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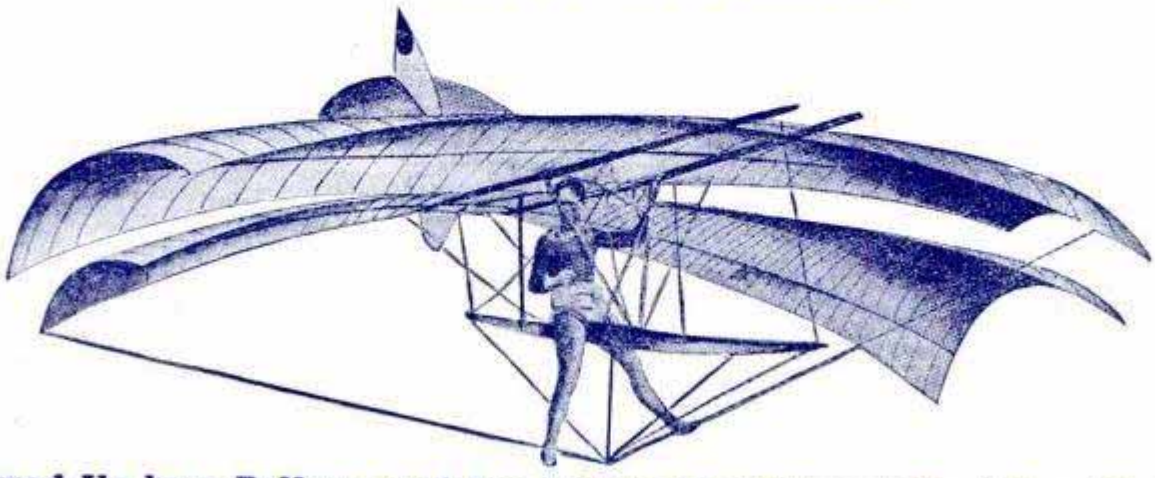

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JUNE, 1905

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H. H. WINDSOR.....EDITOR

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CONTENTS.

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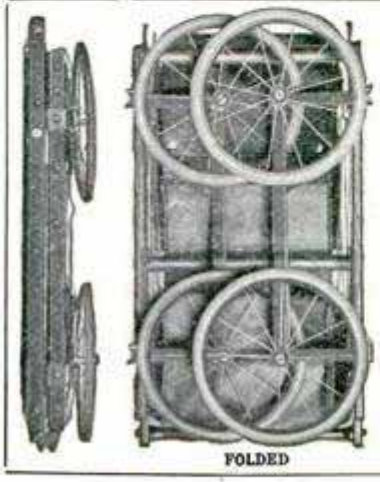

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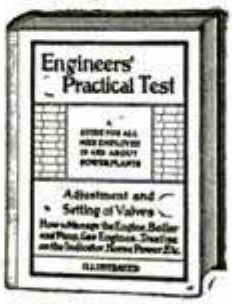

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POPULAR MECHANICS

Vol. 7. No. 6. CHICAGO, JUNE, 1905. 10 Cents a copy $1.00 a year

Harvesting the Forests by Machinery

Conditions Presented by Northwestern Forests Made Change in Laborious Methods Imperative

In no other industry of such great commercial importance and rank as lumbering have the primitive methods of labor obtained for so many years. In 1634 the first sawmill in this country was erected on the falls of the Piscataqua on the boundary line between Maine and New Hampshire. The machinery consisted of a saw stretched upon a huge gate or frame, running in wooden slides on ponderous side posts and having the pitman connected direct to an overshot wheel. The changes from that time to this in sawmill equipment need only be suggested.

Logging Locomotive and Woods' Crew, Including the Cook and His Boxes of Provisions

Nearly everyone is familiar with the whirr of the mighty machinery and the peculiar buzz of the perfect saws which turn out train loads of lumber daily in one of our modern sawmills. But, strangely enough, the old methods of logging, until very recently, underwent no relative improvement. The trees were felled and loaded on sleds and conveyed to some water course to wait for the spring freshets to carry them down to the sawmills—the whole process being carried on by man and horse labor and the work only lasting through the winter months when the snow was sufficient for sledding. Maine saw her forests of pine and spruce depleted and wasted by unscientific methods, and still no change; the middle west began to offer up her primeval

stores, and yet no great inventive economist rose to stay the improvident hand. Then across the continent toward the Pacific and the Oregon crept the destructive caravan, hewing its path into a wilderness of such magnificent growth as only those who have seen can realize. Here grew the California redwood, the Washington fir, the Oregon pine—a vast wealth, undespoiled. Here, however, the old methods of logging did not apply; the trees were of such huge growth and the little snow that fell during the rainy season so quickly turned to slush in that salubrious clime. Thus it remained for the Great Northwest to apply the long delayed "American method."

In time the steel rail threaded the forests, machinery replaced many men and horses masts of ships. It is used exclusively in the construction of all the war vessels of the United States navy, excepting for interior decoration, for the masts and spars of racing yachts and for flag poles to fly the colors of almost every nation in the world.

In the grey dawn—or earlier—the woods' crew turn out of their bunks, which rise tier upon tier along the walls of the log house, and after a hearty breakfast in the cook-house are off to their work in the woods. The trees to be felled are marked by experts who know exactly what trees to choose in order to facilitate the work. The direction the tree should fall is indicated by cutting a notch in that side. No sooner do the markers leave a tree than the fellers are there with their saw and sharp two-

Logs Yarded Near a Branch Railway

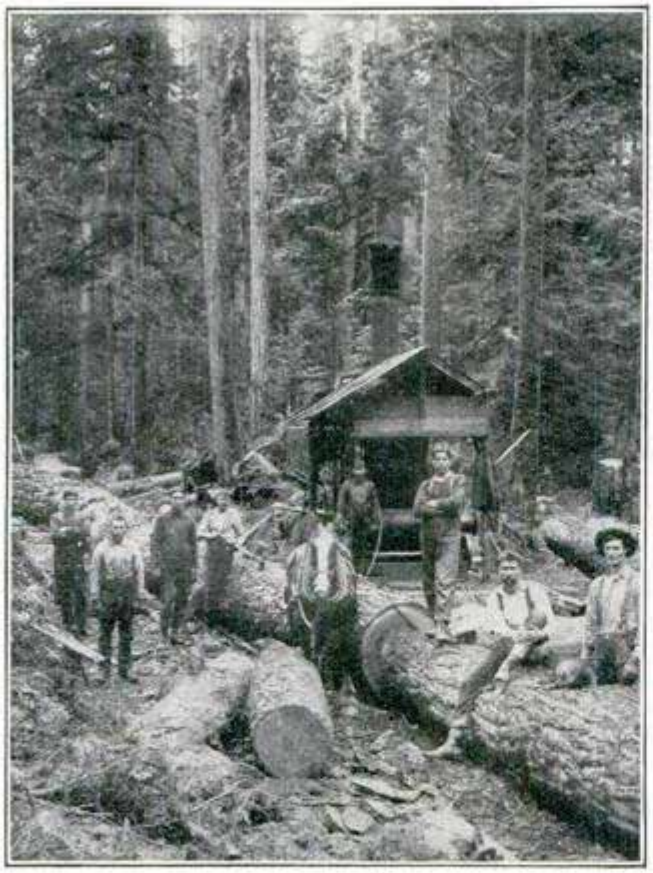
and power was applied wherever possible. The work, too, was apportioned and systematized, each man having skill in his peculiar task, and the operations being conducted on a huge scale throughout the year. For instance, take a lumber company possessing 1,000,000 acres of timber land—not an unusual number—it will likely employ 500 men and use 100 horses, 25 donkey engines, 10 log loaders and will have built upwards of 100 miles of railway. It is estimated that California, Washington and Oregon contain 840,000,000,000 ft. of uncut timber! Of the Northwestern woods the fir is the most valuable. It attains a height of 300 ft., is straight-grained and suitable for the edged axes. Spring boards are stuck in notches cut in the tree and on these the fellers stand while sawing. The saw, ordinarily, is from eight to ten ft. long, having a handle at each end and is operated by two men. Sometimes a tree is so large that two saws must be spliced together. The first cut is made on the side of the fall six or eight ft. above the ground, to avoid the heavy sap and hard grain at the base, at right angles to the line of direction of the fall, and one-third way through the trunk. The sharp two-edged axes are then used to make an undercut and then the fellers begin sawing from the other side. While they work the saw is kept free of resin by

means of a bottle of petroleum hung against the tree. So skillful are the fellers that in the final operation of inserting wedges in the last cut made, they can calculate the fall within a few inches. The tree falls with a crash that shakes the earth and reverberates through the dim forest, but the fellers do not pause to regard the fallen monarch. The work is carried on with factory-like system and they are off to another marked tree almost immediately. Likewise the fallen tree has hardly settled into place before it is marked off into the required lengths—from 28 to 40 ft. Men called "buckers" saw up the logs as marked, using a stiff saw having but one handle. The bark is cut from the side of the log on which it is to be dragged, by "barkers." This saves friction in passing over the rough ground.

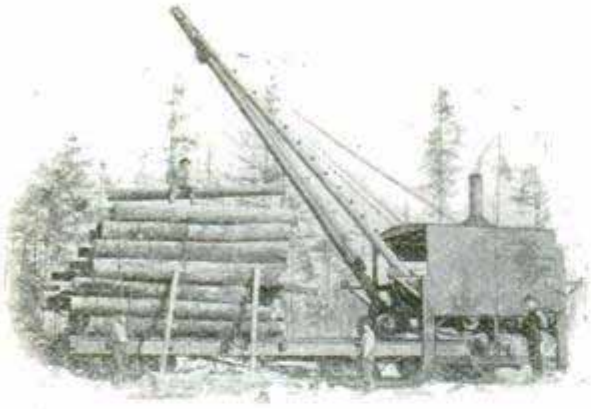
In the meantime the path of the log to the "yarding" point has been cleared of underbrush and other obstacles by "swampers." The "yarding" place is some convenient central point where the logs are collected until such time as they shall be sent to the banks of a stream or to a branch railway to be loaded on flat cars. Where a company has many miles of track threading its acreage the yarding may be done immediately alongside a railway. In conveying "yarded" logs to the railway or stream two donkey engines are used. These engines have reels wound with steel wire cable, from 500 to 3,000 ft. of ½ to 1-in. wire to a reel, and the two engines are stationed the length of the cable apart. The hook tender then fastens a heavy chain, which is attached to the cable, to the log by means of gripping hooks and the yarding engine drags the logs to the main skid road. The log is then gripped by the hooks on the cable of the other engine, and it is dragged rapidly over the road to the point desired, nothing interrupting its passage, save a break in the cable or some accident to the engine. To make a turn the cable is run over blocks fastened to trees and stumps and, at a signal from the hook tender when the turn is reached, the engine is stopped till the block is removed. A smaller cable trails after the log as it is dragged along and by this the yarding engine draws back the cable from the landing engine.

Time was when these same engines were used for loading the cars, but now the ideal loader runs on the railway track and the loading is accomplished much more rapidly. This engine is self-propelling and the largest size will handle logs scaling up to 2,000

The Fellers with Their Saw and Two-Edged Axes



Showing Donkey Engine and Cable



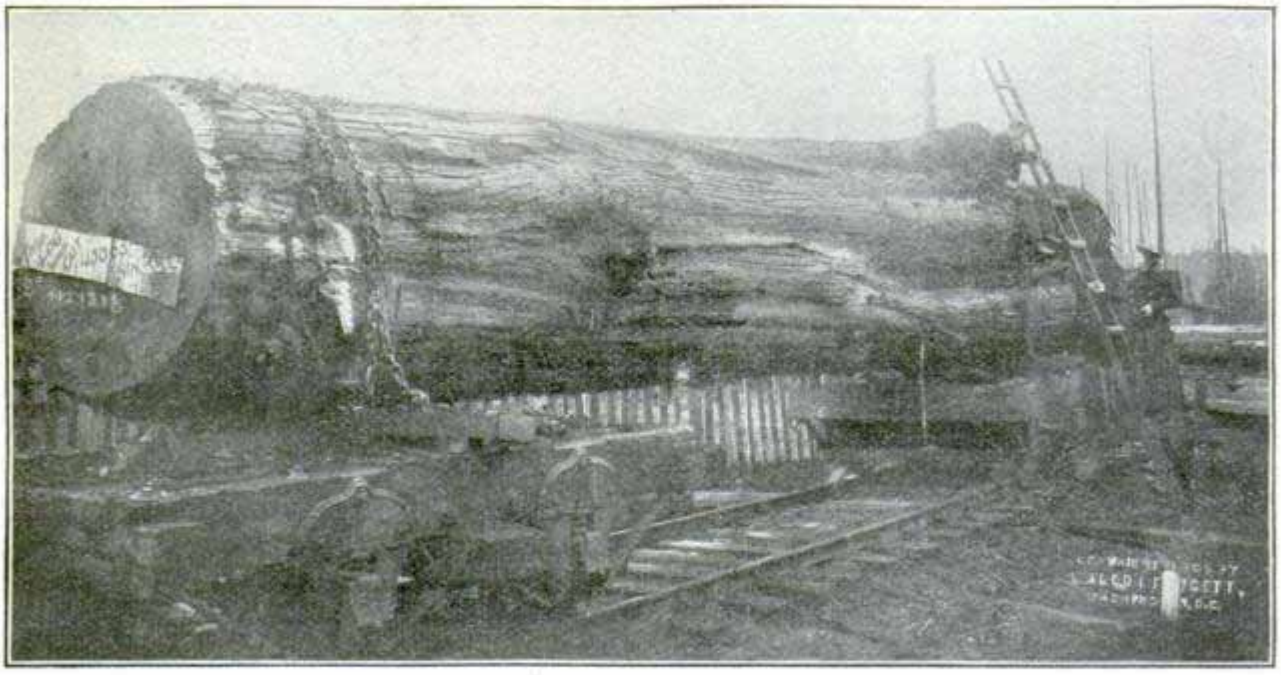
Loading Flat Cars

ft. and not longer than 60 ft. Its power apparatus consists of a double cylinder hoisting engine with two friction drums and ample boiler capacity. The hoisting gear includes a heavy swiveled boom block with attachments, ⅞-in. steel wire guy lines, 150 ft. ⅝-in. steel wire hoisting rope fitted with hook, pull-down ropes, crotch lines and bunch chains. The loader is constructed to allow empty cars to pass under it. Each axle is hung in a frame which supports the car and this frame-support is hinged at the top on a large shaft attached to the under side of the deck. The frames may be swung outward and up by means of wire cables extending over wheels at the end of the platform. The car settles on shoes at the base of corner legs and the track beneath it is clear.

In loading cars the loader pulls a train of "empties" to the first skidway, the wheels of the machine are swung up, the spotting cable is run under the engine back to the second car and they are all pulled forward until the first car is in position under the boom. When loading regular flats, after the front end is loaded the car is hauled forward so that the rear end may be loaded, and so on through the whole string of cars. Logs may be dragged from each side of the loader at the same time, often from a distance of 1,000 ft. They are skidded right up to the car and then the skidding tongs are transferred to the center of the log, or if there are two pair, a pair to each end, which plan holds the log much steadier and makes it easier to place it in position. The great improvement in method is shown in an instance where a log scaling 2,000 ft. was skidded by the loader over 500 ft. of rough ground and loaded on a car in just 15 minutes. The same task would have given men and horses five or six hours hard labor to accomplish.

Steam is the power on both donkey engines and loader and a pack horse is usually kept busy all day carrying water. The average daily record for the loader is from 100,000 to 125,000 ft. It's operation requires an engineer, a top loader and two hook or ground men. Logs can be loaded from the water, from a high bank, or from a ditch. The load is fastened on the car by chains and at last the long train of loaded cars is ready to be hauled to a main line—the load requiring a good strong locomotive.

The logging locomotive is to the woods'



A Huge Log Felled in the Northwestern Forests

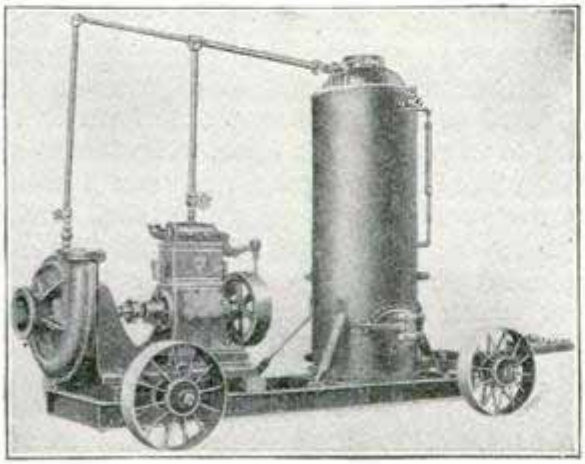
Log Held Steady While Loading by Tongs at Each End

crew what the private carriage is to the citizen. It frequently carries him to and from his business; it conveys the camp cook and provisions, and it is fired by the ever-abundant fuel—wood, which, if necessary, may be replenished at almost any point on the line.

A PORTABLE PUMPING ENGINE.

The portable pumping engine shown in the illustration has entered upon a wide field of usefulness. Contractors find it especially convenient in pumping water out of excavations and it has become an essential feature of the equipment of the fire and street departments of many cities, where it is used for draining cellars and pumping out sewers and street excavations.

With an electric motor directly connected to the pump, in place of the engine and boiler, the apparatus becomes even more efficient, and where an electric current is available the motor is frequently substituted The machinery is arranged low and built especially strong, so that transportation over rough ground is rendered safe.

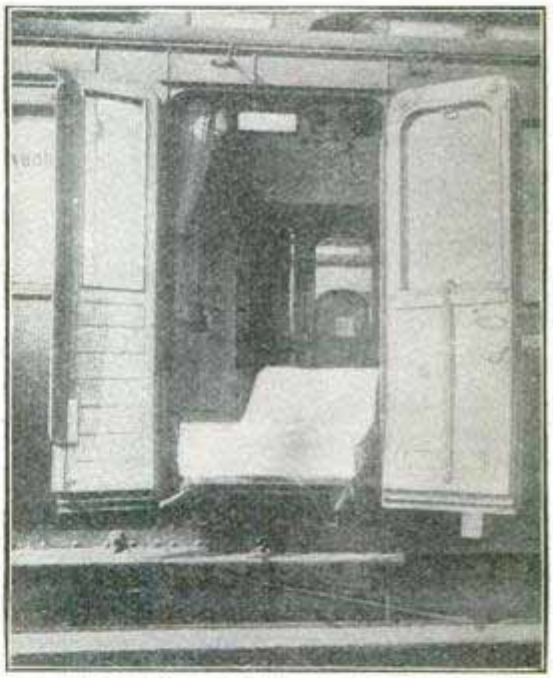


For Pumping Out Excavations

HOW INVALIDS TRAVEL ABROAD.

English and German Lines Provide for Their Comfort.

Invalid compartments for fast passenger trains is one of the features of transportation that is receiving considerable attention abroad. English coaches are now provided with a special hammock which is kept in the guard's van and may be swung at a moment's notice in case of accident or illness. One German line has provided a more elaborate system and has introduced forty special carriages, which resemble ordinary carriages, except that two compartments are arranged with a cot and a shelf for medicine, water, etc. The doors are wider, also, so that the bed may be admitted through them. Specially qualified attendants are engaged for these compartments.



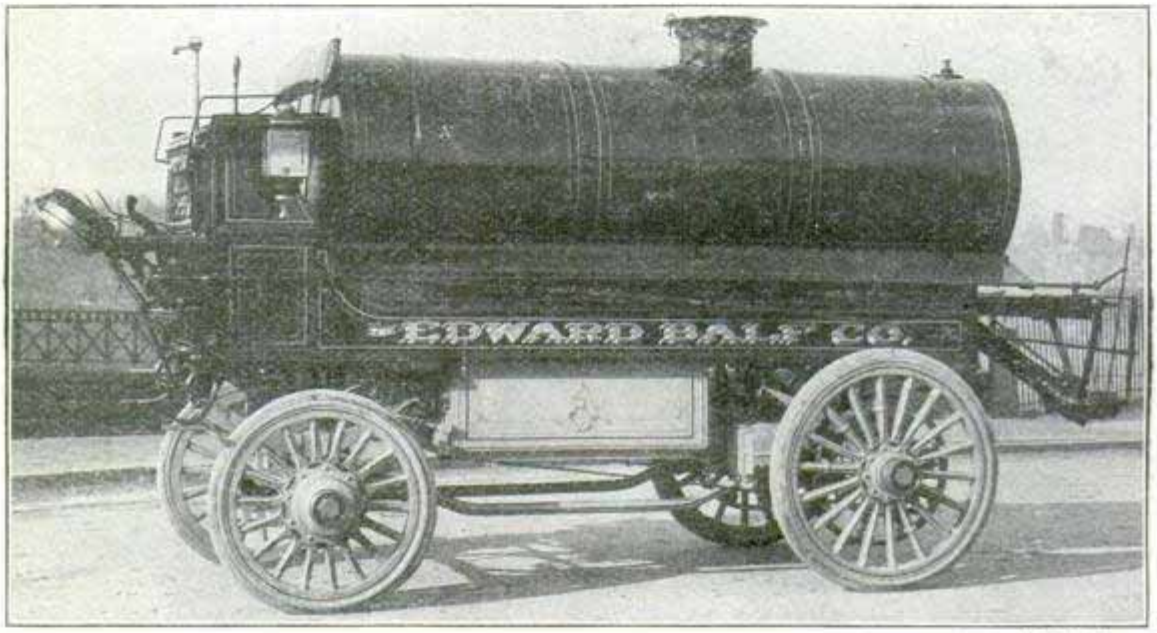
Compartment for Invalids on German Railways

MOTOR STREET SPRINKLER SUPPLANTS FOUR HORSES.

Along with the motor fire engine, motor police patrol, motor disinfecting machine, etc., comes the motor street sprinkler, the first one now being in regular service at Hartford, Conn., and already accredited with a promising degree of success.

In general style the sprinkler resembles the ordinary build of the horse-drawn sprinkler. The iron water tank is of the usual boiler pattern and has a capacity of 600 gallons. This tank is mounted on a medium-weight truck chassis, power being derived from an underslung Exide battery of 44 cells. There are two motors, normally rated at from eight to ten horsepower, and the normal speed is six miles per hour. The machine covers from 30 to 40 miles daily in actual use, or about twice the mileage of a two-horse sprinkler with one change of horses; in other words, the machine does about double the work of four horses. It is in the elimination of the horse that the motor sprinkler obtains its greatest advantage. At times when the sprinkler cannot be used on account of the season or wet weather the owner is not obliged to maintain horses in idleness, thus deriving no profit from his expense, as he would in the case of the old vehicle.

For use on the paved streets of the city motor vehicles are admirably adapted and it is now but a matter of a short time until they shall be installed for many forms of municipal service. The results with the electric street sprinkler, however, it is said, do not warrant the sprinkling company's disposing of their horses and horse-drawn carts immediately. The cost of maintenance will be watched very closely and compared with the old figures; on this basis the actual efficiency of the motor sprinkler will be determined.



Courtesy of The Electric Vehicle Co.

Motor Car That Sprinkles 40 Miles of Road Per Day

NEW PROCESS FOR MAKING BRICK.

An English gas light and coke company have invented a process utilizing two of their by-products, clinkers from the furnaces and spent lime from the purifiers, in making brick, reports United States Consul Stephens, of Plymouth, England.

The proportions of the materials used are about one-fourth lime to one of clinker, and the two are mixed and then raised into a calcining tower and converted into carbonate and silicate of calcium. It is then slaked with water and two more parts of clinker to one of calcium material is added. The proper amount of water is added and the mixture is passed through a tempering mill. After that it is carried to a platform and delivered to a toggle press, out of which the brick is turned in soft form. The bricks are then placed on wagons and run into an "auto clave," a large tubular vessel, having capacity for 7,000 brick, in which they are subjected to 110-lb. pressure for 12 hours, after which they are stacked ready for sale.

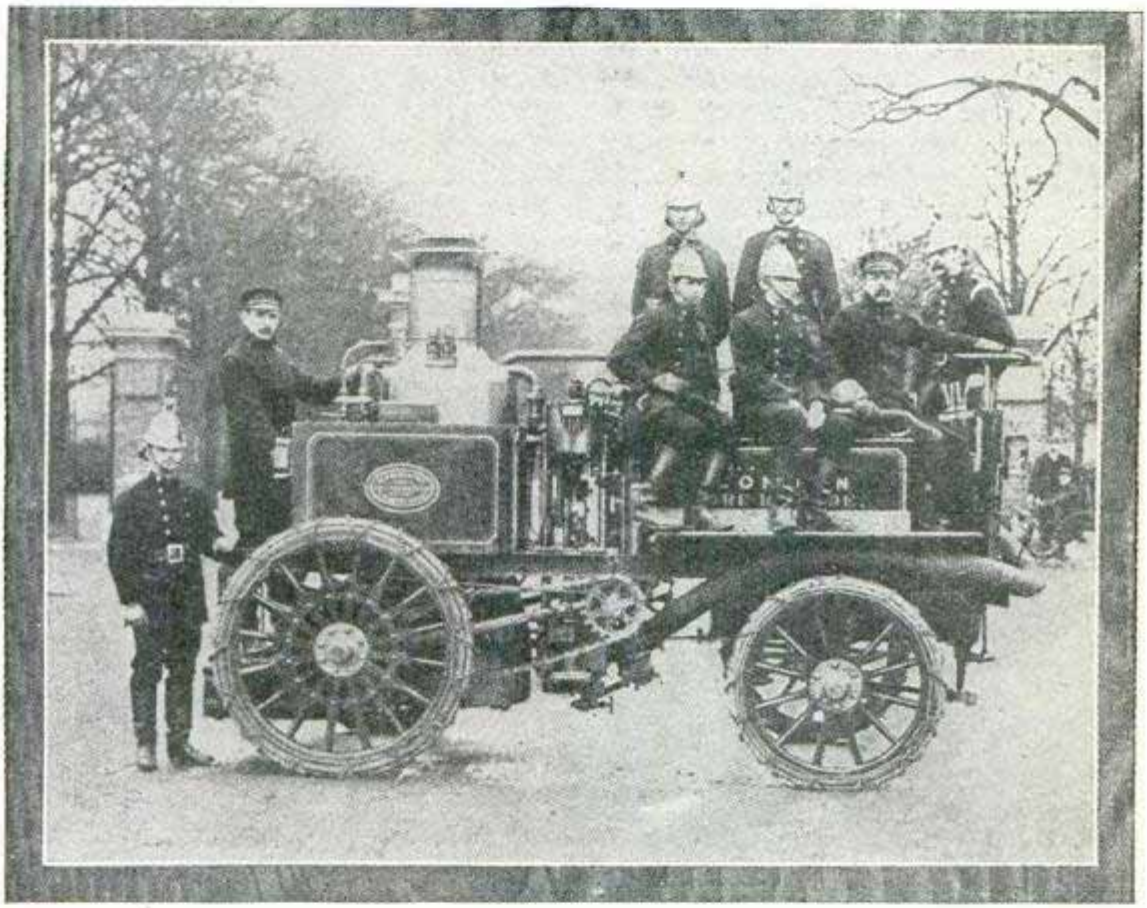
The resisting strength of these bricks is 350 tons to the square foot and the absorption of water is very small—about 4½ or 5 per cent. They have successfully withstood tests of alternate freezing and thawing and also acid tests.

MOTOR STEAM FIRE ENGINE FOR LONDON FIRE BRIGADE.

The London fire brigade has just been provided with a motor steam fire engine of 50 hp. capable of throwing 500 gal. of water per minute to a height of 150 ft., and the most powerful of its kind in that city.

The boiler of the engine is fitted with a petroleum burner of new pattern and produces steam very quickly. A pair of inverted steam cylinders driving two direct and double-acting pumps comprise the machinery, which is placed vertically between the frames in front of the boiler. The power for propulsion is taken from a crankshaft on this engine, says Technics, London, by putting a counter-shaft into gear, from which the road wheels are driven by a pair of steel roller chains running over sprocket wheels. Only one set of machinery is required for propelling and pumping, as it is possible to connect or disconnect the pump pistons from the engines in a few seconds. A hand-wheel with irreversible gear is used for steering and levers for steam, reverse and brakes control the engine. There is a large hose-box and the machine will carry eight firemen and an engineer. The road wheels are of the artillery pattern, with steel rims and solid rubber tires.

Engines of similar type have been installed in many of the important English cities.



The Powerful Motor Fire Engine of the London Fire Brigade

ACETYLENE USED FOR BLASTING.

Acetylene has not met expectations for lighting purposes in Germany, according to leading papers there. U. S. Consul-General Guenther, at Frankfort, announces a new use for calcium carbide. It can be used as an explosive, the process being a very simple one.

By means of an air mixture explosive force is obtained which can compete with that of powder and dynamite. The explosion takes place in an air chamber and is caused by an electric spark. For this purpose carbide of calcium is reduced to small particles and put into a cartridge, consisting of a tin box. In this the carbide lies at the bottom and above it is a partition filled with water. Above this is a vacant space

with the electric percussion device. On the side of the cartridge is an iron pin by means of which the partition between the carbide and the water can be perforated. After the drill hole has been completed the cartridge is placed in it and the hole is closed with a wooden stopper. Then the protruding iron pin is dealt a blow, by which the partition is perforated and the water is caused to come in contact with the carbide, whereby acetylene gas is generated. This mixes with the air of the drill hole. After five minutes the gas is ignited by an electric spark.

By this method of blasting the rock is said to be not thrown out, but rent with innumerable cracks, so that it can be easily removed afterwards. About 1.7 ounces of carbide, which produce about 16 quarts of acetylene gas, are used for each cartridge.

The Electric Funeral Car

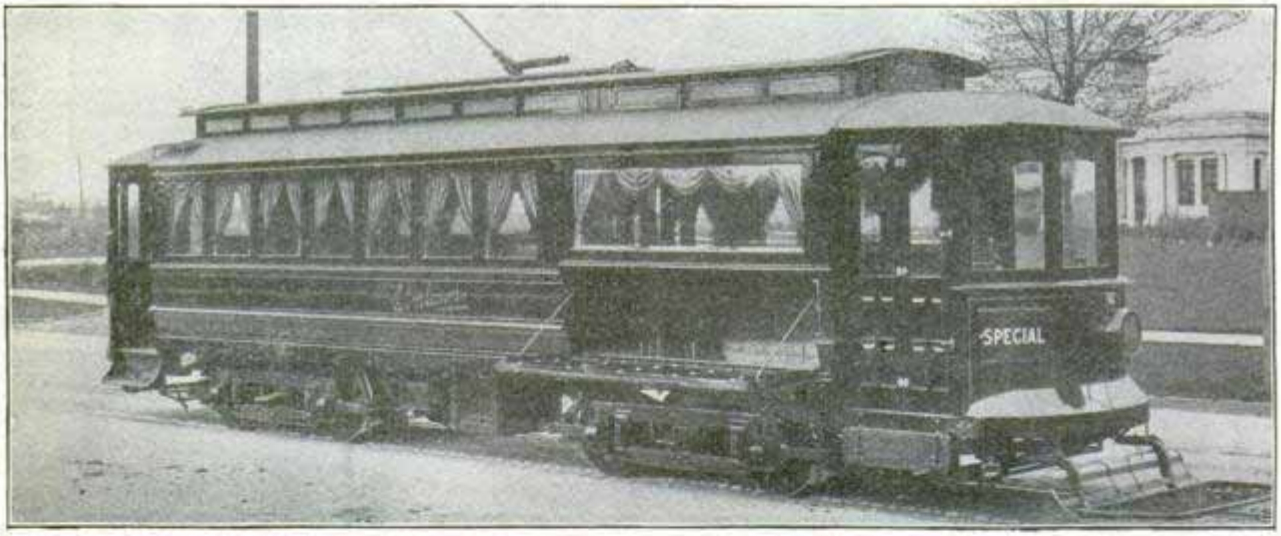
Has Many Advantages Over the Old Way

The electric funeral car is the latest departure in street railway equipment, and affords many advantages over the old method of traveling to the cemetery in carriages. The car is run to a point convenient to the house, at a pre-arranged time. The privacy, speed, and warmth in winter of the conveyance combine to relieve what is often a trip dangerous to health, especially of people advanced in years. The expense also is said to be less, placing the conveyance within reach of a large number of persons.

The International Railway Company of Buffalo, N. Y., at the request of undertakers and the public generally has constructed a car of special design for the sole purpose of carrying funeral parties to cemeteries in the neighborhood of Buffalo and surrounding cities. The car was built in the shops of the company, and as it now stands is divided into two separate compartments.

The front and smaller of these contains the casket compartment, which is accessible only from the outside of the car, and a longitudinal seat for the pall-bearers and chief mourners. The other compartment is arranged similar to the regular passenger car with cross seats capable of holding thirty-five persons.

The casket receptacle is 8½ feet long and 32 inches wide, and the top comes to the level of the window rail, leaving plenty of space above for floral contributions. Access to the casket compartment is had through a door from the outside, hinged at the bottom as may be seen in the illustration. In placing the casket in the car the door is let down, a sliding shelf is drawn out and the casket laid upon it; after being fastened by several pegs the shelf is pushed back again and the door is locked.

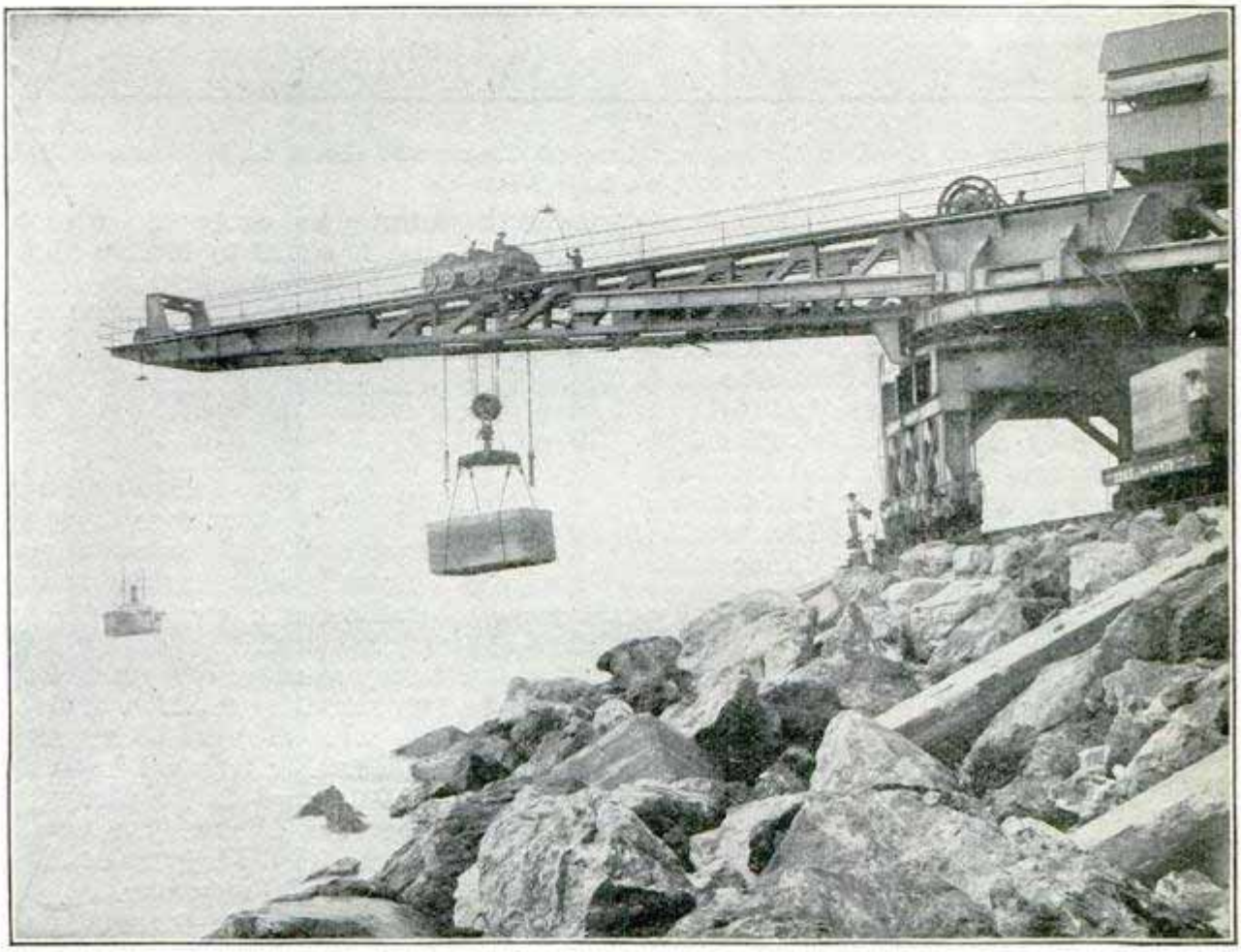


Electric Funeral Car Used in Buffalo

The exterior and interior of the car is finished in a dark green with heavy draperies at the windows and doors. A charge of from $25.00 to $35.00 is made for the use of the car, and, says the Street Railway Journal, the greater comfort, privacy and convenience of the funeral car as compared with horse-drawn coaches seem to be appreciated by the public.

Mexico to Compete with Panama Canal

Isthmus Railway Shortens Haul 1,000 Miles or More--Saves Four Days' Time--Cargoes Must be Transferred



Immense Electric Crane Used in Building the Breakwater

Mexico will compete with the Panama Canal, not with a water route, but with a steam railroad. President Diaz is the moving spirit and is pushing the work with relentless energy. Already the track work is completed, and the terminal harbors are being constructed to equal any in the world.

The road is 125 miles long, connecting Coatzacoalcos on the Atlantic side with Salina Cruz, the Pacific port. At both places enormous breakwaters are being built far out into the ocean, and great wharves, some of stone and others of steel are nearing completion. When the plans are worked out a great fleet of the largest ocean-going steamers can tie up and all unload at the same time.

It has remained for the present administration to execute a very old idea. As long ago as the sixteenth century a survey for an isthmus canal was made over the route of the present railroad, and from time to time during the succeeding years new plans and re-surveys have been made. Wars and changes in administration have always prevented the completion of any of them. Mexicans, Englishmen and Americans have in turn been granted concessions, all of which resulted in failure.

In 1881 James B. Eads, the great American engineer, planned a ship railway by means of which loaded vessels were to be floated into a great cradle resting on wheels, and to be drawn by locomotives across the isthmus on a railway of several rails, and again floated at the farther terminal. This would have obviated the transfer of the cargo as will now be done. Eads was very sanguine of success from an engineering standpoint, and was granted a concession. The magnitude and cost of the undertaking, however, discouraged

Terminal Harbor Under Construction at Coatzacoalcos to Be One of the Finest in the World

financiers, and this plan, too, was finally abandoned after considerable money had been spent in preliminary work.

The concession under which the present construction has been done, was executed May 31, 1904, with the English firm of S. Pearson & Son. This concern took over the railway already in operation, completed the gap necessary to finish the line, and began the harbor work, which is already well along toward completion. The working agreement runs for 51 years, during which the net profits are divided between the government and the Pearsons. For the first 36 years the government receives 65 per cent, the contractors 35 per cent. Thereafter by periods of 5 years the government receives more until during the last 5 years it is to have 76½ per cent.

The track is of standard gage, of 80 lb. rail, laid on creosoted pine, native hardwoods and California redwood ties. The bridges are steel, the grades and curves easy; the highest point is only 760 ft. above sea level. The road is very picturesque in places, winding through lofty canons which rise abruptly for 5,000 feet.

The road is the first in Mexico to burn oil in its locomotives. This oil comes in tank steamers from Beaumont, Texas, and is 30 per cent cheaper than other obtainable fuel. Storage tanks at the Atlantic terminal constantly contain 1,500,000 gallons; local supply stations along the line are kept filled. Oil has been found on the isthmus, and is expected in the near future to furnish the supply. Native oil is already sufficient to run the company's machine shops.

Immense electric cranes are now being erected for discharging and loading vessels in the quickest possible time. These cranes will transfer direct from the ship's hold to cars, or through hatches in the roof into the warehouses. The terminal yards are very complete; in fact everything has been planned with the main object of saving time.

The saving in sea travel by using the isthmus railway as compared with the Panama Canal, is stated by Modern Mexico to be:

New York to San Francisco.....	(miles)	1,182
New York to Sitka.....	"	1,208
New York to Yokohama.....	"	1,227
New York to Honolulu.....	"	1,139
New Orleans to San Francisco....	"	1,854
Liverpool to San Francisco.....	"	797
Liverpool to Honolulu.....	"	865

As the average freight steamer makes 250 miles a day there is about four days' difference in favor of the isthmus railway, allowing two days for unloading and re-loading on the railway and one day for passage of steamer through the Panama Canal. Of course there are many cargoes which it would be impractical to transfer, and it is assumed there will always be a waiting steamer at the farther terminal to receive the goods, and destined to the port of delivery. In the case of getting a warship or other vessel across the isthmus of course the canal would be the only way.

It is estimated the cost of canal tolls, say, $2,000, and four days' sailing, say, $8,000, for a 5,000-ton cargo would about equal the transfer and freight charges via the railway, but there would still be the saving of four days' time.

President Diaz recently completed a tour of inspection of the railway and harbor works, and was well satisfied with results already accomplished and progress being made.

PANAMA CANAL CONSTRUCTION.

Construction work on the Panama canal will be actively pushed on the same business principles which characterize railroad operations. The President has reorganized the canal board and placed in charge an experienced railroad man, Theodore P. Shonts, who says "Direct business methods, publicity, and absolutely no politics—this is the keynote of the policy of the Panama canal commission. We are all pitching in with our coats off, and

there will be no time lost either now or in the future."

As a graceful compliment the government has sent an invitation to England, France and Germany to furnish each three

Theodore P. Shonts

engineers to assist our own engineering department in an advisory capacity.

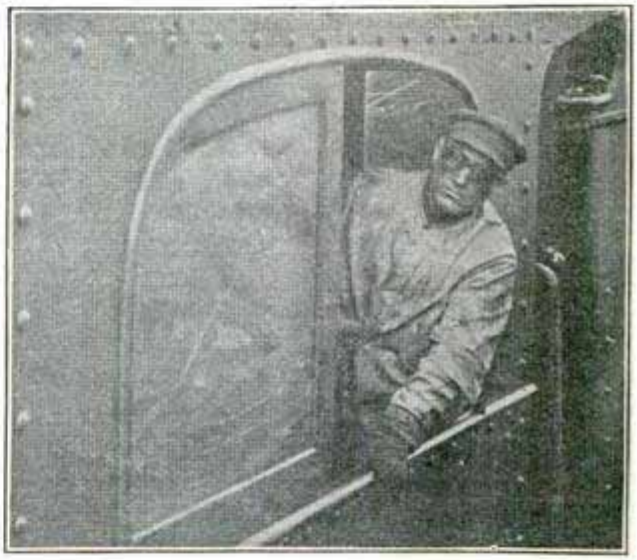
TO AVOID RISK OF ACETYLENE EXPLOSIONS.

There are a few facts concerning acetylene gas, which if borne constantly in mind and properly regarded will greatly eliminate the dangers of explosion with this gas. Acetylene gas is of the same weight as atmospheric air, consequently it cannot be removed from a receptacle by merely opening the receptacle, nor even by forcing air into it, but the gas and air combine to form an explosive. For this reason a light should never be brought near acetylene apparatus which is being cleaned; repairs of a vessel that has held acetylene until it has been filled with water should not be made with a soldering iron or flame. A person smoking tobacco should not approach the acetylene.

Acetylene gas apparatus should not be made of zinc, as this metal is especially subject to the action of the gas, and two years is sufficient to disintegrate it and leave it full of small holes. Galvanized iron, or black iron galvanized after it has been made up, is advised as a suitable metal, and the apparatus should be most carefully tested, as the lowest explosive limit of this gas is 3 per cent acetylene and 97 per cent air.

GOGGLES FOR LOCOMOTIVE DRIVERS.

Engineers on the Chicago and Alton Railroad system now protect their eyes by the use of automobile goggles. The goggles were first tried by Engineer Frank Benjamin, driver of the fast passenger train running between Chicago and St. Louis and known as the "Hummer." The engine is a monster, with driving wheels 7 ft. 2 in. in diameter and capable of making a speed of 70 miles an hour under ordinary pressure. At the top of a certain grade on the line where the highway runs parallel with the track, automobilists often wait for the fast train and race with it. It was at this time Benjamin realized that the automobilists had one point of advantage—their goggles—while his eyes were filled with dust. The next run when Benjamin poked his head



Engineer Benjamin Wearing His Goggles

out of the cab window, he also wore a pair. The goggles are an important innovation among the engineers on the Alton, and when they come in from a run with grimy hands and faces, the clear white disk around the eyes testifies to the protection afforded by their use.

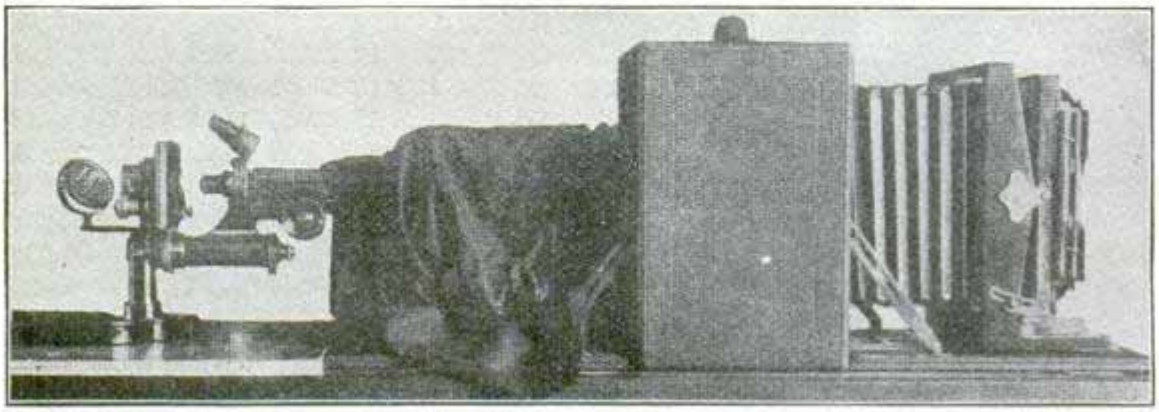
UTILIZING BLACK SMOKE.

Black smoke is utilized in many Belgian factories instead of being allowed to pass off into the open air, says the Journal of Gas and Sanitary Engineering, London. Fans drive the smoke into a porous receptacle, over which flows a stream of petroleum or other liquid and the smoke is converted into gas. This gas gives a high heat and is used for running gas engines.

HOW TO TAKE MICROPHOTOGRAPHS.

Any photographer can take up the branch of microphotography without putting a large sum into special apparatus. Ordinarily the photographer considers that this branch involves an outlay of about $300 and then a year's time spent in learning to run the machinery successfully. He is deluded! Microphotographs can be made with an ordinary camera—any camera which has a ground glass for focusing will serve.

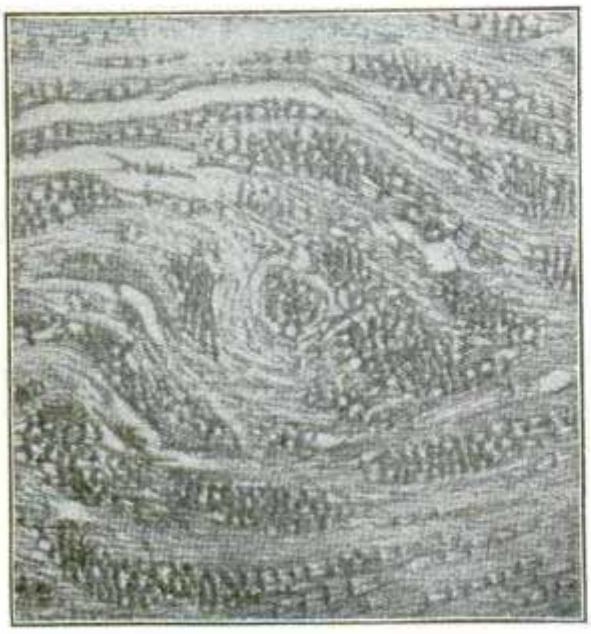
Mount the object to be photographed and place it in a compound microscope in the usual way. Bring down the microscope tube till its axis is horizontal and place the substage reflector so as to throw a strong light through the section. Then place the camera directly back of the microscope, so that the camera lens is within a half inch of the microscope eyepiece, the axis of the camera lens coinciding with the lens in the microscope as nearly as possible. An image can be secured without either camera lens or microscope eyepiece, or without both, but more satisfactory results are secured with these lenses in place. Cover the juncture of the camera and the microscope with black cloth. This too can, on occasion, be dispensed with.



Arrangement of Camera and Microscope

To locate and focus the image on the ground glass, the substage reflector must be adjusted so that it gives a strong and even illumination all over the field and both microscope and camera must be focused. These last two operations can be combined at times, to an extent, and after a little practice exact focusing becomes an acquired habit, and with the naked eye a minute difference in microscope focus can be discerned.

Anything that can be seen in the microscope can be photographed on the plate in this way, and sometimes the effect in the photograph is better that that which was impressed on the vision. The quality of the work is equal to that produced with expensive machinery. The illustration gives an example of the results obtained with this apparatus. The subject is an indifferent section of wood tissue, unstained, and prepared not at all. It is magnified 1,000 diameters and the pitted wood cells of the ducts are plainly visible.

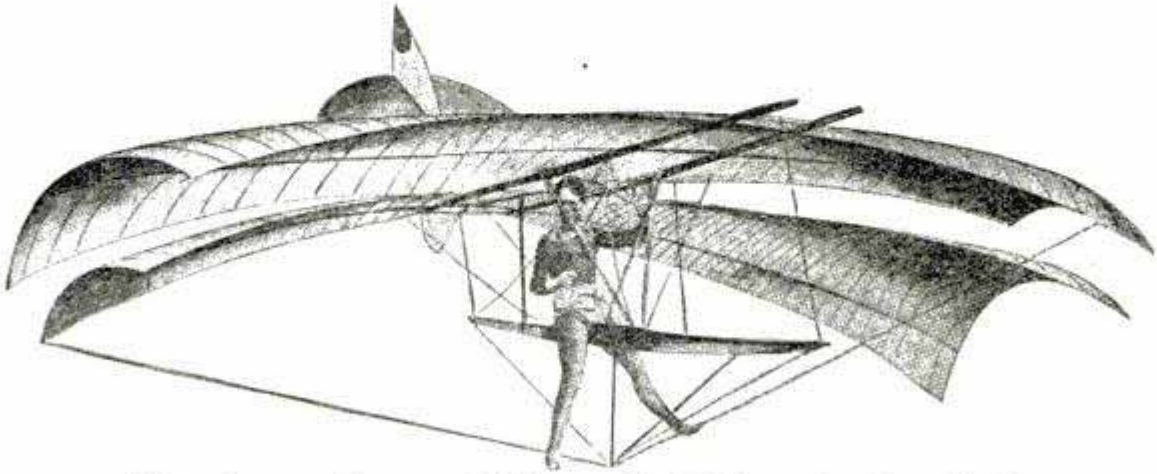


Section of Plum Graft

During a recent voyage when a heavy fog had shut down and rendered navigation perilous, the liners "Kaiser Wilhelm II" and the "Teutonic" were warned of the latitude and longitude of many huge icebergs by means of wireless telegraph messages sent from the Cunarder "Caronia." Wireless telegraphy is destined to find its most important field in rendering the navigation of the seas less perilous.

Plunges Into Space 4,000 Feet Above the Earth

Most Daring Test of Flying-Machine Ever Made—Machine with Operator Towed up by a Balloon and Cut Loose



"Cut Loose from a Balloon 4000 Feet in the Air"

Cut loose from a balloon 4,000 ft. in the air and under the guidance of a skillful aeronaut, Professor John J. Montgomery's birdlike aeroplane made a successful and spectacular flight at Santa Clara College, California, a few days ago. The machine which weighs but 42 lb. disported itself with something of the grace and buoyancy of a wild bird, though its wings sustained the weight of a 142-lb. man.

The aeroplane consists of four wings, having a spread of 22 ft. and built of spruce ribs with light cross ribs of hickory, upon which canvas is stretched. Each of these wings is rigid at the front, and a series of guy wires which are controlled by the aeronaut run from the frame to which they are attached to points along their sides. When the aeronaut pulls the wires one wing curves downward while the opposite wing relaxes. The four wings are operated as but two. The machine is steered by a tail which the aeronaut raises or lowers at will. When it is tilted upward the machine raises in front, or to dip downward, the tail is lowered. To alight the aeronaut raises the tail at the close of the descent and the machine assumes a horizontal position and the aeronaut may step off.

Such was the machine on which the flight was made—probably the nearest approach to flying man has ever achieved. The ascent was made by means of a huge egg-shaped balloon, which broke away from its moorings just before the appointed time and carried the aeronaut up sooner than he had intended. A great altitude was attained with startling rapidity, and at a height of something more than 4,000 ft. the aeroplane was cut loose from the balloon. It instantly settled on its wings while the performer directed it in circles, or caused it to mount or dip. Then he began steering downward, and lighted without the suggestion of a shock on a spot previously selected. The flight occupied just fifteen minutes and was carried out in every particular just as previously arranged.

CONCRETE BEAMS 102 FEET LONG.

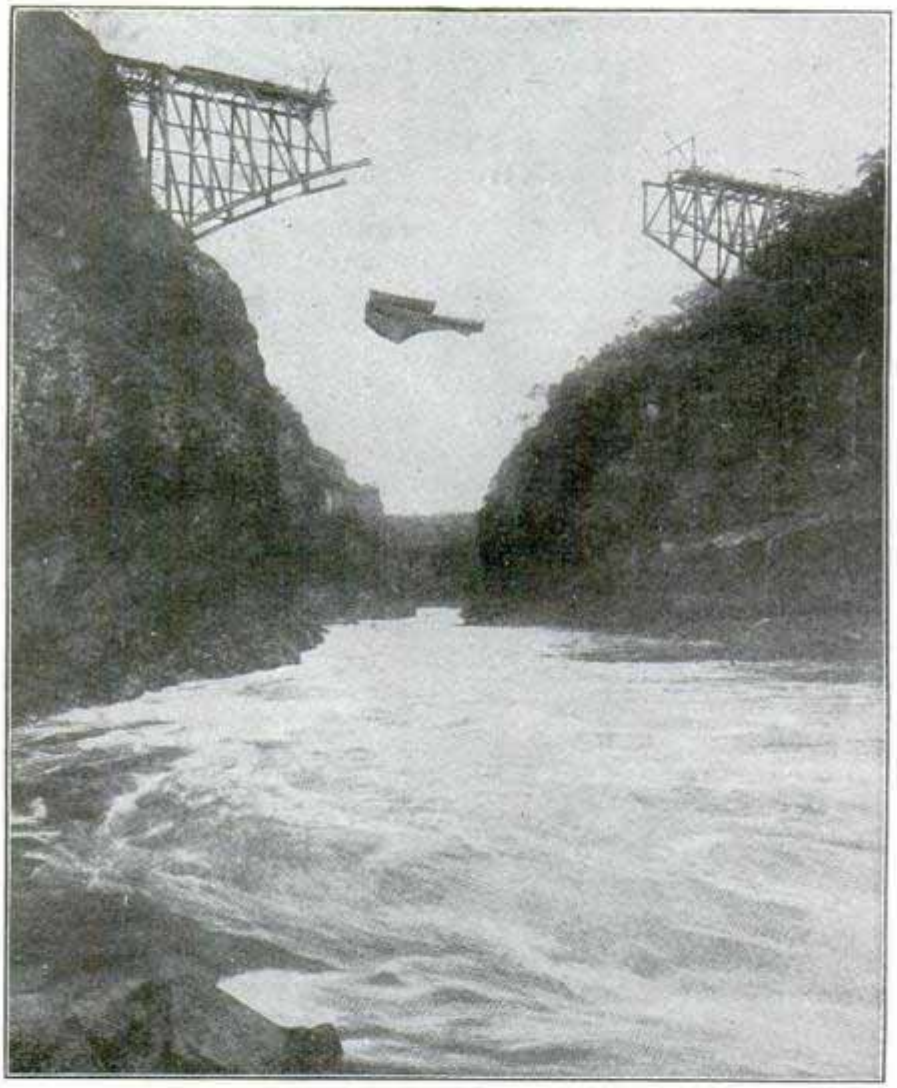
Eight huge concrete beams 102 ft. high support the roof of a concrete warehouse now under construction in Los Angeles, Cal. These beams are the largest ever made of concrete, 52 ft. being the nearest approach.

The building in which these huge supports are being used is being built entirely of concrete for experimental purposes. The walls and roof are of concrete blocks and while the front is built up of compressed brick, it is coated over with a layer of the concrete. The last beam finished supports the middle arch of the warehouse and for all its great length is less than 2 ft. thick. Iron hooks were imbedded in the huge beams before the concrete set and it is intended to attach a suspended gallery to them. It is said that when the supports were removed from the beams they had settled but sixty-eight-hundredths of an inch.—Contributed by R. W. Elliott, Los Angeles, Cal.

Building the Highest Bridge in the World

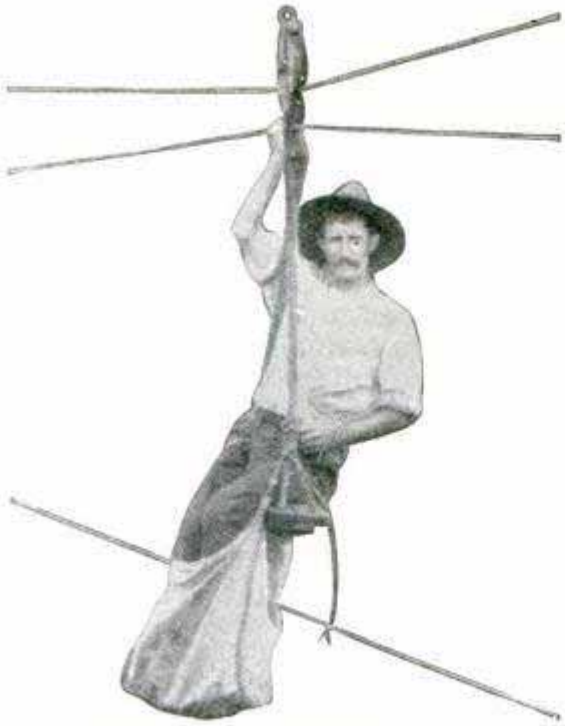
Work Proceeds 400 Feet Above the Zambezi's Boiling Pot--How the Telephone Furthered Construction

At a point on the Zambezi river, just below the magnificent Victoria Falls and where the river disappears into a deep canon, in the midst of the most luxuriant growth and beautiful scenery to be found in Africa, the construction of the highest bridge in the world is proceeding to a successful completion. In the vast solitude of an untamed country the bustling camps of workmen with their modern engineering devices have been established for some time, and already the approach spans reach out from either side like two huge arms which would fain clasp hands across the abysmal deep and link the shores of that smiling land. Just below the precipitous banks strike sheerly down 400 feet to the deep river and the "Boiling Pot" that marks its entrance to the 20-mile canon. Above the river, in mid-air, and suspended from the approach spans by wire ropes, swings the great traveling safety-net or cradle, which is to catch workmen and tools should either fall from that giddy height above.



"Suspended From the Approach Spans Swings the Great Traveling Safety Net or Cradle"

The erection of the mighty span is unique in the annals of bridge construction. Owing to the conditions presented by the deep



Crossing the Gorge in a Sling

gorge it was impossible to erect scaffolding and the structure, which is built on the cantilever principle, has been entirely self-supporting. The first means of crossing the gorge employed was by firing across a rocket to which a slender cord was attached. Then a stouter cord was drawn across, and finally a telephone wire, and telephone communication was immediately set up. The distance straight across the gorge at the point selected is only 600 ft., but the telephone saved the engineers traveling a distance of ten miles around. After the telephone wire, came a marked steel wire on which a strain was put. A spring balance which computed the sag of the wire was the means of measuring the strain. For a time workmen and tools swung out across the gorge on a strong steel cable; later an aerial electric cableway 900 ft. long and capable of carrying ten tons was provided. One of the illustrations shows the aerial car passing along this cable way.

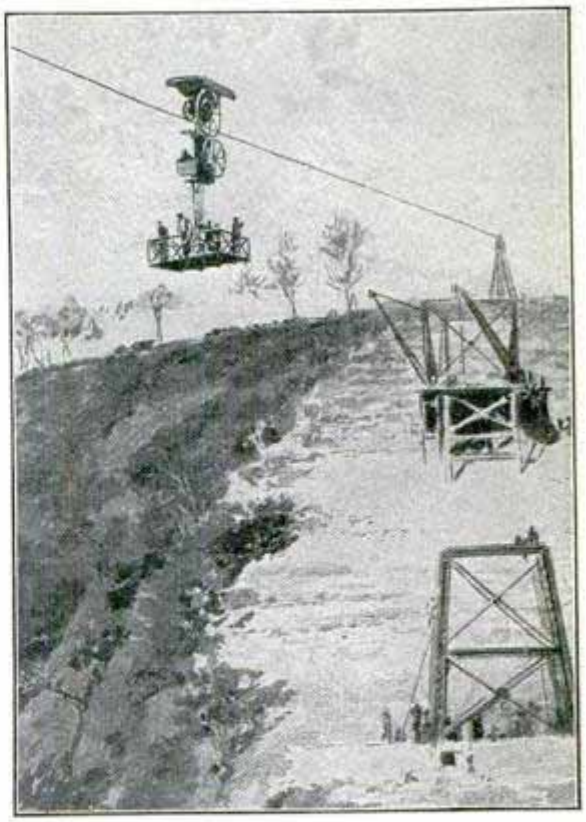
The total length of the Victoria bridge, which will form an important link in the Cape to Cairo railroad, is to be 650 ft., comprising three spans. The northern approach span will be 62½ ft. long, the southern 87½ ft. long and the main span 500 ft. The distance from rail level to low water level is just 420 ft. to high water level, 380 ft.

In design, the bridge is intended to enhance rather than detract from the grandeur of the spot. All that appears above the tracks is a simple iron railing. There are no concrete piers or unsightly towers; very little masonry is visible; the structure appears but a lattice work of graceful girders. A huge hotel is being constructed near by and an area of six miles on each side of the river is to be reserved as a public park. It is expected that the place will become a point of great interest to tourists.

The Cape to Cairo route will not be a continuous trunk line, but will comprise 4,000 miles of railroad and 2,000 miles of waterway on lakes and the Nile river.

NEW TOY FOR THE FOURTH OF JULY.

The small boy may yet be able to celebrate the glorious Fourth after his heart's desires and without danger to himself, despite all that has been said about a "bloodless Fourth." A member of the Lehigh University, it is said, has invented a toy cannon which makes a loud report and a bright flash, but cannot explode nor burn, and shoots corks only. In this toy an electric spark ignites gas and air, which causes the report and flash and shoots the cork. The flame emitted is of such low temperature that it will not scorch tissue paper. The cost of 5,000 shots by the cannon will not be more than 5 cents.

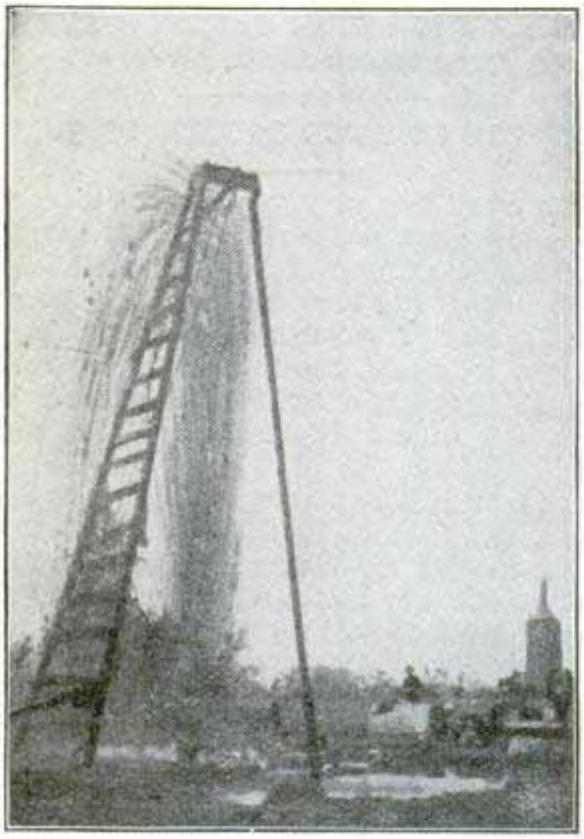


The Aerial Electric Cable Which Now Spans the Gorge

BLOWING SAND OUT OF WELLS BY COMPRESSED AIR.

High Pressure Creates Artificial Geysers—Material Spurts 75 Feet Into the Air

For removing sand from wells the compressed air method recently experimented with may prove to be superior to the sand-pump, though the method has not as yet



"With Geyser-Like Effect the Material Shot 75 Feet Into the Air"

been tried under wholly favorable conditions. The process consists in pumping up a high pressure in the receiver and discharging it through a small pipe put down into the well. By this means the sand is stirred up and carried off by the large flow of water due to the action of the air-lift. This action is so violent that any rust on the perforations is knocked off and blown out also.

Three wells of different depths and presenting different conditions were experimented with. In one water and sand shot into the air to a height of 75 ft., making a roaring noise as it came, but despite the amount of material discharged, the flow of the water remained about the same. In another having a 6-in. wooden casing fine sand poured in as rapidly as it was pumped out.

Several important facts were decided, however, says Compressed Air. To obtain good results with the air lift the well must be able to furnish enough water to carry off the sand, rust, etc., in the discharge; it is sometimes better to pump the well steadily rather than to use the discharge from the receiver. Sudden diminution of pressure on the inside of the casing is caused by a discharge from the receiver, and if the casing is old and the well's water supply small, the casing may collapse. It is not always necessary to put the end of the air pipe at the bottom of the well. With a careful study of these deductions, excellent results may yet be attained by this means.

SHOOTING THE CHUTE ON BOARD A CRUSIER.

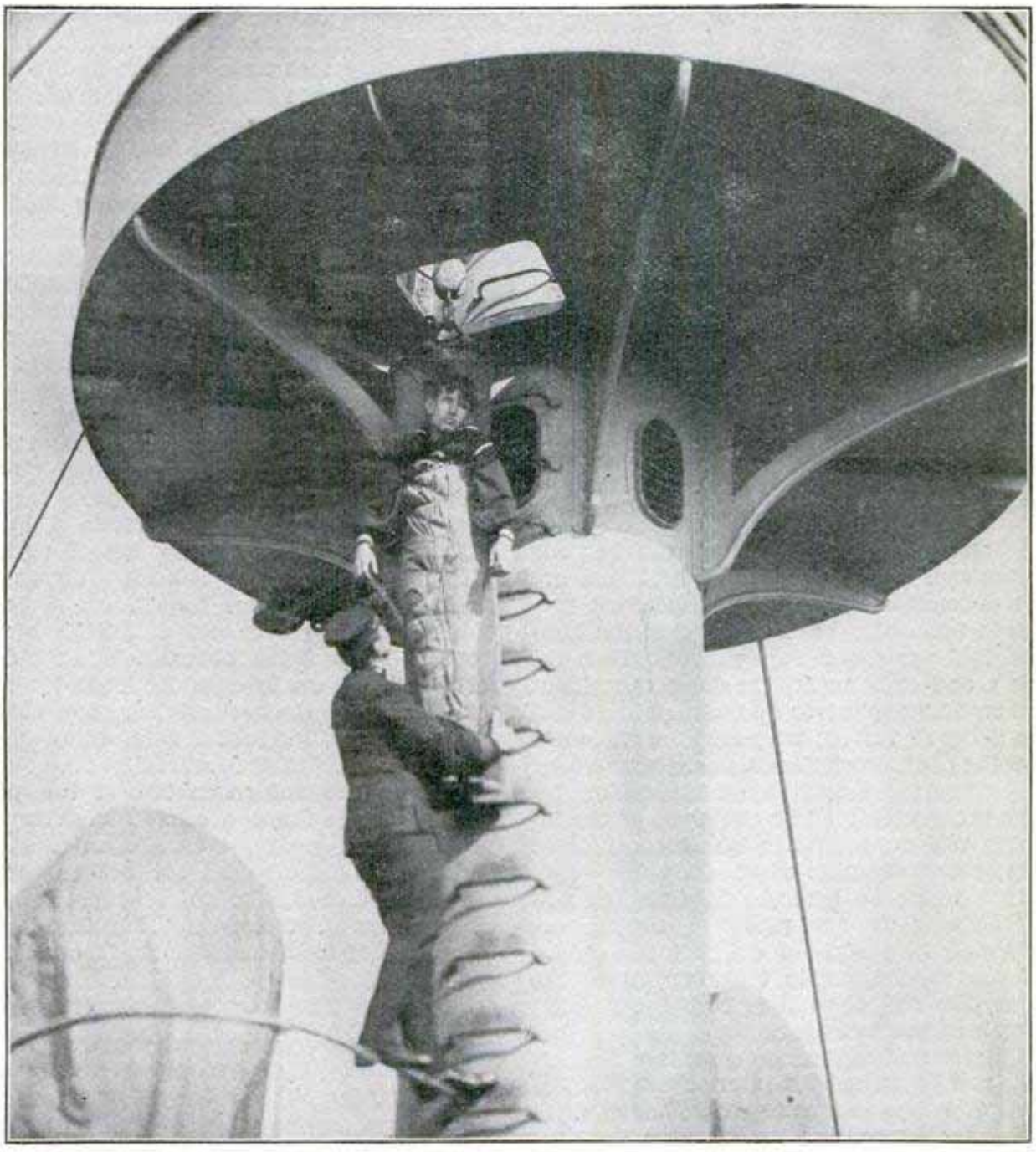
At a children's party given on board an English cruiser in the Bosphorus strait recently a canvas chute sloping from the upper bridge down to the deck was rigged up, and was the most popular amusement arranged for the children. As will be noted

Shooting the Chute

from the illustration the canvas was secured with strong ropes to the guard-rail, and then to test its safety several of the heaviest officers made preliminary slides.

The Apron Stretcher in Naval Surgery

Surgeon Lung, of the American Navy, Invents a Life-Saving Stretcher.



Injured Sailor Being Let Down From Fighting Top.

The most important auxiliary to the work of the surgeon on board a man-of-war, which has appeared in many years has been invented and tested by Dr. George A Lung, chief surgeon on the battleship "Kentucky," United States Navy. The doctor has named his device the "Apron Stretcher"; it is to be used on all the vessels of our navy, and will save not only untold tortures to many a brave sailor, but many lives. It is something which has long been needed, for nowhere are accidents more likely to occur, even in times of peace, than on a modern man-of-war.

Owing to the crowding of men in relatively small places, the employment of complex

Manner of Removal From Turret.

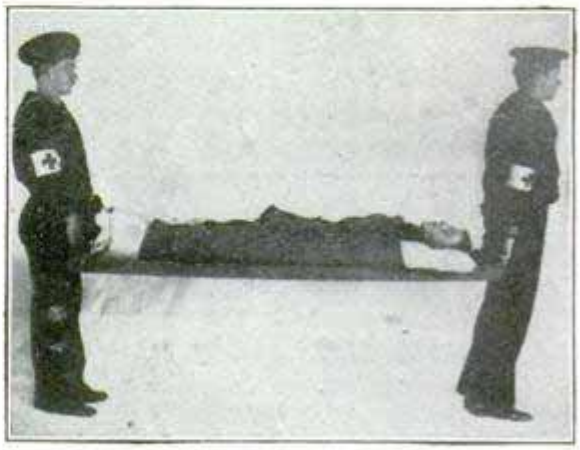
mechanical contrivances, and the hazards of unusual occupations, many accidents are not uncommon. These conditions that prevail in times of peace are aggravated a hundred-fold during an engagement. Then the hurry and excitement, the dangers incident to handling explosives and ammunition, and the firing of various weapons of war, to say nothing of the countless dangers imposed by the enemy, multiply the chances for injury innumerably. The character of the injuries will vary from slight contusions to complete destruction of the body.

In a battle on land the fighting line will probably shift its position leaving the wounded in a zone of comparative safety, but on the battleship the removal of the injured is full of peril to both the hospital corps and the wounded.

Unless one has been on a modern man-of-war and examined its interior construction he can have no adequate conception of what the naval surgeon has to contend with in his care of the injured.

With its mass of machinery, its tangle of pipes, conduits, wires, rods and hoists, its labyrinths of compartments, its maze of long narrow and often tortuous passages, its hatchways leading down to depths or opening up to lofty elevations, it is confusing in the extreme. The structure is as complex as the human anatomy. The multiplicity of barriers are as embarrassing as those artificial obstructions one encounters in an obstacle race. Even for a healthy sound man to move about within a man-of-war, such as we have in mind, calls for almost the constant use of both hands and feet, and more than ordinary agility.

There are coal bunkers into which men go, work and are sometimes injured, the only exit from which is through a circular opening twenty inches in diameter. There are military tops many feet from the deck in which men are stationed in time of battle, and while there they may be severely wounded. Access to and from these tops is through a small aperture in their floors and down many feet by perpendicular ladders, and over bridges and various platforms. There are fire rooms, whose only means of egress, especially during an engagement is a perpendicular ladder twenty or more feet in height. And so one might go on naming many similar difficulties encountered in going from one part of a ship to another. Obviously the patient cannot be treated where he is injured; the problem has always been how to remove him to another part of the ship, or to another ship. Suppose, for instance, a man has his leg broken while in the upper forward fighting top of such a ship as the "Kentucky." A healthy agile man, free handed and free footed, would come down climbing over the following structures:—Through the lubbers hole in the floor of the top, down by a ladder let in the side of the mast to the lower fighting top, thence through a similar lubber hole, and down a similar ladder to the searchlight platform, thence to the bridge on top of the pilot house, thence down a narrow stairway to the forward bridge, thence down another ladder to the fore and aft bridge, thence down another ladder to the upper deck, thence forward twenty or thirty feet to another ladder to the main deck, thence down



Ready to Carry.

Descending Steep Stairs

still another ladder to the berth deck on which the sick bay is located. Excepting the ladders on the side of the steel mast, all the other so-called ladders are really flights of stairs made of steel and inclined at an angle of forty-five degrees, and about twenty inches wide from side to side. Their sides are protected by hand ropes, that is a single rope on which one ordinarily holds in going up or down. The average man would almost prefer death to the suffering entailed in being carried down in the arms of his mates, as fireman rescue people from burning buildings.

With all these conditions in mind Dr. Lung set to work, to invent something practical, and he succeeded. His apron stretcher consists of a frame of ash, 6 ft. 4 in. long, with canvas handles on the ends and sides. The frame is covered with canvas, with a flap extending along each side which spreads out like the leaves of an open book. The patient is placed at full length in the stretcher, then the side flaps are laid over the body and fastened securely with hooks and lacing through holes in the canvas flaps. When the lacing is done the man is held as firmly as a corset holds the body, and he can be carried in any desired position, let down with a rope, or hauled up as the case may be. The stretcher incloses the entire body very much as a broken arm or leg is held in a splint. The canvas can be fastened loosely over the injured part, and the placing of the patient is the work of only a few moments. The stretcher is equally valuable for police ambulances and other outside hospital work.

Dr. Lung is a genuine fighting surgeon. In April, 1899, he accompanied a detachment of 60 American officers and men, who left Apia, Samoa, with a detachment of British marines for the purpose of breaking up a camp of rebellious Mataafa natives. The party was ambushed and all the officers killed, leaving the command in the hands of Dr. Lung. He fought his way desperately to the American consulate, which was only reached after many hours of great danger. The doctor also took part in the Boxer trouble and marched with our forces to Pekin. Later he had entire medical charge of the province of Cavite, in the Philippines, during the plague, and cleaned the towns, streets and houses as they had never before been cleaned. He holds rank as lieutenant, and has served as the President's physician.

WOOD-OIL—CHINESE PRODUCT— PUT TO MANY USES.

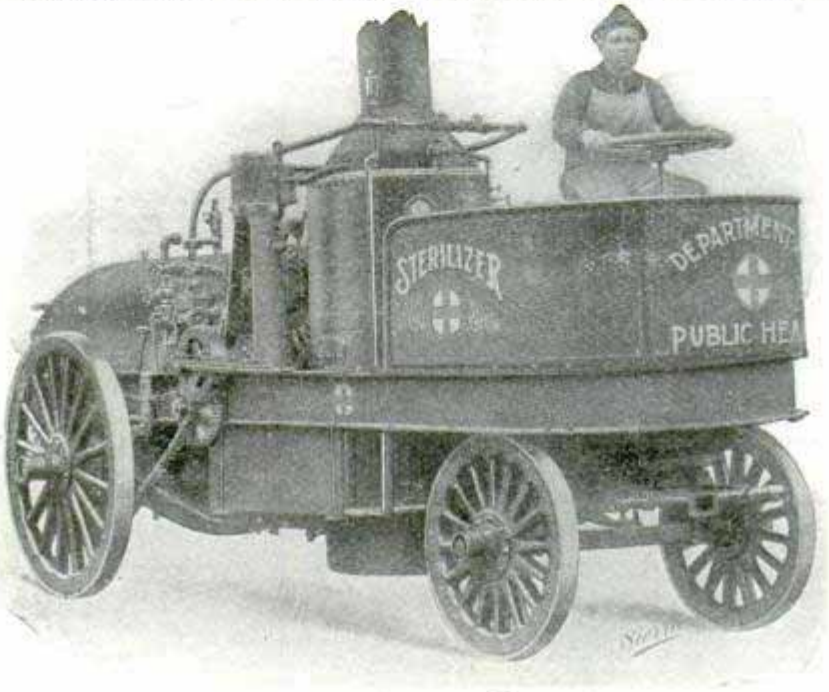
Wood-oil—produced from the nuts of the wood-oil tree of China—has found such a good market in this country for the past six years that the cultivation of the trees from which it is extracted is being experimented with here.

There are three grades of the oil, light-yellow, brownish, and black, the first being the grade used most. For polishing unpainted boats it gives the wood a bright, clean, light-yellow appearance, acts as a preservative and makes the craft impervious to moisture. Mixed with quicklime it makes a good glazier's putty. It is, also, a good dressing for leather, and makes an excellent varnish for fine furniture. It is used in soap-making also.

In this country the trees would not bear nuts farther north than Georgia or Alabama, but might be grown for shade trees and their wood in colder climes. The trees average about 20 feet in height and from 7 to 10 inches in diameter. They are very stately, with smooth green bark and spreading branches. The nuts on the tree are about the size of a small orange, and have segmented shells which burst open when the fruit is ripe. These shells contain three triangular seeds resembling Brazil nuts in taste and shape.

DISINFECTING MACHINE MAKES SHORT WORK OF GERMS.

The health boards of a number of large cities are watching with interest the results produced by a novel germ killing machine recently added to the equipment of the San Francisco Health Department. The machine which is self-propelled, is called the "Sterilizer," and whenever there is a call from an infected house, it lumbers away at the rate of six miles an hour to render clean and sanitary the disease-infested habitation.



Disinfecting Machine in Use in San Francisco

Bedding, carpets, clothing and other articles where the germs are apt to linger are loaded into a cylinder, 5 by 7 ft. in dimensions, located at the rear of the machine and then the air-tight door is swung to and secured. All the air is then drawn from the cylinder by means of a vacuum pump and steam at a pressure of 25 lb. to the square inch is turned in. By reason of the absence of air and the high pressure, the steam penetrates between every fiber of the carpets, and through the thick mattresses, doing its purifying process in a thorough manner. At the end of 30 minutes the steam is turned off, every germ having been destroyed, it is said.

When fine fabrics, such as silks and tapestries, are to be disinfected formalin is used instead of steam. A half pint of formalin placed in the cylinder forms a deadly gas which kills the bacteria in a few minutes, without injuring the articles.

MAKING CEMENT POSTS.

Farmers all over the country are learning that the cement post is the proper substitute for the old wooden ones which have always caused considerable trouble, rotting, blowing down, or being rubbed down by stock. Many farmers are now making their own cement posts. A correspondent of the Rural New Yorker, who did this, tells how he went about it. He says:

The first step is to make a mold in which the post is to be cast. This mold is nothing more than a wooden box without lid, and made in the shape you want your post. A common form is that of the old-time sawed post, tapering from the bottom to top. The sides of the mold should be on hinges, so that when the post is made they can be dropped in order to facilitate the removal of the post. The mold can be held together by means of clamps or hooks.

To prepare the cement have a strong mixing box, and into this put cement and a sharp sand in the proportion of one part of cement to five of sand. Some finely crushed stone may be used with the sand. Some use one part cement to six of sand, but the less sand you use the stronger your post will be up to about half and half. Mix cement and sand thoroughly dry, and then add water until you have the mixture in the shape of soft mortar. Lay mold down on a couple of blocks near mortar box, and in it place three or four strands

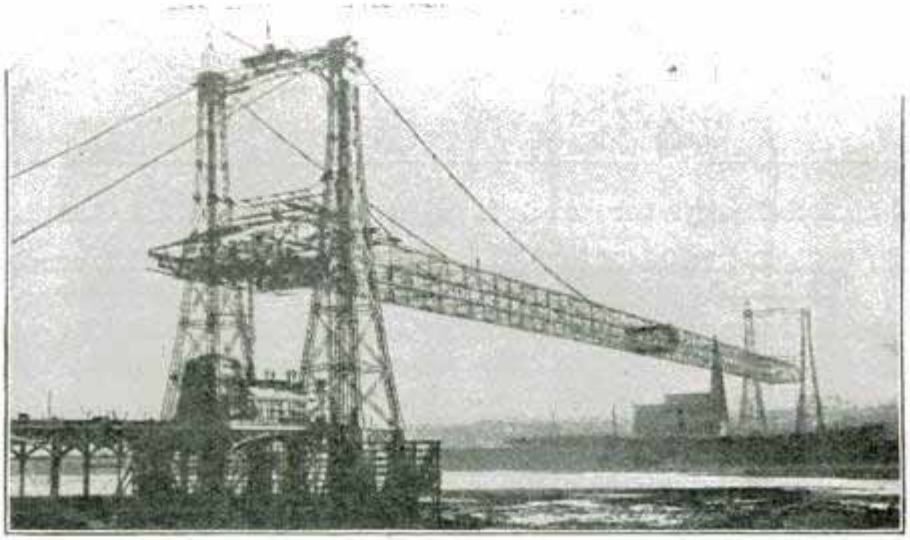
of barbed wire, bent and curved so they will run all through the post. Then fill up mold with "grout" (or sand and cement), smoothing off the top with a trowel. If you want eyes in posts to fasten fence to, take a heavy wire or small rod and make some staples which may be inserted in the post while the cement is still soft. If you do not care to wait for the cement to set it is not a bad plan to have two molds, so that one post will set or harden while the other is being made. The cement post will break off sometimes unless there is a rod or wire cast inside to give it strength. An ordinary-sized cement post will cost from 30 to 40 cents, according to price of material used in its construction.

SPARKLESS MOTORS FOR MINING OPERATIONS.

Sparkless machinery is said to be the only safe apparatus in guarding against explosions in mines. All gases will permeate throughout the most minute openings and hence it is impossible to make an enclosed motor absolutely gas proof. The Electrical Review, London, advises the use of the semi-enclosed motor as safest, that is, motors having the openings entirely closed over by a fine gauze network, rendering them dust proof, but not gas proof. It says that motors without sparking commutators are preferable and would advocate the use of induction motors for mining operations, as they are free from sparking and also stronger to bear the rough usage given them in mines.

TRANSPORTER BRIDGE 1,000 FEET LONG.

An aerial ferry or transporter bridge, 1,000 feet long in the clear, and spanning the Mersey has been opened to service connecting Widnes and Runcorn. The bridge has the longest span of any bridge in the United Kingdom designed for road traffic. The overhead truss-work is hung from two cables each containing 2,413 wires and weighing 243 tons. The truss is 18 ft. high by 35 ft. wide and allows a clearance of 82 ft. above high water, and is fixed to vertical rockers at each end to provide for expansion and contraction. The towers are of steel, 190 ft. high and rest on eight cast iron cylinders 9 ft. in diameter which are anchored to the solid rock.



An Aerial Ferry 1,000 Feet Long

The transporter car is 55 ft. long by 24 ft. wide suspended by cables from an overhead trolley 77 ft. long and running on 16 wheels. Four electric motors propel the car, power being generated by gas engines in one of the towers. Four loaded wagons and 300 passengers can be taken across on each trip which occupies 2¼ minutes in crossing. The bottom of the car is 12 ft. above the water. The bridge cost $650,000.

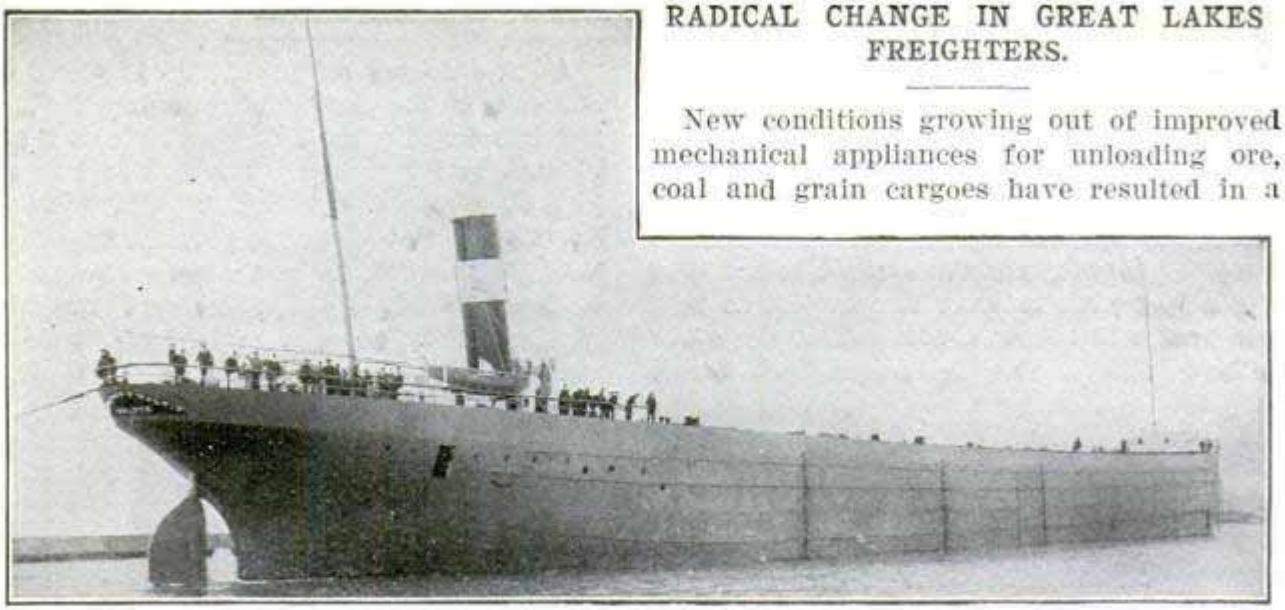
For the month of January, the total amount of traffic which passed through the Suez Canal amounted to 345 vessels and 1,038,356 tons.

RADICAL CHANGE IN GREAT LAKES FREIGHTERS.

New conditions growing out of improved mechanical appliances for unloading ore, coal and grain cargoes have resulted in a radical change in the construction of the mammoth steam freighters on the Great Lakes. A few years ago when the whalebacks came into service they displaced hundreds of sailing vessels, and now the whalebacks are to be sent to the Atlantic coast trade.

The development and general erection of the clam-shell bucket hoisting system and the unloading ports, has brought about the change in the carrying craft, just as heavier engines forced railroads to rebuild bridges and tracks.

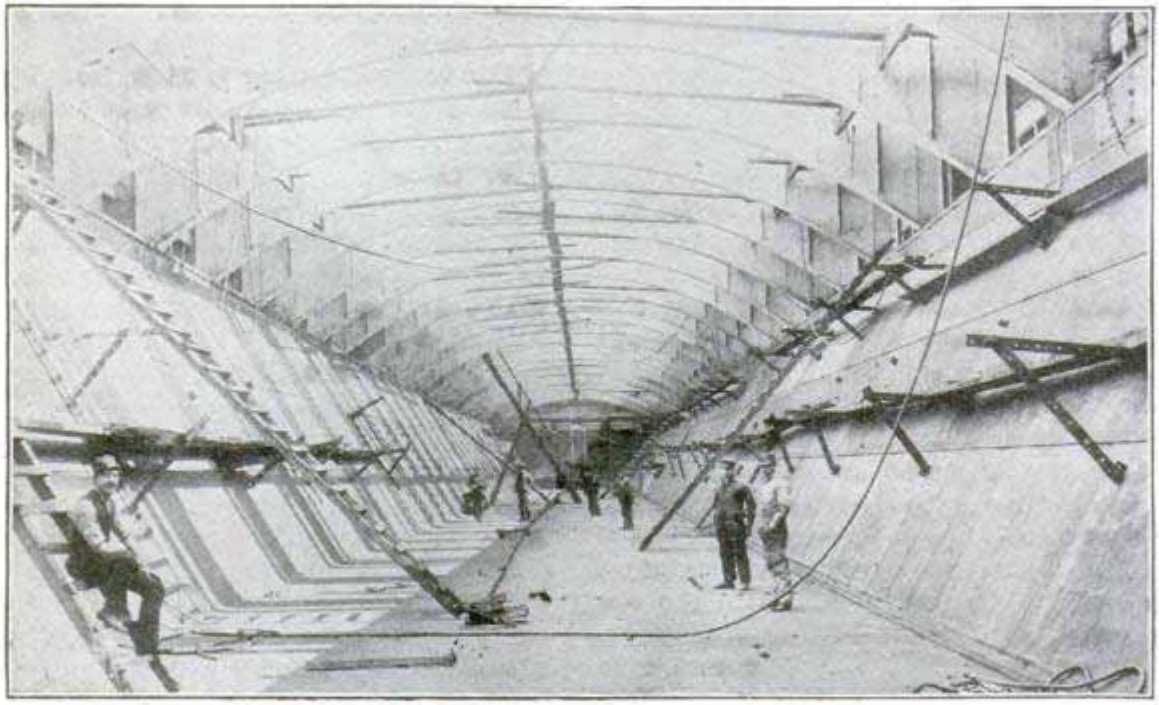
The new vessels are already nearly 600



Type of Lake Freighter which is to Supplant Old Cargo Vessels

NATURAL COLD STORAGE.

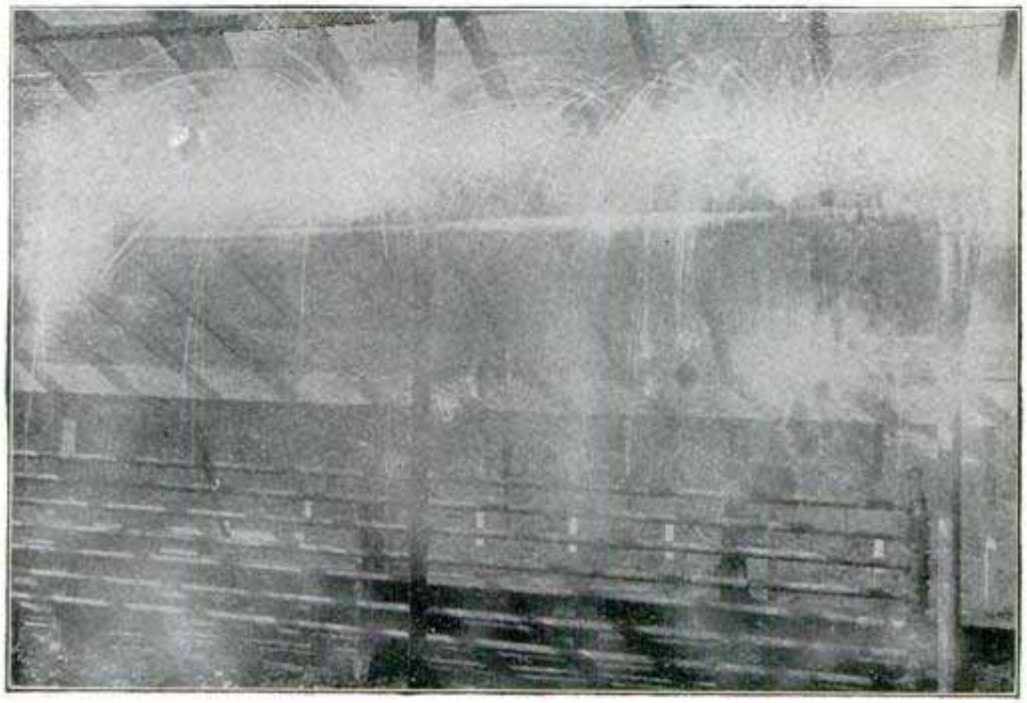
Nature has provided persons in the vicinity of Pineville, Mo., with a perfect cold storage plant. Perishable products, such as apples, potatoes, etc., placed in the entrance of a cave there, it is said, are kept in a state of perfect preservation. The entrance which is 2½ by 8 ft., extends back 75 ft. into a room 24 ft. wide and 180 ft. long, whence a draft of cool air is always pouring through the entrance. There are many such caves in this country, in some of which ice forms throughout the summer season.



Working In the Hold of the New 10,000-Ton Lake Ship

ft. long, with one large compartment usually 400 ft. in length for the cargo. This space is clear of posts and braces, the floor and deck construction being such as to avoid these obstructions and still retain the necessary strength. Space beneath the floor leaves ample room for water ballast. The interior construction is illustrated, although the small braces shown are only temporary to support platforms for the workmen. When completed the cargo space is clear from end to end. The boilers and machinery are placed at the stern. One of these boats will carry 10,000 tons.

Mechanical Watering Device for Greenhouses



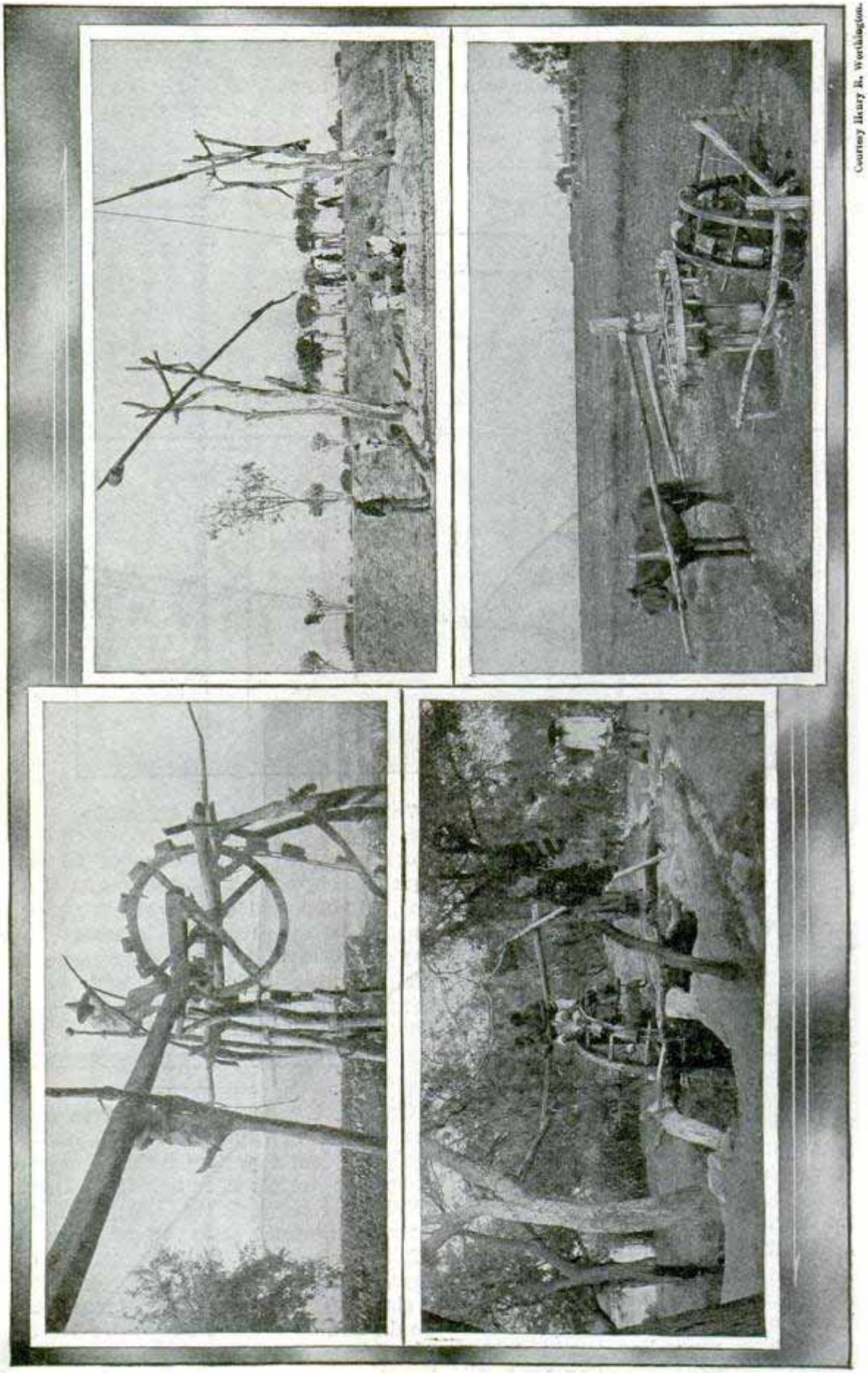
Section Showing Pipe, Nozzle, Valve and Swivel Handle

In many vegetable houses, particularly those where lettuce is grown, irrigation is accomplished by means of a mechanical watering device, says the Florist's Review. The device consists of a line of pipe, or if the house is large, two lines, having small nozzles with spray caps inserted about three feet apart. The pipe turns on a swivel which has a handle for the convenience of the operator and the spray may be directed as pleased, or made to cover a large radius if desired. When the water is under high pressure the stream is broken up into a fine mist which would not beat down the most delicate plant, nor bruise the smallest petal of a flower. The water is thoroughly aerated, also, it is said, and this too is an advantage.

The device may be operated nicely with a pressure not under 40 lb. but is more satisfactory where a gasoline pumping engine is installed. An engine having a capacity of 20 gal. per minute and capable of working against a pressure of 90 lb. per square inch, pumping directly into the pipe line, will supply 150 spray nozzles, and will consume two gallons of gasoline in one day's run. The device is soon to be tested for watering cut flowers and in plant houses.

DENTISTS ON OCEAN VESSELS.

Ocean-going passenger steamers may in the future be provided with modernly equipped dental parlors under charge of a competent ship's dentist. The American Shipbuilder suggests the great comfort this innovation would often afford passengers, officers and crew. Without it, an entire voyage might be rendered miserable by a single aching tooth. Also many persons would find themselves at greater leisure to have their dental work attended to on board ship than on shore, and the chairs would be filled from port to port.



Courtesy Henry R. Worthington.

How Water is Pumped in Mexico

PUMPING WATER IN MEXICO.

Primitive Devices that Have Remained in Use Even to the 20th Century

Mexico, so near to and yet so far from the United States and our progressive cities and farmlands, only within recent years is beginning to feel the iron grip of progress struggling with her shackles and seeking to strike them away. Among the ancient and picturesque devices still in general use in that country are the "pumping engines" for elevating water.

Some of these machines are shown in the accompanying illustrations. In the first one it will be noticed that but one man is required to keep the wheel with its continuous chain of buckets in motion, and the work is not so strenuous but that he can bear the warmth of full garb, while in another two men clinging to a sapling placed above the wheel are required to generate the power, and are working without shirts. The fact that one is subjected to the glare of the sun, while the others are protected from it by trees may account for this difference in the amount of clothing worn, however. The other devices are so familiar in one form or another to everyone that a glance explains them.

Modern type irrigation pumps of the turbine pattern are now rapidly replacing these quaint devices. Power is cheaply developed by utilizing the many mountain streams for generating electric current, and then distributing it over the vast agricultural areas lying between the mountain chains.

THE FINEST FIRE DEPARTMENT IN THE WORLD TO INSTALL MOTOR FIRE ENGINES.

The fire service department of Vienna, Austria, long held up as a model on the European continent, has taken one of the most important steps in the history of fire-protection service—i. e., the installation of self-propelled fire engines. The municipal authorities have ordered 53 motor chemical engines—the beginning of a sweeping change which is to re-equip both the city's professional fire brigade and the auxiliary suburban volunteer fire brigades. The change will cost the city about $180,000, it is estimated, but will effect a saving of more than $15,000. The machines are to be of the latest improved type.

NOVEL CONTEST OF ICEMEN.

One Prize Winner Carried a Load of 405 Pounds

The Ice Producers' Association of the Middle States held its annual convention recently at Cleveland, O. The reading of papers was varied by a most original and interesting contest, in which a large number of employes of ice companies took part. Many of the delegates brought one of their

Courtesy Ice and Refrigeration

Delivering a 400-Lb. Cake of Ice

star wagon men along. Some of the contests, and winners, were as follows:

Loading three tons of manufactured ice in blocks weighing 300 lbs. each, into a covered wagon. Won by Wm. Diller, Cincinnati; time 4 minutes, 58½ seconds.

Lifting a block of ice weighing 150 lbs. from the ground to the shoulder, and carrying the load 300 ft. and return. Won by John Dallcher, Cleveland; time 25 seconds.

Cutting a 400-lb. block into 40 equal parts. Won by H. Luth, Cleveland; time 2 minutes, 14 seconds.

Ice carrying contest; won by Chas. Chevanki, who carried a block of ice weighing 405 lbs.

The contest was the first of its kind and was witnessed by a large crowd in addition to the convention delegates.

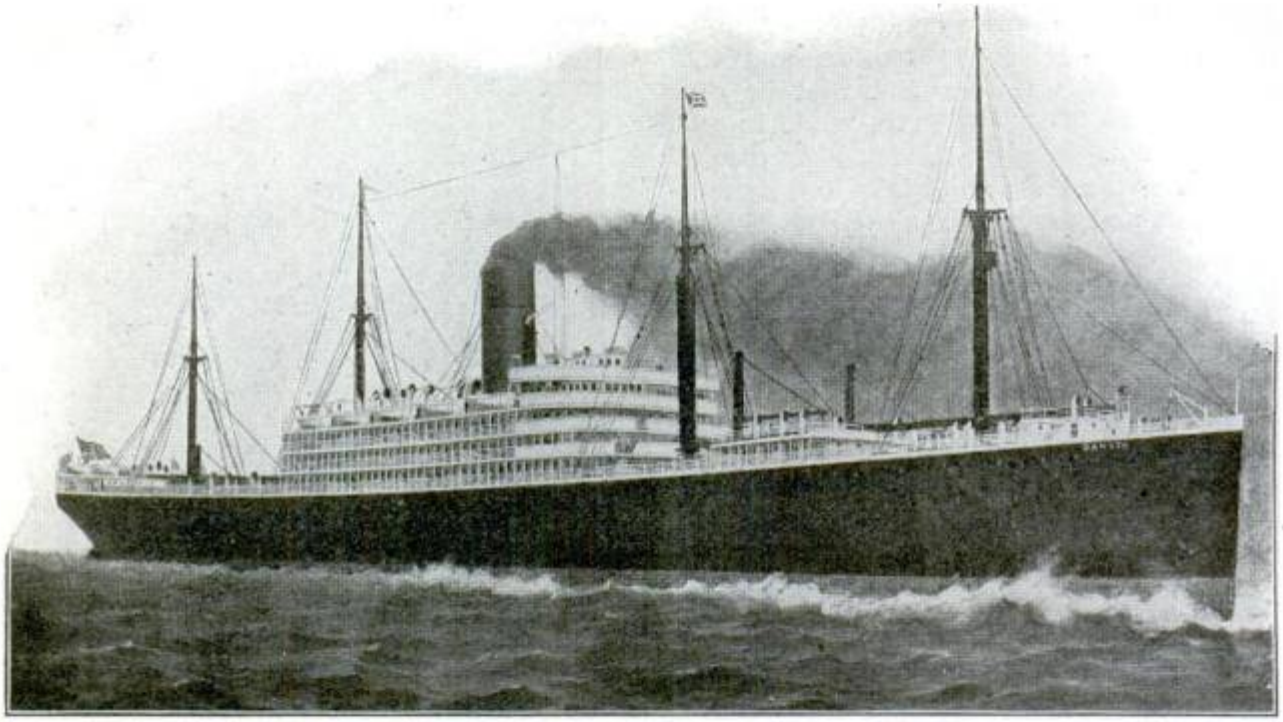
THREE HUNDRED PINS PER MINUTE.

A machine has recently been perfected at Springfield, Mass., by means of which three hundred pins can be manufactured in one minute, this being five times the capacity of the machines now in use. Not only this, but an auxiliary machine is said to have been designed which will insert the pins in paper thirty at a time, when the present equipment allows only one at a time to be inserted. This will mean an enormous increase in the daily output of the factories, which even now is exceedingly large. The output of the largest pin manufactory in the world, at Birmingham, England, is 37,000,000 for every working day, and the total production in Europe is 602,000,000 a week. In the United States also the daily product figures into the millions. And of all these thousands of tons of pins, only about one per cent are worn out or broken, the other ninety-nine per cent are lost or thrown away.

It is stated by the London county highways committee that in England the cost of running motor omnibuses carrying 34 passengers is from 22 to 24 cents per car mile, while for electric tramcars which carry from 50 to 70 passengers it is only 10 to 12 cents. The tramways pay rates and maintain 18-in. carriage way on either side of the line.

THE "DAKOTA" FOR PACIFIC TRADE A MONSTER.

The huge twin-screw steel steamship "Dakota," together with her sister ship the "Minnesota," built for the Orient freight and passenger trade are wholly products of American designers and workmen, and as such are commanding the admiration and, we may add, due respect, of all the world. The vessels are the largest and fastest ships which will engage in the Pacific trade, and will remain so for many years, says the American Shipbuilder. The two vessels are the investment of James J. Hill, and together cost $6,000,000, on which the owner expects to realize a goodly profit.



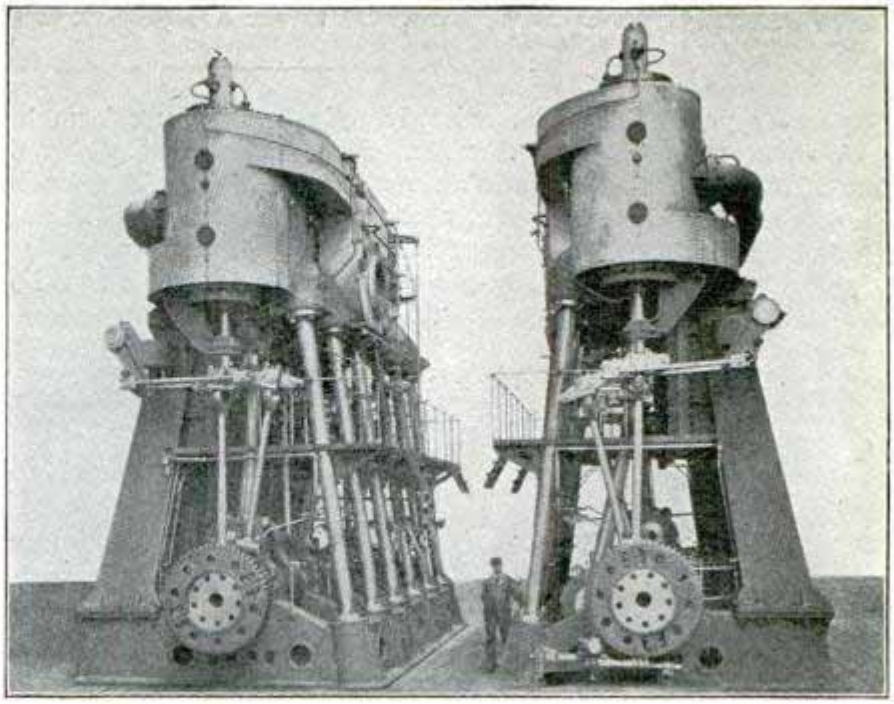
The "Dakota" Carries 21,000 Tons of Cargo.

The dimensions of the "Dakota," which is just completed, are as follows:

Length, 630 ft.; beam, 73 ft. 6 in.; depth, 56 ft.; draft loaded, 38 ft.; gross tons, 21,000; net tons, 13,500; displacement, 37,500 when loaded to the Plimsoll mark. She has accommodations for 206 first and 66 intermediate class, and 720 steerage passengers, and 21,000 tons of cargo. As a troop ship she could carry 1,200 troops, with their baggage and full equipment, besides a large cargo. Her officers and crew number about 450.

The motive power of the vessel is said to be one of the finest jobs ever turned out by an American concern, and is the most interesting feature of her construction. The

main engines consist of two sets of three-cylinder vertical, inverted, direct-acting, triple expansion engines, with cylinders 29, 51 and 89 in. in diameter by 57 in. stroke, designed for 78 revolutions per minute, and to develop about 4,800 hp. each with a steam pressure at the engine of 230 lbs., driving the ship at 14 knots' speed The boilers are of the Niclausse water-tube type. The entire construction of the vessel, or vessels—for it is but natural to speak of the "Minnesota" in the same connection—reflects high credit upon American skill and ability.



"Built in America."

Compressed Air in Dentistry

Nowadays no dentist's office is modernly equipped without a compressed-air outfit, and the number of uses for the air-blast found in dentistry is astonishing. Not only does it make the dentist's work easier, but it also renders it less painful to the patient. In a paper read before the Michigan State Dental Association at Lansing recently, Dr. George Zederbaum enumerates the uses he has found for compressed air in his own office.

There are two outfits practical for the same purpose. One consists of a small pump connected by a pulley to an electric motor. When the motor is set in motion the pump compresses the air into a storage tank which, by means of an air gauge, accurately registers the pressure of air stored. From the storage tank leads the outlet pipe guarded by a suitable valve. This, of course, requires an electric current. The other outfit is in reach of all those in small towns as it depends on a water supply, no very high pressure being necessary. The air pump is attached to the city water-supply pipe which keeps the desired pressure of air in the storage tank automatically. Either apparatus described may be had for $25 or $30.

The compressed air is used for drying cavities, which are to be filled, a current of air applied for two minutes being sufficient for cooling compounds used in taking impressions and bites, such as wax and gutta-percha, and which, because of their plasticity, must be applied warm; in treating injuries which are hard to reach and see, using either liquid applied by means of a pointed atomizer tube and the air, or powder applied by means of a glass pipe. In preparing cavities it is frequently necessary to blow out the chips and uncomfortable heat is generated by the revolving bur. The point of operation may be kept free from chips and the bur be prevented from heating by wiring a small rubber tube around the engine cable down to the handpiece and turning on the air pressure. The opening in the tube need not be larger than one-thirty-second of an inch.

For deodorizing malodorous mouths, spraying a solution of lavender or other perfume about the room to rid it of disagreeable odors, drying up the mouth in bridge or crown work, or for connecting to the blowpipe in soldering, the air-current will be found equally efficient. By turning it squarely into the face of a patient who has taken an anesthetic, or one who has fainted after an extraction, the patient may be quickly revided—a pleasanter means than putting water on the face.

How Fine Tool-Makers' Files are Manufactured

For many years there has existed an inherent superstition that the fine files manufactured in Switzerland by a laborious hand process could not be successfully competed with in this country by the application of the speedier American methods. The demand, both in this country and to an extent in foreign countries, for the larger, heavier and coarser grades of files used by machinists was supplied with the American product, but the fine file industry in Switzerland was created of necessity in the manufacture of Swiss watches and bade fair to remain there exclusively. Now, however, the successful manufacture of these fine files in this country by machinery which puts out an enormous product in much less time has introduced a new regimé in file-making and demonstrated that there is no inherent merit in hand-cut files.

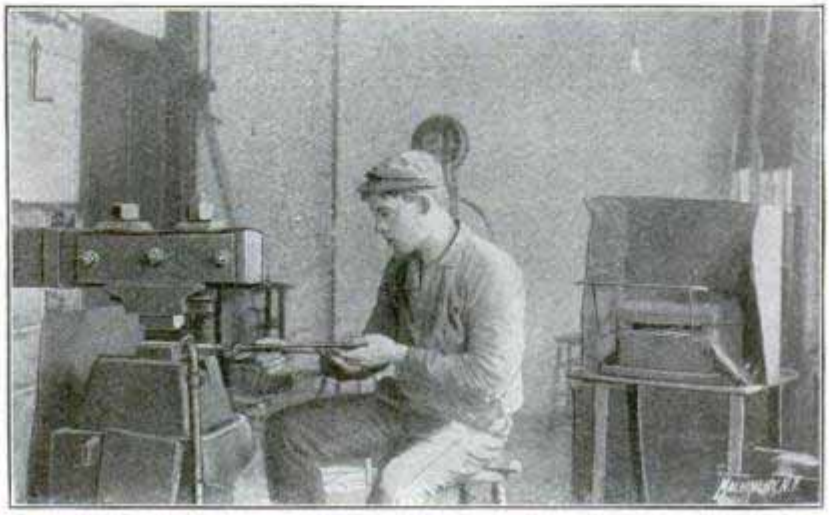


Fig. 1. Gas Forge in Use

In manufacturing the files the heat treatment of the steel is most important, as it must be done in such a way that the stock is of uniform hardness throughout all the various lots of files in process of manufacture. The heat applied is gas, generated from naphtha and used in burners. Naphtha is best for the purpose because all the substances it contains can be atomized by moderate force or vaporized under a temperature below 80 degrees. Also, it contains no sulphur or other element which might injure the steel and the stock may be subjected to direct heat at the proper temperature.

Forging the blanks is the first step in the process of manufacture. This is done by the use of a gas forge and a Bradley hammer. (See Fig. 1.) The die used determines the rapidity with which the blanks are shaped. Three pairs of the dies are shown in Fig. 2. The pair at the left is for forging the blanks for warding files, the center pair is used for half-round files and the other pair is used in a drop-hammer only, for finishing the blanks of half round files.

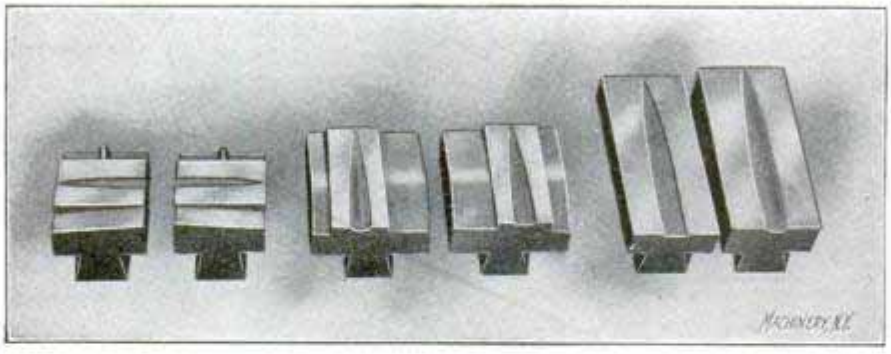


Fig. 2. Three Sets of Dies for Forging the Blanks

The face of each die is in three sections, the section on one side being used for breaking down the edge of the stock and the one on the other side for bringing the edge of the stock to about the right dimensions, while the central section is used for forming the flat sides or faces of the blanks. All special shapes are finished by drop forging. Bradley hammers are used for ordinary shapes.

After the blanks are forged they are ready for the annealing process. This is done in a gas furnace, the files being placed tangs outward so that the delicate and useful tips will not be subjected to injurious heat. The heating process occupies from four to five hours, depending on the size of the blanks, the files are then allowed to cool for twelve or fifteen hours. The blanks are straightened after being annealed by holding for a second over a gas flame and subjecting them to a slight pressure in the direction required at the same time.

Fig. 4. Cutting by Hand

Fig. 3. "Stripping" File Blanks

In grinding the blanks for cutting special machines are used. The files are clamped to a flat plate which is locked in position in a holder in which it fits "This holder," says Machinery, "reciprocates in a vertical direction and moves the faces of the files up and down against the surface of the rotating grindstone, the stone at the same time having a longitudinal motion crosswise of the files."

The blanks are next finished by draw-filing, or "stripping." (Fig. 3.) This is a hand process and gives a superior finish to the file that no machine work can produce. The next operation is the one that has destroyed the ancient belief in hand-cut files. The essential points in cutting a file properly are that the blank be of uniform hardness throughout, the cutter of proper shape and adjustment, and the machine adjusted to strike a blow of sufficient intensity to produce a sharp tooth at the pitch at which the file is being cut. Fig. 4 shows the method of cutting files by hand, while in Fig. 5 is shown a row of machines now used for the purpose. The blows are delivered at the rate of 2,000 or 3,000 per minute, so that the cutting is very rapid. When one side of the file is cut the blank is turned over and the other side is cut. To avoid injuring the teeth during the cutting, the blanks rest on a strip of sheet lead. The work of file-cutting is such that hand labor must frequently supplement the machine work, but the quantity of output is remarkably increased. A method called etching is used for forming the teeth of files with very fine cuts. This is a hand process in which the finished product resembles knurled work done on an engine lathe. Minute teeth are knurled or milled on the three edges of the cutting tool—a long triangular bar—used. These teeth are of the depth and shape of the file teeth to be cut. The file blank is clamped in position, or, in the case of round files, is rotated gradually, and the cutting tool is passed over the blank in a manner similar to the movement of a file when

draw-filing. The process is one requiring considerable skill. In the hands of a skilful workman the knurling tool can be given exactly the right angle and the right pressure, securing teeth of absolute regularity.

After the cutting process the number and the maker's name are stamped on the file and it is sent to the hardening room, where it is heated in a gas furnace and cooled in brine. Before it is quite cool it is straightened and is then cleaned by the sandblast, in which fine clay powder, which will not injure the teeth of the file, is used. The product is finally inspected, oiled and packed ready for delivery to the customer. Our illustrations are by courtesy of Machinery.

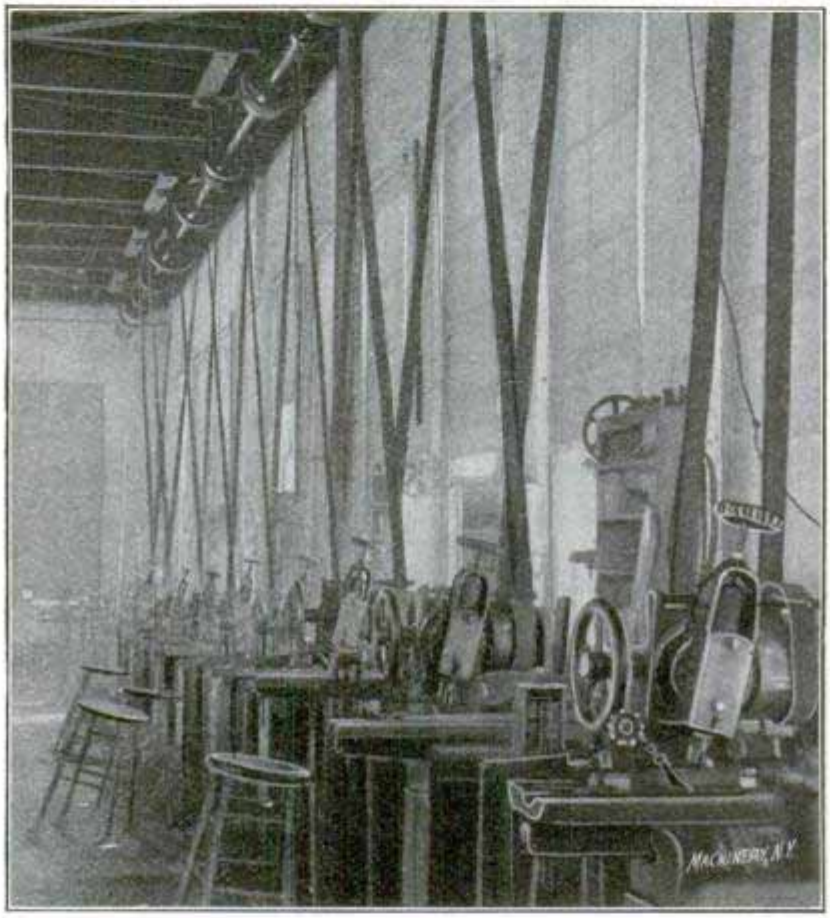


Fig. 5. A Row of File-Cutting Machines

LOCATING MANHOLE COVERS WITH A COMPASS NEEDLE.

When the iron covers of man-holes are covered with ice so that it is difficult to locate them, if one knows the approximate position of the cover he can soon settle the point by means of a compass needle, says the American Telephone Journal.

First hold the needle four or five feet above the ground and note the direction in which it points—always toward the north. Then hold the compass close to the ground, walk a few paces from east to west parallel with the curb and near the spot where the manhole is believed to be. Retrace your steps and again retrace, getting a little farther away from the curb each successive time. When you are within two feet of the manhole the needle will begin to deviate from the northward direction. The deflection of the needle will indicate the size of the manhole and help make sure that it is the right one before proceeding to dig it out of the ice. The needle will work just as well on streets where there are trolley lines, but if the manhole is near an iron pillar of an elevated structure, some difficulty may be experienced.

If one is mistaken as to the location of the manhole, it may be necessary to take a new starting point and try again.

A one-cent telephone call rate has been inaugurated by a telephone company in Sandusky, Ohio. The rate has made the system very popular and a great many slot machines are being installed.

The Harnessing of Heat

Part I--Sources and Nature of Heat

Heat is of service to man in two ways—it keeps him warm, and it does a great deal of his hard work for him. For the former service we probably give this beneficent agent all the credit which is its due, but the part that heat plays in doing our work for us is so obscure and so complicated that we often fail to appreciate the services rendered. The object sought in this and the following papers is to bring to the mind of the reader a clear conception of the methods and means by which heat is of service to us as a lightener of toil.

First, as to the sources of heat. These are many. There are natural sources and artificial sources. In the former class is included the heat given us by the sun, and by the interior of the earth. The amount of heat given us each day by the sun is enormous. It has been estimated that the sun gives to each acre of the earth's surface the equivalent of 175 horsepower during each hour of daylight, or 800,000 horsepower per year. We have not yet learned to utilize this source of energy, although this may some time be a most important problem.

Besides this heat given to us directly by the sun, there is an almost inexhaustible supply stored up for us in the earth, a legacy to the present age, from ages long since passed away. Down deep in the earth we find plenteous stores of coal, the remnants of a decayed vegetation, every bit of whose energy came originally from the sun. So the sun is directly or indirectly the principal source of heat.

Other means of producing heat are, however, familiar to everyone. Friction is one of these sources. Every machinist is familiar with the fact that a drill becomes heated when forced to bore into a mass of iron, or that a chisel will become heated when held against an emery wheel. Stories are told of how savages kindle fires by the friction of two pieces of wood properly arranged. Then there is the heat generated by percussion. Our forefathers kindled their fires by a spark generated by the concussion between a piece of flint and a piece of steel. Our own bodies generate heat apparently, by the action of the food we eat and the air we breathe.

There are then, many sources of heat—the sun, the earth, friction, concussion, animal processes and chemical processes in general.

Now as to the nature of heat. People in past ages regarded heat as some sort of a fluid which is transmitted from one body to another in much the same manner as water flows through a pipe. In 1798, Count Rumford, then in the service of the Bavarian government, presented to science a new theory of heat. He had carried on a series of experiments, among which was the boring of a cannon in the arsenal at Munich, and he very justly argued that anything that could be produced indefinitely by the friction between a drill and the substance in contact with the drill could not be a fluid. Besides, a body weighs no more when warm than when cold. If heat were a fluid, we would expect a body to gain in weight when heated. Heat then, cannot be a fluid. That which we call heat must be due to some peculiar condition of the interior of substances, and not to any fluid within them.

The theory of heat is summed up in the familiar statement that "heat is a mode of motion." Not motion that we can see or feel as motion, but infinitely small and rapid vibrations of the particles of a body. Science teaches us that the particles of a body are in constant motion or vibration, in some cases very rapid motion, in other cases slower motion. When we impart heat to a body we simply increase the rate and extent of the vibrations of its particles. When we cool a body we decrease this vibration. If we could cool a body to such a temperature that all motion of its particles were stopped, then it would contain no heat, and it would be at "absolute zero."

The effects produced by heat bear out this theory. We all know that a body when heated expands. This is what we would expect if the motion of its particles were increased. If we heat a solid body hot enough, its particles are pushed so far apart that it becomes a liquid; and if this liquid be further heated it becomes a gas. The reverse process, that of cooling, if applied to any gas, will reduce that gas to a liquid, and finally to a solid, if we can secure a low enough temperature. This is most strikingly illustrated in the case of liquid air, a discovery of recent times.

The difference between heat and temperature must be clearly understood. The temperature of a body gives us no idea of the amount of heat it contains. A penny at a temperature of 70 degrees contains far less heat than a pound of copper at the same temperature. And a pound of copper will

hold only one-tenth as much heat as a pound of water at the same temperature. The amount of heat in a body cannot be determined from its temperature alone. Neither can we determine the temperature of a body from the way it feels to us. A piece of iron may feel cold to the touch, while a piece of wood at the same temperature feels warm.

Heat is transferred from one point to another in three ways. It may travel by conduction, as when it passes from one end of a bar of iron to the other. Or, it may travel by convection, as in the case of a current of warm air, or a current of warm water. Here the particles of the air or water actually move from place to place, carrying with them the heat they contain.

The third method by which heat is transferred is called radiation. This is the method by which heat reaches us from the sun, through millions of miles of space in which there is no substance to conduct the heat, nor any air to carry it by convection.

Having now considered the sources, nature and transference of heat, it remains for us to see by what methods we turn the energy which heat puts at our disposal into useful work.

(Continued next month.)

RELIEF FOR THOSE INJURED BY ELECTRICITY.

The following rules are printed in large type and posted in factories in Germany, where electricity is used for light or power:

(1) The current should be shut off at once if the means are at hand and the person called upon understands how to do it.

(2) If this cannot be done, be careful not to touch the injured person's body with the hand. If no rubber gloves are at hand, the body should be dragged away from the wires by the coat, or a coat should be taken off and folded (a dry cloth may be used for the purpose), when the injured person may be grasped through it and dragged away.

(3) When it is not possible to remove the injured person from the wires, raise that part of the body that is in contact with the earth or the wire from it, using the covered hand. This will break the current, and it will generally be possible then to get the body out.

(4) If this cannot be done, take a dry cloth and place it between the body and the ground, and then disentangle the body from the wires.

(5) If the body is freed from the wires, remove all the clothing from the neck and treat the injured person as one drowned. Open the mouth and grasp the tongue, which should be covered with a cloth; then pull the tongue forward and gradually allow it to fall back. This movement should be repeated 16 times a minute. Take care that the root of the tongue is thoroughly moved.

(6) The bystanders should not be allowed to give the injured person wine or spirits.

HOW TO MAKE AN OLD GUN SHOOT CLOSER.

An old shotgun can be choke-bored so that it will shoot closer, and a good cheap gun thus transformed into the equal of some of the highest grades of guns by the following method:

If the barrel is sprung, it must first be straightened. This is hard to do on double guns, but if the barrel cannot be straightened do not attempt to bore it. A good auger will be required for the boring. Place the barrels in a wooden clamp and screw the clamp in a vise. Insert the auger in the breech and bore clear through with a light cut, taking care to have the band straight. Then screw the blades of the tool slightly open and take a light cut to within 2 inches of the muzzle and continue thus until the pits are all out. The blades of the tool must be kept very sharp by rubbing on a fine oilstone and grinding only on dull spots to keep the blades straight and prevent ring-boring.

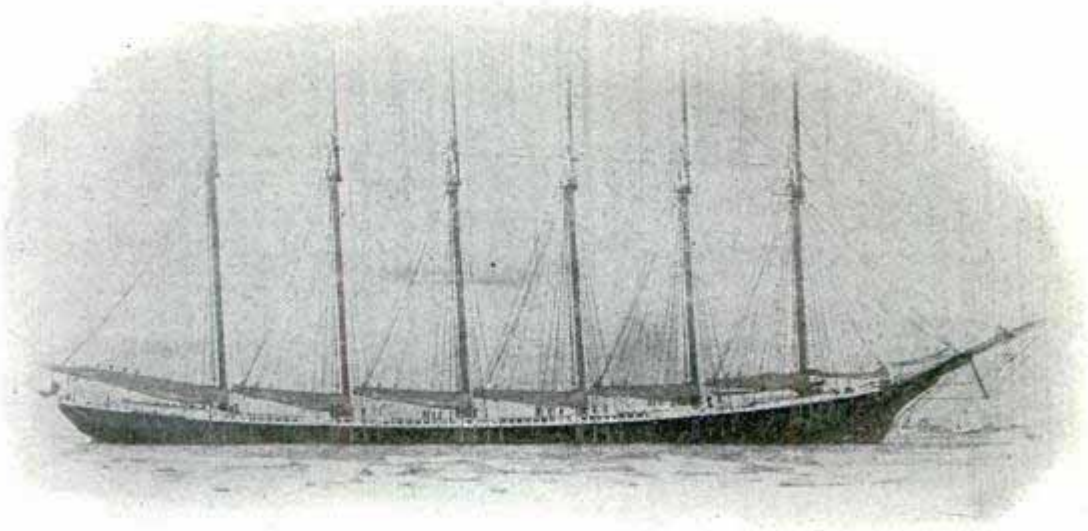
Reverse the tool and, standing at the breech of the barrels, bore a recess four inches long and about ¼ inch from the muzzle (the deeper the recess the closer the gun will shoot). Now take a half round file and smooth off the shoulder at the muzzle, so as to prevent powder cake. At this point you must use strong soap sups as a lubricant (never use oil, as it will tear the barrels), taking light cuts to smooth the barrel and using plenty of suds. Use the blade that cuts best and keep the blades very sharp. Have no niches in them, as that will scar the barrel. Turn the tool slowly and feed slowly.

A correspondent of the American Blacksmith says he has bored in this way ten-gauge guns that patterned 85 with No. 4 shot in a 15-inch circle at fifty yards. Load 4 drs. powder, one and one-fourth shot.

Have you a good kink which might help some one else in an emergency? If so, send it in.

SIX-MASTED WOODEN SCHOONER.

The six-masted schooner, the "Ruth E. Merril," is interesting in these days of steel ships, because this one is built of wood. The vessel is 3,000 tons; is 380 ft. on keel; 48 ft. beam; draws 28.5 ft., and cost $135,000. The lower masts are 118 ft. long and 30 in. diameter; topmasts 56 ft. long. The spanker boom is 81 ft. long, and the jib boom 78 ft. long and 21 in. diameter; the vessel spreads 10,000 yds. of canvas. A telephone connects the captain's office with all parts of the ship, says the American Shipbuilder. Three strips of steel 6 ft. apart and 132 ft., 198 ft., and 221 ft. long respectively are strapped on each side of the hull.



New Wooden Schooner

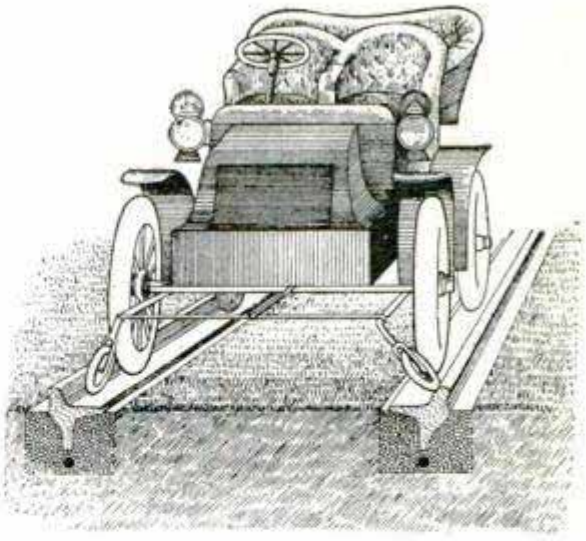
"TRIED" A CASE BY TELEPHONE.

A farmer near Elkhart, Ill., was recently arrested on a charge of drunkenness and disorderly conduct. The man was too busy to leave the farm to go to town to be tried, so he suggested conducting the trial by telephone. The matter was easily arranged, the judge preferring the charges against him by wire. The farmer plead guilty by the same means and promised to send the fine fixed, $14, by mail. The whole affair required but a few minutes.

A pressure of 1,600 lb. per square inch, the highest pressure ever observed in any natural gas well was shown by a well in the Ninevah region of Greene county, Pa. The well struck the Campbell's Run oil sand and the rock pressure passed the gauge limit of 1,500 lbs. per square inch and blew off the 2-in. pipe which shut the well in.

CONCRETE AUTOMOBILE ROAD.

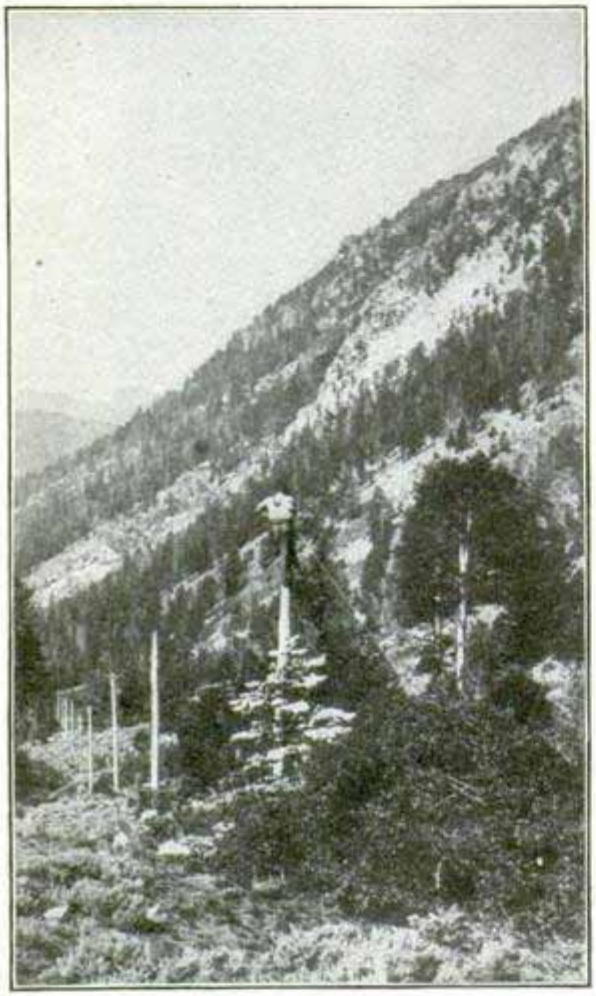
An Illinois inventor proposes a concrete rail for use of autos and farm vehicles on public highways. The suggestion some time ago of an eastern man to lay broad, flat rails on country roads has not been adopted, owing to the great cost. Concrete is less expensive and the track could be manufactured right on the spot. The illustration shows the shape of the proposed "rail" and the gravel foundation on which it rests. By using guide wheels, as shown, an auto would keep the track without steering by hand. If the track should prove a success a desirable occupation suggests itself for the employment of convicts in our state prisons.



Concrete Track

LINEMEN IN MOUNTAINOUS REGIONS WORK AT GIDDY HEIGHTS.

Telephone lines are now found in many places which are almost inaccessible. There is a pass in the Rocky mountains through



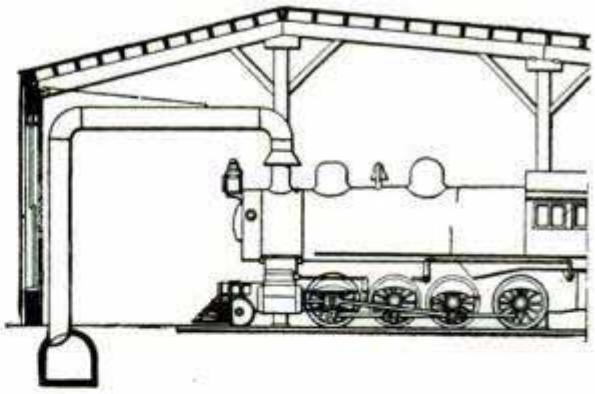
Working Over a Dread Abyss

which a road has been blasted in the face of a cliff. The poles which carry the telephone wires along this road are inclined outward in order that they may clear the overhanging rock. When it is necessary for a lineman to climb one of these poles to make a repair the man is suspended over the pass hundreds of feet above the base of the cliff. A fall would mean death on the rocks far below. Accidents among the large force of men who are constantly on duty along lines in such localities are very rare. The men employed are the most skillful and agile to be found and on this greatly depends their safety. Great precautions, however, are taken by the telephone companies in constructing lines in such places. Poles and equipment are subjected to the most rigid inspection and the construction work is done only in ways which have been approved by the telephone engineers.

Often the repairmen must start out in the dead of night for some isolated point where the wires are out of order. The fiercer the elements, storm, wind, rain and sleet, the more work there is for them to do. When the Kaw river at Kansas City swept over its banks, carried away bridges and submerged a large section of the town, the repairmen of the telephone companies began a battle with the flood and kept up the fight for days. When they were beaten at one point and communication was broken, they established it at another. One span of a bridge went down stream just after the gap had been covered by a telephone wire. Then wires were strung along the piers of the bridge and when these wires were broken masts were erected on the banks of the river and a long loop of wire suspended between them. Communication was maintained with many persons held prisoners in the upper stories of their homes, and by this means a number of lives were saved.

EXHAUST VENTILATION FOR LOCOMOTIVE STALLS.

A system of exhaust ventilation for roundhouses, in which the smoke and gases from the locomotives are carried off through floor ducts to a single chimney, is being tried. Such a system would do away with the open smokejack by which it is impossible to completely remove the gas because of the



Exhaust Ventilation for Roundhouses

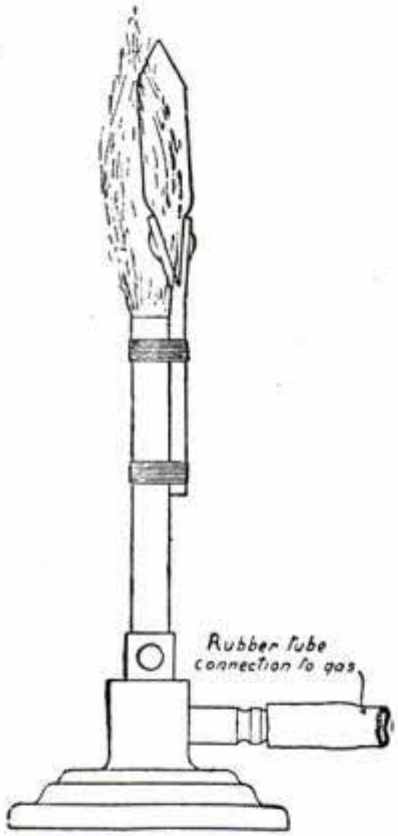
cold air entering it. The "smoke nuisance" also would be solved in this instance at least. The Baldwin Locomotive Works has an exhaust plant in operation and also the testing shops of the L. S. & M. S. Ry. at Collinwood, O.

Articles published in our "Mechanics for Young America" department have been issued in book form and will be sent to any address on receipt of 25 cents.

SHOP NOTES

HOW TO MAKE A SELF-HEATING SOLDERING IRON.

A useful and simple self-heating soldering iron made like the one shown in the illustration will be found a great convenience to its owner.



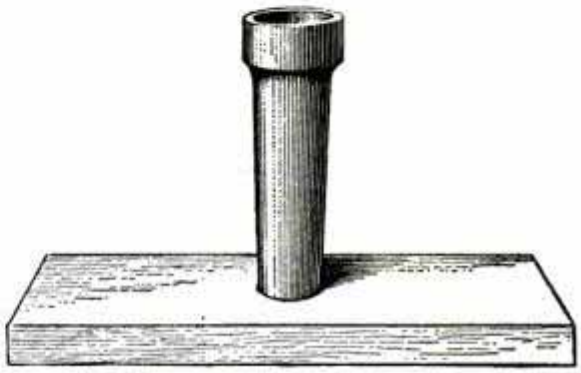
An ordinary burner, having an end off, has a soldering iron fastened to the end by means of copper wire bound around it. To use, the gas is turned on full and the iron allowed to get well heated. The gas is then turned half off or until the flame just fills the surface of the iron and comes quite to the point. The iron will keep hot quite a while, says the Model Engineer, London, and when cool, is quickly heated again by turning the gas up. This is a cleaner method than using the fire, and after a little practice the iron is not at all awkward to hold.

MAKING A SOLDERING IRON OUT OF SCRAP SHEET COPPER.

For material the copper bottom of an old wash boiler will suffice. Cut the copper into pieces about 1 in. square and put them in the melting pot. Place the pot in a large fire and bank up well with wet coal, as the copper will melt more quickly if the pot is covered up, says a correspondent of the Blacksmith and Wheelwright.

Burn the grease out of an old buggy wheel box until the box is clean and dry. In a piece of board bore a hole ½ or ¾ in. deep so the small end of the box will fit in as shown in the illustration. Pour the melted copper into this box, taking care to keep the face well away, as the molten metal may spatter.

If the copper cannot be punched out of

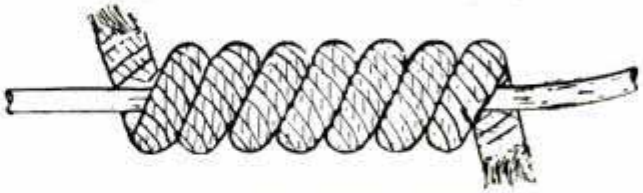


Mould for The Melted Copper

the box, break the box with a hammer. Good copper can be forged at a dull red heat, but if it will not hammer, rasp the end to the desired point. Cut off the right length, drill a hole in the blunt end, tap it out and screw in a ⅜-in. piece for a handle.

HOME-MADE METALLIC PACKING.

Where the size of the pump stuffing-box is wholly inadequate a home-made metallic packing, consisting of a combination of soft wire solder wound with asbestos wicking and dipped in a mixture of graphite and



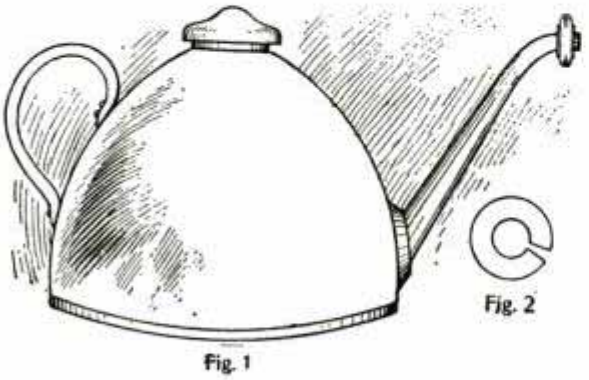
Home-Made Metallic Packing

cylinder oil, may be used to advantage, says a correspondent of the Engineer's Review.

The packing will leak at first, but as it becomes fitted to the rod will gradually stop. The packing has not been tried on hot water, but being metallic would probably work alright.

AN IMPROVED FILLER FOR THE LUBRICATING SYSTEM.

Engineers and oilers who are not so fortunate as to have a "piped-up" oiling system on their engines and machines, will find the following a handy addition to their fillers:

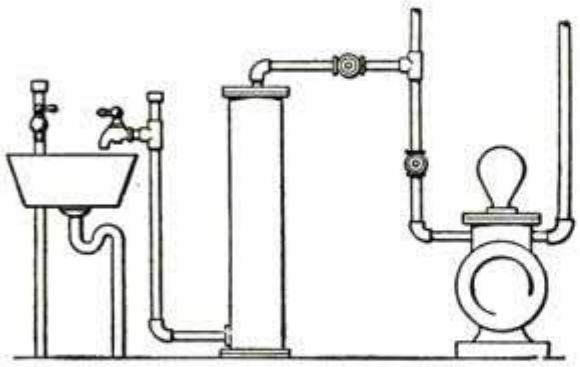


Bend a piece of No. 8 iron wire (No. 6 copper wire is better) into a ring or collar (Fig. 2), just large enough to slip over the spout of the filler. Put this on the spout about ¼ in. from the end as shown in Fig. 1, and solder in place securely. This ring prevents the spout slipping too far into the hole in the cup.—Contributed by Lee Boyer, Okmulgee, I. T.

TANK FOR CATCHING CONDENSED WATER.

For providing water for washing hands, face, etc., in the plant the following arrangement was tried by a correspondent of the Engineer's Review and was found most useful.

A tee was put in a live steam pump and



Condensed Water for Washing

a pipe connected from the tee to the top of an 8-in. capped pipe 4 ft. high. This tank is kept full of the condensed hot water all the time. The water is run to the sink by means of a pipe connected at the bottom of the tank.

TREATMENT FOR BURNS AND SCALDS.

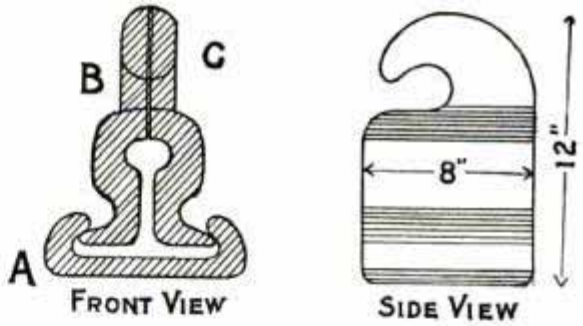
To draw the pain from a burn, exclude the air and cause it to heal rapidly, apply a good coat of a mixture of linseed oil and air slaked lime. Let this remain on until it wears off.

An excellent treatment for scalds is to bathe or immerse the injured parts in boiling grain alcohol, which will take the pain out, and then apply a healing salve, or treat as a bad wound. These treatments are so simple and relieve the pain so quickly that they rank with the best.—Contributed by R. E. Blondell, Pasadena, Cal.

SAFE RAIL GRIP FOR WRECKING CREWS.

A new and simple rail grip now used by the wrecking crew at Sayre, Pa., on the L. V. R. R. was designed by one of our readers, D. H. Utter, foreman of the cab shop at Sayre.

The grip, which is very simple in construction, is 8 in. wide and 12 in. high and



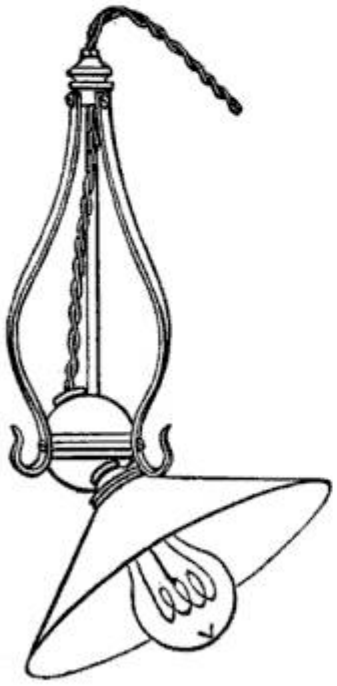
composed of three pieces of forged iron. Section A is placed under the rail, and sections B and C are placed one on each side of the rail, entering section A and closed together at the top. The grip can be adjusted to the rail in one-half minute and makes a secure hitch that will not slip.

HOW TO PRODUCE FLEMISH OAK.

Dissolve in one gallon of water, one-half pound of bichromate of potash and coat the woodwork with the solution. When it is dry sandpaper it down smooth and give a coat of the best drop black ground in japan, thinned with turpentine. Let it stand for five minutes, says the Master Painter, then wipe off clean, coat with pure grain shellac and sandpaper with fine sandpaper. Apply a coat of beeswax in proportions of one pound to the gallon of turpentine and having four ounces drop black mixed in the wax. Use cheese cloth to wipe off clean.

A HANDY LAMP PENDULUM.

A lamp pendulum which is adaptable for flexible cords is used in England, says the Electrical Review, London.



Lamp Pendulum

The sketch shows the arrangement. The cradle is attached to the flexible cord by cord grips, and inside the cradle rests a heavy ball through which the flexible cord passes, and to which the lamp and shade are attached. The ball is of sufficient weight to rest firmly on its seating and so holds the shade at any desired angle and keeps the cradle perpendicular at the same time the lamp is tilted.

TO USE OLD DRY ELECTRIC CELLS.

The cells of exhausted dry batteries will make good Grenet cells, if the bottoms are cut off and the filling and paper lining, if any, are removed. Be careful not to break off the carbon rod.

After the filling has been removed, if there is a paper lining, it may be removed as follows: Drill an exhaust hole through the cement in the top of the cell, then stand the cell in a watertight receptacle and fill the receptacle with water to within ¼ in. of the top edge of the cylinder. Let it stand until the paper lining is loosened and may be entirely removed.

The electrolyte to be used is 7 oz. of bichromate of sodium dissolved in 1 qt. of water. Add, very slowly, ⅓ pt. strong sulphuric acid, stirring the mixture slowly with a glass rod all the while. When the mixture is cool pour it into a glass battery jar and add 1 oz. bisulphate of mercury, which will amalgamate and keep amalgamated the zinc cylinder. The solution should be sufficient in quantity to extend up the zinc cylinder for three-fourths of its height. When not in use take the cylinder out of the solution.

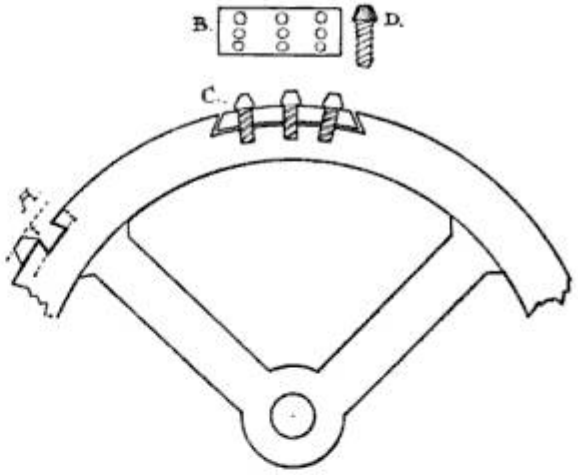
If while working with the batteries any of the acid or the solution should get on the hands or clothes, rinse off immediately with clean water. This experiment was sent us by a correspondent who has used it successfully.

HOW TO REMOVE PUTTY FROM OLD SASHES.

Cutting the putty with a knife and hammer is very apt to damage the woodwork. Instead, give the putty three coats of ordinary paraffin oil, allowing a half hour between coats. The petroleum will penetrate into the pores of the putty and dissolve the hardened linseed oil, making the putty plastic in a short time and in two or three hours it can be readily removed.

HOW TO REPLACE BROKEN TEETH IN GEARS.

To properly dovetail a tooth in a gear, requires a slot as deep as the tooth is high (A in sketch). If the gear is subject to hard work this will not hold, but will surely work loose. There seldom is metal enough to dovetail the proper depth without weakening the



Replacing Broken Teeth in Gears

rim of the gear. A method for light rim gears, that holds where all others fail, is as follows:

Bend a piece of boiler plate to the proper circle, as at B; dovetail it in the gear, as at C; make it a driving fit. Then drill through the plate and rim of the gear; tap out and screw in steel studs, as at D.

This will certainly hold because the studs are all solid in the boiler plate and cannot tear loose.—Contributed by Paul S. Baker, Muscatine, Iowa.

GETTING A BLOCK AND TACKLE TO THE TOP OF A STEEL STACK.

An engineer who had experienced some difficulty in getting a block and tackle to the top of a steel stack 38 in. in diameter

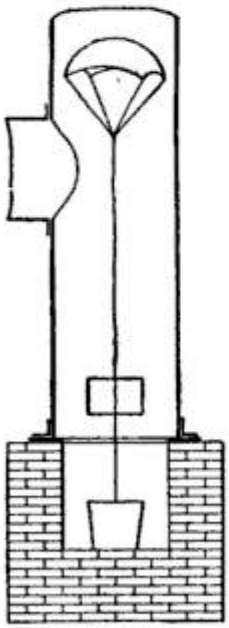


Fig. 1

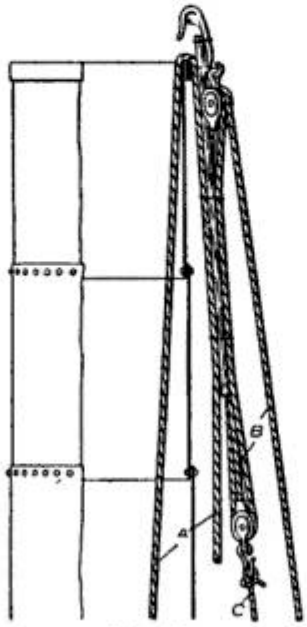


Fig. 2

and 80 ft. high, tells, in the Engineer, how at last he was successful. The stack had previously had a rope running through a pulley at the top for raising a block, but the rope had parted and come out of the pulley.

The materials the engineer collected to work with were a double and single block, 320 ft. of ½-in. rope, 200 ft. of chalk line, 200 ft. of common fish line, ½ yd. of cheesecloth, a stick 1x1x8 in., a pine board 1x12x16 in. with cleats on one side, 90 ft. of ⅜-in. rope, a pail and some wrapping twine.

The first thing to do was to get a line to the top of the stack. Four pieces of line, each 2 ft. long, were tied to the corners of the cheesecloth and the loose ends were tied to one end of the fish line. This formed a parachute. The other end of the fish line was tied to the handle of the pail, the loose length of the line having been run into the pail so that it might be rapidly paid out when required. The pail was then placed in the bottom of the stack and by means of a stick the parachute was pushed past the tee with which the boilers were connected (See Fig. 1). The air or gases soon lifted the parachute through the stack and out at the top, where it was possible to get hold of it. Then by means of the chalk line the ½-in. rope was drawn up through the inside and down the outside of the stack. The hook on the double block was replaced by one made of ⅝-in. steel and of suitable size to hook over the band at the top of the stack. The blocks were then threaded up with the other end of the ½-in. rope and pulled about 12 ft. apart.

The ½-in. rope, A, Fig. 2, was now hanging on the outside and to this was attached the stick to which the tackle had previously been bound. The old ⅝-in. rope, C, was tied into the hook of the single block and the tackle hoisted by pulling the rope, A, down and out through the manhole in the stack. Getting the hook over the stack band required some patience, but was finally accomplished. When secured, a few hard pulls on the various ropes broke the wrapping twine by which the tackle was bound, and the rope, A, fell down on the inside of the stack, and the stick fell on the outside. The single block was then pulled down by means of the rope, C, and a swing, Fig. 3, made of the 12-in. board attached. The engineer then collected his painting materials and with the aid of an assistant pulling on the rope started up. It was only necessary to make three trips to the top, as a white-wash brush attached to a broom-

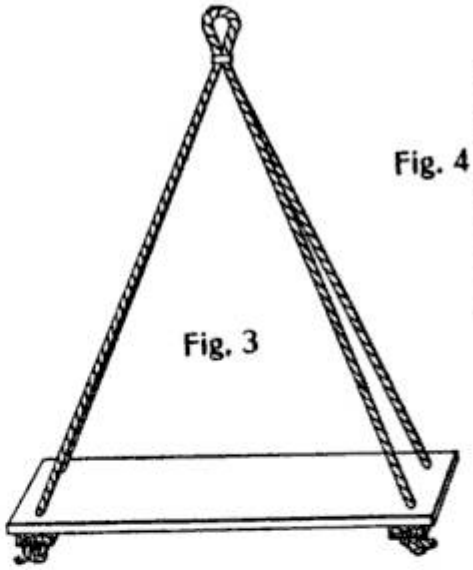


Fig. 3

Fig. 4

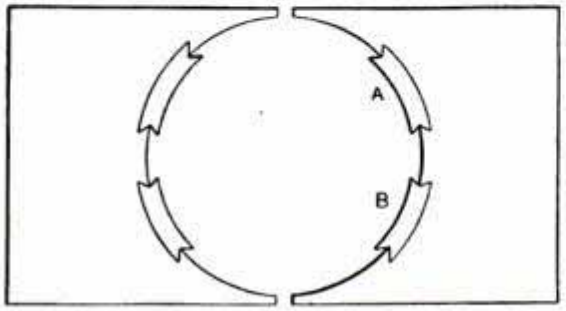
stick enabled him to reach one-half the circumference of the stack. Fig. 4 shows a safe hitch which is quickly made and by means of which the man fastened himself at whatever point he wished to stop.

The thinnest coat of paint and varnish that will give a good finish should be used for cars, and they will not crack so soon. Too much varnish is often the fatal mistake made in this line.

ANOTHER METHOD OF BABBITTING CRANKPIN BRASSES.

Old worn-out crankpin brasses may be babbitted in the following manner and made as good as new, says a correspondent of the Engineer's Review:

Dovetail places into the brasses on the quarters as shown in the sketch, leaving a space of about ¼ in. on a 2½ in. pin. The dovetailed part need be only 1-16 in. deep to hold the babbitt in place and from ½ in. to ¾ in. is quite wide enough for the babbitt. A pin fixed in this way does not



Babbitted Crankpin Brasses

wear quite so flat and makes a smooth running box; it wears better than brass and requires less lubrication.

GRINDING CAR WHEELS AT SLOW SPEED.

In some St. Louis street car shops it has been discovered that better results are obtained by removing car wheels from the trucks and grinding them at a slow speed than by the old method in which the wheels, run at a high speed by the motors under the car, were ground under the car.

The wheels removed are run at 6 r. p. m. This speed is regulated by means of a countershaft fixed above the wheel grinder, says the Street Railway Journal, from which a belt is run to a split pulley which is placed on the car axle. The excellent results obtained make the means worth while.

REPAIRING A THERMOMETER.

For a thermometer in which the mercury has separated try the following remedy:

Place the thermometer in a long stocking, having the bulb toward the toe and then grip the stocking tightly at the top and whirl rapidly. The centrifugal action will drive the mercury to the bulb, and the thermometer will be as good as new.—Contributed by Raymond J. Edwards, Shullsburg, Wis.

WHY WAGON WHEELS ARE DISHED.

The reason for dishing wagon wheels can very easily be demonstrated by making a couple of tin wheels for one axle of a child's toy wagon, says a correspondent of the Blacksmith and Wheelwright. If the wheels are made straight, as shown at A,

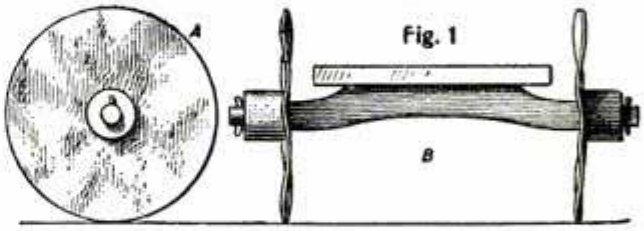


Fig. 1

Fig. 1, they will take the shape shown at B, Fig. 1, a very short time after being in use, especially is this true when the wagon is loaded. The hubs of these wheels are made of a bit of wood nailed to the tin.

The superiority of the dished wheels is shown in Fig. 2. The tin wheel is cut into at C, lapped over to the dotted line and riveted or soldered into a flat cone. This wheel put on the axle at the proper angle will stand a great deal of hard usage. The difference is in the degree of stiffness obtained in the two forms of wheels. The dished wheel is stiffer than the flat one and so will not easily bend and wobble. Put on as shown at E, Fig. 2, however, the dished wheel will not stand constant usage and loading. The spokes in the hub will become loose and the only remedy is to cut out a piece of the rim and reset the tire, causing a greater and rather unsightly dish,

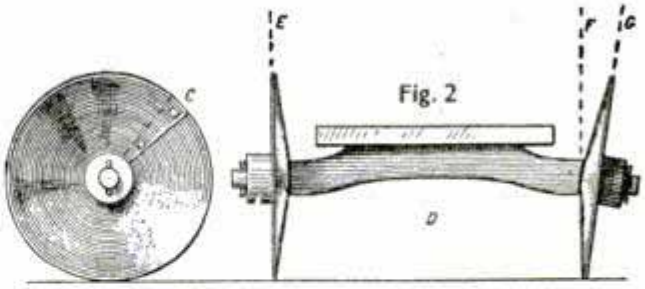


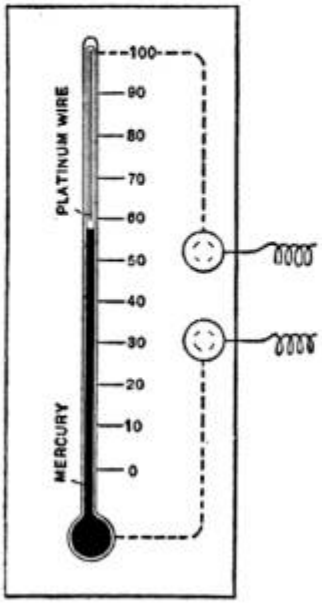
Fig. 2

which will probably have to be increased in time.

If the wheels are "gathered" at the bottom so that the spokes below the hub stand parallel with the vertical line, F, Fig. 2, the wheel will carry its load direct through spokes, rim and hub and there is no undue strain on the spokes. The gathered wheel throws mud in the direction of line G, away from the wagon instead of into it and is preferable for this reason also.

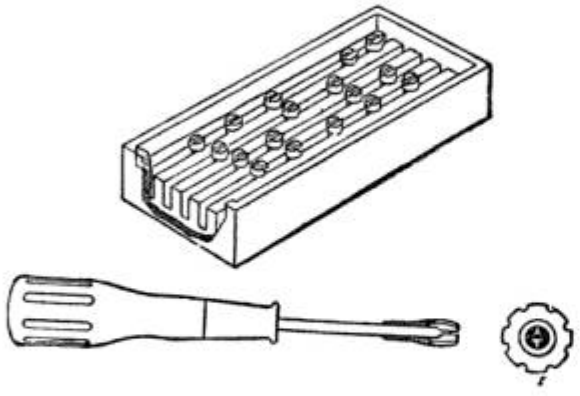
A TEMPERATURE ALARM.

Temperature alarms are of great service in greenhouses where a drop of a few degrees may mean a loss of a goodly sum to the florist. There is a thermometer on the market, having a platinum wire in the bore and suitable connections to electrical terminal posts on the thermometer board, says a correspondent of the Metal Worker. The platinum wire can be adjusted to any desired temperature and to effect the alarm, the wire is connected up so that a metallic circuit is broken whenever the temperature drops below the set point and the alarm bell rings. The apparatus connected up with suitable bells and batteries and installed so that the alarm can be heard in any part of the greenhouse costs less than $10.



TRAY FOR HOLDING SCREWS.

If a box of screws be poured into the tray, constructed as shown in the illustration, and it is then shaken two or three times, every screw will fall into the grooves head upward, says the American Electrician.



Screw Tray

If small brads are driven in the tops of the ribs (not shown in cut) the screws will fall into the grooves more readily. The screwdriver is then pressed over a screw, the spring sides of the tray being stiff enough to hold the screw so it can be entered and screwed until pressure comes on. Then the driver revolves part of a half turn, until the positive drive blade slips into the slot of the screw head and a firm pressure can be applied and the screw picked out.

GOOD PACKING FOR A STEAM CHEST.

One-sixteenth inch asbestos sheeting makes a good packing for a steam chest. This material costs about 45 cents per yard and if put on wet will bear 150 pounds steam pressure. In tests with this packing a joint was broken six times and tightened up satisfactorily with the wet asbestos. It is just as tight as the best rainbow packing can ever be made.—Contributed by T. H. Konrad, Burlingame, Cal.

HOW TO REPAIR A SPIRAL SPRING.

A spiral spring, 1 in. in diameter, which was used in an engine governor and which parted in the middle one morning just before starting up, was repaired by a correspondent of the Engineer's Review in the following manner:

Spiral Spring Repaired

Four holes were drilled in a piece of steel as at A, and the broken ends of the spring were forced through the holes into position as at B. The spring was then replaced and the engine started. The job took about 30 minutes.

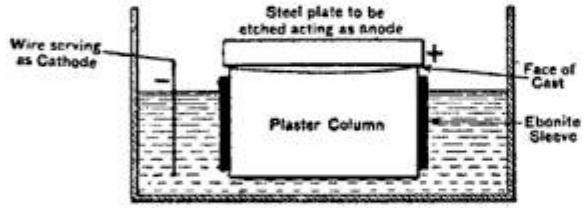
HOW TO THAW DYNAMITE.

A safe and sure way of thawing out dynamite is as follows:

Procure a small box or a nail keg just large enough to hold a lantern, and knock the bottom out of it, to admit air so the lantern will burn. Tack a piece of burlap over the top, on which to lay the dynamite, and set the apparatus a safe distance from all buildings. Throw an old coat or a sack over the dynamite. The heat can be regulated by turning the lantern up or down. "I have used this method of thawing dynamite for four years," writes N. G. Hall, of Parker, S. D., "and have always had the best of results."

ELECTROLYTIC PROCESS FOR ETCHING STEEL.

A process of electrolytic etching, invented and patented by a German, makes it possible to obtain exact reproductions of articles in low relief, such as medals and coins, in hard steel. The principle of the process is quite simple. Plaster of paris is poured upon the



Arrangement for Electrolytic Etching

article, let us say a coin, sufficient to form a column several inches high and a cast is taken. The plaster of paris is then removed from the coin and fitted with an ebonite sleeve, leaving exposed only the face and the corresponding blank at the opposite end of the short column of plaster.

A vessel containing an electrolyte, such as ammonium chloride, is prepared and the cast placed face upward in it, so that the face projects above the level of the liquid, and the liquid can only reach the face by absorption through the column of plaster. The piece of steel on which the reproduction of the coin is to be etched is placed on the face of the cast and is made the anode of the cell. A wire spiral placed in the liquid in the vessel is the cathode. Thus the steel plate rests on the high parts of the cast and at those points flows a current which dissolves the steel and the liquid steel flows into the cast. This process is kept up until the whole surface of the steel is in contact with the surface of the cast. Of course the process involves a number of details.

The best electrolyte is made by electrolytically dissolving an iron anode in a solution of ammonium chloride. Every five or ten seconds the steel must be cleansed of its constituents, notably carbon, which are left as it is dissolved. A reproduction of a coin can be etched on a steel blank in about three hours. A high voltage—10 to 15 volts—is efficient.

FLEXIBLE VARNISH FOR BALLOONS.

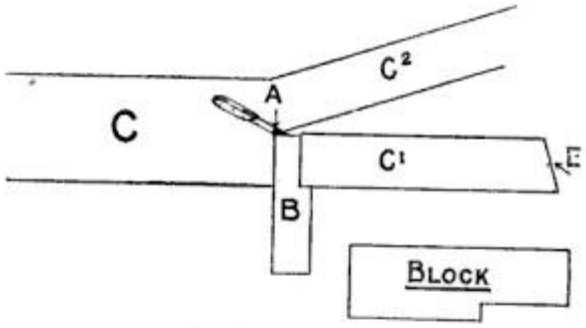
Digest at a gentle heat 1 oz. India rubber in shavings and 2 lb. mineral naphtha, using a closed vessel. Strain carefully.

CEMENT FOR BELTS.

Cook thoroughly 6 oz. of Peter Cooper's white or cream glue and when it is well done add 2 oz. of powdered white lead. Mix well. Use same proportions for larger quantities. For use for any length of time in summer leave thick and thin down with alcohol. When thoroughly cooked turn out into something to cool. Cut off a piece as wanted. In applying, make the splice the same length the belt is wide, hammer it well together and the belt can be used in one hour. A correspondent of Power says he has used this cement for six years and has never had a splice come apart.

HOW TO CUT BELT LACING.

In the diagram the various parts are as follows: A, sharp pocket knife; B, block; C, belt lacing, C^1, size of strip to be cut; C^2, other part of C; E, end of lacing. Place the left hand on B, holding it firmly and with the right hand take hold of E and draw it



Cutting a Belt Lace

towards you. The knife, A, will cut C in two equal parts, providing C has a straight outer edge. In this way C can be cut straighter than a string. The cut in block, B, may be any breadth or depth. The pocket knife should be driven into the bench or other base and must be very sharp.—Contributed by R. V. Archambault, Norris, Mont.

PAINT FOR SHIPS' BOTTOMS.

The following recipe is recommended by the Master Painter as a good paint for painting the bottoms of ships:

Eight lb. of rosin; 1½ lb. of Cologne brown dry color; 15 oz. of shellac; 25 gills of alcohol; 6 gills of benzine; ¼ gill of toluene and 10 drops of pyridine. Finish with a coat of paraffin wax and white lead boiled together and applied hot.

HOW TO MAKE GLASS SLEEVES FOR MACHINE BOXES

Their Use Makes Lubrication Unnecessary—Many Persons Experimenting with Them.

A very fair bearing for a common box can be made from broken bits of bottle or plate glass. Many machinists and power transmission people who desire glass journals for

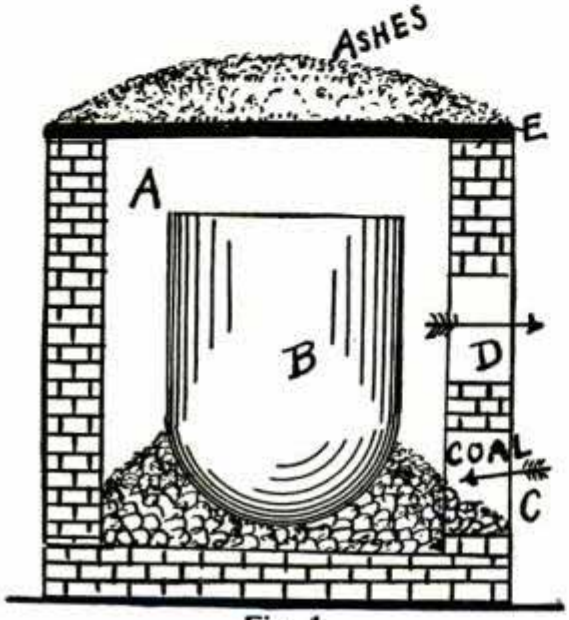


Fig. 1

special purposes give their orders to the glass works where any required pattern of sleeves can be manufactured. The glass manufacturers have every facility for making glass journals, but, as a rule, they are obliged to make excessive charges for special work of this kind; and besides, they cannot very well make just what one wants from drawings. Therefore, many people who are interested in the use of glass sleeves in journals for machinery, shafts for power transmission, engine bearings, etc., undertake to make the bearings themselves. There are many experiments in progress in the glass bearing line at the present time, and several different processes for making glass sleeves are in use at various important machinery centers. In some shops quite elaborate apparatus for the melting of the glass and

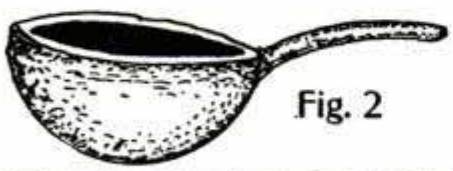


Fig. 2

casting the same has been installed; in others, the workman may be seen melting some broken pieces of glass over a fire with a ladle, he then pours the melted substance into the sand mold. Before we undertake to make any glass bearings, either in a crude way or in a mechanical way, let us observe the grades of glass used.

The Japanese use glass bearings for the purpose of saving oil. In fact they do not apply any oil at all to lubricate the journals fitted with glass sleeves. They take ginger ale bottles and break the pieces fine with a hammer and melt them. Flint glass is used by some of the American makers. The grades of glass in which silicate of potash and oxide of lead are prominent are considered the best grades. These are flint, crystal and strass. The coarse green bottle glass, which is so often used and which is so readily obtained, includes in its physical make-up silicate of soda, alumina, lime, and oxide of iron. The chief reason why one sees this grade of glass used frequently is because it is always convenient. Some of the glass bearing makers and users evidently consider all species of glass alike. The English crown glass is sometimes used, also the refractory Bohemian types. There are two ways: One is to select the glass from bottles or broken window panes; the other is to go direct to a glass works and purchase the kind of glass desired. Common white is a good sort to buy. If one uses bottles, he may as well use whatever is handy, and mix

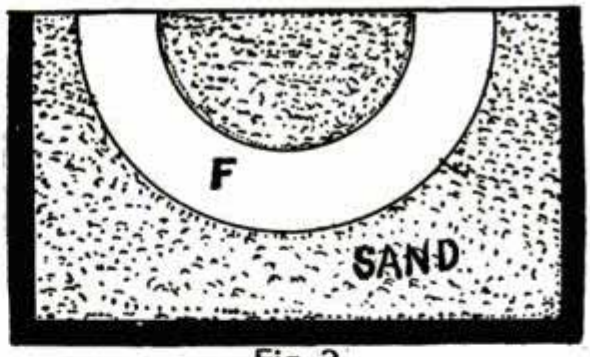


Fig. 3

and grind all together, as an assortment, except by an expert is not possible. But even when the glass is ready, and the pieces all broken up, so they have a degree of uniformity, the work is only begun.

For melting, an apparatus like the one shown in Fig. 1 is recommended as good, but such an apparatus involves both labor and expense. As a substitute one might melt the glass in an ordinary melting ladle. (Fig. 2.) In a shop, where it is intended to fill orders for glass bearings, it is a good plan to erect the brick or stone enclosure as shown in Fig. 1. This should be of proper dimensions to accommodate a crucible 3 ft. high and 20 in.

in diameter. Such a crucible can be purchased at a foundry. The melting of the glass is best done if the crucible is enclosed. Therefore build up the walls to make the chamber A. Have the inlet for the coal at C and the outlet for the draft and smoke at D. Cover the top with sheet metal, C, and to keep the heat in cover the sheet metal with ashes. Pack the crucible, B, with the broken glass and cover it. Put the crucible in through the top of the chamber. Cover the chamber, make a coal or coke fire and keep it up until the glass is melted. Then remove the covers and ladle out the melted glass. This is a first-class method, but as before stated, the glass can be melted in a common open ladle (Fig. 2) over a hot coal fire.

The next part of the process is the pouring and moulding. It is a good plan to make some sand moulds precisely like those used in the foundry for casting metals. Fig. 3 is a plan of one of the sand moulds. Use moulding sand and shape the form of the article to be cast in the sand as at F. Pour the glass direct, or use the usual gate and runners of the standard flask. Fig. 3 is a sectional view.

First cast very plain sleeves in open flasks and finish the exposed side by grinding on an emery wheel. After a while, almost perfect sleeves may be cast ready for use, by employing the facilities of the finished flask. Some of the sleeves are cast round complete as in Fig. 4. Fig. 5 is a view lengthwise of this design of glass bearing. The glass bearing is often supported in a cushion of rubber or a padding of felt. Sometimes, if thick, it rests directly upon the metal. Fig. 6 shows the arrangement frequently used when the sleeves bear in metal boxes. The shaft, G, contacts direct with the glass facing of the sleeve. The sleeve is supported in the metal frame of the box, H. This part of the box fits into the journal of the hanger or machine frame. Some of the boxes are put up as illustrated in Fig. 7. This involves either a tight fit of the glass sleeve or ridges provided on the sleeve to fit into corresponding grooves in the metal cap or seat of box. The adjustment of the ridges and the grooves prevents the sleeve from working out of its position. Some of the glass sleeves are made up in sections as illustrated in Fig. 8. Sometimes the sleeve is in one complete part, again in two halves and then again in four parts, as in this case; sometimes the sleeves are capped at the ends with metal enclosures and these caps protect the edges of the glass.

After the casting of the sleeves comes the smoothing and finishing. Some of the sleeves will be warped and crooked and have to be

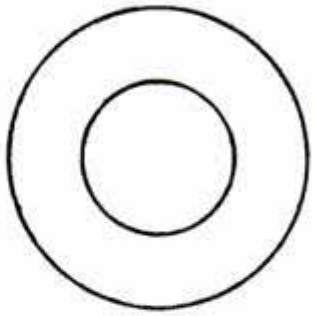


Fig. 4

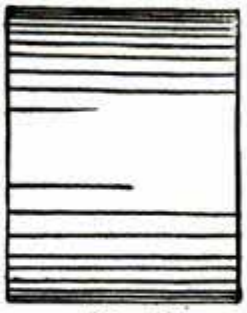


Fig. 5

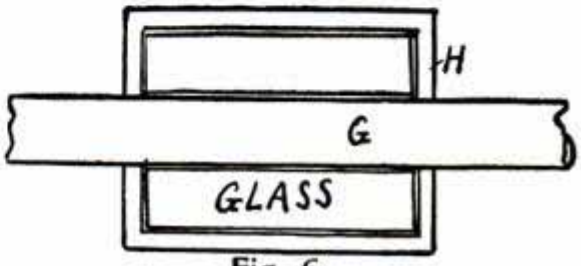


Fig. 6

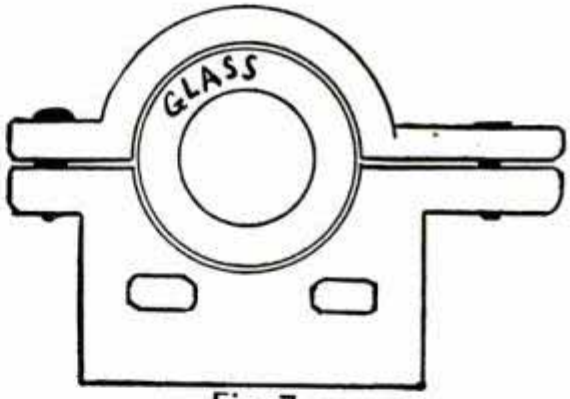


Fig. 7

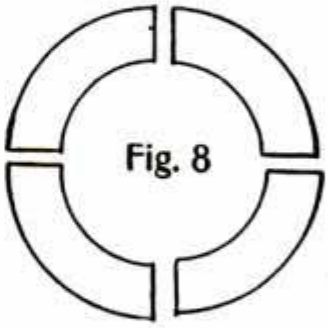


Fig. 8

remelted; others are cracked too badly for use; some are very rough and the roughness must be ground off on the emery wheel. This is quite fine work. In fact, all of the glass sleeves must be subjected to more or less grinding to get them into the proper

order for use. After the final grinding, rub the parts with an oily cloth, and then the sleeves are ready for work.

The object of the glass bearing is to do away with lubrication. Glass sleeves are used on water wheels, where the water constantly moistens the bearings, and no oiling is necessary; but in nearly every other instance of the use of the glass sleeve, it will be found that a drop of oil is slyly deposited in the glass bearing. Almost all makers of glass sleeves, however, declare that no oil is needed. The glass sleeves are hard and smooth, and for sewing machine bearings, etc., may run without oiling, or at least with little oil. In the large shafts, however, although practically no lubrication is made, daubs of grease plastered against the sides, "just to help out," may be observed. No oil holes are bored through the glass sleeves.

Despite these contradictory facts, the indications are that there is a future for glass bearings and many intelligent men are experimenting with them in spare hours.

"Traveller."

ANOTHER METHOD OF CUTTING A FINE-TOOTHED SAW.

The following method of cutting a fine-toothed saw is recommended as a better way than the one described on page 347 of the March Popular Mechanics.

Clamp a clock spring or corset steel in the vice firmly. To cut the teeth hold a sharp and hard cold chisel so that its front

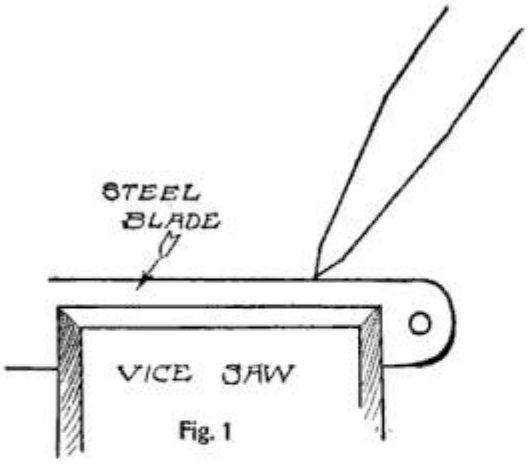


Fig. 1

cutting edge stands nearly plumb (see cut), then with a light hammer strike a blow of sufficient power to cut to the depth required. Now place the chisel on the steel and draw it toward the tooth just cut. When it strikes against the burr thrown up by the first cut, strike again with the hammer, being careful to strike with the same power as in making the first cut. Repeat this until all the teeth are made.

By using a fine chisel and light hammer, saws may be cut as fine as 30 to 40 teeth to the inch, and with heavier tools, as coarse

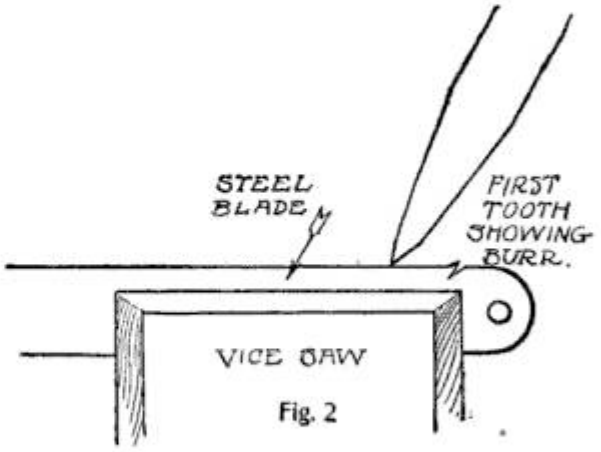


Fig. 2

as 12 to 16 teeth to the inch. After a little practice anyone can cut these teeth as fast as he can strike the blows.—Contributed by C. G. Evans, 380 Bowen Ave., Chicago, Ill.

THE DANGERS OF A SCRATCH

Scarcely a day passes that many workmen do not, in some way or other, get a scratch, a small cut, or a bruise that may break the skin. In most instances not the slightest attention is paid to this beyond the temporary annoyance of the pain and the possible irritation when the hands are put into water, or some subsequent blow in the same spot brings an exclamation on account of the hurt.

This, while a common practice, is by no means a wise one. The air is full of floating disease germs, especially the air of cities and towns, and an injury of this sort, be it ever so slight, might furnish excellent breeding ground for some deadly bacteria. It is a good plan always to keep a bottle of prepared carbolic acid and glycerine, and frequently touch all bruises or sore spots with it. This is one of the most convenient and effective germicides imaginable. It is believed that many cases of fever and other serious ailments can be contracted by a floating germ coming in contact with the abraded skin. Once snugly lodged in this most congenial dwelling-place, the germ multiplies with amazing rapidity, and soon overruns the entire system. Therefore, whenever there is a bruise or scratch, or any injury of this sort, germicidal applications should be at once resorted to.

HOW TO MAKE A CLOTHES LINE TIGHTENER.

To keep clothes line wires from sagging when hung full of heavy damp clothing, the following contrivance will be found efficient and can be made by anyone.

Procure a strong, straight-grained fence post, 9 ft. long, and saw a section about 8 or 10 in. from the top, as at K, Fig. 4. Bore a ¼-in. hole through the post as at F, Fig. 2. Set the post in the ground to a depth of 3 ft., tamping the earth around it firmly. The post must be well set, as there will be considerable strain.

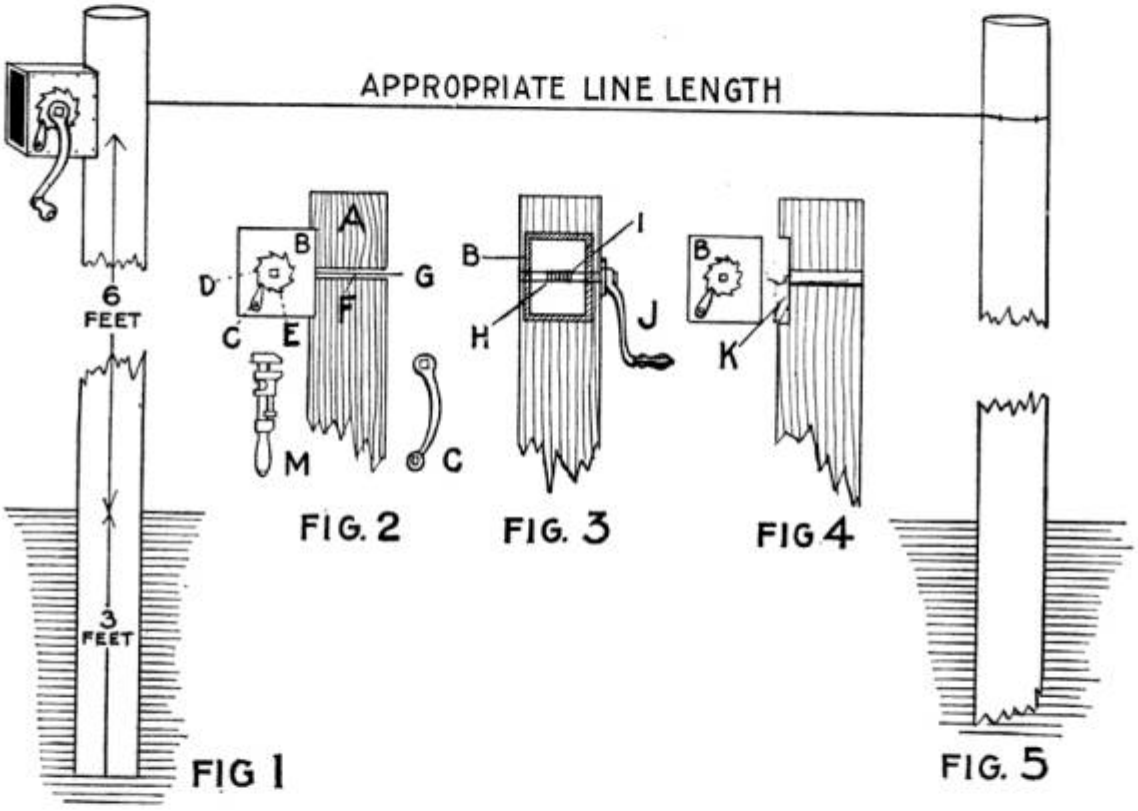


FIG 1 FIG. 2 FIG. 3 FIG 4 FIG. 5

Construct a boxed enclosure with a ratchet wheel and ratchet as at B, Fig. 4. Nail this box in the post at K, Fig. 4, run the wire through the hole in the post on to the ratchet shaft, H, Fig. 3, and then run the wire from this post to another post or to a building. Attach a crank, as at C, Fig. 2. If there is no crank to be found use a monkey wrench. The apparatus is now in working order. All that is necessary is to turn the crank on the ratchet until the wire is stretched as tight as desired.—Contributed by Leroy L. Kenny, Hawarden, Iowa.

Pencil drawings may be fixed to stay by applying a coat of 3 oz. gum mastic dissolved in 1 pt. of alcohol. Put on with a brush.

TO GIVE WOOD AN EGGSHELL POLISH.

Make a polish of 3 parts shellac, 1 part mastic resin, and 1 part sandrac resin, dissolved in 40 parts methlyated spirits. Apply with a rag.

RECIPE FOR FRENCH POLISH.

Dissolve thoroughly ¾ oz. gum benzoin, 3 oz. gum juniper, 14 oz. orange shellac, ¼ oz. dragon's blood powder and ½ oz. powdered borax in ½ gal. methylated spirits of wine contained in a bottle. Strain through thin muslin.

HOW TO SOFTEN CAST IRON.

Put a cap or plug in one end of a piece of gas pipe larger and longer than the work to be annealed. Put a layer of equal parts of sand and powdered charcoal mixed together into the pipe, put in the work, and then fill the pipe with the sand and charcoal mixture, tamping down lightly. At night, heat to a red heat, cover well with hot coals and then with green coal and leave until morning. Remove from the forge in the morning and set aside to cool. A correspondent of the American Blacksmith says finished work can be annealed in this way.

JACKS FOR HOLDING AND LIFTING PUMP PIPES.

In Fig. 1 is shown a jack and its parts in detail for holding pipe. The jack may be made of either 1¾ in. by ½ in. steel very good iron tire or of 1⅛ in. square axle stubs taken from an old carriage axle, says a correspondent of the American Blacksmith.

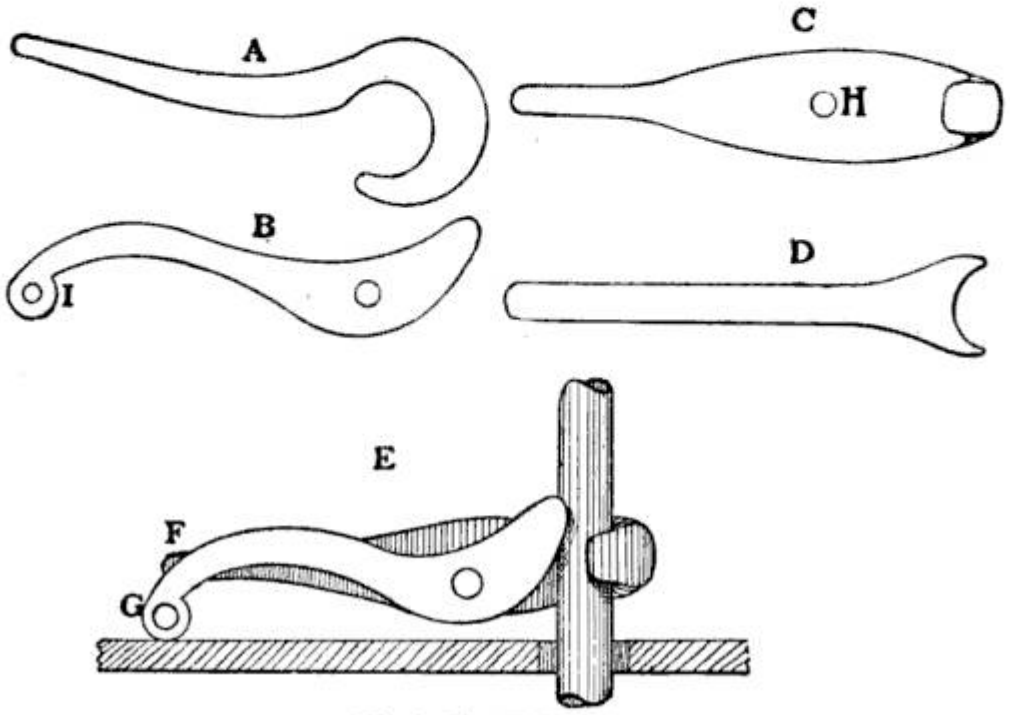


Fig. 1—Pipe-Holding Jack

The hook or claw which holds the pipe is shown at A, and a side view of it, showing the manner of forging so as to strengthen it at H, where a hole is drilled to receive a ⅝ or ¾ in. rivet, is shown at C. This claw is made for 1¼-in. pump pipe, the size most commonly used. The lever and rest is shown at B. It should be curved in the arm so that when in use the hook cannot touch the platform to loosen the hold on the pipe. D shows a top view of B. The hole I, in the lever, B, is for receiving a chain or rope when using the tool over an old-fashioned well or cistern, and prevents the tool from falling in and being lost. The rivet holding the parts together should be strong and fit like that in a pair of tongs. The tool opens and closes by lifting away from G.

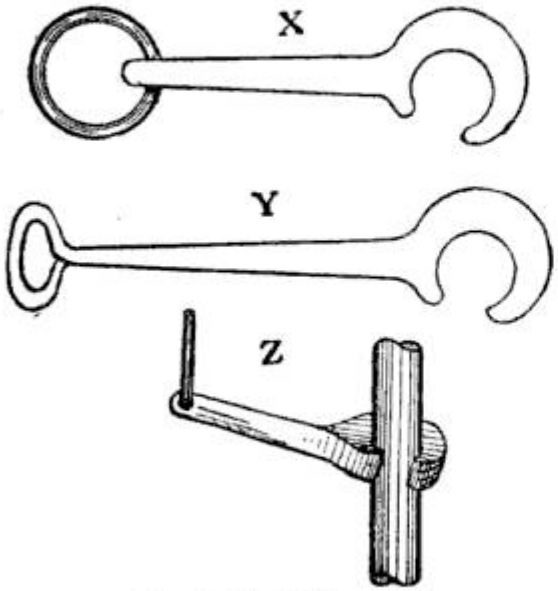


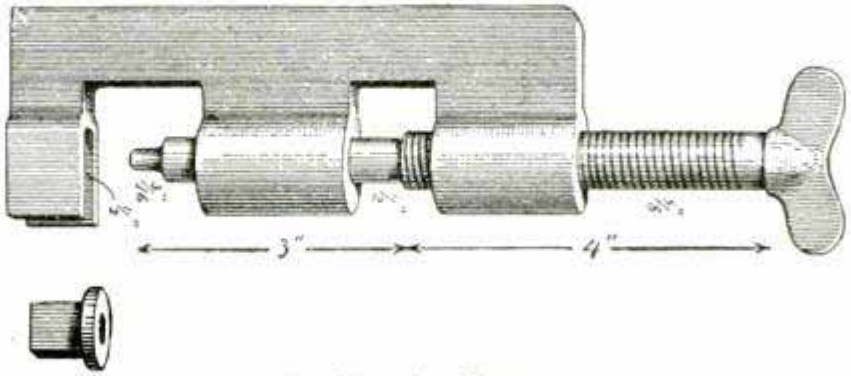
Fig. 2—Pipe-Lifting Jack

For lifting and lowering pump pipes a tool like the one shown at X is satisfactory. it may be used either with a rope or by passing a bar or hand spike through the ring, so that two men can lift on it. It is made of 1⅛-in. axle stub of square stock, the opening being just large enough to let the pipe into the hole of the tool which should be but ⅛ in. larger than the pipe. This tool is shown in use at Z.

A tool for hand use is shown at Y, and it may be used singly or in pairs. The ring at the end provides hand-hold and it is turned out of the handle solid, just like a poker hand-hold. The light part should be ¾ or ⅞ in. round and the rest 1⅛ in. square. A set of these tools should comprise a jack as at E, rope and a lift like X, or a jack and two hand lifts like Y.

DEVICE FOR REMOVING BROKEN RIVETS

For removing broken rivets in buggy bow sockets the device shown in the sketch is guaranteed by a correspondent of the Blacksmith and Wheelwright to be all right. The sketch is self-explanatory. For the inside end of a rivet, place a washer large enough to go over the head of the rivet to hold it firm in its place. There is no danger of breaking the socket in using this device, and one man can do the work more easily and quickly than by the old method.



For Removing Rivets

HOW HORSEPOWER COMPARES WITH MANPOWER.

The measurement of a horse's power of work, first ascertained by Watt, the inventor of the steam engine, was founded upon the basis that the average brewery horse was capable of doing work equal to that required to raise 330 lb. of weight 100 ft. in one minute, or 33,000 lb. one foot in one minute. This estimate, however, was for one minute; it would not be possible for a horse to perform this amount of work continuously for eight consecutive hours. One horse could exhaust 12 men in a single day, for where a strong man could perhaps pull half of 330 lb. to a height of 100 ft. in two minutes, he probably could not repeat the operation more than a few times. A man's power is about one-tenth of a horse's power. That is, where a horse could pull 330 lb. to a height of 100 ft., one minute, and then slack up and repeat the operation, for eight hours, thus pulling four hours, and slacking up four hours, it would require ten strong men to perform the same amount in that length of time. When man put horses to work the gain in labor for the world was thus tenfold. Multiply this by steam power, water power, air power, and above all, electric power, and one has a problem in mechanical progression.

RULE FOR CONSTRUCTION OF ELLIPSE

The following on the construction of ellipses may be of interest to many mechanics, as this subject is not taught in public school text books. I had occasion to use this rule but recently in certain designs, and noting certain comments on ellipses in April Popular Mechanics, offer this for the benefit of those who are interested. The difference between the squares of the axis of any ellipse is equal to the square of the difference between the foci.

To reduce this rule to a formula, let

L = Long axis.
S = Short axis.
D = Distance between foci.

Then

$$L^2 - S^2 = D^2.$$

To construct an ellipse of any given dimensions, say, with long axis 5 in., short axis 3 in., substituting in formula—

$L^2 = 5^2 = 25$
$S^2 = 3^2 = 9$
$25 - 9 = 16$
$\sqrt{16} = 4$ = Distance between foci.

To construct ellipse, insert pins in line of long axis 4 in. apart, or ½ in. from each end of ellipse to be constructed. Then with a loop 4½ in. long draw ellipse.

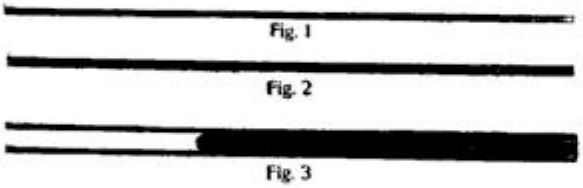
In addition to the remark in April Popular Mechanics that the curve of the distances of any point on the curve from the foci is always the same, it may be added that this distance is always equal to the longer axis.—Contributed by W. G. Frisbie, Athens, Pa.

A CORRECTION.

The article entitled "Using Motorcycles for Shop Power," which appeared in our May issue was by mistake credited to the American Blacksmith instead of to the Blacksmith and Wheelwright in which paper this interesting kink first appeared.

A LESSON IN FRESCO PAINTING.

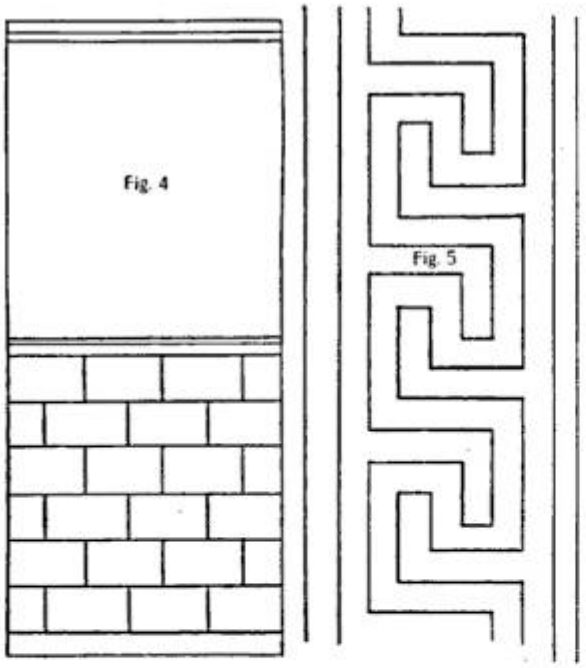
The materials required by the beginner in fresco painting are a perfectly straight piece of wood, 3 ft. long, 2 in. wide and of about the thickness of a lath, and a brush, called a "fresco liner," made of white bristles, and varying in size from ¼ in. upwards. The smallest size is best for the beginner, says



a correspondent of the Western Painter. It is not only cheaper, but if mastered first, it will not be hard to learn to handle the larger sizes. To practice with use black marking ink, which flows evenly and is easy to use.

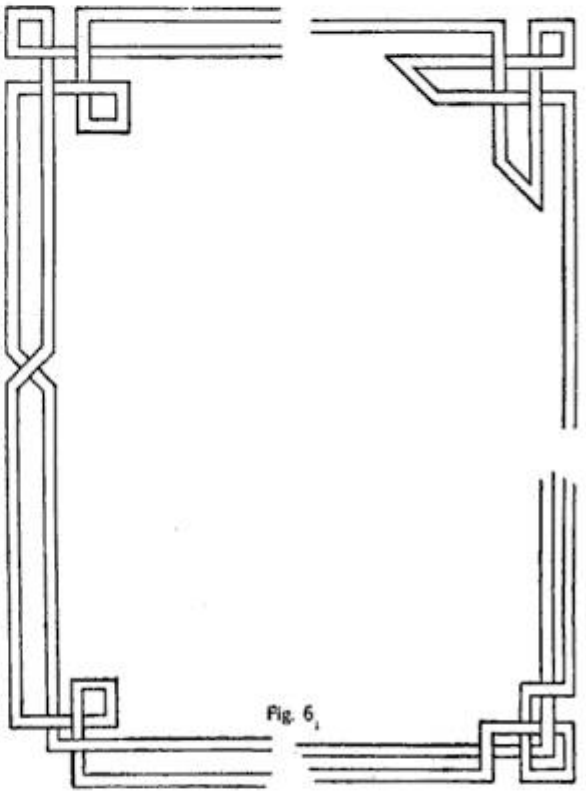
Good lining is the first thing for the amateur to master. If he practices until he can make perfectly straight lines of uniform thickness and having neatly joined corners he has gone a long way toward becoming an expert fresco painter.

To begin work select a smooth board surface or wall space and hold the straight



edge against the wall, using the left hand and grasping it at the extreme left end, the back of the hand being against the wall and the thumb facing the body. The right end of the straight edge should touch the adjoining wall; the straight edge does not lay flat on its surface. Take the brush in the right hand, holding it at the extreme end of the 10-in. wooden handle between the thumb and first finger. Dip the brush in the fluid, touch it lightly against the side of the pot to remove all excess ink and, starting at the left, run the line lightly to the right. Do not hesitate or the line will waver, due to varying pressure.

When able to make such lines perfectly, try making lines several times as long. Make first a guide line by fastening one end of a 6 ft. line to the wall with a tack, drawing it taut and running a piece of char-



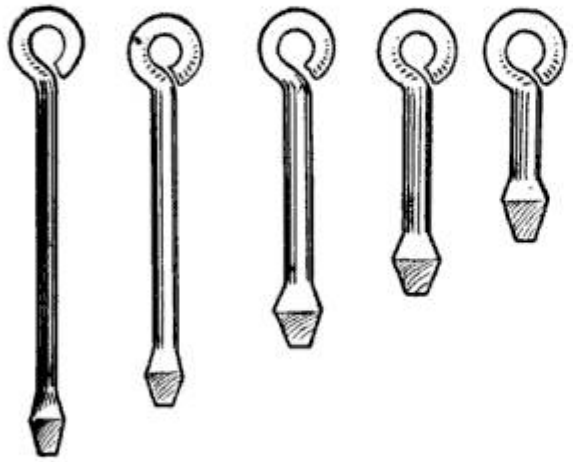
coal over it. Then stretch it perfectly tight and level along the wall and pull it out at the middle and let it snap back against the wall. Repeat this several times and a fine guide line will result. In practicing on long lines be very careful to join the strokes neatly.

The illustrations show some lines to practice on. Fig. 1 represents a fine line made with a light, quick stroke; Fig. 2 requires a heavier brush; Fig. 3 is made by filling in between two fine lines, using another brush, and Figs. 4, 5 and 6 show various decorations which may be executed by the amateur.

On an average from 10 to 12 lb. of hard coal, or 18 to 20 lb. soft coal can be burned on one square foot of grate. Nearly double this amount can be burned with forced draft.

HOW TO MAKE A GOOD SCREW DRIVER.

Take ⅜-in. round spring steel and forge the end to the proper shape. Bend an eye in the other end. For hard work place a bar through the eye. There is no handle

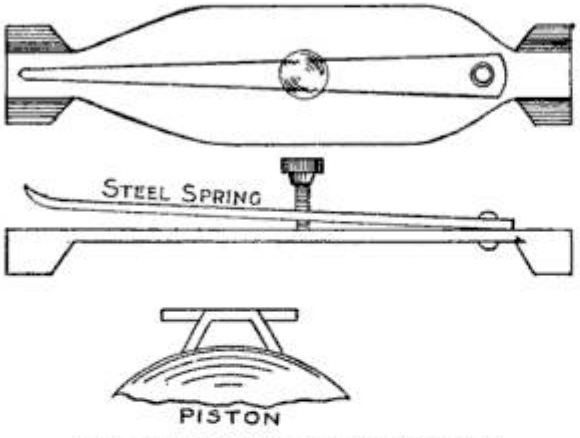


Set of Screw Drivers.

to come off, and if the point breaks it can be forged again. The long one, or lazy man's driver, should be about 30 in. long; the short one about 8 in. long.—Contributed by Paul S. Baker, Muscatine, Iowa.

HOME-MADE TURTLE-BACK STUFFING-BOX CALIPERS.

The illustration shows top, side and end views of some turtle-back stuffing-box calipers which any engineer can make and will find them a valuable addition to his kit of tools. The calipers are used for tru-



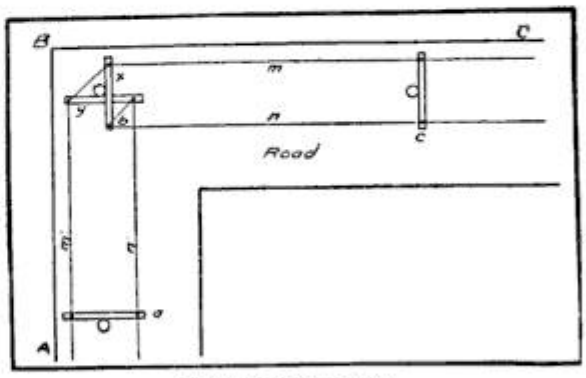
Calipers for Turtle-Back Stuffing Box.

ing up the piston in the stuffing-box.—Contributed by W. O. Fischendorf, Mt. Vernon, Ind.

An excellent marking ink, which dries quickly, will not spread and is almost indestructible, may be made by dissolving asphaltum in turpentine to a thin fluid.

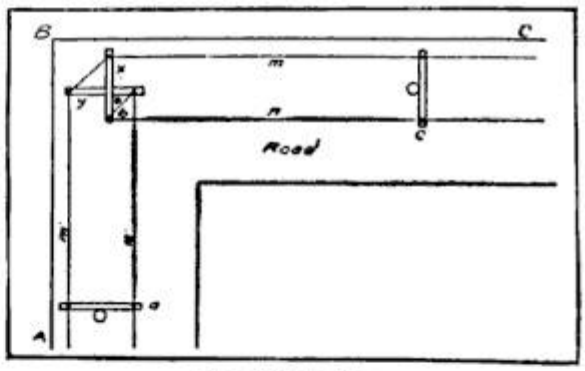
TURNING CORNERS WITH TELEPHONE WIRES.

Editor Popular Mechanics: On Page 444, of your April issue, I notice an article on telephone line construction. The description is right, but the artist got the pole on the wrong side of the crossarm. The cut shows as follows:



Wrong Const uction.

As shown above the pull comes so that the strain is on the bolt or lag screws instead of on the pole. The proper way is to place the crossarms as shown in the cut below, viz.:



The Right Way.

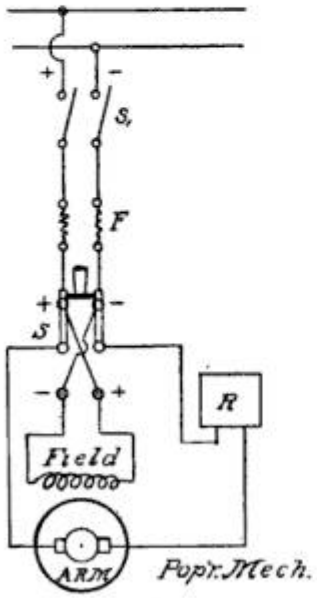
I have frequently seen crossarms pull off when faced as shown in the first cut.—John Reiland, Lena, Ill.

COOLING A DYNAMO.

A dynamo which had given considerable trouble heating and cutting of brushes and commutators was arranged by a correspondent so that it was kept cool by its own power. An electric fan was placed on a stand just high enough so the current of air would be thrown on the armature. The fan was then connected with the wires from the generator and there has been no trouble from heating since.

SIMPLE WAY OF REVERSING A MOTOR.

The diagram shows a simple way of reversing the direction of a motor with a double pole double throw switch. The fields are in circuit as soon as the main switch is closed and by using the double pole double



Plan of Wiring

throw switch on one side the motor runs one way, and by changing the switch the motor runs in the opposite direction. An ordinary rheostat is used for controlling the armature. —Conducted by G. H. A., Chicago.

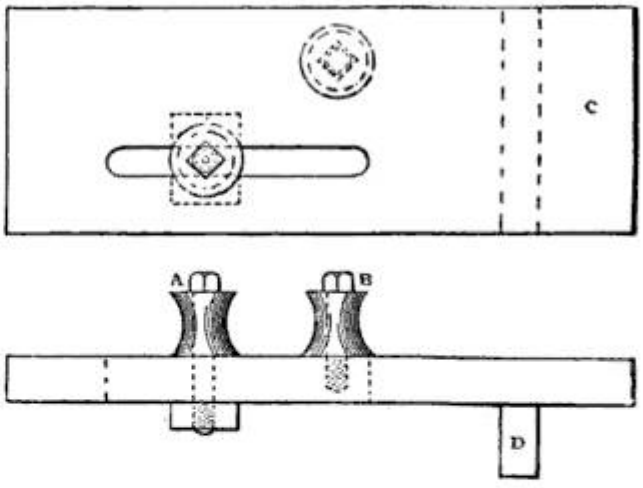
DRIVING AND HOLDING POWER OF CUT AND WIRE NAILS.

Prof. Carpenter of Cornell has made some experiments in nail driving. These experiments would seem to establish: First, very much more force is required to drive a cut nail a given distance than a wire nail. Second, more force is required to start a cut nail generally than to drive it, and that it invariably starts much harder than a wire nail. Third, the work in inch-pounds per nail required in driving cut nails is much more than that in driving wire nails. Fourth, the work in inch-pounds in pulling cut nails is about equal, sometimes less and sometimes greater, per nail, than that for pulling wire nails. Fifth, the maximum force per pound in driving or starting wire nails is more nearly equal to that of the cut nails than when estimated on the basis of that of a single nail, but it is still less. Sixth, the work, in foot-pounds, per pound of wire nails required for driving is less than that required for the cut nail, and that for pulling is considerably more. Seventh, the relative efficiency which is here considered as the ratio of the work of pulling to that of driving is much higher for the wire nail than for the cut nail. In making experiments it was noticed that the cut nail bruised and broke the fibers of the wood, principally at the end of the nail, whereas the wire nail simply crowded them apart, and probably did not move them much beyond the point from which they would return by elastic force, and hence the nail would be grasped much stronger per unit of area of surface by the wood. Presenting less surface, there would be, however, less resistance to starting. To see what the effect of change of form would be, a number of ten penny cut nails were sharpened on the point by grinding to an angle of about 30 deg., so that the fibers in advance of the nail would be thrust aside and not bruised and broken. This served to increase the holding power over the cut nail of ordinary shape about 50 per cent, in starting force, and about 30 per cent in work of resistance to pulling.

AN ADJUSTABLE PIPE-BENDING DEVICE.

The pipe-bending apparatus shown in the illustration, which can be adjusted to vary the radius of the curve to be bent, is so simple that any workman could make one like it, says a correspondent of the Engineer's Review.

To the plate, C, is fastened a stud, B,



Adjustable Pipe Bending Device

while the stud, A, moves in a slot in the plate. The pipe is bent between these two studs, by prying in the direction in which the pipe is to be bent. The movable stud regulates the radius of the curve. The rib, D, is for holding the plate in the vise while bending pipe.

MECHANICS FOR YOUNG AMERICA

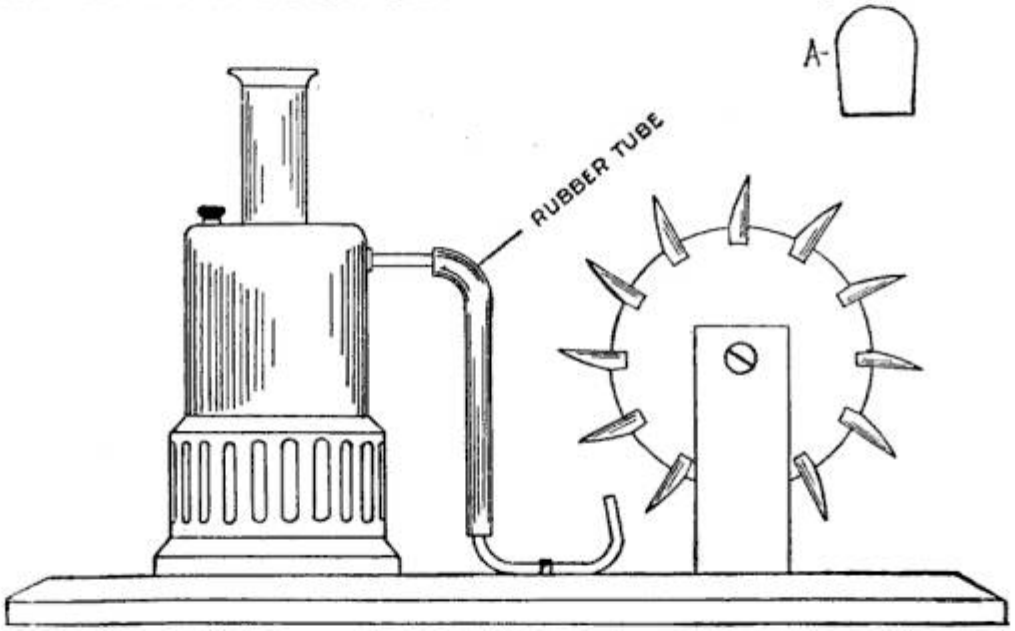
HOW TO MAKE A MINIATURE STEAM TURBINE

With an old toy steam engine boiler and a little work a steam turbine can easily be made but it will not generate ten thousand horsepower as some of the giant turbines do.

When you have the boiler the next thing to do its to make a disc of wood about ¼ in. thick and 3½ in. in diameter. Mark twelve points around the edge of the circle of wood, the points being at equal intervals all the way around. Cut with a fine saw 3-16 in. at each of these points. Twelve paddles should then be made of sheet copper or brass and cut in the shape of the figure shown at A in the sketch. Then wedge the paddles tightly into the saw cuts and bend them into the shape of a spoon. For the axle take a wire nail, cut off the head and sharpen each end to a fine point. Force the nail securely into a central hole in the disc.

Now we may go back to the boiler. As there is generally a small piece of brass tubing left on the side of a boiler, which was formerly connected to the steam engine, this piece may now be joined to a four or five-inch length of rubber tubing and bound with wire. The rubber pipe is then attached in the same manner to a piece of metal tube bent into the shape shown in the drawing and fastened to the base with a staple.

In mounting the wheel make two blocks of wood each 3 in. high, ½ in. thick and 1 in. wide. On the flat end of one of the blocks screw a small plate of sheet brass and punch a very tiny hole which should fit the point of the axle. For the opposite bearing file off the point of a one-inch screw and also make a small hole in the end of this to fit the other point of the axle. Then put the screw into the second block at the same height as the hole in the piece of brass on the first block. Fasten these bearings to a base made of a board one foot long and six inches wide. A fairly good idea of the way the wheel is to be mounted may be obtained from the sketch.



Plan of Steam Turbine

The turbine is now complete and ready to run. Power is obtained from an alcohol lamp or Bunsen burner and when under full steam the wheel will revolve with considerable rapidity.—Contributed by E. H. Klipstein, East Orange, N. Y.

HOW TO SEE THROUGH YOUR HAND.

Roll a tube out of a piece of pasteboard about 5 in. square, having one end just large enough to fit around the eye and the other slightly smaller. Take the tube between the thumb and finger of the right hand and put the large end close against the right eye. Hold your left hand against the other end of the tube and keep both eyes

open. There will appear to be a hole through your hand and objects beyond it will be plainly visible. The left eye is actually doing all the seeing of objects beyond, but it will seem like the right eye sees them, too, through the hand.

HOW TO MAKE A WOOD-TURNING LATHE OUT OF AN OLD SEWING MACHINE.

With a hack-saw, cut off the arm containing the needle on line AB Fig. 1, leaving the shaft only. On the end of the shaft will be found a round plate, in which drill four 3/16-in. holes. Now secure, or have turned, a piece of iron or steel 1½ in. in diameter, Fig. 2. Drill and countersink four 3/16-in. holes in it to fit the holes on the shaft plate. File a spur center 5/16 in. long, and two side points 3/16 in. long. Bolt this plate to the shaft plate with four flat-headed stove bolts, 3/16 in. in diameter by 5/8 or ¾ in. long, Fig. 3.

For the bed, use a board 32 in. long and as wide as the base of the machine arm.

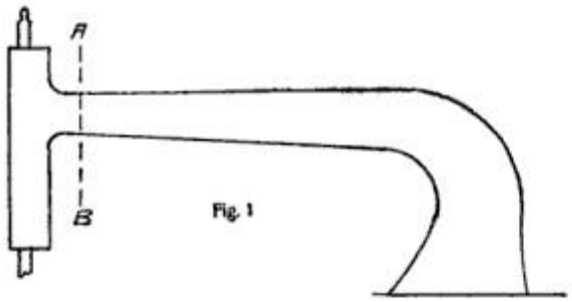


Fig. 1

This gives a limit of 2 ft. between spur and dead centers. Let this board be made level with the rest of machine table by making a pair of legs if needed. Next make a T-rail, Fig. 4, of two boards, one 5 x ¾ x 32 in., the other 3½ x ¾ x 32 in. Three-quarters inch of the wider board projects over each of the smaller boards. Nail firmly and clinch nails, or screw together. Screw this rail on the machine board so that its center coincides exactly with the machine centers. Bore a number of ¾-in. holes with centers 2¾ in. apart along the center line of this rail, beginning 6 in. from the end nearest the machine. Make another T-rail for slide tool rest, of two pieces 32 x 3 x ¾ in., and 32 x 1½ x ¾ in. Fasten this in front of the larger T-rail and parallel to it, the center lines being 6½ in. apart.

To make the tail-piece, that is, the part

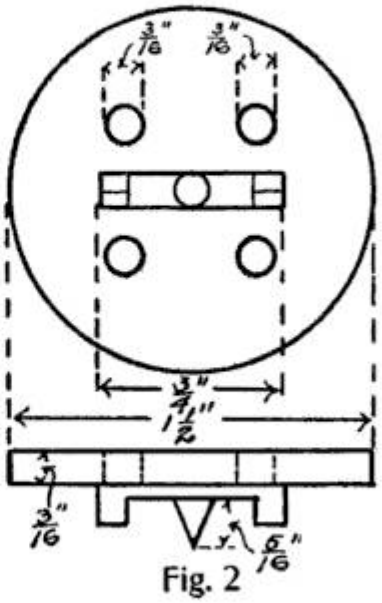


Fig. 2

to hold wood to be turned, get a board 6½ x 7 x ¾ in., and on the edges, Fig. 5, A, screw two pieces 7 x ¾ x 1½ in. so that the cap thus made will fit snugly over the large T-rail. Fasten to these last two pieces, with screws, two more pieces 7 x ¾ x ¾ in., Fig. 5, B. This tail-piece should move smoothly back and forth with no side motion. Now get a block of hardwood 4 x 2¼ in., and 1¾ in. higher than the spur center when mounted on the middle of the tail-piece just described. At exactly the height of the spur center bore through this block a ¾-in. hole, Fig. 5. Have a blacksmith make a crank 8 in. long, threaded for 5 in. as shown. At the dead center end taper the crank and make a cup center, out of which allow a 3/16 in. point to project. The cup prevents the point from boring into wood too rapidly. One inch from the outer end of the crank block, Fig. 5, bore a 3/16-in. hole, and force a ¼-in. bolt to cut its thread in the wood. This is a set screw to hold the crank in any position desired. Place a strap nut, threaded to fit the crank, on the head-end of the crank block, and a plain nut to act as a bearing, on the crank end. One and one-half inches from the back of the

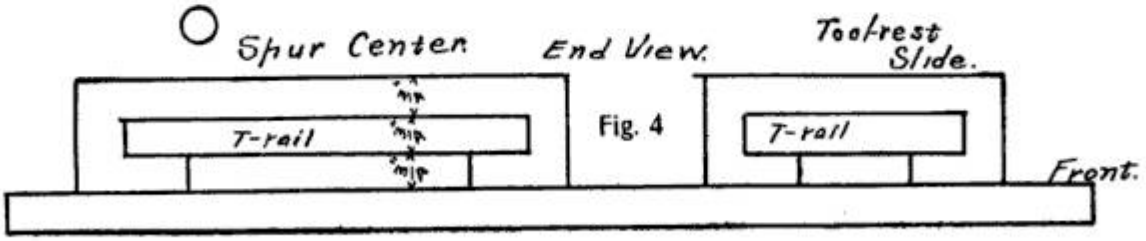
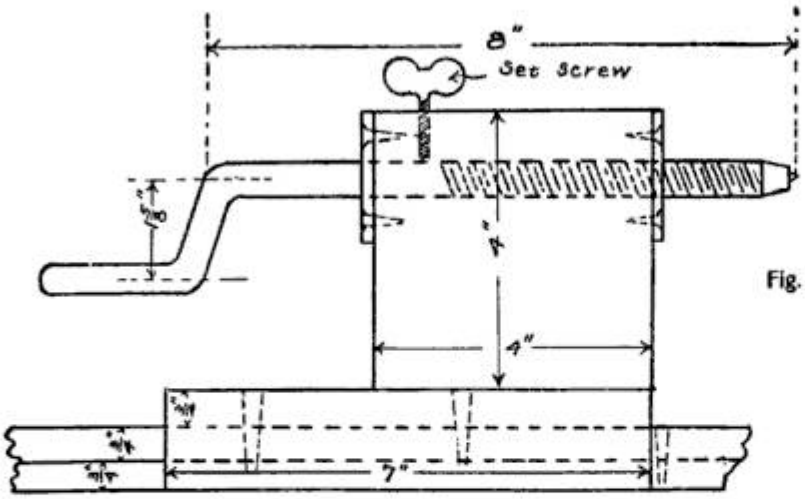


Fig. 4



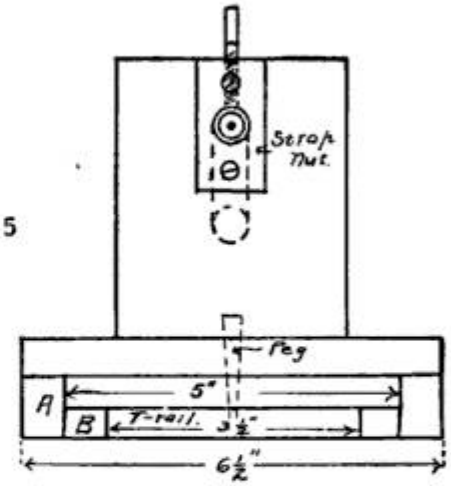


Fig. 5

tail-piece bore a ⅜-in. hole. Make a peg ⅜ x 2 in. To put in a piece of wood to turn, move the tail-piece back until the head end is over the center of the hole nearest the end of the block, then the peg will slip into second hole from the head end of the tail-piece, and into a corresponding T-rail hole, pinning the two together. Insert wood and screw up dead center to hold it.

For a tool rest make a second piece like the base of the tail-piece, 11 in. long and fitting the small T-rail. Cut out two blocks 1½x2¼x¾ in. and screw them, one on each end of the base of the tool rest, covering the half farthest from the centers, and having an 8-in. space between blocks. On the tops of these blocks screw a strip 11 x 2¼ x ⅝ in. Now for the rest proper, cut out a board 8 x 11/16 x9 in. to slide in the slot of the rest. Take a piece of oak 11 x 2 in., and high enough so that the top will be level with the centers of the lathe, and bevel as shown in Fig. 6. Screw on one end of the 8 x 9-in. piece exactly in the middle. This piece will slide in and out, closer or farther from the centers as desired, and also along the T-rail.

A center for turning rosettes, saucers, etc., may be made as follows: Remove the spur center and bolt in its place a 1-in. circular board of the same diameter, using longer 3/16-in. stove bolts with heads countersunk. Rotate the lathe, and with a gimlet bore a hole at the exact center and through the board. Now take off the board and countersink on the back a place for the head of a coarse threaded screw. Turn in a 1¾-in. screw, replace the board and any block held on the end of the rotating screw will turn on and be held while being turned. —Contributed by L. L. Winans, Mexico, Mo.

HOW TO REMOVE STAINS FROM MARBLE.

When other methods fail, try dissolving 1½ lb. potash and 1 lb. virgin wax in diluted muriatic acid or warm soap and vinegar. Boil the whole for 30 minutes and let cool. The wax will then float on the surface. Remove the wax, put it into a mortar and triturate thoroughly with a marble pestle; add soft water to it to form a soft paste. Apply this paste to the stained marble and let it dry. Rub off with a woolen rag.

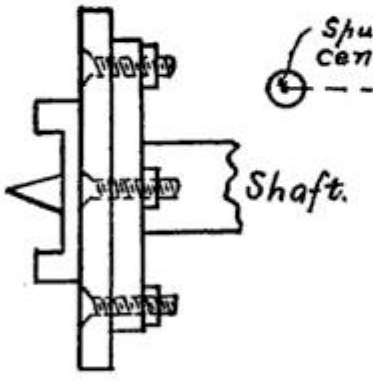


Fig. 3

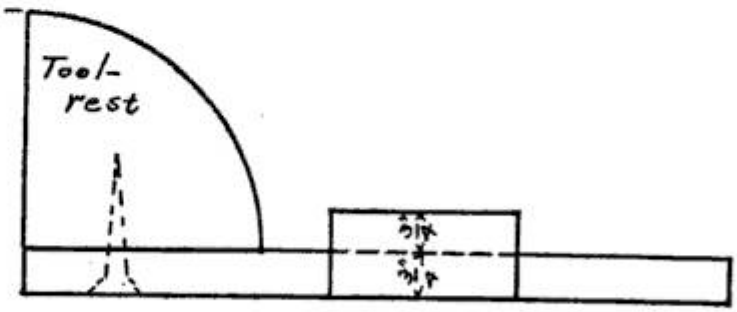
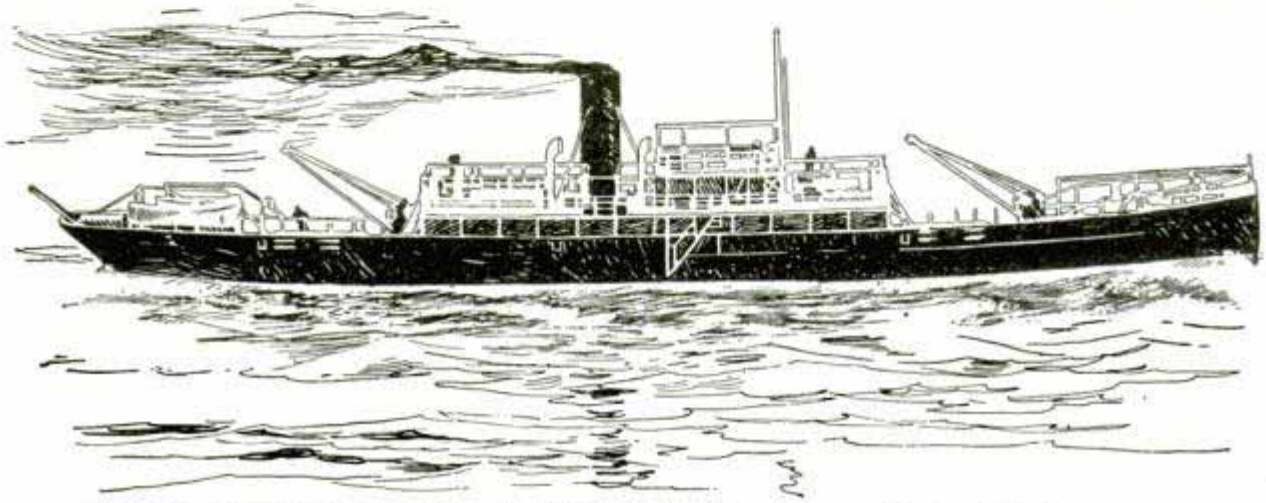


Fig. 6

STEAMER SAILS ON LOFTY MOUNTAINS.

Built in England and Carried Up the Andes.

Not since the ark landed on Mt. Ararat has, in all probability, any large vessel aspired to so lofty a home as the steamer "Inca." Built in Hull, England, she sailed under her own steam to Mollendo, South America; was then taken to pieces and carried up the Andes to finish her career on Lake Titicaca, Peru, over 12,000 feet above the ocean.



"The 'Inca' Was Carried Up the Andes to Lake Titicaca."

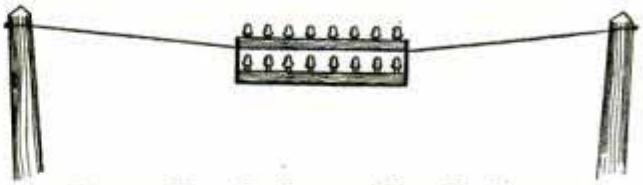
The dimensions of the "Inca" are 220 ft. by 30 ft. by 14 ft. She is propelled with twin-screw engines of 1,000 h.p., and has a speed of 12 knots. She is fitted with good accommodations for 24 passengers, will carry 550 tons d. w., and has good arrangements and facilities for working cargo. Before being taken apart for shipment, she was equipped for service in every particular. A portion of a joiner's shop was prepared to represent a ship's deck and here were built up the saloons, staterooms, pantries, etc. Even the upholstery, curtains, rods and dining tables were furnished. A system of steam heating was installed and on the cabin sides were marked such details as leads of wires for electric lights, positions of switches, etc.; the auxiliary machinery, fans for forced draught with pipes and connections, were all fitted up on the ship.

Everything complete, the "Inca" was then taken to pieces and packed in over 3,000 separate packages, each carefully marked so there would be no mistake in re-erecting the vessel, and bearing other marks for shipment purposes. The vessel was conveyed 150 miles by rail, the railway running along the mountain side and across the valleys of the Andes, and rising to an altitude of 12,000 ft. in the distance traversed. The "Inca" is well named, as Lake Titicaca lies within the boundaries of the land said to have been the cradle of the old Inca races.

PLAN TO SAVE SHADE TREES WHEN RUNNING WIRES.

Frequently when putting up a pole line for telephone or electric light wires along the side of a street, the workmen utterly destroy the beauty of shade trees by cutting away large branches. Even with this defacement there is apt to be frequent interference with the wires when the wind blows, or during a severe storm. At all times the wires are liable to cut into large limbs or tree trunks.

A remedy is suggested in placing a pole on each side of the street and suspending an ordinary cross arm from a strong wire extending from pole to pole. When the



Does Not Injure Shade Trees

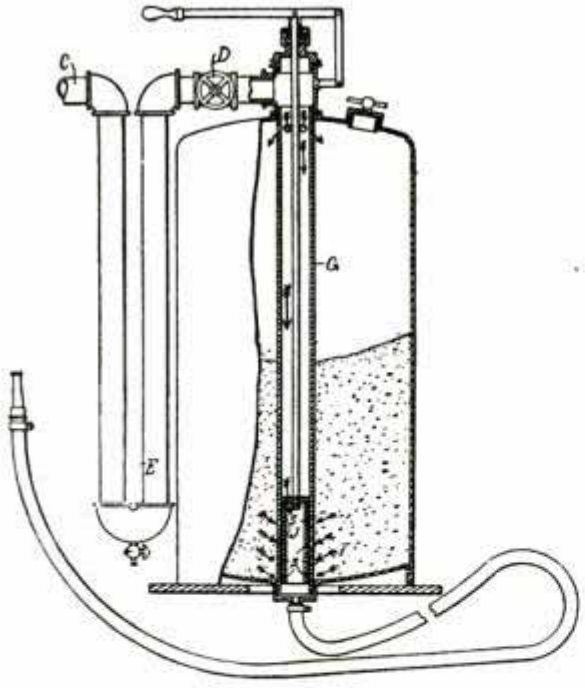
trees have been passed the line wires can be turned to the ordinary single pole placed near the curb.—Contributed by W. E. McChesney, Berkeley, Cal.

The Chinese government has entered upon the granting of letters patent, the first having just been granted. It is to protect an electric lamp, called "bright moonlight," and which its inventor claims is far superior to glow lamps of foreign manufacture hitherto used in the Empire.

PORTABLE SAND-BLAST OUTFITS.

In bonding the girders of the Brooklyn elevated railway system recently, two portable sand-blast outfits were used with very satisfactory results. One of these outfits consists of a motor-driven air compressor and three 24½ x48-in. reservoirs mounted on a platform wagon. The air compressor consists of a duplex, horizontal single-acting pump mounted on a common bed plate with a direct-current series railway type motor and when pumping against 100 lb. air pressure develops 9½ mechanical h.p., says the Street Railway Journal. Its capacity is for 50 cu. ft. of free air per minute, with 600 volts line current.

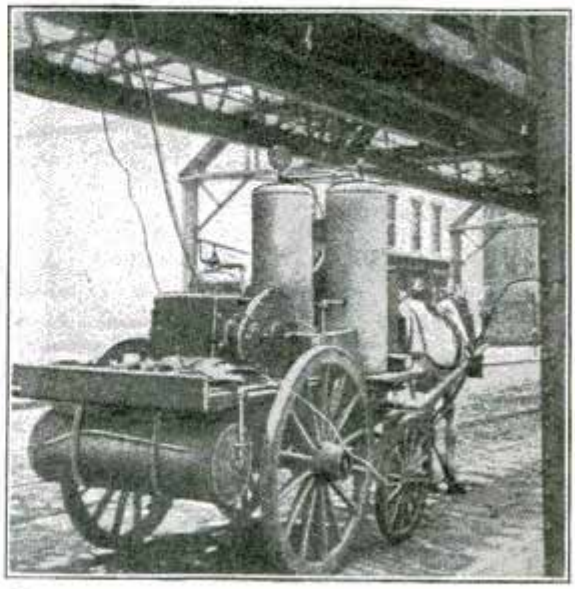
In using this outfit for the bonding referred to, the positive lead to the motor was connected with the trolley wire of the surface line and consisted of a wooden pole having a copper hook on one end for hooking over the trolley wire and having a copper wire bound to the side of the pole running to the motor. This did not interfere with the running of the surface cars. The negative lead from the motor was connected directly to one of the columns by inserting the end of the wire in a small drainage hole. On the front board of the wagon is placed an electric pump governor, which was



Outline Section of Sand-Blast

connected in the positive lead to the motor, and which starts and stops the motor compressor at given maximum and minimum pressures in the reservoirs.

The operation of the sand-blast apparatus may be understood by reference to the sectional view. Air enters from the reservoir at C; the two upright pieces, E, are merely a trap to gather entrained moisture. The supply of air is regulated by the valve, D;



Portable Sand-Blast Outfit

the supply of sand is regulated by the plunger, J. The plunger rod connects with the lever on top and by raising this lever one or more of the series of holes, S, in the bottom of the tube, G, are opened by the plunger. The supply of air and of sand can be operated independently. Plain beach sand, not necessarily dried, may be used.

The blast is applied through plain soft cast iron nozzles having ⅜-in. circular orifices. These nozzles wear out quickly, but are cheap and simple. The outfit complete weighs 4,200 lbs. It is so well adapted to the use of a wide range of industrial establishments that it will undoubtedly be added to the increasing number of efficient portable outfits of various kinds in common usage.

WINDMILLS FOR POWER SUPPLY.

For many years a man on Prince Edward island has had his windmill harnessed and used this novel power supply for running his shop machinery, says the American Blacksmith. Because of his location there is always plenty of wind to keep his power apparatus going, the windmill requires little or no attention, and the owner is at no operating expense as he would be if he used an engine. The wind-power is used for driving a turning lathe, emery wheel, drilling machine and blower.

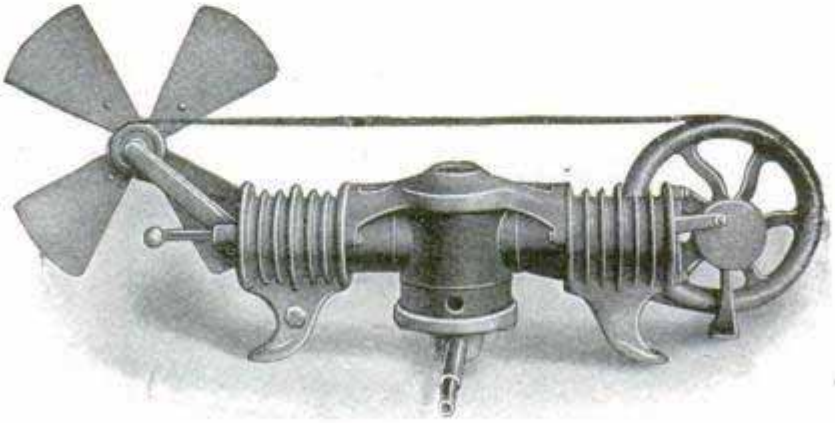
Practical Small Hot Air Engine

Will Run a Fan, Etc.--Operates with Ordinary Illuminating Gas or Alcohol Lamp

At last a really practical, simple and reliable hot air engine of small power has been perfected. The cut shows one operating a fan, it will run a revolving window display of five moving pieces equally well. It requires no attention whatever, beyond an occasional drop of oil on the piston rod. The air for operating the engine is heated by ordinary illuminating gas through a small rubber tube connected to any convenient gas jet, at a cost of less than three cents a day with gas at $1 per thousand. Where gas is not obtainable a small alcohol lamp can be used.

The engine is perfectly safe, cannot explode or set anything on fire, and runs noiselessly. It cannot fail to attract a crowd in front of a show window, even if not connected to revolving displays.

The engine shown weighs 18 lbs., has a speed of 500 revolutions per minute and the fly wheel, which is grooved for a round belt, is 6¾ in. diameter; power 1/40th h.p.



Practical Hot Air Engine

Popular Mechanics offers the engine shown in the cut, complete with 10-in. fan, all ready to run, for a club of 20 new yearly subscriptions. Revolving tables with gearing for window displays are extra. Larger sizes of this engine are made up to 1/10th h.p., suitable for operating dentists' tools, jewellers' lathes, sewing machines, etc., etc. A lady or a child can start the engine in a moment; nothing to get out of order; will last for years.

NOVEL ENDLESS CABLE SYSTEM PROPOSED FOR BROOKLYN BRIDGE.

The hundreds of thousands of people who cross Brooklyn bridge daily, engineers claim, are rendering the structure unsafe and some remedy is being sought constantly. The most recent means of relief proposed is extremely novel and comprises an endless cable system having a loop 400 ft. in diameter at each end of the bridge, the inside of each loop being occupied by a rotating platform locked to the cable. The platform would thus travel at the same rate as the cars and passengers could mount without the cars stopping. Entrance to the platform would be by a revolving staircase at the center, where the speed would be much less than at the circumference. If the speed at the circumference were 20 miles an hour, at the center it would be about a mile an hour, and thus people could mount the platform there without danger.

Tropical Farming

Is a safe and profitable business. It not only provides an income for the investor but for his posterity, for it constantly increases in production beyond one generation. ∴ ∴ ∴

The Mexican Mutual Planters Company

Invites attention to the following facts relating to the planting on its plantation "La Junta," of 5554 acres, in the Trinidad Valley, Isthmus of Tehuantepec. ∴

RUBBER	Acres
4 years old,	455.26
3 years	390.99
2 years	380.49
1 year	851.58
	2078.32
Contracted, 1905	741.
	2819.32

Approximately 2,000,000 Trees

COFFEE	Acres
4 years old,	29.64
1 year	285.77
	315.41
Contracted, 1905,	142.
	457.41

Approximately 450,000 trees

CACAO	Acres
5 years old	7.5
2 years	36.
1 year	83.29
	126.79
Contracted, 1905,	100.
	226.79

Approximately 40,000 trees

Cleared and planted to tame grasses for cattle and horses, 1190 Acres

We began our planting in 1900 and complete it in 1905, making, we believe, the largest planting of cultivated rubber in the world.

We have not paid dividends—the trees must grow first.

We expect to pay a dividend in 1907. From that time we believe they will increase rapidly and afford returns that will amply justify and reward the faith and patience of our investors.

During the past three years over one hundred visitors, a large portion of whom were owners of bonds in this company, have been on the property and inspected it thoroughly. All of them have been satisfied with the work done and the prospects for the future.

We know from an experience of six years in the cultivation of this property, and from a close study of older places in our neighborhood, that within a few years it will pay from 25 to 40 per cent, and long before the property is in full production the bonds of the company will be worth from $600 to $900 each; the few remaining to be sold will not be on the market long. To those interested we will be pleased to furnish full information. This proposition ought to be of interest to every careful investor.

. . . . . ADDRESS . . . . . .

Mexican Mutual Planters Company

Dept. D **910 JOURNAL BLDG., CHICAGO, ILL.**

THRILLING VISIT OF EMPEROR WILLIAM TO AN AMERICAN CRUISER.

Some years ago, writes Lieutenant Garden in Ideal Power, the American armored cruiser "New York" was sent to Germany to represent this country at an official function. The ship was visited by the German Emperor, who was dined on board. At the conclusion of the dinner, which ended shortly after midnight, the Emperor suddenly made a request to be shown the engine-room. The ship's officers promptly escorted him below. As the emperor entered the upper engine room platform, he stopped and gazed in admiration on the massive machinery spread before him, representing collectively something like 18,000 horsepower. Now the "New York," it must be understood, is fitted with four engines, two to a shaft. When economical speed is all that is required, only one set of engines is employed, but when full power is called for, all four engines are thrown into play. The passing from economical speed to full power is effected through the medium of a mechanical contrivance, and is referred to ordinarily as "coupling up." The Emperor was aware of this, and turning to the chief engineer, Mr. Cipriano Audrade, inquired of him:

"How long does it take you to connect your forward engines with the after engines?"

"Your Majesty," replied the chief engineer, "it generally takes about five minutes."

A smile was seen to play over the Emperor's face, and looking out of the corner of his eyes, he said:

"Really, I know something about engines; how long does it take you to connect the forward engines with the after engines?"

"Your Majesty," answered the chief engineer, "it usually takes about five minutes."

"Would you mind doing it?" said the Emperor.

The answer of the chief engineer was to call several machinists to take their posts for connecting up. The men jumped to their stations. The order was given, "Connect up!"

The Emperor timed the operation—two minutes and forty seconds.

The Emperor could hardly believe his eyes, turning again to the chief engineer, he said:

"Why, I understand that on board the 'Blake' and 'Blenheim,' British ships, fitted with engines of a similar type to these, it takes for this operation one hour."

"Ah, yes! Your Majesty," replied the chief engineer, "but Your Majesty forgets that this is an American ship and these are American engines."

When the Emperor came out on the gun deck, it was at a point well forward. Now, the "New York" has a long gun deck extending almost from the eyes of the ship to the bulkhead which divides the admiral quarters. In other words, one can stand well aft, and except for some bulkheads amidships, one has an almost uninterrupted view to the bows of the ship. At the time the Emperor came out on the gun deck it was between half-past twelve at night and one in the morning, and along that great expanse of deck some 500 men were asleep in their hammocks. Not a sound could be heard except the occasional snore of some sleeper or the swish of the water against the ship's side. All lights were extinguished except here and there a dull glow was showing, low down, giving off just enough light to enable one to pick his way over the deck without stumbling over a deck bolt. The Emperor and the officers with him stooped their shoulders so as to avoid striking the hammocks and awakening the men, and walking on their toes all made their way very quietly under the line of hammocks until a point was reached well aft where there was a little

space cleared of hammocks, and then the Emperor stopped, and as he did so the officers gathered around him and in an undertone the Emperor said to Captain Evans:

"Captain, how long does it take you to close your water-tight compartments?"

"Your Majesty," replied the captain, "it generally takes about two minutes, and we always close the water-tight compartments as a part of battle drill."

The Emperor was intensely interested, hesitating just for a moment, he looked up suddenly, and said, "Would you mind doing it now?"

"If Your Majesty," replied the captian, "will touch that gong there it will be done."

Now, in the after part of the "New York" are a number of alarms covered with glass in the same order as in some of our cities the fire alarm boxes are covered with glass. The Emperor indicated his wishes to a staff officer, who took the hilt of his sword, broke the glass and sounded the gong.

In an instant five hundred men were springing from their hammocks. Every man was taking one turn around his hammock either unlashing and throwing his hammock to the right or the left against the side of the ship, clearing the decks. Chaos broke loose. Ammunition hatches were torn off, breech blocks were flying open. Gunports were thrust out, the cable was slipped, the engines were turning over, and amid all the noise and uproar and confusion could be heard the cries of the division officers, "Battery No. 1 ready!" "Battery No. 2 ready!" "Battery No. 3 ready!" Suddenly clear and distinct above it all rose the cry, "Silence!"

Not a sound could be heard except the chug, chug of the engines as the ship gathered way, while along that great expanse of dimly lighted gun deck some three hundred half naked men were standing crouching at the breeches of the guns, every gun was loaded, every gun lanyard taut; it needed but one word and the ship would have opened fire from one end to the other; and at that instant the executive officer, turning to the captain, said:

"Sir, the ship is ready for action," and the Emperor announced the time.

One minute and ten seconds.

SHIP'S PAINTER LIKES "POP."

U. S. S. Denver,
St. Josephs Bay, Fla.,
April 9th, 1905.

Editor Popular Mechanics: "Please send me the Popular Mechanics Magazine to begin with the January number. I never have been a regular subscriber, but have bought the magazine at newsstands wherever I happened to be able to get it, when on shore leave.

"I am yours as a subscriber. I would not do without it, as I have frequently referred to it and found many practical hints that were worth more to me than its price of subscription for ten years. I will boom it among my ship mates.

"Hoping that it will come aflying, as I am anxiously awaiting, I am. Yours truly,"

JOHN RHODES.

Ship's Painter, U. S. S. Denver, care Postmaster New York City.

ENGLISH COMMENT ON PANAMA CANAL.

It is by this time evident that the completion of the Panama Canal is likely to be postponed for a longer time than was thought when the United States succeeded in pushing through their treaty, and thus securing, so far as it seemed possible to secure, the dominant position in the great concern. That it will be carried out, and that the States will do pretty well what they like with it, there can be little doubt. Ten or twelve years is now put as the necessary time for completing the project, without locks; but this is a minimum, and a great many things may happen, politically as well as commercially and financially, before the real completion. Then the expense is huge; it is now estimated at £47,000,000, without interest.—Shipping World, London.

AN EXPERIENCE WITH A MORAL.

One of the chief officials of a big Chicago business corporation recently told a peculiar experience which has a moral in it for many employees, says the Keystone. Some years ago when he was an assistant chief clerk for the firm he became dissatisfied with his position and salary, and the dissatisfaction engendered, as it always does, a certain amount of apathy in the performance of his duties. The apathy was not unnoticed by his employers, although the dissatisfied clerk was not aware of the fact. The more he brooded over the supposed inadequacy of his salary the more dissatisfied he became, and he finally advertised for a position more to his liking. He received several answers, chief among them being a proposition from his own house. He had asked for five dollars a week more than he was then paid, with opportunity to advance, and he was startled to learn that his employers were more than willing to pay the increase in salary and to guarantee advancement to a man capable of taking interest and initiative in the work. Completely nonplussed the young man tried to realize the situation. The result was that he went back to his desk with so much determination that he is today secretary and treasurer of the incorporated firm. The moral is self-evident.

CONCEIT.

Some men such high opinion hold
  Of all they do, and think, and say,
They seem of eighteen karat gold
  To think they're made, instead of clay.
They force on us advice unsought,
  Attempt to mold our minds like wax,
And seem to think their trains of thought
  Are run on elevated tracks.

—Four Track News.

THEY ALL KICK.

A trust magnate, whose income was $500 an hour, consulted a nerve specialist, who devoted an hour to his case and charged him $50, and the trust magnate kicked.

The nerve specialist went to a dentist, who charged him $5 for an hour's work, and the nerve specialist kicked.

The dentist went to a mechanic, who did an hour's work for him and charged 50 cents, and the dentist kicked."

And when the mechanic had a tooth filled and learned that the bill was $5, he kicked; but the trust magnate and the nerve specialist and the dentist all turned away in disgust and murmured, "damn a kicker."

APPROVES "POP'S" POLICY.

Your notice that my subscription to Popular Mechanics had expired is just received. Glad to hear from you, and glad to know that you stop the magazine when time paid for is out. I believe that way of doing business suits subscribers of periodicals the best.

I don't particularly need your magazine as I am not in the machinery business, but I like to know what is going on and I like your way of doing business, as above stated. Hence, I renew for another year.—P. W. Putnam, Greeley, Colo.

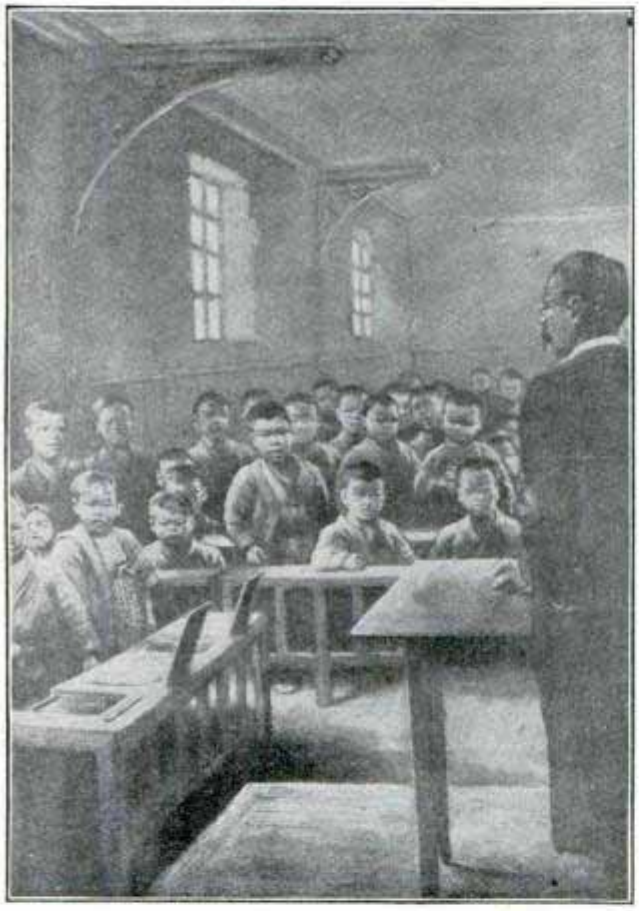
Pausing uncertainly before a desk in the big insurance office, the Hibernian visitor said to the clerk: "Oi want to tek out a pawlicy."

"Life, fire, or marine?" drawled the dapper clerk with infinite sarcasm.

"All three. Oi'm thinkin'," retorted the applicant. "Oi'm goin' fer a stoker in th' navy."

HOW JAPANESE SCHOOL CHILDREN CONTRIBUTE TO THE WAR FUND.

Many a little Japanese boy, and girl, too, for that matter, is contributing his breakfast to the war fund. A breakfast may seem like a little thing, but when



"Sixty Per Cent of the Children Stood Up."

thousands of little fellows "chip in" it may amount to quite a sum. In one Japanese school the teacher requested all the children who had had no breakfast that morning to rise. Sixty per cent of the boys and girls stood up, hungry, but proud of being able to do something for their country, and their little faces showing the same patriotic determination that prevailed here in the days of '76.

WHAT MIGHT HAVE BEEN.

"The hand that rocks the cradle"—but there is no such a hand;
It is bad to rock the baby, they would have us understand;
So the cradle's but a relic of the former foolish days
When the mothers reared their children in unscientific ways.
When they jounced them and they bounced them, those poor dwarfs of long ago—
The Washingtons and Jeffersons and Adamses, you know.

They warn us that the baby will possess a muddled brain
If we dandle him or rock him; we must carefully refrain;
He must lie in one position, never swayed and never swung,
Or his chance to grow to greatness will be blasted while he's young;
Ah, to think how they were ruined by their mothers, long ago—
The Franklins, and the Putnams and the Hamiltons, you know.

We must feed the baby only by the schedule that is made,
And the food that he is given must be measured out and weighed;
He may bellow to inform us that he isn't satisfied,
But he couldn't grow to greatness if his wants were all supplied;
Think how foolish nursing stunted those poor weaklings long ago—
The Shakespeares and the Luthers and the Bonapartes, you know.

We are given a great mission, we are here, today, on earth
To bring forth a race of giants and to guard them from their birth,
To insist upon their freedom from the rocking that was bad
For our parents and their parents, scrambling all the brains they had!
Ah, had they been fed by schedule would they have been stunted so—
The Websters and the Lincolns and the Grants and Lees, you know?

—Los Angeles Searchlight.

When an automobile runs over a man the automobile is never running too fast. Of course not. The man is running too slow.—The Chauffeur.

PATENT ENQUIRIES.

Our patent bureau frequently receives enquiries from inventors who want to know the advantages or disadvantages of making early applications for patents on their inventions. The following answer to T. G. of Trenton, N. J., indicates our views and opinion on such questions:

The only disadvantage of filing an application for patent before a search is made, is the risk of losing the cost of the application, which is ordinarily $45. The chief advantage in filing the application promptly is the possibility of getting in a few days ahead of some one else who has invented the same thing, or who is trying to steal your invention. A delay of two, three or four weeks is very rarely of any importance one way or the other. Even if another inventor should apply for a patent on the same invention a few weeks before you did the mere fact that he put in his application first would not necessarily give him the right to the patent. He would have to prove when he first made the invention and you would have to make the same proof and whichever one showed to the satisfaction of the patent office that he was the first inventor of the complete invention would get the patent. Of course, this does not apply where the delay is prolonged for months or a year or more. It is of greater importance that the invention should be complete before the application for patent is made than that the application should be made immediately upon conception of the invention. Of course, if you have reason to believe that some one is trying to take advantage of you by stealing your invention, then it is important for you to lose no time in filing your application for patent, provided always your invention is complete. By complete we do not mean that it should have been worked out or demonstrated in all details, proportions or sizes, but that its principles, general construction and method of operation should be determined by you so that they can be set out fully in the patent papers.

The general rule may, therefore, be briefly stated in two clauses:

1st. Get your invention into practical or workable form.

2nd. Lose no time in employing a competent patent attorney to take the steps necessary to protect your invention.

Yours very truly,
Popular Mechanics Patent Bureau.

J. A. B., of Lewistown, Mont., writes Popular Mechanics Patent Bureau as follows:

"I send you by express a small model of my invention and I also enclose a brief description of the same. Please examine the same and let me know whether it is practical and patentable. The model was made several years ago, and since then I have made many improvements on it, but the principle remains the same. I had not the time to make a new model, and I hope you will get an idea of what I am trying to invent."

We have answered this letter as follows:

"Your letter of 20th inst. and model of your invention in reapers are at hand and noted. The manufacture and sale of, or the market for agricultural machinery is absolutely in the grasp of comparatively few concerns who control enormous capital.

If your machine should prove a success it would mean revolutionizing the agricultural machinery business so far as grain harvesters are concerned. These large corporations would fight the introduction of such a machine because it would require the investment of new capital, impair the value of their plants and cause a shrinkage in their assets. No individual could afford to oppose this combination of capital even if he was in command of a million.

"We have made several attempts to promote new and useful farm machines for our clients, but have always met with opposition from the interests mentioned. Very few investors want to start out on a scheme that means an expensive fight. We see no reason why your machine is not practical, and believe it would prove useful if introduced, but we think it is very doubtful whether it would pay you to devote any more time or money to it, for the reasons above stated.

"We regret we cannot write you more encouragingly, but presume you want our honest opinion and the benefit of our experience and this is what we have tried to give without any cost to you. We suggest that you devote your inventive abilities, which are evidently of a high order, to the production of some simple implement, tool or device which would be useful on the farm or in the average home. There is a constant demand by manufacturers for such inventions and the supply never exceeds it. We have several clients who are anxious to get hold of such inventions. We have recently placed with one of these manufacturers patents on a metal grind-stone frame, a wire stretcher, a door hanger and on a barn door latch. This concern makes a specialty of hardware devices used by farmers. Here is a wide field for useful inventions and we believe that a man of your ability can work it to your advantage.

"We enclose our booklet on patents and believe you will find in it some helpful points. Hoping to hear from you again, we remain,"

Yours very truly,
Popular Mechanics Patent Bureau.

GASOLINE ENGINES IN CHINA.

(From United States Consul Anderson, Hangchau, China.)

Labor is so cheap in China and the cost of installing a power plant is comparatively so much that there is reluctance on the part of Chinese manufacturers to introduce power, even where it is evident that they could do so with considerable saving of labor, and eventually of money. Under the present cheap-labor system of doing things there is no outlay for high-priced machinery, and the result is that

if for any reason an establishment is shut down there is no loss to follow the idleness of money invested in a power plant.

The "fung shuey," or doctrine of the "wind spirit," and "good luck" has also a direct bearing upon the situation. It is believed that tall smokestacks and high buildings will interfere with this "wind spirit" and bring bad luck, and it is safe to say that no ordinary attractions of investments will lead the average Chinese business man into doing anything to conflict with his belief.

There is a growing conviction of the advantage of power plants in the larger concerns, and the number of mills with fair-grade power plants is increasing. It will be only a matter of a short time until the smaller manufacturers come to appreciate the need of power, and when that time comes there will be a field for gasoline engines almost beyond conception in its scope.

Did you ever think what a men's furnishing store the average flour mill is? Caps on the steam pipes, pants in the exhaust, collars on the shafting, ties in the packing department, pins in the crankshaft, belts on the pulleys, shoes on the grain cleaners, boots on the elevators, buttons on the electric bell systems, brushes on the purifiers, etc., etc.—Roller Mill.

READING WATTMETER DESCRIBED LAST MONTH.

A correction is due our readers regarding "Fig. 9. How to Read the Dials of a Wattmeter," on page 534, May number of Popular Mechanics. The wrong illustration was engraved and the mistake was not discovered until the entire edition had been printed.

Dial E should be marked "1000" instead of "10"; Dial D, "10,000" instead of "100", etc. The pointer on the right hand dial registers 1000 watt hours or one K. W. hour after a complete revolution, or 100 watt hours for each division of the dial. Hence, read the hands from left to right and add two ciphers to the reading of the lowest dial of the meter to obtain the reading in watt hours. A complete revolution of the hand of the right hand dial will move the hand of the second dial one division. A complete revolution of the hand of the second dial will move the third hand one division, and so on. Hands should always be read as indicating the figure they have last passed and not the one to which they are nearest. Thus, if a hand is very close to a figure, whether it has passed this figure, or not, must be determined from the next lower dial. If the hand of this dial has just completed a revolution, the hand of the higher dial has passed the figure; but if the hand of this dial has not yet completed a revolution the hand of the higher dial has not yet reached the figure, even though it may appear to have done so, as sometimes the hands become slightly misplaced.

Our reading then, referring to Fig. 9, should be 441,700 watt hours. Take from this the figures of the last reading paid for, say, 341,700, and you now pay for 100 K. W. hours. Always note if a constant is marked at the bottom of the dial plate. If so, the difference of the readings must be multiplied by this constant to obtain the amount to be paid for.

New Mechanical Devices

COMBINATION GASOLINE SOLDERING IRON AND BLOW TORCH.—In operating this device the cap A is removed and the magazine is filled with gasoline until it lacks one-half inch of being full. The cap is then screwed on tightly and an alcohol lamp accompanying the tool is lighted. The iron is heated at B for at least three minutes, being held in a slanting position, head downward, and keeping the valve C closed to generate a hot gas pressure. When the iron is heated, the valve is gently opened and the torch is lighted by passing the tool over the

flame at F. The heating of the tool should continue for three minutes longer, the operator regulating the blast to suit the work to be done by means of valve C. For work outside in a heavy wind, or used as a blow torch, the shuttle at B should be closed. Any shaped soldering copper point can be used with the tool. The device is 21 in. length tip to tip; 1⅜ in. diameter, 3½ lbs. weight, complete with both coppers. It costs about 5 cents per day to keep in operation, is never too hot or too cold, it is said, and will not blow out in the strongest wind.

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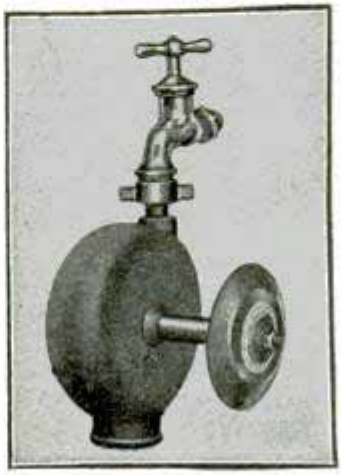
SHOP NOTES FOR 1905 in cloth binding, $1, heavy manila paper cover 50 cents postpaid anywhere. Address Popular Mechanics or get it from your newsdealer.

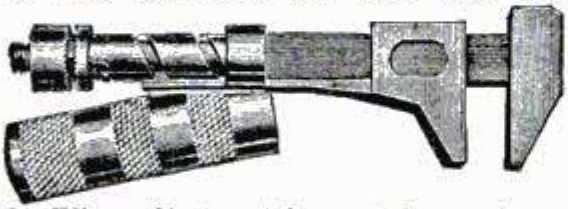
SMALL WATER MOTOR.—This little motor actually develops one-eighth brake horsepower on 80 lbs. pressure from a city main. It develops a speed on pressure mentioned of 4,500 revolutions per minute with an ordinary 5-in. emery wheel, or a 9-in. buffing wheel (for polishing). The emery wheel is suitable for grinding knives, scissors, razors, axes, hatchets, hammers, or in fact any edged tool. The buffing wheel is suitable for polishing, cleaning and buffing any metal surface. The illustration shows the motor attached to an ordinary screw sink faucet in a private residence. It can be adjusted to either the right or the left hand side. Has sufficient power for running sewing machines, small lathes, scroll saws, dynamos, etc.



THREE-WHEEL PIPE-CUTTER.—For certain work the three-wheel cutter is necessary. The tool shown here comes in two sizes, is very strong, being made of wrought steel, and is lighter than the ordinary tube-cutter. It will cut any tube up to 2 in. and so in many instances takes the place of two tools, says the Plumber and Decorator, London.

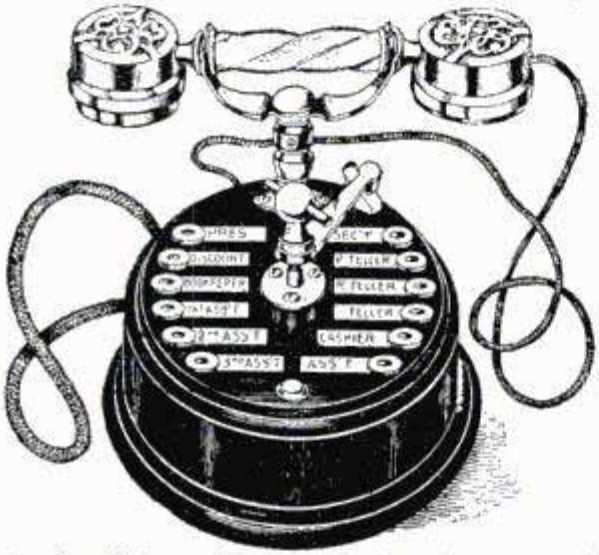
Cuts Any Tube Up to 2 In.

TIME SAVING WRENCH.—Quickly adjusted, specially desirable for the automobilist. Two turns of the wrist carries the jaw from wide open to



closed. When adjustment is secured wrench can be locked.

METAPHONE.—A new system of house and office telephone for communication between all parts of a building. Communication is secured by taking the



"metaphone" from the hook, and moving the switch lever to the desired contact point. The cut shows a desk set for a bank.

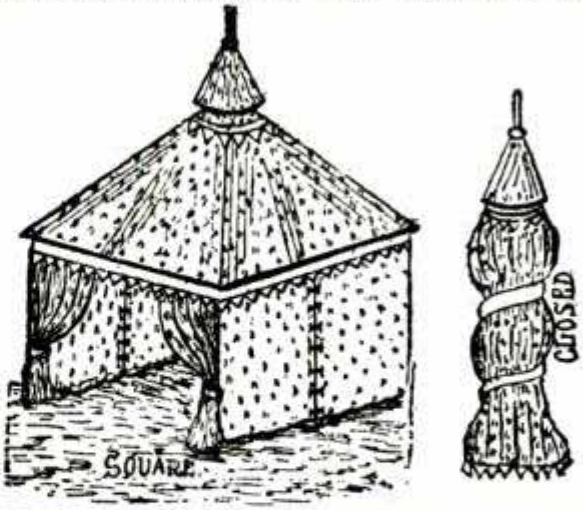
ADJUSTABLE HANDLE DRAWING KNIFE.—The handles of this drawing knife each have a ratchet which allows them to be set at any angle

to the plate that is required, or they may be removed from the knife entirely. The improved device is both strong and simple. The knives come in ten sizes.

EMERGENCY PIPE CLAMP.—This clamp is designed for the rapid repairing of splits, pitted holes and other leaks caused by corrosion of pipe. It is somewhat more elaborate than the ordinary devices for this work and in cases where it is necessary to keep the pipe in constant use for several days after it has split, it will be most advantageous. It is

made in two sections hinged on one side and clamped together by two bolts on the other, and can be applied to the leak in a few seconds. It is made of malleable iron in sizes to fit from ½ inch to 4-inch pipe.

POLELESS TENT.—A tent that is erected and held in place without the support of poles, guys or rope will be found a convenience to the camper who desires to carry as little luggage as possible into the wilds. It has a light metal frame-work which locks into position when the tent is raised



and folds up neatly and compactly when it is taken down. The cover can be quickly adjusted or removed. The walls when closed all lock on the inside and cannot be opened from without. They turn in at the bottom from 12 to 18 in. and so shut out cold air from that source. The walls may be opened or entirely removed as desired.

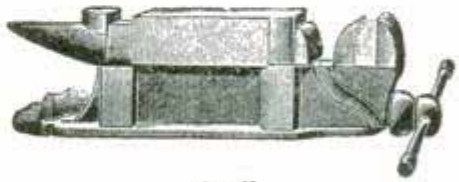
SELF-HEATING SOLDERING COPPER.—This is a new device so simple and effective the wonder is no one has thought of it before. It is for light work such as needed by electricians, jewelers, mechanics and in the home. On the rod holding the copper is placed a cup filled with asbestos. The

cup slides freely to any position on the rod. To heat the copper, fill the cup with alcohol and slide it up close to the copper which it will heat to the soldering point in a few minutes, saving the trouble of starting a fire. When copper is heated the cup slides back out of the way.

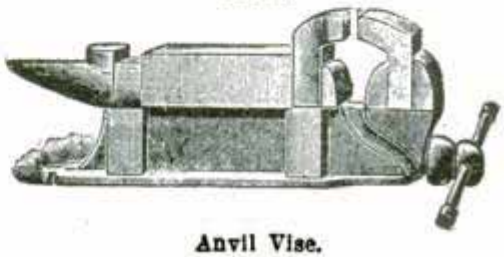
WATERPROOFING CEMENT BLOCKS.—Astralite is the name of a new preparation said to render cement blocks, etc., waterproof. It is applied in liquid form, two coats. One gallon mixed with two gallons of water will cover 350 sq. ft. at a cost of one cent for each 7 sq. ft.

WELDING COAL.—This coal is put through a chemical process and in use is mixed with any ordinary coal and burned in the blacksmith's forge. By its use steel can be welded to malleable iron; malleable to malleable; welds spring steel, etc., without the use of welding compounds.

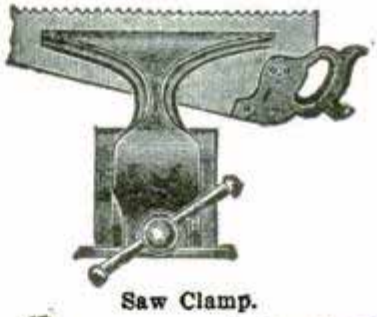
COMBINATION VISE.—Consists of five tools in one, anvil, anvil vise, saw clamp, drill and pipe vise. The combination of the vise is such that the various tools can be quickly applied and readily changed,



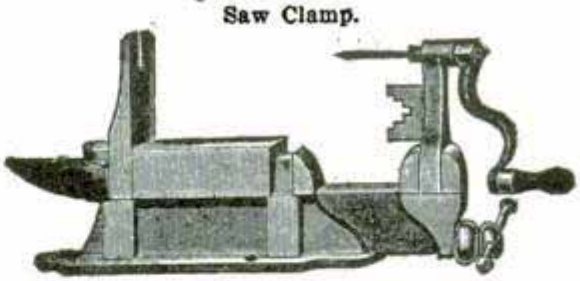
Anvil.



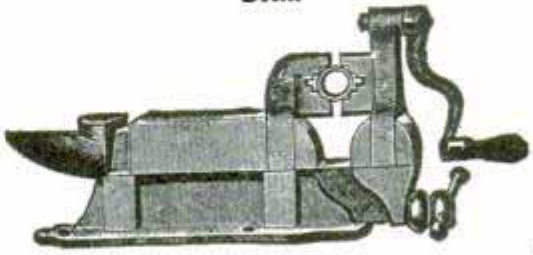
Anvil Vise.



Saw Clamp.



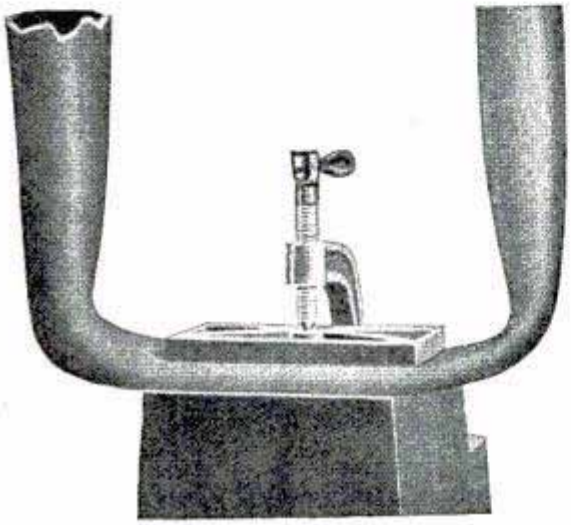
Drill.



Pipe Vise.

there being no screws or bolts to rust or get lost. All of the tools are packed together in a neat wooden box, and the complete outfit weighs about 60 lbs.

VULCANIZING OUTFIT FOR REPAIRING RUBBER TIRES.—This vulcanizer is 9x6x6 in. in dimensions and weighs less than 20 lbs. By its use damaged motor-car tires can be repaired so that the vulcanized portion is scarcely distinguishable from the rest of the rubber and the expense of carrying



Vulcanizer which Can be Carried in the Auto

extra tires is eliminated. Take a serious injury to a tire such as a 5-in. burst, the repair would be made in the following manner: Clean and trim the edges of the gash, fill it with plastic compound, place in the vulcanizer and cure for the proper length of

Sections of Tires Repaired with Vulcanizer

time by heat generated by steam. The tire will come out whole, says Technics, London. The repair is made of pure virgin rubber vulcanized in the usual manner and can be made by anyone of ordinary intelligence. The vulcanizer is so small that it can be carried on any motor car.

"Want" and "For Sale" Ads. 2 cents per word, payable in advance. Replies may be sent to a number, care Popular Mechanics, and will be forwarded promptly without extra charge.

"SHOP NOTES"—Paper covers 50 cents. Popular Mechanics.

AUTOMOBILES.

FOR SALE—Steam Automobile, runabout, little used. Cost $650.00, price $250.00. E. A. Wright, Canton, O.

FOR SALE—At a bargain. National Electric Runabout, long-distance batteries. Also 6 h. p. gasoline engine, generator and switchboard, for charging automobile or electric lighting (50-light capacity); will sell separately if desired. J. J. Rendleman, Cairo, Ill.

BLACKSMITHS.

GOOD BLACKSMITHS ARE SCARCE AND BUT FEW LEARNING THE TRADE.

And the smith comes first of all professions or trades. The smith must make the tools first for all, from the surgeon to the safe blower, by using Toy's Treatise on new steels explaining how to work them with 75 new methods for working all difficult jobs. Ten receipts for making your own compounds for welding different kinds of steel solid. Thermite welding fully explained; also two colored tool tempering charts; chart A explains all annealing and hardening; Chart B explains both scientific and plain tempering to a standard. All the above for $1.00. Valuable samples free. W. M. Toy, Sidney, Ohio.

BUSINESS CHANCES.

FOR SALE—A very desirable machine and repair shop, residence, location and business; manufacture wood sawing machinery, which is in great demand; more business than can attend to; want to retire; a bargain. Irving Fox, Rochester, Minn.

ENGINES.

FOR SALE—$800 buys Gaar, Scott outfit, 16 h. p. traction engine, 33 x 52 separator with weigher, wind stacker and new self-feeder tank. Pump and hose complete ready to run. Address P. A. Friend, Burrows, Ind.

A PRACTICAL BOOK, "Dies and Diemaking." Postpaid $1. J. L. Lucas, Bridgeport, Conn.

FOR SALE—Watch and shotgun. H. Davis.

FOR SALE—One-sixth horse power motor, direct current, build according to No. 1210 Scient. American Supl. Well made, well running. Price $25.00. John D. Werzinger, 1612 Sixth Ave., Watervliet, N. Y.

FOR SALE—One-quarter and ½ h. p. hot air engines, 8 h. p. electric motor, 4 x 8 air compressor, 2 emery stands, 8-in. smith blower with countershaft. John Schuiz, North Chicago, Ill. Box 176.

ONE H. P. GASOLINE ENGINE, Barnes scroll saw and friezer, rip saw and table, 8 x 10 portrait camera, library, etc., sell or exchange for lathe (iron), compact, folding, 5 x 7 camera, with tripod, etc. R. M. Dalrymple, Greenville, O.

FOR SALE—Half h. p. gasoline engine, second-hand and in good order, water cooled. First check for $20.00 takes it. G. A. Foland, 125 E. Broadway, Mt. Pleasant, Mich.

18- FT. LAUNCH, 2 h. p. engine, and auto sparker, price $175.00. Built 1904, used two months. Thos. Hudson, 33 Springdale St., Cumberland, Md.

FOR SALE—Webster 10 h. p. gas or gasoline engine, has been used but a few weeks and is in good condition. Will be sold at half price. If you want a first-class engine cheap don't delay. Address A. 11, Pop. Mechanics.

MISCELLANEOUS.

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

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

WANTED—Experienced machine shop foreman. Must come well recommended. Address W. E. D., care Popular Mechanics.

HEALTH WANTED.—Nervous wreck from tea. I want a pleasant substitute for tea, to which milk and sugar may be added (or without). Must not taste like medicine. Information paid for. Postals answered. Chas. M. Young, 110¼ Langton street, San Francisco, California.

STEEL STAMPS, 6c a letter; seals, 18c; door plates, 8c; presses, $2.00, etc. Postal brings price circulars. J. Kiola, engraver, 155 W. Madison St., Chicago, Ill.

WANTED—Prices on manufacture of a top spinning pistol—quantity unlimited. Address for particulars. Macomb Novelty Co., Macomb, Illinois.

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

BICYCLE RIDERS—No walking if you carry our single tube band tool; tool and material for 6 punctures for 15c or stamps. Crone Tool Co., 2265 Union St., Toledo, Ohio.

WANTED—All issues Popular Mechanics up to and including 1904 unbound. State price. Thos. V. Bell, Box 126, Montreal, Can.

AUTOMOBILES—Their operation, care, management and construction, together with scale drawings showing how an up-to-date machine can be built for $500, sent on receipt of request enclosing two-cent stamp. McLaren Automobile School, 54 N. 13th Street, Philadelphia.

START A MIRROR FACTORY—Make novelty and large mirrors, resilver old ones in dressers, sideboards, book cases, etc. I teach you and guarantee you success; 32-page prospectus of 20 money-making methods for stamp. Start now. L. G. Hullinger, Francesville, Ind.

COAL MINING profits with bank safety is what we offer investors. $1.00 invested now will be worth $3.00 in a year. Banks and mercantile agencies as references. Write 540½ Andrus Bldg., Minneapolis, Minn.

HAVE YOU A KODAK?— I develop six exposure films for 15 cts., twelve exposures, 25 cts. I print pictures on best carbon paper and mount on gray cards for $1.00 a dozen. Satisfaction guaranteed. W. H. Guest, Box 115, Russellville, Ark.

FOR BLUEPRINTS showing running and testing of 3-wire balancers or compensators. Send 50 cents to C. E. Bryson, 3807 E. 17th St., Kansas City, Mo.

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

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

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

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

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

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

DEATH is said to be pleasant when it takes place by drowning; however, we do not believe you want to die that way. "How to Swim" is the book that will teach you how to swim. Contains 100 illustrations; sent postpaid for $1. Popular Mechanics.

WANTED—If you have anything in light metal manufacturing, job or experimental work, write me. Lowest prices. Schwabe & Son, 35 W. Washington St., Chicago.

MISCELLANEOUS.—(Continued)

FOR SALE—Foundry and Machine shop. Complete equipment for building mine cars. Location midway between the great coal fields of Indiana and Illinois. Also equipment for building several sizes of stationary and marine gas engines, and a good line of patterns for jobbing work. In a good manufacturing town, 2 railroads, 2 navigable rivers, no other foundry within 25 miles. Real estate, stock and tools invoice about $8,000.00. A great bargain. H. H. Mason, Mt. Carmel, Ill.

EVERYBODY should have a "Slot" Pencil Sharpener. By mail 10 cents. V. B. Rouillot, Germantown, Philadelphia, Pa.

TO EXCHANGE, $15 violin for typewriter. Address G. V. Ryland, 704 N. Lake Ave., Seattle, Wash.

PATENTED INVENTION of merit for sale outright or royalty. E. I. Fletcher, 54 Lincoln Ave., Norwich, Conn.

WANTED—Parties wishing to purchase half interest in patent hydraulic regulator for connecting with pumping windmill to generate electricity. Address R. W. Wilson, Noblesville, Ind.

FOR SALE—At half price, complete International Correspondence School "Electrical" course. Also a ten-volume set Modern Engineering Practice. A. M. F., Popular Mechanics.

WANT TO EXCHANGE—Columbia chainless bicycle with coaster brake and Winchester repeating gun, 12 Ga., with two sets barrels, sole leather carrying case for all, for Barnes screw cutting Lathe, or what have you. Address 29, Popular Mechanics.

FOR SALE or trade for something useful. Small but complete job printing outfit, new Golding press, 13 fonts type, and all accessories for doing job work. Could use large wind mill as part payment. J. J. Rendleman, Cairo, Ill.

WANTED—To exchange, section of land in Canada for offers. Wm. Bright, Mazeppa, Minn.

FOR SALE—Machine and repair shop, ground and building, central Illinois. A 12, care Popular Mechanics.

FOR SALE—$1,500.00 buys a blacksmith and repair shop doing good business; $2,000.00 buys a farm, stock and tools. For further particulars address Box 191, Enfield, N. H.

FOR SALE—Pre-historic Indian relics, flint-lock pistols, and all kinds of curios for sale, list free. N. Carter, Elkhorn, Wis.

Six Thousand acres of fine timber land in Idaho (deeded) for sale cheap if taken soon. Address W. J. Ramey, Nezperce, Idaho.

FOR SALE—A Blickensderfer typewriter in good condition $12.50 cash. Also slate bottom aquarium, 14½ x 23¾ inches, $5. Edwin Trube, 2415 Market St., Galveston, Texas.

WE WANT AGENTS, preferably boys and girls, to take orders for calling and business cards and other printing. No extra work. No capital. Write to Keystone Ptg. Co., 237 S. Hoyne Ave., Chicago.

WANTED—Experienced machine shop foreman Must come well recommended. Address W. E. D., care Popular Mechanics.

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

A PRACTICAL BOOK, "Dies and Diemaking." Postpaid $1. J. L. Lucas, Bridgeport, Conn.

NEW BOOKS

TECHNIC OF MECHANICAL DRAFTING. By C. W. Reinhardt. Cloth, oblong; 11x8 ins.; 42 pp.; 90 text illustrations; 11 full-page plates. Price, $1. Engineering News Publishing Co., New York.

While not intended as a manual for beginners exactly, but rather as a guide and help for draftsmen who are familiar with the mathematical principles of mechanical drafting, this book is written and illustrated in such a simple practical manner that it is quite within the comprehension of any person of average ability. The work begins with general instructions on the care and handling of draftsmen's instruments and materials and then proceeds to treat of the following topics: Outlining, outline shading, section lining, curved surface shading, shading of inclined surfaces, map drawing, character and finish, and others. The mathematics involved in the subject are ignored entirely and the book is devoid of all technical terms that might confuse rather than aid the student or draftsman. It is elementary enough for the mechanic without a college education and has been adopted as a standard in many technical schools.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES FOR BUYERS AND SELLERS. Fourteenth Annual Edition; over 1,300 pp.; 350,000 names and addresses; over 14,000 classifications. Cloth. Price, $7. S. E. Hendricks Co., New York.

This book comprises a complete and thoroughly classified register of every branch of the architectural, engineering, mechanical, electrical and kindred trades and professions of the United States, is issued annually and covers the entire country. Take the least unit that enters into the requirements of any craft, turn to the index, and you will be sure to find it listed with the page on which all the manufacturers of the article in this country is given. The great and essential quality of the work is its thoroughness. It does not give just the names of the firms patronizing the publishers, but the name, address and business of every firm, regardless of any patronage. For a railroad it gives everything from a track spike to a locomotive, for a machine shop everything from a nut to a traveling crane; for a farm, everything from a hoe to a steam plow and so on through the whole list. The classifications are carried out in an especially convenient manner for reference. All the larger trades or professions are classified by states, but in manufacturing branches where the firms are few, the classification is alphabetical. It gives not only the name and address of the manufacturer, but also the name and address of the consumer. It contains many valuable mailing lists of the entire country.

TELEPHONE TROUBLES AND HOW TO FIND THEM. 1905 Edition. Single copies, 25 cents; in lots of 10, 15 cents; lots of 25, 10 cents.

Every owner or frequent user of a telephone will find this little booklet of great help. It is up-to-date on all matters pertaining to telephone troubles and their remedies on both magneto and central energy systems. The 1905 edition contains considerable new matter and a number of diagrams. It is not scientific, but plain and practical.

CATALOGUES RECEIVED.

COLUMBUS, OHIO, is the title of a handsome little booklet published by the Jeffrey Mfg. Co. and relating the beauties and advantages of that city where the company is located. The book is illustrated with engravings of many features of interest in the Ohio city and also contains a map showing the coal fields, natural gas fields, steam and electric railroads and all important cities, towns, villages, and streams tributary to Columbus within a radius of 70 miles.

PATENT WOOD-WORKING MACHINERY is the subject treated of in a handsome illustrated catalogue (No. 194) issued by The Defiance Machine Works of Defiance, Ohio. The catalogue is a substantial cloth-bound volume of 475 pages, containing many views of various parts of the machine works and many wood-working machines with descriptions of them and explanations of their operation. The book is indexed and printed on an excellent quality of paper in large type.

THE EXPRESS TRAIN.

(Two long and two short whistles are the signals for a crossing, and are most familiar sounds to travelers and all within hearing of railroad trains.)

I.

I hear a faint sound far away—
Two long and two short notes at play—
As soft and sweet as silver flute,
The locomotive's first salute,
"T-o-o-t, t-o-o-t, toot, toot!"

II.

I hear again the tuneful sound,
Now waking woodland echoes round;
The locomotive seems to say:
"We are coming—coming, clear the way;"
"T-o-o-t, t-o-o-t, toot, toot!"

III.

And now a rumbling noise I hear,
And clouds of smoke and steam appear;
The locomotive seems to shout:
"We are coming fast. Look out! Look out!"
"T-o-o-t, t-o-o-t, toot, toot!"

IV.

And now I hear a brazen bell
That lifts aloud a warning knell,
The engine now begins to yell
Like frantic fiend escaped from hell:
"T-o-o-t, t-o-o-t, toot, toot!"

V.

'Mid hissing steam and deafening roar
I hear that awful sound once more;
"Keep back, keep back! Don't cross the track!
For love of life, stand back, stand back!"
"T-o-o-t, t-o-o-t, toot, toot!"

VI.

With clanging bell and clattering steel
And flaming breath and flashing wheel,
The lightning train goes crashing by,
Like fiery bolt from stormy sky,
"T-o-o-t, t-o-o-t, toot, toot!"

VII.

A whirlwind follows on behind,
With clouds of dust our eyes are blind;
Yet from the curve around the hill
Is heard the engine whistle shrill,
"T-o-o-t, t-o-o-t, toot, toot!"

VIII.

Again, a faint sound far away—
Two long and two short notes at play—
The locomotive's farewell call:
"We are chasing time. God speed us all"—
"T-o-o-t, t-o-o-t, toot, toot!"

—Henry Crocker, in Beacon.

WORKED BOTH WAYS

An old German who, after some hesitation, had decided to have his frozen water pipes thawed out by electricity, protested vehemently at paying the charge of $10. The work had occupied but a few minutes after the connections were made and the current turned on, and consequently the regular price seemed too much to the old man, who began to abuse the company.

When he had finished, the manager asked him if he refused absolutely to pay; he responded that he did. The manager turning to his assistants, said: "Alright, boys, reverse the connections and freeze him up again." The shot told and the old fellow paid the bill.

SHOP PROVERBS.

The following edicts are from the Wood-Worker:

Putting a big monkeywrench on a little bolt is a good way to start trouble.

A little scorching in grinding can undo a lot of care in tempering knives.

Better walk around a circular saw three times than to reach over it once.

Figures will tell you the truth all right, but you needn't expect them to do your thinking for you.

Sometimes a poor machine man has the making of a good boss in him, but he doesn't always get made.

The outside appearance of a factory is worth something, but a good inside appearance is worth more.

If we but gave a little more attention to preventing waste, there would be no need of so much effort to save it.

WING PIANOS

Are Sold Direct From the Factory, and in No Other Way

You Save from $75 to $200

When you buy a Wing Piano, you buy at wholesale. You pay the actual cost of making it with only our wholesale profit added. When you buy a piano, as many still do—at retail—you pay the retail dealer's store rent and other expenses. You pay his profit and the commission or salary of the agents or salesmen he employs—all these on top of what the dealer himself has to pay to the manufacturer. The retail profit on a piano is from $75 to $200. Isn't this worth saving?

SENT ON TRIAL

Anywhere

WE PAY FREIGHT
No Money in Advance

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

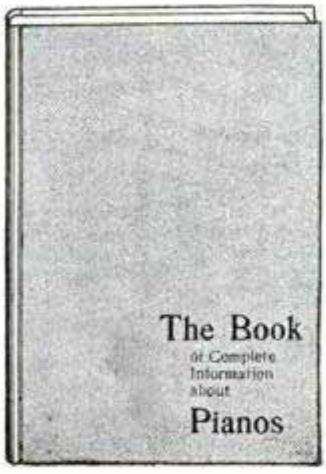
Do not imagine that it is impossible for us to do as we say. Our system is so perfect that we can without any trouble deliver a piano in the smallest town in any part of the United States just as easily as we can in New York City, and with absolutely no trouble or annoyance to you, and without anything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

A guarantee for 12 years against any defect in tone, action, workmanship or material is given with every Wing Piano.

Small, Easy MONTHLY Payments

In 37 years over 40,000 Wing Pianos have been manufactured and sold. They are recommended by seven governors of States, by musical colleges and schools, by prominent orchestra leaders, music teachers and musicians. Thousands of these pianos are in your own State, some of them undoubtedly in your very neighborhood. Our catalogue contains names and addresses.

Mandolin, Guitar, Harp, Zither, Banjo— The tones of any or all of these instruments may be reproduced perfectly by any ordinary player on the piano by means of our Instrumental Attachment. This improvement is patented by us and cannot be had in any other piano. WING ORGANS are made with the same care and sold in the same way as Wing Pianos. Separate organ catalogue sent on request.



YOU NEED THIS BOOK

If You Intend to Buy a Piano—No Matter What Make

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

Send a Postal To-day while you think of it, just giving your name and address or send us the attached coupon and the valuable book of information, also full particulars about the WING PIANO, with prices, terms of payment, etc., will be sent to you promptly by mail.

Cut or tear out this coupon and mail to us, after writing your name and address at bottom. We will promptly mail book and other information.

WING & SON
351-355 West 13th St., New York

Send to the name and address written below, the Book of Complete Information about Pianos, also prices and terms of payment on Wing Pianos.

WING & SON

851-855 West 13th St., New York

1868——37th YEAR——1905

ALTAR DECORATIONS WITH ELECTRIC LIGHTS.

Rev. Father Pfaffhausen of St. Patrick's Cathedral, St. Louis, is an electrician of no small ability. Recently he planned a series of decorations which were specially pleasing and effective. The altar was adorned with 50 electric lights of a leafy green. The saint's statue and the altar stand in an alcove, which appears charmingly cavernous. In order that the altar of the Blessed Virgin, on the opposite side, may not be eclipsed, 50 pale-blue electric lights have been placed around it, and these give the heavenly hue to the delicate tracing of the statue and the marble decorations. The main altar is aglow with 72 golden lights, at the top of which the crucifix is outlined in lights of red, the color that represents the love of God.

JOURNEY OF A TELEPHONE MESSAGE.

Thousands of people spent several days on railroad trains to reach the St. Louis Exposition. A booklet by the American Telegraph & Telephone Company describes the route of a telephone message as follows: Suppose the message comes from a New York office building. From the transmitter on the desk of the person who is speaking, the sound is carried over wires, concealed perhaps behind the window casings, through the partition to the corridor. It flashes down the elevator shaft, and thence to a cable under the street. Here it journeys over a wire, one of 800 wrapped together in a lead-sheathed cable, and thus reaches the nearest central office, where it passes through the main and long-distance switchboards and their apparatus. Then it flashes through a cable to the banks of the Hudson, where it dives under the river in another cable, and so reaches Jersey City. Here it goes to the pole lines on which it will make its journey westward. It crosses the meadows and pinelands of New Jersey, mounts the slopes of the Alleghanies in eastern Pennsylvania, and descends to dart through farming lands and mining regions, past Pittsburg, with its foundries, and over a little strip of West Virginia. On the banks of the Ohio, it enters another cable, and emerges on the farther shore to travel through the pleasant farming lands of Ohio and Indiana, and over the undulating surface of the Prairie State, by roads which wind through great corn and wheat fields. Its journey is now nearly over, but the mighty Mississippi flows between it and its destination. Crossing on one of the great bridges, it makes the last stage of its journey through the conduits under the streets of St. Louis, thence in and out of the central office, back through conduits, and over aerial wires to the telephone of the person with whom the man in New York is talking. And the sound has been carried between the two cities in a fraction of the time required for the conductor's warning cry of "All aboard" to reach the people hurrying across the station platform to take the express train which spends 29 hours on the trip from New York to St. Louis.

A dam which will cost $1,100,000 and will be one of the largest in the world is to be constructed in the Salt River Valley, Arizona. The dam will supply water power for hundreds of places throughout the territory and will overflow 350,000 acres of land. It will be 225 ft. high and 200 ft. thick at the base.

MECHANICAL TRADES

AMERICAN ARTISAN MANUALS. Cloth, price $3.50 each. Each the highest authority in its particular field and recognized as a standard work by those who know.

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MANUAL OF RECEIPTS. 240 pages, cloth, price $3.50. Tells how the various lacquers, bronzes, solders, varnishes, alloys, cements, etc., are made. Receipts for 119 different kinds of solder and the voluminous index comprises 1,718 references. Processes given will be found of special value to sheet metal workers. In a number of cases the information is furnished by manufacturers or by skilled mechanics.

HARNESS MAKER'S COMPLETE GUIDE. By C. C. Martin. 6th edition, 240 pages, cloth, price $2.50. One of the best text books on harness making ever published. A complete key to lengths and widths. Ninety different kinds of harness cut, weighed and made before your eyes, also all kinds of strap work illustrated. A vast avalanche of information that cannot be found anywhere else. This work combined with an apprentice all that is needed to produce a first-class cutter that will not waste leather.

PRACTICAL BLACKSMITHING, compiled from the practical articles which have appeared during the last few years in the columns of "The Blacksmith and Wheelwright." 4 volumes, cloth, prive, each, $1. Treats of the details of the practical application of the trade and is suitable for those wishing to establish the trade as well as for those advanced in the art. The only book of the kind in the language. Volume I treats of ancient blacksmithing, tells how hammers should be made, etc., etc. The chapters are: 1. Ancient and Modern Hammers; 2. Ancient Tools; 3. Chimneys, Forges,

Fires, Shop Plans, Work Benches; 4. Anvils and Anvil Tools; 5. Blacksmith's Rules. Vol. II, in 7 chapters. In Chapter 1, treats of iron and steel, wrought iron and steel, rotting and crystallization of iron, heating steel, testing iron and steel, treatment and working of steel, hardening steel, restoring burnt steel, cold hammering iron. In Chapter 2 may be found several ways of making these tools and Chapter 3 tells how to make all kinds of chisels, including clipping and cold chisels. Chapter 4 treats of drills and drilling, method of making several styles of drill presses. Also an article on drifts and drifting. The principles of fullering may be found in Chapter 5, with numerous examples. The principles on which edged tools operate found in Chapter 6, with hints on the care of miscellaneous tools. Chapter 7 is a continuation of Chapter 6, and with each description of the method of making are illustrations. Volume III. Even more useful and instructive than two previous volumes. Chapter 1 gives blacksmiths' tools, their preservation, bench tools, tongs, tools for farm work, tools for holding plow bolts; Chapter 2, wrenches and their use; Chapter 3, welding, brazing and soldering; Chapter 4, uses of steel, tempering, hardening, testing, etc.; Chapter 5, hand forgings; Chapter 6, making of chain swivels; Chapter 7, plow work. Volume IV completes the series and like its companion volumes, contains very numerous illustrations. Chapter 1. Miscellaneous carriage irons, hammer signals, etc. Chapter 2. Tires, cutting, welding, bending and setting; how to make a tire; heating furnace. Chapter 3. Setting axles, axle gauges, thimble skeins, etc. Chapter 4. Springs, how to make and reset; different ways of welding. Chapter 5. Bob sleds. Chapter 6. Tempering tools. Chapter 7. Proportion of bolts and nuts, forms of heads, etc. Chapter 8. Working steel, welding and case hardening. Chapter 9. Tables of iron and steel, including size of iron and different forms used by carriage, wagon and sleigh makers.

GUNSMITHS' MANUAL. Large 12mo, 400 pages, illustrated, cloth, price $2. To be found here are descriptions of guns and pistols; fitting up a shop; general gunsmithing; taking apart, cleaning and putting together; tools required, how to make tools, the work bench, working in iron, steel, copper, brass, silver and wood; gun stocks, gun barrels; tools for breeching guns; tools for chambering breech loading barrels; browning and receipts for browning; valuable miscellaneous receipts; powder and shot; judging the quality of guns; using the rifle; using the shotgun; using the pistol; vocabulary of chemicals and substances used in varnishes, etc.; calibres of guns; rifling, twist of rifles, etc.; directions for taking apart and assembling guns, rifles and pistols. In fact, a complete practical guide to all branches of the trade.

JAPANNING AND ENAMELING. By William Norman Brown. 52 pages, illustrated, 8vo, cloth, price $1.50. Contents: Enameling appliances and apparatus; japans or enamels; to test enamel for lead japanning metals; japanning tin; enameling old work; for cast iron, copper cooking utensils, stoves, etc.; paints and varnishes for metallic surfaces-backing for iron; processes for tin plating; galvanizing; metal polishes; colors for polished brass; a golden varnish for metal; painting on zinc; carriage varnish; japanese varnish and its application.

PRACTICAL MANUAL OF HOUSE PAINTING, GRAINING, MARBLING AND SIGN WRITING. By Ellis A. Davidson. 12 mo. 394 pages, price $2. Full information on the processes of house painting in oil and distemper, the formation of letters and practice of sign writing, the principles of decorative art, a course of elementary drawing for house painters, writers, etc., and a collection of useful receipts. Its illustrations are colored plates of woods and marbles, and numerous wood engravings.

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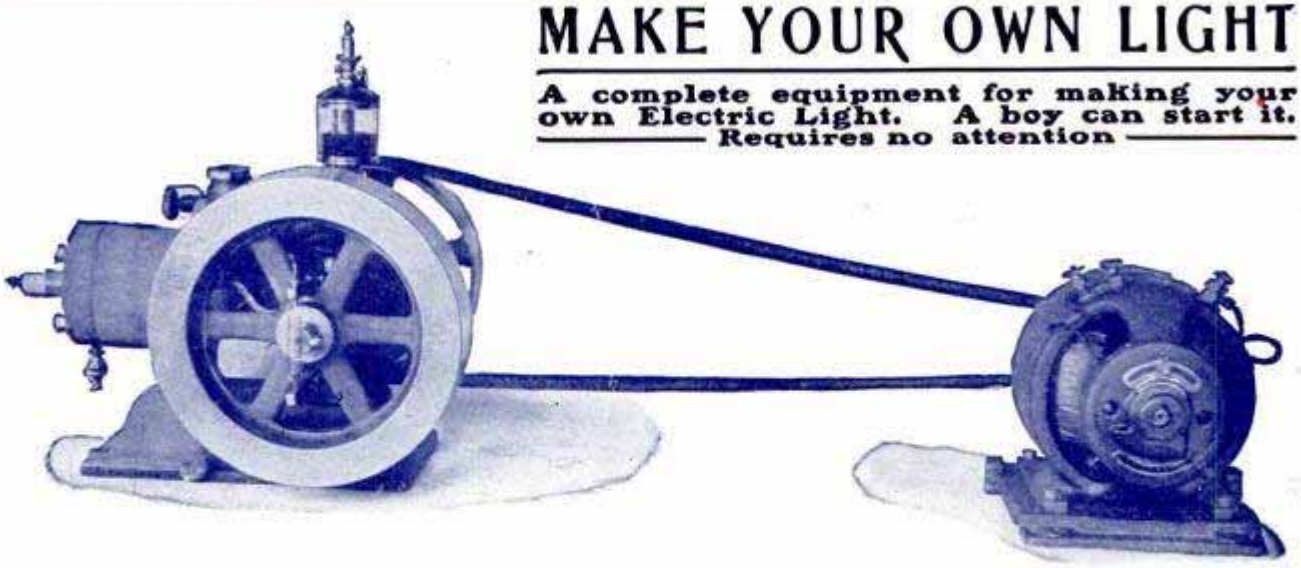

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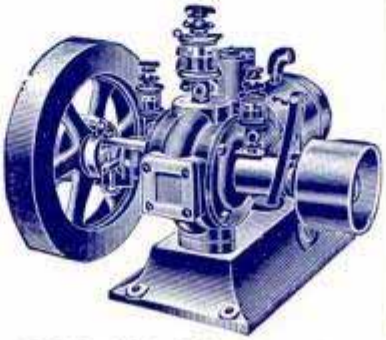

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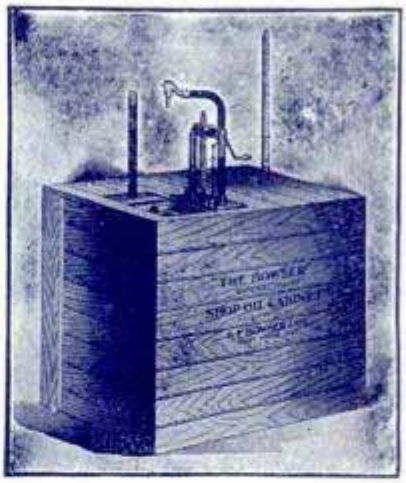

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