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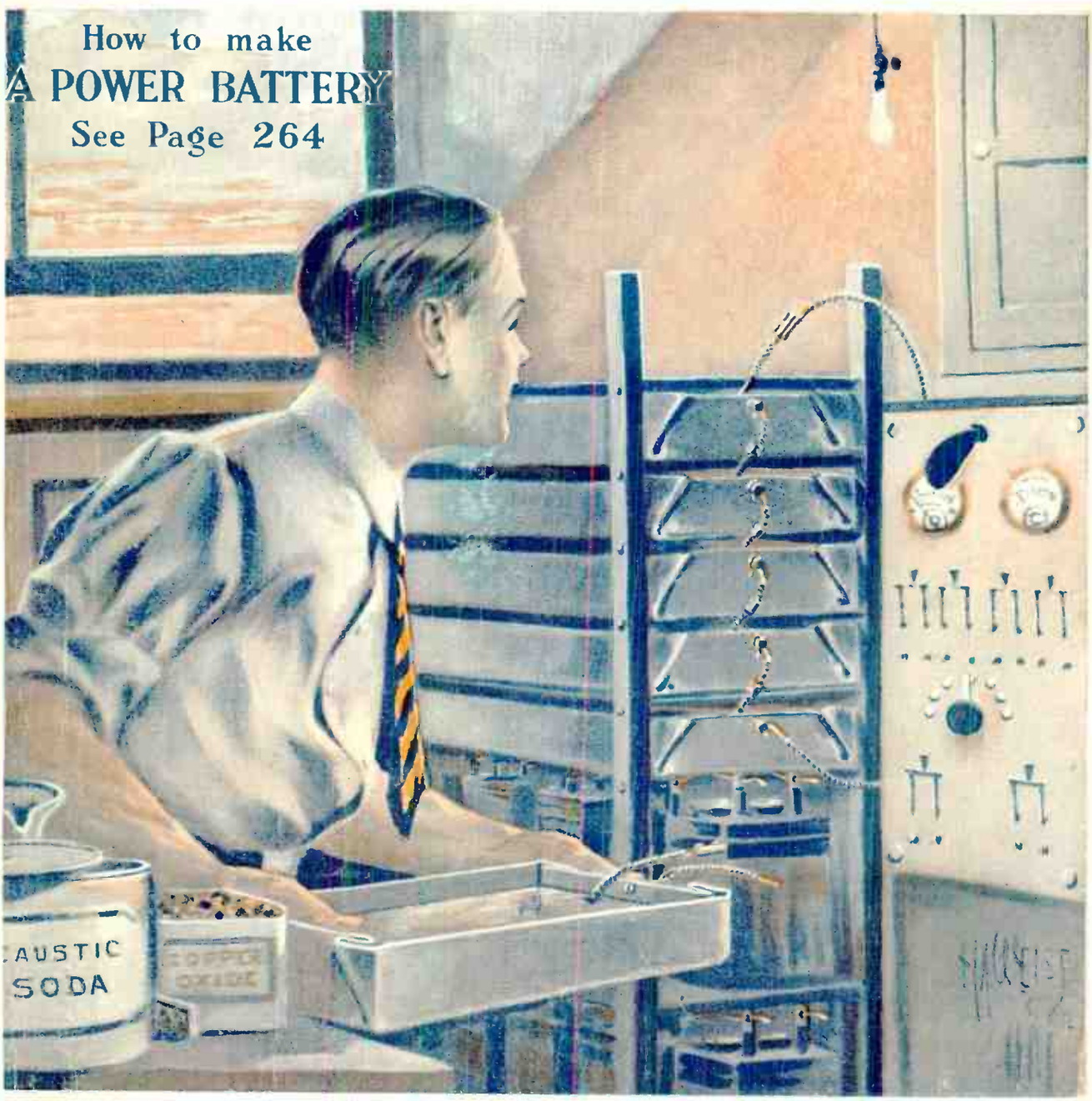

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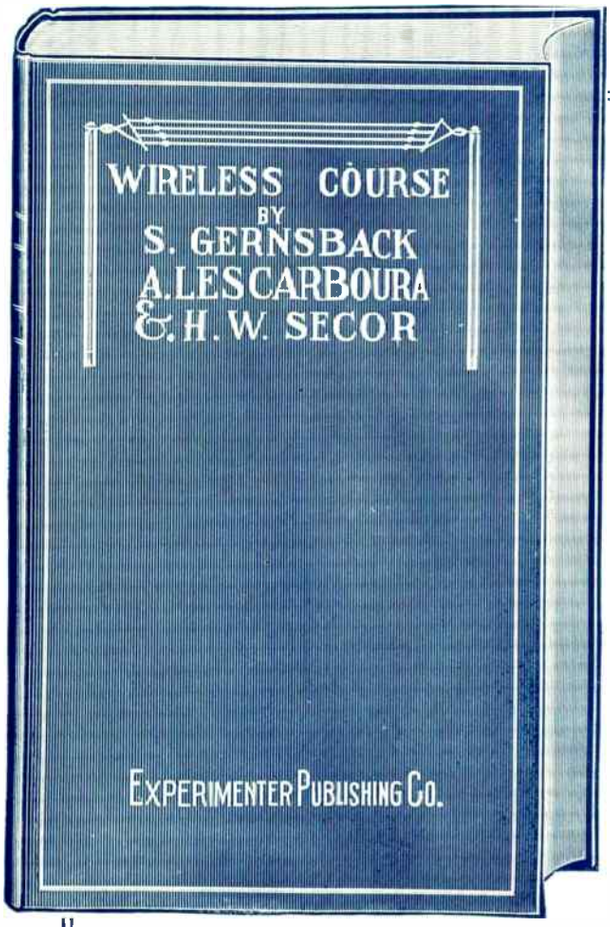

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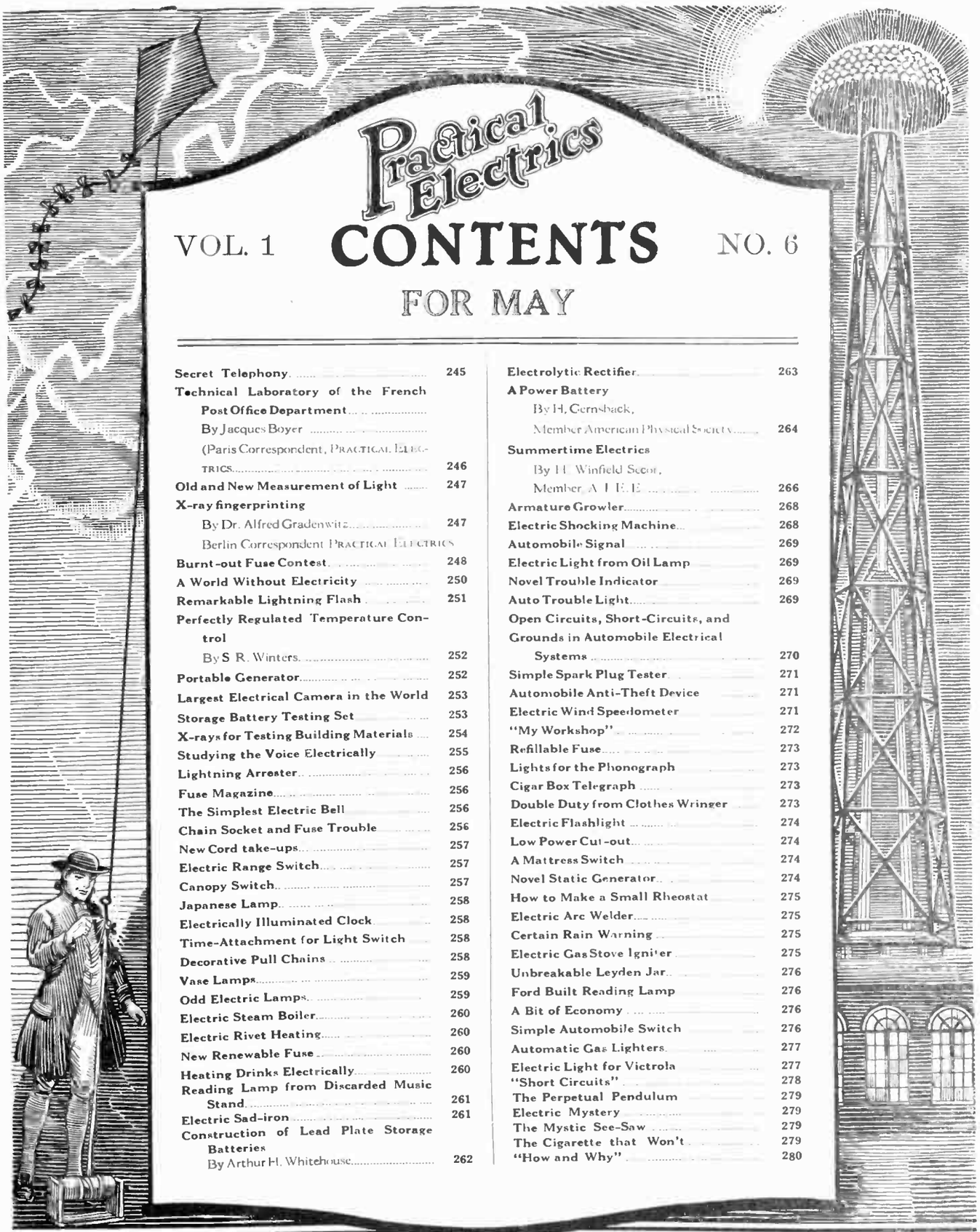

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VOL. 1 **CONTENTS** NO. 6

FOR MAY

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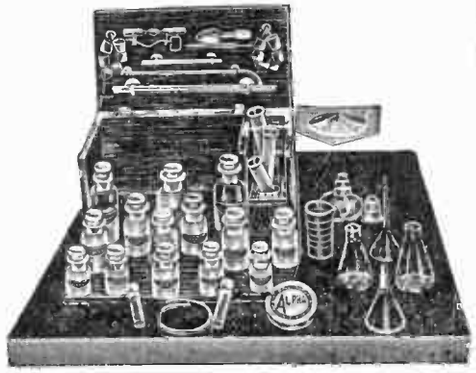

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Volume 1
No. 6

Practical Electrics

May
1922

H. GERNSBACK,-EDITOR T. O'CONOR SLOANE, Ph. D.:-ASSOCIATE EDITOR

Secret Telephony

A new telephone which originated during the war, called the Superphone. The vacuum tube amplifier is used, as the current is such that the message cannot be received on an ordinary telephone. Anyone attempting to listen in on the line finds it absolutely silent.

NEARLY a half century has passed since Alexander Graham Bell exhibited his telephone at the Centennial Exposition in Philadelphia in 1876. With the Blake transmitter, a sort of standardization was soon reached, but soon improvement began, and telephony became better each year.

As a general rule, the telephone operators do not "listen in", but now and then cross wires occur, or telephone lines are tapped, and former secrets of others become public property. The adage that scandal will out is particularly true when that gossip is promulgated over a telephone. On party lines, privacy is utterly impossible.

There is a new device, a photo of which is shown, which was originally a war measure, rather than an invention intended for private use. During the war, messages over telephone lines (acknowledged to be the speediest), could not be transmitted unless private wires were laid between intercommunicating offices, for fear of the ever present spy. At the present time, the private line system is being used in Wall Street, where central offices are communicating with branches throughout the country. Here again, the cost of installing such private wires is very great, and communications narrow themselves down to the number of such private wires.

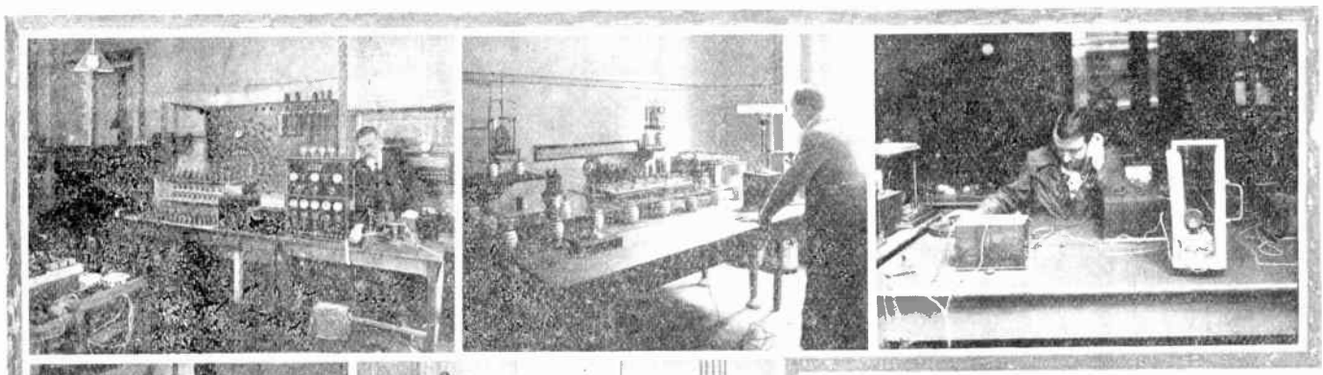
But the office of the Signal Corps has not been quiet, and resting, all these years. As a matter of fact, private telephone conversations have been conducted over the regular telephone lines by the aid of a new invention called "Superphone." This device is an ordinary telephone apparatus connected to a transmitting and receiving unit of the vacuum tube type in such a manner that after the physical line and connection has been established in a normal manner, a switch button is thrown, which automatically cuts out the regular telephone and replaces it with the Superphone connected to the vacuum tube apparatus. In this manner the ordinary audio frequency current affects the amplitude of radio waves to correspond with the speaking or telephone undulations. The infinitesimal radio waves follow the wire. They cannot cause the telephone receiver to "speak" as they are so weak, but at the receiving station, strengthened by audion, the amplitudes of the waves are integrated.

The result is that anyone attempting to listen in on the conversation finds the line entirely silent. At the distant end of the circuit, another vacuum tube device similar to the receiving apparatus of a wireless set is connected into the circuit, and the high frequency waves are here integrated, bringing the current effectively to a frequency audible to the human ear. Circuits are tuned in a manner similar to wireless tuning, and when once adjusted require no further regulation. By actual test it has been found that this device will work equally well on underground telephone cables or with overhead wires, such as are employed in long distance telephone transmission.

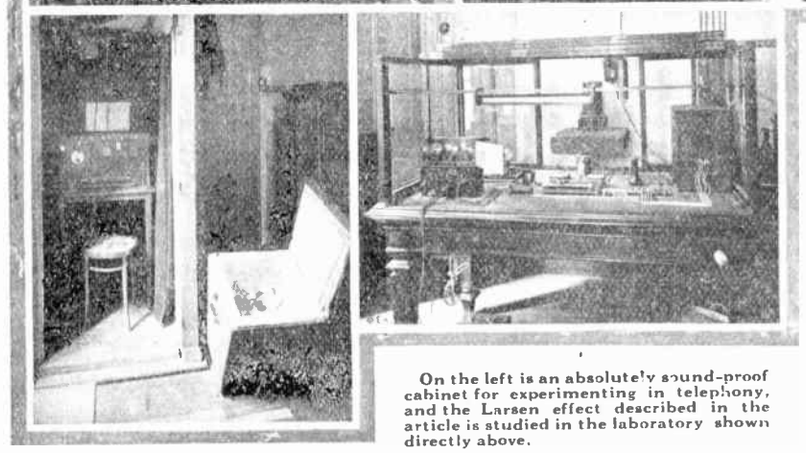
The installation no doubt will prove of great utility in ordinary commercial life, because it in no way interferes with the regular telephone system. If, for instance, a New York office desired to speak to a Chicago office regarding some secret matters, undesirable for even the telephone operator to listen in upon, several code letters could be called out at first. These codes will correspond to different settings of the tuning condenser at the receiving end of the telephonic connection. The operator here adjusts the condenser to the point indicated by the code and presses the button upon the Superphone, which automatically cuts out the regular telephone, and substitutes for it the Superphone with its audion or vacuum tube circuit. Then whatever he hears or says is transmitted clear through to the other end of the line without interruption and with absolute secrecy inaudible to everyone except those at the ends of the line. The system should be of further value to detective agencies, who may by its use broadcast criminal information to other points, and thus apprehending a criminal without the slightest danger of having a "tip" leak out.

Technical Laboratory of the French Post Office Department

By Jacques Boyer
(Paris Correspondent, PRACTICAL ELECTRICS)



These five illustrations show scenes in the technical laboratory of the French post office. Above on the left hand, work is being done on the application of five audions for the reception of cable messages. The central scene illustrates how measurements are made by means of the Thompson galvanometer and the Lord Kelvin bridge. These operations are of the highest degree of accuracy. Above, telephonometric tests are being carried out.



On the left is an absolutely sound-proof cabinet for experimenting in telephony, and the Larsen effect described in the article is studied in the laboratory shown directly above.

THE technical engineers of the French telegraph and telephone administrations are engaged in developing the best methods of operation of telegraph and telephone lines.

The laboratory wherein these important researches are carried on is part of a Center of Technical Studies directed by M. Donnery, Inspector General of the Post Office and Telegraph Departments, which includes besides the higher School of Telegraphy, the Technical Research Service of the Post Office and Telegraph Departments, and the technical committee of the Post Office and Telegraph Departments.

The instruments for measurement and experimental apparatus contained in this laboratory which are to be seen there, will bear comparison with similar laboratories of the General Post Office of London or of the Western Electric Company of New York.

At the request of M. Donnery, the administration sent M. Valensi, Engineer, and M. Montorfol, Inspector of Telegraphs, to study the subject in England and in the United States, and on their return they made out a schedule of installations to be set up, and a program of the most important researches to be carried on in different branches of telegraphy and telephony.

The laboratory now is devoted especially to telegraphic, telephonic, radio-telegraphic and radio-telephonic research of all kinds. Work on a very original installation of multiple telephony is in progress. With this arrangement three persons can talk at the same time over the same line with three other persons in a distant receiving station. Following up the results obtained in the laboratory, the next step will be to put this system into operation on an exterior line. For instance, they can superimpose on the regular line four other communications by means of alternating, high frequency currents, received at the transmitting station by microphone and separated at the receiving station by the proper electric filters and then received and amplified by audions. This multiple telephonic apparatus will augument the work of the existing lines four times.

Telephonic relays are being experimented with every day in the laboratory. As amplifiers, audions are used for amplifying telephonic conversation weakened by a long distance. These telephonic relays not only render possible conversation at enormous distances, but effect considerable economies in the construction of the lines.

The technical service of the Post Office or Telegraph Departments has on foot a project for a cable between Paris, Nancy and Strassburg, with thin copper wires insulated by paper, contained in a lead tube and with Pupin coils and amplifying relays. The conductors thus established will improve the hearing to a considerable degree and permit Alsace and Lorraine to speak with any part of France.

In the same laboratory, amplifyers with five vacuum tubes are being tried, to facilitate the reception of cable messages. For this the experts are utilizing experimental lines. At the time of our visit, we saw portable resistances and condensers, which represent a cable from Marseilles to Algiers. Another series of resistances and capacities correspond to those of Brest to Daker. The operator near the audion 5-tubes (Figure 1) receives by means of a siphon recorder a cable message sent through the experimental lines. These amplifying apparatus, applied to the real Brest-Daker (Africa) cable, with proper resistances and batteries, have increased the speed of transmission 30% and have improved the form of the signals, giving an increase of 40% in commercial rendition. If these theoretical studies dispense with the laying of a second cable—which was imperatively needed—an economy of $2,000,000 will be effected.

We now may go into the principal room of the laboratory, where the different electrical measurements are carried out. Here is the installation for measuring insulation and high resistance by means of a Thompson (Lord Kelvin) Galvanometer (Figure 2.) The Lord Kelvin bridge, highly perfected, is used here, and the foot of the table and the galvanometer supports are all insulated. The experiments shown in our engraving are devoted to a small condenser seen at the left; with Lord Rayleigh's bridge as basis, the impedances of telephonic apparatus at different frequencies are being tried out. The experimenter is busy measuring that of a head receiver for an operator. The apparatus shown in the illustration speaks for itself.

A reasonance bridge is used to measure capacities, inductances, effective resistances, and frequencies by the method of resonance.

Telephonometric tests are carried on in several departments of the laboratory. The operator has before him an experimental telephone line, which can be modified, so as to represent a regular cable, such as used by the European and American companies. There are three little signal lamps which tell how well the apparatus is working, whether better or worse than the microphone or telephone with which it is to be compared.

Other technicians use a special, soundproof, double walled cabinet with cork and felt insulation, in studying the burning out of microphones as shown. The sound insulation is so perfect that the observer can hear the exceedingly attenuated noise produced by electric sparks springing between the granules of carbon of the microphone, as the current is slightly changed in intensity.

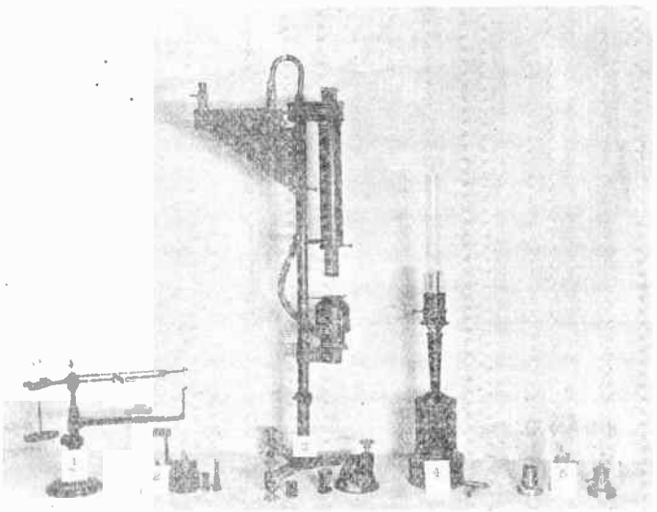
The Larsen effect is studied in the apparatus shown in Figure 5, which is highly original. This electric phenomenon gives trouble in the combined receiver and transmitter used in France, where a handle connects the microphone and the receiver, so that these two organs have a triple acoustic connection, (A) through the air, (B) through the solid material of the apparatus, and (C) the normal electric one. It follows under different circumstances, and especially with certain frequencies, that parasite currents are established between microphone and receiver, producing a hissing sound called the "Larsen" noise in the technical language of the telephone engineer, which is very annoying for telephonic conversations. For observing this effect, the combined apparatus is enclosed in a box, seen in the last illustration The binding parts of the receiver and microphone are connected to four binding posts, as shown on the box, and an alternating cur-

(*Continued on Page 284*)

Old and New Measurement of Light

AN interesting historical exhibition of different standard lights is shown in the illustration. It was collected by the Bureau of Standards, Washington, D.C.

In olden times, and even to some extent to the present day, a standard sperm candle was and is used as the test for the illuminating power of commercial lamps gas burners and the like. The apparatus shown in Fig. 1 is the candle balance. The candles, in order to secure a better average, were burnt in pairs. They were hung on a delicate balance, in order to determine how much sperm



Old time standards of light; the four early ones are extinct, as they have been superseded by the standardized electric lamp seen on the right of the illustration.

The old photometric observations lastd either five or ten minutes. Ten successive observations were taken. The standard electric lamp gives an immediate result with a single observation.

was burnt. The standard was 20 grains of sperm consumed in ten minutes for each candle and if the candle burned a little more or a little less, a correction was made. The apparatus was used at one end of a graduated bar, at whose other end was placed the light to be tested. A special screen was moved back and forth along the bar until it received an equal amount of light from both ends, and its relative position gave the value of the light under trial in terms of the standard candle. If it was gas that was being tested, it was burned as nearly as possible at the rate of 5 feet an hour, and might show anywhere from 12 to 30 candle power of light.

Old time gas engineers used this photometer constantly, taking observations day after day. It was quite a troublesome process sometimes; in warm weather the candle would burn too fast, which would make the observations valueless. Sometimes, they were put on ice before the test in order to chill them, but candles were anything but an accurate standard.

In Germany the lamp shown at No. 2, the Hefner lamp, was used for many years as a standard. It was supposed to be burned under standard atmospheric conditions, and the Germans termed this unit the Hefnerkerze.

England is the home of the standard candle, and in this country it was adopted from them. An English scientist, Vernon Harcourt, produced the Pentane standard. His elaborate apparatus is marked Fig. 3 in the photograph. Pentane is one of the paraffine series of hydro-carbons, and the Pentane lamp is constructed to give as near as may be, a light of ten candles. Pentane is more volatile than kerosene oil, but is supposed to be a fluid which is easily procurable of chemical purity.

One of the great crops of France in old days was what is known as the Colza bean, and the lamp shown in Fig. 4, called the Carcel lamp, burning Colza oil, made from the Colza bean, was the working standard used by the French for a great many years.

Now all is changed; electricity has come to the front as usual, and standard electric lamps carefully rated are accepted now instead of candles or oil lamps. In America and Europe, standardized electric lamps for all accurate measurements have displaced oil lamps and candles. Fig. 5 shows a group of electric lamps such as preserved at the Bureau of Standards.

The electric lamp, with all the improved photometric apparatus, has changed photometry, as it is called, from an approximate affair to an exact science. Not only this, it has also made the testing of light quicker and easier in every way and in the highly developed instruments has brought it to a very great degree of accuracy.

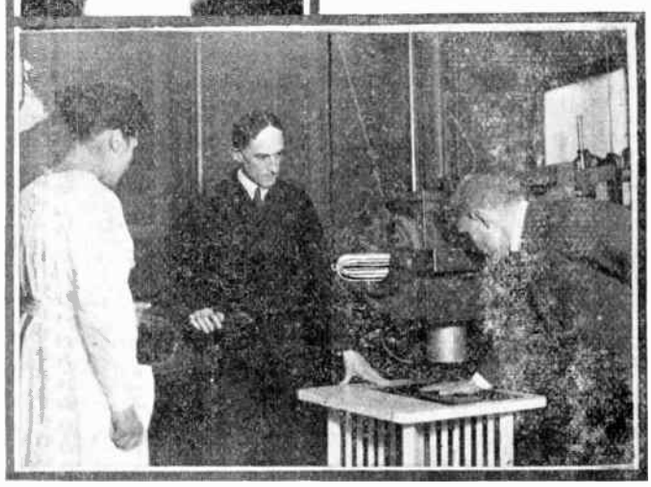
The old rating for gas of 16, 18 or 25 candles as the case might be, was an approximation. To-day when candle power is measured, it has at least the elements of scientific accuracy.

X-Ray Fingerprinting.

Dr. Alfred Gradenwitz.

An interesting development of finger-printing. It is found that radiographs give excellent finger-prints better than the pigment prints. The process and one of the prints are shown here.

The great delicacy of the lines in the radiograph will be noticed. The illustration below shows the operation of radiographing the finger lines.



IT HAS long been known that each individual's identity is told by the "papillary" lines of the fingers. While these lines may be classified under a limited number of types, each classification comprises a truly infinite variety of forms, in fact, one characteristic form for each individual, which from the cradle to the grave will cling to him, baffling any attempt at alteration by artifical means.

When taking a print of the blackened finger, these characteristic lines are brought out strikingly and may be examined and compared under the magnifying glass, the usual process employed in modern "Dactyloscopy" which is so invaluable in the detection of criminals. In order to make this process even more effective, it has lately been suggested to resort to X-rays. A French scientist, Dr. Henry Beclere, some time ago, devised a method allowing the finger lines to be made visible in a radiogram. Inasmuch as the finger, after being massaged for about 10 minutes, is in this case, coated with "covering" salts, many details of the characteristic lines are consequently obliterated.

This drawback is avoided by another method suggested by that well known engineering expert in modern criminology, Mr. S. Nelken, of Berlin.

It has long been known that photographic plates are very sensitive to the perspiration of the human body. If, accordingly, the hand or a finger be placed on the coated side of a plate, the photographic layer will be decomposed at those points coming into contact with the plastic lines, the pattern of which will be seen upon developing the plate.

This is the principle underlying Mr. Nelken's method. In order to produce an X-ray picture showing the lines of the fingers, the hand is placed on the plate under some light-tight cover, after which a radiogram is made, as usual. Specially sensitive plates are chosen in order to increase the effect, and a light coating of the finger (or hand) with a trace of vaseline is found useful. Nelken has lately been preparing some particularly sensitive plates, and he is now engaged in producing a photographic paper, permitting the use of the glass plate to be dispensed with.

The finger lines on these X-ray pictures, as seen from one of the accompanying figures, will appear much more clearly than on an ordinary finger-print, an additional advantage being that the outlines of the fingers, as well as the nails and bones, are reproduced side by side with the finger-lines. Whenever, at first sight, there is some similarity or contrasting appearance of the bones it affords additional evidence as to whether or not there is a case of identity. In fact, a combined picture of finger-lines **and** finger bones, of course, is incomparably more typical of the subject and more informative than a mere finger-print.

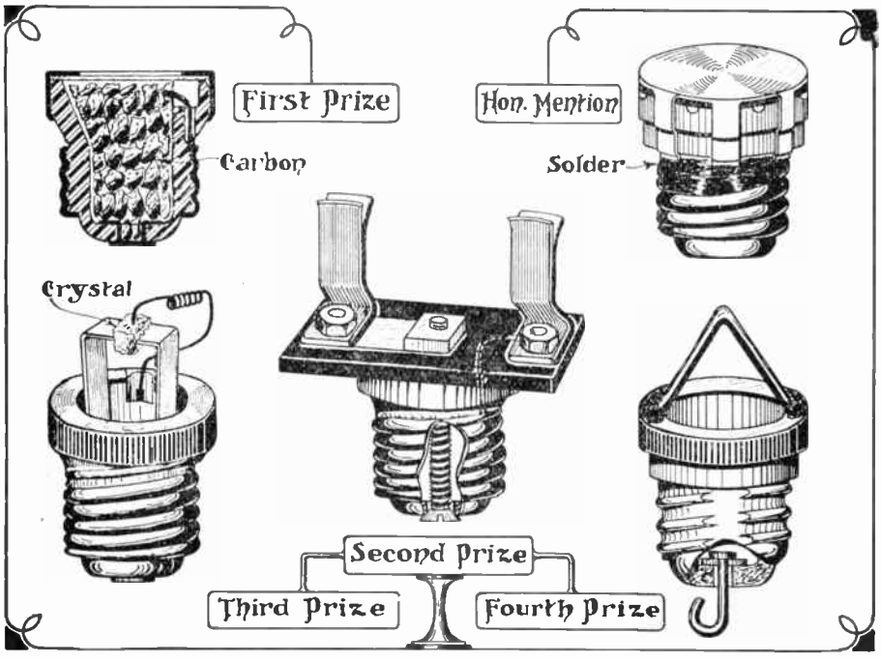
Even from a medical point of view, this process, which is of a very simple technique, has been lately arousing some interest, radiograms having so far been unable to bring out any connection between the bone and skin. Whether there is any inter-dependence between the bones and finger-lines, will undoubtedly be ascertained in the future by further investigation.

Our Burnt-Out Fuse Contest

1st Prize
Sam Latchinsky,
Box 298,
Drum Haller, Alberta,
Canada.

2d Prize
Robert J. Williams,
412 N. Hickory St.,
McAlister, Oklahoma

3rd Prize
A. B. Ringold,
600 W. South St.,
Angola, Indiana.



4th Prize
Luther McGinty,
Elberton, Georgia.

Honorable Mention
C. S. Pawlowski,
120 Oakland Ave.,
New Castle, Pa.

Above are what we have selected as the best five appliances made out of burnt-out plug fuses in the contest just closed. The first one is a very adaptable resistance, using carbon granules, whose resistance varies according to how tightly they are pressed together. The second prize was won by the re-fillable fuse holder; here we go back to the fuse, and the receptacle of the burnt-out fuse is made to carry clips for a new and easily replaceable one. The third prize represents a crystal detector, with cat whisker, all of the most orthodox description. Radio could not be forgotten. The fourth prize is a simple insulator, whose merit really lies in its simplicity, and adaptability to so many purposes. The water distributor for use on lawns is another very simple yet meritorious suggestion, which almost seems to deserve more than a mere honorable mention.

ANNOUNCEMENT was made in the February issue of a $50 prize contest, offering prizes for the four most ingenious utilizations of old, burnt-out fuse plugs. Our suggestion as a possible use was to make attachment plugs out of them, and it was specified definitely that the contest embraced only those fuses which screw into receptacles—that is, those having a thread like an electric lamp bulb. It was stated that combinations of fuse plugs were permissible, and that models should preferably be sent with each prize entry submitted. The date of closing was March 5th.

It soon became obvious that the contestants noted carefully our request that models be sent; the mailmen deposited heavy loads of boxes and parcels of all shapes and sizes. But upon examination, we found that it was only quantity, not quality. Ingenuity in ideas for this contest was conspicuous by its absence. There was also much duplication of ideas, particularly suggestions for uses of burnt out fuses which had been published not only in past issues of PRACTICAL ELECTRICS, SCIENCE & INVENTION and RADIO NEWS, but in other scientific periodicals.

Many models were submitted, showing the use of a burnt-out fuse as an attachment plug. This particular contrivance appeared so frequently that very soon, through force of habit, before a parcel was opened, we could guess that it was another burnt-out fuse applied as a plug for some extension, and such a guess often proved to be correct. Why our contributors deliberately chose the self-same idea which we suggested, is more interesting to the psychologist, than to **ye editors.** Neither could we determine why, contrary to published rules of the contest, cartridge fuse adaptations were submitted.

Next in the long list of entries, in order of frequency of appearance, is the use of these fuse plugs, as bases for instruments, and next in precedence, the use of the fuse containers as crucibles. Nevertheless, out of the group there were a few ideas of interest and novelty. Twenty five dollars seemed a pleasing enough offer to some, who worked up several ideas, and in some instances submitted models. One of the most ingenious of the ideas submitted is the use of the fuse plug as a resistance. This device was awarded first prize by the judges, after being carefully considered and compared with the device subsequently awarded second prize. The distinctive features of both ideas, and the ingenuity displayed by the contestants, caused considerable furore while the prizes were being decided upon. A check for $25.00 therefore paves the way for further experiments which Sam Latchinsky of Drumhaller, Alberta, Canada, may care to conduct. He says in part: "Blown fuses when filled with broken carbon, make excellent resistances. A number of them placed in series will step down house current sufficiently to run small toy motors. If direct current is to be stepped down for battery charging purposes, two or three in series and then several of such units in parallel, make a very neat resistance, which may be varied considerably. It is merely necessary to break up some carbon rods, remove the mica cap by bending up the metal rim, fill with the carbon grains, and then replace the cap." He submitted a model which the editors found to work very well.

The second prize was awarded to one of the two models which Robert J. Williams of McAlister, Oklahoma submitted. This is a re-fillable fuse, and is shown above. In the device a piece of hard rubber, 2 inches long and ⅞ inch wide, had three holes drilled through it, one in the middle, and one hole at either end of the hard rubber piece. The bottom contact and the brass top was then removed from a fuse, and a machine screw, 1½ inches long, was passed through the plug, and through the center hole of the hard rubber piece. Two brass strips, 3 inches long and ¼ inch wide, were bent in the middle, after a hole had been drilled through them, and were fastened to the hard rubber piece by means of screws. They were then bent upwardly, making very serviceable clips. Another piece of brass or wire connected with the center screw to one of the clips, and the other clip was connected by a wire to the screw part of the plug. This made a very serviceable extension fuse by simply inserting a strip of tin foil into the clips. The fuse thus formed could be adjusted by the size of the tin foil strip for any amperage. When the fuse blows it is a simple matter to re-fill or replace it, the cost being negligible, Mr. Williams earns $15.00 for this excellent suggestion.

The third prize was awarded by the judges to Mr. A. B. Ringold of Angola, Indiana. Strange how the lads out west are much more ardent in building devices, and used so much more ingenuity than the city folks. There are few in the country districts who have as many facilities for the construction of such contrivances, or who can look up as many references in the libraries as those in Greater New York, and yet in nearly every

More About The Title Contest

IN our last issue we instituted our title contest, offering $50 divided into five prizes, for the best titles of the picture on the front cover page of the magazine in question.

We have already received a number of titles, good, bad and indifferent, and we are inserting this notice to remind our readers that there are still many days left for them to use in exercising their ingenuity in this contest. We shall hope before the 30th of May to receive a number of additional titles, so that the contest will become most interesting..

The full conditions are given on page 214 of our last issue.

prize contest heretofore conducted, the western lads come out on top. In this contest it will be noted that a Canadian won the first prize, an Oklahoma lad the second, and an Indiana boy the third.

For this simple detector, Fig. 3, for use in Radio, an award of $8.00 is being made. The device scarcely needs an explanation. Two pieces of spring brass were bent so as to form suitable grips for the crystal. Teeth were filed into their ends, and the spring brass was then soldered to a screw and fastened into the base of the fuse-plug. The cat whisker was merely soldered to a piece of the fuse wire still remaining in the fuse. A dozen or more of these could easily be mounted in a radio receiving set, and various crystals could be quickly substituted by simply unscrewing one of the detectors, and re-placing with another. Such removal although seemingly a little more difficult than the replacing of a crystal, does away with the troubles in handling the crystal. If three or four of them are all mounted in the same circuit, the fuse plugs themselves may be used as switches, by giving them a half turn.

The fourth and last prize, (an award of of $2.00), was awarded to Luther McGinty of Elberton, Georgia. This is an insulator, the construction of which is simple. The mica is removed from the fuse, leaving the brass rim on top. A piece of heavy copper wire, V shaped, is soldered with hard solder to this top, and a nail is inserted through the aperture in the bottom, then bent into the shape of a hook; a washer is preferably placed around the head of the nail.

We could now list many honorable mention awards, but will only speak of one, which showed a little more than passing ingenuity. Mr. Casimers Pawlowski of New Castle, Pennsylvania, is awarded first honorable mention. He filed six small grooves into the porcelain top of the plug, after removing the brass rim and the metal contact at the base. He then covered the top of the entire fuse plug with a rubber washer, and a piece of metal, which he secured in place. Attaching a garden hose to the plug he obtained a very serviceable lawn sprinkler. The hose is merely supported with wire, and will sprinkle larger or smaller areas of lawn according to the pressure of the water. If Mr. Pawlowski continues to demonstrate his ingenuity in some of the future contests, there is no doubt but that one of these days he will carry off the first prize.

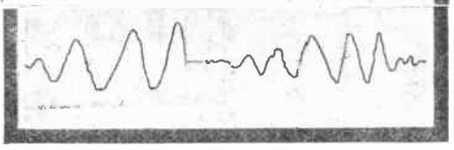
We are rather surprised at the apparent disregard city people have for these prize contests. It surely must be worth while to expend an hour's time and brain power and to fuss with a device for another hour, with the possibility of winning our prize. We trust, however, that our future contests will be entered into with a little more vigor, and a wee bit more originality than in the present case.

Speaking Movies

THE illustration shows a combination of a moving picture camera with a voice reproducer. The idea is to simultaneously photograph the person on the film in the regular way, but the actor has his part to speak, and delivers it exactly as if he were on the stage of the ordinary theatre. An auxiliary apparatus registers the voice, so that we have here a definite attempt to synchronize, at least in the taking, the spoken word and the accompanying facial change and action of the actor.

Of course, this is but one-half the problem, and whether by the most delicate electric adjustments the synchronism can be maintained in the reproduction on the screen, is an open question.

Treating Strabismus By Electricity



On Left. Electrically driven apparatus for talking movies.
Above. Electric treatment for the cure of strabismus.
On Right. Electric apparatus for photographing the traces corresponding to sound waves. The traces of a soft and hard cough are shown.

BAD cases of strabismus often make their appearence in children and are treated, as a rule, surgically.

Experiments are now being conducted in the direction of curing this deformity by the application of a direct current of electricity. A double head band is placed on the patient, which carries an electrical apparatus set in motion by a battery. The effect is supposed to be to establish a series of gymnastics for the muscles of the eye, so as to bring them up to their proper strength and enable them to retain the eyeball in its proper position.

The surgical operation is not universally successful, and there is plenty of room for belief that the electric apparatus may yet successfully displace the surgeon's ministrations.

Sound Traces Photographed

IN THE older books of physics, we see described numerous experiments in the direction of making sound waves visible by their effects.

A very interesting manometric flame test comes into this category also. The illustrations show how a step beyond these old-time experiments has been taken. Here we have a camera with a moving sensitized film, the film being driven by an electric motor. A diaphragm carries a mirror, which reflects a spot of light upon the sensitized film. The experimenter talks, shouts, whistles and makes other sounds into the receiver of the apparatus, causing the mirror to oscillate; the reflected light spot produces upon the sensitized film after development and fixing, a trace of the sound waves.

Result of Our Voting Contest

WE ARE pleased to report the final results of our voting contest, whose conditions were published in our November issue. In that issue we wrote:

"The first issue of PRACTICAL ELECTRICS is before you. Now, frankly, how do you like it? The Editor has tried to guess what you like best, but has he succeeded? You must be the judge; vote on the adjoining ballot."

Below will be found the results. 13009 readers voted and, from the list shown below, it will be seen which of the departments pleased the most. Thus, Experimental Electrics, How and Why, Junior Electrician, and New Things Electric were at the head of the list. The balance did not come out so well, as for instance, in Motor Electrics 4621 wanted more and 2603 wanted less. The Electrical Digest fared the worst, with 3608 readers wanting more of it, and 2309 wanting less. In other words, approximately one third of the voters wanted less.

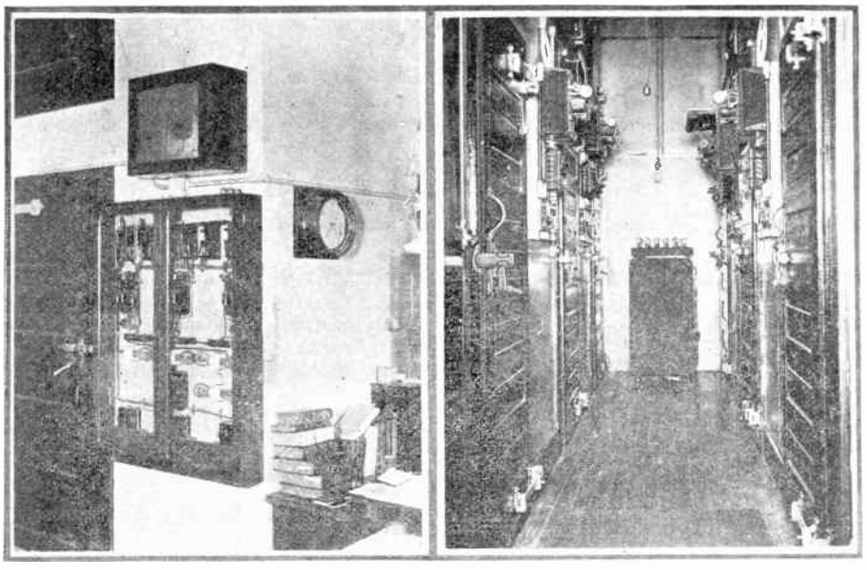
This voting contest was very illuminative for us, as well as instructive, and shows us just exactly what our readers desire. We will, therefore, in the future greatly enlarge the four departments, Experimental Electrics, How and Why, Junior Electrican and New Things Electric; while the other departments will be kept large enough to satisfy the minority, whose wishes of course we must also heed.

Be sure whenever you may feel like it, to let the editor know just what class of articles you would like to have published. With our well trained editorial staff, we can treat almost any subject, and we are always open to suggestions.

	More	Less
Experimental Electrics	8802	109
How & Why	7409	614
Junior Electrics	6710	1050
New Things Electric	5502	1050
Motor Electrics	4621	2603
General	4101	2356
Short Circuits	3906	2003
Electrical Digest	3608	2409
Less		
Motor Electrics	26	
Electrical Digest	24	
General	23	
Short Circuits	20	
Junior Electrics	10	
New Things Electric	10	
How and Why	6	
Experimental Electrics	1	
Magazine All Right as Is	34	
Total Voting	13009	

Perfectly Regulated Temperature Control

By S. R. Winters



The above apparatus, in use by the Federal Department of Agriculture, automatically controls the temperature of the entire laboratory so that it does not vary more than 1 degree Centigrade. It is an example of the wonderful work being done in Washington by the Government scientists.

Growing minute organisms extracted from diseased tissues of domestic animals—strange vocation, it would seem—is a procedure instrumental in effectively combating diseases peculiar to live stock. Tuberculin is available in quantity production for staying the progress of animal tuberculosis. Cultures of micro-organisms in laboratories involve infinite patience and care, the period of incubation requiring a temperature of slight variation. Recognizing this essential, John T. Bowen, technologist of the Dairy Division, United States Department of Agriculture, has developed a method for automatically-controlling laboratory temperatures without a variation in excess of one degree Centigrade for seven days in a roomy chamber. The temperature-control board and the specially-designed rooms of the Government laboratory are novel and probably represent the best regulated heating system in the United States.

The walls, floors, and ceiling of the laboratory were designed and constructed with utmost regard for a condition guaranteeing an inescapable confinement of heat. The compact enclosure likewise insures the constancy of the temperature for a considerable period of time in the event of a discontinuance of the supply of heat. The large incubating compartment accommodates smaller units for bacteriological investigations, separate heating devices being maintained, although they are in absolute harmony with the predominant method of automatic control. The disintegration of the laboratory into units permits of a variation of the maintenance point of temperature.

There are four coils of 110 ohms each in the temperature-control equipment proper. Two of these units are connected in series and immediately across the main line, with a switch for cutting out the coils. The coils are forced into service in cold weather, and they are so proportioned that when constantly in use they will maintain the temperature barely below the desired point. The two coils connected in series supply the additional heat for bringing the temperature of the room to a specified degree. The latter coils are identified with and operated by the controlling system, and are connected through the relay to the other side of the 220-volt line through a variable resistance in series with the instrument. The resistance is ample to curtail the voltage in the relay circuit to four volts, thus avoiding arcing and burning of thermostat and relay contacts. Condensers are inserted in the circuits with the view of absorbing the inductive discharge from the coils when the former are broken.

The relay works in double and reverse action, namely, when the electric circuit is completed through the thermostat, due to rising temperature in the room, it acts in breaking the main heating-coil circuit, cutting off the supply of heat. Similarly, assuming a different rôle, when the relay circuit is broken in the thermostat, attributable to a decline in temperature in the laboratory, the relays close the heating-coil circuit. An overload device, affixed to the temperature-control outfit, serves the purpose of cutting out of the entire system in the event that the apparatus fails to function. The overload device, in principle, duplicates that of the temperature-control equipment. The thermostat closes the electric circuit through the overload relay at a room temperature a few degrees above normal operating heat, the relay in turn breaking the circuit through the overload coil in the main line, cutting off the electric current in the entire system.

A special thermostat is employed in the incubator rooms, one capable of making and

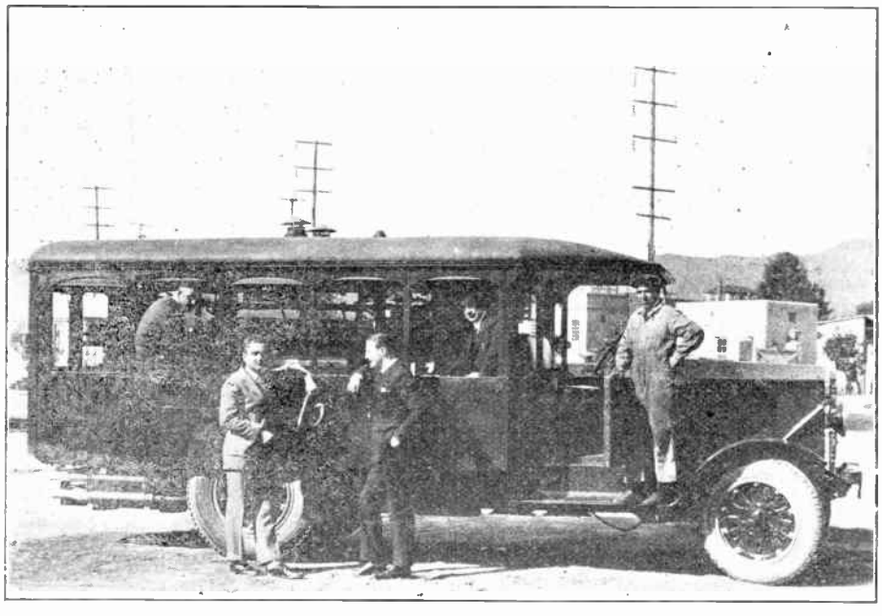
(*Continued on page 284*)

Portable Generator.

WHAT is claimed to be the largest portable electric generating plant in the world has recently been placed in operation by a Western moving picture concern.

To take moving pictures requires a constant flood of light, and except for places illuminated by natural daylight, the only method of obtaining such light is in the studios. The consequent result is that natural settings must be erected in the studios but they fall far short of nature's own. With the coming of the sun-light arc lamp, producers found that it was quite possible to photograph outdoor scenes in the light emitted by these powerful search-lights. However, the expense of leading cables from the generating plants to distant mountain scenes for several miles was entirely too great to permit of employing these arcs on distant outdoor scenes.

Accordingly, under the direction of Marshall Neilan, a well-known producer, a generating plant was built upon an automobile chassis. This comprised two Liberty motors driving a generator capable of delivering enough current to light up a fair sized city. It required two years to build the moving plant, which on actual test was found capable of traveling on its own power at a maximum speed of 45 miles per hour. With this plant, and a properly arranged searchlight, moon effects and sunrise effects may be obtained and photographed in one-fourth of the time ordinarily required.

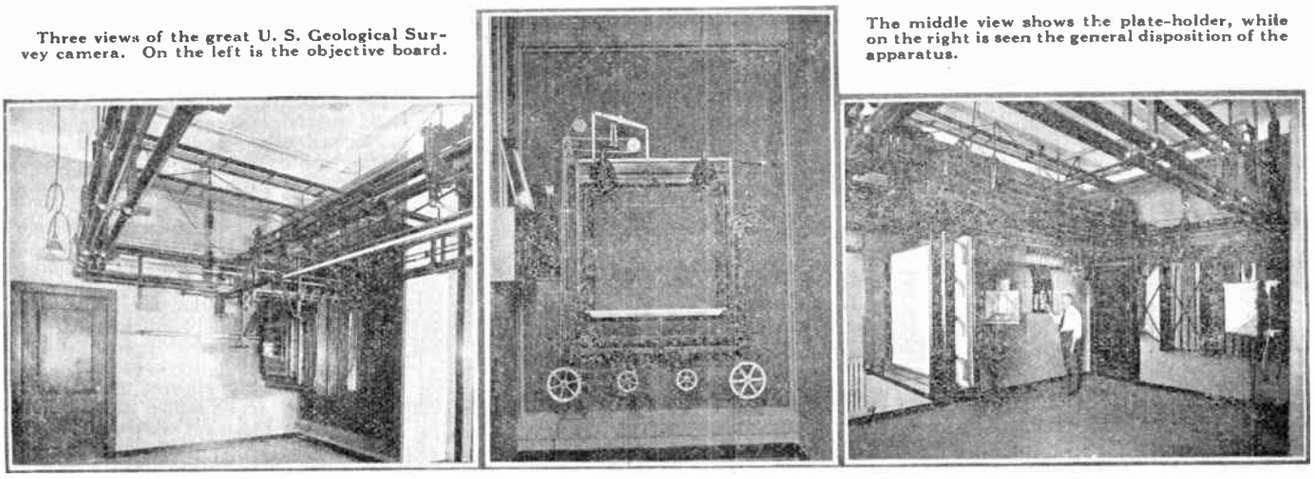


The largest generator in the world for producing electric light in the open for the taking of moving pictures. The generator not only produces light, but transports the great lighting plant through the country by its own power.

Largest Electrical Camera In the World

By S. R. Winters

Three views of the great U. S. Geological Survey camera. On the left is the objective board.



The middle view shows the plate-holder, while on the right is seen the general disposition of the apparatus.

THE largest metal camera in the world .....weighing 7,000 pounds....has been designed by A. H. Linsenmeyer and recently installed in the photographic laboratory of the Geological Survey, United States Department of Interior. The magnitude of the equipment, however, should not obscure its claims to novelty of construction and the mathematical precision with which it operates. This process-copying mechanism was built for the purpose of reproducing maps for the United States, a responsibility devolving upon the Geological Survey.

"Do it electrically," is a popular injunction to which this huge camera is obedient. Alignment focusing, and similar adjustments common to hand-manipulated photographic instruments, in this Brobdingnag of cameras, are responsive to electrical impulses, when, suspended from the ceiling, it is put into action for process-copying; except for rubber bellows and curtain-slide, the entire outfit is constructed of metal. Flexure and distortion of image....shortcomings of other cameras ....are studiously avoided in this wonderful piece of mechanism. A rigid tubular steel frame, ten by sixteen feet in dimensions, is suspended from the ceiling of a first-floor room of the Department of Interior building, by springs. The latter are so fixed as to avert any possible vibration from the building. From this metal framework, with such ramifications as to remind one of a factory, the varying units of the camera are suspended.

Situated in one corner is the plate-holder extending itself a bit into the darkroom. Fronting the plate-holder is the bellows, terminating in lens and prism, affixed to a carriage which operates on two parallel rod-rails. Supported on the carriage and traveling at right angles is a second carriage serving as a base for the copy-holder. The lens and copy-holder move toward or away from each other, a direction determined by the size and scale of map sought. The plate-holder, however, is not moved, remaining stationary in the darkroom. This novel procedure eliminates the practice of repeated squaring-up of the camera and copy-holder. Likewise, the time-consuming operation of focusing is practically dispensed with. The lens is propelled forward or backward by the motion of the first carriage. Leisurely-operating lazy-tongs regulate the uniformity of the bellows movement. The front of the camera thus assumes the resemblance of a huge Jack-in-the-box, to employ the picturesque terms of the inventor.

The plate-holder, is rigidly fixed to the major frame of the mechanism and is projected into the darkroom. An automatic plate-centering device, aluminum drip-trough half-tone screen holder, screen-distance-regulator, spring support for securing the plate in position, and a rubber curtain for barring light during exposure, are appliances surrounding the plate-holder. Immediately beneath the latter are four hand-wheels, an arrangement which is described as resembling a pilot-house. Two of these wheels actuate the lens, giving a horizontal or vertical motion, as need may dictate. The other two units move the bellows and regulate the matter of copy-distance. These four wheels are intimately related by chain gear to square revolving rods, along which slide bevel gears, a grouping which facilitates the communication of motion to the gears at any point on their journey. The photographer, if he deems expedient, may seclude himself in the darkroom and operate the camera from a switch box by looking through a tiny red window, thus observing the copyholder and lens swing into place for the photograph.

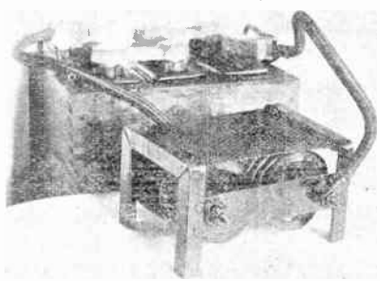
The copy is placed between two substantial plate glasses, four by six feet in size, carried in a steel frame. The front plate, it must be emphasized, is permanently fixed. It is always in alignment with the lens and plate-holder. The rear glass, however, drops back from the top, bookwise, when a hand-wheel is turned at the side of the frame. This action releases eight felt-covered cams-four on each side of the frame-and when the

(Continued on page 284)

Storage Battery Testing Set

THE usual way of testing storage batteries is by determining the specific gravity of the electrolyte. This simply denotes whether the battery solution is in good shape, and gives an approximate idea of its degree of exhaustion. But this tells nothing about the working capacity of the battery. Sometimes as a crude test a very quick contact is made between the poles by a bit of wire with an insulated handle, so as to see to what extent it sparks. An every day ammeter put upon a large storage battary is apt to burn out. In dealing with a storage battery, we are face to face with quite a serious problem, because it gives such a very heavy current when called upon.

The battery discharge set shown in the illustration consists of several resistance coils made of metallic ribbon, so as to give a good cooling surface. The resistance coils are of such size that they can be connected to a 6 or a 12 volt battery without injury, passing a continuous discharge without burning out the ribbon.

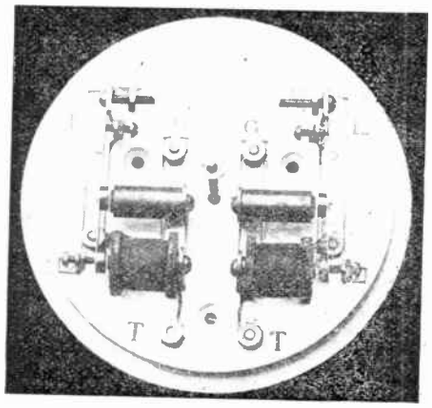


A most useful apparatus for determining definitely just what a storage battery will do. A heavy current is taken from it to see if it stands up as it should under the strain.

The connections can be changed so that currents ranging from 50 to 600 amperes can be passed. But the battery is designed for testing 6 and 12 volt automobile starting batteries and can pass with its standard connections from 75 to 150 amperes at such voltages; that is to say, its resistances are such as to hold the battery under test down to such discharges. In carrying out the test, a voltmeter is used to determine the condition of each individual cell. A table supplied with the apparatus gives the discharge which the typical starting batteries should stand. Thus a 6 volt 11 plate battery, such as used on automobiles, should maintain a discharge on specified connections of the apparatus, for fourteen minutes, before the voltage falls to 1.6 volts on any single cell. If any of its cells only needed seven minutes to fall to this voltage, the cell in question would only be of one-half its proper working capacity.

No ammeter is used, because the connections control the current. It is a sort of automatic testing apparatus.

Lightning Arrester



A lightning arrester, which operates by opening the circuit and grounding the outside circuit through the magnet core. A carbon head is placed on the core so that the armature will at once be released when the heavy current ceases.

THE majority of lightning arresters or protectors are made on one of the three following principles, viz: choke coil, air gap or cut-out switch to the ground.

The one we illustrate is supposed to combine all three.

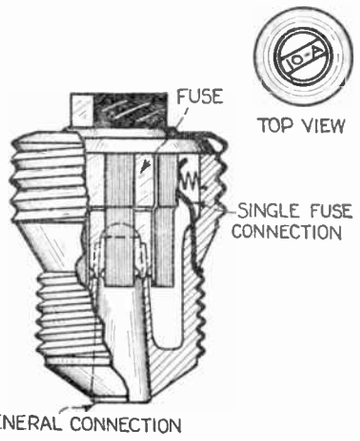
Explanation of its operation follows: A magnet wound with several turns of heavy wire, upon a soft iron core, which core is provided with a carbon head so that it will not retain residual magnetism, is mounted on a yoke, that acts as a support for the magnet, and grounds the magnet core. A vibrating armature is mounted on the porcelain base on suitable supports at the opposite side of the base from the magnet, in such manner as to be attracted by any excess current that comes on the circuit; when the attaction is produced the soft iron hammer on the vibrator makes contact with the grounded core. This operation switches the current from the instrument being protected into the grounding wire and thence to the ground. The instant the excess current ceases the vibrator returns to normal and allows the passage of the service current on the line into the instrument.

The machine is made in two styles for telephones and telegraph circuits, one being for ground circuits and the other a double machine for all-metallic circuits. In addition to individual machines, cable head machines are made to order, for any number of pairs, each pair being protected by a separate automatic switch.

In radio work, this instrument finds a field of usefulness. As the ordinary lightning switch and the necessity of cutting out, when excess appears, are done away with, operators may continue their work without interruption or fear of having their outfit destroyed.

The machines are all provided with adjustments to enable them to handle large and small currents.

Fuse Magazine



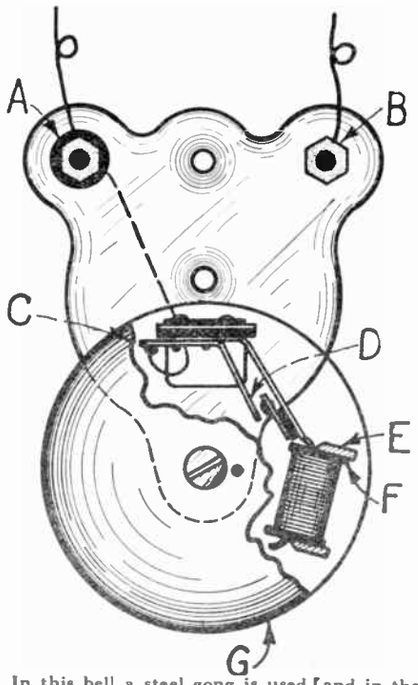
A fuse containing six links, which can be brought into action one by one by simply turning the handle so as to avoid the annoyance usually incident to replacement of fuses.

REPLACEMENT of burnt-out fuses, while some speak of it as an expense, is not very serious from the financial standpoint, but certainly it is a great annoyance to search around to find which fuse is burnt out, then to get out the old one and to screw in the new, perhaps in some dark part of the cellar.

The testing out of the fuse to tell when it is burned out is not always agreeable. The efforts that have been made to cause a fuse to disclose its condition have not proved very successful, on account of the accumulation of dust and discoloration of the mica, where the fuse is a mica-enclosed one.

The fuse shown here is a sort of magazine gun among fuses; it contains within its case six fuses. By turning the handle, they are thrown one by one into circuit. All that needs to be done when a fuse blows out is to turn the handle one-sixth of a rotation, and it snaps into position. This is repeated until the six fuses are used up, when it is naturally the proper time to insert a new magazine. Nothing could be easier than this method of replacing a fuse, but there is more than that to the trick. It will be seen that turning the handle gives what is practically a test for the integrity of the fuse; it is almost equivalent to using a lamp tester and bridging across the suspected fuse, because it takes no time at all to test the different fuses of this type one by one, and of course, the minute the house system lights, you have found the defective fuse.

The Simplest Electric Bell



In this bell a steel gong is used, and in the action of the current the magnet is drawn against it, so that the magnet core acts as the clapper or hammer.

WE illustrate what seems to be the last word in the simplification of an electric bell.

The bell gong, G, is made of steel. An electro magnet, F, has projecting metal ends, one at each pole as shown at E. At D there is a simple make-and-break and the connection with the battery or source of current is from A to C. The other connection is to the frame of the bell, to which one end of the magnet winding connects. The contact at D is normally closed. When the signal button or other switch is pressed, a current passes through the magnet. The pole pieces E are polarized and are attracted by the steel of the bell G; they are drawn forward and strike it, giving a ring. This breaks the contact D, the magnet springs back, only to repeat the blow as long as the circuit is closed. In this way the ringing is maintained indefinitely as long as current passes.

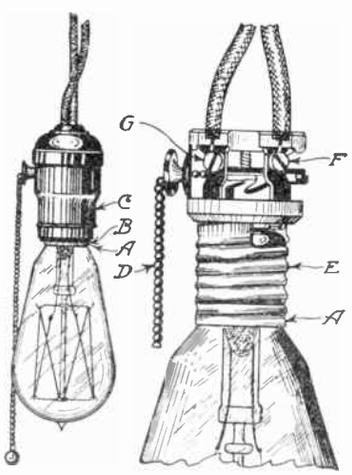
It is hard to see how anything could be simpler in the way of the production of an electric bell. Of course, it can be adapted for emitting single rings, if desired, by slightly changing the circuit.

Chain Socket and Fuse Trouble

IT is quite common experience that fixtures equipped with chain sockets blow the fuse when the chain is pulled to light the lamp. To many it is a mystery. The bulb is good; the socket is good; so what is the matter?

The trouble actually lies in the connection of the socket. It is so connected that the current is led from the ungrounded wire directly to the binding screw (g) of the threaded portion of the socket, and the grounded or neutral wire is fastened under the screw (F) of the strip serving for the base or center spring contact of the socket. When a bulb is inserted, a portion of the brass base (A) will sometimes remain exposed and not within the protection of the socket insulation (B).

In cities of the first class electric fixtures are by law specified to be grounded, and they therefore serve as a conductor of current. The socket shell (C) and pull chain (D) be-



The difficulties of a chain socket and the way of avoiding such difficulties are discussed at length in the article. Some times the chain make a sort of short-circuit, thereby giving much trouble.

ing metallically connected to the fixture also act as a conductor if the ungrounded wire were to come into contact with them.

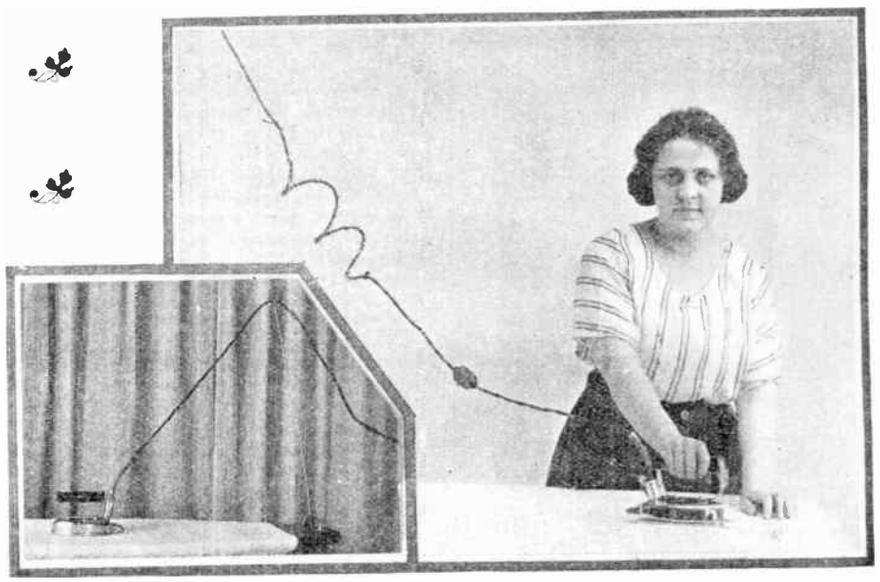
(*Continued on page 284*)

New Cord Take-Ups

TAKE-UP devices for cords have, for a long time, assumed the form of reels. Such reels are not very applicable to the use of the ordinary electric iron, and are rather expensive. Two of the many devices which have recently found their way to the American market are illustrated here. One of these is a flexible spiral spring. This is speedily attached to the cord by simply twisting the cord around the spiral in the space between adjacent convolutions, thus securing it within the spring-like arrangement.

Due to a certain amount of elasticity which all steel springs possess, the cord attachment "gives" freely whenever a slight pull is exerted upon the appliance to which it is attached, in the accompanying photograph, an electric iron. On bringing the electric iron back again to its former position the cord is automatically pulled up out of the way, preventing obstruction while ironing, and permitting the housewife to complete her ironing in record time. The bothersome cord never rests upon the piece to be ironed, therefore eliminates to a very great extent the danger of creasing the material by the cord.

Another device of a slightly different nature for the same purpose, is a standard which is attached to the ironing board. This holds the cord high above the ironing board. The connecting wire is likewise free to move backward and forward. The device is made of a piece of spring steel rod, and the results obtained from its use are practically identical with the cord take-up device described above. In this instance, however, the spring steel rod springs back and forth whenever the cord is pulled out or relaxed. Once more, the task of the busy housewife has been lightened.



A simple and obvious improvement in flexible cords, especially for use with electric sad-irons, keeping the cord off the table and combining a convenient electric switch, which is also kept off the table by the elastic coil as shown.

Electric Range Switch

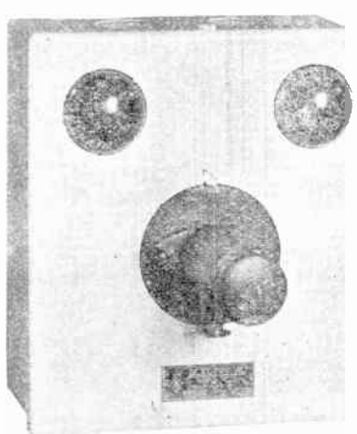
SHOULD you ever see one of these neat, white, enameled boxes with a dull black handle in the center, and two red bull's-eyes above and on either side of the handle, you will know immediately that it is a safety switch with which the electric range has been equipped.

This switch may be installed on any standard three-wire range. It is equipped with a fuse on either side, and also two bull's-eyes, back of which are lamps. These lamps are connected across the load side of the switch, consequently, when the current is turned on, by pushing the plunger inwardly, the indicating lamps behind the bull's-eyes light immediately, warning the housewife that the heat is turned on. As long as the lamps continue to burn, the range is in good order. Should one of the sections of the range become short-circuited, a fuse on either side of this switch will blow, and one of the tell-tale lights will be extinguished, indicating at a glance which section of the range is defective.

In order to turn off the current, the button immediately below the plunger is pressed upwardly. This releases the plunger and opens the circuit. A double break occurs, which is very quick indeed, diminishing arcing at the contacts.

In addition to its utility, the symmetrical and compact appearance of this little switch is readily apparent.

One of the troubles when fuses blow out, is to find out where the trouble lies. Especially is this the case in a range or heater, where the fuse is apt to be in a somewhat inaccessible place, and where the heat of the oven will make investigation difficult. Here we have the tell-tale lamps, which at once disclose which fuse is blown out. When a trouble is located, it is more than half disposed of. So when the lamp goes out, the heat can be turned off, making the fuse accessible, and the same can then be readily replaced, because it will be known exactly where the place is.



An advanced system of switch for an electric range, with signal lights to disclose the blowing out of fuses.

Canopy Switch

It is rather interesting to observe that much attention is being given to the minor appliances in electricity. Here we have, for instance, two very representative switches, one for use on electric ranges and the other for canopy installation. It is quite interesting to observe the attention which is being given to such devices, and the constant production of new ones indicates that we are not affected by too much standardization.

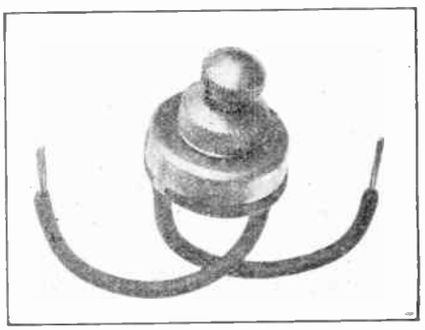
It is generally recognized that while standardization is of great value in many fields of mechanics, in some cases it is absolutely opposed to progress; because, by the very nature of things, it is opposed to changes for the better as well as to changes for the worse.

The many new appliances, which make their appearance in these columns, show that domestic electricity, as it may be called, is making constant progress, and, that much thought is being given to the electric home. It is hard to see where the line will be drawn, where a practical and controlling limit will be reached in electric appliances for the home.

THE trend in the manufacture of electrical controlling devices is towards the design of small, neat accessories which can be placed upon every conceivable construction without altering the original installation.

Such is the case with this small canopy switch, which has been placed upon the market by one of the largest electrical manufacturers to augment their standard line of push and pull canopy switches.

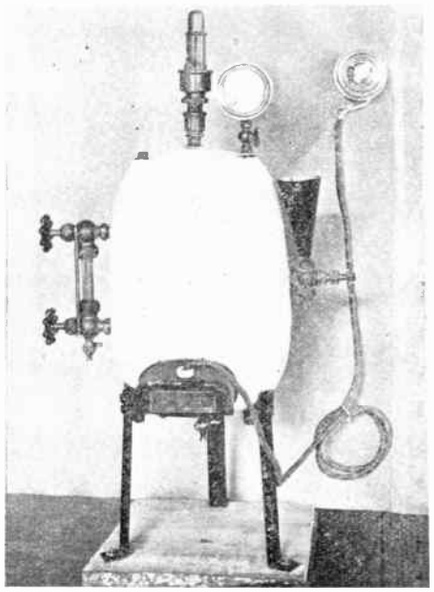
The depth of the body of this switch is only three eighths of an inch. This makes its use possible where the canopy recess in the wall is even as small as one half of an inch, without cutting away any of the plaster. The device may be used with either a sheet metal or cast metal canopy, and is rated at 107 volts with a possible current of ½-ampere flowing across the contacts.



A compact and very convenient canopy switch; it is small in dimensions and very neatly designed.

Electric Steam Boiler

WE always think of electricity as doing away with steam, but instead of the awkward, hot steam engine, an electric motor,



An electric steam boiler of comparatively small size, yet of high efficiency from the standpoint of convenience and quick action.

running coolly and nicely, which can be stopped on the instant and started on the instant as desired, is a great improvement.

Nevertheless, in some technical work it is an object to have steam. Thus, in vulcanizing India rubber, for instance, the steam process, which operates by subjecting the material to steam at high pressure, is incomparably the best. It is the best because by holding the steam at a given pressure, the temperature is fixed with accuracy, and a glance at the pressure gauge is as good as looking at the thermometer. There are many other places where steam is also required.

Our illustration shows a very diminutive boiler operated by electric heating units. It seems a poor economy to use electricity in an indirect way for producing steam, but if steam is to be produced, electricity certainly is a most convenient agent in so doing.

The present little boiler is only about 20 inches long and 20 inches high, and is carried on 10 inch extension legs. It is lagged and coated with asbestos, to preserve the heat. The boiler and fittings weigh 50 pounds. Heating units are supplied for a maximum capacity of 1200 watts. They are controlled by a three-heat switch, that is, a switch which cuts the current down to 600 watts, at the first point, to 300 watts at the second. A rheostat may be similarly used in circuit with the heating units. Such rheostat, of course, will regulate from its minimum delivery, which is, 400 watts, to its maximum delivery of 1200 watts, in very gradual steps.

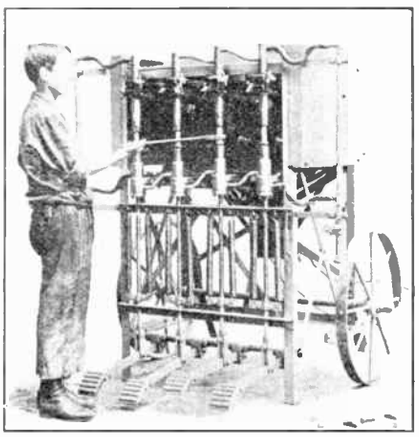
The boiler is equipped with all kinds of appliances, such as required by inspectors, including fusible plugs, glass water level gauge, steam pressure gauge and everything needed which appertains to the ordinary boiler. It seems as if this apparatus will become a very convenient annex to a laboratory of the larger scale, because by its use steam can be obtained at short notice. It has been found useful in shoe repairing installations. The safety blow-off valve operates at 30 pounds pressure. It is adapted for either 110 or 220 volt potential, and may be changed rapidly from one to the other voltage by simply connecting the units in series or parallel.

Electric Rivet Heating

A NEW and very useful application of the electric welding machine is for the heating of rivets. The process is accomplished by placing the rivet between a pair of electrodes, and passing a heavy current through it. The rivet closes the circuit between two electrodes of an electric welder. The increase of temperature is produced absolutely in the interior of the rivet, the heating commencing where the section is smallest. There is little loss of heat; the temperature rises with great rapidity and the economy is readily manifest.

In the regular forge, on the other hand, the heat is applied to the exterior, so that the rivet has to be heated very strongly in order to get the interior hot. The current is obtained by means of a step-down transformer, which reduces the voltage from 110 or 220 volts to a tension of 10 or 12 volts, of course bringing up the amperage to a very high figure.

The machine comes in different models,



The successor of the hand forge for heating rivets; an advanced accession to the shipyard and to the steel frame building constructors.

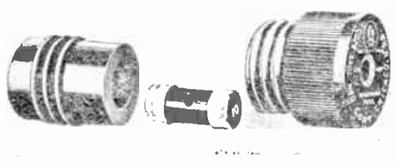
with two, three or four pairs of electrodes, each pair heating a single rivet. Water cooling is applied where necessary to prevent the machinery over-heating. The convenience of these machines is very great; they are mounted on wheeels and can be rolled about to any desired place. They economize time, as they can be put out of action instantly by the turning of a switch.

As regards the expense of fuel, an open forge fire uses three pounds of coal to one pound of rivets; in the electric machine seven pounds of rivets can be heated by one kilowatt hour. There is no waiting for the heat to come up, as in the case of a cold forge.

New Renewable Fuse

THE blowing out of electric fuses is a source of some expense. Another disagreeable feature is that on some types of fuses there is danger of a shock when effecting the replacement. We show in our illustration a fuse of the Edison type and renewable for use on circuits of 125 Volts with ratings from 3 to 30 amperes.

The fuse shown consists of three parts, the body, the cap and the refill.



An easily replacable fuse. An Edison type plug which is rated from 2 to 30 amperes, and which virtually consists of three pieces.

The cap and body are of heat resisting moulded insulation, and are built of good size and proportions, because the first cost of these parts is only once to be met. No skimping is necessary. Because of this heavy construction, they cannot be harmed by either dropping or by the repeated blowing of the fuse element.

The fuse in its cartridge constitutes the refill, a little cylindrical casing properly vented for the emission of gases when the fuse blows. The refill has the rating of the fuse in amperes stamped on both ends so that it is always visible through the aperture regardless of how it is inserted in the body. The cost of this refill is very low.

The main feature of this fuse is the ease with which it is renewed. The refilling operation consists of merely dropping the cartridge into the cup-like body and screwing down the cap. When so assembled there are no live parts of the plug exposed, rendering shocking impossible, a feature appreciated especially by the housewife who is often called upon to renew a fuse blown while ironing or washing with electrical appliances. This also leaves the rating visible at all times. Other features that appeal to people having had experience with porcelain renewable fuses are its freedom from breaking or cracking when dropped, and the permanence of the type of installation. The fusing of the electrical system of a building in this manner insures it permanently against further trouble or expense, for all that is then necessary is a supply of the small inexpensive refilling cartridges, called for shortness" refills".

Heating Drinks Electrically

IN older times there were two classic ways of heating punch and similar products of the bygone day. One was to thrust a red hot poker into a tumbler of the mixture. Another way, commemorated, we believe in Dickens, was to pour the drink into a long, conical metal vessel and thrust the end into the coals of a fire. The illustration shows the successor to these contrivances, but which unfortunately seems to have come some years too late to be fully appreciated.

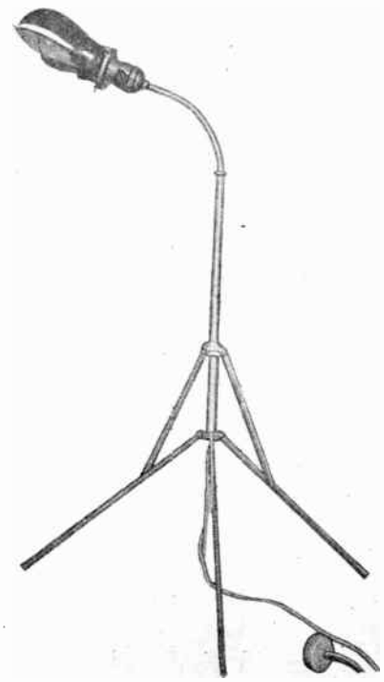
A hightly scientific heater for beverages, probably more useful in former years than it will be in the future.

It is simply a resistance element, bent into such a shape, that it can rest securely against the end of a vessel, and when the current is turned on it will bring the solution rapidly to boiling. As will be observed, the contrivance lies quite close to the side of a vessel, so that it can be used not only for warming milk and the like, but may be even used for boiling an egg and other minor culinary processes.

Reading Lamp From Discarded Music Stand.

THE stand used, should be preferably one which is made of brass tubing.

The flattened end of the top piece of tubing, is sawed off, and the tube filled with hot resin.



A lamp made from the standard of a discarded music stand. The tube is permanently bent so as to give the right curve.

After the resin cools, the tube is bent with a long bend, to nearly a right angle, care being taken not to kink the tube. The resin if well melted in and cold will prevent such kinks. After the tube is bent, heat it, to melt the resin, which will then flow out without any trouble.

An electric socket is either soldered or threaded to the tube, and fitted with a parabolic reflector and a light bulb. You then have a reading lamp, which can be adjusted to several different heights, and can easily be carried from one room to another. When fitted with a ruby bulb, it is an excellent darkroom light, for photographers.

To make the better looking lamp shown, in the second illustration, instead of bending the top tube, cut threads on it. Get a goose-neck, and a coupling from a fixture store, and put together, as shown in photograph. Wire the same as above.

Contributed by Lloyd Ringer

Hearing Fly's Footsteps

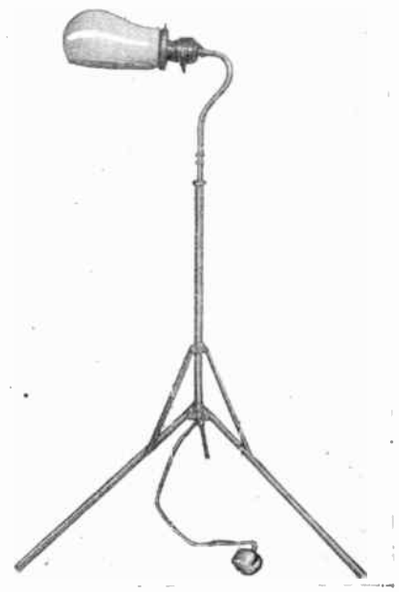
Footsteps of a pesky house fly booming out like thunder as he leisurely ambled across a piece of paper were heard today by scientists who visited the Bell telephone system's research laboratories.

Utilizing specially developed Rochelle salt crystals and an amplifier constructed by the Bell company, engineers and scientists listened to the promenading of the fly.

"Tomorrow," said the engineers, "we are going to put a trained flea on a piece of paper and listen to him tumble. We haven't been able, as Mr. Edison suggested on his birthday, to hear ants talk, but it is interesting to hear a molecule washing its face."

There is an atmosphere of picturesqueness about this description.

The principle involving the application of the salt crystals and the amplifier was first adopted during the war for submarine detection work. More than 100 crystals were developed in the Bell laboratories of the British navy.



A variation of the preceding lamp is shown here, in which the lamp is held in position by a goose neck with screw coupling.

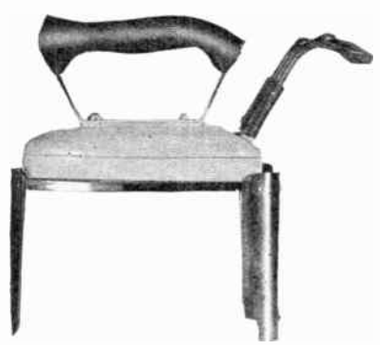
Novel Electric Sad-Iron

ONE of the objects of the modern electrical constructor seems now to be in the direction of getting as many uses as possible out of the familiar sad-iron of the laundry.

The illustrations show a sad-iron with a three-legged stand. It is adapted for various uses. In the first illustration it is shown, right side up, upon a stand supported three or four inches above the table or ironing board. Here it is in position for use in its ordinary functions in the laundry.

But the ladies of the present generation are addicted to curling their hair with hot irons. By reversing the iron in the stand and putting the receptacle upon its upturned face, curling irons may be very nicely heated. However, inasmuch as curling irons seem out of place in a laundry, the illustration shows a near relative thereto, a fluting-iron for forming ruffles on starched goods. Then if hot water is needed, the little receptacle for the fluting-iron is removed and a special saucepan takes its place, in which water may be heated rapidly.

It would seem that this iron with its stand and the facility for reversing it therein, could be used for many other purposes.



The electric sad-iron, standing on its support This keeps it well above the table or ironing-board beneath it, so that it can do no harm to any fabric.

Better Light in the Kitchen

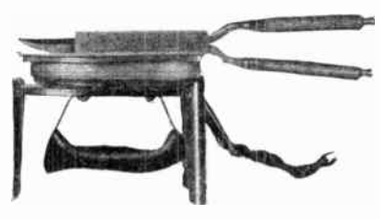
This tells of indirect light in the kitchen. The indirect light penetrates to every corner of the room and casts no shadows anywhere. The metal shade already in use in the kitchen, a small bowl of green enamel on the outside and white within, is turned upside down, and by suspending it, a new lighting fixture is produced. The bowl was hung to any convenient pipe and a 75-watt lamp was inserted.

The small kitchen was completely changed as a result of the innovation. On a stormy afternoon, or in the dusk of early evening it was possible to work conveniently at any side of the room. Mrs. Housewife was amazed. She didn't quite understand how her husband had suddenly become such an electrical wizard.

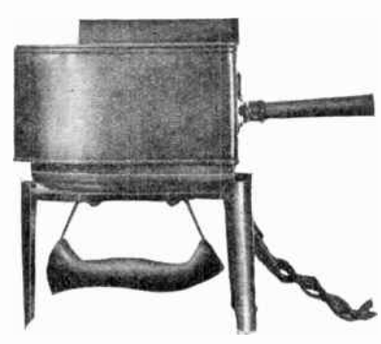
"To think that my hands are never in a shadow—it's quite beyond me," she declared. "I never did enjoy my kitchen so much before. And I can see into every drawer and cupboard much better than by daylight."

The secret, as Mr. Handy Man explained, lies in the fact that light rays are reflected from every possible angle all over the room when they come from the indirect shade. There is practically no shadow at all, and so this makes ideal illumination for the home workroom.

From *Philad. North American.*



The iron inverted in its stand and used for heating a fluting-iron, or perhaps a curling iron.

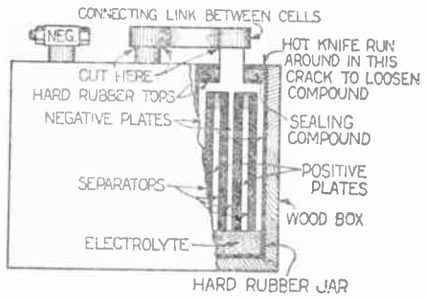


Here the obliging sad-iron still inverted acts as a stove for heating a vessel. It is obvious that many other uses are possible.

The Construction of Lead Plate Storage Batteries

By ARTHUR H. WHITEHOUSE

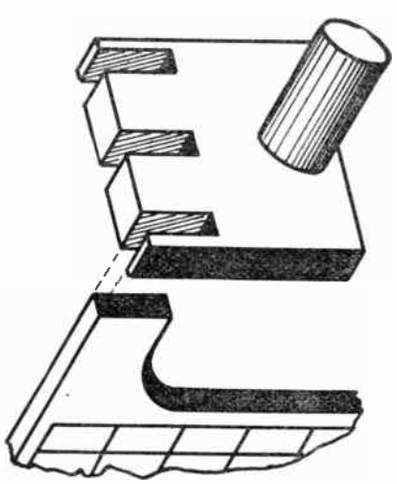
EVERY experimenter no doubt feels that his equipment is not complete without a storage battery, and in fact the experimenter in radio work finds that a storage battery is essential to the operation of a vacuum tube set. Those who attempt to use dry cells for filament lighting soon come to realize that the dry cell is not capable of giving a steady current, such as is required for the filaments of vacuum tubes, for any length of time, and



A diagram showing the way in which a storage battery is put together and how to attack the problem of opening it for removing the plates.

that a storage battery is the only thing which will give satisfactory results on this class of service.

Unfortunately, a storage battery is a comparatively expensive piece of apparatus, and there are no doubt a great number of experimenters whose resources are too limited to permit of their investing in this necessary article.



The method of bunching the groups of positive and negative plates with a connector, giving a single terminal for each set of plates in the cell.

It is for the experimenters in this class that this article is written, the writer proposing to describe a simple way of constructing, or perhaps a better term would be "reconstructing", storage batteries capable of giving very good results, if carefully built and properly looked after. The cost is well within the means of every experimenter, and in most cases will be within the price of two or three sets of dry cells.

The necessary parts required in the construction of a battery are as follows;—

One discarded storage battery, such as is used for starting and lighting duty on automobiles.

A quantity of red lead. (Pb_3O_4)

A quantity of litharge, or yellow oxide of lead. (Pb0)

The necessary wood separators, and the electrolyte.

The discarded storage battery should be easily obtainable, gratis, from any automobile owner, who, perhaps through neglecting his battery, has found it necessary to purchase a new one, and who no doubt will be glad to give you the old, and to him, useless battery, for the trouble of carrying it away; or it may be obtained from a garage for a small sum, where there are usually a number of old batteries on hand which are not considered worth repairing. The battery used by the writer was discarded as useless over five years ago, yet proved to be an excellent specimen for the use to which it was put.

The red lead may be obtained at any hardware store for a few cents a pound, while the litharge will probably have to be purchased at a drug store, at a somewhat higher price than the red lead. The separators and the electrolyte are easily obtainable at any battery service station.

The old battery must first of all be taken completely to pieces. The connecting links between each cell should be cut off with a hacksaw, after which the cells can be separated from each other, and from the box which holds them.

The next operation is to remove the hard rubber tops, or caps, from each cell, to do which a hot thin-bladed knife, passed around inside the cell, between it and the sealed-in top, will be found necessary. Great care must be taken not to crack or otherwise damage the jars while doing this. Once the top is loose in the cell, the contents can be lifted out quite easily.

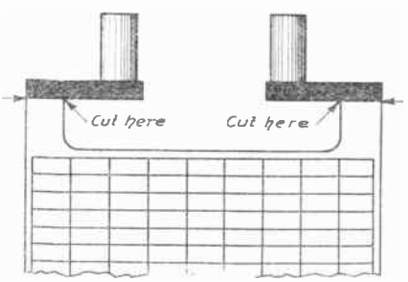
The next step is to cut off each plate with a hacksaw, as close up to the terminal as possible, as shown on the right so that the projection left on each plate will be of exactly the same size. At this point the old separators can be discarded, as they will no doubt be found to be no stronger than wet paper.

The plates will be found to be in the form of lattice-work grids, with more or less of the active material still sticking in the interstices. This material must all be carefully removed, leaving nothing but the clean metal grids. The blade of a penknife, or any convenient tool, can be used to perform this operation, but care must be taken not to injure the grid itself in any way. It may be found impossible to remove the active material from some of the grids without breaking them up, in which case all such plates will have to be discarded. Although the active material is insoluble in water, a good soaking in boiling water will help to loosen it considerably. In the case of an old battery used by the writer, only the negative plates could be used, the positive plates being so hard that the active material could not be removed.

The grids themselves are exactly the same for both positive and negative plates, therefore they may be used for either one or the other in the battery being constructed.

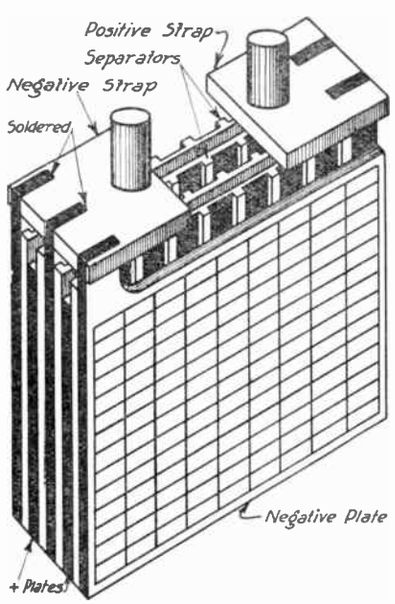
The number of plates in a cell is always odd, there being one more negative than positive. This arrangement is resorted to in order that each side of each positive plate may have a negative plate opposite to it.

The total number of grids available for use should now be divided up between the total number of cells, and an odd number of grids apportioned to each cell.



Where the old plates are cut off so as to separate each group into single plates for cleaning and pasting.

We are now ready to paste the plates with new active material. The positive plates are filled with a thick paste, made up of red lead and sulphuric acid, diluted with distilled water beforehand to a specific gravity of about 1.275.



A diagram of the grouping of plates showing how positive and negative sets are connected, each to a single terminal.

As already mentioned, this electrolyte may be purchased, if it is not desired to mix it at home. In mixing sulphuric acid and water, always pour the acid slowly into the water, never the reverse. The red lead paste, which will be of a rich chocolate color, should be of such consistency as to spread smoothly into all the interstices of the grids so that they will be

uniformly filled, and smooth on both sides. The level of the paste should not be higher than the surrounding ribs. As each grid is filled set it carefully aside to dry and harden.

The negative plates are made in exactly the same way, except that the paste used is made up of litharge (yellow oxid of lead), and electrolyte. This paste is a bright yellow in color. Only a small quantity of either paste, about enough for one plate, should be made up at a time, as it hardens quickly, in a similar manner to plaster of Paris, and must therefore be used very quickly.

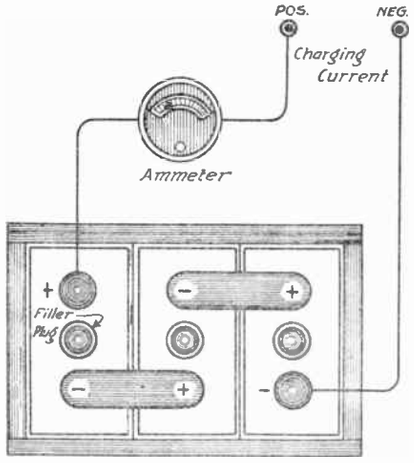
The successful operation of the finished battery depends to a great extent on the care used in pasting the plates, as if the work is not well done, the active material is liable to fall out of the grids in use.

When all the plates have been pasted, and hardened thoroughly, which they will do in a day or two, they can be assembled with wood separators into groups. The separators are made of thin porous wood, grooved on one side, and should be just as wide as the plates are, and about a quarter of an inch higher.

On a flat surface lay one of the negative plates, with the projection to the left, on top of this lay a separator, with the grooved side **down**, and with the grooves running vertically with the plate, never horizontally. Then lay on a positive plate, with the projection to the right, then another separator, with the grooved side **up** this time, then another negative plate in the same way as the first one, and so on alternately, until all the plates and separators for one cell have been used. To keep this group in place, slip a couple of elastic bands around the whole, handling carefully all the while. The group will now consist of alternate positive and negative plates, with a separator between each plate, the first and last plates in the group being both negative. The projections from the negative plate will all be in line on one side, and those from the positive plates on the other. The grooved side of each separator should be against a negative plate, and the flat side against a positive in each case.

A similar group will, of course, be required for each cell.

The next step will be to connect all the negative plates in each cell to a common terminal, and all the positive in each cell to another common terminal, just as they were before being cut apart. The simplest and best way of doing this is to cut slots, the thickness of the plates, in the original terminals, so spaced that the projections on the plates will fit snugly into the slots, and so that the terminals will be exactly central over the groups. They should then be held in place, and well soldered. The completed group should now appear as shown here. Although "burning" the parts together with a hydrogen flame is the standard method of connecting, the writer has found that soldering is quite satisfactory although not so lasting.



This diagram shows how the storage battery is to be charged, an ammeter being placed in the circuit, so that the current can be regulated, according to the size of the battery.

The completed groups can now be placed in their respective cells, which should first be thoroly cleaned inside, and then tested for leaks by filling with water and allowing to stand for a few hours. Small leaks can be repaired by thickly smearing the outside of the cell, over the leak, with a quantity of the melted compound used in sealing. Any space between the groups and the interior walls of the cells should be taken up by inserting small pieces of wood of the correct thickness, so as to keep the groups central in the cells.

The electrolyte, of about 1.275 Sp. Gr. may now be poured into the cells, to just cover the tops of the wood separators, and the hard rubber tops put in place. It is assumed here that these tops, together with the compound, have been removed from the old groups when first taken apart, but if desired they can be left in place. The best course to pursue depends somewhat on the battery. The cells may be sealed up again with compound, but this is not absolutely necessary, except to retard evaporation of the water, and to keep the electrolyte from slopping over the edges of the cells.

The cells should now be placed in a suitable wooden container, and connected up in series, by means of heavy lead-coated copper strips, soldered in place; or the original connecting links may be used over again.

The completed battery is now ready for charging. The first charge will require from 30 to 50 hours, at the normal charging rate, or until the plates are formed, by which is meant that the active material in the positive plate is completely converted into peroxid of lead, and that in the negative plate into spongy metallic lead, the acid in the plates being transferred to the electrolyte. At this stage the electrolyte will commence to "boil", and give off a considerable amount of gas (hydrogen), and the specific gravity of the electrolyte and the voltage will have reached a maximum point, at about 1275 to 1.300, at 2.5 volts per cell, respectively. If the specific gravity of the electrolyte at the end of the **first** charge is not somewhere between 1.275 and 1.300, it should be corrected by adding either distilled water or dilute acid, when the specific gravity is too high or too low, respectively. This applies only to the first charge; at other times only distilled water should be added, to replace that which evaporates. The acid itself does not evaporate.

It will require several successive charges and discharges before the maximum capacity of the battery will be obtained, but all charges after the initial one will require only about 8 hours.

The normal rate of charge and discharge can be found by multiplying the total area in square inches of **both** sides of **all** the positive plates in **one** cell by .04. This rate is uniform, regardless of the number of cells in series. Since the rate as determined above is the normal 8 hour rate, the capacity of the battery in ampere-hours can be determined approximately by multiplying this figure by 8. For example, a battery whose normal charge and discharge rate is 5 amperes, will have a capacity of about 40 ampere-hours.

(*Continued on page 285*)

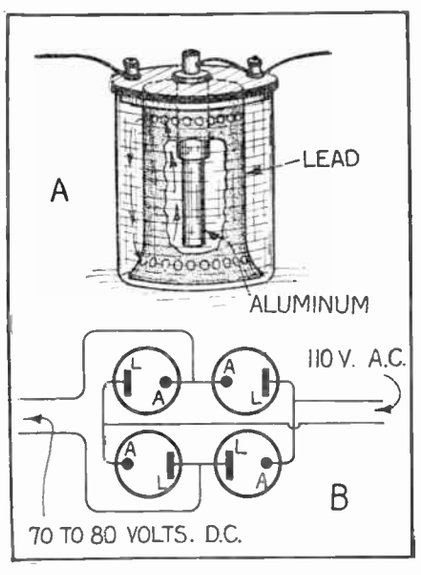
Electrolytic Rectifier

NO doubt there are many amateurs like myself who have occasional trouble with their electrolytic rectifiers, so I venture to give some advice as to how to diminish the heating of rectifiers. If the apparatus is not given too much work to do, the home-made one here illustrated will work excellently. Because of the constant circulation the solution is kept cool.

As everyone does not have the same sized jars, I will not give dimensions. A large fruit jar will answer the purpose if the top is cut off straight. A top is turned that just fits in the mouth of the jar; then a piece of lead pipe about ¾-inch smaller than the inside of the jar and the length of the jar. The bottom of the lead should be flanged out as shown in the picture. About a half inch from the bottom bore a row of ¼-inch holes all around, also bore a row of ¼-inch holes about an inch from the top. A hole that will just hold an insulating fibre bushing is also made in the top of the lid. The bushing should be about four inches long. Into this bushing an aluminum rod (which can be obtained at a brazer's), is inserted.

The solution used by myself was borax, but there are many others which can be employed. A good hook-up, which rectifies both sides of the cycle, is shown.

Contributed by Marvin Strouse.



A simple electrolytic rectifier for construction at home; this will rectify both divisions of the alternating current.

The connections of a multi-cell electrolytic rectifier are quite interesting. The alternating current is connected to both positive and negative plates, so that on one cycle it is rectified by one set of cells, and on the other cycle by another set. The current taken from the cells has one lead connected to the positive elements in parallel with each other, the other to the negative elements in parallel with each other also. In general terms, the alternating current forms two series-connections, while the rectified current has a single connection in parallel.

It will be seen that the idea is to have one half of the battery take care of the cycles of one direction, and the other half of the battery take care of the cycles of the other direction.

Many devices have been originated for rectifying alternating currents, many of them being partly mechanical. The advantage of the electrolytic rectifier is in its simplicity. It can be constructed by anybody, with hardly any apparatus, except that of the most ordinary description. Of course, a home-made apparatus will hardly be as efficient, as one produced in a technical factory. Again, in the tungar and mercury vapor rectifiers, the home-made electrolytic apparatus certainly has a pair of formidable competitors.

A Power Battery

By H. Gernsback,
Member American Physical Society

THE average experimenter, when the term power-battery is mentioned, is apt to smile, because many still think that there is no such thing, and never was. Then also, the question comes up "What is the use of having such a battery in these days of electric light, storage batteries, and the like, when we all know that the primary battery no matter what its make, always will be far more expensive as a generator of power than the electric light plant?

All this is perfectly true, but to the dyed-in-the-wool experimenter there is nothing more fascinating than a good primary battery that will furnish a constant current without diminishing during practically the whole of its life. Then too, a most important point to consider is that we do not all live in the city so that many experimenters located in the country, even today, have no electric light circuit with which to charge their storage battery and make their experiments. On the other hand, even the city experimenter who has his 110 volt circuit at hand cannot always use it, because he cannot reduce its voltage sufficiently to make all the experiments. A country experimenter as a rule has nothing but alternating current, which is not suitable for many purposes such as charging storage batteries, etc. Of course, he can use a rectifier, but some of these are rather expensive. Then there is always the fascination of having a battery, which does the work right, with which you can make your experiments, charge your own storage batteries, etc., satisfactorily.

An efficient primary battery should have the following outstanding qualities.

It should be able to furnish a powerful current.

Its voltage should be reasonably high.

Its capacity in working should be large.

The internal resistance should be very low.

Short circuits should not harm it.

Such a battery should not develop noxious fumes of any kind.

The solution (electrolyte) should not be dangerous.

Local action, that is consumption of materials when the battery is not in use, should not take place.

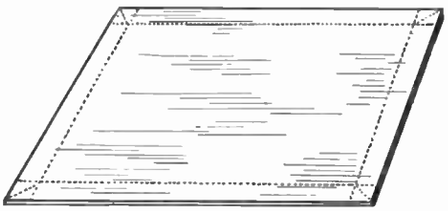
The price should be reasonably low.

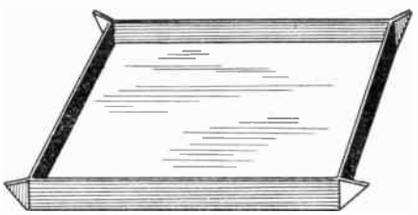
The cost of renewals should also be low.

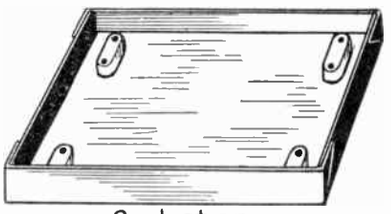
The battery should need no attention when not in use.

The power battery described here, the writer believes, has all the good qualities enumerated, with the possible exception of item 2. The voltage of one couple of this battery is only about 0.9 or almost 1 volt, but if we consider all its other good qualities, this need not worry us, because the price being reasonably low, it does not cost much to add a few extra cells in order to bring up the voltage. If therefore, we would like to have 6 volts, we would need 6 or better 7 cells; for 10 volts, we would need about 11 cells. In the author's younger days when electric light was not what it is to-day in the country districts, the writer constructed one of these batteries of 125 couples to light up his father's estate, and so successful were his efforts, that they were used at one time to supply 25 incandescent 16 candle power lamps, the battery carrying the load remarkably well. These batteries were also used frequently to light two arc lamps, to run a sewing machine, to operate fans, etc. After a year's successful use, the author, instead of taking off the current direct from the batteries, first charged a bank of storage batteries in the day time, and by a clever switching mechanism, all the storage batteries were connected in series for the night, and a very fine and steady light was obtained in this manner.

This battery, which is of the Lalands type, has the peculiarity that when working, it produces pure copper electrolytically which can be sold at the prevailing market price. The battery described, herewith, can furnish about ½ a pound of pure copper per cell in three or four weeks. If the experimenter buys anywhere from 12 to 24 of such cells, the investment will be a good one, for the reason that in other cells nothing is won, and some of the parts, even if not used up entirely, must be thrown away.



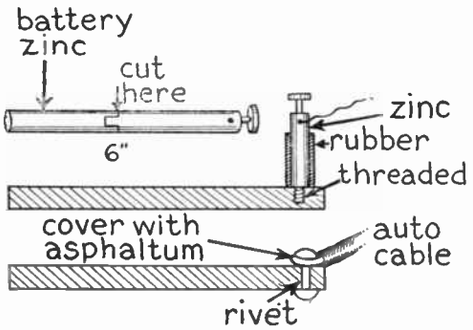




These illustrations show what may be termed the three steps in preparing the container which is at once container and negative electrode. The first step is to rule off on each side of the iron or copper sheet a line parallel to the side, to indicate where it is to be bent upwards. The sides are then bent up, and this must be done accurately, producing the four projective corners seen in the second step. Porcelain cleats are placed in the tray after the projecting corners have been bent over, as shown in step three, and the container is complete.

The Container

The size of this battery is immaterial. No special dimensions are given here for the reason that any size will do, the size depending entirely on how much money the experimenter desires to spend. It should be borne in mind that the size only increases the ampere capacity for each cell; it does not affect the voltage. No matter how large the cell, it will only give 0.9 volt. The container is made preferably of sheet iron or better of copper. If sheet iron is used, it is absolutely necessary before starting the battery that the bottom is sandpapered bright, so that metallic contact is made with the copper oxide.



The zinc plate is seen in section, with its connecting post made from a Leclanche zinc; the post is covered with rubber tubing. The alternative connection of the cable to the same plate, by riveting, is shown also.

When copper sheet is used, it is also preferable to scrape the bottom clean for better contact. The container is made of a single piece of sheet iron and in the writer's instance, the battery measured 24 by 16 inches. The height of each container was about 2 inches. Our illustration shows exactly how the metal is bent to shape in order to produce a waterproof vessel, that is strong and will positively not leak. It will be noted that the four corners are simply bent over and may afterwards be hammered into place. The illustration shows this better than words can describe. On the outside of each container a stout copper wire is soldered. This may be No. 14 wire preferably, which should be insulated except at the point of contact, and where connections are made. The connecting wire should be about 6 to 8 inches long.

For support of the zinc plate, we use ordinary porcelain cleats. Four cleats will be found sufficient. Do not use unglazed cleats as these soon become encrusted with copper, forming a by-path for the current. If no porcelain cleats can be secured, insulators ½ to ¾ of an inch high should be used. Always remember that the nearer the zinc plate comes to the copper oxide, the more amperes of current each cell will give. The electrolyte necessarily has some resistance. We can readily see from this that the more we separate the elements, the less amperes we will get. The writer even found it practicable to decrease the distance between the zinc and the copper oxide to ¼ of an inch. A single cell of the battery in this case gave from 30 to 40 amperes.

When the insulators are put into place and the battery of the container is scraped perfectly clean, we place a layer of red copper oxide at the bottom of the container. This material is not very expensive, and the more you use the longer the battery will last. Use about 1-2 pounds for each container of the size given above, namely 16 by 24 inches. By means of a piece of wood or other implement, spread the copper oxide as evenly as possible, tamping it down gently. It will of course be understood that the insulators must be left clear of copper oxide, and no copper oxide should be on the top of the insulators themselves. If the copper oxide comes within ¼ of an inch of the top of the cleats or insulator, it will be satisfactory, as long as the zinc plate does not touch the copper oxide.

Positive Element

The zinc plate or positive electrode must now be made. Let us say here for the benefit of the inexperienced, that in a battery, the electrode furnishing the positive pole is negative, and not positive as is often thought. The negative electrode on the other hand, furnishes the positive pole. Consequently the zinc plate is the positive element, but gives a negative pole.

The zinc plate should be made of rolled zinc, cast zinc not being so good for the purpose. Zinc about ⅛ of an inch to ¼ of an

inch thick should be used. In one corner drill a hole to which rivet with an iron, not copper rivet, a piece of No. 14 copper connecting wire. It is better to rivet the wire than to solder it, because a soldered wire underneath the solution will wear off sooner or later.

If you wish to make a still better job, instead of riveting a connecting wire, tap a hole into the zinc plate and bring out a post as shown in the illustration. If you use this method, the post must be screwed into the plate as tight as possible. A rubber tube must fit over this post just as snug as it is possible to make it. It is used to insulate the post from the electrolyte. This post should be made of no other material save zinc, and can be turned out from a common zinc, such as is used in the old type Leclanche sal-ammoniac cells. The rubber is necessary so that no action takes place around the post, which otherwise would make an active couple, whose local action would soon wear the connection down to nothing. Before slipping on the rubber it is necessary to varnish the joint with asphaltum so that no electrolytic action takes place there. The bottom should be varnished as well.

If you prefer the rivet method, it is necessary that the entire joint shall be well covered with asphaltum, and the connection wire must be covered with rubber. Ordinary rubber cable will do nicely, but be sure that no wire is exposed to the action of the liquid. Insulate well with asphaltum varnish.

The next and most important step is amalgamation of the zinc plate. Unamalgamated zinc gives a somewhat lower voltage and also does not wear as well as amalgamated zinc. Proceed with the amalgamation as follows:

In a glass tumbler mix 4 parts of water and one part of muriatic acid. Wet an old rag with this solution, and apply to the zinc plate. A small drop of mercury (quicksilver) is then placed on the moist plate, and same is rubbed into the zinc by means of a rag. The mercury is then rubbed over the entire surface—both sides, including the vertical piece—till the plate is brilliantly white and shines like polished silver. The entire process does take not more than 2 minutes. The plate is then well washed off in water and stood up on one of its corners for at least 6 hours. This brings all the superfluous mercury down and it can be collected for further use.

Great care must be taken with amalgamated plates as the mercury renders them extremely brittle. Amalgamated metals can not be soldered.

When all the superfluous mercury has been collected the zinc plate is placed upon the four insulators.

Electrolyte

The electrolyte or exciting fluid is prepared as follows: In 100 parts (by weight) of distilled or rain water, 40 parts (by weight) of powdered caustic potash is dissolved. This chemical is quite cheap, but not all grades are suitable for battery work; the right kind is usually carried in stock by electrical houses handling chemicals. It should be commercially pure.

The electrolyte thus prepared should never be used while warm. As soon as cold it should be poured very slowly on top of the zinc to break up the stream. If poured too fast the layer of oxide of copper will be disarranged, which should be avoided.

Enough electrolyte is poured into each cell for the solution to stand at least ½ inch over the surface of the zinc plate.

Last, on top of the solution slowly pour a film, at least ¼ inch thick, of good parafine oil, or if this cannot be obtained, kerosene oil can be substituted. This film of oil is absolutely necessary, as it keeps the electrolyte from evaporating and also from "creeping" and prevents the formation of alkaline carbonate from the carbon dioxide of the atmosphere.

It is understood that once assembled, these batteries cannot be moved about, and should never be shifted while assembled. On this the success of the installation depends.

Suitable racks with shelves one above the other should be built to hold the batteries, (see cover illustration) which latter should best be assembled while in the racks. The distance between the shelves should be about 4 inches. Each cell can then be watched readily.

If several cells are to be connected in series, use short pieces of No. 14 or No. 16 copper wire to make connections. Thinner wire than this will cut down the current.

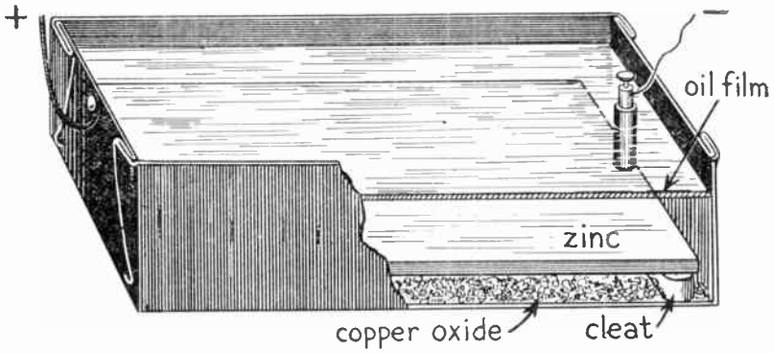
As soon as all the cells are connected up, short-circuit the entire battery for 2 to 4 hours. This is necessary as it will reduce some of the copper oxide to pure copper, which will establish perfect contact between the oxide and the container. This short circuit is not harmful, but beneficial to the cells. Of course, after this first short-circuit, others should be avoided.

If the battery is now tested on open circuit, each cell should read 0.9 to 1.0 volt. The total amperage of each cell, if well constructed, should run from 20 to 30 amperes. One can draw as much as 4 amperes continuously without harming the battery. Under full load the voltage will hardly ever fall below 0.7, which figure should be taken as an average, when computing the installation. For instance, if we desire a battery of 6 volts, we must have 9 or better 10 cells.

These batteries are well adapted to run spark coils, to charge storage batteries, to drive motors, to light lamps, in fact for every purpose where a steady, strong current is desired.

Once assembled the cells need practically no attention at all, and will not deteriorate when unused.

This battery will give a steady, uninterrupted current for weeks and months at a time and is always ready for use. It can be short-circuited for practically any length of time without damaging it in the least. The battery will work until the zinc is entirely dissolved and the copper oxide reduced to pure copper. When the battery is entirely discharged, there will be found on the bottom of the container a layer of pure copper which can easily be peeled off. This can be placed in boxes until enough has been gathered for sale.



This illustration shows very clearly the complete layout of the battery. The zinc plate is seen resting on the insulations, one of which is shown where the container is broken away. On the bottom of the container is the copper oxide. The container is filled rather close to the top with the solution of caustic alkali, and above that, floating on it, is a film of non-volatile oil, paraffin or kerosene, as the case may be. This film of oil is an absolute necessity, to exclude the carbon dioxide of the air; its function is not only to prevent evaporation. The construction of the container is clearly shown here, with its bent over corners producing a seamless vessel.

Copper Oxide

There are several grades of copper oxide on the market, black copper oxide as well as red copper oxide. Both can be used, although the red copper oxide is the better. There is also another oxide, namely copper suboxide or cuprous oxide.

The red oxide is difficult to obtain in the United States at the present time, but it is by far the best to use if it can be procured. This oxide does not come in flakes like the regular oxide, but comes in a small pebble-like form. It is red in color. Some of the large chemical houses may make it on a special order if they are approached in the correct manner.

Keeping The Toy Transformer Busy

THE experimenter who possesses a small transformer of the type used for running toy motors, can keep it busy with the following suggestions:

Hook up the door bell on two and a half or five volt circuit and throw away the old batteries.

The fancy candle sticks can be made useful as well as ornamental by making them into real lights. To do this, first make an imitation candle of good paper by rolling around a large pencil until it is large enough to fit the socket of the candle stick. Fit an Ediswan double contact socket in the candle and wire with a conductor made by two strands of D. C. C. No. 24 wire.

The Ediswan sockets can be obtained of any dealer in automobile supplies, as can the 6-8 volt lamps such as are used in automobile head and tail lights. These lamps can be obtained in candle power ranging from two to twenty-five, but a four candle power is the most appropriate for a candlestick.

Ordinary battery switches can be used and the writer made several such from junk, by using the small bolts from the carbons of dead dry batteries for connections and contacts and a strip of brass for the switch arm.

Annunciator or bell wire can be used for leads and may be run along the base-board of a room without being noticeable. One of these lights in a bed-room makes a very fine night light, for it may be turned on and off without making any noise.

As the amount of current used by these lights is so small that it barely registers on the meter, one may have handy lights in many places at very little expense except the time and work.

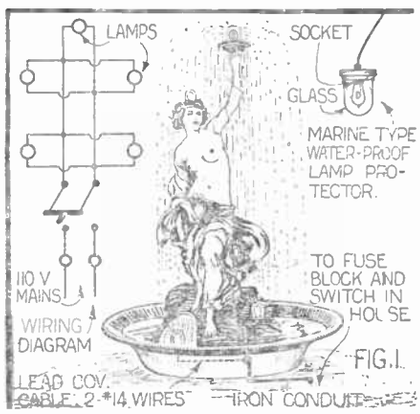
Contributed by M. J. McCall

Summertime Electrics

By H. Winfield Secor

Associate Member, American Institute of Electrical Engineer.

WITH the approach of the Summer season, we are reminded of the many uses to which electric lights can be put, especially out-of-doors, about the lawn. We frequently see electric



A fountain, electrically illuminated, a reminder of the Venus of Milo, illuminated by the light of the twentieth century. The artist has restored her arms to the goddess of 2000 years ago.

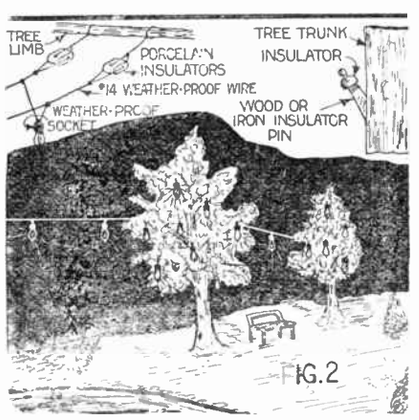
lights suspended from the limbs of trees, and even in the trees themselves on some estates; this is a very practical idea, and one that will undoubtedly spread, for there is no reason why we should go groping around yards or grounds about the house in the dark, when the faithful servant electricity is available.

An electric fountain is a valuable adjunct in decoration of both large and small lawns or yards. On small fountains, a few lights will work wonders, and you will be surprised at the attractive display these will give. Half a dozen 25 watt lamps, colored red, white and blue, or simply white, or any other desired colors, and preferably placed in water tight glass shields, such as those sold for marine work or ship work, as shown in the detail at Fig. 1, are excellent for this purpose. The wires leading to the lamp sockets about the statue or other part of the fountain, are best encased in thin lead pipe, but with a little care and ingenuity in installing the wires, ordinary pipe conduit can be used or else BX flexible conduit. BX cable has also been used in some cases with satisfaction. Regulation lead covered duplex cables can be purchased at electrical supply houses also. All outside circuits, especially fountain circuits, which are liable to give more trouble than is ordinarily the case, owing to the water and dampness present, should be connected up with a separate switch and fuse block in the house. If you do this work yourself, you should inquire of your electrician as to the size of wire to be used and how many lamps you can operate and their size, and particularly what circuit you can operate these lights from, as some of the house circuits will already be loaded to their full capacity. Electric fountain lights are sometimes operated from a storage battery, which battery will require recharging about once a week, if say, six to eight Christmas tree lamps or their equivalent, are employed. The lead covered cable, or else pipe in which the rubber covered wires are run to the fountain, can be buried in a small trench dug in the ground. Where the fountain may happen to be under a tree, the wires may drop down through the tree in such a manner as to be almost invisible to ordinary inspection.

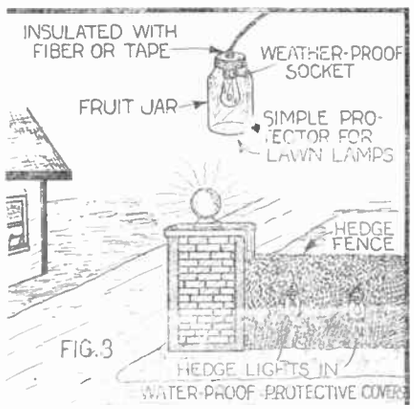
Fig. 2 shows another idea for employing electric lights, which is particularly desirable where lawn fetes are held, or where people enjoy sitting on the lawn or under the trees on summer evenings. Where the grounds about the dwelling are quite extensive, it is a very practical idea to have at least one electric light in each large tree, so that the grounds are properly lighted, and not blanketed in total darkness. The initial expense of wiring up the tree lights or other lights suspended from wires running between the trees, or between posts erected about the yard, is small indeed, in comparison to the results obtained. Such lights are useful as prevention against thieves who may be prowling about. The tree or yard lights may be connected in several groups to a series of switches inside the house, so that they can be turned on in sections, or may all be connected to a single switch. You may obtain the necessary data for the size of wire to use for a certain length of circuit, and the number of lamps you can light properly on a certain size of wire at a given distance, from your local electrician, or else by consulting any good wiring handbook procurable at your local library. Cushing's Wiring Manual is one of the best, and Cooke's is also very good. For ordinary short runs, No. 14 double braid, rubber covered wires is used for all concealed work, such as for molding, conduit or circular loom; while for outside use, freely suspended wires, not concealed, No. 14 weather-proof wire is to be employed. The wires should be arranged so as not to touch any of the foliage or limbs of the trees, and they must of course, be thoroughly insulated from the tree limbs, as shown in Fig. 2.

Several styles of insulators are available nowadays for wiring trees and these can be purchased at any electrical supply store. Where joints are made, the wire should be thoroughly cleaned with a knife, by cutting away the rubber, being careful not to nick the wire, and after twisting the bared end of one wire tightly around the other, five to six times, with the aid of a pair of pliers, the joints should be soldered with a non-corrosive flux and then well taped, using rubber tape first, and finally black friction tape. Where but one light is used in a tree a 100 to 150 watt unit may be necessary.

Illuminated hedge fences or in fact any form of fence, and particularly gate posts, as shown in Fig. 3, are not only a safeguard against marauders, but also serve to illuminate the yard or grounds at night, both from the artistic and the utilitarian point of view. The lamps used for illuminated fences or hedges, including gate posts, may be fitted with glass water-proof protective covers of the marine type; in any event all of the wiring, and especially the sockets used, must be of the weather-proof type with sealed-in wires. An idea is given in the detail at Fig. 3, whereby one can easily make water proof protective covers for out-door lamps, using Mason or other fruit jars and taking care to seal the wires into a hole in the metal top, a fibre bushing being placed in this hole preferably at first, and then afterward filled with sulphur, rosin, or simply paraffin wax. It is best to paint all metal parts on exposed fixtures and lamps such as this, with heavy black asphaltum; ordinary paint may be used if this is not available, giving the metal parts several coats to prevent corrosion.



Trees used as poles for lines or festoons of electric lamps, to illuminate the summer lawn and groves. No electric poles deface the scene, and the wire is invisible at night.



A privet hedge illuminated by electric lights, each protected by a fruit jar, so that rain and dew shaken from the leaves will not break the lamp.

Gate posts are usually fitted with inverted porch light globes as shown in Fig. 3, these glass globes being available in any size, both in clear glass as well as in milk or opal glass. Where the opal glass balls are used, about one-half the candle-power of the lamp will be lost, and if the same amount of illumination is desired as when clear glass is employed, an incandescent lamp of twice the wattage and candle-power rating must be placed under the ball.

Those interested in building out-door electric fixtures for the porch as well as in-door fixtures of the Mission style, made of wood, which lend charm to any home, will undoubtedly find of interest an article which the writer recently contributed to the May SCIENCE AND INVENTION, entitled—"Building Your Own Electric Fixtures".

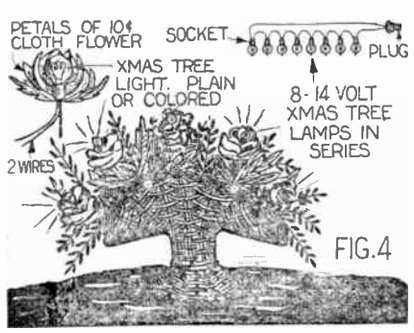
The wire used for connecting the various lamps along hedges, etc., may be No. 14 weather-proof, and it should be kept free from limbs, etc., and rigidly supported on porcelain knobs or glass insulators secured to wooden strips fastened to the hedge as inconspicuously as possible, painting the wooden strips green. The two wires should be separated at least 3 inches and care should be taken to see that they do not sag and touch one another. This necessitates placing porcelain cleats or knobs every 3½ ft. to 4 ft. in most cases. The wiring running up to gate post lights can be carried in iron pipe, and here No. 14 double braid rubber covered wire may be used, or better still BX cable, or else lead covered cable.

Has your admiration been aroused by the beautiful baskets of electric roses and other flowers, which the shops are showing these days? They are variously priced from $10.00 up to as much as you may care to spend, some of the flowers sets being very beautiful indeed. You can build one of these electric flower baskets for the dining room or living room or living room table at small cost, especially if you happen to have some Christmas tree lights which are lying idle in the storeroom awaiting the next Yuletide season.

As the illustration at Fig. 4 shows, an ordinary wicker basket, or a metal or glass fern dish will serve to hold the flowers, the flowers themselves in the writer's case having been purchased at the 5 and 10c. store at 10c.

a piece. The necessary artificial leaves may be purchased also, but in the summer time the bouquet can be kept up to date and more "alive" in appearance, by using natural leaves, and also natural flowers, interspersed with the artificial ones in which the tiny electric lamps are hidden. Usually these electric flower displays are operated from the 110 volt lighting circuit, and this will require eight fourteen volt series type lamps connected in series. The terminal wires from the series of lamps are connected to a standard screw attachment plug, and the wire used for this purpose should be regular silk covered flexible twin cord, procurable at any electrical supply shop. This silk covered flexible cord comes in a variety of colors, so as to match the surroundings. Colored lamps are generally preferable for lighting the artificial flowers, and the cloth petals of the flower should be arranged so that the lamp bulb is invisible in most cases. Different colored lamps may be used for the various flowers—red for roses; purple for flowers of that color, etc. Where suitably colored bulbs are not procurable, plain white glass ones may be used, and colored by the builder or else simply used plain, depending for the color effects upon the rays of light shining through the cloth or silk composing the flower

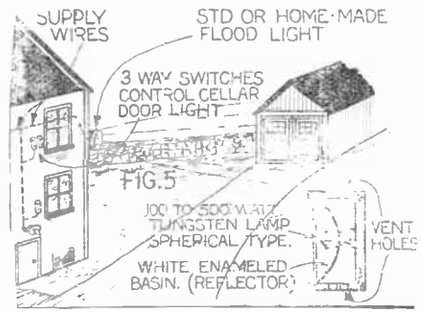
Out-door illumination for summer time requirements and also for the winter time, are often taken care of in a most efficient way by utilizing what is known among engineers, as **flood lighting.** Fig. 5 shows an application of this scheme now being used by the writer for lighting up the road leading to a garage, about 30 ft. from the house. Flood lights are available at a cost of a few dollars at electrical supply houses and dealers, and are in fact miniature searchlights. They comprise a water-proof case containing an excellent reflector, measuring from 10 inches to 12 inches or more in diameter, with a plain glass front to protect the reflector from the elements. By using a high-power tungsten lamp of the spherical type with a concentrated filament in these flood lights, which can easily be made by anyone with a little ingenuity, as the detail in Fig. 5 shows, very powerful illuminative effects can be obtained at slight cost. The reflector for home-made flood lights may comprise a white enameled wash basin, or else a tin or galvanized basin, which has first been given a coat of white paint and then a coat or two of white enamel, so as to make a suitable reflecting surface. Vent holes should be drilled through the top and bottom of the wooden case containing the reflector and lamp socket. The tungsten lamp may be rated at 400 to 500 watts with a candle-power value of about one watt per candle-power. Such a flood light or illuminator placed about the house is very advantageous in the event that one hears suspicious noises in the night, as they can be controlled by switches at a distance from the point where the flood lights are mounted. In the diagram at Fig. 5 the cellar-door light, which also helps to illuminate the grounds, by means of a 100 watt tungsten lamp placed in the focus of a 14 inch white enameled metal reflector, is controlled by two three-way switches, one



A great basket of leaves and flowers, which may be artificial, and which, when illuminated by a quantity of Christmas tree lamps, presents a very beautiful appearance for outdoor display.

up-stairs, and one down-stairs, so that it can be lighted or extinguished from either position.

Now that so many motor-car thefts are being reported by police departments not



The much discussed flood light, adapted to lighting up garage doors, and of course applicable to many purposes. It has been applied to the illumination of huge office buildings; here we see its use on the country place.

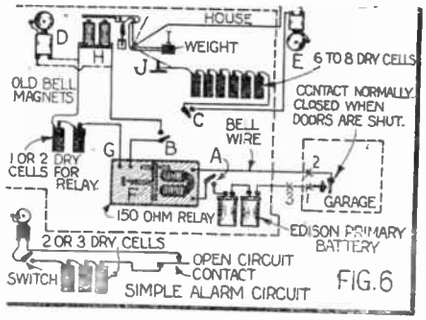
only in the larger cities, but in suburban residential sections as well, the writer believes that a good burglar alarm system will be welcomed by all automobile owners. The diagram at Fig. 6 shows an out of the ordinary burglar alarm which can be used for protecting garages, chicken coops, or any other outbuildings as well as for guarding the windows and doors of the home, if desired.

When more than one contact is to be used, they are connected in series, as at 1 and 2 in the diagram at Fig. 6. All of the contacts must be closed before the relay circuit switch A is closed. This is a closed circuit system employing two or more gravity cells, or as in the writer's case, two Edison primary cells procurable from your electrical supply dealer. These cells give about .75 volts each, and while one may be used in connection with a 150 ohms telegraph type relay F, two are much better, as it is difficult to obtain reliable adjustment on the relay armature with but one cell, although the writer used this system with but one cell for over a year. Two cells are now being used, giving better results.

Alternating current stepped down from the lighting circuit by means of a bell-ringing transformer, was tried with a 150 ohm relay, so as to give 6 volts to operate the relay magnets instead of the low potential of the Edison cell previously used, but this proved unsatisfactory. Here's why nearly every night for two weeks when this system was in use, the electric current would cease for a moment about three in the morning, when dynamo switches were being changed at the power station, presumably, bringing the household out of bed armed with shot guns and revolvers; for this reason the Edison primary cell or gravity battery will be found the best. It is interesting to note that when the stepped-down A. C. was applied to this relay circuit, the armature could be regulated by loosening up the contact and back-stop screws, so that the armature would stay in the middle of the gap, away from the pole pieces, and thus prevent the humming noise caused when the armature was permitted to touch the pole-pieces. This peculiar fact was stumbled upon by experimentation, and it may be of value to some readers who wish to use the A. C. lighting current for this or other relay circuits. The 150 ohm relay is of the standard telegraph type, or it may be made from a 150 ohm telephone bell ringer.

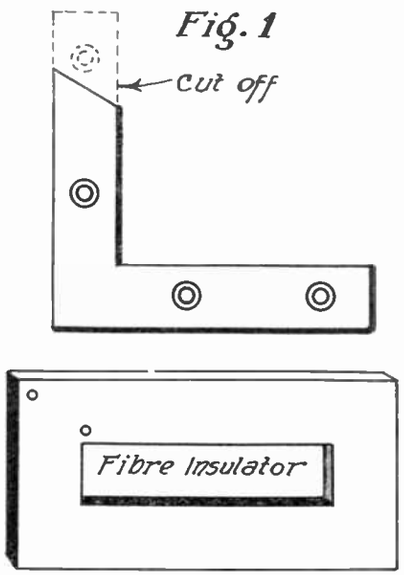
Referring to the diagram at Fig. 6 once more, it will be seen that the local circuit G from the 150 ohm relay is connected with a few dry cells, the current from which may be used to do either one of two things; it may simply operate a bell D, when the garage door contact is opened, or when one of the wires running across the yard is cut; or secondly, and preferably, it is allowed to actuate a constant-ringing drop relay H. This relay can be built by anyone from old bell parts, the two electro-magnets being procured from a discarded bell or a cheap new one The iron armature is pivoted in such a fashion that when it is attracted by the electro-magnets, it will allow the pivoted circuit-closing bell crank lever I, to drop down on the contact screw J, and close a local circuit through several dry cells and an alarm bell E. The larger this alarm bell, the greater the number of dry cells required in the circuit. Three to four cells will operate a 6 inch to 8 inch bell usually, while a 10 inch to 12 inch gong or bell will require six to eight dry cells. The batteries may be placed in the cellar or in the garage; the two relays and the control switches, A, B and C, or simply A and B if the third local circuit including relay II is not used, are best arranged in a small wooden box on the wall with a hinged glass door to protect it from dust. Ordinary bell wire may be used in the garage, and from the house to the garage, etc., as this is a high resistance circuit anyway, but in the writer's case No. 14 rubber covered electric light wire was used, as this will stand the strain of swinging in wind and be fully protected in rain storms. This, furthermore is not so liable to break at about 2:00 a. m. in the morning and cause a false alarm. With the burglar alarm system installed on the garage, a button should be provided at the top of the doors, so that they will be kept securely in place when the wind blows, or as experience has shown, the wind may cause the door to swing upon sufficiently to actuate the contact spring, and cause an erroneous alarm. The closed circuit contact spring can be made or else purchased in an electrical supply shop, and it is usually installed behind the door by boring a hole in the door frame. The contact is adjusted so that it will open or cause the alarm to ring when the door has been opened about 3 inches to 4 inches at the center line of the doors. If set any closer than this, it is too sensitive. Such burglar alarm systems should be tested every day and a few drops of oil should be placed on the contact spring behind the garage door now and then to keep it in good working order.

For those not interested in the more elaborate, closed-circuit burglar alarm system just described, the simple open-circuit alarm system also shown in the smaller diagram at Fig. 6, will no doubt be of interest. This system has been used by the writer in many cases, especially where a quick installation is desired, as the materials are usually available at short notice, and in fact with a few yards of wire, it can be hooked up to the house door bell system. This open-circuit garage or chicken coop alarm, comprises a simple vibrating bell of the 40c. variety, two to three dry cells, a 10c. switch, an open circuit contact spring, and the necessary length of bell wire. Here the door permits the contact spring to close against the stationary contact, as the door is forced open, and the bell then rings. If the wire running across a yard in this case is cut, then the bell will not ring and your car may be stolen. The auto thief, who is usually quite



A closed-circuit burglar alarm system. This is supposed to use very little current, although on a closed circuit, but if the wires are tampered with in any way whatever, the bells will ring, or any desired alarm will be given.

Armature Growler



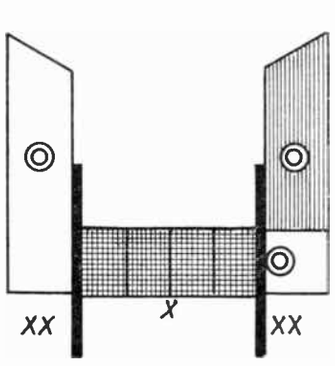
The upper illustration shows one of the angle irons and indicates where it is to be cut off. The core is built up out of these. The lower cut shows the insulator of thin fibre, two of which hold the coil in place.

A VERY efficient type of armature tester or growler for small work such as automotive equipment, including generator and magneto armatures, both high and low tensions, is shown in the accompanying illustration,and is simple to make for anyone having any knowledge of electrical work.

First secure a number of 'flat corners', 30 is about right, but a few more or less will answer, which should be 2½ x ½ or 3 x⅝. Assemble as shown in the drawing and insulate the lower portion with two layers of cotton tape and shellac. After this is dry, proceed with the winding in the approved manner, using double covered cotton magnet wire, from No. 24 to No. 28, the larger sizes giving more strength.

When the winding has reached a thickness of ¼ inch it should be tested for heating with an armature in place. If heating develops, some more wire must be wound on and another test made, proceeding in this manner until the correct point is reached, when it is ready for the outside insulation, which should be four layers of cotton tape well impregnated with shellac.

It will then be ready for mounting on the base as shown in the drawing.

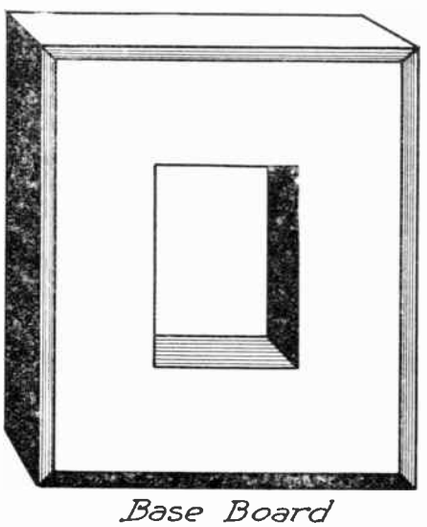


The building up of the core; the heavy black lines are the fibre insulators XX, and the wire is wound on X.

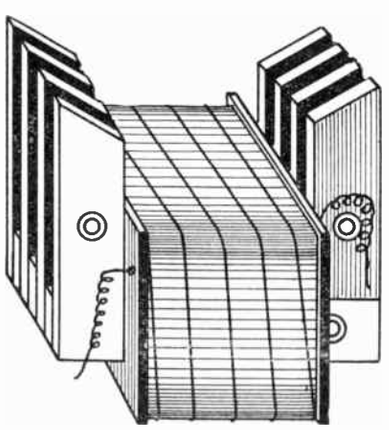
This outfit and a test lamp with points will detect all troubles which occur in an armature, and the whole operation requires but a few minutes.

The interesting feature of this apparatus is that no special parts are used, as the angles already drilled are to be had at any hardware store, where also fibre of various thicknesses can be obtained. It makes an admirably compact apparatus, and by riveting the core with distance pieces between the angles, if necessary, it can be made a very solid structure.

Contributed by H. A. Higbee.



The substantial baseboard, on which the growler is mounted; the opening in the center accommodating the projection of the coil and fibre insulators.

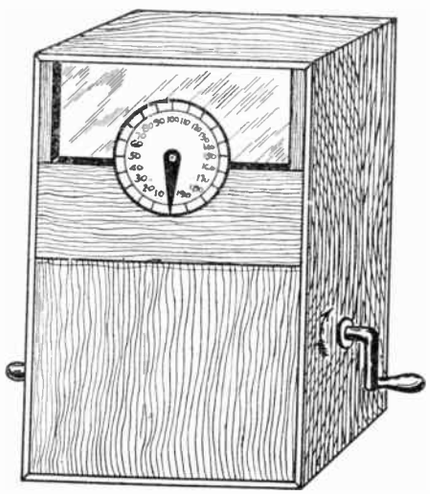


The apparatus put together all ready for mounting on the baseboard. The angle irons are securely rivetted together. It will be seen that the whole structure, while made of every-day materials is very symmetrical and solid.

Electric Shocking Machine

DESCRIPTION is here given of a small electric shocking machine which can easily be constructed by anyone who possesses a small shocking coil as shown in the illustration.

The old way of using a shocking coil is to connect it up each time, which necessitates dropping handles while pulling the regulating tube out. With the aparatus described a shocking machine is all set up and ready; all you have to do is hold the fixed handle with your left hand and the movable one with the right. Just turn about half inch or so and the current is on, all you have to do then is keep turning in order to get a strong shock. The way of increasing the shock is as follows: when *d* makes contact with *e* current is turned on,the greater the current, the more it pulls down the rod *f*, thus actuating the horizontal slotted bar which draws the regulating tube out of the coil, thus increasing the shock. This also turns the



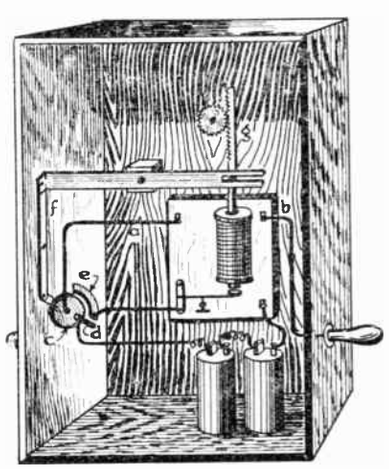
Exterior of an electric shocking machine, which presents in its construction some interesting features in the line of regulation of current of potential, so as to moderate the shock.

small gear-wheel moving the pointer on the front of the case. *g* is a strip of brass ⅛ inch thick soldered to the tube of the coil and teeth are filed into it so as to fit the small wheel. The disc graduations may be 200 or more, enough to show relatively how much current you can stand.

Fig. 1 shows a view from the front of the case. The disc is sunk back ⅜ or ½ inch from the front and a glass covers the top half. Fig. 2 is a view from the back showing the interior of the case. Dry cells can be placed flat in the bottom if they are found in the way of any of the parts. Wire *a* should be soldered to the centre of movable spindle.

The illustration shows the simplicity of the apparatus and an interesting feature is that the shifting of the regulating core of the electro-magnet directly operates on the gear wheel by rack and pinion, so as to move the hand and give readings on the dial on the exterior of the case, indicating what it is doing in the way of shocking or treating the patient.

Contributed by J. Clarke.

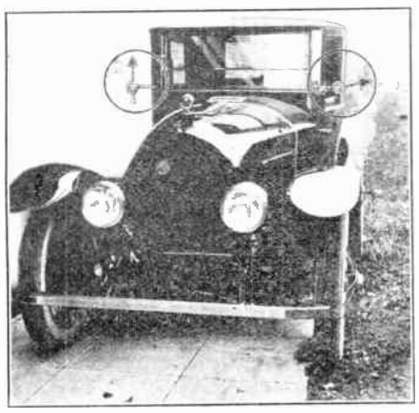


Interior of the electric shocking machine, showing the simplicity of construction and the effective method of regulating, and how the dial index is turned.

Motor Electrics

Automobile Signal

AN all-electric indicator, for automobiles, which dispenses with the use of his arm by the chauffeur, is illustrated here.

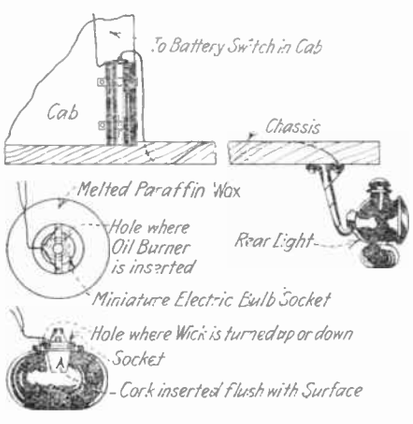


A very neat electrically operated signal, moved by pressing a push button, to tell the man behind when you are going to turn your car.

The indicator represents a pivoted arrow. At the middle there is a stationary winding and by the touch of an electric button, the arrow is made to take a horizontal or vertical position. One end of the arrow carries a tringular head, within which there is a light, and the head is enclosed, in front by a clear and in the rear by a red glass, so that it gives a quite complete night signal. There is a two-candle power lamp within the triangular head which shows a red light in the rear and a white light in front owing to the two glasses. The arrow has two positions, horizontal with the head pointing outwards, or vertical with the head pointing upwards. The horizontal position indicates that the automobile is about to turn. A current of twelve amperes passing for one or two seconds puts the arrow into the desired position.

The installation resembles that of a spotlight. It can be used as an economical parking light visible from both front and rear. The two-candle lamp, showing white in front and red in the rear, is a complete protection to the stationary car.

Electric Light From Oil Lamp



How an oil lamp was changed into an electric light for a tail lamp for a truck, without the use of any machinist's tools.

AUTOMOBILE and truck drivers often experience great trouble with the rear light if it is an oil lamp. The lamp will flicker out very easily and it also inclines to smoke.

After experiencing the same difficulty, I decided to install an electric tail light. Taking out the oil reservoir containing the burner, I removed the oil-burner and cleaned the oil font. I then took a cork and closed the hole in which the burner is inserted, cutting off the top of the cork flush with the surface at the edge of the hole. A miniature electric light socket, with annunciator wire attached to both terminals, came next. The wires were led out through the hole through which the stem is turned. The socket was then placed on the cork in the center, and melted paraffin wax was poured around it, reaching up to a point just above the terminals and the wires. The wax holds the socket firmly in place and the cork prevents the paraffin from running into the oil reservoir.

The lower part of the lamp was then screwed into place and the wires led around the chassis and up into the cab, under the seat. The battery was fastened into the corner with straps.—One wire goes to one terminal, and the other wire which was fastened to the other terminal of the battery, is led up along the seat to a small battery switch in some suitable place in the cab.

I installed this in my Brockway motor truck and it proved to be very efficient. A rear light more complicated can be obtained, but for the nominal cost of about one dollar the light described is both practical and efficient.

Contributed by Merritt Pike.

Novel Trouble Indicator

THE Tel-Auto-Spark is the name given to a new instrument which is designed for locating ignition troubles. Many very spectacular claims as to its usefulness on an automobile, are advanced by its sponsors.

Essentially, it consists of four spark gaps, each of which is connected into the circuit of individual spark plugs. In the center and free to rotate, is a three-fingered device, which for lack of a better name may be called a disc. This may be moved around so as to short-circuit any of the points on the indicator, as it is connected to the ground. With this indicator in place upon the automobile, many adjustments are possible. Misfiring, open plugs, commutator troubles, fouled plugs—all possible mishaps are promptly located and indicated, we are told.

For instance, assume that all three of the series gaps show the presence of a small bright flash across them, and one is out. This indicates that either the vibrator on the ignition coil is sticking or that a wire may be broken. If the spark or flash appears continuously between the series gap and one of the metal fingers on the disc, then the gap in the plug is evidently too large. If one of the plugs is fouled, one need merely turn the triple arrowed disc so as to short-circuit three of the plugs, leaving but one of them open. Attempting to run the machine on one cylinder will be possible, as long as the plug in that cylinder is in good condition. (Under ordinary conditions an engine will continue to run operating on one cylinder only.) For instance, cylinder 1 could be left open, the metal fingered disc short-circuiting cylinders 2, 3 and 4; if the engine continues to run, turn the disc, short-circuiting 1, 4 and 3, leaving 2 open. By repeating this process, the plug that is fouled is instantly located. If no spark appears in any of the series gaps, the trouble is either in the switch or in the main ignition circuit, while streaming sparks from the plug to the arrow finger arrangement show when the gasoline is low or is not being fed to the carburetor.

A dial for attachment to the dashboard of an automobile, with spark gap for each cylinder, whose sparking or lack of sparking tells the story of how the engine is working.

Auto Trouble Light

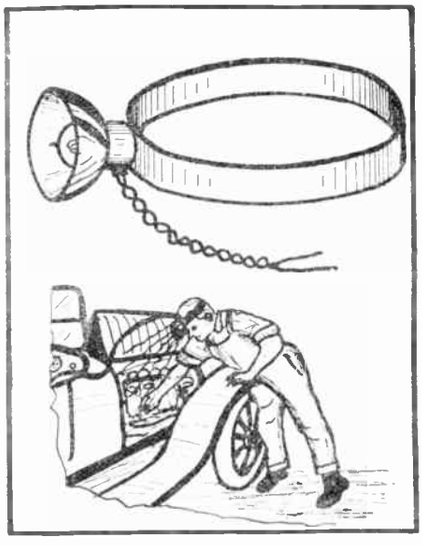
USING the reflector from a large flash lamp and a 6 volt 10 c. p. bulb, I contrived a very handy trouble lamp for working underneath my car.

The reflector contains the socket for the bulb, so I soldered the reflector to a strip of sheet brass 1½ inches wide and 2½ inches long, and then cut a slot in each end of the strip, through which I slipped the ends of a piece of elastic belting long enough to go around my head. The ends were turned over and stitched down to hold them in the slots.

A piece of lamp cord long enough to reach to the storage battery carries the current to the lamp. I find this lamp very convenient in use for I can direct the light anywhere I wish to by slightly moving my head.

An important point is that both hands are left free for work.

Contributed by M. M. Hunting.



A simple head lamp to be used in looking for trouble on the automobile, the light being supplied by the storage battery. It is held on the chauffeur's head by a band while he is inspecting his engine.

piece of apparatus.

Contributed by C. Marshall.

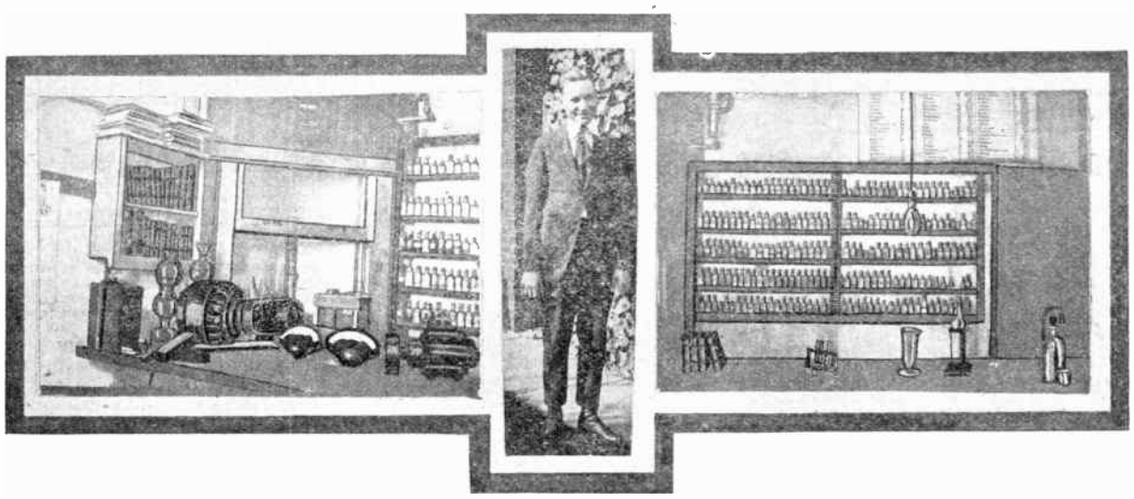
ed with the wind driven motor.

THIS department is open to all readers, whether subscribers or news-stand readers. We aim to show here for the benefit of others the best photographs of amateur work shops and laboratories. Nearly every experimenter has his own work shop, and we would like to receive photographs of all these. Photos are judged for best arrangement, and novelty of the apparatus, neatness of lay-out and effect, etc. The prize does not necessarily go to the shop containing most apparatus and instruments.

In order to increase the interest in this department, we make it a rule not to publish photographs unless accompanied by portraits of the owner. We prefer dark photographs to light ones. Prize photographs must be on prints not smaller than 5 x 4½ inches. It is impossible to reproduce pictures smaller than 3½ x 3½ inches. All pictures must bear name and address written in ink on the back. A letter of not less than 100 words with full description of the shop must accompany the picture.

PRIZES: One first monthly prize of $3.00; all other published pictures will be paid for at the rate of $1.00 each. Pictures and photographs will be returned upon request.

Riser Laboratory.



Mr. Cecil Riser of Cincinnati, O. sends some interesting particulars of his laboratory. He is devoted to the chemical side of electricity, investigating the arcana of electro-chemistry.

He writes as follows:

"I present herewith photographs of my laboratory, of my workshop and of myself. The photos show only the chemical department but I have a large quantity of electrical apparatus in a cupboard which I also use for a dark room when developing pictures. My workshop has about 200 tools, all kept in a large tool chest. My laboratory bench has a large projecting piece to which I can clamp vices, bench hooks etc. My chemical outfit is a well equipped one, having over 350 chemicals in it. I have also numerous miscellaneous pieces of apparatus, and two balances; as can be seen from the photo there are some original pieces also. My electrical laboratory is not so well equipped, except for the purpose of electro-chemistry. The other photo is one of the cabinet in which I keep my chemicals. I find that neatness and order are essentials in this work. Do the photos show it?"

Martin Laboratory.

FROM Detroit we receive the following interesting account of the Martin L. Hussey laboratory:

"Herewith I present three photos, one of myself and two of my laboratory.

The first is of my chemical laboratory which contains about 200 solid chemicals and over 75 solutions and liquids. It also contains many pieces of apparatus such as retorts, flasks, beakers, pippets, crucibles, burners, balances, etc.

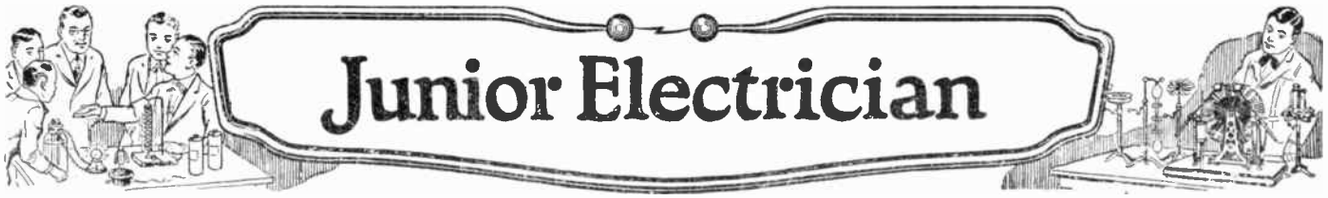
The table is equipped with gas and water and there is also a distilled water spout running from a tank. I have a hood for obnoxious gases and also an electric furnace for fusing minerals.

The second picture shows my collection of electrical apparatus; such as motors, particularly a ¼ H. P. machine driving a large generator for charging batteries etc. There are two large meters pictured, one a voltmeter the other an ammeter.

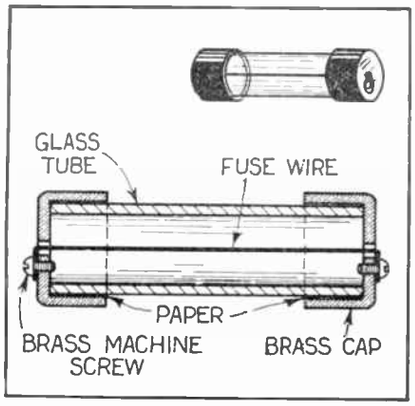
There are also storage batteries, static machines, rectifiers, transformers and many other pieces of apparatus; I also have a Radio receiving set with which I spend much time.

I have quite a number of electrical and chemical books including a great many numbers of the ELECTRIC EXPERIMENTER."

This interesting letter is also from an electrician devoted to the chemical side of his profession, in which branch there is much good work to be done.



Refillable Fuse

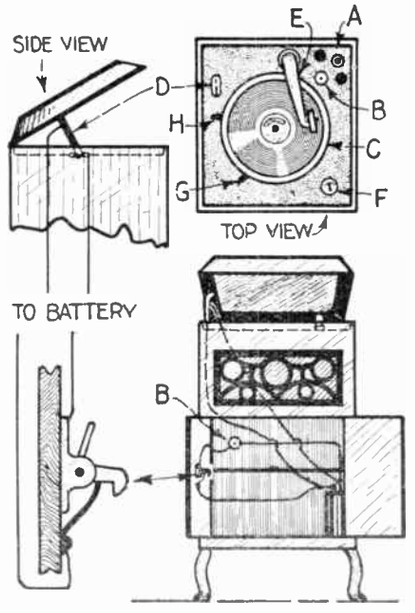


A very simple and efficacious fuse which is refillable, and which by inspection permits the young electrician to see if it has blown out.

IN the illustration is shown a refillable fuse which is easily made from two brass caps of an ordinary burnt out cartridge fuse, and a glass tube, through which the fuse wire can be seen. A hole large enough for the wire to pass through is drilled in each cap. The wire is then fastened to the cap with screws as shown. A narrow strip of empire cloth makes a tight fit to the cap and tube.

Contributed by Frank Harazim.

Lights For The Phonograph.



A lighting system for a phonograph; when the lid is raised a light shines upon the needle box and turntable; when the cabinet door is opened the contents of records are illuminated.

THE following system of lighting a phonograph has been found practical and useful by the writer.

By this method, the motor board light is on only when the cover rests on the cover support; the lower door light operates only when the door is opened. Both lights work independently of each other.

These lamps draw their power from the same set of batteries; all wires and batteries are concealed and out of view.

On the motor board, in the illustration, A, is for needle cups, B is the light and receptacle. Care must be taken in placing it, so that E, the tone arm, will not strike the bulb. C is the turntable. F is the speed regulator. G is the regular stop. H is the automatic stop. D is the automatic switch and cover support. All makes of phonographs are not constructed identically, but all have such articles placed on the motor board. The only necessary articles, however, for successfully lighting the phonograph by this method, are the cover support, the light and its receptacle along with the wires and source of electric supply.

Two very fine holes are drilled in the motor board for the wires, close to the light receptacle. One wire runs direct to the batteries, the other to the cover support. One wire is grounded to the metal, the other is soldered to a metal strip with a small hole in it, which is to be screwed to the motor board. This metal strip must be large enough to make a contact with the bracket of the support, when the cover is raised in a standing position.

For the door light I used a small cupboard-door-fastener of the kind which is usually employed to shut two doors. When the door is opened to insert a record or remove one from the cabinet, the catch automatically falls down upon the contact wire; the result of this automatic action is a light.

Such lighting is very appealing in a dark room, where music is more enjoyable, as the imagination has freer range than in surroundings with bright illumination.

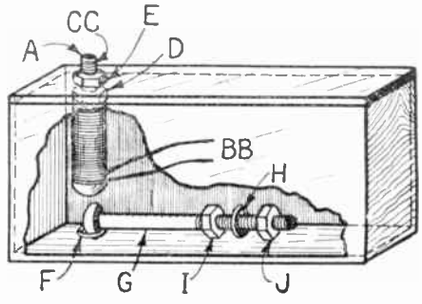
Contributed by A. H. Hager

Cigar Box Telegraph

THIS unique "Cigar Box Telegraph" is constructed in accordance with the following directions:

An iron machine bolt (A) is wound with about three layers of No. 24 insulated c.c. magnet wire; the two ends of the wire (B, B) are to be drawn out. The threaded end of the bolt (C, C) is not to be wound, the wire being placed on the smooth shaft only. A nut (D) is screwed on the bolt as far down as the wire wrapping. The threaded end is then pushed up through the hole in the top of the cigar box. Another nut (E) is then screwed upon the bolt, holding it in position by adjusting the nuts (D) and (E) one above and one below the wood.

A screw eye (F) large enough to form a rest for the head of another machine bolt (G) is screwed into the back of the box about three-fourths of an inch below the head of the suspended bolt (A). Two or three inches away at a slightly higher level another screw eye (H) is screwed into the back of the cigar box. This screw eye must have an opening large enough to permit an iron machine bolt (G) to pass through it easily. A nut (I) is screwed down on the threaded end of a machine bolt until about an inch of the bolt projects beyond the nut. This projecting part of the bolt is then passed through the screw eye (H), another nut (J) is screwed on it to hold it in place. This nut must not be so tight as to prevent the free play of the bolt, as its head rises and falls under the magnetic attraction of the vertical bolt. The head of the horizontal bolt rests upon the screw eye, which is directly below the head of the suspended bolt. An electric current passing through the wires of the vertical bolt will therefore lift the head of the horizontal bolt, which will drop back to its position on the screw eye when the current is broken.



A capital suggestion for making a loud sounding telegraph receiver out of a cigar box and a couple of bolts.

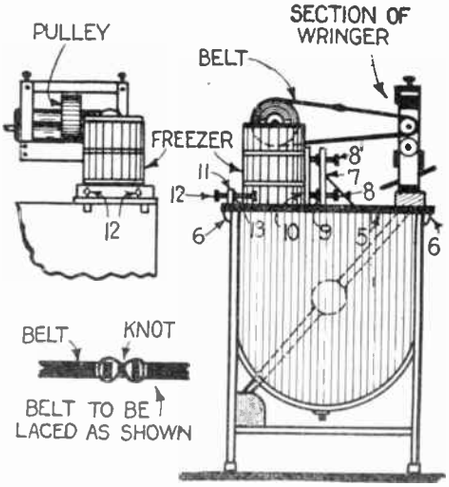
The box will act as a magnifier of the sound and a more simple sounder is not easy to imagine.

Contributed by M. Shovitz.

Double Duty from Clothes Wringer

SOMETIME ago I was in the laundry turning the ice-cream freezer, when, noting the washing machine standing idly by, it occurred to me how I might make it do the heavy work. I therefore prepared myself for the next time it should fall to my lot to do the turning.

A board, 5, is placed across the top of the washing machine and cleats, 6, at each end of the board, keep it from moving endwise.

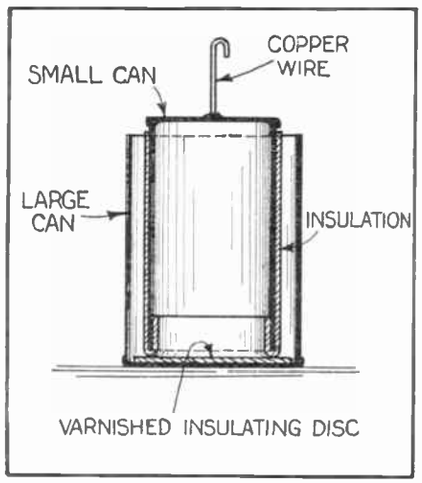


Giving the clothes wringer Sunday as well as Monday work; on Monday it wrings the clothes, and on Sunday it makes the ice-cream, thus paying a double debt.

An upright board, 7, is placed transversely across board 5 and braced. Four holes are bored into the vertical board 7 and long bolts 8, are passed through these holes. Nuts, 9, are then screwed on the bolts and a loose board, 10, is provided.

Near one end of the board, 5, is a second upright, 11, through which pass two similar bolts, 12, with nuts 13. These are arranged to bear against cleats, 14, nailed to the sides of the iron.

An Unbreakable Leyden Jar.



A simple construction of Leyden jar, using no glass jar, so that it is unbreakable, yet employing a very simple make-up and easily procurable materials.

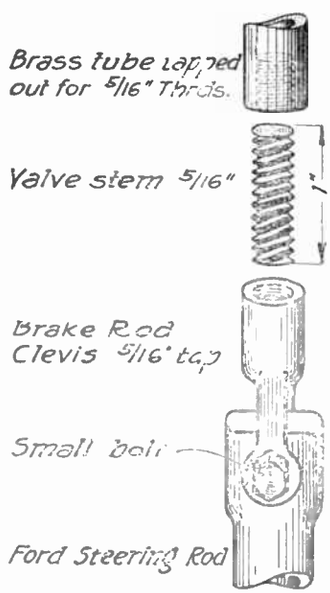
NEARLY everyone has had trouble with continual breakage of Lyden Jars, which readily fall off shelves. So I tried the following "stunt" and was troubled no more.

Procure two tin cans such that the diameter of one is ½ inch larger than the other. Cover the bottom of the large can (inside) with a disk of well-varnished cardboard or better with asbestos board. On the bottom of the small can (outside) solder a piece of copper wire about two or three inches long and make a hook on the end as shown in the diagram. Around this small can place a few layers of well varnished cardboard, or asbestos board, which should be bent down over the edge of the can a little over an inch. Place the small can with the insulation covering in the large can, with the disk on the bottom; and your Leyden Jar is ready for charging.

Contributed by Storling S. Beechwood

Ford Built Reading Lamp.

SOME handy workmen find that metal is easier to work with than wood and an operator possessing a reasonable amount of skill can turn out many useful novelties.



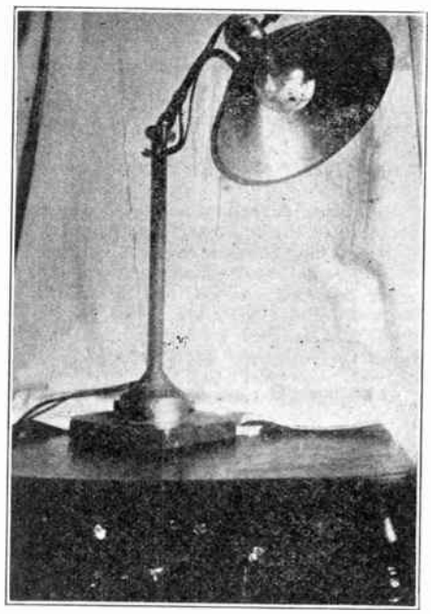
Some details of the construction of the standard lamp described here, which is made up of Ford automobile parts.

Illustrated is a novel reading lamp, adjustable to any angle, which can be manufactured from discarded automobile parts. The only wooden part used is the base, which was originally part of an automobile floor board. A hole was bored in the center of this, large enough to admit a section of Ford steering connecting rod, which is hollow tubing. This tubing formed the upright standard.

A hole the size of this upright is to be drilled in the center of a Ford timer, or commutator case. (The oiler on the timer was removed and the spark rod attachment sawed off, also the four terminal screws).

One end of the upright was flattened out, and a 5/16ths hole drilled through it. Just below this a larger hole was drilled half way through the pipe, and an inch or so from the opposite end another hole was made.

The tubing, flattened part way up, was inserted in the hole in the timer case, and allowed to project about one-half an inch below the rim of the latter. With a pen knife, a shallow groove the size of the timer was cut in the piece of floor board, and the upright was inserted in the hole and groove of the base, which thus held it firmly.



A standard lamp with adjustable arm for the light, all made up from parts of the Ford car.

The upper part of the lamp consisted of a discarded head lamp reflector, the hole in which, after reaming and round filing, received an ordinary brass lamp socket, which was inserted to a depth of ⅛-inch. It was held in place by being soldered.

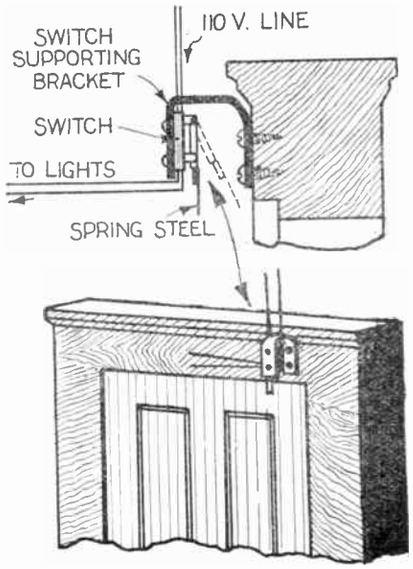
A bent piece of copper gas line tubing was flattened on one end and soldered to the shade. The inside diameter of this copper pipe permitted the cutting of 5/16-inch thread and this threading was done on the end not attached to the shade. A close nipple made of a Ford valve stem, threaded 5/16-inch on both ends, connected the copper pipe to a Ford brake rod clevis. This clevis with the shade assembled was attached to the upright by means of a 5/16-inch bolt.

The necessary wires were run through the oil hole in the timer in the bottom hole of the spindle connecting rod, through the inside of this, and out of the top to where it was fastened in the socket.

This lamp can be turned at any angle without moving the base. It is an admirable reading lamp and very useful in repairing watches, clocks and typewriters, where a bright concentrated light is needed.

Contributed by Glen F. Stillwell

A Bit of Economy



A door switch turning a light on and off as the door is opened and shut, so that if you forget to turn off the light, the door does it for you when you close it.

MANY a dollar on my light bill has been saved by the appliance illustrated. Have you ever left the lights in a basement or similar place on all day and night because you have forgotten to turn them off? I have, and when two or three lights are left in this manner I find it increases the light bill considerably.

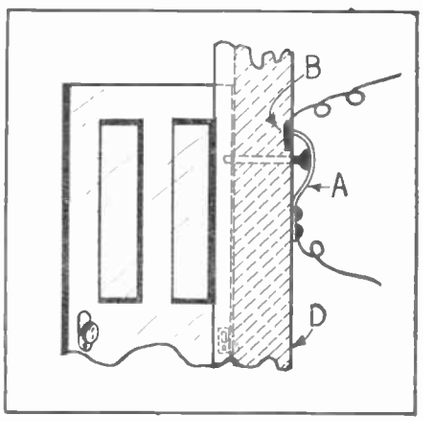
A small single throw double pole switch was employed. First remove the handle and replace with a length of spring steel (I used an ordinary bicycle pants guard after straightening it out and punching a hole in one end large enough to take a bolt which will be used to fasten it to the switch. Fasten the switch in such a position that the door will just catch the lengthened handle when it is opened or closed as in the illustration. It may be necessary to fix a stop in such a manner that it will keep the switch blade from flying back too far.

Contributed by Arthur Hagerman.

Simple Automatic Switch

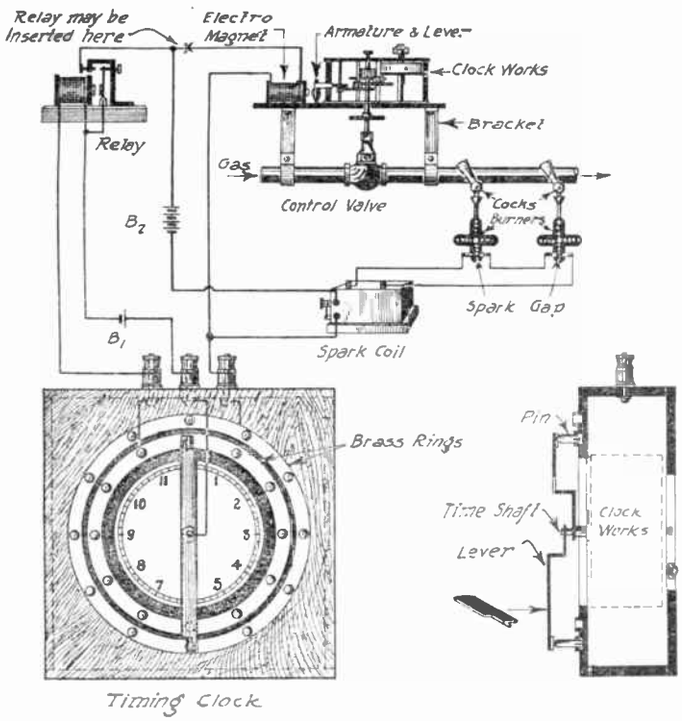
A VERY simple efficient automatic switch for low voltage lighting, employing only two pieces of brass and a few nails, can be made as follows: A, is a brass strip 3 inches long and ¼ inch wide; B is a brass strip ¾ inch long and ¼ inch wide; both are to be nailed on the door jamb. D. Bore a ⅛ inch hole in D and cut a nail of the proper length, so that when the door is closed it pushes the nail, which in turn pushes A from B, breaking the contact, and when the door is opened, A makes contact with B.

Contributed by L. Rusch.



A very simple door switch, operating essentially as does the one described in the preceding article.

Automatic Gas Lighters



This gas lighter is quite an elaborate appliance; it can be set to go off at any minute by the clock. When the timing clock makes connection, the gas valve supplying the gas stove is opened automatically, lighting sparks are produced at the burners so as to ignite the stove, and when the stove is started the current is cut off. It operates by a relay so as to give plenty of power for doing the work.

DO you hate to get up in the morning to light the fires and boil the coffee on these wintry mornings Mrs. Housewife—or does hubby do it? If so he can find a painless way of performing these duties by turning friend alarm clock into an automatic gas lighter.

The parts necessary to construct a device that will turn on and light the gas in cooking and heating appliances are as follows:—one perfectly good and accurate alarm clock, the works of an old discarded one, a relay with retaining spring removed, an electro-magnet, a ½ or ¾ inch spark coil, a few odds and ends of brass and wire, and three or four dry cells.

The clock is removed from its case and mounted in a thin board frame or cabinet having a circular opening cut in one side slightly smaller than the face of the clock. A hole is also cut in the opposite side of the cabinet to give access to the keys for winding. Two brass rings are mounted on the face of the cabinet concentrically with the time shafts of the clock, see diagram. Twelve 5/32 inch holes are drilled equally distant around the inner ring, which is traversed by the lever attached to the hour-shaft. The outer or minute ring may be drilled similarly if only five minute variations are wanted, or sixty holes are drilled to give one minute variations. The hands are removed from the clock and two spring brass levers, shaped as in the diagram are fixed in their places. Two pins are made from 5/32 inch brass rod. These are pointed at one end to allow the levers to slip over them easily, and are slotted and spread slightly to insure good contact.

The works of the discarded alarm clock are used to operate the gas valve. The clock is prepared for use by removing the hands, balance wheel and escapement so that the wheels will turn freely. The valve is connected to the works by threading the minute hand shaft into the top of the valve wheel, as in the diagram. The works are kept from running by a small lever which engages the teeth of the escapement wheel. The lever is held against the wheel by an armature mounted opposite the electro-magnet. When the magnet is energized the armature is attracted, disengaging the lever from the gear teeth, allowing the works to run. The clock works, electro-magnet, and armature are mounted on a thin board base and clamped to the gas pipe by means of two brackets as shown in illustration.

The relay is used to close the main circuit when the instrument is set for a length of time greater than one hour. By removing the spring, the armature is allowed to retain its position by gravity. The relay is connected as shown in the diagram.

The primary of the spark coil is connected as in the diagram, while the secondary is connected to spark gaps arranged across the burners. The gaps are connected in series and may be provided with switches for short-circuiting any one of them. Care should be taken to select a coil that will give a hot spark in all the gaps.

To operate, the food is set upon the stove, the cocks leading to individual burners are set for the proper degree of heat, and the pins are plugged into the holes indicating the time at which the lighter is to operate. When the hour lever engages the pin in the ring it closes the circuit through the relay magnets. The relay armature is attracted and remains against the magnets, thus keeping its contacts closed. The minute lever is then able to close the circuit actuating the gas lighting mechanism, which it does when it strikes the pin in the outer ring. When the current flows through the electro-magnet it disengages the lever holding the clock works, and incidentally opens the gas valve. The spark coil vibrator begins working, and the mechanism stops when the minute lever has passed over the contact pin.

The apparatus may also be used to control any electric devices by inserting a relay in series with the electro-magnet, see diagram.

Contributed by R. A. Mall.

Electric Light for Victrola

HAVING had great satisfaction with electric light attachments for a victrola, I am submitting a description of it herein for the benefit of others who likewise indulge in "canned" music.

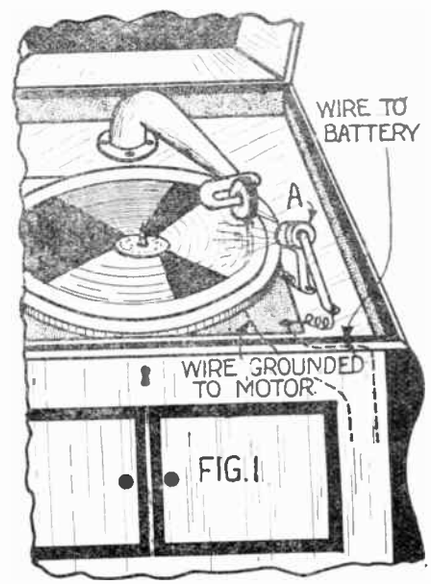
The device acts automatically, that is, the light is flashed on when the record is set in motion, and is extinguished when it stops, and I can testify with pleasure that the one I made and installed on my machine is a success.

As we all know, it is often difficult to insert the needle without getting it either too far in or too far out, especially if the room happens to be dark. As for homes that are equipped with gas light only (and sometimes not even that), the inconvenience is still greater. The appliance, described in detail, is as follows:

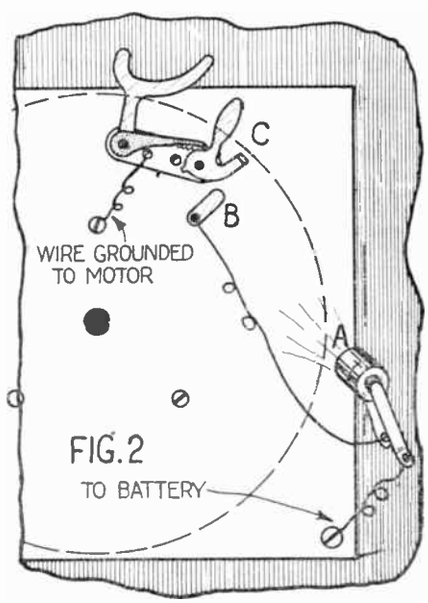
Take the socket and bulb from a tubular flash light; to this, solder a strip of ⅜ inch or ½ inch metal of sufficient length and bent to form a stand or bracket, as shown in sketch No. 1. Take another strip of the same material and attach both to the victrola in a position as shown in sketch No. 2.

Take a third strip of this same material say about an inch long, fasten one end of it near the victrola starting switch or brake, in such a position that when the turn-table is released and in motion, the switch will be in contact with said strip. Then wire up as shown in sketch. The current can be supplied by either a flash light battery or a common dry cell. The battery can be placed inside between the record cabinet and outer wall, so that very little of the equipment is visible when finished.

Contributed by Oscar S. Hanson.



View of the disk and sound arm of a phonograph illuminated by an electric light which can be operated from a dry or flash-light battery. A is the lamp.



Details of the connections under the turntable so that the brake of the phonograph operates to turn the light off, and on. B and C are the switching device and A as before is the lamp.

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.

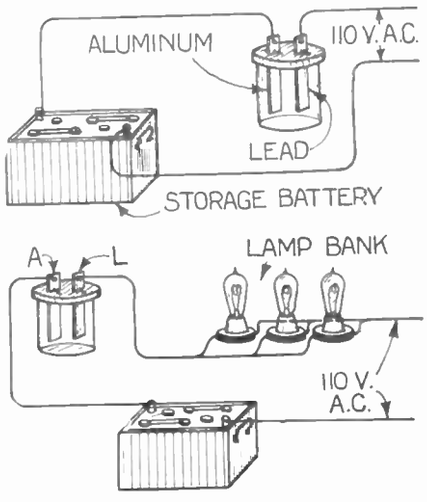
1. Not more than three questions can be answered for each correspondent.
2. Write on only one side of the paper. all matter should be typewritten or else written in ink. No attention can be paid to penciled letters.
3. Sketches, diagrams, etc., must always be on separate sheets.
4. This department does 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 considerable 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

Rectifier Inquiries

(76) L. W. Mima, Atlanta, Ga., asks.

Q1—"What is the voltage loss through one cell of aluminum and lead plate electrolytic rectifier?"



The electrolytic rectifier with and without a lamp bank connection.

A1—The voltage loss through one cell of an electrolytic rectifier depends largely upon the size of the cell, size of the electrodes, the electrolyte, and the general resistance. These rectifying cells are seldom connected in series or parallel, but four may be connected in a peculiar manner so as to give full wave rectification.

Q2—"Data on a transformer for a 6 ampere Tungar bulb to be used for charging 5 Edison nickel-alkali cells, A-4 type, 150 ampere hour capacity. Can this battery be charged successfully at a 6 ampere rate?"

A2—The data for transformer for the charging of storage batteries appeared in the January, 1921, issue of SCIENCE AND INVENTION magazine. This charge can be used to successfully charge the Edison cells of which you speak. These cells will take on a very rapid charge or a small trickle charge for a longer length of time. The lower charge rate will not affect the cell.

Q3—"Could an electrolytic rectifier be made to change regular 110 volt A. C. house lighting current to charge at 30 amperes?"

A3—The electrolytic rectifier can be made to operate on 110 volt alternating current circuit at a normal charging rate of 30 amperes.

Tungar Bulb Action

(77) Irving B. Harris, Kansas City, Mo., asks:

Q1—"What action takes place in the Tungar rectifier bulb and what kind of gas is in it?"

A1—The action taking place in a Tungar rectifier bulb depends on the Edison effect, the same which is utilized in the audion detector, which has been described in these columns. The heated filament allows for a flow of current in one direction only, viz. toward the plate, but a potential in the opposite direction will not pass through.

Magnetizing Steel

(78) M. E. Forris, Shouns, Tenn., asks:

Q1—"Can a piece of steel weighing 50 pounds be sufficiently magnetized with a lodestone, to attract a magnetic needle 200 feet away?"

A1—In our opinion the steel object could never be sufficiently magnetized with a lodestone to attract a magnetic needle at a distance of 200 feet.

Q2—"Is the charge indefinite and is it effected by atmospherieal changes?"

A2—The charge lasts practically an indefinite period and atmospheric condition have no effect on magnetic attractions.

Current from Telephone Generator

(79) L. Corbin, Bearden, Ark., asks:

Q1—"In making an electric organ, I placed weights on the organ keys, and it took six ounces of pressure to depress them. Would a telephone generator delivering 110 volts A. C., do the work?"

A1—A telephone generator will not work for the particular purpose intended by you; primarily because of the fact that the current is interrupted very rapidly and secondarily because the amperage developed by it is extremely low.

Q2—Do all the generators listed as telephone magnetos give the same voltage.

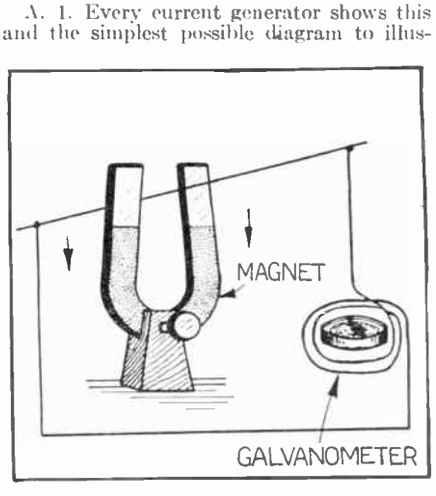
A2—No.

Lines of Force Demonstrated

(80) M. S. Grenoble, San Diego, Calif. asks:

Q. 1. Is there any simple way of showing the effect of cutting the lines of force by an electrical conductor forming part of a closed circuit?

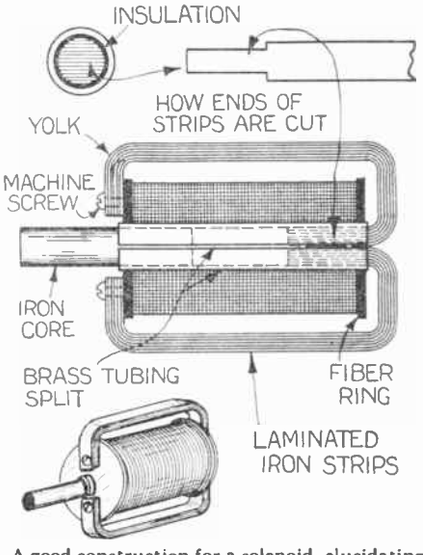
A. 1. Every current generator shows this and the simplest possible diagram to illustrate it is given herewith. The wire is supposed to be moved rapidly through the field of the magnet, and with a suffieiently delicate galvanometer the potential induced will be demonstrated.



A simple demonstration of the effect of cutting lines of force with a conductor in a closed circuit.

A. C. Solenoid Data

(81) John A. Maguire, San Antonio, Texas, writes:



A good construction for a solenoid, elucidating the two queries given here. The jacketting with sheet iron helps to concentrate lines of force.

Q1—"Give me data on small solenoid with quite a pull, using current at 12 volts A. C."

A1—On a copper tube 1½ inch in diameter, and 3 inches long, wind No. 2 D. C. C. wire to a thickness of 1¼ inches. Halfway into the core, sheet iron is driven. This is then bent around the coil as illustrated in the accompanying diagram, to give a yoke. This yoke increases the efficiency about 50%. The solenoid will lift about 2½ pounds on 1/3 of an ampere at a pressure of 12 volts A. C.

Another Solenoid

(82) W. M. Barrett, Shreveport, La., asks:

Q1—"What size wire would you recommend to make a solenoid of the smallest possible dimensions which will permit of a ⅜ inch movable core, operating on 115 volts A. C., 60 cycles, and exerting a minimum force of 2 lbs.?

A1—We would advise that you wind your solenoid on a piece of brass tubing slighty larger than ⅜ of an inch, split longitudinally along its entire length, with No. 30 S. C. C. wire. The solenoid should be wound to a diameter of 1½ inches. A yoke must be provided which will consist of laminated iron, and should be so arranged that it will encompass the coil and come down close to the core as illustrated clearly in the above diagram.

Gravitation vs Magnetism

(83) John Bostow, Velva, N. D.. asks:

Q1—"Is there any relation between gravitation and magnetism?"

A1—No.

Q2—"Is there any substance that will screen off magnetism?"

A2—There is none. The only way to

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This antenna connector is made entirely of aluminum, is light and will not rust. The only connector of its kind. The 4 antenna wires go to the upper holes; the lower hole takes the lead-in. Don't solder your aerial, don't have loose connections. Dimensions 2" high, 1¾" wide, 5/8" thick.

No. 999, Connector, each. $0.35

999

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No. 6241 is well made and has a good corrugation. Its dia. is 1", height ½", hole 5/32". The shank is ¼" high.

6241

838

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MARCONI KNOB

Has a central hole of 5/32" and seat to hold the screw; dia. is 1¼", height ¾".

No. 838, Marconi Knob, each.....$0.15

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These are our very own patterns from our own designs and look mighty handsome on any instrument. The top knobs are of composition, the bottom parts brass nickel plated polish.

202 201 030 029

No. 202 is nickel plated at bottom part.

"Rasco" Binding Post, 8/32 thread, each, $0.10; doz., $1.00.

No. 202, Post, each, ...$0.08

Nos. 650 and 651 made entirely in composition with a hexagonal brass nut in center.

No. 650 has 8/32 machine screw.

No. 651 has bottom wood screw.

No. 650, Post, each.....$0.08

No. 651, Post, each.....$0.08

Dozen, each style.....$0.90

650 651

BRASS NICKEL POSTS

No. 029, Binding Post, each.....$0.05

No. 030, Binding Post, each.....$0.04

RASCO SWITCH POINTS

Nickel plated and polished. The following have been found the most popular.

75 1 2 3 4 5 6 7 77 76

No. 1 ¼"x¼", 6/32 thread, ea., $0.03; doz., 35c

No. 2, 3/16" high, ¼" dia., 6/32 thread, ea., $0.03; doz., 35c.

No. 3. 3/16" x 3/16", 4-36 thread, ea., $0.03; doz., 35c.

No. 4, ¼" dia.; ⅛" thick; stem 6/32, ea., $0.03½; doz., 40c.

No. 5, ¼" dia. 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c

No. 6, 3/16" dia.; 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 7. 3/16" dia.; ⅛" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 75, Switch Stop. ⅞" long, 4-36 thread, complete with nut, ea., $0.05; doz.. 50c.

No. 76, New style Switch Point, to be pressed into bakelite panels with forced fit. Wire is soldered to pin end. Head ¼"; dia., 1/16" thick, ea., $0.03½; doz., 40c.

No. 77, same as above, but head is ¼" dia. x 3/16" thick, ea., $0.03½, doz., 40c.

1898

THE RASCO BABY DETECTOR

In presenting this little Detector, we feel sure that it fills a place never taken before by any small detector. It does a variety of things and does them all well and better than many $5.00 detectors. The base is solid, black composition. Mounted on same is a nickel holder and binding post which holds a fluted hard rubber knob with its sliding rod member.

The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cap unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary purposes.

No.1898,.Rasco Baby Galena Detector. Price, prepaid $0.50

No. 1899, Rasco Baby Detector with Galena and Radiocite Crystals. Price, prepaid..... .....$0.75

PANEL SWITCH LEVER

New style switch lever with lock fork. It is impossible for this lever not to make positive contact at all times. The blade radius is 1¼". Blade is nickel plated and polished. Fork is phosphor bronze. The lock fork holds the screw (in which it rotates), securely. A loose contact is impossible.

200

No. 200, Switch Lever, complete as illustrated..$0.30

LITZ WIRE

This wire is recognized as the only thing for winding coils for Radio instruments. Particularly recommended with our No. 343 Variocoupler Rotor, for vario-couplers, banked windings, etc.

323

No. 323, Litz Wire, 20 No. 38 strands, enameled double silk wire, per foot, $0.02; per 100 feet, $1.15

No. 890, Litz Wire, 10 strands No. 38 wire, per foot, $0.01; per 100 feet, $0.75.

No. 891, Litz Wire, 16 cables of three strands No. 38 wire, per foot, $0.03; per 100 feet, $2.25.

NOTE: This page contains only a few of our 300 specialties.

PANEL KNOB

This is a very distinctive knob and can be used on dials, panels, switches, condensers, etc. It is exceptional and well made. Dia. 1 1/16"; height 11/16"; comes with 8/32" bushing.

815

No. 815, Knob, each.....$0.18

VARIOCOUPLER ROTOR

This rotor is used by all up-to-date amateurs. Is accurately turned of hard wood and is used as a secondary coil. It takes any finish, either shellac or stain and can be drilled readily for any size hole. Large hole 2" dia. Width of spool is 2". Total dia. 3⅜".

343

No. 343 Variocoupler Rotor, each $0.75

827

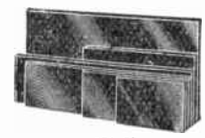
"RASCO" NAME PLATES

839

Our name plates are of brass with a black background. Letters are polished nickel. Order by name and number.

	Each		Each
807 "Phones"	$0.05	810 "Ground	$0.05
809 "Aerial"	$0.05	812 "Primary"	$0.05
811 "Secondary"	$0.05	814 "Detector"	$0.05
813 "Audion"	$0.05	866 "On"	$0.05
865 "Off"	$0.05	840 "Increase Current" (Left)	$0.10
839 "Increase Current (Right)	$0.10	834 "Series"	$0.05
813 "Vacuum Tube"	$0.05	830 "Receive"	$0.05
831 "Transmit	$0.05	820 "2nd Step"	$0.05
821 "3rd Step"	$0.0	827 "Tickler"	$0.05
819 "1st Step"	$0.05	825 "Plate Variometer"	$0.05
826 "Grid Variometer"	0.05	835 "B Battery"	$0.05
823 "Secondary"	$0.05	817 "Output"	$0.05
836 "A Battery"	$0.05	824 "Primary Condenser"	$0.05
818 "Input"	$0.05	828 "Parall'l"	$0.05
829 "Telephone"	$0.05	837 "+ —"	$0.05
833 "Detector Tube"	$0.0	841 "(Blank) "(takes pen or pencil writing)	$0.05
822 "Coupling"	$0.0		
808 "Load'g Coil	$0.0		

Price of all of our name plates in dozen lots, 50c, with the exception of the two "Increase Current"



350-55

BAKELITE PANELS

We list below six panels, the sizes of which have been selected after carefully checking up many dimensions of the most popular radio apparatus on the market.

Note particularly that our prices are anywhere from 25 to 50% lower than those quoted by most other concerns. The reason is that we buy these panels in very large quantities, **and we do not cut sheets to order.** Remember always that when sheets are cut to order they cost you at least 50% more than our prices, because **you must pay for the cutting and the necessary waste. Note also that we ship these panels prepaid.** This alone amounts to a considerable saving.

No. 350	6"	x 12"	x 3/16"	thick, each	$1.90
No. 351	6"	x 18"	x 3/16"	" "	2.85
No. 352	9"	x 12"	x 3/16"	" "	3.00
No. 353	12"	x 18"	x 3/16"	" "	5.65
No. 354	6½"	x 19½"	x 3/16"	" "	3.50
No. 355	6"	x 7½"	x 3/16"	" "	1.20

"RASCO" LUBRICATED PANEL SWITCH

A radio switch that has two nuts at the end is a monstrosity, for the reason that it will never stay put. Our patent spring fork holds the switch handle always under uniform tension, at the same time it insures the best contact possible. **New wiping contact,** which covers every point of the switch point. Another new improvement is the lock fork, which can assume three different positions to accommodate the switch to various thicknesses of panels

1921

No. 1921 "Rasco" Switch., as illustrated, each $0.50.

KNOBS

These knobs are favorites with all experimenters The size of both is: dia. 1⅛", height ⅝". No. 4451 comes with 8/32 and 10/32 bushing.

199 4451

No. 4451, Knob, each...$0.06

No. 199 (screw length ⅝") Knob, each $0.10

NAVY KEY KNOB

This navy key knob is now used on all standard wireless keys. It gives the right swinging mation and rests the fingers. It is a favorite with all advanced amateurs. Once used always used. The screw is 8/32 and will fit all keys.

748

No. 748, Key Knob, each.....$0.28

803?

THREADED BRASS ROD

We carry two styles, 6/32 and 8/32 thread. **Only 6" lengths sold. No others.**

No. 8032, Threaded Brass Rod 8/32 thread, per 6" length $0.08

No. 6032, Threaded Brass Rod, 6/32 thread, per 6" length $0.06

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage radio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

15c in stamps or coin.

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This business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be sidetracked by us. A trial order will make you a life customer. Order from the above illustrations. "We can only stick you once." Try us with a 50c order, ALL GOODS PREPAID.

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Factories Brooklyn, N Y.—Elkridge, Md.

Technical Laboratory of the French Post Office Department

(*Continued from Page 246*)

rent coming from a 3-tube oscillator placed on the left on the same table is sent through them. Induction currents are thus developed, which are caught by a detector and affect the Deprez-d'Arsonval galvanometer seen in the background.

Among the other recent investigations of the technicians, we must note the adaptation to telegraphy of the Cooper-Hewitt mercury vapor rectifiers and Tungar rectifiers, in which last the tungsten filaments are contained in an atmosphere of argon so as to act like large duty Fleming valves.

The laboratory has made great advances in a recording radio telegraph system. This renders possible even now the direct utilization of the Baudot radio apparatus. A commercial speed of 700 letters a minute can be attained by it, whereas by ordinary hand transmission and sound reading, 100 letters per minute is exceptional speed.

Perfectly Regulated Temperature Control

(*Continued from Page 252*)

breaking the electric circuit on a variation in temperature of one hundredth of a degree Fahrenheit. Temperature adjustments are made by transferring mercury from the small reservoir to the capillary tube, and vice versa. A continuous seven-day recording thermometer which enables the operator of the laboratory to note excessive variations in temperature is a fixture of each incubation room, the recording elements being stationed on the wall outside the room, the capillary passing through the wall. The bulb of the thermometer is located near the top and in center of the room.

Electricity is the heating agent for the temperature-control compartment designed and constructed by the Bureau of Animal Industry, as well as for the unit equipped with commercial apparatus. The heating units embrace resistance tubes or coils fed from a 220-volt, direct-current line. Current is turned on and off by means of a thermostat, finely adjusted as to turn off or renew the flow of current with a variation of room temperature of only one degree Centigrade; that is 0.5 degrees above and an equal figure below the optimum. Closer limitations are possible, but a "cleaner shave" is not essential. An electrically-driven fan as an agency of continuously stirring the air in the room is effective in maintaing uniform heat in all parts of the room. The fan operates at a speed of 1,400 r. p. m., delivering 190 cubic feet of air a minute, or 26 complete changes of air in the room every sixty minutes. The motors are shunt-wound, 230-volt, direct current. The fan is belt-driven at half-normal speed, thus insuring a thorough mixing of the air, and, in consequence, a uniformly heated room.

Largest Electrical Camera in the World

(*Continued from Page 253*)

copy is inserted, either from the top or from the side, the wheel is again turned and the rear plate is jammed against the front, thereby flattening out the copy.

Focusing is accomplished in this fashion: An electric contact is set at the desired point on the scale of the copy-holder carriage, which, with another contact, is then put into motion. The two points having met and the electrical circuit being completed, a small incandescent lamp flashes the warning signal, "Halt." This is evidence that the copy-holder is in correct position. If the carriage travels past the point of contact, the operator employs a finely-adjusted hand-wheel to draw the carriage back. The tiny lamp again sheds its glow. The photographer forthwith busies himself with the primary carriage, carrying the lens and prism. The scale is adjusted, corresponding to that on the other bar, and the motor is set in motion to propel the carriage forward until the proper figure is attained. The hand wheel again lends itself to final adjustment of the object.

Chain Socket and Fuse Trouble

(*Continued from Page 256*)

Supposing that as in this case, the exposed portion of the lamp base is carrying one potential and the pendantchain a potential of probably 110 volts difference, we can readily see what would happen were these two to come into contact with each other. When the chain is suddenly released after being pulled down, it springs back, sometimes wrapping itself around the fixture and frequently touching the exposed part of the lamp base (A) blowing the fuse.

Some sockets are constructed so that the switching on and off of the current is done so as to effect the center contact at the base of the socket, leaving the current always on at the thread contact (E). Others are built in just the reverse way so that the thread contact is effected by the pull-chain switch. Of the two the former method is more desirable because there is no potential in the socket when turned off, if the ungrounded wire is connected to the center contact of the socket, which is the correct way for any type of socket. With the other type connected in that way there would always be potential present though not for light, because the thread part (E) would be dead, but the shell (C) would always have the same potential as would the thread when the socket was turned on.

Under such a condition, in cleaning the bulb and socket for example, the hand may come in contact with the metal base of the bulb and the socket shell at the same time, resulting in a shock. In causing such a shock the current would pass through the filament in the bulb to be sure, but nevertheless would be sufficient to surprise the cleaner and possibly cause a fall. By changing the connections of this socket we would be a little better off. Then the risk would not be present except when the current was on. So if we take off the shell of the socket, changing connections so that the ungrounded wire leads to the center contact, we can have the best operation possible with the equipment on hand. The fuses must first be removed in order to prevent accident as a result of short circuit. This transposition would make the potential of the brass base of the bulb and that of the pull-chain the same so as to avoid accident.

The Construction of Lead Plate Storage Batteries

(*Continued from Page 263*)

The voltage of each cell should never be allowed to drop below 1.7 volts, and it is usually better to recharge the battery before this point is reached. The specific gravity is a good indication of the condition of a cell, it varying from about 1.150, in a completely discharged cell, up to between 1.275 and 1.300 in a fully charged one.

A reliable voltmeter and a hydrometer for testing the specific gravity of the electrolyte are necessary to the care of a storage battery, particularly if the experimenter does his own charging, in which case an ammeter is also essential.

The builder of a battery such as is described above will not only be the owner of a reliable source of low voltage power, but he will also have acquired a certain amount of practical knowledge of storage batteries, which should prove useful for many future experiments.

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 April 1, 1922.

STATE OF NEW YORK —
COUNTY OF New York, New York

Before me, a Notary Public in and for the State of New York and county of Queens and authorized to act in the 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 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., 233 Fulton Street, New York City.

Editor, Hugo Gernsback, 233 Fulton Street, New York City.

Managing Editor, Thomas O'Conor Sloane, 233 Fulton Street, New York City.

Business Managers, Robert W. DeMott, 233 Fulton Street, New York City.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) Practical Electrics Co., Inc., whose stockholders consist of: Hugo Gernsback, 233 Fulton Street New York City., Sidney Gernsback, 233 Fulton Street New York City, Robert W. DeMott, 233 Fulton Street 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 stockholders or security holders 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 trustee, 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: [illegible]

(This information is required from daily publications only.)

Practical Electrics Co., Inc.
H. Gernsback, President.

Sworn to and subscribed before me this 21st day of March, 1922.

Joseph H. Kraus.
(My commission expires March 30, 1923.)

Form 3526.—Ed. 1916.

NOTE.—This statement must be made in duplicate and both copies delivered by the publisher to the postmaster, who shall send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the post office. The publisher must publish a copy of this statement in the second issue printed next after its filing.

ELECTRICAL EXPERIMENTERS!!

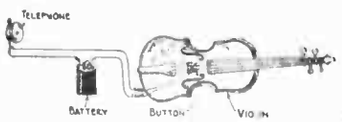
SKINDERVIKEN TRANSMITTER BUTTON

MOST SENSITIVE MICROPHONE

YOU can easily make a highly sensitive detectophone by using a Skinderviken Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. Think of the fun you would have with such an instrument! It's very simple, too, and inexpensive.

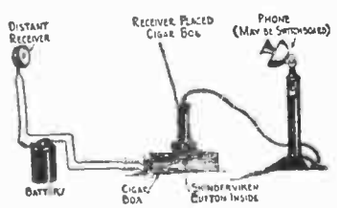
You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *This outfit was used by secret service operatives during the War. It is being used on the stage.*

So much for its commercial adaptations! *You* can procure apparatus of the same type.



One of the main advantages of the Skinderviken Transmitter Button lies in its ultra-sensitiveness. You can place it in any position you like. It is the greatest invention in micro-phones and has won recommendations from men of high standing in the scientific world. It is being used all over the world. You can mount it most anywhere. Card board boxes, stove pipes, stiff calendars and hundreds of other places will suggest themselves to you. The buttons cannot be seen by any one in the room as they are so small and light. Only a small brass nut is exposed to the view.

The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.



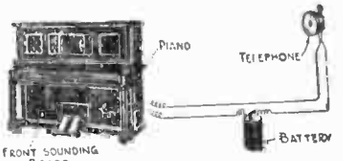
AS A PREMIUM


Actualsize.

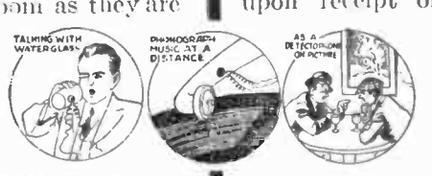
MR. H. Gernsback, editor of this magazine, who is the dean of electrical experimenters, said: "In the writer's opinion, obtained by actual elaborate tests, the Skinderviken Transmitter Button is probably the most effecient device of its kind on market today, due to its simplicity and other outstanding features. Should have a great future."

The same circuit connections apply to all experiments, regardless of how the transmitter button is mounted.

The Skinderviken Transmitter Button operates on one or two dry cells. It often happens that two cells produce too much current and the sounds are deafening. We recommend either one fresh cell or two worn out cells.



We have acquired a limited amount of these Transmitter Buttons and offer same free to our subscribers as a Premium, with a one year subscription to PRACTICAL ELECTRICS. These Buttons sell everywhere for $1.00 and are worth it. We send you one prepaid upon receipt of the coupon below and the subscription price of our magazine. Do it today.



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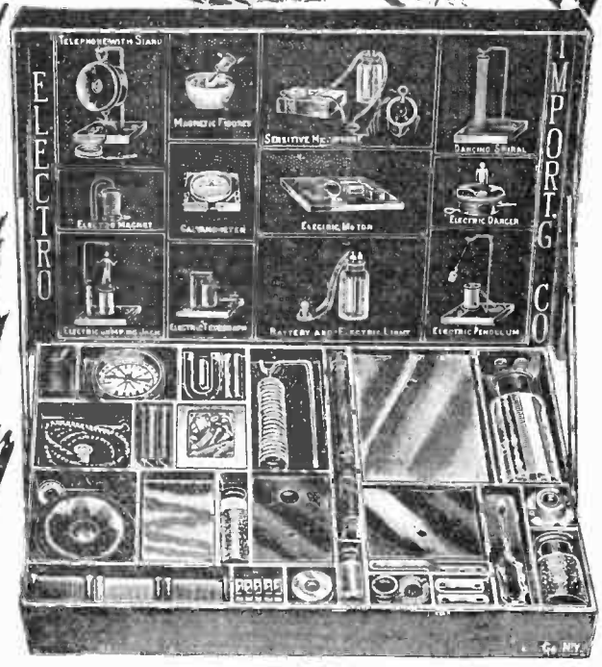

As Shown

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Teaches you all the principles of electricity by the "Learn by Doing" Method. Entertaining, Instructive, More Fascinating than any game. The most complete electrical experimenters' outfit that has ever been put on the market.

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With each outfit we furnish free a very comprehensive book of electrical instruction. All the fundamentals of this fascinating science are clearly explained so even a layman can understand every word. Profusely illustrated. The instructions for building the apparatus are given in such a simple and easily grasped manner that anyone can make them without the least trouble. Over a hundred experiments that can be performed with the outfit are listed in the instruction book, nearly all of them illustrated with superb drawings.

Teaches You How To Build Electrical Apparatus

THE BOY'S ELECTRIC TOYS' contains enough material to make and complete over twenty-five different electrical apparatus without any other tools, except a screwdriver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

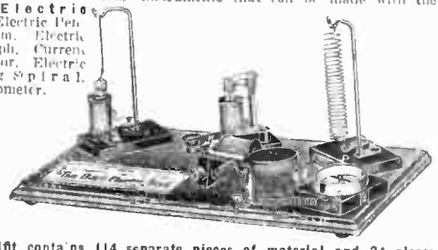
Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

Shipment guaranteed within 24 hours.

A Sample of What You Can Do With This Outfit

This illustration, made from an actual photograph, shows only a very few of the many instruments that can be made with the **Boy's Electric Toys:** Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral Galvanometer.



The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material are included: Chromic salts, lamp socket, mercury core wire, iron fillings, three spools of wire, carbons, machine screws, flexible cord, wood bases, glass plate, parafine paper, binding posts, screw-driver, etc., etc.

SEND NO MONEY

We have so much confidence in this set that we desire to ship it to you C. O. D. with the privilege of inspection. It does not cost you one cent to take a good look at the outfit, and see if it comes up to your expectations. If it does, pay the postman $7.50, plus shipping charges. If it does not, you need not accept it, and we will pay the return charges as well.

THE ELECTRO IMPORTING CO.
231 Fulton St., N. Y. City

ELECTRO IMPORTING CO.,
231 Fulton St., N. Y.

As per your advertisement, ship to me at once, C.O.D., the Boy's Electric Toys with privilege of inspection. It is understood that if I do not like the outfit I can refuse it.

Name .....

Address .....

City..... State.....

P. E. 5-22

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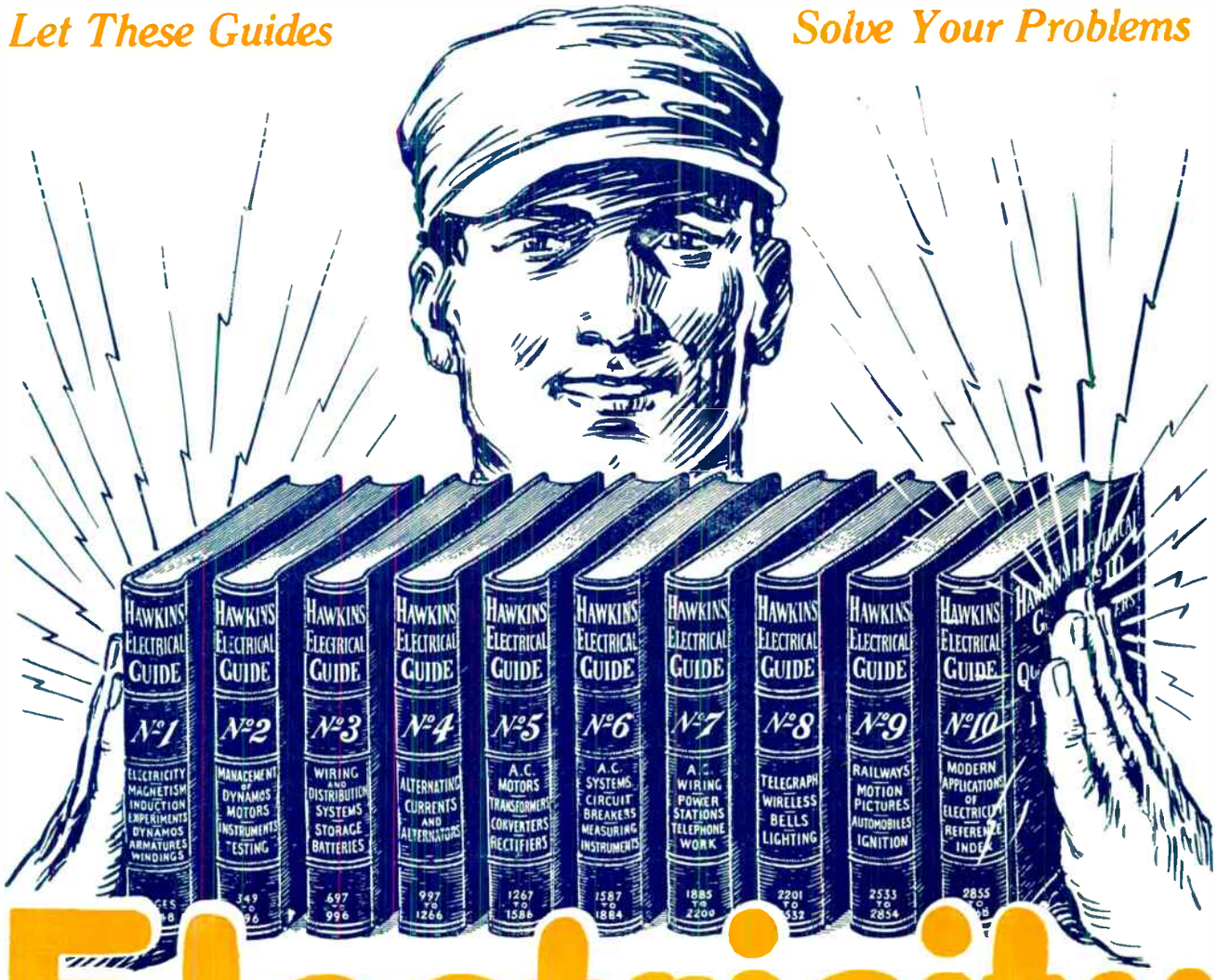

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