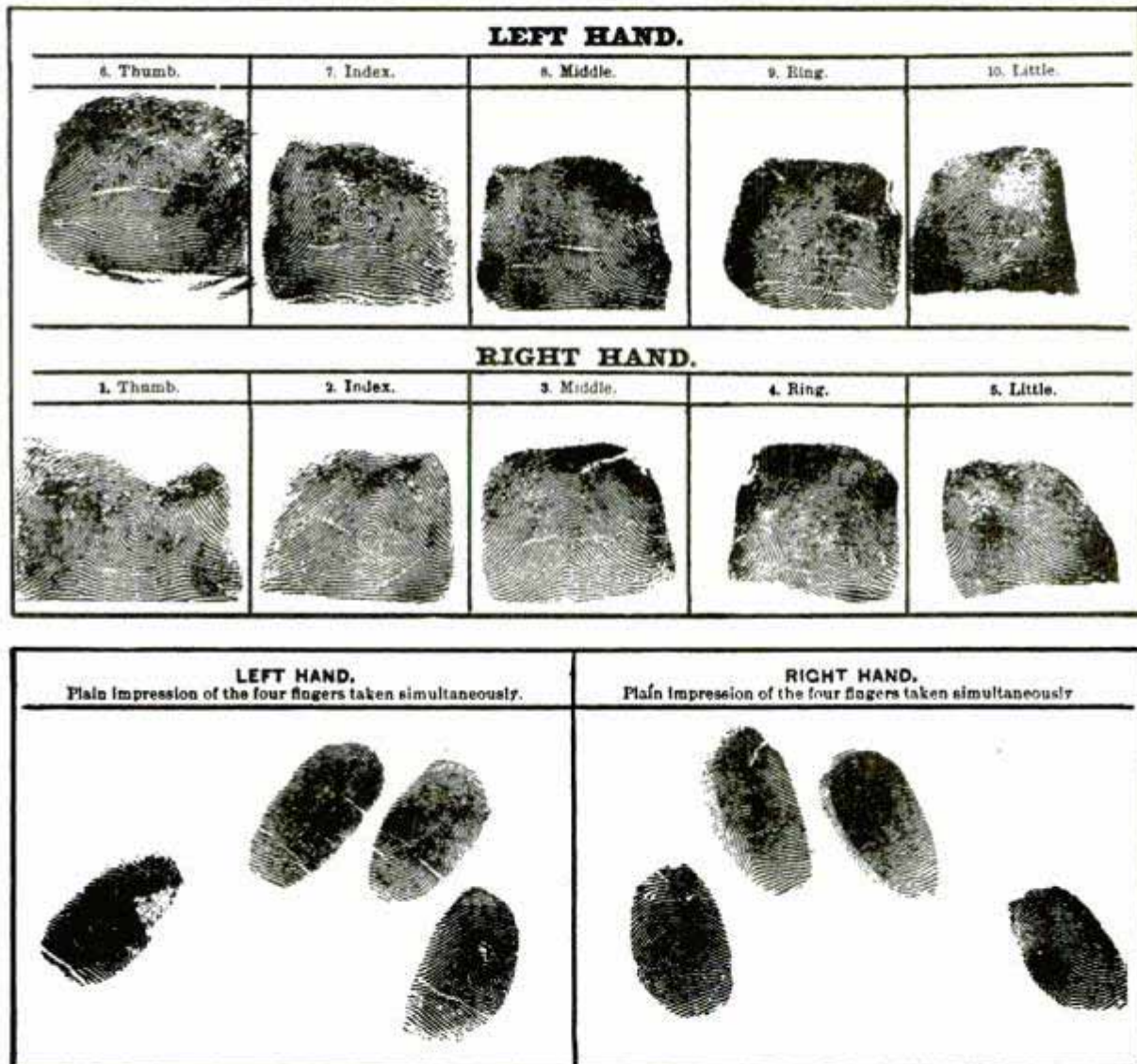
In the capital of India the coolie women carry bricks and mortar on their heads and climb bamboo ladders

to the third and fourth stories of buildings as helpers to coolie masons. These women sweep the streets and do all sorts of menial labor. They carry on their heads burdens seemingly large enough to bend the backs of bullocks and donkeys. Even girls of

8 and 10 years of age carry loads on their heads weighing 50 and more pounds and trudge along under the sun's intense rays with the mercury rising to 100° in the shade. An effort is being made to change these deplorable conditions.

SOLDIERS IDENTIFIED BY FINGER PRINTS

From Birth to Death the Same Pattern and in No Two Individuals Alike



The finger prints of every individual are distinctively and exclusively his very own. In eyes, nose, hair, even the entire face, he may so closely resemble some other man, as scarcely to be distinguished from him. In fact, the statement is made that somewhere in the world there is always a "double" for every one. But

the patterns made by the little lines in the pulpy ends of the fingers never conflict. Not only do these prints differ in men, but the lines on each of your ten fingers are different from each of the other nine fingers. The discovery of these facts is now employed in a system of identification which is absolute and permits of an

enormous number of combinations. The finger print identification is an outgrowth of the Bertillion system, but has many advantages. A change in whiskers, the removal of a mole or tooth is easily accomplished and makes a stranger of an oldtime friend. Many a man has shaved his beard and had his own children deny his identity. The color of hair, and even of the eyes, alters during life, as may one's gestures, features and handwriting; but throughout an entire life and even after death, the little ridges on the finger ends alone remain true and unchanged to the patterns which only a microscope can discern on a baby's hand. The War Department has now adopted a finger print record and every man who enlists has his record taken and sent to headquarters at Washington. How this is done and what becomes of the records is described in detail by Maj. J. R. Kean, M. D., surgeon U. S. Army, in the *Journal of the American Medical Association*.

When a man enlists a front and side view photograph are made of him, with a camera which is the same as used at all other recruiting stations; the camera in every case being stationed 54 in. from the subject. This results in a uniform system of photographs. Impressions are then made on paper of each of the ten fingers, one at a time. The finger is pressed against an ink pad and gently held to the proper column of the record sheet for a moment. Then an impression is taken of all four fingers at one time, of each hand. A forward rolling motion is given the finger tip in making the print.

Should our soldier or sailor boy ever meet with death in battle, and every other mark of identification be destroyed, a print of even one of his fingers would enable the department to complete his record, and mark his honored grave with his name, age, and company.

The reading of a print is really a remarkable performance; in other words

taking a finger print and identifying its owner. This is done by experts at headquarters. In filing, a division is first made of two general classes, loops and whorls. In the former are included the arches and in the latter the composites. Each of the ten prints will be there, either a loop or a whorl, designated L or W, respectively, and the ten digits, being taken in pairs, there will be four possible combinations of each pair, which are written

as a key thus:

LL	LW
WL	WW

The classification is then extended to its limit, and so perfect is the work that an expert can find and identify a print by its owner's name in a section containing 100,000 cards, in five or six minutes.

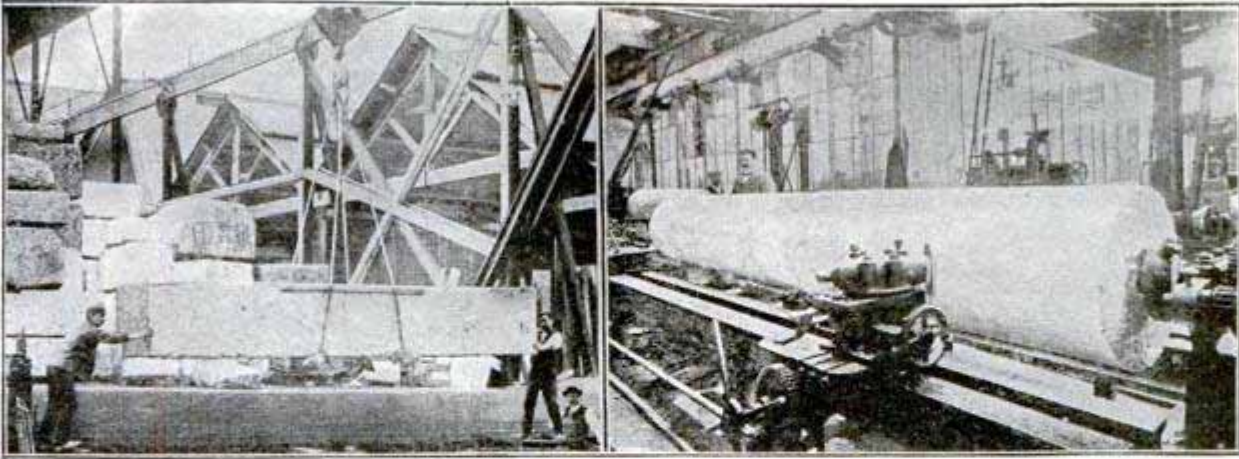
Major Kean says: "This system will be very valuable in obviating the necessity of much correspondence and collection of evidence at present required to prove identity in cases coming before the War Department and the Pension Bureau. After the introduction of this system, any man who has had service in the Regular Army, can at once establish his identity by placing his right forefinger on the ink pad of an ordinary rubber stamp and making a finger print below his name. Unknown dead, or unconscious men, brought from the battlefields into field hospitals, or who die there, can in this way give a record which will lead to their identification; and a copy of the finger print buried in a vial with the body will be a permanent identification of it."

◆◆◆

Don't try to use an incandescent light too long, as it grows old you are using just as much current and getting less light all the time; 800 hours is usually long enough.

◆◆◆

A telephone line has been built to the summit of Mount Graylock, the highest mountain in Massachusetts. Where the line makes a nearly vertical ascent for several hundred feet the wires are carried in an iron pipe.



From the time a block of stone weighing many tons is cut from the quarry until placed in position to ornament or support some great building, the work is practically all done by machinery. Two or three men with suitable hoisting apparatus handle these immense weights easily and safely. Pillars are turned in lathes, carborundum wheels driven by an electric motor taking the place of a steel knife; otherwise the process is quite similar to that of turning a table leg.

BOAT POLO FOR LADIES

DUPLEX WIRELESS SYSTEM

Boat polo, which was introduced last summer in England, proved a great success, the game being full of excitement for both players and spectators.

Specially built small boats are required and the player is allowed only one oar with which to guide the boat and play the ball. As the boats are easily and frequently capsized much skill is required, and the players must be good swimmers. The general rules of the game are the same as when played on land, but the playing is more interesting on account of the single oar. The frantic efforts to maintain the boat in position and strike the ball at the same time are extremely amusing.

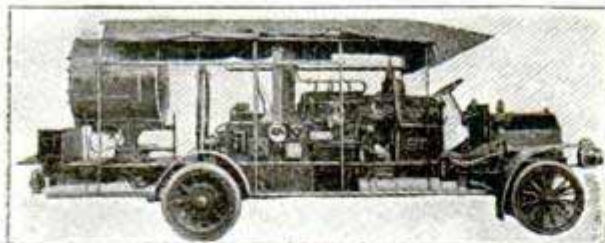
Mme. Curie, the first woman to occupy a chair at the Sorbonne University, Paris, has opened her lectures on radio-activity.

A new system of wireless telegraphy which was recently invented by Vladimir Poulsen, of Copenhagen, is said



"The Boats are Frequently Capsized"

to have solved the troublesome problem of interference between stations while working simultaneously. In the new system a continuous flow of energy to the receiving apparatus has replaced the intermittent sparks used in other systems, and it is claimed that any number of stations within range of each other can intercommunicate without mutual interference.



PORTABLE ARMY SEARCHLIGHT

A powerful searchlight is the surest safeguard against a sudden night attack, and is now recognized as just as essential a part of an army outfit as its tents. The latest portable motor searchlight equipment for the British army is the large machine shown, the wheel base being 12 ft. The generating outfit for the searchlight is an independent motor of 35 hp. The projector is 36 in. diameter; an extra lens being carried.

A NATION ON WHEELS

The recent statement in these pages that there were in use today automobiles and motor cars to the value of

\$200,000,000, occasioned considerable surprise—and some doubters. When one realizes, however, that there are more than 100,000 of these machines, and that \$2,000 would be a low rather than high average price, the figures are found to agree. This number and amount are the accumulations of several years, and not the production of the past 12 months.

In the line of vehicles drawn by animal power, including carriages, trucks, merchants' wagons, drays, farm wagons, etc., the annual production numbers nearly 2,000,000 vehicles, which with an average life of, say five years, would give for the entire country approximately 10,000,000 vehicles of one kind and another, and the capacity of the combined assortment is sufficient to give every man, woman and child in the entire United States a ride at the same time.

Evidently the motor car has some little distance to travel yet before the faithful horse and mule are entirely displaced.

HOW GOLD LEAF IS MADE

Why Gold-Beating Machines are Failures

Strange as it may appear, the process of beating gold has not been changed during the thousands of years in which it has been practiced. While nearly every other art and industry has been greatly benefited by the application of mechanical devices, the gold-beater has been constantly pounding away and furnishing the world with his splendid product, apparently indifferent to the mechanical progress that has been made in other directions.

The first operation in manufacturing gold leaf is the preparation of the metal. The gold is obtained originally in its pure state from the Philadelphia Mint and is then alloyed with $\frac{1}{2}$ carat each of silver and copper, thus leaving the gold 23 carat fine. The object of adding this alloy is to increase the strength of the gold, which is very soft in the pure state.

The gold is melted in crucibles about 6 in. high which are placed in a small furnace where the metal melts at a yellow heat and is then poured into molds, in the form of bars about 10 in. by 1 in. by $\frac{1}{2}$ in.



The Gold-Beater

The bars of gold are then passed between steel rollers and rolled into ribbon several hundred feet long and about an inch wide, the rollers being brought closer together after each operation, until the metal is as thin as paper. It is then cut into small squares ready for the first beating.

The first beating is done with a 16-lb. hammer. Two hundred pieces of sheet gold are placed between sheets of oiled paper, used exclusively for the purpose, the sheets being held together by two parchment bands. This forms a package $3\frac{1}{2}$ in. square and about $\frac{3}{4}$ in. thick, known as a "cutch."

The cutch is then placed on a marble anvil sunk 3 ft. in the ground and is there hammered with the 16-lb. hammer, thus causing the gold to flatten and spread out between the sheets of oiled paper. When all the pieces have spread out evenly to the edges of the cutch they are taken out and each square is cut into four smaller squares.

The 800 pieces thus formed are placed in a package of oiled papers $4\frac{1}{2}$ in. square called a "shoder." This is hammered with a 12-lb. hammer until the gold is driven beyond all four edges, the gold extending over the edges, known as "sfruf," being scraped off with a knife and saved to be melted over again.

The 800 large squares are then removed from between the oiled papers; placed, one at a time, on a leather cushion and cut into four smaller squares. The 3,200 leaves thus formed are placed in three packages of skins called "moles." These skins, which will be described later, serve in the same way as the oiled papers in the

former operations, but are much smoother and present very little friction to the spreading gold. The moles are beaten on the marble anvil in the same manner as the cutch and shoder except that two hammers are used. The first beating is done with a 6-lb. hammer and is continued for two hours, after which the beating is continued with a 10-lb. hammer two hours longer.

The gold-beater examines the work from time to time by slipping off the parchment bands and turning over the edges of the skins, thus showing where the gold is spreading the least



Gold-Beater's Tools

and enabling him to determine where to strike the greatest number of blows.

After the final beating the gold leaf is trimmed into $3\frac{3}{8}$ -in. squares which is the universal standard in all countries and it is then packed in books ready for the market.

Considerable time is required to learn all the branches of the gold-beater's art and an apprentice is not considered proficient until he has had at least four or five years experience. A complete knowledge of the peculiar properties of the gold-beater's skins is essential as the success of the

operation depends largely on their condition. These skins are obtained from the intestines of cattle, only one portion being suitable for the purpose, the size of which is barely sufficient to make one skin. Each mole or package of skins will therefore represent over 1,000 head of cattle.

Gold-beater's skins are now furnished exclusively by a London firm, who prepare them by a special process, which has been carefully guarded and kept a family secret for many generations. In Chicago the fresh skins are obtained from the stockyards and are then sent to the English firm where they undergo the secret process after which they are shipped back.

Before each beating the skins have to be carefully prepared by the gold-beater. They must be neither too hot nor too cold; must have just the right amount of moisture, and require more skill in their preparation than any other branch of the art.

If properly used and cared for one package of skins will give constant service for about a year and a half, but if given a single foul blow, i. e., struck with the edge of the hammer, the whole pack will be ruined. Overheating will also damage the skins and if carried too far will spoil them entirely.

The adhesive properties of gold leaf render it fatal if swallowed in sufficient quantities, and the nobility of China frequently commit suicide in this way, the gold leaf often completely covering the walls of the stomach and preventing nutrition.

The extreme thinness of gold leaf, $1/200,000$ to $1/250,000$ of an inch, makes it transparent to light, a single leaf, held between the eye and the light, having the appearance of green glass or very fine green gauze. It is so transparent that a person would have no difficulty in recognizing a friend by looking through it towards the light, but let a beam of light strike the side of the gold leaf on which the observer stands and it suddenly appears to be opaque. All objects ap-

pear to have a green color when viewed through a piece of gold leaf the same as when a piece of green glass is held to the eye.

In all industries where gold leaf is used care is taken to save all the scraps and waste, which are returned to the gold-beater to be remelted. Several bookbinders of this country realize in this way as much as \$500 to \$600 each month. The daily sweepings from gold-beating establishments are saved and sent to the smelter, as they are rich with gold.

Several machines have been designed for beating gold but none of them have met with any practical success. In discussing the possibilities of beating gold by machinery, Mr. A. H. Williams, one of the most practical gold-beating experts in this country, says:

"The process of beating gold today is the same as it was in King Solomon's time. No improvement in the art has been made since then nor are there indications of any for the future. It must be remembered that gold-beating is an art and that the apparent indecision with which the skilled gold beater strikes his work, is in reality the result of many years' experience. Thus it is that the true art hides itself and while to the ordinary observer the blows are simply given at random, the gold-beater must know just where to strike each blow in order to spread the gold successfully without pounding it full of holes.

"If the beating is done too fast the skins become overheated and the work is ruined. For this reason a machine even if successful would turn out no more work than a single operator and would therefore be more expensive than the present method.

"I am of the opinion that the art of gold-beating has long past reached its final state of perfection. It would be a waste of time for any person to endeavor to invent a mechanical process to do the work who had not first become experienced in the present method."



SHOP NOTES



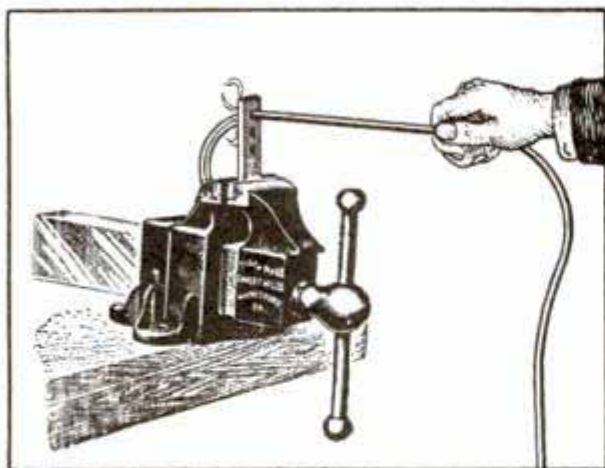
Unloading Big Revolving Field

The revolving field for a 6,600 k. w. alternator was shipped on a special flat car having an opening in the middle which allowed the bottom of the field to come $3\frac{1}{2}$ ft. below the surface of the car. The field weighed 42 tons and it would have been necessary to raise it $3\frac{1}{2}$ ft. in order to clear the car in unloading, which involved the erection of powerful hoisting apparatus.

Instead, one end of the car was lifted from its truck to a sufficient height and the field, which was $13\frac{1}{2}$ ft. in diameter, was rolled out from under the car.

To Make a Round Leather Belt

Cut the leather into long strips, having a square section, and then draw through a die made by drilling holes in a piece of steel, as shown in the illustration. The holes should be drilled of different sizes and the belt

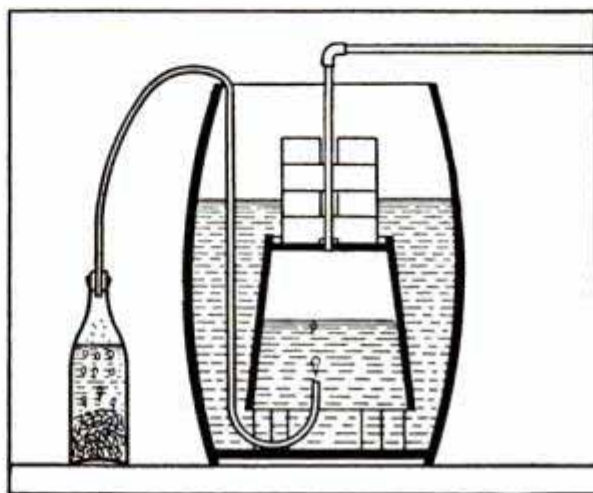


Making a Round Leather Belt

should be drawn through the largest hole first. To polish and smooth the belt draw it through a tapered hole, having the belt enter at the large end.—Contributed by A. W. Griggs, 955 Market St., Kenosha, Wis.

Hydrogen Generator

A good hydrogen generator for furnishing a non-oxidizing flame can be made, as shown in the sketch. A tall bottle, A, is fitted with a perforated cork which has a small glass tube in-



Hydrogen Generator

serted to connect the rubber hose, B. Dilute sulphuric acid and bits of zinc are placed in the bottle, and the resulting reaction liberates hydrogen gas, which passes through the hose, B, and bubbles up into the receiver, C.

The receiver consists of an inverted butter tub, D, placed in a barrel of water and held down by bricks, E. A $\frac{1}{8}$ -in. pipe, F, is connected to the bottom, as shown, and carries the gas to the burner, which can be placed in any convenient location.

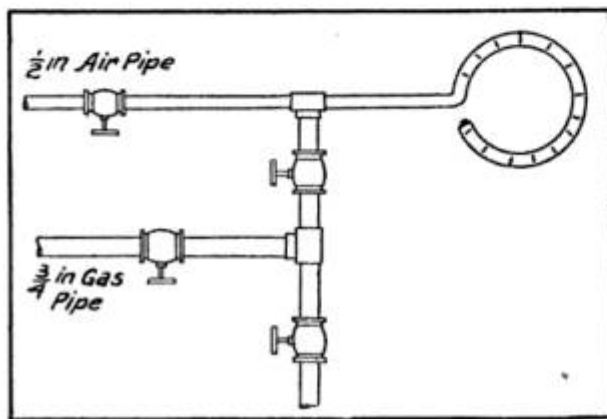
Pure hydrogen without air will not burn, but when mixed with air an explosive mixture is produced. For this reason the air space in the top of the bottle should be relatively small, and it is well to let the gas generate a minute or two before connecting the hose, in order to drive out the air.

The inverted tub should be entirely filled with water in order to prevent air becoming mixed with the gas. If it is desired to increase the pressure,

pour more water into the barrel. It is well to construct a small generator first, if one is not familiar with the properties of hydrogen, as an explosion would then be less dangerous.—Contributed by A. G. Ward, Peebles and Edgerton Aves., Wilksburg, Pa.

Gas Burner for Melting Lead

Having occasion to melt a large quantity of lead in a pot 16 in. in diameter and 10 in. deep, a piece of $\frac{3}{4}$ -in. pipe was bent in a circle and



Gas Burner for Melting Lead

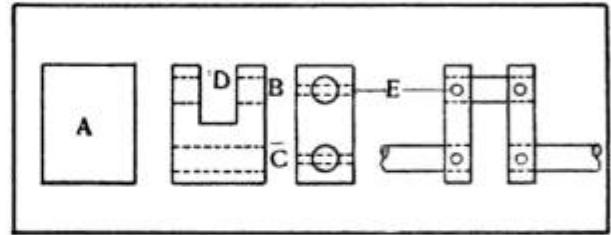
the end capped, says the Journal of Electricity, Power and Gas. Slots were then cut with a hacksaw. To this a $\frac{3}{4}$ -in. gas pipe was attached with gas under 5 lb. pressure, and a $\frac{1}{2}$ -in. pipe from compressed air tanks. By regulating the air and gas valves, 10,000 lb. was melted and poured in four and one-half hours.

Crankshaft Made Without a Lathe

A crankshaft which will run true and serve a practical purpose may be built up as follows:

Mark off two centers, E and F, the distance apart of the throw-off crank on a piece of mild steel, A, and drill holes B and C. Cut out the portion D by drilling a hole at the bottom and sawing down to it. Drive a piece of rod—a tight fit—through B to form a crankpin; drive a longer piece through C to form a shaft. Secure these rods at the joints by brazing,

and put a safety pin, G, through. Saw away part H, then file the crank and round it off. A double crank

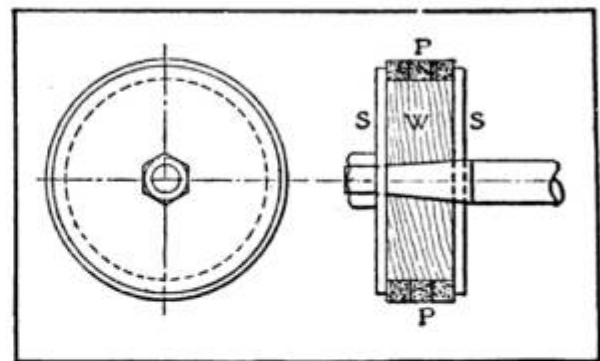


Crankshaft Made Without a Lathe

may be made in this way, but all depends on the holes being drilled parallel and true.

Making a Temporary Piston

One of our water service pumps failed, and an examination of the piston showed that it had been broken beyond repair, writes a correspondent of Power. No spare pistons were on hand, and the pump was needed. The sketch herewith shows how a temporary piston was made. A wooden disk, W, was turned, faced and bored to fit over the piston rod; this was reinforced by two steel plates, SS, about $\frac{1}{8}$ in. thick, that were in stock. One plate was bored smaller than the diameter of the piston rod, fitting the small end of the taper part as shown

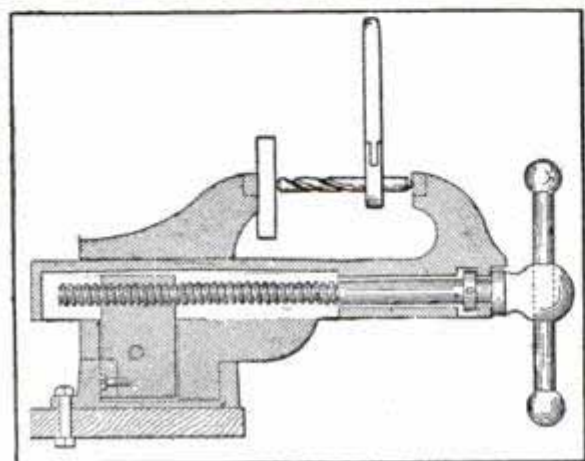


Temporary Piston

in the sketch. Square packing, P, was put between the plates, and the piston was completed. This piston gave no trouble, working all right for several weeks, when the plant shut down; then a new cast-iron piston took its place.

Drill Press Made from a Vise

An ordinary bench vise with a small hole in one of the jaws makes a very good drill press for small work. The work is placed against one jaw and the end of the drill placed in the hole in the other. Round shank drills may be turned by means of a small pipe wrench or gas pliers and square shank drills may be turned by using



Vise Used as a Drill Press

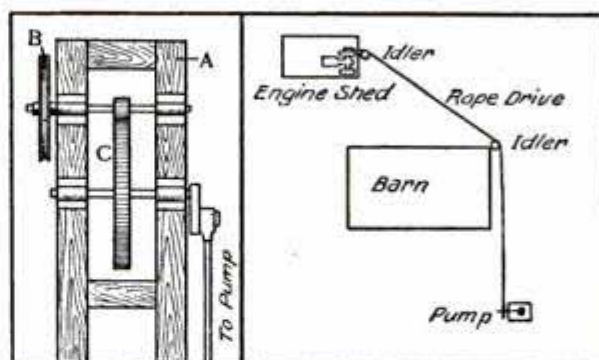
a monkey wrench.—Contributed by Reader, Chicago.

Home-Made Power Transmission Device

Anyone desiring to pump water, or perform some other operation with the power from an engine some distance away, can easily do so by means of a rope drive. Where little power is required, a rope $\frac{3}{8}$ -in. or $\frac{1}{2}$ -in. diameter will be large enough and the power may be easily transmitted to a distance of 100 ft. or more.

In the device I made, which is used for pumping water, a wooden frame, A, supports the sheave, B, which is connected by the rope to a similar sheave on the engine shaft. Both sheaves are made of wood and have sharp V-grooves which prevent the rope from slipping. The spur gears, C, while not absolutely necessary, are useful in reducing the speed and save the extra work of making a larger

sheave which would be required if the gears were omitted. A crank on the shaft of the larger gear operates a



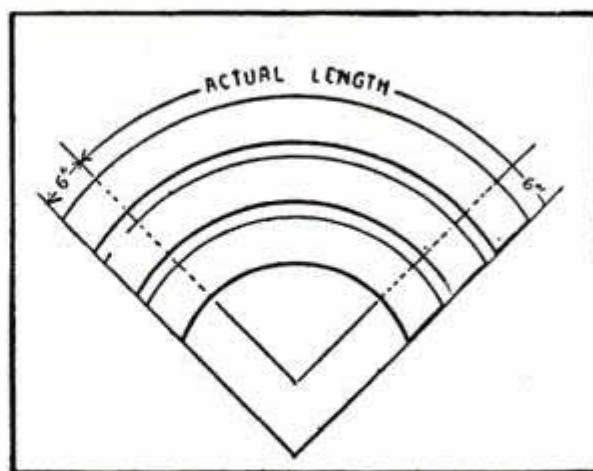
Pump Operated by a Rope Drive

connecting rod, which is attached to the pump rod.

It will be noticed in the plan view that the barn comes between the pump and engine. In order to make the bend around the corner, I used idlers, the bend from the engine being made in the same way.—Contributed by Harry E. Fillberg, Taylors Falls, Minn.

Obtaining Correct Pipe Bends

For bending 3-in. pipes, one a little shorter than the other, so that they can be located one under the other, the drawing shown in the sketch will



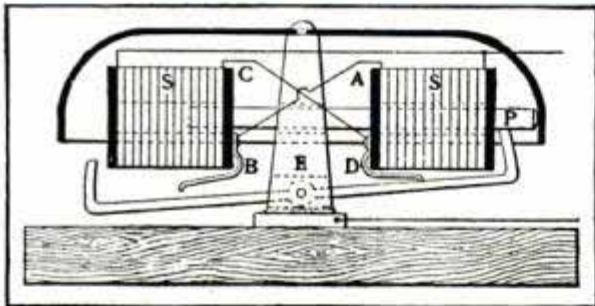
To Make Correct Pipe Bends

be found to give accurate results. The drawing should be made accurately on the machine shop floor, so that it can be used at any time. About

6 in. is allowed for cutting off at the ends. The drawing, says the Practical Machinist, shows how to find the correct length of pipe to be used and the radius of the required bend.

How to Make a Continuously-Ringing Plunger Bell

The continuously-ringing bell is constructed so that wire, A, from the right-hand solenoid crosses to the left-hand contact piece, B, and the wire, C, from the left-hand solenoid crosses to the right-hand contact piece, D. The switch is pivoted at E, and when the plunger is in the position shown it is attracted toward the right-hand end. When it moves to the right-hand it touches the contact, D, and closes the circuit for the left solenoid and opens the circuit for the right solenoid. Then the left solenoid drives the plunger, P, through to the



Continuously Ringing Bell

left and strikes the bell. The plunger is then an electromagnet because of the action of the coil and draws the left end of the switch toward it, the switch being made of iron. The switch then touches the left contact piece and closes the circuit for the right-hand coil and opens the circuit for the left-hand coil. The plunger then flies to the right and strikes the bell. The switch is hung so as to be slightly unbalanced, says Machinery, thereby securing contact to one of the coils and enabling the plunger to start.

The University of Wisconsin will use phonographs in teaching students at their homes.

Wasting Water

Where water is sold through a meter, landlords are wise enough to have spring closing faucets on all bathroom fixtures especially. The practice of washing the hands with running water causes a greater waste than if the water were caught in the bowl for use. This is not the case where the hands are only to be rinsed or damped.

A faucet may leak slightly, yet waste a large amount in the 24 hours. One was leaking at a rate of over 60 drops a minute, and it was found to fill a pint measure in 10 minutes, making a waste of $\frac{3}{4}$ gal. per hour, or 18 gal. a day.—Contributed by W. D. Browning, Collinwood, O.

How to Open a Book

Hold the book with its back on a smooth or covered table; let the front board down, then the other, holding the leaves in one hand while you open a few leaves at the back, then a few at the front, and so on, alternately opening back and front, gently pressing open the sections till you reach the center of the volume. Do this two or three times and you will obtain the best results, says Modern Bookbinding. Open the volume violently or carelessly in any one place and you will likely break the back and cause a start in the leaves. Never force the back of the book.

"A connoisseur many years ago, an excellent customer of mine, who thought he knew perfectly how to handle books, came into my office when I had an expensive binding, just brought from the bindery ready to be sent home; he, before my eyes, took hold of the volume and tightly holding the leaves in each hand, instead of allowing them free play, violently opened it in the center and exclaimed: 'How beautifully your bindings open!' I almost fainted. He had broken the back of the volume and it had to be rebound."

Home-Made Automatic Gas Regulator

Fit a 1-in. brass pipe, A, 12 in. long, into a T reduced for a $\frac{1}{2}$ -in. pipe, B. Fit the other end with a coupling, C, into which screw a $\frac{3}{4}$ -in. angle valve, from which the stem and valve disk have previously been removed. In place of the valve stem fit in an iron rod of the same size as the valve stem and having the top end, D, looped as shown. Thread the bottom end and put on two washers, E, between which wind hemp packing. Hold this in place with a nut. The steam connection to the boiler is through the pipe, P. This brings the steam pressure on top of the piston, says the Engineers' Review, and necessitates that the stuffing-box of the valve be packed. Run the cord over pulleys, so arranged that convenient connections are made with the valve levers on the gas burners.

Fig. 2 shows the position of the burners and the gas supply as arranged on the front of the boilers. Fit valves V V V V (of the straight

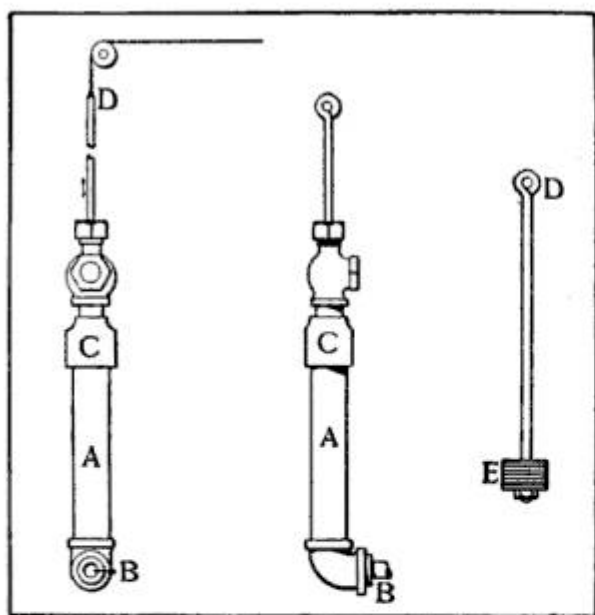


Fig. 1--Gas Regulator

way type) with levers about 8 in. long and connect each of the first three levers to the other by means of a rod long enough to extend from the first valve to the third. The fourth valve is not operated by the regulator at all,

but is always left burning at its full capacity while the boiler is in operation.

The valve levers are connected to the rod R so that when the regulator operates them the valves do not all shut off the same amount. For instance, if the valves are open full and the regulator operates, the rod R is

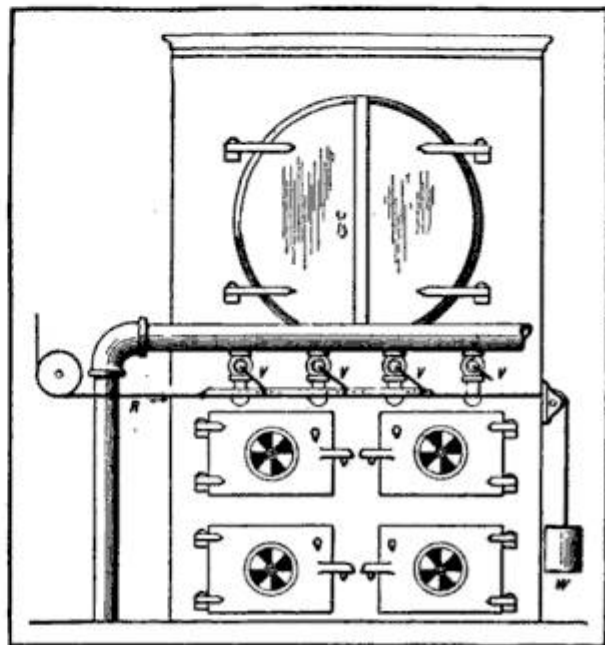


Fig. 2--Burners and Supply Arrangement

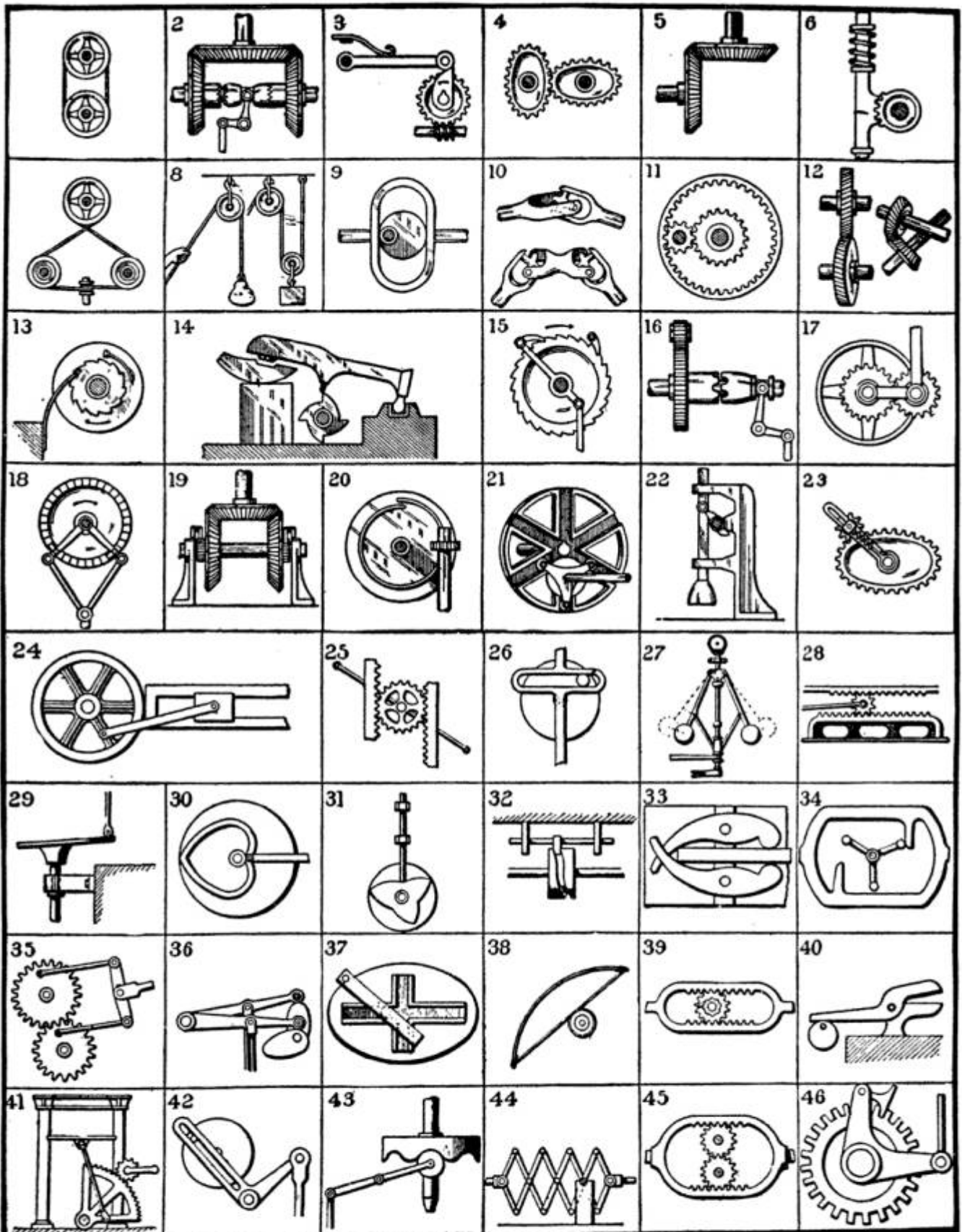
pulled to the left in the direction of the arrow. This closes the first valve a certain amount, the second valve a little more and the third valve still more. In this way the gas is not all shut off, but enough to permit the steam to drop. When the piston of the regulator is relieved of the excessive amount of steam pressure on the top side of the plunger, the weight, W, pulls the rod, R, to the right, opening the valves wider, permitting more gas to enter the cylinder to be burned. This pulls the plunger of the regulator up, and when the steam pressure again reaches the desired point the plunger is forced down and the gas is once more partly shut off.

Steam hose containing rubber should always be heated until pliable before uncoiling, says the National Engineer. If this precaution is taken the rubber will not crack, and the hose will last longer.

Practical Mechanical Movements

Every mechanic or inventor should study to avoid clumsiness in the construction of his model or machine and so arrange the several parts as to produce the result desired with the least number of parts possible. He should, therefore, be very careful to select as far as possible the simplest and best forms of mechanical movements. Some of the more common movements are here illustrated, and the following is a brief description of the various movements as numbered:

1. Pulleys with a belt passing there-over.
2. The ordinary sliding clutch and pinions.
3. Means for imparting a jumping motion to a horizontal arm. A cam secured to a cog wheel alternately lifts and drops said arm.
4. Elliptical spur-gear for securing variable speed.
5. Beveled gears.
6. Means for imparting an alternate rectilinear motion to a rack-rod by a continuously rotated mutilated gear.
7. Means for transmitting motion from one shaft to another, said shafts being in the same plane but at right angles to each other.
8. Pulleys for lifting weights.
9. An eccentric upon a revolving shaft adapted to impart a reciprocating movement to a yoke strap.
10. Two forms of universal joints.
11. Differential gears. The inner and outer gears move in opposite directions at different speeds.
12. Different kinds of gear for transmitting rotary motion from one shaft to another arranged obliquely thereto.
13. Means for imparting a partial revolution to a ratchet-wheel at the completion of each revolution of the main wheel.
14. A tilt-hammer. The wiper-wheel lifts the hammer four times each revolution.
15. Means whereby a reciprocating rectilinear motion of a vertical rod transmits an intermittent circular motion to a toothed wheel.
16. An ordinary sliding clutch and pinions.
17. Sun and Planet motion. The outer gear is fixed to the connecting link and moves around the axis of the fly wheel.
18. Means whereby the reciprocating motion of a jointed rod produces an almost continuous rotary movement of the ratchet-face wheel.
19. Gearing for transmitting a continuous rotary motion to a vertical shaft from a horizontal shaft, by the alternate revolution of gears upon said horizontal shaft. These gears are loose upon their shaft, and have ratchets which are engaged by pawls fixed to the shaft.
20. Means for transmitting rotary motion from one shaft to another at right angles thereto.
21. Multiple gearing. The triangular wheel drives the large one.
22. A simple ore stamper or pulverizer. The plunger is raised and dropped twice for each revolution of the shaft.
23. Variable rotary motion produced by uniform rotary motion.
24. Ordinary crank-motion.
25. Air pump; piston motion. The racks are moved in opposite directions by the revolution of the gear.
26. Crank motion. The wrist-pin upon the disk works within the slotted yoke.
27. Centrifugal governor for steam engines, etc.
28. A lower fixed rack having a gear mounted thereon and meshing with an upper movable rack. As the pitman secured to the gear reciprocates, said gear revolves and imparts a movement to the upper rack which is double that of the gear.
29. Means for imparting a reciprocating rectilinear motion to an upright rod by rotating an upright shaft having an oblique disk secured thereto.
30. A heart-shaped groove engaged by a lever, is adapted to impart an



irregular swinging motion to said lever.

31. A triple cam adapted to lift the rod three times at each revolution of the disk to which said cam is secured.

32. Means for producing a uniform reciprocating rectilinear motion by the rotary motion of a grooved cam.

33. A carpenter's bench clamp. By pressing a strip against the crossed ends of the dogs, the rounded heads thereof will clamp said strip.

34. Means whereby a reciprocating motion is imparted to a frame by a continuously rotating shaft. This shaft has three wipers adapted to

contact with inwardly extending arms within the frame.

35. Means whereby the rotation of two spur gears having crank wrists produces variable alternating traverse of a horizontal bar.

36. Means for converting uniform circular motion into alternating motion. Cams are mounted upon a revolving shaft and alternately lift and drop levers to which are attached rods.

37. An ellipsograph. By attaching a pencil or other instrument to the cross-bar ellipses may be readily drawn. Studs upon the bar engage the grooves.

38. A fiddle-drill. A strap is secured between the ends of a bow and encircles a shaft or drill which is revolved by the back and forth motion of the bow.

39. A crank substitute. Two loose pinions with reverse ratchets are attached to the shaft, with pawls on the pinion ratchets. Each rack meshes with the reverse pinion for continual motion of the shaft.

40. Metal shears. The arm of the moving blade is raised and lowered by the revolution of the cam.

41. A vertically movable presser platen. This platen is secured by a rod to a toothed sector pivoted within a frame and which receives motion from a small pinion meshing therewith.

42. Means for converting circular motion into variable alternating rectilinear motion. A wrist-pin upon a revolving disk works within a slotted lever.

43. Means for converting circular into rectilinear motion. A waved wheel mounted upon a rotary shaft rocks a lever upon its fulcrum.

44. "Lazy tongs." A system of crossed levers pivoted together by which the amount of a rectilinear motion is increased by the proportional number of sections in the tongs.

45. A rack adapted to receive rectilinear motion by the rotary motion

of toothed wheels meshing therewith.

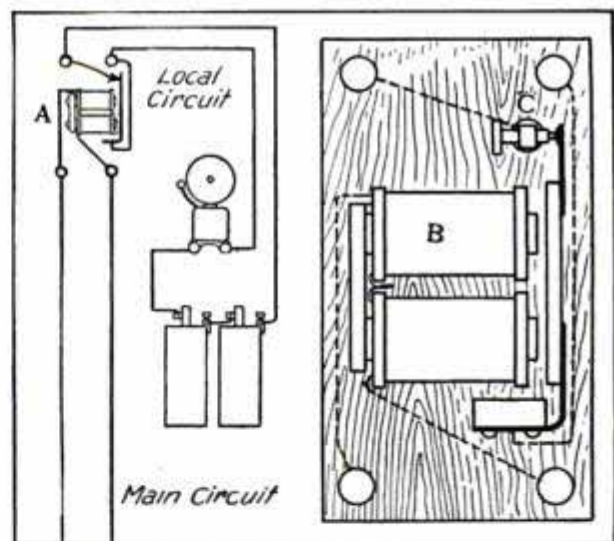
46. Means for converting reciprocating rectilinear motion into intermittent circular motion.

(Continued next month.)

Relay Saves Battery Current

By using the device here shown, a very weak line current may be used. The relay, A, is connected with the main circuit and operates the local circuit, which may contain a bell, telegraph sounder, or any other electrical device by making a contact at the armature and completing the circuit of the local battery.

The relay may be made from an old bell magnet, B, rewound with fine wire about 28 or 30, single covered, and should be mounted on a wooden base, with the armature in position, as



Wiring Diagram and Construction of Relay

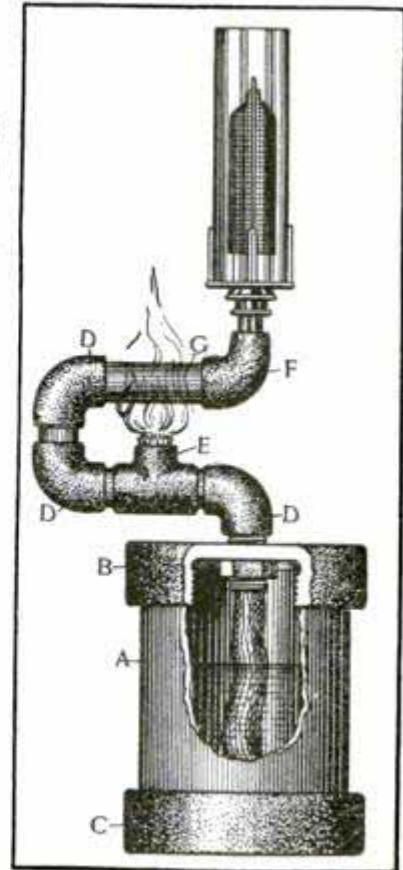
shown. The contact, C, can be made from the circuit breaker of the bell and should be so adjusted that the point nearly touches the contact when no current is flowing. Then the least current flowing through the magnet will cause the armature to move and make contact, thereby closing the local circuit. Relays of a similar nature are in common use in telegraph and fire alarm lines and can also be used for battery call telephones.—Contributed by A. G. Ward, Peebles and Edgerton Aves., Wilkesburg, Pa.

How to Make An Alcohol Lamp

An alcohol lamp, which will prove very useful to the student draughtsman, or mechanic, is shown in the accompanying illustration. A piece of 2½-in. pipe, A, about 3½ in. long is fitted with caps, B and C, the cap B being tapped for a ⅜-in. pipe in the center. Three ⅜-in. ells, D, one ⅜ in. by ⅛ in. tee, E, and one ⅜-in. by ⅛ in. ell, F, are connected with ⅜-in. nipples and arranged to support the incandescent burner as shown.

A cotton wick extends through all the fittings and terminates in a knot at the end of the long nipple, G. If it is found difficult to pass the wick through the fittings, they may be strung on the wick in the proper order, before being screwed together.

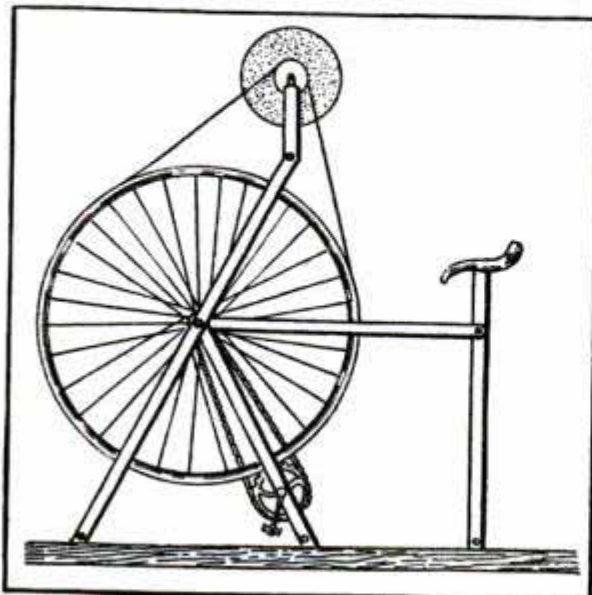
A portion of the wick is pulled up at E and is used to furnish the necessary heat for vaporizing the alcohol in G. If desired, a small metal cap can be made to cover the wick at E and thus prevent the evaporation of the alcohol when the lamp is not in use.—Contributed by a reader, Chicago.



How to Make an Emery Wheel from an Old Bicycle

The illustration shows a home-made emery wheel, which was constructed by a correspondent of the American Blacksmith, and is described as follows:

The parts were procured from an old bicycle. If these are not at hand, they may be purchased at a very small cost. The frame is of course a double

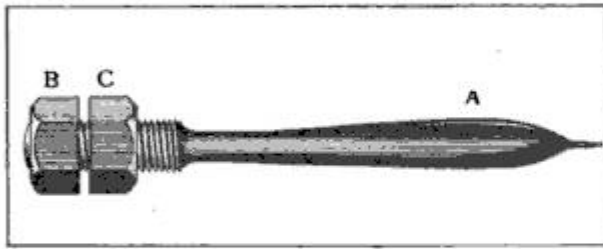


Emery Wheel Made from Old Bicycle

one and is constructed throughout of 1¼ by ¼-in. stock. The two parts of the frame are put together by means of bolts run through pieces of gas pipe. By this means it is possible to tighten and brace the frame so as to allow little or no give or spring. The seat for the operator may also be taken from the old bicycle. I used an old seat from a binder. This answers the purpose very well. The top end of the longest piece is fitted with a T which is babbitted and in which runs the spindle for the pulley and the emery wheel. The bicycle part consists of the hind wheel, the sprocket, chain and pedals. The wheel from which the tire has been removed, is hung in the frame by means of a large axle bolt. The crank is then hung as shown and the bicycle chain used to connect the sprocket attached to the wheel and that of the crank. A belt is now used to connect the pulley with the driving wheel and the machine is ready for work. By using the bicycle bearings in the three boxings, an easy running and very serviceable emery stand will be the result.

A Home-Made Jack of All Trades

The illustration shows a very handy device, which can be made of a piece of $\frac{3}{4}$ -in. round steel, A, about 8 in. long; one stationary nut, B, riveted on



Handy Device with Many Uses

and one movable nut, C. Turn threads on one end of the rod and turn a handle near the other end, making a screwdriver point at the extreme end.

With both nuts screwed up tight the device makes a very good hammer for driving tacks and small nails and the screwdriver end is very useful for opening boxes, pulling tacks, etc. By loosening nut C and adjusting the distance between the two nuts the implement is converted into a very effi-

cient wrench. The device is also useful as a hand vise for filing small articles which may be firmly held between the two nuts. The illustration was made from a "shadowgraph" contributed by Dr. C. E. Warren, North Easton, Mass.

A Quick Setting Cement

One of the best cements that can be found for fastening tools into handles, or uniting small parts of metal or other material, is common orange shellac dissolved in sufficient alcohol to form a paste. To use, place the required amount in a small tin (the top of a baking powder can will do) and set fire to it. As soon as the flame dies down, use immediately before it has a chance to get cold.

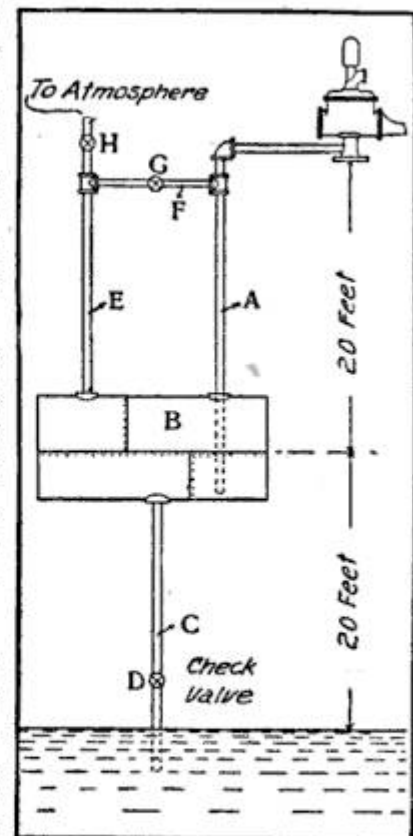
When fastening tools into wooden handles it is well to heat the tang over the flame previous to fastening in the handle. This cement is strong and waterproof.—Contributed by E. V.

Lifting Water by Suction

The right method of connecting a pump in order that it will lift water 40 ft. and deliver it to the boiler is shown in the accompanying sketch from the Practical Engineer. A suction pipe, A, extends into and within $1\frac{1}{2}$ in. of the bottom of an air-tight tank, B, holding say 1,000 gal. and situated midway between the water level and the pump. Another pipe, C, in which there is a check valve, D, connects the tank with the water.

Thus far, there is simply an air-tight suction line 40 ft. long, the tank, B, being merely an enlargement of the pipe half-way up. E is an air pipe extending just through the top of tank and is connected with the upper suction pipe, A, by means of a by-pass, F. A globe valve, G, is placed in the by-pass and one is also placed in the air pipe, E, above the by-pass connection, designated at H.

In starting, close valve H and open valve G; this allows the air to be exhausted from the lower suction pipe, C, and the air-tight tank, B, through the air-pipe, E, and the by-pass, F. Of course, in starting up, and until water has attained a depth of $1\frac{1}{2}$ in. in the tank, some or all of the air may take a direct course up through the upper suction pipe, A; but



Pumping Water 40 Feet

after it has reached a depth sufficient to submerge the lower end of pipe A, the rest of the air will be exhausted through the by-pass; hence the necessity of the by-pass or some similar arrangement.

As the air is exhausted, the water will be forced up the suction pipe, C, into the tank, B, until it is full, and possibly a short distance up the pipes A and E; then open valve H and the air rushes in and destroys the vacuum, which is holding the water up this far, and the water starts back down the suction pipe, C, when the check valve, D, closes and we have the main body of water trapped 20 ft. from the pump with atmospheric pressure on it. Then by closing valve G in the by-pass, the pump will lift the water the rest of the way and deliver it into the boiler.

This chuck is not adapted to work where there is much variation in the size of the stock, but is very useful

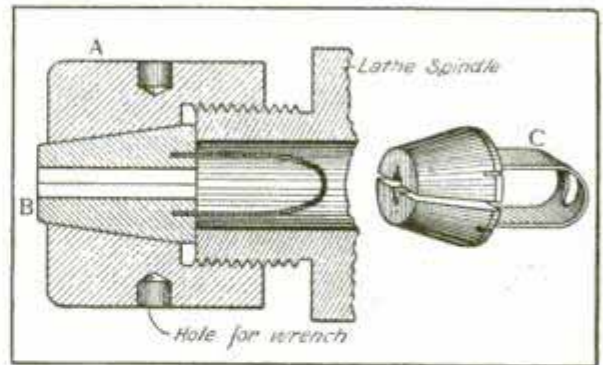


Fig. 1

Fig. 2

and convenient for duplicate work. By making several jaws with openings of different sizes they may all be used in connection with a single barrel.—Contributed by Geo. W. Smith, Jr., 122 Genessee St., Marquette, Mich.

To Find the Clearance of an Engine

A good way to find the clearance of an engine, especially when the cylinder heads are provided with indicator connections, is to place a strip of lead inside the cylinder and then turn the engine over the center. The thickness of the lead should be greater than the clearance, so that the piston will compress it against the cylinder head, thus giving the true clearance. This method can also be used to advantage in finding the clearance of an air compressor.—Contributed by A. E. Schutz, Trevorton, Pa.

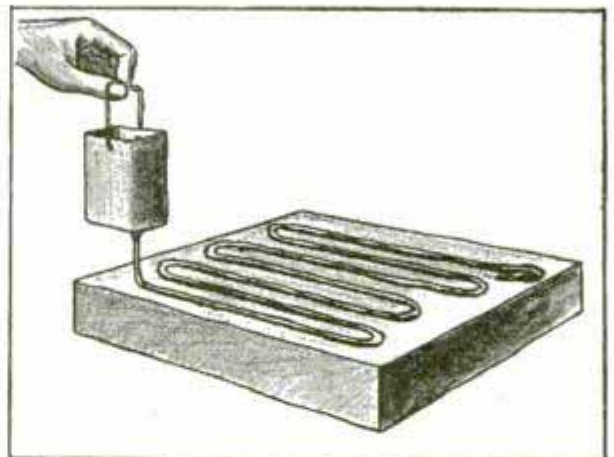
Lathe Chuck for Small Work

The drawing shows a chuck that I constructed for holding small rods in making duplicate work. A steel barrel, A (Fig. 1), is tapered inside to receive the jaws, B, shown in detail at Fig. 2. The jaws are held apart by the spring C until the barrel is screwed on the lathe spindle, which forces the jaws into the taper and brings them together.

To Make Solder Wire

Having used up all my solder wire and having an abundance of stick solder on hand, I used the following method of making it into wire:

Punch a small nail hole in the bottom of a cocoa can and pour the

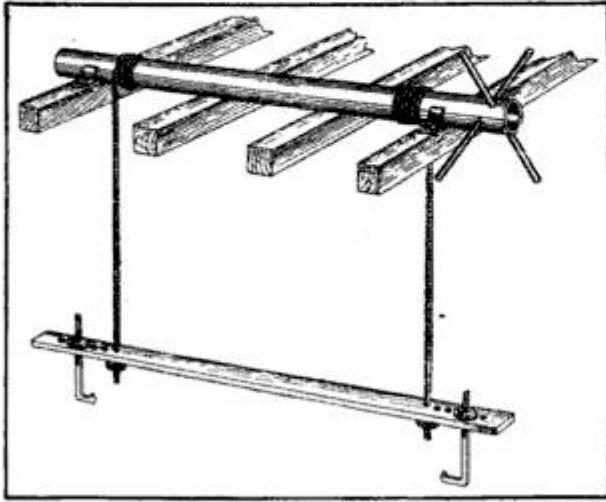


Pouring the Solder

melted solder into the can. Move the can over a cold flat surface, as shown in the sketch, thus making a long, thin, wirelike strip, which may be rolled up in the form of a ball, for convenience in handling.—Contributed by Chas. Grogan, 295 Bainbridge St., Brooklyn, N. Y.

Raising Device for Wagon Boxes

The accompanying engraving shows a simple device which may be rigged up by most any smith having need of an apparatus of this kind. The



Simple Labor-Saving Device

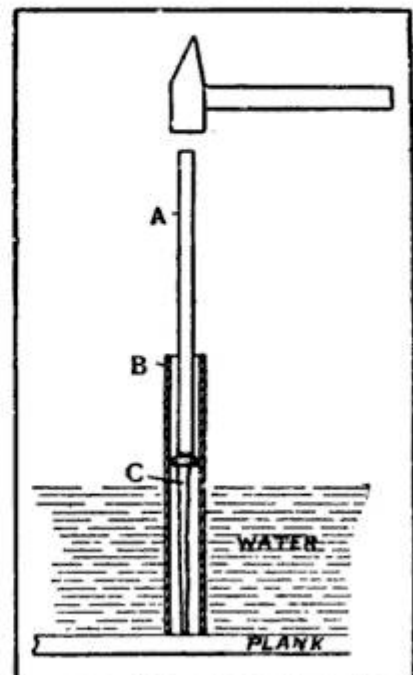
work of lifting a wagon box becomes mere child's play with a windlass arrangement of this kind, says a correspondent of the American Blacksmith. As seen in the sketch, A is a piece of 4-in. pipe long enough to pass over four of the crossbeams overhead. Our shop in which the wagon work is done has no upper story and we therefore placed the pipe directly on the beams which support the walls and run across just overhead. After securing the pipe and cutting to right length,

drill four holes in one end of it. These holes should be drilled in such manner as to have each set of two directly opposite each other, so that when two pieces of gas pipe are inserted in the end they will pass each other as in the engraving. Before placing on the beams, two holes are drilled in the pipe to receive the rope ends. This will prevent the ropes from slipping around the pipe. The pipe is now placed upon the beams and either brackets placed each side of it or long spikes driven into the beams to keep the pipe from rolling. Two good stout ropes of equal length are now secured and after binding the ends with wire, drive and fasten in the holes made for this purpose. Now secure a good stout plank of 2-in. timber about 6 in. wide and long enough to go across your widest wagon box. In each end of this bore four holes. Now forge two hooks and thread the ends of both of them to receive a large nut. The loose rope ends are now thrust through the two holes nearest the center of the plank and your device is ready for use. The holes in the ends of the plank are for adjusting the hooks to different sizes of wagon boxes. A stop to keep the device from turning after the box has been raised is simply an iron rod which fits loosely into a hole drilled through one of the beams.

To Drive Spikes Under Water

Spikes and nails can be driven in several feet of water at any angle desired by the use of the following method:

Place a piece of gas pipe, B, long enough to extend above the water to a convenient height and just large enough to drop the spike in readily and still keep it upright, in the water, as illustrated; drop in the spike, C; then by using a steel drift, A, and holding the gas pipe at whatever angle required, drive the spike. The steel drift should be long enough to drive the spike down and leave a handhold above the pipe sufficient to hammer on, says the American Miller. This method is of great help in building forebays, pits and bottoms for foundations. The spike will go at whatever angle the gas pipe is held.



Decimal Equivalents of Drill Sizes

The following table gives the sizes in decimals of an inch, of all drills from number 80 to 1/2 in., and will be found valuable for figuring clearances, driving fits, etc. For example, supposing you want to drill a bearing

SIZE.	Equivalent Decimals of 1 inch.	SIZE.	Equivalent Decimals of 1 inch.	SIZE.	Equivalent Decimals of 1 inch.	SIZE.	Equivalent Decimals of 1 inch.
1-2	0.500	G	0.261	5-32	0.1562	51	0.067
31-64	0.4843	F	0.257	23	0.154	52	0.0635
15-32	0.4687	E 1-4	0.250	24	0.152	1-16	0.0625
29-64	0.4531	D	0.246	25	0.1495	53	0.0595
7-16	0.4375	C	0.242	26	0.147	54	0.055
27-64	0.4218	B	0.238	27	0.144	55	0.052
Z	0.413	15-64	0.2343	9-64	0.1406	3-64	0.0468
13-32	0.4062	A	0.234	28	0.1405	56	0.0465
Y	0.404	No. 1	0.228	29	0.136	57	0.043
X	0.397	2	0.221	30	0.1285	58	0.042
25-64	0.3906	7-32	0.2187	1-8	0.125	59	0.041
W	0.386	No. 3	0.213	31	0.120	60	0.040
V	0.377	4	0.209	32	0.116	61	0.038
3-8	0.375	5	0.2055	33	0.113	62	0.037
U	0.368	6	0.204	34	0.111	63	0.036
23-64	0.3593	13-64	0.2031	35	0.110	64	0.035
T	0.358	7	0.201	7-64	0.1093	65	0.033
S	0.348	8	0.199	36	0.1065	66	0.032
11-32	0.3437	9	0.196	37	0.104	1-32	0.0312
R	0.339	10	0.1935	38	0.1015	67	0.031
Q	0.332	11	0.191	39	0.0995	68	0.030
21-64	0.3281	12	0.189	40	0.098	69	0.029
P	0.323	3-16	0.1875	41	0.096	70	0.027
O	0.316	13	0.185	3-32	0.0937	71	0.026
5-16	0.3125	14	0.182	No. 42	0.0935	72	0.024
N	0.302	15	0.180	43	0.089	73	0.023
19-64	0.2968	16	0.177	44	0.086	74	0.022
M	0.296	17	0.173	45	0.082	75	0.020
L	0.290	11-64	0.1718	46	0.081	76	0.018
9-32	0.2812	18	0.1695	47	0.0785	77	0.016
K	0.281	19	0.166	5-64	0.0781	1-64	0.0156
J	0.277	20	0.161	48	0.076	78	0.015
I	0.272	21	0.159	49	0.073	79	0.014
H	0.266	22	0.157	50	0.070	80	0.013
17-64	0.2656						

hole for a 1/8-in. shaft. By using a drill 1/64 of an inch larger the hole would be too large and would allow the shaft to run out of true. A 1/8-in. drill on the other hand would make it a driving fit, as the drill is made a trifle smaller than the nominal size. But by referring to the table it will be found that a No. 30 drill is about .008 of an inch larger than the shaft, which is just about the proper clearance.—Contributed by A. Edwards.

A good rust preventive, and one which is extensively used, is banana oil, which can be obtained at any drug or paint store. First polish the article and then apply the oil, using a soft brush.—Contributed by E. V.

Water-Cooled Motors in Winter

For winter use instead of water for water-cooled motors, one of the automobile companies recommends a mixture of 1 part wood alcohol, 1 part glycerine and 1 part water. Get it in early. If the car is laid up for the winter, drain dry, pour two quarts of wood alcohol into radiator and run the car for a few minutes.

Renewing a Gauge Glass

In opening the water glass connections after putting in a new glass, it is generally recommended that the pet cock at the bottom of the glass be opened first and then the steam valve at the top, thus allowing steam to blow through the glass and warm it gently. Next open the water valve and close the drain at the bottom of the glass. If water is admitted first, and then steam, the glass will often break, says the Practical Engineer. This is because the water is much cooler than the steam and there would be a greater expansion in the upper half of the glass than in the lower half.

To Tin a Soldering Copper

Chip a depression in one side of a common red brick and put a few bits of solder and rosin in the hollow. Heat the copper to the usual working heat and rub it briskly in the rosin and solder, holding the handle high so as to work on the point of the copper.—Contributed by Wm. Ed. Jackson, 18 N. Washington St., Tarrytown, N. Y.

To Remove Piston Rod Packing

To remove the packing around the piston rod of an engine remove stuffing-box gland and turn on steam. The packing will then be blown out as slick as a whistle.—Contributed by Fred Eckley, Tekamah, Iowa.



Mechanics for Young America



Foundry Work at Home

Part I--The Equipment

Many amateur mechanics, who require small metal castings in their work, would like to make their own castings. This can easily be done at home without going to any great expense and the variety and usefulness of the articles produced will make the equipment a good investment.

With the easily made devices about to be described, the young mechanic can make his own telegraph keys and sounders, battery zincs, binding-posts, engines, cannons, bearings, small machinery parts, models and miniature objects, ornaments of various kinds and duplicates of all these and many other interesting and useful articles.

The first thing to make is a molding bench, as shown in Fig. 1. It is possible to make molds without a bench, but it is a mistake to try to do this as the sand is sure to get on the floor, whence it is soon tracked into the house. The bench will also make the operation of molding much easier and will prove to be a great convenience.

The bench should be made of lumber about 1 in. thick and should be constructed in the form of a trough, as shown. Two cleats, AA, should be nailed to the front and back to support the cross-boards, BB, which in turn support the mold while it is being made. The object of using the cleats and removable cross-boards

instead of a stationary shelf is to give access to the sand, C, when it is being prepared.

About one or two cubic feet of fine molding sand will be required, which may be purchased at the nearest foundry for a small sum. Yellow sand will be found a little better for the amateur's work than the black sand generally used in most foundries, but

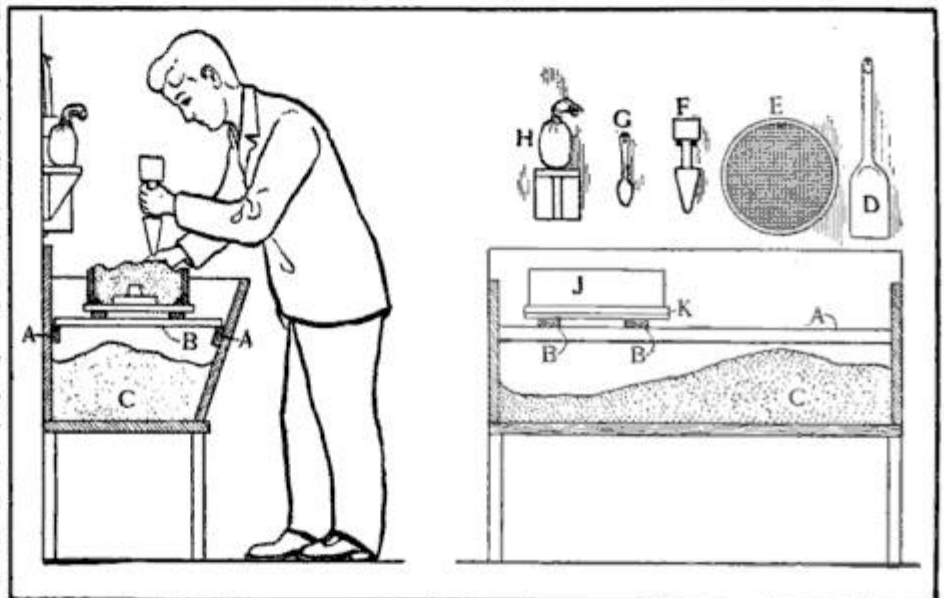


Fig. 1--Convenient Arrangement of Bench and Tools

if no yellow sand can be obtained the black kind will do. If there is no foundry near at hand, try using sand from other sources, giving preference to the finest sand and that which clings together in a cake, when compressed between the hands. Common lake or river sand is not suitable for the purpose, as it is too coarse and will not make a good mold.

For mixing and preparing the sand a small shovel, D, and a sieve, E, will be required. If desired the sieve can be home-made. Ordinary wire netting, such as is used in screen doors, is about the right mesh and this, nailed to replace the bottom of a box, makes a very good sieve.

The rammer, F, is made of wood and is wedge-shaped at one end and

flat at the other, as shown. In foundries each molder generally uses two rammers, but for the small work which will be described, one will be sufficient. An old teaspoon, G, will be found useful in the molding operations and may be hung on the wall or other convenient place when not in use.

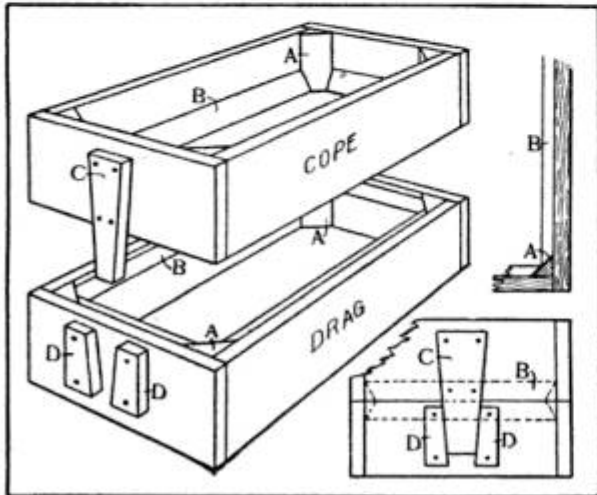


Fig. 2--Home-Made Flask

The cloth bag, H, which can be made of a knotted stocking, is filled with coal dust, which is used for a parting medium in making the molds. Take a small lump of soft coal and reduce to powder by pounding. Screen out all the coarse pieces and put the remainder in the bag. A slight shake of the bag over the mold will then cause a cloud of coal dust to fall on it, thus preventing the two layers of sand from sticking, but this operation will be described more fully in a subsequent chapter.

The flask, J, Fig. 1, is shown more clearly in Fig. 2. It is made of wood and is in two halves, the "cope" or upper half and the "drag" or lower part. A good way to make the flask is to take a box, say 12 in. by 8 in. by 6 in. high and saw it in half longitudinally, as shown. If the box is not very strong, the corners should be braced with triangular wooden strips, AA, which should be nailed in, previous to sawing. The wooden strips, BB, are used to hold the sand, which would otherwise slide out of the flask when the two halves of the mold are separated.

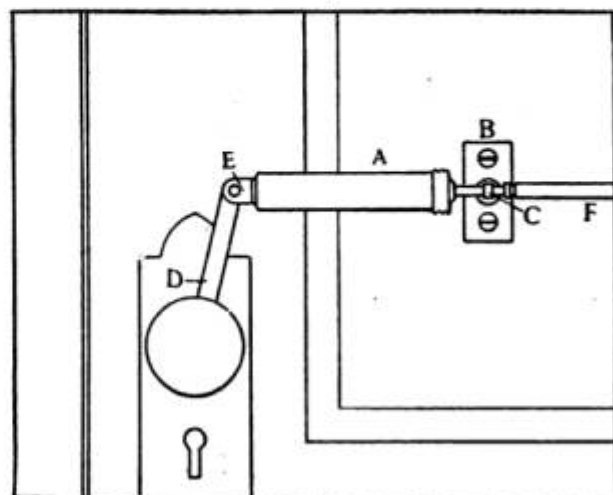
The dowels, CC, are a very important part of the flask as upon them depends the matching of the two halves of the mold. A wedge-shaped piece, CC, is nailed to each end of the cope and the lower pieces, DD, are then nailed on the drag so that they just touch C when the flask is closed. The two halves of the flask will then occupy exactly the same relative position whenever they are put together.

After the flask is done make two boards as shown at K, Fig. 1, a little larger than the outside of the flask. A couple of cleats nailed to each board will make it easier to pick up the mold when it is on the floor.

A cast-iron glue pot makes a very good crucible for melting the metal, which can be either aluminum, white metal, zinc or any other metal having a low melting point. This completes the equipment with the exception of one or two simple devices which will be described under "molding" in the next number.

Home-Made Pneumatic Lock

Mount an old bicycle hand-pump, A, on the door by means of a metal plate, B, having a swinging connection at C. Fasten the lever, D, to the door knob and make a hinge connection with the pump by means of a piece of sheet brass, E, soldered to the end of the cylinder. All this apparatus is on the inside of the door and is connected by a small rubber



Pneumatic Door Opener

tube, F, to a secret mouthpiece placed at some convenient location. A small piece of spring brass, screwed to the door frame, will open the door about $\frac{1}{2}$ in. when the operator blows in the mouthpiece, or if the door is within reach of the mouthpiece, the operator can push the door at the same time that he blows, thus doing away with

the spring, which is only used to keep the door from relocking.

One way of making the air connection with the outside is to bend the tube, F, around and stick it through the keyhole. Few burglars would ever think to blow in the keyhole.—Contributed by Orton E. White, 1740 Main St., Buffalo, N. Y.

HOW TO MAKE A PADDLE BOAT

A rowboat has several disadvantages. The operation of the oars is both tiresome and uninteresting and the oarsman is obliged to travel backwards. By replacing the oars with paddles, as shown in the illustration, the operator can see where he is going and enjoy the exercise much better than with oars. He can easily steer the boat with his feet, by means of a pivoted stick in the bottom of the boat, connected by cords to the rudder.

At the blacksmith shop have a $\frac{5}{8}$ -in. shaft made, as shown at A, Fig. 2. It will be necessary to furnish a sketch giving all the dimensions of the shaft, which should be designed to suit the dimensions of the boat, taking care that sufficient clearance is allowed, so that the cranks in revolving will not strike the operator's knees. If desired, split-wood handles may be placed on the cranks, to prevent them from rubbing the hands.

The bearings, B, can be made of hard wood, but preferably of iron pipe filled with melted babbitt. If babbitt is used, either thoroughly smoke or chalk the shaft or wrap paper around it to prevent the babbitt sticking. The pieces of pipe may be then fastened to the boat by means of small pipe straps,

such as may be obtained at any plumber's at a very small cost.

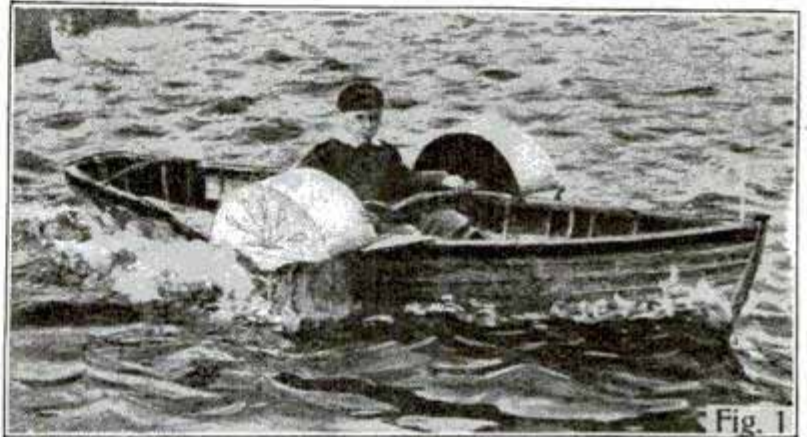


Fig. 1

Paddle Boat in Operation

The hubs, C, should be made of wood, drilled to fit the shaft and mortised out to hold the paddles, D. The covers, E, may be constructed of thin wood or galvanized iron and should be braced by triangular boards, as shown in Fig. 1. If galvanized iron

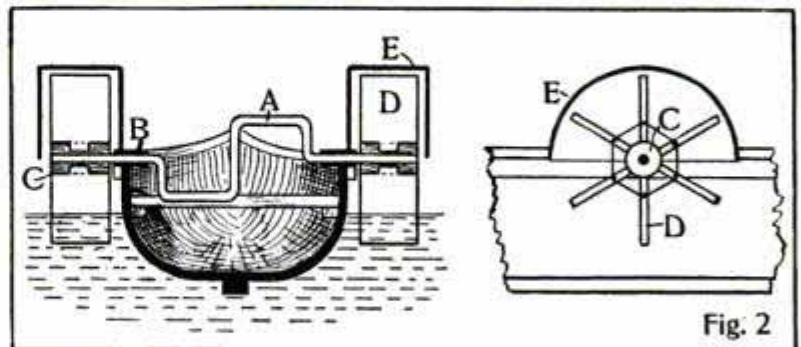


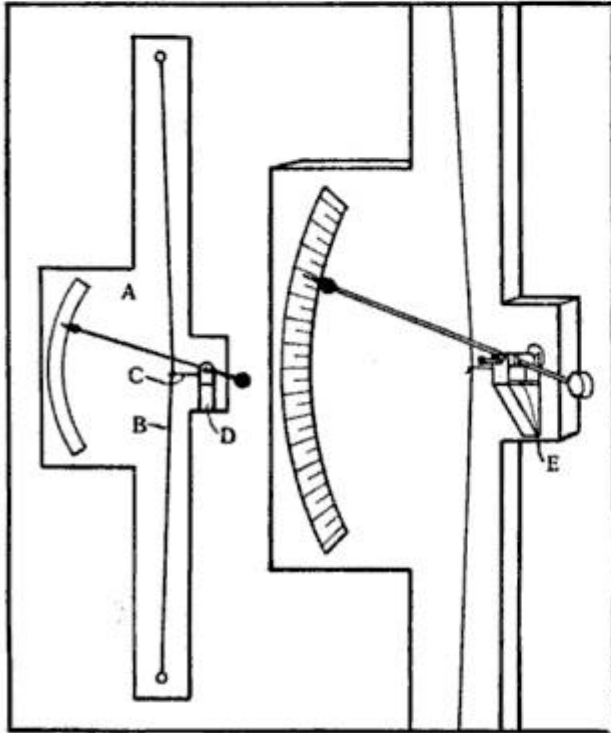
Fig. 2

Details of Paddle Boat

is used it should be exposed to the weather two or three months before painting or the paint will come off, spoiling its appearance.

How to Make a Hygrometer

A home-made hygrometer, for determining the degree of moisture in the atmosphere, is shown in the accompanying sketch and consists of a board, A, with a nail at each end to



The Hygrometer

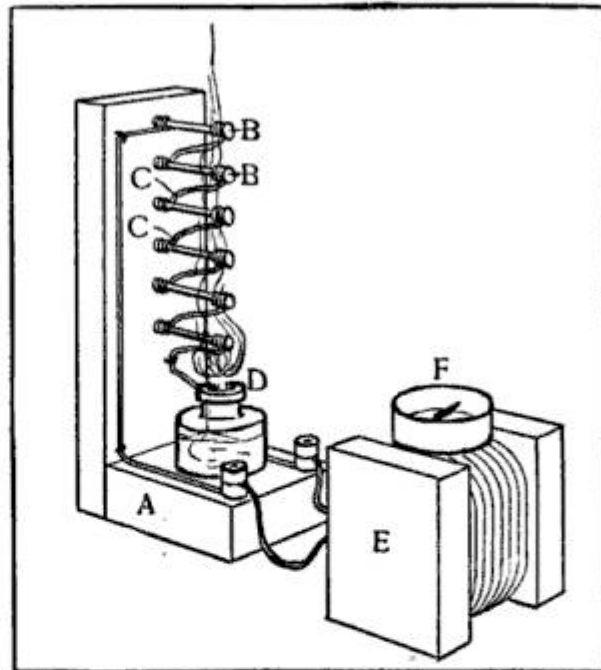
hold the silk thread, B. A second piece of silk thread, C, is tied to the center of B and connects with an indicating hand or pointer supported by the bracket, D. The axle on which the pointer revolves consists of a piece of round wood, about the size of a lead pencil, with a pin driven in each end. A piece of tin, E, is cut V-shaped at each end and bent up at the ends to form bearings for the pins. The silk thread, C, is fastened to the wooden axle and is wrapped one or two turns around it, so that when the thread is pulled the pointer will move on the scale. It will be noticed that the thread, B, is not perfectly straight but bends toward D. For this reason a very small shrinkage of B, such as occurs when the atmosphere is dry, will cause an increased movement of C, which will be further increased in the movement of the pointer. An instrument of this kind

is very interesting and costs nothing to make.—Contributed by Reader, Denver.

How to Make a Thermo Battery

A thermo battery, for producing electricity direct from heat, can be made of a wooden frame, A, with a number of nails, B, driven in the vertical piece and connected in series with heavy copper wires, C. The connections should all be soldered to give good results, as the voltage is very low and the resistance of an unsoldered joint would stop the current.

The heat may be supplied by an alcohol lamp or other device and the current may then be detected by means of a simple galvanometer consisting of a square spool of No. 14 or 16 single-covered wire, E, with a pocket compass, F, placed on top. Turn the spool in a north and south direction or parallel with the compass needle. Then when the nail heads



Thermo Battery

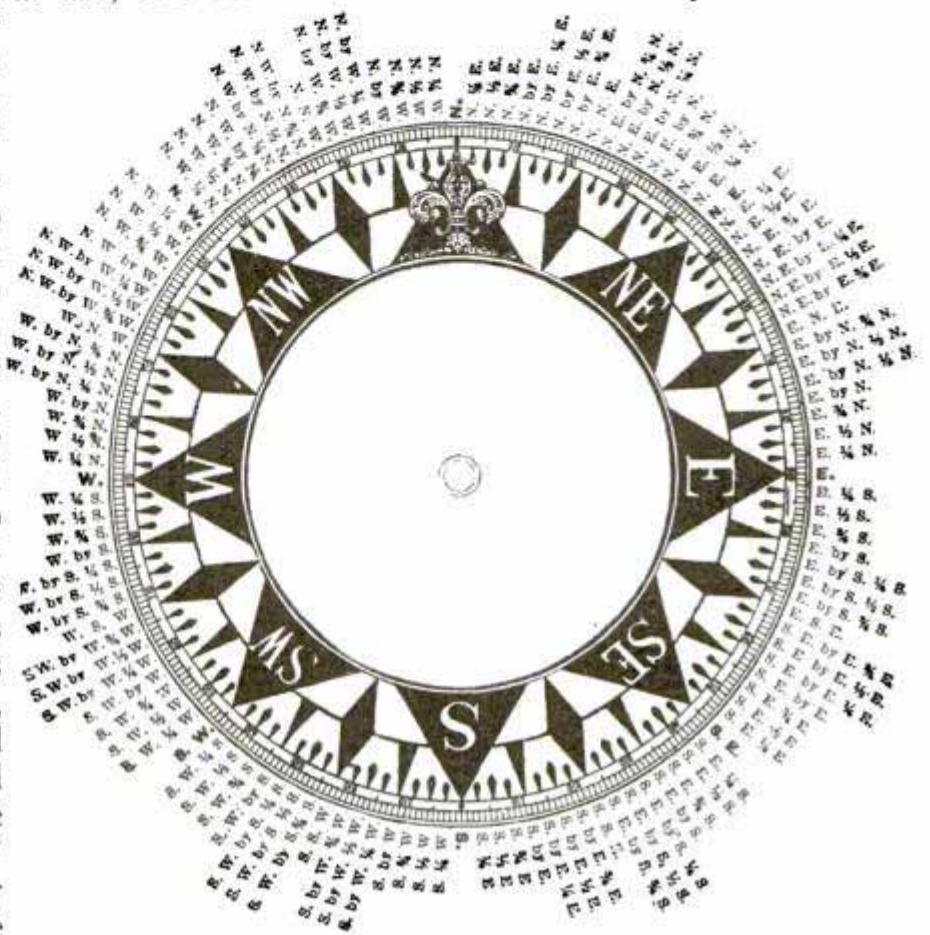
are heated and the circuit completed the needle will swing around it at right angles to the coils of wire. Applying ice or cold water to the nail heads will reverse the current.—Contributed by A. C. A., Chicago.

Invention Saves Boxing Compass

If the new compass card invented by an Englishman named Collins should come into general use, one of the hardest tasks for the young sailor would be removed. To learn to "box the compass" is one of the first lessons, and reference to the cut will suggest it is by no means easy to memorize. The Collins compass card takes the quadrants of 90 deg. each, and commencing at north numbers them consecutively from 0 to 360, the figures increasing in the same direction as the hands of a clock travel. Thus 0 would be north; 90, east; 180, south, and 270, west. Any land lubber ought to be able to head a boat "S. 45° E." if told to steer "135," which is the same thing. The inventor explains allowances for deviation, and apparently his plan supplies all necessary requirements.

On investigation we find the system is not entirely new in the United States, and that the same method, or practically the same, was launched by

our navy department several years ago. With all its simplifications and certain positive advantages, the old sea dogs of the general maritime interests outside the navy received it



Standard Compass Card--To "Box the Compass" Start at N and Read to the Right

poorly. What was good enough for their fathers for several generations back was still good enough for them, and like other admitted reforms this one fell down on account of the difficulty of forgetting a life-long method and learning the new. For instance: A master who is used to directing his quartermaster to steer NE. by E. ½ E. (N. 61° 52' 30" E., roughly N. 62° E.) would be at a loss to express it steer 62°, or if the course were SW. by W. ½ W. (S. 61° 52' 30" W., or roughly S. 62° W.) to say steer 242°.



Section of Collins' Compass Card

The German army has a portable wireless outfit weighing only 300 lb., in which a 45-volt generator is driven by a soldier who sits on a bicycle frame and pedals.

Pulverized Coal for Locomotives

Burns Otherwise Worthless Fuel--No Manual Labor for the Fireman

Railroad managers are now looking to pulverized fuel as promising a great saving in coal bills. Experiments have been made under severe conditions in both passenger and freight service. The system permits the use of low grade coal, but also of sizes not now marketable. The two things necessary to successful operation of the new system are that the fuel be dry, and the particles not too large nor too fine dust. The fuel is prepared by drying and grinding and the particles passed through a 60-mesh screen.

The prepared fuel is fed into the firebox by means of a blower on the tender operated by a turbine taking steam from the locomotive boiler. Best results are obtained with 1,000 volumes of air to 1 of coal. When this mixture is fed into the firebox it is instantly converted into gas and burns with such an intense heat that special provision must be made to withstand it. The flow of fuel is subject to the same regulation as in oil burning, and like that system the grates are removed and the doors all made tight. The exhaust draft is dispensed with. The fuel is fed through nozzles which face each other across the firebox, the opposing currents producing a mushroom shaped body of flame. Both the firebox and boiler required are smaller with this system than where ordinary coal is burned, two features greatly to be desired. Combustion is so perfect there is an entire absence of smoke, cinders and

sparks. The Railway Age says: "The simplicity of the whole device, its ease of regulation, economy on all ordinary loads and capacity for very great overloads, its cleanliness and freedom from sparks have appealed strongly to railroad officials interested in its operation."

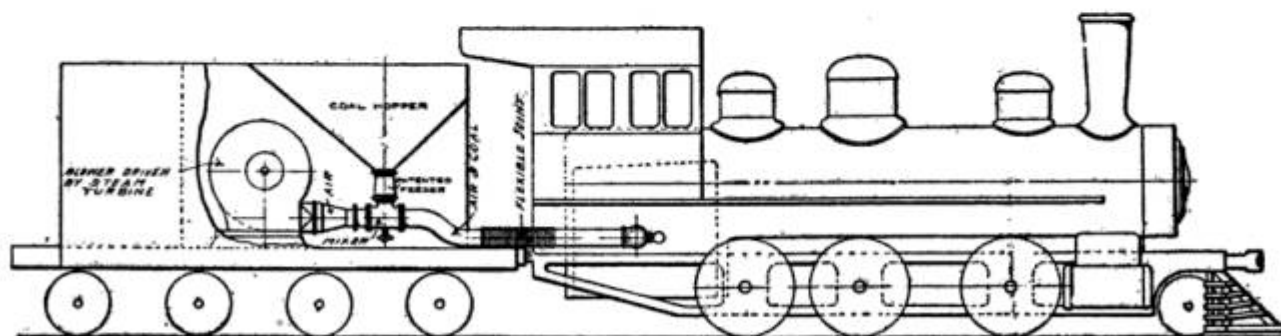
Home-Made Electric Light

For summer homes, farm houses and residences where no electric light service is furnished, or in homes where a generous supply of light is desired, the small electric light plant will be found a genuine comfort. As now made the outfit is by no means expensive and will last a lifetime with a few insignificant repairs. Many of the machines now in common use on farms for various purposes are really more complicated than this.

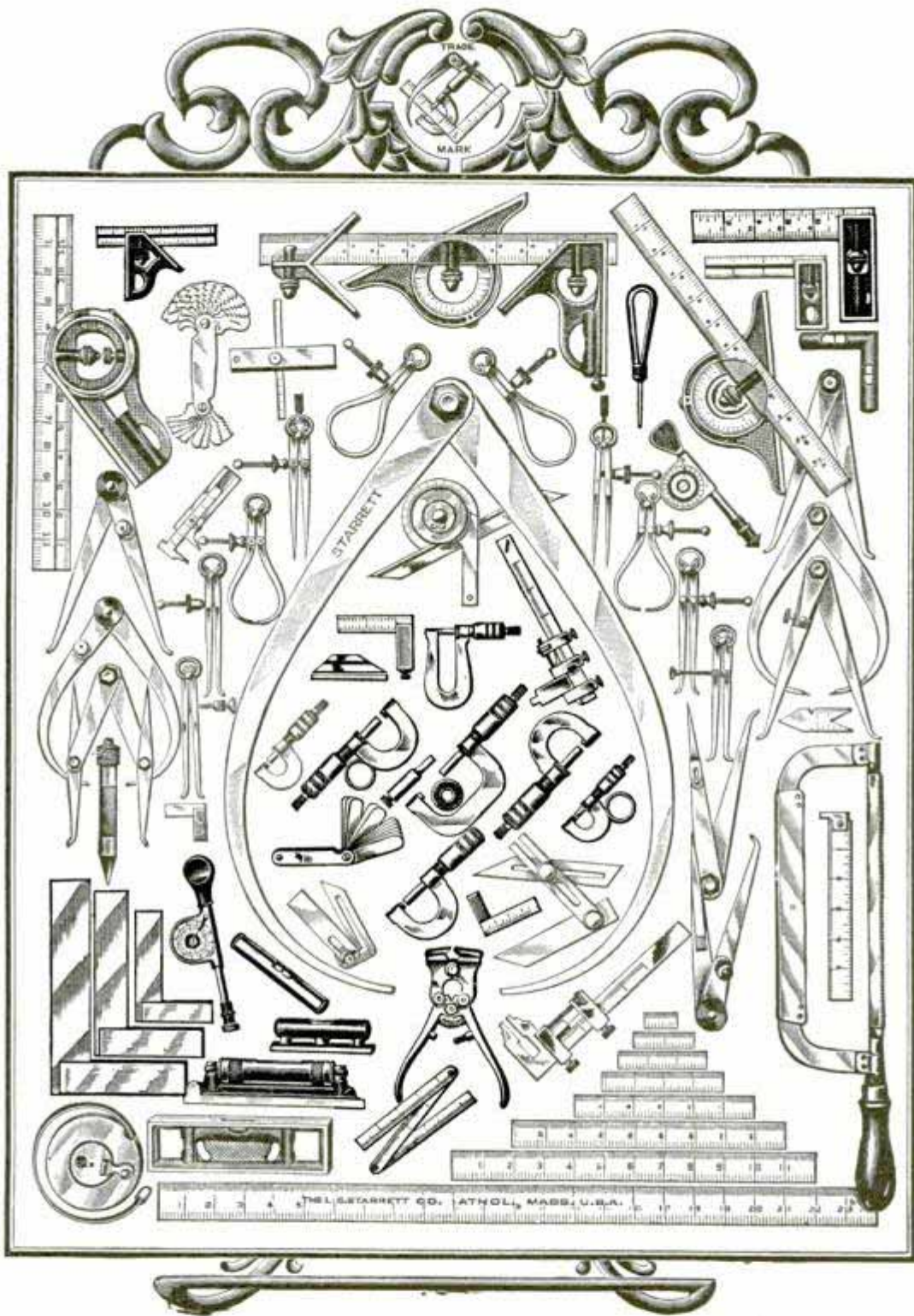
At a recent test of a 2-hp. gasoline engine electric light outfit made by the Kansas State Agricultural College it was found the cost for eighteen 16-cp. lights was only 5 cents an hour. The engine and generator received no attention whatever during the 10-hour runs.

As all the lamps in a house are never required at the same time, probably one-third of the lamps would be a liberal average in use—a 2-hp. outfit is competent to take care of a 15-room house with, say, 50 lamps. Of the two a mower or a sewing-machine is much more difficult to operate than the lighting plant.

Covered automobiles with sleeping bunks for four are being used by hunting parties.



Showing Arrangement for Burning Pulverized Coal



STARRETT TOOLS

are accurate time and labor saving devices for meeting mechanical needs—short cuts through mechanical difficulties—they are recognized by amateur and professional mechanics as the standard for accuracy, workmanship, design and finish. Send for free Catalogue No. 17AP, of the largest line of fine mechanical tools.

THE L. S. STARRETT CO., ATHOL, MASS., U. S. A.

OTTO

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UNSOLICITED PRAISE

Farrand Bros., proprietors of the Lakeside Stock Farm, Colon, Michigan, write: "Our engine has run nine years without trouble, but all machinery is bound to wear out." They then ask for platinum with which to tip the electrodes—a trifling and inexpensive repair. *Nine years* and just beginning to need attention. The average life of the *cheaper* makes is about *five years*. There is a moral in this for the prospective buyer—Get the "**Otto**" for long life, and no trouble.



OTTO GAS ENGINE WORKS, Phila., Pa.

STANDARD OF THE WORLD

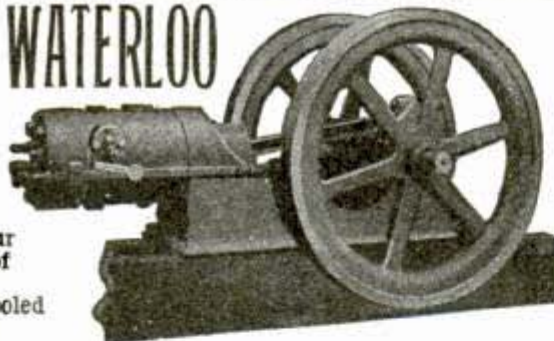
SMALL MOTORS All Variable Speed

Alternating dental and jewelers' motors...	Each \$32.50
Direct current " " " " " " " " " " " "	23.00
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Same motor wound for direct current.....	48.00

These motors are the newest improved variable speed motors, and guaranteed for two years. Send for booklet "A." A thousand other motors in stock.

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Secure our Catalog of Air and Water Cooled Engines

The Most Popular Gasoline Engine in the World

A high-class engine at a reasonable price

WATERLOO GAS ENGINE CO.

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WATERLOO, IA.

HOW THE FIRST ALASKAN RAILWAY WAS BUILT.—

When Mr. J. Warren Dickson, constructing engineer for the first standard gauge railway in Alaska, left New York for the Arctic regions in the spring of 1903, only six weeks of the short open season remained. Construction was to begin near Nome, 6,000 miles away. Specifications for supplies to build 50 miles of railway, a machine shop and for a camping outfit and commissary for 600 men were made on the train to Chicago. The only material on hand on leaving New York was two little engines from the elevated railway's old stock, says *World's Work*, London.

In Chicago the specifications were completed, competitive bids passed on and all necessary supplies (excepting lumber) purchased in nine days of 20 working hours each. The supplies included 2,750 tons of steel rails. Fifteen freight cars were purchased also, to be sent to Seattle on their own wheels and loaded with pieces of engines and other supplies.

The engineer landed on the coast of Seward Peninsula, 36 miles east of Nome, on June 19, 1903, at 1 a. m. It was the season of continuous daylight. Twelve hours later twenty tents were up and a telephone system was being installed. An hour later the engineer broke ground for the railway and 87 men went to work. In three days 450 men were at work and at the end of two weeks 600. To set up the first locomotive, a pit was dug in the sand and covered with a trestle and track, and the parts of the engine—some of them weighing more than 8 tons—were hoisted into position by man power alone, and then joined.

When the season closed, October 19, exactly four months later, 8 miles of track had been built and rock-ballasted; the railway yards and sidings were complete; a 12-room dwelling-house and an office-building were up, each two and a half stories high and fitted for steam heating; a machine shop was running, in which the first standard gauge car ever made in Alaska was built in 13 days; there was a complete telephone system in operation; and the sleepers, rails and other supplies for completing the road were hauled to the yards and piled in position for expeditious use in the following season. When the party broke camp, an inventory was made of every item on hand, and of the more than \$400,000 worth of supplies bought, all but \$100 was accounted for.

VALUABLE FORESTS OF MOSS IN NORWAY.—Ashes from seaweed which is gathered and burned on the coast of Norway every spring are shipped to England, where iodine and other valuable chemicals are extracted from them. The moss grows in veritable forests, the trees being from 5 to 6 ft. high with stems like ropes and leaves as tough as leather. The moss industry is a profitable one.



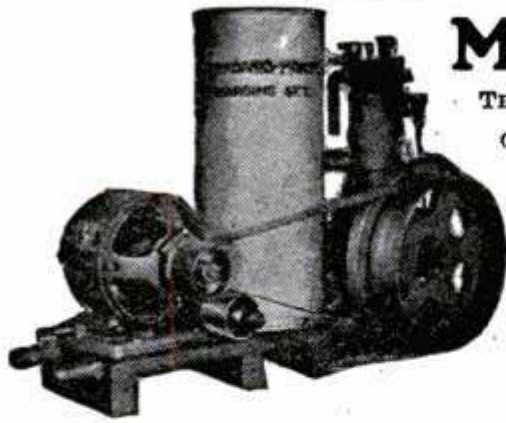
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Indistinct Vision; Muscular Troubles, Chronic Diseases of the Eye all successfully treated by Scientific Massage at any age.

English, German or Spanish pamphlet mailed free.

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THE FAIRBANKS-MORSE Electric Light Outfit gives plenty of good light at a moderate cost.
Gas, Gasoline or Kerosene Engines for all purposes, from 2 h. p. up.
Cut out complete advertisement and send to

Fairbanks, Morse & Co.
Monroe Street, Chicago, Ill.

Please send me illustrated Catalogue No. C 449 Gasoline Engines

I may want..... h. p. to run.....

Name.....

Street No.....

Town..... State.....

THE SHIPS THAT SINK.—What becomes of the ship that sinks in mid-ocean? If it is of wood it takes, in the first place, considerable time for it to reach the bottom. In a hundred or more fathoms of water a quarter of an hour will elapse before the ship reaches bottom. It sinks slowly, and when the bottom is reached it falls gently into the soft, oozy bed, with no crash or breaking.

Of course, if it is laden with pig iron or corresponding substances, or if it is an iron ship, it sinks rapidly and sometimes strikes the bottom with such force as to smash in pieces. Once sunken a ship becomes the prey of the countless inhabitants of the ocean.

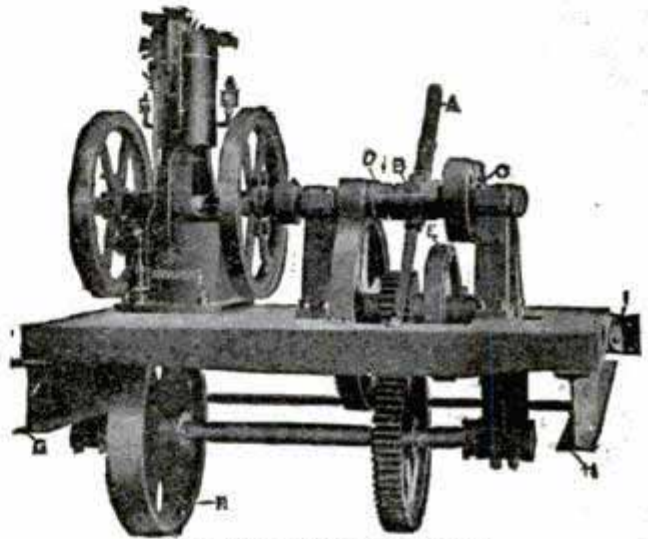
They swarm over and through the great boat and make it their home. Besides this, they cover every inch of the boat with a thick layer of lime. This takes time, of course, and when one generation dies another continues the work, until finally the ship is so laden with heavy incrustations, corals, sponges and barnacles that, if wood, the creaking timbers fall apart and slowly but surely are absorbed in the waste at the sea bottom.

Iron vessels are demolished more quickly than those of wood, which may last for centuries. The only metals that withstand the chemical action of the waves are gold and platinum, and glass also seems unaffected. No matter how long gold may be hidden in the ocean, it will always be gold when recovered, and this fact explains the many romantic and adventurous searches after hidden submarine treasures lost in shipwrecks.—Baltimore Sun.

FIFTEEN CENTS TIES UP TRAIN.—A limited mail train on the Pennsylvania system was held up for 46 minutes recently because a passenger tendered the conductor a fare of 15 cents in silver in lieu of a ticket and the conductor refused to take it, demanding 30 cents because a ticket had not been purchased. The two argued the point until the passenger's destination was reached, where he carried the matter to a justice's court. After a hearing lasting 46 minutes, while passengers and mail waited, the case was continued. The railway company is liable for \$1 to each passenger for the delay and then there is the affair with the government in regard to the mail. All for 15 cents.

NEW ENGINEERING DEPARTMENT BUILDING IN UNIVERSITY OF PENNSYLVANIA.—On October 19 the University of Pennsylvania opened its magnificent new building for the engineering departments for private view to invited guests. The building is admirably equipped throughout for instruction in every branch of engineering.

FAIRBANKS GAS ENGINES



TURNTABLE OUTFIT

use manufactured, natural or producer gas, gasoline, alcohol, or distillate as fuel; there are six distinct types ranging from 1 to 100 H. P., including stationary, portable and marine, of both two and four cycle. We send experts to make direct connections of these engines to pumps, compressors, generators, hoists, etc. We are also headquarters for Scales, Trucks, Transmission, Valves, Railroad, Factory and Mill Supplies, Machine Tools, etc. Write us for catalog.

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YOUR INTERESTS AND OURS ARE IDENTICAL

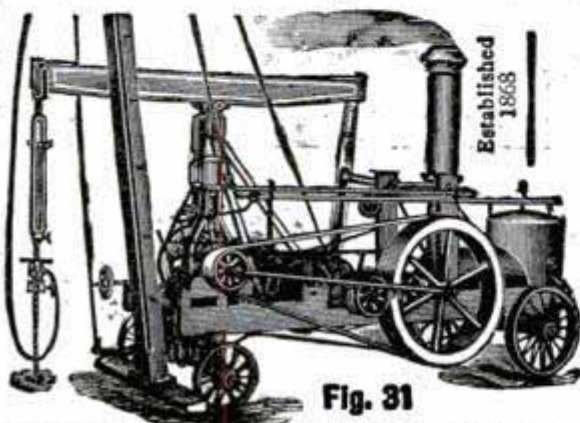


Fig. 31

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3 Horse Shoe pocket piece puzzle. Carry it for luck and an entertainer. 10c a set, 3 sets for 25c, with Booklet of all good puzzles.



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 TO YOU IF YOU WILL LET ME HAVE
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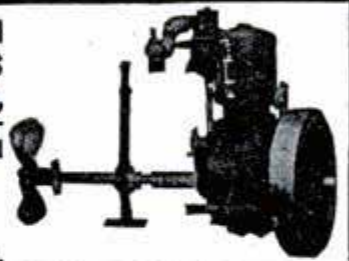
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 latest improvements; best ma-
 terial; lowest prices. Also sell
 castings, with drawings.

State your want.

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 580 East St., Holyoke, Mass.**



POWER OF FALLING WATER.—It is perfectly well known to every one that water constantly dropping upon a stone will wear it away, and there is a trite old proverb regarding this fact. The force of a single drop of water falling from a height is not great, but the results of this tiny blow when it is many times repeated are astounding, even though we do know that the stone will, in time, yield to their power.

There was a form of torture known to medieval days as the "ordeal of dropping water," but the term conveys little idea of the horrible suffering which this punishment is said to inflict, says Electric City.

There is a story of one poor wretch who was bound with his back to a stone wall and had a stream of water "of the bigness of a man's finger" directed onto his bare head, the water falling from a height of about 18 ft. The receptacle from which this apparently harmless stream trickled was a barrel holding only 20-odd gal., but before the water had more than half run out the man was dead, with a hole in his skull which exposed the brain.

By way of experiment, an American, who is mentioned as "a sport and an acrobat," made a wager in Vienna with an athlete that the latter could not endure the falling of a pint of water on his hand, drop by drop, in one spot, from a height of only three feet.

The athlete had an enormous hand, lined with skin almost as thick and tough as cowhide, and all the spectators pronounced the bet a foolish one as far as the American was concerned.

But when about 300 drops had fallen there was a change of sentiment. The athlete did not say a word, but it was very apparent from the flush on his face and his uneasy manner that he was suffering great pain. At the 420th drop he gave up, declaring that he could no longer endure the torture.

The palm of his hand was then badly swollen and rapidly inflaming, and in one spot the skin had broken, exposing the raw flesh beneath.

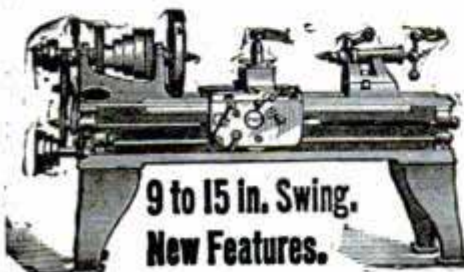
MOVED WHOLE TOWN IN KANSAS.—Nothing feases the Kansan. Not long ago it was discovered that the town of Englewood, having a population of 450, was located on a quarter section having a clouded title. The enterprising founder moved the entire village one mile south to a new site of 240 acres.



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Please Mention Popular Mechanics

"GET THE BEST"

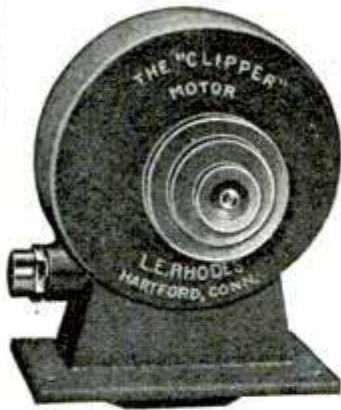
which means

The Clipper Water Motor

We do not claim it THE CHEAPEST, but we do claim it THE BEST.

Buy one for the boy and watch him "get busy." Send for circular with full description and price.

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HARTFORD, CONN.



SEE the Subject Matter in the Fifth Page of the Index of the

THE PRACTICAL GAS ENGINEER

Fifteen Pages of Index like this:

5th Page Index

Fly wheel, weight and diameter
Foundation for gas engine
Foundation, "any old floor"
Foundation, object in
Foundation, depth of
Foundation, dimensions of
Foundation, height of
Foundation, concrete
Foundation, capped with stone or timber
Feeding gasoline by gravity
Feeding gasoline by pump method
Fire insurance companies require pump method
Fluid battery
Fuel consumption
Fuel consumption under full load
Fuel consumption in relation to speed
Fuel consumption guarantee
Fuel consumption, rules to follow
Fields of dynamo should run cool
Firing every charge taken
Feed more fuel
Feed less fuel
Freeze up water jacket
Fire resulting from gasoline
Gasoline
Gas, natural

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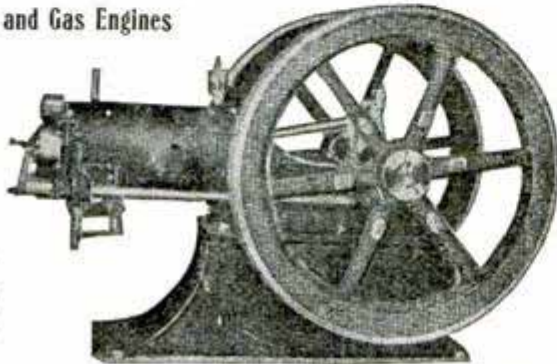
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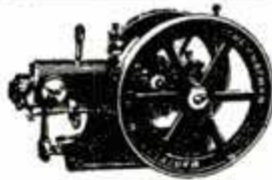
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1½ horse, but tested to 33¼ per cent above rated power. DON'T buy a CHEAP engine; it doesn't pay. Buy the simplest, strongest and best designed engine at the lowest possible price; that's right, we build them.

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CEMENT BLOCK MACHINE \$10

100 BLOCKS A DAY

MOLDS for Cisterns, Silos, Fence Posts, Drain Tile. Write today for particulars.

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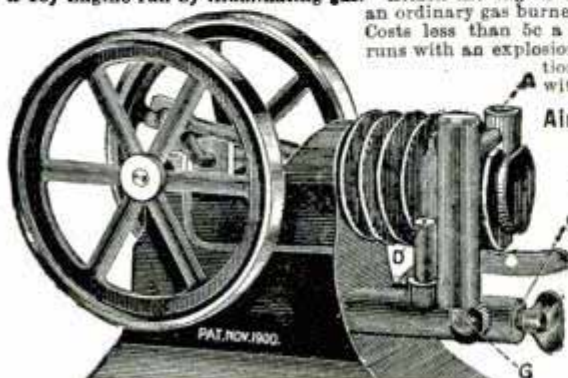
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Delivered, prepaid,

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RUNS LIKE A BIKE.

BALL-BEARING STEEL-FRAME GRINDSTONE

Frame strong and rigid.

Fine stone 20-in. diam. 2-in. thick.

Shipped crated. Weight 75 pounds.



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AUTOMOBILES \$100 AND UP

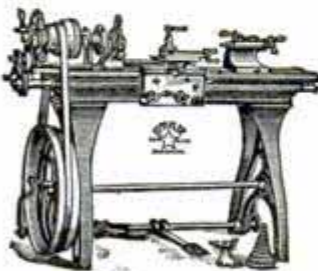
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No other machine can do it successfully for lack of original patents owned by us. No twist motion in our drive. No belt or switch necessary. No batteries whatever, for make and break or jump-spark. Water and dust-proof. Fully guaranteed.

MOLSINGER DEVICE MFG. CO.
 146 Main St., Pendleton, Ind., U. S. A.

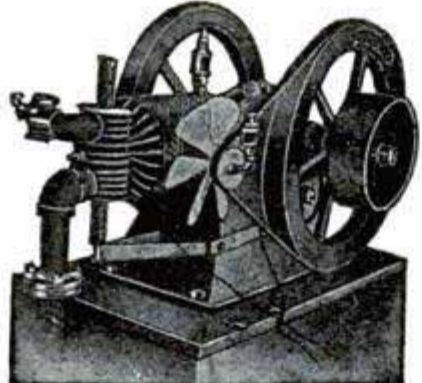
HERO WORKMEN.—A manufacturing concern which burns crude oil has a receiving tank with an underground pipe leading to a pit 3 ft. wide, 6 ft. long and 12 ft. deep. Pipes connect the pit with other tanks which were being repaired. The receiving tank was being filled when an employe noticed that the valve in the pit was turned the wrong way, oil was flowing into the pit and from it to the secondary receiving tanks. At once he got into the pit to turn off the flow of oil. He was overcome by the fumes and suffocated. A second man jumped down to him but he also was suffocated. A third man exclaimed: "Well, these two men are married and I'm not," and he too sprang in to meet the same fate. A fourth man was more circumspect. He had a rope tied around his body and then went to the rescue of his comrades in that open grave. But he was not successful and was dragged from the pit in such condition that he spent two weeks or more in the hospital. The Monthly Bulletin of the Fidelity and Casualty Company goes on to say: "This story is printed to indicate the rare and admirable devotion often exhibited by laboring men when their comrades are in danger of suffering. The helpfulness and charity rendered by them is more creditable than the benefactions of the rich. The rich give of their abundance; the poor cast in all that they have, even all their living."

SPLICED MAN'S BACKBONE WITH DOG'S SPINE.—An Alabama man suffering with a broken back underwent an unusual operation recently, and is said to be recovering satisfactorily. A piece of spine 3 in. long was taken from a St. Bernard dog and used to splice the injured man's spine.

SELF-DESTROYING PAPER.—A prepared paper has the property of disappearing or entirely decaying at the end of a fixed time. The paper is steeped in acid, the strength of which varies with the length of time it is desired that the paper should last. Here is a grand opportunity for novelists.

THE LARGEST AIR-COOLED MOTOR MADE 5 HORSE POWER

Bore 6x6 inches. Plenty of cooling surface. No engine ever constructed with so few working parts. You can hold your hand on the flanges after it has been working all day.

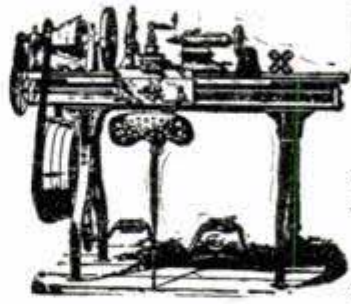


Write for Agency. Gasoline tank in base or outside.

Air-Cooled Motor Co., - Lansing, Mich.

FAN BLOWERS. EXHAUST FANS. PRESSURE BLOWERS. VENTILATOR WHEELS. HEATING AND VENTILATION.
 SEND FOR LATE CATALOGUE No. 24
EXETER MACHINE WORKS,
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ELECTRIC BOOK FREE Full of HOLIDAY Suggestions
 Shows all the newest high grade Electric Supplies and Novelties at lowest prices in the world. **T. DEWEY ELECTRIC CO., Milwaukee, Wis.**

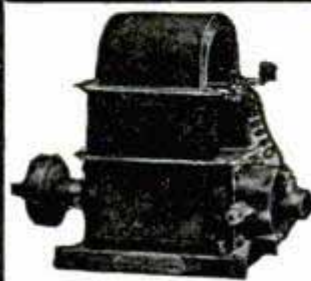


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9 to 13 inch Swing

List price, \$65.00 and up according to size. When ready to buy send for Lathe Catalog and prices

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"Quick Action" IGNITING DYNAMOS and MAGNETOS

The Most Reliable Sparkers on the Market.

Take the Place of Batteries



Jump Spark Coils

FOR ALL PURPOSES Single, Double, Triple and Quadruple for Stationary Engines and Automobiles. Guaranteed in every particular. Fine Vibrator.

SEND FOR CATALOGUE D.
THE KNOBLOCK HEIDEMAN MFG. CO.
 SOUTH BEND, IND.

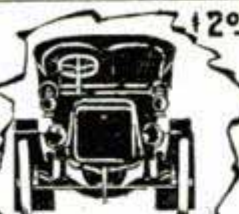
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THE BEST BOOK ON AUTOS

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HIGHEST AWARD **WORLD'S RECORD**
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G. H. CURTISS MFG. CO., Hammondsport, N. Y.

TROUBLE IN A MOTOR CAR.

The tank called the Gasoline dirty,
 The remark made the water boil,
 The Engine got hot in a minute,
 And said it was Spit-off the Coil;
 The Shafts then began to get cranky,
 The Wheel thought he'd give them a steer,
 When the Carbureter tried to get loaded,
 The transmission got all out of gear,
 The Clock called the Car an old woman,
 With her bonnet, apron and fan,
 The Clamps tried to break the Accuser,
 But couldn't get out of the Pan.
 The Mat said the Seats had false hair,
 And proved it by pulling the Switch;
 Could the Engine have shaken his Jacket,
 He'd have thrown himself into the ditch;
 The Rim said the Chain was a golfer,
 Because he had links of his own,
 The Chain said his clubs were the levers,
 And the balls he stole from the Cone.
 The Radiator said he felt cooler,
 Now that the muffler was off,
 And was sorry it shocked the Absorber
 To hear the poor horn with a cough.
 If the Gas hadn't been so exhausted,
 He'd have called down the Valves good and hard
 For getting stuck up like the Oilers,
 And forcing the Spark to retard.
 Then in fear the Cone clutched the Fly-wheel,
 The latter was strong for a spin,
 But the Spark tried to jump the whole contact,
 So the Cogs didn't dare to butt in.
 The wires were for doing a Circuit,
 But the Wheels were so horribly tired,
 That when the Hub spoke to the Axle,
 The Car said it couldn't be hired.
 All this trouble would never have happened,—
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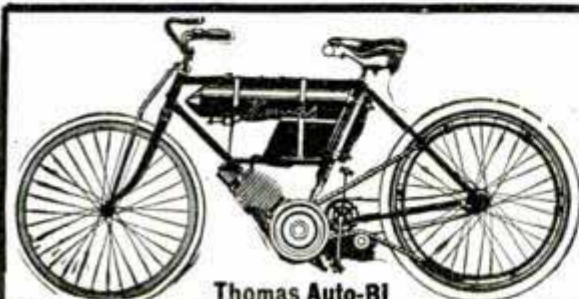
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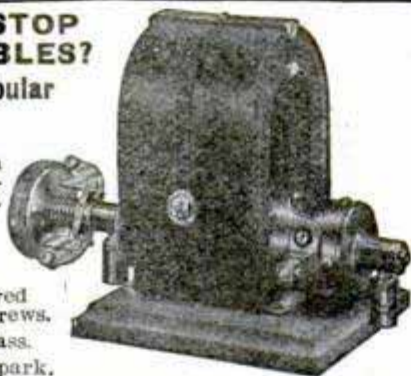
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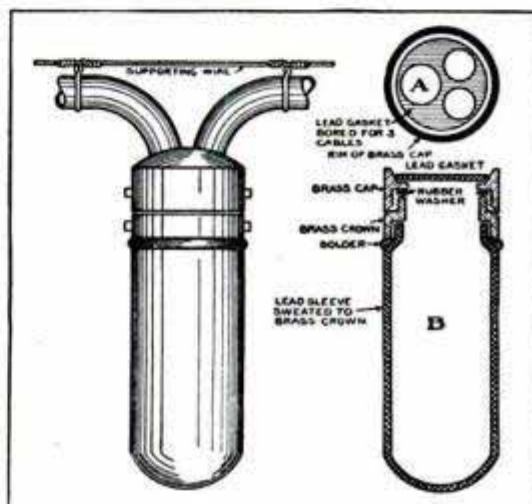
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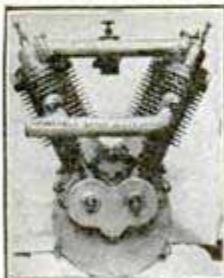
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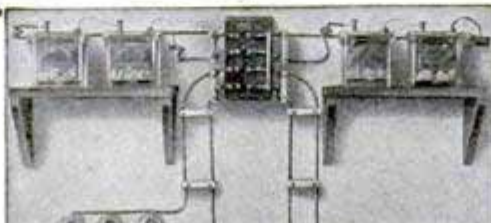
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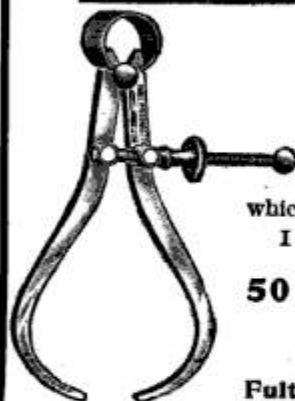
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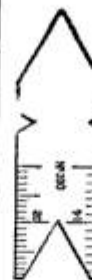
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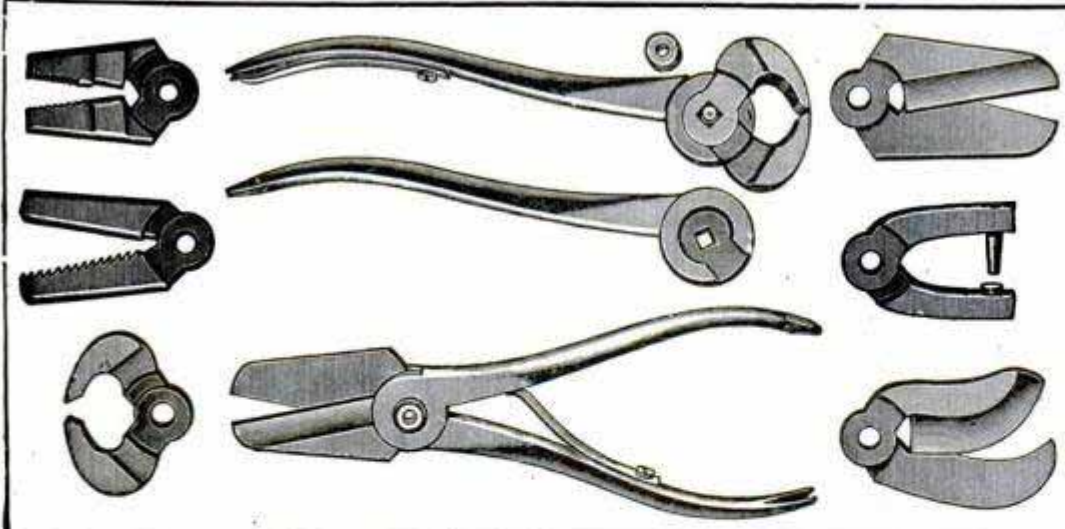
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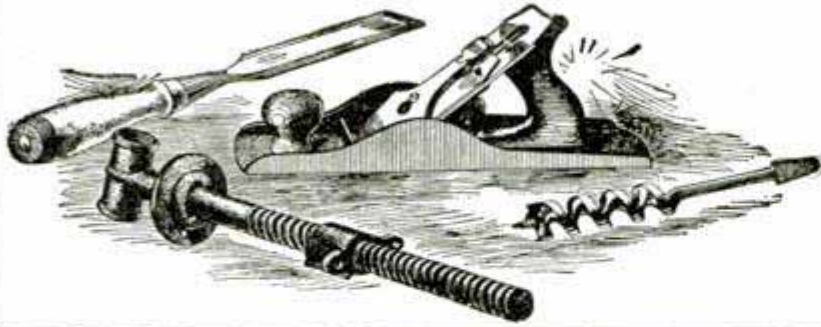
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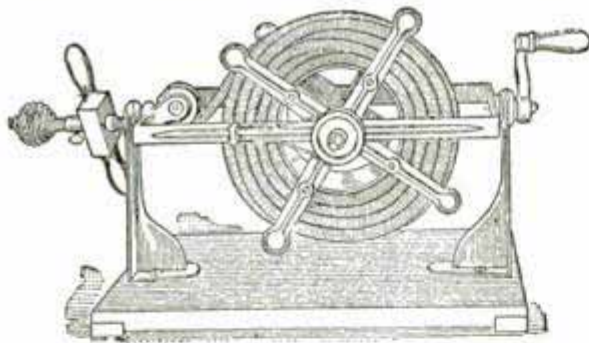
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1. When you have made an invention, show a drawing or model of it to two friends in whom you have confidence, and have them sign the drawing or write their names on the model. Don't lose or destroy the drawing or model, for some day it may be needed as evidence.

2. Select a good patent attorney, pay him \$5 to find out whether your invention is new and patentable, and have him send you copies of the patents which he finds most closely resembling your invention.

3. If there are real differences between your invention and those shown in the patents sent you, and your invention is better than the others, apply for a patent as soon as possible. If, on the other hand, the differences are slight or superficial, and do not add to the commercial value of the article, don't waste any money in getting a patent.

4. If you cannot afford to apply for a patent, give an interest in your invention to some good business man who will furnish the necessary money to get the patent and build a satisfactory model or sample of your invention.

5. After you have applied for a patent and made a model or sample, prepare either to manufacture and sell your invention yourself, or to sell the patent to some one who will do so. Find out what it will cost to manufacture the invention in quantities, what such things usually sell for to jobbers, retailers and the public. This information is valuable in negotiating the sale of the patent and should be full and accurate.

6. Don't expect to make a fortune from your patent at once. If you cannot sell for cash, sell on a royalty, provided the buyer is reliable and responsible.

7. Don't sign any contracts without first submitting them to your patent attorney, and be governed by his advice.

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PATENTS IN MANUFACTURING BUSINESS.—A valuable contribution on this subject is made by E. J. Prindle, a New York attorney, in the Engineering Magazine. He says: "Patents are the only legal form of absolute monopoly, and they are absolute so far as they go. In a recent decision the court said, 'Within his domain the patentee is Czar. The people must take the invention on the terms he dictates, or let it alone for seventeen years. This is a necessity from the nature of the grant. Cries of restraint of trade and impairment of the freedom of sales are unavailing, because for the promotion of the useful arts the constitution and statutes authorize this very monopoly.' The possession of suitable patents is, therefore, of great importance to the manufacturer. On the other hand, it is equally important to the manufacturer whose competitor has patents, to understand what limitations, if any, there are to his competitor's advantage, and how, if at all, a counter-advantage may be gained. Considerable confusion is apt to arise in the minds of laymen as to what constitutes a patentable invention. There are four classes of inventions for which patents are granted—namely, arts, machines, manufactures, and compositions of matter. An art may be any process or series of operations for accomplishing a physical or chemical result; for instance, the casting of car wheels, in which a jet of molten metal enters the mold in a tangential direction, producing a whirling motion which causes sound metal to float to the rim of the wheel, thus preventing cinders and bubbles from occurring in the rim. The patentability of the process is not affected by the fact that no new mechanism may be required. It is at this point that the manufacturer is often misled into thinking that there is no patentable invention present.

"A machine is any assemblage of mechanical elements having a law of action of its own. The definition covers a jack-knife as well as a steam engine.

"An article of manufacture is anything made by hand that is not an art, machine, or composition of matter; for instance, a safety pin, tooth brush, etc.

"Composition of matter is any mixture or combination of chemical elements, such as calcium carbide from which acetylene is made, acetylene itself, a soap, or a tool steel.

"A new combination of old elements may be patentable, if it produces a new or improved result, or an old result in a new way. A new form of an element of a combination that is old, as a whole, may be patentable. Improvements and attachments on old machines may be patentable. A new use of an old device, or machine, or process, may be patentable, if the new use is so different from the old use as not to be obvious to an ordinary skilled workman in the art.

"The grant of a patent purports to give the inventor the right to make, use, and sell the invention; but in legal effect it really gives him only the exclusive right to prevent others from making, using, and selling the invention. If his invention happens to embody the principle of some invention that is covered by a previous patent, the owner of the previous patent can prevent the making, using, and selling of any embodiment of the later invention using the earlier principle, and the later patentee must either make terms with the earlier patentee, or wait until the earlier patent is dead. But the later patentee can prevent the earlier patentee or any one else from using the later invention during the life of the later patent."

Regarding the claims of a patent, there is no piece of English composition that is more generally misunderstood, yet the general nature of the claim is not beyond the comprehension of the layman. A strange thing about a claim is that the more it says, the less it means. Suppose the claim to be a bill of sale giving title to cattle on a large Texas ranch. If it gives title to all the Shorthorn Durham steers having one white forefoot and three red feet, the purchaser would get very few cattle. If, however, the bill of sale gave title to all the live stock on the ranch, the

PATENTS GUARANTEED

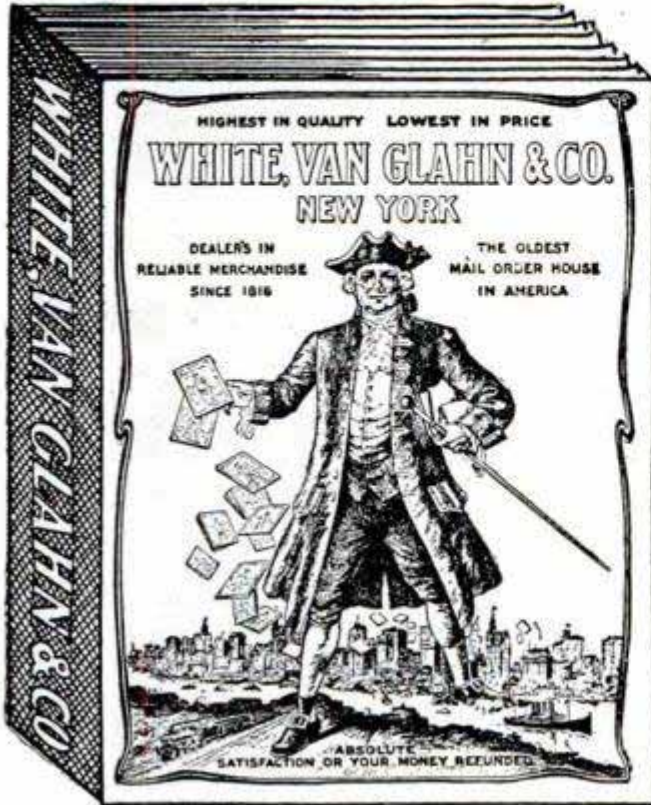
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purchaser would not only get all the Shorthorn steers with only one white foot, but he would get all the steers of every description, and all the heifers, bulls, horses, and pigs that there might be there. The mistake arises from supposing the best form of claim to be a detailed description of the particular embodiment of the invention shown in the patent, when it should be a description of every class of machines which embodies the principle of the invention, whether or not the details not essential to that principle are copied. In other words, the claim is not a list of elements whose virtue is greater the larger the number of elements enumerated; but it is the description of a class of combinations of elements, and the fewer elements stated the larger the class of machines is likely to be in which that combination of elements is found.

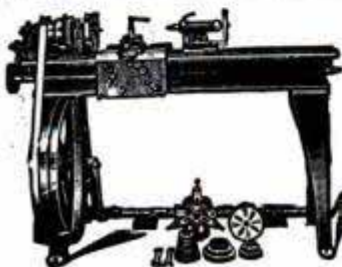
The Supreme Court of the United States has said that the claim of a patent is one of the most difficult pieces of English composition to write. It is often thought that the particular wording of a patent is not important, the skill required being in enforcing the patent in court; but it must now be clear that there is great opportunity for skill and foresight in drawing the patent. A well drawn patent may make plain sailing in court, while a poorly drawn patent often has a hole in it through which serious competition can escape.

FORTUNES IN THESE IDEAS.—There are lots of chances for inventors still. It is an old saying that the simplest devices are the ones which prove most profitable to their originators. The field is not yet exhausted.

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heel feels for a step; there is a flash of filmy, fluffy, rustling skirts, and a pretty face, set off by a great hat, a mass of hair and a princesse gown. The promenade deck is crowded with those who are to sail and those who have come down to see them off. Some are walking up and down the deck, others are standing in groups. Yonder is a prominent actress or operatic singer, whose arrival at New York will be heralded by every newspaper in the western world. Nearby is a great American politician whose friends a week hence will welcome him from the deck of a chartered tug-boat. Hither and thither, the heavyweight pugilist, the eminent divine, the great social light, the central figure in the latest divorce scandal, and the big trust magnate are, for the first time perhaps, elbowing one another with the utmost unconcern. Down below the salon tables are banked with flowers—wreaths, baskets, bouquets the last testimonials of friendship from relatives or friends from whom an increasingly greater distance will separate us as the hours flit by and the ship steadily forges ahead on her course. The second cabin passengers are less picturesque; to look for color one must confine himself to the salon and the steerage. It is here that the tragical fears and grief of farewell are openly expressed. Dignity, reserve and stoical control of emotions, which mark the salon, are not in evidence here. Perhaps it is because partings are rarer among them, perhaps it is because at the last stage of their journey toward the "land of the free" they are suddenly seized by a last longing for their old home and its associations. Who knows what tragedies have caused their departure from the confines of Europe? Who could analyze the thoughts of these men and women, encumbered with crying children as they crowd on their part of the deck, watching the final preparations for the approaching time of sailing? They have had a hard day, these emigrants. They have been counted, examined, fumigated and re-checked by the American officials before being allowed on board, and what poignant grief is still in store for those who will be denied admission into America! To some of them it means returning to a hopeless social thralldom and to everlasting misery. Somehow the sailing hour seems to mean more down in this part of the ship. There are tears and demonstrations and cries of sharp sorrow. The noon hour is now drawing nigh. The captain and pilot are on the bridge, an officer is standing at the engine-room telegraph, and the inspector is handing the captain his final papers. The toll of a bell is now heard and stentorian cries of "All ashore—that's going ashore!" Follow the last few words, the last few kisses, the last silent embrace, and then all ways lead to the gangplank. All turn at the foot of the gangplank, a constantly increasing crowd, craning their necks upward, shouting and throwing kisses. An officer is giving orders to lower the gangplank; in another minute all communication from the vessel to the wharf will have been cut off. A realizing sense of what that means sweeps over the passengers and those on the pier in a wave, and faces grow tense and smiles disappear. With a bang down comes the gangplank. Seamen are seen hauling in the lines. The second officer is at the stern standing at the telegraph through which he receives his orders from the bridge. The crowd is strangely silent. Among its components you may pick out gowns of the smartest cut and hats of the most expensive creation, and top hats and frock coats, and the plain suits and bowlers of workmen, the jumpers of laborers and the dress of the uncouth and ill-bred—all mingling in a kaleidoscopic ensemble. Suddenly a great gruff whistle roars, the water under the stern boils with the kick of the screws, the stern lines slacken and are cast off the pier posts—the vessel is under weigh. Everyone is on tiptoe. Slowly the ship's head is turning outward. On the pier, the crowd has been transformed into a vibrant mass—handkerchiefs, flags, shawls, hats flutter in the air; women place their hands on their escort's shoulder giving little upward jumps to better their view, and on the departing vessel the passengers are not a whit less agitated. It is a scene so thrilling, so full of life—the fluttering color, the shouts, the fanfare of bugles, the constant roaring of the whistle and the tooting of the tugs—that one used, or unused to it all, feels uplifted, confused, almost carried away, a prey to all sorts of emotion. Those on the pier strain to catch a last glimpse of loved ones, shouting messages of cheer and farewell as futile as though uttered within the roar of Niagara. That sea of yearning faces turned toward the liner; one does not forget them quickly. Now the vessel is clear of the pier. Full speed ahead! A flutter, a faint hurrah is borne across the waters, and the crowd turns slowly and leaves the pier, dispersing for the office, the workshop, or the home, where duties for the time being forgotten, await. The philosopher, homeward bound, is thinking how light-heartedly so many now embark upon an ocean voyage which, but a generation ago, was fraught with such dangers. 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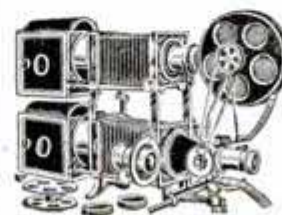
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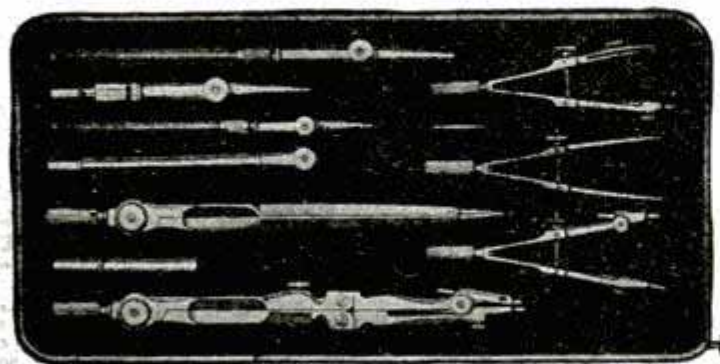
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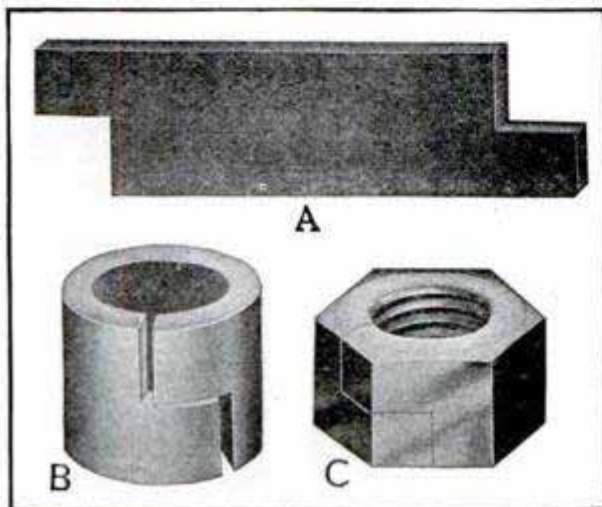
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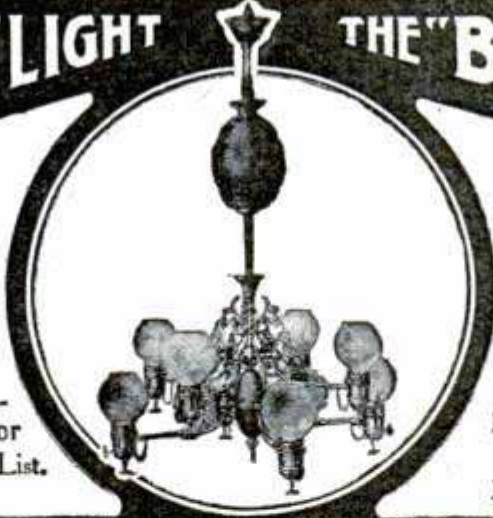


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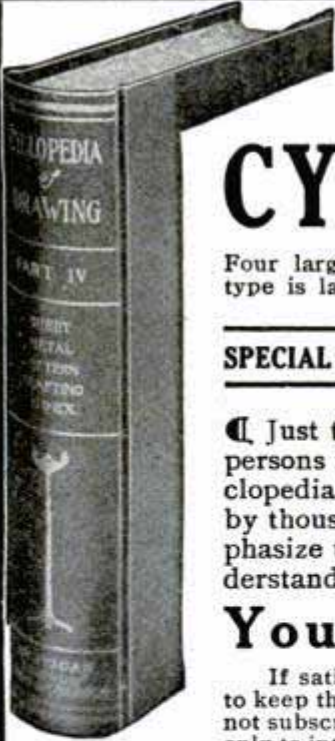
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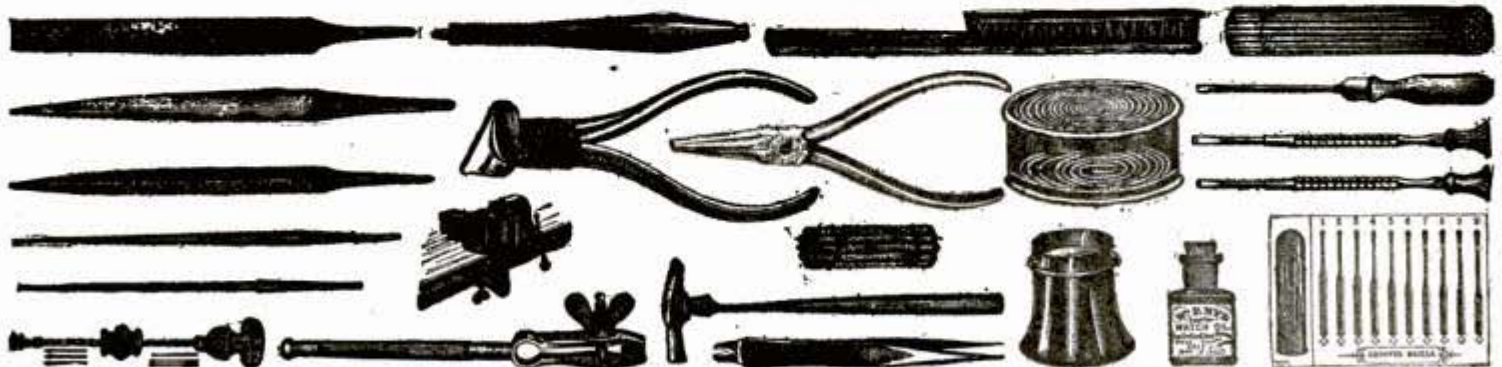


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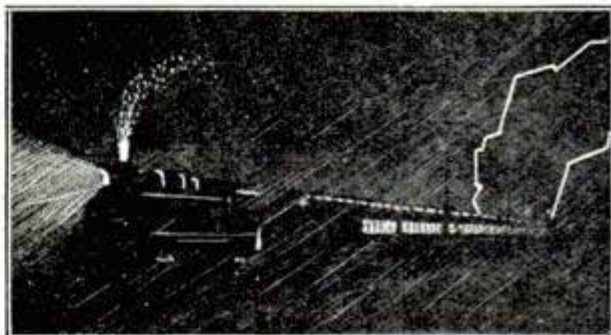


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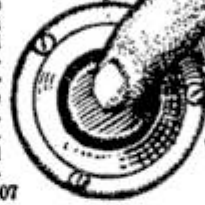
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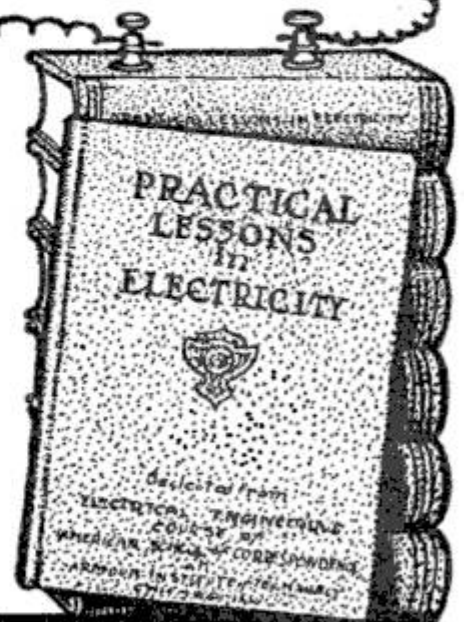


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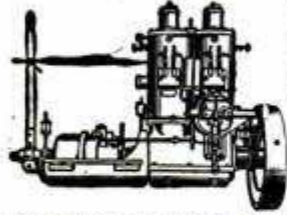
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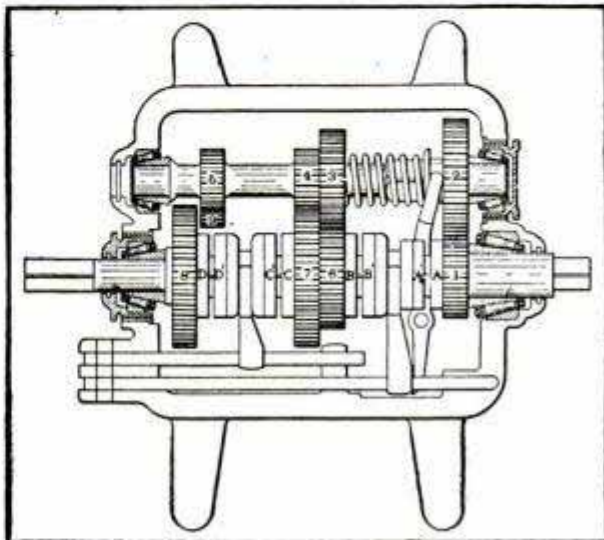
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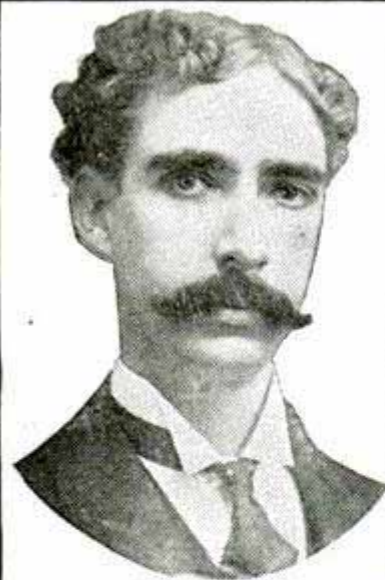
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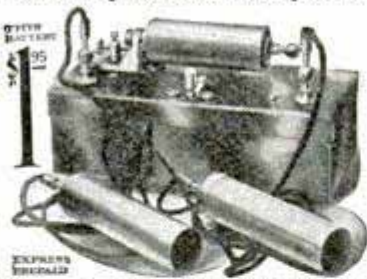
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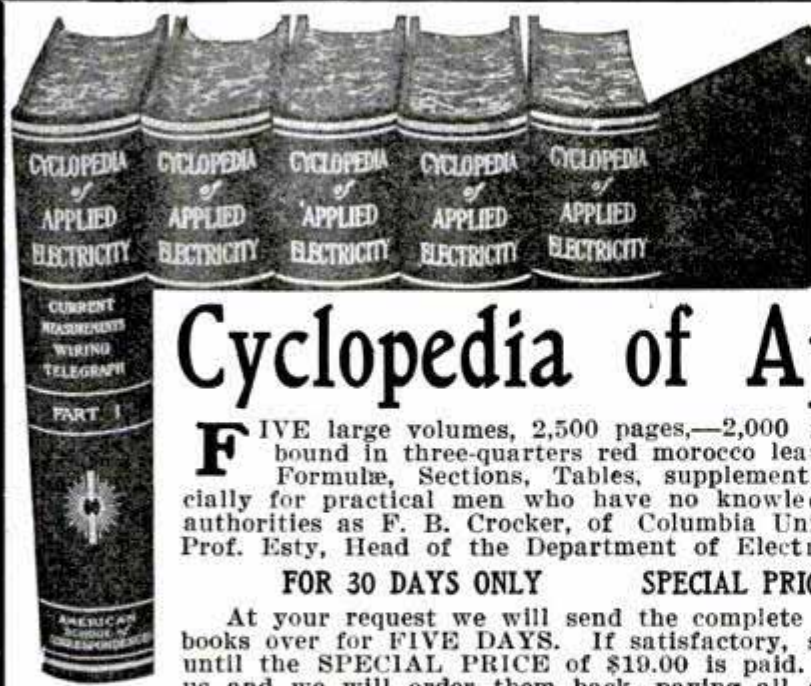
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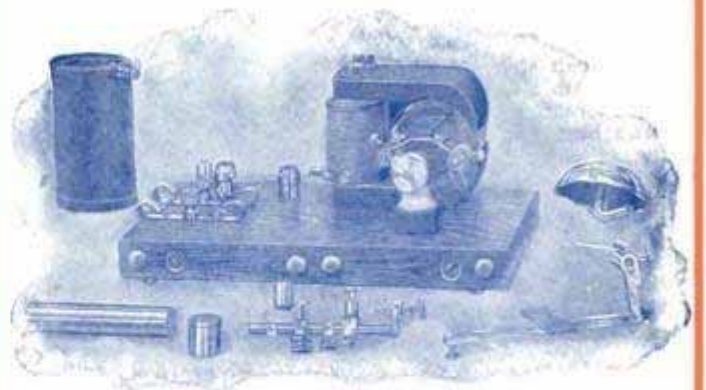
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