The WORLD'S ADVANCE

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A RELIC OF THE UNDER-SEA

MANY are the points of interest for the visitor to the New York Navy Yard, but perhaps none is of greater interest than that which greets the landsman as he enters the yard; resting grimly on the lawn is a curious object in sombre gray that represents one of the first attempts at submarine boat construction. A clumsy and ineffectual affair it appears to be, and when one learns its history, the appearance is found to have been borne out in practice.

A tablet attached to the submarine tells us that the *Intelligent Whale,* as she was called, was built in 1864 by C. S. Bushnell, Augustus Rice and Halstead of New Jersey. In marked contrast to the present day construction, the craft was built with an exceedingly wide beam; indeed, the diameter of the vessel is nearly one-third of its length

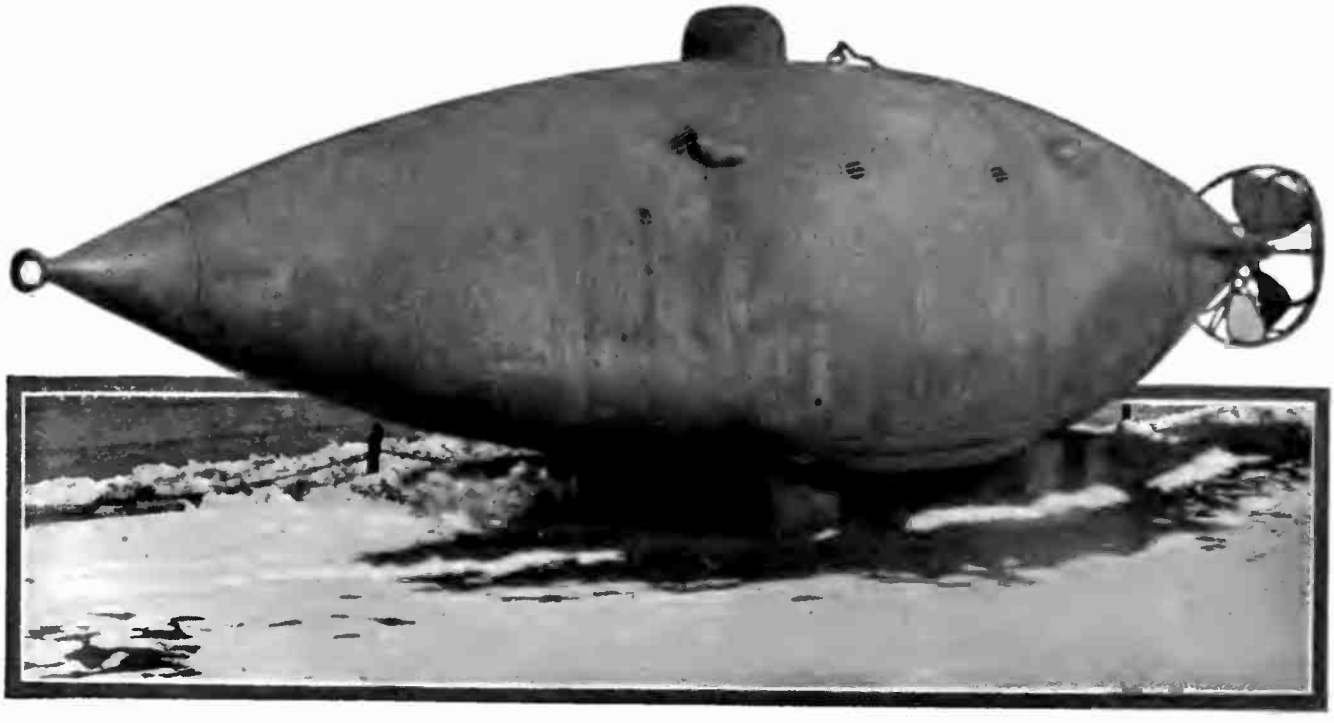


Photo. International News Service

The "Intelligent Whale," One of the Earlier American Submarines, Built in 1864, and Now Resting in the New York Navy Yard.

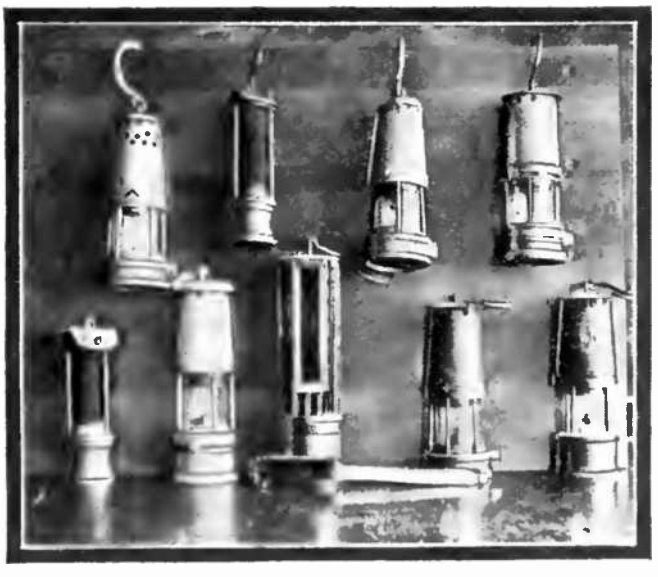
of about 28 feet. The crew numbered thirteen, and it is safe to assume that their efforts were confined chiefly to the matter of propulsion, which was effected by hand power applied to a screw propeller. It is said that a speed of four knots per hour was attained with the craft submerged.

Submergence was accomplished by means of water ballast, and diving through the agency of horizontal rudders placed at the stern. The inherent tendency of this type of boat to plunge straight for the bottom instead of to settle quietly on an even keel proved to be the undoing of the *Intelligent Whale*, for in 1872 she was tried and condemned after having carried her crew to the bed of the sea, where they paid for their bravery with their lives.

HOW SAFETY LAMPS ARE USED IN MINES

The principle of the safety mining lamp is based on the fact that a flame will not pass through a metal screen. The metal rapidly absorbs the heat and dissipates it into the air, so that it is impossible for a flame to pass from one side to the other. This fact was first discovered by Davy, an English scientist, and the principle of the Davy lamp has been embodied in all others ever since. In modern lamps, glass has been substituted in part for the screen, to provide better illumination.

The safety mining lamps are not only used for lighting purposes, but also have come to be of great value in testing the air of mines for the presence of explosive gases. The gas passes through the gauze and on coming into contact with the flame small amounts of it burn with a slightly different colored flame than that of the wick, forming what is known as the flame cap. A skilled observer is able to tell very accurately just what percentage of gas is present by the size of the flame cap.



A Collection of Safety Lamps Used in Coal Mines. Many of these Lamps Are Now Using Glass Instead of Wire Gauze.

THE ENERGY OF A MOVING AUTOMOBILE

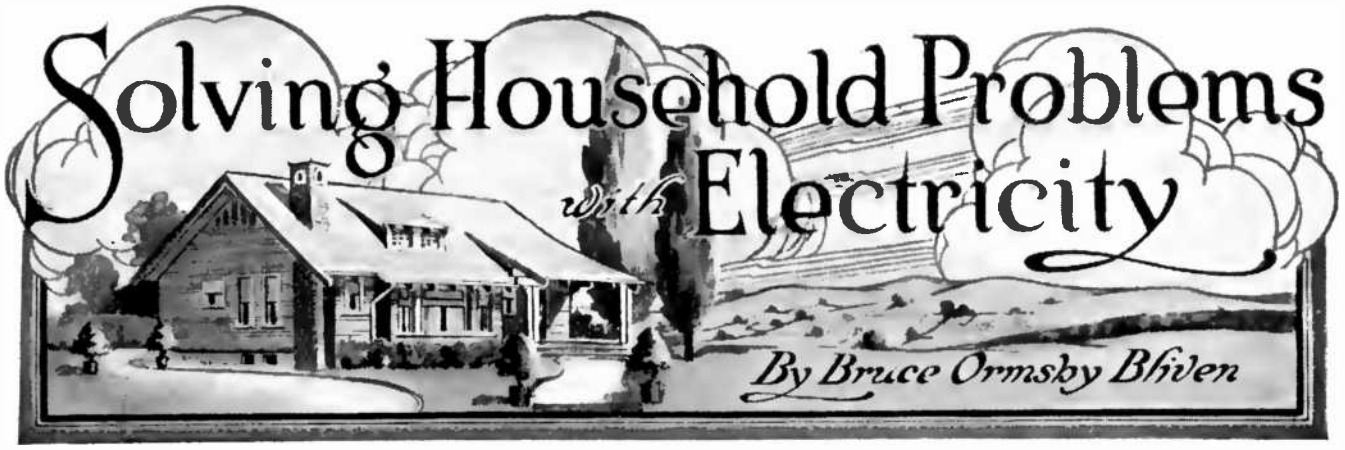
It was going 60 miles an hour!

That is a favorite expression used when describing the speed at which a train or an automobile travels past.

What if an automobile traveling at the rate of 60 miles an hour should come to a sudden stop, such as, for instance, by striking a heavy bridge abutment? A fair idea of the completeness of the wreck may be had by imagining the machine falling from a height of 120 feet, or from the top of a ten-story office building. An object falling from a height of 120 feet would have the same velocity at the instant of striking the ground as the automobile would have when traveling 60 miles an hour.

The energy possessed by a 2,400-pound automobile traveling at the rate of 60 miles an hour is 290,000 foot-pounds, which is the same as that of a body weighing 1,000 pounds at the instant of striking the ground from a drop of 290 feet.

Were a resistance of 6,600 pounds applied to the automobile, it would come to rest in a distance of 44 feet in one second of time, and in coming to rest would be doing work at an average rate of over 527 horsepower.



THE ideal home of the future will be one wherein human labor will be reduced to a minimum by the application of labor-saving machinery and methods. And beyond the question of a doubt the main agent in the realization of this ideal will be the electric current. Here is an instance of the profuse application of electricity that might well be followed with profit.

IN the heart of Southern California, a few miles from Los Angeles, a beautiful home lies among the foothills, snuggling up to the base of the mountains; a home which is said to be the most completely electrified home in the Southwest, if not in the entire country. Every function of the household which demands the application of continuous power is carried on by means of the omnipotent "juice"; and by ingenious adaptation of machinery several tasks are performed in this way which are ordinarily thought to be impossible of accomplishment except by manual labor. Moreover, the ultra-modern home in question is an object lesson in the possibilities of country life. The house is situated several miles from the nearest town—a condition which is ordinarily thought to be incompatible with comfort in living; and yet, at a cost which certainly cannot be called excessive, this home has been fitted with far more conveniences than any town house can boast.

The home in question is "Anoakia," the famous residence of Mrs. Anita M. Baldwin, whose father, famous the country over as "Lucky" Baldwin, when he died bequeathed to her the splendid Baldwin ranch. The house on the ranch is, however, new and was designed by Mrs. Baldwin herself. Comfort and convenience were the ideals strictly adhered to, although the home is esthetically beautiful and architecturally satisfying as well.

Power for all the various enterprises of the "Anoakia" ranch is secured from one of the big power companies, and no attempt is made to generate it on the ranch. One of the most important of the duties outside the house is performed by the electric pump, which pumps water for the irrigation of several thousand acres. There are a number of wells in various parts of the estate, and from these the water is pumped into a main reservoir with a capacity of over 4,000,000 gallons, from which the water is distributed as needed.

An interesting feature of the house itself is the big "Jinks room," especially dedicated to the good time spirit. The walls of this room are decorated with some charming paintings, electrically illuminated by indirect lighting. Through the swinging doors is to be found a tiny

electric kitchen, completely equipped. The fumes and odors from the cooking are dispelled by an electrically-operated exhaust fan.

A novel electric device is the hair-drier, which provides a blast of air with which to dispel the dampness in Miladi's tresses. A one horsepower motor is attached to a small compressor, and one hour a day of operation provides an ample quantity of compressed air. Pipes from the compressor tank run to the several dressing rooms.

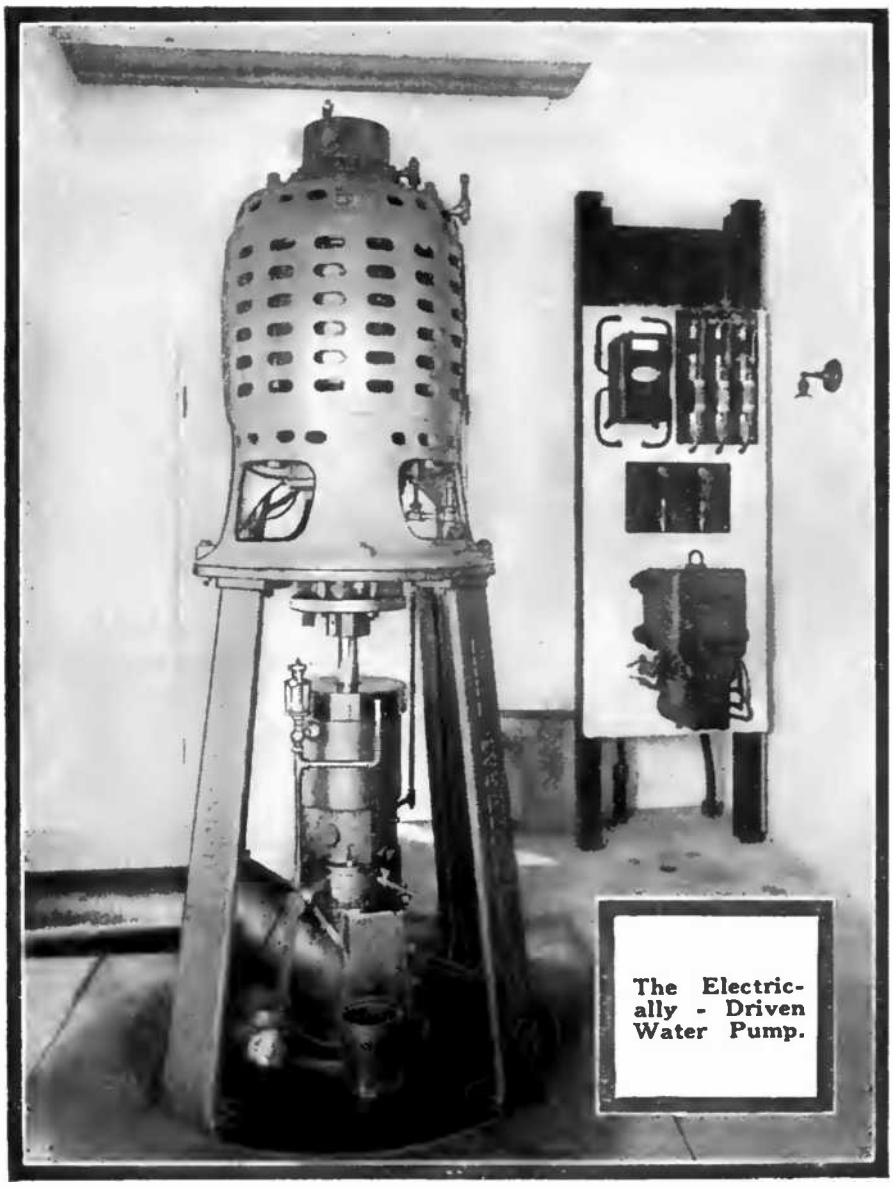
A refrigerating plant of six tons' capacity is located in the basement. A fifteen horsepower motor operates it, producing about 400 pounds of ice a day, providing refrigeration for several boxes containing approximately 1,500 cubic feet. While the machinery is running, a small pump, driven from the main shaft, circulates brine through the cooling pipes in the boxes. Two or three hours of operation each day will maintain a temperature in the boxes just below freezing point.

A separate circulating system provides cold water for drinking purposes in nearly every room in the house. A tank has been provided through which passes a set of brine coils for cooling the water. The pump is operated by a small electric motor.

As might be expected, the problem of keeping the house clean is also solved by resource to electricity. An electric vacuum cleaning machine is located in the basement, and operates in every room. There is no such thing as sweeping or dusting at "Anoakia" ranch.

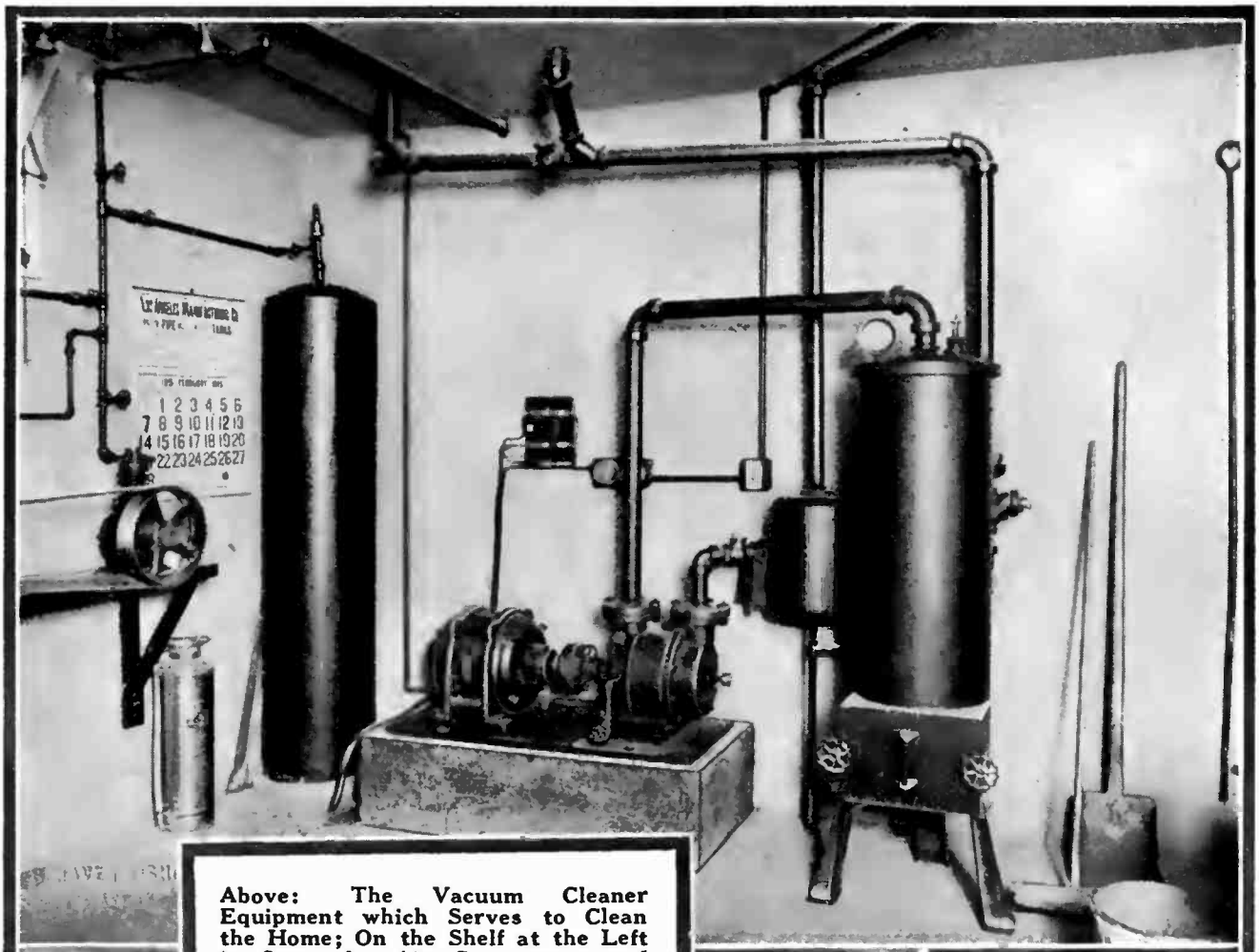
The laundry is in a building of its own near the residence. Here an electric washing machine, an electrically-operated mangle, and several small electric irons are found.

A vacuum cleaner is also found in the garage, where it is used in the care of the several automobiles which are kept in constant service. In connection with the garage is a beautifully-equipped machine shop, prepared to do anything necessary in repairing the ranch machinery. In this machine shop all the motive power is, of course, electric. A lathe, drill press, grinder and several smaller pieces are all operated from a shaft attached to a five horsepower motor.

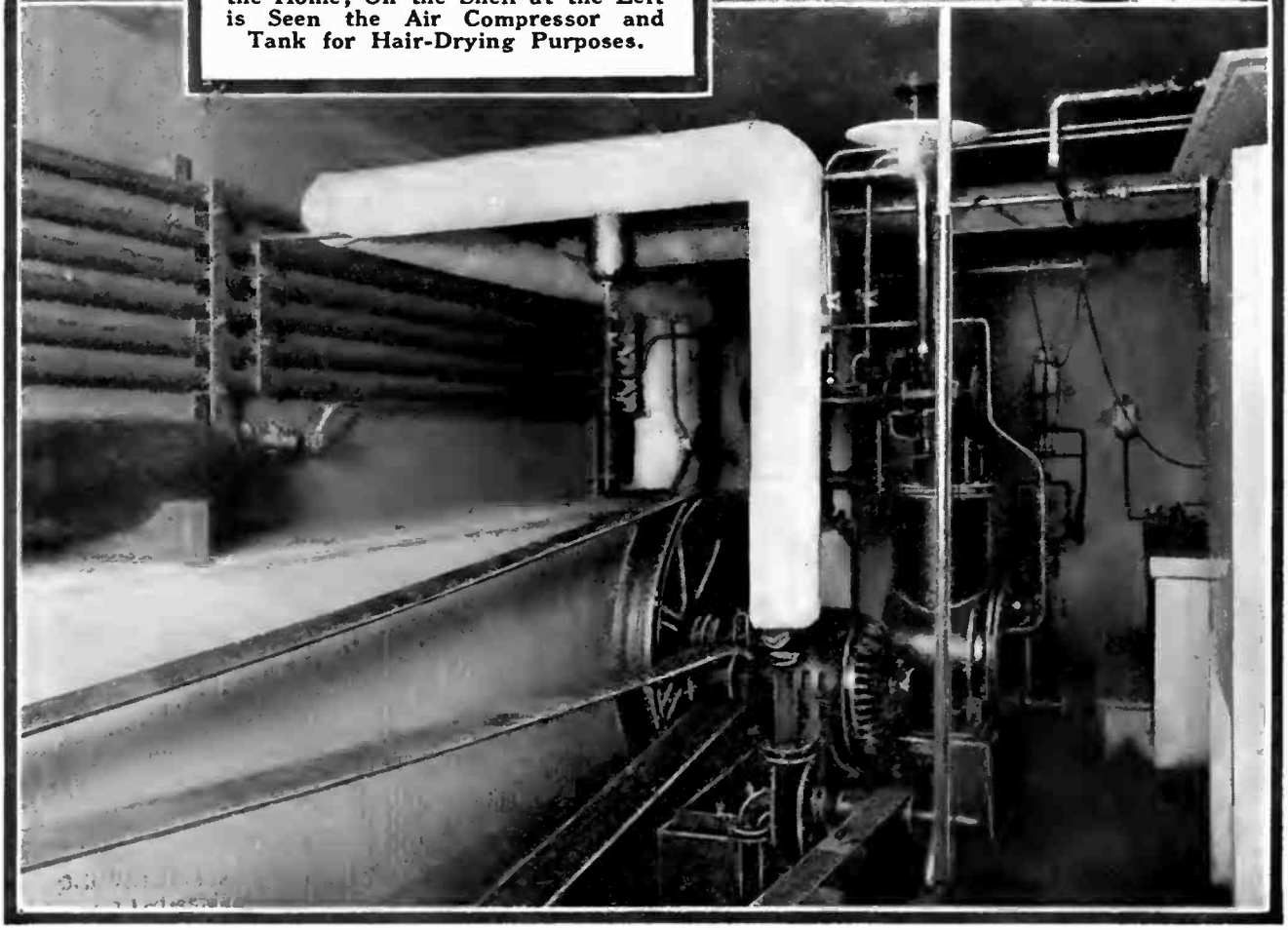


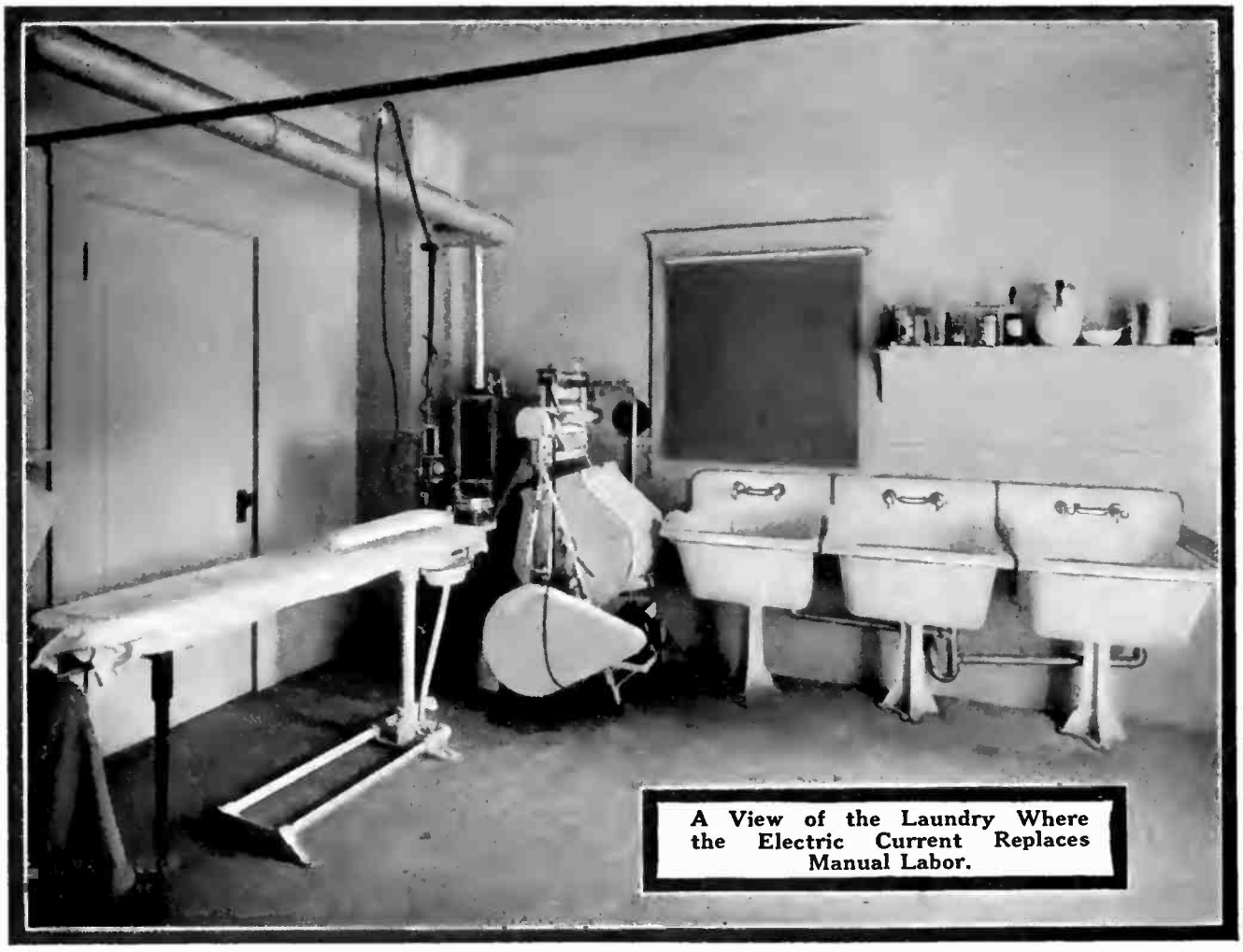
The Electrically - Driven Water Pump.

The water used in the household is procured from a well remote from the buildings. Near this well is a large cement reservoir built on top of the ground. A compartment in the same structure contains a pressure pump, a filter and an iron tank with a capacity of 1,800 gallons. The pressure pump sends the water into the tank, whence it is distributed under fifty-



Above: The Vacuum Cleaner Equipment which Serves to Clean the Home; On the Shelf at the Left is Seen the Air Compressor and Tank for Hair-Drying Purposes.





A View of the Laundry Where the Electric Current Replaces Manual Labor.

pounds pressure to all the buildings. Water for all other purposes on the estate is lifted from the well into the reservoir by a direct-connected forty horsepower motor operating a centrifugal pump. From the reservoir it flows by gravity to all parts of the estate.

As might be expected in such an efficient home, the lighting system has not been neglected. The house is lighted throughout with the indirect lighting system, an interesting feature being the outdoor lighting on the broad verandas which surround the house. A large number of bronze metal lighting standards are carried around the edges of the porches, each containing a single frosted globe. When all of these are lighted, the effect, especially from a little distance, is extremely striking and well deserves that much overworked comparison to "fairyland."

THE JITNEY BUS IN NEW YORK

A new public vehicle has recently made its appearance on the streets of New York City. It is an electric storage battery bus, which greatly resembles the convertible street cars used in most American cities. It is known as the "jitney bus."

The electric bus is an innovation in motor bus transportation, and from the claims of low operating cost should prove wonderfully efficient for such service.

Buses of this type have a 2½ h. p., 60 volt, 32 ampere, 1,200 r.p.m. motor direct connected through a concentric reduction gear to each wheel, making all four wheels active drivers and allowing of an equal distribution of weight over all four wheels. This results in the elimination of slipping and skidding, affords maximum tractive effort, and tends towards a rolling motion when

starting rather than a lifting motion, as is the case with the two-wheel drive. Complete drive and unit may be removed in a few moments, so that in case of an accident either motor with its gearing can be quickly disconnected; the vehicle being capable of operating temporarily on the remaining two or three motors.

A 60-cell Edison storage battery supplies the motive power, giving a radius of 50 miles on a single charge, and, by the method of boosting permitted under the guarantee of this battery at a rate much higher than normal for a short period, over 100 miles actual operation has been obtained in 18 hours, including eight stops to the mile under a service test, in addition to stops caused by street traffic and the time required for boosting.

The body design of these buses follows more nearly that of street car practice, the prepayment system being used, with entrance at the rear and exit at the front. The buses have a seating capacity of 36 passengers, with cross seats and center aisle. They are semi-convertible; *i. e.*, the panels and glass are replaced by screens in the summer.

An Ingenious Water Wheel Arrangement in Which the Power is Applied to Another Wheel in Order to Raise Water to a Higher Level.

RAISING WATER BY NOVEL METHOD

The water wheels shown in the accompanying illustration were constructed in order to raise the water from the river into an adjoining canal. This was necessary because of the fact that the water in the dam is quite often a foot or two below the level of the canal. The larger wheel is the open wheel and it serves to drive the smaller one. The latter is a wooden box wheel that lifts the water into a little channel built to conduct it under the hill, shown in the picture, into the canal. These wheels are made entirely from wood, the larger one being 15 feet in diameter and the smaller one 10 feet.

One of New York's Jitney Buses, which Are Destined to Relieve the Present Congestion of the Metropolis's Street, Elevated and Subway Lines.

ELECTRICITY AND THE "MOTOR POINTS" OF THE BODY

A curious application of the electric current is that made by experimenters in medical science in producing certain desired facial expressions. These are, it is stated, obtained by applying one pole of the circuit to the "motor point" necessary and the other pole to an indifferent portion of the body of the subject. This part is generally the breastbone. It appears that these motor points are the only ones at which the electric current produces the desired effects. In this relation it should be added that it is at these points that the nerves controlling certain muscles enter those muscles.

If it be the object of the experimenter to produce upon the subject's face an expression of deep dejection, all he has to do is to place the two poles at the sides of the chin—one at each side. The current causes a contraction of the muscles controlling the upper lip. This lip is drawn downward and outward, thus producing immediately the desired effect.

If the experimenter wishes to get an expression of great mirth on the part of the subject, the electrodes are placed one in front of the lobe of each ear on the cheek. The effect of the bilateral contraction is to draw the angles of the mouth outward, to throw the skin of the cheeks into arc-like folds, and to close the eyes. An expression of sardonic mirth may be brought to a point of horror, thus giving to the face of the subject an expression of great repulsiveness.

An expression of conceit and haughtiness may be obtained by the contraction of the "elevator" of the lower lip and chin, the effect being to flatten the chin and to produce a slight rise in the under lip.

What is stated above with reference to the facial muscles applies also to the other muscles of the body. The electric current can produce any effect practised by Nature. Each separate finger or toe can be wriggled, the leg can be drawn or kicked out with force, the arm can be made to perform various motions, the ears even can be made to move, the skin to tremble, or the teeth to chatter. In brief, electric current can produce any expression of the human face, from extreme pleasure to extreme pain; from the direst anger to the most exalted repose. The mouth can be made to assume a "pucker" for kissing; and the tongue may be made to "loll out," or to move back and forth outside the mouth.

A HANDY DEVICE FOR THE FISHERMAN

A native of Virginia has recently invented a convenient contrivance that may be employed to good advantage by the fisherman who uses a rod. It is a metal stamping of a peculiar form which adapts

Applicable to a Wide Variety of Different Purposes, this Recently Invented Device is a Boon to the Fisherman.

The Handy Fisherman's Device in a Number of Different Applications: In One View it is Shown in Use as a Holder for a Fishing Rod; it is Fastened to the Side of a Row Boat and Leaves the Fisherman's Hands Free for Other Tasks. In Another it is Depicted as a Worm Digger, while in Still Another it is Used to Hold a Rod to the Belt of the Fisherman.

it to a plurality of purposes. For instance, the device may be used to dig up worms, when utilizing its sharp end. Then again, it can be employed as an implement for cutting and cleaning the fish. But the most important function of the invention is to hold a fishing rod in a number of different positions and to signal by means of a small bell when a fish is on the line. As shown in the accompanying illustrations, the fishing rod may be held over the side of a rowboat or even in the fisherman's belt so as to allow his hands full freedom. A number of holes into which fits a split pin permits the adjustment of the device to hold any sized rod in any position desired.

ELECTRIC SCALES FOR RAPID WEIGHING

Electrically-operated scales which automatically control the amount of goods entering a container are in use in wholesale establishments where packages of standard weight are made up, as well as in retail stores putting out large quantities of sugar, coffee, rice and other staples in paper bags.

In the accompanying illustration is shown a typical electrically-operated scale. The large, funnel-shaped container above the scale serves to hold a full sack of sugar, a drum of coffee or other goods in bulk. It can be lowered

Much Time and Labor is Saved by the Use of the Electric Weigher, Which Automatically Weighs Out Goods in Bulk.

to the floor to receive its contents and then raised to a position above the weighing table. The lower end of the funnel is supplied with a little metal disc about the size of a dollar, which slips into place to check the flow when the proper amount has been delivered. This action is accomplished by an electrical device; the current being furnished by a set of dry cells. The current is switched on and off at the proper moment by means of a contact formed by the needle of the scale dial. Suppose the package is to contain twenty pounds; the face of the dial is provided with a small indicator at the circumference, which is set at the twenty-pound mark, and the needle, coming in contact with it as the package reaches that weight, forms an electrical circuit and instantly checks the delivery. Even the weight of a paper bag can be allowed for, so accurate is this time-saving device.

NITROGEN LAMPS IN ARC FIXTURES

When the New York City arc lighting system was abandoned and the new nitrogen filled tungsten lamps were installed, instead of following the usual expensive practice of dismantling the old posts and fixtures, only a slight change was made. The arc mechanism was removed from the casing and large sockets installed so that the tungsten lamps could be inserted. These fixtures are in process of installation throughout New York, an interesting feature being that in substituting the new lamps for the old the service does not suffer interruption.

DREDGING MACHINE LOADS TRUCKS ELECTRICALLY

The speed with which motor trucks can be handled and the high cost of their maintenance has resulted in the invention of an electric loading machine which, so it is claimed, will do the work of a dozen men. The new electric loader can dig easily into piles of large cobblestones, as well as various grades of earth and sand. No skill is required in its operation. The truck is driven under a chute, the buckets or clams of the digging mechanism are adjusted, and the current is turned on. Broken stone, sand and

This Electrically-Driven Machine Takes the Place of Several Laborers in the Loading of Broken Stone, Sand, Gravel and Other Similar Material.

gravel are loaded at the rate of one cubic yard per minute at a cost of less than one cent per cubic yard for electric current.

The manufacturers claim that contractors have increased their output of broken stone 200 to 300 per cent. with the electric loader. It is built entirely of steel so as to withstand hard service.

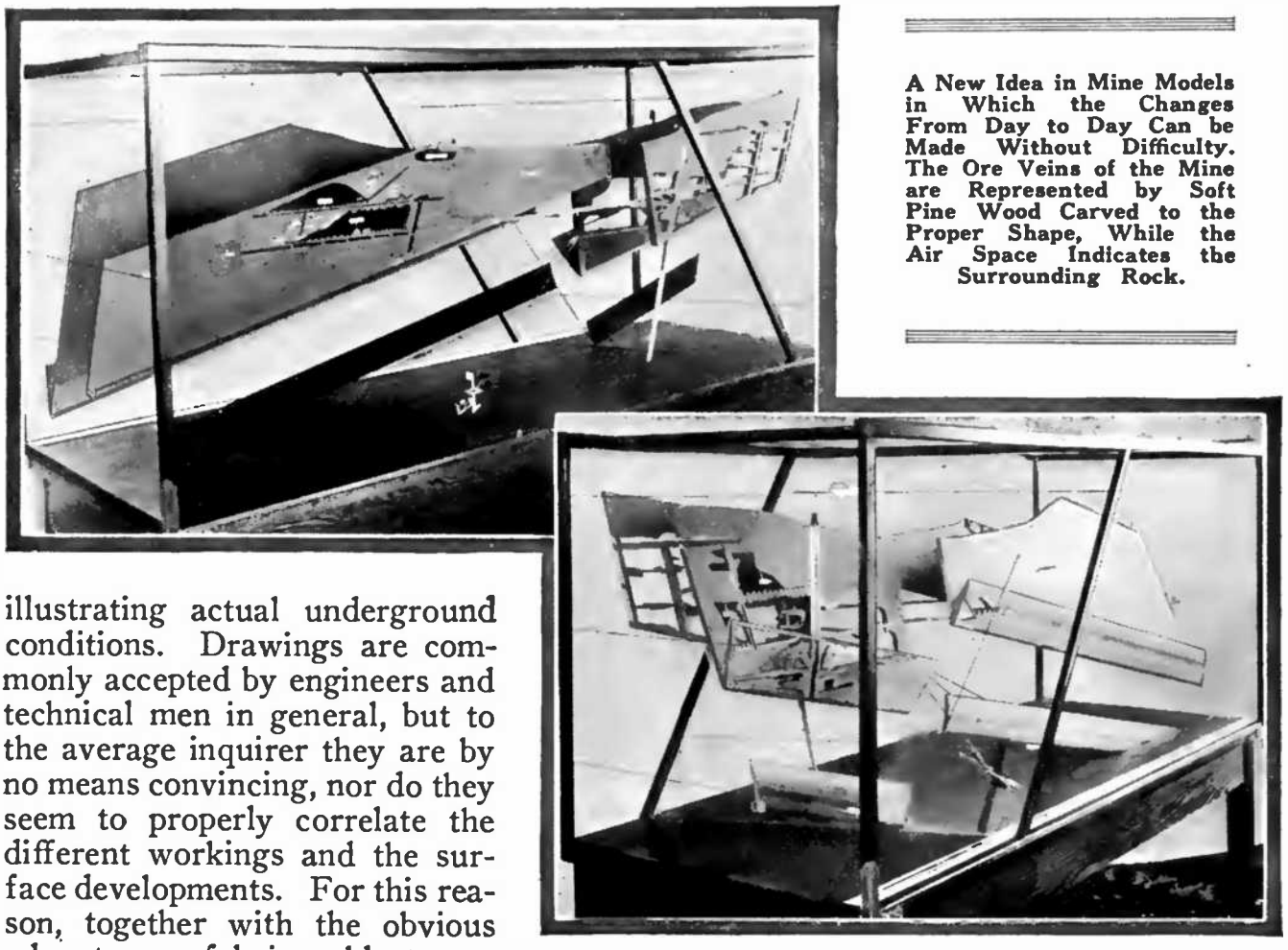
IMPROVING SAYVILLE WIRELESS STATION

The transatlantic wireless station at Sayville, L. I., which has been serving as a direct means of communication between Germany and the United States during the present war, is now being improved to make it more effective.

A NEW IDEA IN MINE MODELS

The difficulty of getting a clear conception of the interior workings of a mine has led to a great many methods of illustrating actual underground conditions. Drawings are commonly accepted by engineers and technical men in general, but to the average inquirer they are by no means convincing, nor do they seem to properly correlate the different workings and the surface developments. For this reason, together with the obvious advantages of being able to see at a glance the condition of the various ore bodies, actual models have been constructed that show on a small scale the interior of mines and the daily progress made in their working.

Mine models are often made of glass or celluloid, so that, being transparent, a view of all parts can be secured at the same time. The workings in ore and in barren rock are painted in different colors on the transparent material. These models are rather inflexible, though, so that the latest development, which overcomes its defects, is a model in which the surrounding rock is represented by space and the ore veins are pieces of soft pine wood carved into the required shape. These pieces are suspended in place in a glass frame. The various workings are outlined upon the wood and then cut out with a jig saw, the vacant spaces representing the places from which the ore has been mined. The remaining portion is painted as nearly as possible to the ore color. Where the ore bodies intersect the surface, they are cut to agree with the actual land contour.



A New Idea in Mine Models in Which the Changes From Day to Day Can be Made Without Difficulty. The Ore Veins of the Mine are Represented by Soft Pine Wood Carved to the Proper Shape, While the Air Space Indicates the Surrounding Rock.

Since only the ore is represented, the intervening rock being left to the imagination, the work of keeping up the model is facilitated, and an illustration is obtained which enables any one to get immediately a perfectly clear idea of the value and extent of work in the mine.

RIFFELHORN LIGHTNING-TUBES

At a meeting of the Geological Society in London there were recently exhibited some specimens of "lightning tubes," found on the summit of the Riffelhorn, a sharp, rocky point near the celebrated Matterhorn in Switzerland.

These tubes were about one-tenth of an inch in diameter, and lined with a thin film of glass, black or dark brown in color, and formed by the melting of some of the constituents of the rock as the lightning penetrated it.

ANOTHER "SMALLEST MOTOR"

An electric motor only 5/16 inch in height and 3/8 inch in length, in the construction of which no lathe or machinery was used, is shown in the accompanying illustration. "The smallest motor in the world" has been claimed on numerous occasions before, but this tiny motor has undoubtedly better claims than any of those which have gone before. It is only half the height of a five-cent piece and is self-starting, running at high speed on 1½ volts. Some of the parts are almost microscopic. The diameter of the shaft is 1/32 inch, the diameter of the commutator 1/8 inch and its length, 1/16 inch. The length of the brushes is 1/4 inch and the thickness 1/1000 inch. The armature is of the three-pole type, with eighteen turns of wire on each pole.

Here is the Latest Claimant to the Title, "The Smallest Electric Motor in the World." Any Challenges?

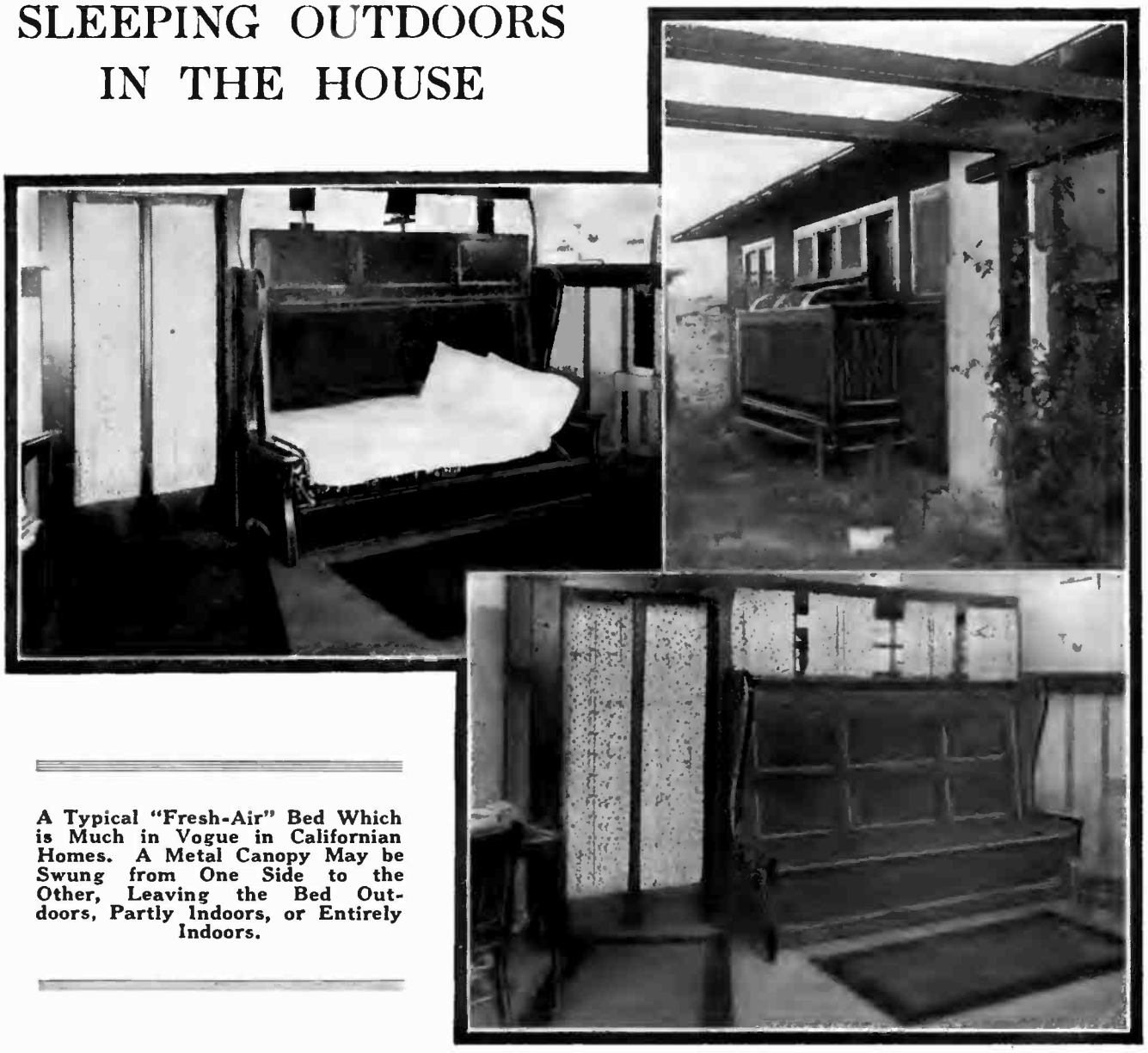
GERMAN DISINFECTION OF CARS

A German engineer has solved the difficult problem of sterilizing a railway car quickly, thoroughly and inexpensively, without taking out fittings and hangings. It is easily understood that cars may readily be carriers of disease germs and of more repulsive, if less dangerous, vermin. The German coaches returned from Russia are often in filthy condition. By the German plan each is run into a specially constructed steel cylinder, at the Potsdam shops, sealed in and heated by steam coils to 140 degrees Fahrenheit. Air is then pumped out until such a vacuum is formed within the cylinder that water will boil in it at that temperature. Thus all moisture is evaporated from the car without injury from great heat. For special purposes of disinfection the cylinder is then filled with formaldehyde gas, which kills all insects and germ life in the car. In twenty-four hours the car is again ready for service.

THE DECAY OF GLASS

It is probable that but few persons who admire the iridescence of ancient glassware know that the prismatic hues displayed are a result of the decay of the glass. When disintegration sets in, the substance of the glass splits into exceedingly thin laminae, which, as the sunlight traverses them, give rise to a splendid play of colors. As in the instance of the leaves of a forest, these delicate glasses signalize their approaching dissolution by becoming more beautiful.

SLEEPING OUTDOORS IN THE HOUSE



A Typical "Fresh-Air" Bed Which is Much in Vogue in Californian Homes. A Metal Canopy May be Swung from One Side to the Other, Leaving the Bed Outdoors, Partly Indoors, or Entirely Indoors.

What is known as a fresh-air bed has been designed by a Californian and used with success in Los Angeles residences and apartment houses. The fresh-air bed is built between a tiny balcony—too small to be called a sleeping porch—and the interior wall of the room. Its most interesting feature is a canopy which swings from a position outside the bedroom and leaves the couch outdoors. This canopy, or dome, is of metal, covered with wood veneer. It swings over the bed and may be left with an opening to the interior of the room and to the outside air, thus leaving the occupant of the couch in a through draught. Or it may be swung clear back into the room, shutting out the bed and leaving it in the open air. The sleeper outdoors is protected from insects by a screen, and from prying eyes by a window curtain which may be drawn at daybreak. The advantage of this form of bed is that it requires so little space to get the results of a sleeping porch. The balcony is only two feet or so outside the exterior wall. The bed is concealed from the interior of the room by day, as it is readily converted into a broad divan as shown in one of the accompanying illustrations. Unlike most built-in beds, this one can be made up and receive an airing from the balcony all day. Another interesting feature is a reading lamp as a fixture, similar to the lights used in sleeping car berths.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us. Why not lend this copy to a friend when you have read it through?

CONCRETE FENCE-POSTS

Several English railways, notably the London and Northwestern, have recently constructed fence post of reinforced concrete, and the results are reported to be very satisfactory. It is estimated that the life of such posts may extend to one hundred years, while that of creosoted deal posts does not exceed twenty years.

The concrete posts cost about forty cents per yard, and it is said that in many places cement, sand and iron can be obtained and made into posts at a less price than deal timber. The same material has been tried for "railway sleepers" with good results. Steel sleepers were first tried, but were found to be too noisy.

WHEN RUSSIA OWNED ALASKA

In the accompanying view is seen one of the old Russian forts built on the island of St. Michael in the Bering Sea, at a point not much over sixty miles from the shores of Siberia. Needless to say, this fort is of no value to-day, although in its day it was effective.

A Russian Fort Built on the Island of St. Michael, Alaska, Many Years Ago.

REMEASURING THE STANDARD YARD

Recently an exquisitely careful remeasurement of a treasured standard yard in the possession of the Royal Astronomical Society of Great Britain was made by the Deputy Warden of the Standards.

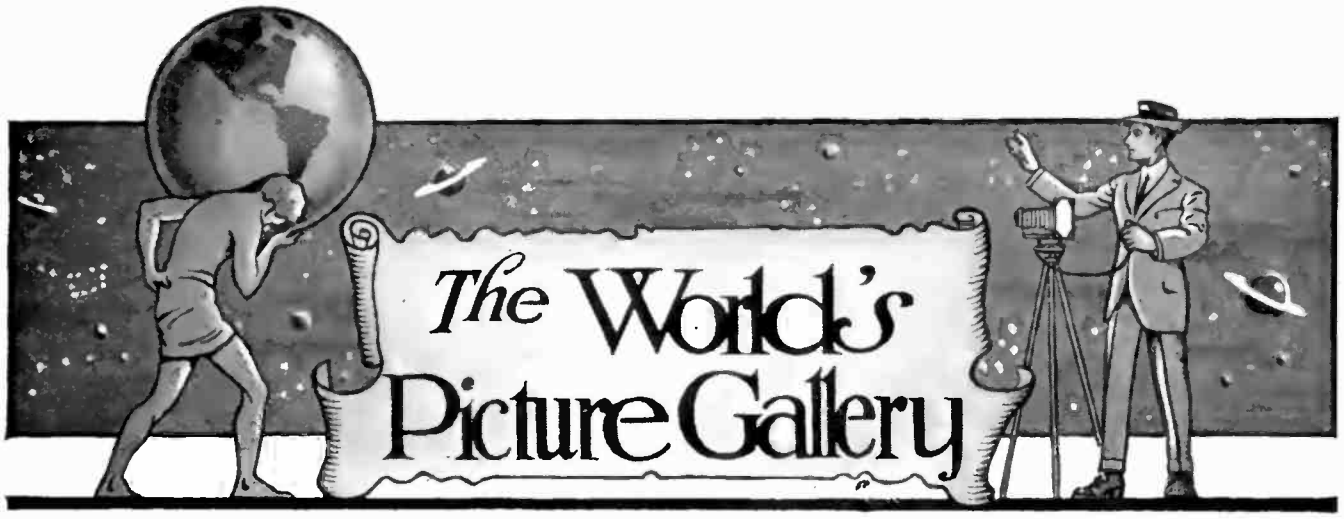
This standard, which consists of a brass tube 63 inches long on which the yard is laid down, the divisions being cut in palladium pins inserted in the brass, was measured with extreme care and accuracy by Francis Bailey in 1834 and again in 1851. Astronomer Airy then showed that there had been a measurable increase of length. The last measurement shows that the standard has further lengthened to the amount of .00063 of an inch since 1851. It is suspected that this increase is due to molecular changes in the metal. Curiously enough, the relative length of the subdivisions remains unchanged. The fact that changes to be measured only in hundred-thousandths of an inch should lead to a long and earnest discussion is calculated to increase confidence in the accuracy of scientific proceedings.

IONO-MAGNETIC ROTATION

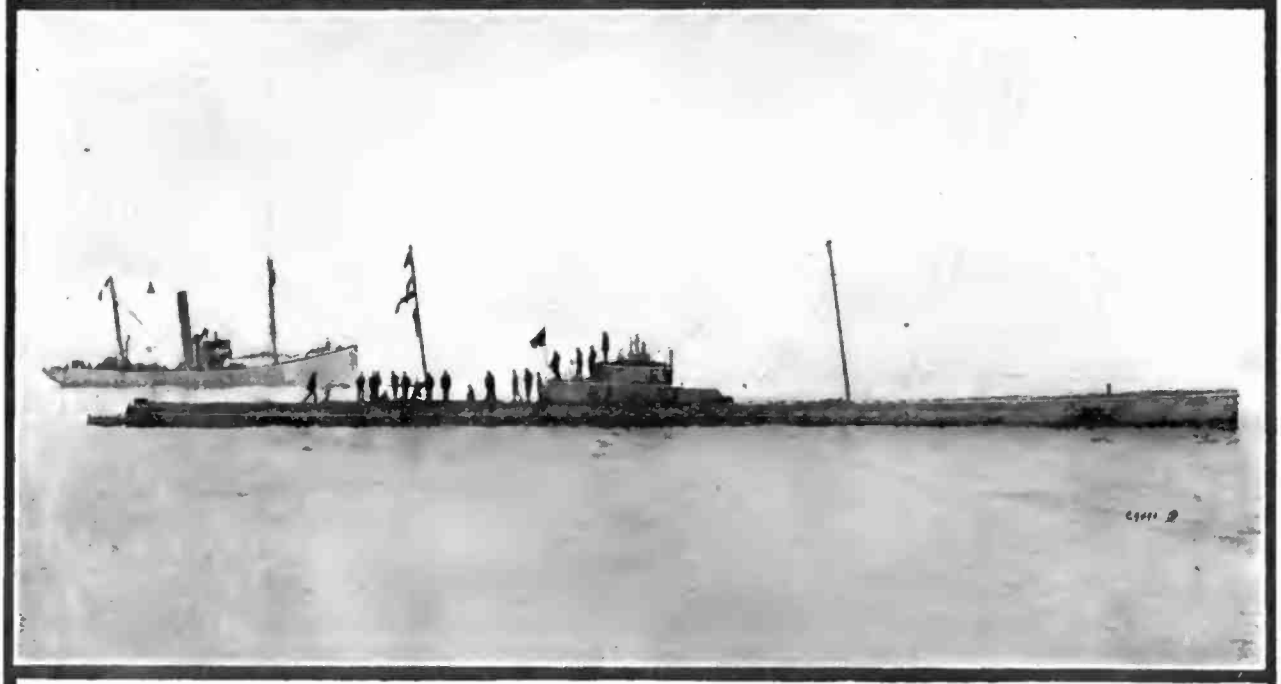
This is the term given by Professor Righi to a certain phenomenon.

If a spark from a condenser of considerable capacity is sent horizontally through a gas, and two small vertical planes of mica in the form of a cross are suspended in the middle of the discharge by a fine fibre attached to the center of the cross, the spark produces no rotation of the cross. If, however, a vertical magnetic field is established in the gas, the cross rotates through a considerable angle if the gas is air, and over a small angle in other gases.

Doctor Righi ascribes this rotation to the bending of the paths of the ions or electrons and to the additional protection which the vanes afford each other against impacts from one side rather than from the other in these circumstances. The observed rotations indicate that the effects of the positive ions are in general greater than those of the negative.



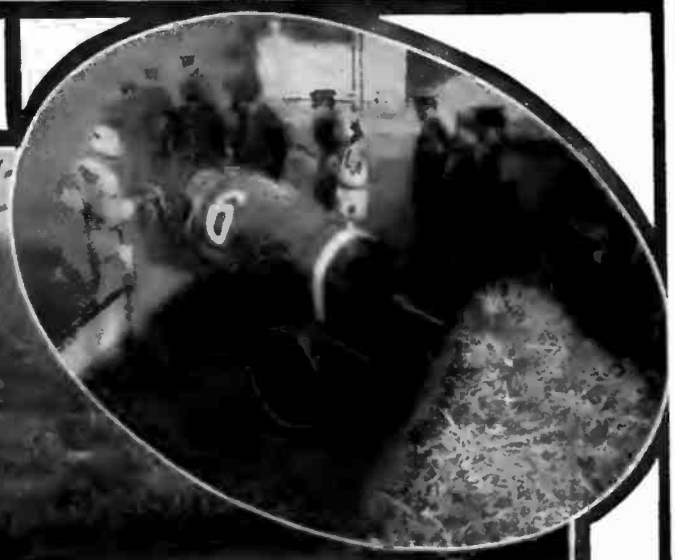
GERMAN SUBMARINE AND ITS TENDER



FOR many weeks the world has followed with mingled interest and awe the German submarine blockade of the British Isles. Rumors have occasionally gained circulation that the German raiders are replenishing their oil and other supplies by means of tenders, and at last this is proven by the view presented above. A. E. Wallace, staff photographer of the International News Service, after having spent several weeks with the German army in the East in taking both still and motion pictures, was ordered to England, from where he was to go to the front with the Allies in France. Mr. Wallace, in company with another American newspaper correspondent, A. F. Beach, sailed from Holland on the Dutch steamer, "Batavier V." Early one morning, while off the Belgian coast, Wallace and Beach were amazed on coming up on deck after breakfast to see a German submarine cutting across the stern of their boat at twenty knots per hour. It proved to be the "U-36," one of the latest German submarines.

THE VANDERBILT CUP AUTO RACE

At the Right: The Car that Took Second Place. Below: the Winning Peugeot at the Finish.



Dario Resta, America's New Speed King, Covered the 296-mile Course in his Peugeot No. 9 in 4 Hours, 27 Minutes and 37 Seconds. His average Speed was 67½ Miles an Hour.

Three of the Contesting Cars Taking One of the Turns During This Race, Which Was Held on March 6th, at San Francisco, and Won by Dario Resta.

Photos Rockwell Feature Service

WITH THE FIGHTING MEN OF EUROPE

French Naval Reservists Chopping Beets for Military Horses.

Military mass for the German and Austrian Forces in Poland. All the Fighting Nations are Now Intensely Religious, and Services are Usually Held Before Going Into Battle. In this Instance the Mass Music is Furnished by the Military Band.

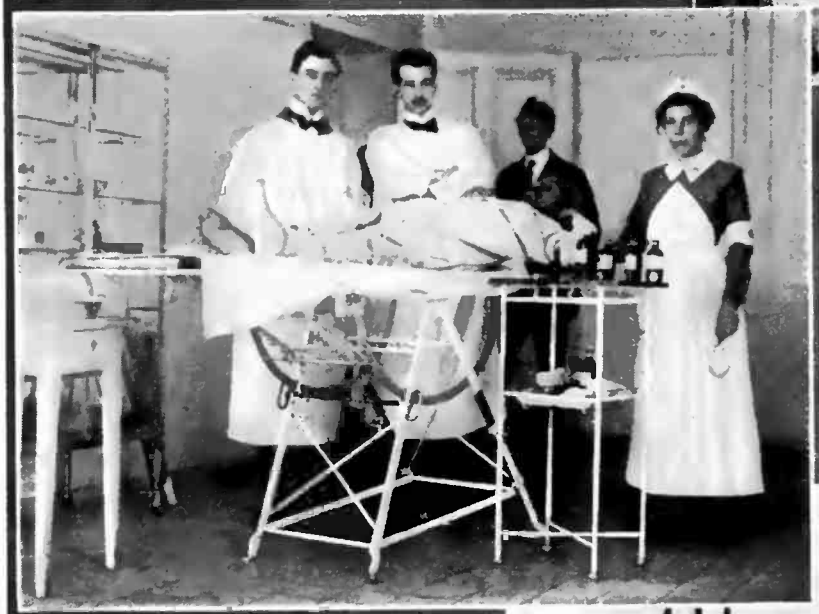
German 15-Centimeter Shells, Showing the Wicker Basket Protection

Above: Austrian Field Piece in Action During a Battle in Poland. At the Left: German Soldiers Near Gundsak, Poland, Receiving Their Pay. The Money for Paying the Soldiers is Sent to the Front in Chests, Carefully Guarded by a Strong Detachment of Cavalry, in Order to Defend it Against Possible Cossack Raids.

INTERESTING SIDELIGHTS OF THE GREAT WAR

A Bombproof Telephone Station for the Austrian Artillery in the Carpathian Mountains.

Above: German Soldiers of the Landstrum Companies, as a Rule, Cannot Write. The Few Men Among Them Who can Write are Kept Busy Writing Letters for Their Companions. Here is Seen One of These "Company Writers." Below: One of Germany's Latest and Largest Submarines, Photographed from the Dutch Steamer "Batavier V."



American Hospital and Attendants in Servia. The Worst Enemy that this Gallant Little Kingdom has to Fight at the Present Moment is the Dreaded Typhus Plague, Brought About by Lack of Medical Attendance in the Early Days of the War. There are Now Numerous American Medical Attendants and Hospitals Combatting the Plague and Caring for the Wounded.

Photos. Copyrighted International News Service.

WHERE SCIENCE AND INGENUITY ABOUND

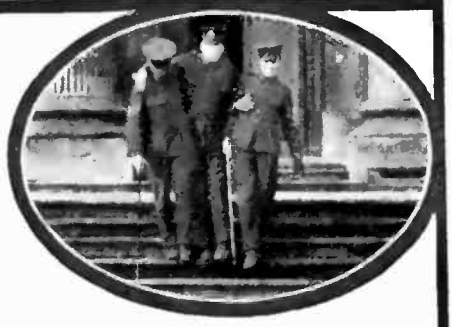
A Pontoon Bridge Thrown Across the Irrigation Canal Near the Australian Camp at the Pyramids, in Egypt. It is the work of the 3rd Field Company of Engineers of the Australian Contingent.

An Example of the Ingenuity of French Soldiers. The Cylindrical Frames Made of Wooden Sticks and Twisted Twigs are Filled with Earth and Used to Cover the Guns When They are not in Action.

British Soldiers in Egypt Using the Heliograph. This Method of Signalling is Largely Employed by the British, Owing to the Favorable Climatic Conditions of Egypt.

The Soldiers of All the Nations Engaged in the European War have Shown a Marked Degree of Ingenuity. They Have in Many Instances Erected Elaborate Shelters Under the Most Trying and Difficult Conditions. Here is a Typical Example: A Row of Shelters Built by the French Soldiers in the Vosges Mountains and Used for the Cavalry Horses.

HOW ENGLAND CARES FOR HER WOUNDED



Three British Tommies who have been Wounded on the Battlefields of France and Are Now Convalescing in England.

Above: Wounded British Soldiers Playing Football on the Great Lawn at Blenheim Palace.

Wounded and Maimed Soldiers are Quartered in the Blenheim Palace, Affording Them Every Possible Comfort Indoors, as Well as the Use of the Beautiful Surrounding Lawns and Walks.

The Convalescing Soldiers Spend Much of Their Time by the Banks of the River that Passes Through the Grounds.

Photos. Janet M. Cummings.

NEWS IN UNDER-WATER AND AERIAL NAVIGATION

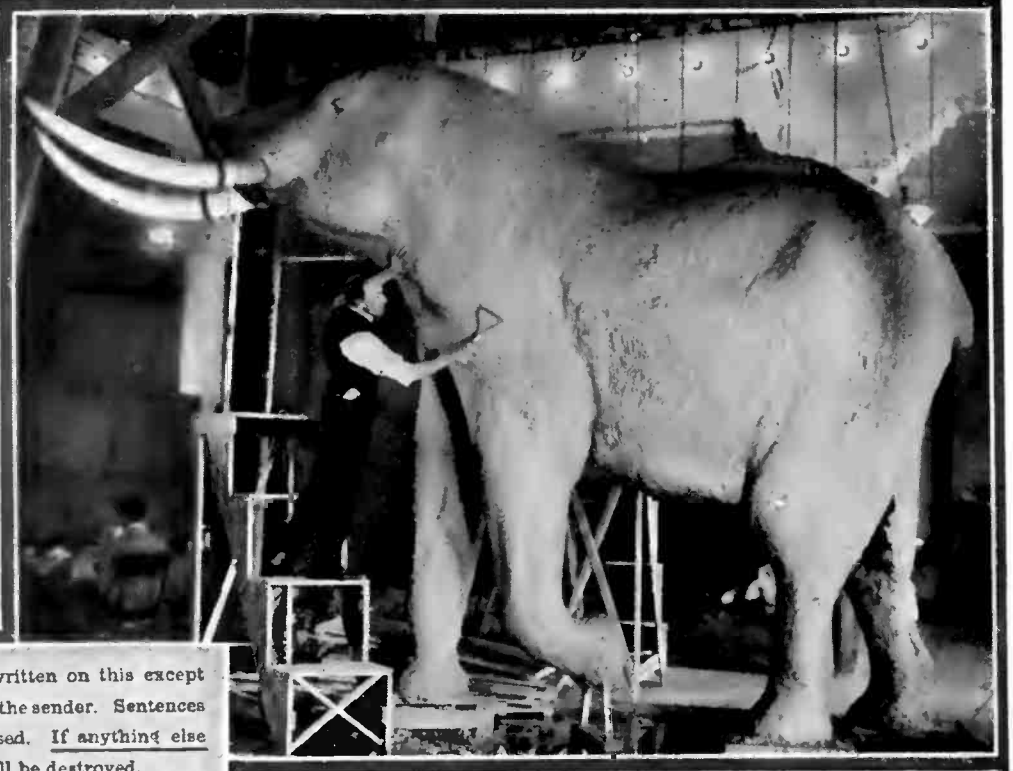
The New American Submarine, the "L-1," Leaving the Fore River Shipyards at Quincy, Mass., for a Trial Trip. This Underwater Craft is the Largest Yet Built by the United States Government, Being 170 Feet Long and Having a Displacement of 600 Tons.

In the View Below: The Wrecked Monoplane of Lincoln Beachy — the well-Known American Aviator Who Fell to His Death in San Francisco Bay Several Weeks Ago— Alongside an Army Transport After Being Dragged Up from the Bottom.

Another View of the Wrecked Monoplane. The Small Rowboat in the Foreground is Carrying the Body of Beachy, which was Brought Up by a Diver of the Battleship "Oregon."

Photos. Copyrighted International News Service.

ODDITIES FROM HERE AND THERE



Mounting the Largeat Elephant Ever Brought Out of Africa, for Exhibition in the New African Hall of the Museum of Natural History, New York City. The Elephant — a Young Bull — Stands 12 Feet High at the Shoulders.

NOTHING is to be written on this except the date and signature of the sender. Sentences not required may be erased. If anything else is added the post card will be destroyed.

I am quite well.
~~I have been admitted into hospital~~
{sick / wounded} and am going on well.
{sick / wounded} and hope to be discharged soon.
~~I am being sent down to the base.~~
I have received your {letter. / telegram. / parcel.}
Letter follows at first opportunity.
~~I have received no letter from you~~
{lately. / for a long time.}

Signature only.

Date

[Postage must be prepaid on any letter or postcard addressed to the sender of this card.]

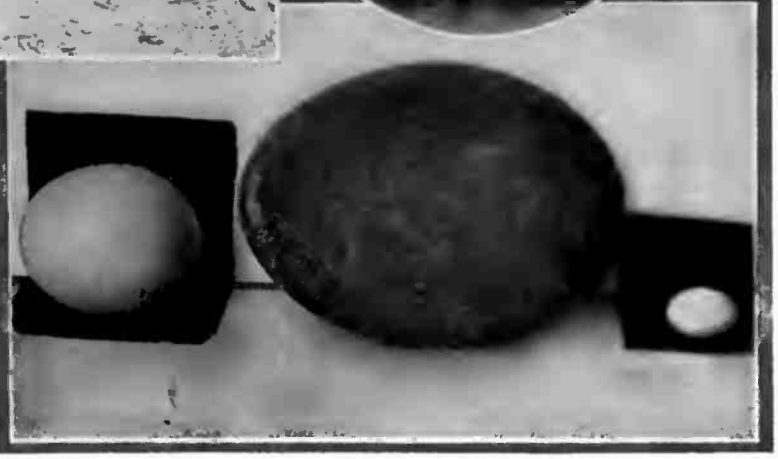
In Order to Prevent Soldiers at the Front from Divulging Important Military Information When Writing to Relatives and Friends at Home, the British Authorities Provide Postal Cards with Printed Sentences. Soldiers are not Permitted to Write, but can State Their Physical Condition and Other Details by Crosaing Out Everything but the Information that Must be Conveyed. The Postal Card Shown in the Accompanying Illustration was Received by an American Soldier from a Friend Serving in the British Cavalry now in France.

A Beach Rookery on One of the Pribilof Islands in the Bering Sea, Showing the Large Number of Seals that Come There to Breed. The Last Census of the Seals Indicated a Total of 268,305 Adult Animals and 92,269 Fur-Seal Pups.

Photos. Herbert Beardsley and Pacific Photo News Service.

THE CURIO SHOP OF THE WORLD

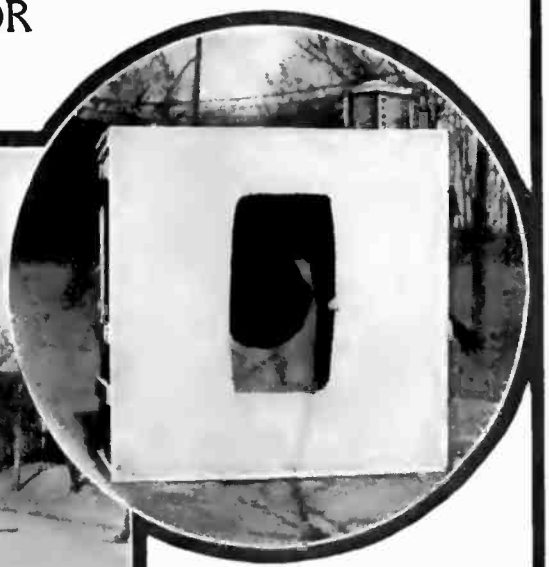
A Chinese School Located in the Chinatown Section of New York City. The Children of the Leading Chinese Residents are Sent to this School at 4 o'Clock in the Afternoon. The Earlier Part of the Day is Spent at Public School.



Above: A Compressed Air Locomotive Used for Hauling Ammunition at the Iona Island Arsenal. In the Oval: A Peculiar Burial Pole of the Alaskan Indians. A Chief's Wife is Enclosed in the Upper Cross-Piece, while the Chief's Body is Encased in the Upright Pole. At the Right: In the Center of the Group is the Egg of the Aepyornis—an Extinct Bird. The Other Eggs are Those of the Ostrich and the Hen.

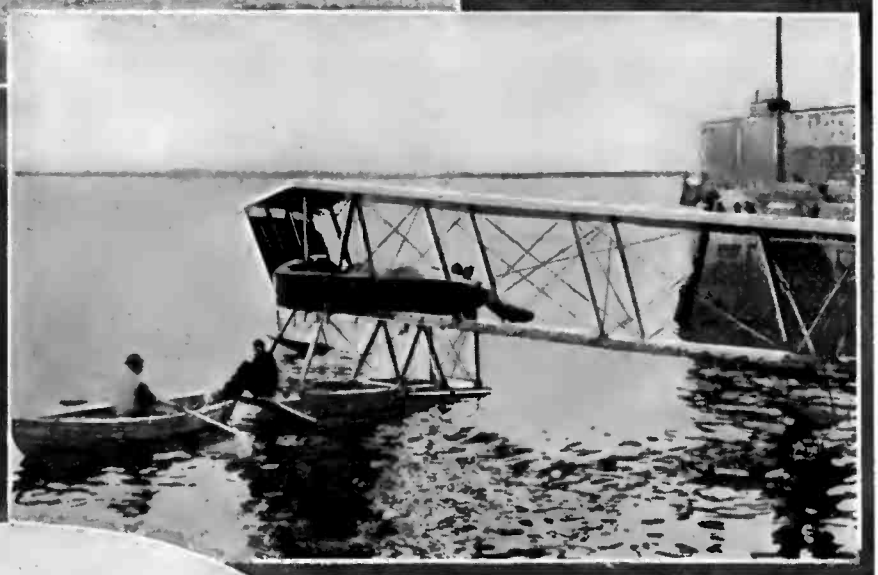
Photos. Herbert Beardsley.

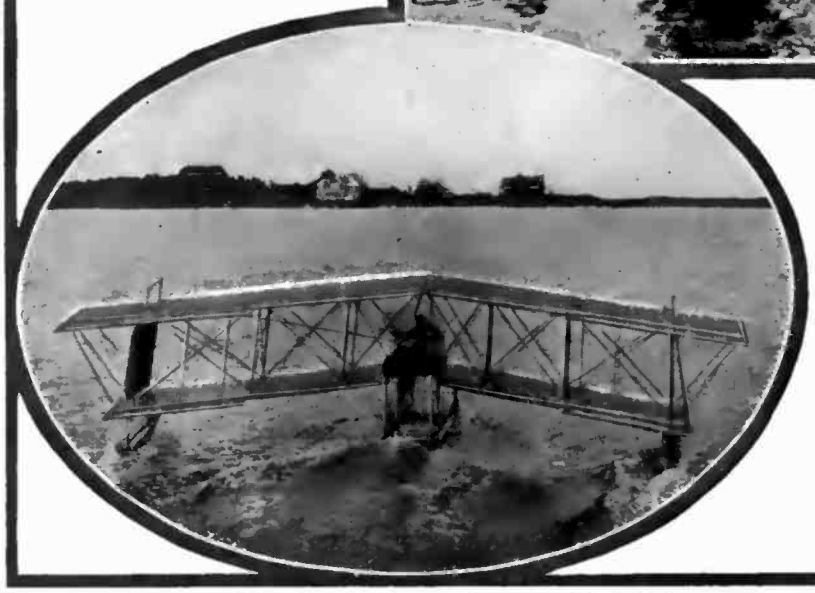
THE TRAINING OF BASEBALL PITCHERS AND THE TESTING OF AEROPLANES FOR MILITARY DUTY



The Target Used in the Coaching of the Pitchers of the Harvard Team.

Above: Arrangement Used by Coach Sexton of Harvard University in Training the Pitchers of His Team. The Testing Device is Placed Over the Home Plate. A "Groove" Ball Hits the Bull's Eye, while a Curved Ball Strikes the Sides.





A Burgess-Dunne Biplane Receiving Its Official Tryout at Marblehead, Mass., Under the Personal Supervision of Agents of the Russian Government. The Latter is in the Market for 200 American Aeroplanes Capable of Meeting the Conditions of the Test. The Machine Shown will Fly in Excess of 80 Miles per Hour and Climb 400 Feet a Minute with a Load of 700 pounds.

ELECTRIC ALARM SAFE.

The introduction of an electric alarm device in a small strongbox intended for the safe-keeping of jewelry and valuable papers offers an interesting problem in its design. Above all, the device must be simple in operation as well as positive; its setting and use must impose no annoyance or trouble upon the user; and to be a successful product in a commercial way the device must be low in cost or at least low enough to make the purchaser feel that the added cost is but a fair premium to pay for the insurance offered.

These requirements appear to have been met in every detail in a recently invented safe. The alarm device is the acme of simplicity and it resets itself automatically. A glance at the illustrations will serve to make clear the principle of operation. The reader will note that in the bottom of the safe are installed a battery, an electric bell, and the contact mechanism. The latter is of greatest interest, of course. Through the bottom of the safe is drilled a hole slightly smaller in diameter than the steel ball which may be noted in the enlarged view in the oval. Upon this ball is balanced a spring contact which is so nicely adjusted that the slightest movement of the ball causes it to slip off and complete the circuit through battery and bell. The latter will continue to ring until the safe is opened with a key held by the owner, and no effort expended upon the outside of the case will serve to stop the ringing. Immediately upon opening the safe the alarm is reset automatically through the agency of the small rod which may be seen projecting above the edge of the safe.

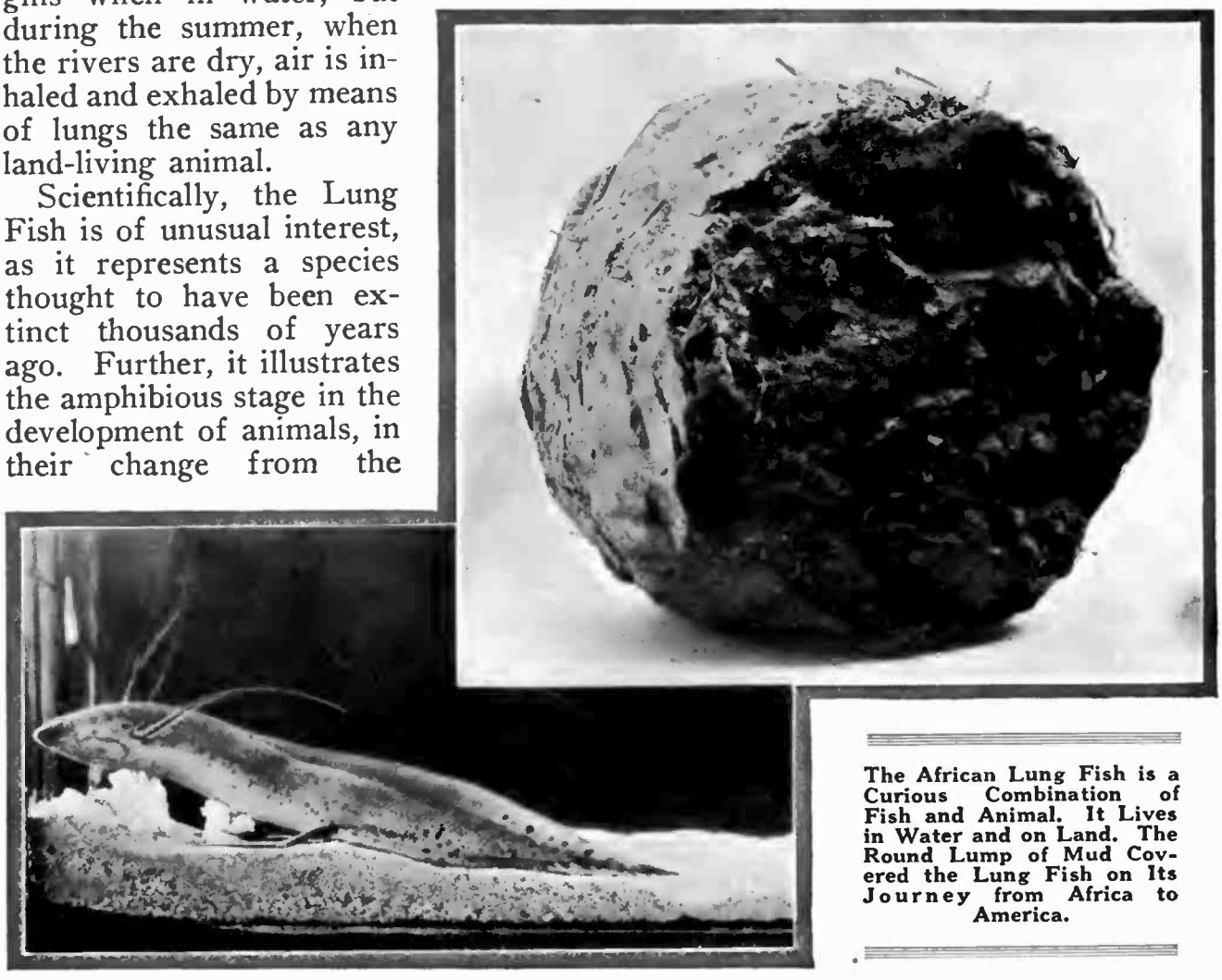
Interior and Exterior Views of the Alarm Safe, in which an Electric Bell is caused to Ring When the Safe is Moved in the Slightest Degree. In the Oval Below is Shown the Alarm Device which makes Contact through the Battery and Bell.

CURIOUS FISH WHICH INHABITS AFRICAN WATERS

A remarkable species of fish from eastern Africa was recently added to the collection of a New York aquarium. It is known as the African Lung Fish on account of its unusual ability to live out of water for several months at a time. The African Lung Fish makes its home in mud or clay and when it was transported to this country, instead of being placed in the customary tank of water, it was embedded in a large block of dry earth in which a hole was made so that the fish could breathe.

The Lung Fish breathes by means of gills when in water, but during the summer, when the rivers are dry, air is inhaled and exhaled by means of lungs the same as any land-living animal.

Scientifically, the Lung Fish is of unusual interest, as it represents a species thought to have been extinct thousands of years ago. Further, it illustrates the amphibious stage in the development of animals, in their change from the water to the land-living state.



The African Lung Fish is a Curious Combination of Fish and Animal. It Lives in Water and on Land. The Round Lump of Mud Covered the Lung Fish on Its Journey from Africa to America.

In appearance, the Lung Fish resembles a salamander; it is long and eel-like, and its fins are used as legs in travelling over dry land. This is supposed to be the first living specimen of a Lung Fish to be brought to this country, and is therefore of great interest.

UNDERGROUND TEMPERATURES

It was formerly believed that the temperature increased at a fairly regular rate with descent into the crust of the earth, but the experiments of Professor T. L. Watson have shown that measurements in deep mines and borings do not bear out the assumption.

Some investigators are now disposed to think that, instead of regularly increasing, the temperature is not far from stationary below the superficial zone. In the Witwatersrand mines the average rate of increase, carried down to 8,000 feet, is only one degree, Fahrenheit, for each 250 feet of descent. The bottom temperature is 102.35 degrees. Measurements in other places have given various results. In the Kalgoorlie mines in Australia practically no variation of temperature is shown between depths of 1,400 and 2,300 feet. The result of recent figures shows that there is no general law governing the increase of rock temperature with depth.

A TELEGRAPH which takes its message on a modified form of typewriter at the transmitting end and prints the same message in type at the receiving end of the line would seem to be the last word in telegraphic progress. The engineers who designed and developed the new printing telegraph have not been satisfied with this achievement, however. They have gone a step further and have produced a machine that will send eight separate messages over the same wire at the same time. Truly the device marks a new era in the field of telegraphy.

PICTURE in your mind a girl seated at a contrivance resembling a typewriter and typing a message which is reproduced with infallible accuracy in clear, readable type on a message blank, ready for delivery, perhaps thousands of miles away from the transmitting point. Then think of four girls at each end of the line and all of them sending separate messages at the same time over a single line. With this mental picture comes slowly a realization of the profound importance of the wonderful collection of apparatus which makes possible this feat.

No really great invention or achievement is conceived and also brought to completion in a day or even many days. True, the basic idea may come in the flash of a second, but in the development of even the simplest of devices, months and frequently years are spent before the invention is brought to a state even approaching perfection. Furthermore, every epoch-making invention must have been developed as the direct result of a demand. In the present instance, the demand was created largely through the vast increase in the business done by one of the greatest telegraph organizations in the world. This steadily increasing volume of business necessitated an increase in the facilities for handling it and to broaden the facilities meant either of two things—additions to the line equipment, or an improvement in the efficiency of existing methods of using the lines then installed. Obviously, the latter option was preferable, and, believing it to be practicable, the officials of the telegraph company called upon one of the prominent electrical manufacturers for coöperation in designing an equipment that was not only to increase the number of messages per line at the same instant, but which would expedite the transmission and handling of the messages at both sending and receiving ends. The result of the team work of the engineers

of both companies is seen in the quadruple-duplex telegraph printing system.

The far-reaching effects of the system will be appreciated when it is realized that the message typed at the sending end is duplicated at the receiving end just as fast as the sending operator can operate the typewriter. The increase in speed over the old method of forming each letter in a word by a series of dots and dashes as in the Morse code can readily be understood. A graphic evidence of the practicability of the system is supplied in the trial installation of the apparatus between New York and Boston; on this line, the apparatus has been constantly in service day and night for a year and a half, and, during this time, the speed of transmission has frequently reached 360 words a minute.

A Multiplex Table Equipment of the Printing Telegraph. On the Left is Shown the Printer with its Relay Box, the Transmitter and Automatic Control are in the Center, and on the Right is the Keyboard Perforator. Four of these Table Equipments would be Required at Each End of the Line in a Quadruple-Duplex Installation.

Operations Involved in Sending a Message

The principle of operation of the apparatus is clearly explained in the words of one of the engineers, as follows:

The transmission of messages by this system involves the following sequence of events: The operator prepares a tape by means of a key board perforator; the tape then passes through a transmitter which, working in conjunction with a distributor, sends certain electrical impulses over the line. These impulses operate a relay at the distant end which, working in conjunction with another distributor, passes the impulses on to a receiving printer, which translates them and prints the letters in the form of a message.

An analysis of these various steps will show that this new printing telegraph operates, to a certain extent, like a pianola. Just as the perforations in a pianola roll determine the particular notes to be played by the instrument, so the perforations in the telegraph tape determine the letters and characters to be printed by the receiving printer.

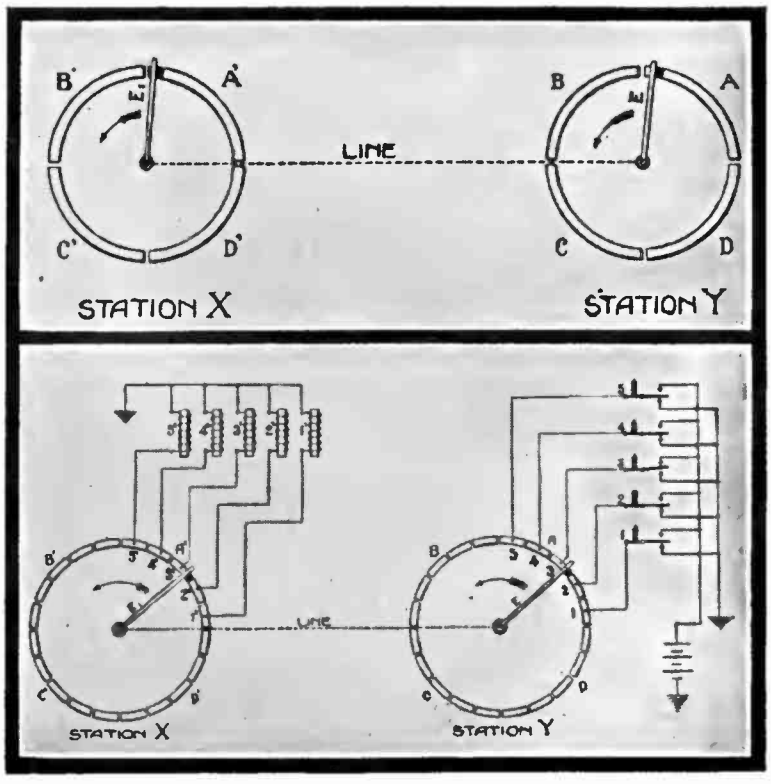
The Printing Telegraph Alphabet

In any printing telegraph system, the alphabet or code employed is of prime importance. Fundamentally, the code of the present system resembles the ordinary Morse telegraph code, in that it uses a series of electrical impulses which are variously combined to represent the letters of the alphabet. In the Morse code, however, the combinations are of unequal length. In the new printing telegraph code they are all the same length. Each letter or character signal is composed of five units, each unit being either a positive or negative electrical impulse. One of the accompanying illustrations shows the code. The heavy black lines *above* the dotted lines at the left represent *positive* current impulses; those *below* the dotted lines represent *negative* current. Each character, therefore, is represented by a combination of positive and negative current impulses. Thus the letter A in the printing code is composed of 2 positive and 3 negative units, *i. e.*, + + — — —. The letter D is also composed of 2 positive and 3 negative units, but the combination is different: + — — + —. The letter O, another combination of 2 positive and 3 negative units, is the exact opposite of letter A: — — — + +.

Coming now to the method of obtaining a number of transmissions over a single wire, it should be made clear, first, how four messages may be sent in one direction at one time. This constitutes what is known as quadruple operation.

Referring to the sketch of the quadruple principle, suppose that two metal rings (Station *X* and Station *Y*) are each divided into four equal parts, or quadrants. Contact brushes (*E* and E_1) rotate over the surface of the two rings, the brushes being connected to the opposite ends of a telegraph line, as indicated. If these brushes start from the same position, and rotate at exactly the same rate of speed, so that they remain constantly parallel, each quadrant of Station *Y* will be connected with its corresponding quadrant at Station *X* once for every revolution of the contact brushes, the duration of this connection being one-quarter of a revolution.

If, as shown in the other diagram, quadrant *A* be in turn divided into 5 segments, each segment representing one signalling unit, it will be possible to send 5 signalling units, or, in other words, one complete letter signal from *A* to *A'* for every revolution of the contact brushes.

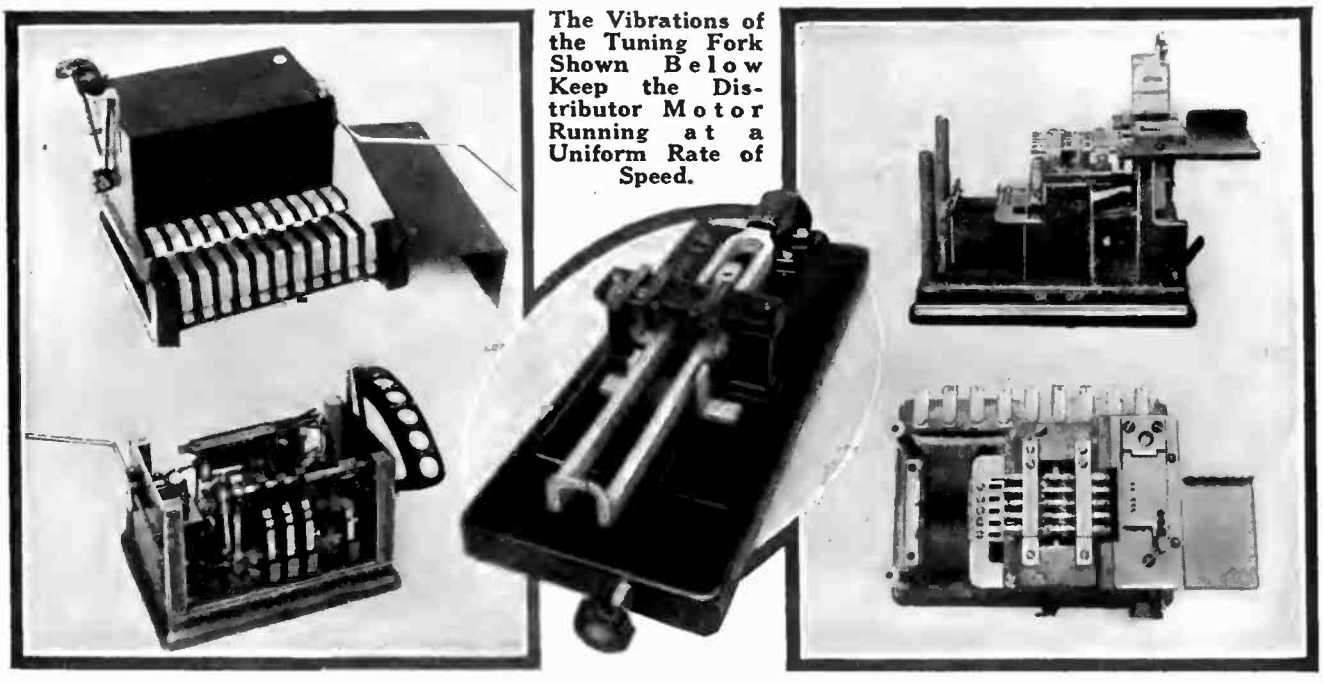


Diagrams Showing the Principles of Quadruple Telegraphy and How it is Applied to the Printing Telegraph in Order that More Than One Message may be Sent over One Line at One Time.

Each unit-segment of quadrant *A* is connected to a lever, as shown. This lever may engage either of two contact points; one point is grounded, while the other is connected to a source of electric current (a grounded battery in the illustration). Each corresponding unit-segment of quadrant *A'* is connected to ground through a relay.

Suppose now that, at Station *Y*, lever No. 3 of quadrant *A* be held against the contact that is connected to the battery. Then as contact-brush *E* passes over unit-segment 3, an electrical current will pass from the battery through lever 3, segment 3, and brush *E*, and over the line to brush E_1 at Station *X*. Since

The Vibrations of the Tuning Fork Shown Below Keep the Distributor Motor Running at a Uniform Rate of Speed.



At the Right: Interior Views of the Transmitter Mechanism, Showing the Contact Levers which Perform the Functions Described in Connection with Station Y in the Diagram Above. At the Left: Interior and Exterior Views of the Automatic Control which Stops the Transmitter in Case the Operator is Unable to Keep Up with the Pace Set by the Distributor.

brush E_1 is at exactly the same point of its revolution as brush E, the current will pass through unit-segment 3′ of quadrant A', and thence through relay 3′ to ground. Likewise, if any combination of the 5 levers connected to the segments of quadrant A be similarly operated, current will pass through corresponding relays connected to A'.

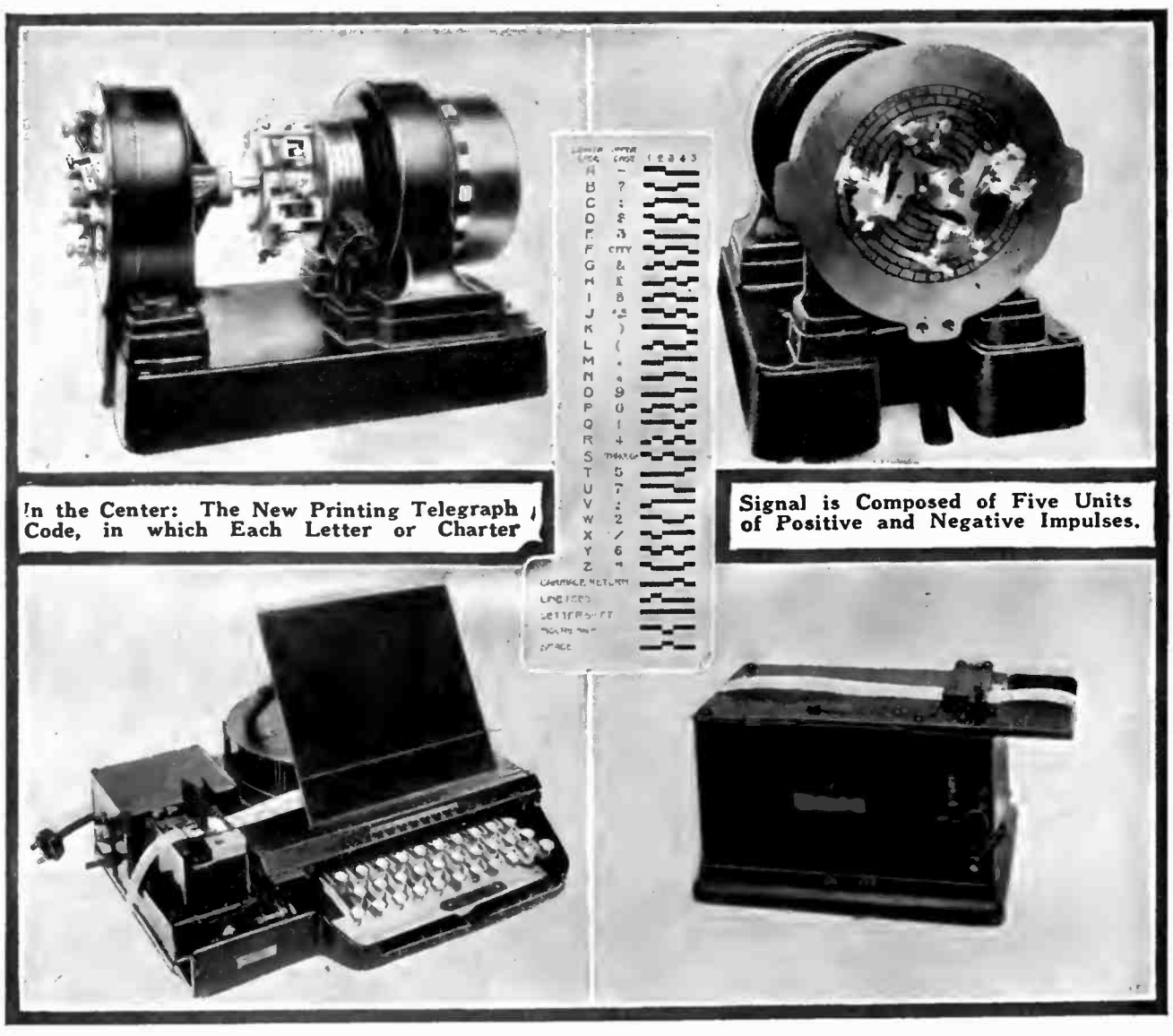
The function of the levers 1, 2, 3, 4 and 5 is performed by the transmitter of the system, the transmitter being controlled by the perforations in the tape. The corresponding relays, 1′, 2′, 3′, 4′ and 5′ are, in actual practice, a part of the receiving printer. The operation of a combination of these relays determines the letter to be printed. Thus the letter A will be printed by the operation of relays 1′ and 2′ together; the letter D by relays 1′ and 4′; and the letter O by relays 4′ and 5′.

The selection of the letter takes place while brush E_1 is passing over quadrant A'. A and A' being unconnected while the brush is passing over B', C' and D', the printer at A' has time to print the letter and move the paper forward for another signal, while the transmitter at A has time to "step" the tape ahead and determine the combination of levers for the next signal.

What has been said regarding quadrants A and A' applies to quadrants B and B', C and C', D and D'. Thus we see that with distributors as shown in Fig 3, it would be possible to send four messages simultaneously from Station Y to Station X. This constitutes quadruple operation. Now if the line is worked "duplex," it is possible to send four messages in the opposite direction at the same time. Space, however, will not permit a description of the details of duplex operation.

One further point needs explanation before leaving the last mentioned diagram. It is obvious that for the quadruple operation the contact-brushes at X and Y must rotate in exact unison. Otherwise, a signal impulse from lever 1, for example, might pass through relay 2′, causing a wrong letter to be printed.

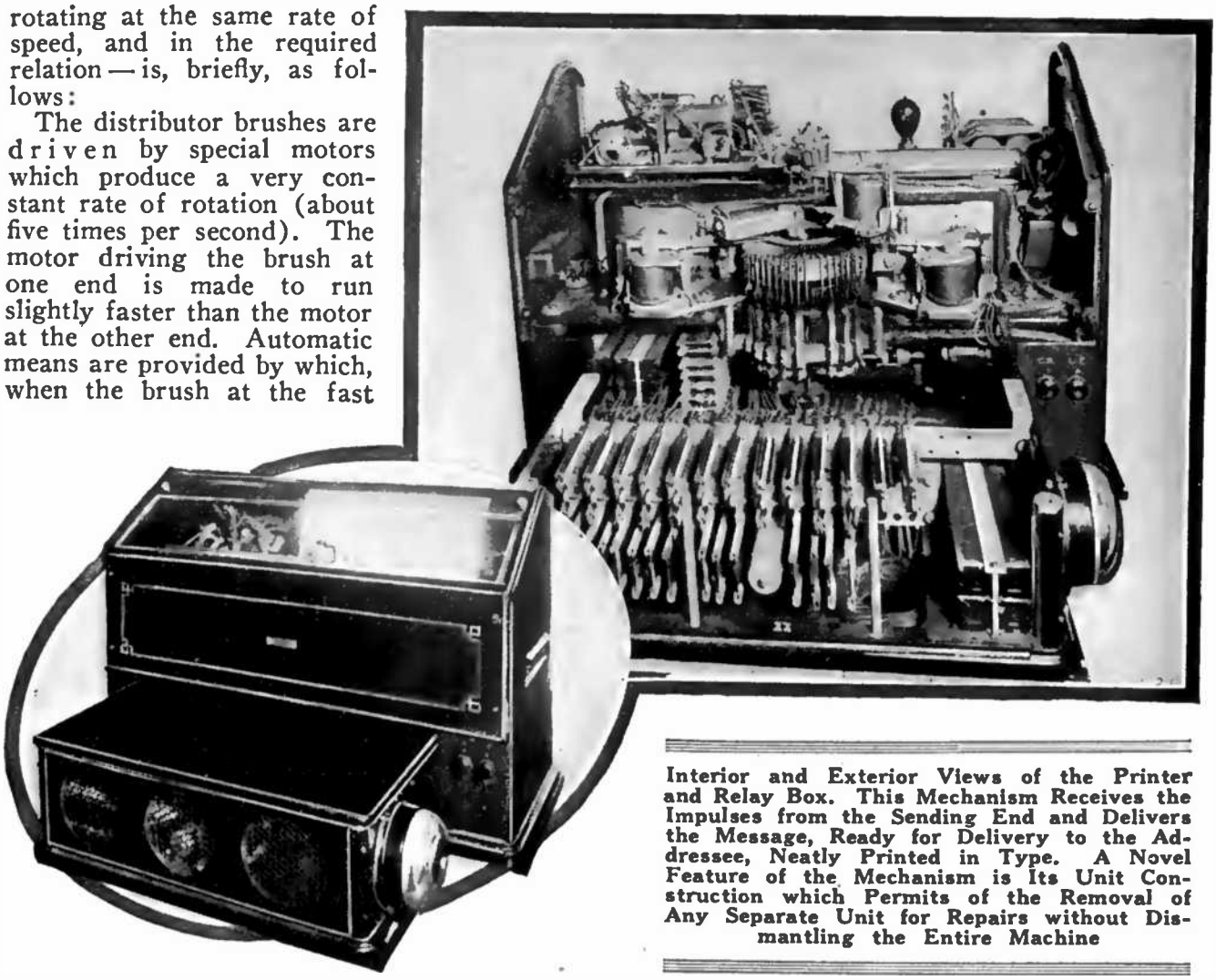
The method of "synchronizing" the corresponding contact-brushes—*i. e.*, keeping them



Above, to the Left: The Distributor Motor and Its Mechanical Corrector which Automatically Steps Back the Brushes at the Fast End when They Have Gained a Small Angle on the Brushes at the Slow End. To the Right: The Distributor by Means of Which Four Messages may be Sent Simultaneously. Below, to the Left: The Keyboard Perforator which Prepares the Tape for the Transmitter which is Shown at the Right.

rotating at the same rate of speed, and in the required relation — is, briefly, as follows:

The distributor brushes are driven by special motors which produce a very constant rate of rotation (about five times per second). The motor driving the brush at one end is made to run slightly faster than the motor at the other end. Automatic means are provided by which, when the brush at the fast end gains a little on the brush at the slow end, a mechanism is operated which automatically sets or "steps" back the brush at the fast end. Thus, by intermittently stepping back the brush at the fast end when required, the brushes are maintained in proper relation.



Interior and Exterior Views of the Printer and Relay Box. This Mechanism Receives the Impulses from the Sending End and Delivers the Message, Ready for Delivery to the Addressee, Neatly Printed in Type. A Novel Feature of the Mechanism is Its Unit Construction which Permits of the Removal of Any Separate Unit for Repairs without Dismantling the Entire Machine

It is difficult to imagine the possible limits in the field of usefulness of this system. While primarily designed for heavy commercial work over long distances, the small, independent user has not been forgotten. For use in factories, for transmitting material orders where absolute accuracy is essential, for hotels in paging guests, and for innumerable other purposes, an equipment known as a short line printer has been developed. While this apparatus does not combine the feature of several messages over one wire at the same time, still it offers every advantage in the way of telegraphic printing and amply serves the purpose for which it is intended.

In press work and the distribution of news matter, the system should prove invaluable. When the popularity of the present "ticker" system is taken into consideration, despite its limitations, the advantages offered by the printing telegraph, which prints the bulletins out in full just as fast as a typewriter can be operated, may well be realized. From a central distributing station, complete news bulletins could be sent in duplicate to any number of points at which the matter could be read without the annoyance attendant upon deciphering the puzzling codes now in use. Truly, the new system seems to be the last word in the transmission of written intelligence.

PAINTING WALLS BY MEANS OF TRANSPORTABLE PUMP

A small pump with a gas engine as motive power is trailed behind the little auto of a Los Angeles painter. It is mounted on a two-wheeled vehicle formed of parts of an outworn runabout and is readily taken to the job. When in use it is supported by a small trestle and the large cans containing paint are

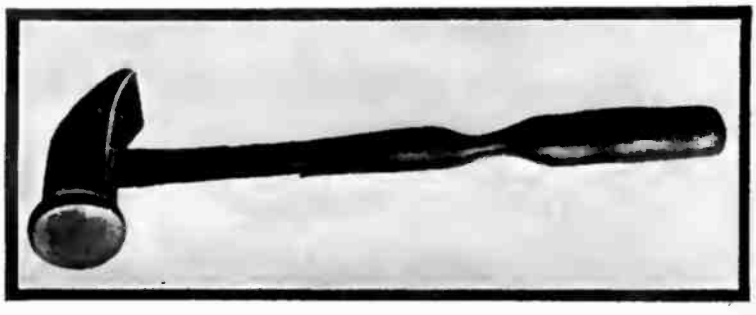
This Home-Made Machine Constitutes a Very Complete and Useful Paint Sprayer. As the Illustration Shows, it is Quite Portable and, Although Crude in Construction, the Device is Capable of Heavy and Practical Service.

set alongside the trailer. A length of hose connects the pump with the liquid, which is conveyed to the wall that needs painting. The workman applies the color with a spray brush. For whitewashing and kalsomining this method is particularly effective. The method of painting by hose can be used on comparatively small jobs with economy by means of this pump-carrying trailer, which makes it easy to get the machine to the site of the work. Only a few dollars' worth of "junk" and a few hours' time went into the handy little vehicle.

HAMMER HANDLE WORN DOWN BY LONG SERVICE

Through constant use a shoe-maker's hammer, owned by a Western cobbler, has been worn until the grip of his hand is very evident on the handle, which at one place is worn to less than half an inch in thickness. The cobbler has used the hammer exclusively for thirty years, and in wearing down the hammer he has developed a very hard callous on the inside of his hand.

During the first ten years the cobbler owned the hammer he made more than 3,000 boots and shoes. When the large manufacturing plants began to take away this business most of his time was spent at repairing for the next twenty years. He repaired an average of forty-eight pairs of shoes a week. Using these facts as a basis for calculation, some of the work of the hammer is ascertained. It takes 140 nails to put half-soles and heels on a pair of shoes. During twenty years 52,000 pairs were repaired and it took 7,280,000 nails. The cobbler strikes an average of three blows to open a hole with the awl and drive the nail, so that 22,000,000 blows were struck with this hammer. There are 1,600 nails to a pound, therefore 3,640 pounds were used in the repair work, aside from the nails consumed in making boots and shoes.



A Cobbler's Hammer That Has Been in Continuous Use for Thirty Years, and as a Result of Its Long Service the Handle has been Worn Nearly Through at the Point Gripped by the Cobbler's Hand.

ARTIFICIAL SILK MANTLES

Some time ago it was discovered that incandescent gas-mantles made of ramie fiber are much more efficient than those made of cotton. Ramie fiber possesses a wider mesh, and so affords a larger radiating surface. It has been found that woven artificial silk is rougher than ramie fabric, and consequently more luminous. Mantles made from continuous fibres of artificial silk are said to be elastic, supple and durable. The continuous fibers remain distinct and unbroken during use, whereas the short fibers in mantles made of cotton or ramie untwist more or less from the original structure of the spun yarn.

The Filming of Animated Cartoons

MENTION the name "Colonel Heeza Liar" to almost any one and you'll see his or her face light up and a smile spread over it. Who doesn't know the funny little Colonel—who hasn't laughed at his antics as he hunted wild beasts in Central Africa, outwitted cannibals on the River of Doubt, cultivated his farm with the aid of some strange assistants and hunted ghosts in Castle Clare? The Colonel's friends are legion—probably no films made have as large a following among young and old alike as these, and speculation has been wide as to how these pictures are made—what gives the drawings those life-like motions and who is the genius who creates them.

One of the Popular "Colonel Heeza Liar" Animated Cartoons the Production of which Require a Vast Number of Pen and Ink Sketches.

J. R. Bray is the originator and creator of these drawings and he was the first to put motion into the drawing itself. That there is no royal road to success is again proven by the fact that Mr. Bray started his experiments over seven years ago, and that was when motion pictures were still very young. Years of careful, arduous work was necessary before the results satisfied him. Today he is the head of an organization devoted to making his pictures, has a corps of artists working under his supervision, and has patents on his process which cover the use of transparent material or material made transparent by any agency whatever in the making of animated drawings.

Mr. Bray was found in his sunny New York studio engaged in conducting

Heeza Liar through another series of escapades. Tall, slender and blonde, he looks more like a successful business man than an artist. Mr. Bray readily consented to talk about his work, which is now so well known to millions of movie fans the world over.

"The public," he said, "demands drawn illustrations which reveal the personality of the artist. The newspapers and magazines all prove that. It is easily seen that to illustrate fiction, for instance, a photograph rarely can be well used. The artist's drawing, on the other hand, can be idealized to fit the situation. This value of the illustration was recognized in everything but motion pictures, and now there, too, it has found its place. It is well to remember that an artist can draw that which is a physical impossibility for an actor to enact before a camera. The artist's possibilities are unlimited. The opportunity for real humor may be seen when one reflects that the humorous is almost invariably the unusual.

"Very few artists have the ability to make drawings that move. An extraordinary imagination is absolutely essential, as is also a perfect knowledge of the science of motion. Problems come to the artists in this work that never arise in ordinary art. I have employed some very able artists to assist me, and find that very few of them can get the knack. For instance, one of the hardest things in the world to handle in these animated drawings is perspective. To have a figure come from the far horizon straight toward the observer—to have it grow from a dot to the proper size and preserve the 'balance'—makes an almost insurmountable problem. I think I am correct in saying that not one artist in a thousand can put motion into drawings."

J. R. Bray, Originator and Creator of the Pathé Animated Cartoons, Began his Work Over Seven Years Ago and has been Perfecting His Productions Ever Since.

Few people would have the patience to do Mr. Bray's work. It takes between four and five thousand drawings to make 1,000 feet or one reel of film. In addition to the colossal toil of the art work it takes a week to photograph the drawings one at a time. Great speed united with unvarying accuracy is essential. Every stroke of the pen must count. Mr. Bray works so fast that he is able to keep four trained artists "inking in" the outline drawings which he makes. The necessity for accuracy is evident when it is learned that the drawings are magnified on the screen at least twenty-five times.

Mr. Bray spent years in study before he attempted to make an animated cartoon film. For months he haunted the Bronx Zoo in order to study the animals there and analyze their motions. He even bought a large farm across the Hudson from Poughkeepsie and stocked it with various animals in order to further extend his knowledge of animal anatomy. The result of these studies finds expression in the life-like motions of the various animals which move across his films.

He was born in Detroit, Mich., and has lived in New York since 1901. He was for seven years a newspaper artist, being also a steady contributor to the humorous weeklies, such as *Life, Puck* and *Judge*. He took his ideas to Pathé Frères over three years ago, since he felt that such a house with its many foreign branches could give him a larger international circulation than any other. The Pathé officials at once saw the value of his work and from that day to this he has dealt only with Pathé. Millions of persons have laughed and are laughing at the "Heeza Liar" and "Police Dog" series, and his political cartoons in the Pathé News, the motion picture weekly, have attracted widespread newspaper comment. Mr. Bray has truly originated a new school of art, and has given to the motion picture followers a distinct type of comedy that stands alone in the field.

Director and Camera Man Engaged in Producing a Scene of a Master Picture.

PRODUCING THE MASTER PICTURES

In the accompanying illustration is seen W. Christy Cabanne directing some street scenes in "The Lost House," a new Mutual five-part master picture by Richard Harding Davis.

The Mutual forces have recently announced their intention to produce multi-reel subjects of high quality. The film stories will be prepared by well-known writers and every effort will be made in producing the pictures to keep the standard high.

FILMS OF BIG SIEGE

When it was learned that Przemsyl was destined to become famous in spite of its name, the Pathé News sent its special war correspondent in Russia, Mr. Ercole, straight to the Galician front to the Russian army besieging the city. He was sent there to get pictures, and he did so. While he was turning his camera he was hit by a piece of shrapnel and painfully wounded, but he did not cease to turn and in consequence he has been decorated by the imperial government of Russia with the Cross of the Order of St. George.

His films were rushed by way of the Pathé agencies in Moscow, Stockholm and London to the United States, so on the very day the newsboys were using their fifty-seven different ways of pro-

nouncing Przemsyl to tell the public that the Austrian fortress had fallen, in the Pathé News projecting rooms at Jersey City the editorial staff of the News was looking at some very fine pictures of the siege.

THESE CITIES WANT THE MOVIES

Motion picture producing is proving such a remarkable advertising medium that practically every city, town and hamlet in southern California, as well as many in other sections of the State, has put in a bid for companies to film scenarios in its locality.

Thomas H. Ince, the well-known producer, is in receipt of several letters daily from secretaries of chambers of commerce and other public bodies, dwelling on the beauties of their respective communities and adding that their respective localities were ideally gifted for motion picture purposes. In some cases a community has offered to pay the entire expense of bringing out a company and installing the players in the best hotel free of charge.

A WELL-KNOWN CAMERA MAN AND HIS WORK

G. W. Bitzer, the best known of motion picture camera men, is D. W. Griffith's chief of staff at the Reliance and Majestic studios at Hollywood, Cal.

Bitzer has been acknowledged by film experts to be a master hand at the camera.

As chief photographer Bitzer supervises the work of the fourteen Reliance, Majestic and Komic camera men, and his suggestions to them are visible in their work.

It was about six years ago that Bitzer was assigned to turn the crank for D. W. Griffith. At a little later date Griffith reported that in his new camera man he had made a "find."

Some of the features he has photographed are "The Battle of the Sexes," "Home, Sweet Home," "The Escape" and the Griffith masterpiece now the subject of comment in film circles, "The Birth of a Nation." He was born in Boston, Mass.

EDITING OF MOTION PICTURE FILM

It is not generally known to the layman that in the producing of motion pictures it is necessary to photograph many hundreds of feet of action in excess of the finished subject in order to secure the most successful results. For instance, it is said that the total amount of negative film taken and developed for each two-reel Biograph photoplay is sufficient to make a three or four-reel picture. The film is gone over carefully in order to cut out sections that have a tendency to drag or that are not essential to the story of the photoplay. Scenes are shortened wherever possible until every foot of the 2,000 feet is full of action.

COMMUNITY CENSORSHIP FOR MOTION PICTURES

In lieu of any state or national censorship for moving picture films which they thought adequate to protect the morals of their community, several women of West Medford, Mass., have obtained permission of their Mayor to act as a committee to pass on all moving picture films shown in their district. As a result of their activities the film producers are sending only the highest grade films into their community and the tone of theatres in that vicinity has been raised to a most conservative level. Their Community Board is the first of its kind to receive official power to pass on pictures before they were shown.

RAPIER TIP SAVES EYESIGHT

Only the little metal protective tip on the top of a rapier saved William Bertram, of the American-Mutual studios, from losing the sight of his left eye. As it was, the sword top lacerated the eyeball and it was necessary for a physician to take several stitches in the wound.

THE dare-devils of the movies—the men who daily risk their lives to film the stories of news events—are the aftermath, the outgrowth of that intrepid band of young Americans who regenerated the moving picture industry some years ago, and who are responsible for the very existence of that industry today. No feat is too difficult or dangerous for them to attempt, if a lively subject is the incentive. They are the bulwark of the spirit that is keeping the movies alive today.

THERE is only one reason why the movies are alive to-day. That is, because several years ago, when the American public suddenly grew bored with the insipidness of photo-plays as a whole, a regenerating force in the shape of vital new blood was injected into the anæmic system. Intrepid young Americans with brand new ideas came to the front and insisted that these ideas be given at least a trial. The old régime shook its head with a doubt born of ancient stubbornness—and in so doing the old régime quietly passed.

Then the bored public suddenly became aware that something galvanic was happening. It took a second look at the hackneyed screen—and it has been looking with steadily increasing interest ever since.

The fact that "Standing Room Only" signs aren't hung out in front of the majority of moving picture theatres nowadays is simply because the signs are worn threadbare.

The keenness and the forcefulness of the Young American Business Man is proverbial. He is the rejuvenating force that has made this country the success that it is. Certainly, he has dragged the moving picture industry to the comfortable niche on the pinnacle it now occupies.

The same forcefulness, the same boldness and recklessness, characterizes the methods that qualify the movies for their immense popularity to-day. I do not refer to the creditable people who are concerning themselves with the dramatic uplift of the movies—theirs is another sphere entirely—but to those who risk life and limb every day in the week in putting news facts into filmed stories.

Down by the water front in an out-of-the-way tenement and factory district of New York is located the office and the

studio of the "Imp" and the "Animated Weekly." No more appropriate name than the latter could have been selected for the enterprising corps of young men who dash in and out of its grimy doors. They defy even death itself in their efforts to give the public the flickering story of the latest news happenings. Dramas of a wholesome sort are enacted before the camera on the floors above; but that part of the organization will be taken up briefly later.

Publishing a moving picture news film involves vastly different methods than producing a newspaper or a magazine, although the contrary belief is usually held. News events often happen which cannot be told in a filmed narrative at all interestingly. An individual suddenly made important by some stroke of genius or luck is rarely handsome enough to hold attention very long on a screen—three or four feet of him is usually sufficient. Here, the background is vitally important. For example, if he is photographed on the steps of a capitol building, or as he is walking down the busy street of a city, then the picture will demand attention. The camera man, obviously, must have a well-developed "nose for news," which means that he must have had newspaper experience in order to understand the technique of building up a story properly. He must gauge his subject carefully; then focus his camera from the most interesting angle.

Animated News Getters

Six expert moving picture photographers are constantly within call of the "Animated Weekly" office, ready to be sent out on assignments at a moment's notice, day or night. Their orders come from the Editor, Mr. Jack Cohn, whose ideas and ideals quite typify the periodical. His nickname is not elegant, but it is none-the-less complimentary: "Live Wire Jack Cohn," he is called.

Mr. Cohn's latest creation for the advancement of the Art makes possible the feat of taking pictures from an automobile travelling at a high rate of speed. It consists of a square plate of metal, fastened to the floor of the car, and two strong upright rods to which the camera man is securely strapped. Remarkably steady pictures have been taken from the automobile when it was speeding at a rate of more than forty miles an hour. The road must be quite smooth, of course, for successful photography of this sort.

The First Man on the Eitel

The risks which the "Animated" reportorial staff will take and have taken to secure news photographs are occasionally quite hair-raising.

"The first man aboard the *Prinz Eitel Friedrich,* when she came into Newport Harbor," Mr. Cohn said with unassumed pride, "came from this office. He was put off the boat—with force—three times. But he got the pictures just the same. He knew it was 'up to him' to get photographs—and he brought back some dandies. I think the Captain would shoot him if he put foot on board again!"

A Trip on a Derrick

"My men always bring back the pictures they're sent for." He smiled. "It's worth their jobs if they don't. Sometimes they must scale the side of a building, or, as one man had the experience lately, they may even be hoisted in derricks. He was sent to Nicholson, Pa., to take pictures of a new bridge. There was no way out of it except for him to be hoisted, as they hoist beams, 350 feet into the air. He spun around several times on the way up, and got some excellent panoramas as the result. To keep grinding, no matter what happens, soon becomes a matter of instinct—of second nature—with a good camera man."

A Somersault in a Motor Boat

"Another time—it happened last summer—one of our reporters was sent to Lake George to get pictures of the speed boat races. He was in a swift hydroplane going at the rate of 43 miles an hour, when another speed boat—Blackton's *Speed Demon*—crossed the bow,

Editor Jack Cohn of the Animated Weekly and His Staff of Photographic Reporters.

and the tremendous wake tossed the boat he was in so high into the air that it turned a complete somersault! The camera man, with the heavy camera and tripod, was thrown forty feet through the air. Fortunately, he was a good swimmer; but a leg of the tripod had caught in his coat, and the sixty pounds of weight commenced to drag him down."

"What happened?" I gasped.

"Why," smiled my informant, "he removed his coat—and the camera sunk. When they pulled him out of the water he was unconscious. I think they rolled him over an old gasoline barrel, to get the water out—there wasn't a pulmotor within a hundred miles."

"And the camera?"

"We offered a reward of $200 for the camera, and every grappling hook on Lake George was sharpened up and put into service. Finally, we were compelled to hire a diver from New York. He was down three hours before he found it. And, strange to say, although the camera had been in water for three days, the film was in excellent condition—and we exhibited the Lake George race pictures all over the country!

A Camera Saved His Life

"Perhaps the most thrilling experience I can tell you about a camera man happened during a fierce chemical fire down on the waterfront. In an effort to secure an exciting rescue scene—dragging people who were overcome by smoke out of the building—he climbed to the roof of the building opposite. The view was partially obstructed by a chimney and a huge cornice; so, using his camera tripod as a balance, the camera man walked along a narrow ledge to a building nearer the fire. The building, it seemed, was one of the old-fashioned peaked roof mansions which had been transformed into a tea commission house. The gutter was rusty tin—and it suddenly gave way under his weight. Sixty feet below, the engines were fiercely pumping streams of water into the building. Hundreds of people in the street stood breathlessly watching the imperiled camera man. Quick thinking saved the day. He tossed the camera forward, catching it in the upper part of the chimney. Through sheer luck, it held, and he hung, dangling

from a leg of the tripod. By this time a number of the women in the street below had fainted. But he crawled back to the roof, and to safety, then went on taking the picture as if nothing at all had happened. Later, he admitted that he'd had a close call; but he claimed he had the best fire picture ever taken, and I guess he was right.

"It might interest you to know that we answer every two-alarm fire in Greater New York. An automobile is always ready to hustle an operator to the scene of the fire. Lots of them, of course, are not of any value to us, but we are always on hand in case anything does happen."

The Captain Was Wrong

"Do you remember when the dreadnaught *Wyoming* was put into commission, just recently? I sent one of the men down to cover the target practice off the Virginia Capes. The Captain of the *Wyoming* told the camera man the safest place on board from which to film the big guns in action was amidships, between the fore and aft turrets, on top of the galley roof. But the Captain had erred in his reckoning. When the *Wyoming* was opposite the target, a ten-gun broadside boomed out. The back draught caught the camera man, camera and all, blew him off the galley on to the deck and dislocated his wrist. The camera was smashed, port holes were staved in, deck planks were torn out, and a large hole was blown in the hull of one of the cutters. Almost a death in the family, too, as the cat mascot, in fright, jumped into the sea!

"Our photographers with Villa and Carranza in Mexico have had some lively experiences. We call them the 'bullet dodgers,' although they know that tact, properly used, will save them that trouble. Once, near Vera Cruz, one of the operators' film supply became exhausted. He borrowed a hand-car, and with the aid of a *mozo,* made the dangerous ride to Vera Cruz and back. On the return trip he was held up by a detachment of Mexicans. But the officer in charge at once recognized him as a 'movie operator' and allowed him to proceed. Moving picture operators, you know, are not at all unpopular in Mexico. From all reports, it appears to me that more shooting is done down there with films than with bullets.

Taking Motion Pictures from a Fast Moving Automobile has been Rendered Practicable Through the Use of an Iron Framework in which the Camera Man is Strapped.

Camera Man Filming Action from an Ice Boat.

"Of course, you must understand that these incidents I have told you about are by no means rare occurrences—they happen every day in the week. Here's a man, for instance,"—he handed me a photograph that was lying on his desk—"who is ready to take pictures from the bow of an iceboat—one of the fastest in the world. It can clip off a speed equal to that of an express train. That camera, by the way, is the one we fished out of Lake George, and we are very fond of it. It is the best moving picture camera I have ever seen."

The camera, luckily, was on its tripod in the office at that moment, its small, sunken eye looking gloomily out over the room. What exciting adventures that tell-tale eye has been the witness to! The wooden box itself was badly scarred and scratched.

"We call it the 'cigar box camera,' " he went on, "because it is so compact and light; not more than a third of the size of the usual motion picture camera, yet it cost over $600.

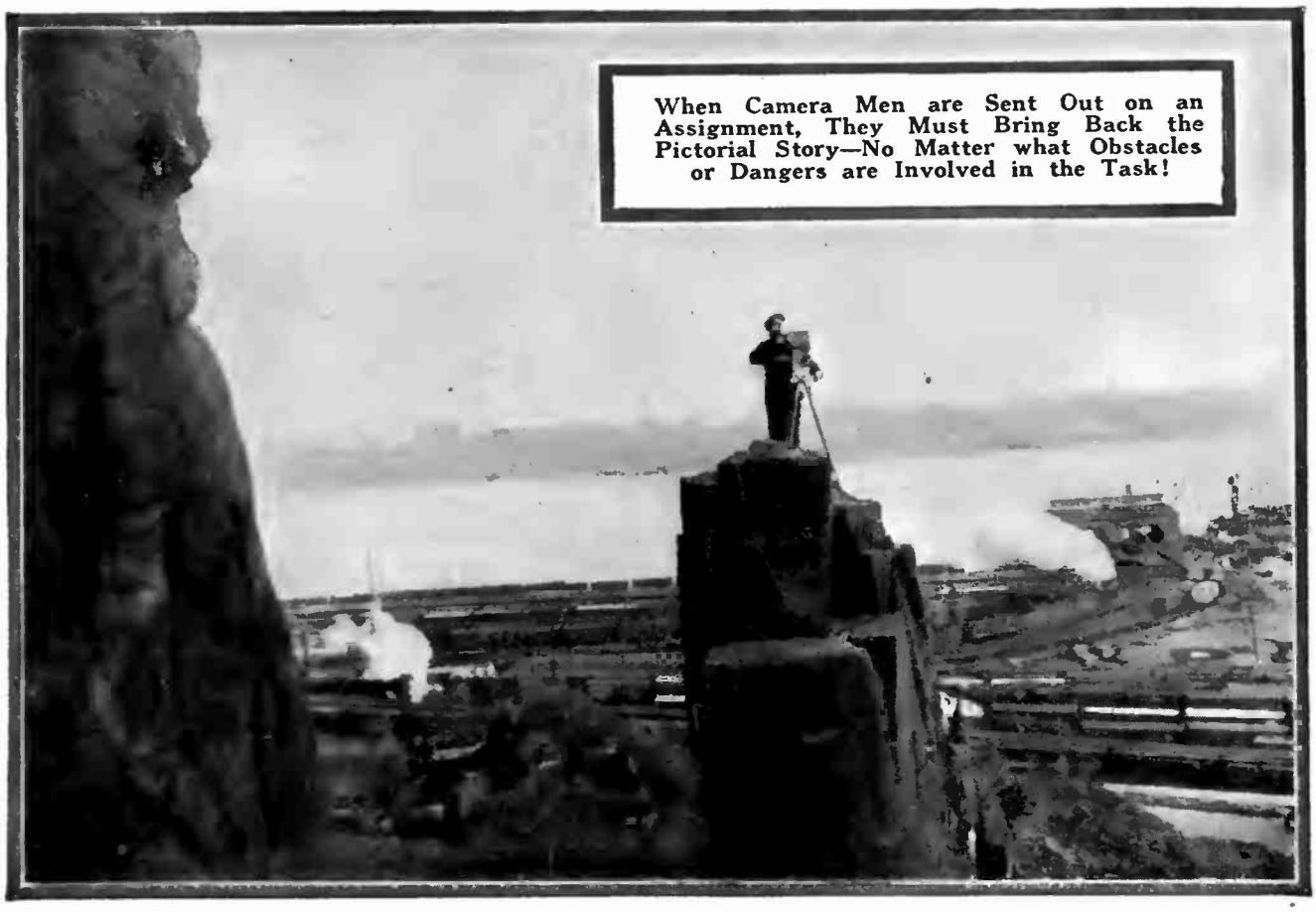
"Before long, we expect to use the new gyroscopic camera. No cranking is necessary. The operator merely tucks it under his arm and walks casually about. In this way, he is put on an equal basis with the ordinary news photographers; he is not compelled to erect a clumsy tripod and run the risk of having the crowd come between his camera and the object of interest."

A Case of Unmistaken Identity

"The broad scope of our system is one of the main reasons for our being in existence. We have representatives—always on the alert for news happenings—in all of the largest cities, besides 172 contributors, or correspondents, scattered throughout the country.

"Speaking of the scope of our system—or the smallness of the world, if you will—let me tell you about a lost child we restored to its parents. Last summer we sent a man down to Atlantic City, and when his film was reproduced, a man in a small town near here recognized his child, who had been lost for several months. At his request, we enlarged a portion of the film and by means of a little detective work the child was found and taken back to its home.

"Contributions come in by the score from our representatives and correspondents every week. Most of these contributions, as is the case with contributions to the popular magazines, are not usable. My hardest work is to edit these—to select the good from the bad." He pointed to a large heap of



When Camera Men are Sent Out on an Assignment, They Must Bring Back the Pictorial Story—No Matter what Obstacles or Dangers are Involved in the Task!

round, flat tins, stamped and addressed for mailing. "All those have rejection slips," he explained. "This week, I could only use five out of sixty that were submitted."

The Pearl in the Oyster

With respect to the "Imp" studios, to which passing reference has been made, these are situated on the two floors above the "Animated Weekly" office. Certain individuality can be claimed for them in the fact that they are probably the most difficult studios in America to gain entrance to. There is no name-plate on the door—only the glaring blue label of a detective agency, which lends further discouragement to the prospective sight-seer.

Outwardly, the building is forbidding and gloomy. You could pass by it a hundred times without suspecting that drama — genuinely good drama — was being made on the other side of the wall. In the waiting room—beyond the tall, locked rail—twenty florid signs, worded in twenty different ways, agree on the single thought that you—Y-O-U—are positively not wanted. Y-O-U are rather discouraged, until the czar at the gate gruffly invites you to enter, and you are taken in charge by an affable guide.

I must confess that the "Imp" studios —as studios go—are not vastly different, at least to the lay eye. There is the rather temperamental camera man, standing beside his machine, looking very bored; the thickly rouged players, who talk shop incessantly; the flood of ghastly blue-green light from the luminous Cooper-Hewitts; the excitable and profane Director. But I am wrong there! The Director-in-charge at the Imp is neither excitable nor profane. He is an anomaly in the form of the kindliest, most-likable man you could ever desire to meet. He is gentle and patient, with a generous crop of fatherly white hair—and his results are wonderful. He speaks in a voice low and soothing. Contrasted to the usual fiery and redundantly profane director-type, he is a decidedly pleasant surprise.

Mary Fuller was rehearsing a part that afternoon in the play "A Girl With a Soul." Talk with Mary for two sentences and you will never gasp at the mention of her salary! She fairly vibrates with personality—an unassumed, girlish *pétillante*—yet she can be serious and sympathetic when her part requires

it. A remarkable fact about Miss Fuller is that you would not recognize her, no matter how familiar her face may be, if she should pass you on the street. I do not mean that she is not equally as attractive off the screen as on, but that her features seem to have an entirely different cast.

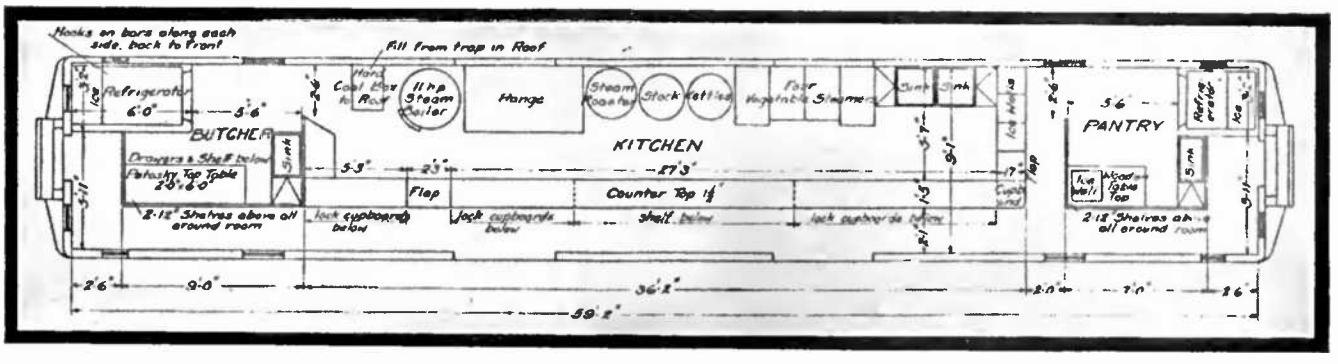
Utter quiet is an unyielding rule at the Imp studio. The moment the Director utters the electrical command, "Camera!" all talking must cease. That is one reason, probably, why the "Imp" does not welcome visitors with open arms.

As plans are shaping now, by the time this issue of the magazine comes from the press the gloomy structure down by the waterfront which now houses the "Imp" will be hardly more than a dark memory. Necessity, years ago, demanded the old building in its unbeautiful surroundings of factories, warehouses and corner saloons. But a greater necessity has arisen, and it has been answered in the mammoth new concrete-and-steel plant of the Universal Company in New Jersey.

It will be one of the greatest moving picture factories in the world, reflecting not alone the ideas of the men who are making it, but the spirit of the fearless band of youthful *entrepreneurs* who have fostered and who were at the beginning the source of the regeneration of the movies.

MILITARY COMMISSARY KITCHEN CARS.

IN transporting the troops from various points in Canada to the concentration camp at Valcartier, Quebec, a big problem was presented. While the transportation of the troops itself was a considerable task, the problem of feeding the men through the journey pre-



Plan of a Commissary Kitchen Car Used by the Canadian Government in Connection with the Troop Trains. Several of these Cars have been Provided by the Canadian Pacific Railway Company, through the Conversion of Standard Baggage Cars.

sented greater difficulties, as none of the existing railway equipment could be directly used for the service, the dining car service being entirely inadequate and unsuited to the requirements. The Canadian Pacific Railway Company solved the difficulty by converting standard 60-foot baggage cars into commissary kitchen cars. This conversion was made at the company's own shops in Montreal, Quebec. The layout of the cars is shown in the illustration.

Each of the cars is a well appointed hotel kitchen on wheels, and comprises three main sections: kitchen proper, butcher shop and pantry. The interior corridor arrangement resembles the company's compartment cars, since from each end the passage leads from the central entrance way and along a 2 ft. 1 inch corridor on one side of the car. The two baggage door openings on the corridor side are fitted with permanent screens for ventilation purposes, and the similar openings on the other side have been blocked up.

The butcher shop and pantry are in

partitioned off rooms, while between the two is the main part of the kitchen. Along the corridor side of this kitchen is a full length counter, fitted with two flap entrances, with cupboards and shelves below. Along the blind wall of the car is arranged the cooking apparatus, consisting of steam roaster, two stock kettles, four vegetable steamers, a large range and other facilities. These are nearly midway in the kitchen proper, with two sinks at one end and an 11 horsepower vertical steam boiler, with adjacent hard coal bin, at the other end, for supplying steam to the cookers.

The butcher shop contains a large table, a sink in one corner and a refrigerator at the other, in which the meat is kept fresh. The pantry at the other end of the car contains a table, a sink and a smaller refrigerator. It has two 12-inch shelves around the room.

The agateware plates used are suspended from the roof, and the shelves and cupboards under the counter are used for storing plates, saucers and dishes of various kinds, and also the knives, forks and spoons. The orderlies' soup and coffee carrying cans are suspended directly over the counter. Vegetables are stored in boxes underneath the car. In addition to an overhead storage of water, there are suspended beneath the car three tanks of water, giving a total capacity of 1,490 imperial gallons. All the sinks have a supply of both hot and cold water. The windows and doors are equipped with screens to keep out insect pests.

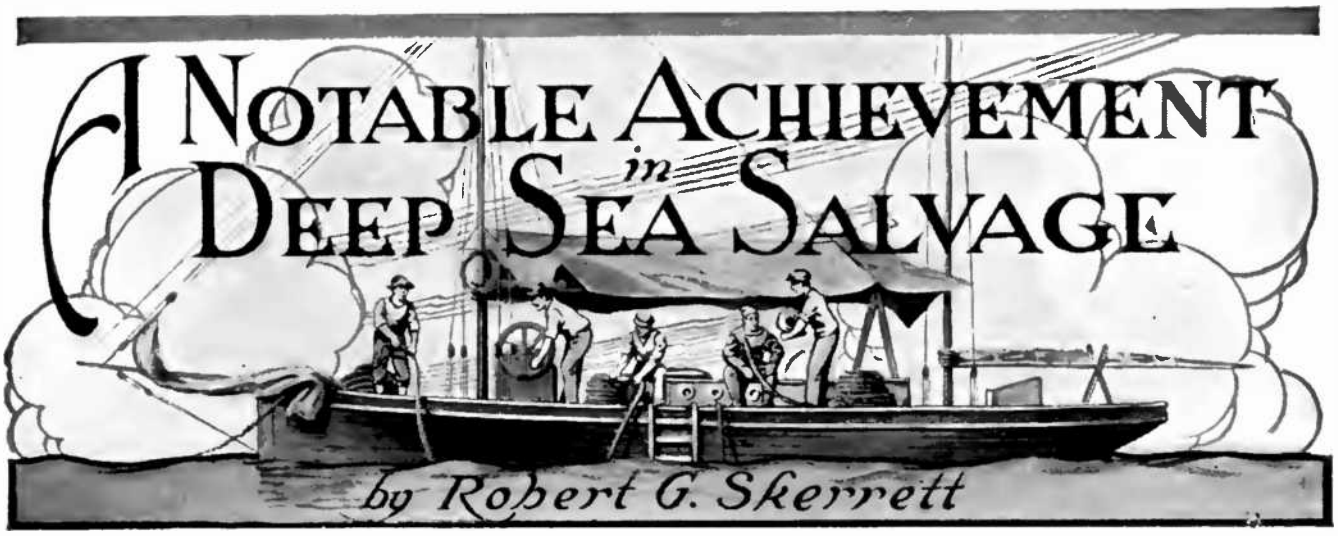
For serving the meals the orderlies from each company file in from one end of the car, line up in front of the counter, are allotted the portions for their men, and pass out of the other end as rapidly as served. The operation of the car is said to be most satisfactory and exceeds the expectations. The capacity of each car is three meals a day for 1,000 soldiers. The crew consists of twelve men, headed by a steward, one of the twelve being a boiler man and the others serving as cooks.

A SUGGESTION FOR THE HOME

Wishing to train her baby daughter to be independent and to understand early in life the care of her own room, and yet not wanting to leave the child in a separate room where she might throw the covers off and become cold in the night, a Californian woman had a special window, without glass, cut in the wall between her own room and the one she gave to the child. By placing her own bed beside the window and the child's little bed next to the window on the other side of the wall, she can keep watch over her in the night. The child learns the lesson of having a room of her own, thus developing individuality, but for the first few years of her life her mother will use this means of seeing that she does not catch cold. The simple style in which many of the Californian beach bungalows are built, the walls being of one thickness of redwood, makes it easy to cut a window like this in a few minutes.

Although in a Separate Room and Deriving the Consequent Benefits, the Child may be Observed by the Mother.

A Notable Achievement in Deep Sea Salvage



by Robert G. Skerrett

ENTERPRISES for bringing up the treasure of foundered ships are not lacking in number. But how many are successful? Most of them never reach beyond the stage of securing capital for the project; few actually make an attempt at working the wreck under consideration, and still fewer are a success in any degree. Here, however, is a striking exception. Silver bullion carried down in the ill-fated "Empress of Ireland" has been salvaged by a most remarkable undertaking.

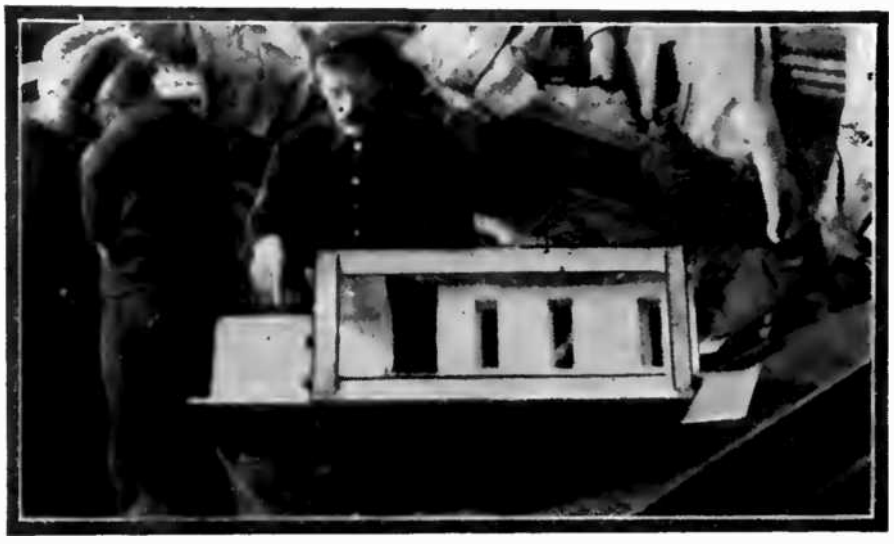
THANKS to the leadership of an American engineer, Mr. William W. Wotherspoon, the Canadian Salvage Association has recently finished a notable achievement in deep-water salvage. Indeed, the work done is another proof of what science makes their activities, the film producers are remarkable performance, let us see how the state of the art has suddenly advanced from a standard set a good many years ago.

The work of the submarine diver has always made a strong appeal to popular interest, and the hazards run have given an element of fascination to this field of human activity. In February of 1884, the Spanish liner *Alphonso XII* foundered off the Canaries when bound for Cuba with a very valuable consignment of specie aboard. To be exact, she had a half a million dollars in newly minted coin. She sank in twenty-six fathoms of water—a matter of 156 feet. The salvage operations covered an interval of about thirteen months, and the only diver found capable of doing the work, a man named Lambert, made on an average something like two descents a month. Even so, he suffered from the hydrostatic pressure to which he was subjected, and at times was completely played out when he reached the surface. Indeed, he paid the price of his venturesomeness and was paralyzed shortly after his dangerous task was finished.

From the specie room of the sunken *Empress of Ireland*, Mr. Wotherspoon's associates have recovered the silver bullion and the purser's safe—not to mention the salvage of the pouches of postal matter and the reclaiming of hundreds of bodies of the stricken passengers. To reach the specie room the divers had to descend to a depth of 160 feet; they had to break their way into the craft and to follow a devious passage; and it was nec-

essary for them to work in extremely cold water and amid a gloom that was well-nigh inky. Instead of only one diver being engaged there were twelve of them, and the circumstances of their operations must be made still plainer in order that the layman may grasp the really extraordinary nature of the undertaking.

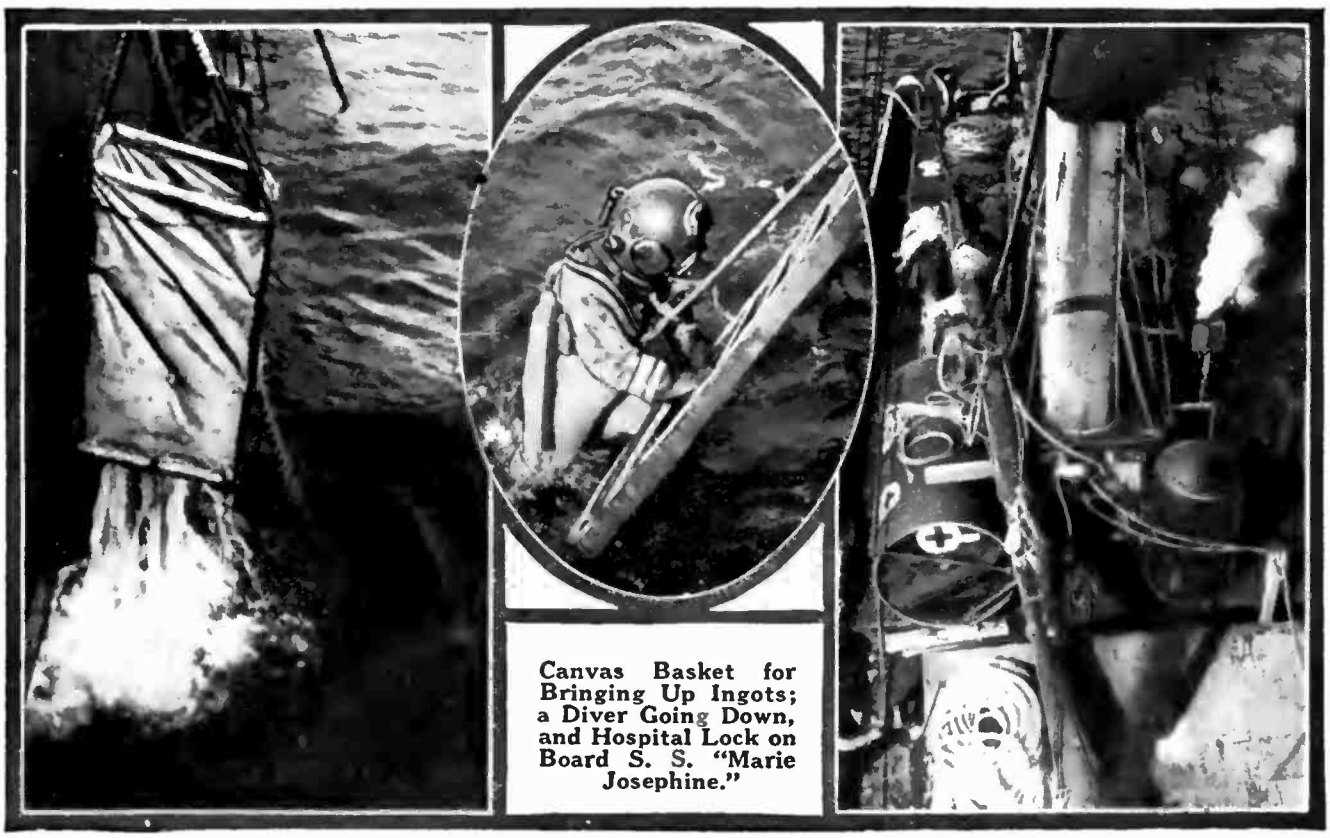
First, it was necessary to locate the position of the foundered ship in relation to the channel and then definitely to establish the manner in which she was resting on the bottom. The Canadian Government had planted wreck buoys a few hours after the *Empress of Ireland* went down, but these merely indicated in a general way the area in which she lay. Now, the St. Lawrence has a normal rise and fall of more than 14 feet where the liner sank, and this means a very strong current at the ebb and flow. Accordingly, only a brief interval of something like half an hour was available at the slack of the tide when diving operations could be carried out in comparatively still water. The first diver that went down to locate the wreck hit the bilge keel and then dropped off into deeper water where he hung without being able to tell anything. It was the red paint on his suit and his description of the projection that revealed the bilge keel and proved that the steamer lay turned over and flat upon her injured side.



The Divers Engaged in the Work were Instructed by Means of a Cardboard Model of the Section of the Wreck Containing the Treasure.

The next problem was to find out how the hull lay in relation to the tideway, and this was no easy task in the dark depths of the river. More than once the divers became bewildered as they groped their way over the upturned ship and tried to identify the different portions of her. To add to the grewsomeness of their job, they stumbled every now and then upon huddled groups of victims held in the open spaces between the promenade deck, and kindred fairways. It was in recovering some of these bodies that one of the divers lost his life—the only fatality that occurred during this extremely difficult and hazardous enterprise. That man's death taught an early and a very valuable lesson. He was a splendid physical specimen of manhood, a very careful liver, and an experienced under-water worker. While walking along the slimy side of the liner he slipped and dropped suddenly to a greater depth. Possibly he was frightened or more likely stunned by the instantaneous "squeeze" of water pressure. Be that as it may, he instinctively tried to do what the emergency called for, *i. e.,* to open wider his air supply valve and thus equalize the external pressure by increased air pressure within his suit.

Unhappily, in his confusion he turned his valve the wrong way! He shut off his air instead of increasing the vital flow. He was very strong and by struggling more and more in the wrong direction he finally wrenched off the little wheel and thus sealed his fate. Before relief could be sent to him he was too far gone to be saved. That accident established the rule thereafter that the divers should work in pairs, and it also led to a trifling modification in the equipment which justified itself several times afterwards. The valve was so arranged that it would not be completely closed, and thus a sufficient leakage was insured which would keep



Canvas Basket for Bringing Up Ingots; a Diver Going Down, and Hospital Lock on Board S. S. "Marie Josephine."

the man alive if, by chance or confusion, he repeated the unfortunate manœuvre of his ill-fated associate. This simple expedient had not been thought of before, despite all of the years in which divers have toiled at their dangerous calling.

Shortly after the wreck of the *Empress of Ireland* was accurately located, her cargo shifted, and this raised the hull to a part-way upright position while the craft sank deeper into the mud. This added to the difficulties of the salvors, because they had planned to cut a hole in the upturned side of the vessel for the purpose of getting into the specie room and the mail room. The diagram accompanying this article shows the final position of the ship in a vertical direction. The slanting side of the hull offered a very ticklish footing for the divers, and besides this they had the puzzling problem of locating a particular airport, among scores of others, that marked where a crosswise passage in the body of the boat extended from the skin plating inboard to a fore-and-aft gangway forming the most direct and logical route to the places where the mail bags and the specie were to be found. The identification was ultimately accomplished by having the divers work from both ends of the ship toward their objective—counting each airport on the way. Little electric submarine lamps helped them amid the frigid gloom in which they labored.

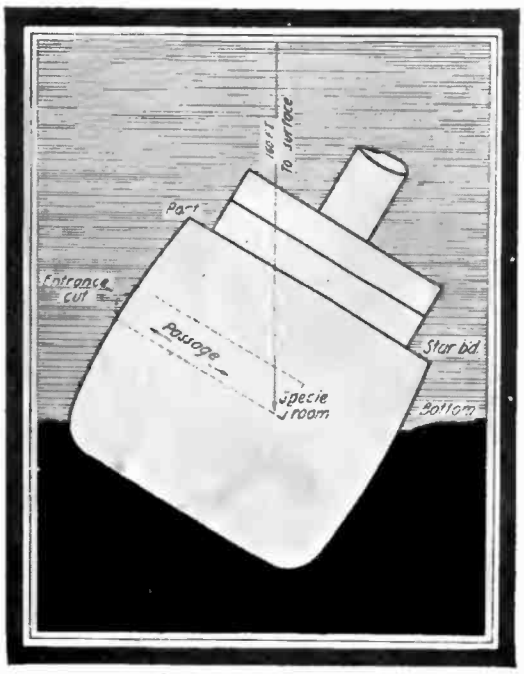


Diagram of the Location of the Treasure in the Wreck of the "Empress of Ireland."

By means of pneumatic drills, the divers finally cut a good big hole in the outside plating at the proper point, but the salvage engineers were not yet ready to let the men undertake the recovery of the bullion and the purser's safe. There were too many openings

Members of the Salvage Crew and the Treasure They Brought to the Surface from the Sunken Steamer.

along that route into which the divers might turn by accident and get lost or entangle their air hose and lifelines. Accordingly, the menacing doorways were sealed and the longitudinal gangway bulkheaded off so that the operators would have a straight path to the first-class baggage room and then a comparatively easy route into the mail and the specie rooms. This was not all that was done in the name of safety. A pasteboard model of the internal structure adjacent to and forming part of the divers' pathway was fashioned, and one by one the men were made to familiarize themselves with the physical situation, so that they could describe every part of the way and tell just what they would have to do to get in or out if caught there without their hand lamps or should the lamps fail them.

Possibly you do not know it, but a diver is guided to a great extent in dark or muddy waters by his sense of touch, and therefore his hands are commonly bare. The water about the wreck of the *Empress of Ireland,* however, was so cold that the men's hands soon became numb and their usefulness hampered proportionately. To overcome this difficulty, they were finally provided with rubber mittens of American make sufficiently thick to protect the hands and yet thin enough to permit of satisfactory tactile acuteness. Scores of pairs of these mittens were used up during the operations. Finally, when everything was in readiness, the divers went into the specie room and got out the ingots of silver and into the mail room where they recovered the pouches of postal matter, but the biggest problem was that of removing the purser's safe. The divers could not do any strenuous work themselves, and the safe had to be pulled out of its resting place and then drawn through the succeeding doorways and along the passage leading to the cut in the side of the ship before it could be lifted directly surfaceward. The power had to come from the salvage steamer above, and a wire hawser was the connecting medium.

The little plan of the upper deck shows the round-about route for the safe, and the ticklish part of the job lay in exerting a uniform pull on the line. Any jerky motion due to careless control of the hoisting engine might have jammed

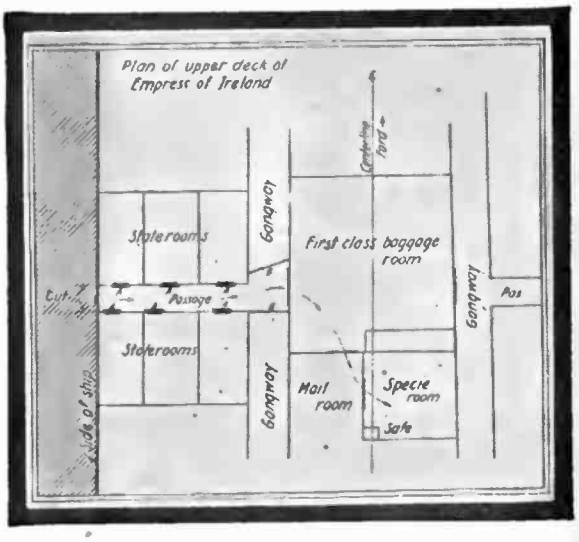


Diagram of a Section of the "Empress of Ireland," Showing the Relative Position of the Specie Room.

the safe or have snapped the wire rope, to the imminent peril of the divers, and but for the telephone equipment employed it would have been well-nigh im-

possible to have executed the work as quickly and as efficiently as it was done. By means of the submarine telephones used, which in themselves were the latest thing in the art and modified on the spot to agree with the best American practice, continual communication was maintained between the men below and the responsible officers on the salvage vessel and, at the same time, by means of a relay, the two divers of a working couple could talk to each other. This facility of vocal intercourse aided materially in the carrying out of the work and insured complete co-operation at every stage. The men did not have to depend upon signals transmitted by means of pulls on the lifeline; there was no chance for misunderstanding, because every order was by word of mouth.

In the past, it has been the uniform practice to supply the divers with air by means of hand-driven pumps. When working at moderate depths, this is not such a hard thing to do, but when the under-water workers are down 150 feet and more it takes the continual efforts of four men at the cranks to supply enough air for two divers. Indeed, the maintenance of the supply is a burdensome task, and the four men soon become exhausted by their labors. If the air should fail it is perfectly plain that the divers would be in grave peril unless they could be brought quickly to the surface or speedily succored by a renewed flow. To overcome this difficulty the Canadian Salvage Association availed itself of experiments made by the United States Navy.

Instead of using hand-driven pumps, steam compressors were employed which stored the needful air in two large tanks, and from this abundant source of supply the divers were fed. In this way all danger of either a failure of vital air or

Below: One of the Submarine Telephone Switchboards which Played an Important Part in the Undertaking.

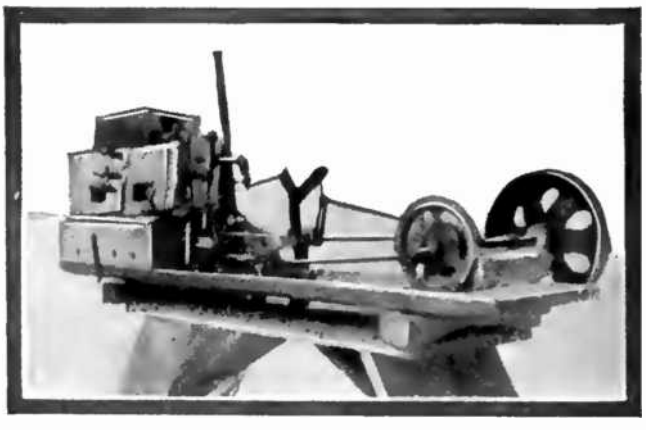
Above: Bringing Up the Purser's Safe—The Climax of this Difficult and Remarkable Undertaking which has Set a New Record in Salvaging Operations.

a sufficiency of it was obviated, and a material advance in the art of submarine operations effected. Apart from that, there was a gain in economy, because the steam-driven compressors could do their work much better and cheaper than the gangs of men otherwise needed to work the hand pumps. By means of reducing valves placed between the reservoirs and the air hose leading to the helmets, a safe maximum pressure was secured which was just a trifle in excess of that required for the deepest submergence of 160 feet, and then the quantity of air was left entirely to the control of the divers—each man regulating the flow to suit his individual needs and the conditions under which he was working. An insufficiency of air has been the cause of a great many diving disasters, and it was only a few years ago that the British Admiralty demonstrated that most of the hand pumps supplying under-water workers were unequal to the drain imposed upon them for really deep submergences. The pumps failed to supply to the diver all the air he needed, while their gauges indicated the contrary—a state of affairs that is obviously dangerous in the extreme.

Apart from the value of the present accomplishment, the task carried through by the Canadian Salvage Association on the sunken *Empress of Ireland* is of suggestive importance, because wrecks that have hitherto been abandoned without an effort could have been worked upon in the light of the state of the art to-day, and vessels that may be lost under kindred conditions hereafter will be within the reach of the scientific salvor.

STEAM ENGINE BUILT WITH SIMPLE TOOLS

With the aid of a hack saw, a file and several drills, a youthful mechanic constructed the model steam engine which is the subject of the accompanying illustration. Notwithstanding the crudeness of the tools and material, it will run and generate a small amount of power. It was built along the line of the Stevenson link motion engine, having a reverse rod and valve gear. The boiler was made from short pieces of iron pipe.



A Model Steam Engine Built by a Youth with the Aid of Crude Tools.

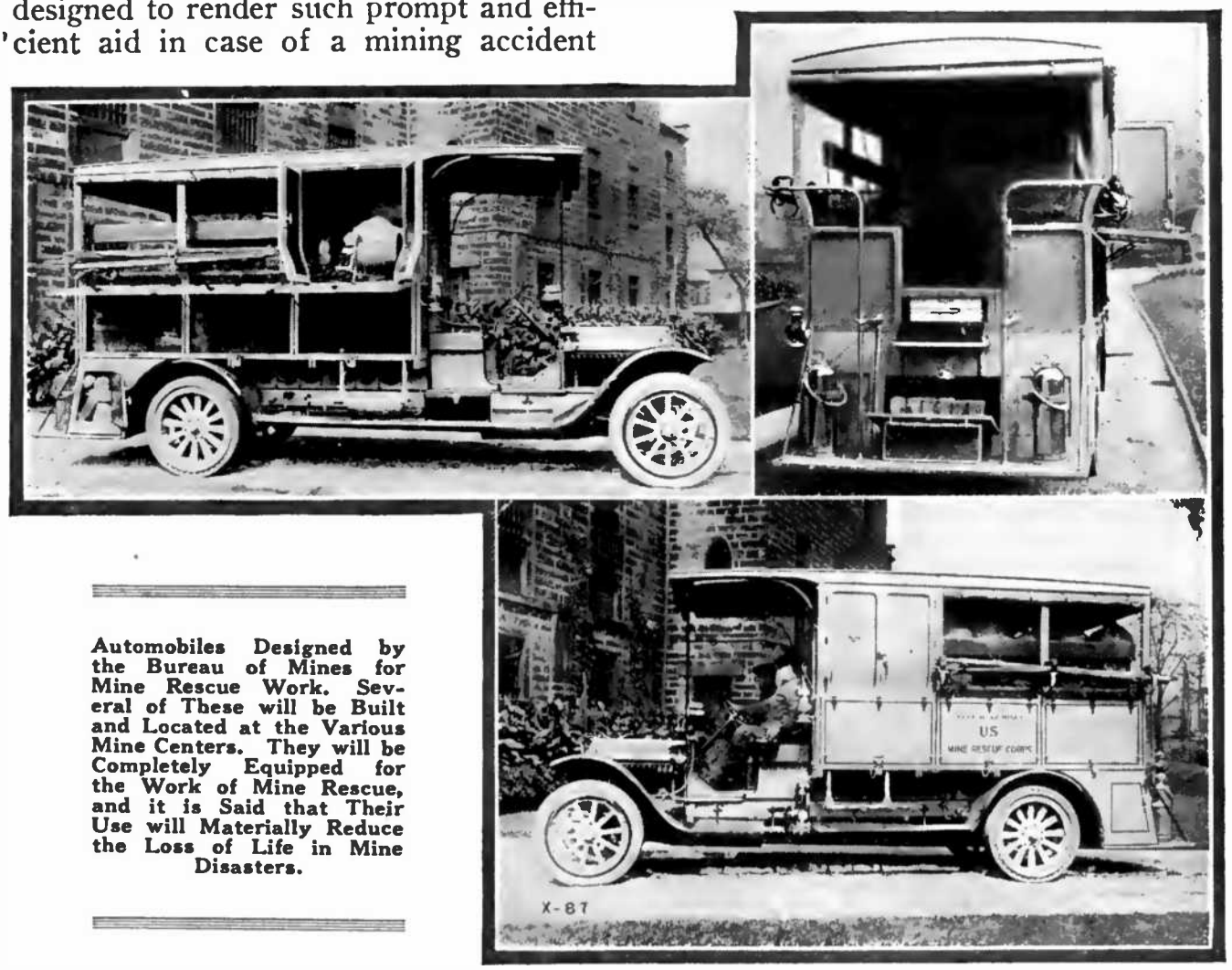
ALUNDUM

Alundum is an electrically fused alumina of exceptional purity and great power of resistance to heat. It is used in the making of furnaces and other objects in which a material able to withstand excessive temperatures is required. It is made by calcining bauxite and fusing it in a water-cooled electric furnace. The less pure products are used for abrasive purposes. Alundum comes from the furnaces in pigs of five tons each, which are crushed and molded with a refractory bond of a ceramic nature. Attempts to make articles of cast alundum have been only partly successful in the past.

AN AUTOMOBILE EQUIPPED FOR MINE RESCUE WORK

There is an abundance of talk in these times about the wonderful completeness of rescue work and appliances for the aid of the injured in war. On the other hand, but little is said about first-aid for those who fall in the battle for livelihood. It is well known that mining is a hazard-

ous occupation, particularly coal mining, in which the mortality is high. The U. S. Bureau of Mines, whose first thought is the reduction of mining mortality, has had built a type of automobile designed to render such prompt and efficient aid in case of a mining accident



Automobiles Designed by the Bureau of Mines for Mine Rescue Work. Several of These will be Built and Located at the Various Mine Centers. They will be Completely Equipped for the Work of Mine Rescue, and it is Said that Their Use will Materially Reduce the Loss of Life in Mine Disasters.

that the percentage of life losses will be materially cut down. These automobiles are to be stationed in mining centers where they can reach the scene of an accident very promptly. They are to be manned by a crew of trained experts in saving life, and are equipped with all the apparatus required to give aid to the injured. They carry drugs, bandages, stretchers and a wonderful variety of scientific paraphernalia, such as pulmotors, oxygen pumps, tanks, respirators, fire extinguishers, explosive materials, a complete underground telephone system, full stock of miners' and firemen's tools, and in short everything to aid in succoring the wounded.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.

"SOLIDS"

The usual assumption has been that changes in the volumes of "solids" are due to changes in the extent of empty spaces between the molecules. But, within recent years, there has been a tendency to question this assumption. It is asked whether, after all, there are any such empty spaces in solids and liquids. One authority, after discussing the phenomenon of porosity, goes on to say that the ordinary conception of a solid has always seemed to him little short of absurd. The most reasonable conclusion, it seems, is that in solids and liquids the interstices between the atoms are usually small in proportion to the sizes of the atoms themselves, even if there are any interstices at all. This authority has suggested the alternative hypothesis that atoms are compressible. If that be the case, they should be able to contract and expand or vibrate within themselves, even when their surfaces are prevented from moving by being closely packed.

A New Type of Railroad Crossing Signal in which the Arms Change Position to Warn Oncoming Pedestrians and Drivers.

DANGER SIGNAL FOR RAILROAD CROSSING

The danger signal shown in the accompanying illustration was erected at the intersection of a railroad line and automobile road. As a train enters the danger zone the signal reads "STOP, DANGER," and at other times, "SLOW, CAUTION." In the view the blades may be seen changing position as a car is approaching. As a further warning and protection, a bell rings during the day, while at night a system of lights is employed, a red light flashing out when the bell rings.

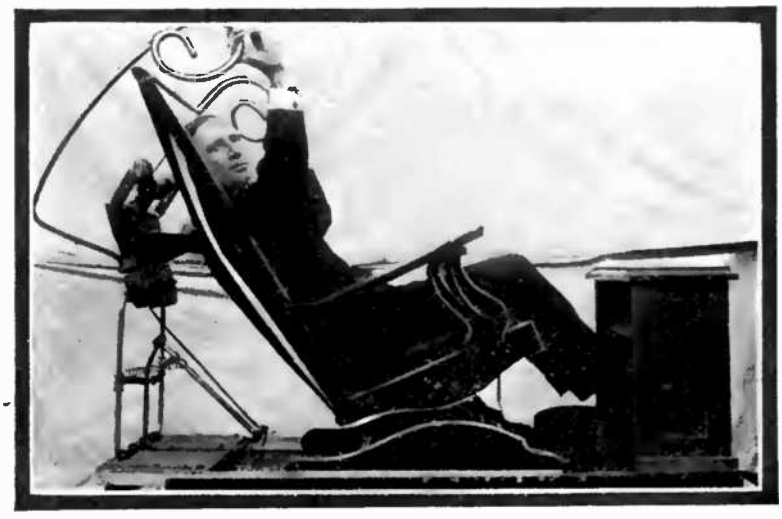
A new Italian wireless telephone system employs a call bell with an effective range of 40 miles.

RAISING BUTTERFLIES FOR PAGEANT

The students of the University of California are preparing for a large, open-air pageant which will require the use of hundreds of live butterflies. In order to secure such a vast number of insects the students are canvassing the campus for cocoons and will raise the butterflies from these under the direct supervision of the Entomology Department. Such an undertaking has never been attempted before, and the Pacific Coast entomological societies are watching with eager eyes for the result of this novel experiment. The number of butterflies needed is about 4,000.

NOVEL MASSAGING MACHINE

A novel massaging machine devised by an invalid-inventor permits a patient to massage his own back. The patient reclines on a "chair" consisting of a strip of heavy fabric stretched between and supported by adjustable frames. In the rear of this "chair" back, massage rollers are provided which are under the control and may be operated by the patient. Levers which the patient may grasp extend back and connect with the device on which the rollers are mounted. The whole device is resiliently mounted so that the pressure to be applied in massaging is wholly under the control of the operator-patient. The contrivance is intended to stimulate the blood circulation and produce a consequent beneficial ef-

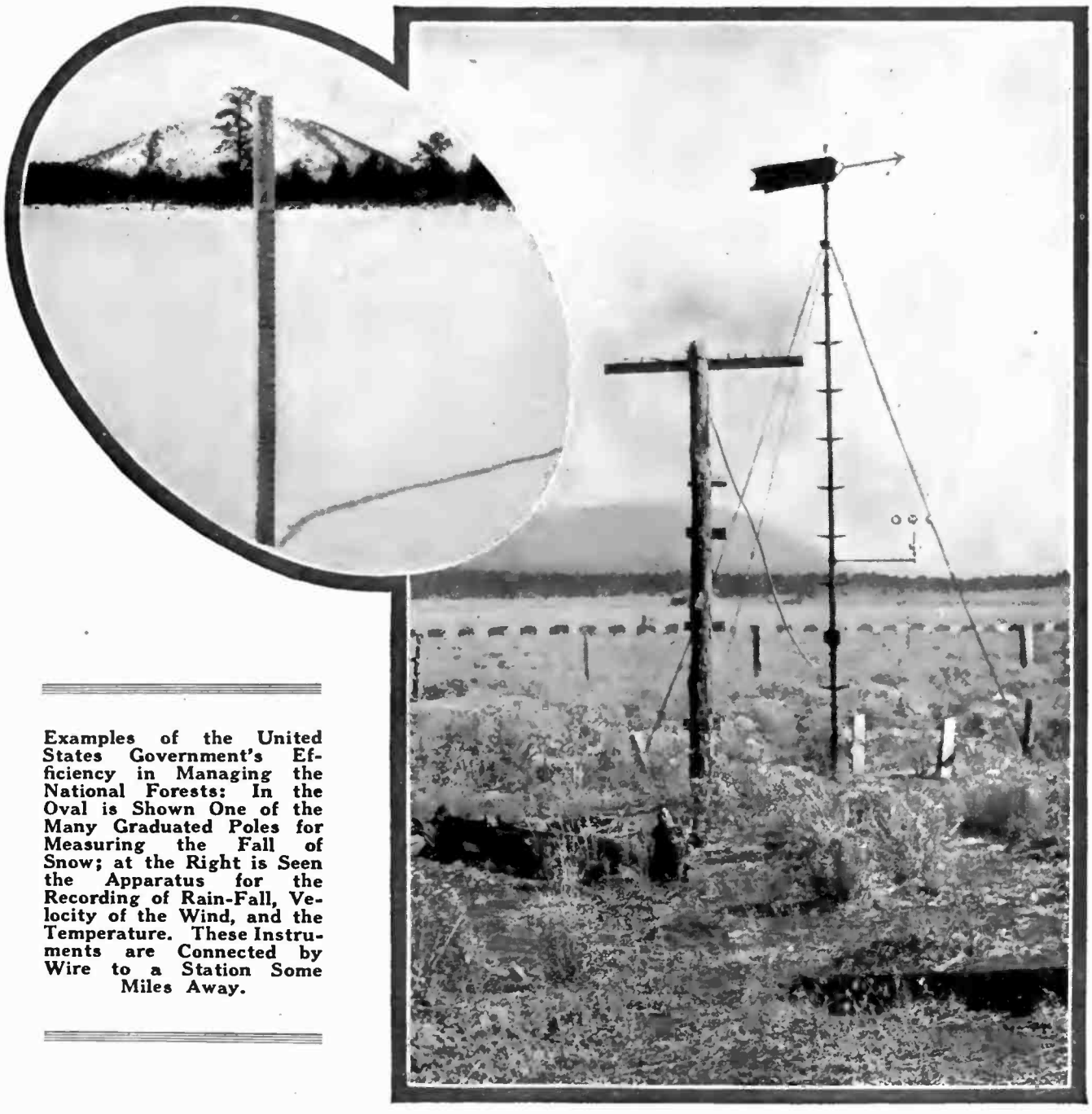


By Means of this Newly Invented Device, a Patient can Massage His or Her Own Back.

fect on injured nerves through the effect of massage on the spinal column. The chair frame is slidably mounted so that the patient can push himself backward or forward to regulate the vigorousness of the massage.

RECORDING WEATHER BY ELECTRICITY

An illustration of Uncle Sam's efficiency in the management of one hundred and eighty-five millions of acres of land included in the National Forests are the electrically-operated weather stations. In classifying the National Forests for grazing, agriculture and other uses by the people, an accurate knowledge of snowfall and rainfall and temperature is required, and for this purpose many weather stations are maintained. They comprise an anemometer which notes the velocity and duration of the wind, a wind vane, thermometers



Examples of the United States Government's Efficiency in Managing the National Forests: In the Oval is Shown One of the Many Graduated Poles for Measuring the Fall of Snow; at the Right is Seen the Apparatus for the Recording of Rain-Fall, Velocity of the Wind, and the Temperature. These Instruments are Connected by Wire to a Station Some Miles Away.

WANTED—SPECIAL MOULDING SAND

A sand is wanted to take the place of "French Sand" for fine statuary casting in bronze. The sand imported from France for this purpose contains about 80 per cent. silica and 20 per cent. alumina. It is a prepared mixture of very fine clay and sand. When slightly damp it feels like putty if crushed between the fingers.

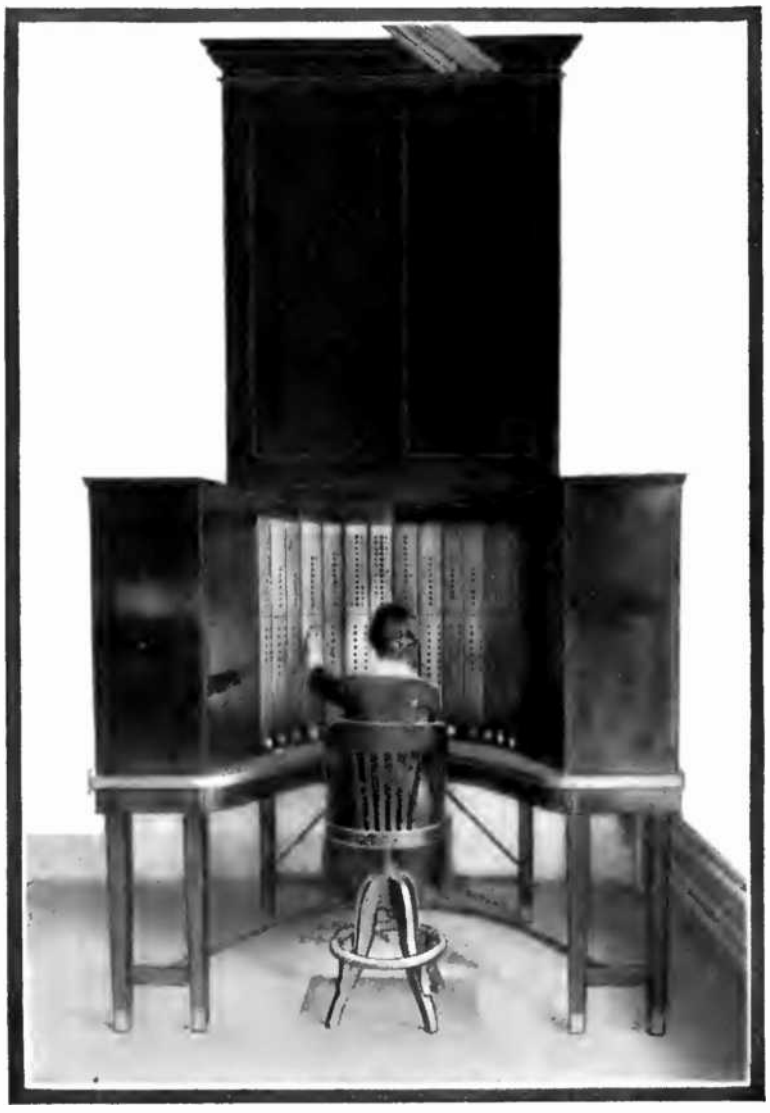
and rain gauge. All of these instruments are connected by wires with the station, some distance away, where an electrical device makes a minute and mathematically correct record. A recent addition to the equipment of the stations are the snow gauges which have been placed in the high altitudes where it is important to know the depth of the snow in order to determine the practicability of opening the land to homesteaders.

NOVEL CONTROL FOR DUMBWAITERS

In one of New York's big department stores there are fourteen electric dumbwaiters, all of which are under the instant control of a single operator at a central switchboard. In this switchboard there is one vertical panel of control buttons and lights for each dumbwaiter; the round bull's-eye at the bottom of each panel is the pilot light for that dumbwaiter, showing whether the latter is in operation or closed.

The buttons at the right-hand side of the lower half of each panel are the controlling buttons for dispatching and calling the car, and the buttons at the left are the signal buttons. Each button is connected to a buzzer at its proper floor, and the operator signals that the car is coming or that a door has been left open.

In the upper half of each panel there are three vertical rows of lights, red ones in the center and white ones at each side. The red lights are a position indicator and show the location of the car at all times. The lights on the right-hand side are the "call" signal lights. There is a button at each floor connected to its proper light and the attendants at the floor thus signal that the dumbwaiter is wanted. These "call" lights are so arranged that when the dumbwaiter car is sent to a floor it automatically cancels the call light of that particular floor, but if there should be any other calls they remain lighted and are only extinguished after the car has been sent to the other floor calling. The lights at the left-hand side are the "send" signal lights and are connected to a bank of buttons in the dumbwaiter car itself. They are used in inter-floor service, that is, the attendant on the floor will call the car to that floor, and when it arrives place the package therein and by means of these buttons and lights signals to the operator the floor at which the package is to be delivered. These lights are also arranged automatically to cancel themselves as soon as the car is sent to the floor wanted.



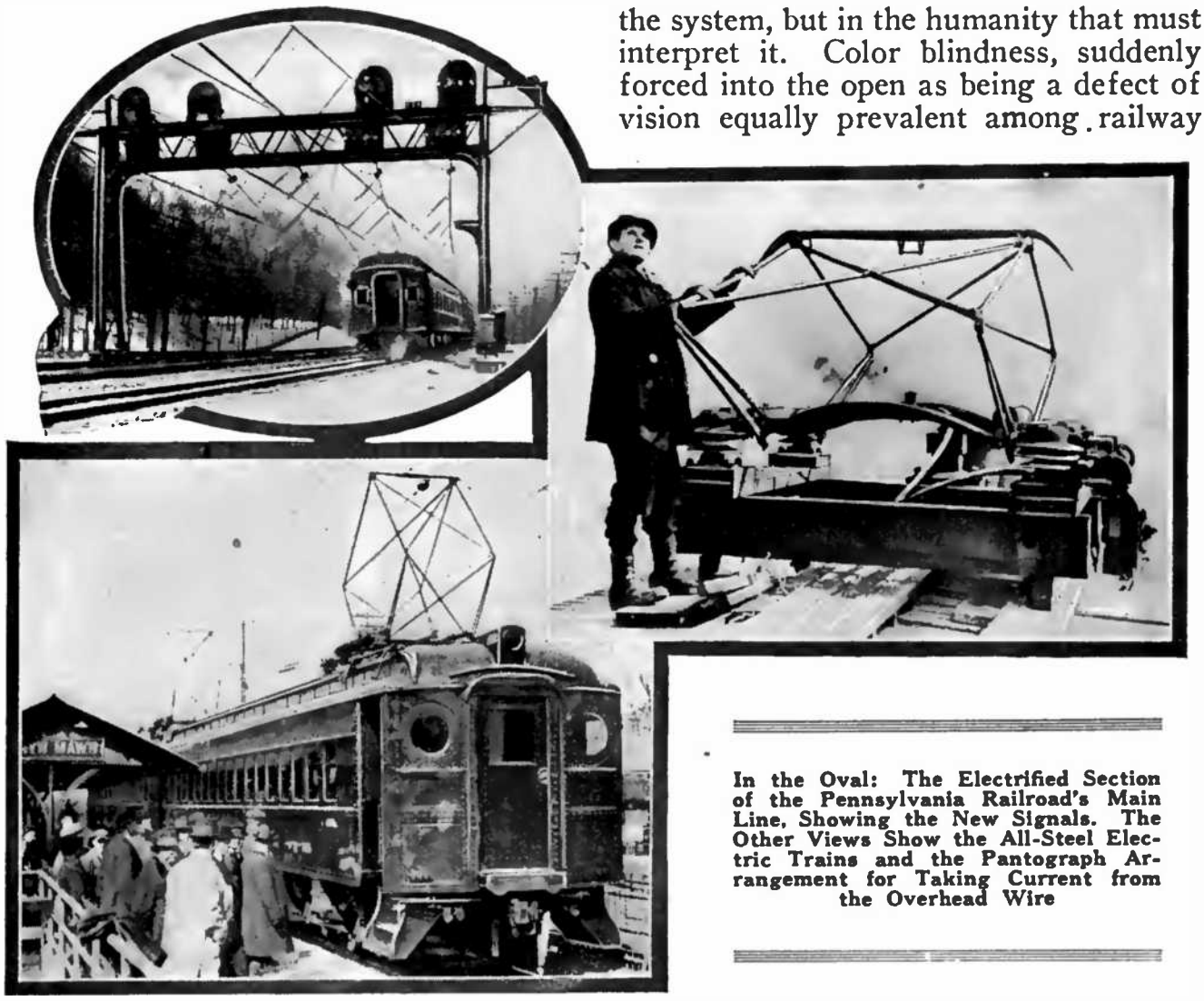
The Fourteen Dumbwaiters in a Large New York Department Store are All Controlled by a Girl Operative, Sitting Before a Large Switchboard.

It is stated on good authority that the method of range finding employed on American battleships is the best in the world. It is being kept a strict secret.

Railroad Safety in Pure White Light.

By Camillus Phillips

THE advent of a new era in railway safety is marked by the installation on the Main Line of the Pennsylvania Railroad of a signal system, for the present unique, which eliminates absolutely the dangers arising from color blindness by relying upon the use of one color only—white. The signaling is accomplished by means of the simple differentiation between light and darkness, all signals of the code being read in terms of vertical and horizontal white lights.



In the Oval: The Electrified Section of the Pennsylvania Railroad's Main Line, Showing the New Signals. The Other Views Show the All-Steel Electric Trains and the Pantograph Arrangement for Taking Current from the Overhead Wire

Until now the railway world has struggled ineffectually for absolute signal safety in the face of human sense limitations which are apparently unalterable. When the simple but crude mechanical contrivance of the signal arm was supplemented at night by the colored lights familiar to the block system, it was believed that the absolute safety sought was actually attained. Numberless accidents, costly in life and property, remained inexplicable until the advance of science revealed an inherent weakness—not in the system, but in the humanity that must interpret it. Color blindness, suddenly forced into the open as being a defect of vision equally prevalent among railway employees and the remainder of the population, had to be rated as a defect fatal to any career on the rail, and it rendered imperative the most rigid tests of vision throughout all branches of the service. Human knowledge then believed it was using the only precaution possible, and practicable, for the wiping out of humanity's proneness to error.

The ideal, however, remained unachieved; and it must remain unachieved until some device should appear which would do away wholly with the human color sense as a means of protection. The

problem appeared impossible of solution; yet the essentials of that solution were already a matter of ancient history to the manufacturers of electric signs as displayed profusely along Broadway, in New York.

The electrification of the Pennsylvania's Main Line is a matter of grave importance, not only to the immediate locality but to the road at large, for it concerns the crack service of the line and it affects probably the wealthiest body of commuters in the world. During a period of nearly two-score years the Pennsylvania Railroad has pursued consistently the policy of building up the stretch of country between Philadelphia and Paoli until it should include estates owned by all the wealth and fashion of the community; and now the land, for miles beyond the road's right of way, is a succession of magnificent country seats interspersed with properties rivalling the manorial holdings of England. Short as the electrified line is to Paoli, the new service required the building of 93 all-steel cars, to be in readiness for May 30, the opening day, with 54 trains outbound daily and 51 inbound. A considerable reduction in the running time of all inbound trains with the installation of the electrical service emphasized the need for some system of signalling which would be infallible. Apart from the necessity of safeguard in the face of higher speeds, the mere fact that the "trolley" wires are designed to carry 11,000 voltage and employees are warned that it is dangerous to come nearer than 14 inches of them gave an indication of the foresight which had to be exercised throughout the new system.

In the new signal apparatus no movable parts exist; the code is identical during every hour of the 24; and it is read in fixed, brilliant, white electric lights which define themselves sharply against a dead black background. By the use of vertical and horizontal light series it was easy to arrange a code of light signals which correspond in meanings to all semaphore arm positions—vertical, horizontal and diagonal. Every signal is equipped with lights in rows equivalent to the purposes of two semaphore arms.

Lights instantly burning and as instantly extinguished have long been a commonplace feature of street signs and preceded the new white light signals by many years. The utilization of the principle for railway protection involved, however, the vital feature of ample visibility in full daylight. That difficulty has been overcome by quadrupling the voltage during daylight hours. The white light signals, as they are in operation now, are clearly distinguishable in the most brilliant sunlight at a distance of 4,000 feet; at night, when the full current is used, large type can be read 1,000 feet away.

The lamps, spaced 18 inches apart, are up to 12 volts, with 4-candle power, 5-watt Mazda, concentrated filament and adjustable base. At night, they burn 3 volts; at twilight, 6 volts, and in bright daylight, 11 volts. They have special inverted 5⅜ inch lenses, with reflector mirror above the light, to throw down some of the rays for close range.

The engineer in control of every electric Main Line train receives his warning of a possible stop at a distance of 7,000 feet from the spot where ordinary caution calls for the halt, being confronted with at least two premonitory signals, each guarding a block of 3,500 feet, before he comes to the signal reading "Stop." When a train moves into a 3,500-foot block, the signal which it passes in entering sets itself automatically for the light code signal reading "Stop." As the train passes into the block beyond, the first sign shifts to the light code signal, "Caution." When the two full blocks have been left clear, the first signal announces track conditions accordingly.

The new electric cars are equipped with a pantograph, thus being superior to the trolley pole used on the Pennsylvania's seashore line in New Jersey. The pantograph adjusts its working height automatically to the varying level of the catenary electric wires above the car's roof, as does the ordinary trolley pole with its wheel. But the flat, wide edge of contact which it presents to the wire permits of an enormous play in rounding curves, as compared with the pole and its grooved wheel, and renders it practically impossible to break contact with the wire above.

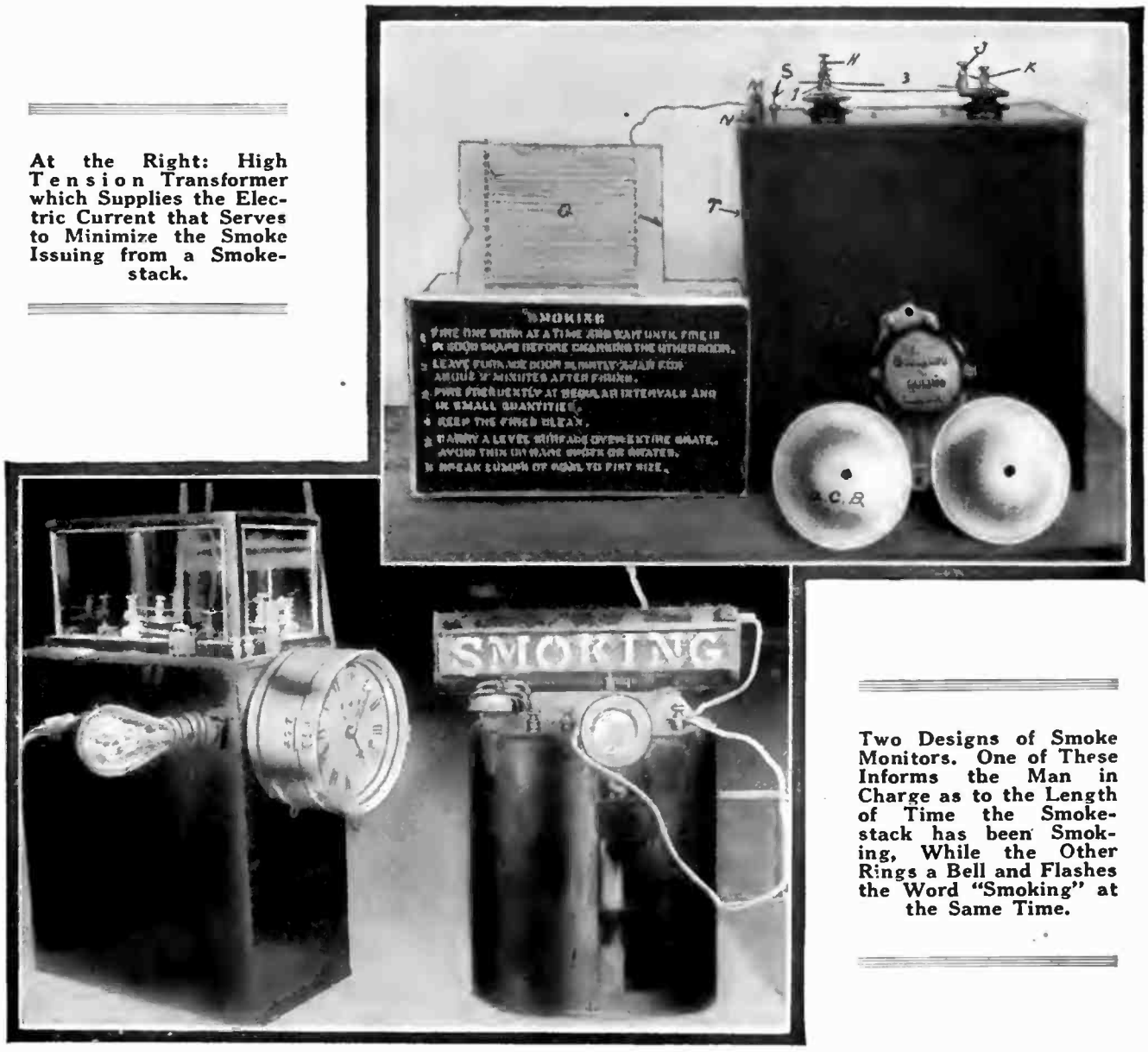
ELECTRICITY ABATES SMOKE

An interesting device known as the smoke monitor has been perfected, and while it does not do away with all the smoke belching from smokestacks, it aids in a great way in the fight against the soft-coal nuisance. The apparatus eliminates that part which does the most damage, and permits a clean, white column of vapor to rise from the factory stack, protecting its owner against a warning notice from the city smoke inspectors.

The first experiments were carried on at the Mellon Institute of Industrial Research; the treatment of Pittsburgh smoke, due mostly to the steel mills, and found to consist of from one-third to one-half of iron oxide, being first undertaken. With the application of a powerful current of electricity through the wires of the appliance, the small particles of iron oxide are changed to larger ones and by their own gravity fall into the furnace bed far below.

So far, various forms of the smoke monitor have been perfected. By the aid of a clock attachment the electric monitor will signal to the manager of the plant or the man in charge exactly how long the chimney has been smoking. The appliance accomplishes even more than this—it actually flashes electrically-lighted instructions for the proper and efficient firing of the furnace. Another design flashes the word "SMOKING" and at the same time rings an electric bell, attracting the attention of the fireman to the fact that he is not firing the furnace properly, and is sending a portion of the firm's good money out of the top of the smokestack.

At the Right: High Tension Transformer which Supplies the Electric Current that Serves to Minimize the Smoke Issuing from a Smokestack.



Two Designs of Smoke Monitors. One of These Informs the Man in Charge as to the Length of Time the Smokestack has been Smoking, While the Other Rings a Bell and Flashes the Word "Smoking" at the Same Time.

The electric monitor is not only efficient in lessening the smoke nuisance, but its action is effective upon cement and ore dust as well. The electric current used in the electric monitor is insignificant as compared to the results; at the rate of three cents per kilowatt hour the cost of operation is claimed to be no greater than one cent per day.

ELECTRIC CALL BELL OUTFIT.

The trend in the design of electrical novelties is clearly in the direction of greater simplicity and utility. While the devices strictly new in idea are comparatively limited in number, still the improvements in existing devices are many. An interesting example is seen in the accompanying illustrations. The inventor of this call bell outfit has combined a dry cell, bell, cord and push button into an outfit which is truly a marvel of simplicity and all-around utility.

The battery is contained within a wooden case which carries the bell on its cover. The connections with the battery are effected merely by pushing the cell in place after its cardboard carton has been removed. A spring contact at the top establishes connection with the center binding post or the carbon in a cell wherein the post passes through the carbon. A second spring contact at the bottom of the case takes care of the connection with the zinc of the cell.

The bell is operated when the binding posts at the top of the wooden container are connected together, and from this the reader will see that the outfit may be used as a call bell with the cord extension and push, an auxiliary for an annunciator set, or it may be permanently installed as the door bell for a house, in which case the purchaser has only to run two wires from the door to the bell, connecting a push button at one end and the binding posts on the top of the case at the other. Thus it is quite necessary to devise ways and means for storing the battery in an inconspicuous place and likewise the layman in setting up the outfit is not required to install a special circuit of wiring, simple enough in itself but confusing at times to the uninitiated.

A Simple and Convenient Call-Bell Outfit. The Dry Cell may be Inserted or Removed Without the Necessity of Connecting or Disconnecting Wires.

A GIANT CRANE

One of the hugest cranes in the world is that erected at Gavan, Scotland, on the river Clyde, for the Fairfield shipyards. On slow gear it will raise 200 tons at a distance of 75 feet from the mast, and on quick gear it will carry a load of 100 tons at 133 feet extension. The foundations of the crane consist of four large tubes, 15 feet through at the base, filled with concrete and sunk 74 feet below the surface.

THE wireless telephone has always toiled under an unlucky star. It was exploited before it was ready —a disastrous step for any new science to take. The recent unqualified success of the radio telephone on a moving train, however, should help tremendously in the living down of this unsavory past, and in paving the way to a much brighter future.

WHILE the Lackawanna Limited was travelling at high speed, one day in the early part of February, a man stood before a queer looking telephone in a small booth in the end of the smoking car. He was talking quietly, and frequently moving a little switch from side to side, and listening. Finally, he hung up the receiver with a smile of satisfaction.

"Just talked to Binghamton, twenty-seven miles away," he announced.

"Could you hear him clearly?" asked his companion, who had been waiting anxiously for the results.

"Clear as a bell!" was the answer. "And as soon as we get this"—he indicated some instrument on the machine—"in better running order, fifty miles will be just as easy!"

It was the first really successful exchange of wireless telephonic messages that had ever taken place from a moving train, and the train was moving considerably, too, at the time.

Last year, the Lackawanna, after a series of successful experiments in telegraphing without wires to and from one of their limited trains, decided to substitute wireless telephony in case it should prove feasible. The purpose of the intended change was, primarily, to obviate the necessity of adding a telegraph operator to the regular train crew. The Superintendent of Telegraphs of the Lackawanna, Mr. L. B. Foley, who has been for years an advocate of the commercial application of wireless to railroad work, estimated that the saving thus represented in one operator's salary equalled the interest at 6 per cent. on a $15,000 investment, and that therefore his road could well afford to go to the additional expense of equipping two of the limited trains on the New York-Buffalo run with radio telephone apparatus in place of the wireless telegraph.

The problem of designing and constructing a radio telephone that would measure up to the difficult requirements was put before Dr. Lee De Forest. The first wireless telephone designed for train work was installed at the Scranton wireless station of the railroad, and the voice of the speaker on one occasion was clearly heard on the train as far east as Stroudsburg, over 52 miles distant. The train during this test was travelling at a

speed of more than fifty miles an hour.

Recently, a De Forest train equipment was installed, and the results, which have been mentioned, are considered so satisfactory that a further extension to other trains of the Lackawanna system has been announced for the near future.

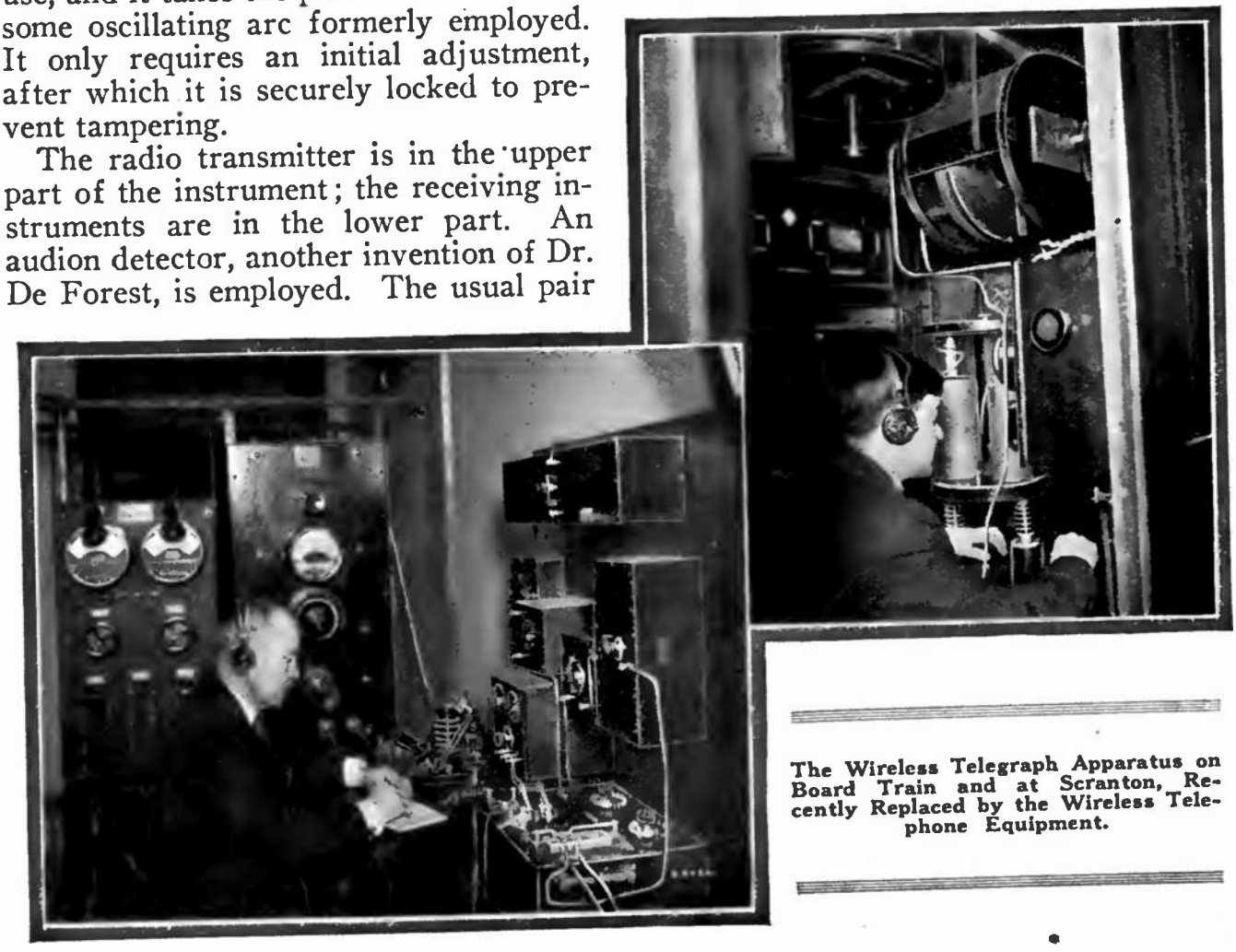
Emulating the Wire Telephone

In appearance, the equipment closely resembles the ordinary wall telephone, and in fact it was designed with that intention. It is quite compact, and all of the working parts are within easy reach of the operator. One of the principal aims of the inventor was to make the new telephone as fool-proof as possible; in effect, a person of no more than average skill can do all the manipulating necessary.

The adjustments of the wireless telephone are made on a sloping board on the front of the instrument. At the side, a quenched gap is installed. The quenched gap is a new creation of Dr. De Forest, at least for this particular use, and it takes the place of the troublesome oscillating arc formerly employed. It only requires an initial adjustment, after which it is securely locked to prevent tampering.

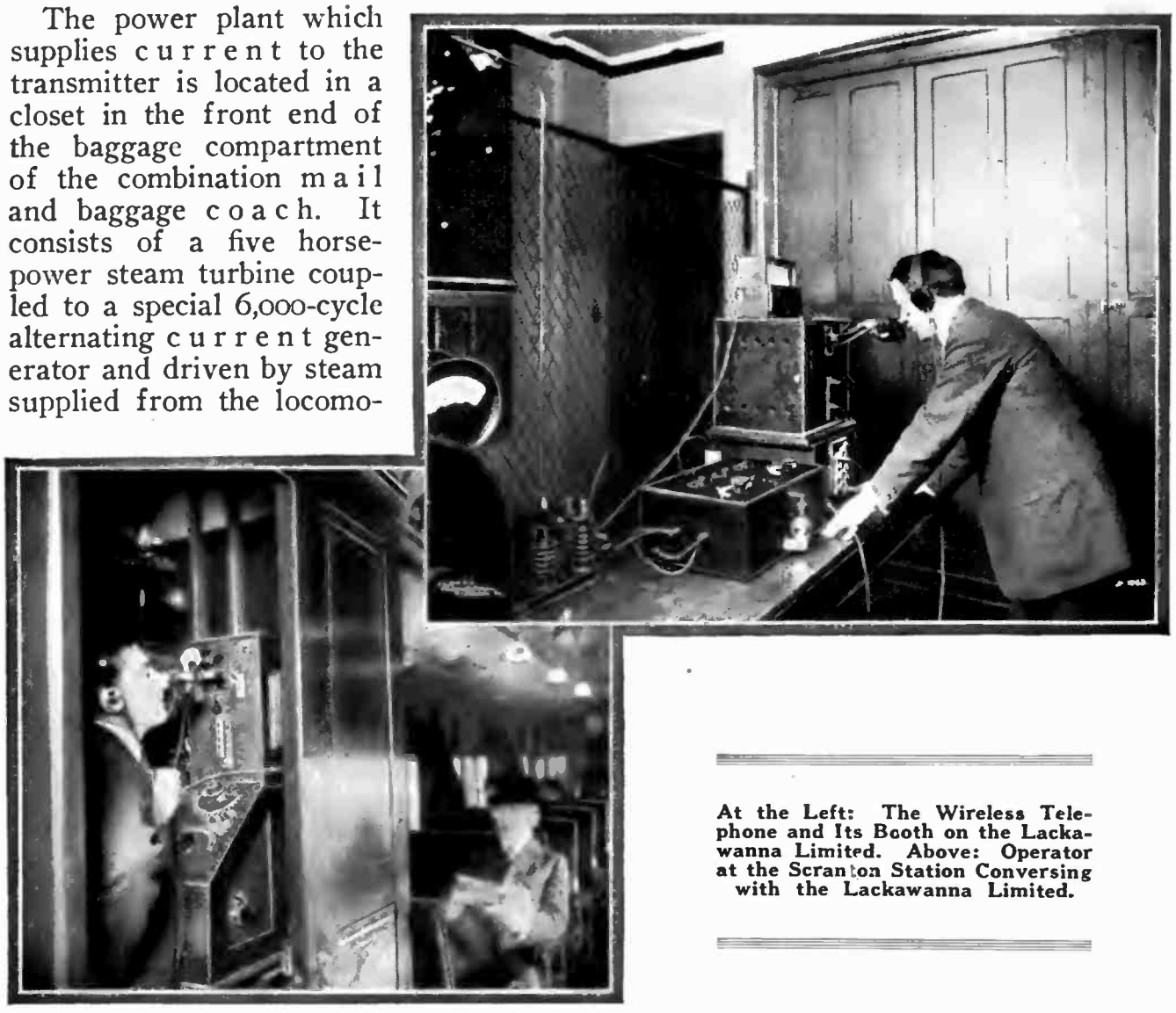
The radio transmitter is in the upper part of the instrument; the receiving instruments are in the lower part. An audion detector, another invention of Dr. De Forest, is employed. The usual pair of sensitive, high-resistance telephone receivers are used in connection with the audion.

The transmitting circuit is peculiar to this type of apparatus and does not embody the "tuned coupled circuits" usually employed in wireless transmitters. This novel circuit arrangement greatly simplifies the tuning of the transmitter. Moreover, the antenna system is not tuned to the primary, nor even "substantially in tune" with it; but the wave-length of the radiation may be varied through wide limits by merely shifting the contact switch located on the front of the transmitter case. When this is once set to the desired wave length, no further attention on the part of the speaker is required except to push down the little "listening switch" for talking, and to release it for listening. This switch also controls the filament-lighting current of the audion bulb, which thus becomes a visual signal to guide the speaker. He cannot telephone when the light is burning, nor can he receive when it is not lighted.



The Wireless Telegraph Apparatus on Board Train and at Scranton, Recently Replaced by the Wireless Telephone Equipment.

The power plant which supplies current to the transmitter is located in a closet in the front end of the baggage compartment of the combination mail and baggage coach. It consists of a five horse-power steam turbine coupled to a special 6,000-cycle alternating current generator and driven by steam supplied from the locomotive boiler. The turbine exhausts directly downward onto the track bed.



At the Left: The Wireless Telephone and Its Booth on the Lackawanna Limited. Above: Operator at the Scranton Station Conversing with the Lackawanna Limited.

The operating speed of the turbo-generator is necessarily high, being in the neighborhood of 2,500 r.p.m., a speed which is maintained within close limits by a special governor. A great deal of difficulty was encountered in designing this generator so that it would respond to the sudden and frequent switching of the load from full to practically zero, as the radio telephone apparatus is constantly changed from transmitting to receiving.

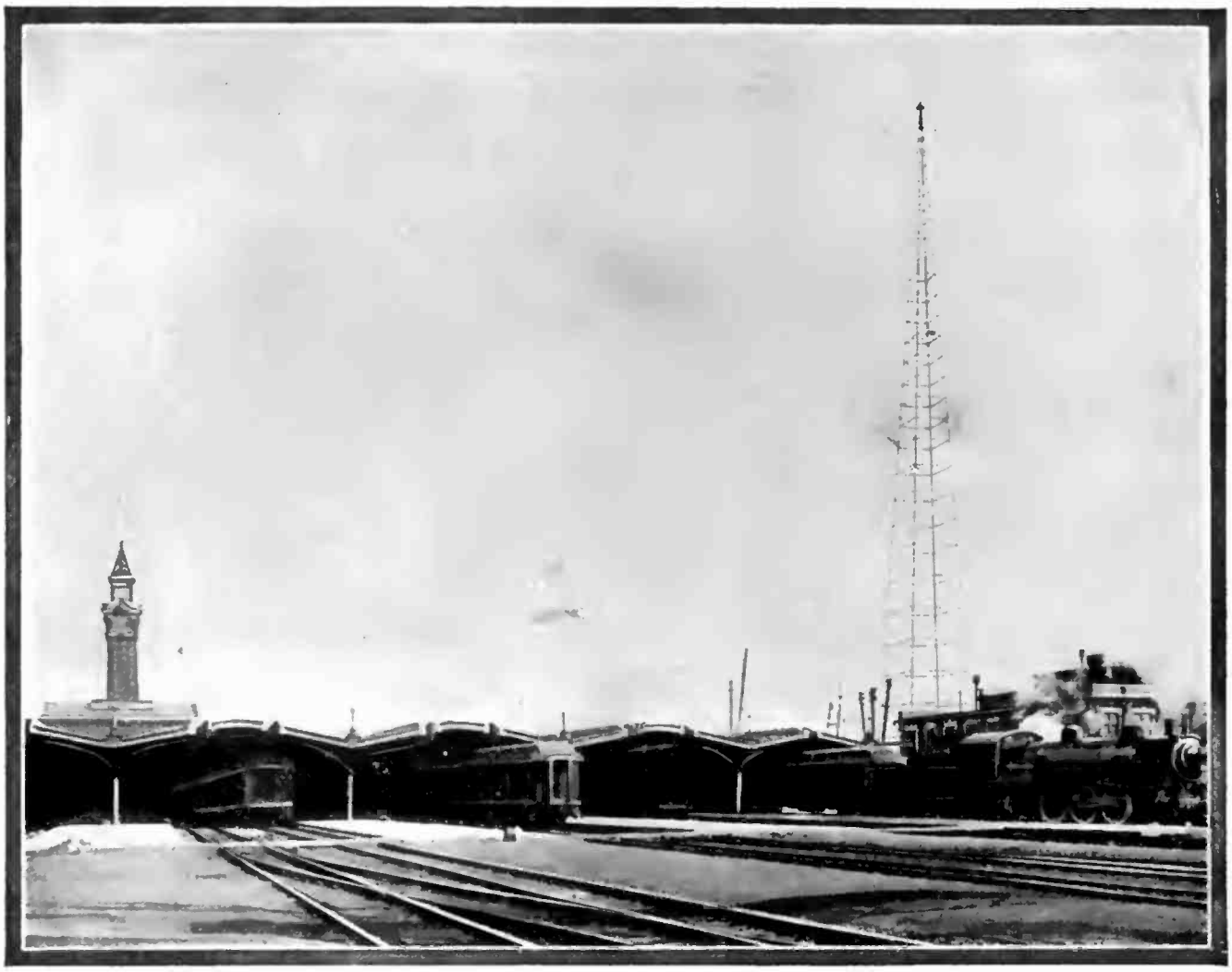
The antenna system is composed of four stranded wires stretched along the roofs of four coaches and held on porcelain insulators. An interesting feature in connection with the use of this aerial is that transmission and reception are accomplished with equal efficiency, whether the train is in a tunnel or travelling in the open air.

For the Travelling Public

An unique feature has been planned for the convenience of passengers who desire to communicate with friends who are not convenient to the nearest wireless telephone land station. By a retransmitting arrangement, the voice is transferred to the local telephone line, and, in fact, long distance calls can be handled to any distance in the same way. The cost of using the train-board radio telephone will, of course, be considerably more than for usual long distance service.

The Radio Telephone in Freight Service

Railroads throughout the country have already shown a keen interest in this pioneer work of the Lackawanna, especially for freight service, where, it is



General View of the Lackawanna Passenger Terminal at Hoboken, N. J., Across the Hudson River from New York City. The Aerial of the Wireless Telephone Installation is Strung Between the Steel Tower at the Right and the Tower at the Left.

claimed, a great economy can be effected even by the simplest one-way radio telephone service from signal towers to the cabooses of through freight trains. Each unnecessary stop that a long, heavy train is now compelled to make represents a loss to the road of from $20 to $30. It frequently happens that scheduled wayside stops of a "manifest" freight train could be avoided if it were possible to telephone the latest orders to the train crew while under full speed.

By a series of small radio telephone stations located at certain signal towers along the right of way, it would be possible to directly convey these orders verbally to the train engineers or conductors. Dr. De Forest has recently brought out a very small radio telephone transmitter which can be installed for less than $400, capable of telephoning to a caboose over a range of two to three miles. He estimated that a 500-mile railroad line can be fully equipped for such freight signalling service for an initial outlay of $30,000. The monthly interest on this sum is $125. Operating expenses of these small transmitters plus that of the caboose receiving stations would not exceed $1,000 annually. When it is considered that the daily loss in "unnecessary" stops of freight trains over such a road amounts to more than $200, the great saving resulting from the use of the wireless despatching system is obvious, actually amounting to considerably more than $70,000 yearly.

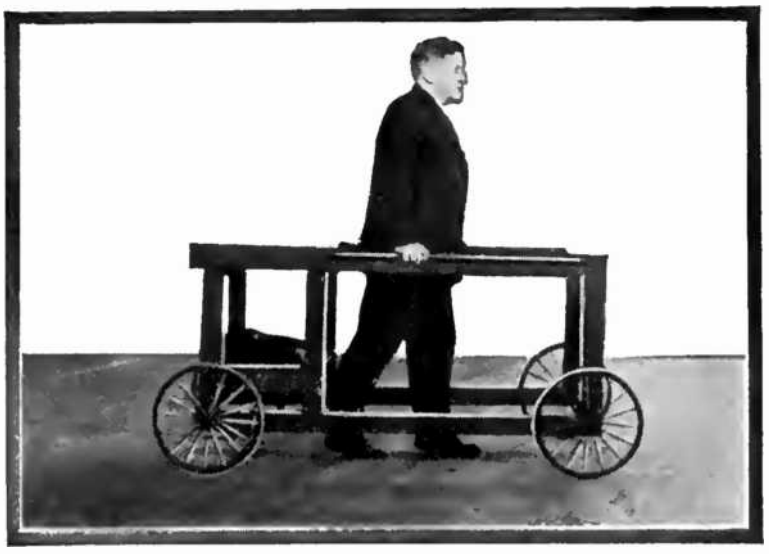
There are, of course, certain drawbacks to the extensive application of wireless telephony to passenger and freight trains. But these will be removed as soon as the natural structural difficulties are thoroughly mastered. As a commercial enterprise, wireless telephony has always toiled under an unlucky star. It was exploited before it was

ready—an inevitably disastrous step for a new science. There is no reason now, however, why the wireless telephone in its perfected state should not receive the recognition it so fully deserves, and take its place in the commercial world.

VEHICLE THAT TEACHES INVALIDS TO WALK

In the treatment of many invalids it is necessary to re-teach them to walk. This is notably true in cases of broken limbs, paralysis, locomotor ataxia and other similar maladies.

A device to aid the patient in learning to walk again has been devised and is in successful use in a Michigan sanitarium. It is called the walking chair, and by making use of the vehicle, the patient may first learn to use his feet while in a sitting posture. Later, when his strength is equal to the task, he can stand, supporting himself on the bars of the carriage. The wheels are rubber tired and the whole carriage is very light, though strong, offering practically no resistance to the motive power furnished by the invalid.



This Vehicle, Known as the "Walking Chair," has been Found Very Useful in Enabling Patients to Regain the Use of Their Legs.

The walking chair is especially valuable in the treatment of improving cases of locomotor ataxia, in which disease it is very difficult for the patient to recover the use of his limbs without an artificial support of some kind. This machine is used so frequently in cases of this kind that it is sometimes referred to as the "locomotor ataxi-cab."

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us. Have you any suggestions? If so, why not write and state what they are?

FULMINATING MERCURY AND ITS USE IN WARFARE

One substance that is helping to fight the great European war is not getting the credit it merits. And that substance is fulminating mercury. It forms the cartridge caps that explode all the small arms ammunition, and it detonates all the mines and torpedoes, as well as the shells that explode on contact.

The fulminates are queer substances, and all of them are formed by the action of nitric acid on a metal, in the presence of alcohol. All fulminates explode on lesser provocation than any other solid bodies. The mercury fulminate, especially if mixed with powdered glass, explodes on being pounded or rubbed. Silver fulminate will blow up when touched with a feather. Mercury fulminate is, on the whole, the safest, but at that it will explode from no apparent cause.

RADIO-ACTIVE POTASSIUM

The experiments of Elster and Geitel, supported by those of MacLennan, Henriot and others, appear to show that potassium belongs to the list of substances possessing the property of radio-activity. It has been found that salts of potassium, obtained from the mines of Strassfurt, spontaneously give out an emanation which ionizes the surrounding air.

ELECTRIC GEMS SPARKLE FROM EXPOSITION TOWER

A tower of sparkling gems of various colors is the dazzling sight which greets the visitor to the Panama-Pacific Exposition grounds after nightfall. The tower is built in the shape of a pyramid, rising to a height of 433 feet. From top to bottom, jewels of every conceivable hue are suspended in various color groupings; altogether there are more than 125,000. They are made of colored glass and were cut and polished by Austrian lapidaries.

Each jewel is set in a large metal ring suspended from a hook. The gems are free to swing in the wind, so that when the light from fifty huge searchlights is played on them, they blaze with a constantly changing brilliancy. At the apex of each jewel a small mirror is suspended, greatly intensifying the refractive power of the facets. Both the jewel and the mirror are held to a bracket through a loop joint; the bracket being firmly held to the concrete wall by means of an expansion bolt, as shown in the sketch.

Views of the Tower of Jewels at the Panama-Pacific Exposition, Depicting the Arrangement of the Glass Jewels.

TWO NEW TUNNELS SHORTEN RAILROAD ROUTE

No longer will overland Southern Pacific trains crossing the Sierras be compelled to take the dizzy curve on the precipice above the American river known as "Cape Horn." Two tunnels have just been completed by the company at Wirts station through which all the transcontinental traffic will be deflected, thus doing away with the circuitous and somewhat hazardous route.

Trainmen have named these tunnels the "Panama Canal" for the reason that they have rendered unnecessary the journey around the "Horn."

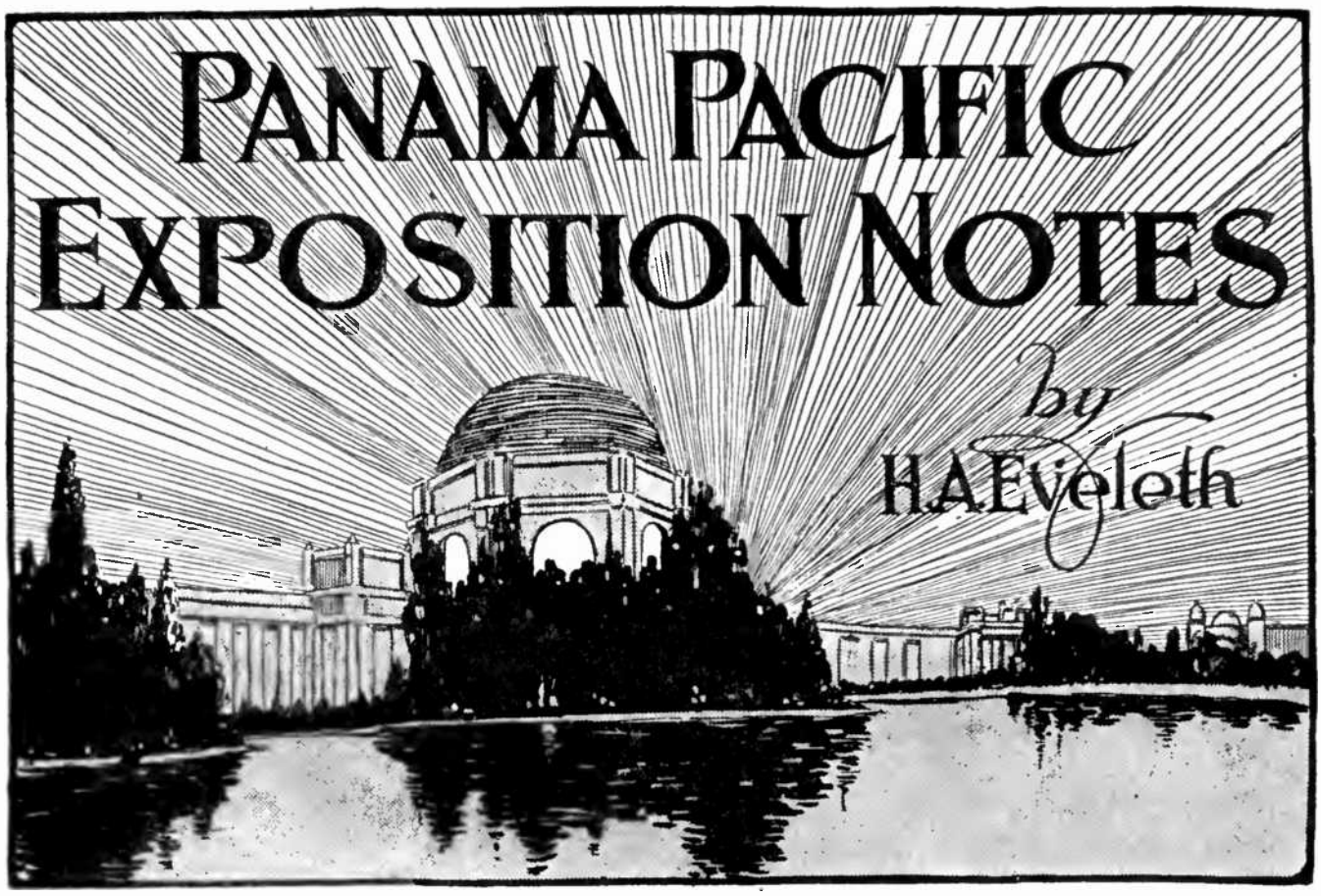
KNOWLEDGE OF THE SOIL

An expert of the Department of Agriculture at Washington avers that there are lands in the Old World, particularly in Europe, where the soil is platted and analyzed to the last square meter. This meter is worth so much; that meter is worth so much more; the grapes from that little patch are reserved for certain "cabinet" wines; the grapes from this patch are less valuable. In this relation special reference is made to the Schloss Johannisberger vineyards in Germany.

In China, too, there is found this exact knowledge of the value of every foot of soil; but in the Orient the knowledge came by tradition and custom rather than by laboratory analysis, as is the case in Germany.

In the United States the work of platting soil has only just begun, and the unit of measurement is much more likely to be an acre or a ten-acre field than a square yard.

All this furnishes a good reason why the crops of Europe are superior to those of our own country. Their land is no better than ours, says the expert quoted, but they know it better.



THE daily demonstration of mine rescue work given by the U. S. Bureau of Mines in the Mining Palace is attracting a great deal of attention. It is so realistic that the greater number of the spectators believe it to be a real calamity, and act accordingly. The visitor is suddenly startled by two terrific explosions, followed by an outpouring of dense smoke from one of the mine shafts located in the building. In a few seconds the mine rescue car speeds up to the door, four men clad in mine rescue suits and carrying a stretcher jump out, run through the crowd of questioning spectators and enter the smoke-filled shaft to rescue the dead and dying. In a few minutes they reappear carrying an unconscious man on the stretcher. They doff their cumbersome suits and headgear and set to work to administer first-aid treatment to the victim. Artificial respiration is given in the manner approved by the Bureau of Mines and employs no mechanical devices nor the complicated system usually practiced. The victim is placed on the floor, stomach downward, and pressure applied by one man to the lower ribs at the rate of sixteen times per minute. The pressure forces the air out of the victim's lungs, while the action of the muscles sucks it in again. Upon signs of consciousness his body is vigorously rubbed *towards* the heart. The next step is to ascertain the presence of other injuries and apply first aid. Our unfortunate miner is found to have a compound fracture of the left leg and an injury to his head, said injury being designated by a dab of red paint. The first-aid box—one of many placed in various parts of the mine—is resorted to; a tourniquet is applied to the leg to stop the arterial bleeding and the leg is put in splints. Next, the head is bandaged, and here it is noted that the wound is not cleansed, for it would be dangerous to do so with the impure water at hand. The injured man is now carefully placed on the stretcher and carried to the hospital maintained by the Bureau of Health, near the entrance to the mine, where the necessary surgical operations are performed. This over, the public is invited to go below and inspect the model coal mine, complete in all details, which has been sunk beneath the floor of the building.

The exhibit of the DeForest Radio

Telephone & Telegraph Company in the Palace of Liberal Arts is of considerable merit. A complete line of Audion and Ultraudion detectors, together with Audion amplifiers and radio-telephone apparatus, is on display. Among the last named is a 2-kw. 3,000-cycle generator for radio-telephony and a radio-telephone transmitter and receiver wall set of the type used by the Lackawanna Railroad. A wire of stranded phosphor-bronze strung to the top of the 435-foot Tower of Jewels serves as an aerial for the elaborate receiving set which is installed in the DeForest booth. Here will be seen the "DeForest Navy Receiving Tuner and Ultraudion Detector," which, together with the "Two-Step Amplifier," probably represents the latest development in the art of radio-telegraphy. With this combination the noon signals from Arlington, Va., ring a bell at the exhibit. It is claimed that the stations at Hamburg and Nauen have been picked up.

A well-known automobile manufacturing concern maintains a novel exhibit in the Palace of Transportation. The complete assemblage of an automobile from the bare frame to the finished product is shown in less than an hour's time. Six steps are required to do this, and the rapidity with which it is done is due to the efficiency and team work of the men employed in each step. As the machine is gradually assembled it travels very slowly along a track in order that it may be in place for the next series of operations at the finish of the preceding series. In this manner it is passed from hand to hand, so to speak, and no time is lost by slackness of the workmen. Four to six men are employed at each step, and as each gang is constantly at work the machines are turned out at the rate of six an hour. In the first step the front and rear axles and framework are assembled. In the second the engine, dashboard, tank, steering and driving gear are installed. In the third the radiator, mud guards and running boards are bolted to the chassis. In the fourth the body is lowered into place, the windshield bolted to the dashboard and the wheels and tires are put on. In the fifth the engine is wired up and the horn, lamps and other accessories are installed. In the sixth the tank is filled with gasoline, the machine tested by bringing its rear wheels into contact with a motor-driven revolving cylinder, then the throttle is manipulated and the finished automobile travels to the shipping department under its own power.

An exhibit of special interest to the hydraulic engineer is that of the Pelton Water Wheel Company in the Palace of Machinery. The principal machine is a 20,000 h.p. Pelton-Doble single-discharge hydraulic turbine with overhung runner, which has been built for the 1916 installation of the Pacific Gas and Electric Company at Plant 5 of the Lake Spaulding development. It has a weight of 186,000 pounds, while the head is 500 feet, and the speed is 360 r.p.m. The exhibit also includes a 10,000 h.p. Pelton-Doble water wheel with interlocking buckets. The total weight is 12,000 pounds with a head of 1,350 feet and a speed of 360 r.p.m.

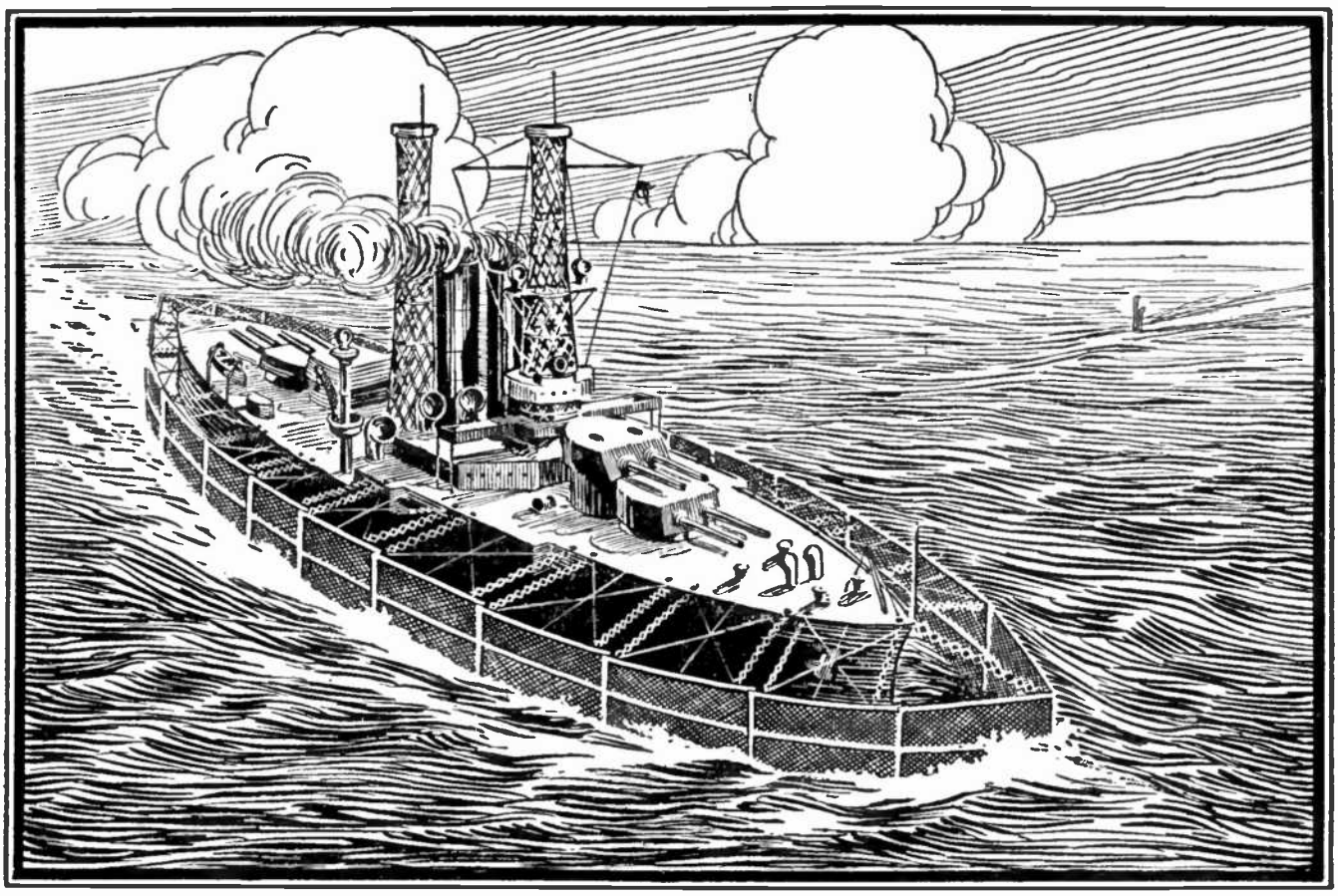
NEW USES OF TUNGSTEN

Tungsten is finding an ever-increasing use in electrical work aside from its application in incandescent lamp filaments. In certain of the newer Crookes, or X-ray tubes, which are designed to work at high intensities, being capable of absorbing 10 kilowatts and taking pictures through even the thickest parts of the human body, tungsten has been used as the anode target for the cathode rays, the rare metal being backed with copper to convey away the heat developed. Although rendered molten by this instantaneous impact of electrons, the great surface tension of the tungsten prevents loss or change of shape. Tungsten electrodes have also been used for gas engine spark-gaps, and show longer life than those of other metals of equivalent cost.

This is your magazine. It is edited to please you. Are we succeeding? Have you any suggestions to make?

NEW DEVICE PROTECTS VESSELS FROM MINES AND TORPEDOES

GRIM evidence of the effectiveness of the submarine mine and the torpedo has been given in plenty in the European war and it is but natural that the minds of inventors should turn toward the development of devices which shall protect vessels at sea from the danger of contact with submarine explosives. pended from the sides of a vessel and reach down into the water to a depth greater than the ship's draft. The intention is to suspend these shutters on all sides of the craft in order that the torpedo or mine may strike the shutter and explode before it comes into contact with the side of the vessel. The idea is that

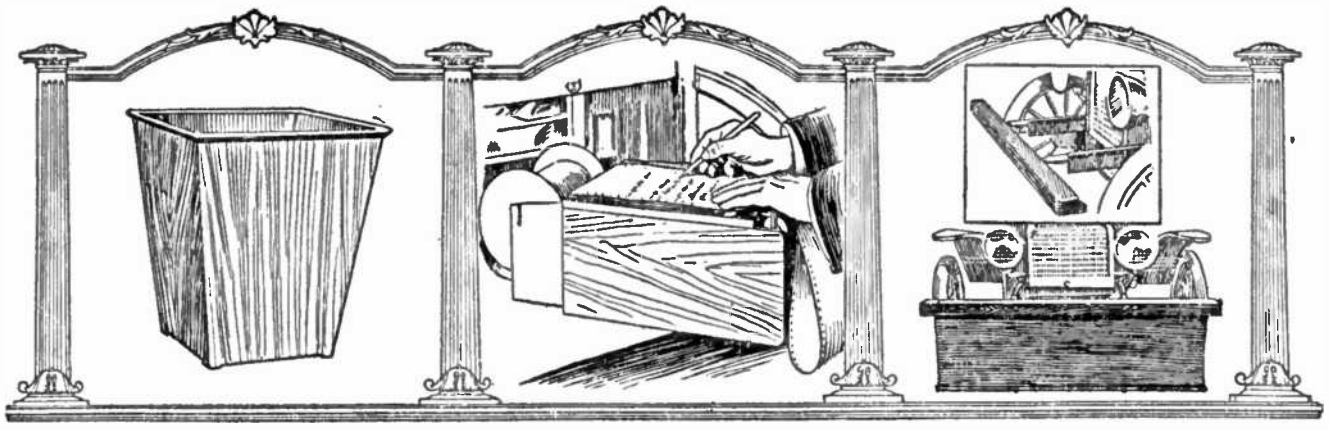


A Dreadnought Protected Against Torpedo Attack by Means of Screen Shutters which are so Designed as to Offer the Minimum Resistance to the Forward Movement of the Vessel.

While the torpedo net has been known and used for years, its efficacy has long been a matter of conjecture and possibly of doubt, for the modern automobile torpedo can be so arranged as to cut its way through the heavy steel netting, thus nullifying the protective value of the torpedo net.

Now comes an inventor with a device which looks ingenious in the patent drawings and which may prove at least a partial solution of the problem. The equipment consists essentially of a series of shutters of rugged construction and so arranged that they may be held suspended from the sides of a vessel and reach down into the water to a depth greater than the ship's draft. The intention is to suspend these shutters on all sides of the craft in order that the torpedo or mine may strike the shutter and explode before it comes into contact with the side of the vessel. The idea is that the explosion at a distance of a few feet from the ship would be comparatively harmless.

The protective shutters are to be arranged in such a manner that they will fold up and in close to the sides of the ship when not in use. The apparatus intended to perform this feat is in the nature of a pair of lazy tongs at each end of a section of shutter. This device, in connection with a suitable arrangement of cables and pulleys, is supposed to raise and lower the shutters as well as control the distance between them and the vessel.



A Metal Basket. A Machine that Remembers. An Automatic Fender.

Recent and Improved Devices

Metal Basket Resembles Wood

A metal waste basket, finished to resemble wood so perfectly that it is almost impossible to detect the difference, is being manufactured in Syracuse, N. Y. No screws or rivets are used in its construction. The bottom can be pressed in, the top rim removed and the sides collapsed, so that the basket can be shipped in a flat bundle. The baskets are finished in mahogany, oak and olive.

A Machine That Remembers

A machine which will remember the date and hour of an appointment made several weeks previous is one of the latest efficiency devices to be placed on the market. A roll of paper strip passes over a flat surface where the appointment is indicated and a punch mark made in the margin. When that time occurs a gong is sounded and a reference to the strip will give the information as to what appointment is to be kept.

A Telescopic Fender

A telescopic fender for automobiles which recently won third place at the New York Invention Show is shown in one of the drawings. The instant a body touches the bumper a curtain drops in front so that it is impossible for the body to be crushed or injured by the wheels. This device, when struck, automatically shuts off the magneto so that the car comes to a standstill.

Further Details Concerning the Phonoscope

In the April issue of THE WORLD'S ADVANCE there appeared a short article telling of the newly invented "phonoscope"—an instrument for rendering sounds of speech and music recognizable to the eye. Additional details have recently been secured through the kindness of Mr. S. B. Banerjea of Calcutta, India.

The phonoscope is the invention of Dr. Fournier Dalbe, professor of science at the Government College, Lahore (Punjab), India. It consists essentially of a sensitive monometric flame of acetylene gas, mounted close to a brass disc in which are bored a number of holes arranged in concentric circles. A small electric motor rotates the disc at a constant speed. When sounds are spoken or sung into a small trumpet attached to the instrument, the revolving disc appears to break up into a number of patterns that vary instantaneously with the variation of the sound, however slight. By means of the phonoscope,

Space does not permit these interesting devices to be described at greater length. However, any reader desiring more detailed information concerning devices described in these columns can secure it upon request.

Electric Motor for Dentists. Go-Cart with Curbstone Wheels. A Novel Wrench.

persons who are totally deaf are able to observe the sounds of speech and music by means of the eye. The phonoscope may be considered to be a companion instrument to the optophone; the latter enabling blind persons to read by means of the ear. Dr. Dalbe's invention is very recent and it is said that only his students and a few fortunate outsiders have been permitted to see it. It is expected that he will shortly exhibit it to the public.

Tiny Motor for Dentists' Use

A motor which is said to be the smallest one in the world used for commercial purposes is employed by dentists for drilling operations on the teeth. A marked advantage of this little motor, which makes it peculiarly valuable to the dentist, is its unobtrusiveness, in decided contrast to the usual formidable dental engine which frightens the nervous patient and creates the fear of painful grinding and drilling. The weight of the motor is only five and one-quarter ounces. It consumes 12 watts and runs at a normal speed of 1,500 revolutions per minute.

Curbstone Wheels on Go-Cart.

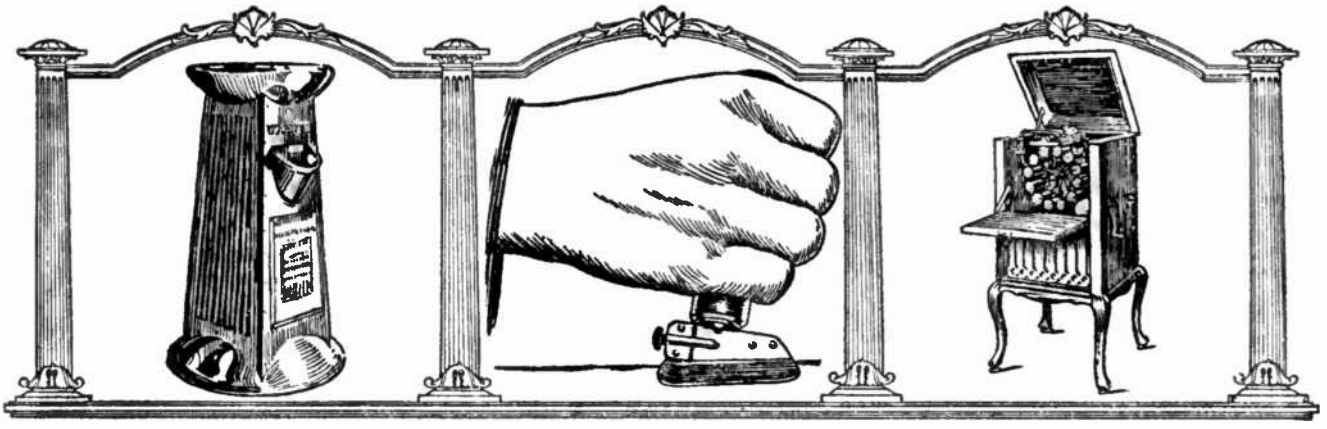
An Ohio inventor has devised a go-cart with small wheels in the rear by means of which it may be pulled up over the edge of curbstones without jarring the child. The curbstone wheels are small, supplemental wheels that project back of the carriage, and ordinarily do not extend much more than half way to the ground, but which assist in lowering or raising the main wheels over curbstones and steps. The go-cart may be folded up when not in use, so as to take up but little room.

A Novel Wrench

A wrench which is adapted to fit hexagonal nuts of any size has recently been put on the market. Adjustment is made by a notch in the handle, into which fit the links of a chain. The chain is wrapped around the nut, pipe or part to be gripped, tightened and slipped into the notch. A pull of the handle in the proper direction will cause the jaw to tighten and grip the object in a vise-like hold. The wrench is either right or left handed.

The Specific Gravity Balance

In the ordinary specific gravity balance the substance under investigation is weighed in water, and from the weight of the water displaced the specific gravity of the substance is calculated. There has been devised by Professor A. F. Rogers of Stanford University a balance which does away with the necessity of a calculation. The specific gravity of the substance weighed is read directly from a graduation on the beam of the balance. In practice, with specimens of mineral weighing only two or three grams, the indications have been found accurate to



A Sanitary Cuspidor. A Box-Opening Knife. Phonograph of New Design

about two units in the second decimal place.

A Sanitary Cuspidor

A neatly finished brass and aluminum receiver, intended to be used in place of the unsightly cuspidors and waste baskets commonly seen, has been devised for service in hotels, depots and other public buildings. A bowl is placed at the top, while chutes open at the sides for waste paper, pealings and other rubbish. The bowl is fitted with a brass rim which contains a perforated pipe connecting with the water system, so that the bowl is rinsed continually.

A Box-Opening Knife

An ingenious knife for opening pasteboard boxes and sealed cartons without danger of cutting ones fingers or projecting the knife into the contents of the box has been invented in Connecticut. The knife is a short blade projecting centrally from an angular shoe, the sides of which are placed at right angles to each other in order to form a channel that runs smoothly along the edge of the box while the blade slits its edge. The blade is adjustable in order to regulate the depth of the cut. Different sizes of cutter blades are contained within the handle.

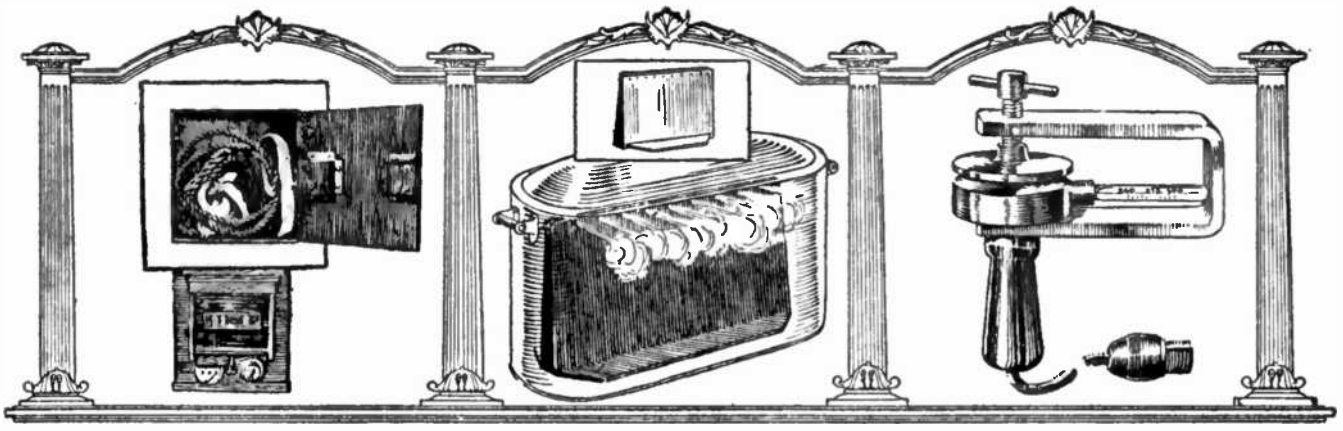
THE WORLD'S ADVANCE is your magazine—edited especially to meet your desires and pet hobbies. Is there anything you have in mind which would improve it?

Phonograph Plays Continuously

A phonograph which will play twelve different records in succession by an arrangement of automatic mechanism has recently been put on the market. The records are of the cylindrical type and are attached to twelve arms which radiate from a central shaft. The motor is wound, a button is pressed and the twelve records play automatically. The makers of the "Autophone," as it is called, claim a minimum of sound distortion—that the resultant music faithfully reproduces the original.

The British Radium Safe

Radium being incomparably more costly than gold—its price being quoted at more than $3,000,000 an ounce, although no one is prepared to furnish so great a quantity of it—naturally has to be carefully guarded, and a special safe for this most precious of metals was some time ago constructed for the British Radium Corporation. The safe-maker had to "face his defenses both ways." To defy burglars' tools he had to have walls of steel, and to keep the radium emanations from escaping he had to construct an interior cage of lead—lead being practically the only metal not penetrable by the rays. Another difficulty to be overcome was the construction of a door that would prevent the loss of emanations when it was opened. Valves are fixed in the door, through which tubes of mercury can be passed for the collection and storage of the emanations.



A Combination Fire Alarm. Wash Boiler Attachment. A Low-Voltage Vulcanizer.

A Combination Fire Alarm Box

A departure from the ordinary types of fire alarm boxes is shown in one of the illustrations on this page. Breaking the glass in its cover will not only permit the alarm being registered at some centrally located point, but upon opening the door a rope and harness are found which are to be used in escaping from the burning building.

Makes Washing Machine of Wash Boiler

The cumbersome mechanism of the usual rather costly washing machine is entirely done away with in a simple device which may be attached to a wash boiler. It consists of a wedge-shaped metal box, flared at the bottom and punched with a number of small holes at the top. Water is heated in the bottom of the wedge, so that the steam generated forces twenty streams of boiling suds into the clothes, thoroughly cleansing them.

A Low-Voltage Vulcanizer

A new vulcanizer, which is compact and well made, will operate on a six-volt storage battery. The total weight, including the carrying case, is about two pounds. A thermometer is attached to the base in which the heating coil is placed, its use there being to regulate the heat, which under ordinary conditions should be maintained at 275 degrees.

Demand for Alligator Skins and Oil

For a long time the demand for alligator skins has been so great that the manufacture of serviceable imitations has attained a point where even experts are sometimes deceived. At least such is claimed to be the case in Europe, where "alligator" skins that grew on the backs of sheep are passed for the genuine article. In order to increase the supply of the real skins, the possibility has been considered of raising alligators in certain of the French possessions.

Alligator oil or grease is also in great demand, especially by the manufacturers of articles made from chamois leather.

Submerged Firing

The Brünler system of submerged firing constitutes a remarkable method of producing steam. The usual method —that is, conveying the heat to the water through the walls of the boiler—is wasteful both of heat and of material. In the Brünler system, a high-pressure gas jet is ignited under the surface of the water in a steam generator of cast steel, and a cast-iron boiler receives the liquid, the steam, and the gaseous products of combustion. The fuel is coal-tar oil. It is said that a firm of chemical manufacturers in Germany has used a Brünler boiler with great success.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us. Why not hand this copy to a friend after you have read it through?

A PORTABLE PRINTING CABINET

By Robert C. Schimmel

Ordinarily the photographic amateur has little available working space. The basement is usually very damp in the summer and the attic very cold in the winter. A portable printing and developing cabinet, accordingly, will be of interest to the average amateur.

The cost of building a cabinet depends, of course, on the amount of material that the maker has on hand. A list is given below of the materials that will be required.

FOR THE FRAME.

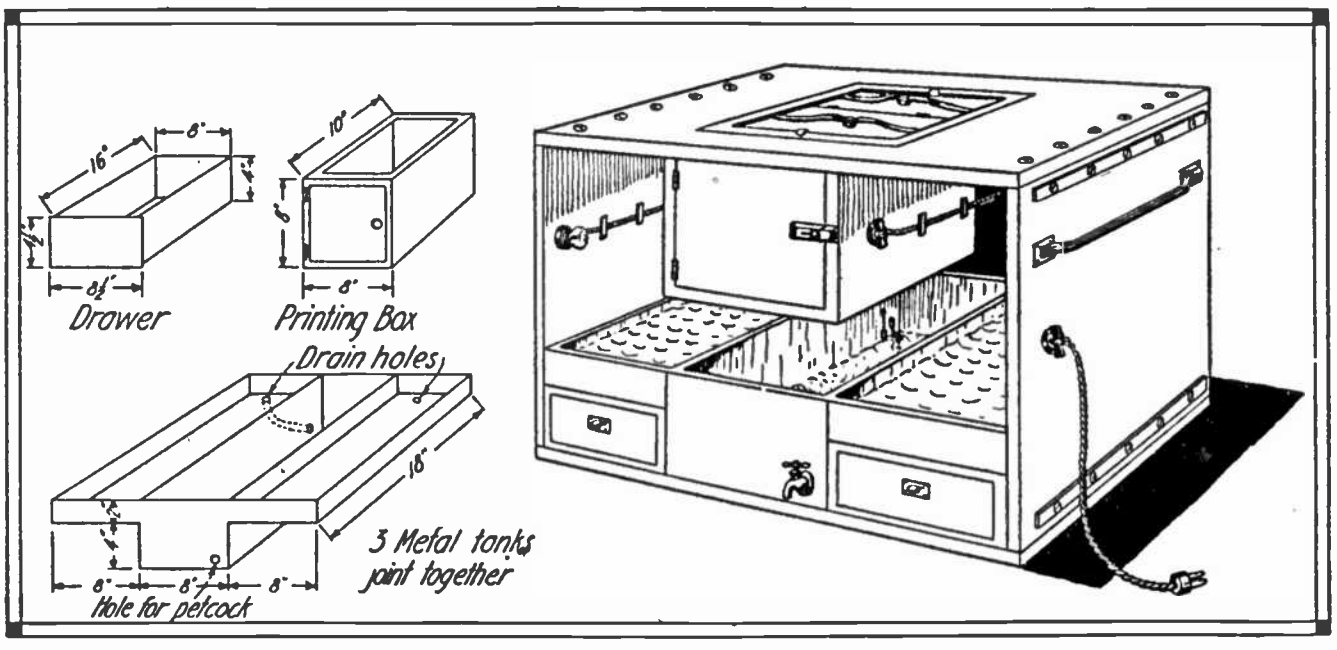
Six 2 ft. poplar 9″ x ½″
Four 18″ poplar 9″ x ½″.

FOR THE DRAWERS.

Two 8½″ poplar 4½″ x ½″.
Four 16″ poplar 3½″ x ½″.
Two 16″ poplar 8″ x ½″.
Two 7″ poplar 3½″ x ½″.
Two 6″ lengths ¼″ lead pipe.
Two snap switches.
Ten feet lamp cord.
One plug.
Two small corks.
One small pet cock for water tank.
Two small hinges for printing cabinet door.
One box of one-inch *brass* flat-headed screws.

METAL WORK.

Two 18″ x 6″ galvanized iron. (Medium weight.)



Two 8″ x 6″ galvanized iron. (Medium weight.)
Four 8″ x 2″ galvanized iron. (Medium weight.)
Two 18″ x 2″ galvanized iron. (Medium weight.)
One 8″ x 10″ printing frame.
Four wall sockets.
Two carrying grips.

The material for the printing box depends solely on what sized pictures the maker wants

to print. The dimensions given are for an eight by ten printing frame.

PRINTING BOX

Two 8" x 8" x ½" poplar.
Two 8" x 10" x ½" poplar.
One 9" x 11" x ½" poplar.

FOR JOINING FRAME.

Four 2" x 18" x ½" poplar.

The first part of the cabinet to make is the frame. The completed casing will measure 24 x 18 x 18 inches. Back boards should be cut to cover the joints made by the other boards. The whole should be put together with brass screws, as they do not rust when the wood becomes damp. It is difficult to prevent the wood from warping, for a certain amount of the water in the different steps in developing is certain to be splashed upon it.

The box for the printing frame should be assembled from the four pieces named for the purpose. The printing frame itself should be of the 8 x 10 size. Two small blocks of wood should be nailed a short distance down the side of the box in order to hold the frame in place. Two tungsten lamps will be necessary to print the pictures, and a small 4 c.p. red light should be installed as a pilot for the operator in making true and even prints. The arrangement for these lights is shown in the diagram. The red light may be connected to burn continuously; the white lights should be controlled by a switch.

The most difficult part of the task in building the cabinet will be encountered when the metal work is taken up. Unless the builder has had considerable experience along those lines, it is best to give the making of the tanks to a competent plumber. The water tank is the largest of the three and should be made first. The hypo and developing tanks should be of the same size. A quarter-inch hole should be cut in one of the corners of each of the smaller tanks and several feet of lead pipe soldered to them. A stop cock should be soldered over a hole cut in the front of the water tank.

Into the space under each of the smaller tanks, drawers should be fitted. These may be used for storing paper of various grades, negative albums and chemicals.

In wiring the cabinet, a wall socket should be placed above the developing tank for the red lamp. This socket should be provided with a snap switch.

The printing box should be placed under a hole cut in the top of the cabinet and the cracks puttied to prevent light leakage.

Carrying handles should be fastened at each end of the cabinet and the woodwork coated inside and out with gloss enamel.

Head Band for Jewelers' Glass

A head band to obviate the uncomfortable procedure of squinting the eye to hold a jewelers' glass in place can be made from a length of watch main-

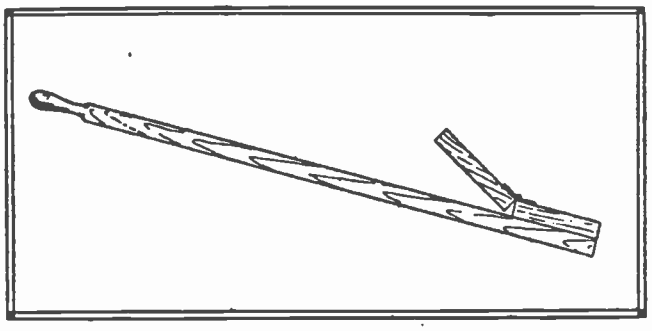
spring. One end of the spring should be riveted. When the glass is not in use it can be pushed up out of the way on the forehead.

Contributed by

JAMES MCINTYRE.

A Home-Made Jack

A home-made jack which may be used for light work is shown in one of the drawings on this page. It consists of a



sound 2x4 scantling about 5 ft. long to the lower end of which a 10″ strip is bolted. A ten or twelve-inch length of the same material should be hinged to the upper end of this block and the opposite end of the scantling whittled off to form a handle.

Contributed by

GLENN G. FOGLESONG.

An Aluminum Moving Picture Screen

A brilliant, aluminum screen for moving picture houses can be made quite easily and the results will be practically as satisfactory as if a high-priced manufactured screen were used.

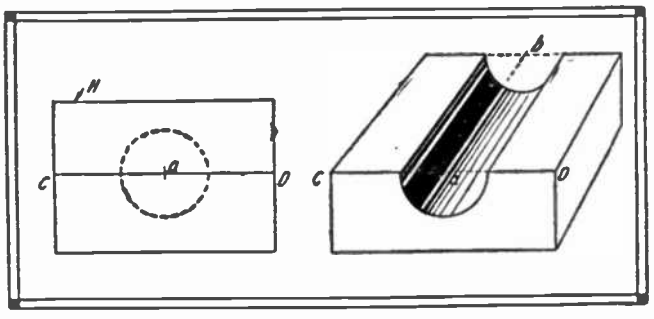
If the screen is to be made on a plaster wall, a coat of white calcimine should be applied and allowed to dry for twenty-four hours. Upon this, one coat of glue size should be applied and allowed to dry from five to eight hours until it becomes tacky—not sticky, but still not quite dry. Aluminum powder should be brushed rapidly over the glue surface with a soft flannel cloth. Afterwards, the surface should be smoothed over with silk or soft flannel.

Contributed by

C. W. SMALLEY.

To Cut Half Circle Across Timber Face

A semi-circle can be cut across the face of timber in the following manner. A line, *A B*, which will be the center of the half circle desired, should be drawn. This line should be cut to a depth of 1/16″ with a fine saw. A block, *H*, should be placed on block *C D* and the pieces clamped together. The hole should be started with an expansion bit at *A*. The spur will follow the saw cut.

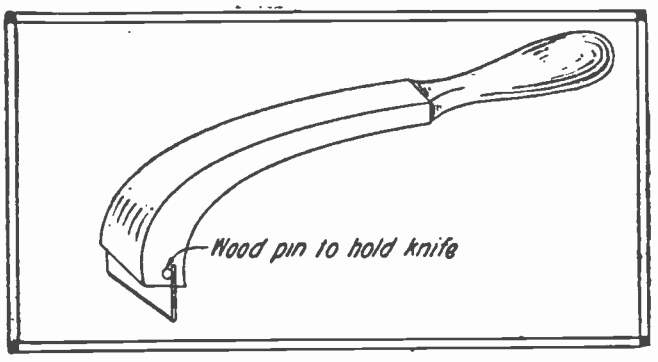


Contributed by

M. D. CROSS.

A Hard Wood Floor Scraper

A scraper for hard wood floors can be made by fashioning a heavy wooden handle and cutting a slot into its lower end in order to insert a blade of some sort. The blade should be held in place by a wooden pin. A sharpened fragment of an old saw will serve for the scraping edge.

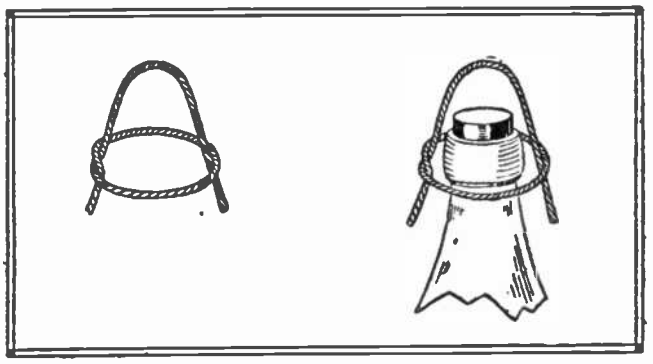


Contributed by

L. M. NIXON.

To Tie a Cork in a Bottle

A cork may be held securely in a bottle if a knot is tied about it and the neck of the bottle, as shown in the accompanying drawing. The ends of the string or cord should be drawn up and tied upon the top of the cork.



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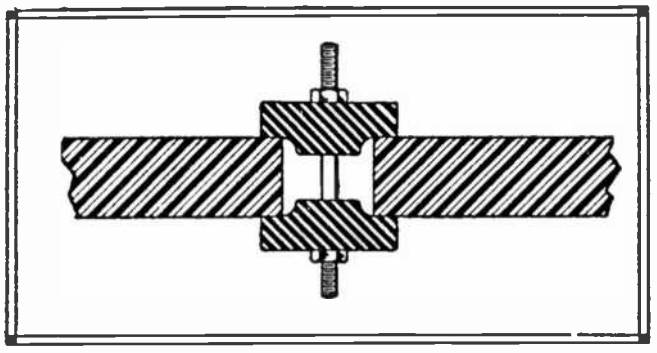


Insulating a Lead through a Switchboard

A lead through a switchboard panel can be well insulated by boring a hole in the switchboard large enough to accommodate the projections of porcelain clamp tops and bolting these together by means of a threaded brass rod. The threaded ends which project should be of sufficient length for making connections to the bus bars or wires.

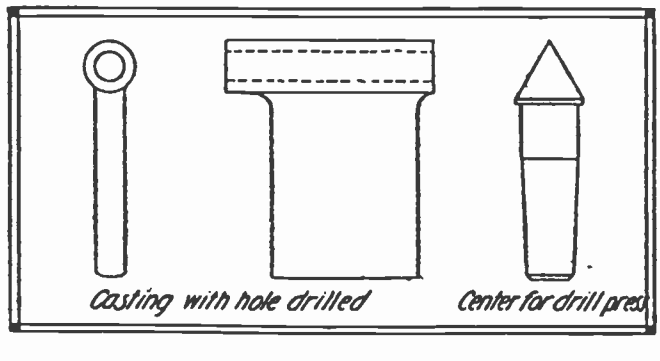
Contributed by

FRANK HARAZIN.

To Make and Use a Center in the Drill Press

Castings of the form shown in the accompanying drawing can be machined in an ordinary drill press if the directions given below are followed. Each end of the part to be bored should be center-punched and the hole drilled from one end to within ⅛ in. of the other end. The holes should be finished by placing the casting on a board, running the drill through—the drill being guided by the length of the hole already drilled—so that the holes come straight with respect to the centre punch marks. A wrench can be used to hold the casting while the operation of drilling is performed.

The writer used a sensitive drill press which embodied a socket on a slide beneath the table in which a cup center or "V" center was held. A taper was turned to fit into the headstock of the lathe. It was then put between centers and turned so as to fit snugly in the drill press socket. This socket had parallel sides. In turning the taper to fit the drill press, part was cut away, but enough was left so that the 60° angle easily turned, the center being held in the head-stock.



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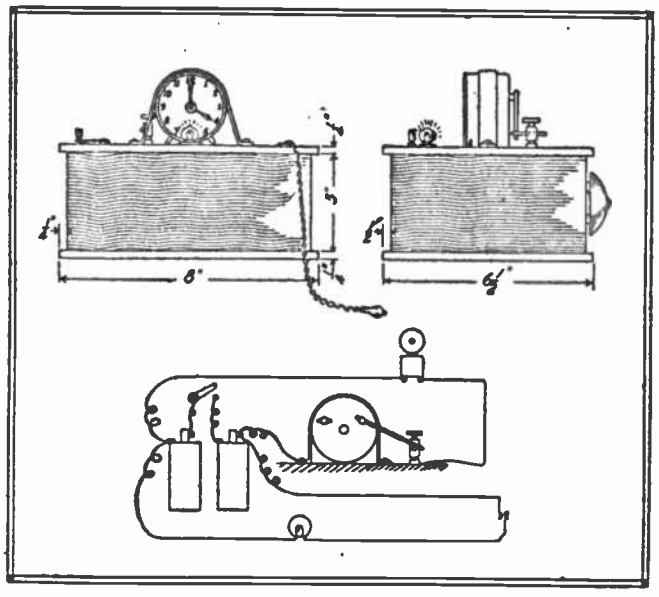
CLARENCE H. ANDERSON.

An Electric Alarm Clock

For the construction of an electric alarm clock shown in the accompanying drawings the following material will be required:



For the mechanism:

Four dry cells, one door bell, one one-point switch, one 2½-volt lamp, 20 ft. soft braided covered wire, one rosette push button, one miniature socket, one binding post, one alarm clock, one brass strip, and two bolts to fasten band to box for holding clock down.

For the box:

Two pieces 6½ in. x 8 in. (for the top and bottom); two pieces 7½ in. x 3 in. (for the sides); two pieces 5½ in. x 3 in. (for the end pieces).

The sections of which the box is made should be beveled at the top and bottom. The switch, socket and binding post should be fastened upon the top board, together with the clock, which is secured by means of the brass strip and two screws or bolts. A short length of wire should be passed through the hole in the

binding post parallel to the side of the box, as indicated in the drawing. A wire should be soldered to the alarm winding key of a sufficient length so that it will rest upon the wire which passes through the binding post when the alarm goes off. This completes the circuit and causes the electric bell on the back of the clock to ring until the switch is turned off.

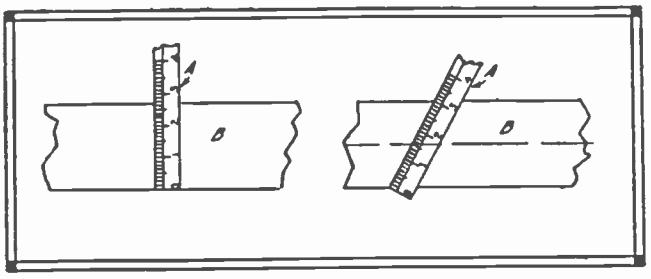
In a dark room, the time may be found by pressing the button of the rosette and lighting the bulb, which illuminates the dial.

Contributed by

LOUIS WOLDMAN.

Finding Centers of Boards

The center of a board of uneven width may be found quite easily by placing the end of a ruler at one edge and swinging it until one of the inch marks is opposite the other edge. This number should



be divided in half. The dividend, when found on the rule, will mark the center of the board exactly.

Contributed by

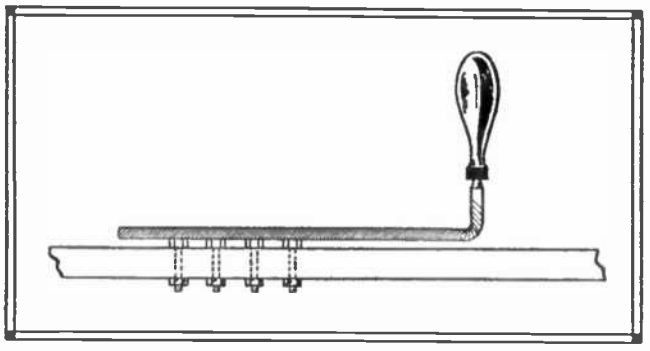
DELBURT SAGE.

Repairing Rubber Boots

A cracked rubber boot can be repaired much in the same manner as is followed in mending inner tubes. The surface about the crack should first be sandpapered and cleaned with gasoline. A section of inner tube vulcanizing gum about ½ inch larger than the hole should be cut and cleaned with gasoline after the cloth covering is removed. It should be held in place over the hole and vulcanized in the usual way.

Contributed by

CLARENCE O. WHEELER.



A Handy File

Difficulty to an exasperating degree is usually encountered when an attempt is made to file projecting bolt heads, switch points or nail points with an ordinary file. To prevent the difficulty, the file should be softened at a point near the handle in the flame of a torch, and bent to form a sharp right angle.

Contributed by

FRANK HARAZIN.

To Remove White Spots From Varnish

If a cloth of soft texture is rubbed briskly enough over a milky spot on varnish the heat generated by the friction will heat the varnish and cause the spot to vanish.

Contributed by

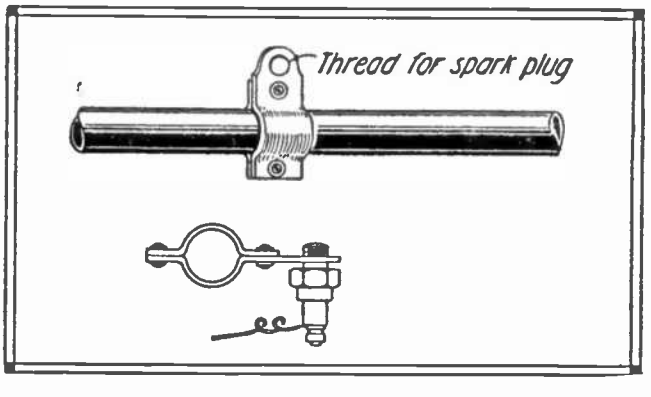
A. STANLEY WIENOLD.

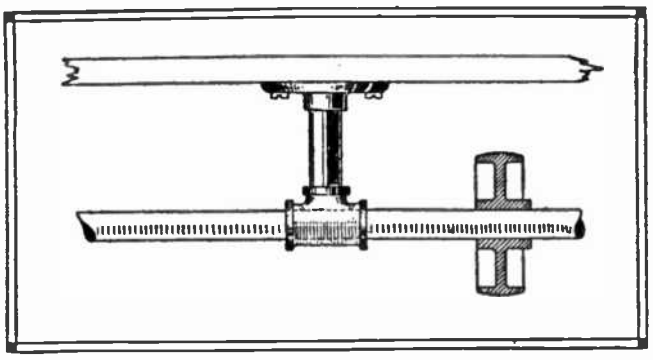
Spark Plug Testing Rest

Instead of following the usual inconvenient procedure in testing motorcycle spark plugs of holding them in the hand or laying them on the frame, a small clamp, with a projecting flange bored to contain the spark plug screw, may be fastened to one of the pipes of the engine.

Contributed by

A. ANDERSON.





Shaft Hanger for Pipe Fittings

A good pipe hanger can be made from pipe fittings. The pipe through which the shaft runs should be babbitted and reamed to size, and the other parts fitted, as shown in the drawing. Two oil holes should be bored in the top of the bearing pipe, and, if desired, an oil groove cut in the babbitt metal.

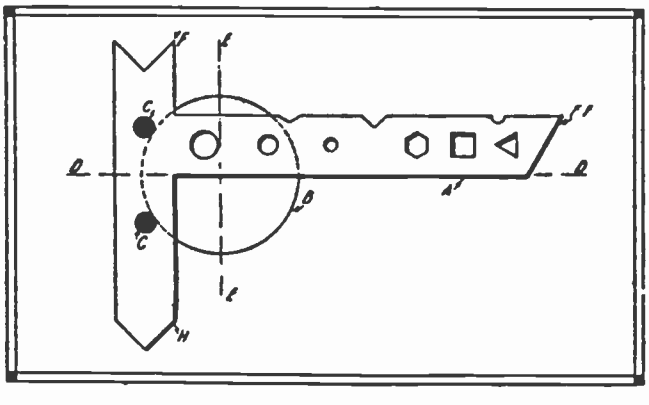
Contributed by

R. E. NELSON.

Combination Center Square

A center square for locating the center of round stock can be made from a plate of sheet steel cut to shape shown in the drawing. It should be ⅛" thick, and cut to form a perfect right angle. Two stationary pins, *C C*, should be cut from ¼" iron rod and riveted to the head of the square, *A*. The ends of the square, *H* and *F*, are used for center gauging; the end *D* is used as a miter. The square, *A*, should be provided with three holes for drill gauges, one of them six-sided or hexoganal; another square, and the remaining one triangular. Notches should be cut in the side of the square for thread tool gauges.

The method of using the tool in marking round stock is as follows: Lines should be scratched across the end of the stock from *D* to *D*, then from *E* to *E*. The intersection of these lines makes the center desired.



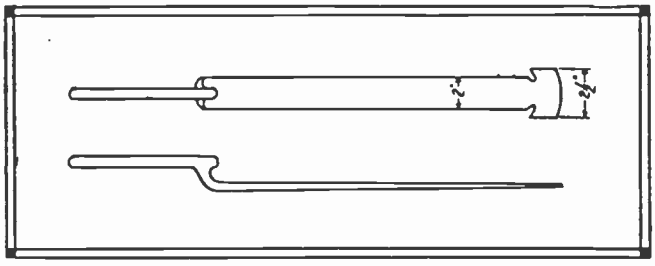
Contributed by

ARTHUR L. KERBAUGH

Chisel for Shingling

A shingle chisel can be made from the blade of a steel square with the cutting end drawn out ⅜ in. and a slot filed, as shown in the accompanying sketch. The handle should be fashioned from ⅝ in. steel stock and welded to the blade so that an offset of about ¾ in. results. The cutting end should be tempered hard enough to cut off nails.

The object of the handle offset is that



it may be raised above the butts of the shingles, so that the chisel may be driven out easily, and if the hook is over a nail, it will pull it out.

This tool will not split the old shingles in removing them and it will extract all of the old nails without disturbing the other shingles.

Contributed by

WM. ALBIN.

New Idea for File Handles

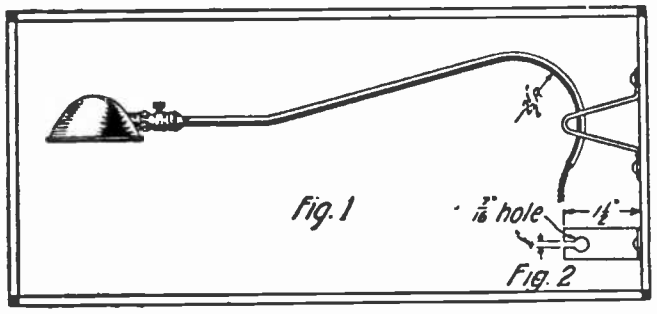
Handles for small files and chisels can be made from the wooden part of the ordinary bundle carrier. After the wire is removed and the hole plugged, the tang of an old file should be heated red and a hole burned in the end of the handle to a depth not quite that desired for the tang. The tang should then be driven in tightly. The fact that the hole has been previously burnt will prevent the handle from splitting. Handles for larger files can be made by the same method from the handles of old pails and tubs.

Contributed by

CLARENCE H. ANDERSON.

Adjustable Lamp Bracket

An adjustable lamp bracket which will be suitable for the workshop or laboratory can be made by bending a length



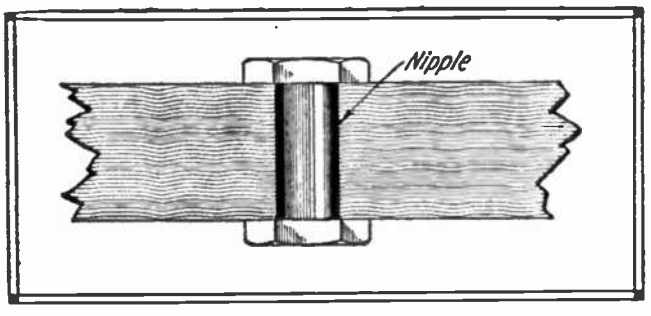
of 3/8 inch brass tubing, such as is commonly used in electric light fixtures, into the shape shown in Fig. 1, attaching a socket to one end and passing the other end through a bracket. This bracket, Fig. 2, should be made from a strip of No. 10 or 12 gauge sheet brass, 4½ in. long and ¾ in. wide, bent as shown. A 7/16 in. hole should be drilled through both sides, about ½ in. from the end, and a ¼ in. slot cut as shown. Two small holes should be drilled in the shoulders for mounting purposes. To complete the lamp, the wires are to be inserted through the slot and the brass tubing placed in the bracket.

Contributed by

C. P. CLEARY.

Metal Bushing for Wooden Pulleys

When it is desired to insert a metal bushing into a wooden pulley, lever or wheel, for the purpose of rotating it on a bolt, a pipe nipple with an inside diameter equal to the diameter of the bolt can



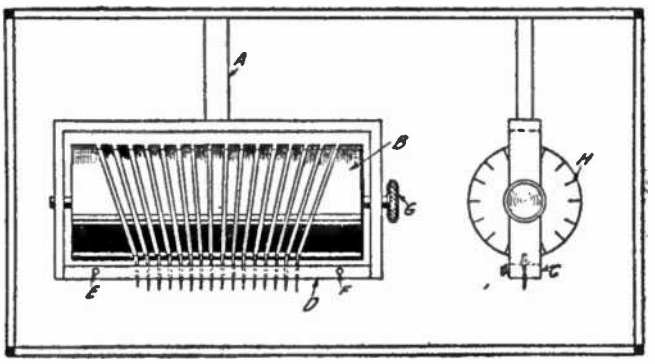
be used. A pipe flange screwed on each end will hold the nipple rigidly in place.

Contributed by

WM. HALK.

Spacer for Use in Drafting

This spacer should be found quicker and more accurate for laying off rack teeth, bolt threads and similar measurements than ordinary dividers. Its use overcomes the trouble frequently experienced in spacing equidistant points along a line with dividers. It consists of a rectangular frame, *A*, in which is pivoted the groove cylinder, *B*. A beveled piece, *D*, is fastened to the lower bar of the frame by means of set screws, *E* and *F*. In the spaces between these two bars a number of cross-shaped prick needles are inserted. The unpointed ends of these needles should fit with surface contacts within grooves on the cylinder. The grooves converge from their widest spacing toward a common apex. Hence they are equidistant along all elements of the cylinder. By turning a thumb screw, *G*, the cylinder in revolving slides the prick points nearer or farther apart according



to the direction of the motion, right or left. An index plate, *H*, on the end of the cylinder, gives the spacing per inch. The smallest spacing to which the needles may be set is limited by the width of grooves and interspaces. Allowing a width of 1/64 in. for each groove and another 1/64 in. for each interspace, a spacing of 1/32 in. is obtainable.

No difficulty is encountered in obtaining larger spacing than those indicated on the dial, as the needles may be set to the multiple of any desired spacing, then, by skipping the necessary number of intermediate points, the required spacing is arrived at. The application of this procedure reversed will give smaller spacings than are possible on the cylinder. In this case the needles are set to ½ of the required points per inch; then, by two applications of the needles

to the line, the second being half the spacing of adjacent needles in advance of the first application, a very exact result is obtained.

Contributed by

DANIEL MOLONY.

To Drain a Boat—Bore a Hole in the Bottom!

During a race on the Allegheny recently one of the motor boats, a light racer, was found to have sprung a serious leak. It was not equipped with draining equipment or a power pump of any kind. The hand pump was insufficient. The engineer hurriedly bored a hole slanting astern in the bottom of the boat. No sooner was the bit drawn from the hole than the suction of the water rushing by beneath completely drained the boat. Then a wooden plug was inserted. During the remainder of the race this plug was removed at intervals and the boat was drained effectually each time.

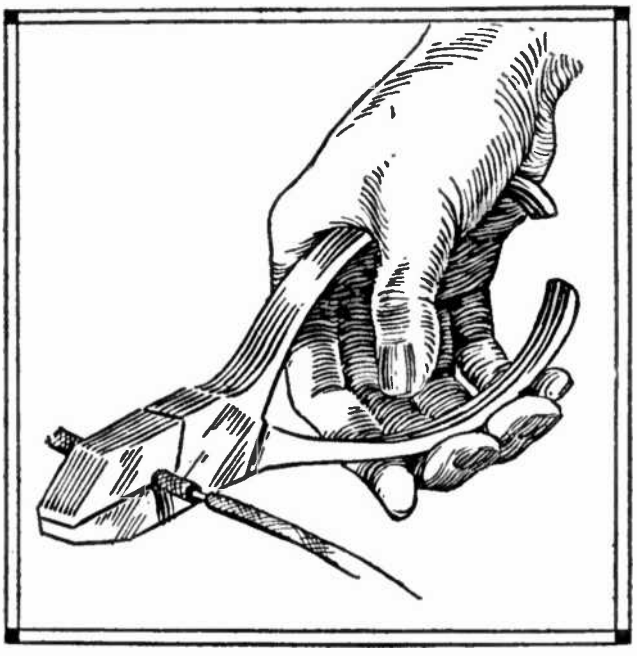
Contributed by

JOSEPH J. STEEDLE.

Wire Cutters to Remove Insulation

If a small hole is filed in the cutting edges of pliers, the insulation of wires can be easily cut without injuring the wire.

Contributed by L. L.



Hatpin Protector

A protector for hatpin points can be made from a tapering tube, sealed at the thick end and fitted with a light spiral spring running the entire length and forcing a ball bearing over the small opening. When the hatpin is inserted, the spring forcing against the ball will exert sufficient pressure against the shaft of the pin so that it can only be withdrawn with difficulty.

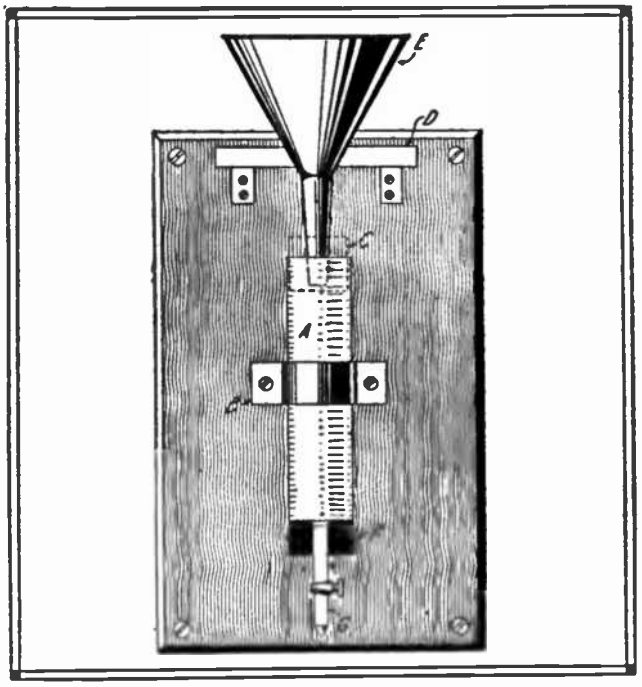
Contributed by

JAMES MCINTYRE.

To Purify Mercury

When mercury is used for experimental purposes it frequently becomes contaminated with other metals. For most purposes it is of the greatest importance that these impurities be removed. A simple plan for accomplishing this is to allow the mercury to pass through dilute nitric acid in a fine stream. The apparatus described here can be made quite easily and may be used any number of times. It may be made in a suitable size for the work required.

The accompanying drawing shows the various parts attached to a baseboard. Glass tube *A* is held in a vertical position by a brass saddle *B*. This tube should have a capacity several times greater than the volume of the mercury to be handled. The upper end should be closed by a removable cork *C*, to exclude dust



when not in use. A wooden bracket *D* should be attached to the baseboard above the tube for the purpose of supporting a glass funnel. The end of the stem of this funnel should be cut off square and held in the flame of a bunsen burner until the aperture is very small. The lower end of tube *A* should then be closed with an india rubber cork *F* very securely held in place. A glass tap fitted with a valve at its lower end should pass through the cork.

When this apparatus is to be used the cork *C* should be removed and the mercury to be purified poured into the tube. The tube should be filled to within an inch or two of the top with dilute nitric acid. Twenty or twenty-five per cent. acid is desirable. The mercury should be drawn from the tube by means of the tap *G* and poured into the funnel. From here it will flow in a fine stream through the acid and be thoroughly purged of all impurities. When the mercury has settled in the bottom of the tube it may be drawn off into a beaker from the tap. This cleansing process should be repeated several times in order that the acid may take full effect. Afterwards the mercury should be freed from the acid by washing with clear water. It may be dried by heating to a temperature of 212 degrees F.—the boiling point of water—in a non-metallic vessel.

Contributed by H. JOHN GRAY.

Another Furniture Polish

A few grains of butter of antimony added to a bottle of ordinary sewing machine oil makes an excellent brightener for old furniture or scarred varnished surfaces. It is easily made and one bottle will cover a great deal of surface. Apply sparingly and rub to a polish with a soft rag.

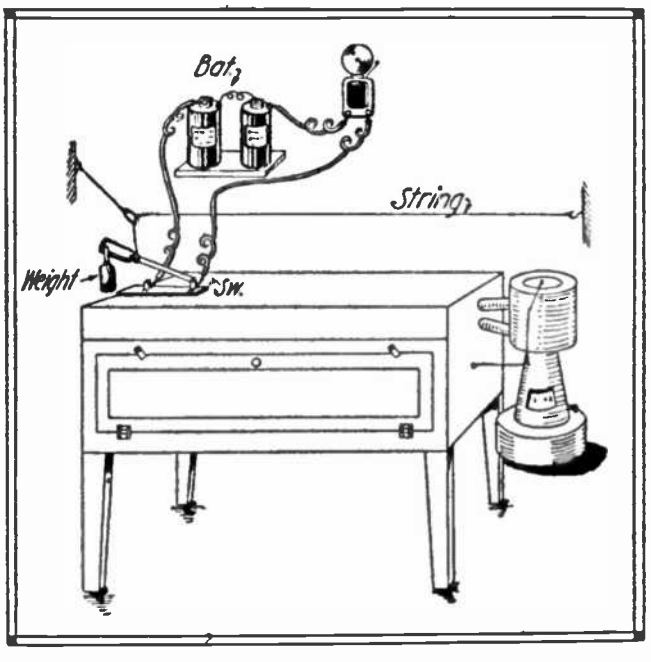
Contributed by
LOREN THOREAU WARD.

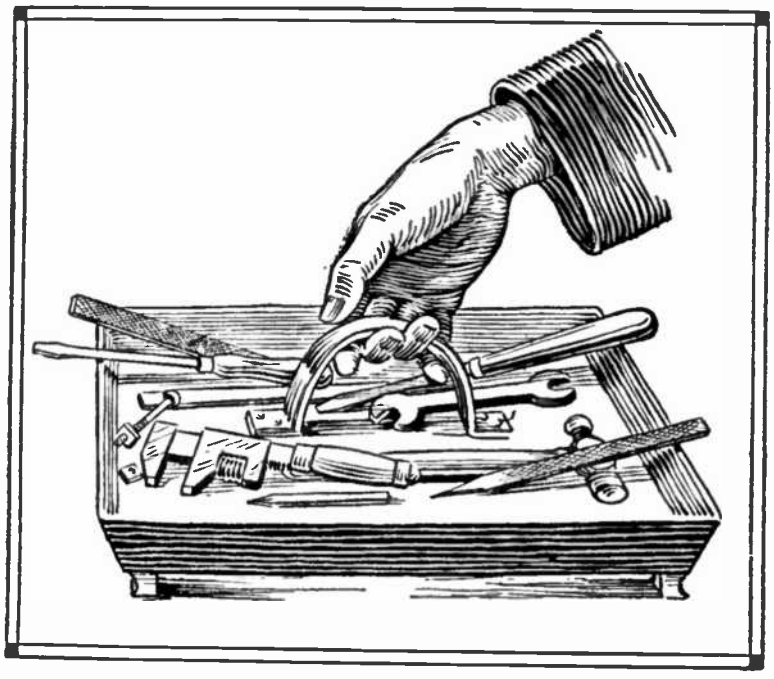
Fire Alarm for the Incubator

Incubators nowadays are built in a way that usually banishes the fire hazard. However, some danger of fire is always present in a gas or oil heated incubator. A suitable design for a fire alarm which will serve to call the owner should an incubator catch fire, is described in the following:

Fasten a long-bladed knife switch to the top of the incubator. The pivot of the switch should be adjusted until the blade works very easily. A light cord should be strung a few inches above the incubator and fastened to the wall by means of a screw-eye. The other end of the cord terminates at the handle of the switch. If the incubator should burn, the flames will ignite the string, the weight on the switch handle will cause the circuit to be closed, and the bell, which could be located in any part of the house, will ring the warning.

Contributed by F. E. POISTER.





Portable Tool Box for the Workshop

A portable work box for the shop can be made in the following manner. A board about ten inches wide should be dressed and a handle fastened exactly in the center. Sloping metal sides should be nailed to the edges of the board and soldered or welded along the seams. Small legs can be added, if desired, to support the box.

Contributed by

J. N. BAGLEY.

Hints for Erecting Fence Netting

When netting is unrolled it works into a circle for the reason that the wires passing through the inner edge are strained tighter than those passing through the outer edge. The result is that when the netting is straightened the upper edge is tight, while the lower edge is loose and bulging. This seemingly undesirable feature may be taken advantage of by putting up the netting with the loose edge along the ground, so that it will conform with the irregularities of the surface.

In some soils the netting rots rapidly. This can be overcome by tarring the bottom edge. Coal tar should be placed in a tub or similar vessel to a depth of seven or eight inches. The roll should be placed in this liquid, bottom down, for several minutes and then raised by a block and tackle and allowed to drain.

Staples mean the destruction of netting when stock push against it. At the straining post a wire should be passed in and out through the mesh and fastened to the post with nails.

The old method of unrolling a coil of netting was to draw it out over the ground. An improvement can be made by passing a bar through the roll, a man grasping each end and carrying the coil, which pays out freely.

Contributed by

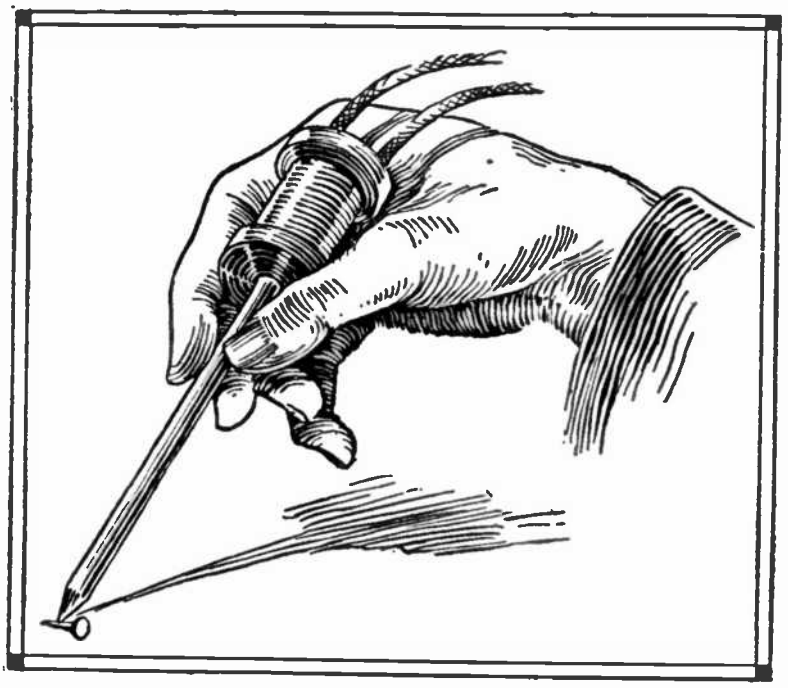
LEONARD KEENE HIRSHBERG.

Hand Magnet Picks Up Tacks

A hand magnet for picking up tacks and filings can be made from a steel spike and a bobbin of coarse magnet wire held in place at the head by insulating tape. One or two dry cells will provide the necessary current.

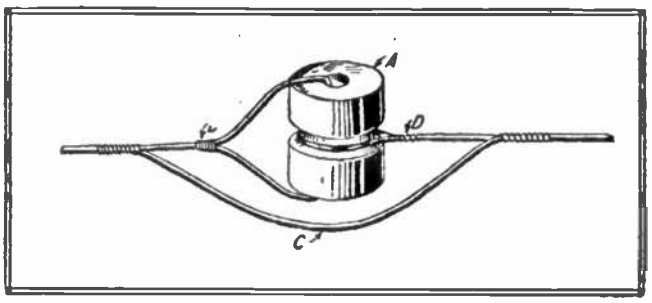
If the reader possesses a fair amount of ingenuity, he may arrange some sort of switch in the magnet circuit so that the hand will automatically turn on the current. This will save the battery.

Contributed by L. L.



Stops Hum of Telephone Wires

The unpleasant humming of telephone wires can be prevented by inserting a porcelain knob, *A*, in the circuit and



bridging the short length of wire, *C*, around it. The splices, *B* and *D*, should be carefully made and soldered.

Contributed by

B. SCHUMM.

To Lift Driving Wheels

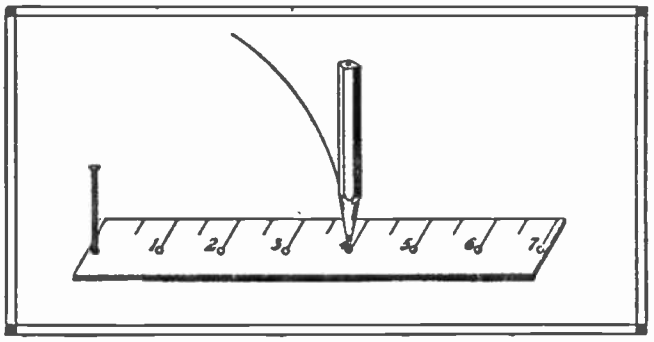
A device to lift heavy driving wheels in pairs from one part of the shop to another is illustrated herewith. The cross bar of the dimensions shown is far superior to the older method of using chains alone, as it relieves the shaft of all bending strain and the turned up ends of the bar eliminate all possibility of accident through the wheels slipping off the bar.

Contributed by

JOSEPH K. LONG.

Drawing Circles with a Ruler

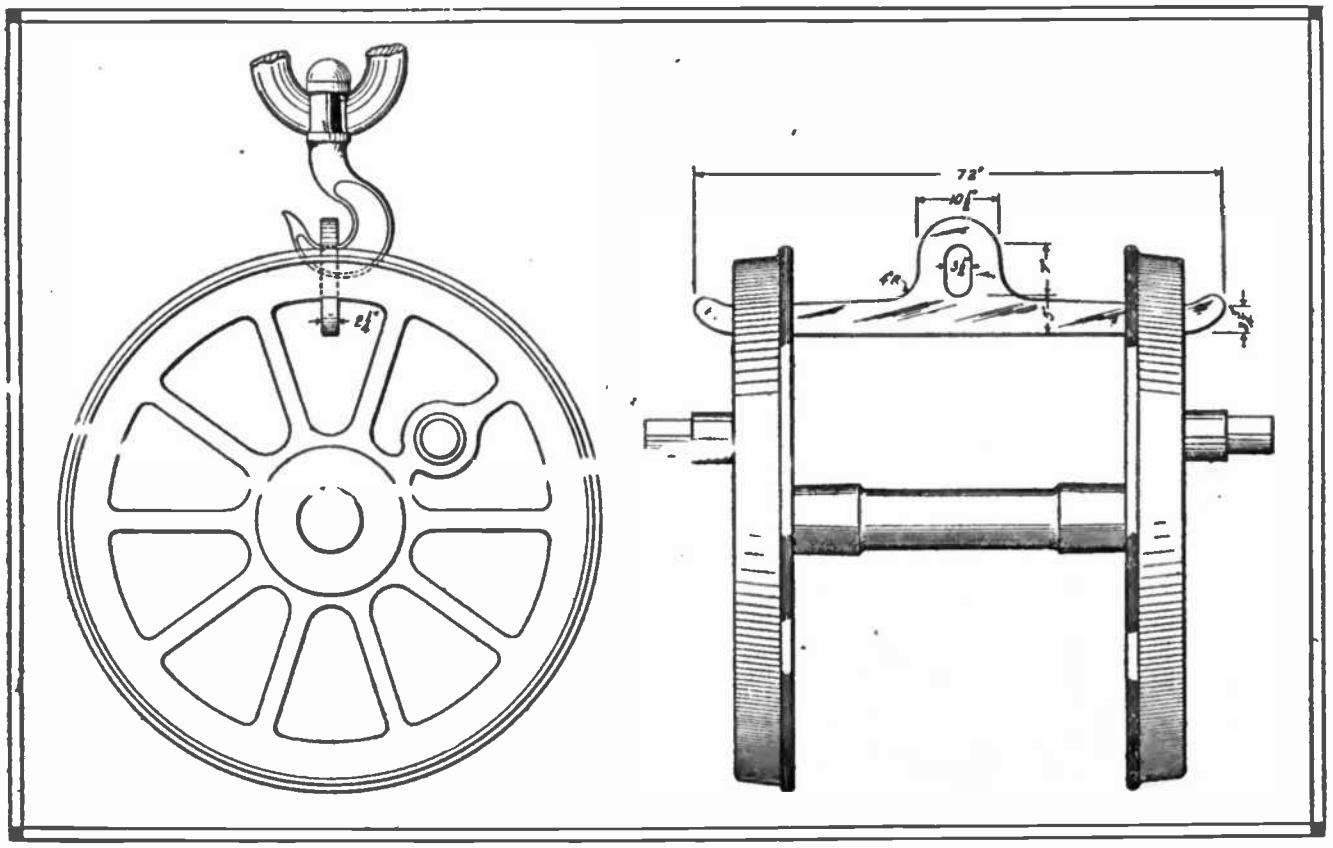
A small pocket rule may be used as a compass with the aid of a pencil and an ordinary pin. A small hole should be drilled near the end of the ruler just large enough to admit the pin. Holes as large as the point of a lead pencil should be drilled through the rule at various markings. By placing the pin in the first



hole, the pencil point in one of the others and swinging the rule, a circle may be drawn.

Contributed by

HAMILTON A. HOOPER.

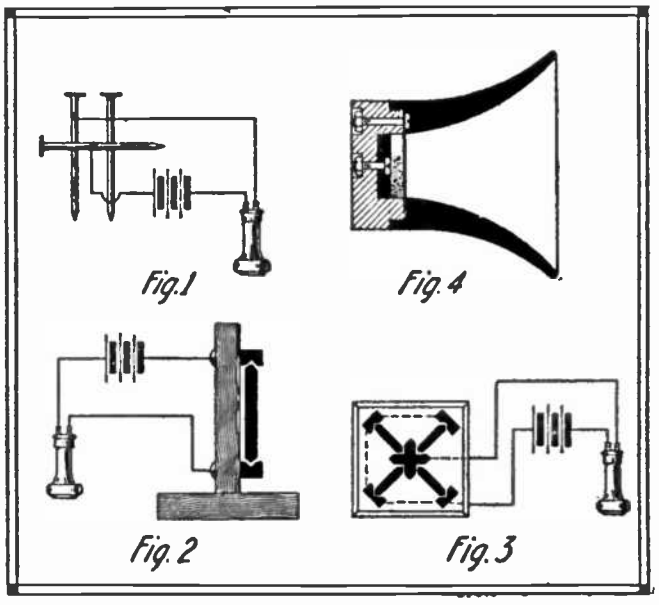


SOME SIMPLE MICROPHONES

By Kenneth Kirkwood

Microphones play a most important part in modern telephony, and for this reason the amateur should know something about them.

Probably the simplest form of microphone consists of two bright wire nails across which a fine wire or another nail is laid. The next simplest type is one which is known as the Hughes microphone. It makes use of a slender carbon rod fitted loosely between two carbon sockets on a suitable stand, as is shown in Fig. 2. The carbon rod should have pointed ends which fit into small holes drilled into each of the supports. The wires should be connected to the two end carbons. This is a more sensitive instrument than the first



Following these types, which were developed early in the career of telephony, came a number of improvements which embodied the same general principle but greatly increased the efficiency. The Crossley is one of a group of microphones which utilize carbon rods, as in the Hughes, but employ a number of rods and sockets in each instrument. This is illustrated in Fig. 3. The Crossley microphone can be made extremely sensitive. On account of the flat surface, this instrument can be placed on the under side of a table in any desired position. The series of rods may be mounted on the back of a picture hanging on the wall, and used as a dictograph for secretly listening to conversations. A thin box—a cigar box, for example—may be fitted with this microphone by placing the carbons on the back of a large, thin diaphragm which serves as the lid of the box. The diaphragm should be made of some light insulating material, such as wood veneer or hard rubber sheet. The box may be hung up over the desk or work table of the experimenter, who can thus talk directly toward the wall in front of him in order to telephone.

Following the Crossley type of microphone came the Hunnings, the first of the modern forms of telephone transmitters. In this instrument, the words are spoken into a funnel-shaped mouthpiece leading to a thin metal diaphragm which imparts the sound vibrations to a collection of carbon balls, granules or powder. A transmitter of this type is shown in Fig. 4. A number of improvements have been added to this type of microphone from time to time, but the general construction remains the same. This is the type most commonly used at the present time.

A very sensitive type of microphone is described in the February, 1915, issue of this magazine.

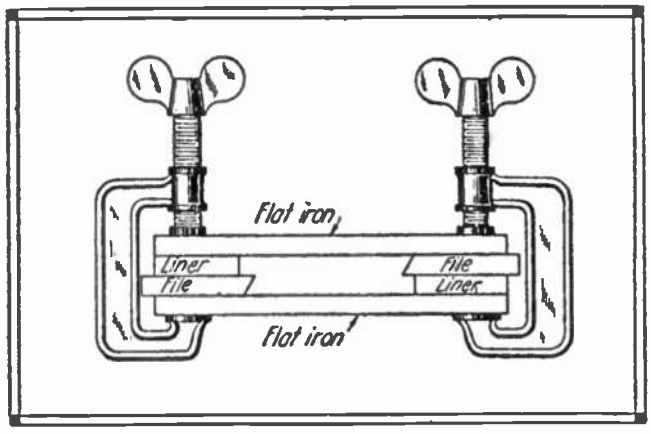
To Hold Long Board in Vise

A long board may be held securely in a vise if a hole is bored some distance away in the side of the bench and a wooden peg, or pin, inserted in it. One end of the board should be clamped in the vise and the other end allowed to rest on the peg.

Contributed by

DONALD OLSON, JR.

Have you any original ideas for this department? Why not send them in and be paid at space rates?



Shoulder Cutter for Wires or Rods

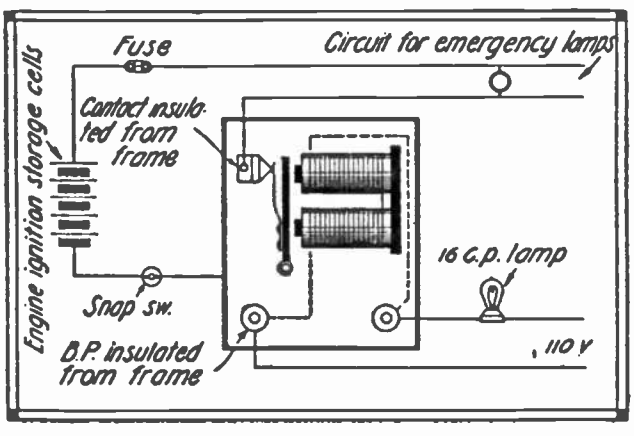
It is sometimes necessary to cut a shoulder on a rod or a length of wire. A simple tool for performing this operation rapidly can be made by grinding cutting edges on the ends of two pieces of a flat file and lining them up between strips of flat iron. They should be wedged tightly, as shown. It is obvious that the cutters are readily adjustable for large or small shoulders. The rod may be held in a chuck and should be pointed before feeding into the cutter. If the rod cannot be held rigidly, a block of steel with a V cut into its end, fastened to one of the liners, will simplify the work.

Contributed by

WM. HALK.

Battery Emergency Lamps Controlled Automatically

In small power plants the possibility of accidents to the generating machinery is always present. To forestall the confusion occasioned by the darkness which results, an automatically controlled battery lighting system should be provided.



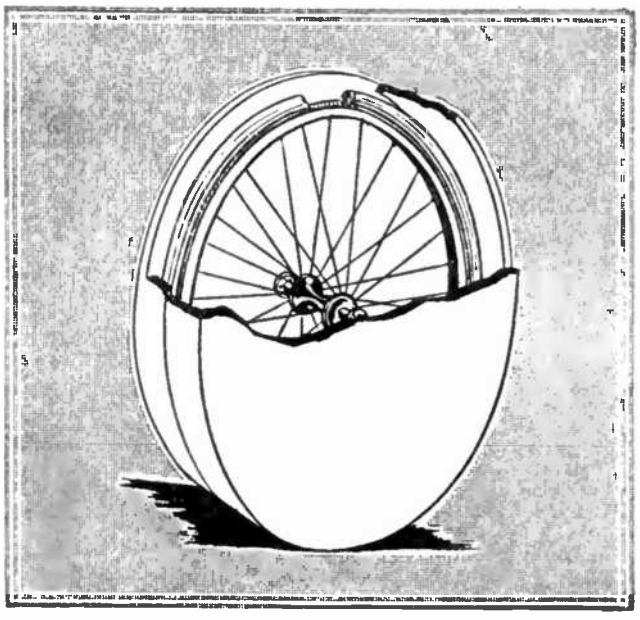
An ingenious arrangement for accomplishing this is illustrated in the drawing. Two giant magnets are fastened to a base and energized by current from the power house generator flowing through a 16 c.p. lamp. When the flow of current stops for any reason the armature is released, making contact immediately with a metal pillar directly behind it. The armature and pillar complete the battery circuit, and the emergency lamps are instantly lighted.

Contributed by

DAVID SCHELL.

A "Wrestling Cheese"

An amusing experiment can be performed with a large and thick disc



shaped like an ordinary cheese and colored—to carry out the illusion—to resemble one. If the instructions which follow are observed carefully the "wrestling cheese" which results will prove to be a veritable miracle of strength. Spectators can be invited to roll the cheese over upon its face, and a strong man can push with all his might, but the cheese will persistently remain on edge.

The outer casing of the "wrestling cheese" should be constructed of two hollow cups, 30 in. in diameter, which screw together. In the center should be placed two metal "horses," one on each side, which support an ordinary 24-in. bicycle rim with a hub and ball bearings. Into the space usually occupied by the

tire a solid lead pipe should be wound and turned so that the wheel runs true. The wheel is made to run at a high speed by bringing the surface of a fibre pulley attached to an electric motor in contact with the lead pipe. This should be done with the top of the "cheese" removed and the wheel in an upright position. The tops should be replaced and the cheese wheeled out onto the stage. The fun follows when persons called from the audience attempt to turn the cheese face down.

The action of the wrestling cheese is, of course, gyroscopic. The wheel will revolve for more than thirty minutes if the bearings have previously been well oiled.

Contributed by

JAMES MCINTYRE.

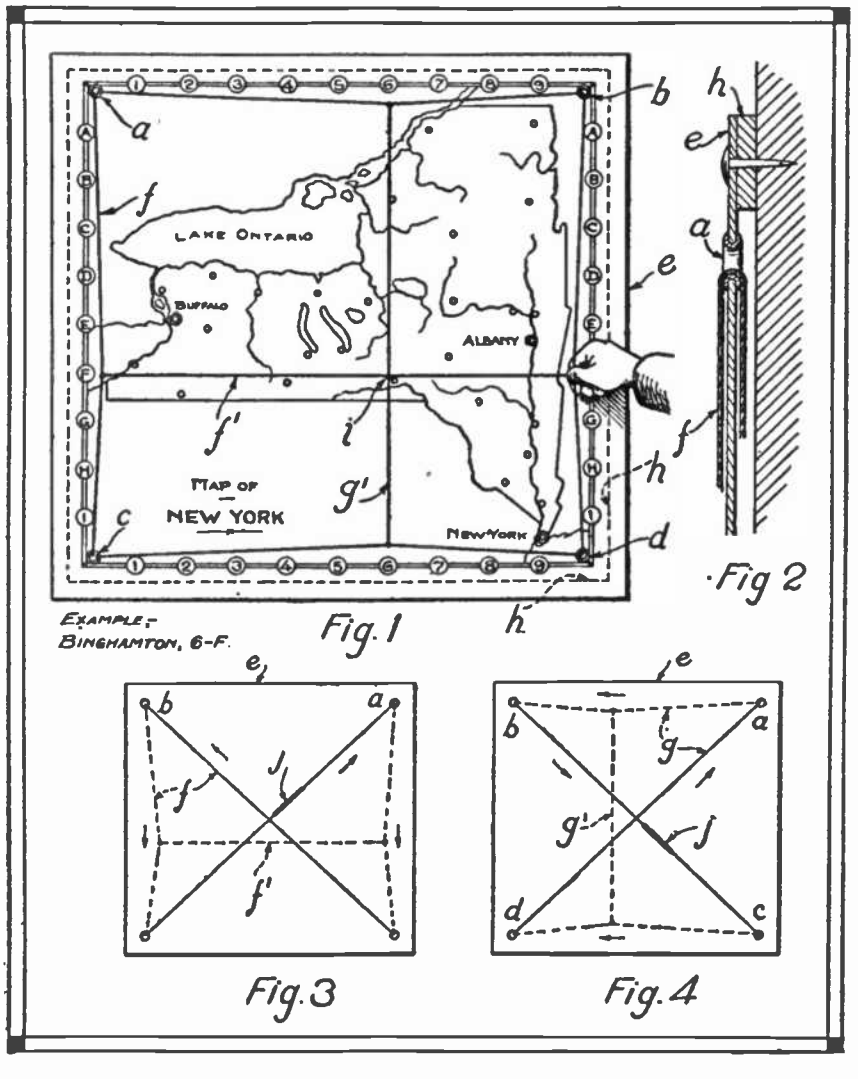
A SIMPLE FINDER FOR MAPS

By R. N. Van Buskirk

Most commercial maps have their top and bottom borders divided into several parts, the divisions having consecutive numbers and the side borders being likewise divided but having consecutive letters by means of which desired locations are found. But the trouble with these maps is that three hands are required, two for the border indices and another to hold at the intersection of the imaginary lines while the exact location of the city, street, building or company is being found.

With the attachments shown in Fig. 1 only one hand is necessary to locate a desired spot, and, furthermore, one is not required to continue to hold a finger on the map to keep the place while talking or making notes.

If the map is printed on paper it should be pasted on a fairly heavy bristol board, *e*, and the metal eyelets, *a*, *b*, *c* and *d* placed near the corners, as shown. Silk-woven fish-line should be attached to the line *f*, as shown in Fig. 3, using a strong rubber band, *j*, to keep it taut, and to this the horizontal finder line, *f'*, should be attached by knotting it securely to *f*; the line, *g*, and vertical finder line, *g'* are similar, but threaded through the eyelets differently. While the two lines, *f* and *g*, pass through the same eyelets, the action of each is independent of the other. Figs.



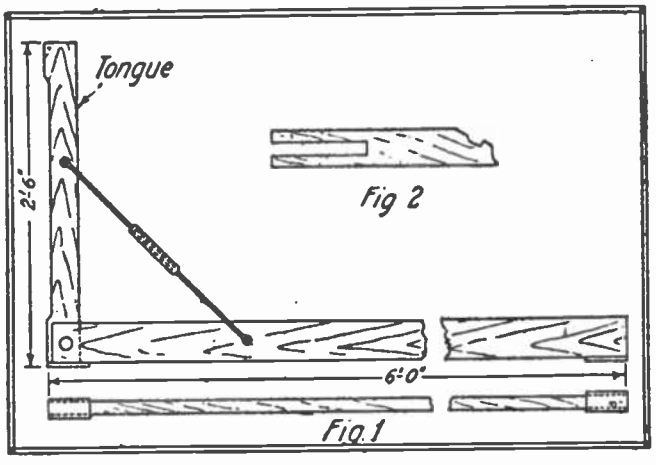
3 and 4 represent the back of the map, and the two views are presented merely for the purpose of showing clearly just how each line runs. The wood strips, *h*, should be either glued or tacked to the bristol board before attaching to the wall, and need be only of sufficient thickness to permit the lines to pass freely on the back.

With this arrangement both right and left-hand lines will travel up and down in a uniform parallel movement; the top and bottom lines will also both travel horizontally together. One hand may be used by grasping either top or bottom line at any point and shifting the line until the vertical finder line is at the figure desired; then, by grasping either the right or left-hand line and placing the other finder line at the proper letter, the desired location can be quickly found at, or near, the intersection, *i*.

Square for Fitting Doors

A square for fitting heavy doors can be made as follows:

A six-foot length of soft wood, 1⅛" x 3¾", should be sawed with a slot in one end 7/16" wide and 3" long, to receive the tongue. This is shown in Fig. 2. On the edge of each end, which will form the back of the square, a 4" length of wood, ⅜" x 1½", should be nailed and allowed to project 3/16" over each side of the body. When the square is placed on the door these strips touch the edge of the door and hold the square in place.



The tongue of the square should be 2 ft. 6" in length of 7/16" x 3" material, cut out along the top edge for clearance over any uneven portion of the head jamb. The tongue should be hinged into the slot cut in the body of the square with a 3/16" x 1⅛" stove bolt, the nut of which is set in flush with the surface of the wood. A small adjusting rod should be made 12" in length from old motorcycle spokes. The turnbuckle can be made from small lengths of tubing.

This tongue is large enough for squaring doors from 2 ft. 6" to 3 ft. 2" wide. A shorter tongue can be used with the same square for smaller doors.

Contributed by

BERT FISH.

A Use for Empty Fuses

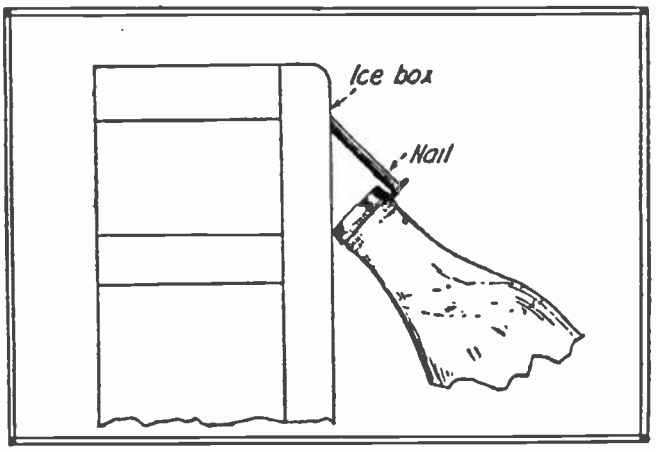
Burned-out cartridge fuses can be used for carrying small taps, drills, punches, screwdriver bits, etc. The cap should be removed from one end and the asbestos filing taken out.

Contributed by

J. SPRINGER.

Nail Removes Bottle Caps

The cap of a bottle can be removed by the head of a nail which is driven into the wall at an angle of about 45°.



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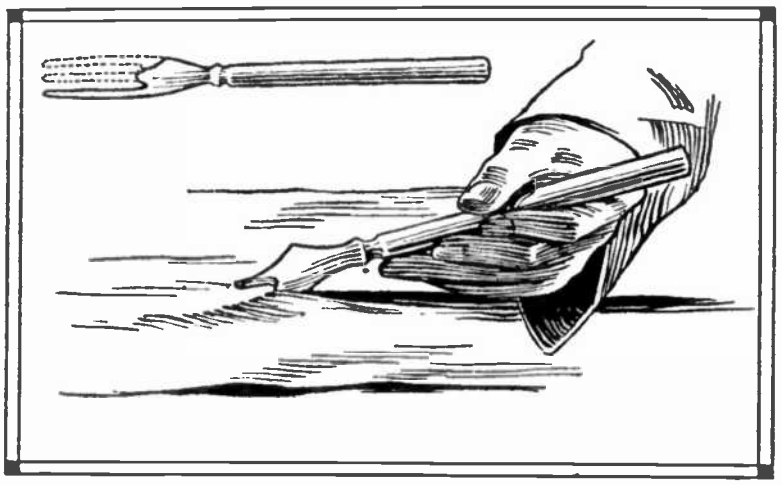


Cloth Cutter Made from Fork

A cloth or paper cutter can be made from a fork if the tines are hammered flat, two of them cut off and the edge of the remaining one sharpened.

Contributed by

F. MAURER.

To Keep Fire in Range Over Night

Fires have an unpleasant habit of going out very easily in extreme cold weather. Many northern people burn a cheap grade of soft coal and allow the kitchen fire to go out at night. This, of course, necessitates rekindling the next morning.

A very good plan is to "bank" the fire, which is accomplished in the following manner: Shake out the ashes well, and let the fire burn down to a hot bed of coals spread evenly over the grate. Put in fresh coal until the fire-box is almost full. The drafts should be opened until the bottom layer of the fresh coal has become ignited, after which the fire should be smothered with a thick layer of ashes so that they cover every portion of the fresh coal. The draft openings and the pipe damper should then be closed.

If the draft is properly checked, there will be enough ignited coke in the stove next morning for preparing breakfast.

Some difficulty will be experienced in damping the draft sufficiently to prevent the coal from burning if the stove is an old one. In this case, one of the rear lids should be removed and the cold air allowed to rush in at this point instead of through the fire-box. After a few trials, the proper adjustment of the draft can be found.

When the fire is started in the morning the grate should be shaken thoroughly to allow the dead ashes to sift through. The fire will at once begin to burn brightly and more fuel can then be added when found necessary.

Contributed by

FRANK L. WHITAKER.

An Ingenious Tray for Leftovers

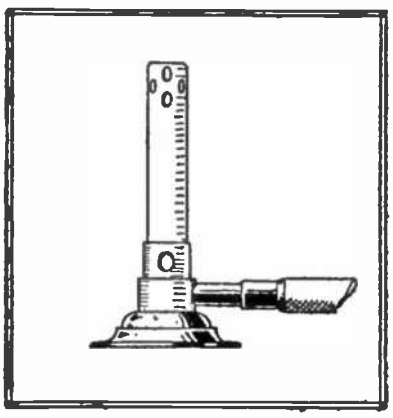
Instead of scattering small bolts, wood screws, rivets and similar articles about the top of the work bench or putting them in cans or boxes, piece by piece, a tray with a hole cut at one corner can be used, and it will be found to be a great time saver. When the tray is full, its contents can be poured into a can or box.

Contributed by

JOHN HOECK.

To Increase the Efficiency of a Bunsen Burner

The efficiency of a bunsen burner can be doubled if the air vent is closed and eight or ten small holes are drilled at the top. When this is done the burner acts as a blow torch and its usefulness for soldering is greatly increased, as it may be tilted at any angle.



Contributed by

F. B. FALKNOR.

To Protect Floor Under Baseboards

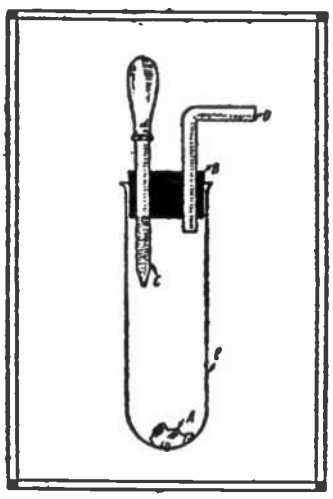
A strip of cardboard placed directly under a baseboard will adequately protect the floor while painting, staining, etc., is being done. The cardboard will absorb all stray drops of paint or stain.

Contributed by

VICTOR C. CASPER.

A Portable Oxygen Generator

For generating small amounts of oxygen for use in experiments in chemistry the apparatus shown in one of the illustrations on this page will be found very useful. A fragment of sodium peroxide should be dropped into a small test tube, and a two-holed rubber cork plugged tightly into the mouth of the tube. A pipette, *C*, containing water, should be forced into one of the holes and an L-shaped glass tube inserted into the other. When the pipette bulb is squeezed water drops upon the sodium peroxide and oxygen is instantly liberated.

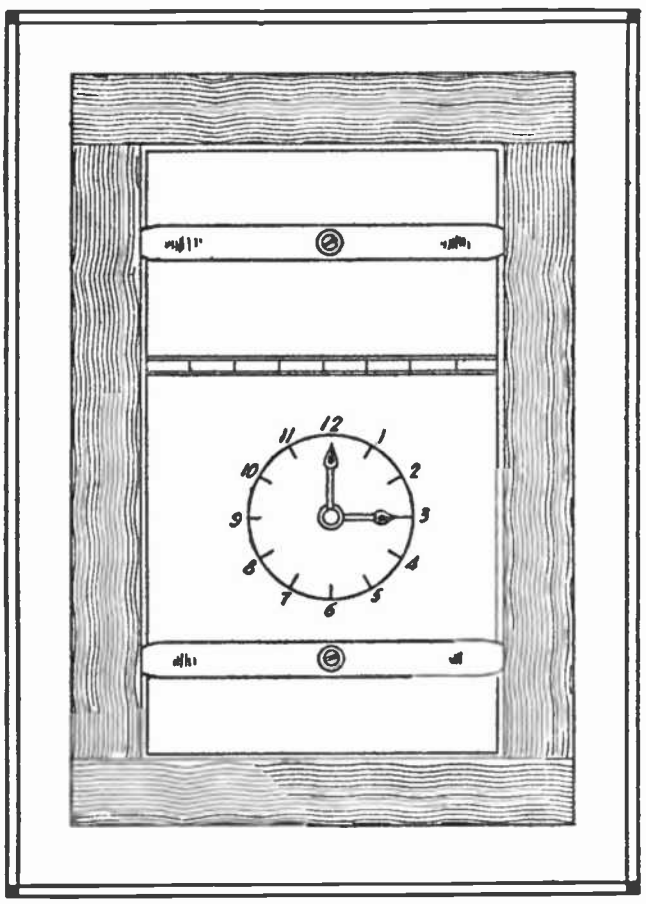


Contributed by

FRANCIS PALMER.

A Counter for Photographic Prints

When several prints are to be made from one negative the photographer very often misses count; he finds it difficult to remember just how many prints he has made and how many are yet unfinished. A print counter, or recorder, of some sort will save him time and money—in the form of wasted paper. Probably the simplest arrangement by means of which this waste can be done away with is a counter of some sort fastened on the back of the printing frame. A good plan is to mount the face and hands of an old watch on the wooden back. The minute hand may be used to keep track of the single prints made, and the hour hand will denote the dozens.



Contributed by

KARL WEGNER.

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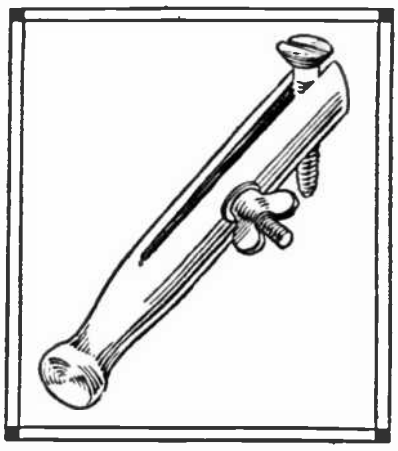
Hand Vise from Clothespin

A small jeweler's hand vise can be made from a clothespin by cutting off one-half inch from the ends, boring a hole at right angles to the slot and fitting it with a small clamp screw provided with a winged nut.



Contributed by

JOHN SCHMELZEIS.

Casting Small Metal Parts

Occasionally it is desired to reproduce quickly some small metal object such as a medallion or scarfpin. The method described here for this purpose involves very little labor and produces exceedingly sharp castings.

A piece of cuttlebone of the quality known as No. 1 should be obtained at a drug store. It should be divided with a sharp knife into two or more pieces according to the size of the object to be cast. Both surfaces should be filed flat and rubbed together to insure perfect adaption. The model should be placed on one section of the bone well towards the end and pressed firmly with a small stick. The model should then be tapped gently and tipped out of the impression. A V-shaped groove should be carved in the bone for a pouring gate and the second half of the mold placed in position. The molds should be bound tightly together and the casting metal poured into the gate until the mold is full. Gold and silver can be used successfully in molds of this type, but a blowpipe and bellows, together with a considerable knowledge of the properties of these metals, are necessary.

Contributed by

AUGUSTUS SAULTIS.

Ideas published in this department are paid for at space rates.

Hints to the Painter

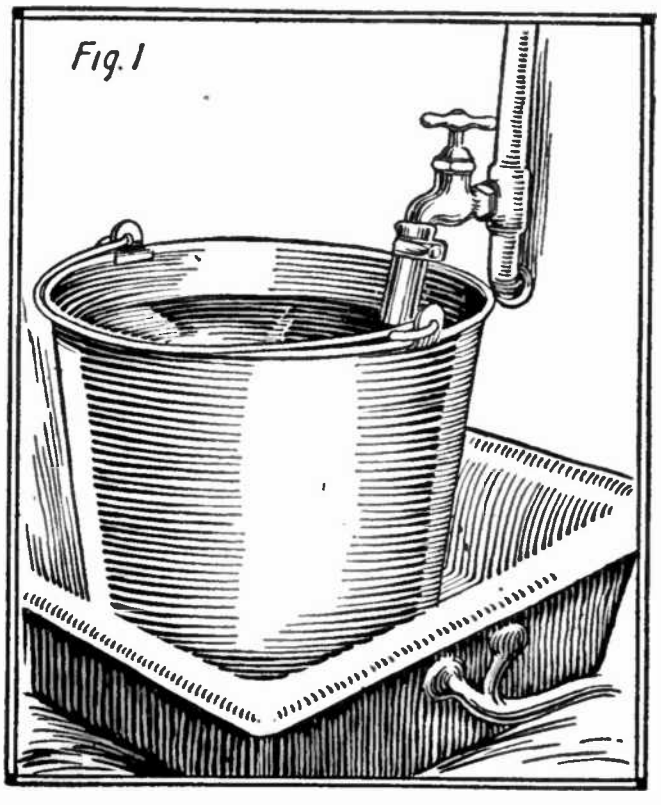
White lead naturally commences to dry as soon as the pail is opened. A coating or skin on the surface forms rapidly. This action can be prevented by covering the white lead with water. Water does not injure white lead, and it can be poured off easily when there is painting to be done. Putty kept in a tin can be protected in the same way. Paint brushes may be kept fresh in a mixture of linseed oil and turpentine. Paint brushes can be cleaned by rinsing in kerosene, after which they should be thoroughly worked out on old rags or paper. Turpentine will clean a varnish brush.

Contributed by

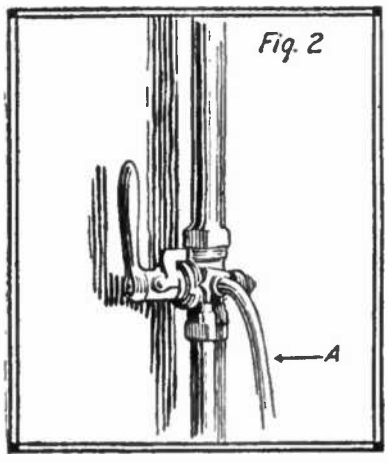
PETER SWAN.

Syphon Provides Running Water in Basement

A syphon consisting of a pail of water and a makeshift pipe line will provide running water for the photographic dark room in the basement. A small rubber hose is attached to the drain outlet indicated by *A* in the accompanying illustration. A large hose attached to the faucet on the floor above extends to within one inch of the bottom of a pail. To start the flow of water, the faucet is



opened, and when the pail is filled, the water in the basement is turned off, and, due to syphon action, water may be drawn from the pail above to the developing trays. When the pail is empty, the cut-off in the basement is opened until the pail is refilled. When the cut-off is closed the flow continues as before. If the cut-off is turned to a position half way between "on" and "off" the water will not flow in either direction, thus providing entire control from the basement.



Contributed by

ANDREW G. THOME.

To True Up Lathe Centers

The majority of present-day lathes are equipped with compound rests and in such cases it is a simple matter to swing the rest to the required number of degrees to turn the centers. If the lathe has no compound rest, however, the worker must resort to one of three methods to true up the centers. One option is to use a motor tool post grinder; second, a square-nosed tool that is set at the desired angle and run up to the center by the cross feed—not a very satisfactory method, as the broad tool will usually cause chatter; and, third, to use a device similar to that shown in the accompanying illustration.

This implement really comprises a crude form of compound rest that may be made by the average workman and which may be used to turn practically any angle desired. With reference to the illustration, the framework *A* is cut from a piece of 1½-inch square steel stock and attached to the shank *B* by two heavy screws. The traveling toolholder *D* is made in the form of a long nut, having a threaded hole to engage the rod *C*, which turns in the framework and carries the toolholder throughout its length of travel. The guide plate *F* is cut from ⅛ by 1-inch bar steel and the slot should permit the toolholder to slide freely within it but without undue looseness.

The method of using the device is shown in the illustration.

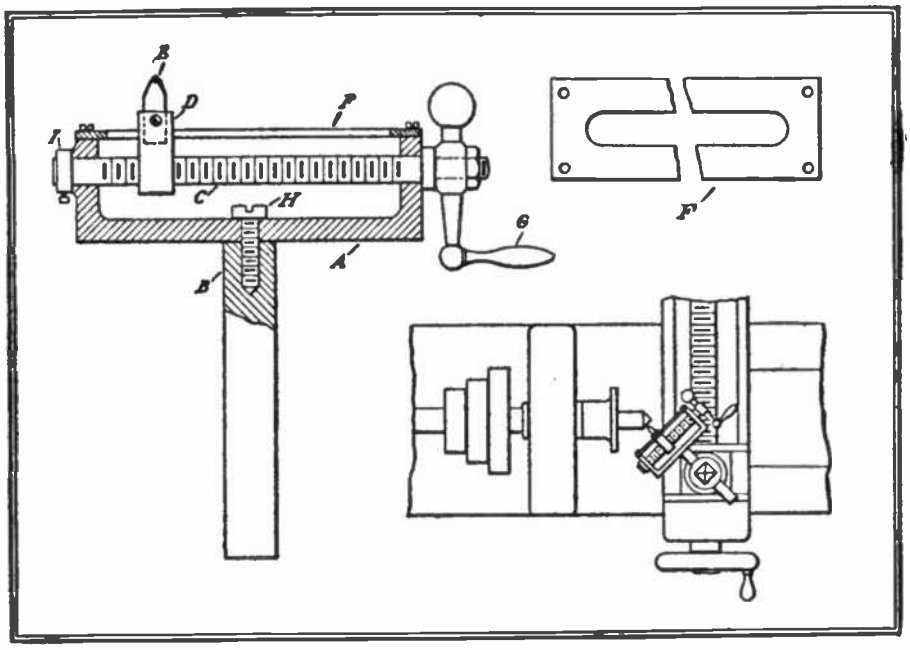
Contributed by

JAS. MCINTYRE.

Cat Fishes Wire Through Ceiling

In a certain job of wiring which the writer witnessed, there was no fish wire at hand, and the electrician was puzzled with getting a wire through a 35 ft. ceiling. The question was solved finally by recruiting one of the cats in the neighborhood.

The cat was held at one opening with a twine tied to one of its legs. After a great deal of coaxing, it crawled through to the other end. Then by means of the cord, the wire was easily drawn through.



Contributed by

MAX C. VAN ANTWERP.

A TRIPLE MYSTERY

by G.H.Hines

THE illusion which is described herein comprises actually three separate and distinct "tricks" which, when worked together, produce an almost inconceivable effect, although in reality they are very simple.

The effect produced is as follows: The performer first calls attention to a cabinet, about four feet long and three feet high; the cabinet being mounted on four legs which elevate it about three feet from the floor. This cabinet is placed about four feet from the back curtain.

After the performer has proved that there is no deception about the cabinet, his assistant enters and lays down on the floor of the cabinet. The curtains are drawn and at the instant the front curtain has been closed, the performer fires a pistol. When the curtains are pulled back, the assistant has disappeared.

The performer then calls attention to a small stand about a foot high and two feet in diameter, and also to a tube which is suspended about six feet above the stand. This tube is made of canvas, with a wooden hoop at the bottom; the top being cone-shaped and made of wood or some other suitable material. The tube is folded up as shown in the accompanying illustration.

Then the performer puts on a robe and mask, and places a screen behind the stand. He steps up on the stand, the tube is dropped over him, hiding him from view, and in about three or four seconds afterwards a bright light is seen to flash above the tube, which is then pulled up and discloses that the performer has vanished, his place having been taken by the assistant who had previously disappeared.

Immediately after the assistant has reappeared, a trunk that has meanwhile been suspended above the audience is let down on the stage and opened, when to the amazement of all, the performer jumps from within, thus bringing the illusion to a startling climax.

To begin the explanation, we will first look at the setting of the stage. At the back of the stage is placed the ordinary magician's back-drop, with a small opening or slit in the center. Four feet in front of this is placed the small cabinet, while in the middle of the stage is placed the small stand, with the tube suspended above it. At the side of the stage, just even with the wings, is placed the screen, and over the audience is suspended the trunk.

When the assistant enters the cabinet the back and side curtains are first drawn, and then the front. While drawing the front curtain the performer

spends a few seconds arranging the positions of the curtains. Meanwhile the plank has been pushed out from the back curtain to the floor of the stand, thus enabling the assistant to escape unobserved through the back of the cabinet. After she has safely accomplished this, the plank is withdrawn and when the curtains are drawn back the cabinet is found empty. To prevent any possibility of the board or the assistant being seen by the audience, about four or six inches of fringed material should be tacked around the bottom of the cabinet.

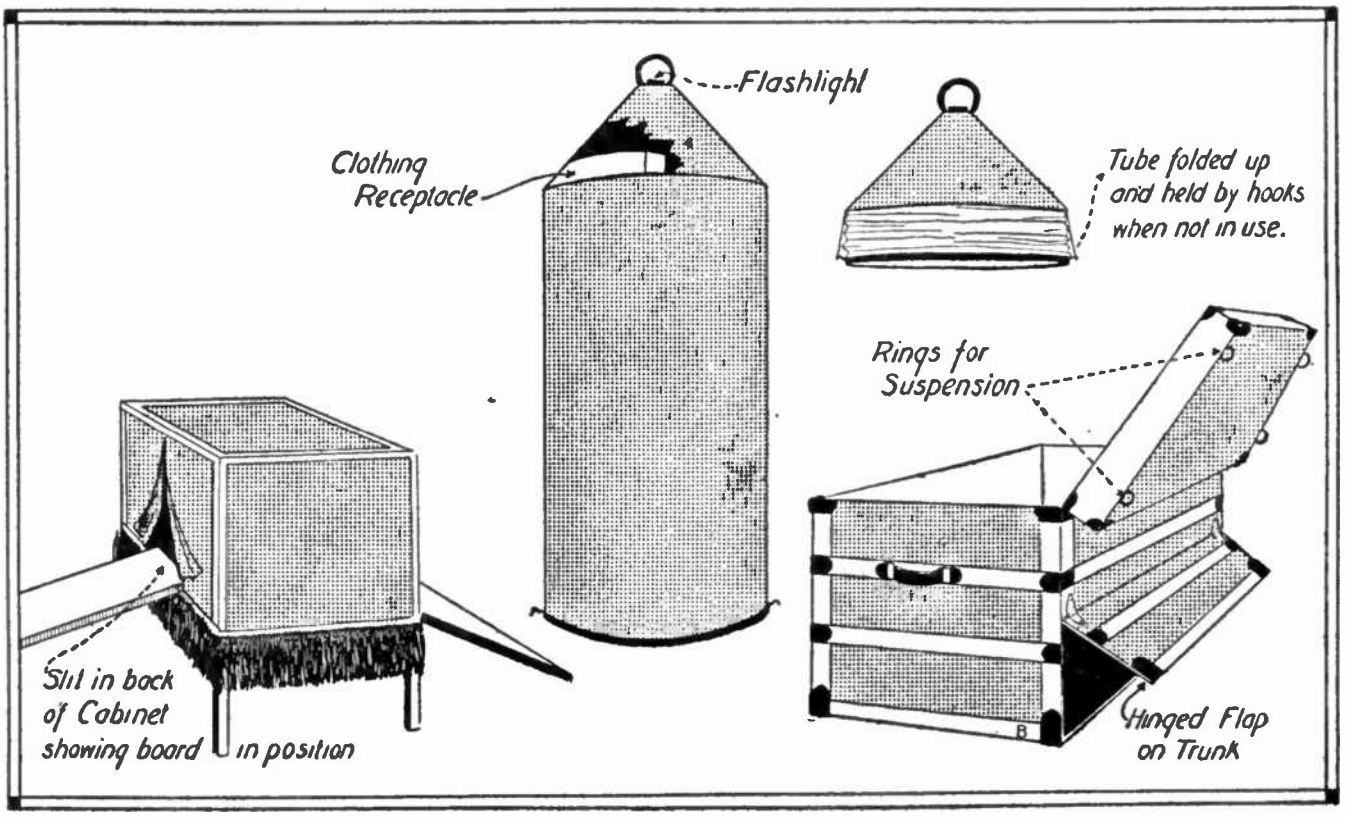
We will now go to the second part. When the performer has donned the mask and robe, he steps behind the screen as if to pick it up, but instead he changes places with his assistant who, after having passed through the back drop, dons the same costume as the performer. Thus, the assistant picks up the screen and places it behind the stand as if to box it in. It goes without saying that the assistant must be of practically the same size as the performer.

The assistant then steps on the stand and the tube is dropped over her. She then secretes her costume in a small compartment in the top of the tube shown in the illustration, and lights a flash powder placed in the top of the tube. The tube is then drawn up and the assistant is seen to have changed places with the performer.

Attention is then directed to the trunk hanging over the audience, which is then let down and placed on the stage right in front of a trap-door in the floor. The performer, who has meanwhile placed himself immediately under the trap, can then climb up into the trunk through the hinged flap on the back of the trunk. This must be worked at a fairly good rate of speed in order to obtain the most thrilling effect.

KIOGRAPHY

One of the newest things in photography is a paper on which pictures may be printed in the sunlight and then attached to any object, such as china plates, glassware, lamp shades or in a watch-case. The special paper, known as Kiograph paper, is coated with a thin tissue which is stripped after the print has been made and developed. The tissue is then placed on any object desired and adheres firmly forever, according to the inventor.



Various Pieces of Apparatus that are Used in Producing the Triple Mystery, Showing the Construction of Each.

A CRAFTSMAN SUMMER COTTAGE

Describing a Summer Dwelling that May Be Constructed by the Average Handy Man at Low Cost.*

By Ralph F. Windoes

Instructor of Manual Training, Davenport High School, Davenport, Ia.

Illustrations from drawings made by the author

WITH the materials described in our last installment purchased, our craftsman is ready to begin his building operations.

If the point of purchase was such that delivery can be made as the work proceeds, it is much the better way; but if all materials are brought to the site at one time, storage must be provided. This might be secured by renting a nearby cottage, an empty barn, or erecting a tent—the latter method not being recommended, on account of its accessibility to thieves, unless the builders are living in the same tent. Under the protection, whatever it may be, must be kept the tools, nails and other hardware, paint, roofing, cement, windows and frames, doors and frames, screens—in fact, everything that might be harmed by exposure.

The flooring and framing lumber must be carefully piled off the ground, so that there is little danger of warping.

With the materials provided, the builder must check over his tools and see if he has the following on hand. More might be handy, but these are essential:

Spade	Hand Axe
Shovel	1-in. and ½-in. Chisels
Hoe	Screw Driver
Axe	Brace and Bits
Sledge	Tin Snips
Level	Compass Saw
Steel Square	Pinch Bar
Plumb Bob	Pipe Wrench
Chalk Line and Chalk	Mallet
8 or 10 ft. Rule	Trowel (Pointed)
Steel Tape Line, 50 ft.	Cold Chisel
Hammer	Pliers
Rip Saw	18 ft. Ladder
Cross-Cut Saw	Step Ladder
Try Square	Two Galvanized Iron Pails
Jack Plane	

Of course, there should be one hammer, one square, one rule, one rip and one cross-cut saw for each workman, as these tools are being used constantly, and a great waste of time is effected if workmen are continually borrowing.

Begin the actual construction by clearing the site of the building. Remove all trees, shrubs, etc., that are liable to in-

*This article is one of a series that will appear regularly in THE WORLD'S ADVANCE until completed. The first installment appeared in the May issue, copies of which may be obtained at 15 cents while the supply lasts.

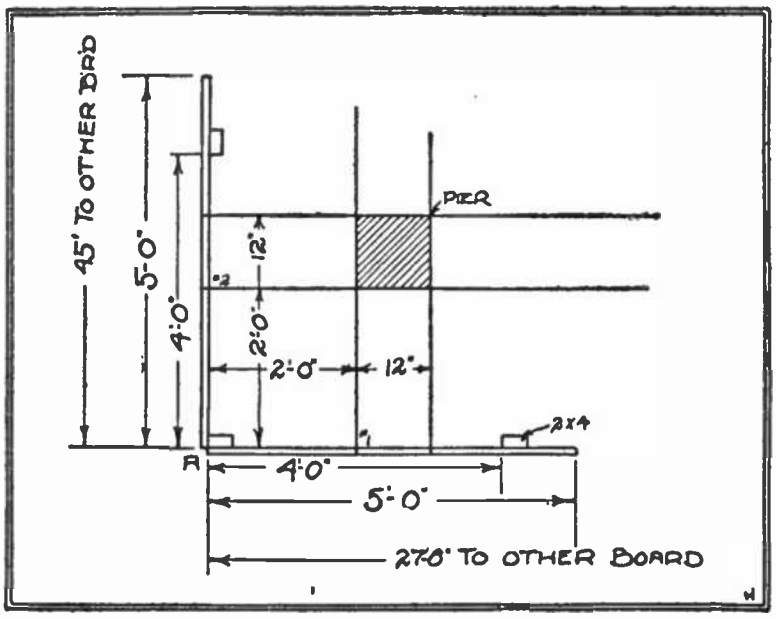


Fig. 5.—Ground Plan, Showing the Lay-out at Corners.

terfere with the building operations, and carry them to a place far enough away so that they will not be constantly interfering with the workmen.

Next, at the front left-hand corner of the plot—as you stand facing it—indicated by *A* in Figs. 5 and 6, drive a 2 by 4, pointed at one end, firmly and straight, so that about 1′ 8″ is above ground. Measure, with the steel tape line, 27′ 6″ across the front of the plot, and drive another 2 by 4 at this point, indicated by *B* in Fig. 6. The front of your finished cottage will be parallel to the tape, hence you can settle the angle at which it will face the lake, street or other objective by swinging the tape from the first stake as a center.

Now stretch a chalk line between nails driven in the two stakes, and on this line measure out from the corner 4 feet, as seen in Fig. 5. At this point drive a 2 by 4 so that the outside edge is even with this line.

Next, from corner *A*, measuring in towards the center of this same line, lay off 6 feet and mark the point. Cut a straight stick 1 inch square and 10 feet long, and with one end of this stick on the point marked, swing the other end so that it just touches the 8 foot mark on the steel tape which has been swung from *A* towards *C*, Fig. 6. This forms a right angle, and stake *C* is located, 45 feet from stake *A*. Locate stake *D* from *B* in exactly the same manner, and stretch lines around all four; then carefully drive the second and third stakes at each remaining corner.

Next, cut eight boards about five feet long and four inches wide to nail between the stakes, as seen in both Figs. 5 and 6. Starting at corner *A*, measure up 1½ feet from the ground. At this point will come the *top* edge of the boards on stake *A*. Drive one nail in each board at this point, and, placing the level on each in turn, swing the free ends up until they are level, then nail the other end. It is very essential that these boards be perfectly level, as they will locate the height of the piers, their size and their location. To locate the height of the boards on corners *B* and *C*, swing a line from corner *A* until it is exactly level, then mark

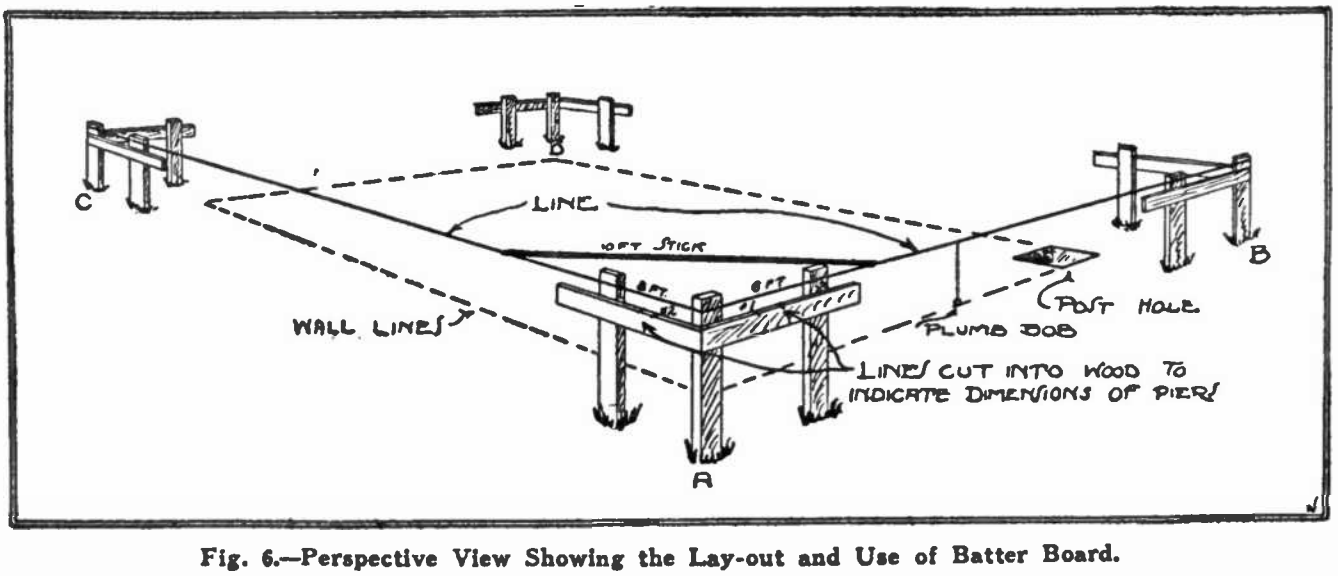
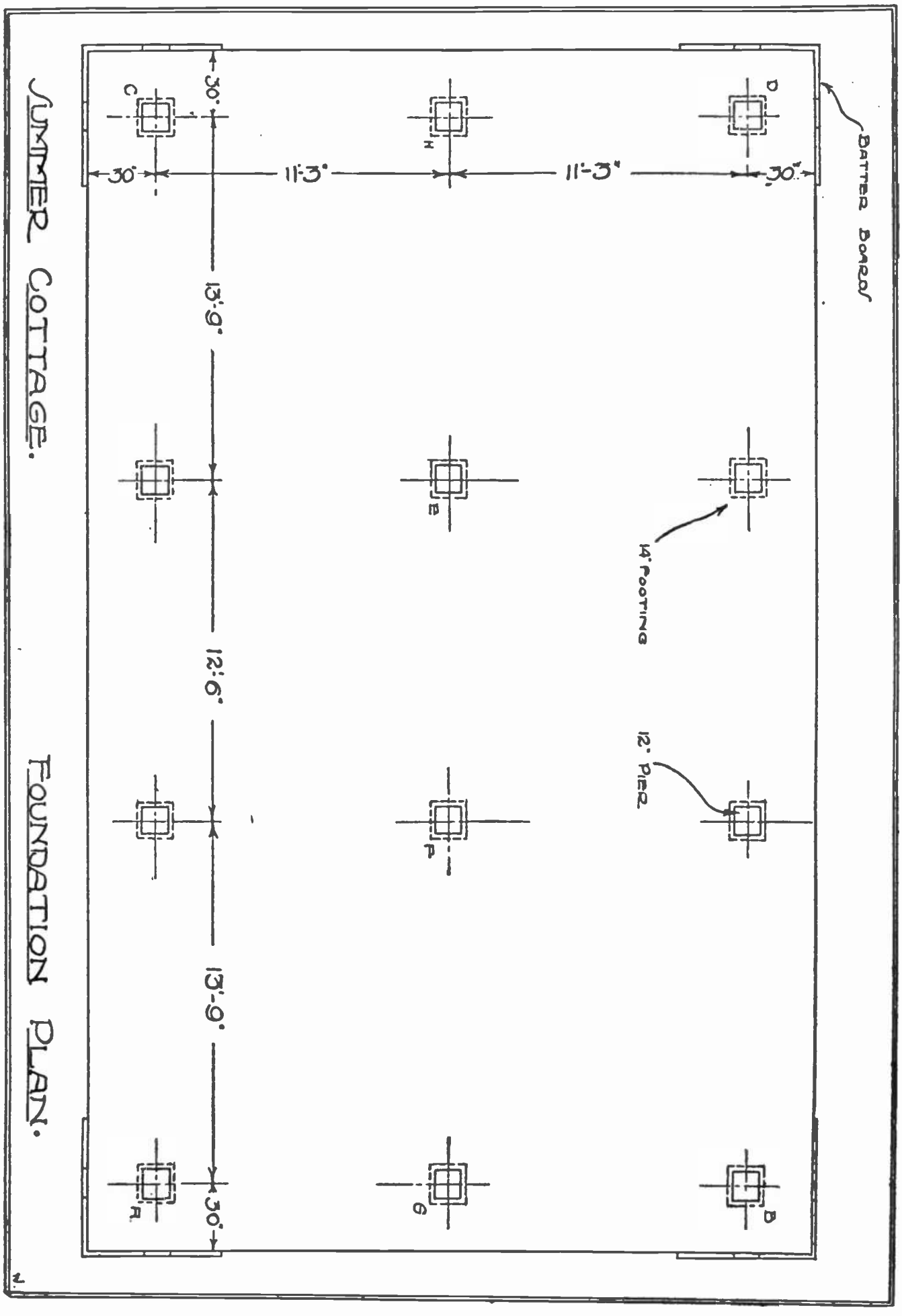


Fig. 6.—Perspective View Showing the Lay-out and Use of Batter Board.



SUMMER COTTAGE. FOUNDATION PLAN.

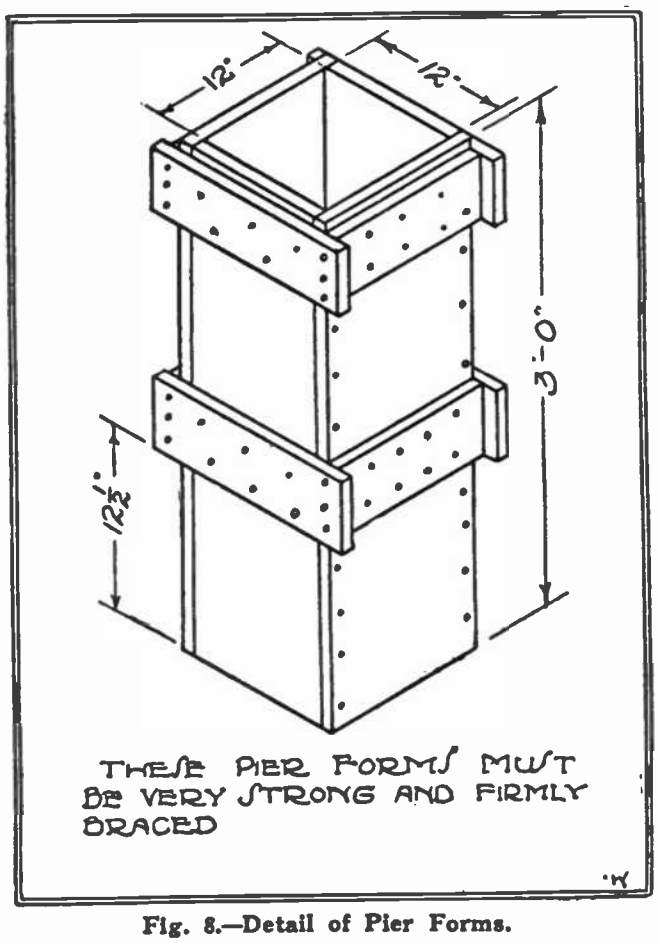


Fig. 8.—Detail of Pier Forms.

on the stakes where the line passes them. At these points fasten the remaining boards. The *D* boards will be located in the same way from stake *B*, and tested by a line from *C*.

Next, the wall lines should be located. In Fig. 5 the dimensions are given. From corner *A* measure over on the top edge of each board two feet, and make a line with a knife, or cut straight in at these points with the saw, about ⅛ inch. Measuring over from these points 12 inches, make similar cuts. These will locate the wall lines and the dimensions of the outside piers.

From line No. 1, measure across the front 23′ 6″ to locate the *outside* line at corner *B*. Then back toward *A* measure 12″ to locate the width of the right-hand wall. On the other board of corner *B* locate the cuts as was done at *A*. Similarly locate the cuts at the other corners, being careful at *C* to measure 41 feet back from No. 2 to locate the outside line cut. A careful study of Figs. 5, 6 and 7 will make this all very clear to the builder.

Now the builder is ready to dig the post holes. Through the cuts, made in the batter boards, stretch lines, and, at the intersection of these pairs of lines at the corners, dig holes exactly beneath the 12-inch squares formed. These holes will form the corners, and they should be about 15 inches square and dug to a depth that will give the builder three feet from the chalk lines. According to Fig. 7, measure down the side lines and locate the other piers of the outside walls. Dig these holes accordingly, being very sure that the work has been accurately laid out, and locate the two center piers *E* and *F* by means of lines stretched from the wall lines, and crossing at the centers of *E* and *F*. After digging holes at *E* and *F*, the builder is ready to build the forms.

Use some of the flooring for these forms, as they may be taken apart and cleaned after the piers have been cast. Fig. 8 gives a detail of the forms, and they should be very carefully made and accurate as to dimension.

Select a hard packed piece of ground upon which to mix the concrete, or, better yet, if some old boards are at hand, build up a platform about five feet wide and seven feet long. The proportions for the concrete mixture should be one part of Portland cement to five parts of unscreened gravel. Or, if you are located at a section where gravel cannot be obtained, use one part of Portland cement to two parts of sand, and four parts of crushed stone. The sand or gravel

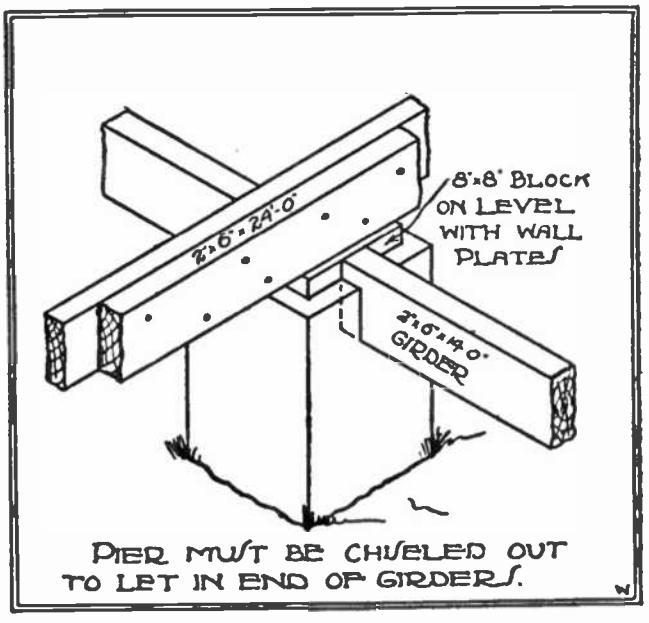


Fig. 9.—Detail of Construction at Center Piers E and F.

must be clean and free from loam. A test for loam may be made by working a quantity of damp gravel in the hands for about five minutes. If it leaves a sort of sticky clay on the hands, it contains loam and should not be used. Assuming that the builder is working near a lake, he can readily secure perfectly clean, sharp gravel without much trouble.

Empty fifteen pails of dry gravel on one end of the board or the ground space, and spread three pails of cement over them. With a workman on each side of the pile, turn all of the gravel over until it has been formed into another pile. By shoveling the sand from the bottom, the cement will roll down from the top, which assists in the mixing. The builder should make sure, if working it on the packed ground, *that he does not dig some of the dirt into the pile,* as the mixture *must be kept clean.* Turn it back again into its original position, and repeat. This means that the dry mixture is turned over three times, and, if properly done, it will have a uniform color.

Now flatten the mixture and wet it with pails of water. Turn it over the same as before, while wetting, until it becomes "mushy"; to make it more explicit, it should be of such consistency that it will *not* bear the weight of a man. Turn this wet mixture two or three times, and your green concrete is ready to pour.

Into one of the holes drop concrete to the depth of six inches, which forms the footing, and into this concrete bed one of the forms so that its top is just even with the lines. The form must also be perfectly plumb. Small pieces of wood can be placed between the sides of the hole and the form to hold it in place.

Now fill the form with the wet concrete, and tamp it down firmly with a short 2 by 4. Rough the top up somewhat, as you will later put a layer of cement upon the end in which to bed the sills, and it must have a rough surface to lay on, otherwise it will not hold.

Similarly make each pier and allow them at least 24 hours in which to set before removing the forms. If the weather is very cold or damp, give them 48 hours.

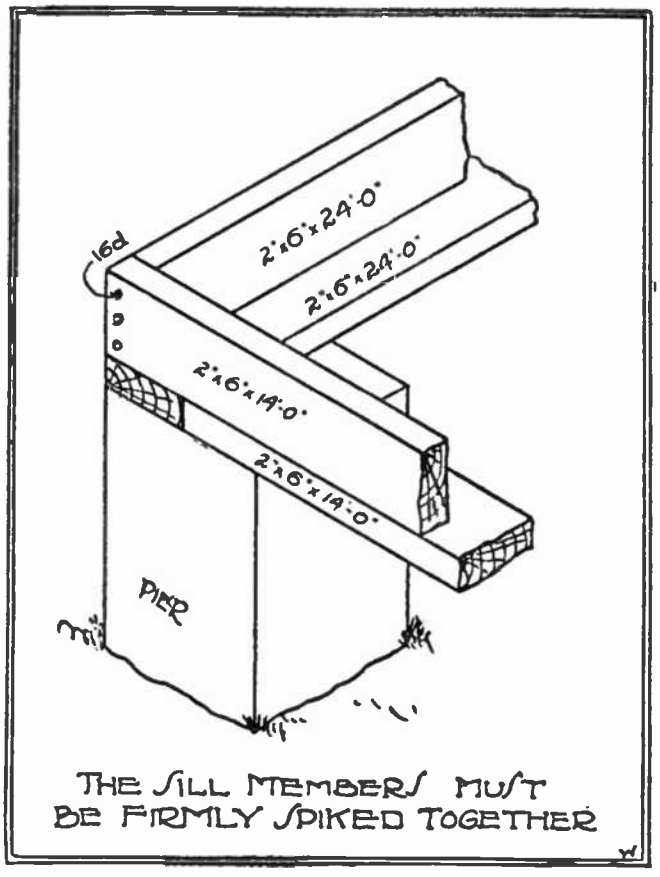


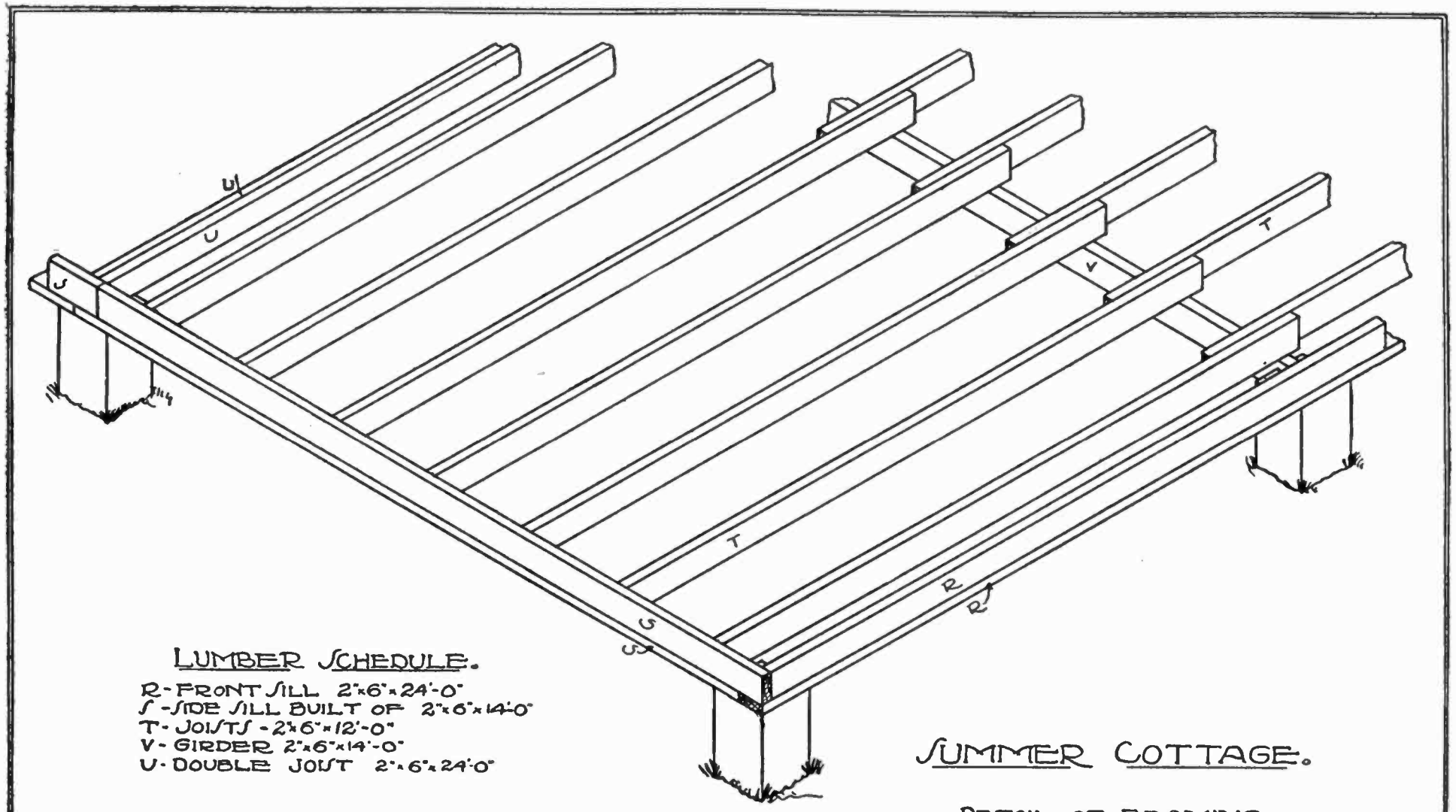
Fig. 10.—Detail of Sill Construction at Corners B and C.

It will be noticed that the girder, *V*, in Fig. 11, is set below the top of the piers, *E, F, G* and *H*, Fig. 7, which will necessitate chiseling out the concrete unless holes are made in the piers as they are cast. A simple way to cast the holes is to nail a block on the inside of the forms at the point where the girders will enter. On piers *E* and *F* there will be two holes each, while on *G* and *H* there will be but one. (See Fig. 9 for a detail of *E* and *F*.)

If the forms have been removed and cleaned up, and the batter boards taken down, the next step is to frame the floor.

A study of Figs. 10 and 11 will plainly show the construction. Notice that the 2x6's that cross from side to side *over the piers* are all one piece, while the joists between them are built up of 2 by 6 by 12's, the ends crossing on the girders *V*. The side sills are composed of lengths of 2 by 6 by 14's, the ends meeting on the piers, and the joints in both members *not* meeting at the same point.

Begin the construction by nailing up



LUMBER SCHEDULE.

R - FRONT SILL 2"x6"x24'-0"
S - SIDE SILL BUILT OF 2"x6"x14'-0"
T - JOISTS - 2"x6"x12'-0"
V - GIRDER 2"x6"x14'-0"
U - DOUBLE JOIST 2"x6"x24'-0"

THE JOISTS ARE SPACED 24 INCHES ON CENTERS, SPACING FROM THE CENTER OF EACH SECTION

SUMMER COTTAGE.

DETAIL OF FRAMING.

the end sills. For the members that lay flat, we will call them *wall plates,* select planks that are straight, and nail the upright pieces to them with the 16d nails. Notice in Fig. 10 that the uprights are set back the thickness of the side sill, and that the plates run even with the outside edges. This construction will make a more solid corner. Next, fit the side sills while the ends are in place, and firmly spike all members together. If this has been properly done, there will be an L-shaped box all around the *outside* edges of the wall.

Now mix up a rich and rather dry batch of one part cement to two parts of fine, screened sand and, lifting each corner of the sill in turn, place about ½ inch of this cement on the end of each pier. Drop the sill and proceed to the next, until they have all been bedded. Of course, if all piers have been made exactly the same height, and the same amount of rich cement has been put under each section of sill, the latter will be level, but the chances are that by sighting it the builder will find that some corner is low, or too high. Hence it will be necessary to level it up. Sighting with the eye, and placing more cement under the low parts will help a great deal, but the constructor must finally test the sill by means of a level placed on the upper edge of a *straight* piece of casing, about ten feet long. Running this diagonally on the corners will point out the low spots.

When this is as near flat as it is possible to get it, spike the two double joists that run through the center and level them up at piers *E* and *F* with blocks bedded in cement, as seen in Fig. 9. Then place the girders in the piers so that the upper edges are just even with the lower edges of the double joists, and cement in around them. Finally, nail the 12-foot joists in place, as illustrated in Fig. 11, firmly spiking them to the girders and the sill, and to each other where they cross. This completes the floor framing.

One word of caution about fitting all of this framing—*the ends of the planks must be square* as to width and thickness, especially where they fit against other pieces, as in the case of the joists.

ATMOSPHERIC ELECTRICITY AND CARRIER PIGEONS

In finding their way, birds of passage are said to be influenced by the magnetic meridian. M. A. Thauzies, a French specialist in carrier-pigeons, has recently disclosed some interesting information respecting their perception of terrestrial magnetic currents.

That the sense of direction in these birds is influenced by such currents is believed to be proven by the fact that during a day in July, 1906, and another in August, 1907, the results of numerous flights by carrier-pigeons were very unsatisfactory. Pigeon fanciers, meteorologists and astronomers who were consulted could give no explanation. A specialist in electro-magnetic research found what he believes to be a solution. He discovered the fact that on these two days an exceptional electric tension of the atmosphere manifested itself in magnetic storms. Such observations accord with the fact discovered by pigeon fanciers that, with the great increase of wireless telegraphy, much less reliance can be placed on carrier pigeons.

NEW USE FOR ALUMINUM

Recent experiments have shown that aluminum and manganese play an important part in the growth of vegetation. Professor Stoklasa, of Prague, concludes that these elements possess a special function in the process of assimilation, and his experiments have shown that it is the leaves which contain the greatest quantities of them. Gabriel Bertrand has shown that vegetable production can be increased by adding manganese to the nutrition. All vegetables that contain a certain quantity of manganese always contain aluminum.

BICYCLE SLIDING—A NEW SPORT FOR BOYS

The most up-to-date out-door sport is bicycle sliding. The bicycle sled invented by a Pennsylvania athlete makes possible

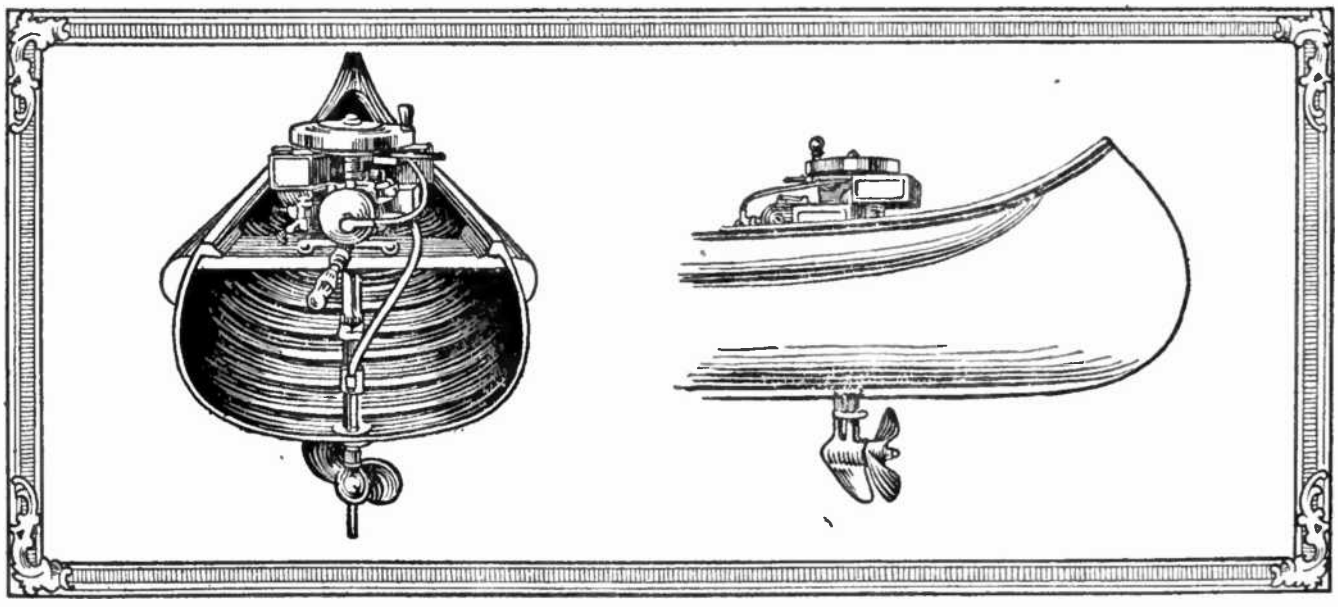
Bicycle Sliding is a New Sport that is Proving Very Popular with the Boys.

this safe and comfortable sport, which, in conjunction with the motor wheel, may yet boost the bicycle back to its former prestige. Narrow toboggan-like runners replace the wheels of the ordinary bicycle frame. A convenient foot rest is added to the frame instead of pedals, replacing the old-fashioned coasting forks. A brake shoe pivotally connected to the lower portion of the frame completes the bicycle sled. The brake shoe is normally kept in a raised position from the ground by a spring. It is fitted with a foot-braking lever extending upward from it, which, when depressed by the foot, presses the brake downward so as to engage with the ground and slacken the speed.

CONVERTING THE CANOE INTO A MOTOR BOAT

It is generally conceded by all who are familiar with water craft of all kinds that the American canoe is by far the most comfortable type of boat in which to travel. There is a smooth, gliding sensation in traveling in a canoe that cannot be approached by other types of craft.

With a view to eliminating the necessity of paddling, yet retain the advantages of the canoe, an American manufacturer has recently placed on the market a portable engine that may be installed in any canoe with practically no alterations. As may be seen in the accompanying illustrations, this portable engine is placed in the canoe and held in place by a board that also serves to



Any Canoe can be Readily Converted into a Fast Motor Boat by the Installation of a Portable Motor. As the Illustration Shows, Practically no Alterations are Necessary.

stiffen the framework of the craft. A hole is bored through the bottom of the boat to pass the propeller shaft.

A canoe fitted with the portable engine can travel at a fair rate of speed. The owner can enjoy the pleasures of canoeing without the usual fatigue incidental to paddling long distances. The engine is self-contained and operates with the minimum of noise. No rudder is necessary, the propeller being swung from one side to the other by means of a suitable handle for altering the course of the craft.

SPECTACULAR ARTIFICIAL ERUPTION OF A VOLCANO

The genius of the lighting experts of the exposition at San Francisco was responsible for a most remarkable volcanic eruption which took place on the evening of March 10th. The long-dormant Mt. Tamalpais, familiarly known as "The Silent Sentinel by the Golden Gate," belched fire and smoke from her lofty summit in a most realistic manner. Five tons of fire and smoke producing combustibles were burned in the gorgeous display, and the grand old mountain painted the sky with lurid hues in her answer to the giant searchlights on the exposition grounds. The unique spectacle was planned as a fitting celebration on the eve of the Marin County day at the Fair, and, as it had been previously announced, the entire populace of the Bay cities was watching for the unusual sight.

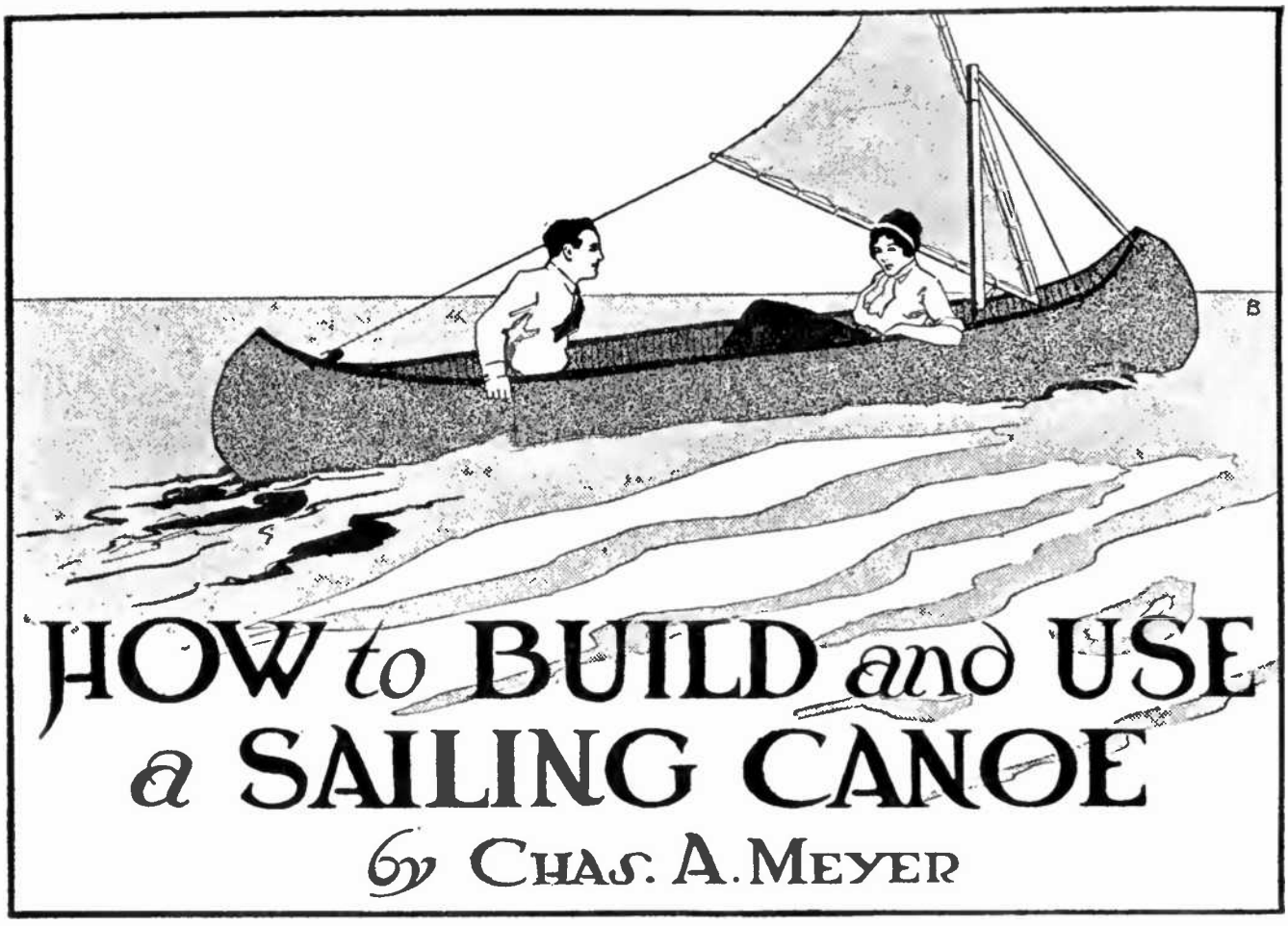
MOTOR TRUCK VS. HORSE

Reduced to simple terms, the comparative cost of hauling material by horse cart and by auto truck have been worked out by the engineering department of the city of St. Paul, Minn. The final figures show that for anything up to a one-half-mile haul the motor truck is more costly than the horse-drawn vehicle. Between one-half mile and one and one-half miles the cost is about the same, slightly favoring the motor truck, however; while for any haul above one and one-half miles the motor truck is decidedly the cheaper. In working out the comparative figures it was assumed that a team had an average speed of three and one-half miles per hour and could be employed at a cost of $6 per day, while a motor truck had a speed of 11 miles per hour and cost $20 per day to operate.

SOIL RADIATION AND HEALTH

It has been suggested by the distinguished British scientist, Professor John Milne, that certain experiments made by him, showing that photographic effects are produced by some form of radiation from chalk and granite in the Isle of Wight and Cornwall—radiation which he thinks is probably of an electrical nature—may possibly throw light upon differences of climate observed in places which are relatively near together. Further research, he thinks, may perhaps show that the well being of living things on the surface of our earth is more dependent upon its radiations than has hitherto been supposed.

The German army in its recent terrific assault upon the Allied line in Flanders employed a deadly gas to overcome its enemies. According to good authority, it is gathered that the Germans employed compressed chlorine in tanks. Before an attack and when the wind blew towards the trenches of the opponents, the Teutons released the gas, which floated over the Allied lines, killing many of the soldiers. This yellowish gas is exceedingly deadly, and proves very effective in this connection because of its great weight.



HOW to BUILD and USE a SAILING CANOE

by CHAS. A. MEYER

CANOEING, though a popular aquatic sport in America, is not enjoyed as extensively as it might be for the reason that many cannot afford to purchase a suitable craft. It is the purpose of this article, therefore, to explain as simply as possible how anyone, possessing sufficient mechanical skill to manipulate a hammer and saw, can construct, at but a slight expense, a serviceable canoe.

The pleasure of canoeing is greatly increased by the addition of a sailing-rig. It is generally supposed that a canoe is a very dangerous craft, liable to capsize at the slightest provocation. But this is not the case. When properly handled, a canoe is a reliable and safe craft, even when equipped with a sail.

Construction of the Canoe

It is advisable when building a canvas-covered canoe to first construct it upon a temporary base, *A*, Fig. 1, which is removed later. Select for this purpose a board 14 feet long, 1 inch thick and of any convenient width.

The stem and stern pieces, *B*, Figs. 1, 3 and 4, are made of any variety of tough wood which is capable of being bent to the required shape. Green elm, ordinarily obtainable at a carriage maker's shop, is admirably adapted to this purpose. Two pieces are needed, each measuring 33 x 1½ x 1 inches. The wood may be rendered pliable by soaking it in boiling water.

A number of molds are required to give form to the frame while the ribs are being put in place. These auxiliary parts are built up of pieces of wood 1 inch thick, as illustrated at *C*, Fig. 2.

The gunwales, *D*, Figs. 1 and 4, comprise two pieces of straight-grained wood, preferably ash, 15 feet long, 1 inch wide and 1 inch thick. They should be lightly nailed to the molds. At the ends they are *beveled* to form a joint as shown in Fig. 4. Two additional strips, *E*, on each side, are temporarily put in place.

The ribs are formed of strips of elm or hickory 1½ inches wide, ⅜ inch thick, and long enough to reach from gunwale to gunwale when bent as per diagram.

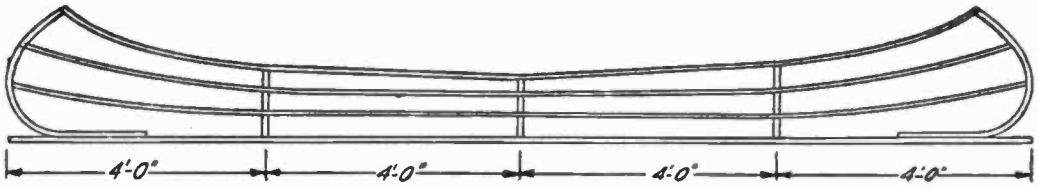
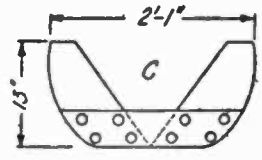


Fig. 1



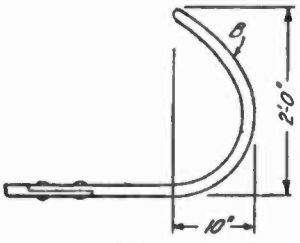


Fig. 3

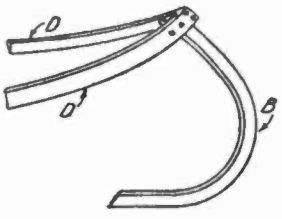
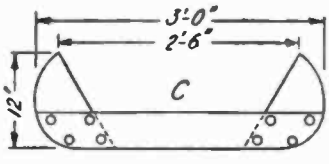


Fig. 4



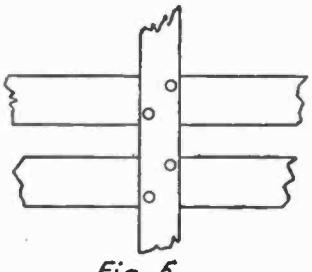


Fig. 5

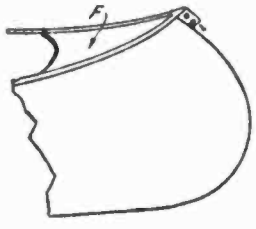


Fig. 6

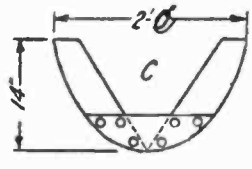


Fig. 2

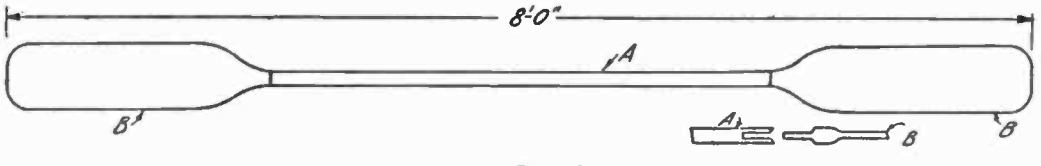


Fig. 7

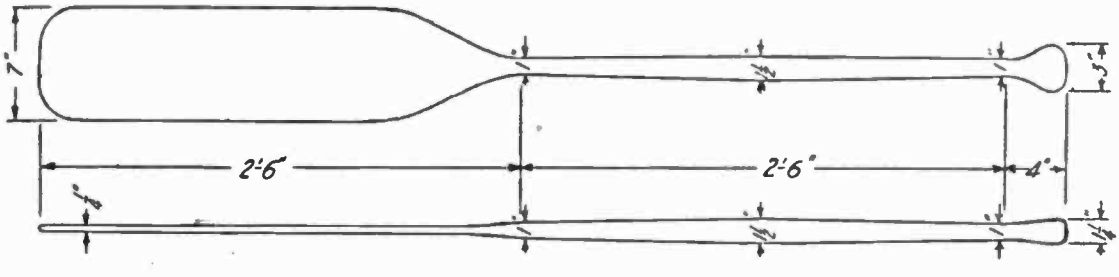


Fig. 8

The Different Parts of a Canvas Canoe, as Well as the Double and Single Paddles.

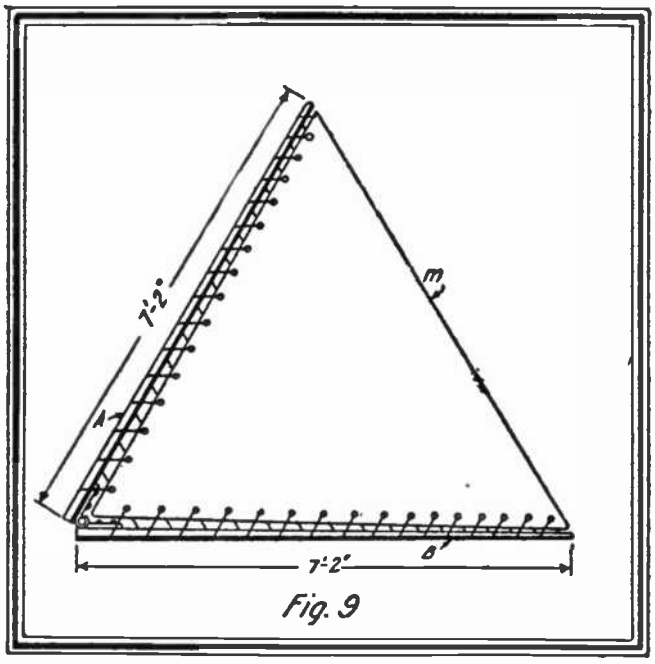


Fig. 9

Details of the Sail to be Used in Connection with the Canvas Canoe.

Soak the strips in boiling water or steam them until they can be readily bent to shape. The best method of setting the ribs is as follows: Beginning at the center of the boat, place a rib upon the upper side of the base, *A,* and secure it in place with a nail. Then, following the curve of the molds and strips *E,* bring the ends up to the gunwales, where they are fastened with brass screws. Continue in this manner, spacing the ribs one inch apart, until they are all in place.

The temporary base may now be replaced by a permanent one and the molds removed. This new base is a strip of strong, clear-grained wood measuring 2 inches wide by ⅝ inch thick. It is joined to the upper side of the ribs with brass screws and to the stem and stern pieces as shown in Figs. 3 and 5. The two upper edges are finished off with a ¼ inch bevel. Two wicker seats are placed five feet from each end of the canoe. The two end pieces, *F,* are cut from ⅜ inch thick board and are held in place by finishing nails driven through the gunwales, as depicted in Fig. 6.

Cover the frame with a heavy grade of canvas, applied to the bottom or under side. Procure a strip of material 18 feet long. Locate the center of the strip and tack it to the ribs opposite the floor-piece with copper tacks. Then, working from the center of the boat, tack the cloth to the ribs and gunwales, always keeping it taut and free from wrinkles. At each end it will be necessary to split the cloth in order to make it fit neatly. When this has been done, trim off all the surplus material.

When the operation of covering the frame has been completed, give the canvas a coat of thin glue to shrink it. Sheet glue, heated with water in a glue pot or double boiler, is best for this purpose. After the coating of glue has thoroughly dried, apply two coats of paint and stain the interior wood work with waterproof varnish. A light keel of hard wood, 1 inch wide by ½ inch thick, although not absolutely necessary, will serve to protect the bottom of the canoe when landing in shallow water.

The Paddles

There are two general types of paddles, single and double. The double paddle consists of a central pole, *A,* Fig. 7, of spruce or ash, 6½ feet long and 1¾ inches thick. The two ends are shaped as shown to receive the paddle blades. These latter, *B,* are cut from pieces of spruce 12 x 9 inches. The blades are fitted to the pole as illustrated.

By carefully studying the plan given in Fig. 8 it will be understood how to cut out a single paddle. Spruce is well suited to this purpose, since it is strong, light and easily worked.

The Sailing-Rig

For a canoe of this size, a sail of about 40 square feet is large enough. What is known as the "Lateen" rig is generally used in this type of sailing craft. The sail has the form of an equilateral triangle, 7 feet on a side. The mast also is made in the form of a triangle.

The spars for the sail are two round spruce poles, *A* and *B,* Fig. 9, 7 feet 2 inches long and 1½ inches in diameter. They are joined at one end by a hinge.

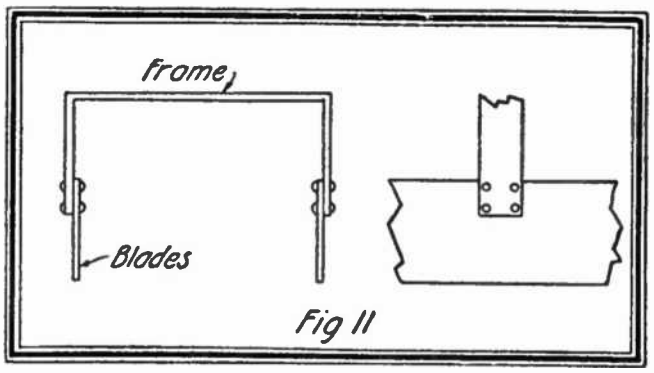
The mast consists of two spruce spars 5 feet long and 1 inch in thickness, joined at the top with screws and separated at the bottom by a strip 1 inch square. This

last named piece is made just long enough to cause the base of the mast to fit snugly in the bottom of the canoe.

The sail should be made of light weight canvas or duck. A hem is made along each edge and a length of ¼ inch rope is run through the free edge, *m*, as shown in Fig. 9. Eyelets along the other two edges provide means for lacing the sail to the spars.

Assemble the complete rig as follows: First screw the mast to the bottom of the canoe 4 feet from one end. Two wire stays, *M* and *N*, Fig. 10, fastened to the gunwales, and one bow stay, *P*, hold it rigidly in place. Attach a rope to the upper sail spar 2 feet from the hinge joint, and, after passing it through a pulley at the apex of the mast, fasten it to a cleat, *S*. This arrangement allows the sail to be raised or lowered at will. A short length of rope at *T* holds the lower spar in place, while still another piece, *U*, controls the swing of the sail.

In order to keep the canoe from "sliding"—that is, drifting sidewise before the wind—a lee board is necessary. This attachment consists of two cedar blades 4 feet x 12 inches, mounted on a frame that fits over the gunwales, as illustrated in Fig. 10. The frame is composed of two pieces of wood, 1 x 4 x 15 inches, joined at right angles to a third piece



Details of the Frame and Cedar Blades.

measuring 1 x 4 x 30 inches. (See Fig. 11.) The entering edges of the blades should be beveled to a sharp edge in order to reduce the head resistance of the water.

Handling a Sailing Canoe

A few words of advice regarding the management of a sailing canoe may be of service to the uninitiated. To begin with, it should be borne in mind that when sailing, the paddle serves as a rudder.

The sailor sits in the bottom of the canoe, more or less on the side opposite the sail, according to the strength of the wind. In a very stiff breeze, it may even prove necessary to sit on the gunwale to preserve the equilibrium of the boat.

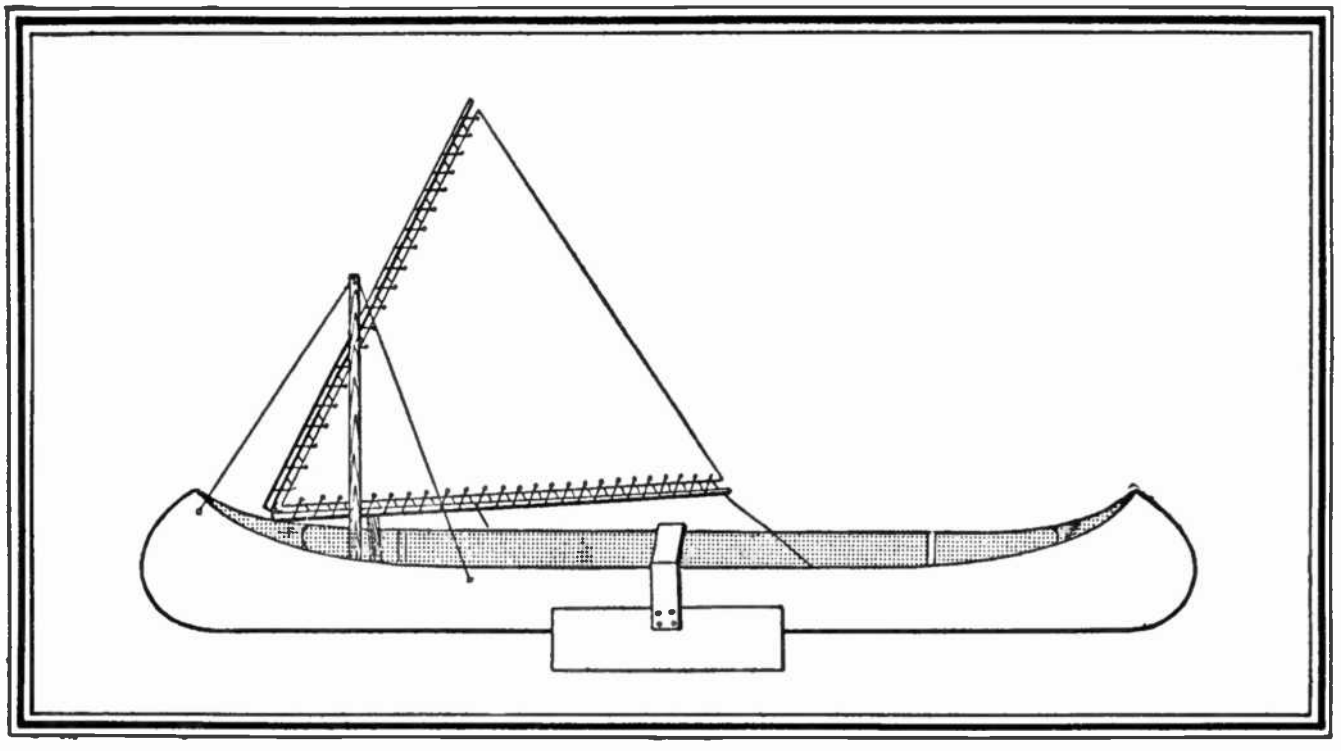


Fig. 10.—Canvas Canoe Complete, Showing Method of Attaching the Two Cedar Blades and the Sail.

As to "tacking," "going about" and other manoeuvers, a sailing canoe should be handled in the same manner as any other sail boat.

The amateur canoeist should learn to manipulate his craft in shallow water and where there is the least danger should he be in trouble. It is only after he has become competent and understands his canoe thoroughly that he should venture far away from land and in deep water on long journeys.

POWER FROM PEANUT-OIL

It seems that one of the advantages of the latest type of Diesel oil-engine lies in its ability to produce power by burning not only the cheapest grades of natural mineral oils and the by-products of coal distillation and coke plants, tar and cresote oils, but also vegetable and animal oils. Indeed, it is claimed, it can use peanut oil almost as effectively as mineral oil. The use of fat oils from vegetable sources for fuel will, it is predicted, promote industrial development in regions where the cost of coal is prohibitive—in northern Africa, for instance, and in many parts of our own country. The inventor of the engine declares that those oils make it certain that motive power can still be produced from the heat of the sun, even when all our natural stores of solid and liquid fuels are exhausted.

VENTILATORS IN THE HAY MOW

Air drainage in the hay mow is necessary. Thousands of tons of market hay are annually ruined as a result of molding, heating and firefanging caused by the storage of the feed in tight barns, where the fresh air has no chance to circulate and aid in curing the forage. This loss is easily and cheaply controlled. It is necessary to lay a system of wooden ventilators through the hay mow so that a complete circulation of air is obtained. The ventilators are about ten inches square and appear as four-sided ladders, since the sides are left partly open, so that the air current which constantly passes through the ventilator, is able to penetrate the hay.

The length of the ventilators is determined by the width of the hay mow, as the aim is to have the open ends of the drains at the opposite sides of the mow. The ventilators are spaced about fifteen feet apart and a layer of them is placed through the mow to every six feet in depth of hay. It involves a little trouble to build and arrange these air-drainage tiles in the mow, but the work pays big returns. In one hay barn where this system was employed, 1,000 tons of hay have been stored during the last four years and none of it has molded or firefanged. Previous to the use of the air drainage system fifty tons of hay were spoiled for market purposes in one season in this barn, with a resultant loss of $1,000.

MUSK IN CHEAP PERFUMES

The chief ingredient of low-priced perfumes is musk, a substance derived from various species of animals, of which the muskrat is the best known.

As an article of commerce, however, the musk supplied by civet cats is probably the most widely sought. The odor is strong and sweet, but in its strength lies the particular reason for employing it as the base of perfumes. The visitor to any zoölogical institution that possesses specimens of these cats can, if he be of an investigative turn, easily catch the musky odor from their cages.

But little musk is required to give the most lasting odor to an ounce of perfumery. The musk itself, however, is not cheap, since much time and labor must be given to the task of collecting it.

This magazine is now located in its new home, 239 Fourth avenue, New York City. Much time may be saved by addressing all communications to the new address.

Electric Lights for the Summer Cottage

WITH the publication of the details of the interesting little summer cottage in Mr. Windoes' article in the current number of this magazine, it seems likely that many readers will seriously contemplate or actually start the construction of one of the cottages in anticipation of the summer months to come. The editor of this department has studied the plans for the cottage with more than a little interest and with this examination has come the belief that herein may be found an excellent opportunity for the electrical handy man to exercise his ingenuity in the design and installation of an electric lighting equipment for the cottage.

In considering such a design the first requisites which come to mind are as follows: The equipment must be low in cost in order that the necessary expenditure may be commensurate with the cost of the cottage as well as with the usefulness of the lighting plant; it must be perfectly simple in operation in order that its use may not involve labor which would place the equipment in the category of nuisances; it must, above all, be practical in the supply of a useful volume of light and not merely a toy that looks pretty in theory but which fails dismally in its mission when the camping party is perhaps forced to remain indoors on a rainy evening and when a good, strong reading light is a blessing.

Summing up these specifications, there occurs to the thoughtful reader but one solution of the problem. The answer is found in the modern automobile lighting equipment with some modifications. Obviously, if the cost is to be within reason, the most expensive part of the entire outfit—the storage battery—should be so arranged that it may be used, not only in the lighting of the house, but for the motor car as well. It is here assumed that the builder of the cottage or else some member of his camping party owns a car of some sort; or if not a car, then a motor boat. If such is not the case, the only alternative is to add a small generator and gasoline engine to the lighting equipment, unless there should happen to be a small waterpower available near the site of the cottage. The case of the complete isolated plant, however, requires a different treatment and, while a six-volt installation is contemplated in the present article, the complete generating plant permits of the use of a higher voltage which is advantageous to a degree. Assuming, however, for the sake of coherence in this article, that the cottage owner has access to a car or boat engine and small lighting generator, we may proceed to consider how the plant may be arranged to take care of the house lighting.

The greatest advance in interior lighting equipment in recent years was made when the mazda lamp was perfected. Now, to cap the climax, we have the nitrogen-filled lamp, which is very nearly 100 per cent. greater in efficiency than the ordinary mazda, and what is of greatest moment in our own case is the fact that the nitrogen-filled lamp is now available in a 6-volt, 21-candlepower size. This lamp consumes about 13.65 watts and gives a light that, when properly

shaded, is ideally adapted to the present requirements. This, then, solves the problem for the units of greatest power that we shall require for the living room and the combined dining room and kitchen. The sleeping balconies may have a 6 c.p. mazda lamp each, above them, and the porch should also be similarly equipped.

Assuming two of the 21 c.p. lamps in both living and dining rooms and the three 6 c.p. lamps in the remaining nooks, we have a total wattage of 54.60 for the nitrogen and 18 watts for the mazda lamps, or a total of 72.60 in all. If every one of the lamps were to be turned on at one time, the current would reach rather more than 12 amperes, but in view of the fact that the various members of the party would scarcely be so distributed about the cottage that they would require all of the lamps, since such a use would involve the combined occupations of sitting on the porch, retiring, reading, cooking and eating. Therefore, we may estimate that the average peak load, so to speak, would be in the neighborhood of six amperes. For a compromise in the selection of our battery, we may say that the battery should be capable of standing a discharge of eight or ten amperes for ten hours.

An examination of the data supplied in connection with several prominent makes of lighting batteries discloses two models either of which should serve our purpose admirably. The advantage to be found in the larger battery is principally in its ability to stand up under harder usage and in the fact that the recharging need not be done so frequently. The specifications referred to are as follows:

6-Volt	60-80 Amp. Hrs.	37 Lbs.	Price	$16.00
6-Volt	80-100 " "	49 "	"	22.00

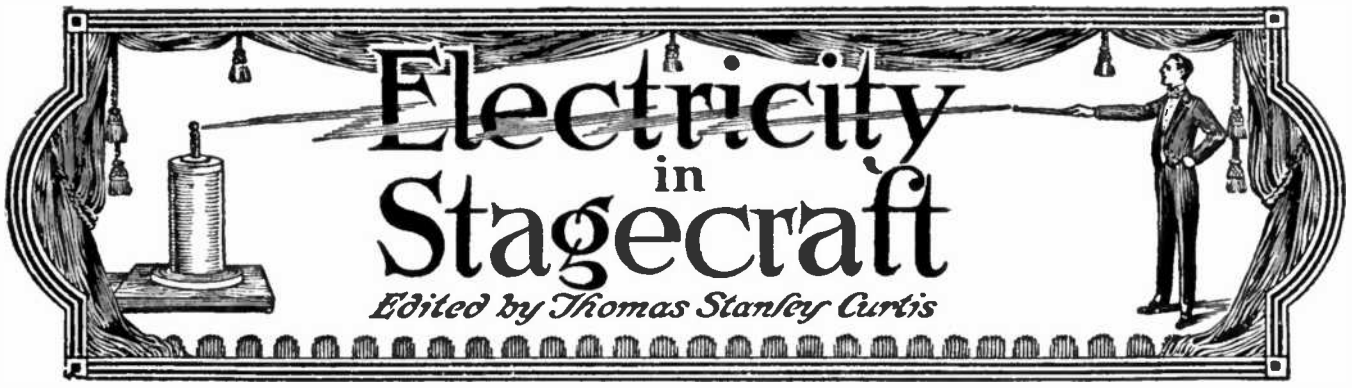
In the recharging of the battery it is intended that the case shall be placed in a carrier on the car or in the motor boat in order that the charging may be done while the engine is running, and without necessitating a special run of some ten hours solely for the purpose of charging the battery. If the battery is placed in the car each day, or perhaps every other day, sufficient charging will be done to keep it in good shape during the ordinary course of running about.

The selection of the lighting fixtures should properly rest with the individual. The use of lamps equipped with one of the miniature bases is strongly recommended, first, because such bases are now standard in automobile lighting equipment, and, secondly, because these lamps are much cheaper than the low-voltage lamp fitted with a standard Edison base. The lamps may be fitted either with the candelabra Edison base or the Ediswan type. The latter has advantages in point of positive connection and easy removal.

The sockets, switches and wiring may be of the standard or the miniature character. Adapters are provided whereby the candelabra size of base will be fitted to a standard socket which offers the advantages of cheap and readily obtainable shades and other accessories. However, if the scheme of everything in miniature is to be carried out—and for the sake of appearances this is recommended—the small fittings may readily be obtained, even to tiny push switches for the wall and dome lights for the ceiling. Space will not permit of the illustration of these many interesting little fixtures but the reader has only to send for the catalogue of any prominent electrical supply house for the fullest information and prices.

The wiring of the cottage is an important consideration for the voltage is so low that the distribution must be correct in order that all lamps may burn at full candle power. This article may therefore be considered as an introduction to the subject and for those who contemplate an installation it is suggested that they secure an abundance of catalogues and become familiar with the names and uses of the various fixtures which will be referred to in the next article. The complete wiring diagram for the house will be worked out in the July issue of THE WORLD'S ADVANCE.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us. Have you any suggestions to make? If so, send them in.



The Electrical Entertainer's Program*

THE selection and preparation of the experiments to be used in his program must needs rest with the entertainer himself. The work must show the individuality of the entertainer, since he is to perform the experiments and is responsible for their reception by the audience. The hints offered in this article should, therefore, be considered in the light of suggestions only, and the most the writer can hope is that they will start the entertainer on the right track. Constant experiment day after day will serve to bring out the wonderful possibilities in the apparatus, and as the worker proceeds he should make note of the effects produced and strive in future attempts to make the manner of presentation more striking and interesting. The one big thing to be borne in mind, as outlined in the last article, is that the experiments must hold the interest of the audience without the necessity of discourse or explanation. In the first place, the high frequency discharge produces a deafening noise which in itself renders speech inaudible while the coil is in operation, and, secondly, the audience as a rule does not care what the entertainer has to say and it must be shown. Simplicity should be the keynote throughout, for the average theatre audience may be treated as a more or less unruly crowd of children who want solely to be amused and entertained. With these facts in mind, the entertainer may plan his program. The number of experiments is seemingly limitless when one starts to operate the apparatus, and as the time allotted the average feature act in vaudeville is from twenty to thirty minutes, it is obvious that only the pick of the lot should be chosen. Some may be selected for their beauty, but the majority should be picked with a view to their sensational qualities.

Probably the most effective opening number is produced by the high frequency transformer in operation at full power with a dark stage. The streamers of fire leap out for several feet in all directions from the ball atop the transformer. The discharge makes a tremendous crackling and crashing noise which impresses the audience through its weirdness even before the curtain rises. As the curtain ascends, the center of the stage appears to be filled with a twisting, darting mass of slender, purplish fingers of fire which snap at the entertainer as he enters through the center door and walks down stage or toward the footlights. The current may at this time be shut off and the lights turned on full for the opening remarks which were discussed in the preceding article.

After the short preliminary address the performer may briefly explain to the audience how modern science enables man to make electricity his servant, and a servant whose services are to be respected but not feared. For instance, he can say that if he were to place his hands across the terminals of the low frequency transformer (pointing out the instrument, but not explaining its prin-

*This article is one of a series that has appeared in past issues of *Modern Mechanics* and THE WORLD'S ADVANCE since September, 1914. Previous installments have covered the construction of the apparatus referred to in this article. The demand for the back numbers has been so great that several issues are now out of print and can no longer be supplied. The author has in preparation, however, a very complete book dealing with this subject in a thorough manner and interested readers may obtain information relative to the work through our Book Department.

ciples) he would receive a shock that would positively be fatal, since its voltage is in excess of that used in the electric chair. He may then go on to say that through a simple process of conversion which changes the nature of the current but which does not in any way materially reduce its strength, and which, indeed, serves to increase its voltage to near or quite the million mark, he is enabled to apply that erstwhile destructive force to the good of mankind, curing diseases, relieving pain and in countless other ways fulfilling the claim that electricity is man's greatest servant when intelligently handled. The performer may then show how the tremendous current can be taken through the body without danger, even though its voltage is hundreds of times that used for purposes of electrocution. A metal rod is grasped in the hands, and while standing on an insulated stool the performer approaches the ball discharger of the transformer with the lights out and the coil in operation. As the rod nears the ball a beautiful halo or luminous vapor gathers at the point and increases in intensity as the distance is shortened. Finally, when the rod is within four or five feet of the ball, an enormous sheet of purplish-white flame crashes across the intervening space and into the rod held in the hands. The spark leaps into the air and breaks as the heat causes it to rise, and the moment the discharge is broken another flame takes its place. If the distance is shortened to within six inches or a foot of the ball, a piece of stick or bit of paper held in the spark will be ignited immediately.

The performer may then withdraw and have the current turned off for a few words of explanation. The next experiment may be made to show that the current is actually going into the body of the entertainer. To this end, he approaches the ball with his rod held in one hand and in the other he grasps an electrode to which is connected a wire leading to one terminal of an incandescent lamp. The other terminal of the lamp is attached to a second electrode which is held by the assistant. When the current is turned on the spark leaps to the rod as before and the lamp is lighted to full incandescence or even burned out by the current passing between the bodies of the performer and his assistant standing nearby.

WHY ALCOHOLISM MAY PRODUCE FATNESS.

It is noticeable that those addicted to the use of alcoholic beverages often reveal a tendency to corpulence which is proportionate to their use of the drug. This is sometimes taken as an indication of health and is often pointed out by the defenders of the drink habit as being sufficient proof of the harmlessness of the use of such stimulants. This fatness, however, is not a sign of health. It is not even an indication that alcohol is harmless. It is merely the result of the complete oxidization of the substance of alcohol by the human body. In other words, the fact that the absorption of a protoplasmic poison is complete rather than partial. The body will oxidize a two ounce quantity of alcohol in twenty-four hours, and will do it so completely that no trace of alcohol can be found in any excretory substance.

This simply means that the unnatural heat produced in the body by the presence of the stimulant answers, for the time being at least, for what would otherwist be produced by the expenditure of fats and carbohydrates. These latter are the fuel stored up by the body and normally burned up in the production of necessary bodily heat. When alcohol is consumed it furnishes heat—though not a natural heat—and this expenditure is avoided. The fat is therefore stored up in the body unused, and corpulence is the necessary result.

This, of course, is not a normal condition nor a proper process. It becomes more unnatural with increasing use of alcohol.

Practical Electro Therapy

Edited by Thomas Stanley Curtis

High Frequency Apparatus*

DISREGARDING for the moment the effects of the various frequencies upon the body, we may turn our attention to the broad classifications given by the manufacturers of apparatus to the currents produced. The classes are in the main but three: the Tesla or high potential current, the D'Arsonval or medium potential current, and the Thermo, or as it is sometimes called, the Thermo-Faradic current which is of comparatively low voltage as high frequency currents go. In order that the respective uses of the three currents may be the more fully understood, it is proposed to treat them under their proper headings.

THE HIGH POTENTIAL OR TESLA CURRENT.

This current is that taken from the terminal of the post which tops the high frequency apparatus and it is generally applied through a vacuum electrode of glass which is held in an insulated handle of suitable form. The application is quite without pain, and, in fact, without much of any sensation other than gentle warmth, unless the electrode is lifted from the skin in which case the resultant spark is rather painful. Therefore, one of the first points for the operator to impress upon his mind is the fact that the electrode should never be applied or taken away from the patient without the operator placing his own hand upon the glass to divert the current from the patient. The entire success of the electro-therapeutic treatment may be said to rest in the practitioner first of all inspiring confidence in his patient.

The most pronounced physiological effect of the high voltage current is shown in the increase of blood supply to the part under treatment. This results in an improvement in the local nutrition. Other characteristic effects are an increase of heat locally without a rise in the body temperature, a marked increase in excretion and secretion, and a general effect which may be either sedative or stimulating accordingly as the current is higher or lower in frequency.

In at least one particular can the vacuum tube application be said to be the direct opposite to the low voltage or D'Arsonval treatment. The effect of the vacuum tube treatment is to increase the arterial tension when the tube is passed up and down the spine, while the auto-condensation treatment with the D'Arsonval current is exceedingly efficacious in reducing the blood pressure. The pertinent fact here is to note that in cases of arteriosclerosis, the application of the vacuum tube to the spine should never be made. However, where the blood pressure is found to be normal, this treatment is of great advantage in producing a general tonic effect upon the system, particularly if a moderately low frequency is used.

In cases of alopecia and other diseases of the scalp and skin the vacuum tube treatment has been found invaluable. The treatment has received a large amount of publicity under the misnomer of "The Violet Ray," and so far has this misleading advertising been carried that the treatment has frequently been condemned as quack. The violet ray part of the proposition is simply a fascinating and perhaps mysterious-sounding trade

*This article is the fourth of a series on high frequency apparatus. The first article appeared in the March issue of *Modern Mechanics.*

name which was undoubtedly coined as a result of the appearance of the vacuum tube when the current is passing. The interior is filled with a purplish blue light which has lead to the deception which, while it makes no claims definitely, leaves the uninitiated under the impression that the treatment is in some way associated with the famous ultra-violet ray of Finsen. The fact of the matter is that even though there were an appreciable amount of ultra-violet light generated within the tube (as is probably the case), the glass walls are practically opaque to the ray and its passage to the patient would be stopped. However, beyond the mere fact that this slight deception has lowered the dignity of the treatment and has made it a name almost as common as that of a patent medicine, the incident need not concern us. The merit of the high frequency current properly applied is now definitely established beyond question, and the physician who first learns its powers and then uses it honestly is sure to derive everlasting satisfaction from the treatment.

The treatment has met with the most encouraging success in the stimulation of the growth of hair on heads not hopelessly bald, and the experience of a number of prominent workers goes to show that even gray hair may be restored to its original color through a perfectly natural process. While success has not come in every case, still the results are so encouraging that the writer believes he is justified in stating that this treatment offers a distinct opportunity to the scalp specialist who is willing to apply himself with the same diligence that he would bestow upon some unfamiliar but promising drug. The effects of the treatment are cumulative, and in stubborn cases patience is necessary, for while the first few treatments do not perhaps have the desired effect, the cumulative characteristics come out after persistent administrations.

For the application of the high voltage current vacuum electrodes are made in almost every conceivable form. The scalp is treated with a sort of rake or comb electrode; the cavities are approached with forms expressly made for the purpose, and for general bodily application a variety of surface electrodes may be obtained.

(*To be continued in the July number.*)

MARINE SURVEY DISCLOSES MENACES TO NAVIGATION

In that portion of southeastern Alaska forming the well-known inside passage followed by steamers, in a distance of 42 miles of ship channel, there has recently been discovered by Field Agent J. A. Daniels of the United States Coast and Geodetic Survey 21 pinnacle rocks hitherto unknown to navigation. One of these rocks, described as a submerged Washington monument, is 600 feet high and rises to within 17 feet of the surface. All of the rocks are located in water of from 20 to 100 fathoms deep.

When the original soundings were made it is probable that if the lead struck any one of the pinnacles it slipped off into deep water, thus failing to reveal the danger which of course could not therefore be charted. In locating these rocks a wire drag about a mile long, supported by cables to surface buoys and towed by small boats, was used. When the old survey was made the wire drag was not in use, and before this last survey four pinnacle rocks were discovered in this 42-mile stretch by ships being wrecked on them. They are named for the ships that were lost—the Idaho, Ohio, Potter and California rocks, respectively. The area covered by the wire drag was 60 square miles and it cost $675 to discover each rock. The Department of Commerce states that the cost of the wreck of the *State of California* was 31 lives and $300,000, so that this wreck alone would pay for the location of 400 pinnacle rocks, or would run a wire drag party for twenty field seasons of three months each.

If Congress will appropriate the necessary funds the work will be continued with vigor, so that mariners would feel safe in sailing those uncertain waters. Hundreds of miles are yet to be surveyed.

Plant Culture by High Frequency Current*

Part IV. Construction of the High Frequency Coil

IN previous articles the reader has been told of the construction of the transformer which steps the commercial lighting current up to a potential of several thousand volts, the condenser which stores up this high voltage, and the spark gap or discharger across which leaps the stored-up current in the condenser. The discharge of the condenser across the gap sets up electric oscillations or, as it is termed, a high frequency current. In order that this current may be rendered suitable for the purposes of electro-culture, however, its potential must be raised to a very much higher degree and the object of this article will be to explain the construction of the special type of transformer or coil employed in the process of stepping up the already high potential, high frequency current.

The high frequency transformer differs from the type used for the conversion of low frequency or commercial currents in that it has no core of iron and the turns in its primary and secondary are numbered in tens and hundreds, respectively, instead of in hundreds and thousands, as is the case with the transformer used for lighting and power work. Furthermore, on account of the extremely high potentials induced in the oscillation transformer, the insulation problem must be treated in a somewhat radical manner. This problem is not, however, so difficult of solution as it might seem. The coil may be of generous proportions, since close coupling of the primary and secondary winding is not essential, and the permissible air space affords a most effective insulator. While the efficiency of oil insulation in cases similar to the present one is not questioned for one moment, still the air insulation, if properly carried out, offers exceptional advantages over all other forms wherein the windings are hidden from view and are inaccessible. The latter method has accordingly been selected.

The transformer consists essentially of a primary winding of eight turns of copper strip placed at the base of a cylinder around which is wound the secondary of 300 turns of No. 30 D. C. C. copper magnet wire in a single layer. The starting point of the primary, as well as that of the secondary, is connected to a stud of metal which passes through the base of the instrument for ground connection. The primary of the coil is connected in the circuit of the condenser and spark gap in order that the oscillations may pass through the copper strip and thus induce a high frequency current of higher voltage in the secondary winding. The general appearance of the completed coil is shown in the illustrations, Fig. 1, and in Fig. 2 the reader will find details of the parts from which it is constructed, together with the dimensions of the various pieces.

*This article is one of a series dealing with various methods of electrical plant culture that has appeared in this publication since September, 1914. The various instalments have dealt with the different methods of applying electricity to horticulture, as well as described the construction of the apparatus required. Back numbers may be secured at 15 cents each while the supply lasts.

The secondary cylinder is of cardboard and made expressly for the purpose. In designing the coil, the writer has purposely chosen, wherever practicable, dimensions which correspond with the standard sizes of the parts now obtainable through electrical manufacturers. Accordingly, the cylinder has been made eight inches in diameter and 13 inches long. The wall is about one-fourth inch thick. Into each end of the cardboard cylinder is fitted tightly a head turned up from whitewood and soaked for an hour in melted paraffin. The heads are drilled for the terminal post and the brass stud, respectively. The details of the terminal are given in Fig. 2 but the stud has been omitted, since its construction is obvious. The next operation is to treat the cardboard cylinder to three coats of shellac, making certain that each coat is bone-dry before applying the next and baking the cylinder after each coat in a moderately warm oven.

With the third coat of shellac quite dry, the cylinder may be mounted in the lathe between centers, a slender screw driven into the wooden head and catching a slot in the faceplate to afford a means of driving. The lathe should then be speeded up and the surface of the cylinder carefully gone over with the finest sandpaper to remove the inevitable irregularities caused by particles of dust and dirt. On no account must emery paper or cloth be used and the lathe bed must be scrupulously clean while the cylinder is being handled, as the least trace of metal chip or dust under the winding would be fatal to good results.

The surface of the cylinder having been carefully smoothed over, the lathe may be prepared for the winding. The gears are set to cut 24 threads per inch and the winding of No. 30 D. C. C. wire is started one-fourth inch from the end. In starting, the wire should be passed through a small hole in the cylinder and the hole immediately plugged with a bit of wood covered with wet shellac. This will prevent the winding from coming loose during subsequent handling. The lathe should be turned slowly and backward, and the wire fed through a guide held in the tool post. When the finishing turn, the 300th, is in place, the final end

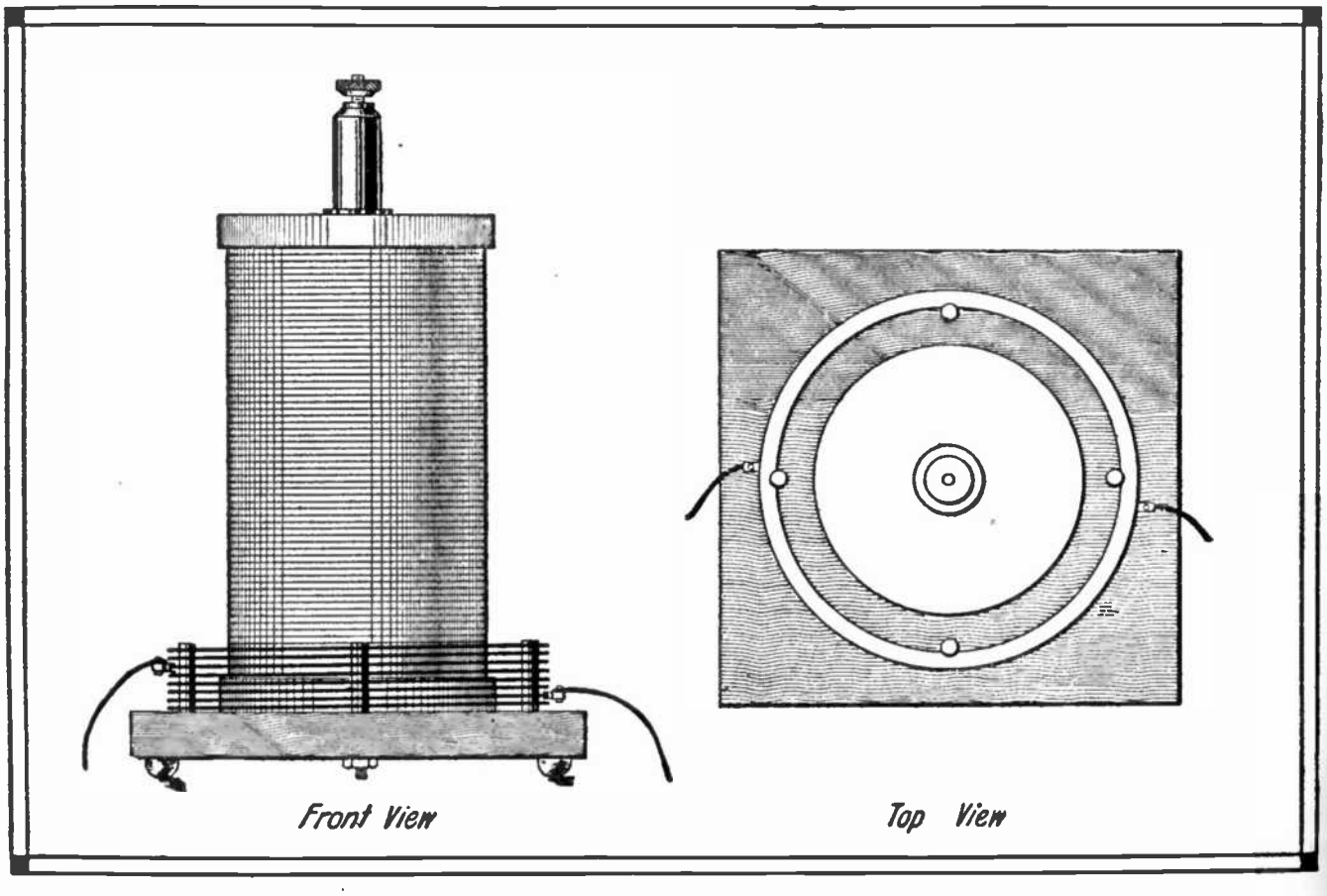


Fig. 1.—The High Frequency Coil for Plant Culture as it Appears when Completed.

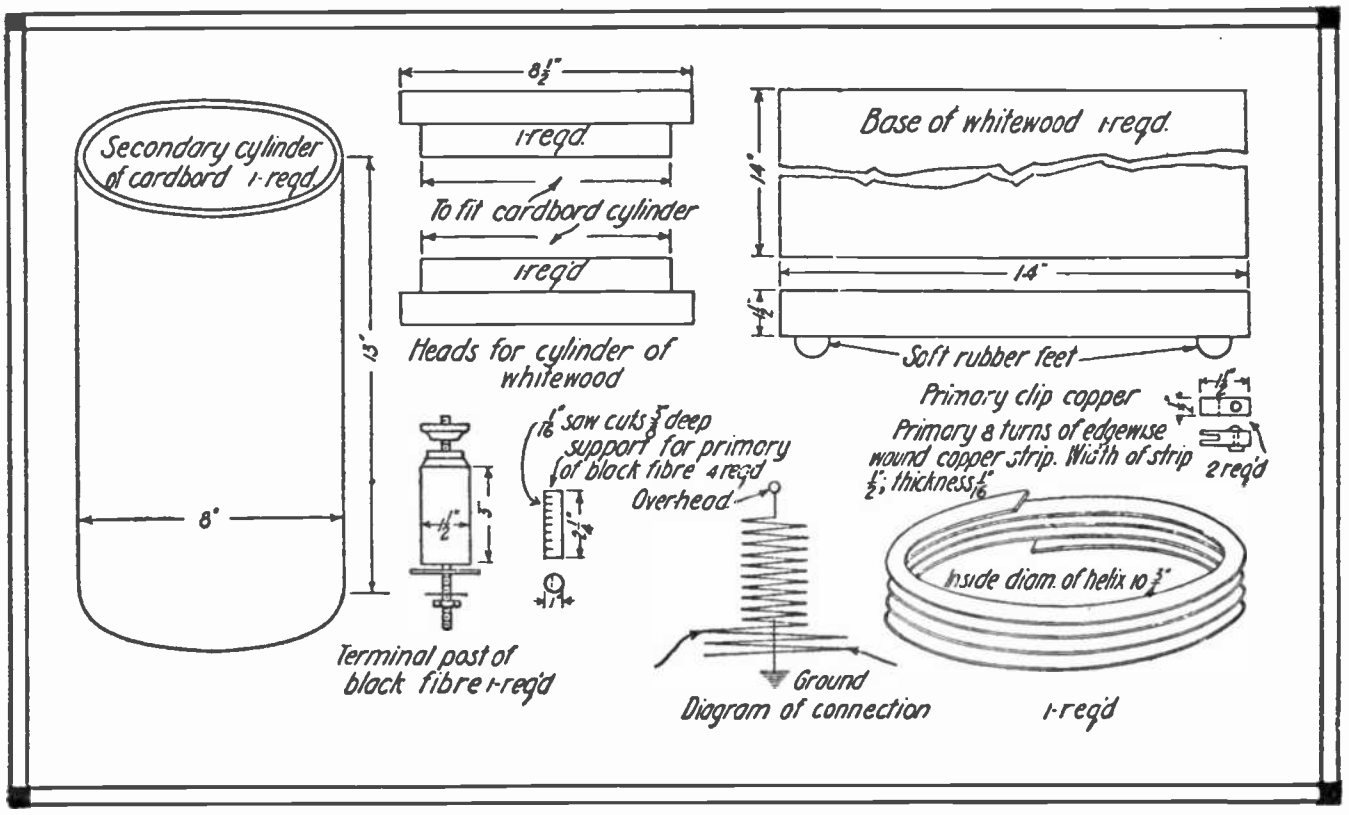


Fig. 2.—The Various Parts Required in the Construction of the High Frequency Coil.

of wire may be passed through the cylinder and secured as was the starting end.

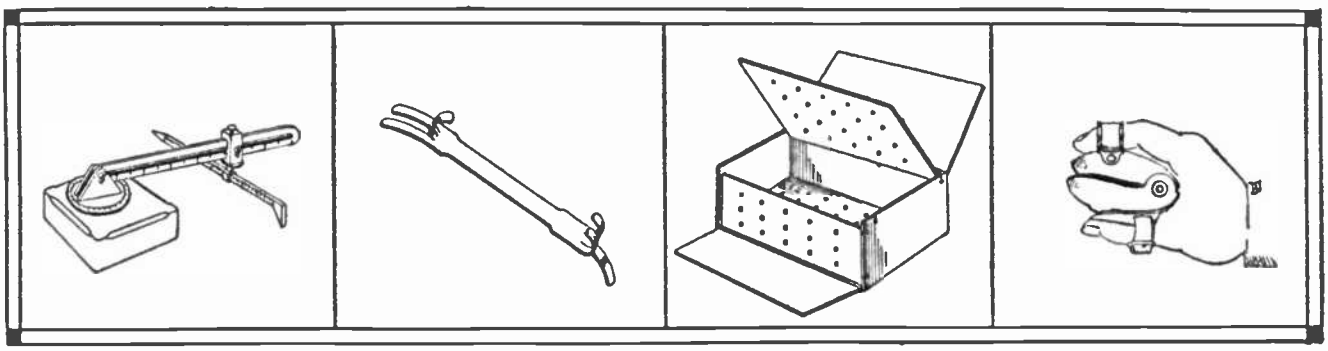
While the coil is still in the lathe, the winding should be coated with shellac applied in a thick solution and with a soft brush, the greatest of care being taken to see that the fluid soaks well into the turns and between them and also that no air bubbles or particles of dirt are permitted to remain. When the first coat has dried for an hour or more, the cylinder may be carefully removed and placed in the oven, wherein the temperature should not be over 150 degrees F. The baking may continue for a few hours and the second coat applied after the coil has been put back in the lathe. The builder is strongly advised to do all of the painting in the lathe, as the examination and turning of the cylinder is greatly facilitated thereby. The third coat may be the final one and it should be dried as thoroughly as the first and second.

The secondary finished, the wooden heads may be removed and connection made with the terminal and base studs. This is easily accomplished if the ends of the wire are left long and passed through the holes in the heads with the studs fitting loosely. When the heads are replaced, the wires may be drawn taut and the nuts of the studs turned up to grip the bare wire. The heads may then be secured in place by plugging with wood dipped in shellac, the small holes drilled around both top and bottom of the cylinder.

The base of the instrument is simple in construction, as is readily seen in the drawing. The method of supporting the primary strip, as well as the nature of the latter, will, however, bear some explanation. The copper strip is one-half inch wide and one-sixteenth inch thick and is wound edgewise into a helix having an internal diameter of 10¾ inches. This helix material is also to be obtained in the size given and it can be purchased far more cheaply than it can be formed up by the amateur workman unless he has the necessary equipment for the bending operation. As this device is quite complicated, the space necessary for its description will not be taken here. The problem is to bend the thin strip edgewise and prevent it from buckling.

Assuming that the builder has procured the helix material, eight complete turns of which are required, the attention may be directed to the posts which support the helix on the base and at the

(*Continued on page* 861)



Recent Novel Patents

A Surface Gauge

A New York inventor has just secured patent rights on a very novel design of surface gauge which is illustrated in one of the accompanying sketches. As will be noticed, it consists of a heavy block on which is pivoted a long arm. The arm may be set at any angle by means of the protractor. On this arm slides another arm. This device should prove very convenient in laying out work.

A Pot and Cover Lifter

An Austrian inventor has been granted a patent upon an ingenious pot and cover lifter, made from a strip of sheet metal. It is slotted at both ends, so that the fingers, which have been curved, will easily grasp pots and pans of various shapes.

Cigar-Box Humidor

A cigar-box consisting of two thicknesses of wood on the top, bottom and front, containing moistening pads between the two bottom layers, is the subject of a patent recently granted to a Florida inventor. The inner layers of wood are perforated so that the moisture from the pads can penetrate to the cigars.

A Fruit-Picker

A scissors-like fruit stem cutter which is adapted to fit the hand of the cutter has been patented by an inventor in California. The two blades of the cutter pivot at a point within the small of the hand, and they are held to the forefinger and thumb by small straps, so that they may be opened and closed readily.

A Coat and Vest Combined

The man who likes to work in his shirt sleeves and at the same time has no convenient place to hang his coat will be interested in a combination coat and vest upon which a patent has been granted to an Illinois inventor. The coat flap is made in combination with the vest flap. The coat flap has an inner pocket.

A Knife Sharpener

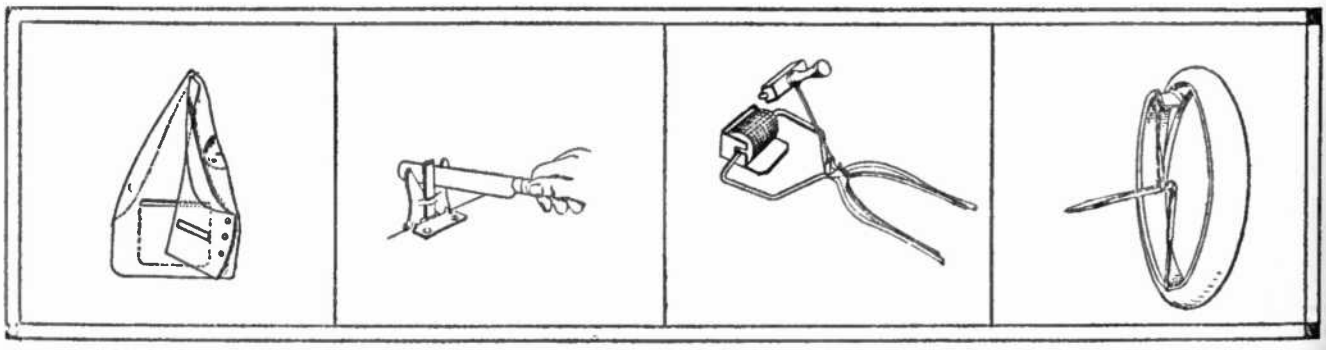
A knife sharpener of unusual design has been patented by a man in New York. It consists of a hinged plate which is screwed to a table edge or shelf, an upright plate, cut with a V-shaped notch, and a sharpening steel fixed upright in the wedge. The knife to be sharpened is drawn across the steel, the angle of the sharpened edge being controlled by the wedge.

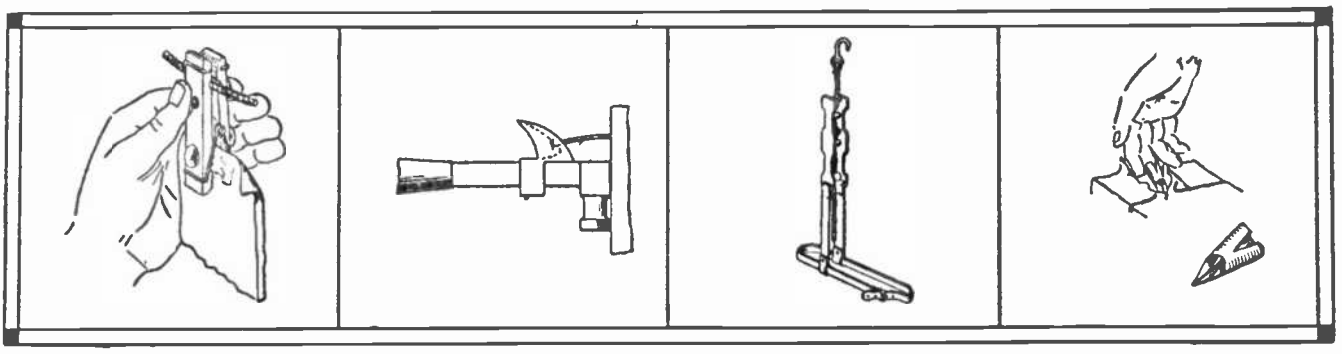
A Coin Wrapper

A new coin wrapper has been devised by a Chicagoan. It consists of a metal box, open on two sides, with slots at the ends. A clamping tool forces the coins together for wrapping, when its ends are inserted in these slots, and it removes them when the wrapping is completed.

Tool for Demounting Rims

Demountable rims and demounting tools for automobiles have been the subjects of countless patents. A new tool for this purpose, however, is unique in some of its features. A Connecticut man is its inventor. The tool consists of a lever arm to which is attached two arms of steel. These arms with the handle act as a double lever. The ends of the arms are bent to fit the edge of the rim. Depressing the lever pries one end of the rim downward, so that the tire can be removed.





A Spring Clothes-Pin

A clothes-pin, which is fitted with a spring so that it can be clamped upon the wire and the object to be suspended, has been patented by a New York inventor. A groove is cut in the upper end of the pin in order that the clothes-line will fit in it and be held tightly. The lower inner surface of the clamps is corrugated in the same way so that the article to be dried will not slip.

Ingenious Claw-Hammer

A claw-hammer which is provided with an adjustable claw that slides at the will of the operator, up and down the handle, has been patented by a California man. A locking pawl is fitted at the bottom of the slide, so that the claw may be locked in any position. This device will be found very convenient in removing nails of all lengths from wood. Sometimes a nail is protruding some distance and cannot be removed with the ordinary claw-hammer.

A Portable Fire Escape

A portable fire escape, which is to be attached to the body of the person making the escape, has been designed by a Maine inventor. A belt is provided at the lower end, which is intended to be passed around the body. A rope is hooked to the building and is passed through several metal pins set rather close together and the upper part of the contrivance. As the escaping person slides to safety sufficient friction is exerted by the pins against the rope to sufficiently retard the passage to the ground.

Twine Cutter for Finger

A small metal cap made to go on the finger and fitted with a sharp edge for cutting the twine on boxes is an ingenious little device recently patented. The tip is made flexible so that it will fit a variety of finger ends. The great advantage of this device is that it is constantly at hand. Much time is often wasted by clerks in hunting for a knife with which to cut the string of packages.

Sanitary Drinking Cup

A sanitary drinking cup, by means of which the faucet to which it is attached may be independently used, has been invented by an Oregonian. The cup comprises a bent tubular stem which is pivoted to a clamp attached to the faucet. When the cup is used the bent end of the stem is swung under the faucet; when the faucet is used, the cup is swung up out of the way on the same pivot.

A Swimming Machine

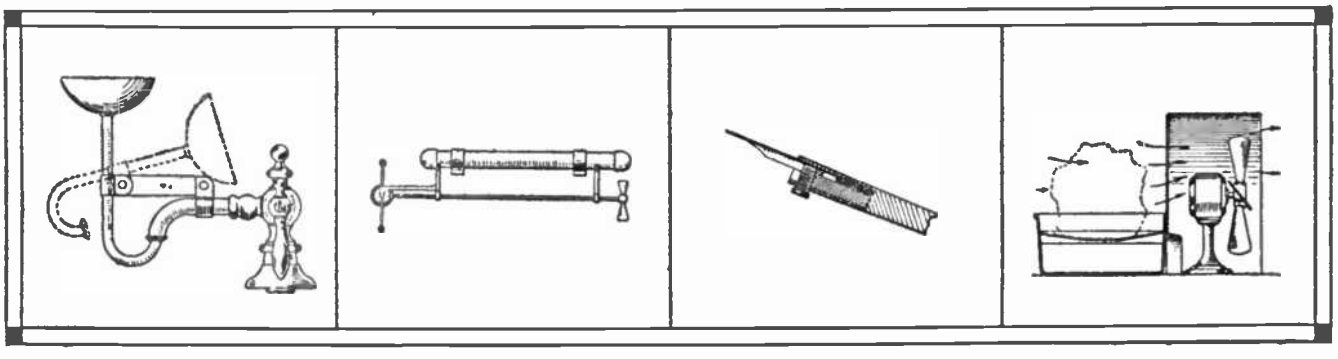
An ingenious swimming machine is the subject of a patent granted recently to a Colorado inventor. It consists of a number of floats to the bottom of one of which is connected a small propeller and a driving gear. A swimming device of this kind makes it possible for anyone to cover long distances in the water with the minimum of fatigue and at far greater speed than by ordinary means.

Set Screw Holds Pen in Place

To vary the monotony of the ordinary type of pen, an inventor in Oregon has brought out a somewhat complicated pen clamping device. The end of the penholder, which is hollow, is fitted with a plug in which is placed a spiral spring. The pen point is inserted so that it forces against this spring, and can therefore be adjusted. A thumb screw, set at right angles, passes through the end of the pen holder and clamps the point in place.

Fan Cools Air by Ice

The combination of an electric fan, a protecting shield for the blades and a pan to hold a block of ice is the subject of a patent recently issued to a man in Iowa. The ice is placed in the receptacle behind the fan and shield. The fan, revolving, draws warm air over the ice, cools it and projects it out into the room.



BOOK REVIEWS

A Telephone Handbook

While there are many telephone reference works available at present, the latest contribution of David Penn Moreton, entitled *Drake's Telephone Handbook,** fills an important want. It is in the nature of a handbook, and as such it covers the subject in a concise, practical and handy manner. The author does not give lengthy and overdrawn discourses on electrical and magnetic principles, but instead he introduces the subject proper to the reader with the least amount of preliminary discussion. It is assumed that the reader has a good fundamental knowledge of electricity in general and wishes to use Mr. Moreton's work as a pocket reference book.

* *Drake's Telephone Handbook,* by David Penn Moreton, E.E., B.S. Published by Frederick J. Drake & Co., Chicago, Ill. Contains 286 pages and over 160 illustrations. Cloth bound. Pocket size. Price, $1.00.

Electrical Measurements

A handy reference work for those interested in electrical measuring instruments and their uses has recently been published under the title of *Electrical Measurements.** The commendable feature of this work is that the authors have taken it for granted that the readers have a good basic knowledge of electricity, and, as a result, it opens without loss of time or space to the subject under discussion. The authors appear to have covered the subject in a thorough manner, and, what is more, they have devoted a goodly part of the work to recording watt-hour meters.

* *Electrical Measurements,* by Bushnell and Turnbull. Published by the American Technical Society, Chicago, Ill. Contains 170 pages and 139 illustrations. Cloth bound. Price, $1.00.

Electro-Chemistry and Welding

Intensely interesting subjects are electro-chemistry and welding, and it is doubtful if they could be covered in a more comprehensive and entertaining way than in the work of Messrs. Burgess and Cravens entitled, *Applied Electrochemistry and Welding.** In truth, the book is really two separate works: the first, dealing with electro-chemistry, has been prepared by Charles E. Burgess and deals with all that is worth knowing regarding this fruitful field of electrical application; the second, prepared by George W. Cravens, discusses at length the various methods of welding, both ancient and modern. In connection with the latter portion of the book, the sections dealing with Thermit and electric welding are of particular interest.

* *Applied Electrochemistry and Welding,* by Burgess and Cravens. Published by the American Technical Society, Chicago, Ill. Contains 132 pages and is profusely illustrated. Cloth bound. Price, $1.50.

A New Wireless Book

What is beyond doubt an innovation in wireless books is the recent work entitled, *A Wireless Receiving Set for Time Signals.** It is evident that its author has endeavored to describe in the simplest and most comprehensive manner how to build a wireless set for receiving Government time signals. While primarily intended for jewelers and watchmakers, this book should be of almost equal interest to the beginner in wireless telegraphy, or the amateur who desires to build a long-distance receiving set at a small outlay for materials. It enjoys the distinction of being one of the few books that really describe the construction of the different pieces of apparatus in a complete manner, leaving nothing to the reader's imagination.

* *A Wireless Receiving Set for Time Signals.* Published by C. Brandes, Inc., 32 Union Sq., New York City. Contains 32 pages, 15 illustrations and a code chart. Durable paper cover. Price, 25 cents.

An Electrical Book for the Beginner

To the reviewer of the books in these columns there is a particular and personal interest attached to the work entitled, *Practical Lessons in Electricity,** by Millikan, Crocker and Mills. It is quite some years ago now that he received a copy of an earlier edition of the same work and spent many an hour diligently studying and learning by its aid the elementary principles of electricity and electrical machinery. The present edition incorporates several minor changes that have been necessitated by improvements in electrical machinery during late years, although in the main it is much the same as the earlier editions, indicating that the work has been popularly received. While much could be said regarding *Practical Lessons in Electricity,* briefness compels these points only to be mentioned: It covers the important principles of electricity in a concise manner; important electrical devices, such as the telephone, dynamo, motor, batteries, storage batteries and the telegraph are touched upon; and, in a word, it may be added in conclusion that the book is unhesitatingly recommended to the layman desirous of securing a fundamental knowledge in electricity.

* *Practical Lessons in Electricity,* by Millikan, Crocker and Mills. Published by the American Technical Society, Chicago, Ill. Contains 318 pages and is profusely illustrated. Cloth bound. Price, $1.50.

Questions and Answers

This department will appear regularly in THE WORLD'S ADVANCE, subject to following regulations: The questions must be legibly written with typewriter or in ink, on one side of the sheet. Each question must be definite and cover but one point of the subject under consideration, although a letter can contain more than one question. On the 10th of the second month preceding the date of issue of the magazine, all the questions on hand will be considered and those which are put in the most intelligent manner and of widest general interest will be selected for publication in such issue, the number being governed by the space available. All other questions will be returned to the writers with a statement of the price for which they will be answered by letter. Return postage must be enclosed with each letter containing questions, and the letters must be addressed to the Questions and Answers Department and contain nothing relative to other departments of the magazine.

WEATHER BULLETINS.

Although we have at various times explained the meaning of the code used by Arlington and Key West in sending the weather bulletins at 10 P. M., we still receive many inquiries as to their meaning. We will, therefore, attempt to cover all of the many inquiries by the following explanation:

The bulletin is preceded by the letters USWB, meaning U. S. weather bulletin. Then follows a series of characters thus, S99131, T00618, etc. The letter stands for the place at which the observations were recorded. These stations are S-Sidney, T-Nantucket, DB-Delaware Bay, H-Hatteras, C-Charleston, B-Bermuda, K-Key West, P-Pensacola, for the Atlantic group; and DU-Duluth, M-Marquette, U-Sault St. Marie, G-Green Bay; CH-Chicago, L-Alpena, D-Detroit, V-Cleveland, and F-Buffalo, for the Great Lakes group. The first three numbers indicate the barometer reading. The first figure of the barometer is omitted, for it is known that if the first figure of the bulletin is an 8 or 9 the omitted first figure of the barometer reading was a 2. If the first figure in the bulletin is other than an 8 or 9 the omitted figure was a 3. Thus in the above illustration the barometer was, Sidney 29.91 and Nantucket 30.06. The fourth figure in the bulletin is the direction of the wind. The compass is divided into 8 parts, each designated with a number, north being 1, northeast 2, etc. The last figure is the velocity of the wind in the Beaufort scale. The complete translation of the above example is, then, Sidney, barometer 29.91, wind east three miles, Nantucket, barometer 30.06, wind north forty miles. The observations are taken at 8 in the evening.

DYNAMO DATA.

(35) W. F., Des Moines, Ia., asks:

Q. 1.—Will the following design and dimensions be suitable for making a dynamo for 50 volts and 10 amperes? Upright field magnet (Thomson-Houston type) with cast-iron magnet cores, 2½" dia., 2" long. Armature core 2¾" dia., 2¾" long, with 16 slots, each ¼" x ⅜". A speed of 2000 rev. is preferred. If possible, Nos. 17, 18, 21 and 23 wire should be worked in, for a considerable quantity of those sizes are on hand.

A. 1.—Using a size of wire to permit an output of 10 amperes, you can get on only enough turns to produce about 20 volts. You will need to increase the dimensions of all parts about 20 per cent. The proportions are good. For your guidance we would refer you to Watson's "How to build a ¼ h. p. Dynamo," and "How to build a ½ h. p. Dynamo," but will be pleased to advise you further, if you desire it.

MOTOR PROBLEMS AND AUTOMOBILES.

(36) A. S., Chicago, Ill., asks:

Q. 1.—What horsepower of alternating current motor would be required to drive a 5 k.w. 110-volt direct current generator?

A. 1—About 7 or 8 h.p.

Q. 2—How many minutes does it require for a generator to "build up" to the point at which it would be suitable to start a 5 h.p. motor?

A. 2.—About 10 to 30 seconds is supposed to be allowed for starting a motor of the size you mention, and the generator ought to have its field magnet well established in the same time. Evidently you have some particular application of electric power, and we advise you to consult the engineering authorities at the offices of some of the manufacturing companies, General Electric, Westinghouse, Allis-Chalmers, etc. They have apparatus to sell and are very free with reliable advice

Q. 3.—Does it require the same horsepower to drive an electric car as a gasoline car?

A. 3.—Under the same conditions, yes, but in consequence of the gasoline engine having very small overload capacity, as compared with an electric motor, the former must be built powerful enough to supply the maximum re-

quirements. For this reason it may not work at as high an efficiency at ordinary loads as desirable.

CONNECTIONS FOR TRANSFORMERS.

(37) E. H., Placerville, Idaho, asks:

Q. 1.—How to connect three transformers in such a manner as to change a primary voltage of 19,000, three-phase, to 440 volts, two-phase?

A. 1.—This cannot be done with three transformers, but with two, connected on the "Scott" or "T" plan, it can be accomplished. For this purpose you need transformers having primary coils wound in two sections, each for 9,500 volts, which can be coupled in series, also having taps brought out at the 16,400 volt points. Secondaries are both alike, being for 440 volts. Connect No. 1 transformer primaries in series and having this middle point connected to one terminal of No. 2 transformer. The two terminals from No. 1 and the special tap from No. 2 will give the three to which the line wires connect. The four secondary wires will permit connections of two-phase order.

REWINDING A MOTOR INTO A GENERATOR.

(38) J. G. E., Phillipsburg, N. J., asks:

Q. 1.—What should be the new winding for a 220-volt ½ h.p., 2,150-rev. direct current motor to permit its use as a 30-volt 30-ampere generator, at a lower speed? It has a shuttle armature and 42-segment commutator.

A. 1.—To get the ½ h.p. you probably would have put in about 2.75 amperes, or about 600 watts To ask for an output of 900 volts, and that, too, at a reduction of speed, will clearly be impossible. You can get about 20 amperes at 30 volts by rewinding the machine with wire six numbers larger than at present. We suppose you meant a toothed drum armature rather than "shuttle," for this would permit but two commutator segments.

REWINDING A MAGNETO.

(39) H. B., San Francisco, Cal., asks:

Q. 1.—Can a 3-bar telephone magneto generator be rewound so as to give 6 volts and 1½ amperes, direct current, a 2-segment commutator being used?

A. 1.—Yes, but you will get more satisfactory results if you adopt a 6-slot laminated drum armature and a 6-segment commutator. Especially for operating ignition apparatus the shuttle armature will be irregular.

INDUCTANCE FORMULÆ.

(40) Roy Hustor, Toronto, asks:

Q. 1.—Can the formula—

$$L=\frac{(5 \times D \times T)^2}{1000\ (1/3\ D + 3/2\ M + 5/4\ N)}$$

where L is inductance in microhenrys, D average diameter in inches, N depth of winding in inches, T number of turns, M length of coil in inches, be applied to a single layer coil of a loose-coupler, or to a doughnut coil such as is used in variometers?

A. 1.—The above formula applies to the doughnut type of coil. That is, to a coil of more than one layer and whose length is small compared with its diameter. For a single layer coil such as the ordinary tuning coil the formula simplifies to—

$$L=\frac{(5 \times D \times T)^2}{1000\ (M + 1/3\ D)}$$

Of course, it is to be understood that these formulæ are only for the self inductance and moreover are only approximations. A good treatise on self and mutual inductance is found in Reprint No. 93, "Formulæ and Tables For the Calculation of Mutual and Self Inductance." This bulletin may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for thirty cents. It contains many formulæ and explains the cases to which each applies. It is a book well worth having. Fleming, in his "Principles of Electric Wave Telegraphy and Telephony," explains several formulæ for calculating inductance for high frequency currents.

CHANGING A MOTOR INTO A GENERATOR.

(41) C. E. H., Deerfield, N. Y., asks:

Q. 1.—Can a ⅛ h.p. 500-volt .4-ampere motor—Crocker-Wheeler, type S—be rewound so as to give an output as a generator of 10 volts and 8 amperes? It has a laminated armature with 8 slots and a commutator of 16 segments.

A. 1.—The figures you have indicated allow for a motor input of 200 watts, so you ought readily to obtain the 80 watts from use of the machine as a generator. Perhaps you prefer to drive the armature at a lower speed. It would appear that the present field winding might be of the series rather than of the shunt type, in which case you may possibly be able to utilize it merely by connecting the two coils in parallel with each other rather than as at present in series. At any rate, it would be well first to rewind the armature, then to try the machine. You will require only about one-fortieth as many turns of wire, you can therefore use wire of 40 times the size. For instance, if the present wire is No 30, you could use No. 16, double cotton covered. Wind a given slot and its opposite one-quarter full, bring out a loop, then wind it and its opposite one-half full, and bring out a second loop. Then do the same in the next slot and its opposite. You will thereby get 16 loops for attachment to the commutator. If you have to rewind the field magnets, use No. 19 or 20, single cotton covered.

RADIO SECTION

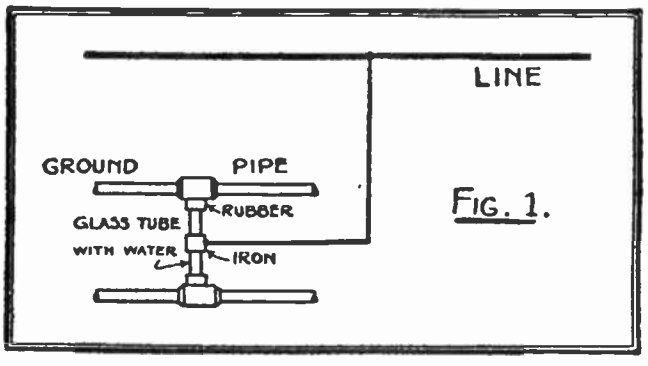
Devoted to the Encouragement of Amateurs and Experimenters in the Field of Radio Communication.

Lightning Protection

By A. S. Blatterman, B. S.

IT is generally recognized that a lightning discharge is oscillatory and that the oscillations are of high frequency, perhaps from 100,000 to several million cycles per second. At these high frequencies the electric constants of conductors are very different from those normally. In the passing of high-frequency currents, energy is expended in two ways, as heat at the surface of the conductor and in electromagnetic radiation into surrounding space. In the case of an ordinary lightning rod, the resistance, which depends on the material and cross-section of the rod, is of little importance; even the shape of the conductor, which is of much importance with frequencies from 100 to 100,000 cycles per second, is of relatively little importance at frequencies from a million to ten million cycles. It is evident from this that, provided a lightning discharge is oscillatory, it matters very little whether copper or iron, flat or round, stranded or solid conductors are used, though, to be sure, there is some advantage in flat ribbons at all but the highest frequencies. One object of a lightning rod is to form a path for the discharge, a path offering much less obstruction than any path through the structure to be protected. If the *resistance* were all important, this could well be done by using a very large copper rod, but at these very high frequencies the *impedance* is measured in tens or even hundreds of ohms, whereas the resistance may be but a small fraction of an ohm. Thus the inductance of the rod at these high frequencies is of great importance.

Lightning discharges from cloud to earth undoubtedly take place, not only at moderate voltages, but also at voltages which are extremely high, the latter being the case when the charged cloud is separated from earth by a layer of more or less dry air. Under these conditions the distribution of potential may be quite uniform and the air may, as a limiting case, be charged to its breakdown point all through its mass, when the p.d. may be great, perhaps hundreds of millions of volts. The maximum value of the discharge current may also be very great, reaching thousands, if not hundreds of thousands, of amperes. Such enormous currents passing through a conductor at high frequency give rise to exceedingly high potential drops along the conductor, and for this reason a lightning discharge



Method of Grounding a Line in Order to Remove Static Charges.

would frequently rather jump several feet in air than travel one foot in the conductor. Sharp bends should be avoided.

For the protection of transmission lines the lightning rod is usually a horizontal wire or a couple of wires carried along the towers above the line and grounded. Such construction brings ground, or zero, potential up to a point above the transmission line and thereby lowers the electrostatic potential of the space in which the transmission line is located. The ground wire also protects the stations along the line in case a direct stroke of lightning reaches the line, by its damping effect as a secondary grounded conductor.

Inasmuch, however, as a system of overhead ground wires cannot be a complete enclosing shell of perfect conductivity its protective effect, however great, cannot be quite complete; therefore, protective devices have to be installed at the stations as safeguards against the entrance of lightning from the line.

Station protection differs somewhat from the ordinary protection of buildings. As far as safeguarding buildings is concerned, there are to be considered either the direct lightning stroke, or else the secondary discharge caused by a violent primary discharge in the neighborhood. But in the case of the transmission line, where station damage is due largely to surges which are characterized by the electrical constants of the line, it is not simply a matter of conducting a lightning stroke safely to earth.

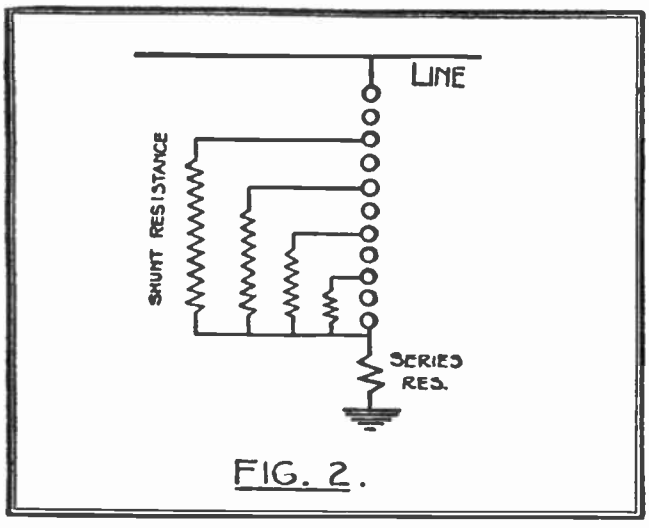


FIG. 2.

Connections for a Multigap Arrester with Shunt Resistances.

It is true, as regards sudden versus sluggish lightning discharges, that the sudden variety is most dangerous. Even the slow accumulation of charge on a line, which is called the static charge, is a series of spits, as can be shown by connecting a telephone to a suspended aerial conductor; but such accumulation can be taken care of by grounding through a high resistance. (See Fig. 1.)

When a pure electric wave containing equal amounts of electric and magnetic energy is created on a transmission line by a lightning discharge, the energy of the wave is dissipated with a minimum of surging of current if the two wires be connected at the end of the line by a non-inductive resistance of which the value is $\sqrt{\frac{L}{C}}$ where L and C are respectively the inductance and capacity of the line. This is evident because a resistance of value $R = \sqrt{\frac{L}{C}}$ does not reflect any portion of a wave, but swallows up its energy completely.

In Fig. 2 is shown the connections of a multigap arrester with shunt resistances. Such an arrester automatically inserts a low resistance or a high resistance between the line wires, according as the energy to be dissipated is large or small. The action of the arrester is as follows:

The arrival at the end of the line of a traveling wave from the point of lightning stroke causes the voltage to rise to an excessive value. Consider the arrangement shown in Fig. 3. The point p is at ground potential so that the series gaps break down first, and this throws the line potential directly across the shunted gaps and the shunt resistance. Generally the shunted gaps will now break down; but if the various parts are properly proportioned the shunt resistance will take so much current from the shunted gaps that the arcs in these gaps will drop out. Once the arc drops out of the shunted gaps it must pass through both series and shunt resist-

ances, which will reduce the current strength so much that the series gaps can suppress it altogether. The use of the series resistance is found necessary for the successful operation of the above to prevent enormous rushes of current. It is in general an objectionable feature, but, if small, it is practically harmless. The use of the shunt resistance allows the series resistance to be kept comparatively small.

From the standpoint of lightning protection an interesting feature may be observed in the construction of the line itself, namely, to so design the transmission line as to realize the condition of the distortionless circuit, so that any wave starting out from the place of lightning discharge would retain an unimpaired abruptness at its front, and thus be of a character to be easily arrested by a choke coil and deflected to earth through a spark gap.

When the resistance per unit length of a line (counting both lines) is related to the leakage resistance between unit length of the wires in such a way as to cause an equal decay of the electric and magnetic fields in a wave (so that $\frac{1}{2}LI^2 = \frac{1}{2}CV^2$ at all times) then the wave travels along without distortion.

Referring to Fig. 4, we represent the resistance per unit length of the circuit by R_w, and the inductance and capacity respectively by L and C. The current at the point considered is I, and the p.d. between wires is E. The leakage resistance between unit length of the wires is R_1. We have,

Loss due to wire res. $= 2R_wI^2$

Loss due to leakage $= E^2/R_1$

The condition for no distortion is that these two losses be constantly equal.

$$2R_wI^2 = \frac{E^2}{R_1}$$

Solving for R_w, and using the well-known relation $E^2/I^2 = L/C$,

$$R_w = \frac{L}{2C} \times \frac{1}{R_1}$$

In the usual transmission line R_w is so large that this equation does not hold, and hence, to obtain the distortionless condition, it may be of advantage to lower R_1, *i. e.*, to provide high-resistance

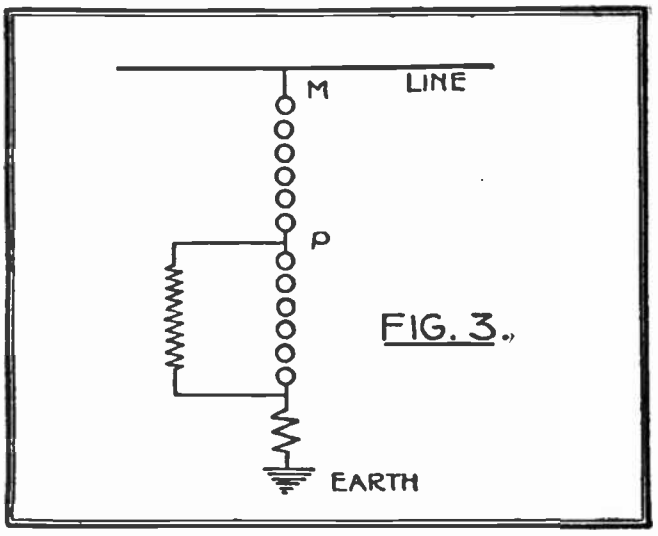


FIG. 3.

Another Form of Multigap Arrester for Removing Static Electricity from a Line.

leakage paths to earth from the line, or from wire to wire of the line. A traveling wave would then retain its steep front and be the more readily stopped by the choke coils at stations and thence conveyed to earth through the spark gap arresters. Fig. 5 shows the arrangement of appliances at stations along a transmission line for protection against lightning.

In regard to the non-arcing power of the gaps in the multi-gap arrester, some of the influencing factors are:

1. Material of gaps.
2. Length of gap.
3. Temperature of gap.
4. Short-circuit current through gap.
5. Inductance in circuit.
6. Frequency.
7. Phase of e.m.f. at time of discharge.
8. Shunt resistance.

The character of the metal forming the electrodes of the gap is very important, as is also the length and temperature of the gap. Those metals which have the greatest non-arcing power are zinc, bismuth, antimony, cadmium. Brass, an alloy of zinc and copper, also posseses non-arcing characteristics, and, in general, the addition of zinc to a metal or alloy renders it non-arcing.

With gaps 1/64" to 1/16" the non-arcing power varies somewhat less than proportionally to the length of the individual gaps. It is a peculiar fact that while n sparks in series require the same voltage as (in some cases very much *less* voltage than) one spark n times as long, *n arcs* in

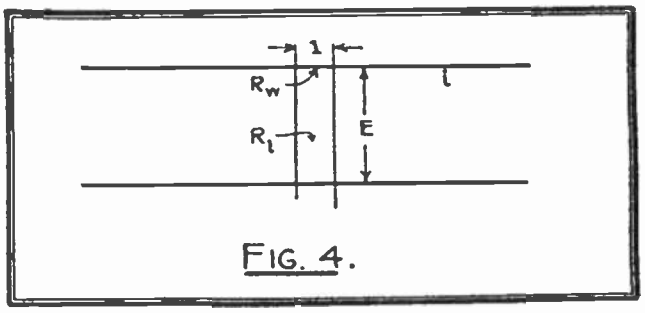


FIG. 4.

Diagram to Illustrate Various Mathematical Calculations in Connection with Lightning Arresters.

series require nearly *n* times the voltage of a single *arc n* times as long. Hence, the greater the number of the spark gaps, and the shorter, therefore, their length, the more favorable is the relation of arc voltage to spark voltage.

A great increase in temperature reduces the non-arcing power of the gaps. The heavier the short-circuit current through the gaps the more heat is liberated, and hence the non-arcing power drops off with increased short-circuit current; and, as the heating varies as I^2 the non-arcing power follows nearly a square law with respect to current.

The amount of inductance in circuit is another important factor, its presence tending to prolong the arc. The effect is very noticeable in an electric spark where arcing exists. Addition of inductance changes the white, sharp crackling discharge to one more violet in color and of a weaker, mushy sound.

Frequency, at least between 25 and 60 cycles, has little effect on non-arcing power. The length of a single alternation is, of course, greater at the lower frequency so that more heat units are developed before the zero point of the wave is reached. On the other hand, the duration of the period of small current is longer, which has a compensating effect.

The laws determining when the shunt resistance will be able to draw sufficient current to cause the arc to drop out in the shunted gaps are as follows, and are taken from a paper by P. H. Thomas which appeared in the Proc. A. I. E. E. (The shunting power is measured by the greatest number of ohms per shunted gap allowable in the resistance.)

1. *Number of Shunted Gaps.*—The amount of shunt resistance which will allow these gaps to be non-arcing varies directly as the number of these gaps.

2. *Short-Circuit Current.*—The number of ohms allowable per shunted gap varies approximately as the square of the current through the shunted gaps following the static discharge.

3. *Power Factor.*—The number of ohms allowable varies slightly with the power factor of the current following the static discharge.

4. *Ratio of Series to Shunted Gaps.*—The best ratio of the number of series gaps to the number of shunted gaps seems to be unity, *i. e.*, half the total number of gaps should be shunted.

In regard to the action of the lightning conductor in connection with the protection of buildings, this is regarded as an illustration of the action of induction and of the property of sharp points; when a storm cloud positively electrified, for instance, forms in the atmosphere, it acts inductively on the earth, producing a negative charge on bodies placed on the surface, the larger as these bodies are at a greater height. The density is then greatest on the highest bodies, which are therefore most exposed to the electric discharge; but if these bodies are provided with metal points, like the rods of conductors, the negative electricity flows into the atmosphere and neutralizes the positive electricity of the cloud. Hence, the action of the lightning conductor is two-fold; not only does it tend to prevent the accumulation of electricity on the surface of the earth, but it also tends

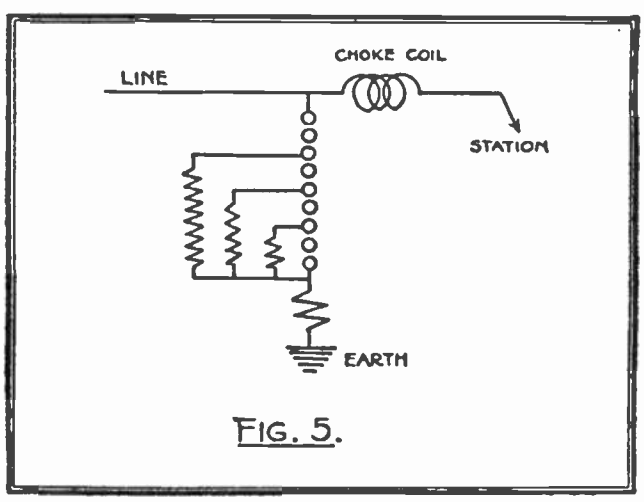


FIG. 5.

Arrangement of Lightning Arresters at a Power House.

to restore the clouds to their normal state, both of which concur in preventing lightning discharges. If the quantity of electricity is, however, so abundant that the lightning conductor is inadequate to discharge the electricity accumulated, then the lightning strikes; but the conductor receives the discharge, in consequence of the greater conductivity, and the edifice is preserved.

WIRELESS TRANSMISSION OF POWER

NOT only trains, but steamships and trolley cars may be operated some day by means of an "Energy Path" instead of a visible transmitting medium. The idea is not new, as it was advocated by Nicola Tesla years ago, and became the basis of a patent for transmitting energy without wires on a large scale. At present, by wireless, the power is radiated in many directions without concentration. It does not follow a definite path. This is because the energy is sent into a non-conducting medium, the ether. In a non-conducting body, electricity is found at rest, therefore it is called static. When it is in locomotion, as Sir Oliver Lodge terms it, it appears as current electricity. Conductors then carry it, or fluids or even non-conducting bodies, when it is forced through the latter. When electricity is made to rotate or set up whirls in the ether, magnetism is created. By means of magnetism motors and dynamos produce mechanical power and electricity, respectively. But the motor must have the electricity conducted to it by means of metal paths. The dynamo is attached to metal circuits, by means of which the electricity is transmitted to points of consumption. When brought to a certain point, if a motor is attached there, the electricity is forced to produce mechanical power, through its ability to create magnetism or etheric whirls. If transmitted to another point it may be forced to produce vibration or intense radiation, called light and heat. Light means electricity forced to produce visible vibrations. Heat for warmth or cooking is generally an invisible type of ether wave. One is short, the other long. The whiter the light the shorter the wave, up to a certain point. The ether wave used in wireless telegraphy is very long in comparison. It does not carry much energy in any particular direction at present. That is why it is only used for delicate signalling, such as wireless telegraphy and telephony. For the delivery of greater quantities of power, more concentration would be necessary or an entirely different wave.

Electricity, according to Sir Oliver Lodge, Clerk Maxwell and Lord Kelvin, is supposed to be a fluid of perfect incompressibility—in other words—a perfect liquid, extending everywhere and permeating everything. In a conducting material this liquid is capable of free locomotion while in *insulators* and *general space*, it is, as it were, entangled in some elastic medium or jelly—to strains in which electrostatic actions are due. This medium might be burst in a disruptive discharge (lightning or sparks) but an easy flow can go on only through channels or holes in it called conductors. The locomotion of current takes place in electric lighting, when motors are operated, or when heat is produced. Otherwise electricity produces rotation of the ether or magnetism or vibration and radiation, causing the many effects of visible or invisible light. Therefore the phrase "locomotion of electricity" is employed to distinguish between its rotation or vibration.

Sir Oliver Lodge states as his belief that positive and negative electricity together make up the ether. To quote his words, "the ether may be sheared by electro motive forces into what would become positive and negative electricity if they were really separated. A continuous shearing force applied to the ether in metals produces a conduction current." This we are all familiar with in the industrial use of electricity. We cannot affect

the ether directly at all. Indirectly it is affected by the ether bound up in matter, which thus affects it. In a conductor the bound ether is not rigid. In an insulator it is resilient, when displaced, it springs back again. In space, electricity exists, as it does in conductor or matter. It must be sheared, to produce the separation resulting in two streams of positive and negative, as in a conductor. To shear it, electromotive forces, electric pressures, are required. When a method is discovered, electric energy will be sent over long distances for industrial purposes, without wires.—NEWTON HARRISON, E. E.

THE COLORADO WIRELESS ASSOCIATION

At a recent meeting of the Colorado Wireless Association of Denver, Colo., the following officers were elected: President, W. S. Lapham; Vice-President, H. O. Whitman; Secretary, Ernest Anderson; Treasurer, E. S. Stockman; Chief Operator, W. H. Smith.

With the help of the Instruction Department of the Y. M. C. A., the officers of the Association have mapped out a complete course in the theory and practice of a modern wireless station, and expect all members to be expert operators when they finish the course. The course is free to all members.

The Association has at the present time many enthusiastic members, which accounts largely for the success it has enjoyed. At present, the permanent quarters of the Association are on the top floor of the Y. M. C. A. Building. On the roof of the building an aerial has been erected measuring 400 feet long, with an average height of 150 feet. Each member has donated some piece of apparatus and the complete set is claimed to be one of the best in that section of the country. On several occasions members have heard HU (Kahuku, Hawaiian Islands), a distance of about 4,000 miles; and KET (Bolinos, Cal.), and NAA (Arlington, Va.), in mid-day. At night the station has worked with 9XN (University of North Dakota), 70H (Le Grande, Ore.), and other amateurs at less distance. The receiving records have been made with a galena detector.

The Colorado Wireless Association will be pleased to hear from amateurs and other clubs in their section of the country, either by wireless or by mail. Correspondence should be addressed to the President, W. S. Lapham, 1545 Milwaukee St, or the Vice-President, H. O. Whitman, 2252 Washington Ave., both of Denver, Colo. The wireless call letters are CWA.

TRANSPARENCY OF METALS

It has been known for years that thin sheets of gold and silver, mounted on glass, may be made transparent by heat; but it is only within recent years that serious study has been given to the conditions under which such transparency may be obtained.

It is said that a sheet of gold one three-hundred-thousandth of an inch thick becomes transparent when heated to 550 degrees Centigrade. The transparency is ascribed to the gold aggregating and allowing white light to pass through the interstices.

With silver one-hundred-and-twenty-thousandths of an inch thick no transparency is produced so long as the atmosphere is a "reducing" one, such as hydrogen or coal-gas. But in the air the transparency begins at 240 degrees and is remarkably complete at 390 degrees.

Copper one-seventy-five-thousandth of an inch thick does not become transparent in a reducing atmosphere, but in air it is transparent between about 200 degrees and 400 degrees. At the lower temperature the light is a brilliant green, but as the temperature rises oxidation takes place, and the color ranges through olive and dark red to black.

Rotary Spark Gap Efficiency

By Charles L. Whitney

OCCASIONALLY one may hear an amateur station using a new rotary gap, which, strange as it may seem, does not come in louder nor does it carry further than the straight gap that was being used before in that particular station. Of course, the spark may be of a very pleasing tone, but after all the carrying power is the prime factor to be considered. Why is it that the rotary gap does not increase the sending radius?

The main reason why many amateurs are not securing greater transmitting range with a rotary gap than with a straight gap is due to the fact that they are having too many spark discharges per second. The transmitting condenser in most cases does not have the opportunity to become fully charged in the period when the gap is not sparking. While the condenser might be reduced in size so as to become fully charged, the disadvantage then would be that the full power of the transmitter would not be utilized. The only satisfactory alternative is to reduce the number of discharges so that there will be one spark for every alternation of the current. This may be accomplished by the use of a synchronous gap.

As there are few amateurs who are using a motor-generator set in conjunction with their sets, it is impractical for them to use a gap, made synchronous by mounting it on the shaft of the generator itself. A satisfactory substitute for this form of synchronous gap is a non-synchronous gap operating at such a speed as to make it synchronous with the alternating current supply. As for example, suppose a motor used to operate a gap has a speed of 1800 revolutions per minute. If the rotating disc has four plugs, the number of discharges per second will then be $\frac{1800 \times 4}{60} = 120$ sparks. Thus by using a 60 cycle current for the transformer and a rotating discharger with four plugs on the disc, operating at a speed of 1800 revolutions per minute, the spark will be synchronous with the current. As it is next to impossible to have the motor speed remain exactly constant at all times, the spark will waver very slightly. This latter feature, however, will give the spark a pleasing tone. The best motor to use for the purpose is one in which the speed can be varied by the use of a variable resistance of about 500 ohms, placed in series with the line. This resistance may be placed within convenient reach of the operator.

It is advisable to use a motor that has a speed of at least 200 revolutions per minute more than that which will be required for the rotary gap, since the speed can be regulated more readily if the frequency of the alternating current should run slightly over its rating. For instance: Supposing the line frequency should be raised to 62 cycles, the voltage remaining the same. The rotary gap would then be obliged to discharge at the rate of 124 sparks per second in order to be in synchronism with the current frequency.

The table that follows indicates the correct number of plugs to use on a rotary disc for different motor speeds:

Speed.	Plugs (60 cycles)	Plugs (120 cycles)
1000 R.P.M.....	8	16
1200 "	6	12
1800 "	4	8
2400 "	3	6
3600 "	2	4

When using an odd number of plugs for speeds between 2400 and 3600 revolutions per minute the plugs are placed at equal distances apart around the disc and the stationary electrodes are so arranged as to come opposite two of the rotating plugs at the same time. An odd number of plugs is no drawback if the gap is properly constructed.

The data given in the foregoing permits of the use of the correct con-

denser capacity with any transformer.

A rotary gap of the set on board the U. S. transport "City of Memphis," stationed in Mexican waters during the recent trouble in Mexico, enabled distances of 400 to 500 miles to be covered in daylight with one kilowatt of power. This was due to the fact that the gap was properly designed to conform with the current supply frequency. Before that time a rotary gap with ten plugs was used and the maximum daylight radius never exceeded 300 miles, since the current supply was 60 cycles and the speed of the gap 2400 revolutions per minute.—CHARLES L. WHITNEY.

GOVERNMENT RESEARCH IN ELIMINATING ELECTROLYSIS

HOW to prevent expensive damage to the pipes and cables of water, gas and telephone companies by roving electric currents from street railways is a problem toward the solution of which Uncle Sam has made important strides recently. The problem arises from the tendency of negative return currents from street railways of overhead trolley construction to leave the rails and find their way back to the power house over such available metal pathways as underground pipes. Where the currents leave the pipes and find their way back to the power house through some direct conductor, they set up what is known as electrolysis. The effect of electrolysis is to cause corrosion of water pipes, which results in time in serious leakage.

Experiments with methods of mitigating the evil are being pushed by the United States Bureau of Standards, and surveys have been made of conditions in various cities.

The electrolysis situation in all cities having modern traction facilities is sharply felt by the owners of the injured pipes and cables, but at first sight it does not seem seriously to affect the railway companies, if they take only a selfish point of view. Most of the surveys of the Bureau of Standards have been made at the request of the suffering utilities, but marked success has been had in winning the approval and cooperation of the railway companies.

In several instances it has been found that the traction companies can bring about a sufficient saving of current, by following the recommendations of the bureau's experts, to make the course worth their while. It is also coming to be recognized by many companies that the taking of steps to minimize the ravages of electrolysis is advantageous in order to escape damage suits and drastic legislation which may stipulate that the defects be remedied in a more expensive way than is necessary.

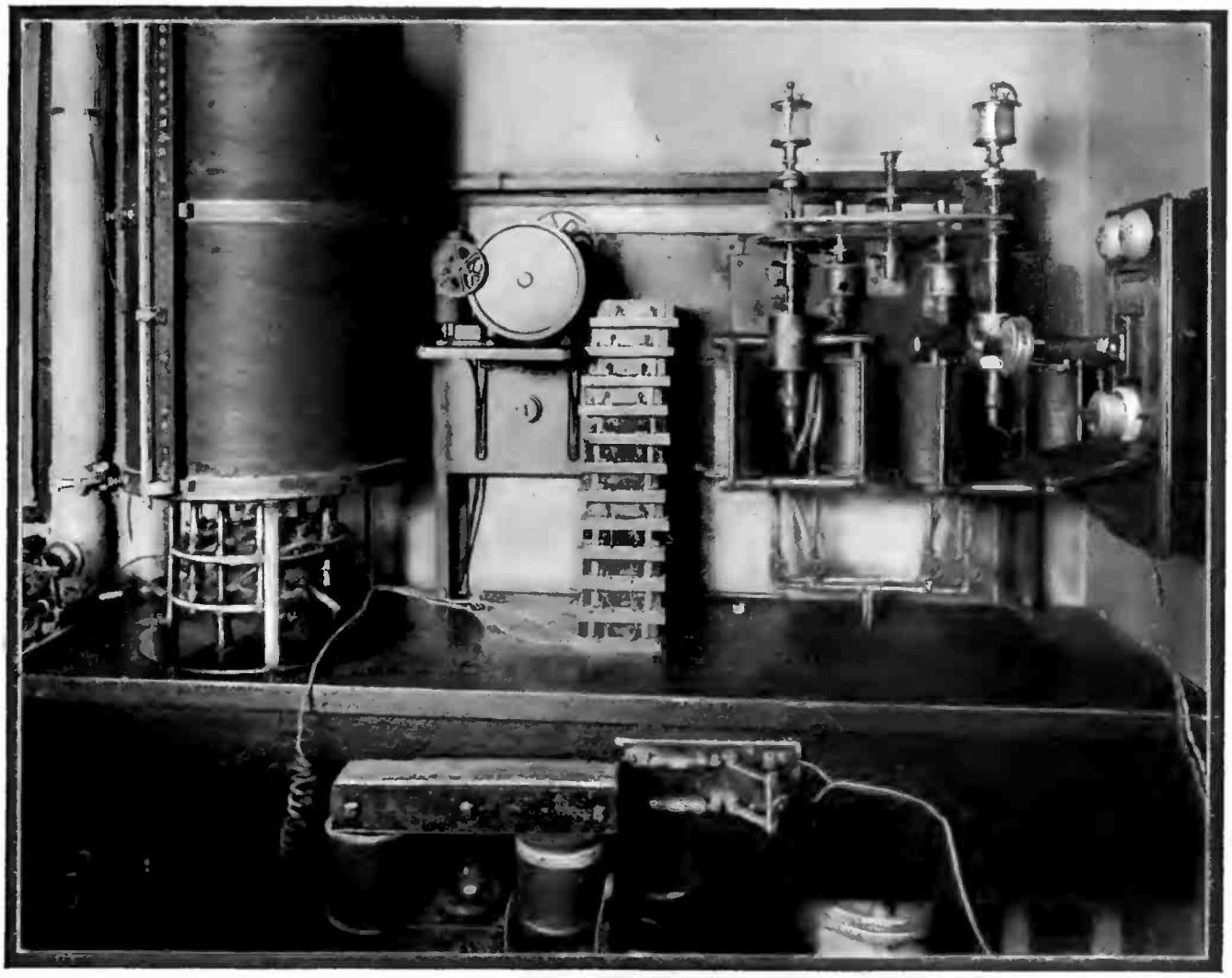
In exceptional cases only does the bureau advise the use of "pipe drainage" systems—the tapping of current from pipes by methods which prevent corrosion. The Government electrical engineers recognize this as treating a symptom rather than the disease. The procedure of the bureau's experts is, usually, first to examine into the power distribution system to see whether it is arranged to the best advantage. The next step is to examine rails to see if joints are made in such a way as to furnish a good conductor for return currents. The third step is the designing of an adequate "negative feeder" system.

The negative feeder system consists of insulated copper wires connected with the rails at various points throughout the network of tracks, furnishing a return path which is a better conductor for the current than pipes or rails. By connecting this feeder to the rails at various points with properly adjusted resistance, the differences in potential, which cause the return currents to leave the rails, can be kept very low. Though such a system does not entirely eliminate leakage of electricity, it reduces the escaping currents to such an extent that they cause practically no loss either to the railway or to the pipe owners.

Radio Telephone on Railroad Trains

By Frank C. Perkins.

SOME interesting experiments have recently been conducted on a western railroad system in the way of communication between trains, and between stations and trains, by radio telegraph, radio telephone and by wire. The experimental work has been in charge of Dr. Frederick Millener and for the greater part the experiments have been made of iron and steel. The course of the truck was on a narrow-gauge track which ran through the shop yards of the railroad. An antenna mounted on the truck was connected with a set of receiving instruments, including a special controlling device. It was found on trial that the car could be caused to move backward and forward at four different



Experimental Wireless Telephone Set of Dr. Frederick Millener, Who is in Charge of the Wireless Equipment Used by the Union Pacific Railroad.

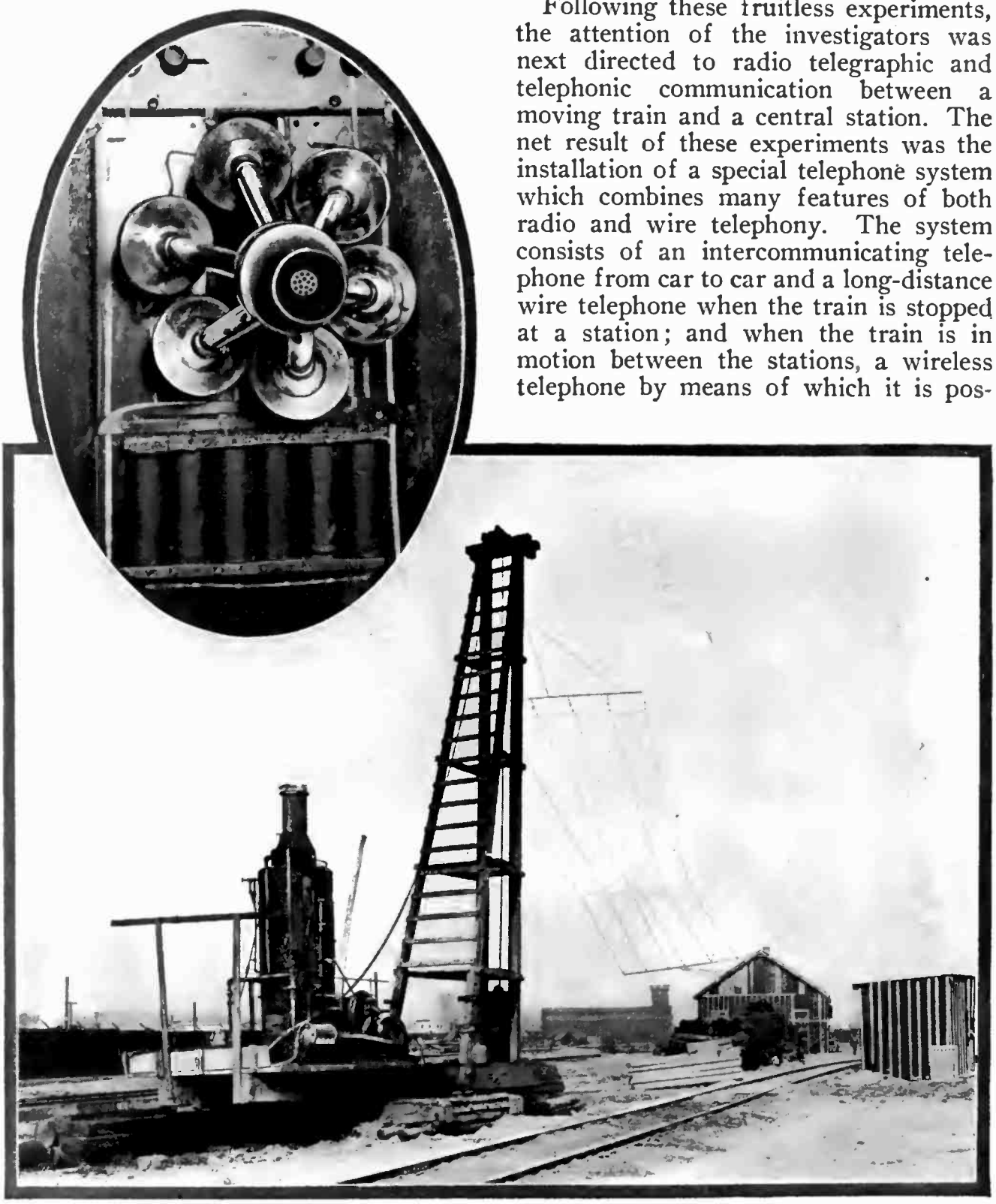
made with a view to furnishing a means of signaling the cab of a locomotive or communicating with a train without interfering in any manner or placing any obstruction along the right of way.

In the early experiments, a storage battery electric truck was utilized. The machine weighed 5500 pounds and was speeds at the will of the operator handling the key of the wireless transmitter. No attempt was made to establish a good ground connection, as the mass of metal in the car itself provided a capacity ground which amply sufficed for the purpose.

It is generally conceded that a railroad

signal to be of practical value must operate at least 100,000 times without a failure and furthermore must not be affected by any other than the means intended. In this connection, the experiments on the truck proved the plan to be impracticable, as it was found that at times the lighting of an arc lamp or atmospheric disturbances would throw the signal. The unreliability of the entire system, therefore, resulted in the discontinuance of the experiments.

Following these fruitless experiments, the attention of the investigators was next directed to radio telegraphic and telephonic communication between a moving train and a central station. The net result of these experiments was the installation of a special telephone system which combines many features of both radio and wire telephony. The system consists of an intercommunicating telephone from car to car and a long-distance wire telephone when the train is stopped at a station; and when the train is in motion between the stations, a wireless telephone by means of which it is possible to talk to the train ahead, the train behind, or the nearest station. The device is so arranged that while talking



Antenna and House Used by Dr. Millener in Conducting His Wireless Experiments. In the Oval: A Multiple Microphone and the Induction Coils Used in Dr. Millener's Wireless Telephone System.

from car to car it provides selective talking and selective signaling facilities. While talking long distance by wire, only one person can talk from the train at a time and the train is connected to the city trunks.

FIELD TELEPHONE ACTS AS WIRELESS RECEIVER

A curious wireless vagary occurred at the Military Training Camp in Toronto, Canada, on March 19th, during the artillery practice while observers on the top of the "chutes" were communicating by field telephone with the battery commander. The insulated wire of the field telephone was strung from the top of the structure to the ground, there being probably 200 feet or more of wire suspended in the air. While receiving messages from the observation point the signaler noticed a buzzing sound on the wire, which he supposed was caused by the buzzer used on the telephone when it is desired to use the apparatus as a telegraph instrument. On having his attention called to this, Capt. S. D. Dunn, divisional signaling officer, listened to the buzzing, and in the interval between the telephone messages caught portions of messages relating to the question of neutrality and matters connected with shipping. Capt. Dunn, who has had long experience in telegraphic work of every kind, recognized the message as part of a press despatch. Owing to the fact that the telephone was in use for artillery purposes he was not able to read the message clearly. The explanation given by Capt. Dunn was that the wire of the telephone acted as an aerial, and by some chance the telephone was "in tune" to receive the wireless waves. He thought the message was probably coming from Buffalo, where one of the papers makes use of wireless communications.

There will be more wireless in the July issue than in any previous issue. Many special features in the form of constructional articles will be included, among them an article describing the making of a multiple tuner.

The Steel Towers of the Aerial of the Chelsea Station, and the Wireless Station Building.

THE NEW GOVERNMENT STATION AT CHELSEA, MASS.

In the accompanying view are shown the steel towers of the high powered radio station situated on the grounds of the U. S. Naval Hospital at Chelsea, Mass. This station is one of the links of the chain of radio stations that extends to Panama along the Atlantic Coast and from there to the Philippines.

Each tower of the Chelsea station is 300 feet high. They are set over 600 feet apart on concrete foundations that are over ten feet deep.

There are two one-story buildings formerly used by the hospital, situated near the towers. These will serve for the receiving and generating rooms, as well as for accommodating the operators of the station. The station will probably be rated between 50 and 75 kilowatts although it is not certain at the present writing.

A NEW HIGH SPEED INTERRUPTER

The platinum break is without doubt the most simple and reliable for medium sized spark coils. Its main fault is the slow speed at which it works, usually from 25 to 35 breaks per second. The interrupter described in the following gives a much higher rate of interruptance and a comparatively long duration of contact. The latter feature is of great importance in wireless work, while the higher speed is essential for X-Ray purposes in order to obtain a clear and steady image on the screen.

The main parts of the rapid break illustrated in the accompanying drawings are:

Part *A*—A pillar carrying parts *B* and *C* which are adjustment screws.

Part *D*—A flat spring supported by part *E* which is a short length of fibre shaped as shown in the sketch on the facing page.

The spring, part *D*, carries a platinum contact piece and a soft iron hammer, part *G*, on its upper end. On the lower end of the strip a small disc of fibre is glued on in order to insulate parts *C* and *D* from each other.

The lower adjusting screw, part *C*, presses the contact piece of the spring against the contact piece on the adjusting screw part *B*. The current flows from the battery through the primary winding of the induction coil into the pillar part *A*, through the contact pieces into the spring and from there through a flexible cable soldered to the spring and back to the battery.

The core of the coil becomes magnetized, attracts the hammer and breaks the circuit. Immediately the contact pieces are pressed together again since the tension in the spring tends to make contact. This tension may be regulated by adjusting screw part *C*.

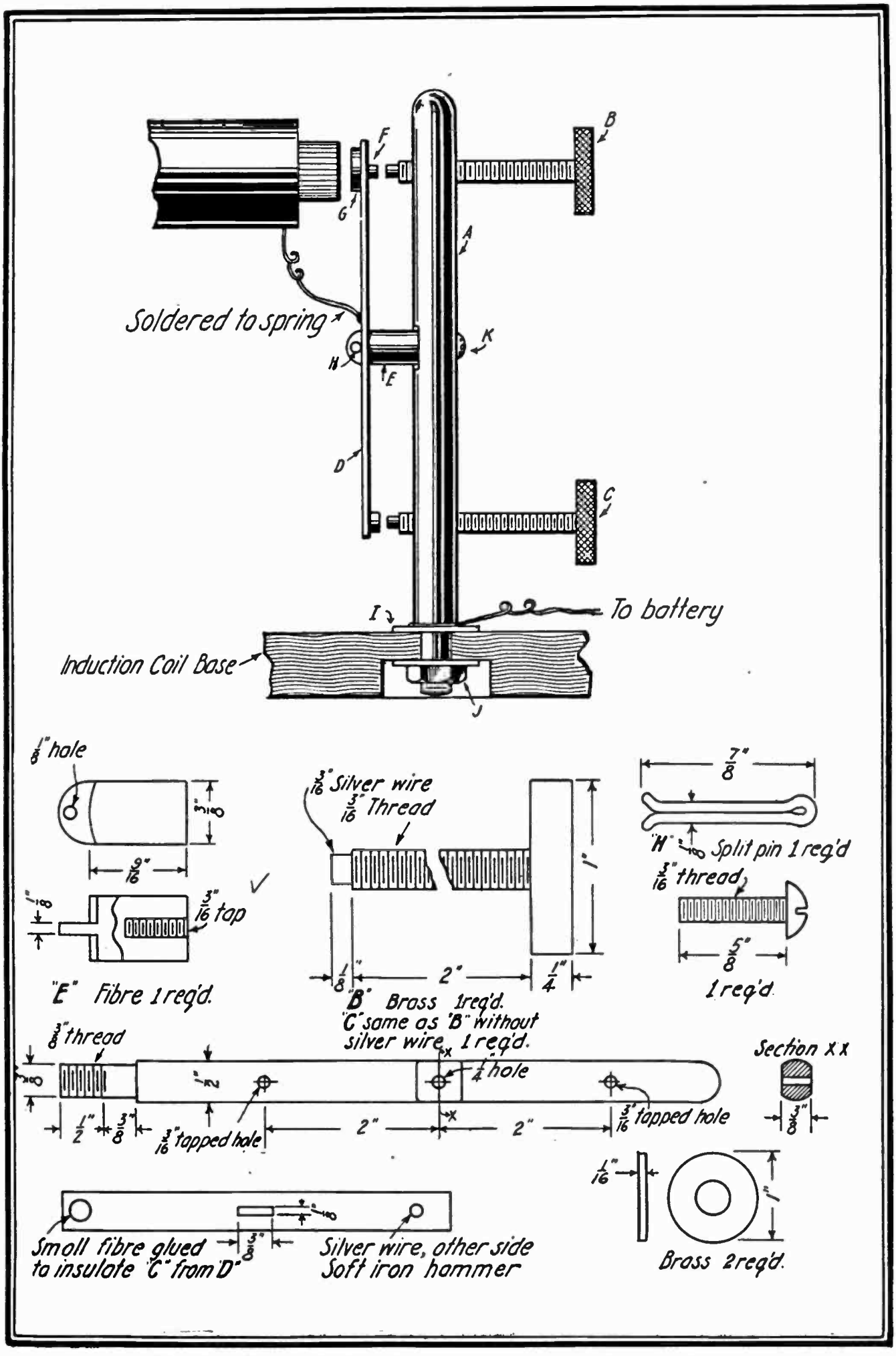
The break is very easily made, the only tools necessary being a few taps and dies and a drill, possessed by most amateurs. The spring may be either of bronze or steel, but the author believes that the latter is better by far. Inasmuch as platinum is expensive at the present time, silver may be used for the contact pieces. It is much better to have ample and clean silver contacts than small and badly fused platinum ones. Part *H* is a standard split pin to keep the flat spring in its proper place. Part *I* is a brass washer for the pillar and part *J* is a standard ⅜-inch nut.—C. A. OLDROYD.

INTERESTING EXPERIMENTS WITH ATMOSPHERIC ELECTRICITY

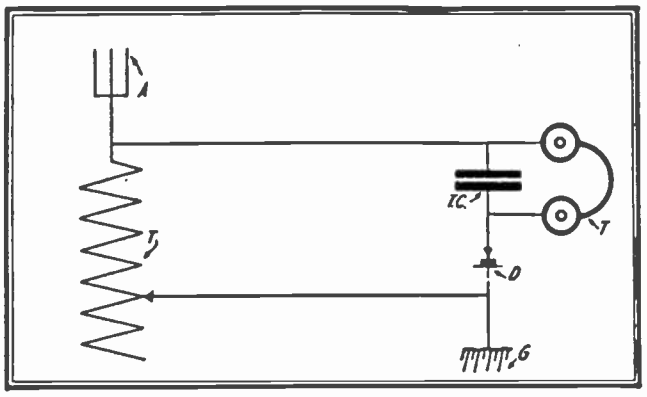
The author has conducted a series of experiments in connection with atmospheric electricity, using his aerial, which is 60 feet high at one end and 70 feet at the other, and composed of two wires 190 feet long, mounted on 7½-foot spreaders. The lead-in is from the higher end of the aerial and measures 120 feet long.

During snowstorms the author has succeeded in obtaining sparks up to three-eighths of an inch long between the lead-in and the ground. The length of the sparks increased with the strength of the wind and the amount of snow falling. A few times during clear weather, sparks up to one-fourth of an inch have been obtained for short intervals. When the secondary of a ½-inch spark coil has been connected in series with the aerial spark gap and the ground, every time a spark would leap the gap a 2½ volt lamp connected across the primary would flash.

The rate at which the sparks jump across the gap depends on the length of the gap. During a severe snowstorm sparks have jumped a ⅜-inch gap at the rate of one per second.—BEN GRABER.



Assembled View of the High Speed Interrupter, As Well As Its Parts.



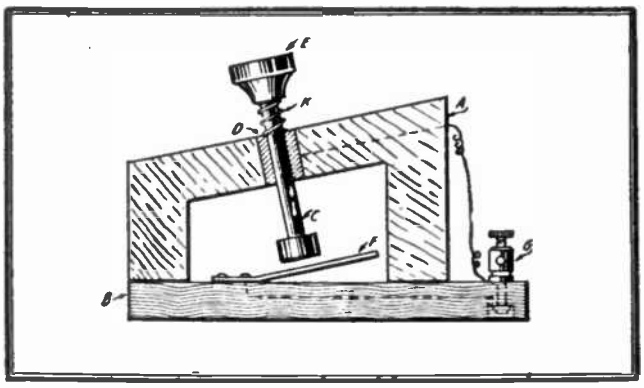
An Effective Hook-Up for Use in Connection with a Single Slide Tuner and Crystal Detector.

AN EFFICIENT SINGLE SLIDE HOOK-UP FOR BEGINNERS

Although single slide tuners have come into disfavor among most amateurs, these simple instruments, in connection with a crystal detector, condenser and telephone, comprise an outfit that will be found more efficient in many cases than a two-slide tuner. For best results, the hook-up in the accompanying diagram should be followed. The greatest advantages of a single slide tuner are the simplicity of operation and the small chance of imperfect contact and consequent weak signals.—CHARLES E. DAVIS.

A FOOT-OPERATED PUSH BUTTON FOR TEST BUZZER

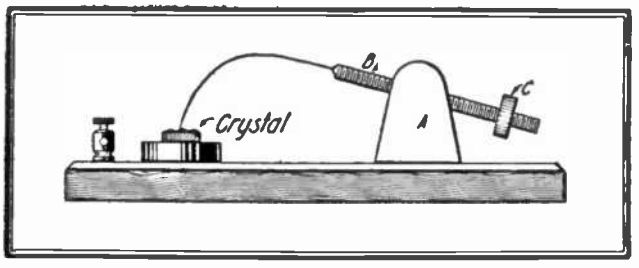
It is often found inconvenient when adjusting a crystal detector such as that of the galena type to push with one hand the button or switch controlling the buzzer circuit. In order to allow the freedom of both hands for adjusting the apparatus yet still be able to operate the buzzer when desired, a switch arrangement that may be operated by the pressure of the foot is illustrated in the accompanying drawing. This device consists of a wooden block, *A*, measuring 2 by 1⅛ by 2 inches, another block, *B*, measuring 2½ by ¼ by 2 inches which is used for the base, a metal pin, *C*, which is threaded at one end and fitted with the composition knob *E*, a spring on the pin *C* shown at *K*, a metal strip *F* and the binding posts *G*. The construction of the push button can readily be followed by studying the drawing.—R. C. ROBINSON.



A Foot-Operated Push Button That May Be Used to Good Advantage with a Test Buzzer.

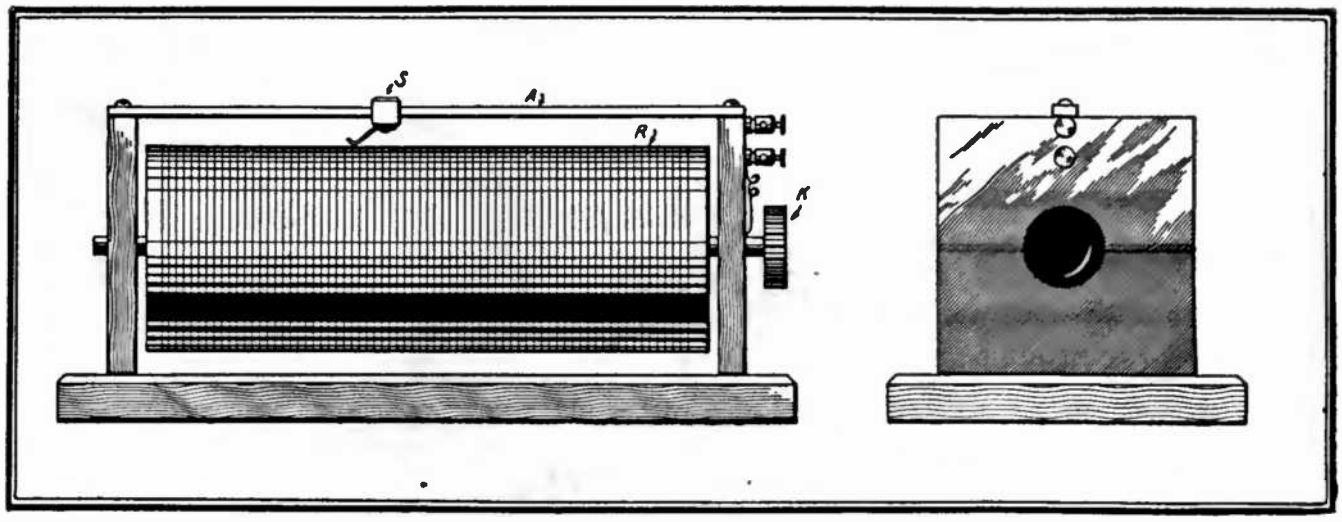
A SIMPLE YET EFFICIENT GALENA DETECTOR

The detector illustrated in the accompanying illustration, while easily constructed, will be found extremely sensitive when used in connection with galena. Most galena detectors have a coiled spring for making contact and the changes in temperature are apt to affect the spring and consequently alter the adjustment. In the detector illustrated, however, the curved wire is not affected.



A Galena Detector That Can Readily Be Made from Odds and Ends.

The main features of the detector that are different from other types are the two pieces side by side, *A*, about 1½ inches apart and between which passes a brass rod *B* pivoted by a cross rod to the two side pieces. The rod *B* is so mounted that it can be freely swung up and down. The small weight *C* which is screwed on the threaded end of the rod *B* can be moved back and forth to alter the pressure of the phosphor bronze wire on the crystal.—EMERSON SMITH.



An Improved Type of Tuning Coil in Which the Cylinder Is Mounted on Shafts to Permit of the Slider Making Contact with Any Portion of a Turn.

A NEW IDEA IN TUNING COIL DESIGN.

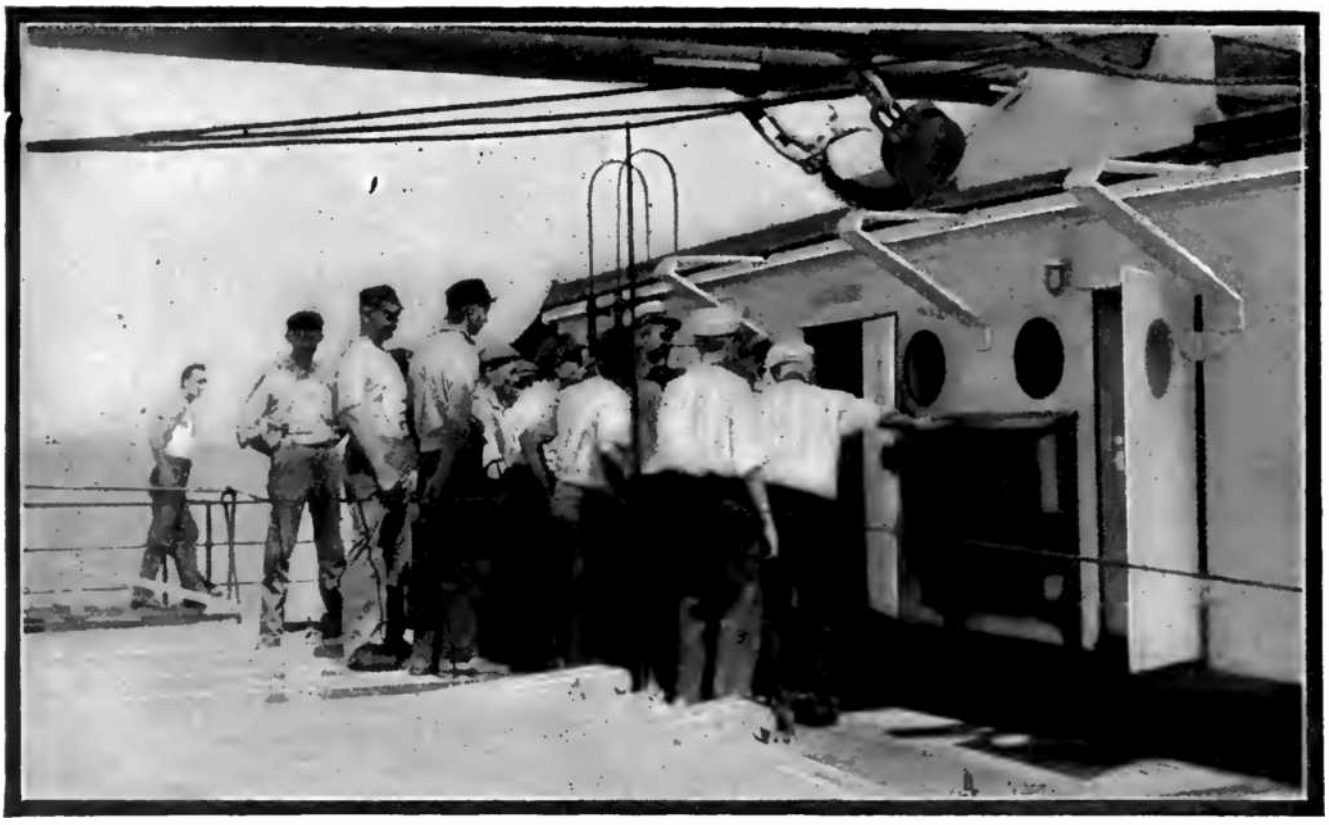
IN the accompanying illustration is shown a type of tuning coil that has been constructed and used by the author with unusually good results. The main and striking feature of this coil is that in operation the slider is moved back and forth until a signal is heard as loud as possible, and the tuning coil proper, which is mounted on shafts so as to revolve, is turned in either direction to make the signals louder still. It is immediately obvious that with a tuning coil of this type it is possible to tune accurately for the reason that any portion of a turn can be cut in.

The tuning coil is made as follows:

A base of hard wood is finished to measure 15 by 5 by ¾ inches. Its edges are beveled and the surface given a coat of paint of any color desired. The next step is to make two end pieces measuring 4½ by 5 by 1 inch. The tuning coil core is made from a common rolling pin *R* from which the handles have been removed. At one end of the cylinder is placed a metal or wooden rod to act as an axle. At the other end is provided a metal rod fitted with a suitable handle. The cylinder is then given a coat of shellac and, when it is almost dry, it is covered with turns of No. 24 bare copper wire. In winding on the wire the builder should be careful not to let the various turns touch, although they should be placed as close together as possible. One end of the wire is tacked fast, while the other is soldered to the brass rod which mounts the handle. Holes are bored in the end pieces to allow the cylinder to turn when placed in position. In one of these end pieces a brass tube of a size to permit the brass rod of the cylinder to pass is placed in the holes so as to allow the cylinder to turn freely. This brass bushing is connected to one of the binding posts on the end piece by means of a short length of wire. The next step is to secure a square ¼-inch brass rod, *A*, an inch longer than the wooden cylinder, as well as a regular tuning coil slider, *S*. The rod is placed in position and the slider mounted so that it will freely slide back and forth. Connection with the remaining post is made by means of a short length of wire from the slider.

The use of a tuning coil of this type will serve to make the use of a condenser unnecessary, since accurate tuning can be accomplished with the inductance alone.—F. H. FITCH.

The July issue will contain more wireless articles than any previous number. One of the features will be a description in detail of a multiple tuner receiving set.



During War Time the Wireless Station on Board a Steamer Is the Center of Attraction for the Crew. The Men Gather About the Door of the Wireless Cabin Waiting to Hear the Latest Reports of the Fighting.

THE WIRELESS ROOM IN WAR-TIME

In the present war, whether a battleship is under fire or is cruising peacefully in the open sea, the wireless room is the liveliest place on board. Messages, whether for that particular ship or not, must be copied and handed over to the captain. The war office is sending orders almost continuously, and these must be copied *verbatim*—a most arduous task, for the reason that all orders are transmitted in a secret code and one letter or figure wrong might change the meaning of the entire despatch. If the ship is one of a fleet, the operator must be alert constantly for war orders from the admiral.

The operator is stationed behind closed doors, so that the noise of the heavy guns will not interfere with the reception of messages. He is in momentary danger of quick death from foes who are apt to attack by sea, by submarine and by air.

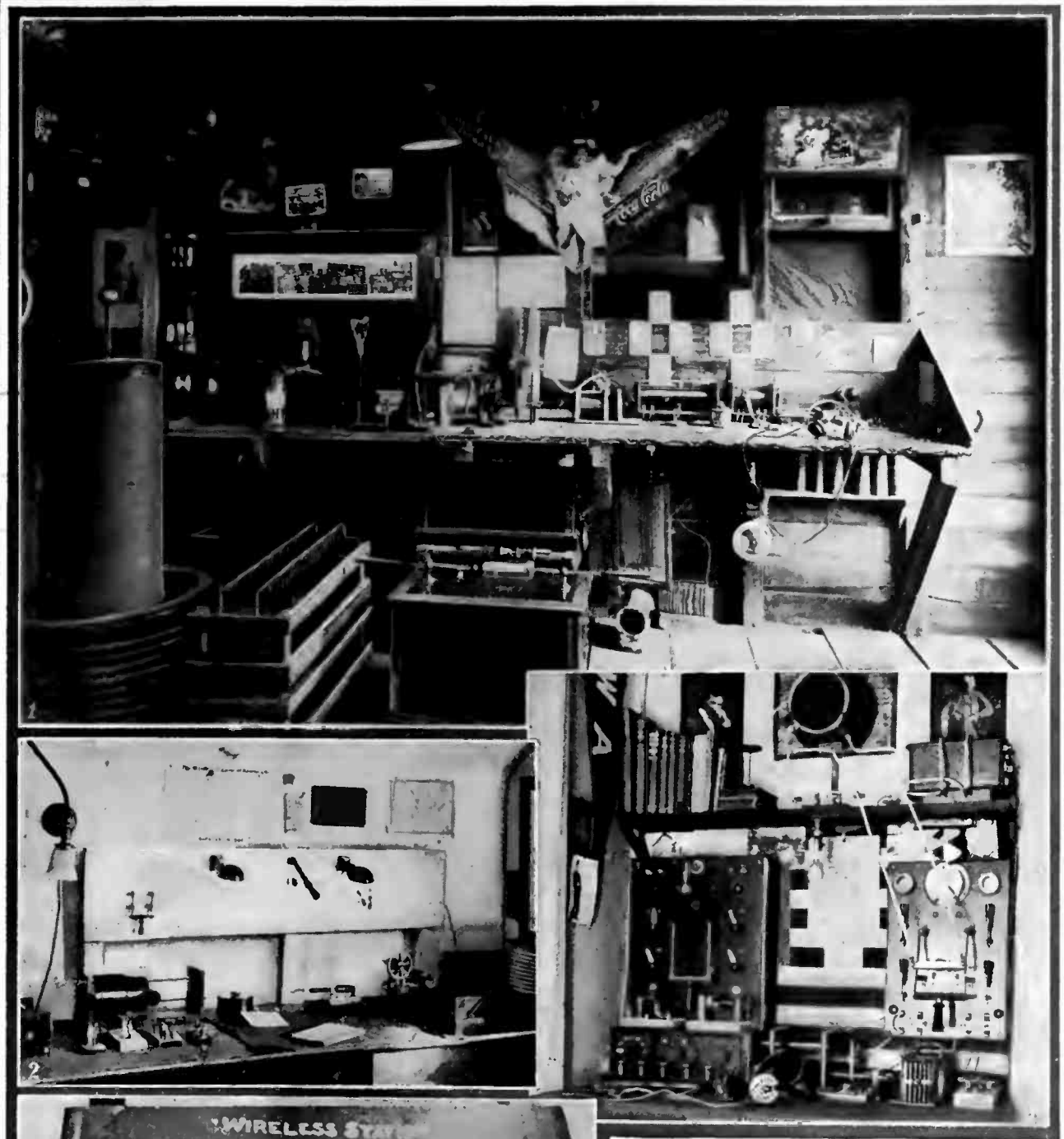
THE WIRELESS ASSOCIATION OF PENNSYLVANIA

It is announced by the Wireless Association of Pennsylvania that the board of directors for 1915 consists of F. B. Chambers, chairman; W. Holzbaur, L. M. Knoll, H. W. Denshan, C. A. Service, R. E. Peterson, W. N. Reiff and the officers.

This association has confined itself mostly to Philadelphia and immediate vicinity in the past. However, it now expects to extensively enlarge its territory. At a recent meeting of the Publicity and Organization Committee, the Secretary was instructed to request all organizations in Pennsylvania to communicate with the Wireless Association of Pennsylvania with the idea in mind of forming a state-wide association.

Watch out for the Radio Section in the July issue of THE WORLD'S ADVANCE!

AMATEUR WIRELESS STATIONS

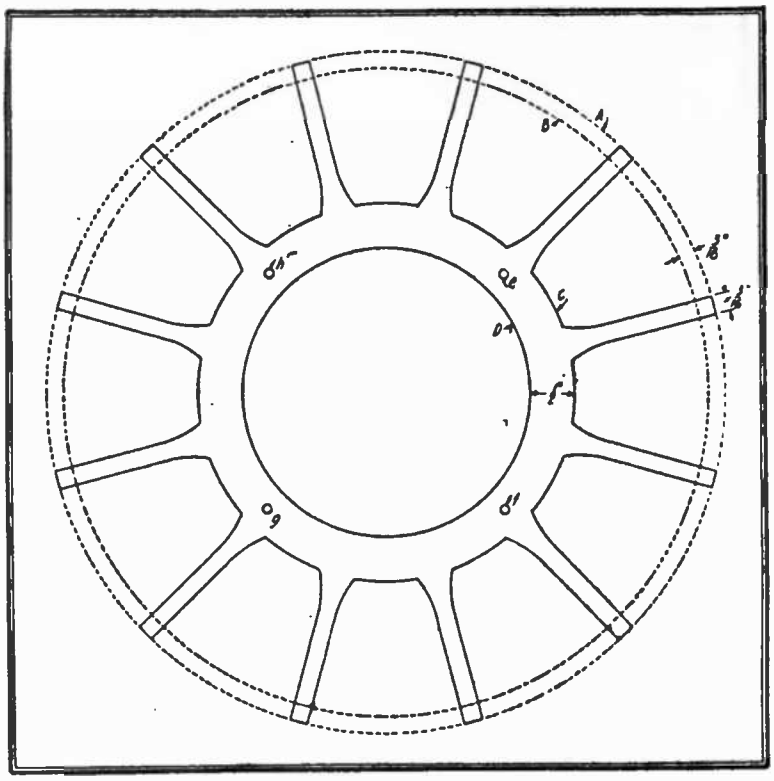


(1) Wireless Station and Laboratory of Stephen E. Horton, of Pasadena, Cal. This Experimenter Has a Set of High Frequency Instruments, Shown In the View. (2) Sending and Receiving Apparatus of George O. Forrest, Kansas City, Mo. (3) Portable Wireless Outfit of Henry C. Sauyer, Astoria, N. Y. (4) Wireless Station of Antone Sylvia of New Bedford, Mass.

A SIMPLE AND EFFICIENT ROTARY GAP DISC

ALUMINUM and aluminum alloys are now being extensively employed in the construction of commercial spark gaps. The method of construction followed by the amateur when making an aluminum disc is to cut out "saw-teeth" around a thick disc of the metal. Those who have tried this know what a job it is; for aluminum, though light, is very difficult to work. The ease of construction of the disc herein described will appeal to the experienced ones, and if followed by the novice will save much labor and patience.

First secure a piece of hard aluminum sheeting 1/32" thick. With a compass or dividers carefully measure and mark out the piece as shown in the diagram. The disc should be 8" in diameter to be most efficient (as was pointed out by E. E. Bucher in the March issue of *Modern Mechanics*). Twelve electrodes is the practical number for a motor having a speed of 2500 to 3000 R. P. M. If the motor is faster than this, 8 or 10 will do; if slower, increase the number to, say, 16. Now cut around the blades with tin shears. Do not cut the parts to be cut on circle C with tin shears. The latter are too unwieldy and would bend the metal out of shape. Instead, cut these places half way through with a chisel, then bend the pieces out. Now center a disc of 3/32" fibre, the size of circle *C*, on the aluminum disc, and mark four places for the holes *e*, *f*, *g* and *h*. Bore the holes for small machine bolts. The center of the aluminum disc (circle *D*) may then be cut out. Bolt the aluminum to the fibre. Now bend back the tips of the blades on the dotted lines, at right angles to the blades. It will be noticed from the dimensions in the diagram that these tips afford an ample sparking surface 3/16" square. The disc is now ready to attach to the motor shaft. This is done in the regular way, either by bolting to a pulley wheel or fastening in an emery wheel clamp found on some motors.

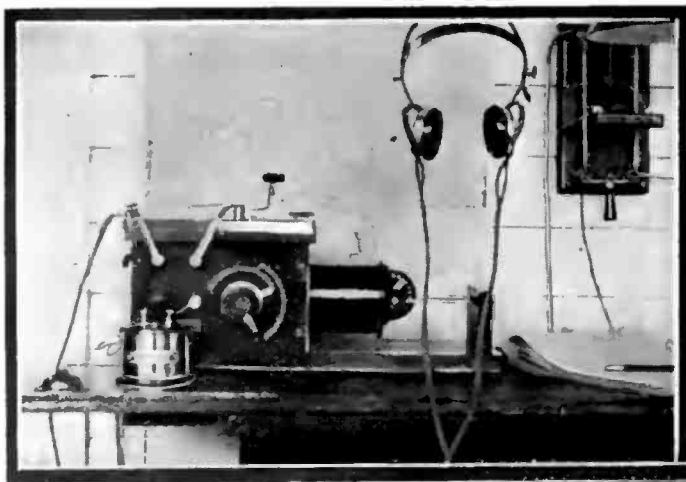


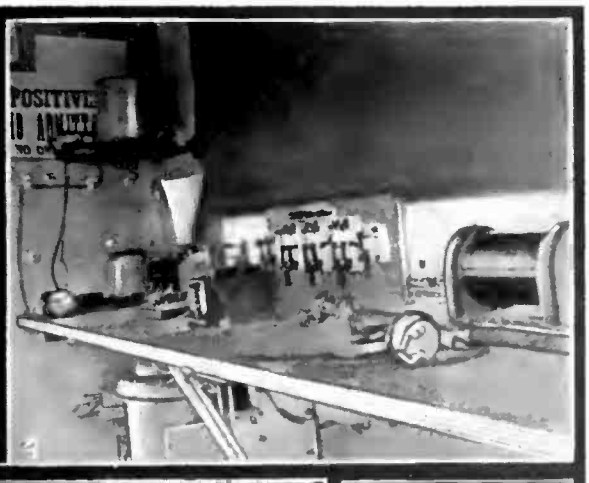
Pattern for Aluminum Disc, Showing the Location of the Screw Holes and the Shape and Size of the Arms.

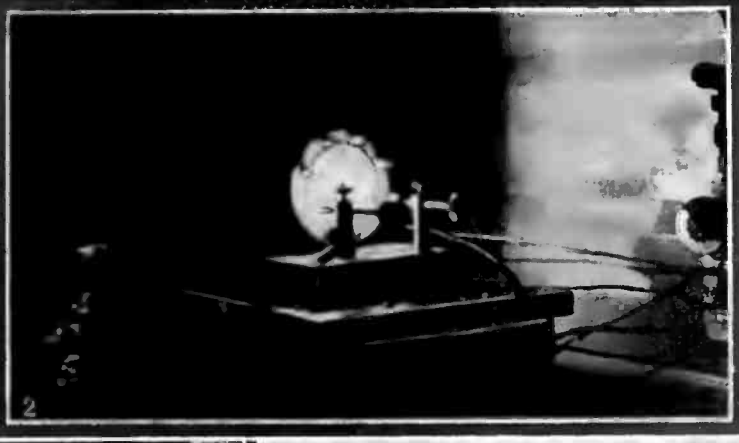
After the disc is assembled twist the blades so that they have a pitch of about 15 degrees. Twist them in such a way that the tips turn away from the direction of rotation. Pitching the blades in this manner serves three very important purposes. First: By carefully adjusting the degree of pitch the speed may be permanently fixed at which the spark-note is most resonant. (The greater the pitch the slower the speed.) Second: The fan effect of the blades draws air through the motor, thereby cooling it. Third: The air resistance against the pitched blades, when the motor is running, gives the motor a slight load, which keeps it from "racing" as it would otherwise do with such a light disc. No. 6 aluminum wire, or 3/16" aluminum rod, makes good stationary electrodes.

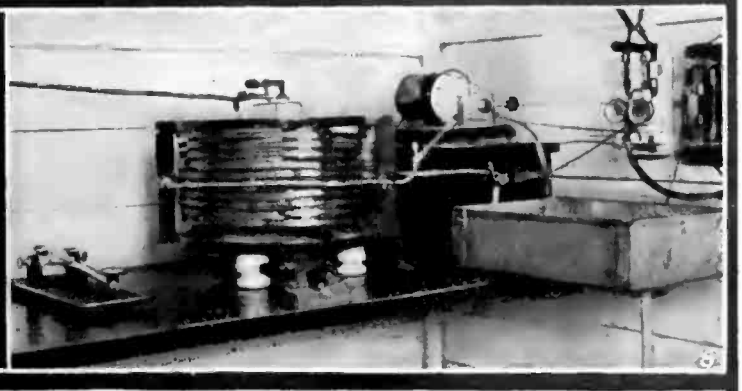
Some persons may be skeptical about the wearing qualities of this disc. The writer has one which has been in regular use on a ¼ k. w. transformer for five months and at present shows no appreciable signs of wearing out. In case any of

AMATEUR WIRELESS STATIONS









THE WIRELESS STATIONS APPEARING IN THE VIEWS ARE:

(1), (2) and (5)—Various Views of the Wireless Station of Raymond Myers, of Tiffin, O. In the First View Is Seen His Navy Type Receiving Transformer, Fixed and Variable Condensers, Galena Detector, Telephone Head Set and Aerial Switch. The Second View Shows His Rotary Spark Gap in Operation, While in the Third View Is Seen the Complete Transmitting Set, Which Is Rated at ¼ KW. (3)—The ½ KW. Wireless Station of Palmer Leberman, of Sheboygan, Wis. (4)—The Two Wireless Sets of Arthur C. Stansfield, of Lawrence, Mass. Practically All the Instruments Were Made by the Owner of the Station.

the tips do wear off after long use, cut them all off even at the place where they were bent and bend new ones. This may be done several times, providing the disc is made large enough at the outset.

This disc, aside from having so many advantages, is also efficient. The efficiency lies in the fact that aluminum is the metal used. Those who get a ragged spark with zinc or brass electrodes will secure a pure note with aluminum. The reason for this is that zinc and brass will warm up a slightly defective condenser, thereby causing it to buckle. No such effect is noticed when aluminum is used.

GEORGE H. BRINKERHOFF.

TO ERECT LONGEST WIRELESS SPAN IN THE WORLD

THE United States Government, through the Bureau of Yards and Docks of the Navy Department, during the month of March awarded contracts for the erection of what will be the most wonderful wireless system in the world. Spanning the Pacific Ocean it will reach from San Diego, California via Honolulu, to the Philippine Islands, a distance of more than 5,000 miles. The San Diego station will be located in the Cholas Valley, the Honolulu station in Pearl Harbor, the army and navy post, and the Philippine terminal at Cavite, overlooking Manila Bay. The Pearl Harbor and Cavite link of the system will be more than 3,000 miles in length, whereas the greatest communicating link of wireless now in existence is that across the Atlantic, slightly under 2,500 miles.

Excepting the Eiffel Tower in Paris, andwhose efficiency is comparatively small, due to the fact that it has no complement, the towers of this Pacific system are also to establish a new record for height, for they will be in the neighborhood of 600 feet high. And in every other way will this system be framed on lines of immensity

Tips for the Wireless Amateur

¶ Don't receive with the switches out. It's bad for the instruments.

¶ Don't think you are getting blank place if you accidently happen to push the buzzer test.

¶ Don't stretch the sending of your coil. You have probably stretched the spark only.

¶ Don't believe all you hear. If someone says he can receive 2,500 miles, take the square root of it and then divide by two to find his true radius—or ask to be shown.

¶ Don't tell a wireless yarn until you are absolutely sure that you have a greenhorn to deal with. You may need a smaller sized hat afterwards if you do.

¶ Don't hold on to the spark gap and accidentally press the key. It's bad for the coil as it short-circuits the secondary.

¶ Don't receive messages all the evening and then before you go to bed go to ground your aerial and find it is already grounded. If you do we would advise having the telephone tested since they would probably be strained.

¶ Don't try to read static. He uses a private code.

¶ Don't try to manufacture a spark coil without proper equipment. You may exhaust your vocabulary.

¶ Don't try to put up an aerial 25 feet long and expect to get blank station 500 miles away.

¶ Don't rate the voltage of your spark coil on placards. It may look well but think how many times you would have been electrocuted if the notices were true.

One Who Knows.

never before attempted, for the various stations will possess generating facilities that may be virtually compared to all others as the candle to the incandescent light.

Each station will consist of three triangular towers, set on a triangle of 1,000 feet from point to point; a power house of generating facilities comparable with that of a town of 5,000 persons, and the usual attendant quarters. With a height of 600 feet, as already stated, each tower will be 150 feet in base measurements, and will consist of 300 tons of steel, for they will be of all-steel construction. The cost will be $29,100 each for the fabricating and erecting of the San Diego towers, $30,900 each for the Pearl Harbor towers, and $34,200 each for the three towers at Cavite. The contract for the stations at San Diego and Pearl Harbor was secured by the Llewellyn Iron Works of Los Angeles, California, and the one for the towers at Cavite was awarded to the Pittsburgh-Des Moines Steel Company of Pittsburgh, Pennsylvania. A year is given in which to do the forging and erecting of the towers. The entire distance will be covered by these three stations.

THE CENTRAL RADIO ASSOCIATION

The Central Radio Association is making plans to publish a directory call book of all amateur stations known to them in twenty-four states lying between the Rocky Mountains on the west and the Ohio River on the east. All amateur operators living in this territory can have their stations listed in the book by writing to H. B. Williams, Secretary of the Central Radio Association, Chanute, Kansas. All names must not be sent in later than June 5th.

BINGHAMTON PROGRESSIVE RADIO ASSOCIATION

At a meeting of the wireless amateurs, held April 20th, 1915, in Binghamton, N. Y., the Binghamton Progressive Radio Association was formed and the following officers elected for the first term: Kenneth Kingsbury, President; Wallace Dunmore, Vice-President; Ray H. Holmes, Secretary; Mr. Bovee, Treasurer, and Mr. Hollister, Sergeant-at-Arms. Seventeen members were present at this meeting and it is said by the Secretary that every indication points to a successful year for the association. The purpose of the club is to promote good fellowship among the amateurs in Binghamton and outlying districts. An experimental department is to be established in which interesting and instructive experiments will be carried out. The club will be glad to hear from other clubs and individuals. Correspondence should be addressed to the Secretary, Ray H. Holmes, 157 Robinson street, Binghamton, N. Y.

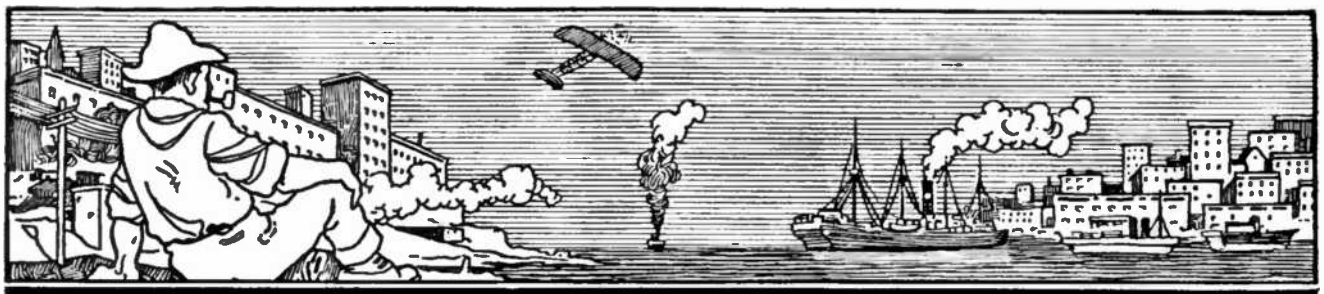
PLANT CULTURE BY HIGH FREQUENCY CURRENT.

(*Continued from page* 835.)

lower end of the secondary cylinder. From the detailed drawing in Fig. 2 the reader will note that four posts of black fibre rod, 2¼ inches high and one inch in diameter, are given a series of saw cuts to a depth of three-eighth inch. Eight cuts will be required in each post to take the eight turns of primary strip. The cuts may be made with two blades of a hacksaw placed side by side to give the required thickness or, what is by far the better method, the cuts may be taken in a milling machine if one is available. The posts are located on the base-board and secured with short machine screws tapped into the fibre. Care should be taken to see that the screws do not pass into the posts beyond the bottom turn of the primary.

The assembly of the parts is clearly shown in Fig. 1 and it is believed that no further comment is necessary other than to say that the bottom turn of the primary is connected with the ground stud, as shown in the diagram of connections.

Wireless club notes and announcements will be published in these columns whenever received.



What the World is Doing

WHATEVER may be the political and economic effects of the European war, there is one fact that stands out prominently amid the chaos. That fact is the advancement made in chemistry as a result of the military operations. Before the war many American industries were dependent on German manufacturers for certain chemicals, and during the early days of August many organizations spent more than one sleepless night in wondering how they could keep their factory wheels going without the heretofore easily procurable German chemicals and dyes. And this very state of business gave American ingenuity and inventiveness an opportunity of asserting itself. One of the chief industries to suffer, the dyeing industry, was soon aided out of its serious predicament by the wonderful discovery of an American chemist. So it has been in many other fields, with the result that we Americans have been made an independent community and given a great opportunity of developing our resources to the utmost. Meanwhile our European brothers have experienced the same difficulties and consequential advantages. Countries other than Germany have always been more or less dependent on that nation for many of their chemicals. When the war broke out they were also confronted with the problem of making their own raw materials. It was the opportunity for the chemical engineers and inventors—and they took it. These countries, as in the instance of the United States, have become more independent than ever before. But chemistry has not rested here. It has been developed even on the battlefields. First the French and English made extensive improvements in the explosives used in their shells in order to make them more deadly. Then the Germans retaliated by releasing deadly gases that were blown by the wind over the trenches of their opponents. The effects of the gases—said to be chlorine—have been far more deadly than artillery fire. Men have been killed almost instantly by the heavy fumes, which can penetrate deep into the trenches and bomb-proofs. Now the French and British soldiers have again applied their chemical knowledge in counteracting the deadly effects of the German gas bombs and tanks. Latest reports have it that they are spraying ammonia into the air, which, on mixing with the chlorine fumes, converts the latter into harmless ammonium chloride—a soft powder which soon sinks to earth. Thus the war at its present state is a war of chemicals. It is true that the advantages derived from the war will be far outbalanced by its terrible cost. Yet is it not fortunate that at least one advantage—the development of chemistry—is accruing?

With the fast approach of summer and its thunder showers, the article entitled "Lightning Protection," by A. S. Blatterman, appearing in this issue, must necessarily prove of interest to readers of an electrical turn of mind. While the article is in truth a purely electrical one, since it deals with lightning protection on long transmission lines, still it has been included in the Radio Section for the reason that it should be read by every wireless amateur. In a great measure the information it contains will be found very valuable in effectively protecting a wireless station from the possible ravages of lightning.

The wireless telephone has at last come into its own—at least in one of its numerous fields of application. We learn that the Lackawanna Railroad in the East is using a wireless telephone equipment on one of its fast trains, and that the service is proving practicable. The range of the apparatus is being increased, and it is not a wild flight of fancy to look forward to the extensive employment of the radio telephone on all through passenger trains—and even freight trains for reasons of economy. While the Lackawanna Railroad is developing its wireless telephone service, news comes of the experiments of Dr. Millener with wireless telegraph and telephone apparatus for the Union Pacific Railroad in the Middle-West. Surely we are on the eve of a new era in wireless communication.

The rapid growth of THE WORLD'S ADVANCE has necessitated the removal of the organization from the former offices at 32 Union Square to its new home at 239 Fourth Avenue, New York, where it occupies the entire twelfth floor.

Short Circuits

Teacher—Now, Willie, mention one of the customs at Christmas time?

Pupil—Running in debt.—*Life.*

Willie—Paw, why is the way of the transgressor hard?

Paw—Because so many people have tramped on it, my son.—*Cincinnati Enquirer.*

"I think if I were a Tommy Atkins going to France, I'd join the bicycle corps."

"Why so?"

"Then, if I got homesick, I could puncture a tire and once again breathe my native air."—*Boston Transcript.*

"I'm not at home to that gentleman, Jane," declared the belle.

"You haven't seen his card, yet," protested mother. "You don't know who it is."

"True; but it isn't the machine I am waiting for. I can tell by the honk."—*Louisville Courier-Journal.*

"What could have brought you to this, my poor man? You appear to have seen better days."

"Yes, I was once an author, madam. I lost all I owned trying to find a publisher for my last book, on 'A Hundred Ways to Get Rich.' "—*Follia.*

Teacher—Now, who can tell me which travels fastest—heat or cold?

Johnny Bright—Heat, of course; anybody can catch cold.—*Selected.*

Mr. Henpeck—Is my wife going out?

Jane—Yessir.

Mr. Henpeck—Do you know if I am going with her?—*London Tatler.*

"Coal and diamonds are really made of the same substance."

"Well," replied the young woman who typewrites, "I'll take the diamond. I don't care for the carbon copy."—*Washington Star.*

The Applicant—There's lots of push and go in me. I'd like to show you.

The Boss—Very well. That door opens outward. Try your push on that and then demonstrate your go on the outside.—*Chicago News.*

Teacher—Jane, can you tell me who succeeded Edward VI.?

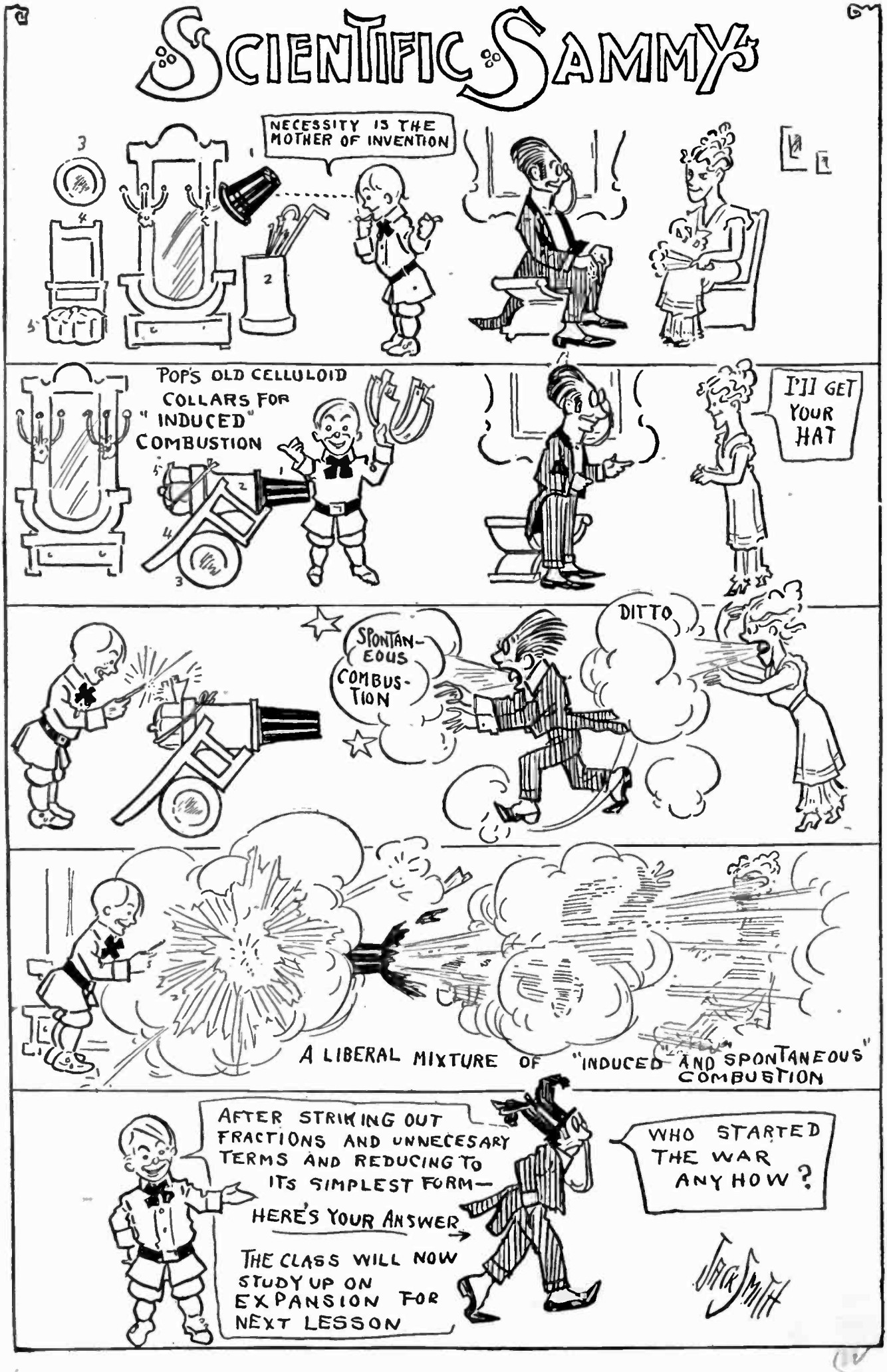
Jane—Mary.

Teacher—Now, Lucy, who followed Mary?

Lucy (absent mindedly)—Her little lamb.—*Theosophical Path.*

"Have you a circulating library?"

"No ma'am; but I can show you some nice revolving bookcases."—*Judge.*


SCIENTIFIC SAMMY'S
NECESSITY IS THE MOTHER OF INVENTION
POP'S OLD CELLULOID COLLARS FOR "INDUCED" COMBUSTION
I'LL GET YOUR HAT
SPONTAN-EOUS COMBUS-TION
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A LIBERAL MIXTURE OF "INDUCED AND SPONTANEOUS" COMBUSTION
AFTER STRIKING OUT FRACTIONS AND UNNECESARY TERMS AND REDUCING TO ITS SIMPLEST FORM—
HERE'S YOUR ANSWER
THE CLASS WILL NOW STUDY UP ON EXPANSION FOR NEXT LESSON
WHO STARTED THE WAR ANY HOW?
JACK SMITH