Practical Electrics

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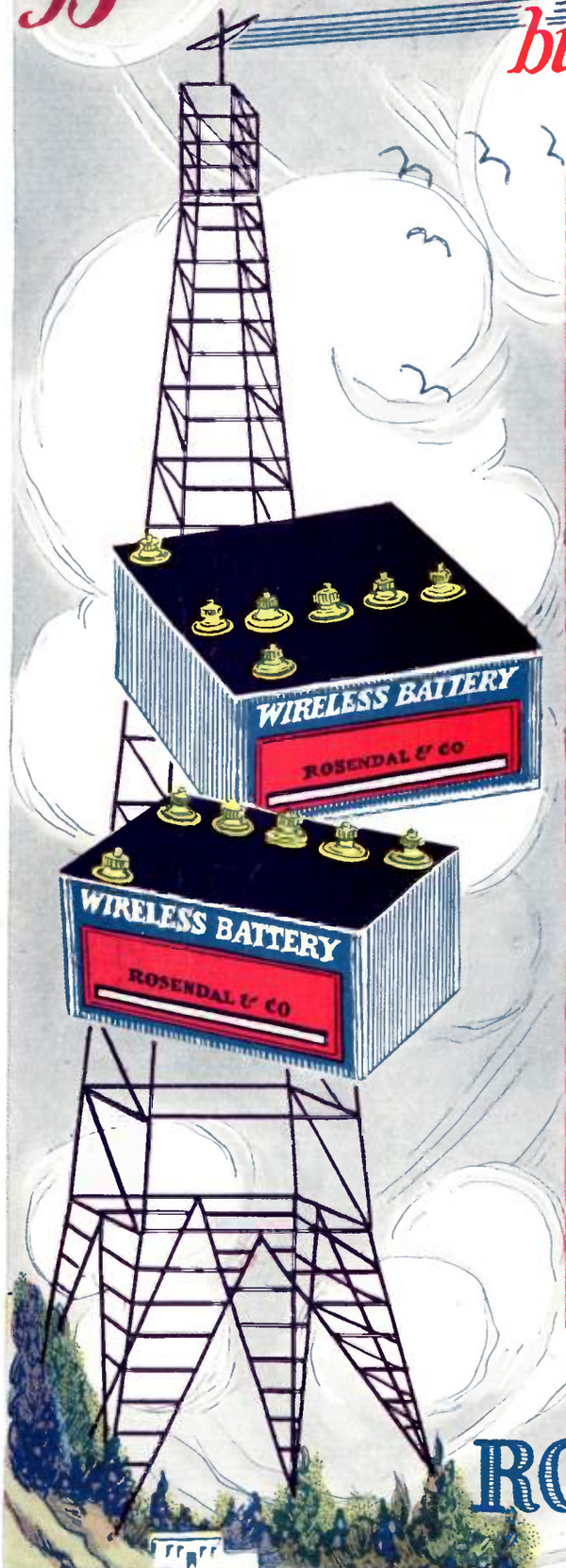
Dec. 1923

EDITED BY H. GERNSBACK

HOW TO MAKE AN ELECTRIC CARILLON

See Page 62

"B" Batteries that are built with a conscience



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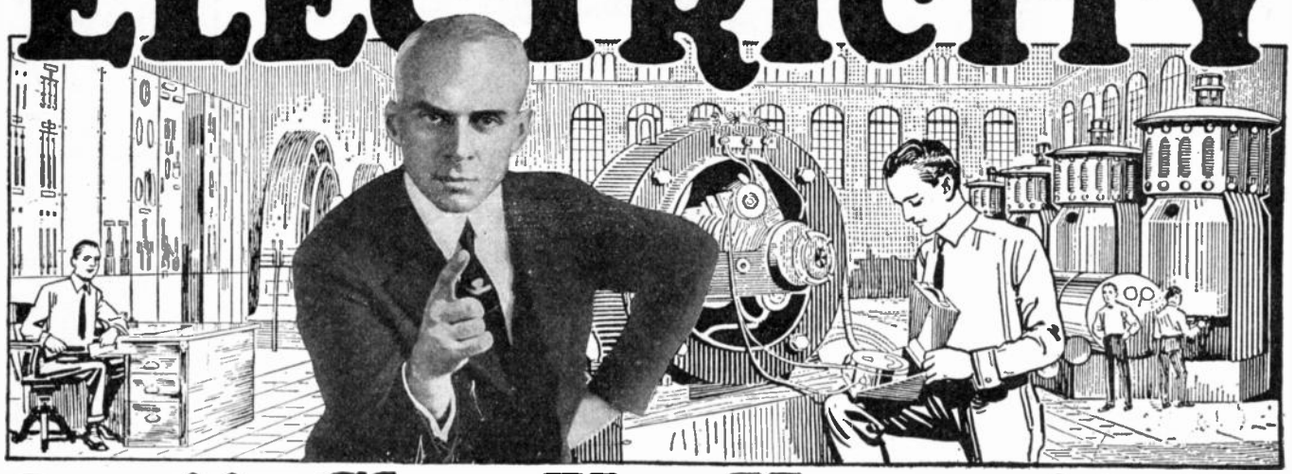

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L. L. Cooke, Chief Engineer,
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W. E. Pence.

L. L. Cooke, Chief Engineer, Chicago Engineering Works, Dept. 219, 2150 Lawrence Avenue, Chicago, Ill.

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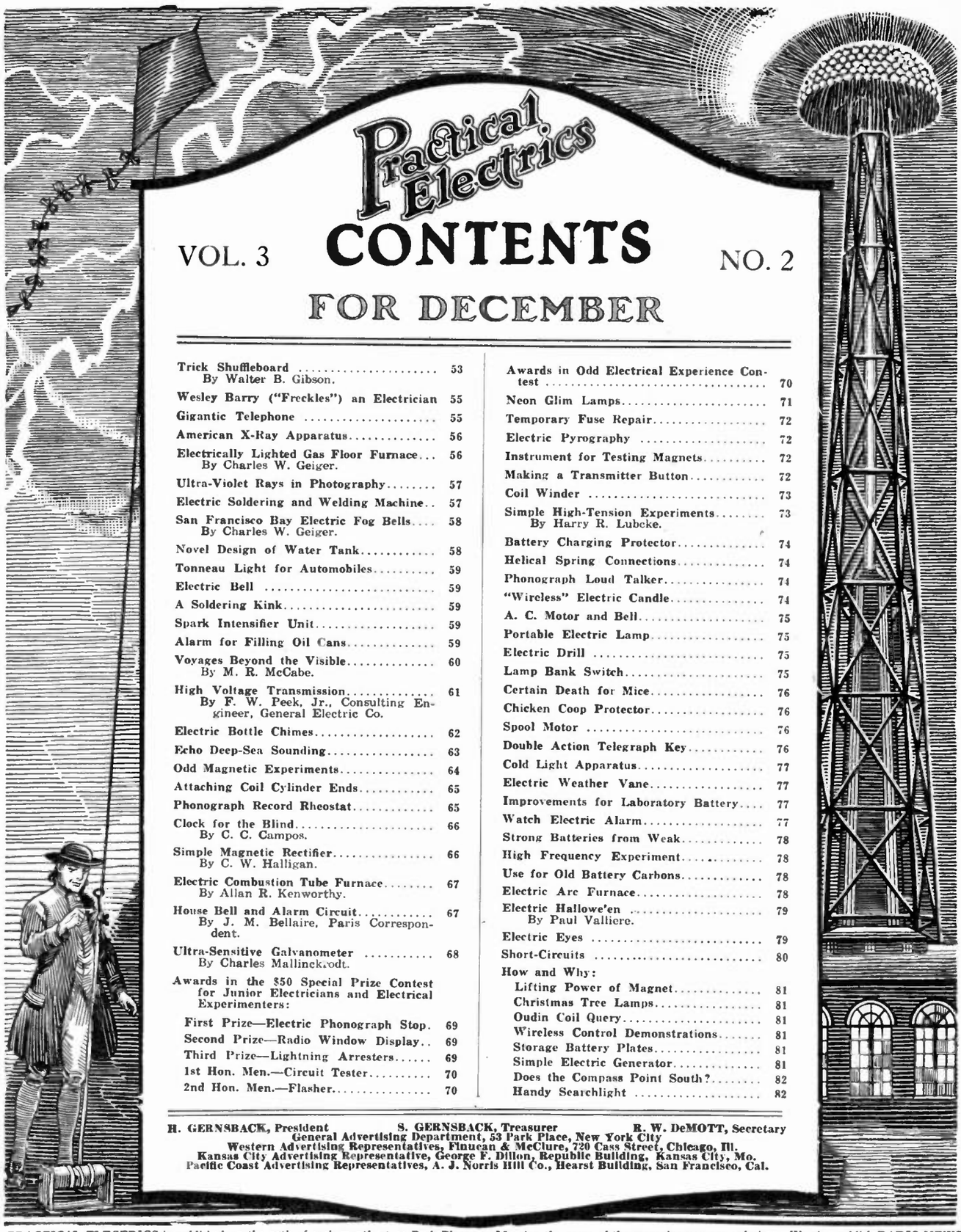

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FOR DECEMBER

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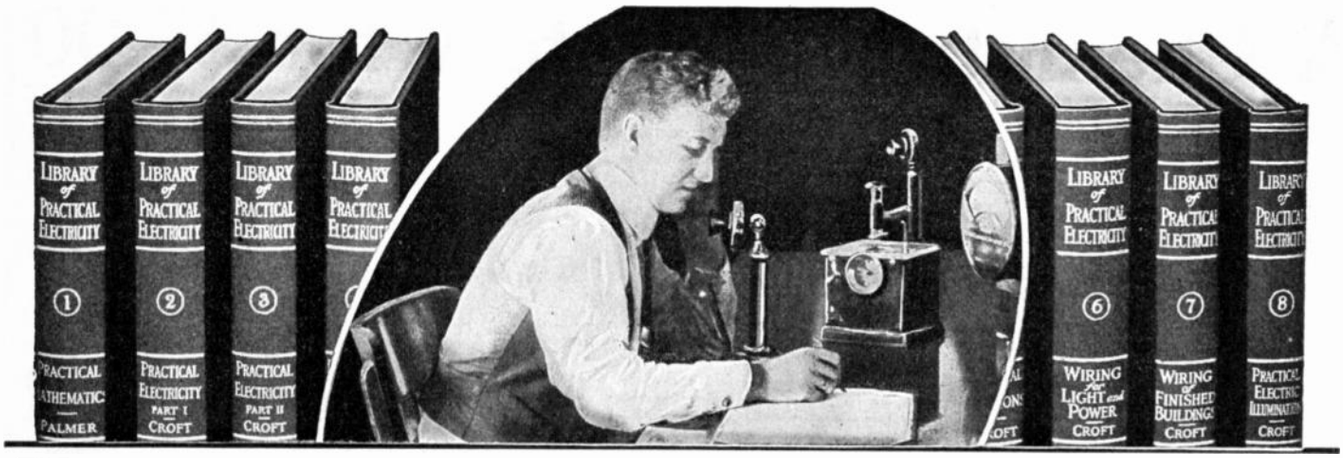

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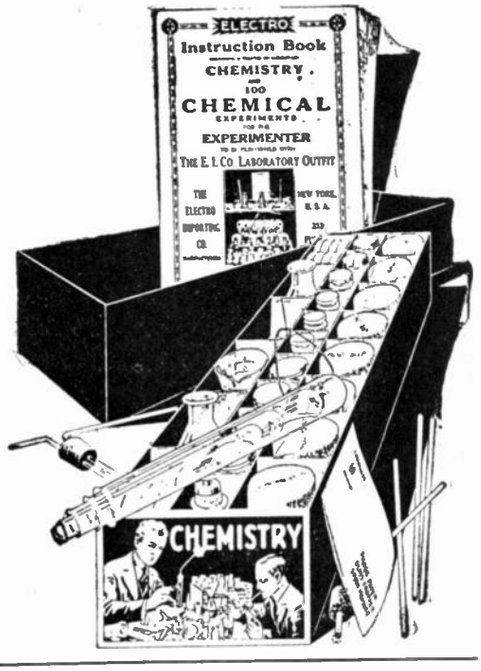

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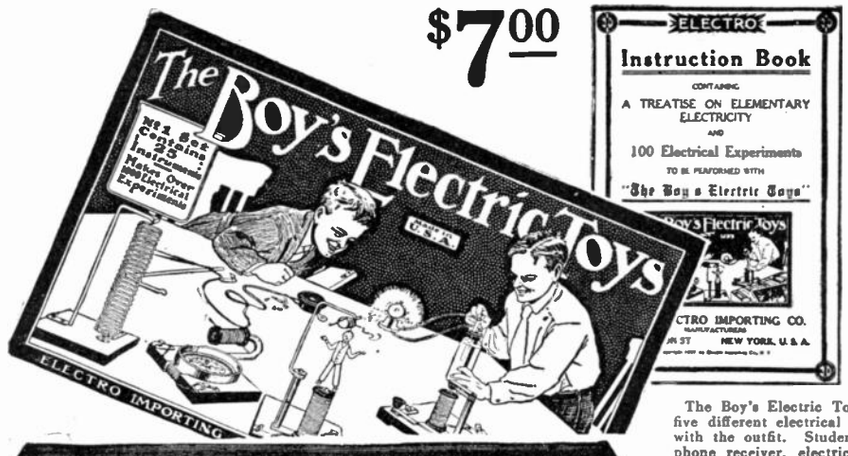

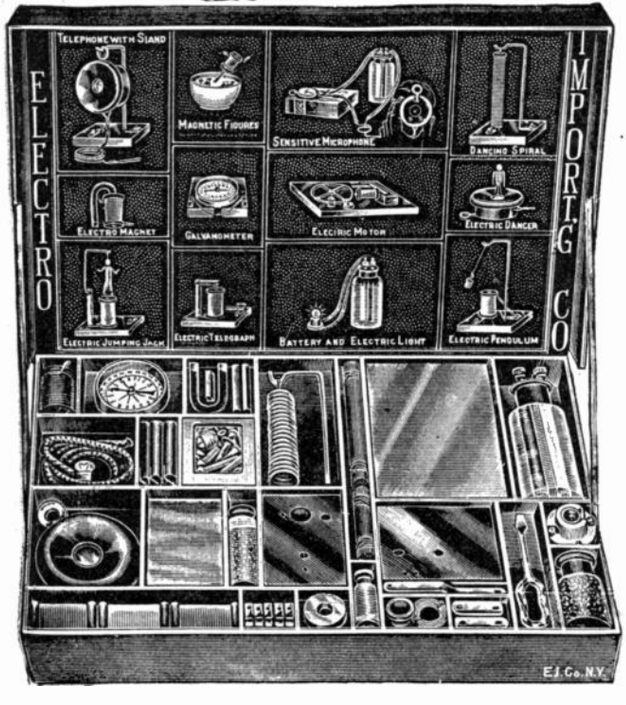

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Volume 3
No. 2

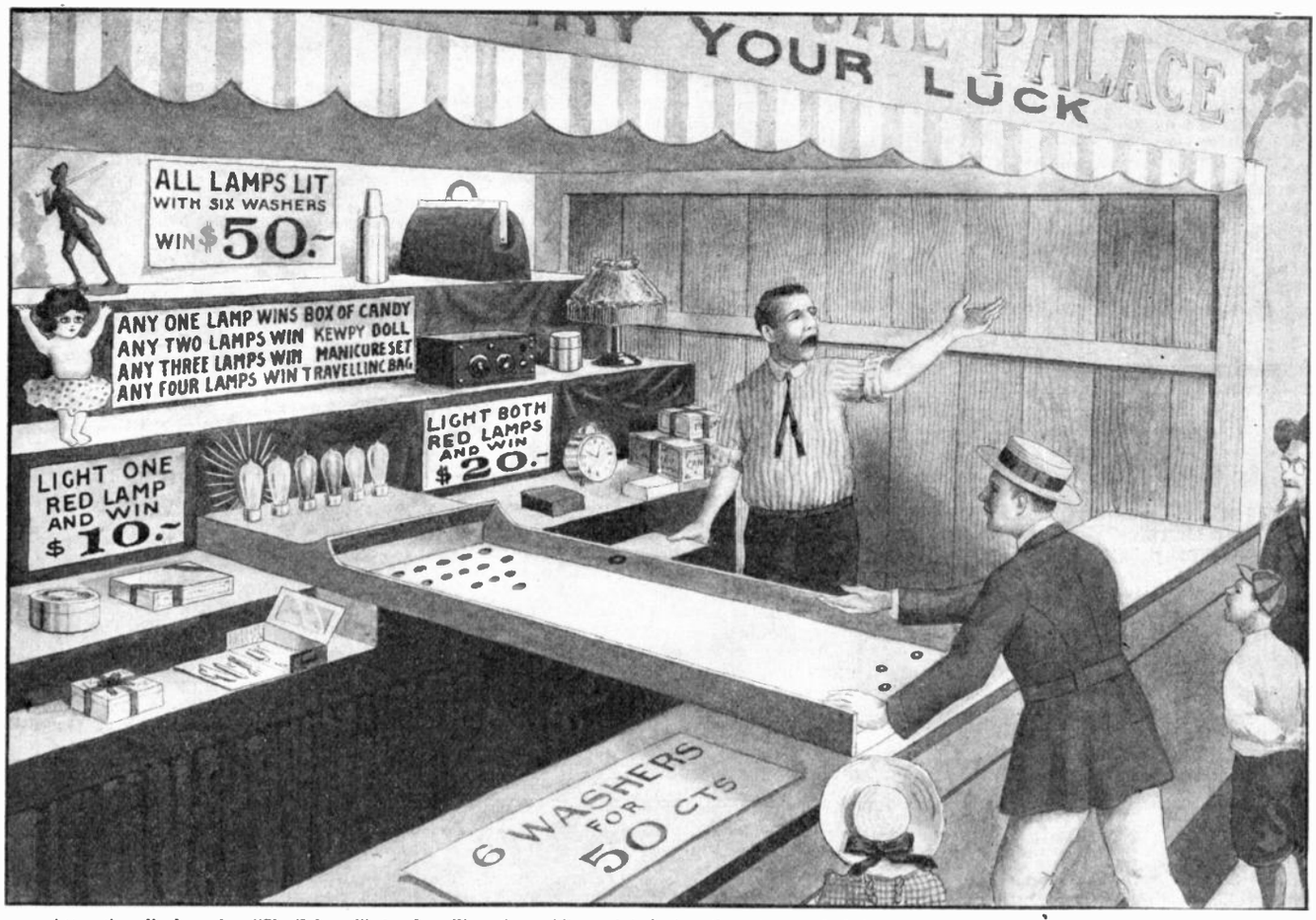
Practical Electrics

December
1923

H. Gernsback, Editor and Publisher T. O'Conor Sloane, Ph.D., Associate Editor

Trick Shuffleboard

By Walter B. Gibson



Attractive display of a "Shuffleboard" for beguiling the public and inducing them to spend their money on a hopeless game, where neither chance nor skill can possibly win the big prizes.

IN a previous article on the "Flashing Star," the writer emphasized the fact that electrical devices are superseding the old-time games at carnivals and country fairs. Not only do the brilliant lights attract larger crowds than did the antiquated swindle games, but in many localities, electrical games have gained the approval of the authorities; in fact, at many seashore resorts practically all the gambling devices are operated by electricity.

Carnival games are divided into two classes: those which operate on a "percentage," which favors the operator; and those requiring "science and skill," where the player apparently holds his fate in his own hands. Hitherto, all electrical games were of the former class; but during the past season, a game appeared which was quite unique—a game of "science and skill" operated by electricity.

Among the gamesters, this new device carries the rather ambiguous title of "The Electric Washer Joint"; its more pretentious name is "Carnival Shuffleboard." The illustration above shows the game ready for operation.

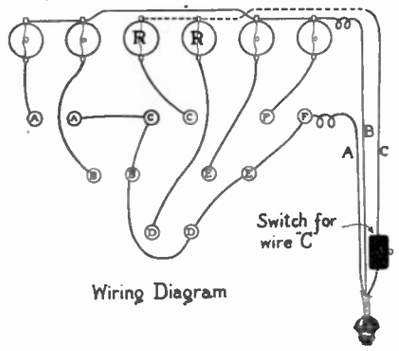
At the end of a sort of alley, or shuffleboard, are twelve bolts, set in the wood, so that their heads barely project. The drawing, page 54, shows the exact arrangement. The bolts are set in pairs. The player steps up to the front end of the alley, and pays ten cents for the privilege of sliding six washers along towards the set-in bolts. If one washer forms a contact between the two bolts of any pair, one of six incandescent lamps is lighted, and the player is entitled to a small box of candy as a prize; if he succeeds in lighting two, three, four or all six incandescent lamps he receives larger prizes, according to the chart which is displayed at the end of the alley.

It is quite a difficult matter to successfully slide a washer to touch and stay in contact with two adjacent bolt-heads, and the player who wins a prize usually more than earns it. But there is bigger bait held out for the "suckers" who indulge in "Carnival Shuffleboard." It will be observed that the two center incandescent lamps are red. If the player succeeds in making a contact that will light one of these, he receives ten dollars in cash; if he puts on both red lights, he receives twenty dollars; while if he succeeds in lighting all six incandescent lamps, he gains an award of fifty dollars.

This is a remarkable offer, and it is little wonder that the shuffleboard is popular among the players wherever it is introduced. But the most remarkable part is the fact that no one ever wins the cash prizes, and the operator usually "cleans up" a tidy sum from the unsuspecting public.

A close study of the game will convince one that the cash offers could not be *bona fide;* however, any one imbued with the gambling fever is apt to hesitate at nothing. But the man viewing the game from the practical standpoint soon wants to know "where the trick is."

As far as the white lights are concerned, everything is above board. Sometimes the game is played with white lights only, four lamps being used. The prizes are not really so valuable as they appear, and the operator is sure of an enormous profit, without resorting to fraud. But



Wiring Diagram

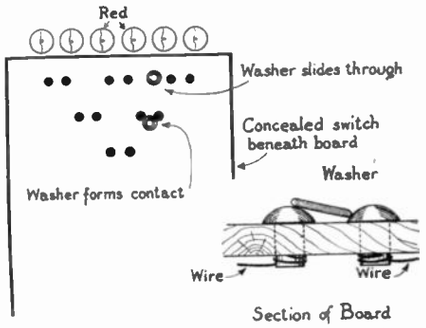
The wiring diagram for the trick shuffleboard used at fairs and the like to cheat the public, and to win their money.

the red lights with their large cash awards are the great attraction; so the wily operator uses them also, and incorporates a concealed mechanism that enables him to disconnect them without detection.

The explanatory diagram shows the arrangement of wiring beneath the shuffleboard, and reveals the swindle. (A-A), (B-B), etc., represent the pairs of bolts as seen beneath the board, looking up at the bottom. One bolt of each pair is connected to a main wire (A) through which the current passes; the other bolt of each pair leads to one of the incandescents. Two other wires, (B) and (C), are connected with the incandescents; (B) with the white lights; (C) with the red. These wires join wire (A) and run to socket. When the current is on, the circuit is complete except for the gaps between each pair of bolts. If a washer is laid on bolts (F) and (F), the circuit is completed, and the white light on the right lights up.

Bolts (C-C) and (D-D) supply the contact points for the red lamps. But wire (C), before it joins wires (A) and (B), is controlled by a switch. This switch is conveniently located and hidden underneath the board at one side. The operator, demonstrating the "fairness" of the game, pushes a washer on each pair of bolts (on top of the board), using a glass rod as a pusher. All the incandescents light up. But as he reaches over and slides the washers off the bolts, his other hand, resting on the side of the board, secretly turns off the concealed switch. The red lights are now dead; and so are the player's chances of winning a cash prize!

Of course, at any time, the operator may prove that all the incandescents are active, by merely turning on the switch as he drops a washer onto two adjacent bolts. If some one slides a washer on to bolts (C-C) or (E-E), he will not be surprised if they do not light, for the operator explains that a perfect contact has not been formed.



Section of Board

The supposed operations of the shuffleboard and the washer clearly shown; the distribution of bolt heads on the board for the washer to make contact with.

If only four white lights are employed, the secret switch is not necessary, for the odds are in the operator's favor; but he may offer a grand prize for lighting all four lights; in which case, he will find it advisable to use a controlling switch that will eliminate one of the white lights.

IMPORTANT ANNOUNCEMENT

THE January issue of PRACTICAL ELECTRICS will be increased one-third in size in pure text matter. A great many pages will be added and a number of new and distinct features will appear which will appeal to every reader of PRACTICAL ELECTRICS.

We have been urged to take this step by our many readers who in the past, have complained that there was not enough reading matter in PRACTICAL ELECTRICS.

There will be a series of improvements in PRACTICAL ELECTRICS. We intend to enlarge the magazine right along from now on, adding such features as will be of interest to all of our friends.

In order to put through our new plan, beginning with the January issue, the price of PRACTICAL ELECTRICS will be 25 cents. We believe you will agree with us that this is a moderate increase, because while we are increasing the magazine 33⅓% in pure text, we are only increasing the price by one-fourth.

The subscription price of PRACTICAL ELECTRICS up to January 1, 1924, will be $2.00. After January 1, $2.50. If you or your friends are not subscribers, we urge you to take advantage of the present low rate.

In order to guide the editors as to just what material you like most, a coupon is printed below which we ask you to be good enough to fill out and return to the editors. They will then be in position to give you just the sort of reading matter you desire.

THE PUBLISHERS.

THE EDITORS ASK A FAVOR

TO OUR FRIENDS:

The editors appreciate that in order to please you they must print the sort of articles you like best. Every so often we hear from readers who desire us to print certain articles. As a rule we immediately get such articles in preparation. Will you be good enough to fill out this coupon and paste it on the back of a postal card and send it to the editors? It will be the means of bringing you the articles you want most.

I like PRACTICAL ELECTRICS as it is.....Yes.....No.....

I like the following departments best.....

.....

.....

Please print the following articles (State articles you would like us to print).....

.....

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Name .....

Address .....

Wesley Barry ("Freckles") an Electrician

Three portraits of Wesley Barry, the well-known "Freckles" of the moving pictures, showing him in the guise of an electrician, for he is developing into a devotee of the science, with special interest in small motors. He is celebrated for his smile, which is shown in one of the pictures, but the freckles are not so evident.

THERE are various kinds of fans and the word itself, if it is always to be called a word, has very distinct uses. The original fan was an instrument for producing a breeze, and the electric fan has displaced the palm leaf implement and the Hindoo punkah to a considerable extent.

But the term fan when applied to an individual has quite a different signification. It means one who is devoted to some subject, and presumably is derived from the word fanatic.

Our illustrations present to the reader several portraits of Wesley Barry, the famous moving picture juvenile, whose freckled face and characteristic grin attract audiences of movie fans in all parts of the country. While those who look at the performances of this attractive young man on the screen are movie fans, the boy himself is a fan in other fields, and is shown here working at his favorite electricity, his devotion to which is largely directed to the miniature motors. So he is termed sometimes a motor fan, quite another thing from a movie fan.

In conversation with one of the Westinghouse representatives, it came about that Wesley Barry had a great fondness for working with small motors. This, of course, interested the representative of the great electric company, and we are indebted to them for several photographs of Freckles, as he is called, amusing himself with his motors.

Sometimes there is a bit of pathos attending the very early success of movie actors and the like, for while it may be a money-making profession, it is abjectly shallow. We cannot but think that those who have enjoyed this young actor on the screen will have a warmer feeling for him when they learn that he is really an embryo electrician, with other interests than the moving picture drama.

Incidentally, it is not only his freckled complexion which pleases his audiences; he has a very witching smile for which he is celebrated, and this appears in one of our portraits.

Gigantic Telephone

OUR illustration shows a somewhat mysterious presentation. The young lady is Miss Primrose Leigh, well known in artistic circles, who poses here apparently to use two gigantic telephone instruments.

It will be observed, however, that she is not holding her face to the transmitter so we have to suppose her listening to some message from the giant receiver, which, by the way, is not held to her ear.

We are informed that she is taking a hand in telling the whole country that it is Greater New York's twenty-fifth birthday, apropos of the recent exhibition at the Grand Central Palace.

Consciously or unconsciously, however, our informant was wrong. The fact is that these two objects were made of wood for window display purposes by the New York Telephone Company, and were used, we understand, in connection with a normal set to indicate the growth in the use of telephones in a certain section of the city.

It certainly made a forcible presentation of the case and also afforded a very good chance for the picture to be posed.

The system of illustrating the growth of an industry by constructing large reproductions of some part of its apparatus is quite frequent, and is seldom carried out in a happier manner than in the case exemplified in this illustration. The trouble with it is that of course there are three ways of indicating the growth in its proportion. One would be to make the enlarged object vary in their linear dimensions with the growth that it is desired to indicate. The other would be to use the area of the objects and the third would be to use the cubic content. Undoubtedly, here, the cubic content was used and which was made to vary in proportion with the increase in telephone business. But one should be told which it is.

Two gigantic telephone instruments constructed of exact proportional size to show the growth of telephone business and to demonstrate its increase in this city. They are not bona fide instruments, but only models.

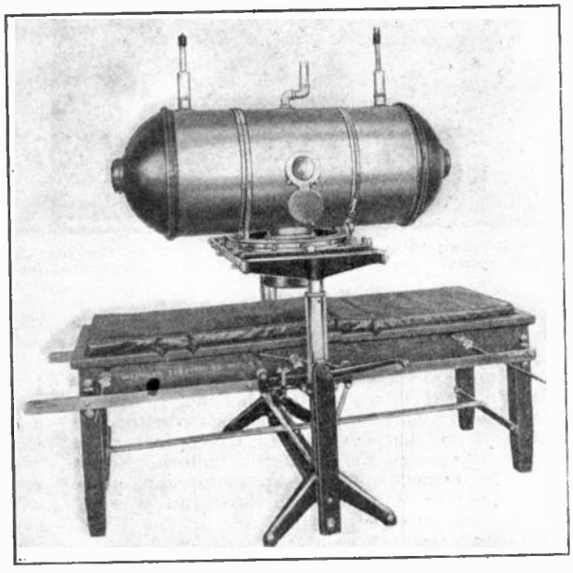
SCIENCE AND INVENTION in some of its illustrations has gone many steps beyond these reproductions and has used the telephone receiver as the model for a gigantic monument. Its shape lends itself very well to this design as it is more or less of the contour of an obelisk and gives an architectural effect which is very impressive.

American X-Ray Apparatus

WE have illustrated recently a hospital X-ray apparatus as constructed by the famous house of Siemens, Germany. In the present issue we show an American product, an X-ray apparatus for treating recumbent and seated patients. The same sort of protection from shock, against nitrogen oxide gases and ozone, is well provided for, just as in the Siemens apparatus.

In this apparatus it will be understood that the tube is contained in the lead receptacle above the table. Arrangements are provided for shifting this receptacle about, and while the table is adapted for treating a patient while lying flat, in an absolutely prone position, the supporting surface can be shifted about, raised or lowered, so as to bring the patient into a sitting position when required.

The lining of the drum is most substantially constructed: it is ⅛-inch sheet lead and is covered with polished sheet copper. The whole apparatus, X-ray casing and operating table, are in one as set up; although they are not fastened together, yet they do represent in a sense a unit. The table is made of wood, in order to secure the best possible insulation. The metal drum can be grounded so as to give full protection from shock. The port hole is closed by a piece of lead glass opaque or approximately so to X-rays. The small door which closes it has a lead coating one-eighth inch thick also. An exhaust pipe is provided to carry off the gases from the case. A rotary suction pump driven by an electric motor is connected to the exhaust. The case on its carriage can be moved the full length of the treatment table, and the drum can be revolved in both directions.



X-ray apparatus made upon American ideas which treats patients in any desired position. The patient lying prostrate on the bed can be brought up to a sitting position and his position can be adjusted according to requirements.

In placing the patient in position, the case on its carriage is wheeled to one end of the table, giving free access for placing the patient thereon. The case can be raised and lowered. The lowest position is 27 inches above the table top; the highest position is 51 inches above the same. The carriage can be moved laterally 12 inches and longitudinally six feet, both referring to the table. The adjustment is very accurate; thus in changing its height, six turns of the handle are required to raise it one inch. This not only implies close adjustment, it is fair to say to quite an unnecessary degree of fineness, but the heavy lead lined copper case is thus easily raised or lowered, a very essential thing, so as to conserve the nurses' and operators' strength.

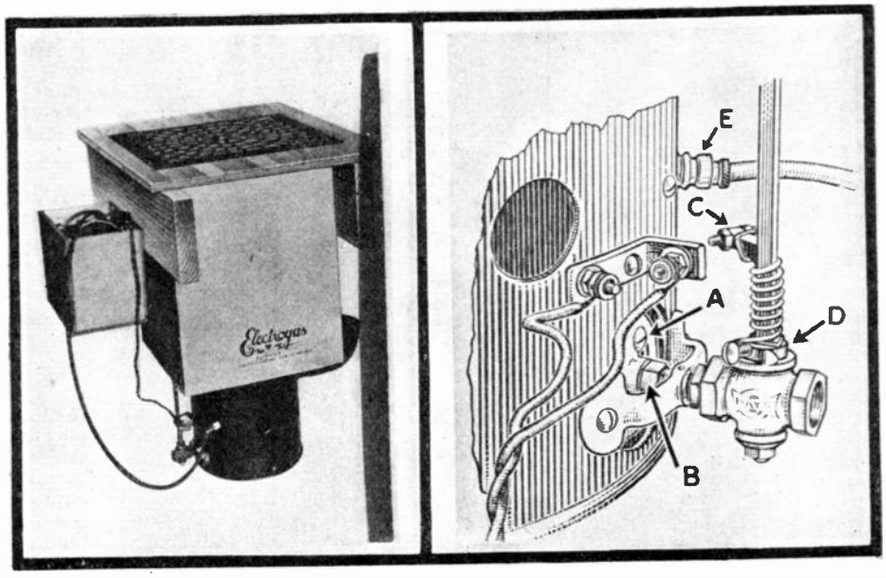
An interesting adjunct is the sphere gap; this consists of two spheres carried on glass pillars, each one 12.5 cmm in diameter, or five inches. One of the standards can be moved back and forth so as to change the opening between the gaps. By a cord, this adjustment can be done from a distance. The gap acts as a measurer of potential and regulator thereof.

Electrically Lighted Gas Floor Furnace

By Charles W. Geiger

A GAS fired, electrically lighted floor furnace has been perfected by two San Francisco inventors, the entire control and lighting apparatus of which act as one.

When the gas is turned on, an electrical contact is formed by which the switch shown in drawing at (C), which gives a spark in plug (E). This lights the gas and hot air begins to flow into the room. Lighting is thus positive and instant, without the use of matches or pilot. This must not be confused with the ordinary "electric push-button control" method, which comprises a valve actuated by an electro-magnet and requires a pilot light to be burning constantly.



Compact gas furnace, lighted and extinguished by means of electricity, a four-cell battery and a spark coil doing the work. The right hand diagram shows the connections.

When the control key is turned fully to the left in this new furnace and held there against the slight spring pressure at (D), the gas is full on and the electric contact is made by lever (C), thus producing the spark which lights the gas. When the operator's hand is removed from the control key, the coiled spring rotates lever (C) back slightly, which automatically breaks the contact, but does not turn the gas valve, as the control rod fits the socket at (D) loosely. The flame may then be regulated—turned down and up, without causing another electrical contact.

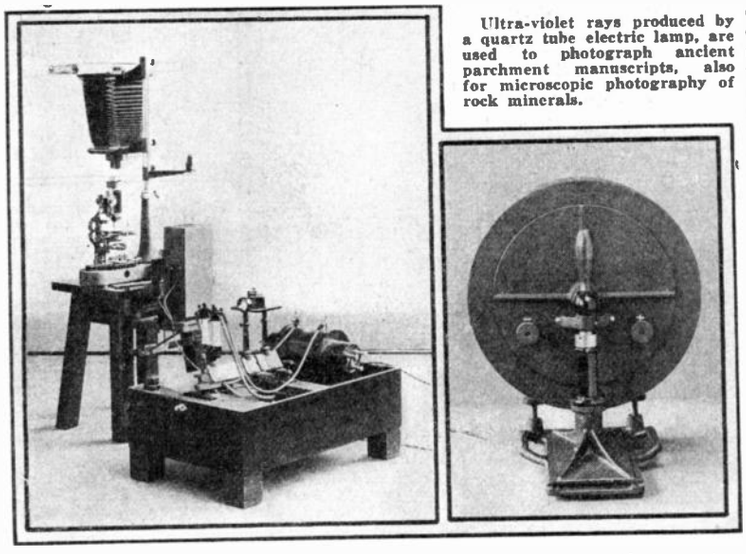
The electric current is supplied by a four-cell dry battery and a standard spark coil. The spark plug is contained in a cast iron chamber and does not come in contact with the flame. If so desired, the dry battery may be eliminated by connecting the spark coil to a bell-ringing transformer of the proper size.

Ultra-Violet Rays in Photography

By Dr. Albert Neuburger, Berlin

WHEN a mercury vapor arc is produced by an electric discharge within a quartz glass tube, ultra-violet rays emanate therefrom. Other electric discharges give these rays, but if they are produced within a glass tube the glass cuts out the ultra-violet rays, as it is opaque to them.

A very interesting application of the ultra-violet rays produced by this type of electric lamp has recently been made in the reading of palimpsests. In olden times when manuscripts were written on parchment, it was a practice to save the expense of new parchment by erasing the old manuscripts by scraping or the use of pumice, and to write new ones on the parchment thus cleared of old writing. Such manuscripts are called palimpsests.



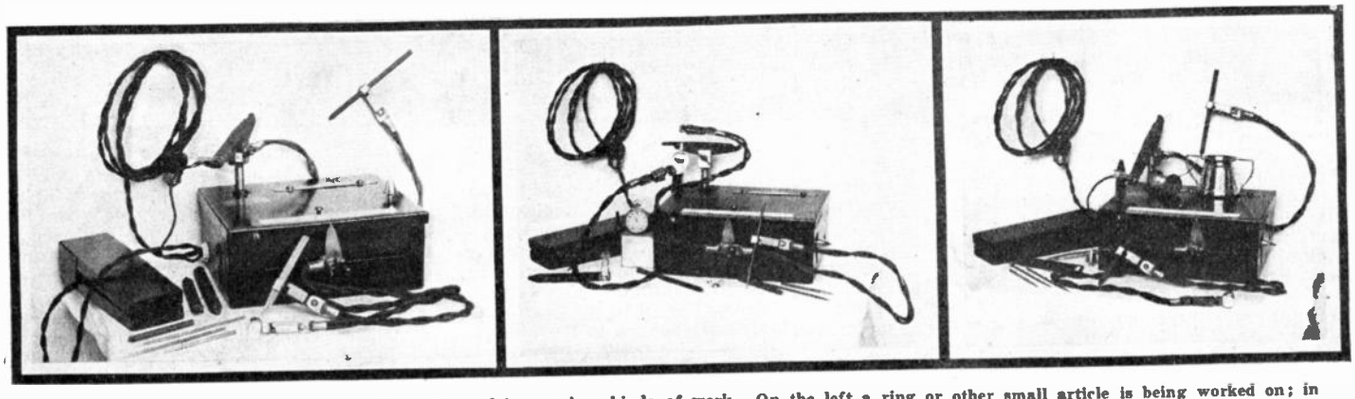
Ultra-violet rays produced by a quartz tube electric lamp, are used to photograph ancient parchment manuscripts, also for microscopic photography of rock minerals.

It is unquestionable that most valuable material was lost by this practice, and the powers of the ultra-violet rays are now being utilized to recover the literary treasures, as they may be in many cases, which have been lost by the erasing.

By the use of the ultra-violet rays, photographs of the writings on parchments thus erased, can be made, as the old writing will have left enough traces on the skin to be reproduced in the photographs. It is impossible to foresee what old matter may be thus recovered. Perhaps even the missing poems of Sappho or the lost books of Livy may be recovered by the ultra-violet ray.

A very important application also of the ultra-violet rays in photography is in the study of minerals. By taking photographs of these with the ultra-violet rays, identification is made simple, and this applies especially to the study of rocks, which are built up of minerals in microscopic particles. These can be photographed through a microscope by the rays in question and give a rapid identification of the composition of the rock. For we must picture to ourselves that most rocks are an agglomeration of separate minerals, which constitute as it were the bricks of which the same are made.

Electric Soldering and Welding Machine



Electric soldering apparatus is shown here, doing various kinds of work. On the left a ring or other small article is being worked on; in the center a broken spoon is being welded; and on the right the handle of a silver jug is being soldered where it has been cracked.

AN interesting application of the electric arc and electric incandescence for the purposes of doing fine soldering is shown in the apparatus which we illustrate.

The appliance is made largely for jewelers' use, for autogenous soldering and other similar work. Much of this class of operations is usually done by the blowpipe. Silver solder and the general run of jewelry solders require quite a high heat, but other work which the jewelers have to do, such as the setting of jewels in the work of watches, requires a very low heat, for it is only shellac which is to be melted.

By electricity heat can be produced virtually from 205 degrees Fahrenheit to perhaps two or three thousand degrees or more.

Within the case of the machine there is seen a powerful electro-magnet. The current used for the magnet or other purposes is regulated by a rheostat with sliding contact which is shown clearly in the illustration.

For some work a block of carbon provides a sort of table and is connected as one of the electrodes. The article to be soldered or heated may be held in a clamp at the end of the other wire, and on being touched to the carbon, heat is at once produced and the solder and flux melted in the most perfect manner. The current is turned on and off by a foot switch.

All sorts of manipulation are possible with this apparatus. One terminal may be a pointed carbon rod manipulated by hand like a soldering iron, while the piece to be operated on may rest upon the carbon surface or may be held in the other clip; in such case the carbon rod will operate exactly like a soldering iron and may be made to give a sort of mixed arc and incandescent effect.

Setting jewels in a watch is naturally a delicate operation, requiring a very low heat. A special connection is supplied whose circuit includes high resistance, which cannot be changed, so that the operation is absolutely safe.

One of the illustrations shows the mending of a spoon which has been broken. Here the two pieces may be made to act as electrodes. They are placed accurately in position with flux and solder as required, and the heat is turned on by the foot pedal. As illustrating the capacity of such a machine, a case is cited where a tin roof on a church was soldered by the use of this apparatus, using the pointed carbon as a soldering iron.

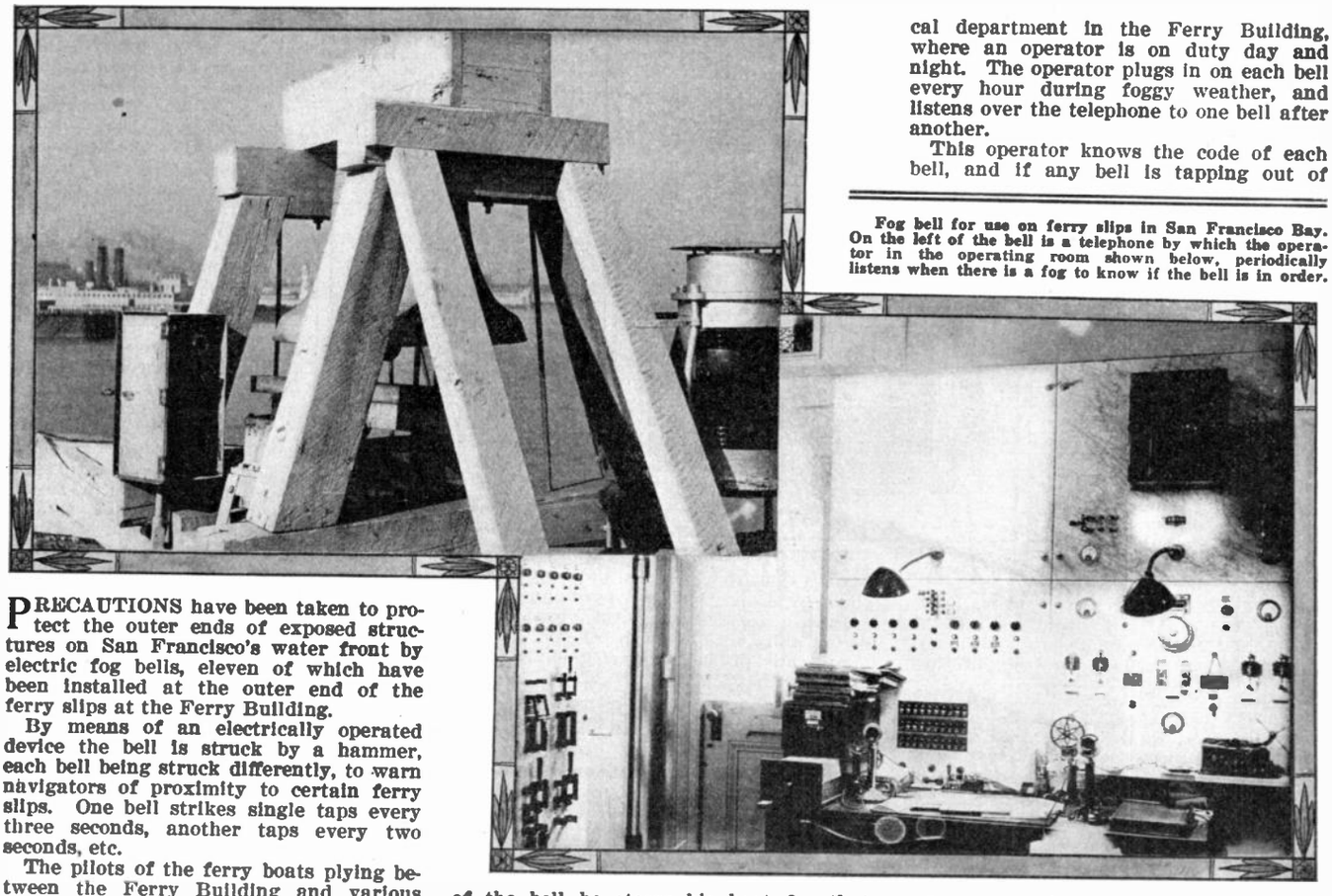
With alternating current, a watch can be demagnetized. It is held near the end of the box where the pole of the magnet extends and is pulled away quickly, which demagnetizes it. There is also a special pole piece which affixed to the magnet gives an eye magnet for drawing particles of steel out of the eye.

It is seldom that an apparatus deserves the name of five-in-one, which has been conferred by the proprietors on this one. We believe that with a little meditation it might have been called six, seven or perhaps more in one, the functions are so many.

One of the peculiarities of electricity, or at least some of its appliances, is that they seem to lend themselves to the most varied operations. Here we have an apparatus which can be used by the watchmaker for cementing his minute sapphire bearings in place with a bit of shellac, while we are told in the same article of the soldering of a tin roof with it. These certainly are the antitheses of each other.

San Francisco Bay Electric Fog Bells

By Chas. W. Geiger



Fog bell for use on ferry slips in San Francisco Bay. On the left of the bell is a telephone by which the operator in the operating room shown below, periodically listens when there is a fog to know if the bell is in order.

PRECAUTIONS have been taken to protect the outer ends of exposed structures on San Francisco's water front by electric fog bells, eleven of which have been installed at the outer end of the ferry slips at the Ferry Building.

By means of an electrically operated device the bell is struck by a hammer, each bell being struck differently, to warn navigators of proximity to certain ferry slips. One bell strikes single taps every three seconds, another taps every two seconds, etc.

The pilots of the ferry boats plying between the Ferry Building and various points on San Francisco Bay depend upon these bells to find their proper ferry slip during heavy fogs. The pilot knows from his code that certain taps come from certain slips.

One ferry boat pilot knows that the bell at the outer end of the slip into which he is to take his ferry taps 20 single taps per minute. When he gets within sound of the bell he steers his boat for that slip. Now if this bell should get out of order, the pilot might have trouble in finding the proper slip. So here the telephone renders important service.

At the side of each bell a telephone transmitter is installed as shown in the accompanying illustrations. This telephone is connected by two wires to the main telephone switchboard in the electrical department in the Ferry Building, where an operator is on duty day and night. The operator plugs in on each bell every hour during foggy weather, and listens over the telephone to one bell after another.

This operator knows the code of each bell, and if any bell is tapping out of order, or tapping improperly, he detects it instantly. An expert electrician is also on duty day and night, and as soon as a bell is detected tapping out of order, he is dispatched at once to make the proper adjustments.

Thus the telephone is the means of safeguarding the lives of persons traveling on the ferries. It is estimated that nearly 50,000,000 persons use these ferries yearly.

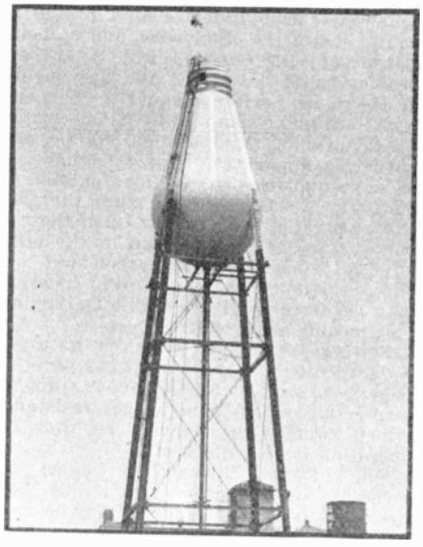
Novel Design of Water Tank

THIS tank is located at the Waverly plant of the Edison Lamp Works of the General Electric Company in Newark, N. J. It serves as an auxiliary water supply for the sprinkler system and fire hose throughout the plant. It is of 50,000 gallons capacity and is an exact replica of one of the well known types of Standard Incandescent Lamps.

The dimensions are on a scale of one-eighth of an inch to the foot, or nearly one hundred times the size of the lamp. The extreme height from ground to top is 115 feet, height of tank from base to tip 40 feet, largest diameter 21 feet, diameter of base that represents the threaded part, 8 feet 6 inches.

This threaded section of the tank is probably the most interesting feature of the structure. The water is not permitted to fill this part of the tank, as this portion is merely intended to carry out the desired shape, and a door giving access to the interior is cut through this threaded section.

The lines of the usual steel elevated tank structure are carried out with an external balcony girder into which the post connections are framed, but in this tank all bracing to provide for the horizontal stresses are installed in the interior of the tank, eliminating anything tending to distract the eye from the true proportions of the bulb.



Large water tower whose tank is constructed to represent an electric lamp. It is no trifling structure, as it carries 209 tons of water.

The weights of this structure are as follows:

	Tons
Water load	209
Weight of structure	30
Weight 4 concrete footings	74
Total	313

There is also a wind load equivalent to a pressure of 220 tons on the footings of this structure.

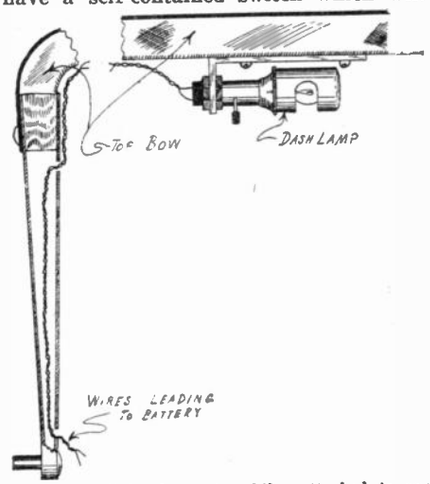
The idea of using the Standard Electric Lamp as a design for this tank was conceived by Mr. D. H. Canner, Factory Architect and Engineer of the Building Department, and the structure was erected under his supervision.

The tank is an example of design suggested by actual utilitarian structures. It would have pleased Ruskin from that standpoint, as he liked to trace architectural designs to their originals. The fluted column of Grecian architecture is attributed to a military stand for holding soldiers' spears.

Motor Electrics

Tonneau Light for Automobiles

THE illustration shows how to arrange a tonneau light for touring cars or roadsters. An ordinary dash lamp is used to furnish the light. The lamp should have a self-contained switch which will



Tonneau light for automobiles attached to one of the bows of the cover, the wire going through the hollow metal of the bow standard.

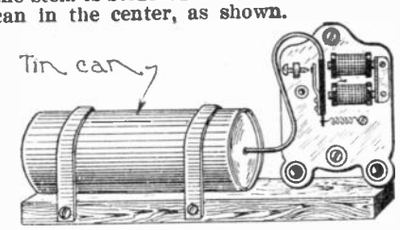
simplify the wiring. The lamp is secured to the top bow by means of a strap iron bracket as shown.

The wires from the lamp are carried along the bow to one side and down through the center of the side bow as illustrated, a ⅜-inch hole being drilled near the top and bottom of the bow through which the wires pass. The lamp being placed as shown does not interfere with the putting back of the top when desired.

Contributed by HAROLD JACKSON.

Electric Bell

A SIMPLE electric horn can readily be constructed from an electric bell. The gong and the head of the clapper are removed from the stem, and the end of the stem is soldered to the end of a tomato can in the center, as shown.



Automobile horn made with an old electric bell and a tin can, a home-made substitute for the Klaxon.

Two strips of tin are next fastened to the can with solder, and screwed down to a wooden base. When the current is turned on, the tin can will be set into vibration, thereby producing a good substitute for the familiar electric horn.

Different bells and different cans will give varying notes.

Contributed by WILLIAM LOBACK.

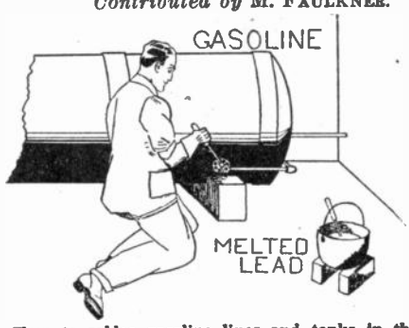
"A Soldering Kink"

IT is necessary sometimes to heat a soldering iron at a location where it is not practical or safe to use a torch, as in soldering gasoline lines.

In such cases the writer has used a lead pot about half full of melted lead. In this I heat the iron, and take the pot to the work where the iron may be reheated at will—a good sized pot of melted lead retaining its heat for some time—thus avoiding all danger of fire or explosion.

To break or melt a soldered joint cold, scrape a portion of the soldered joint bright, and apply mercury to it. The mercury dissolves solder or lead without the aid of heat, thus avoiding all danger when combustible gases are near the work.

Contributed by M. FAULKNER.



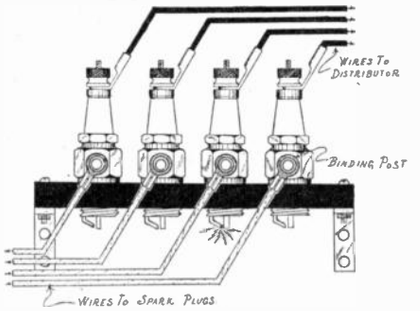
How to solder gasoline lines and tanks in the garage and about automobiles so as to be free from danger of fire.

Spark Intensifier Unit

A PIECE of hard rubber, bakelite or other non-conducting material, 7 inches long, 2 inches wide and ½ inch thick, if for a four-cylinder car, is the base of the appliance.

Four holes slightly smaller than the plugs are drilled in this piece of material, into which the plugs are turned, cutting their own threads.

A binding post is soldered to one flat



Old spark plugs are used to provide spark gaps for an automobile, so that the condition of the ignition is watched to a certain extent and intensification, as far as it goes, is also produced.

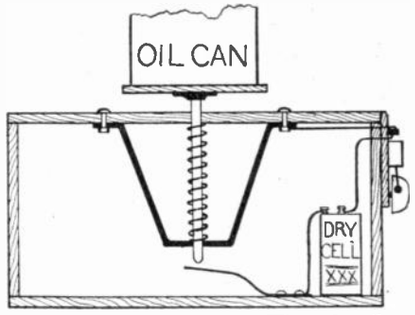
side of each plug as shown. The regular plugs are connected. The distributer wires are connected to the top of the plugs. The intensifier is secured to the dash by two small brackets. Each of the firing plugs on the engine has one of these plugs in circuit. They not only are supposed to improve the igniting sparks, but they give some clue as to how the engine is firing.

Contributed by HAROLD JACKSON.

Alarm for Filling Oil Cans

CYLINDER oil and other thick fluids often cause trouble in cold weather, as they pour slowly, and the cans overflow when allowed to fill without attention.

An alarm to overcome this difficulty is shown in the illustration. It is made of an ordinary wood packing box with a truncated V-shaped piece of flat iron, ⅛-inch thick, to guide a stem supporting a platform on its upper end. A ½-inch rod



Oil can weighing machine. When the oil can is full of oil it forces down a contact by weight, a bell rings, notifying the garage attendant that the can is full. Especially applicable to heavy oils.

surrounded by a spiral spring constitutes this stem and moves freely up and down. A flat spring at the lower end serves to make contacts when the proper weight has been reached to depress the platform. The device can be adjusted by filling the measure or can, and setting the spring to the proper tension, after which no attention will be required. The bell will ring when the can fills as it is set to measure.

Contributed by HOWARD S. BABCOCK.

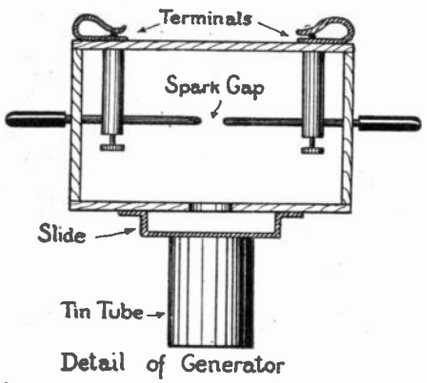
Experimental Electrics

Voyages Beyond the Visible

By M. R. McCabe

UNDER the influence of invisible rays many substances assume beautiful coloring in the phenomena of fluorescence. Dame Nature in one of her more beautiful moods, takes colorless rays and by some wonder of her great laboratory throws them back in every conceivable color. With a few pieces of homemade apparatus anyone can enjoy the experiments to be described and add not a little to their conception of the infinite wonders about us.

To avoid confusing the expressions, fluorescence and phosphorescence, it might be well to state that fluorescence is the light emanating from a substance while under the influence of the invisible ultra violet rays, while phosphorescence is the property certain substances have of storing light energy and again giving it off in the dark. Though entirely different properties, some substances possess both in varying proportions.



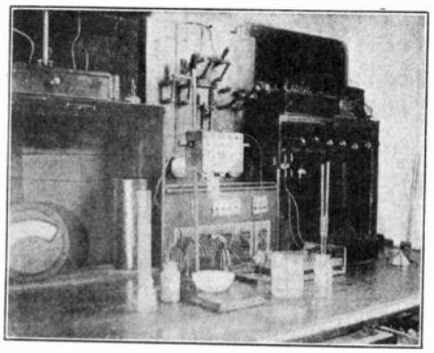
Arrangement and mounting of a spark gap with metal electrodes and spring terminals for producing ultra-violet rays.

The ultra-violet generator may be of the simplest type, a homemade spark gap mounted in a box, with a hole cut in one side to permit the rays to pass through. For those who care to construct a generator for the purpose the illustrative diagram shows a type readily made.

A small wooden box is fitted with two specially long binding posts to act as supports for a pair of iron electrodes. These rods are rounded at the sparking ends and the other ends extend through the side of the box and are fitted with insulating handles for adjusting. Terminals are arranged on the top of the box for the purpose of connection to a current circuit with its coil, inductance, and capacity.

A one inch hole is cut in the bottom of the box and below this hole is arranged a narrow slide for the insertion of glass or other plates as the experiments require. Attached to the slide is a short tin tube to confine the rays in a beam. The box is attached to a burrette clamp, the outer clips of which are removed, a screw passing through the back of the box and into the clamp. Thus the generator may be mounted on a ring stand.

To energize the gap we will require a spark coil giving a ½ inch spark or better, the upper limit on the construction shown being a ¼ K. W. transformer. Beyond this power the heat and noise are rather objectionable. A one or two inch spark

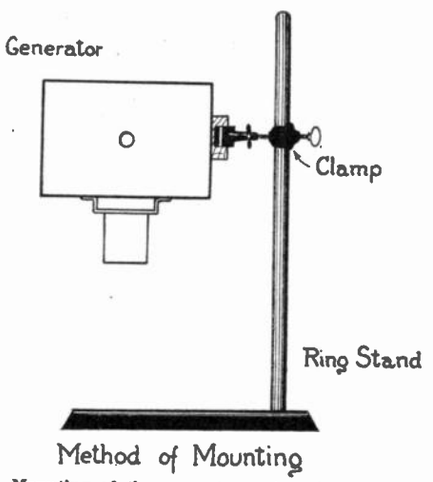


Apparatus set up and ready for work on the laboratory table.

coil is preferable. The usual radio condenser is used or any high tension condenser that will give a good spark in the gap. An inductance is also required, the usual sending helix, or if none is at hand eight or ten turns of heavy stranded wire around a cardboard tube will suffice. The instruments are wired according to the diagram, which many will recognize as the usual radio transmitting hookup.

After arranging the apparatus using as short connections as possible, close the switch to the current supply and adjust the gap to the greatest length that will give a steady flow of sparks. When adjusted, the base of the ring stand will be flooded with ultra-violet light mixed with the visible blue and violet rays. To continue the experiments a few beakers and saucers are all the other apparatus required beyond the chemical and other substances to be mentioned.

We are now ready for the trip to the land of invisible colors. Fill a beaker nearly full of water and set it on the base of the stand under the generator. Drop several pieces of horse chestnut bark on



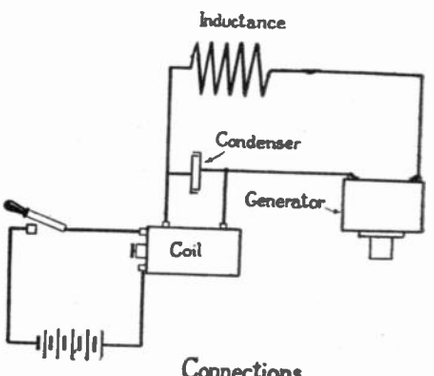
Mounting of the generator and projecting tube, which are shown in section in the first illustration.

the water. Let them stand a few minutes and no change in bark or water is noticed. Turn out all lights in the room and switch on the generator. Instantly we note a bluish gray fluid clinging to the bark like barnacles. The invisible asculin has been revealed in the rays of ultra-violet light. Boil some of the bark in water and filter and you will have a colorless fluid; let the rays fall upon the solution and it gives off a blue glow.

Soak a strip of filter paper in the solution and let sunlight pass through a prism and fall on the paper. The spectrum so obtained will be much longer than usual, because the treated paper reveals the ultra-violet rays beyond the visible violet.

A very beautiful experiment, readily performed, utilizes common red ink as its subject. It has often been noticed that when a large blot of red ink dries it is fringed with green. We can reveal these colors in a very startling manner.

Take a deep glass vessel with straight sides, a tall beaker or glass graduate will



General connections of the ultra-violet ray lamp for the interesting experiments described.

do nicely, and fill with water. Stand this on the generator platform under the tube and let the water become perfectly still. Switch on the generator and with a pipette gently deliver a drop of red ink on the surface of the water. The drop will contract on the surface but the center will sink, forming a tube, the denser coloring matter forming the outer rim. But instantly the tube breaks into a parachute of waving red and green, the outer rim of which breaks up into tubes to go through the same phases as the parent stem. The figure retains its shape for several minutes if the water is kept still and looks very beautiful with its waves of green and red. Viewed from above the edges of the figure are tinged with gold. On placing a drop of heavier liquid, say sulphuric acid, on the surface of the water, it will sink and set the entire figure into motion, giving the appearance of a seaweed moved by water currents. One can hardly realize the beauty of this simple experiment without trying it.

Pour a small quantity of crude resin oil on a watchglass and place on the generator base. This oil is nearly opaque but when the generator is started it glows with a delicate sky blue fluorescence, quite

out of keeping with its appearance under white light. The same phenomena is noticed in paraffin oil which glows blue around the edges.

Some nettle leaves are bruised in alcohol with a glass rod, allowing them to soak an hour. Filter the mixture and pour into a watchglass or beaker. The solution has a bright green color, but on placing it under the generator and switching on the current it is instantly transformed to a bright blood red. A novel method of demonstrating this is to cover the beaker with a piece of cardboard with a small hole punched in the center. The path of the rays streaming through this hole will be blood red.

The coal tar dyes are very remarkable in their effect on light. If a grain of fluorescin is gently placed on the surface of a beaker of water it will sink and leave behind a yellow train with a brilliant green fluorescence. This experiment succeeds with most artificial dyes that water dissolves slowly, markedly so with eosin and erythrin. A very beautiful effect is obtained by mixing together several grains of each substance and placing them simultaneously on the surface of a beaker of water. A truly startling bouquet of colors will result, interweaving and mingling to give myriad hues and shades.

Sulphate of quinine to which has been added a small quantity of dilute sulphuric acid will give a delicate blue tinge when placed under the influence of the generator. "Canary Glass" which is yellow by transmitted light gives a beautiful green glow under ultra-violet light by reason of uranium salts present, which are highly fluorescent. Crystals of uranium salts may be used as objects.

There are a number of minerals that exhibit the property of fluorescence. Willemite is possibly the most common; being a natural silicate of zinc it gives off a brilliant green glow when placed on the generator base, while silicate of soda or water glass emits a blue glow.

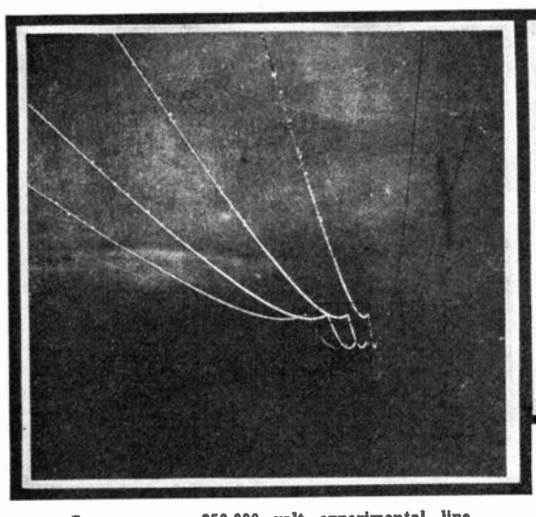
There are a host of variations possible with the above experiments. Thus, a note written with sulphate of quinine in solution is invisible but can be easily read under the generator.

High Voltage Transmission

By F. W. Peek, Jr.

Consulting Engineer, General Electric Co.

WHEN the electrical generator changes the energy of the coal pile or the water-fall into electrical energy, it is not in suitable form to be transmitted any great distance. The electrical pressure or voltage is too low and the current too high. The transformer at the power station is used to increase the voltage and lower the current. After the power passes over the transmission line and reaches its destination it again goes to a transformer and the voltage is reduced to a safe value to operate motors and lights.



Corona on a 250,000 volt experimental line. The corona was produced by using one thousand times the proper voltage.

1,200,000 volt lightning stroke on a shielded insulator string during a heavy rain. It will be noted how the display is magnified by the presence of rain drops, and in the larger photograph they appear quite stationary, as the exposure really lasted less than one-millionth of a second.

A great electric arc or flashover across an insulator string, due to excessive voltage; an unusually beautiful display.

The greater the power and the greater the transmission distance, the higher the voltage must be. The highest transmission voltage used at present is 220,000 volts in California, where over 100,000 horse power are sent from the water-falls in the mountains, about 300 miles away to cities, farms and factories on a single three-conductor line. At a million volts it would be possible to transmit 3,000,000 horse power 1,000 miles on a single power line.

There are many problems in power transmission which must be solved well in advance of actual needs. It is necessary to look many years ahead. For instance, over ten years ago an experimental 220,000-volt transmission line was built and various problems investigated. At that time transmission at such high voltage was hardly thought of. It was only last month that the first commercial 220,000-volt line was put in operation with transformers built in Pittsfield—monsters compared to their ancestors of a few years ago. In September, 1921, the first experimental 1,000,000-volt line was tested in the High Voltage Engineering Laboratory in the same city. It is still too early to say if such high voltage will ever be required in practice.

One of the great problems to solve in high voltage or high pressure transmission is to keep the power from leaking from the wires. If the wires on a high-voltage line are too small there is a hissing noise similar to steam escaping from a high-pressure steam pipe. There is also a crown or glow of light around the wires which is called corona. Corona is very wasteful and must be prevented. The power will also leave the wires by an arc jumping between lines if they are too close together, or around the porcelain insulator chains if they are not properly designed. The men in the High-Voltage Engineering Laboratory are engaged in solving the problems involved in coping with these and other difficulties of high potential practice.

In addition to keeping the power current from escaping from the conductors there is the very important problem of keeping destructive lightning currents from the conductors or at least discharging them harmlessly to ground when they reach the line. This problem is also being investigated in the Laboratory with the lightning generator. The first lightning generator built in 1913 gave 200,000 volts. This was increased to 750,000 volts in 1916 and has just now been successfully increased to 2,000,000 volts.

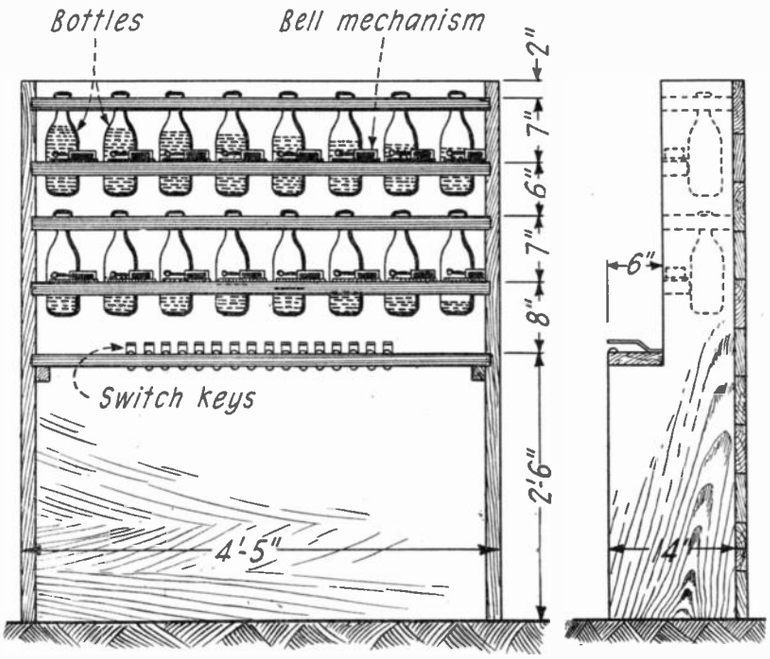
Power electricity flows steadily along the conductors, increasing or decreasing with the demand as lights or motors are turned on or off. With lightning, a few million horse power are released in a fraction of a millionth of a second. There is a flash and a crash and much destruction. Lightning is the "electrical dynamite." The lightning generator gives 2,000,000-volt flashes with all the characteristics of real lightning. The light of the large flash is blinding and is accompanied by a loud explosive report. All this takes place in a part of a millionth of a second and the power may reach the enormous value of a number of millions of horse power. Wooden posts of large size are readily shattered and blown apart. Lightning protection of villages and power plants is now being investigated. Although lightning waves travel along transmission lines at 187,000 miles a second, laboratory methods have been devised for actually measuring them as they speed along.

The good that the electrical industry and the electrical transmission of power is doing for mankind can best be realized by these figures. A single 220,000-volt transmission line in a year can transport for 300 miles energy equivalent to 1,000,000 tons of coal! A 1,000,000-volt line could transport for 1,000 miles twenty-five times this energy.

Electric Bottle Chimes

MUSICAL instruments can be divided into two classes, those producing sounds by percussion, and those which pass from note to note without the staccato effect. The latter class of instruments in some cases may be said to produce a continuous sound running up and down the scale, in accordance with the notes of the piece being played. The piano is the leading representative of the percussion instrument, and the organ of the other type. When we consider the mathematics of music, that notes vary in rigid mathematical ratios, it seems perfectly right to approve of the percussion instruments, and they have achieved a wide popularity, notably the piano.

Everyone is familiar with the xylophone, whose notes are produced by the striking with a hammer on blocks of wood resting on a couple of tightly stretched strings, the blocks being cut so as to give the notes of a musical scale. A variation on this was once made by a persistent individual, who accumulated stones to give him a sufficient range of notes for fairly good execution. It is a percussion instrument that we here describe, in which the objects struck are bottles, tuned by the introduction of exactly the right quantity of water, and struck by wooden headed hammers, each hammer actuated by the mechanism of an electric bell.



Front view of the bottle chimes and side view, showing clearly how they are mounted and the general arrangement of the bell mechanism and keyboard.

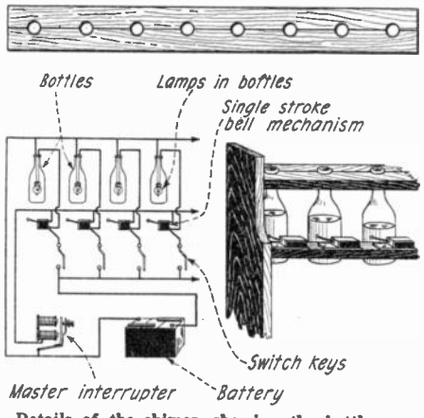
It is of some importance to get the best quality of bottles, that is to say, those whose qualities will give the most musical sound. Such are French clear glass bottles of liter or quart size. Each bottle is tuned by the introduction of water; the more that is put in, the higher is the note which will be produced. If too much water is put into a bottle, a little can be withdrawn by a syphon.

Upright pieces of wood four feet three inches apart, measured from inside to inside, are the main supports of the instrument. A strip of wood an inch thick and three inches wide, has a row of eight holes bored down its central axis, so that they are about six inches apart. The holes must be such as to accommodate the neck of the bottle immediately below the lip. The board is then cut in two with a rip saw down its axis. The two pieces are taken by a gain cut into the side pieces near their top. When the two are brought together they will grip the neck of eight bottles and are secured by wood screws.

This gives the bottles for one octave. One or two additional rows of bottles may be mounted below these, and three octaves will be found quite enough to give excellent results.

A wooden ball thrust upon a wire about a sixteenth of an inch thick will serve for the tuning hammer, and bottle after bottle may be struck and water added and withdrawn, until the right note is reached. A piano, a tuning fork or a pitch pipe may be used for the tuning, for once a single note is obtained, anyone with a good musical ear can tune up for the whole scale.

Towards the base of each row of bottles there is a wooden shelf secured in the same way as described for the rack holding the bottles. It must not touch the glass. On it there is secured for each bottle the striking mechanism of an electric bell, whose gong and appurtenances thereof have been removed by the hacksaw and file if necessary. The contact which causes the hammer to vibrate is also removed, for if left in place it does no work, as the bells are connected as for single stroke. The metal head of the hammer is removed and replaced by a wooden ball. The best way to secure the wooden ball is by a thread cut on the end of the stem. One bell mechanism is provided for each bottle. They are secured to the shelf in such a position that when a current passes through the magnet, and the armature is attracted, the wooden ball strikes the bottle well above the water level. Just as it is essential that the hammer of a piano should strike the string in a certain place to get the best results in the way of overtones, so undoubtedly there is a proper place for each bottle to be struck to obtain the pleasantest sound.



Details of the chimes, showing the bottles provided each with an electric light, the master interrupter for all the striking mechanisms, and how the bottles are supported.

The contacts for each bell are such as to constitute it a single stroke bell, and to obtain the purest sound when the armature is attracted and reaches the stop, which may very well be an adjustable one, the wooden ball should not be in contact with the bottle. The last minute fraction of the stroke of the hammer should be obtained by the elasticity of the stem.

Sometimes, however, a note is to be damped, and on the piano one of the pedals is devoted to this purpose. It would be a simple matter to give the shelf carrying the bell mechanisms a journaled support, so that by pressing the pedals the bell hammer can be brought a fraction of an inch nearer to the bottle, when it will give a deadened sound. The best way to mount the bell mechanisms is with the hammers in the vertical plane.

At a proper height from the ground a shelf is provided which carries a row of keys comparable to those of a piano. Each key when depressed makes an electric contact which actuates the bell hammer, the electromagnet appertaining to which is connected to that key. A storage battery will supply ample current for the musician.

In the circuit with all of the striking mechanisms there is a master vibrator or interrupter. When a key is depressed, the current to its particular striking appliance goes through this interrupter, so that a continuous striking is produced as long as the key is depressed. A quick touch gives staccato, while a longer touch will give a legato effect.

Such is the electric carillon. It will be observed that the touch is independent of the performer, but we do not think that it would be beyond the talent of some of our readers to substitute for metallic contacts, carbon contacts and perhaps even sliding carbon contacts, so as to produce what we might term a microphonic gradation, by which the current could be made weaker or stronger and consequently the blow upon the bottle would be changeable also by varying the touch. It is also suggested that each bottle have suspended within it a miniature lamp to be lighted when the note is given, the bottles being colored by various colored liquids.

The wooden balls are substituted for the iron ones generally used, to soften the sound. The sound can be softened still further by wrapping the ball in thin leather, such as a bit of a kid glove, or in a piece of cloth.

The diagram clearly explains the connections and the general dimensions are also given.

The bottles must be tightly corked. The best plan is to use a very thin cork and cover it with sealing wax.

If we used a long cork forced into the neck of the bottle, it is obvious that it would change the volume of the empty portion of the bottle and thereby undoubtedly affect the note; and, of course, once the cork is in, nothing much could be done to bring the bottle back to its proper note. It would also compress the air slightly, and while all these things would militate against the use of a long cork, it really suggests a method of fine tubing which could be applied in practice. The bottle could be made to give almost a right note by a shade below its proper pitch, and then by inserting the cork to a sufficient distance, the note could be brought up little by little until an exact rendition is obtained.

Echo Deep-Sea Sounding

THE original system of sounding at sea by lead affixed to the end of a marked line was of the crudest possible description, and to make it of any approximation to accuracy it was necessary to have the ship go at a low speed.

This was not a handicap in the case of sailing ships, whose normal speed was not too great to interfere with sounding. To compensate for the motion of the ship, if it was going fast, the lead was thrown as far in advance as a powerful man could project it. When the depth of water was great, the line would perhaps be led all along the side of the ship, the idea being that when the ship had gone ahead enough to bring it over the lead, the line would be practically vertical.

Considerable skill was required in this sounding to throw the lead just the correct distance to secure a vertical line as the ship came over the lead resting on the bottom. Two leads were carried, one heavy and one light, the heavy one called the "dipsy" lead, an abbreviation for deep-sea lead, and the lighter one for shallow waters. Sailors called them the blue pigeons. The work of sounding, which required the full power of a man and the handling of the wet line, was thoroughly hated by the sailors.

On steamers the greater speed hampered the usefulness of this primitive method of sounding; the speed had to be reduced for the operation and one of Sir William Thompson's achievements was his sounding apparatus. In this a glass tube sealed at the upper end with a weight attached is lowered to the bottom; a piano wire with reel represents the sounding line. What this did was to measure the pressure of the water. The pressure increasing with the depth, compressed the air in the tube and the water rose in the interior. The inner surface of the tube is coated with a material which changes color or which is washed away on contact with water, so that when the tube is raised and examined, the position of the mark made by the water shows what the pressure has been, and from this the depth is determined. This device could be used by a ship at full speed, as it makes no difference whether the line goes down vertically or not.

On the Mississippi a marked pole was used for sounding and one designation of the depth included the use of the words "mark twain." Samuel J. Clemens, who used to serve on the Mississippi steamers, adopted this as his *nom de plume*.

The Behm electric sounding apparatus operates entirely from the ship. The ship carries a microphone at each side, set below the water line. An explosive shell is dropped close to one of the microphones and detonates a few feet under the surface. The sound waves go through the water to the bottom and are echoed back to the ship. The body of the ship intervening between the two microphones has protected one of them completely from the effect of the detonation, but the echo from the bottom reaches the distant microphone, hitherto inert, and affects it.

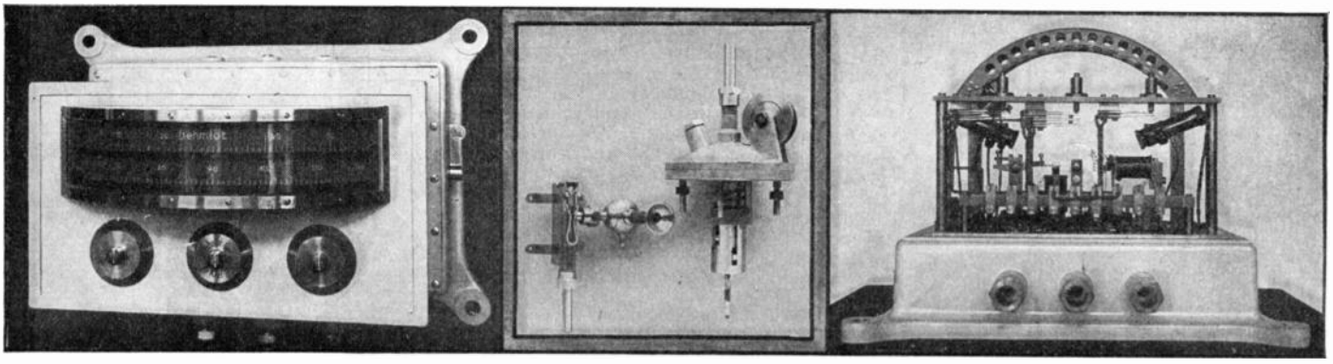
The transmission of sound in water takes place at a speed of about 700 fathoms to the second. The interval between the sound and echo has to be measured therefore with the extreme of accuracy to secure results.

The essential feature of this is a disc which is free to turn, and which if released will be turned part way around by a flat spring bearing against a protection on its circumference. To the disc there is attached an iron armature and the magnet below attracting it, holds the disc stationary and puts the flat spring under tension. The essence of the apparatus lies largely in this flat spring, and it is found to rotate the disc with such accuracy that it can be relied on for the most delicate and precise measurement. While this magnet is excited the disc is stationary.

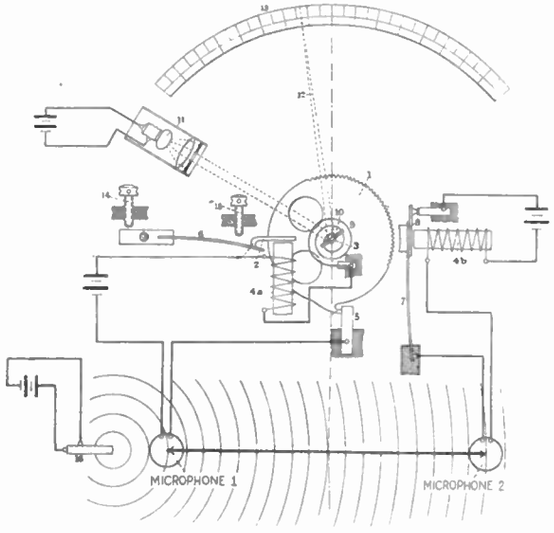
If the current passing through this magnet is cut off or sufficiently reduced so as to release the armature, the flat spring rotates the disc clockwise, always with what we may call absolutely the same speed. On the right of the disc, as shown in the diagram, there is a horizontal magnet with its armature carried on a spring, and this armature when held attracted to the magnet closes the circuit through the magnet, so that if released therefrom the circuit will be absolutely broken. If it is so released, the armature flies to the left, strikes the periphery of the wheel which is toothed, over what may be termed the working arc, and arrests its motion completely. The microphone, which is affected by the detonator, is connected with the circuit of the left hand or releasing magnet. The effect of the detonation on the microphone reduces the current through the magnet, so that it releases its armature, and the disc rotates. The sound goes to the bottom, is echoed back, acts upon the other microphone, and this in turn releases the armature of the detent magnet which flies against the rotating wheel and arrests its motion. Specially made microphones, whose construction Dr. Behm does not disclose, operate the two magnets.

The disc carries a mirror at its center and the rays from an electric lamp are reflected from this mirror upon a graduated scale. When a sounding is to be taken, the disc is turned to the left and held fixed by the left hand vertical magnet, and the mirror reflects its bar of light upon the zero point of the scale. When released, the bar of light travels over the scale until the second microphone operating on the horizontal magnet at the right arrests the motion of the disc, and the bar of light projected from the mirror is held stationary at a point giving the depth of the water.

As worked in practice, there are two projection lamps, one to the right and one to the left of the disc, and there are two mirrors carried by the disc. When the first mirror gets out of the range of the left hand projecting lamp, the second mirror comes into the range of the right hand lamp, so that the effect of the two lamps is to double the range.



The Behm sounding apparatus. On the left is the scale which is supposed to be before the pilot's or captain's eyes when soundings are being taken. A light streak on this graduated scale shows the depth. In the middle there is the apparatus for dropping the bomb into the water. This bomb explodes at a few feet below the surface and affects a microphone in its immediate vicinity. The echo from the bottom affects another microphone, and these operate the two magnets of the measuring apparatus shown on the right. See diagram below.



Simplified diagram of the apparatus. The central disc is held against the flat spring on the left by the vertical magnet. When the first explosion cuts out the current, the disc turns clockwise, actuated by the flat spring, and is arrested by the brake, when the horizontal magnet on the right releases its armature under the action of the echo on the second telephone. Only one of the lamps is shown, and on the lower left is the cartridge apparatus.

Odd Magnetic Experiments

By T. O'Conor Sloane, Ph. D.

IF the elements which compose the earth carry out the numerical theory of electrons, and if we have found the one of highest atomic weight, there must then be 92, and the whole world, as far as we know, is built up of this small number of elements.

The magnetic mountain of ancient fable, holding the armored knight, his spear and sword against its surface.

There is a sort of increase in number of elements by what are known as isotopes, which are the same elements varying slightly in atomic weight. They are found among the metals of higher atomic weights and non-metals, the larger proportion belonging to the first division.

It is fair to say that if one were asked to name the strangest of the metals, radium would be the one selected. It is exceedingly rare, and if it did exist in quantity in the elemental state, would not be a very pleasant neighbor.

If now the question of which is the strangest of the elements is restricted to electrical relations, one of the commonest of them all would be selected, one which is present everywhere in the world in one form or another, and which comes near to possessing absolutely unique qualities. This metal is iron.

It is one of three metals which is attracted by the magnet, which is equivalent to terming it a conductor of electromagnetic lines of force. Nickel and cobalt, the

Chinese figure supposed to be turned by the action of a magnet or loadstone within it, so as to point always to the south. It is to be assumed that the jolting of the cart assisted its movements.

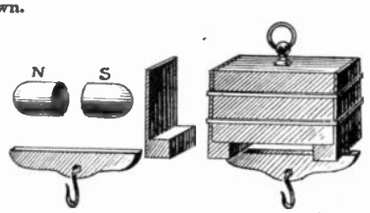
other two of the little group, are very greatly inferior to it, in this respect. By proper treatment, which includes alloying or combining it with carbon, and often with other metals so that it is a steel, and by magnetizing it, as it is called, iron becomes a permanent magnet.

If we go into nature and examine minerals, we will find one mineral which is attracted by the magnet and some samples of which possess magnetic force, or in other words, are polarized. The polarized mineral is the natural magnet. This mineral is an oxide of iron (Fe_3O_4), which is called magnetic oxide of iron, or if polarized is called the loadstone.

It is really one of the wonders of nature that iron stands alone in these respects, because, although nickel and cobalt approach it, iron has no real rival in magnetic quality.

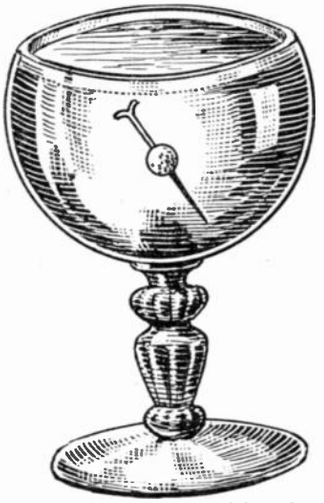
In the old books of travel and fairy lore we read of the magnetic mountain. In a rather famous book of the eighteenth century depicting the life and adventures of

Armored loadstones with top and bottom pole pieces of soft iron fastened on by the wires as shown.



A more modern armored loadstone. The armature is shown separately and is also shown as being removed by sliding off to one side. (NS) represents a magnet cut in two; the part marked (S) will develop a north pole to the left, and the part marked (N) will develop a south pole to the right.

Peter Wilkins, a novel much admired in its day, a sort of Robinson Crusoe story, the hero finds himself alone on a ship which is drawn through the ocean for a long distance without being propelled by the wind. Eventually the vessel strikes upon a rock at the foot of a cliff and stays there. Going below deck the hero finds a lot of iron bars, and picking up one of them it is jerked forward violently through the air to the bow of the vessel. Pursuing his investigations with various objects that he finds there, he discovers that only iron and steel articles are attracted to the bow of the vessel, in other words, toward the mountain, which turns out to be a magnetic mountain of loadstone. The magnetic mountain figures in other fiction, and we reproduce from an old book a picture of a warrior in his armor, held along with his spear against



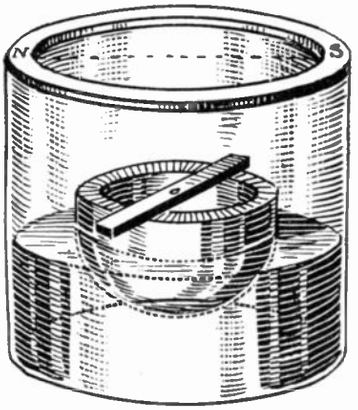
Magnet immersed in water and kept in almost indifferent flotation by a piece of cork.

a loadstone rock, powerless to detach himself.

The loadstone has been known for many centuries. The Chinese are said to have used it on chariots upward of 1,000 years ago; as they do everything the reverse of the Caucasian, they assumed a loadstone to be pointing toward the south. One of the illustrations shows a little figure of jade supposed to be sixteen inches in height, carried on a car and provided with a loadstone so as to point toward the equator.

One of the celebrated early books on the magnet is that written by William Gilbert in the Latin language which is dated, and this gives an astonishing amount of technical information on the magnet, natural and artificial.

Providing a loadstone with iron terminals arranged to fit it as closely as possible and placed one at the north pole and the other at the south pole, was called arming a loadstone. Gilbert found that by doing this he made it much more powerful and he gives an illustration of three

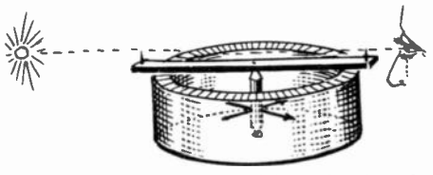


Ancient floating compass, in a sense the predecessor of the modern spirit compass.

such armed loadstones, one hanging from the other, and says that sometimes even a fourth will cling to the three. Another of our illustrations shows a more recent system of arming a loadstone, so that both poles will simultaneously attract an armature with the action of a horseshoe magnet. This is taken from an old book of

scientific recreations called "Hutton's Recreations in Mathematics."

But even in Gilbert's day it was found that artificial magnets could be made by stroking bars of steel with a loadstone. He and other experimenters of that epoch used flotation in water in work upon the



Compass equipped with a sighting bar in order to get bearings of objects.

directive power and dip of the magnet, and in the original Gilbert *De Magnete* there is a picture showing a magnet thrust through a cork so that it barely could float in a vessel of water. If a bar of steel is got into equilibrium by this arrangement, the cork being whittled, filed or sandpapered away until the bar barely floats, and if then the bar is magnetized, it

Old-fashioned way of magnetizing a piece of steel held against a poker, by stroking with tongs. Reproduced from an old book.

would show dip and direction very nicely when floated in water.

The next illustration shows a good example of early compasses. It is hard to set a precise date which will express the first use of the compass by mariners. The wonder is how they could use it with any satisfaction on account of the crudeness of its construction. The plain card compass of today is an immense improvement on the old-time floating compasses, and even though hung in sensitive gimbels, is very unsatisfactory. Curiously enough, to improve and make it dead-beat and to reduce the friction on its pivot, the modern American instrument makers have gone back through the centuries to the floating compass. The magnet in modern floating compasses is attached to a card provided with air chambers, so that it will nearly float in alcohol. The compass bowl is then filled with alcohol, which, buoying up the card, reduces the friction on its point and incidentally makes it dead-beat. Sir William Thompson's compass depends for its dead-beat factor on the reduction of the moment of the rotating parts, using no fluid for immersion.

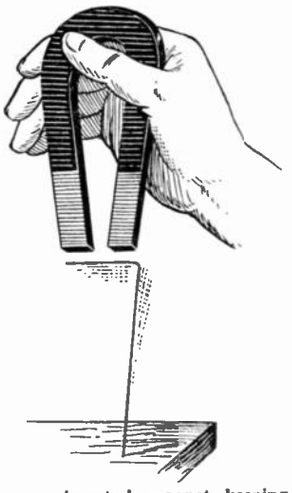
Now the mechanical compass based on the gyroscope is beginning to take the place of the magnetic one, and electricity is directing vessels by radio.

The older manuals give quite elaborate directions for magnetizing steel.

One of our illustrations, which is a reproduction from one of the "Every Boy's Books" so popular one or two generations ago, shows an odd way of making a magnet by stroking the piece of steel with a tongs while it is held against a poker by a thread. We should not like to guarantee the production of a magnet of any power by this method.

And now to come down to the present we give a couple of simple experiments with a horseshoe magnet. In the first one a piece of iron wire is bent as shown and is to be held upright by a magnet, which is kept above it with about a quarter of an inch intervening. The hand must be held very steadily. The magnet can be supported otherwise. Sometimes the wire will vibrate rapidly back and forth in a quite striking way. It may be six or eight inches long. This is a good test for steadiness of the hand. The arm should press against the table edge.

The other experiment is easier. A steel paper clip or other piece of iron is tied down by a thread attached to both ends.



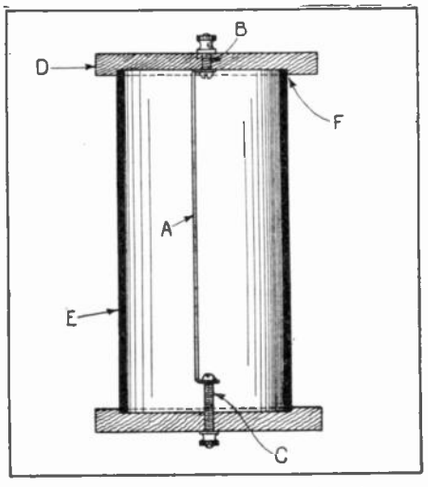
Modern experimenter's magnet, keeping a wire on end by magnetic attraction. It will be found to vibrate back and forth in quite an interesting way.

It is picked up from the table by the magnet, which is then pulled away from it. It will float like Mahomet's coffin between heaven and earth. It can be made to oscillate like an inverted pendulum.

A version of Mahomet's coffin, only instead of being completely free in the open air, is tied down to prevent it attaching itself to the magnet.

Attaching Coil Cylinder Ends

A WAY in which to fasten a tuning coil cylinder to the disc-ends without the use of glue is here described.



Method of attaching the flanged ends to a cylinder for winding a coil on.

A small piece of brass one sixteenth inch thick by five sixteenths inch wide is procured. This strip when bent must be shorter from bend to bend than the tuning coil cylinder. Bend half an inch of each end as shown and drill a hole through each end and through the center of each disc.

On the core-end on one side a binding post (B), which may be procured from a battery, is put into place. Then on the right-hand disc is placed a binding post much longer. The binding nut (C) is then turned until the tube and end pieces are drawn tightly together. (F) is a groove in the discs so that the tube will fit snugly, but this groove is not absolutely essential.

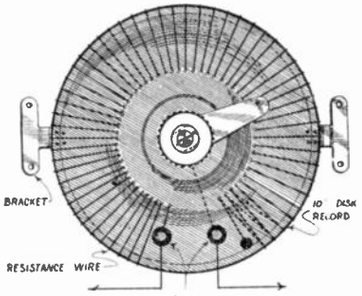
Contributed by ARTHUR GUSTAFSON.

Phonograph Record Rheostat

THE illustration shows how an electrical experimenter can make use of an old phonograph record. Phonograph records being a non-conductor of electricity, can be used in several ways in the construction of electrical apparatus. In this case an old record is used as the core on which to wind the coils of a rheostat.

A circle of one-sixteenth-inch holes are drilled through the record, as shown, about half way between the center and the circumference of the disc. The resistance wire is then wound on as illustrated. Two binding posts are provided at the bottom. One end of the winding is connected to one binding post while the other is dead-ended.

The other binding post is connected to the rotary contact arm, which is pivoted in the center of the record, this arm being operated in the usual manner by a knob.



Very nice construction of rheostat built upon a phonograph disc as a base.

Two brackets are rivetted to opposite sides of the record, with which to mount the rheostat. This rheostat is especially adapted to electro-plating work.

Contributed by HAROLD JACKSON.

Clock for the Blind

By C. C. Campos

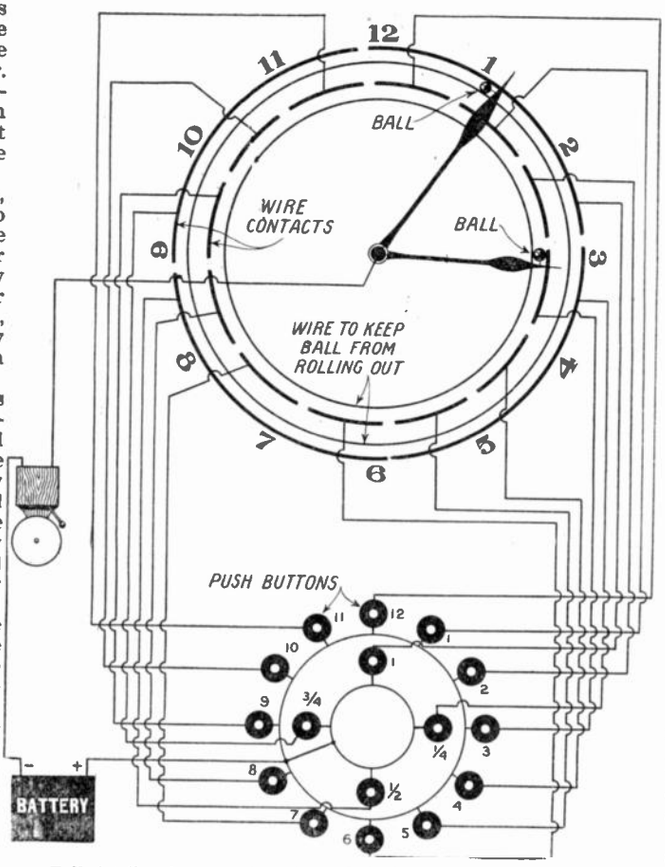
THE clock shown here is designed for the use of the blind and will tell the time within the quarter of an hour. It could easily be modified if desired to tell the time within smaller limits. It can also act as a bedroom clock to give the approximate hour in the dark.

There are two sets of keys, which are arranged in circles to cover the twelve hours. The blind person knows what hour each key refers to. If the key of the hour at which the hour hand is pointing is pressed down, a bell will ring. No other key of the hour set will produce a sound.

For the minute hand there is a bank of four keys. These indicate by the ringing of a bell which quarter of an hour the minute hand is pointing at. Only that button will cause the bell to ring which is connected to the quarter of an hour indicated by the minute hand. Thus one bell tells the story; first the hour keys are pressed until the bell rings, then the fifteen minute keys until the bell rings. The two keys which cause the bell to ring indicate the hour and quarter hour, respectively.

To the end of each hand there is attached a lead ball; the one attached to the hour hand is secured by a short piece of wire so as to make electrical contact with the hand. The ball attached to the minute hand is secured by a cord, so as to be insulated therefrom.

For what we may term the hour hand a runway is provided by two concentric circles of insulated wire. A third broken circuit is made by twelve segments of wire placed between the two guiding circles. This broken circle lies between the two guide wires for the hour pawl. Each of the twelve segments is connected individually to its key and this when pressed closes the bell circuit if the ball is resting on its proper segment corresponding to the hours.



Full details of a very ingenious clock designed for use by the blind. Circles of push buttons are arranged, one circle to represent single hours, the other for one-quarter-hour divisions. By pressing these tentatively one bell will ring for the hour, and another bell will ring for the quarters of the hour, so that the time is audibly given within fifteen minutes.

Another wire from the bell circuit runs to the hour hand shaft, so as to make electric connection therewith by a brush. If the key appertaining to the hour indicated by the hour hand is depressed, the circuit is closed through the bell and battery to the hour hand through the ball, and the ball, touching the segmental circle, completes the circuit through the segment appertaining to the hour in question by the inner wire circle. This in connection with the elaborated diagram which we give will make the construction clear.

The minute hand works in general on the same principle, except that its runway, consisting of two sets or broken circles of segments of wires, each segment covering a quarter of the circle, is insulated from the clock. The ball as it is drawn around short circuits the two quarter hour segments, so that when the key connected to these segments is depressed, again the same bell rings.

The person using the clock presses the hour keys or push-buttons until a bell rings, and then by the position of the key knows what the hour is. He then presses one by one the other four keys and the one which makes the bell ring tells the quarter hours. This clock is not only for the blind, it also is useful for telling the time in the dark, as in the midnight hours.

It will be seen that there is a difference in the hour hand and minute hand connections: the hour hand connection is completed through the metal work of the clock. The wire which is shown running to the shaft of the hour hand could be attached simply to the body of the clock, although the connection to the shaft by a brush pressing on it is preferable as being more direct. It will be remembered that the shaft of the hour hand is annular or tubular, and lies outside the minute hand shaft, so there is no interference with the brush connection resting on it. The minute hand connections, on the other hand, are, by insulated segments, bridged across by the ball as it travels around. It is an interesting study in electric connections.

Simple Magnetic Rectifier

BEFORE attempting the construction of a magnetic rectifier it is well to first inquire into its principle of operation. Let us consider the electro-magnet (M) in Fig. 1. If this magnet is connected to a source of alternating current, pole (P) will change its polarity with every reverse in the magnetizing current. Now suppose that a steel strip or reed be secured to the pole (P) then the polarity of this reed will alternate with the reversals in polarity of (P), in spite of the comparatively great magnetic reluctance of the steel strip. It is evident that the reed (R) will vibrate if placed in a continuous magnetic field, and that these vibrations will occur synchronously with the alternations of the current in coil (M). If the natural period of the reed approximates the frequency of the applied current, the amplitude of vibration will be much greater than if the vibrations are forced.

This vibrating reed constitutes the main feature of the rectifier. It only remains to provide a contact point on the reed and an adjustable set-screw provided with a silver or platinum point. Referring to Fig. 2, it will be seen that the reed makes and breaks contact between (C) and (C¹) once with each complete vibration; or in other words, each time (R) swings to one side it closes the circuit for an instant, opening it with each reverse swing. Since each complete vibration corresponds to a complete alternation of the current, it is plain that the circuit is closed only when the current flows in a certain direction. This can be best understood by examining the diagram in Fig. 3, where (R) represents the reed, and (A) the alternating current curve.

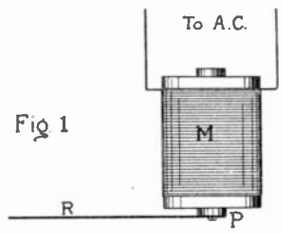


Fig 1

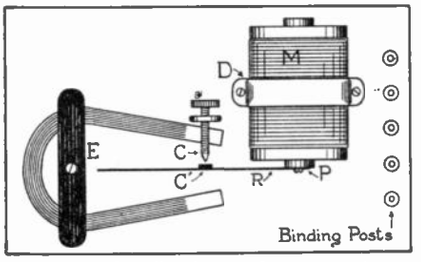
Arrangement of an electro-magnet with vibrating reed, the magnet receiving an alternating current, constituting the basis for an alternating current rectifier.

The best material for the base is hard rubber or bakelite. Ordinary wood can be used, however, providing it is thoroughly impregnated with a good grade of shellac. A strong permanent magnet must be secured for the field, and it should have converging poles, *not* parallel ones; in this way the whole field is concentrated to the immediate vicinity of the vibrating reed. The electromagnet may be of any convenient size; the writer has had fair success with an ordinary bell magnet, used with a toy transformer to supply the current. The magnet is held to the base by a brass strap (D). The permanent magnet is to be fastened with a wooden or hard rubber cleat (E), so that it can be adjusted to the most efficient position with respect to the reed (R). The details of the reed are given in Fig. 2, a; it may be cut from either sheet steel or a broad piece of clock spring.

The contact point is best made of silver or platino-iridium wire, rivetted through a hole made in the steel strip by punching, holding the strip over a hole slightly

Fig. 2

Detail of Vibrating Reed



Details of the vibrating reed, permanent magnet and electromagnet of the magnetic rectifier.

larger than the one to be made. The correct length for (R) can only be found after repeated trials, and depends a great deal on the thickness and width of the stock. To get the correct length, assemble the instrument and connect coil (M) to the source of supply; if the reed does not vibrate freely, adjust the permanent magnet; if it still refuses to respond, it is either too short or too long. If it cannot be made to oscillate freely by gradually shortening it, then it is too short and must be discarded. It is best to cut it as long as possible to avoid the necessity of making a new one.

Set-screw (S) can be made by soldering a piece of silver or the contact point of an old electric bell or to the point of an ordinary screw. These two contact points should be made as large as possible, as the current capacity depends considerably upon their size. Five binding posts are required. One of them should have two connecting screws. The connections are given in Fig. 4.

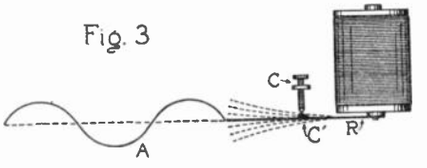


Fig. 3

Diagram illustrating the rectification of an alternating current by the transmission of one-half of its wave only.

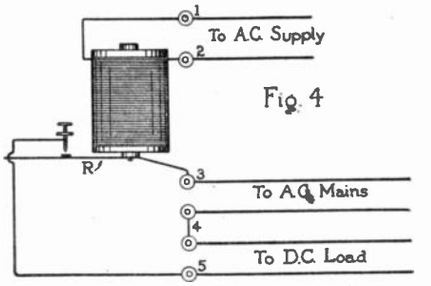


Fig. 4

General diagram of the hook-up of the magnetic rectifier, shown in as simple a form as possible.

In constructing this rectifier, it is well to remember that the larger the magnets used, the more positive will be the action. Also, do not expect too much from this little instrument; it rectifies but one side of the cycle, and does not have as much current capacity as a purchased instrument. But for experimental purposes it will be found to serve with credit the stead of a more expensive rectifier.

Contributed by C. W. HALLIGAN.

Electric Combustion Tube Furnace

By ALLAN R. KENWORTHY

A SMALL, tubular, electric furnace, designed primarily for heating the combustion tubes used in analytical laboratories, and capable of attaining high temperatures in a comparatively short time, is described in the following article.

The body of the furnace is constructed from a piece of brass tubing approximately one-eighth of an inch thick, 4 inches in diameter and 12 inches long. Three lugs are turned down on each end of the tube and drilled and tapped to take the small machine screws that hold the end-plates of the furnace in place.

These end-plates are cut from a piece of sheet brass three-sixteenths of an inch thick, and should be approximately one-half an inch greater in diameter than the body of the furnace. In the center of each is cut a hole slightly larger than an inch in diameter, and in each plate are drilled three small holes to correspond with the holes in the lugs on the body of the furnace. In one of the end-plates at a point halfway between the center and the edge of the plate is drilled a hole large enough to take a small porcelain insulating bushing.

The legs supporting the furnace can be made from brass or strap iron, one-eighth of an inch thick and three-quarters of an inch wide. If they are made as shown in the illustration, approximately 30 inches of material will be required for each one.

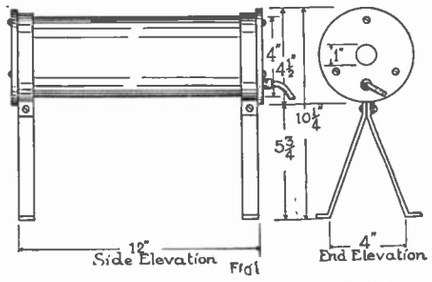


Fig. 1

Combustion tube furnace for use in the laboratory for chemical work, enameling and for use on the electrical constructor's bench.

The resistance wire used for the heating element of the furnace should preferably be of a good quality of nickel-chromium. A very good element can be made by using the resistance wire from one of the cheap electric toasters or stoves which have recently made their appearance on the market.

Ordinarily No. 20 to 24 B. & S. gauge wire is used and the amount of wire needed can be approximated by connecting about 12 feet of the wire across a 110-volt circuit and cutting down the length of the wire until it glows a bright cherry red. When the right amount of wire has been determined, it should be wound into a tight spiral one-eighth inch in diameter. This spiral should then be wound on an alundum tube an inch in diameter (inside dimensions), and 12 inches long, spacing the turns on the tube from one-half to three-fourths of an inch apart.

The tube and the resistance wire should then be covered to a depth of three-fourths of an inch with refractory cement that has been mixed with enough water to form a stiff, plastic mass. Alundum cement is recommended for this purpose, but a mixture of fire clay and sodium silicate can be used with satisfactory results.

A very good heating element can be made by winding the spiraled resistance wire on a slightly tapered wood core one inch in diameter, interposing a leaf or two of oiled paper between the wire and the core, so that the latter can be easily removed. The wire and core should then be covered with refractory cement as in the previously described construction, and when the cement has thoroughly dried the wood core can be removed.

Connections are to be made to the heating element with a good quality of asbestos insulated heater cord, the wiring inside the furnace being kept as far away from the heating element as possible. Connections should be brazed or welded, as soldered connections will prove unsatisfactory.

In assembling the furnace, one of the end-plates is fastened in place on one end of the tube which forms the body of the furnace, and the heating element is inserted in the furnace and held centered while the space between it and the wall of the furnace is packed full of insulating material. If desired, the heat insulating material can be mixed with a small amount of plaster of Paris or refractory cement and enough water to form a stiff, plastic mass, which should be rammed firmly into the furnace around the heating element.

The furnace should be allowed to stand several days until the interior has become thoroughly dry, after which the remaining end-plate and the legs can be fastened on. Before using the furnace at high temperatures it should be operated at a very low temperature for several hours in order to drive out all the moisture.

A rheostat should be connected in series with the furnace when general laboratory work is to be done, for by varying the resistance in series with it, the temperature can be maintained at any degree desired.

Using a nickel-chromium wire for the heating element, a temperature of 1,000° C. 1,800° F. can be maintained in the furnace for long periods. Slightly higher temperatures can be attained, but are detrimental to the life of the heating element.

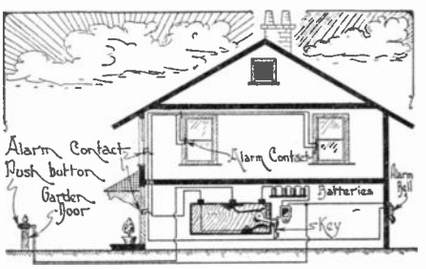
House Bell and Alarm Circuit

By J. M. BELLAIRE

Paris Correspondent, PRACTICAL ELECTRICS

AN old domestic telephone station is procured, and the three posts are connected as shown in the illustration; first, to the different alarm contacts; second, to the button of the hall door; third, to the battery and alarm bell.

Upon examining the diagram it will be seen that when the door key is hung on the hook, the ordinary circuit only may be used. When leaving the house, we take



Suggestion from France for wiring a house, using the same circuit for the door bell, or in the absence of the owner, for an alarm bell. A hook switch on which the key of the house can be hung, connects the door bell when the key is there, and connects the alarm bell when the key is removed, when the owner leaves the house.

off the key, and the hook, pulled against the other contact by the spring, puts the alarm circuit into service automatically.

In this circuit is included a powerful bell, which may be placed back of the house to warn neighbors in case of housebreaking.

Ultra-Sensitive Galvanometer

By Charles Mallinckrodt

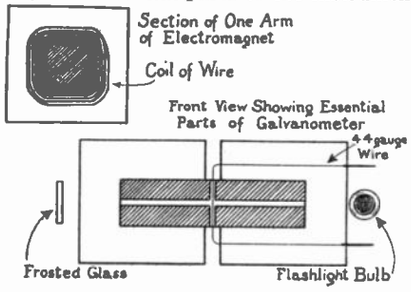
OF all the instruments which constitute the experimenter's laboratory the most generally useful is, perhaps, the galvanometer. It is desirable, consequently, to have an instrument which is as sensitive and as reliable as possible, but in view of the expense many experimenters attempt to build their own.

The author wishes to describe a rather unusual type, which should meet approval, for it is not particularly difficult to construct, yet possesses several advantages over the other inexpensive galvanometers.

The primary feature of this instrument is that adjustment is seldom required. It does not even have to be brought to a level position before being used. Besides this, it is remarkably deadbeat, due to the fact that the entire movable element is reduced to a single wire — a wire which is as fine as possible, for on its fineness depends the efficiency and sensitiveness of the device.

The principle on which this galvanometer acts is this. If a current is passed through a wire lying in a magnetic field at right angles to the lines of force, the wire tends to move through the field, the direction of motion being reversed if the current is reversed.

From this it will be seen that there are only two essential parts to the instrument,



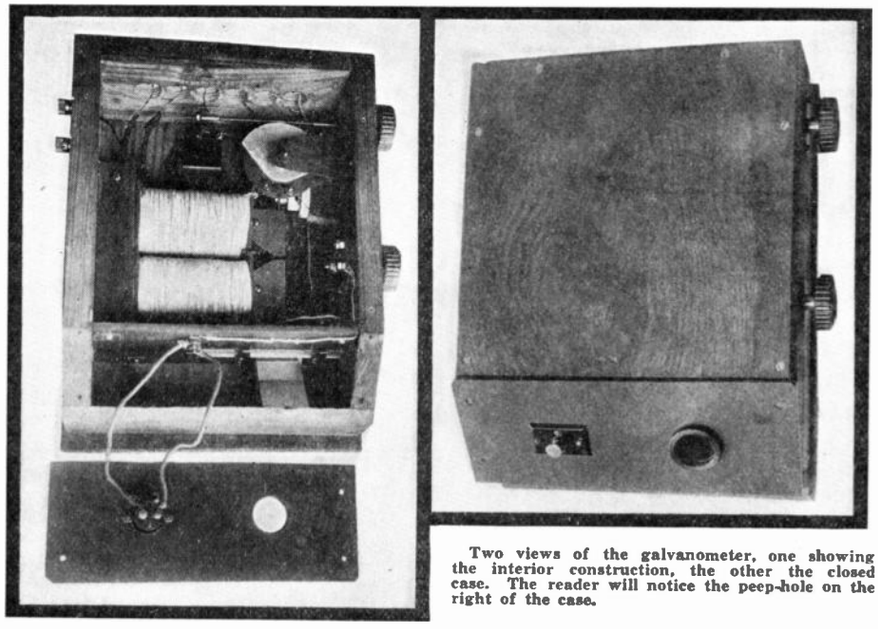
Details of the layout and construction of the galvanometer, showing the moving wire which is extremely thin and absolutely dead heat.

namely, a magnet and a movable wire. Also, it will be understood that, since only one wire lies in the magnetic field, a horseshoe magnet with its poles close together may be used, thus greatly increasing the intensity of the resultant field.

The kind of magnet used is immaterial. The object is simply to produce an intense magnetic field of sufficient width to allow a thin wire to move freely through it. Of course, permanent magnets are more convenient and less complicated than the electro-magnets with their connections, but the writer was unable to procure a permanent magnet of a shape suitable for the purpose.

The core of the electro-magnet shown in the photograph was cast and machined to the proper size. It was then wound with about four pounds of No. 20 B. and S. gauge D. C. C. wire. To allow the movable wire to swing unimpeded across the field generated between the poles of the magnet, the air gap should not be less than one-sixteenth of an inch across, and should be slightly arc-shaped.

A slot one-eighth inch wide and three-fourths inch deep is cut through the ends of the poles for the purpose of observing the deflections of the wire, or, strictly speaking, for producing a shadow of the wire.



Two views of the galvanometer, one showing the interior construction, the other the closed case. The reader will notice the peep-hole on the right of the case.

The shadow is obtained by placing a flashlight bulb at one end of the slot. The light from it passes through the opening and falls on a piece of frosted glass placed at the opposite end, on which the shadow of the wire is plainly visible. In order to prevent the shadow having a large penumbra, the bulb should have a small filament and should be placed in the position shown in the diagram.

The width of the shadow is greater than the diameter of the wire; and the amount of magnification is equal to the ratio of the distance between the frosted glass and the light, and the distance between the wire and the light. Therefore, if the light and frosted glass are equidistant from the wire the ratio will be two to one, or the width of the shadow will be twice the diameter of the wire.

A small mirror is placed at an angle in front of the frosted glass. In this way the person using the instrument may observe the motion of the shadow without sitting in an uncomfortable position. Glass mirrors cannot be used for they have two reflecting surfaces; but small metal mirrors are very satisfactory.

The scale can be readily marked on the frosted glass, and it is seen through a circular aperture into which has been fitted a camera portrait lens. The portrait lens was used because it had a neat appearance and could be easily removed for cleaning.

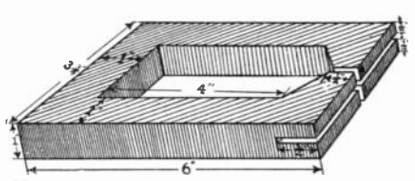
The position of the movable wire is adjusted by fastening it to two fibre discs which are attached to the same brass rod and which can be slowly rotated by means of a miniature worm gear. The worm gear consists of a cogged aluminum semi-circle and a threaded brass rod which passes through the side of the cabinet and is connected to a knob on the outside. There are, however, so many other equally meritorious methods of adjusting the wire that the writer will refrain from describing this particular one more fully, and leave the construction of this part to the ingenuity of the reader.

Inserting the movable wire was, probably, the most difficult task of all, for the wire, being No. 44 gauge, was very easily broken. First, a proper length of No. 44 gauge copper wire was taken and a bit of heavier wire soldered to each end, thus facilitating fastening it to the adjustment device and improving the electrical circuit. The wire was then bent into the shape shown in the diagram and placed in position carefully, so that, in moving, it would not rub against the poles of the magnet.

The photograph shows two knobs on the cabinet. It has already been stated that one of them is connected to the apparatus with which the position of the wire is adjusted. The other is used in conjunction with a useful, though not absolutely necessary part. This is a rheostat which regulates the amount of current flowing through the flashlight bulb.

However, it may be well to make a few remarks concerning the operation of the instrument and the general results obtained with it.

The flashlight bulb can, of course, be operated on a battery, but the most inexpensive as well as reliable way is to use the ordinary lighting current stepped down to the proper voltage by a toy trans-



Magnet core, which may be made of cast iron and machined out with the requisite slots, for sighting and for the moving wire.

former. If this is used, the wires leading to the bulb should be kept well away from those leading to the movable element, for otherwise the induction currents would set it in vibration.

The electro-magnet was designed to operate on a 6-volt storage battery, but, for most purposes, the iron core retains sufficient magnetism to eliminate the use of the battery. On actual test, using no battery, the current generated by heating, for a short time in a match flame, a thermocouple consisting of two wires, one iron and one copper, was sufficient to deflect the wire over the entire scale. Also, the small amount of electricity set up by moving a wire past the pole of a weak horseshoe magnet was readily detected.

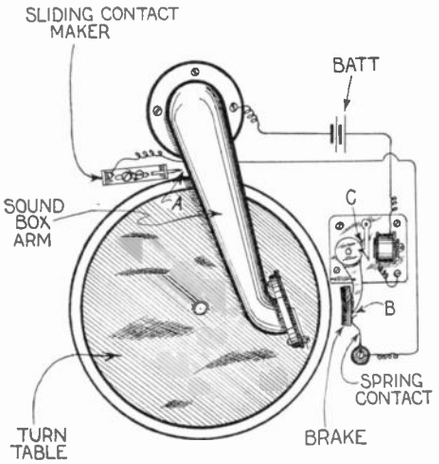
These tests were made using a No. 44 wire in the galvanometer, but No. 40 has been used, and even then the results were quite gratifying.

Awards in the $50 Special Prize Contest
For Junior Electricians and Electrical Experimenters

First Prize, $25	Second Prize, $15	Third Prize, $10	1st Hon. Mention	2d Hon. Mention
Harold Jackson, R. 4, Box 141, Kankakee, Ill.	John Kurdziel, 3800 Archer St., Philadelphia, Pa.	Amedeo Giolitto, 836 Illinois Ave., Rockford, Ill.	Wayne Swingle, 1804 W. 4th St., Hastings, Neb.	Woodson B. Matthews, Lampasas, Texas

First Prize
Electric Phonograph Stop
By Harold Jackson

THE illustration shows how to make an electric stop that will work on any



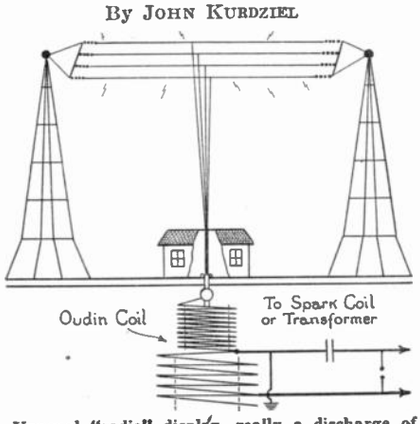
Interesting example of a phonograph stop, adjustable so that it can be used on records of any length.

phonograph. Two contacts are used as shown at (A) and (B). Contact (B) when the brake is lifted away from the turntable is automatically closed, taking the position shown. The brake is held in this position by a pawl (C).

Contact (A) is arranged to slide in and out, so that it may be adjusted for records of different lengths. This is done for each record, by placing the needle in the last groove of the record in question; the sliding contact is then moved toward the sound box arm until the point touches it.

The sound box is then swung over to the outer edge of the record, and the brake is lifted as described above. This closes the contact at (B), leaving but one break or opening in the circuit which is at (A). The circuit is closed at this point also, when the needle has reached the last groove of the record and the brake is put on.

Second Prize
Radio Window Display
By John Kurdziel



Unusual "radio" display, really a discharge of high frequency electricity, designed to attract the public to look into a show window.

THE illustration represents a miniature radio broadcast station mounted on either table or show-window platform.

The antenna masts are made from bus wires to advertise them incidentally, or may be constructed with toy girders from children's Meccano constructing sets. The insulators may be of ordinary radio type to advertise it, or may be of several beads strung to a length of one to two inches, to prevent an arcing over to the masts.

$50 IN PRIZES

A special prize contest for Junior Electricians and Electrical Experimenters will be held each month. There will be three monthly prizes as follows:

First Prize	$25.00 in gold
Second Prize	$15.00 in gold
Third Prize	$10.00 in gold
Total	**$50.00 in gold**

This department desires particularly to publish new and original ideas on how to make things electrical, new electrical wrinkles and ideas that are of benefit to the user of electricity, be he a householder, business man, or in a factory.

There are dozens of valuable little stunts and ideas that we young men run across every month, and we mean to publish these for the benefit of all electrical experimenters.

If in any way possible, a clear photograph should be sent with the idea; but if that is not possible, a good sketch will do.

This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize.

Address all manuscripts, photos, models, etc., to *Editor, Electrical Wrinkle Contest*, in care of this publication.

Antennas proper may be also of bus wire or of other suitable wire; the lead-in is taken off in the center in the regular broadcast station fashion, making a "T" style antenna.

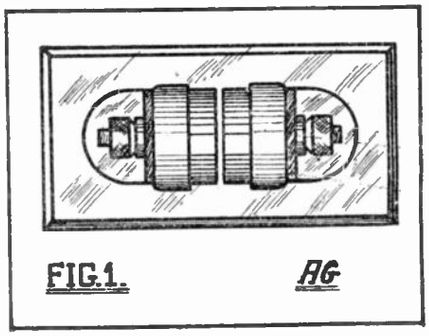
The lead-in then enters the broad-cast station which is a miniature house of either wood or cardboard. The wire is carried down through insulators at the point of entry in the roof and in the table top, within the house. Below the table it is connected to the discharge ball of a fair sized Oudin Coil. The idea is to imitate a broadcast station in actual transmission of "radio waves" which in this case are represented by a myriad of forked streaks of fire.

The apparatus is tuned of course for the desired effect by varying the turns on the primary of the high frequency coil. Opening up the spark gap as a rule lengthens the high frequency spark. The coil is working at its best when the spark has assumed a clear ringing tone.

Third Prize
Lightning Arresters
By Amedeo Giolitto

TWO types of lightning arresters which can be constructed from battery carbons are here illustrated.

Fig. 1 shows the type of lightning ar-



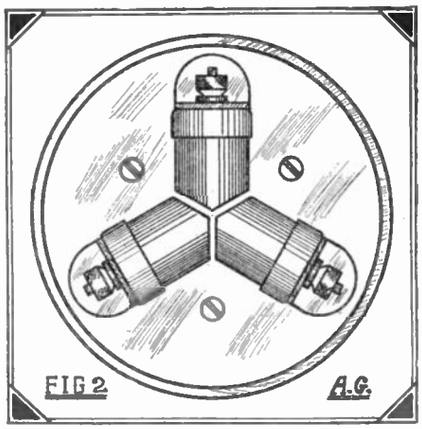
Lightning arrester for a single lead, the gap being formed by two carbon surfaces facing each other. These are the ends of flashlight battery carbons sawed off in a miter-box.

rester which is to be used in connection with a single line wire. One of the carbons is connected to the line wire, while the other is connected to the ground. Now should a high voltage be induced in the line by a lightning discharge, a spark will pass across the air gap formed by the two battery carbons, and thus the charge on the line will escape to the ground.

This simple lightning arrester may be used for protecting a radio outfit. In this case one of the carbons would be connected to the aerial while the other is grounded.

When apparatus connected to a complete metallic circuit or two-wire line is to be protected, the type of lightning arrester as illustrated at Fig. 2 should be employed. It is made up from three battery carbons, which have been sawed off and ground down to the angle as shown.

When connecting up this lightning arrester, any two of the carbons can be connected to the two line wires, while the third is connected to the ground.

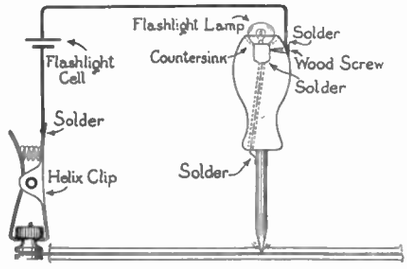


Same kind of lightning arrester, but designed for a double lead. Here the carbons have to be sawed on a bevel, so that the three will come very close and yet not touch.

1st Honorable Mention

Circuit Tester

By Wayne Swingle



The familiar ice-pick converted into an instrument for testing circuits by puncturing the insulation and coming in contact with the conductor. A lamp in the handle tells of the condition of the circuit.

THE circuit tester shown here is made from an ice pick or awl ground to a sharp point. A hole is drilled in the back of the handle to carry a flashlight lamp, being held in place by a jam screw. The wiring connection can be seen in the illustration. A flashlight dry cell which can be carried in the pocket for work on long or outside circuits supplies the "juice."

This is especially adapted for finding breaks in insulated wire by fastening the helix clip to a binding post or other exposed portion of the circuit and piercing the insulation at various points with the tool until the break is found by the lamp ceasing to light.

It is also very handy in testing wireless circuits, transformers, condensers, etc. With the latter the clip may be fastened to one set of the plates and the point applied to plates on the other set.

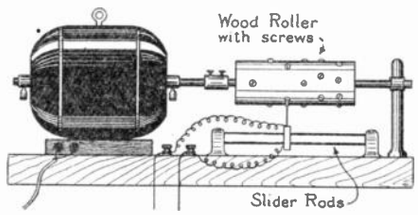
2d Honorable Mention

Flasher

By Woodson B. Matthews

AN interrupter that can be easily adjusted for a wide range of frequencies for induction coils and other apparatus is often needed in the laboratory. One can easily be made from a small motor and a few parts readily procured.

The motor is mounted on a base and the shaft is extended about two and one-half inches by means of a collar with two set screws. The next step is to make a wooden roller 2 inches long by 1¼ inch in diameter. Then with a pencil six rings are drawn around this by holding the pencil point against it as it turns, and six short wood screws are screwed in on the first ring, spaced equally. On the second ring five screws are placed in the same manner and one less screw is put in each following ring and so on until the last circle, which has only one screw, is reached. Next the heads of the screws are filed down so that they protrude only slightly from the surface of the roller.



Flasher operated by an electric motor, the contacts all being on the horizontal rods seen below, no electricity going through the screws on the cylinder.

Then on a small wood or fibre block, a breaker arm and cam, and the spring and its contact are fixed. Lastly the block is drilled to take two slider rods, which are mounted in the right position on the base

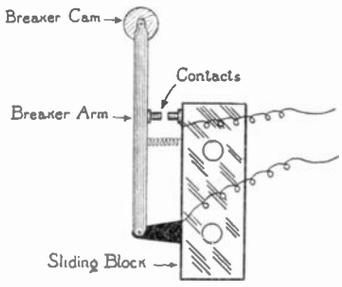


Diagram of the contact, which is closed by the screw-heads on the rotating cylinder and when released opens itself.

parallel to the motor shaft. The object of this is to provide for the breaker to bear on any part of the roller.

When in operation the slightly projecting heads of the screws press upon the breaker arm, and break the contact. By means of a rheostat and a speed indicator the frequency can be finely adjusted. For instance, if the motor is made to run at 1200 R. P. M. and the breaker cam is bearing on the first circle with its one screw, the circuit will be broken 20 times per second. The R. P. M. of the motor divided by 60 and multiplied by the number of screws in the section on which the cam is bearing gives the frequency of the interruptions per second. If desired a condenser may be so mounted on the base and connected up that it can be switched across the contacts when wanted.

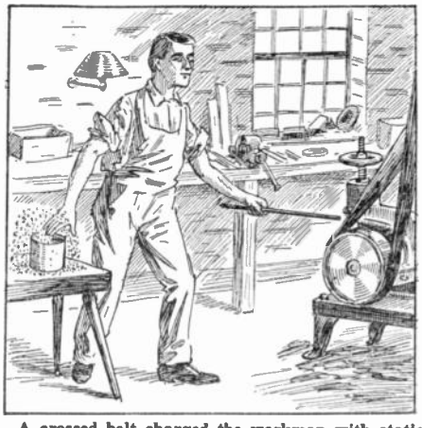
Awards in Odd Electrical Experience Contest

First Prize, $20	Second Prize, $10	Third Prize, $5	Fourth Prize, $2.50
Ray Lulling, 943 Juno St., St. Paul, Minn.	Vicente Agcavili, 2721 Indiana Ave., Chicago, Ill.	Ernest Dumke, New York, N. Y.	W. Stansfield, 137 W. 4th St., Quebec, Canada

First Prize

Static Discharge From Driving Belt

By Ray Lulling



A crossed belt charged the workman with static electricity to such an extent that his right hand touching a can of sawdust made it fly out in the air.

ONE day while at work in a small factory, I noticed that I could get static electricity from the belt that ran my machine. The belt was about twenty feet long and four inches wide, and ran horizontally. Some days I could get a bright blue spark three inches long.

One time there was a tin bread pan on a chair near me with a little sawdust in it, so I held a steel rod about an inch from the belt with one hand, and with the other hand touched the tin bread pan just to see how large a spark I really could get. The result was that no spark occurred when I touched the pan but to my surprise I saw the sawdust rise to about ten inches and fall outside the pan.

The experiment is very interesting to perform and looks like a misty fountain.

Second Prize

Clothes Line Shock

By Vicente Agcavili

I WANT to give you a description of an experience which I never will forget.

Before I ever knew anything about electricity, this funny, yet that time, a wonderful experience, happened to me.

My mother used a wire for a clothes line and as it was raining so much that week, she decided to use it inside the house.

One morning I took the bath towel I had used, and hung it on the line to dry. No sooner had the towel touched the line when gee!—what happened? What did I feel? I could not explain. My arms were thrown back and the towel thrown to the farthest end of the room. I could not see what was wrong so I went to pick up the towel and again put it on the line to dry. The second experience was enough. I called dad who after a little investigation showed and explained to me what it was all about.

A boy got a shock from hanging a wet towel on a clothes line of galvanized wire, which was in contact with an electric circuit.

At one end of the line, an electric wire extension was on the line and unfortunately a contact was made, where there was a broken insulator. He told me that the wet towel caused the shock.

Third Prize

Ball Lightning

By Ernest Dumke

ONE summer night when all of us were sound asleep in bed lightning and thunder began. I was sound asleep when the display commenced, but woke up in time to watch the lightning play.

I noticed that it kept striking an electric light pole about a block away. Suddenly there was a blinding flash in my room and a blue ball of lightning came sailing out of the electric light socket, but the bulb in the socket was not damaged. Then it started for mother's room where it knocked her unconscious for several minutes, although it did not touch her. It continued on its way into the front room, where it passed through the screen of the door and turned it a dazzling white. Then it disappeared in the rain; the size was about as large as a man's fist.

I also witnessed an incident at a bottling works where I was employed. Lightning and thunder began, when all at once a blue ball of lightning shot out of the socket and fell toward the floor. A bottler who was hard at work at a bottling machine did not realize that

Example of a very unusual phenomenon which may be an ocular deception due to the persistence of vision. A wonderful exhibition of ball lightning.

his life was in danger, so one of us, who was close by pulled him out of the way as the firey ball about the size of a dollar missed him by a few feet and hit the floor with a hissing like a red hot iron being dipped into water. After the incident I examined the floor where it struck for some mark, but did not find any sign of burning.

In both cases the rooms had been dark, because the lights were off, but the rooms were lit up brightly by the brilliant balls.

The fact that no harm was done by the balls goes to vindicate the theory of persistence of vision as the explanation of the rare phenomenon.

Second exhibition of ball lightning in a factory, witnessed by the same observer. In neither case did the apparent ball of lightning do harm to individuals or structure.

$37.50 IN PRIZES

We take pleasure in offering a series of prizes for letters giving odd and unusual electrical experiences.

First Prize	$20.00
Second Prize	$10.00
Third Prize	$5.00
Fourth Prize	$2.50

Nearly every one of us has had an odd or unusual experience in electricity, sometimes humorous, sometimes pathetic, sometimes puzzling, and it would appear that our readers should let us have some of their personal experiences for the benefit of all.

The more unusual the experience, the more chance you have to win a prize.

Illustrations are not necessary, but the letter should be either typewritten or written in ink. No penciled matter can be considered. Write only on one side of the paper.

If two contestants should send in the same winning experience, both will receive the same prize. In the event of two or more persons sending in the same as best, second best, etc., each tying contestant will receive the prize tied for.

Prize winning letters will be judged as follows: The first prize will be awarded for the letter giving the oddest or most unusual experience. The second prize to the one considered next best, and so on.

Communications to this department should be addressed *Editor, Odd Electrical Experiences*, care Practical Electrics, 53 Park Place, New York City, N. Y.

Fourth Prize

Static in the Factory

By W. Stansfield

A FEW years ago I was working in a Lancashire (Eng.) cotton mill and there saw a rather unusual freak case.

A large driving belt was crossed to give a reverse motion and crossed in such a way as to cause the working faces, or drum sides of the belt, to rub together at high speed. The spinner, trying (by eliminating slippage) to increase the speed of his machine, applied a quantity of paste—containing a large proportion of resin—to the drum surface. This, in turn, was transferred to the belt, which, at the point of crossing, began to generate static electricity in such quantities that it discharged across several inches to an adjacent iron sprinkler pipe which was earthed.

The effect produced was a thick blue stream of sparks, which as it increased in persistence and intensity attracted considerable curiosity. No one seemed to be able to solve the mystery! Not even the overlooker, who had come on the scene. The spinner however observing that when the belt stopped the stream of sparks stopped also, decided to leave the belt running

Static electricity in a factory, produced by the travelling belts, making a workman's hair stand on end, to the surprise of his companions.

while he climbed up to investigate the mysterious blue stream; but as his head came near enough his hair rose and stood on end, which so scared him that he jumped down, much to the amusement of the onlookers.

One scientifically disposed young man finally came up, who said it was electricity and demonstrated to the incredulous listeners by rubbing a piece of resin on flannel until it would attract bits of paper. And so the phenomenon was explained. I am often amused when I recall the puzzled look on the faces of the spinners and their incredulity at the simple explanation.

Neon Glim Lamps

THE recently developed neon glow-discharge lamp has certain remarkable characteristics. This lamp was placed upon the market in the first place as a unit of low candlepower, suitable for pressures from 200 to 250 volts, either alternating or direct. It has, however, other fields of usefulness owing to the form of its volt-ampere characteristic and the remarkable suddenness with which the glow discharge starts immediately a certain critical voltage is exceeded. Experiments were undertaken with a view to obtaining definite information on these and other points.

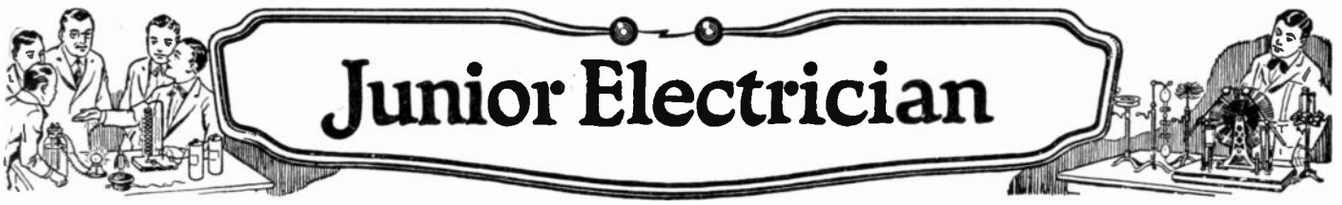
It is understood that the lamp is already in use as a "safe" light for developing photographic plates. It is found that it is necessary to use a red filter in order to cut off the violet end of the spectrum.

If the lamp can be obtained with a red glass bulb instead of clear glass, it would probably be exceptionally "safe" for photographic purposes. Incidentally, it avoids the trouble due to serious heating which is usually associated with electric lamps of the filament type.

It will be found that if the lamp is suspended, without any electrical connections, in the vicinity of a so-called non-radiating oscillation generator, so that the lamp is immersed in a rapidly alternating electrostatic field, then the lamap will glow with full brilliancy.

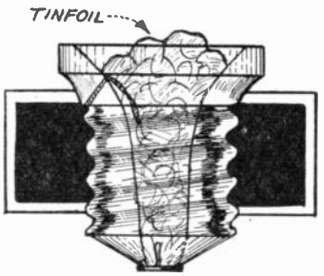
Such a lamp could be suspended near any radio frequency generator as a warning signal to indicate when the plant is generating electrical oscillations. The power absorbed under these conditions is almost infinitesimal.

It developed in the experiments alluded to that the lamp may be used for precision purposes for the measurement of voltages by the use of a relatively crude ammeter. This is due to the fact that a 1 per cent change in current is brought about by a fifth of 1 per cent change in voltage.—*London Electrician.*



Temporary Fuse Repair

OFTEN a fuse burns out just when another is not at hand or when a light is needed to find a new one. The method shown herewith has been used with success by the writer on numerous occasions and has given good results; even an overload on the line will cause it to blow just the same as an ordinary fuse.



Burnt-out fuse repaired by packing it with tinfoil; a temporary repair, which may last a long time.

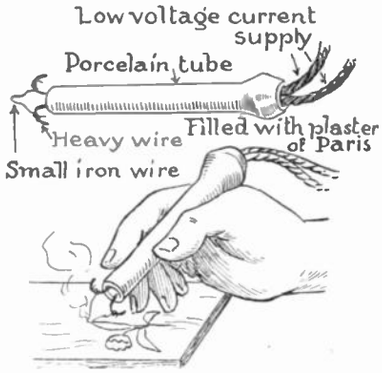
All that is necessary is to cut the mica end out of the burned-out fuse, and fill the opening with a piece of tinfoil, so that it makes contact with the two end pieces of the burned service wire.

Contributed by EVERMONT FISEL.

Electric Pyrography

AN instrument for burning designs and cartoons into wood can be constructed in the following manner: Two No. 16 or 18 copper wires are imbedded with plaster of Paris in a porcelain tube about as long as a pencil. To one end of these a lamp cord is connected; the heating wire of very thin iron or other difficultly fusible metal is connected to the other ends. This heating element may be made of No. 26 iron wire, which will only require a 2-volt potential. The wire is twisted around the ends of the larger wires, leaving about ¾ inch to be heated, and is bent to a convenient shape. It should be kept just below red heat.

Figures drawn on wood or transferred with carbon paper are easily burned in with this arrangement. For straight lines and shading the burning wire is most



Pyrographic pencil for making designs on wood, using an incandescent iron wire as the source of heat.

convenient either bent in a semicircle or left straight, and for short or curved lines the wire should be given a peak or point. Only a light pressure is needed. If the wire burns out it can be easily replaced.

Contributed by C. S. BARRETT.

Instrument for Testing Magnets

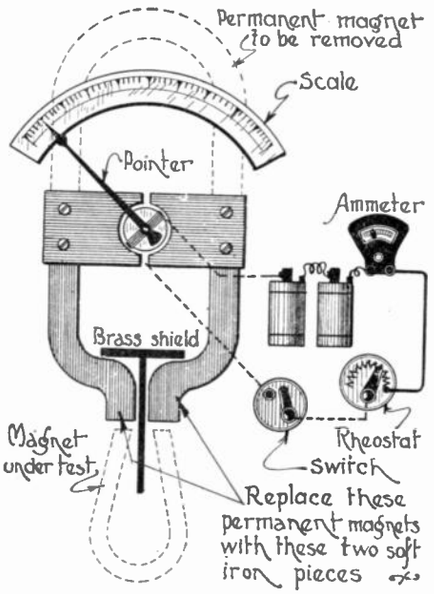
THIS instrument is used where permanent magnets are to be tested for their magnetic qualities.

An old permanent magnet type of direct current voltmeter is the basis of the apparatus. The magnet is removed as indicated and in its stead two pieces of soft iron of the shape shown are substituted. They are in two sections, so that they will permit a sheet or strip of brass to be inserted between the two pole pieces at the end. The brass strip projects out from between the ends of the iron pieces to act as a guide for the magnet under test.

A connection should be provided with the original armature coil, so that two dry batteries can be connected with a small ammeter and resistance to energize the armature only. The scale can be graduated to suit the work being done.

The operation is very simple. As the ends of the pole pieces are separated by the brass, the magnet under test, when placed against the end of the poles on the instrument, will form a magnetic circuit, and by switching on the batteries the pointer will indicate on the scale the condition of the magnet.

For example, if we have a new magnet, extra strong, which is placed on the instrument, and we wait for the pointer to come to rest, we could call this 100 and mark the scale with that numeral. The reading of the ammeter is noted, so that the same current of electricity is passed through the armature under all tests (this can be adjusted by the rheostat). By placing an old magnet on the instrument its strength can readily be known by comparison with the readings of the good magnet.



Very interesting apparatus for testing magnets, where a large number have to be tried out.

When placed in a small box the apparatus can be made into a neat appearing instrument and will always be ready for use.

Contributed by H. L. SMELTZER.

Radio Vision

AT last the instrument that will make sight at a distance possible has been invented. If you are an old reader of our publications, you will remember our articles on the Telephot and various television schemes. But now an instrument has been invented and is fully described in the December issue of *Radio News*, by Mr. H. Gernsback, editor, who saw it in operation at Washington recently. Mr. Gernsback has actually seen a picture of his hand transmitted by radio.

Dr. Lee De Forest, inventor of the audion, comes forward with his latest invention, The Radio Chauffeur Call.

Last, but not least, John V. L. Hogan, famous radio expert, tells us all about the new super-sensitive vacuum tube Sodion, an exclusive article for *Radio News*.

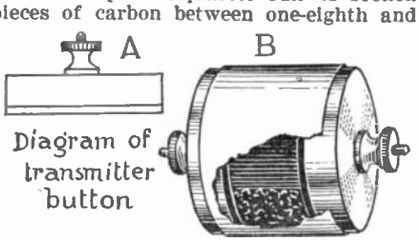
List of other principal articles to appear in *Radio News* for December:

The Clariphone, a New Static Eliminator.
By S. R. Winters.
The Radio-Controlled Aeroplane.
By Maurice Percheron.
Construction of Super-Heterodyne Receivers.
By F. de Willy and R. E. Lacault.
Simplifying the Radio Receiving Set.
By James Ashton Greig.

Making a Transmitter Button

TAKE the carbons out of two old dry cells and saw off the brass caps and binding posts, so that one-sixteenth of an inch of carbon shall project as in Fig. A. This may be done with a hacksaw. Then smooth off the rough carbon surface with a file.

Cut a strip of paper one inch wide and twelve inches long. Roll this paper around the brass caps so that the original upper ends come even with the edge of the paper. Then fill the space between the two caps one-quarter full of broken pieces of carbon between one-eighth and



Carbon grain microphone made up with two capped carbon ends from dry batteries as the terminals, and carbon grains as the active element.

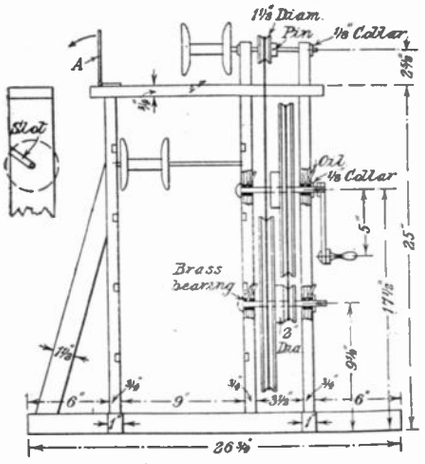
one-sixteenth of an inch square and continue rolling the paper around, fastening the paper with glue or shellac.

Put one thickness of tape around the whole thing and give it time to dry. Fig. B shows a cross section of the finished article. By screwing it to a cigar box it makes a very good telephone transmitter. It should be connected in series with a receiver and one dry cell.

Contributed by DAN DONCASTER.

Coil Winder

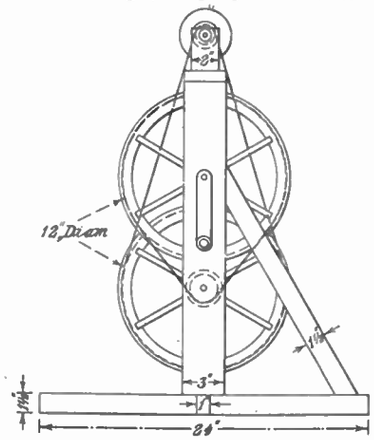
THE apparatus illustrated, while originally intended for winding thread, is



End view of a coil-winding apparatus which, while rapid in its work, is so simple of construction that it can be built at home.

applicable to the rapid winding of wire coils, especially the very troublesome ones in which fine wire is used, and will therefore be of interest to our readers.

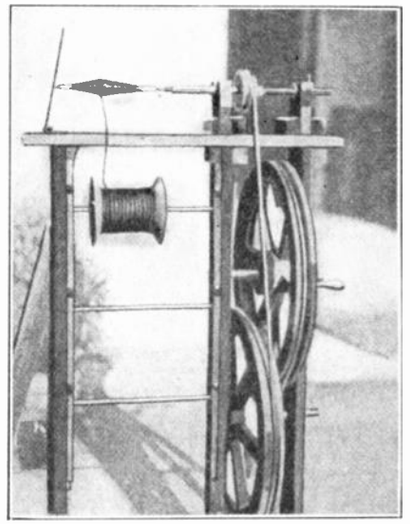
The illustrations are self-explanatory. A spindle on top of the table is supported by two bearings; it projects out at one



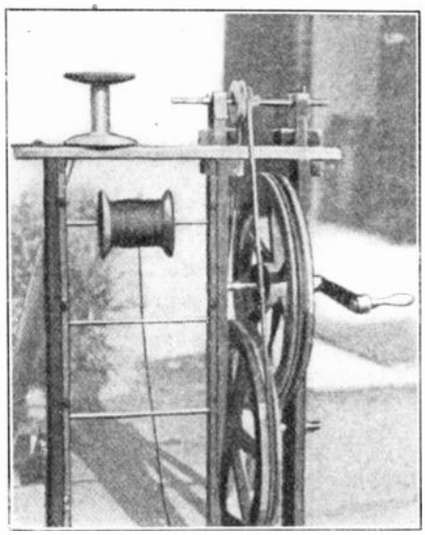
Side view of the winder showing how it is belted up to secure high speed.

side and is driven by a multiplying drive operated by belts.

The author states that he had trouble with the belt slipping, which was overcome by using two belts, one on top of the other. The projecting spindle is supposed to receive the core, matrix or tube on which a coil is to be wound, and of course the ways of attaching it will be manifold, and will be suggested by the needs of the case. If required, an outer support shown in one of the illustrations can be used to stiffen up the end of the core which is being wound.—Abstract from *The Model Engineer and Electrician.*



Perspective view of the winder at work, taking wire from a spool.



View of the machine from which the core to be wound has been removed. It is now ready to receive any desired core.

Simple High-Tension Experiments

By Harry R. Lubcke

THERE are many high-voltage experiments to be made which present beautiful and interesting displays. Many of these mystifying experiments can be performed with inexpensive apparatus and do not require much experience.

As a source of high-tension excitation we can use an ordinary Ford spark coil. Second-hand coils can be secured at garages for inconsiderable sums, probably not over 50 cents apiece. Select one that is in good condition and which will give

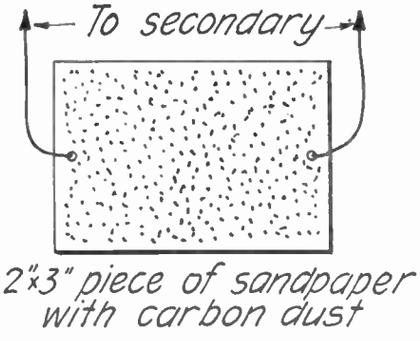


Fig. 1. Sandpaper rubbed with a pencil; when a high potential discharge is passed across its surface it sparkles vigorously.

about a half inch spark. Only a couple of burned-out electric lamps, one 40-watt size and one 60 watts or over, of the nitrogen filled variety, are necessary for the experiments. Of course, a battery and some sort of switch will be needed to operate the spark coil.

Hook up the apparatus as shown in Fig. 1, making a spark gap from two binding posts mounted on a base of dry wood and some electrodes of No. 14 copper wire. Separate the electrodes about a quarter inch and insert a piece of wax paper or mica in the stream of sparks. It will be found that the piece will be punctured with many small holes. This shows how high voltage will puncture or "break down" an insulator.

Next take a piece of sandpaper about 2 inches by 3 inches and rub a pencil point on it till it is filled with carbon dust.

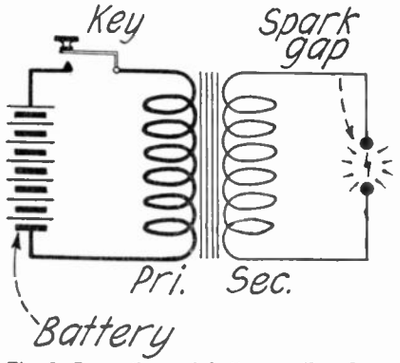


Fig. 2. Connections of battery, coil and spark gap for the sandpaper experiment.

Now connect the secondary leads to each end as shown in Fig. 2. Turn on the coil and darken the room, as this and the following experiments are best done in the absence of light. It will be found that white sparks will jump zigzag across the sandpaper, resembling lightning and accompanied by loud crackling noises.

If the 60-watt nitrogen lamp is connected up as in Fig. 3, using a coil of No. 24 wire of about 25 turns in which the lamp is placed as if in a cage or socket,

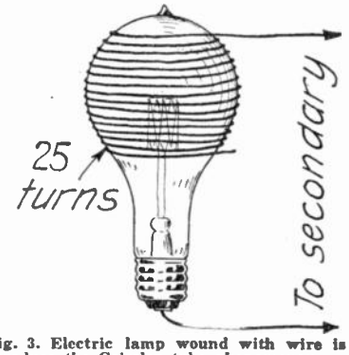


Fig. 3. Electric lamp wound with wire is used to produce the Geissler tube phenomenon.

a very beautiful purplish-blue light will fill the tube and sparks will jump from the shattered filament through the glass to the coil of wire. This is the phenomenon of a Geissler tube.

With the 40-watt lamp and a tinfoil sheet arranged as shown in Fig. 4 we can produce some very unusual phenomena. The tinfoil cap should cover the upper one-third of the bulb. Connections are made as shown. Thin tinfoil gives the best results. In this case a pale bluish light appears and when the current is

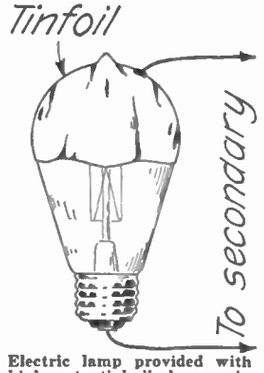


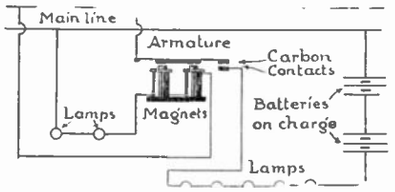
Fig. 4. Electric lamp provided with a tin foil cap; the high potential discharge gives beautiful luminous and glow effects.

turned off the tinfoil gives forth a crackling noise, but by feeling the tinfoil it will be found to be cold.

Battery Charging Protector

HERE is an idea which the writer ran across in a Western sawmill.

The mill maintained a storage battery charging room in which were charged batteries used for various operations



Connection used on a battery charging circuit in which a relay is utilized to prevent the battery discharging itself if the current is cut off.

about the premises. The regular attendant of the room had other duties and could be in the room only at intervals.

At 10 o'clock every night the current was cut off from the mill circuit, and naturally from the charging room. Also whenever there was a breakdown at the mill the current was cut off.

The batteries were charged from a 110-volt D. C. line. The current was cut down by means of a bank of lamps. Now, the difficulty was, that when the current was cut off, the batteries immediately began to discharge through the lamp bank. And at night sometimes the batteries would be left on the line discharging all night. Naturally, it took a long time for the batteries to build up.

To remedy this evil a relay was made from an old double magnet bell ringer. A contact was made from a carbon generator brush and fastened to the free end of the bell armature. A corresponding contact was fastened opposite the first and in such manner that when the armature was drawn down against the magnets, contact would be established between the two carbon blocks. Carbon was used for contacts because it eliminated any danger of the contacts fusing together.

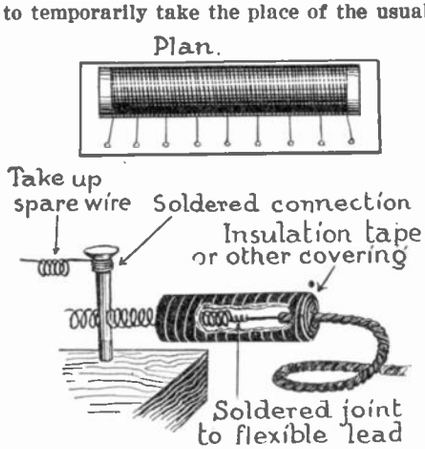
The relay magnets were connected across the main line in series with two ordinary lamps.

Whenever the current was turned on, contact was established between the carbon blocks and the batteries were on charge. If the circuit was opened for any reason, the batteries were automatically disconnected, thus protecting them from discharge.

Contributed by PERRY D. WILSON.

Helical Spring Connections

THE illustration shows a very simple and effective arrangement for varying inductance or resistance which is intended to temporarily take the place of the usual



Method of connecting to different taps from any kind of coil. The short helical spring gives a good grip on brass or copper or even iron nails, in order to change resistance.

system involving the use of a series of contact studs and swinging arm.

The inductance or resistance coil is tapped off in the usual way, and mounted on a base. As shown in the diagram, a number of smooth round nails are driven into the base, in a straight line parallel to the axis of the coil, and the tappings taken from the coil are soldered to the upper portions of the nails. Pieces of brass or copper wire may be used instead of nails. A small helical spring is employed to make connection to any of the nails at will, by merely pressing the side of the spring against the nail.

It will be found that provided the contact surfaces are clean, and the spring is of such a size as to grip the nail firmly, the contact will be as good as the rubbing type. It must be kept in mind, however, that the use of iron or steel nails or springs near coils of required and small inductance may materially affect the value of such inductances.

Contributed by CRISPIN C. REDSHAW.

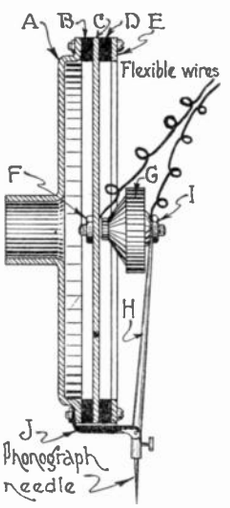
Phonograph Loud Talker

A LOUD talking transmitter for phonographs, made in accordance with the following directions, has been tested by the writer and found to work very well:

We Pay One Cent a Word

WE want good electrical articles on various subjects, and here is your chance to make some easy money. We will pay one cent a word upon publication for all accepted articles. If you have performed any novel experiments, if you see anything new electrical, if you know of some new electrical stunt be sure to let us hear from you. Articles with good photographs are particularly desirable. Write legibly, in ink, and on one side of the paper only.

EDITOR.

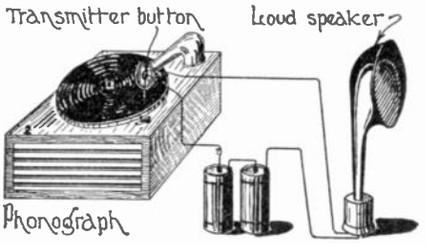


Side view of a loud talker employing a microphonic button bolted to the center of a diaphragm as the microphone element.

Referring to the illustration, (A) is a Columbia reproducer.

(B) is a rubber ring; (C) is a heavy metal diaphragm which is insulated from the frame (A) by the rubber rings. (D) is another rubber ring. (E) is the metal screw ring which holds the rubber ring and metal diaphragm tightly in place. (F) is the nut which holds the transmitter button to the diaphragm. (G) is a Skinderviken transmitter button. (A) is a loop bent in the arm (H) to fit the screw on the button. (I) is the other nut on the button which clamps the end of the arm (H) to the button. (J) is the pivot on the reproducer.

The apparatus is connected as shown in one of the illustrations.



Connection of a phonograph to the loud speaker. It can be heard all over the house.

The loud speaker described in the July, 1922, issue of PRACTICAL ELECTRICS will work very well with this transmitter.

Contributed by BELGRAVE F. GOSTIN.

"Wireless" Electric Candle

THE old style tallow candle being out of date, we give the modern candle.

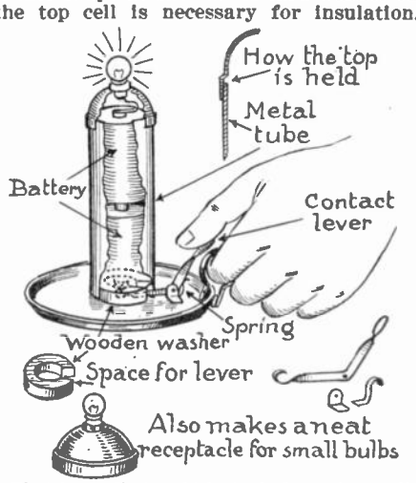
Make or obtain a tube of thin tin or brass of a size to take a double cell, 5-inch by ½-inch battery with case; it should be ½ inch longer than the battery case. About ⅛ of an inch from one end of this tube and an equal distance apart, three dents are punched from the inside. At the other end is cut a slit ¾ inch long and 1/16th inch wide.

Take the top of an Edison lamp socket and insert a miniature bulb in the threaded part. If it does not go in far enough, ream the threads a little, and the set-screw which held the rubber bushing will hold the bulb in place.

Next obtain a base of a hand candlestick and remove the part which held the candle. In its place solder the metal tube with the slit toward the handle. The contact lever can be cut from sheet brass and bent into the correct shape. This lever is held by an upright support attached to the base.

Cut out a 1¼-inch washer of ½-inch wood or fibre and drill a ¼-inch hole in the center. Then cut out a ¼-inch piece from one side and insert it in the tube at the bottom. The lever passes through the slit in the brass tube through the opening in the wooden disc. When pressed down the lever makes contact with the bottom of the lower battery, completing the circuit through batteries, lamp and outer brass tube.

Solder a short brass spring to the brass cup on the carbon of the top cell and bend it into shape as shown. A card washer on the top cell is necessary for insulation.



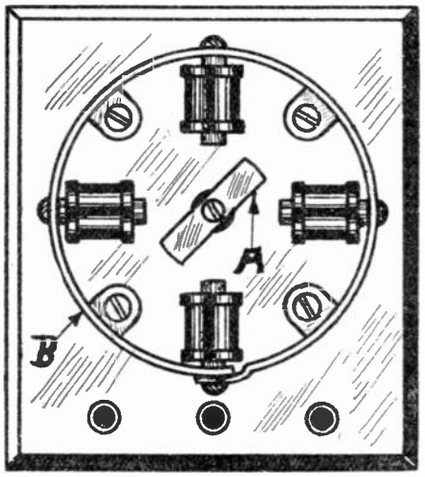
Electric candle in which the body of the candle contains two flashlight candles to supply the lamp.

Place the battery in the tube and snap the top on.

Contributed by A. J. CHRISTOPHER.

A. C. Motor and Bell

ONE of the diagrams shows how to assemble a small motor which will operate on an alternating current in connection with two chemical rectifiers.

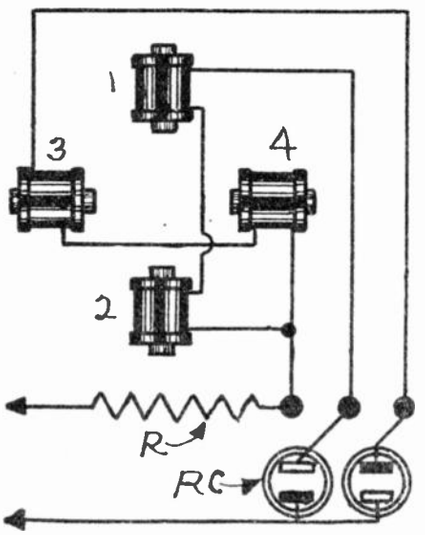


Simple alternating current motor of considerable interest from a demonstration standpoint.

The rectifiers are used to divide the alternating current cycle, that is, one half of the cycle passes through one rectifier, while the other half passes through the other rectifier. Now it is evident that if electro-magnets were connected in series with each rectifier, they would become magnetized at different times.

From the illustration it will be seen that the magnets have been arranged at four equidistant points in a circle around the armature (A). The armature is simply a soft piece of iron cut in the shape of a rectangle and arranged to rotate as shown. The magnets are supported by an iron strap (B) which is fastened to the base.

By studying the wiring diagram it will be found, that when the magnets 1 and 2 become magnetized, the magnets 3 and 4 will be dead. On the other hand when the magnets 3 and 4 become magnetized, the magnets 1 and 2 will be dead. Therefore, since the magnets become magnetized at different times, they will take turns in attracting the armature, thereby causing it to rotate.

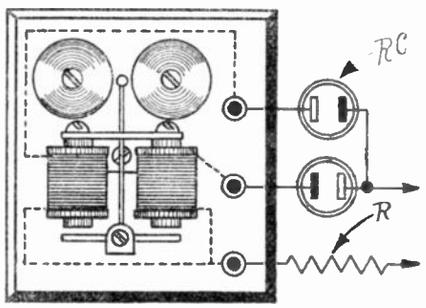


Layout of the motor connections, with two rectifying cells.

An alternating current bell, which has no springs, contacts, or permanent magnet used in its construction is shown in the other illustration. The connection of the bell is also clearly shown in this illustration. Its operation depends upon the scheme of dividing the cycle as already discussed above. Thus, during one half of the cycle one of the magnets will attract the armature, but during the other half of the cycle this magnet becomes dead, while the other magnet will attract the armature. This continues as long as the current reverses, and consequently the vibrating armature will ring the bells.

In both diagrams (R) represents the resistance which must be connected in series with the alternating current circuit in order to reduce the voltage. RC represent the rectifiers. They consist of a lead and an aluminum plate immersed in a vessel containing a solution of sodium phosphate and water. Iron plates can be substituted for the lead plates, but the aluminum plates are absolutely necessary. Care should be taken to connect the aluminum and lead plates as shown, otherwise the results described above will not be obtained.

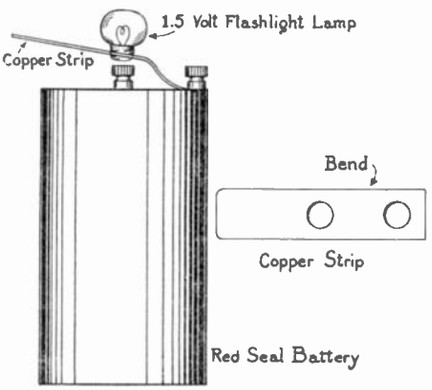
Contributed by AMEDEO GIOLITTO.



Principle utilized in the motor, applied to an A. C. electric bell.

Portable Electric Lamp

THE illustration shows a simple construction of a flash light which has the advantage that it uses a full-size dry battery.



Ordinary dry battery used as the basis of a flashlight, giving a very effectual construction which will last a long time.

To the zinc terminal a piece of hard tempered copper or spring brass bent as shown is attached by putting it on the screw and turning down the regular nut. Directly over the carbon terminal there is a hole in the strip into which the lamp is screwed or otherwise secured.

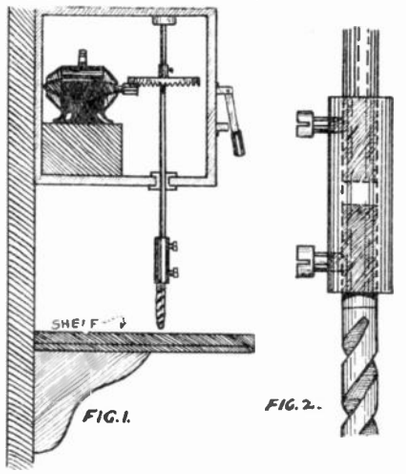
On touching the end of the spring, the lamp is pressed down with its center terminal against the carbon binding post, so that the lamp is at once lighted. Any ordinary dry battery can be used.

Contributed by CHARLES A. PEARSON.

Electric Drill

AN electric drill is an instrument for which many uses can be found in an amateur's shop, but the price of the commercial ones is much more than the average amateur wishes to pay. The simple drill shown herewith will give good results and can be made in a short time.

The motor and gears are inclosed in a box-like fixture for protection from dust, flying pieces of metal, etc.; the same box



Electric drill of the last degree of simplicity, operated by an electric motor.

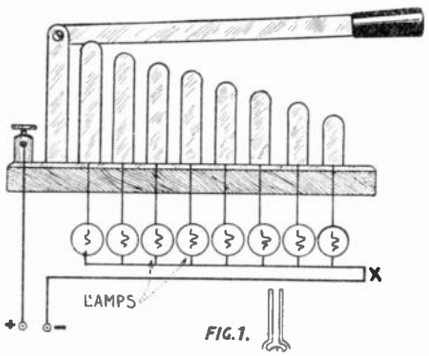
also carries the bearing boxes of the drill shaft. On the shaft of the motor is located a small gear. The vertical drill shaft is arranged as shown, with bushings through which it should run snugly; on the shaft is fastened a crown gear, which meshes with the pinion on the motor.

Fig. 2 shows how the drill socket is fastened to the end of the shaft. It is nothing other than a piece of metal tubing with two threaded holes to fit the set screws as shown. A shelf is arranged under the drill to hold the piece of work; this should be arranged so that it may be raised and lowered with the work while drilling. If more convenient the upper fixture may be made to rise and lower instead of the shelf.

Contributed by EVERMONT FISEL.

Lamp Bank Switch

WHEN employing the usual method of controlling a bank of lamps for battery charging, etc., the switch shown



Switch which as it is depressed throws in one by one incandescent lamps in parallel so as to gradually cut down resistance.

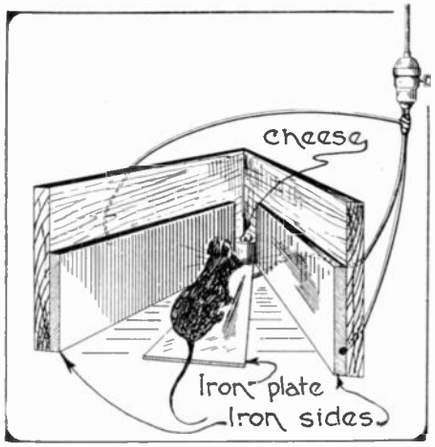
here is easy to construct and will give good results.

The method of forming the blades is shown here. The metal parts may be made of any metal that is a good conductor; it is preferred that brass be used because of its springlike tendency. It will be noted that the blades which make contact with the long switch arm are of different heights, which is the reason any number of lamps may be cut in or out of the circuit. The diagram shows how it is connected. If a battery or other instrument is to be used in the circuit it is connected in at the point (X).

Contributed by EVERMONT FISEL.

Certain Death for Mice

THE illustration shows an electric mouse trap. There are two plates of metal high enough to guide the steps of the mouse, as if they were little fences.



Electrocuting a mouse. There is nothing to excite the animal's suspicion; squeezing between the plates connected to one wire, and standing on a plate connected to the other, his death is certain.

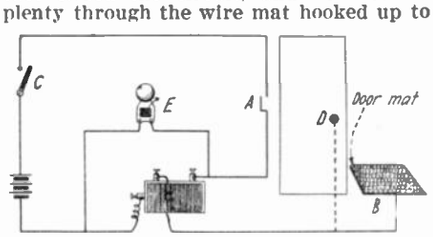
They converge toward a point, and where they are at their closest the bait is placed. A plate of metal lies upon the floor. The converging plates are connected to one lead of the service wire and the floor plate to the other. The only way the mouse can get at the bait is to enter between the plates. He walks over the floor plate and as he begins to get near the cheese, or perhaps even to nibble at it, his body comes in contact with one or both of the side plates, the current passes and the mouse is killed.

Chicken Coop Protector

DURING my visit at a country resort recently, my host was greatly annoyed by chicken thieves, so I got up an arrangement to balk them.

Some binding posts were soldered on an old spark coil. Referring to the illustration, (A) is an open circuit door-contact placed on the jamb of the hen house door. (B) is a woven wire door mat. (D) is the door knob covered with tin foil. (C) is a single pole switch to control the primary circuit from the house. (E) is the alarm bell, also located in the house, for announcing a catch.

At night the chickens were cooped up as usual, but kept away from the door mat, and the single pole switch was closed. We were talking at the table one evening when a horrible yell rang out. The marauder had opened the door, the door contact closed the circuit, and he received plenty through the wire mat hooked up to



Again electricity is called upon to give a shock, this time not a deadly one, designed to be administered to a chicken thief. A steel door mat and a Ford coil are the principal elements of the connection. When the doorknob is touched a violent shock is received.

the secondary coil. Needless to say, no more thieves came.

Contributed by WILLIAM F. LEATHER.

Spool Motor

THE following materials are required: One electro-magnet, one board one-half by four by six inches, one spool, four large headed tacks, four small nails about five-sixteenths inch, two boards two inches high cut as shown in Fig. 3, two pieces of tin as Fig. 2, one piece of tin as Fig. 4, two round pieces of tin with central holes to fit the ends of the spool as Fig. 5, and some wire.

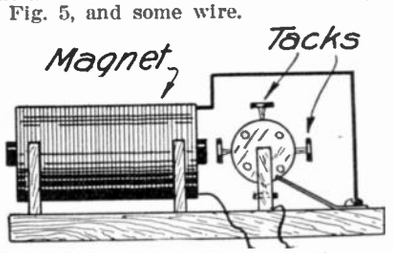
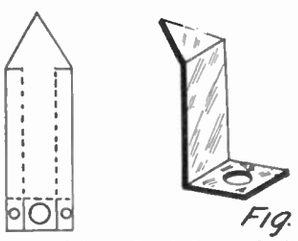


Fig. 1. Strictly home-made motor with a spool as the rotating element and tacks for armatures.



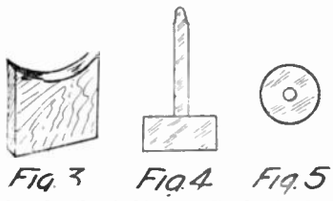
Support and journals of the spool, the pointed ends act as the bearings, although really of flat tin.

Place the two pieces of board on the baseboard at a proper distance apart to support the magnet. Next shellac the round pieces of tin to the ends of the spool, care being observed to put the small hole in the center of the spiral. The two pieces of tin (Fig. 2) are bent to form a stand for the spool (Fig. 1.) In bending the pieces of tin, bend on dotted lines and cut on solid lines.

A bright new nail can be soldered on the point of the tin, or else the points can be made sharp. Now put the four tacks about 90 degrees apart, as in Fig 1, in at the edge of the spool. Then drive the small nails in one end of the spool just between the big-headed tacks as in the same figure.

The supports for the spool are placed in the end of the spool, and it is set as in Fig. 1, so that the tacks miss the core of the magnet but have plenty of room to turn around. Then fasten the spool supports down with screws, putting about a foot of wire on one of them so as to form a connection with the small nails in the end of the spool. Now take the piece of tin (Fig. 4) and fasten it to the base so that the small end just touches the small nails in the end of the spool, acting as a brush. A piece of wire is connected to the screw that fastens the piece of tin down.

Run one wire from the battery to one wire of the magnet, one wire of the battery to the wire on the spool support, and a wire from the piece of tin last put on to the other wire of the magnet. To start the motor going, connect all the wires and turn the spool so that one of the small nails in the end of the spool touches the piece of tin.



Further details of this exceedingly simple home-made motor.

Contributed by SAM FARISS.

Double Action Telegraph Key

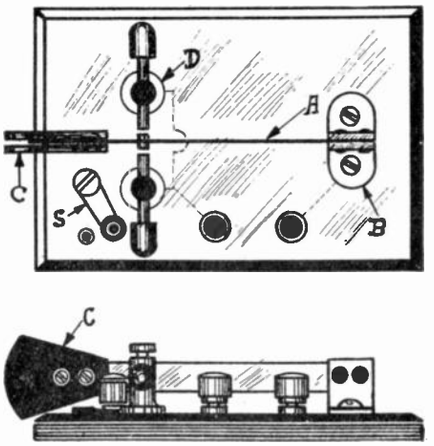
A DOUBLE action telegraph key, or a side motion key as it is sometimes called, is quite simple to construct, as the accompanying illustration shows.

A spring or lever is clamped to the two upright supports, which are in turn fastened down to the wooden base as shown. Two hard rubber pieces cut in the shape as shown, are screwed to the other end of the lever, and serve as a handle for operating.

As will be seen, the lever operates between a pair of contacts. These two contacts are electrically connected together and then to one of the binding posts and the clamped end of the lever is connected to the other binding post.

After this has been done, the circuit closer is to be connected across the two binding posts. This connection is not shown in the drawing, for if the key is to be used only for practice purpose the circuit closer can be omitted.

In order to illustrate the action we will assume that this connection has been made. Then it will be seen that if the letter H is to be made the handle would have to be moved back and forth twice, since this would make and break the circuit four times.



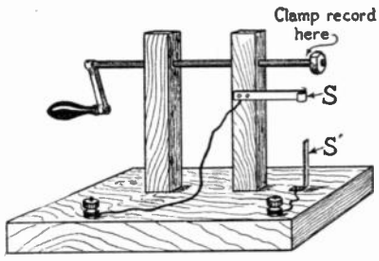
Side action telegraph key adapted for rapid production of the code, yet very simply constructed.

With the ordinary style of telegraph key the lever would have to be pressed and depressed four times in order to make the letter H.

Contributed by AMEDEO GIOLITTO.

Cold Light Apparatus

HERE it is at last: a practical cold light apparatus made from worn phonograph records. Here is the stunt. First make a stand as shown in Figure 1.



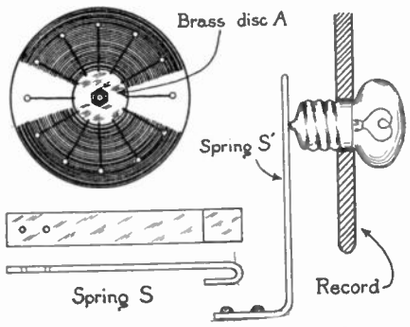
Mounting of an interesting apparatus, really based on the persistence of vision, for producing what the author terms "cold light."

Second, procure 10 flashlight bulbs (or more) of any voltage desired. Third, clamp together two or three records and leaving a 1-inch margin from the edges, drill as many ⅜-inch holes as there are lamps. Now pass the lamps through, secure in place, and connect the brass ferrules to the brass disc, (A). Now clamp the records holding the lamps on the shaft (G).

Next a spring is mounted on the base (as shown) to press against the lamps' bases, one at a time. With the addition of another spring, (S), bearing upon the brass disc, the circuit is complete. It is now evident that by turning the handle, one lamp after the other is switched into circuit, consecutively.

The persistence of vision on the human retina defies the detection of the lamp substitution, and the intermittent flashes produce the illusion of a steady light. You can operate the lamps on two or three times their normal voltage without much harm, providing you turn the handle quickly enough.

Contributed by O. BAIL.



Further details of the interesting cold light apparatus, showing how a phonograph record is used to make and break the circuit.

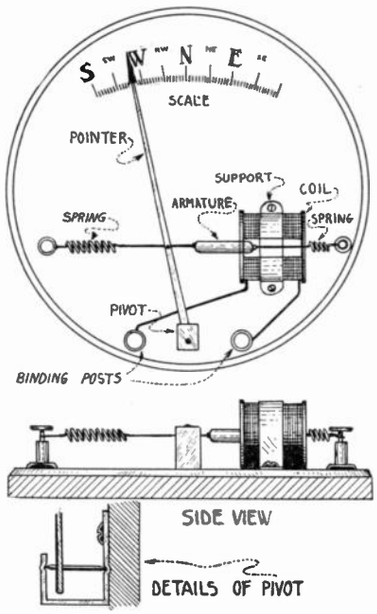
Electric Weather Vane

THIS is quite an interesting instrument because of the fact that it will tell the direction of the wind while you are indoors, without having to go outside. It is quite easily built, the parts needed are few and can be found in almost any amateur's shop.

The first part to make is the recording instrument, which is clearly shown in the drawing. The long pointer arm is journalled by a pivot at the lower end. This pivot and bearing are easily made from a piece of sheet metal and a shaft taken from an old clock. The coil used is a solenoid, the center being open so the iron core or armature may slip through it.

A large spring is fixed to make the pointer arm return to its original position, and a small spring is arranged to balance the pointer and take up the slack in the small wire attached to the needle and core. The operation of the instrument depends upon the amount of current induced in the coil, which tends to pull the armature into the opening left for it. The scale is marked in accordance with the position of the instrument placed outside.

The next part to make is that which is placed outside on the roof or elsewhere. It consists of an insulating ring wound with resistance wire; this is placed in a weather-proof box and a shaft runs to an arrow pointer which is placed where the wind can strike it. The other end is made in the form of a rounded end, which rests in a dent in a piece of metal, which gives an almost frictionless journal. The shaft should be made of metal for best results.



Indicating apparatus for an electric reading weather cock. The weather cock operates a circular rheostat in the usual way. The above shows the distinctive feature of it.

An arm is fastened on the shaft which rides on the resistance wire, thus making a kind of rheostat. The indicating apparatus is shown in the illustration. It is best to use a push button to turn on the current, as to let it run continually would soon run down the batteries. The operation of the instrument is simple; the outside part is a form of rheostat which controls the amount of current to the inside instrument. The inside indicator may be compared with an ammeter and the scale is marked with compass letters, N, W, etc.

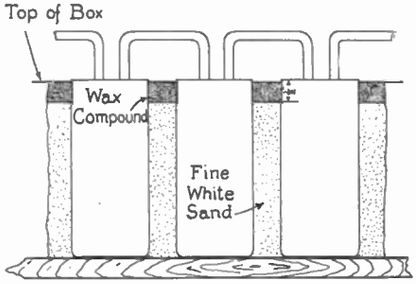
Contributed by EVERMONT FISEL.

Improvements for Laboratory Battery

SINCE the publication of the description of the High Voltage Laboratory Battery in the October issue of PRACTICAL ELECTRICS several important changes have been made which improved its operation and appearance.

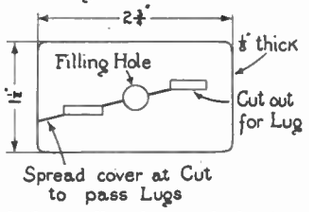
Instead of spacing the cells with blocks of impregnated wood as was done in the old unit, a new wax compound was run in between the cells. In this case the box containing the unit must be as high as the jars, or 3½ inches. As shown in Fig. 1, white sand or other suitable material is poured in to within ½ inch of the top of the jars. Then the sealing compound, consisting of equal parts of paraffin and sealing wax, is poured in till it reaches a level just below the top of the jars. The sand is used to take up space and save the wax.

Fig. 1



Section of a laboratory battery, with several improvements in detail over one shown in a preceding issue of Practical Electrics.

Fig. 2. Covers

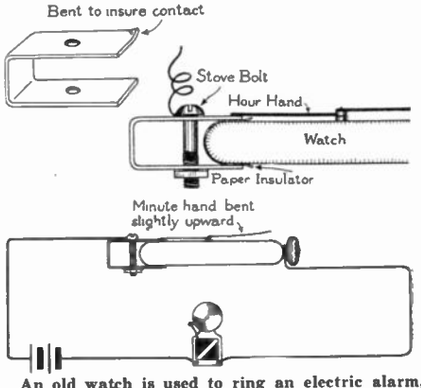


View of the cardboard top of the improved storage battery, showing how it is cut to be sprung around the filling neck and lugs. It is then made waterproof by paraffine.

It was next found that by using individual covers for each cell the acid spray was greatly reduced, producing a much cleaner battery. The covers were made of brown cardboard such as is used by some manufacturers instead of wood boxes. They are cut out of about ⅛-inch material as shown in Fig. 2, and are very thoroughly impregnated with melted paraffin. To put them on the cells they must be sprung apart to go around the lugs, but when in place they spring back and form a simple, effective cover. If desired they can be sealed tight to the jar by applying paraffin with a brush at the juncture of the jar, lugs and cover.

Contributed by HARRY R. LUBCKE.

Watch Electric Alarm



An old watch is used to ring an electric alarm, a substitute for the bulky alarm clock. In all these cases where there is danger of an arc, a very low voltage can be used and the alarm bell can be placed on a relay circuit.

A VERY efficient and economical time alarm can be constructed in a few minutes from an old watch and a few articles that can be found in any experimenter's workshop.

First remove the bezel and crystal. Bend a strip of metal as shown in sketch. Clamp this strip at the point which the hour hand will reach at the time you desire the alarm to ring. The strip of metal is insulated from the case of the watch by a piece of paper placed between them.

The operation of the alarm is very simple. As the hour hand travels over the strip of metal it scrapes over the bent-up corner and closes the circuit.

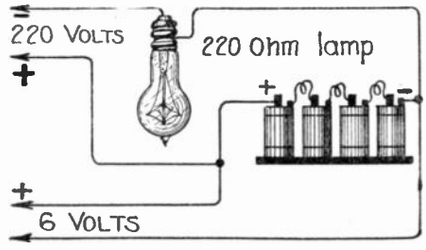
The writer finds this alarm very efficient and the watch has not even been scratched.

Contributed by ROBERT W. ROSE.

Strong Batteries From Weak

AN interesting application of a wornout dry battery is described here:

I was running a radio set that used one audion. Six volts were required to light the filament. Instead of a storage battery I used four dry cells as the A battery. But the dry cells became dead after perhaps only one minute of use.



Exceptionally interesting connection of a dry battery to a high voltage circuit for the production of a potential of but six volts. The lamp and battery are in series on the main line, and the six-volt potential is taken off from the battery terminals.

The local electric supply circuit operates at 220 volts D. C. I knew the audion filament required one ampere of current. So I placed the audion filament in series with a 220-ohm nitrogen lamp and connected the two direct to the mains.

This method, however, did not provide accurate control of current; the hum of the generator was all that could be heard and there was, incidentally, a disagreeable arcing on the opening of a switch, not to mention severe and frequent shocks.

Next I tried charging the old dry cells, using the 220-ohm nitrogen lamp in series with the local mains. After a while the cells appeared a trifle rejuvenated.

Then somehow the idea occurred to me of taking current from the dry cells, while the charging current was passing through them. This time I got what I longed for, an arcless, constant, high amperage circuit. I have also taken absolutely zero dead dry cells, whose zinc was as yet smooth and not cracked, and made them work as described, also.

The only way to get a shock by this method is to purposely form a circuit from one battery to the ground, etc.

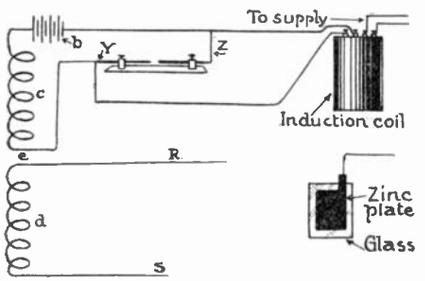
In the illustration is given a diagram of the connections used.

Contributed by ESTEN MOEN.

High Frequency Experiment

WITH an induction coil and a condenser (B) and the spark gap (A), all shown in our illustration, we can start our experiment.

First connect up the spark gap (A) to the two terminals on the induction coil (Q) and (R). Then take a wire from (Z) to the high voltage condenser (B) and from thence on to the helix (C), and



Very simple high frequency experiment, which however will be found to be quite startling in its effects.

then back to (Y). Next wind a coil of wire (D) on the same drum as (C); the wire should be of the same size as (C).

Take the two wires (R) (S) in the hands and whenever you approach anything sparks will jump from your hand to the object that you are almost touching.

The condenser can be made by taking some old glass photographic plates and some zinc plates and joining them up. No shock will be received from the coil.

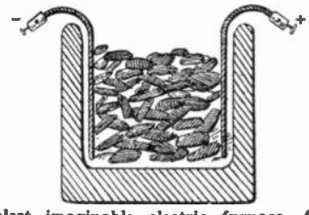
Contributed by R. F. SHENTON.

Use for Old Battery Carbons

CARBON electrodes taken out of used flashlight batteries can be used for electro-technical work. Out of these we can make arc lamps, microphones and also small electric furnaces. The carbons are broken up and put in together along with bits of coke and wood charcoal in an earthen vessel; a current of 2 amperes can be made to pass through the mixture; a very high temperature can be obtained thereby.

"Technik fuer Alle."

We have had frequent occasions to describe and illustrate the uses that can be made of old battery carbons, and the above extract from one of our German contemporaries gives the construction of a furnace differing materially from any we have yet described. It is quite an interesting example of an extemporized heater.



Simplest imaginable electric furnace, from a German source. It is one in which old bits of electric light carbons, coke and wood charcoal are interposed between two electrodes. It is said that a very high temperature can be obtained.

Electric Arc Furnace

AN electric furnace is an apparatus that no experimenter should be without. The furnace described below is simple and easy to make and will accomplish anything that a larger and more expensive furnace will do. It may be used on any voltage between 50 and 220 volts, and draws from 5 to 20 amperes.

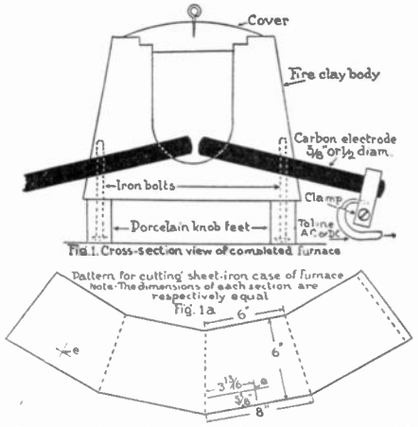
The first part to make is the outer case of galvanized iron, of material such as is used for roofing, and which may be procured from any tinner or plumber; the sheet iron is cut to the shape and size shown in Fig. 1a. At the point (E) a hole ⅞ inch in diameter is drilled to allow the carbons to pass through without touching the sheet iron. Bend the iron on the dotted lines, making sharp bends, and solder or rivet the flap (F) to the edge (A).

Get a piece of soft wood 4 inches square and 5 inches long, turn it on a lathe to the shape and size shown in Fig. 2. Two ⅝-inch holes are drilled in it as shown in Fig. 2a. Another block of wood 5 inches square and 1½ inches thick has an opening turned in it, as in Fig. 3, which shows the cross section of the opening. This is the mould for the top of the furnace.

Two round rods of wood, ⅝ inches in diameter and about 6 inches long, are inserted in the holes drilled in the first piece of wood. Enough fire clay to fill the sheet iron case should be procured and moistened until it can be moulded with the hands.

Place this case upon a board, small end down, and place the wood piece (B) in the center of the space; pack the fire clay firmly around the wood and fill the case up even with the edge, making sure that the clay is packed down well. Set the whole thing aside for at least 48 hours, until the clay is hard and dry. Next take the block shown in Fig. 3 and pack fire clay into the opening, rounding off the top of the clay as shown in the figure. A large screw-eye inserted in the fire clay while it is soft makes a good lifting handle.

The carbon electrodes used in this furnace are the ordinary solid ⅝ inch arc light carbons. They are fed by hand through the holes formed in the fire clay



Cross section of an electric arc furnace, with the layout of the sheet iron envelope or casing, within which the clay or other insulating material is packed.

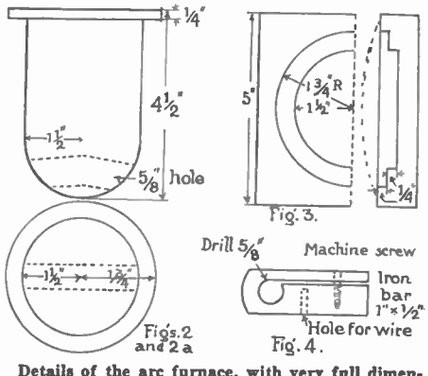
by the wooden rods in Fig. 1. These holes should be just large enough to allow the carbons to be pushed through easily, but not so large that they can slip out of adjustment.

Two clamps, Fig. 4, are made to connect the wires to the carbons. The bare ends of the wires are placed in the holes (H) and held in place by melting solder around them until the holes are completely filled.

If desired, short legs may be made to raise the furnace so that longer carbons may be used. Four large porcelain knobs may be used, fastened to the bottom of the furnace by means of long stove bolts thrust through them and pushed into the fire clay while it is still soft. The outside of the furnace may be painted with a heat resisting paint or may be covered with sheet asbestos as the builder may wish.

This furnace will operate satisfactorily on 110 volts and 5-10 amperes, but for the best results a step-down transformer giving about 50 volts and 20-25 amperes should be used. A water rheostat made of a two or three gallon jar and two sheet iron plates in a solution of common salt in water is used to regulate the current.

A temperature of more than 5,000 degrees Fahrenheit may be obtained and many very interesting experiments conducted with the aid of this furnace.



Details of the arc furnace, with very full dimensions. This furnace will give a very high heat at a reasonable efficiency.

If the cover is not used in any experiment dark glasses of very dark colored glass must be worn to avoid injury to the eyes from the intense light of the arc.

Contributed by J. LESTER SHIPPLEY.

IN this department are published various tricks that can be performed by means of the electrical current. Such tricks may be used for entertaining, for window displays, or for any other purpose. This department will pay monthly a first prize of $3.00 for the best electrical trick, and the Editor invites manuscripts from contributors.

To win the first prize, the trick must necessarily be new and original. All other Elec-Tricks published are paid for at regular space rates.

Electric Hallowe'en

By PAUL VALLIERE

FOR an Electric Hallowe'en, procure or build a wooden box 12" x 10" x 7". Then divide same in three sections, as indicated in Fig. 1. You will soon see why.

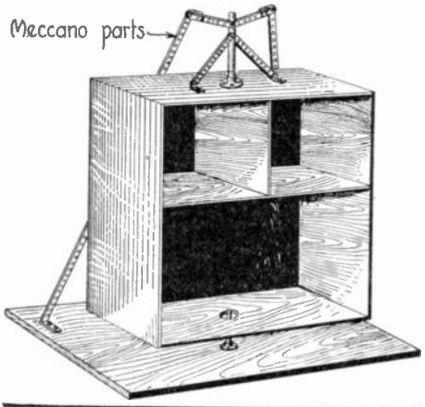


Fig. 1. Wooden box divided into three sections with Meccano auxiliaries for an electric Hallowe'en pumpkin.

A lamp is placed in each partition in such a position as to have each of them directly in front of the eyes, and nose and mouth holes of the Hallowe'en.

To make the face, cut a piece of cardboard of the width and height of the box, so that it may be nailed or tacked in front of the box.

When you have your cardboard cut to the proper size, you will have to use your knife or scissors a little more, so as to cut out the eyes, nose and mouth. (Fig. 2.)

When this is done, paste a piece of tissue paper either behind each opening or from one end to the other of the cardboard. Those openings will then come out brilliantly in the darkness, when lamps are lighted, and will surely frighten some old maid!

Those who do not wish to buy sockets for their lamps may make same themselves, as shown in Fig. 4. If you use threaded base bulbs, wind a No. 16 or 18 piece of bare wire tightly around the

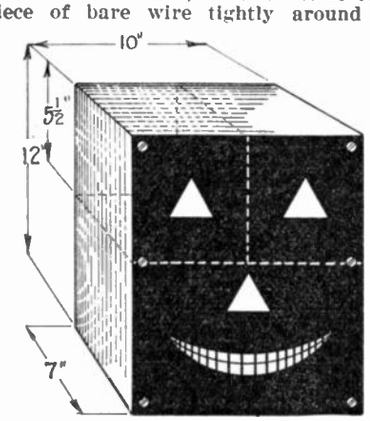


Fig. 2. The face in front of the box. The three partitions indicated by dotted lines show how each eye and the lower part of the face can be illuminated, one division at a time.

threaded lamp so that it will screw in and out as in an ordinary socket. Then insert a wood screw in a little block, about ½ inch thick, which screw will connect with the insulated terminal of the lamp. After this is done, adjust your lamp over it, so that the insulated terminal will come in contact with the wood screw, and then staple the ends of the bare wire to the wood. You will then have a complete socket in every detail, which will cost you practically nothing.

Besides the lamps you may also use some noise maker, such as an electric bell or an electromagnet placed over the bottom of any tin box and operated by alternating current.

The purpose of having three lamps in the box and separated from each other is to make our face "winkle" at passers-by. You may, for instance, cut off current of eye No. 1, for just a moment, and . . Hoo! Hoo! our man is flirting with some vamp on the street! You may then cut off current of the bottom partition, leaving the eyes alight, only, which will look suspicious, in the dark.

The lamp switches are five-hole Meccano strips which are pushed over a con-

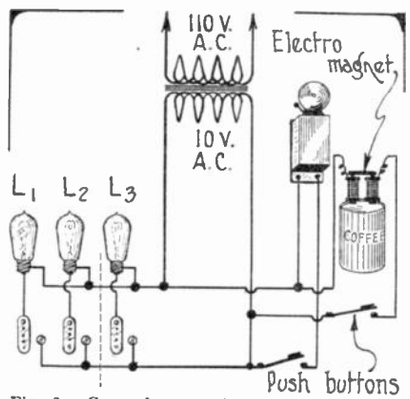


Fig. 3. General connections of the Hallowe'en display with a transformer taking its current from a lighting circuit, showing a noise producer, push buttons and lamp switches. Meccano parts are used for the lamp switches.

tact point connected with the main wire of the transformer or battery, if a storage battery is used instead of a transformer. The switches used for ringing the bell or sounding the buzzer are push-buttons and may consist also of Meccano strips.

Those who wish to put more life in their Hallowe'en may also have the box or "head" go to and fro, by means of a Meccano motor—or any other kind—equipped with gears, and working on the principle of oscillating electric fans. Fig. 6 shows how to install the box and motor. I have tried this mechanism and it works very well, provided enough gears are used.

People who are interested in building this Hallowe'en and who possess a radio outfit may use their two-stage amplifier, if they have one, to amplify sounds, and thus have our fellow speak. Connect a microphone—the Skinderviken button will do—in series with a couple of dry cells between the grid and the positive of the (A) battery.

A simple outfit can be made, of course, by using a single 110-volt lamp, placed in the middle of the box, thus doing without partitions. A switch is placed in series with it and the face is made to appear and disappear in the dark. If one low voltage lamp is used, it may be connected to the secondary of the transformer, as shown in Fig. 4, leaving out the two other ones.

This Hallowe'en, of course, may be placed anywhere, especially if the box

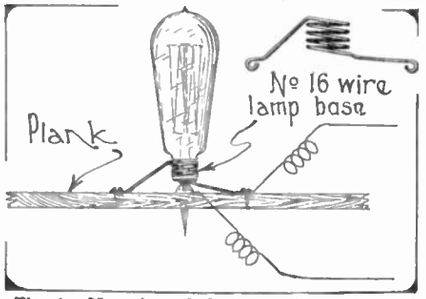


Fig. 4. Mounting of the lamp, dispensing with any bought socket, heavy twisted wire taking its place.

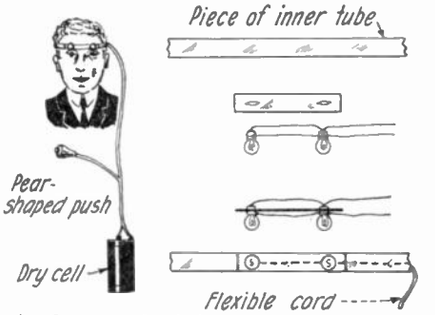
only is used. It could then be installed in a tree, under a porch, in a window, etc.

Electric Eyes

ONE of the best ways to obtain some fun from a good dry cell is to make a pair of electric eyes. The shock these can give when suddenly flashed in the dark is worse than a "jolt" of "220" volts.

From an old automobile tire inner tube cut two strips three-quarters inch wide, one long enough to fit snugly around the head when the ends are stitched together; the other, five or six inches long. In the smaller, cut two small slits as far apart as your eyes, and slip a 1.5-volt bulb in each slit.

With a small soldering iron solder a wire from one base to the other, and from one side to the other side, thus connecting the bulbs in parallel. Run one wire out on one end of the strip and one on the other end. The smaller strip is now stitched to the center of the other, thus securing the lamps. The two wires are connected to a flexible cord which is



Another example of electric eyes, only this time instead of being on a box they are on a person's forehead. Pieces of inner tube from old automobile tires are used in the construction.

stitched to the large strip and runs halfway around it.

Contributed by CONSTANTINE TROY.

Short-Circuits

THE idea of this department is to present to the layman the dangers of the electrical current in a manner that can be understood by everyone, and that will be instructive too. We have given monthly prizes of $3.00 for the best idea on "short-circuits." Look at the illustrations and send us your own "Short-Circuit." It is understood that the idea must be possible or probable. If it shows something that occurs as a regular thing, such an idea will have a good chance to win the prize. It is not necessary to make an elaborate sketch, or to write the verses. We will attend to that. Now, let's see what you can do!

ELECTROCUTED WHILE TAKING BATH IN HIS HOME IN PHILADELPHIA

Philadelphia, Dec. 24.—George Menker was electrocuted to-day while taking a bath at his home.

He attempted to turn the water off in the bath tub while holding an electrical massaging machine in his hand, the full force of the house current passing through his body.

The insulation on the wire of the massaging apparatus is believed to have been defective.

ARC LIGHT KILLS IN SLEEP HUNT

Chicago.—Louis Young couldn't sleep. An arc light at the corner threw suc hstrong light into his porch bedroom that it kept him awake. At midnight he decided to paste paper over half the globe. Friends found him, an hour later, ata the foot of the pole electrocuted.

OWL DARKENS TOWN

CAMDEN, Aug. 17 (AP).—A large barn owl darkened two towns near here last night when it perched on the high tension wire which carries electricity to Swedesboro and Mullica Hill. All the lights in both places went out as the current coursed the owls body. The dead bird is now on exhibition in the offices of the Electric Company of New Jersey. Its wing spread was four feet.

FORGETFULLNESS FATAL

Wire Kills Porch Climber Who Left Key At Home

By Associated Press.

PITTSBURGH, July 23.—Wilbert Corbett of Imperial, Pa., forget the key to his house when he left home last night. Returning this morning he climbed a porch to reach a window and coming in contact with a live wire was instantly killed.

P. P. R. HIRES NEGROES

LIGHTNING WRECKS 'KIDDIE KOOP,' BUT CHILD SLEEPS ON

GRETNA, Fla., March 3 (A. P.)—Lightning struck the home of Mr. and Mrs. J. R. Herring here today, wrecked a "kiddie koop" in which their three-year-old infant was sleeping, burned a hole in the floor near the "koop," but never roused the child from slumber.

The parents were severely shocked, and were surprised to find their child alive.

Road Gang Workman Killed Getting Gopher Out Of Pipe

Efforts to get a gopher out of a pipe being used in construction work on the Lake Geneva-Genoa Junction road caused the death of Axel Johnson, 35, workman on a road gang. He raised the pipe on end to get the gopher out and it touched a high voltage wire above, killing him instantly.

BOY'S KITE STOPS STREET CAR TRAFFIC IN PORTLAND

Special Dispatch to the Globe

PORTLAND, Me, Aug 31—A boy's kite, with its frame made of steel umbrella ribs, caught on wires of the local lighting and power company, brought street car traffic to a standstill, put out the lights throughout the city and was responsible for calling out the fire apparatus when it blazed up. The cars had to make up six minutes of lost time as a result of the short circuit.

INSTEAD of printing the usual pictures which we have been giving right along, we are showing this month actual newspaper clippings describing fatalities and accidents produced by short circuits. We are actuated to do so by several motives.

Firstly, a number of people seem to have an idea that this department is a sort of comic page. Nothing could be further from our minds. The illustration idea was adopted merely to bring directly home to people in a pictorial way just what can, and often does happen, when they are careless in using the electric current. People will scrutinize pictures more readily than dry reading matter, and that we have been correct in our assumption is best testified to by the hundreds of letters we get from readers thanking us for having pointed out to them the dangers of such carelessness.

Secondly, the electrical interests do not like our page overmuch, saying that the pictures we show are far-fetched and untruthful.

PRACTICAL ELECTRICS' mission is to teach people to be careful, and if we can do this, we believe that we have accomplished one of our purposes.

If your newspaper has any clippings on electrical accidents, be good enough to send them to us.

THE EDITORS.

Lightning Bolt Hits Youth; Now He's Minus Sock

AMITE, La., May 29.—Clarence Cutrer is minus a sock, and is in a serious condition, the result of having been struck by a bolt of lightning which hit a community house in a farming district near here during a dance last night. Clarence and Irving Cutrer and Marjorie Cothran were knocked unconscious by the bolt, and Henry Lewis, of Amite, was burned slightly about the neck. The bolt split one of Clarence Cutrer's socks down one side and set it ablaze.

Climbs to Live Wire, Rescues Man Burned

ROCHESTER, N. Y., July 27 (AP).—Disregarding the danger he was placing himself in, Dr. Herbert S. John Cox climbed to the top of a power line pole, unstrapped the belt holding George Bauer to the pole and carried him to the ground.

Bauer had been so badly shocked when he came in contact with a high-tension wire while doing repair work on the pole that he died before reaching a hospital.

COATESVILLE LINEMAN KILLED

COATESVILLE, Pa., Aug. 15 (AP).—Howard Deery, a lineman, was electrocuted here today while erecting an aerial for a radio outfit.

Deery was attempting to fasten the iron supporting upright of the aerial to a roof when the pole fell over and touched a live electric feed wire. The heavy current coursed through the lineman's body and he died before the electricity could be shut off. He was 32 years old.

TELEGRAPH NEWS

BOY IS BURNED BY BROKEN WIRE

Shock Likely to Cost West Caldwell Youth Use of Right Arm.

Linden Terhune, eleven, of Lane avenue, West Caldwell, will probably lose the use of his right arm from burns received yesterday when he picked up a fallen electrc light wire.

Linden was playing with several other children near his home when he discovered the wire, broken in the storm the night before. He walked towards it, but his companions warned him away. Disregarding their warnings, he picked up the wire.

He was thrown to the ground and knocked senseless by the shock. His hand rested on the wire for fully three minutes. His terrified playmates finally stopped a passing autoist, who knocked the wire off the boy's hand with his cap.

The boy was rushed to Dr. Butler's sanitarium, where he remained unconscious for eight hours. His burns are severe, and amputation may be necessary.

Current in Electric Iron Starts $5,000 Factory Fire

Fire in the two-story brick factory of Megibow Brothers, embroidery manufacturers, at 312-314 Eleventh Street, West New York, early yesterday resulted in about $5,000 damage. The upper floor used by the mending and ironing department was burned out.

The lower floor where the embroidery machines are located was damaged by smoke and water. It was said the fire was caused by an electric iron, in which a workman had inadvertently left on the current over night.

Live Wire Kills Youth and Sister

MONTGMAGNY, Que., June 30 (AP).—Joseph Marticotte, eighteen, was killed yesterday evening when he grasped a live wire while drawing a bucket of water from a well.

His sister, Marie Ange, seventeen, died attempting to wrest the wire from his hands, and their father was seriously shocked when he ran to the rescue.

Lineman Killed by Fall as He Strikes Live Wire

NEW LONDON, Conn., March 5.—George Decker, twenty-seven, of Pinebush, N. Y., a lineman, was thrown from the Thames River highway bridge to-day when he touched a live wire. His skull was crushed by the fall.

Decker died in a hospital.

MAN IS ELECTROCUTED

Three Others Seriously Burned at Building Operation

One man was killed instantly and three others are now in the Episcopal Hospital suffering from serious burns received yesterday when a girder came in contact with a heavily charged wire but a building construction at Mascher and Westmoreland streets.

The electrocuted man was Otto Allen, colored, of 522 Wood street. The three injured men, also colored, are William Reed, 40, 1111 Melon street; John Harris, 48, 1341 North Alder street, and Harrison Stovell, 54, 522 Wood street.

BOY GETS 28,000 VOLTS OF CURRENT AND LIVES

He May Recover—Pigeon He Took From Nest on Pennsy High Line Is Electrocuted.

As he was climbing to a pigeon nest under the Pennsylvania high line where it crosses Market street near Thirty-first late yesterday afternoon, Collier Hilferty, 12 years old, of No. 3214 Locust street, slipped from his position on the top of a battery of transformers of the Philadelphia Electric Company, struck a feed wire carrying 23,000 volts and, though badly burned and shocked, still lives. A baby pigeon he clutched in his hand was electrocuted.

The under side of the bridge structure over Market street is a pigeon rookery, and Collier with several of his playmates wanted to capture some of the young and tame them. The battery of transformers, almost directly underneath the bridge, and resting on a platfrom about

Continued on Thirteenth Page.

THIS department is conducted for the benefit of everyone interested in electricity in all its phases. We are glad to answer questions for the benefit of all, but necessarily can only publish such matter as interests the majority of readers.

1. Not more than three questions can be answered for each correspondent.
2. Write on only one side of the paper; all matter should be typewritten, or else written in ink. No attention can be paid to penciled letters.
3. Sketches, diagrams, etc., must always be on separate sheets.
4. This department does not answer questions by mail free of charge. The editor will, however, be glad to answer special questions at the rate of 25 cents for each. On questions entailing research work, intricate calculations, patent research work, etc., a special charge will be made. Correspondents will be informed as to such charge.

Kindly oblige us by making your letter as short as possible.

Lifting Power of Magnet

(349)—Andrew Kerctey, Chicago, Ill., asks:

Q. 1.—If an electromagnet lifts 500 pounds when in contact with the object, how much will it lift when an inch away from the object?

A. 1.—The lifting power at different distances of a magnet of given strength depends upon its shape and proportions and decreases rapidly as the distance between the magnet and the object is increased. If the magnet is long and narrow the lines of force extend out farther and straighter than they do from a short magnet, and its effective lifting distance is greater. The only accurate way of determining the pulling power of a magnet is by actual trial.

Christmas Tree Lamps

(350)—R. L. Chapman, Findlay, O., asks:

Q. 1.—How many watts do 100 of the 14-volt lamps used for lighting Christmas trees consume?

A. 1.—100 of these lamps will consume approximately 250 watts.

Q. 2.—Kindly give details of the construction of a transformer to handle 1,000 of these lamps. The supply current is to be taken from the 110-volt A. C. house lighting system.

A. 2.—This will require a 2½-kilowatt transformer, which is entirely too large for use on the 110-volt lighting ciruit. Eight of the lamps may be lit in series direct from the 110-volt line without the use of a transformer. No more than 350 lamps should be operated at one time from the lighting circuit.

Oudin Coil Query

(351)—C. H. Schlosser, Billwille, Ill., asks:

Q. 1.—I wish to make the Oudin coil described in the October (1923) issue of PRACTICAL ELECTRICS. How many glass plates, 10 by 12, are necessary for the condenser.

A. 1.—10-in. or 12-in. plates covered with tin foil 8 by 10 inches may be used. The connections should be arranged so that more or less plates may be connected in the circuit by means of a suitable clip. If 8-in. by 10-in. plates are used, about 16 will be required.

Q. 2.—Would I obtain better results by using a rotary spark gap?

A. 2.—Yes. Much better results will be obtained with one.

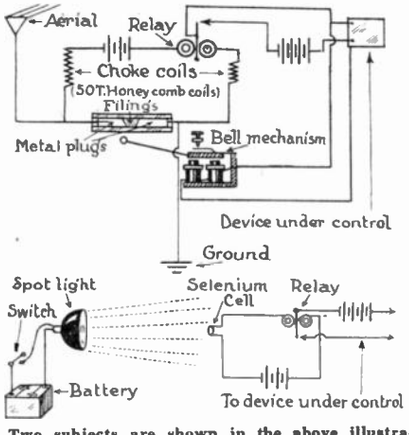
Wireless Control Demonstrations

(352)—R. B. Ambrose, Belleville, Kansas, inquires:

Q. 1.—Kindly give me practical directions for the construction and operation of a sensitive coherer that can be used for wireless control demonstrations for platform use.

A. 1.—The construction of a sensitive coherer requires much skill and experimenting, but no trouble should be experienced in building a suitable one for platform use which will operate a short distance from the transmitting apparatus.

The Marconi coherer consists of two amalgamated silver plugs, slightly beveled, as shown, and about ⅛-inch in diameter. These are placed in a glass tube and separated by nickel and silver filings. The filings almost fill the space between the ends of the two plugs. You may try nickel plated plugs and ordinary iron filings. Although not so sensitive, they may serve your purpose. The distance between the plugs should be varied until best results are obtained. The battery voltage should also be variable.

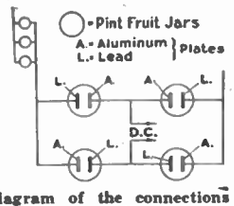


Two subjects are shown in the above illustrations. The upper one is a demonstration experiment of the action of the coherer. The lower shows how to connect a light sensitive cell, such as the selenium cell, in the circuit to be affected by a more or less distant light.

This coherer is of very high resistance until an oscillatory current passes through it, after which its resistance is considerably lowered and enough current passes through to operate a high resistance relay. The relay closes a circuit through the device which it is desired to control. To restore the coherer to its original high resistance state, an ordinary doorbell may be used, arranged so that the hammer taps the glass tube of the coherer every time the relay circuit closes. A spark coil may be used for sending out the wireless control waves.

Q. 2.—Kindly give a diagram of "light" control of equipment with the use of selenium cells.

A. 2.—The control of equipment by means of light with the use of selenium cells is very simple. All that is required is a sensitive selenium cell, a sensitive high resistance relay and a source of light. The diagram shows how they are connected.



Simple diagram of the connections of a lead and aluminum plate rectifier. Note the central connection of the alternating current circuit.

Q. 3.—I have constructed a rectifier as per the attached diagram, using a saturated solution of borax and a lamp bank of 3 100-watt lamps in parallel, but it doesn't seem to rectify at all. What is the cause and how can I remedy this trouble?

A. 3.—We have checked over your diagram of your rectifier thoroughly and find it to be exactly correct. It is possible that the borax you are using is not pure, and we would suggest that you try a saturated solution of sodium phosphate, or else a 10 per cent solution of sulphuric or hydrochloric acid. Before changing the solutions, take your plates out and clean them thoroughly. Then place them in the solution, and connect to the 110-volt A. C., through a lamp bank. The size of this lamp bank will depend upon the amount of current you wish to draw from the D. C. side.

Now turn on the current and short-circuit the D. C. side of the rectifier for about five minutes. This will form the rectifying film on the aluminum plates, and if you follow the directions carefully you should not have the least bit of trouble.

Effect of Sodium Sulphate in the Electrolyte of a Storage Battery

(353)—W. P. Kinkead, Altoona, Pa., asks:

Q. 1. Will sodium sulphate in any way harm a lead plate battery? I would also like to know what sodium sulphate is composed of. I have been experimenting on sulphated plates and have been trying to find some way in which to remove the sulphate chemically without harming the battery.

A. 1. Sodium sulphate indirectly interferes with battery practice as it increases the specific gravity of the electrolyte. It is sometimes used by adding sodium carbonate to the electrolyte. This forms sodium sulphate and is supposed to help desulphate the plate. If thus used and the result attained, the solution must be poured out, the plates and jars washed with distilled water and regular electrolyte introduced. Sodium sulphate is a combination of sodium and the sulphuric acid radical; it contains sodium, sulphur and oxygen.

Storage Battery Plates

(354)—Tom Greensand, Chicago, Calif., writes:

Q. 1.—Please tell me if I can use the negative grid of a storage battery for making a positive plate. As a rule, when a battery gets old, the positive plate is a complete wreck, while the frame of the negative plate is still in good shape.

A. 1.—The frame of the negative plates may be used for making positive plates by removing all the compound and scraping the lead grid clean. The compound may

be removed easily by boiling the plates in water. The lead grids of both positive and negative plates of practically all lead plate storage batteries are similar, the only difference in the plates being the active material used. Complete detailed description of the construction of storage batteries, telling how the active material is made and applied to both plates, appeared in the May (1922) issue of PRACTICAL ELECTRICS. Information on charging the batteries is also given.

Winding an Auto Transformer

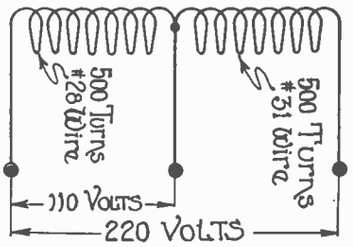


Diagram with data of a small transformer of the auto transformer type.

(355)—O. Schroedter, Chicago, Ill., writes:

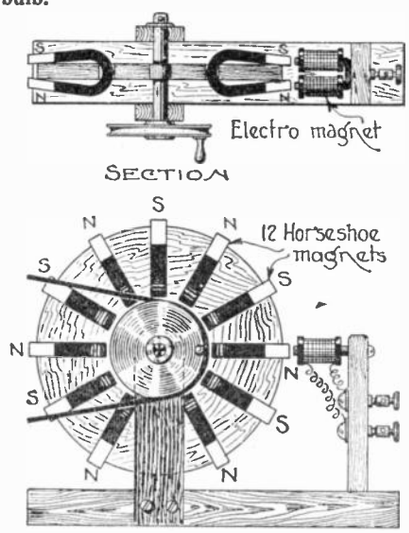
Q. 1.—I have the core and case of a Radio Corporation of America audio frequency amplifying transformer. How can I wind this with wire for an auto transformer, giving 220 volts on the secondary and 110 on the primary, using the connection shown on enclosed sheet?

A. 1.—The winding should be made up to fit the circular core as follows: The first 500 turns consist of No. 28 B. and S. gauge cotton-covered enamelled copper wire, and the next 500 turns consist of No. 31 cotton-covered enamelled wire. The smaller wire is wound directly over the larger and is connected to it, forming the middle tap shown in the diagram. The two windings, connected in series, form the secondary circuit and will deliver a little over .063 amperes at 220 volts without heating. The first 500 turns of the larger wire form the primary circuit and will draw about .125 amperes without heating. The wattage of the transformer is the secondary current times the secondary voltage, or .063 times 220 or nearly 15 watts.

Simple Electric Generator

(356)—Lee Butler, Greenville, S. C., writes:

Q. 1.—Tell me how to make an electric generator out of permanent magnets that will light a three or four-volt flashlight bulb.



Magneto generator similar to the Ford car generator which has done such good work in effecting the ignition and lighting of the car in question.

A. 1.—The illustration shows a simple and reliable generator that will serve your purpose. First, procure 12 four-inch horseshoe magnets of uniform size. These are fitted tightly in a wooden disc having 12 slots, and are held in place with wooden wedges. The finished wheel is mounted on a shaft with a crank and supported on suitable bearings.

An electromagnet taken from an old electric bell is mounted close to the periphery of the wheel as shown. The permanent magnets should be arranged so that their poles are alternately placed north and south, as indicated by the letters N and S. The electromagnet is connected to the two binding posts. The wheel should be adjusted, so that while turning the poles of the horseshoe magnets will come very close but not touch the poles of the electromagnet. Turning the wheel fast will generate current in the windings of the electromagnet, which current may be taken from the binding posts. The current will be alternating, and one turn of the wheel will generate six cycles or reversals of current.

Q. 2.—If larger wire is used in the armature will it generate more power?

A. 2.—The power generated varies with the power expended in turning the generator and depends upon the efficiency of the machine, not directly upon the size of wire. If larger wire is used, more current will be generated, but the voltage will be lower, assuming that with larger wire there will be fewer turns.

Microphone Buttons

(357)—Richard Colman, Brooklyn, N. Y., writes:

Q. 1.—I have seen two or three buttons advertised and have had one in my hand. It seemed to be a little brass affair. I understand that they are used in connection with telephones and loud speakers. Can you tell me anything about them?

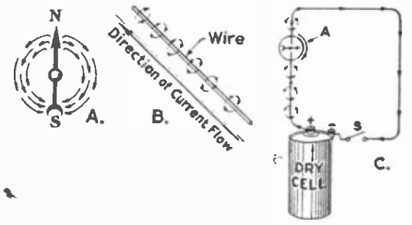
A. 1.—The buttons you refer to are really little powdered carbon microphones. They consist of a little brass cell within which there is a mica diaphragm or partition, and the space behind this partition is filled with pulverized carbon. You will see that this when properly connected constitutes a microphone, and it is as such that they are used. They are applicable to dictograph work, and to loud speakers, it being remembered that the button proper is a transmitter and not a receiver. To figure them to your mind, you have simply to think of a miniature carbon microphone.

Does the Compass Point South?

(358)—Mark Kelsey, Pittsburgh, Pa., writes:

Q. 1.—If like poles of a magnet repel each other, how, then, does the north pole of a magnetic needle point to the north pole of the earth?

A. 1.—The compass needle points to the north geographic pole of the earth, but not to the north magnetic pole. In other words, the north geographic pole is the south magnetic pole. This can be proved experimentally as shown in the illustration. At (A) is shown a magnetic compass needle, and the lines of force are assumed to emerge from the north pole and enter the south pole, as shown by the arrows. We also know that a wire carrying current sets up magnetic lines of force in the direction of the arrows shown at (B). This direction is determined by means of the well-known right-hand rule. Grasp the conductor with the right hand so that the thumb points in the direction of the current flow; then the fingers will point in the direction of the magnetic lines of force. Now place a delicate compass over the wire carrying current as shown at (C). The wire should be running north and south, so that before the switch (S) is closed the compass needle will be parallel to the wire. On closing the switch the needle will be deflected, and by noting the direction in which the needle turns we can determine which pole of the needle is the north pole. It will be observed that the point of the needle will move in the direction indicated by the arrow (A), so that the point of the needle must therefore be the north pole, and since the needle points to the north geographic pole of the earth it follows, then, that the north geographic pole must be the south magnetic pole.



The field of force of the earth and how it affects the magnet, referred also to the field established by an ordinary circuit.

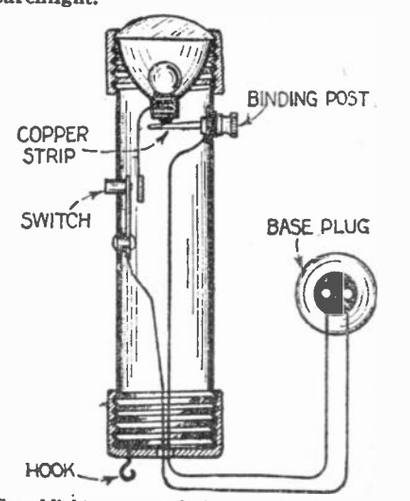
Handy Searchlight

(359)—J. L. Smith, Newark, N. J., writes:

Q. 1.—In your "How and Why?" section please show the construction of a simple hand searchlight that may be plugged into a 110-volt base plug outlet. This searchlight is to be used in a large room and it is desired to use a long flexible cord for connecting the light to the 110-volt outlet.

A. 1.—The illustration shows a simple searchlight which will probably meet your requirements. This searchlight is made from the parts of a large size dry battery flashlight as shown. As there are no small 110-volt bulbs on the market, it will be necessary to use a resistance or step-down transformer in the 110-volt line for cutting down the voltage, so that a lower voltage bulb may be used without danger of burning out.

Perhaps the simplest and neatest resistance unit to use is the type that comes already assembled in a 110-volt lamp socket for dimming the light, or for an all-night light. There are several types on the market, and one should be selected that will have the proper resistance so that the small bulb will light up to full brilliancy. The resistance socket may be screwed into the base plug, and the plug on the end of the long flexible cord is screwed into the resistance socket. Care should be taken to insulate the parts well, or an unpleasant and possibly dangerous shock may result when handling the searchlight.



Searchlight converted into a hand trouble-lamp to be supplied from a plug, and containing no battery of its own.

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D2600 Two foot loop aerial, complete..$1.15

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D2400 Two volt, 40 ampere hour storage battery, size 2¾x8x9" $3.90
D640 Six volt, 40 ampere hour storage battery, size 4¾x7¼x9" 7.25
D660 Six volt, 60 ampere hour storage battery, size 6x7x9¼" 9.50

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Highest grade mahogany cabinets made. Best hand rubbed finish. Top is hinged. Front of cabinet rabbetted to fit panel. Price delivered to your door; no panel included in these prices. Entire cabinet made of ½" well seasoned stock.

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D712 Wood cabinets, panel size 7x12" 3.00
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The finest Bezel on the market. Best brass mesh used. The Bezel comes entirely nickle plated. Will improve looks of your panel 100 per cent. Outside diameter 1". Can be used on ⅛" or 3-16" panel.

D1700 Rasco bezel .....$.15
D1701 Bezel 1½" diam. .20

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THE bearing to hold variometer and variocoupler rotors. Total length of bearing 2¼". Outside shaft, 1¼". Length of thread 1". Length of threaded sleeve, ⅝".

D1375 Bearing .....$.25

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Thinnest copper foil made, .001" thick. Comes 4" wide.

D5025 Copper Foil per ft. $.10
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D350 6"x12"x3-16" thick, each.....$1.50
D352 9"x12"x3-16" thick, each..... 1.75
D353 12"x18"x3-16" thick, each 4.00
D354 6½"x19½"x3-16" thick, each.... 1.90
D356 6"x14"x3-16" thick, each 1.60
D357 6"x4"x3-16" thick, each ..... .65

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D8100 Variocoupler, prepaid $1.50

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D2020 2000 ohms, double head set TUNED. $4.45
D3030 3000 ohms, double head set TUNED..$5.50

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1-D4310 6 ohm Rheostat..... .45
8-D201 "Rasco" Binding Posts..... .80
8-Assorted Binding Post Name Plates .18
5-D6400 Feet Bus Bar Wire..... .25
1-D5209 Consolidated Autoplex pattern .50
Total $15.83

Our special price, complete.....$15.25

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Substitute for Vacuum Tube Socket. Four of these take one Vacuum Tube. Grasp tube firmly. Best contact possible. Take less room. Are better.

D1550 Sockettes, nickeled, set of 4 .....$.25
D1551 Sockettes, nickeled, set of 4 (to take WD-11 Tube).... .25
Note: Set of 4 sufficient to hold 1 tube.

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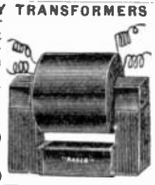

D1100 A.F. Transformer, ratio 4¼ to 1 .....$2.00
D1150 A.F. Transformer, ratio 6½ to 1 .....$2.00

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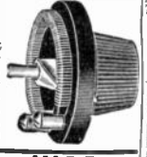
The best Radio Frequency Transformer developed so far. Designed for us by Mr. R. E. Lacault, Associate Editor of RADIO NEWS. Air core. Guaranteed to do the work. This Transformer brings in the long distances.

D2800 Radio Frequency Transformer, size 1⅞"x2½" $1.50

RHEOSTATS AND POTENTIOMETERS



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D4310 6 ohm, each $.45
D4311 30 ohms, for 301a and 201a tubes, each 65
D4312 Potentiometer, 200 Ohms, each.... .85

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D3200 Spider web form, each .....$.25
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3201

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D1425 Brass Rod, plain ¼" round, per length ..... .10
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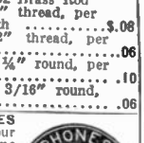
"RASCO" NAME PLATES



The circular plate is our new Binding Post Name Plate, Diameter, ⅞". These denominations: PHONES, GROUND, —, OUTPUT, "A" BATTERY —, "B" BATTERY—, LOUD SPEAKER, GRID, LOAD, "C" BATTERY—, AERIAL, +, INPUT, "A" BATTERY+, "B" BATT +, LOOP, TICKLER, PLATE, "C" BATT +, FILAMENT.

D6000 to 6019 Binding Post Name Plates, each denomination .....$.03
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D2650 Spider-web Reinartz coil $1.15

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The Phonodapter will fit any phone. Metal tube fits any standard phonograph. Make your phonograph a loud talker. Fits Columbia, Victor and Sonora phonographs. Is made entirely of pure soft rubber with brass tube insert.

D1310 Phonodapter .....$.40

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The Double Phonodapter fits all phonographs and will take any standard double head set, thereby making your phonograph a loud talker. Made of cast metal, nickel plated and highly polished. Has three generous soft rubber bushings.

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D823 equals No. 25 B&S, per foot .....$.02
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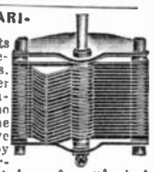

This condenser presents the latest word in precision mechanics. Plates, washers, and all other parts are accurately machined. Positively no better condenser on the market. Shafts ¼". Save from 40% to 60% by assembling condenser yourself. A child can do it in a few minutes' spare time. Capacity guaranteed.

D1111 11 plate condenser, .00025 mfd. $1.10
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D4343 43 plate condenser, .001 mfd. 1.50

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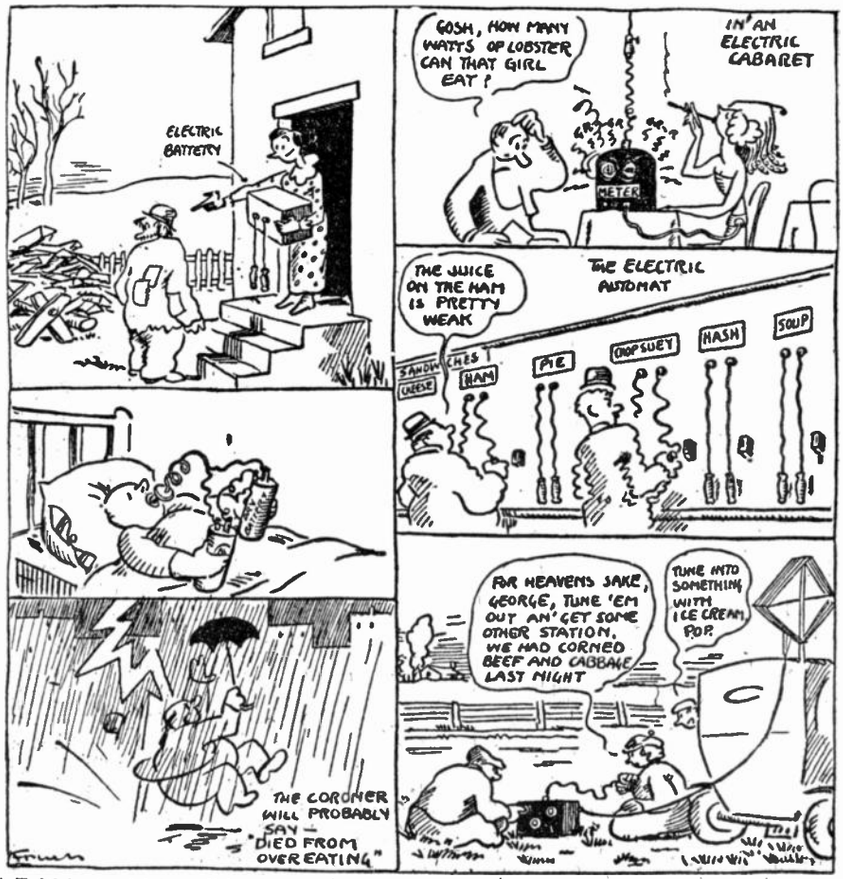


A British physicist predicts that the time will come when MAN will dine on electric vibrations.
Acknowledgments to the New York World

Time Lag Fuse

IN mechanical circuit breakers, time-lag has been recognized as an important element. In some cases the trade name of fuses involves the use of the word "time element" as indicating the nature of the appliance.

In the operation of motors a very heavy current is often required to start with. If this current is left to pass through them, they will draw so much in some cases that they may become overheated and the motor windings will be injured, yet, for a few seconds' use only the heavy current is quite essential.

The construction of the fuse referred to here is quite simple; a copper wire passes the current, and soldered to the copper wire are some beads or globules of a fusible alloy of copper, tin and antimony in a standard construction. The copper wire alone will pass a current much greater than that for which the fuse is rated. But in passing the current above the rating of the fuse, the copper wire is heated, the fusible metals alloy with it after the lapse of a few seconds, and the instant they alloy the fuse parts, the circuit is broken and the motor is protected.

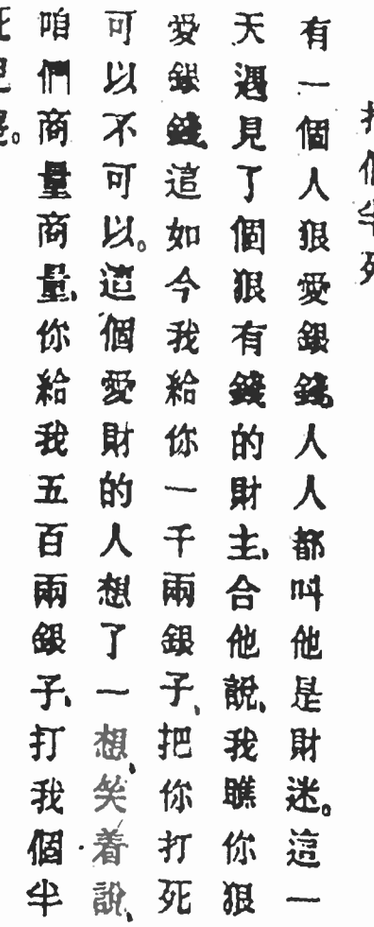
The peculiarity of the action is based on the delay which ensues when too great a current is passed. Thus, presuming a motor is to be started, as there is no counter-electromotive force until it begins to rotate, it takes a very heavy draft of current and then begins to turn, generating counter-electromotive force and so cutting down the current. If protected by one of these fuses, a period of three seconds and upwards may elapse before the alloying of the fuse takes place so that it will blow. This period is sufficient to allow a D. C. motor to develop a full protective counter-electromotive force and to cut down the current to safe limits.

If for any reason, as in the operation of A. C. motors, the full starting current is left on by mistake, the motor is pro-

tected, because the fuse will blow in a few seconds before the armature or rotor coils of the machine can burn out. Thus the fuse renders perfect protection if too heavy a current is maintained, while providing for the passage of a heavy starting current, but for so few seconds that no harm can ensue.

Telegraphic Transmission of Chinese

THE illustration shows a rather interesting example of the transmission of pictures by telegraphy. This is a Chinese message pictorially transmitted by the apparatus described in our issues of August and September, 1923.



We speak of it as an example of picture transmission, and so it is to all intents and purposes, as there would be no other way of transmitting it literally. It certainly is an interesting application of the miracle of telegraphy. The telegraph here has done more than could be done by code unless the operator knew Chinese.

Plant Stimulation by Light

ACCORDING to the *Transactions* of the I. E. S., Dr. William Crocker, research director of the new Thompson Institute for Plant Research which Colonel William B. Thompson is establishing in Yonkers, U. S. A., at a first cost of more than $500,000, intends to use powerful electric lamps to supplement sunlight in growing plants. Eventually the institution is to cost $2,500,000.

"This new institution, with its gardens, greenhouses and laboratories," said Dr. Crocker, "is to be to plants and flowers what the Rockefeller Institute is to humanity. In other words, it is to study

and try to cure diseases of plants and flowers and other vegetation." Dr. Crocker has had wide experience as head of plant physiology at the University of Chicago. On the board of trustees is the scientific group, including Prof. John Coulter of the University of Chicago, Prof. L. R. Jones of the University of Wisconsin, Dr. Raymond Foss Bacon, consulting chemist of New York city, and Dr. Crocker. The laboratories are to be located on a nine-acre plot at 1086 North Broadway, Yonkers. In these chambers the temperature, humidity, carbon dioxide concentration of the air and the quality, intensity and duration of light will be adjustable at will and automatically maintained.

Bare Aluminium Conductors

THERE is no better example of the usefulness of aluminium than as the material for heavy current busbars, or for other bare conductors. For such purposes aluminium can be used instead of copper with a cost saving which at present prices is even greater than formerly. In addition the weight to be supported by the insulators would be halved by such a substitution, and other advantages are obtained in the direction of easier erection and better cooling.

The average specific resistance of aluminium bars can be taken as 2.84 microhms per cm. cube at 20° C. and that for ordinary hard drawn copper bars as 1.76 microhms per cm. cube. An aluminium bar should therefore be 61 per cent larger in section than a copper bar of equal conductance. In actual practice, the size of copper bar used is selected from one or other of the manufacturers' standard sizes, and often is based upon some assumed value for current density, usually 1,000 A. per sq. in. In these circumstances it is unnecessary to consider the exact equivalent section for aluminium, and it will usually be found that, having fixed the size of copper, the most suitable size of aluminium is a bar of the same width and a little over 1½ times the thickness. Suppose, for example, a bar is required to carry 225 A continuously. At 1,000 A per sq. in. the section of copper bar is 0.225 sq. in., and the aluminium section for equal resistance would be 0.362 sq. in. The nearest standard sizes to these are 2 in. by ⅛ in. for copper (= 0.25 sq. in.) and 2 in. by 3/16 in. for aluminium (= 0.375 sq. in.). It will be appreciated that these bars will not be exactly equivalent in resistance, but as the voltage drop is not of vital importance provided that it lies within reasonable limits, they will be equally satisfactory in operation. For round rod a similar working rule is to make the aluminium rod 1¼ times the diameter of the copper rod.

Temperature Rise Data

The section of an aluminium bar being larger than that of a copper bar of equal resistance it will normally have a larger radiating surface, and hence a smaller temperature rise when carrying the same current. Conversely for equal temperature rise a smaller section of aluminium bar can be employed having a higher resistance, and when the necessity for keeping the temperature rise within safe limits becomes the deciding factor on conductor size, an additional cost and weight saving is effected by the use of aluminium.

There is a fairly widespread impression that jointing with aluminium is a matter of some particular difficulty, and that aluminium joints cannot be relied upon. Nothing is further from the truth. Aluminium flat bar is jointed by overlapped joints, clamped or bolted together, as is the case with copper, and there is no difficulty whatever in obtaining a sound

joint having less resistance than an equal length of unjointed bar, and in maintaining this resistance constant.

The best results are obtained by rough filing the bars and arranging that the file marks on the two surfaces will be at right angles when they are put together. This filing is not enough of itself, however, and, before bolting up, the two surfaces should be covered with a thick layer of vaseline and cleaned with emery cloth under the grease. The reason for this is that aluminium oxidizes upon the surface with extreme rapidity, and a freshly filed surface in a few seconds becomes covered with an invisible layer of oxide, which, though microscopically thin, has an appreciable effect upon the contact resistance. If the surface is cleaned under vaseline the oxide is removed and the vaseline protects the surface from re-oxidation by the air. When the two bars are finally pressed together, the tightening of the bolts squeezes out the vaseline and leaves the clean surfaces in contact. Further, the vaseline fills any small cavities which may be left, and tends to maintain the efficiency of the joint by preventing the condensation of moisture within such gaps.

It should be noted that the width of the bar has no bearing on the length of overlap required, the same length of overlap being equally suitable for all bars of the same thickness whatever may be the width.

The welding of aluminium is a matter of simplicity. The usual practice in jointing round rod, for example, is to heat the ends in the flame of a plumber's blow lamp until they begin to melt, when they are pushed together. The result is a joint which is homogeneous throughout, and, when filed up, cannot be detected either by appearance or by mechanical or electrical tests. Although the method of making these joints is ridiculously easy the joints are nevertheless perfect.

Electric welding is not yet commercially possible with aluminium, but welding with the oxy-acetylene blowpipe is a well-established process which would appear capable of solving many of the problems of installation. A more general appreciation of the possibilities of this process should lead to its employment at a wide extent for bare conductor installations, since by its aid bolted joints can be practically eliminated.

On the other hand, aluminium being highly electro-positive, it is somewhat susceptible to corrosion by electrolysis, although, fortunately, trouble due to this cause is always avoidable. Joints between aluminium and other metals, though perfectly satisfactory in a dry atmosphere, are liable to rapid corrosion should moisture condense on them, due to the constant circulation of minute currents under the action of the electro-chemical potential. Too much emphasis cannot be placed upon the desirability of painting such joints when moisture deposits are likely to occur.

For a similar reason a slow leakage of current from an aluminium bar through moisture is also liable to result in local corrosion. In one case recently brought to the writer's notice aluminium bars rested upon unenamelled slate supports in a damp atmosphere. Appreciable surface leakage occurred at the slate, and corrosion of the aluminium commenced at the points where the bars rested on the supports. The whole trouble was overcome by inserting strips of mica between the bars and the slate.

In many cases copper is specified as a matter of habit, and it is now becoming recognized that this is an expensive habit, which adds to the cost of the scheme without in the least increasing its efficiency or reliability.—*London Electrician.*

Peat for Electrical Generation

AN interesting account of a German generating station which is operated mainly by peat as a fuel is given in the Report of the British Fuel Research Board for 1922-23. The station in question is situated on the Auricher Wiesmoor in Prussia, and has a present generating capacity of 21,050 kilowatts. It consumes about 30,000 tons of coal and 60,000 tons of peat per annum. The peat is mechanically handled from the beds to the boiler house by wagons and conveyors, and an interesting delivery arrangement ensures that it is moved into the furnace without jamming. The average result obtained is 3.0 kg. of peat per kilowatt hour, though as low a figure as 2.2 kg. has been realized. This station supplies energy to a considerable distance, transmission voltages of 20,000, 40,000 and 60,000 volts being used. The present annual output of peat is 60,000 tons, though it is hoped to increase it to 100,000 tons. It can only be dug from the beginning of March to the end of July, and this and the drying and storing operations are entirely effected by electrically driven machinery.

A Soldering Kink

IT happens often that the head-phones' cords to which are attached the cord tips are pulled out of the tips, sometimes accidentally or sometimes through carelessness. It is very difficult to solder the cords to the tips, as the fine wires of which the cord tip is composed are in danger of melting off. A better way, I have found, is to take some No. 30 bare copper wire, strip off about a quarter of an inch of the insulation on the cord tip, and wrap the bare copper wire tightly around the stripped wires.

Tie the wire so it cannot untwist. Do not wrap too much wire on the cord, or you will not be able to get the cord tip into the regular tip. Take the tip and hold it in a pair of pliers in the flame of a torch or alcohol lamp. Melt a drop of solder into the tip, with some flux of non-corrosive type, then, still holding the tip in the flame, quickly push the wrapped cord into the tip. The insulation on the phone cord will be only slightly charred, if at all, by this method, and the solder will be forced against the wire-wrapped end of the cord, and the cord tip, which will make a perfect connection and a neat one. The best way is to use cored solder containing flux in the center of the strip—so-called acid-core solder.

Contributed by OSCAR W. SIPPLE.

Silver Contacts for Electrical Apparatus

THERE are few pieces of electrical apparatus which can be constructed without the use of contacts. It is customary to use platinum, but its exceedingly high price is turning us more and more toward the use of silver instead. The following method of making contact pieces has been successfully applied in the construction of bells, buzzers, automatic telegraph keys, relays, etc.

The silver may be obtained from old sterling silver jewelry, spoons, or it may be bought in the form of foil or wire. A piece large enough to form the contact desired is cut off and placed in a little hollow in a block of charcoal and covered with a little borax. The flame from an ordinary mouth blowpipe is then directed upon the silver. It will soon fuse and form a small globule, which, after cooling, should be cleaned in nitric acid and finally attached to its support by solder. The

easiest method of soldering it is to roughen its surface and, after smearing it with solder paste and placing it in position on the apparatus, a drop of solder is allowed to flow between the globule and its support from a soldering iron. The excess solder must then be filed off and the face of the contact leveled.

Contributed by ELLIOTT R. WEYER.

Electric Carbon-Monoxide Meter

TO obtain a perfect control of the operation of a boiler plant, the constant observation of both carbon-dioxide and carbon-monoxide are essential. For measuring both of these gases electric indicators can be used based upon the different heat conductivity of the gases as compared with air. Two short platinum wires are each inclosed within a tube, through one of which passes air and through the other the gas to be volumetrically measured. The wires are electrically heated and change their ohmic resistance according to the amount of CO_2 or CO which passes through the respective tubes. Connecting the air wire and the gas wire into a Wheatstone bridge, a millivoltmeter in the bridge can be directly calibrated in per cent of CO_2 or CO. Both instruments are installed side by side near the boiler, and the gases are forced through their gas tubes by a partial vacuum created by a small water-jet pump. Any number of indicating or recording instruments may be remotely connected to these two sending apparatus. It is claimed that these instruments give far more accurate indications of the amount of these gases in the flues than any chemically operating types.—*M. Moeller in Siemens Zeitschrift.*

Insulation Tests

AS I have been conducting some experiments to determine insulation values I thought that you may be interterested in the results I obtained.

Some of the insulators I tested were hard rubber, fibre, electrose, asbestos, porcelain, bakelite, mica and slate. I found that all but slate were equally good insulators to a direct non-pulsating current. Slate has the lowest insulation value, as there is always moisture present to a slight extent.

When an alternating current of sixty cycles was used there was a very slight drop through marble, porcelain and fibre. The difference in drop of a 60-cycle current and a direct current can only be detected with the most delicate instruments.

At a frequency of 800,000 cycles the drop through porcelain is very noticeable, while the drop in mica and asbestos is not noticeable at 300,500 cycles.

With electrose, hard rubber and bakelite a slight drop was obtained at 280,000 cycles. All the insulators tested had a glazed finish.

Contributed by ROBERT W. TAYLOR.

X-Ray Examination of Strained Metals

THE *Japanese Journal of Physics* contains an abstract of Mr. Akimasa Ono's account of his X-ray interference examination of strained metals, viz., copper wires (in the drawn and annealed states) low carbon steel bars (in the pulled and annealed states), etc., using the rays issuing from a Coolidge tube with a tungsten anticathode. The results show that the crystal lattices of metals display fibrous structures in the pulled or drawn state, the structural rearrangement proceeding as the degree of strain increases. Particularly in the case of copper, of which the atoms are known to be arranged in a face-centered cubic lattice, the inclinations of several simple planes in the lattice to the

primary ray and the relative intensity of diffracted rays are calculated. It is shown that the group of small crystals considered to be symmetrically arranged in such a manner that the trigonal axis of the lattice stands in the longitudinal direction of wire, gives rise to the pattern obtained in the experiment on wires drawn to a sufficient degree. It is suggested that the changes in the lattice arrangement of crystals afford a natural explanation of the change of properties observed in metals that have been subjected to strain.

Electric Lamps in the U. S. A.

THE total sales of tungsten filament incandescent lamps (excluding miniature lamps) in the United States during 1922 amounted to slightly over 200 million lamps—a 25 per cent increase over the 1921 sales of 160 millions, and within 1 per cent of the 202 millions sold in 1920. There were less than three million carbon lamps sold in 1922, compared with six millions in 1921 and nine millions in 1920. It is apparent that the carbon lamp will soon disappear from the market; it is now a negligible item in the total lamp sales. Manufacturers have developed a coloring material for lamps which has been very satisfactory. It is sprayed on the lamp, is weatherproof, and does not fade. It is even more uniform in color than natural colored glass bulbs, which vary in color, due to the variation in density and thickness of individual bulbs. Sprayed colored lamps can be supplied more quickly than natural colored glass lamps, as the sprayed color can be quickly applied to clear lamps in stock, whereas the natural colored glass lamps usually have to be made to order and often the bulbs have to be specially blown. Only four colors are supplied, which are standard shades of red, blue, green and yellow. The sprayed colored lamp is no more expensive than dipped colored lamps and is cheaper than natural colored glass lamps. The sprayed color can also be satisfactorily used on Mazda C lamps up to and including the 150-watt size.—*Transactions, I. E. S.*

Chemicals Produced by the Aid of Electricity

THE Department of Commerce announces that the reports made to the Bureau of the Census show a production of chemicals by processes involving the use of electricity of the value of $58,180,500 in 1921, as compared with $82,590,000 in 1919, a decrease of almost 30 per cent. In 1914, the value of chemicals produced by the aid of electricity was only $29,661,949. The increase, therefore, for the seven-year period, 1921-1914, was 96 per cent. The establishments reporting were 127 in number in 1921, 114 in 1919 and 36 in 1914. The principal products so produced, named in the order of value, are aluminum, the ferro-alloys, calcium carbide, chlorine bleaches (including chlorine and the hypochlorites), sodium hydroxide, the abrasives (including aluminous and siliceous), peroxide of hydrogen and oxygen. Many of these products serve as a basic raw material for the production of a great variety of other chemicals.

Non-Magnetic Iron

IT would seem to be one of the most remarkable coincidences of which we have record, that the production of non-magnetic iron should be simultaneous, as years ago, with that of iron defying rust and stain. The latter is rapidly coming into use in various branches of manufacture. We have a practically complete line of stainless steel cutlery; precise measuring scales for fine machine work are ap-

pearing; and the metal is being employed for making valves and other important parts of operating machinery.

The new non-magnetic cast iron was produced in England, and is the result of experiments conducted by S. E. D. Dawson, chemist and foundry manager for Ferranti, Ltd., Manchester. According to *Iron and Coal Trades Review*, London, the metal, which is called "No-Mag," is an alloy with properties similar to those of brass or gun metal, but is much less expensive. It is especially valuable in electrical construction.

The iron can be cast with the same facility as ordinary cast iron, and has the same appearance. In strength it follows the usual figures for cast iron, but has the advantage of increased toughness and malleability.

The cost of "No-Mag" is dependent upon the type of casting, and, roughly, may be taken to be 20 to 50 per cent higher than that of gray iron. When the price is compared with that of gun metal the advantage is obvious.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of PRACTICAL ELECTRICS, at New York, N. Y. Published Monthly for October 1, 1923

STATE OF NEW YORK—
COUNTY OF NEW YORK, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the PRACTICAL ELECTRICS and that the following, is to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Experimenter Publishing Co., 53 Park Place, New York City.

Editor, Hugo Gernsback, 53 Park Place, New York City.

Managing Editor, Thomas O'Conor Sloane, 53 Park Place, New York City.

Business Manager, Robert W. DeMott, 53 Park Place, New York City.

2. That the owner is: (If the publication is owned by an individual his name and address, or if owned by more than one individual the name and address of each, should be given below; if the publication is owned by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent or more of the total amount of stock should be given.) Practical Electrics Co., Inc., whose stockholders consist of: Hugo Gernsback, 53 Park Place, New York City; Sidney Gernsback, 53 Park Place, New York City; Robert W. DeMott, 53 Park Place, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is:

(This information is required from daily publications only.)

H. GERNSBACK.

Sworn to and subscribed before me this 18th day of September, 1923.

(Seal.) Joseph H. Kraus

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My commission expires March 30. 1925.

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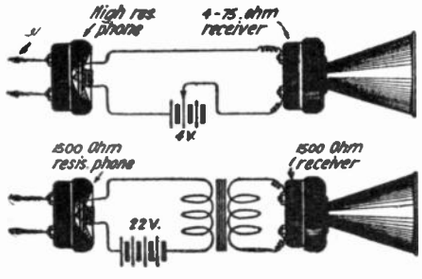

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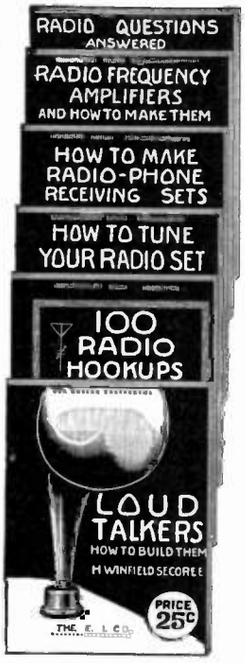

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