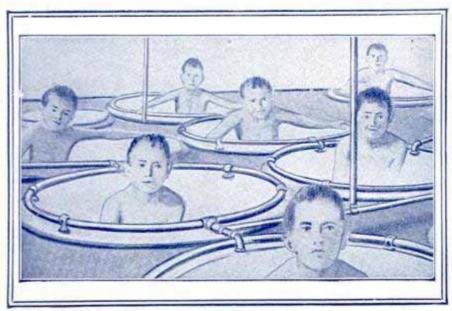


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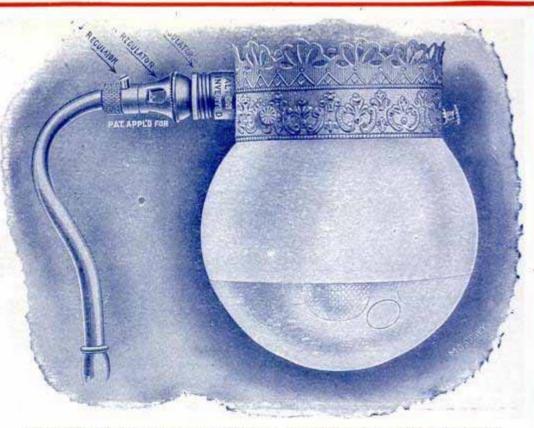
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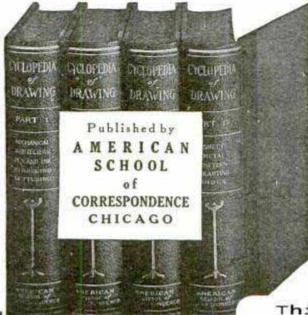
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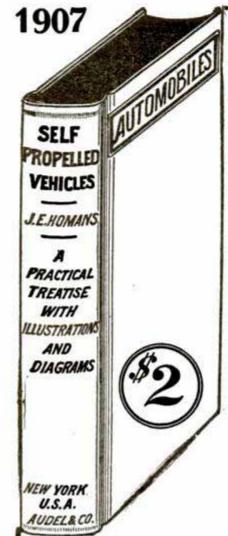
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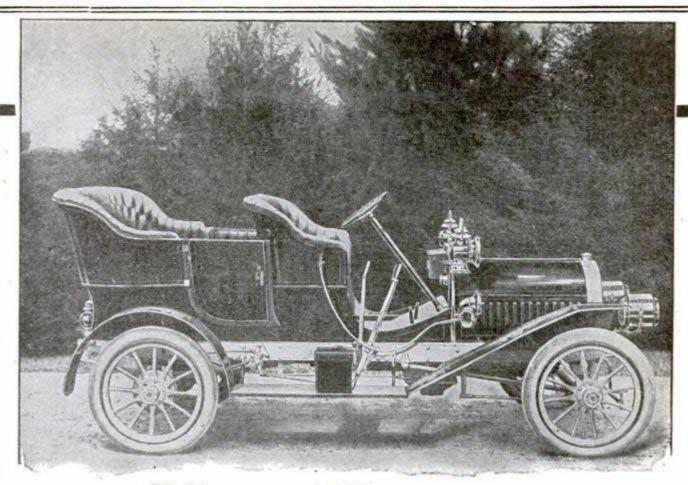
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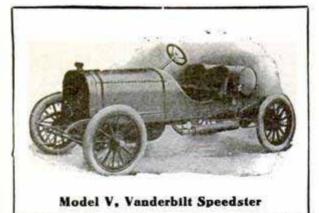


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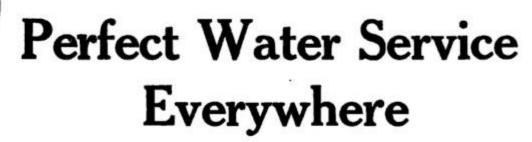
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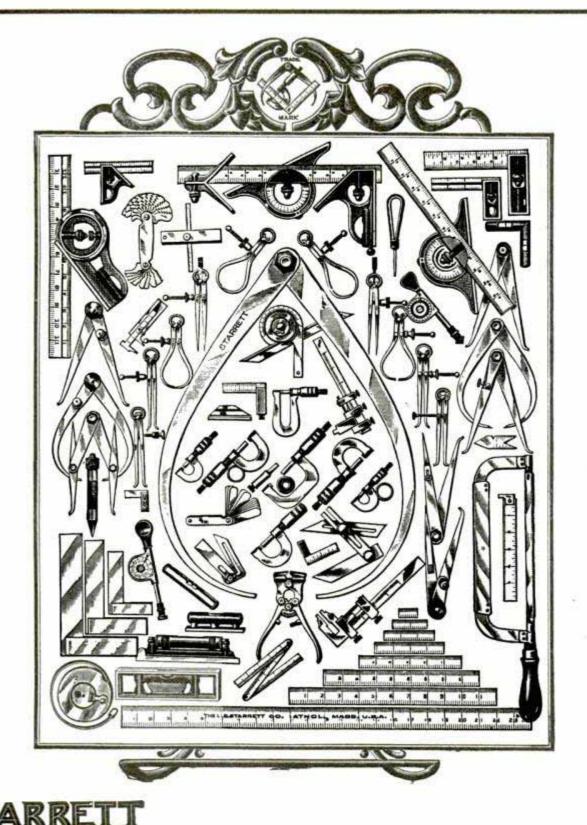
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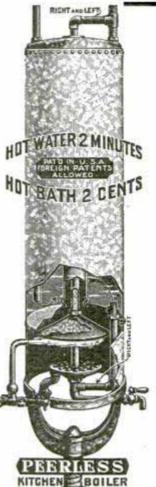
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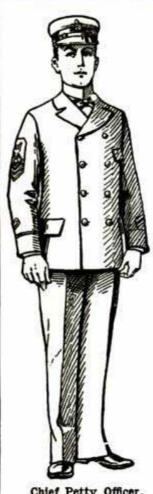
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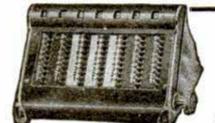
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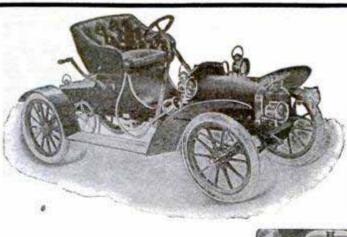
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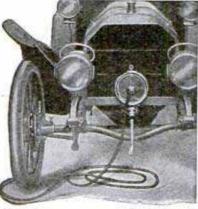
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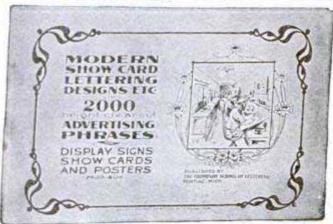
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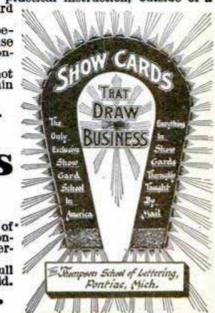
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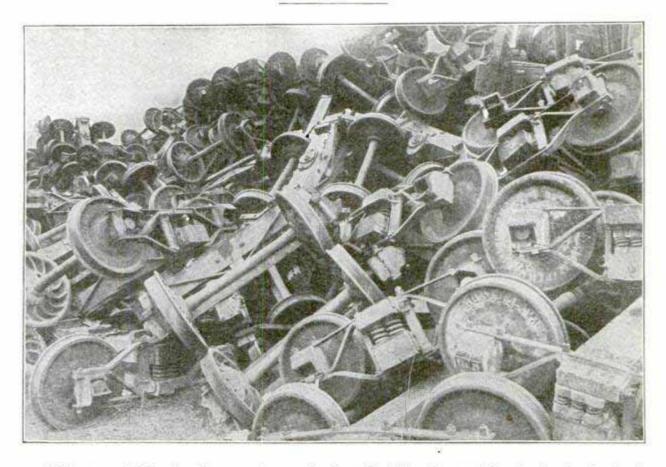
POPULAR MECHANICS

Vol. 9. No. 5.

CHICAGO, MAY, 1907.

10 Cents a Copy \$1.00 a Year

BROAD GAUGE RAILROADS? NO!



This remarkable pile of wornout car wheels and old trucks contains hundreds of wheels. They were taken out from under coal cars by an Ohio railroad and will be broken up and remelted. The wooden cars to which they belonged were also destroyed and will be replaced with steel cars of much larger capacity. If all the railroads should change to 6-ft. gauge there would be hundreds of thousands of tons in similar scrap heaps from the Atlantic to the Pacific.

The most astonishing statement made by Mr. Harriman in his examination before the Interstate Commerce Commission was his remark about changing the standard gauge of our railroad tracks. He predicts the present gauge of 4 ft. 8½ in. will be increased to 6 ft. and cars made 2 ft. wider.

Every practical railroad man in the country from section foreman up to general manager knows this is a practhere was experimenting with the gauge and a 3-rail track to accommodate in one train the cars of narrow and standard gauge lines was no uncommon sight as recently as 10 years ago. The narrow gauges have disappeared and the few 5-ft. roads have narrowed to standard. The best judgment of the railroad profession has decided in favor of the 4 ft. 8½ in.

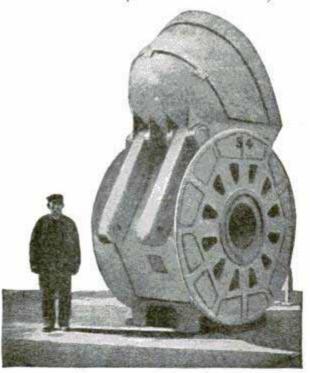
To change this standard would mean

the rebuilding of practically every mile of main line and sidings in the whole United States; roadbeds, bridges, tunnels, trestles, embankments, all would have to be enlarged. Engines, cars, depots, round houses, turn tables, switches would all be changed. Millions of dollars invested in repair and construction shop machinery would become useless. In fact, the revolution would so permeate the whole railroad fabric as to produce a physical and mental chaos.

There was a 6-ft. gauge once in this country—the Erie railway from Jersey City to Dunkirk—but as soon as it became a connecting line the folly of its gauge was remedied. What is needed is not wider tracks but more miles of present tracks and greater care in operating them.

MAMMOTH DREDGE BUCKET

The accompanying illustration is not a picture of a mammoth mortar for coast defense, but belongs to the peaceful occupation of harbor dredging. It is one of the many buckets, or scoops, which connected one to another form an endless chain of excavators. The bucket is shown resting on the drum which is submerged to the bottom, and



Capacity 54 Cu. Ft.

each bucket brings up 54 cu. ft. of bottom at each trip. The "David Dale," a big dredger built for the North Eastern railway of England, specially to deepen the harbor at Hull, is equipped with these mammoth scoops.

TELEPHONE NUMBER FOR TELE-GRAPH ADDRESS

Telephone subscribers in Austria-Hungary have hit upon a bright idea for reducing telegraph charges. Over there each word in the address is charged for as part of the telegraph message. To reduce this expense people register their telephone number with the telegraph company and advise their correspondents to use it instead of the name. In this way an address such as Editor Popular Mechanics, 160 Washington St., Chicago, which would count nine words if paid for, in this country, would be reduced to Main 2682, Chicago, which only counts three words there, as a number and not each figure goes as a single word.

PRISON-MADE SIGNBOARDS

There is a poetic fitness in convicts furnishing the signboards which shall keep other people in the right road, but the superintendent of New York state prisons seems to be the first man to discover its economic fitness. He has promised to have them made in Clinton prison for use on all the state highways.

GREAT STEEL CITY BEING BUILT

An enormous steel plant producing annually nearly two and one-half million tons of steel is being constructed at Gary, Ind., and to accommodate the army of laborers that will be employed an entirely new city is being built. Parks, theaters, streets, water and sewerage systems, all will be in readiness for the people when they arrive.

In the steel plant the machinery will

be electrically driven, the gases from the blast furnaces being used as far as possible for generation of the necessary power. In the rail mill induction motors ranging in capacity from 2,000 to 6,000 hp. will drive the main rolls and a system of control which is said to be "fool-proof" will be employed.

COAL REPLACES OIL FUEL IN NEW ORLEANS

The prospect of a permanent substitution of petroleum for coal, with happy release from smoke and cinders, seems to be another iridescent dream. At least the big coal contract recently closed by the Southern Pacific R. R. and Steamship Co. is a big pointer in that direction. The contract calls for 250,000 tons from Pittsburg, to be delivered on the wharves at New Orleans.

This fact is the more significant because the Southern Pacific made a strong effort to substitute oil for coal, changing its locomotives and burning large quantities of the liquid fuel. But the increase of price, due to a growing scarcity of oil, seems to have forced the railroad to abandon the project, at least in New Orleans.

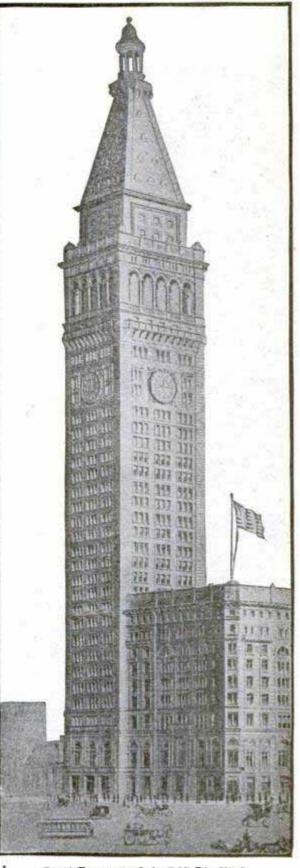
BUILDING 48 STORIES HIGH

740 Feet from Base to Top

Unless somebody starts a new and bigger one before we can get this article printed the highest building in the world may be declared to be in New York City, where a tower is being added to a building in Madison Square. From the top of the building proper a tower 75 by 85 ft. will rise to a height of 492 ft. above the street, from which point it will continue in pyramid form and be surmounted by a cupola 658 ft. above the ground. The tower will be The illustration is used as offices. photographed from a model of the structure.

The tower will contain 8,500 tons of steel or 1,500 tons more than the

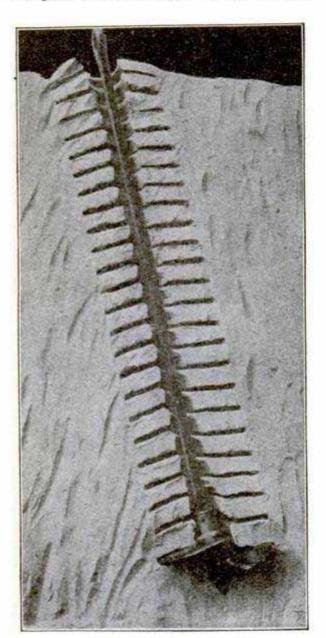
Eiffel tower; the steel framework from the third sub-basement to the top being 740 ft. of continuous perpendicular bridgework. The steel columns at the base are 30 ft. long and weigh 45 tons each—3,000 lb. to the foot—and will be the heaviest ever made.



Steel Framework is 740 Pt. High

HOLDING POWER OF A GUY ANCHOR

A guy anchor for telephone poles is really a post auger which is screwed into the ground and left there. The pole is guyed or held by a small steel rope, one end of which is fastened to the pole and the other to the anchor.



The holding power is something sur-

prising.

Tests made by Prof. Carpenter, of Cornell University, show that a 5-in. anchor, when bored into the ground 5 ft., will hold 12,000 lb.; a 6-in. anchor, 15,000 lb.; 8-in., 20,000 lb.; 10-in., 25,000 lb.; 12-in., 30,000 lb.

The cut represents a cross section of clay through which the helix of the anchor has been bored. For the sake of clearness the spiral path of the helix is left open, as if it had just passed through. The results of the tests show that the holding power of such an anchor is nearly proportional to its size.

OPENS BANK SAFE WITH SMALL HAMMER

The bank at Seward, Alaska, has a big safe with a time lock. Recently the clock stopped and all efforts to open the safe failed. Lock experts were brought from all parts of Alaska, but none were able to solve the trouble. Finally after several weeks the bank officials, in desperation, loaded the big safe on a steamer and sent it to Seattle for treatment. All this time \$50,000 in currency was locked up safe and tight.

When the ship tied up at its dock a safe expert was waiting to go on board. He simply gave two or three light taps with a small hammer, the clock started and a few hours later the

bolt flew back as usual.

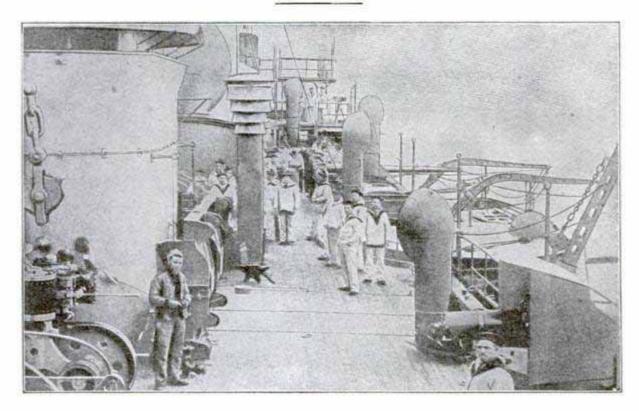
PENCIL CEDAR GETTING SCARCE

Where do all the lead-pencils come from-320,000,000 of them a year? Mostly from red cedar, which is almost indispensable for the purpose, since no substitute for it has yet been found possessing all the necessary qualities. Pencil cedar is the only wood which is always sold by the pound, and it is getting scarcer while the demand for pencils increases rapidly. Measures to increase its growth are being taken by the U. S. Forest Service, but that will take time, and meanwhile the situation becomes more acute. A fortune awaits the man who shall hit upon a satisfac-Inventors, get busy! tory substitute.

All the pig iron furnaces in the United States produced \$400,000,000 worth in 1906, an increase of 50 per cent in four years. Of this total the Steel Corporation is to be credited with 43 per cent, or 18.6 per cent of the total output of the world.

FRENCH BATTLESHIP DESTROYED ON SHORE

Flagship "Jena" Blown to Pieces in Dry Dock—A Remarkable Disaster
—Other Notable Naval Dry Docks



Battleship "Jena" Before the Explosion

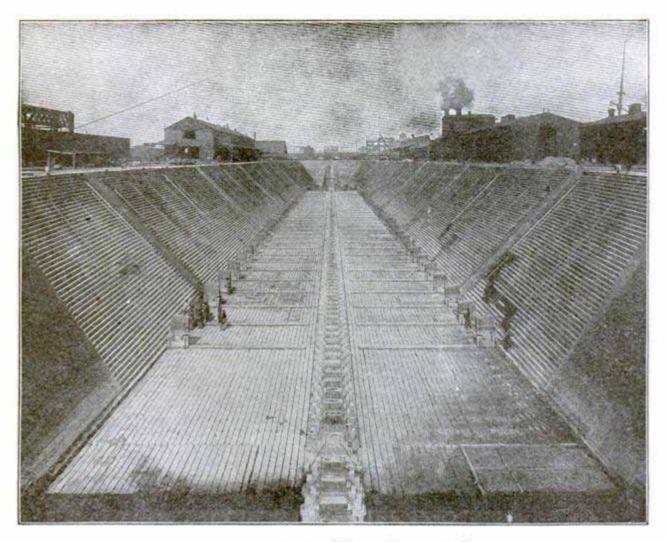
The French battleship "Jena," flag-ship of the Mediterranean squadron, with a rear admiral, two captains and 630 men on board, was blown to pieces in the naval dry dock at Toulon on March 12. It was not permitted this noble ship to sink in action, go down in a storm or even founder on a rock. Taken from her ocean home, propped up with great timbers in a dry dock, and without even a drop of water to wet her sides, she was torn asunder in an explosion which killed 100 and injured 300 men.

For two weeks the work of overhauling had continued; every inch of deck and hull had been examined; every piece of machinery in gun and engine rooms had been overhauled; tons of smokeless powder, shells, torpedoes and other ammunition had been safely taken on and stored away until the magazines would hold no more. The men had finished their noonday meal and in another hour the gates would have been opened and the ship floated

out into the harbor and her voyage begun. Without warning one of the after magazines supplying the 12-in. guns exploded from some cause not yet known, or at least not made public. It has even been questioned whether a spark could have been caused in the magazine by some stray current from a wireless station.

The men below were enveloped in fire and suffocated with deadly fumes, while those on deck in a wild panic jumped overboard only to meet death on the stones 60 ft. below. The other magazines could not be flooded because there was no water, and, unable to execute the orders which would have been the proper thing to do at sea, the bewildered sailors were in much the same position as a company of city firemen would be if brought aboard ship.

Owing to the flying shells it was impossible to open the gates. Those who attempted to do so were killed, and it was finally necessary to open fire



Modern Dry Dock-Water Pumped Out

on the dry dock gates with heavy guns from another vessel outside. A few well directed shots tore the barriers to pieces and the welcome waters of the bay poured in and stopped the explosions which threatened the entire city. Altogether the disaster was as unusual as it was terrible. The "Jena" was built in 1901; was a turret ship of 12,100 tons, with 16,500 hp., and a speed of 18 knots.

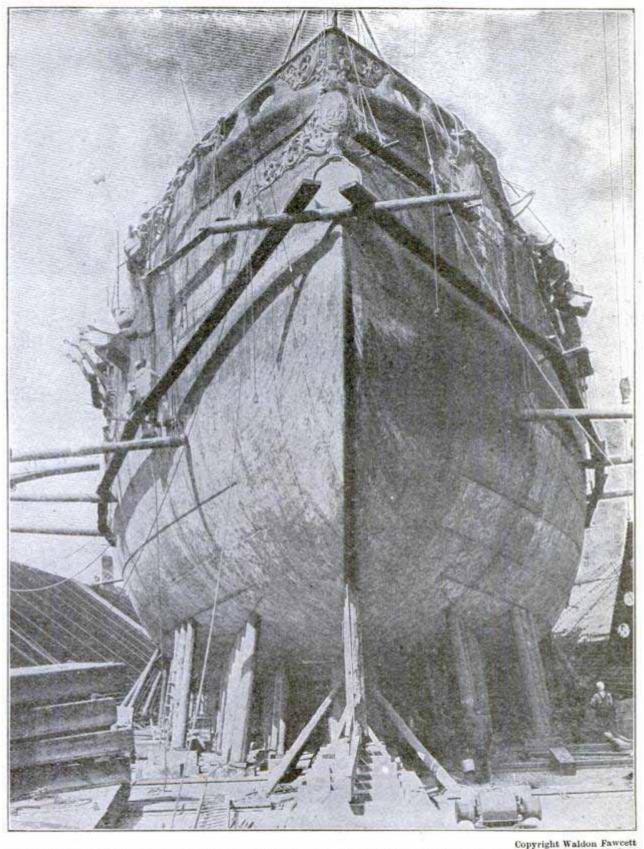
Largest Dock at San Francisco

The largest dry dock in the world will now be built at Hunter's Point, San Francisco, and will exceed in capacity the present docks there, one of which is 750 ft. long, with 32.5 ft. of water. The new dock will be 1,050 ft. long, 175 ft. wide at the top and have 36.5 ft. of water over the sill. It will cost \$1,250,000 and require two years to build.

It will be hewn out of solid rock and the sides and bottom of natural rock will be covered with cement. This new dock will be able to accommodate two of the largest battle-ships in the American Navy at one time. The great liners like the "Dakota," "Minnesota," "Korea," "Manchuria" and "Siberia" can be docked in this gigantic basin and have over 400 ft. to spare. When the nature and magnitude of the work are considered, the cost—\$1,250,000—should be regarded as a low figure. The Navy dock at New York cost the government over \$1,800,000, and it is much smaller than the proposed dock.

The land has already been surveyed at Hunter's Point, and active work will be commenced and crowded forward as soon as the plans are completed.

The Secretary of the Navy recently requested the plans of the two dry docks now in use at Hunter's Point. The drawings were made and have just been forwarded to Washington. Although the company which will

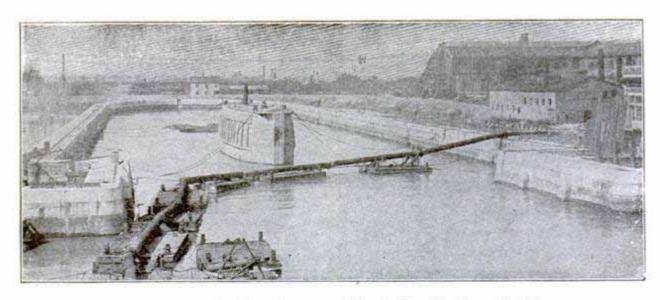


Battleship "Massachusetts" in Dry Dock—The "Jena" Was in the Same Position at the Time of the Disaster

construct, own and maintain the new dock is a private corporation, yet it is generally understood that the great work has been undertaken with the direct and active encouragement of the Navy Department; also that this department has expressed a wish to have the new

dock completed at the earliest possible date.

Strict secrecy has been maintained by both the company and government agents, but the whole matter has lately leaked out and all the facts are now admitted.



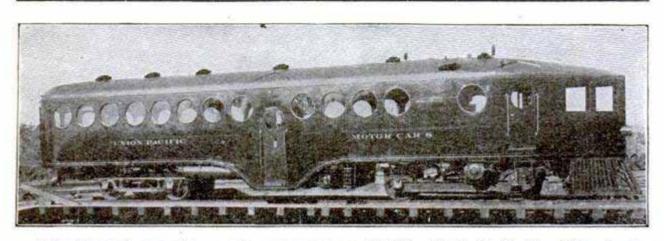
Naval Dry Dock at League Island-Nearly Completed

So great has been the increase of commerce of San Francisco that it often occurs that steamers must await their turn for their periodical cleaning, painting and repairs. However, with the completion of the new government dock at Mare Island Navy Yard, the big double floating dock to be built by the Union Iron Works, and the monster basin at Hunter's Point, there will be ample facilities to accommodate all the San Francisco shipping for years to come.

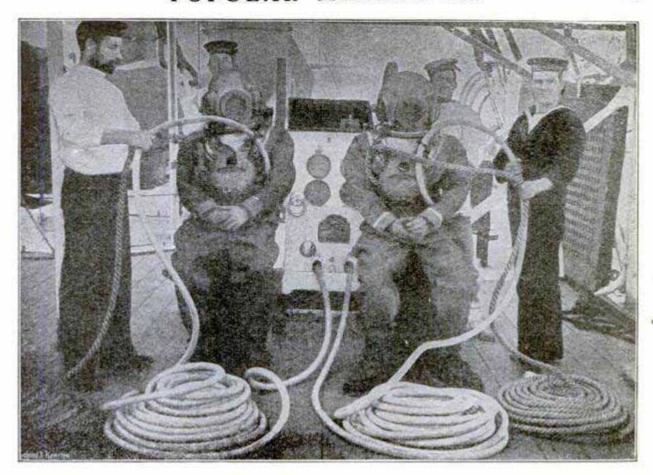
League Island Dry Dock

Naval engineers are preparing to rush to completion the new \$1,800,000 dry dock at League Island, N. Y. In no other naval station in the country will there be a dock that is superior to this. The biggest ships of the line, drawing more than 27 ft. of water and of more than 16,000 tons, can be easily accommodated within the great walls of masonry. At the entrance to the dock there has been erected a costly power house. Far down under the ground, something over 35 ft., are run the giant pipes through which the dock will be filled or emptied of water. Three great centrifugal pumps, each having a capacity of 43,000 gal. of water a minute, will fill or empty the A great fleet of warships, dry dock. it is expected, will be sent to League Island for repairs when the dry dock is ready for use.

Two women made a two hours' trip in a submarine boat, recently, as the guests of J. C. Lake, father of Inventor Lake. The boat was maneuvered on the bottom at various depths up to 27 ft.



The latest of several gas motor passenger cars built by the Union Pacific at the Omaha shops. The chief change in this car is the side doors.



SUBMARINE DIVERS RECOVER TREASURE

With Lives in Peril Every Moment They Explore Sunken Ships

Lost treasure has always possessed a special fascination and has formed the basis of innumerable "thrilling" stories. But no fiction can surpass the sober facts of the history of wealth recovered from the ocean bottom, often at great depths and after long submergence. In our April issue there was a description of the wonderful perfection to which the diving-bell has been brought; here are a few of the more striking instances of the recovery of sunken treasure by English divers in closed suits.

From S. S. "Malabar" was recovered more than \$1,250,000; from S. S. "Alphonso XII," \$450,000; from S. S. "Hamilla Mitchell," \$250,000, and from S. S. "Carnatic," \$200,000. The complete list is long, but these give an idea of the enormous value of the treasures which the greedy waves have swallowed, and the inducement to invest

large capital, construct ingenious and expensive machinery, and run great risks in its recovery.

The men who do this mining in deep waters, at the risk of sharks and asphyxiation, are even more heroic than the miners who face fire and "choke-damp" in the bowels of the Think of working more than 180 ft. below the surface, encumbered by suit, helmet and tubing, and under the water pressure at that depth! That was done by the diver Angel Erostarbe. to secure bar silver worth \$45,000 from the wreck of the steamer "Skyro" two miles off Cape Finisterre, Spain. The was complicated by stormy work weather, strong ocean currents, and the fact that the deck had collapsed within 13 ft. of the floor of the cabin in which the silver had been stored. This made it necessary to blow away the collapsed deck with dynamite in order

[[]For the facts and photographs used in the preparation of this article the editor is indebted to Messrs. Siebe, Gorman & Co., Submarine Engineers to the British Admiralty and War Office.]



Ready to Descend

to reach the treasure, and this feat the diver finally accomplished with great toil and risk, and under a water pressure exceeding 76 lb. to the square inch.

Then there was the ship "Hamilla Mitchell," sunk near Shanghai, with specie to the value of \$250,000 to tempt the adventurous. After long searching on the floor of the ocean, the wreck was located in 160 ft. of water. It had been "in soak" so long that worms had bored through some of the treasure-boxes, dollars were lying around in heaps, and Diver Ridyard worked four hours consecutively at that great depth, sending up 64 boxes of precious coin.

This feat was complicated by pirates, in true story-book style. The work was being done under the shelter of an island and the men supposed that they were safe; but just as the diver came up exhausted from an effort which was without parallel, it was discovered by the merest accident that a vast flock of white sails was sweeping toward them from the mainland. Chinese pirates!

Instantly all was commocion. Exbaustion was forgotten. The diver and all hands sprang to the work of slipping anchor and chains, setting sail, and then everybody to the oars, for the breeze was light. Now both loot and life were the prizes, for Chinese pirates believe that dead men tell no tales. It was a fearfully close call, but they made it.

The recovery of boxes of gold coin worth \$500,000 from the Spanish mail steamer "Alphonso XII," off Point Gando, Grand Canary, was made difficult beyond precedent by the fact that the treasure room was in the "run," or after-part of the ship, and below three decks. It took six months of the hardest kind of work to overcome all the difficulties of the situation. The depth was 160 ft., and the underwriters employed three specially selected divers for the task of locating and getting up the mine chests, each containing over \$50,000 worth of yellow gold.

These tremendous depths have been exceeded, however, by Diver James Hooper, who descended to the wreck of the ship "Cape Horn," off Pichidanque, South America. The depth was 34 fathoms and every square inch of his diving suit must have been pressed



Diver Angel Erostarbe

upon by $88\frac{1}{2}$ lb. So far that is the limit.

When it is considered that the greatest depth of the ocean is about 5 miles, a dive of 204 ft. seems pretty small, but it is really a great performance because of the crushing pressure of the The ordinary pressure of the air at sea level is 14.7 lb. on each square inch, or on the whole human body of 20,000 lb. Of course, if this pressure were not exerted equally in all directions, on the inside as well as the outside of the body, life would be impossible. Now, when a man goes under water its pressure increases rapidly. until at 35 ft. depth it is just about equal to the air pressure. As he continues to descend the pressure increases until at 100 ft. it is about 3 times the air pressure; at 140 ft., 4 times; at 170 ft., 5 times, and at 204 ft., 6 times.

To balance this tremendous pressure from without, a corresponding pressure of air within the diver's body must be carefully maintained by the air-pumping machines with which his helmet is connected by tubing. From this it is evident that only strong and courageous men can stand the strain of the diver's work, and that every precaution must be observed in both descending and ascending, especially the latter. The safe rate of ascent from depths less than 80 ft. is not more than 2 ft. in one second; for greater depths the rate must be still slower. There have been cases of divers who ascended rapidly through fright or carelessness, and on reaching the surface they exploded, the blood pouring out from the openings of the body.

These are but a few pages from the true story of these "toilers of the sea." Here the prizes for toil and danger are scarcely to be exceeded anywhere. It would be another long story merely to recount the ingenuity and capital which have been expended on the problem of locating and securing these prizes, or to name the treasures which the dark, unfathomed caves of ocean hold still out of reach of the searching

hands of men.



Telephoning to Diver

GOVERNMENT WAR BALLOON

Leo Stevens, the well-known aeronaut, has just signed a contract with the War Department to furnish a big balloon and to conduct experiments with it at Fort Omaha, Neb. It will cost in the neighborhood of \$12,000, and it will be capable of lifting more than a ton of ammunition.

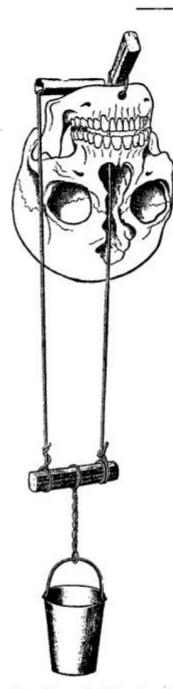
This balloon makes the tenth which the War Department owns and which are ready to be used in case of necessity. This one, however, eclipses all the others in size and capacity. It will weigh 1,700 lb. and have a capacity of 78,000 cu. ft. of gas; the netting over the bag will weigh close on to 290 lb. The bag will have a diameter of 56 ft. and the car is to be 6 ft. long, 5 ft. wide and 4½ ft. high.

A big hydrogen supply tank has been erected at Fort Omaha. The experiments will be begun under the direction of General James S. Allen, commander-in-chief of the signal corps of the army.

Although the balloon is intended mostly for signal work, it will be large enough to carry bombs and ammunition sufficient to play havoc with an enemy.

WONDERFUL STRENGTH OF HUMAN JAW

Experiments Show Surprising Force Used in Eating Ordinary Foods



crushing power is surprising, varying from 150 to 300 It is also surprising how much jaw strength is exerted unnecessarily by many persons in eating, often with result cracking or breaking the Thev teeth. crush their food with the ferocity of wild animals. But direct pressure is a poor way of breaking up most foods, a grinding movement gives better results with much less expenditure o f force.

All this has been known for a long time by p h y s i o l o - gists, but some experiments recently made by

Dr. Joseph Head, of Philadelphia, furnish exact figures on this subject which are as valuable as they are interesting. His method of conducting the experiments is made clear by the accompanying cut of a real skull. After the substance to be crushed had been placed between the teeth, weights were placed in the suspended pail until the crushing weight was obtained. These weights are given for a large list of foods, and a comparison of the figures should be a valuable guide in selecting

the diet of those who are weak for any reason and need to economize their strength, also of those who chew with "store teeth."

The first experiment was made with dry crusts, which broke under 15 lb. pressure. When, however, the combined crust and soft inside were tried, even 60 lb. pressure would not go through the dense mass. When a little saliva was added a pressure of 3 lb. was amply sufficient. The deductions with regard to fresh bread and thorough mastication are obvious. People are sometimes greatly surprised at having broken a tooth when they "only bit a soft crust."

Here are a few figures taken from Dr. Head's tables. Of course, allowance is to be made for the fact that each food, and especially each kind of meat, will vary in reductibility according to quality and other conditions. Consequently these figures should be taken relatively, and not absolutely.

The weight needed to reduce corned beef, with the help of a little grinding movement, was 20 lb.; for roast beef, 20 to 35 lb. Tough "round" required 38-42 lb.; sirloin, 10-43 lb.; pork chops, 25-30 lb. The lowest on the list were boiled beef, 3 lb.; roast lamb, 4 lb.; tongue, 1-2 lb. No mention is made of hash, which would undoubtedly stand at the bottom of the list.

Dr. Black states the human jaw will exert a pressure as high even as 300 lb.

HOW TO MAKE CHEAP, PURE BAKING POWDER

Go to any first-class wholesale drug house and buy 1 lb. cream tartar and 1 lb. bicarbonate soda, the latter extra fine ground. Mix first with the second in proportion of 2 to 1 and run through ordinary flour sifter six times. Reserving a little for immediate use, seal most of the powder in a glass jar or other air-tight receptacle.

At present prices in Chicago this baking powder costs about 28 cents a pound, is absolutely pure, and consequently less is needed to do the work.

MOTOR BAGGAGE TRUCK

"What a shame to make that poor man work so hard; something should be done to railroads." The speaker was a benevolent looking old lady who was seated in a car and watching a slim young man draw a big truck on which was loaded a dozen or more big trunks. The load was a good one for a team of horses, but the man had no assistant.

The old lady's sympathy, however, was not needed, for a closer inspection showed the man was really doing nothing more than walking along the platform and holding the truck handle. The big load followed him like a faithful dog, and

when he turned to one side the truck did the same. In fact, he was not pulling at all, but only guiding the load

and keeping out of its way.

The secret of this demonstration is that the baggage truck is equipped with storage batteries and an electric motor which propels it. In the leading handle is a small switch by means of which the operator can start, stop, or reverse the truck by a mere turn of the hand.

The hardest work about a passenger depot now promises to become the easiest, and bears out the prediction of an English scientist who says the human race will eventually become physically weak, by reason of having no hard muscular work to perform, as it will all be done by machinery.



"The Big Load Followed Like a Faithful Dog"

U. S. BALLOON PRACTICE

About May 1st, weather permitting, four officers of the United States Signal Corps purpose to cut loose from Washington, D. C., in a free balloon. By the same permission they will sail across the country to the Mississippi valley, carrying provisions for three or four days. The main object is to give the officers practice in aerial navigation, their experience thus far having been almost confined to captive balloons.

The new one will be larger than the balloons used heretofore by the Signal Corps, and also different. It is being built in New York city, of varnished silk, and will be inflated with coal gas instead of the usual hydrogen.

COTTON THE PEACEMAKER.—The looms of the world, with millions of invested dollars and millions of men, women and children, would be idle without our cotton. Fivesixths of all the fiber produced in the world are raised in our Southern States. Cotton is the great Peace King, for so dependent are foreign nations on the cotton industry they will go far to avoid conditions which would deprive them of this great necessity.



REMARKABLE RAILROAD WRECK

In the gray dawn, while running at 60 miles an hour, the Chicago-New York flyer on the Grand Trunk railway went through an open switch and plunged into a freight train. The crash awakened the entire town of Bancroft. When the engine left the rails it tipped over and the two mail cars went on over and landed on the main line. The locomotive plowed

through the dirt and came to a stop 30 ft. to the right of the track. The baggage and express cars and day coaches were mixed up as shown in the picture; the four sleepers remained on the track.

The engine crew were scalded and suffered fractured limbs, and the fifty passengers were more or less bruised, but no one was killed.

HOME-MADE TRACTION ENGINE WITH MANY USES

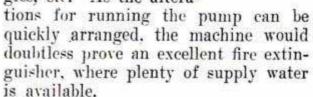
A self-propelled buzz saw, power plant and fire engine is what a Nebraskan experimenter produced with little else than a few harvester parts and a gas engine. The engine used was a 4-hp. stationary 4-cycle engine, which was placed on two 14-ft. timbers. The traction part was arranged by gears and a belt on the side of the machine opposite to that shown in the illustration. The traction gears are operated by a tightener on the belt which takes the place of a friction clutch. For reversing the motion the belt is removed and replaced in a crossed position. This can be done

quickly and does not require an extra belt as the idler takes up the slack.

The two driving wheels are the master wheels of grain harvesters and the gearing and chain drive are from the same machines. The front axle is provided with two sulky plow wheels and the steering gear, consisting of the chains, worm gear and hand wheel, were found on the harvester. On the fore end is rigged a saw shaft and circular saw, capable of sawing a cord of wood in 30 minutes.

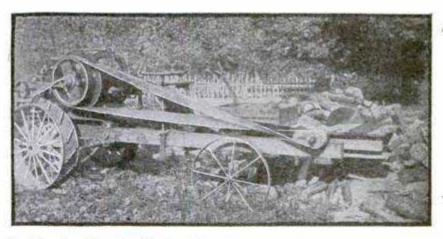
On the rear is a barrel containing water, which is circulated by means of a rotary pump, run by the short crossed

belt shown in the illus-The pulley on tration. the shaft is arranged to slide on the shaft, thus allowing it to be driven from the large pulley, if desired. When this is done the increased speed of the pump produces sufficient pressure throw a good stream from a nozzle and is very gies, etc. As the altera-





A new design in fancy wall-paper patterns comes from Kansas City; also a way to utilize canceled checks. A firm has had all its offices papered with old checks, placed neatly edge to edge; all of the same size of paper, but not of original face value by any means. The face figures of the checks vary from \$30,000 to \$1.000, and the total for one room is \$8,000,000. As a gilt molding runs around the edges of each check-panel, the general effect is rather pleasing.

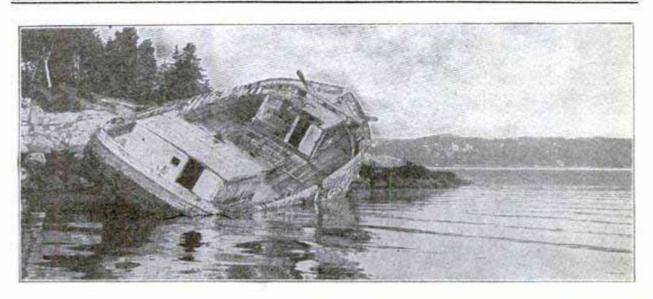


useful for washing bug- Combination Traction Engine, Fire Engine and Portable Power Saw

FISHING BY WIRELESS

A large fisheries company operating along the Atlantic coast keeps track of the shoals of fish by means of wireless telegraphy. The fleet comprises 40 vessels; when the coastwise steamships sight the fish they can communicate their movements to the other vessels immediately. Likewise, a part of the fleet finding fish at one point may notify the rest of the fleet and assemble the ships from remote points without delay.

Hoops on water tanks are usually too thin and unpainted, hence they often give way. They should be of wrought iron, without welds, at least \(\frac{3}{4}\)-in. thick, and painted inside and out. Also, keep them painted, and so avoid rusting and disaster.



THE DERELICT—The United States wrecking steamer is now in commission picking up floating wrecks which are a menace to navigation on the coast waters. These nearly submerged hulls are either blown to fragments with dynamite, or are towed ashore, where they are left securely on the rocks by the tide. The above illustration is from a photograph of one of these dangerous wrecks which has been brought ashore by the derelict hunters.

QUINTUPLE WOOD BLOCKS



Four of them have been finished lately for Carnegie the Steel Co., and the cut gives an idea what big fellows they are. The height over all of each block is 4 ft. 5 in., and the weight is The 640 lb. sheave pin is of

rolled steel, 13 in. Each sheave is 15x 31 in., intended for a 21-in. manila rope.

IS "DREADNAUGHT" THE LIMIT?

Has the limit in big battleships really been reached? There are those in position to know who claim it has. Private letters from men on board the "Dreadnaught" during her recent trip to Trinidad declare the turbines worked well but that the heat in the engine room was something hitherto unknown on board any ship. The vessel also maneuvered badly at slow speed and was unable to keep its place with the other and smaller ships of the fleet.

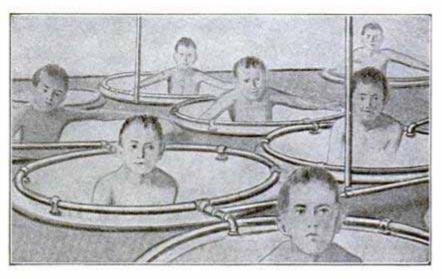
TEACH BATHING IN SCHOOLS

From Boras, Sweden, comes a novel and practical idea on the subject of giving large numbers children separate baths at a minimum of trouble. expense and Briefly stated, a new school building in that town has been built with a bath-room containing enameled tubs round the concrete in floor, each large enough for one child. A circular pipe surrounds each tub and is pierced with frequent small openings, and all these pipes are connected with both hot and cold water reservoirs. In the bottom of each tub is the outlet and stopper.

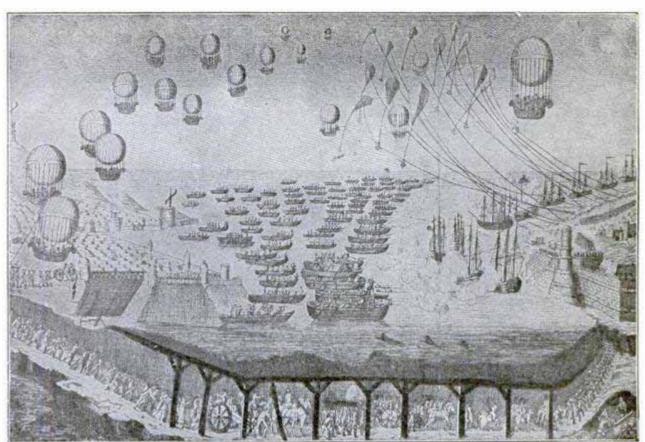
With a child in each tub, the water is turned on by an attendant until all tubs are nearly full. Each tubber is furnished with soap and brush and allowed ten minutes for scrubbing. Then the stoppers are pulled out and each child is given a final shower, beginning at 95° temperature and gradually cooling to 60°. In this way 48 children are run through in an hour. After each relay the tubs are washed out thoroughly by the jets of water from the circular rim pipes, reinforced wherever necessary by brushes in the hands of attendants, and ending with a scald of the hottest water. The tubs entirely remove the danger of drowning where large numbers use a swimming tank.

ASHES FOR FUEL FURORE

The daily papers have gone wild during a lull in the ordinary supply of news and are filling columns with the wonderful discovery (!) of a poor Pennsylvania shoemaker who "burns ashes." One teaspoonful of his secret "dope" in two gallons of water, when poured on ordinary ashes and lighted, is declared to keep a stove red hot for an hour. We recall that the Keeley motor was raised in the same state.



"Each Tubber is Allowed 10 Minutes for Scrubbing"



Courteev London Schere

ENGLISH CHANNEL TUNNEL DEFEATED

The construction of the submarine tunnel under the English Channel has been indefinitely postponed. Parliament listened to the war office and voted against the undertaking. seems strange when one considers the ease with which a tunnel can be closed to an invading army, and evidently the French have no fears of an English invasion through its medium. The tunnel could be flooded in a few minutes; its entrance could be blocked by closing iron gates, or shifting a few blocks of stone into place; a few rapid-fire guns would hold back thousands; a single 1-in. pipe would carry deadly fumes sufficient to asphyxiate a regiment before it could march 100 ft. In short, no harder military accomplishment can be conceived than an invasion in these days through a tunnel from which escape is impossible and the chances of success not one in ten thousand.

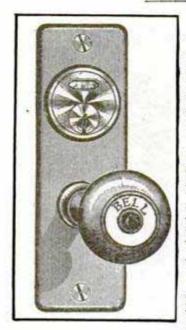
The illustration is reproduced from a French print more than a century old, and shows an invasion of armed forces by means of a tunnel. It is also interesting to note to what an extent the artist of that day recognized the future possibilities of aerial warfare. His dream of 100 years ago is just coming true in respect to air craft. Will it be another hundred before the tunnel feature also materializes?

AERIAL TORPEDO BOAT

The Peace Congress will have to hurry up and set its proposed ban on airship torpedo craft accepted by the big powers or the first conflict will witness a more deadly and dangerous fighting-machine in mid-air than the submarine has proved in naval work. The French army is already equipping with aerial torpedo boats which require only one operator and can go into action in a few hours. Each ship will carry several shells, which require no delicate machinery as the submarine torpedo, and in which practically the entire weight of the shell can be utilized for the explosive. With a few of these volcanoes on board the aeronaut has only to ascend, bring his craft overhead the enemy and let go. Gravity

and the contents of the cartridge can be depended on to make a hit every time.

BELL DOOR KNOB



The most unique door bell yet thought out is the one with a push button in the door knob. in Even the darkest night a caller can readilv locate door knob, and, having done so, to push the button and ring the bell is an easy The matter. bell is placed in the inside knob,

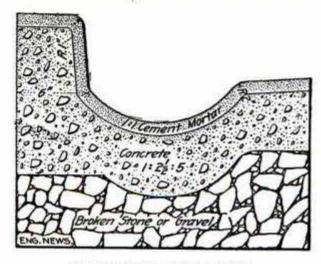
which is made hollow for the purpose. The device can be used on any door by removing the old knobs and substituting the new ones, which any one can do with a small screwdriver.

AUTOMOBILES IN PITTSBURG FLOOD

The recent Pittsburg flood in which twenty lives and millions of dollars' worth of property were lost afforded a new record for automobiles in emergencies. Makers and owners of motor cars rendered valuable service in the free transportation of people in the flooded district while stony-hearted boatmen were demanding \$5 per trip. The sight of automobiles plowing through water up to the hubs was an unusual one to most of the spectators.

NEW FORM OF GUTTER

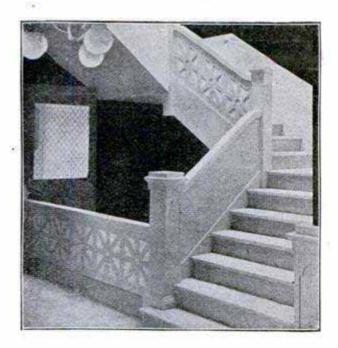
The usual street gutter is merely the angle between the curb and the slope of the pavement. Of course its capacity is very slight and any unusual rain-



Jamestown Exposition Gutter

fall floods both it and the street. To obviate this, the design illustrated has been adopted at the Jamestown exposition. The gutter segment has a 12-in. chord and a 3-in. rise, or an area of 25.2 sq. in., about equal to a 6-in. pipe.

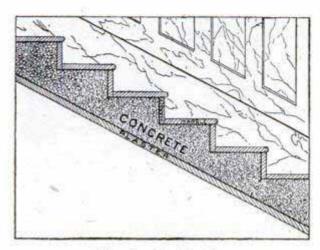




HANGING CONCRETE STAIRWAY

One of the most novel, useful and pleasing uses to which cement has been put in interior construction is the hanging concrete stairway. In the cut is shown a section of cement stairway which runs from the first to the third floor in a Pittsburg white marble apartment building. In its construction no structural iron whatever was used; only small channel bars ¼ in. by ¾ in. spaced about 4 in. and covered with expanded metal lathing. The false work was removed in two weeks.

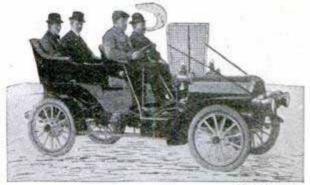
The stairway supports not only its own weight, but in addition 7,500 lb. of marble; and a load of 2,000 lb. has been carried up the stairs without injury or deflection. Only the best quality cement should be used in interior work.



Showing Construction

WIRE STORM FRONT FOR AUTO

A novel storm front has been invented by Dr. Whiting, and is described as having several advantages over the glass or mica front. The front consists of zinc mesh wire gauze attached to a wooden frame which folds up when not in use. It can be removed or put on in five minutes, and when not in use is stowed away taking up little room. The front can be set at an angle and very greatly reduces the wind resistance caused by the solid front. It has been estimated this resistance is not less than 20 lb. per sq. ft. when running against a hard wind. The gauze does not obstruct the vision and allows an agreeable amount of



Patent Applied for

Wire Gauze Protector

fresh air to pass through. In fact, under some conditions it is said the vision is more accurate than through glass.

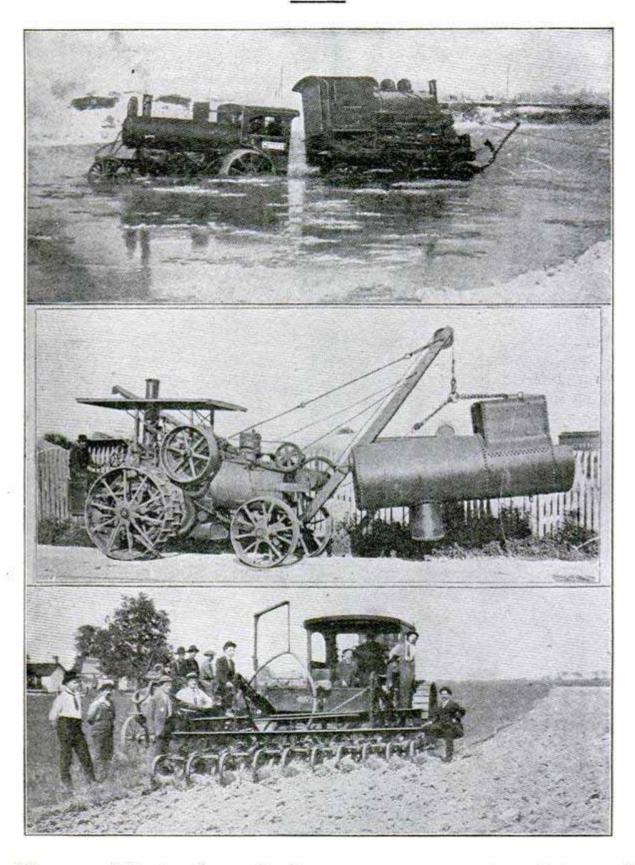
CEMENT CISTERN FLOATS AWAY

A man in Terre Haute, Ind., has lost his cistern: It floated away in a flood. The cistern, which was built of cement, jug-shaped, had been finished but no water had been let in. A levee which kept out the Wabash river broke; the flood poured through and washed the cistern from its place.

It is now up to some notoriety seeking freak to attempt the trip through the Niagara whirlpool in a big cement jug.

A 5-ft. vein of anthracite coal just opened near Marion, Ind., is said to be equal to the finest Pennsylvania anthracite.

INTERESTING WORK OF TRACTION ENGINES



The scope of the traction engine is steadily enlarging: Its operations are no longer confined to running threshing machines. The illustrations suggest a few of the many utilities of which it is capable. The upper pic-

ture shows a situation which caused the engineer some anxiety for a time. The traction engine is hauling a narrow gauge logging locomotive across a river where the water was nearly 4 ft. deep. The locomotive was kept from falling over by strong guy ropes extending to each bank. The voyage was

made successfully.

In the middle picture an idea is given of what a traction engine can do as an improvised crane. The big boiler was not only raised, by means of a winding-drum attached to the traction engine, but was then carried a considerable distance.

The lower picture shows a traction engine harnessed to 10 plows and turning 10 furrows nearly as fast as a team of horses draw a single share plow.

ALCOHOL FROM POTATOES

In Germany potatoes have long been cultivated with a view to producing varieties which give the largest yield of starch for alcohol manufacture, without any regard to their edibility. The results, according to a report by Consul-General Thackara, of Berlin, are remarkable. The appended table shows the yield of these varieties as compared with ordinary yields in this country. Largest yield recorded in the United States in 1905 was 175 bu. per acre and the average was 87 bu. per acre, the average starch content being 20 per cent.

Varieties—	Bushels per acre.	Per cent of starch.
Professor Wohltman	342	16.3
Iduna	284 1/2	16.4
Topaz	326	17.3
Sas		18.3
Leo	412	17.0
Richter's Imperator	476	15.4
Silesia		16.3
Professor Marker		14.5

In this report the consul says: "Messrs. Metz & Co., of Steglitz bei Berlin, a reputable seed house, inform me that they could furnish the Silesia, Professor Wohltman, Leo, and Richter's Imperator varieties, which they recommend for distillation purposes, for about 3 marks (71.4 cents) per 110 lb., delivered at Hamburg. Professor von Eckenbrecker says that the potatoes could be shipped in late October, but he would advise that they should be left here all winter and forwarded in March, as there would be less loss and a much greater chance of the potatoes

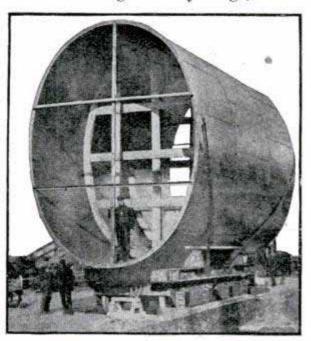
arriving in the U.S. in good condition

for seed purposes."

It is evident from the above that prospective manufacturers of alcohol would do well to investigate some of these German varieties with a view to obtaining larger yields of potatoes than are possible from the varieties now in use in this country.

SHIP'S BIG SMOKESTACK

The smokestack or funnel of an ocean liner does not impress the observer as being so very large, either



Big as a Railroad Tunnel

when seen at a short distance or in a picture. The only way to comprehend what a really enormous affair it is, is to see a section of a funnel by itself. There is room for the largest locomotive ever built to pass through with lots of room to spare. The section of funnel illustrated is 15 ft. in diameter one way by 30 ft. the other.

To deodorize bottles pour a little powdered black mustard seed and some lukewarm water into them, and then rinse with water.

By burning oil in its locomotives the Southern Pacific saved \$950,000 in 1906.

ICE MOTOR SCOOTER, NEW SPORT

Winter sportsmen are already getting ready for next year, and are impatiently waiting to engage in the new and furiously fast sport of their motor racing scooters on ice. The motor scooter is a new kind of craft and only one has been built, but its performance the past winter has set a lot of people crazy to possess them, for 100 miles an hour is declared easy, and onobody knows yet

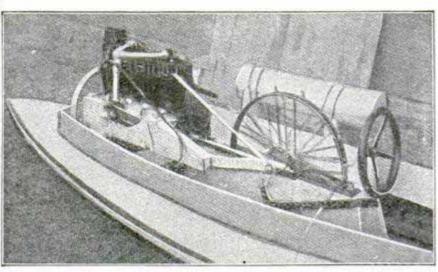
what the limit will be. The sailing iceboat, generally considered pretty swift on the wing, must now go out of business and join the canal boat class.

The motor scooter is the invention of Nathaniel Roe, "who took an ordinary 14-ft, scooter with sharp prow and rounded stern," says the Automobile, and fitted it with a 20-hp. gaso-The driving wheel has line engine. sharp steel spikes and reaches the ice through a casing like a centerboard. Hence if the boat runs into open water or breaks through the ice, no water can enter. Two sharp steel blades at the stern serve as rudders, worked by an automobile steering wheel. The craft also makes excellent time over hard snow and by putting a pair of wheels under it forward and aft, can be towed by a horse or motor car, about the country.

BIG WOODEN FLYWHEEL

After an accident to a flywheel in a large European electric station the superintendent designed and had constructed a flywheel of wood which has a diameter of over 35 ft., and a rim width of 10 ft. The thickness of the rim is about 12 in., and it is made up of 44 thicknesses of beech planks, says Power, with staggered joints. The boards were glued together and then bolted. The inside consists of a double

wheel, the 24 spokes of which are fastened to two hubs. Spokes and hubs



Motor Scooter Swifter Than an Ice Yacht

are of cast iron. The wheel is operated at 76 revolutions per minute, which corresponds to a peripheral speed at the rim of 130 ft. per second (94 miles per hour): This is said to constitute a record for wooden flywheels.

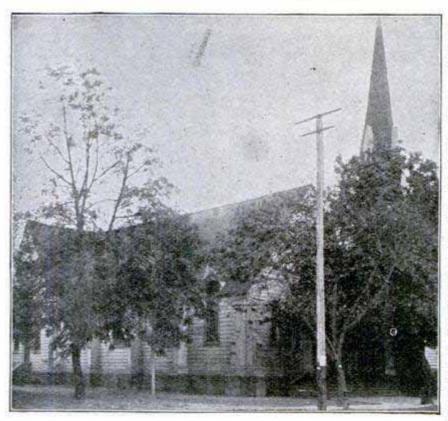
NO AMERICAN MERCHANTMEN IN THE ORIENT

American vessels are never seen in Indian and other Eastern ports. Other nations, even small ones like Belgium, send their own ships to these countries and consequently reap the abundant commercial profits, while United States manufacturers are not able to compete with them.

A commercial agent representing American firms and who has had years of experience in the Orient, declares that he has not known of an American vessel being in any Indian port for years. American products are shipped to England and from there reshipped aboard British merchantmen to India. Consequently Great Britain does 90% of the foreign business with India.

Post cards to be admissible to the mails must conform in weight and size to those printed by the government, may not be folded, and the use of glass tinsel, mica, or metal is forbidden unless the card be enclosed in an envelope.

LARGE CHURCH BUILT FROM ONE TREE



Built From One Tree, the Age of Which Was Estimated to Have Been Nearly 2,000 Years

All the lumber, even to the shingle roof, used in the construction of a large church at Santa Rosa, Cal., was furnished by a single redwood tree. The main building of the church is 40 ft. by 80 ft., with ceiling 22 ft. in the clear; spire, 90 ft. high. There is an audience room large enough to seat 400 persons; parlor, seating 90; pastor's vestibule study. toilet, and yet when the edifice was completed not all the material from the ancient redwood had been used. The tree was grown Mendocino county. California, and felled its age was estimated by scientists to be nearly 2,000 years.

METALS HAVE ODORS

A German scientist declares that every metal has its characteristic odor. Not every one can detect the odor of cold tin, copper or aluminum, but when pieces of such metals are heated to a moderate degree, they give off strong smells, distinguishable by anybody. At higher temperatures metals lose all trace of smell, but again give off an odor on being heated. after a lapse of several hours in a cold state.

PECULIAR AIRSHIP ACCIDENT

An American inventor living in the City of Mexico has amused himself and astonished the natives the past three months by sailing about the town in an airship. When making an ascension recently he accidentally steered into a tall electric light pole, and there he stuck. As usual a great crowd congregated, blocking the streets. In try-

ing to release the ship the gas bag was torn and the craft slowly settled to the street. A photograph was taken which shows the airship as it has begun to descend.



SELF-PROPELLED MOTOR ICE-CUTTER

The horse-drawn and hand-pushed ice plow which has been used for years in harvesting natural ice has a new competitor now in a motor machine.

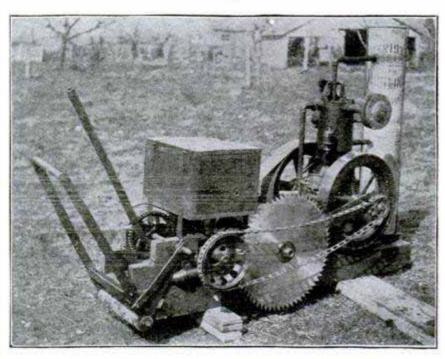
The illustration makes its operation readily understood. A gas engine is mounted on a skid, driving a circular saw on each side and cutting two strips of ice, each the width of a cake, at each trip. The machine is steered by a handle very much as a lawn mower is guided, only in this case the outfit is self-

propelling. At the rear end, projecting from the frame, is a roller full of sharp steel spikes. The roller is turned by means of a sprocket chain driven by the engine, and is thrown in and out of action by the long lever in front of the handle. It is said that with this machine more ice can be cut than in any other way, and that the cuts are smooth, enabling the packing of the ice in the house to better advantage.

SCHOOL OF RAILROAD SHOP WORK

The Missouri Pacific has followed the example of the Baldwin Locomotive Works and opened a school for its shop apprentices. The boys report in squads of five each for 30 minutes each day, the instruction includes mechanical drawing and mathematics. Two instructors with university training do the teaching, and the taking of correspondence school courses is encouraged.

The more volatile oils usually require a higher ignition temperature than those which do not vaporize so easily.

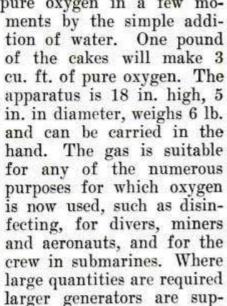


Steered Like a Lawn Mower

OXYGEN MADE AT HOME

Will Keep Milk Fresh for Several Weeks

An English firm has put on the market a chemical in cakes like soap, which when placed in a small steel tank generates pure oxygen in a few mo-



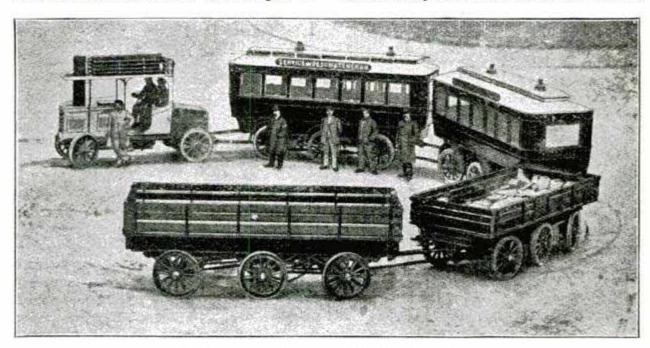
plied. A small generator costs \$6 and the cakes about 35 cents per pound. The process is without danger.

Oxygen has been used with great success for preserving and sterilizing milk which is bottled immediately after milking, under a pressure of oxygen. A light heat is applied for a few seconds in the presence of the oxygen under pressure, and suffices to destroy the microbes and any harmful fermenting matter, without boiling the milk, which will remain fresh for several weeks and preserve its good taste as well as all the other nutritive qualities of fresh milk.

A life-saving box for resuscitating the apparently drowned and asphyxiated is also available, costing, complete, about \$6. It is in use at many mines and blast furnaces and can be put in

TRACKLESS TRAINS FOR RURAL DISTRICTS

The next 10 years will witness as great a revolution in rural transportation of farm produce, as the rural free delivery and rural telephone have made in the domestic comfort of the farmer's home. Every fairly prosperous farmer will be president of his own line, while serving as conductor, engineer and general manager, and can issue annual passes to his neighbors—if the state legislature does not forbid. Incidentally the farm 10 miles from a



Any Farmer Can Couple on His "Car" or Wagon

operation in two or three minutes. The gas is conducted through a "wash bottle" or purifier and thence into a rubber bag shown folded in the lid of the box. One charge will produce a cubic foot of pure oxygen in 10 minutes; the normal dose is one-ninth of a cubic foot in all cases of asphyxia.

The long-distance overland record for wireless was made March 10 when the Government station at Point Loma, Cal., caught a wireless passing between Washington and Pensacola, Fla. The same station also caught a message from the battleship "Connecticut," which was communicating from New York Harbor with Washington,

railroad station will be worth as much as the ones nearer town. When the farmer once comes to realize his possibilities the good roads business will take care of itself.

Our illustration shows a wagon train, the invention of one Renard, a Frenchman. The cars and wagons have each six wheels, the front and rear pair of each vehicle arranged to turn like the front pair on a buggy. The vehicles are not only coupled together but sections of shafting extend through each connecting to the motor car, and by gearing to the wheels of all the others. By this arrangement each car supplies its own necessary tractive weight and the "locomotive" need not be heavy.

MACHINE THAT READS CHARACTER

This machine scientifically measures, delineates, prints and delivers on a sheet of paper, the approximate degree of development of every faculty of the brain. Its operation may well be compared to the working system of a large newspaper. The many radiating pins or rods which come in contact with the subject's head are like so many distant reporters, who telegraph the exact dimensions of the faculties, or "bumps," to the editor's office in the cabinet, the messages being carried by 140 wires contained in the metal tube supporting the head piece.

The editorial department, consisting of an electromagnet, controls the movements of a typed wheel, similar to the typed wheels in automatic weighing machines, thus causing it to perform the function of a compositor. The printing department then comes along with a piece of blank paper, takes an impression from the typed wheels, and passes the copy to a newsboy lever, which seizes the impression and delivers it to the reader. A printed list of vocations, which

accompanies each impression, enables the subject to determine to a certain extent the trade or profession to which he is best adapted.

Of course this machine is not infallible as the interpretations depend on phrenology, which in itself is not infallible; but it will produce in a few seconds as intelligent and complete a record as could be produced by an expert phrenologer in half an hour and if phrenology were reduced to an exact science the machine would probably do the rest.

Although the construction of this machine appears somewhat complicated, owing to the great number of parts, the working principle is very simple. All the little rods or reporters are provided with contacts, which slide on rows of insulated metal points. There are five points in each row and each point has electrical connection with the magnet in the cabinet. fully developed faculty or "bump" will thus push the contact on the rod all the way out to the fifth point, thereby making contact with that point and causing the typed wheel to register five points for the corresponding faculty, while an underdeveloped faculty will



Measuring the Mind

only push the contact out one or two points, thus registering that number of points on the record.

SPECIAL DELIVERY WITH ROCKETS

The most unique method of delivering mail doubtless is that employed by steamers passing the islands of the Tonga group in the Pacific. On account of many reefs, landing is extremely dangerous, and the few letters to be delivered are attached to large skyrockets which are fired and reach the shore in safety.

GLASS PARLOR UNDER SEA

A tower resting on the bottom of the ocean 30 ft. below the surface and extending up into the open air will be built at Long Beach, Cal. The shaft will be constructed almost entirely of heavy plate glass with a glass room 12 ft. square at the bottom reached by an elevator. This will give visitors an opportunity to observe the wonderful sea gardens for which these waters are celebrated.



LONDON'S SUBTERRANEAN THOROUGHFARE

Subway Under Subway—Over 258,000,000 Persons Carried Annually— Safer Than Streets

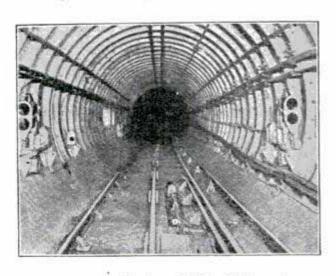
Most of the large cities of the world have turned to underground transit as the solution of congested street and difficulties, transportation structures having been found unsatis-London, with nearly seven factory. millions of inhabitants, long ago availed herself of this recourse, but the old two-penny tubes, operated by steam power and so poorly ventilated that they were a menace to health, are scarcely to be compared to the model, electrically-operated and carefully safeguarded lines that now underlie her streets, sometimes more than a hundred feet below and again following so near the surface that a persevering child might dig through the three feet of soil and touch the top of one of the big steel tubes.

In all, London has six underground electric railways completed and five more are under construction and projected; and of the 600,000,000 persons carried annually on all her railways, 258,000,000 are accommodated by these tunnel lines. The main system was planned by the late C. T. Yerkes and included electrically equipping the old Metropolitan District Railways and the construction of four other great intersecting lines, covering a total route length of 74½ miles. The greater part

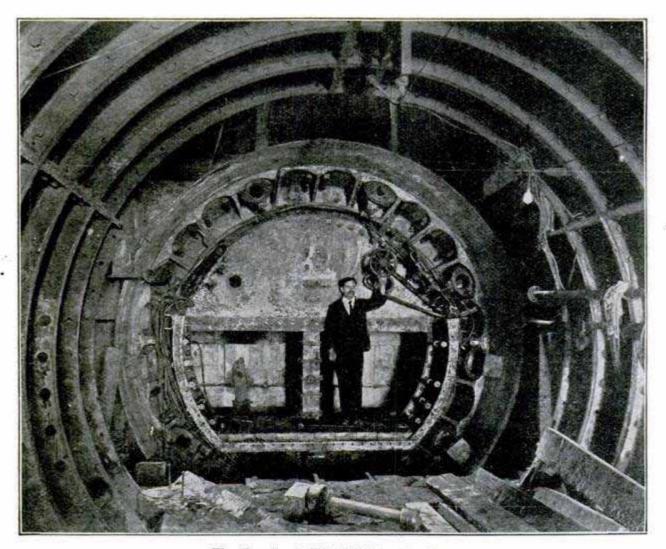
of this enormous undertaking has already been accomplished. The old District lines have been transformed and two of the new lines are in operation.

The Baker Street and Waterloo Railway, 54 miles in length, is a fair type of all the others. The route was formerly covered by omnibuses, about 158,000 passengers being carried daily. The underground line accommodates 35,000,000 passengers annually, and at a rate of 14 miles per hour trains cover the entire route in 22 minutes.

Approaching the Baker street station we are pleased with the handsome effect produced by the dark but brilliant



Signals and Automatic Stop in Tunnel



The Greathead Shield Making the Bore

red terra cotta glazed blocks built up over the strong steel framework. The roof has been left flat. Possibly these Londoners expect to build upward some time as well as downward. The entrance is wide and roomy, and the people are moving leisurely. Having passed through the spacious booking halls and bought our tickets at 2d. (5 cents) apiece, we come upon the elevators or lifts. There are two shafts with two lifts each, of the windingdrum type. Did you notice as we came through that the station buildings are fireproof? Even the joinery of the windows and doors! The only wood used is of teak, which is almost fireproof. And look at this lift! All of steel, with a non-inflammable wood floor. Holds as many as 60 people. The passengers leave at the opposite side from that at which they enter. Saves time, and the attendant does not have to push through the crowd to get

to the exit gate, as it is operated automatically by compressed air. The operator can instantly stop this car at any point, or should it attain undue speed it will be stopped automatically by apparatus in the winding room. If necessary the lift can also be worked by an attendant in the winding chamber through the control apparatus there. Makes one feel pretty secure, doesn't it?

Whew! Feel that draught? Would not expect it down here, would you? It's from the ventilating fans. There's a staircase for emergencies, you know. It's in a shaft 18 ft. in diameter and winds around an iron tube 4 ft. 6 in. wide. A fan 5 ft. 6 in. in diameter is placed in the upper part of the station near the top of the air shaft and is driven by a 10-hp. motor. The air shaft passes under the station platform and terminates in a large cowl erected at one end of the platform, where the

air is sucked in through open wirework. The fan extracts from 18,000 to 20,000 cu. ft. of air per minute, while fresh air enters by the staircase and lift shafts. They say the whole air in the tunnels can be changed once in an hour. Rather an improvement over the

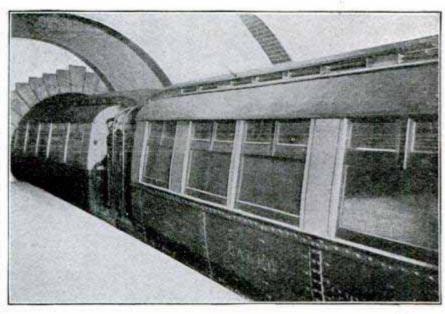
first two-penny tube!

Light as day down here, isn't it? This concrete platform is 400 ft. long. Nice effect, cream - colored those enameled tile walls and that white painted arch. The tunnels at all the 12 stations on this line are over 21 ft. in diameter. There comes a train; they run three minutes apart. Six allsteel cars—a motor at each end and four trailer cars between-all 50 ft. long, 8 ft. 8 in. wide and 9 ft. 53 in. high from rail level. trailers each seat 52 passengers and the motors only 46 each, the remaining space being taken up by the driver's cab, built of steel and containing all the control apparatus, as well as the air compressors.

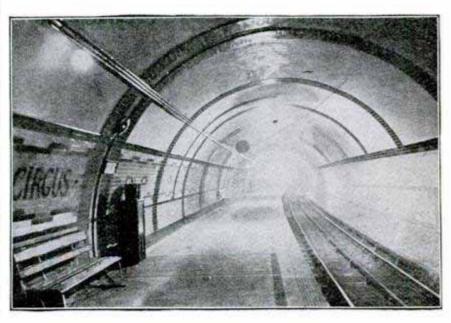
Here we go into the bowels of the earth. It is much like all the rest in construction. Each track in a separate circular tunnel lined throughout with castiron segments bolted together. The steepest

incline on this line is 1 in 60, and the radius of the sharpest curve is 330 ft. Three diameters of running tunnels are used, 11 ft. 8½ in., 12 ft. and 12 ft. 6 in., the largest for the sharpest curves. Never guess we were down so deep; averages between 60 and 70 ft., though. Over in the new Great Northern, Picadilly and Brompton Under-

ground at one point the level is 123 ft., while at another not far distant it is but 20 ft. Much quieter here than one might expect. That's due to the quarter-inch felt pads used on the tracks between the chairs and the sleepers, and the fiber insulators put round



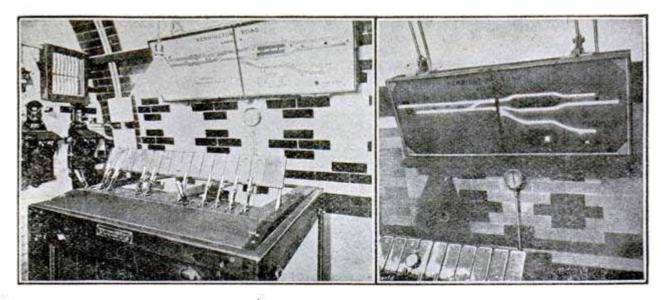
"Here We Go Into the Bowels of the Earth"



"These Concrete Station Platforms Are 400 Ft. Long"

the necks of the bolts that hold the chairs down. These pads, together with the elastic roadbed, have also eliminated the vibration trouble that has sometimes annoyed residents near underground railways.

Twenty electric glow lamps in this car. They are arranged on four circuits. When the train crosses a gap



Signal Box at Kennington Road

Signal Board, Illuminated

in the conductor rails wider than the span of the front or rear shoes of the car only half the lights in the car will go out. The headlights are entirely independent of these. Those 16-cp. lights placed in the tunnel at distances of about 40 ft. give a good light and being so high up, there are no disagreeable flashes. There's a splendid signaling system on this line; block sections, automatic train stops and all that sort of thing; the driver can establish telephonic communication at any point, also.

The big Chelsea power station, the largest in the country, is the heart of it all, however, pumping its power like life-blood along a network of great arteries and small arteries and tiny Never visited it? capillaries. are 64 boilers, each evaporating 18,000 lb. of water per hour. Chain grate mechanical stokers, superheaters, economizers, all the modern apparatus are installed. In the engine room are eight turbo-generators of 7,500 hp. each, a total of 60,000 hp. The steam turbines run at 1,000 r. p. m. and each is coupled to a 5,500 k. w., three phase, alternating current generator. pressure generated is 11,000 volts and the frequency 331 cycles per second. This line alone requires considerable energy to keep it going. There are the high tension feeder cables running along the tunnels to the sub-stations, the conductor rails, two to each track,

which supply the current for working the trains; the 220-volt three-phase circuits supplying the incandescent lamps in the tunnels; the 550-volt circuits for the lifts and the arc lights in the stations; the entire system of telephone circuits, the electrically continuous track rail in each tunnel for the signaling system, the negative main for the same purpose, and besides a compressed air pipe running from end to end of the railway and supplying air to the pneumatic motors, for the signals and switches.

That new tramway-subway built by the London County Council is quite an experiment. Runs close to the surface, you know. The top is only 3 ft. down at one point, and at another point crosses another subway running far below. They expect to build more of them. Wonderful, isn't it!

Let's get off here at the Embankment station and transfer to the Charing Cross station of the District Railway. Oh, no, it is not necessary to ascend to the surface—this is an underground transfer.

The gunboat "Wasp" cruised up the Mississippi river lately, stopping at all important ports to secure recruits for the Navy.

It would have cost \$700,000,000 to pay hand labor for the work done last year by farm machinery.

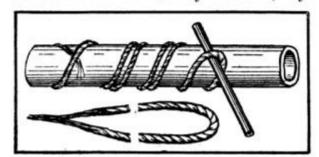


SHOP NOTES



Emergency Pipe Wrench

A file, cold chisel and monkey wrench make a very efficient pipe wrench, except when the pipe is too large such as a 5- or 6-in. pipe. In such emergencies the device here illustrated will be found very effective, says

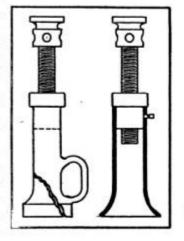


Emergency Pipe Wrench

the American Miller. Take 3 or 4 ft. of new rope. Fray out both ends thin and put them together. Commence with tip ends and wrap tightly around the pipe until you have a loop. Then with a piece of pipe or a round bar for a lever, turn the pipe as you would with a pipe wrench.

Repair for a Jack-Screw

To repair a broken jackscrew, which has been cracked at the base, cut off the lower part, as indicated by the dotted line and insert in a piece of extra heavy pipe flared out at the bottom. If desired a set-screw

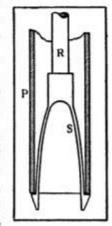


or steel pin may be used to hold the pipe to the remaining portion of the base and if an old flange the same size as the pipe is available it may be used instead of flaring.—Contributed by G. A. B., Chicago.

Device for Removing Underground Pipe

The removal of bored well castings, vertical pipes and other underground

objects is often a difficult task but can be accomplished in many cases by using the device here illustrated. Two pieces of spring steel, S, are welded to the end of an iron rod, R, and formed in the shape of a catch at the The device is pushed down through the pipe, P, until the catches



engage with the lower end as shown.— Contributed by C. R. M.

Chimney Top to Improve Draft

The illustration shows a device for increasing the draft of a chimney and for preventing a reverse draft, which usually occurs when a chimney is located near a high building. In mak-

ing this device, says a correspondent of the Metal Worker, it is necessary to run a joint of pipe above the top of the chimney. Near the top of this pipe run two horizontal braces, one above the

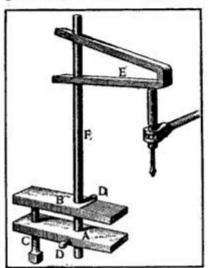


other, for the purpose of fastening a vertical rod, extending about 6 in. above the top of the pipe and terminating in an eye at the top. A conical cap is then made of sheet iron and fastened to the end of the rod by means of a second eye, which passes through the eye at the end of the rod. This allows the wind to tilt the cap in any direction, thus

preventing the wind from blowing down the flue of the chimney. The wind in passing then causes the cap to act like an inspirator and draws air up through the flue.

The "Old Man" and Ratchet Drill

Just why this device is called the "Old Man" is an obscure bit of machine shop mythology beyond the knowledge of the writer, says a correspondent of the Blacksmith and Wheel-



wright. It is easily made in the shop and can be applied to a wide range of work. The device consists of the clamp pieces, A and В, which can be made of bar iron, or

of malleable iron castings. The size of these clamp pieces depends entirely upon the work to be done. For the smith shop, a bit of 1x4 in. bar steel (Bessemer) will answer, but for large work the clamps are sometimes made 3 in. thick by 8 in. wide. The set screw, C, may be 1x6 in. The bar, or shaft, F, should be about $1\frac{1}{2}$ in. in diameter for a length of 3 ft., or 2 in. for 4 ft. in length and for small drills. The set screws, D D, may be $\frac{1}{2}$ in. or $\frac{5}{8}$ in. or they may be placed in collars and slipped upon the shaft above and below the clamp pieces, A and B.

The drill-piece, E, may be made of $\frac{3}{4}$ x3 in. bar iron or steel, or a heavy knee casting may be provided for this piece, as desired. The ratchet is one of the familiar type on sale at any hardware store, and it should be fitted with square shank drills. Do not try to make a ratchet drill; that tool can be purchased much cheaper than made, and five or six dollars will procure a good one.

Cement to Render Cisterns and Casks Watertight

An excellent cement for resisting moisture is made by incorporating thoroughly 8 parts melted glue, of the consistence used by carpenters, with 4 parts linseed oil boiled into varnish with litharge. This cement hardens in about 48 hours and renders the joints of wooden cisterns and casks air and watertight.—Contributed by Frank Pavlik, Jr., Winnetka, Ill.

Waterproof Glue

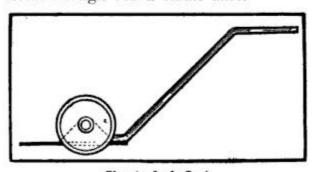
Dissolve gum shellac, 3 parts, and India rubber, 1 part, by weight, in separate vessels in ether, free from alcohol, subject to a gentle heat. When thoroughly dissolved, mix the two solutions and keep in a tightly sealed vessel. This glue resists the action of hot and cold water, and most acids and alkalies. If thinned with ether and applied to leather along sewn seams it gives a strong watertight joint.

Jack Cart

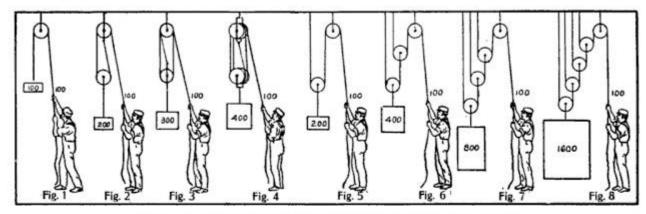
The accompanying illustration from Railway and Locomotive Engineering shows a jack cart which is very convenient, being simple in construction,

light and inexpensive.

It sets low on the floor, thus doing away with the necessity of two men handling a jack of any size; it also permits running the jack right up to the spot where it is to be set. The material necessary to make this cart consists of a few pieces of gas pipe, boiler iron, two small wheels and material enough for a small axle.



Simple Jack Cart



Various Arrangements of Pulley Blocks Showing Lifting Power

Lifting Power with Pulley Blocks

A man pulling with a force of 100 lb. can lift only that amount with a single block, as shown in Fig. 1, but by using two single blocks he can lift double the amount, as indicated in Fig. 2. By using a double block above and a single block below, as shown in Fig. 3, 100 lb. pull on the rope will lift 300 lb. and by using two double blocks, as indicated in Fig. 4, 100 lb. will lift 400 lb.

In Fig. 1 the load is supported directly by one rope; in Fig. 2 by two ropes; in Fig. 3 by three and in Fig. 4 by four ropes; the weight being 100, 200, 300 and 400 lb. respectively. Thus with pulley blocks arranged in this way the weight that can be raised is in direct proportion to the number of ropes that support it. In these calculations the portion of rope which the man holds is ignored, as he pulls in a direction opposite to the movement of the weight, but should he take his position above the pulleys and pull up, then the rope which he holds should be counted also.

Another system of arranging pulleys is shown in Figs. 5, 6, 7 and 8, the pulley blocks being all single. In an arrangement of this kind the power is just doubled by the addition of each pulley as indicated by the figures. In all these calculations no allowance has been made for friction so that the actual force required to lift the given weights will be somewhat greater, the exact amount depending on the flexibility of the rope, diameter of pulleys,

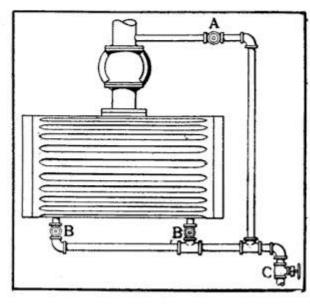
smoothness of the bearings and other conditions.

To Recover Lost Drill Points

When drill points are lost, even at considerable depth, they can be recovered by means of an electro-magnet. A heavy drill point stuck in a well at a depth of 250 ft. was loosened and brought to the surface in this way.

Keeping an Engine Cylinder Warm

A plan for keeping an engine cylinder warmed up in case it is standing idle part of the time, especially in cold weather, is to tap a pipe into the main steam pipe above the throttle valve, the same size as the bleeder drain pipe, as shown in the illustration. To operate, open valves B and B, and slightly open

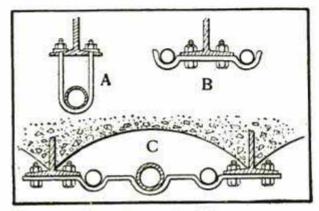


Arrangement of the By-Pass

the valve C, and then open wide the valve A, says a correspondent of the Engineers' Review. The steam will find its way all through the cylinder and steam chest and the condensation will pass away through the valve C.

Pipe Hangers

The accompanying illustration from the Practical Machinist shows a few practical suggestions for supporting pipes from I-beams. The most common form is shown at A and is used



Pipe Hangers for I-Beams

for supporting a pipe directly under the beam. When pipes are to be run on each side of a beam the form of hanger shown at B may be used, unless the pipes are some distance from the beam, when it will be necessary to use the form shown at C.

Home-Made Bromide Paper

When the photographer receives a rush order for a bromide enlargement from a negative and has no bromide paper on hand, nor can procure any as soon as required, the following expedient will help him out of his difficulty:

Prepare a 2½ per cent solution of potassium bromide and place a sheet of ordinary printing-out paper in it, allowing it to float for two or three minutes. Then remove the paper and hang it up to dry in such position that warm air circulates freely about it. Paper thus prepared requires about double the exposure of the regular kind, and the results are satisfactory,

says Camera Craft, for the coarse screen effects of newspaper reproductions.

Hardening Drills

Hardening an ordinary drill in sulphuric acid makes an edge that will cut tempered steel or facilitate cutting hard rock, says Compressed Air. The acid should be poured into a flat-bottomed vessel to a depth of about 1/8 in. The point of the drill is heated to a dull cherry red, and dipped in the acid to that depth. This makes the point extremely hard, while the remainder remains soft. If the point breaks, reharden but with a little less acid in the vessel. After hardening a drill in this manner, wipe off the acid, if any remains on the point of the drill, before it attacks the metal and destroys the cutting edge.

Red Copper Bronze on Tin

Dissolve 9 dr. copper sulphate in pure water to saturation; then add 40 to 80 drops sulphuric acid. Brush the tin, previously cleansed with onion juice, with the liquid. When dry, rub the article with chalk.

To Drill Glass

Use a drill like the one shown and temper by heating to a cherry red and

plunging in mercury. Drill part way through from one side and then finish from the opposite side. This will make a good clean cut and prevent chipping the edges of the hole. Apply sufficient pressure to make the drill "bite" at all times, and keep the drill point moistened with 2 parts turpentine to 1 part sweet oil.—Contributed by H. W. Snook, Prof. Optics, Scottsbluff, Neb.

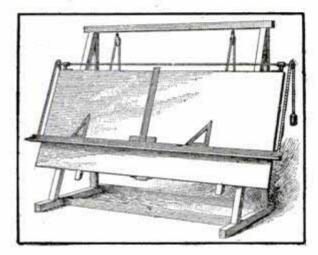


To Fasten Celluloid to Wood or Tin

Celluloid can be fastened to wood, tin, etc., by the use of the following compound: Shellac, 2 parts; spirits of camphor, 3 parts; strong alcohol, 4 parts.

A Large Vertical Drawing Board

The accompanying illustration from the Metal-Worker shows a large vertical drawing board that is very useful for making large drawings.



For Making Large Drawings

A pair of bearings are screwed to the top edge of the board, through which passes a rod or piece of small shafting, running the entire length of the board and extending sufficiently beyond at each end to receive a pair of sprocket Chain belts are attached to wheels. each end of the movable straight edge and are passed over the sprocket wheels and attached to a pair of counter weights sufficiently heavy to balance the weight of the straight edge when at the position most used. As both sprockets are firmly keyed to the shaft, any movement at one end of the straight edge insures an equal amount of motion at the other. Sprocket wheels and chains of the type used on bicycles will be satisfactory for the purpose, though chains of lighter weight, such as those used for hanging pictures, if constructed without play, will perhaps be more desirable. A small clip or slide fixed to the projecting ends of the straight edge at the back and passing behind or under the edges of the board will prevent the straight edge from lifting away from the face of the board.

Monel-Metal

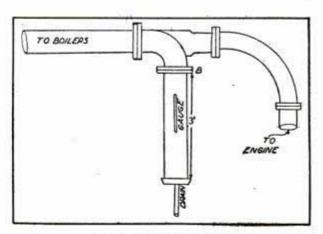
An alloy called "Monel-Metal," says Brass World, consists of:

															Per cent.
Nickel		S	3	8	S		÷					÷	÷		75.0
Copper															23.5
Iron															

The alloy possesses a high tensile strength and elastic limit. It is also non-corrosive and takes a high polish. The color is practically that of nickel.

Home-Made Steam Separator

There are numerous plants where a steam separator would prove a paying investment, but the purchasing power refuses to buy one. Although this be so the engineer need not be discouraged, because he can make one on the premises, says the National Engineer. Take for example an engine with a 5-in. steam supply, with the main supply from the boiler 6 in. As near as possible to the engine use a 6x5x6 long



Home-Made Separator

sweep flanged tee. To the opening, B (see illustration), connect a 6-in. pipe, with a cap on it, and a 1-in. outlet.

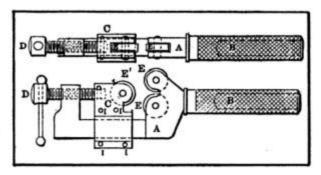
As the steam from the boiler passes through the 6-in. pipe its velocity is somewhat slower than that which will occur in the 5-in. pipe, especially when the engine load is heavy. The water in the steam pipe is carried along the

lower end of the pipe, and as it comes to the long sweep tee it will naturally seek the pipe B, from which it can be drained.

For sizes less than 4 in. screwed fittings will answer. For piping with a vertical riser close to the engine a double sweep is recommended as herewith shown. With the home-made separator, or in fact any make of separator, the engineer should insist on having a first class trap, one that will care for a large volume of water instantaneously and without possibility of failure.

Hand Knurling Tool

The advantages of a tool like this are obvious: stock can be knurled to the full capacity, and to less than ½ in. diameter; lengths can also be fin-



Used Without a Tool Post

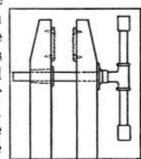
ished, which is not possible with the ordinary style. It is not dependent on a tool post, says the American Machinist, as it is held in the hand and a speed lathe or any other will answer.

The body, A, is one piece with the handle, B. The sliding part, C, is made in two parts and riveted over A. This is adjusted to accommodate the stock by the screw, D. EEE are the knurling rolls. II are rivets. A hole is drilled in the handle to lighten it. The tool is held in the hand, by the handle, B. The stock is placed between the rolls at H. Then the part C is adjusted until the three rolls come in contact with the piece to be knurled. By working the tool back and forth, and by applying pressure with the screw D the piece is soon knurled.

Easily Made Pipe Vise

The sketch shows how I made a pipe vise from an old carpenter's vise.

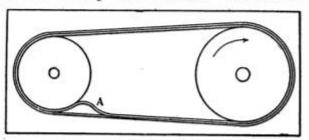
Take an old coarse rasp; break it in half and draw the temper at the ends to allow drilling and coun tersinking for screws, which should be used to fasten the two halves to the jaws of the vise as



shown. Fasten one with the teeth pointing up and the other with the teeth down.—Contributed by C. J. Barton, Big Rapids, Mich.

Double Belts

There are many who think that a long belt drives better than a short one, and under certain conditions it may, but under other conditions the advantages are very doubtful. the case where the drive is nearly horizontal, says a correspondent of the Wood-Worker, and the pull is on the top side; you have the slack side of the belt dropping away from the driven pulley, and, of course, less gripping surface—and with a long belt there is a lot of slack to drop away-so that I fancy it is a disadvantage rather than an advantage to have a long belt. In cases where it is necessary to drive under these conditions it would be an improvement to use compound belts—that is, one on top of the other. The action



Two Belts Run on Same Pulley

is peculiar, for the belt next the pulley rises and clings to the driven pulley, as shown at A, when the strain comes on, giving more gripping surface. I have watched that action frequently, and feel certain that the grip is increased very much.

Blueprint Drying Frame

When blueprints are required in a hurry the drying frame shown in the accompanying illustration from the Railway Review will prove very useful. A white pine latticed frame was constructed on which a large piece of blotting paper is placed to receive the wet

The wet prints on the upper side of the frame and the intense heat of the radiator about 2½ in. beneath the lower side made a specially strong construction necessary to resist the warping and buckling

print.

strains due to the difference in temperatures.

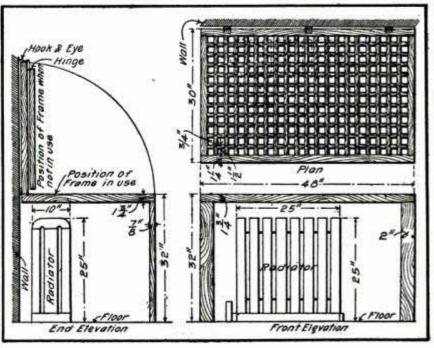
The frame is 48 in. long by 30 in. wide. It is composed of strips 3/4 in. wide halved and screwed at all intersections and spaced 2½ in. apart in centers. The recesses cut in each strip are bolted together in a manner so substantial that buckling is impossible. The frame is finished with shellac. The height above the floor is 32 in. when the table is down ready for service. The frame is hinged and equipped with hooks and eyes so that it folds back against the wall when not in use.

Lamp Cement

A useful cement for fastening the tops on kerosene lamps is as follows: One part caustic soda; 5 parts water; mix with one-half the weight of plaster of paris.—Contributed by Frank Pavlik, Winnetka, Ill.

Emergency Boiler Repair

Temporary repairs on a boiler will often save considerable trouble and expense until permanent repairs can be



Will Dry Blueprints in a Few Minutes

made. The following is a job of this sort which proved successful:

The leak was in a seam of a buttstrap joint, and two 1-in. holes were drilled through the butt strap with a flat end drill, care being taken not to damage the shell itself. These holes were threaded to the bottom with gas taps, and were spaced twice the distance apart that they were from the extreme end of the leak.

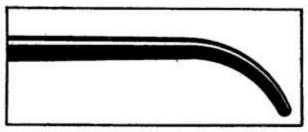
Red lead putty was then prepared smooth as oil, free from grit and not too thick. Round iron rods were threaded to fit the holes already bored and a square end filed to take a wrench, the whole apparatus being termed a "putty pump."

One hole was half filled with putty and the threaded bar screwed down with the wrench; the operation was repeated with the other hole, and then with the holes alternately until no more putty could be squeezed in. Putty could be seen squeezed through aroundthe seams and between the plates,

and plugs were then screwed down hard to the taper threads and cut off flush. The boiler was left for a day or two to let the putty harden, and was then put into condition and used for several months. This method is not to be recommended for a permanent repair, says the American Machinist, but for an emergency job it will answer the purpose until a permanent repair can be made.

Non-Rolling Penholder

When working on a drawing table turned up at an angle, considerable annoyance is often caused by penholders and other round tools. They will not stay on the board.

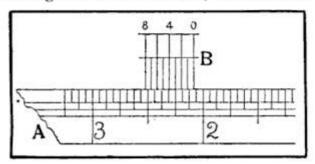


Penholder with End Bent

If you are using a hard rubber holder you can get around the difficulty very easily. Heat the holder over a lamp or in the flame of a match. Then bend the end back slightly as shown in the accompanying illustration. This will overcome the tendency to roll.-Contributed by Wm. E. Jehn, Paterson, N. J.

How to Read a Vernier Scale

A vernier is an instrument used in taking fine measurements, some as fine



Vernier Scale

as 1/1,000 in. The one shown in the sketch consists of a true scale, indicated at A, and the vernier, shown at The vernier is in, divided into eight equal parts; thus when the vernier is used in connection with the true scale, as shown in the sketch, the true scale is subdivided into 128 parts -16 on the true scale \times 8 on the

vernier, equals 128.

To read the units and subdivisions of the vernier in the position here illustrated the Wood-Worker gives the Beginning following instructions: with the zero line on the vernier, we find that the line at the end of the third space coincides with a line on the true scale. As each space on the vernier counts 1/128 in. on the true scale, we have 3/128 in. to be added to the reading of the true scale, which will be 21 in. plus 3/128 in. equals 2 11/128 in., the reading of the vernier, and shows that the zero line of the vernier is 2 11/128 in. from the end of the true scale.

Thoroughly Dried Wood Nearly Fireproof

Many people believe the longer a stick or piece of wood is dried the more inflammable it becomes, but beyond the first thorough drying process this is not true, says Wood Craft.

After wood has been exposed to moderate heat for a long time it becomes partly oxidized and approaches a little nearer the nature of coal, many of the highly inflammable and volatile elements of the new wood having slow-

ly passed away.

The first proof of this fact ever brought to the writer's attention was during the repairing of an old dry kiln. The timbers were very dry and brittle and someone remarked how easily it could be ignited. A piece was tried and to our astonishment it could scarcely be made to blaze at all The fire seemed disposed to hang to it very will though and it burned slowly like punk. The wood, however, seemed to have lost nearly all its elasticity. It appears that those elements in the wood that give to it springiness and elasticity are the very highly inflammable ones and they are also the ones to depart first.

Sustaining Strength of Ice

Two in. thick, a man.
Four in. thick, man on horseback.
Ten in. thick, crowd.
Fifteen in. thick, a railway train.

Rule Used for Computing the Length of Band Iron

Universal Soldering Fluid

A soldering fluid which will not rust or corrode the soldered parts is made by dissolving as much zine in muriatic acid as the acid will take up and then adding water, glycerine and alcohol. To one part glycerine add one part alcohol and one part water; then add two parts of acid with the zinc dissolved. This fluid has been used for all kinds of soldering, says the Street Railway Journal, and has been found especially desirable with greasy or dirty connections as well as for soldering to iron. It is claimed that the glycerine prevents all rust, which plays havoc with many soldering fluids which contain muriatic acid.

Composition of Solders

Fine solder is an alloy of two parts of block tin and one part of lead. Glazing solder is equal parts of block tin and lead. Plumbing solder, one part block tin and two parts lead.

To make a cheap fireproof wash dissolve 1½ lb. salt in 1 gal. whitewash.

the width of the diameter plus once the thickness of the iron, from the inside points, says a correspondent of the American Blacksmith. Then measure the distance between the end of the rule from the inside corners as shown, which will be the length of your iron. If measured right you will find this correct. In case the diameter of the band plus the thickness of the iron is 1½ in., as shown in the illustration, the length of the piece must be 37/8+3-64 in., as shown.

To Find the Length of Band Iron

To find the length of iron for a

band: Take a 2-ft. rule; measure up from the hinged ends 3 13-16 in.;

draw a line across as shown in the

Splicing Broken Armature Parts

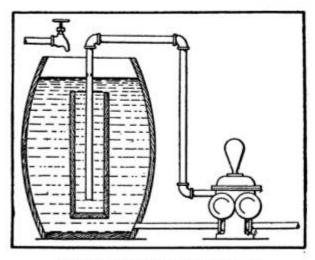
A method of splicing broken armature shafts which is proving satisfactory has been developed at the Columbus, O., shops of the Indiana, Columbus & Eastern Traction Company. Shafts broken near the gear or on the taper at the pinion end are easily repaired so that the armature may be used until it is necessary to tear down the winding for some other reason.

The method of making this splice is simple, says Electric Railway Review. The broken end of the shaft is turned

down in the form of a cone, longitudinal grooves being cut in its surface. After this is done another piece of shaft steel is hollowed out, cup-shape, to fit the taper snugly. One-fourth of an inch of spelter is placed in the bottom of the cup. The two parts are fitted together and placed in a screw jack or wheel press and are then heated by means of a coke air blast flame which is made to circle around the shaft. As the parts to be spliced are heated pressure is applied through the screw jack and the spelter is forced from the bottom of the cup to all parts of the taper. When the shoulders of the two pieces are brought together the weld is complete. The shaft is then placed in the lathe centers and trued. The method described has been used very successfully and in many instances the welded shafts are still in use after several months of severe wear.

Exhaust Muffler and Heater

The accompanying illustration shows how the feed water was heated in a small plant. The exhaust from the pump was brought into a barrel, as shown, and in order to avoid the cracking noise, which usually takes place when steam is condensed in cold water, a wooden box was built around the pipe. This box is about 8 in. square, says a correspondent of the Engineers' Review, and the top is kept below the surface of the water in the barrel about



Method of Muffling the Exhaust

1 in. In a few minutes the water in this pipe becomes hot and then all noise ceases. The hot water overflows and cold water enters over the top, thus making a noiseless heater. A small \(\frac{1}{16} \) in. hole is drilled in the exhaust pipe close to the water in the barrel to avoid a vacuum in the pipe when the pump is stopped.

Air Cylinder Converted Into Post-Hammer

An old air brake cylinder makes an excellent post-hammer when arranged as shown in the accompanying sketch. The object of the home-made appliance is to straighten brake rods, hangers,

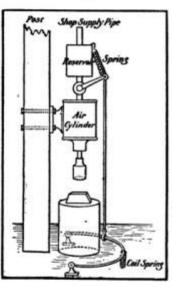


From the upper cylinder head a pipe comes off and supports a 3-way plug cock, which opens and

shuts to let air into the cylinder or exhausts it according as it is moved to inlet or exhaust positions. The supply pipe above the plug cock runs up to a reservoir into which the air supply of the shop is piped. The object of the reservoir above is to keep a sufficient quantity of air close at hand to fill the cylinder quickly without making the shop supply pipe gasp for air every time the hammer strikes a blow.

The plug cock is arranged with its handle connected to a long rod which hangs down nearly to the ground, and to this long rod is attached a piece of ³/₄-in. curved pipe hinged at each end to form a treadle.

A good polishing powder consists of 4 lb. magnesium carbonate, 4 lb. chalk and 4 lb. rouge, intimately mixed.



Luminous Ink

Shines in the dark. Phosphorus, 1 dr.; oil cinnamon, ½ oz. Mix in a vial, cork tightly, heat slowly until mixed. A letter written with this ink can only be read in a dark room, when the writing will have the appearance of fire.—Contributed by Frank Pavlik, Winnetka, Ill.

A Ready Wire Stretcher

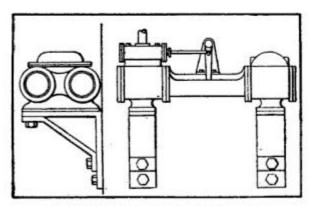
For stretching barbed or other wire in long lengths the farm wagon is a

very handy and efficient tool. One of the rear wheels is raised from the ground and the wire is passed once around the hub and fastened to a spoke of the wheel. The wagon is then braced by any suitable means and the wheel turned in the manner of a mariner's wheel. In this way a pull of 100 lb. on the tire will exert a force

of 400 or 500 lb. on the wire.—Contributed by Experimenter.

Iron Brackets for Pumps

The pump foundations in many plants are only high enough to serve the purpose for which they were intended, little thought being given for convenience and accessibility. Therefore, the under portion of the pump is

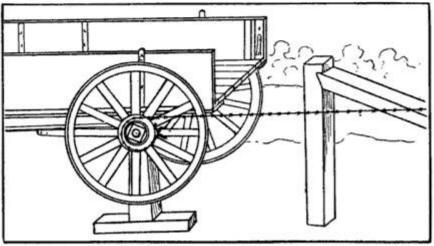


Pump Supported on Bracket Irons

seldom cleaned and in many cases the top is covered with filth.

In the plant where I am employed we have done away with foundations for small pumps, says a correspondent of the Engineers' Review. Instead they are placed on brackets made of a suitable size of iron. The brackets are bolted to the wall of the room where the pumps are located and at a sufficient distance above the floor to permit of an easy access.

The illustration shows the manner in which the pumps are arranged. It will be seen that the floor underneath



Ready Wire Puller

the pump can be kept clean without any trouble, and that it is an easy matter to thoroughly wipe the entire surface of the pump. I have never seen any arrangement which gives as much satisfaction as this method of placing a pump.

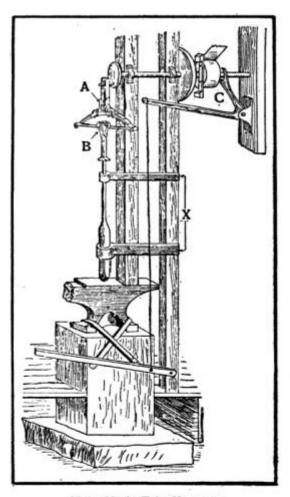
Paper Cambric Screens

Draughtsmen who are obliged to work at south windows find the glare of the sun on clear days a great inconvenience. The light is too dazzling with the shade rolled up and when it is drawn down there is not enough light to work by. This difficulty is sometimes overcome by tacking a piece of muslin over the window frame, but a better way is to use a shade made of white paper cambric. This material is inexpensive, very transparent and, unlike muslin, is not easily soiled, as it has a glazed surface

very much like tracing cloth, which is also suitable for this purpose. The price of tracing cloth is, however, about three times as much as that of paper cambric.—Contributed by W. H. G., New York City.

A Shop-Made Trip-Hammer

This machine, which was made at a very small cost, saves much labor and time and is very useful, especially for drawing-out purposes. The manufacture of this machine, which was built



Shop-Made Trip-Hammer

by a correspondent of the American Blacksmith, is described as follows:

"After picking out a place for its location, I dug down about 3 ft. and placed a large stone. Upon this I erected a good, solid anvil-block, and upon the block I fastened an old anvil which was minus the horn. I then took two pieces of 4 by 4-in. timber and placed one stick directly behind the anvil and fastened it solidly to the

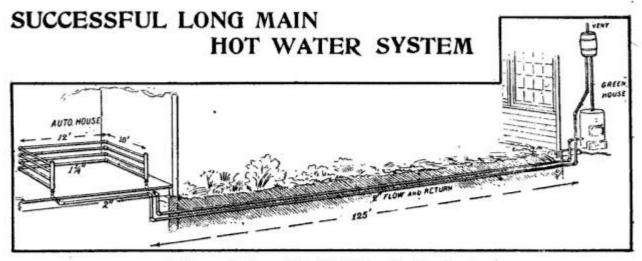
floor and roof. The other piece was placed on the anvil, as shown, and run from here to the roof. I now secured a short shaft and, after placing thereon in the order mentioned a flywheel 18 in. in diameter, a good, stout coil spring and a belt pulley, on the end of which was fastened a piece of flat stock bearing on each of its ends a hardwood block, placed it well up on the uprights. I then run a short, stout piece of timber from the roof, to support the pulley end of the shaft. To the other end I now fastened a small flywheel, which would give me a 3-in. stroke. For the hammer I used an old shaft, to one end of which I welded a tool steel face similar in form to the pene end of a sledge. For the spring I used a five-leaf buggy spring, with the long leaf and loops on the outside. I then took two pieces of 1/4-in. stock the same width as this spring and bent them, as shown at A in the engraving, fastening them in the center of the spring by means of four clips. connecting rod then joins the spring to the small flywheel. I placed guides on the uprights, as shown at X, the lower guide being about 10 in. above the anvil. To connect the foot lever with the clutch pulley I forged a Y-rod, as at C, and connected it by means of a lever and a rod, as shown in the engraving."

Waterproof Ink

An ink suitable for inscriptions on stone, tombs, or other place where dampness may attack is made as follows: Pitch, 11 lb.; lampblack, 1 lb.; turpentine sufficient to make soluble. Mix with heat.—Contributed by Frank Pavlik, Jr., Winnetka, Ill.

To Restore Color to Aluminum

To restore gray or unsightly aluminum to its white color, wash with a solution of 30 parts borax in 1,000 parts water, with a few drops of ammonia added.



A Successful Long Main Hot Water Heating System

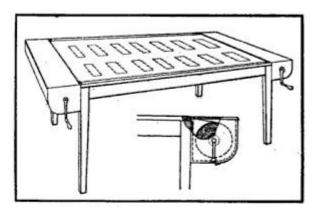
As there are many failures in longdistance heating systems the following successful arrangement may be of value to some readers. In this case the heater is 125 ft. from the radiating The success of the system depends largely on the elevated receptacle. In this case the flow main was carried up from the heater to a barrel. Any other receptacle would serve the same purpose, says a correspondent of the Metal Worker, provided it was located twice the height above the boiler as the drop of the main is below the boiler. The piping must be direct from the boiler to the barrel, then from the barrel to the specially made header coil. This heating system has been working with perfect satisfaction for the past two winters. The header coil is likely to be the cause of trouble if it is not made to form at least one angle, so that the unequal expansion of the hotter pipes at the top and the colder pipes at the bottom may be compensated for in the spring of the piping.

File for Maps or Other Drawings

The usual method of suspending maps from the ceiling not only presents a very untidy appearance but causes rapid destruction of the drawing due to rough handling and allows them to become dirty in a very short time. The device here illustrated is recommended by a correspondent of the American Telephone Journal to

overcome many of the disadvantages of the method mentioned.

It is nothing more than an ordinary table with a box arrangement mounted on each end, in which is fitted a roller with a handle so that it can be rotated conveniently. A drum made of zinc is fitted onto the roller. A heavy grade of linen cloth attached to both drums moves over the surface of the table as the rollers rotate. On this linen cloth are mounted the cable layout maps or other drawings. boxes have lids so that access can be had to the rollers in case they need adjusting. As the drawings are mounted on the linen cloth they are numbered consecutively and a list is



For Filling Maps and Drawings

pasted on one of the lids giving the name and corresponding number of the various drawings so as to facilitate the manipulation of the rollers in locating any particular drawing.

This table can also be used for the purpose of keeping record of the work in hand. Diagrams of the work to be

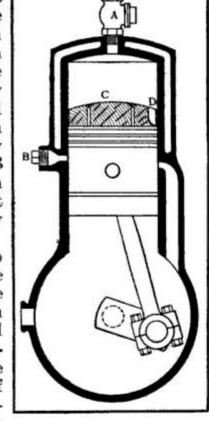
done can be mounted on the linen cloth and as it progresses it can be checked off. When the work has been completed the diagram can be removed from the cloth with the aid of a wet sponge.

To Convert a Gas Engine Into an Air Compressor

Any gas engine of ordinary design can be converted into a fairly efficient air compressor by making a few alterations and additions. If the engine is of the 2-cycle type remove the spark

plug and replace with a check valve as shown in the sketch The at A. exhaust may be plugged up with an ordinary pipe plug, B although this is not absolut e l y necessary.

In order to reduce the space of the compression chamber and thereby increase the efficiency of the compressor fasten a



block of wood on the end of piston as shown at C. This should be of a shape to conform to the top of the cylinder which it should nearly touch when the engine crank is placed on the dead center. In order to avoid obstructing the passage of the air from the inlet port it will be necessary to cut a small cavity in the block as shown at D.

If a 4-cycle engine is used to make the compressor it will be necessary to remove the exhaust valve. It is also a good plan to disconnect the gear in order to prevent noise and unnecessary operation of moving parts. A check valve should be placed on the exhaust, as near the engine as possible and a block of wood similar to that used in the 2-cycle engine should be fastened to the piston. If there are two cylinders on the engine, one may be converted into a compressor as described above and the other used for furnishing power.—Contributed by J. S. Kemp, Chicago.

How to Hang Canvas and Burlap

Raphael Pedretti, in the Master Painter, gives his method as follows:

Our process of applying muslin, or canvas, as it is sometimes termed, is pure and simple handwork. We do not use a brush to paste nor a paperhanger's brush to smooth out the material on the wall.

Ten quarter heavy unbleached muslin is used which is 7 to $7\frac{1}{2}$ ft. in width. The selvage is ripped off, for if left on will show ridges in your work.

It is then soaked in a wooden tub of paste (with a board with a hole in it nailed to the tub) in strips the length of the width of the room.

The muslin is then drawn up through the knot-hole, which removes all the loose paste. When the muslin, thus soaked, is placed on the ceiling, it is thoroughly scraped and rescraped with broad knives and painters' scrapers until all the superfluous paste is removed.

When dry, all blisters, stains and extraordinary cracking of the plaster and mottling of painted walls often seen, caused by the improper gauging of the plaster, is eliminated forever, and nothing can dislodge or disturb the canvas so treated. Burlap, both the lining and dyed, should be thoroughly worked onto the walls with the After applying the paste first to the walls and then to the burlap, if thoroughly worked out with the hands, not using a brush to smooth it out, it will stay out, you will not be aggravated by seeing the butts pull apart and corners turn up or by receiving a hurry telephone call from some fair client to come out and look at your

poorly executed work.

Our method of lining walls is somewhat expensive, but it is thorough and reliable. In preparing the walls I wish to say we invariably use the alum size, for we find that we can use it heavier and stronger; it dries harder and noth-

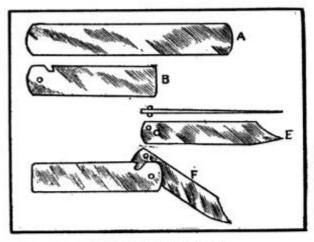
ing softens or disturbs it.

There is nothing so essential in producing good results, in decorative work, as lining walls, for it not only covers up many defects in the plastering, but gives the coloring a soft and brilliant effect, and is very durable if in the last coat a little beeswax is used with the zinc, making what we call an encaustic finish.

How to Make a Pocket Knife

"A thing of beauty is a joy forever" except when it comes to buying a 25-cent pocket knife that was made to sell. A home-made knife while somewhat crude in appearance is very serviceable if well made.

To make the handle take a piece of 3-in, round iron and flatten out a piece



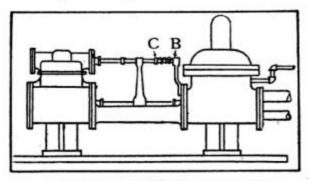
Crude but Serviceable

about 9 in. long and \(\frac{3}{4} \) in. wide. Then bend it double, B, till there is just sufficient room for the blade to go in between. Now bore the rivet hole and you are ready to make the blade. Old files make very good blades, says a correspondent of the American Blacksmith, but most of the blades I make

are of old hay-rake teeth. These are about \$\frac{3}{8}\$ in. thick. I flatten out and shape roughly, then cut off a piece for a blade and anneal it. I do this by heating red and burying it in warm wood ashes till it cools. Then it drills easily and you can grind it down nearly to a finish. You want two holes in the blade, one for the rivet on which the blade turns, the other to receive a rivet which is to act as a stop when the knife is open. After finishing the blade, E, and tempering, assemble in the handle as shown at F.

Balanced Valve Stem for Pump

Pumps often give trouble because of



Pump with Spring to Balance Pressure

an unequal pressure within the steam chest acting on the area of the steam valve, or the valve stem. As the valve stem extends through only one side of the steam chest there is a constant tendency to blow it out. To overcome this trouble a correspondent of the Practical Machinist recommends the use of a coil spring between the bracket B and the collar C in the illustration. The spring should be given sufficient tension to counterbalance the action of the steam acting on the area of the valve stem. While the action of the steam is to force the valve stem out of the chest, the spring forces it in again, and, therefore, the forces are neutralized and the valve stem stays where it is left by the tappet arm.

To make can varnish, dissolve 15 parts shellac, 2 parts Venice turpentine and 8 parts sandarac, all by weight, in 75 parts spirit, by weight.



Amateur Mechanics

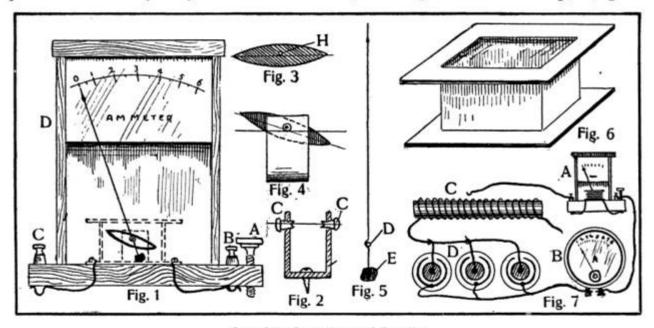


How to Make an Ammeter

Every amateur mechanic who performs electrical experiments will find use for an ammeter and for the benefit of those who wish to construct such an instrument the following description is given: The operative principle of this instrument is the same as that of a galvanometer, except that its working position is not confined to the magnetic meridian. This is accomplished by making the needle revolve in a vertical instead of a horizontal plane. The only adjustment neces-

long, or long enough to reach between the two screws shown in Fig. 2. The ends of this small axle should be ground pointed and should turn easily in the cavities, as the sensitiveness of the instrument depends on the ease with which this axle turns.

After assembling the core as shown in Fig. 4, it should be filed a little at one end until it assumes the position indicated. The pointer or hand, Fig. 5, is made of wire, aluminum being preferable for this purpose, although copper or steel will do. Make the wire 4½ in. long and make a loop, D, ½ in.



Complete Ammeter and Details

sary is that of leveling, which is accomplished by turning the thumb screw shown at A, Fig. 1, until the hand points to 0 on the scale.

First make a support, Fig. 2, by bending a piece of sheet brass to the shape indicated and tapping for the screws, C C. These should have hollow ends, as shown, for the purpose of receiving the pivoted axle which supports the hand. The core, Fig. 3, is made of iron. It is 1 in. long, $\frac{1}{4}$ in. wide and $\frac{1}{8}$ in. thick. At a point a little above the center, drill a hole as shown at H and through this hole drive a piece of knitting needle about $\frac{1}{8}$ in.

from the lower end. Solder to the short end a piece of brass, E, of such weight that it will exactly balance the weight of the hand. This is slipped on the pivot and the whole thing is again placed in position in the support. If the pointer is correctly balanced it should take the position shown in Fig. 1, but if it is not exactly right a little filing will bring it near enough so that it may be corrected by the adjusting screw.

Next make a brass frame as shown in Fig. 6. This might be made of wood, although brass is better, as the eddy currents set up in a conductor surrounding a magnet tend to stop oscillation of the magnet. (The core is magnetized when a current flows through the instrument.) The brass frame is wound with magnet wire, the size depending on the number of amperes to be measured. Mine is wound with two layers of No. 14 wire, 10 turns to each layer, and is about right for ordinary experimental purposes. The ends of the wire are fastened to the binding-posts, B. C, Fig. 1.

A wooden box, D, is then made and provided with a glass front. A piece of paper is pasted on a piece of wood, which is then fastened in the box in such a position that the hand or pointer will lie close to the paper scale. The box is 5½ in. high, 4 in. wide and 1¾ in. deep; inside measurements. After everything is assembled put a drop of solder on the loop at D, Fig. 5,

to prevent it turning on the axle. To calibrate the instrument connect as shown in Fig. 7, where A is the home-made ammeter; B, a standard ammeter; C, a variable resistance and I) a battery, consisting of three or more cells connected in multiple. Throw in enough resistance to make the standard instrument read 1 ohm and then put a mark on the paper scale of the instrument to be calibrated. Continue in this way with 2 amperes, 3 amperes, 4 amperes, etc., until the scale is full. To make a voltmeter out of this instrument, wind with plenty of No. 36 magnet wire instead of No. 14, or if it is desired to make an instrument for measuring both volts and amperes, use both windings and connect to two pairs of binding-posts. — Contributed by J. E. Dussault, 228 Chs. Borromee St., Montreal, Can.

Cheap Telegraph for Learners

An inexpensive telegraph instrument can be made by fastening an electric bell magnet, A, to a small wooden box,

Sheet Iron-

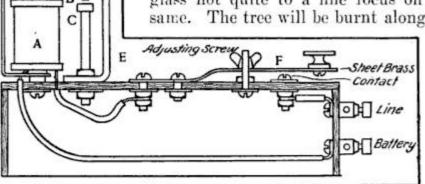
such as a cigar box. The sheet-iron armature is provided with a tapper, B, which consists of a small bolt and nut. The anvil, C, and also stop, D, are from bolts made and are fastened to piece of sheet brass, E, bent as shown. The key, F, is made of brass about 1/32 in. thick

and so adjusted that it nearly touches the contact. If a double contact key is wanted, the adjusting screw may be used for the second contact.

While the instrument as described will work only on very short distance lines, it may be rewound for use on a line 2 or 3 miles long by using about 250 ft. of No. 28 single cotton-covered wire.—Contributed by A. G. Ward, Wilkinsburg, Pa.

Burning Inscriptions on Trees

Scrape off the bark just enough to come to the first light under coating, which is somewhat moist. With a lead pencil make an outline of the inscription to be burnt on the tree and bring the rays of a large magnifying glass not quite to a fine focus on the same. The tree will be burnt along the



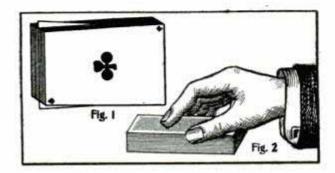
Home-Made Telegraph Instrument

pencil marks, and if the glass is not held in one spot too long, the inscription will be burnt in as evenly as if it had been written. — Contributed by Stewart H. Leland, Lexington, Ill.

To lubricate sheet metal mix 1 qt. whale oil, 1 lb. white lead, 1 pt. water and 3 oz. finest graphite. Apply with a brush before the metal enters the dies.

Mechanical Tricks with Cards

One of the simplest tricks to perform, but one not easily detected, can be executed by using a tapered deck of cards as shown in Fig. 1. A cheap deck of cards is evened up square, fastened in a vise and planed along the



edge in such a manner that all the pack will be tapered about 1-16 in. This taper is exaggerated in the illustration which shows one card that has been turned end for end.

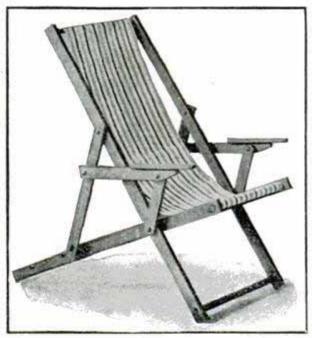
It is evident that any card reversed in this way can be easily separated from the other cards in the pack, which makes it possible to perform the following trick: The performer spreads the cards out, fan-like, and asks an observer to withdraw a card, which is then replaced in any part of the pack. After thoroughly shuffling the cards the performer then holds the deck in both hands behind his back and pronouncing a few magic words, produces the card selected in one hand and the rest of the pack in the other. This is accomplished by simply turning the deck end for end while the observer is looking at his card, thus bringing the wide end of the selected card at the narrow end of the pack when it is replaced. The hands are placed behind the back for a double purpose, as the feat then seems more marvelous and the observers are not allowed to see how it is done.

In prize games, players having the same score are frequently called upon to cut for low to determine which shall be the winner, but a fairer way is to cut for high as a person familiar with the trick shown in Fig. 2 can cut the cards at the ace, deuce, or three spot,

nearly every time, especially if the deck is a new one. This is done by simply pressing on the top of the deck as shown, before cutting, thus causing the increased ink surface of the high cards to adhere to the adjacent ones. A little practice will soon enable one to cut low nearly every time, but the cards must be grasped lightly and the experiment should be performed with a new deck to obtain successful results. —Contributed by D. B. J., Chicago.

How to Make a Porch Chair

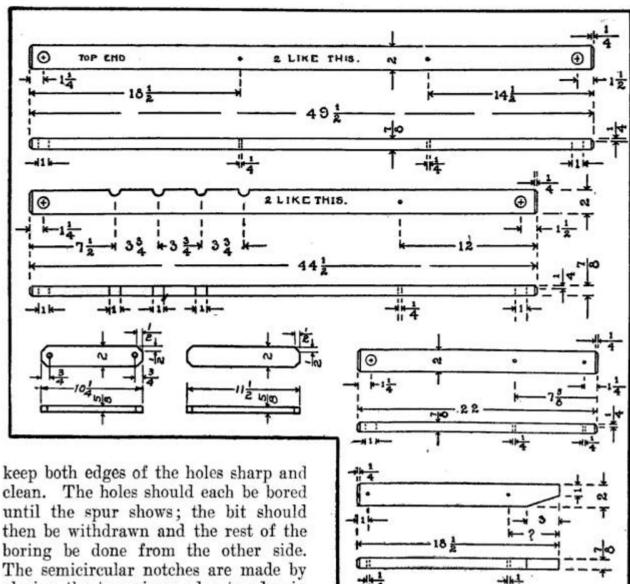
The illustration shows a very comfortable and attractive porch chair that can be made with few tools and easily procured material. Most any kind of wood will answer, says the American Carpenter and Builder, but if open grained wood, such as oak or chestnut,



Porch Chair Finished

is used the parts should be filled with a paste filler. If the natural color of the wood is not desired, the wood may first be stained, the filler being colored somewhat darker than the stain.

Procure enough lumber to make all the pieces shown in the detail drawing and finish to the dimensions shown, being careful to make the corresponding pieces exactly alike in order to preserve the perfect symmetry which is necessary in work of this kind. In boring the holes care must be taken to



Details of Home-Made Porch Seat

keep both edges of the holes sharp and clean. The holes should each be bored until the spur shows; the bit should then be withdrawn and the rest of the boring be done from the other side. The semicircular notches are made by placing the two pieces edge to edge in the vise and placing the spur of the bit in the crack. The 1-in. bit is used. As it will be difficult to finish the boring of these blocks from the second side, the parts remaining may be cut out with the knife after the pieces have been separated.

11 . 2

Five 3-in. dowel rods are needed. It is possible to get these in one long piece if you happen to live near a mill and then all you will have to do is to saw off the desired lengths. However, if they cannot be got easily you can make your own. Two rods each 184 in. long; two rods each 204 in. and one rod 224 in. give the exact lengths. It is well to cut each piece a little longer than required so that the ends which are imperfectly formed may be cut off. These rods should fit tight and may be fastened in addition with a small screw or nail from the under or back side.

The hand rests should be nailed to the arms with small nails or brads before the arms are bolted. The illustration of the assembled chair shows the relative position.

The bolts should be \(\frac{1}{4}\) in. and of the following lengths: 4 bolts 2\(\frac{1}{4}\) in. long; 2 bolts 2 in. long; 2 bolts 3 in. long. Washers should be placed between adjacent pieces of wood fastened together with bolts and also at both ends of the bolts. This will require 26 washers in all. While the size of the chair may be varied, it will be necessary to keep the proportions if the parts are to fold properly.

To make black ruling ink, take good black ink and add gall as for blue. Do not cork, or it will not turn black.

FIRST CHINESE RAILROAD

It is a little railroad, only 30 miles long, with four stations, which has just opened for traffic between Chaochowfu and Swatow.

But it is the first real Chinese railroad.

Built by Chinese with Chinese capital, and operated by Chinese employes.

It is true the three locomotives and the rails came from America and the ties from Japan. Before many years both rails and locomotives will be made in the land which had printing and gunpowder centuries before the Caucasians. Great things will be doing in the land of rice and tea leaves before the century is half over.

THE SIGN THAT COST \$1,000 PER WORD

The most expensive sign in the world, consisting of only six words, each of which cost \$1,000, is in such common use every one of our readers has often seen it, but would doubtless think some time before guessing right. The incident is an interesting one.

A certain eastern railroad erected signs where its track crossed streets and country roads with the warning in big letters "Beware of the Engine and Cars," which was followed by lengthy instructions in smaller letters which would take two or three minutes to read. This was supposed to place the burden of responsibility on anybody who was so reckless as to venture on the track and get hurt after such a warning. But as the highways and grade crossings increased, the making of signs became a financial burden, and the wording was reduced to "Look out for the Engine when the Bell Rings and the Whistle Blows."

After another lapse of some years and the signs had increased from a few hundred to several thousand, it occurred to the management that a needless amount of money was being spent each year in lumber and sign painting, especially in view of the fact that the old signs were giving out and more crossings were constantly required.

But to save paint and boards and the legal advantage of the company all at once proved something too hard for the operating department, and so finally the matter was submitted to Judge Paxton. The judge studied up a sign—it only contained six words—and he charged \$6,000 for his work, but the result needs no addition, neither can a single word be spared for it tells the whole story in one short, crisp sentence:

RAILROAD CROSSING STOP, LOOK AND LISTEN

Yes, it does look like easy money for the judge, and it paid the company. But had he only taken out a copyright and charged a dollar royalty on all the crossing signs in the whole United States—!

SODIUM TRANSMISSION LINES

Wrought-iron pipes filled with sodium may eventually take the place of copper cables for overhead transmission lines and feeders for railway The sodium is a cheap and good conductor of electricity, but as the oxygen causes it to ignite when placed in contact with water, its use must be restricted to the purposes mentioned. The pipes of standard size are heated to a point above the melting temperature of sodium and the melted sodium is then run into them, solidifying when cool. In the small sizes the cost of the sodium conductor is about 50%, and in the large sizes not more than 20% of that of copper cables of the same conductivity. For instance, a 1-in. sodium conductor having a capacity of 109 amperes costs 3½ cents per foot, against 8½ cents for the copper line of the same capacity.



BREAKING ICE GORGE WITH DYNAMITE

Although the Platte river of Nebraska is noted for being an underground stream on account of the entire valley along its course being underlaid with moving waters, which flow with the open current, it is by no means an underground river in the springtime when the ice breaks up. It is then that the floating ice collects in huge masses, and uniting in a mighty gorge, raises the level of the river until it overflows its banks and floods the surrounding country.

The river varies in width from onehalf to one and a quarter miles, and at normal its average depth is not over 3 The entire bed of the river is sand and much of it that treacherous quicksand, which is constantly changing, thus often causing a channel 10 ft. deep to appear where on the following day there will be a sand bar showing above the waters. In many places the banks are not more than 4 ft. above the normal level of the water, so that when a gorge forms across the river, only a few moments elapse before the water is over the banks and spreading out over the country.

The farmhouse shown in the illustration was only one of many in the same condition and while it is a mile from the river it was flooded with 2 ft. of water. The other picture shows where the water and ice is banked and held back by the Union Pacific railroad, which follows the river for several hundred miles. Much damage is done to the track every year by the grade being washed away, which is done in only a few hours when the water passes over it.

The only way of preventing such floods is by keeping the huge cakes of ice from forming a gorge, but this cannot always be accomplished and the remedy then is to break the gorge as soon as possible by dynamiting. The gorge which caused the flood shown in the illustration required nearly 600 lb. of dynamite for its removal. Several charges were exploded with little effect but at the last charge the entire gorge was swept down the river in a wall of water and ice several feet high.



SNOW FORTS NO PROTECTION

The unusually heavy snowfalls in Germany last winter gave opportunity for numerous experiments with defenses made of heavy, hard-packed snow. In the test mounds were built up 6 ft. high and 15 ft. thick, and wooden figures, life-size, and targets were placed behind them. The artillery shot left an open bore through the snow wall and the infantry bullets also went through without losing any power. The dummies were riddled and the targets utterly destroyed. Snow mounds, no matter how thick, afford no protection against modern guns, large or small.

SUBSTITUTE FOR COPPER

The steady increase in the price of copper, with a corresponding increase in its demand, and the certain prospect of new uses arising from year to year have caused considerable anxiety to those manufacturers who cannot do without this metal. Necessity, however, is a great stimulation of ideas, and provider of wants, and long before the visible supply has neared its end, something else will have been found; or at least something else to such an extent that plenty of copper will be left to use where only copper will answer.

Aluminum has proved the best substitute thus far, though at present its manufacture is a monopoly, on account of certain patents. These patents will expire in a few years and then we may look for a substantial reduction in price and an increased volume of the product.

ALL-STEEL 70-FT. POSTAL CAR

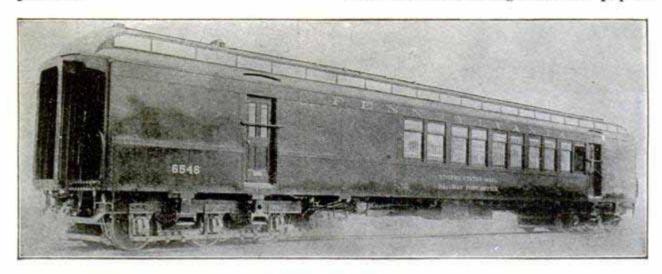
The Safest Postal Car in the World Marks a New Bra for Railway Postal Clerks

Railway postal clerks, who occupy the most dangerous position in a train, because they have no warning or chance to escape, hail with satisfaction the prospect of improved mail cars, the first of which has been built by the Pennsylvania railroad. The car, which



Showing Steel Framework

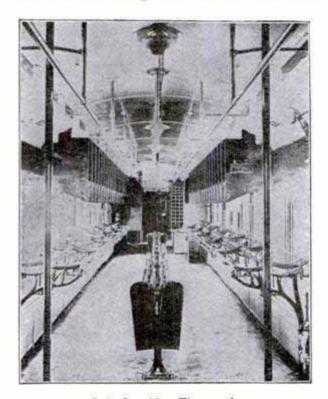
is 70 ft. long inside and 9 ft. wide, is practically all steel, since it contains only 370 lb. of wood. The floor is cement and the sorting cases for papers



All-Steel Postal Car-Largest in the World

and letters and the doors are all of metal. It is the first 70-ft. postal car ever built, and has storage space at each end, which eliminates the necessity of turning the car at terminals for the return trip.

The unusual strength of the construction is indicated in the 12-in. vertical I-beams at each side of the doorways. Electric light is supplied from storage batteries and an axle light generator below the floor. The car body is built on 36-in. steel girders and the framing of 18-in. I-beams.



Interior Also Fireproof

The sides and roof are steel plate, with an inside lining of fireproof composite board, of which there is 2,840 lb. Asbestos cloth is used to deaden the sound. The only danger from fire will be on account of the inflammable nature of the mails. Fire extinguishers will be provided for emergencies of this kind. The car weighs 190,000 lb., and by reason of special spring rigging rides exceptionally easy.

When taken to Washington for the inspection of officials it was pronounced the safest and largest postal car in the world. It is expected that as fast as it can be done this type of car will be required of all the leading railroads.

Courtesy Ry, Review

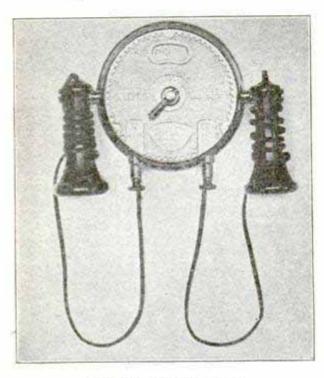
CONCRETE TIE FAILURE

The practical concrete railroad tie seems a harder proposition than has been generally supposed by inventors who have had no railroad experience. The illustration shows at the top one of a considerable number of reinforced concrete ties which were laid February 27, 1906, on one of the steam roads out of Pittsburg. Below are shown some of the same ties after seven months' service. These ties were 81 ft. long, 7 in. deep, and 8 in. wide, except where the rails rest and there they widen to 121 in., where a box is formed to hold an oak block into which the spikes are driven.

PACIFIC LIGHTSHIPS EQUIPPED WITH SUBMARINE SIGNAL SYSTEM

All the lightships along the Pacific coast are soon to be equipped with the new telephone submarine signal system. By means of the apparatus the men on the lightship are able to exchange signals with incoming steamers for a distance of from 10 to 15 miles. This will be of great safety service in case of heavy fogs, darkness, heavy weather, etc.

The system consists of a submerged bell and receiver on each side of the lightship, under water. The approach of an incoming vessel is announced through an electrical contrivance by the ringing of a bell in the pilot house of the lightship, which is connected with the submerged receiver. The steamer, which must also be equipped with a similar arrangement. will receive signals from the lightship and be accurately advised of the bearing of the latter vessel. With this information the incoming liner can steer for the lightship with confidence and certainty, and when the steamer pilot locates the beacon craft he knows just where his own vessel is. The great danger has been in missing the lightships during very thick weather, in which event the vessel is left largely to the mercy of chance.



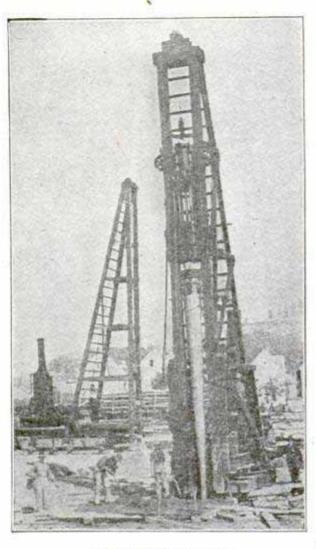
Receivers in Pilot House

The record of marine disasters on the Pacific coast shows that the greatest danger of mariners is attendant upon the attempt to reach port during a fog. The signals which are made in accordance with a code system are sent by striking a submerged bell.

CONCRETE PILES FOR FOUNDA-TIONS

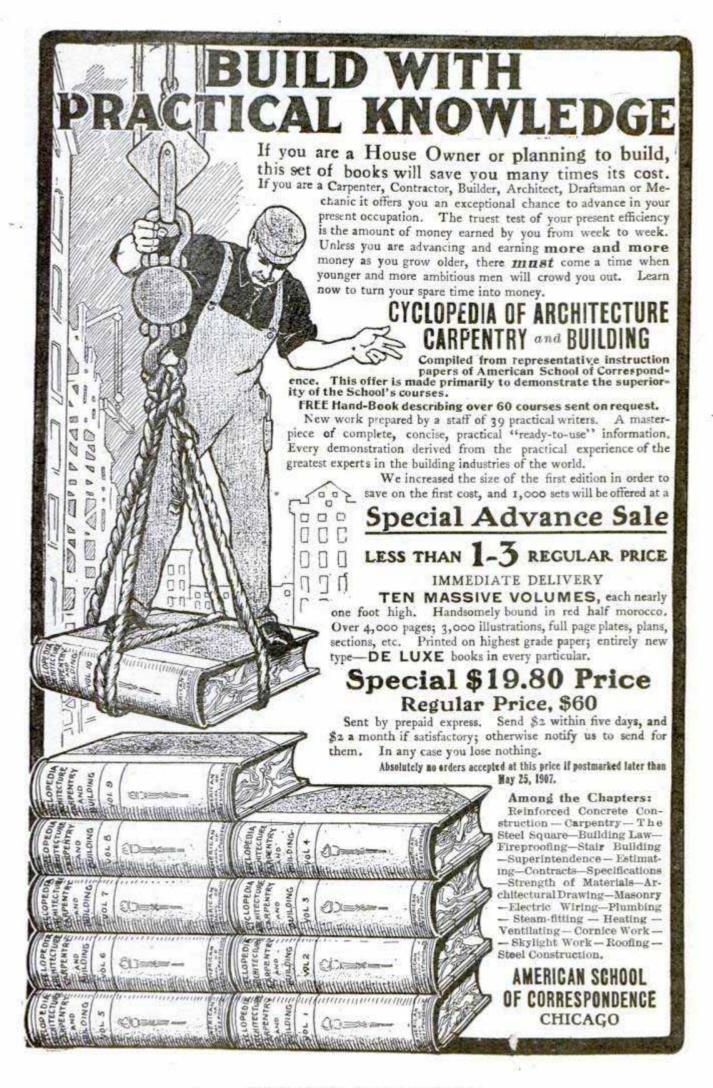
Piles made of concrete are rapidly taking the place of wood for foundation work. The concrete has many advantages. In the first experiments with concrete piles they were made at the place where they were to be used, dried, and then driven with a piledriver. A later process is to drive a steel shell, sharp-pointed at the bot-

tom and tapering to the required diameter at the top. In driving a solid core fills the shell and is with-



Shell Ready to Drive

drawn, leaving the shell to serve as the mould for the concrete. By reason of the tapering form the size of the pile can be determined to suit the case, with a maximum of bearing surface at the top. The approved sizes range from 20 in. diameter at the top and 6 in. at the point for a 20-ft pile, to 18 in. at top and 8 in. at point for a 40-ft. pile. A 25-ft. tapering pile did the work of 40-ft. pile of uniform diameter in New York, while in New Orleans the 20-ft. concrete tapering pile equaled the 50 and 60-ft. wooden A 20-in, concrete pile has the same head surface as four 10-in. piles. Concrete piling of this type has been used in the foundations of large buildings, power houses and lofty smoke-The method has been patstacks. ented.



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Heating apparatus, including radiators, boilers, heaters, valves and fittings.

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Most of our material was secured by us at SHERIFF'S and RECEIVER'S Sales. Besides, we purchased and dismantled every Exposition of modern days, including the Fifty Million Dollar St. Louis World's Fair. Our stock is an ever-changing one and we are able to supply you practically everything in the manufactured line. You are safe to advise us your wants and ten to one we have it in stock. Our prices seldom represent the original cost of manufacture. Ask for our special, free 500-page catalogue. It will teach you the spirit of economy. page catalogue. It will teach you the spirit of economy.

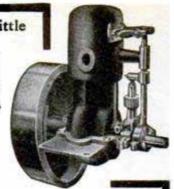
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Department 789

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2 h. p. Marine Engine



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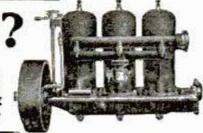
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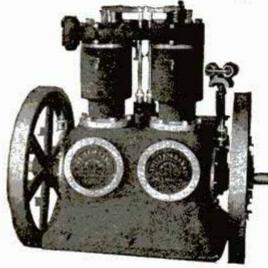
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Baltimore Buffalo Philadelphia London Hamburg

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THE GALLANTRY OF HOOLIHAN.

For fifteen years Dan Hoolihan had run the "Cannon Ball," For lifteen years Dan Hoolihan had run the "Cannon Ball,"
For when it came to making time he always led them all.
And never yet in all those years had he once set his feet
Upon the dreaded carpet in the superintendent's suite.
Whatever he had found to do he did with all his might,
And as well as being faithful he was painfully polite.
But ruthless fate o'ertook him, without a warning word.
For Danny's engine failed him once right at the Edgemoor
yard.

yard.

For twenty minutes there he stayed, and sweated, fumed and raged—

The while his ever-willing hands in its repair engaged.

Three times the lady agent who thereat was employed Had plied bim with sharp queries, which Danny much an-

"The train dispatcher says," she said, "to tell him, right

"What earthly thing's the reason for the 'Cannon Ball's' delay."

delay."

But Danny tolled on earnestly, and no reply made he, Except, "You go and tell him nothin's the matter—see?"

And so he patched his engine up and took his train along, and the lady never really knew exactly what was wrong. But next day, at headquarters, to Danny's great chagfin, "The superintendent sent a boy and promptly called him in. "Dan," said the "old man," sternly, "in all my life as yet "I've never known a 'discipline' to cause me such regret. "Your record is a good one, but stubbornness, 'tis plain, "Won't go, and, so for thirty days you'll not take out a train. train.

One month you are suspended, and new I'd like to know "Why insubordination a man like you should show?"
"Well, sir," said Danny, humbly, "I'm sorry bout this case,

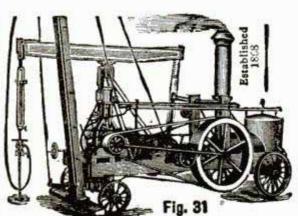
"And I own things looks agin me-that is, upon their face-

"But you see that blasted engin' her petticoat come down (Here Danny's honest features contracted in a frown), "And I leave it now to you, sir—you'n me both bein" human-

"Could I have went and told that thing to any bloomin' woman? -Railway Age.

PRIZES FOR VINEYARD MACHINES.—The Italian ministry of agriculture is offering a number of prizes for motor-driven machines for working vineyards. The prizes are: No. 1, diploma of honor, \$1,930 cash. No. 2, gold medal, \$579 cash. Applications to compete should be sent to Ministero di Agricoltura, Rome, Italy, by September 15.

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A twin cylinder 7 H. P. Marine Motor, installed in Cabin Cruiser "Clematis," 42 ft.x11 ft. 6 in. double decker, 17 tons register. Drove her 1200 miles on 110 gallons of gasoline at 7 miles per hour. Wheel 32 inch x 40 inch pitch, four blades, motor turning 500 revolutions, geared to wheel shaft, 20 and 48 teeth.

A twin cylinder 7 H. P. Marine Motor used by M. J. Gould, of Dexter, N. Y., for 7 seasons. Sent to our shop for a new crank shaft. This motor

averaged 6000 miles during a season, making two round trips of 24 miles each day for six months, Sundays included, making a total of 42,000 miles without an accident.

A single cylinder 31/2 H. P. Stationary Motor used for 6 seasons during the summer months for driving cooling fans, sent to our shop for general overhauling and jump spark ignition.

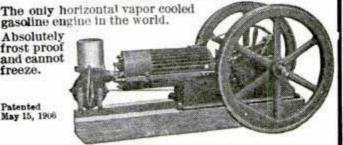
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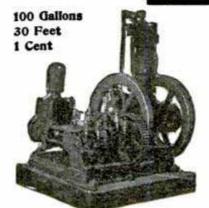


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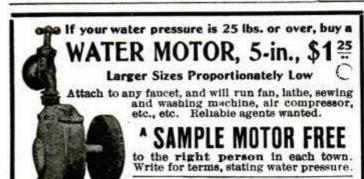
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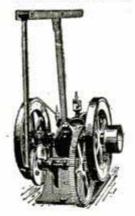


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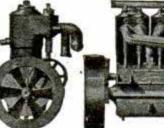
WHEEL STARTS. Reversible. Simple.
Perfect Control. Perfect lubrication and cooling. Efficient carburetor. Best babbited bearings; thrust ball-bearing; grooved drop forge crankshaft; ground cylinders and pistons. We guarantee and replace if not satisfactory. Free Catalog sent on request.

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GEARS

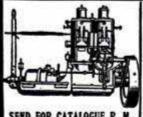
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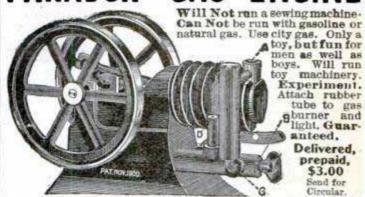


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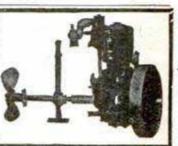


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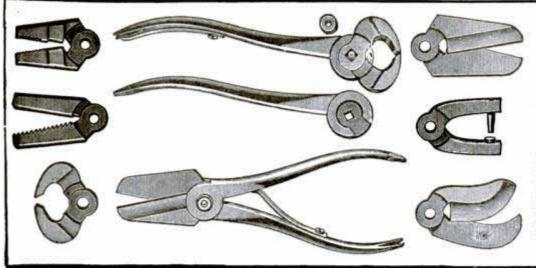
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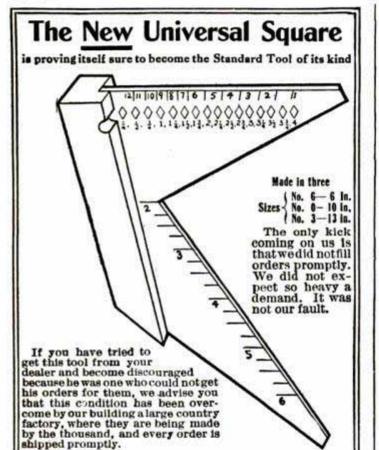


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"DONT'S" FOR THE YOUNG ERECTING ENGINEER .-

In the Electric Journal, in one of the chapters in the series "Experience on the Road," appears the following excellent advice to young engineers:

- 1. Don't tell everything you know the first day you arrive to install appearatus. You may want to carry on a conversation the other days you are on the job.
- 2. Don't promise things that are not in the contract. The factory has a way of turning down such promises which makes you feel badly.
- 3. Don't think you know it all just because you are from a big company. There are a few smart men not working for your company.
- 4. Don't write letters to the local company; the factory has men who are paid to do this work of writing letters.
- 5. Don't say any more than you have to. By keeping your mouth shut you are likely to get the reputation of being a smart fellow.
- 6. Don't think because a man has worked all his life for a local company and you have just arrived, that he cannot give you a pointer or so. The dumbest people sometimes know a thing or two.
- 7. Don't take anyone's word for everything being all right, but see for yourself. Trouble has a way of developing when least expected.
- S. Don't forget what company you are working for, although the superintendent for the local company may say that the man before you would do "so and so." If you do not stick to the contract your company may have a man who can fill your place.
- Don't forget that all of us make mistakes sometimes.It does not follow from this that you must make mistakes all the time.
- 10. Don't think that just because you have had the students' course you know more than the old road men. Some of the old road men bave forgotten more than you ever knew.
- 11. Don't forget that the officials of your company have their eyes on you. Sometimes a position opens up and if you had worked hard you might have gotten it.
- 12. Don't think when you come in from a job that you are expected to hold the office furniture down. If no work is at hand look up some. Get busy.



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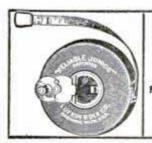
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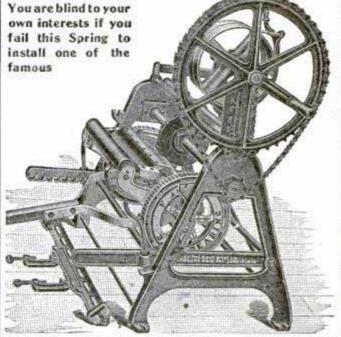
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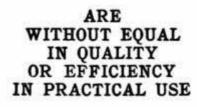
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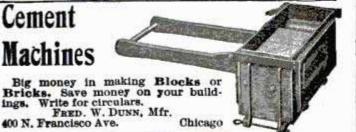


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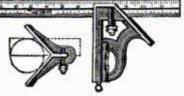
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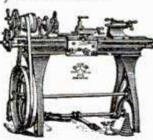


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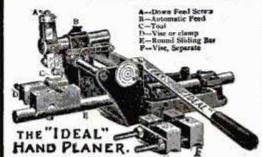
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But the San Francisco affair and its spirit of exclusion! How it recalls our past. Fifty odd years ago we were for closed doors and no Westerners for the East. Commodore Perry came and we yielded. And we have since become an out-and-out "open door nation, largely through the friendly pressure brought on us by the West, especially America. Now the nearest gate to the West is to be shut on us, or at least such of our own blood whose principal fault is that they have not yet learned to go about comfortably in coat and trousers. We sometimes feel as if our patience were wearing out when we reflect what a dominant tyrant dress and color is, and for the moment all the joys vanish

ignorance and prejudice sees repeats itself.

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Will run faster than an auto and cost of maintenance a trifle.

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which we guarantee will run your engine longer with absolute dependability than any other Sparking Outfit on the market. The Gladstone Battery may also be used with other coils and will supply more "juice" cheaply, longer and more uniformly than any other source of battery energy, costing only about one-third as much as dry batteries. Send for the Gladstone Gas Engine Hand Book, compiled by experts and will save hours of trouble.

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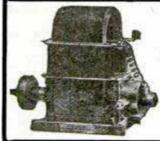
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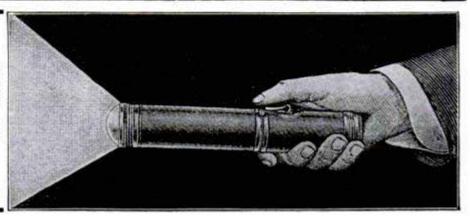
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(Concluded from page 572.)

relations between the United States and this country was the most delicate tact and foresight on the one hand and candor and firmness on the other. It is satisfactory to know that the squadron to represent Japan at the memorable festival is officered and manned by men of the calibre described. We bid them godspeed.-The Japan Times, Tokyo, February 28.



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While pursuing my college course, I managed to help towards paying my expenses by engaging as engineer of a small excursion steamer on one of our large inland lakes, during the summer months.

It was during the first month of my service in this capacity that I made a very humiliating mistake. It happened in this way: Early in the season, the steamer was engaged by a picnic party to carry it up the lake, leaving home at eight o'clock in the morning.

The steamer had not been out for two days, and while cooling the boiler down after this previous trip I had allowed the injector to run until the boiler was filled to the safety valve. I did this because of the well-known shrinkage which takes place in the water of a vertical boiler while it is cooling—particularly when her tubes are a little leaky. This boiler was one of the largest of the ordinary upright flush tubular boilers I have ever seen—rated at 150 hp, it had two hundred and eighty-four 1½-in. tubes.

tubes.

But to return to my story, when the time came to leave the pier, and I had received the signal to back slowly, as a last precaution I tried one of the injectors to be sure of my water supply. It refused to start. I tried all the stop and suction valves, removed the cap and examined the disk of the check valve, but could discover no trouble. I then went to the other injector and proceeded through the same operation, to no effect. This was a strange coincidence and something I had never before known on this boat. All this time the captain had been signaling his impatience from the wheel. I finally sent a boy to ask him to come to the engine room. He was furious, but agreed that we would better be at our dock than in the lake if we were to be without boiler supply. However, after all other means had failed, we decided that we would move out from the pier on my theory that our intake supply pipes were clogged at the boat's bottom. As we backed from the pier the engine suddenly filled with water, although the glass showed only one gauge. As I closed the although the glass showed only one gauge. As I closed the throttle an inspiration, which was the solution of my troubles, came to me at once. I sprang to the glass and "blew it out." Sure enough, it filled to the tcp after this operation. I next went to the blow-off and blew down to two gauges. I had made the old and dangerous mistake of steaming a boiler without making an absolute cortainty. to two gauges. I had made the old and dangerous mistake of steaming a boiler without making an absolute certainty of the water level.

It was while running this same boat that another and more ludicrous incident resulted from my carelessness.

We had carried a picnic party to a sandy, sloping beach, (Continued on page 578.)

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Mr. Parker on November 1, 1903, after having been a member of the Examining Corps of the U.S. Patent Office for over five years, resigned his position as Examiner to take up the practice of Patent Law.

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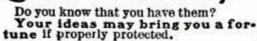
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(Continued from page 574) and had transported them by means of small boats to the shore while the steamer swung at anchor a few hundred yards away, awaiting their pleasure. Only the crew of the engine room was left on board, the rest being with the

engine room was left on board, the rest being with the picnickers on shore.

The operation of cleaning the tubes of this boiler was a very strenuous one, entailing the necessity of letting down the stack and using a long scraper from an uncomfortable position on the top head of the boiler. To avoid this as much as possible I had improvised a blower to be used through the fire-box door. Thus the banking of the fires while laying off shore presented an opportunity to get at the tubes with good dry steam. I had not noticed that a stiff breeze was blowing directly in shore. As the soot accumulation from twelve feet of a 1½-in, tube shot toward the shore we in the engine room were too busy to notice accumulation from twelve feet of a 1½-in. tube shot toward the shore we in the engine room were too busy to notice that it settled directly on the white linen of the table-cloths and shirtwaists dotting the beach. As we shifted the blower the third, fourth and fifth tubes in rapid succession were relieved of large quantities of soot, which all went the same way. The racket of the escaping steam drowned all outside noises, and not until a boat from shore arrived and a man shouted in my ear did I discover the damage being done. It was a most laughable experience, but I certainly did not see the funny side until some time after. Indeed, the homeward trip was a very solemn one for the engineer.—Contributed by L. T. W., Chicago.

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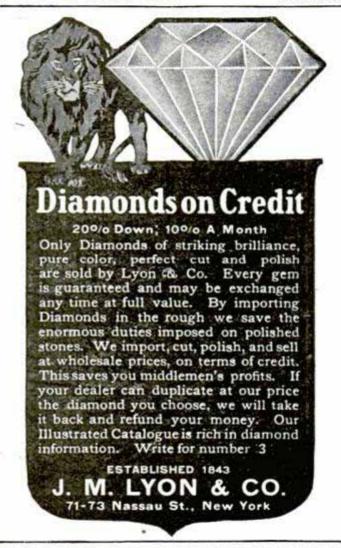
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United States manufacturing what might be termed commercial alcohol."

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"This office knows of no process by which alcohol can be manufactured except by distillation, and as regular distilleries are the only kind recognized by the law, alcohol manufactured under the supervision of this department must be manufactured at regular distilleries. There are absolutely no limitations as to the size of a distillery that can be operated under the law. There are over 1,000 distilleries in operation now, at each of which the daily spirit producing capacity is less than 30 gal. Many of these were set up on an outlay of less than \$200. So far as the internal-revenue laws are concerned, either in theory or practice, the smallest and crudest distillery can produce alcohol, if as a business proposition it is deemed advisable to do so. The small distilleries have always been treated by this department with the same consideration as the larger ones.

"If a farmer or other person desires to go into the business of manufacturing denatured alcohol, at a plant however small, he will be required to construct his plant in the manner prescribed by the general laws and regulations. He will be required to give a bond, the effect of which is to prevent him from defrauding the government of the tax on any distilled spirits produced by him. He will be required to establish a distillery warehouse; to deposit the spirits produced by him in this warehouse; to establish a denaturing bonded warehouse, and to tax pay or denature, just as he may wish, the alcohol produced by him. All of this will be done under governmental supervision, but the government pays for this supervision. The (Continued on page 582)

(Continued on page 582)

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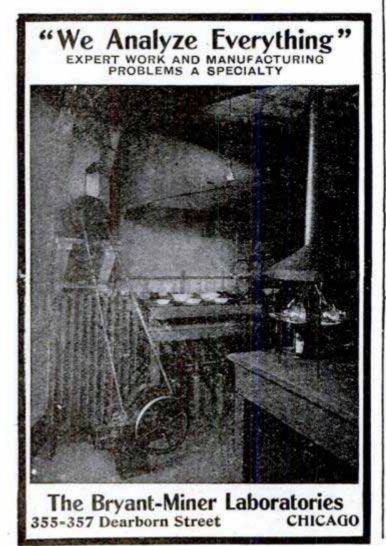
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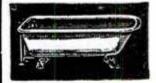
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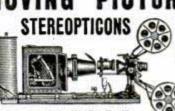
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(Continued from page 580.)

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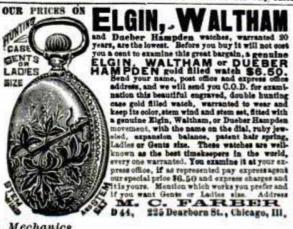
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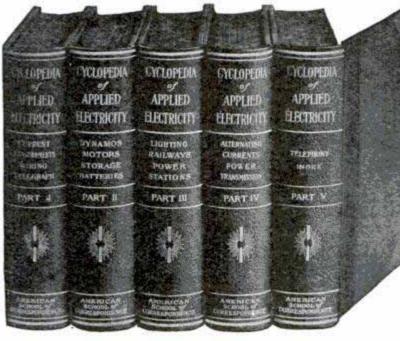
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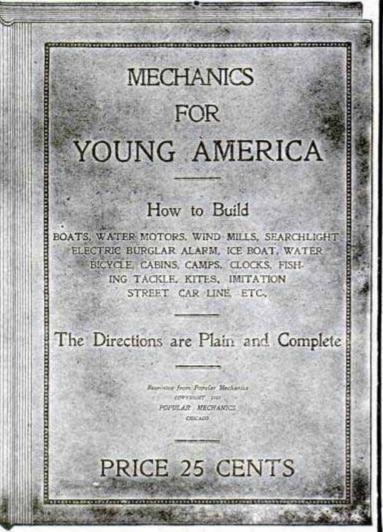
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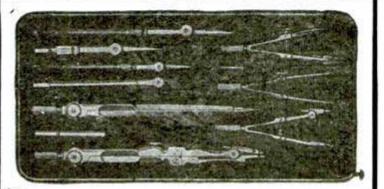
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(Continued from page 582.)

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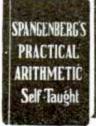
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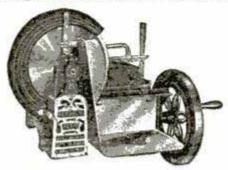
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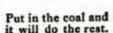
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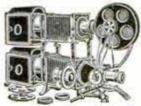
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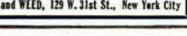
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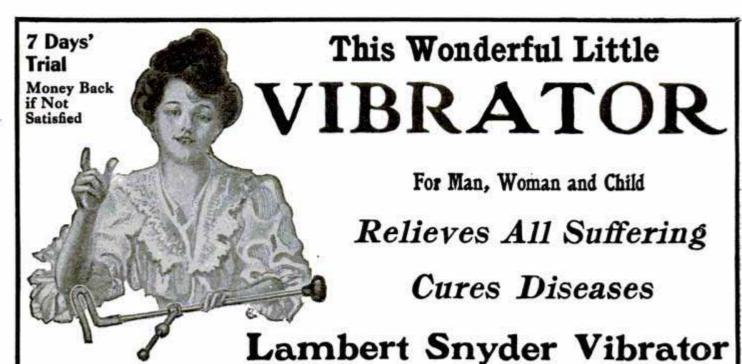


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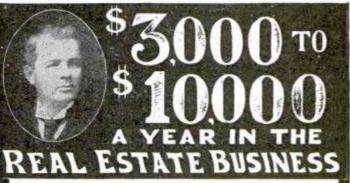
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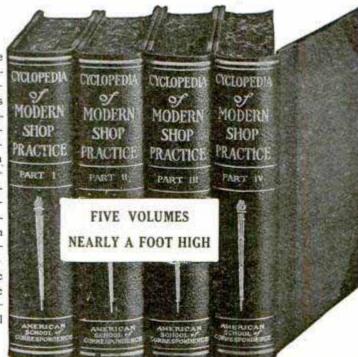
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When the Zuyder Zee breaks on to the land these who

Shopping in boats.

When the Zuyder Zee breaks on to the land, those who wade up to their knees along the streets of a flooded village meet all manner of fish. This is explained by the fact that the Zuyder, with its mud bottom, is literally crammed with finny tribes; and one authority states that if it were well scraped of all its fish one year, it would be full again the next.

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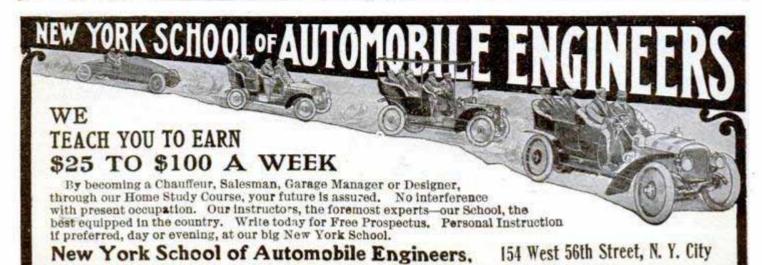
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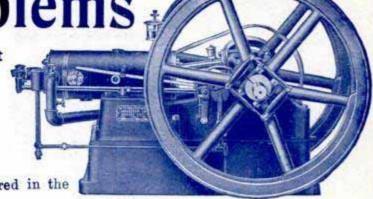
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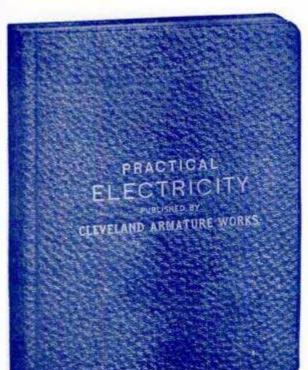


TABLE OF SUBJECTS:

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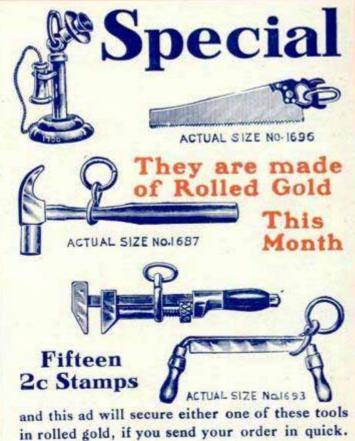
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