Practical Electrics

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March-April 1922

EDITED BY H. GERNSBACK

"Electrical Progress In Plain English"

An Open Letter

Do you recall one of those rare moments in life when the veil is lifted for a moment, when a breath of inspiration comes like a flash, when the future seems to be suddenly illuminated, when you feel a mastery stealing into hands and brain, when you see yourself as you really are, see the things you might do, the things you can do, when forces too deep for expression, too subtle for thought, take possession of you, and then as you, look back on the world again, you find it different, something has come into your life—you know not what, but you know it was something very real?

Winning victories is a matter of morale, of consciousness, of mind. Would you bring into your life, more money, get the money consciousness, more power, get the power consciousness, more health, get the health consciousness, more happiness, get the happiness consciousness? Live the spirit of these things until they become yours by right. It will then become impossible to keep them from you. The things of the world are fluid to a power within man by which he rules them.

You need not acquire this power. You already have it. But you want to understand it; you want to use it; you want to control it; you want to impregnate yourself with it, so that you can go forward and carry the world before you.

And what is this world that you would carry before you? It is no dead pile of stones and timber; it is a living thing! It is made up of the beating hearts of humanity and the indescribable harmony of the myriad souls of men, now strong and impregnable, anon weak and vacillating.

It is evident that it requires understanding to work with material of this description; it is not work for the ordinary builder.

If you, too, would go aloft, into the heights, where all that you ever dared to think or hope is but a shadow of the dazzling reality, you may do so. Upon receipt of your name and address, I will send you a copy of a book by Mr. Bernard Guilbert Guerney, the celebrated New York author and literary critic. It will afford the inspiration which will put you in harmony with all that is best in life, and as you come into harmony with these things, you make them your own, you relate with them, you attract them to you. The book is sent without cost or obligation of any kind, yet many who have received it say that it is by far the most important thing which has ever come into their lives.

Be careful that you do not miss this wonderful opportunity because of its great simplicity. Get your letter in the mail today; it will take but a moment, but it may be the supreme moment, in which you may discover the secret for which the ancient alchemists vainly sought, how gold in the mind may be converted into gold in the heart and in the hand!

CHAS F. HAANEL, 229 Howard Bldg., St. Louis, Mo.

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W. E. Pence
in his working togs

Chehalis, Wash., Oct. 9, 1921

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My success, I owe to you, Mr. Cooke. The thorough practical training which you gave me through your Easily-learned Home Study Course in Electricity has made me an independent, highly respected business man in this community. Sincerely yours, W. E. Pence.

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Use your spare time to get a better job. Most of us have enough spare time every day to sell a little at about $10.00 an hour. Sell some to yourself at this price. Watch how quick you will earn the money back if you put the time into study.

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Every man who enrolls for my electrical course gets a big outfit of tools, material and instruments free. This includes an electric motor and other things not usually found in a beginners outfit. These are the same tools and the same material you will use later in your work. Everything practical and good right from the start.

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Let me send you my big free book giving details of the opportunities electricity offers you and a sample lesson also free. Mail the coupon and get this at once. Learn how other men "got themselves ready to hold good paying jobs" and how I can help you do the same. This is your big chance—take it.

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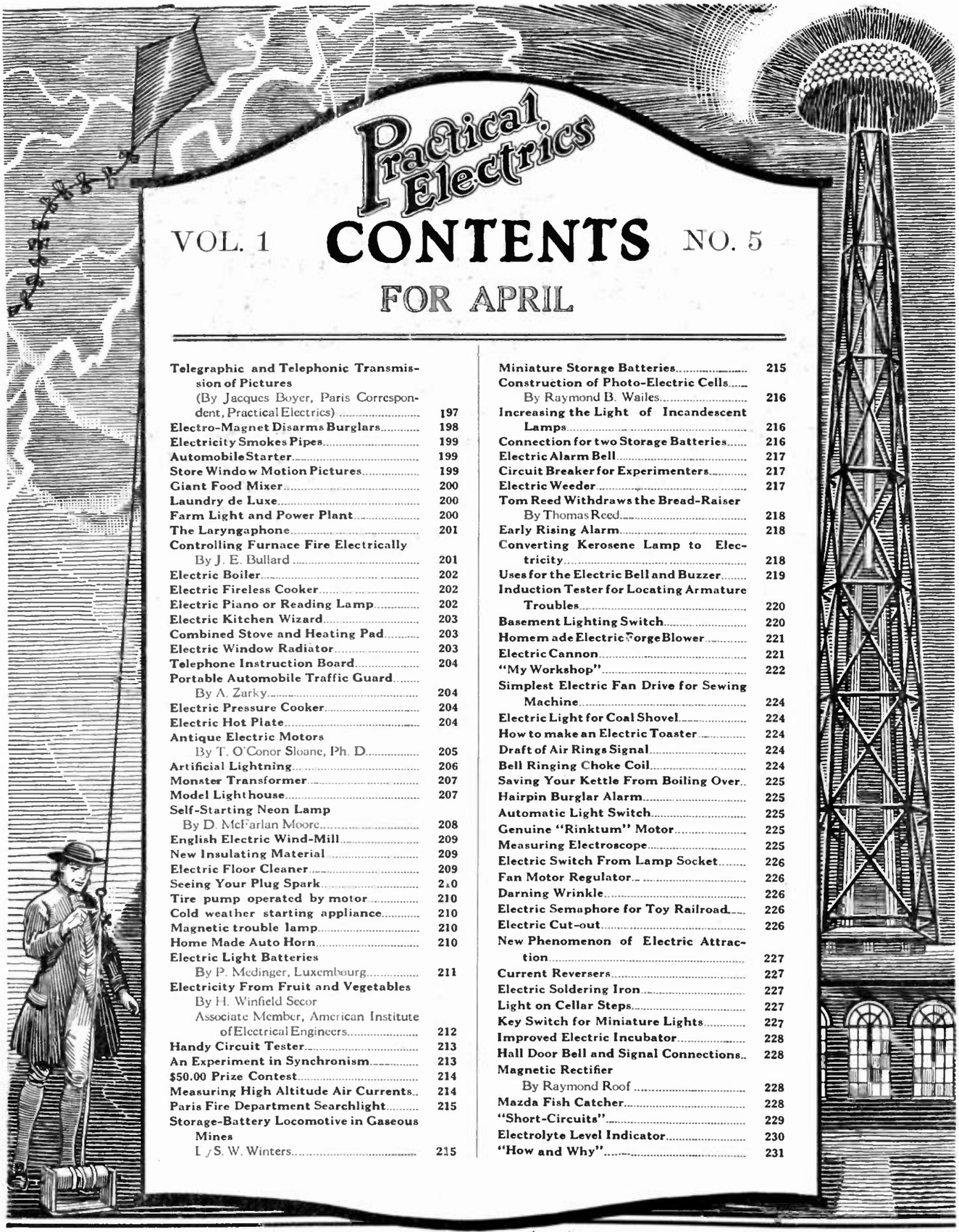

VOL. 1 NO. 5

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FOR APRIL

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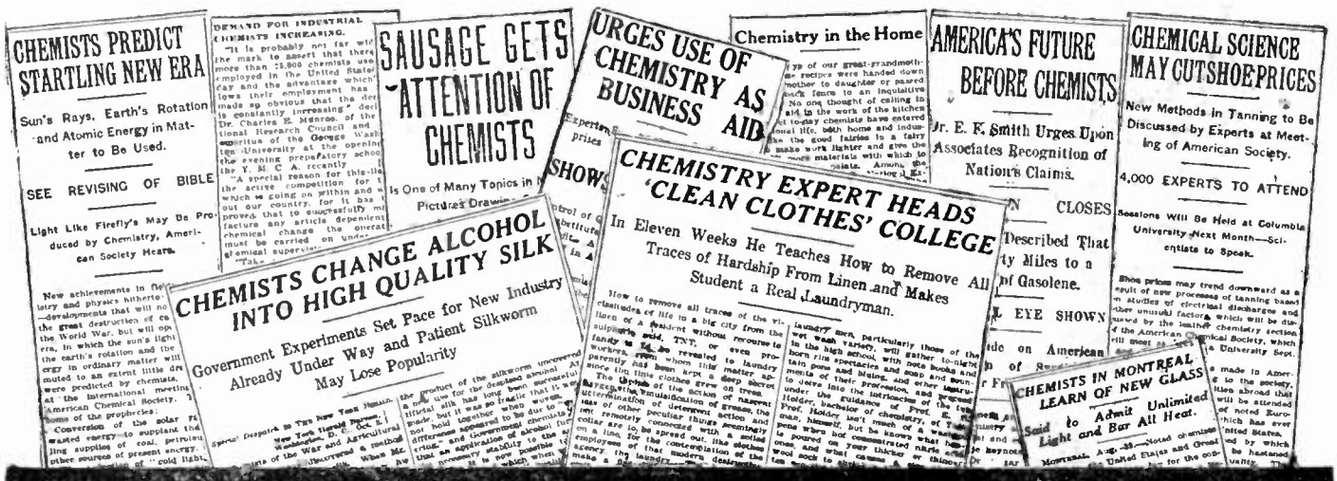
Publishers of "Science and Invention" and "Radio News"

H. GERNSBACK, President **S. GERNSBACK, Treasurer** **R. W. DeMOTT, Secretary**



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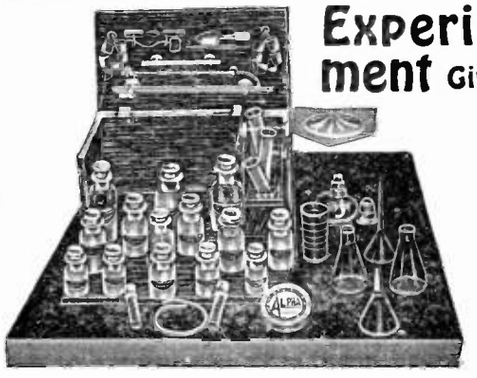

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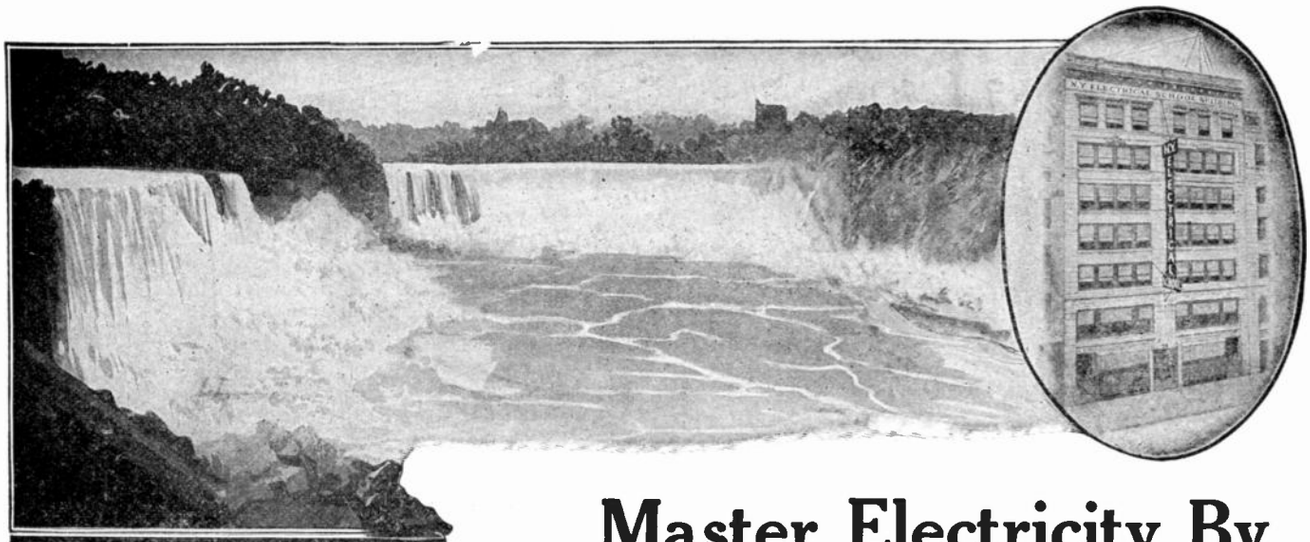

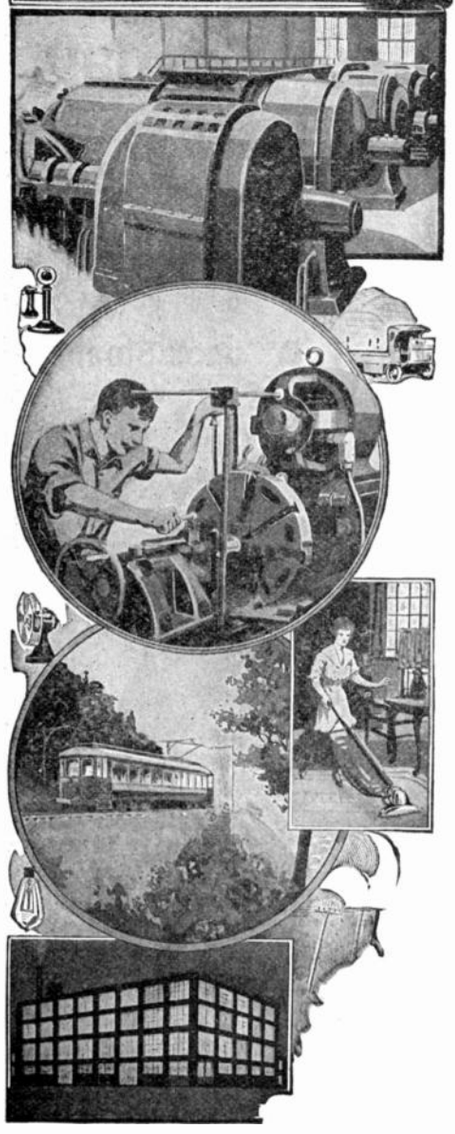

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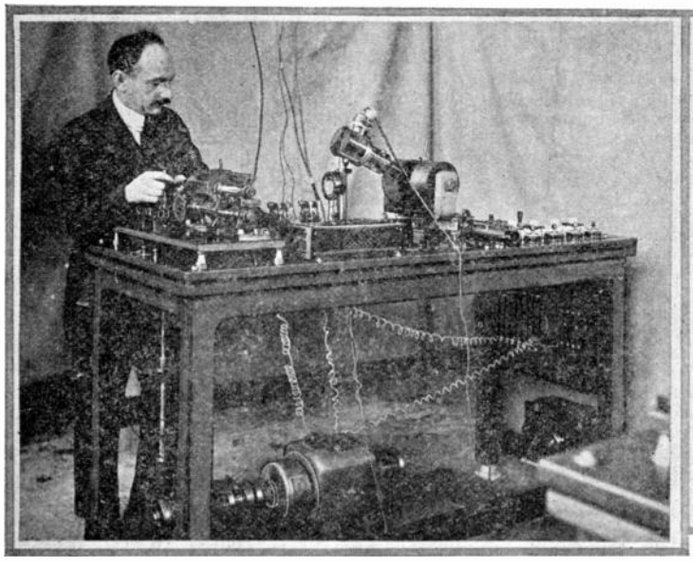
Practical Electrics

March-April
1922

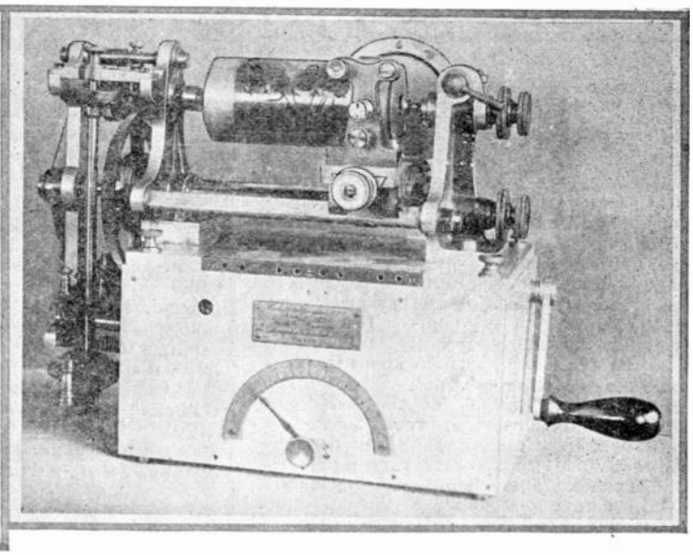
H. GERNSBACK,-EDITOR T. O'CONOR SLOANE, Ph. D.:-ASSOCIATE EDITOR

Telegraphic And Telephonic Transmission Of Pictures

By Jacques Boyer
(Paris Correspondent, PRACTICAL ELECTRICS)



The Belin apparatus for transmitting pictures and other subjects by electricity. It has recently attained wonderful success.



Enlarged view of the Belin apparatus with which the inventor sent pictures and other subjects recently in this country, as well as abroad. This is the portable instrument.

THE problem of transmitting pictures to a distance, by means of electricity, has occupied the thoughts of many inventors in modern times, but it fell to the lot of an English mechanic, Backwell, to invent the first telautograph capable of reproducing any pictures at a distance.

A specimen of this kind was shown in the London exposition in 1851, and a short time afterwards the Abbe Giacomo Caselli developed his celebrated Pantelegraph, which underwent many changes from its original form of 1854, previous to acquiring its final development in the laboratory of the Paris constructor, Gustav Froment, in 1863.

By means of this instrument Nobili, the accomplished student, was able to transmit from one city to another with the exact fidelity of a photograph, any signature whatsoever, a portait, a picture, music etc. Then the French Government, impressed by the results obtained by Caselli, brought forward a resolution to be voted on by the legislative body, which arranged for the introduction of the Pantelegraph on the railroad from Paris to Lyons.

Since February 16, 1863, the administration permitted the public to transmit autographic dispatches between these two cities, and in 1867 the Director of Telegraphs, M. de Vougy, had a second apparatus on the Marseilles—Lyons road. The charge for its use was based upon the dimensions of the surface of the paper employed, at the rate of 0.20 francs per square centimeter; which is about 25 cents per square inch. The telegraph office sold the metallized paper required for the production of the characters.

Nevertheless, in spite of its excellent results, the Pantelegraph had little success. The people of that day did not understand its importance, and the Government gave up its exploitation. The Abbé Caselli went back to his own country, and died at the age of 76 years, in the hospital Santa Maria of Florence, 1891. Modern society, which owes its happiness to scientists, too often rewards their works in this way.

Following Caselli, Meyer, an employe of the French telegraph, invented an apparatus which resembled a Pantelegraph very closely. We will also mention as a matter of record the experiments of Minclin in this line; the phoroscope of De Lazare Weiler, the telautoscope of the French physician Senlecq d'Ardres, the telephotograph of De Porosino, the apparatus of Ayrton and Perry, of Carey, of Bidwell, the telectroscope of Jean Schzepanik, which made considerable stir two or three years before the exposition of 1900, Ritchie's telautographe, pretty well forgotten to-day, and the electric eye of the Russian, Professor Rosing.

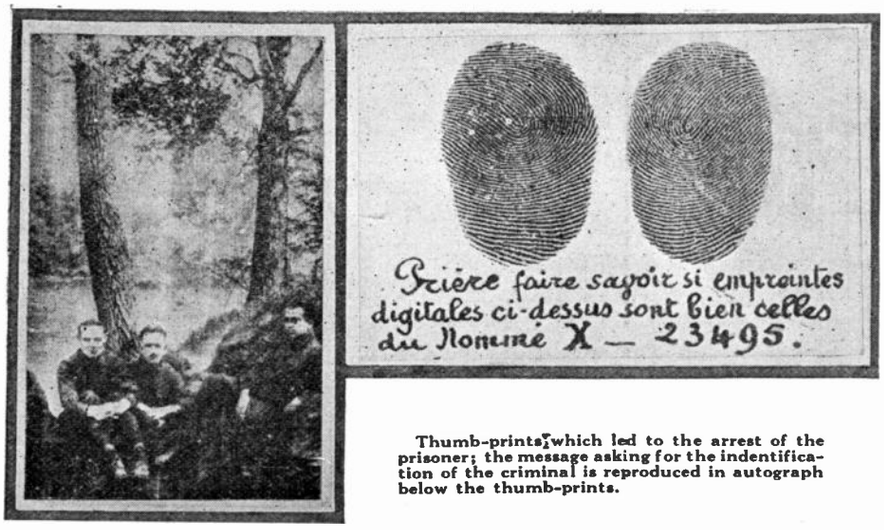
In their turn, Korn of Munich, and the Frenchman Edouard Belin, took up the question about 1907. In fifteen years of laboratory work and with a patience which never succumbed, this last man developed the fixed and portable telestereographs, capable of working regularly on all telegraph lines or even by radio.

During the years 1920-1921 in particular, the inventor carried out numerous experiments either between telegraphic stations which the Belin Company controlled or owned in Paris and Lyons, or between Paris and Bordeaux, Nice, or else on international circuits. Among other achievements, he produced in August 14, 1920, on the Paris-Antwerp line, the first telephotographic newspaper reports which the "Matin" of Paris and the "Daily Mail" of London published the day after they were received. Finally, in the course of, the Washington conference, October, 1921 his telestereographs, installed in the United States, succeeded in receiving various messages sent from France, and in transmitting messages to Europe.

We must now see to what technical progress are due these remarkable results. The action of the Belin telestereographs depends on the photographic sensitiveness of bichromatized gelatin. In carbon printing, invented by Portevin, photographic proofs are obtained with paper sensitized by bichromatized gelatin mixed with a pigment, which becomes insoluble when exposed to light. Taken out of the printing frame, they are washed in warm water, and the gelatin dissolves more or less according to the degree of opacity of the different parts of the negative. It is a case of photography and electricity working hand in hand.

This evidently gives proofs with high and low areas corresponding respectively to the whites and blacks of the original negative. The half lights (tones) are given by intermediate thickness, accurately proportional to their intensity. Finally, the luminous values of a proof are transformed into electric current changes on a telegraphic line, and the receiving instrument changes these electric variations back into pictures.

Theoretically, the transmission of a draw



Thumb-prints which led to the arrest of the prisoner; the message asking for the indentification of the criminal is reproduced in autograph below the thumb-prints.

A picture as reproduced, exactly as it was transmitted by the Telestereograph, as the Belin apparatus is called. A wonderful achievement. The next thing is to do it by radio.

ing becomes the same as that of a photograph, but there are nevertheless practical modifications. The line drawing is a monochrome, with no variation of shade; such are pen drawings, musical characters, printing, and thumb prints. Thus, the Telestereograph will give the greatest service to international police in the capture of criminals. The thumb prints shown above recently transmitted from Paris to Havre, brought about the capture of a dangerous criminal. On the other hand, the examination of the half-tones shows that the images are really formed of continuous flat tints, or of a limited number of shaded tones, or of very numerous graded zones. These definitions being understood, we have to see how we can send a line picture which only has two tone values in it.

The two-tone values may be translated into currents of varying intensity and similar direction, or one value may be given by currents in one direction, and the other by opposite currents, or one value can be given by a current and the other by a cessation of the current. The transmission of a line drawing to a distance is comparable to plain telegraphy. For sending texts or line drawings with the new Telestereograph model, Fig. 2 and Diagram 3, the texts in question may be traced on any kind of paper with an ink which leaves a solid line in slight relief on the paper. The paper is then clamped on a cylinder and turned regularly by machinery, actuated by battery or by clock-work. Clock-work is used in the portable apparatus, Fig. 4. In the course of this movement, the lines of the drawing, which are in relief, touch a point T, Diagram 3, on the extremity of a very light arm, which is one of the essential parts of a minute circuit breaker, all of whose parts can be regulated by means of a micrometric screw. This reproducer rests on a carriage so that it can move along the cylinder on parallel ways, and a screw moves it longitudinally parallel to the axis of the cylinder.

The action of the feed screw and rotating cylinder combined cause the point P of the transmitters to follow a helical path on the cylindrical surface.

Every time a line passes under the point P of the transmitter the flexible plate L is lifted from its rigid support, the current which passes through it is broken, and the circuit is closed, only when the raised line has passed to one side and has released the point of the transmitter.

It is clear that if we put the transmitter in series with the battery and with the line L/L", the receiving station will receive impulses considerably transformed, because of the constants of the circuit. Belin prefers to pass the current only at the moment of the motion of signals, which he effects by putting the transmitter in parallel with a resistance H at the receiving station, Fig. 5. Successive impulses of current are received by galvanometer C with extreme rapidity and sensibility; for receiving the lines and half-tones, Blondel's oscillograph is used, because of its being perfectly dead-beat, and on account of its high frequency. The Einthoven galvanometer is preferred by Belin for receiving photographs. An incandescent electric lamp is used for the source of light, S, as it is very constant, and its filament, of a very regular diametrical shape, is placed in a metallic case, in front of which is a condenser lens G, with a diaphragm ,D, in front of it, whose vertical opening is regulated by means of two plates, actuated by a micrometric screw. A convex lens ,B, focusses the light on a mirror, M, the arrows coming from a luminous source, and by careful regulation the exact focussing of the light is effected. The incident and reflected rays fall into the same vertical plane, but the oscillograph causes them to vibrate horizontally. The ray reflected by the mirror M, is passed through a narrow opening in a screen J, then through a convex lens, and projecting the image of the mirror at the point M 3. On the surface of a cylinder is a sheet of

(*Continued on page 211*)

> We have received a number of suggestions from our readers—some very ingenious and interesting—for utilizing burnt-out fuses, which will prove to be sources of economy.
>
> At the expressed desire of many of our friends, we are extending the closing date of this competition to April 15th 1922 in order to allow some of our corresponcents located in distant sections to submit their entries.

Electro-Magnet Disarms Burglars?

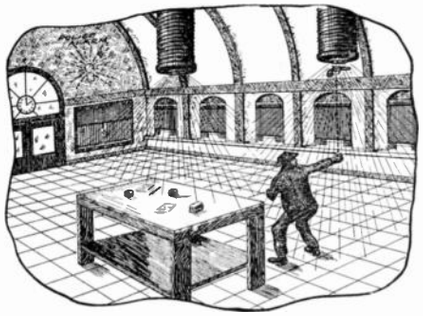
A NEW conception of how to prevent bank hold-ups, is shown in the accompanying drawing, which is interesting because of its ingenious idea of employing electro-magnetism to interrupt the jolly burglar in his efforts.

The coils may be distributed in any section of the bank. By sending a strong electric current through the coils, the magnetism is supposed to force the hold-up-men's guns out of their hands, drawing the gun quickly and directly to the coil, and holding it there by magnetic force until the current is turned off.

The burglars are thus rendered weaponless and defenseless, whereas the officers of the bank have previously had an insulation put on their own weapons so that the magnet has no effect on them. The evil-intentioned visitors will of course not realize that their apparatus is useless until it is too late.

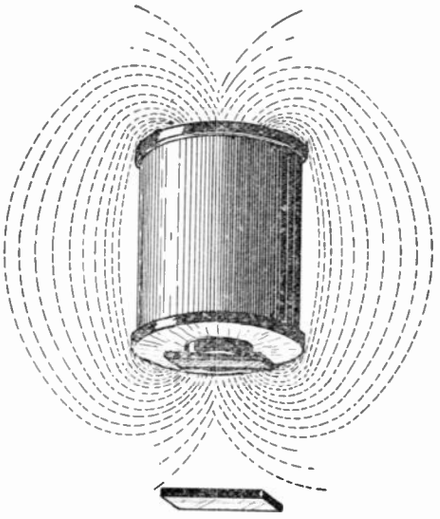
The current can be turned on by the officers in the bank cages, and it can also be utilized to ring the police alarm at the same time that it disarms the burglars. The coils are made by winding layers of insulated wire around a core. The coils are fastened to the ceiling in the bank.

Contributed by Herbert Fisher.



A proposal for disarming bank robbers. It reminds one of the old fairy story of the loadstone mountain, which was said to pull the bolts and spikes out of the ships, and of the old picture of the man in armor, held against the loadstone mountain, so that he was unable to move. There is as much truth in one as in the other.

Our correspondent's idea illustrated by this rather clever sketch made by himself, is absurd. However strong the magnet, the pull on the pistol would not be even felt by the robber. The strength of a magnet is figured in lines of force, and the next illustration shows the general distribution of lines of force in a magnet. Each line of force is supposed to represent the same pull upon a piece of iron subjected to it, so that it will be seen that the distant piece of iron has



The lines of force in a straight magnet. Notice how the distant bar of iron is hardly attracted by the magnet at all, for the lines of force indica te the attraction.

hardly any pull at all exercised upon it; again, there is no insulator of magnetism. (Editor)

Electricity Smokes Pipes

THERE is a process known to smokers as "breaking-in" a pipe. It seems that a new pipe is not agreeable to the smoker, and it is considered desirable by the devotee of the pipe to age it a bit, so as to get the full perfection of the narcotic weed. To obviate this inital process, which of course must be more or less penitential, an enterprising London tobacconist has invented an ingenious apparatus which does the thing by electricity.

The pipe is filled with tobacco; it is attached to the apparatus, the draft is started by the motor and the tobacco is lighted. In this way as many pipefuls are smoked as is desired, until the pipe is brought into condition.

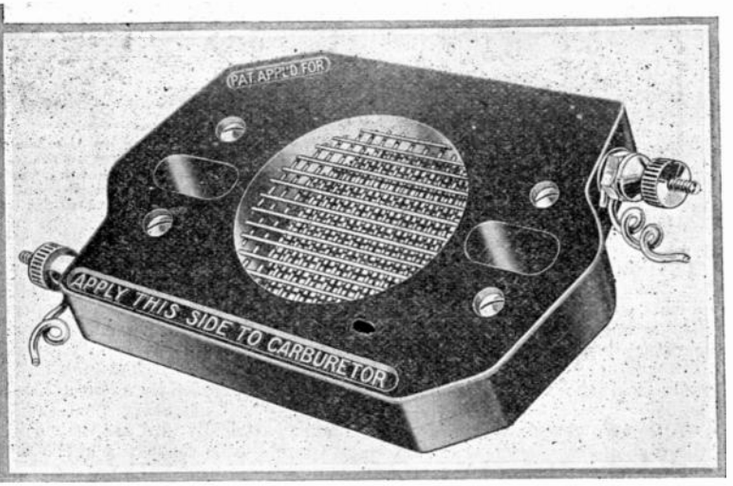
Automobile Starter

ONE of the most recent refinements in automobile development and a true aid to driving comfort in cold weather, is the electrically heated vaporizer. The design is so simple, the basic principle so self-evident, that its positive performance is a natural result. It consists of a set of four metal grids placed in a heat insulating case, made in the form of a gasket and placed between the carburetor and intake manifold flanges. One terminal of the heating grid is connected to the battery through an automatically releasing switch placed in any convenient location; the other terminal is grounded.

By pressing a switch button, the circuit is closed and in a few seconds the vaporizer reaches the proper heat for vaporizing. Stepping on the starter switch in the usual manner draws the gas through the vaporizer, the hot coils of resistance wire vaporize the spray and an almost perfectly gasified fuel will rise, and mixed with air passes into the intake manifold. Any gasoline which may liquify in the cold pipe falls or trickles back to the coils and is again vaporized. This gives quick starting in the coldest weather. The current for the vaporizer is automatically cut off as soon as the finger is removed from the switch button.

The difficulty of starting a cold engine, caused by the slowness with which gasoline vaporizes at low temperatures, is one which engineers have long sought to overcome, but with only moderate degrees of success.

Electricity puts a man's pipe in order so that he starts in with a seasoned implement for the enjoyment of the weed. The English are great pipe smokers, and this naturally is an English invention.



A heating coil for warming the mixture in an automobile, directly above the carburetor. This will start your car in cold weather, by warming the mixture and vaporizing the gasoline spray.

Store Window Motion Pictures

IN former times the moving picture operator was a very busy man, during the long hours of the exhibition. With one hand he turned the crank of the motion picture machine, which fed the film through the gate, and he operated thereby the shutter, the intermittent mechanism, and all the various apparatus of the projecting machine. This was bad enough. But with his other hand he had to keep feeding the carbons of the lamp, keeping the arc of proper length, and maintaining the crater exactly in the optical center of the condenser.

This has all been changed; th· apparatus is now run by electricity, and if the arc is used, its operation is practically all taken care of by an electric motor.

Another thing to be noted is that for rear projection, in which the view is projected on the back of a semi-transparent screen, there is no difficulty in showing good views in daylight. Special screens are made for this purpose, and this system is often applicable, provided there is room to spare at the back of the screen.

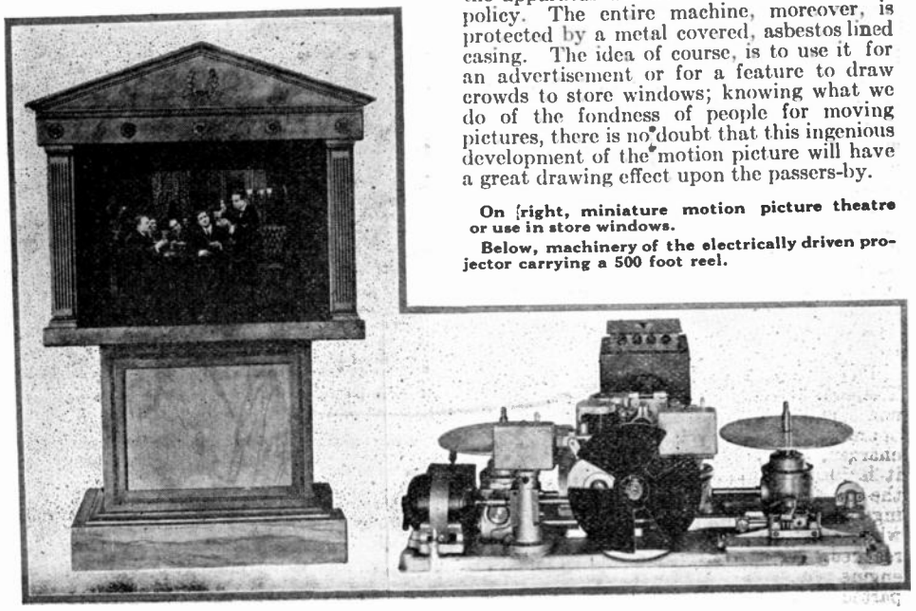
It has long been known that with the translucent screen good daylight views can be given. The presumable reason is that the opaque screen is so poor a reflector that it requires a dark room to bring out the beauties of the projections upon it.

We show in the illustrations accompanying this article a store window cinematograph for rear projection. The view of the apparatus shows the electric motor on the left which operates the machinery. To right and left are seen two discs on which the reels are placed, one receiving the film as it is fed from the other. A distinguishing peculiarity of the apparatus is that the film is fed horizontally. This is a very important feature, since it obviates the need of so much head room, for it is always easier to find room t the sides than at the top and bottom of aahow window. In the back is seen the lamp house containing an incandescent lamp; with the present day high power incandescent lamps, the troublesome arc lamp need only be used for high magnifications. In front is seen a shutter.

Another view shows the miniature theatre with presumably quite an exciting episode being displayed upon its little screen.

The time clock controls the motor driving the machine, so that seven minutes are required for a 500 foot reel, which is a good standard. When the reel is empty, the motion is reversed, the film is re-wound, and the exhibition begins again. All this is done automatically. The film is run through, showing its views; a brief cessation occurs; and the exhibition begins again.

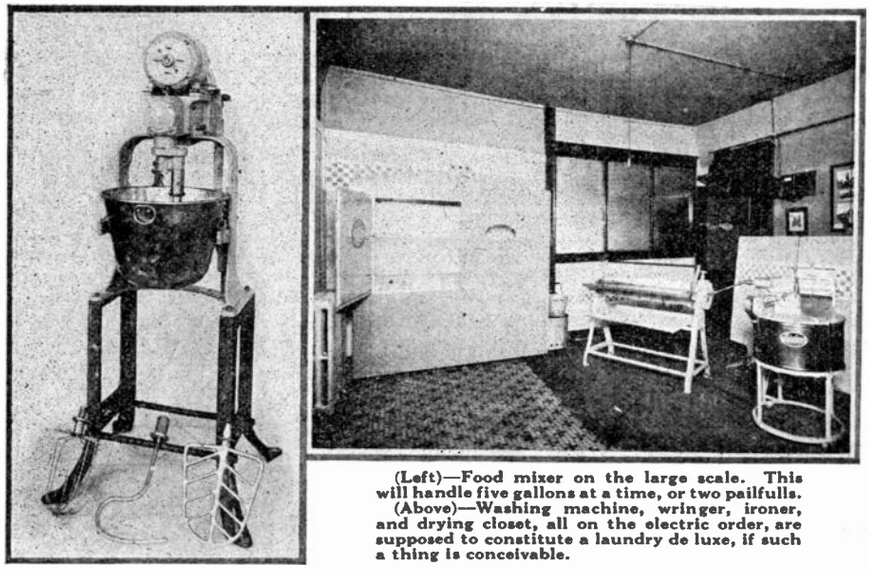
The film used is not inflammable. The perforations of the film are a special type, licensed by the National Board of Fire Underwriters, and the sprocket teeth on the feed-rollers correspond to these perforations. The effect of this is that it is impossible to use ordinary inflammable film on the machine. It must be of the non-inflammable type, so that from this standpoint there is absolute protection from fire, and the use of the apparatus will not vitiate the insurance policy. The entire machine, moreover, is protected by a metal covered, asbestos lined casing. The idea of course, is to use it for an advertisement or for a feature to draw crowds to store windows; knowing what we do of the fondness of people for moving pictures, there is no doubt that this ingenious development of the motion picture will have a great drawing effect upon the passers-by.



On right, miniature motion picture theatre or use in store windows.

Below, machinery of the electrically driven projector carrying a 500 foot reel.

Giant Food Mixer



(Left)—Food mixer on the large scale. This will handle five gallons at a time, or two pailfulls. (Above)—Washing machine, wringer, ironer, and drying closet, all on the electric order, are supposed to constitute a laundry de luxe, if such a thing is conceivable.

THE housewife has reaped much benefit from the small sized electric machinery so characteristic of the modern electric home. But here is illustrated a more powerful apparatus, designed for use where heavy work is to be accomplished, as in restaurants, clubs and the like, including large households.

Although comparatively large in capacity, the machine we describe is reasonably portable, and can be mounted on any counter or heavy table as desired; the illustration shows it mounted on its own iron support. Its functions are many, because so much can be done with food by rotating appliances. Some different forms of stirrers are shown resting against the foot of the stand, and a special arrangement is supplied so that it can actuate a food chopper. The bowl is of 21 quart capacity, certainly quite sufficient to hold the supply for a large family. The equipment has high and low speeds, and is operated by a clutch like an automobile.

The rotary beaters are mounted eccentrically and are driven by a planetary gear, so as to have a cyclic motion, not merely a rotation. The apparatus is driven by a ¼ horse power motor. Other beaters are furnished beside the three typical ones shown resting against the frame in the illustration. A wire whip, a cake beater, a batter beater, a dough hook and a food chopper, represent a complete set of these appliances, which seem to cover all the demands of the chef, no matter how exacting.

A Laundry de Luxe

WE have had occasion to illustrate in our issues various washing machines and household appliances, but here at last we are enabled to present a complete sequence of household laundry machinery.

On the right is shown the washing machine with a wringer on top. It contains an aluminum vacuum cup, as our laundry experts call these appliances, with an agitator, and can wash everything, it is said, from the lightest of fabrics up to woolen blankets. After washing and rinsing, the goods go to the ironer. The ironer has two rolls, which feed the goods over the polished, heated, steel surface that gives them their finish. The ironer is fitted with a stationary table to hold the goods, and it has an enameled receiving tray, so that there is no suspicion even of rust; the gears are absolutely enclosed, a feature ensuring perfect safety of operation.

Now we come to the drying closet. The heat for this may be produced by gas, or electricity; hot air from a coal furnace may be used. It is not allowed to simply pass through the closet among the clothes, but there is a hot air agitator, operated by an electric motor connected to a regular light-socket, and this keeps the air in circulation, and causes it to act at least twice upon the clothes so as to give the best possible drying effect. We are told that less than twenty minutes' time is required to dry clothes, and the expense of running the equipment is put at 6c. per hour. 7½ feet long and 7½ feet high, its capacity is put at 67 feet of clothesline. We suppose the housekeeping electrician now has a new unit; in addition to the volt-ampere, and the kilowatt-hour, he has the clothesline-foot, to use in his calculations.

Farm Light and Power Plant

OUR farmers now are becoming electrical engineers; they are learning to run their small plants, which relieve them of such a great amount of drudgery, and which are making life on the isolated farm better worth living.

When electricity,—in addition to accomplishing the heavy work in the barn, and the lighter operations of the housekeeper, running the sewing machine, operating the churn, doing the cooking, lighting the house and so many other things,—by means of the radio telephone tells them the news of the day and supplies them with concerts, and if they are properly disposed with sermons on Sundays, it truly is revolutionizing life in the rural districts.

We show in our illustrations an interesting farm plant; this comprises a two cycle engine, of 3 horse power, which actuates a direct current dynamo mounted on its own shaft. On the fly wheel perimeter, there are mounted a number of wings, so as to produce a strong draft; the fly wheel is contained within the casing of the engine, so that the escape for the air is vertically above the fly wheel, where it cools the water tank. This is a species of combined water and air cooling.

There are sixteen cells in the battery. There is one very distinctive feature about it, and that is the method of regulating its operation. Once the battery has been charged, and perhaps been gassed a little, it is futile to keep the engine running; at the same time nobody wants to keep watching the hydrometer so as to stop the engine when the proper specific gravity has been reached. The automatic stopping of the engine when the full charge has been imparted to the battery, is effected as follows: In the cast-iron base of the engine is the fuel tank; the gasoline or oil fuel is drawn therefrom so as to feed the engine. A float is provided to indicate the height at which the fuel stands in the tank. In one of the end cells of the battery, which cell is called the pilot cell, there is a compensating hydrometer.

We all are familiar with the hydrometer with which we somewhat crudely test the specific gravity of the solution in the batteries on our automobiles. But a hydrometer is only correct for one temperature, whatever that may be. The compensating hydrometer used in this plant contains a liquid which rises into its hollow stem and expands and contracts exactly like the liquid in a thermometer. If the solution in the battery increases in temperature, this makes it lighter, so that the hydrometer floats too low. But the same heat which makes it too low, expands the liquid in its cavity, so that the column rises. If, therefore, the reading instead of being taken at any point marked on the glass, is taken from the top of the column of solution within it, it will be accurate for all temperatures.

It is known that a gallon of fuel will drive the engine for a specific period; of course it

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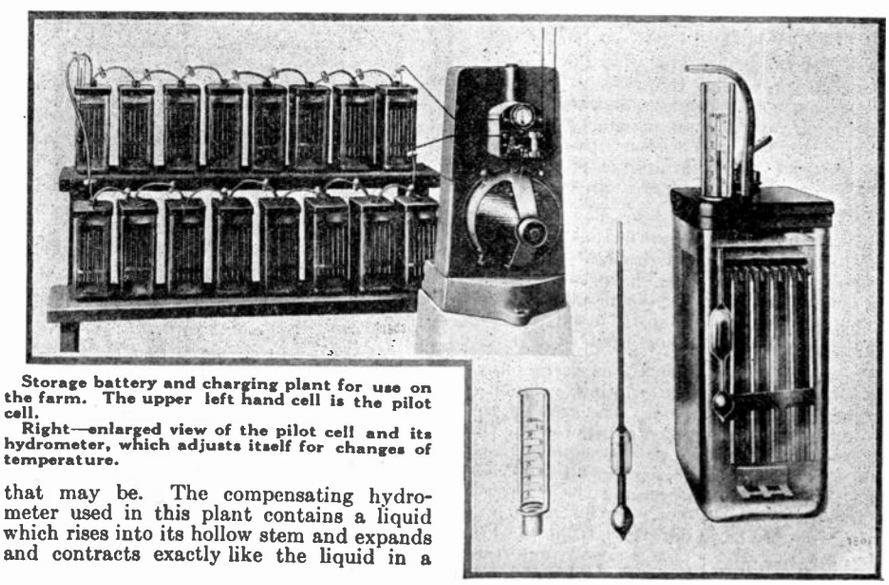
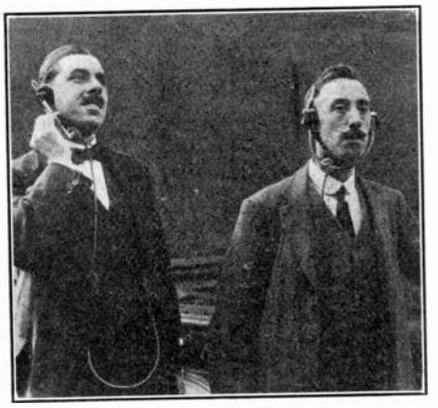


Storage battery and charging plant for use on the farm. The upper left hand cell is the pilot cell.

Right—enlarged view of the pilot cell and its hydrometer, which adjusts itself for changes of temperature.

The Laryngaphone



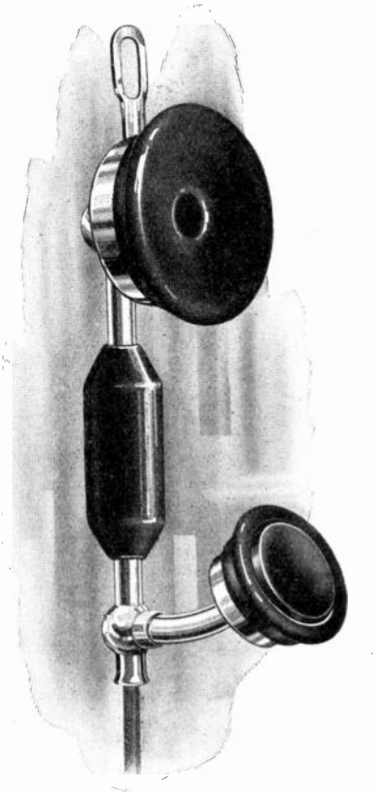
The use of the Laryngaphone, showing the two ways in which the instrument is used, either in the hand or carried by head band. The mouth never approaches the transmitter.

WE presume that many of our readers have amused themselves by experimenting with a telephone transmitter, holding it against the chest when transmitting instead of speaking directly into it. If this is done, speech can be transmitted exactly as if the instrument has been held to the mouth.

The Laryngaphone is somewhat on these lines and its object is to provide a telephone transmitter which will operate quite independently of the sound of the voice. The illustration shows how the appliance is used. The transmitter rests against the neck in the region of the larynx, and the receiver, of course, is at the ear. The idea of the instrument is that the vibrations of the larynx and of that region of the neck, will actuate the receiver. It is almost as if a physical contact of the body with the instrument did the work. The effect is two-fold; it seems that extraneous noises such as those incident to factories do not affect the rendition of the instrument—yet in a place where the speaker cannot be heard even by himself, the instrument operates with perfect efficiency.

The field for its use, therefore, would seem to be in engine rooms, the more noisy class of shops, among printing presses, in boiler works, and the like. It is constructed for mining and fire work, also, where the noise of engines and shouting etc. may make it impossible to transmit speech by the ordinary instrument.

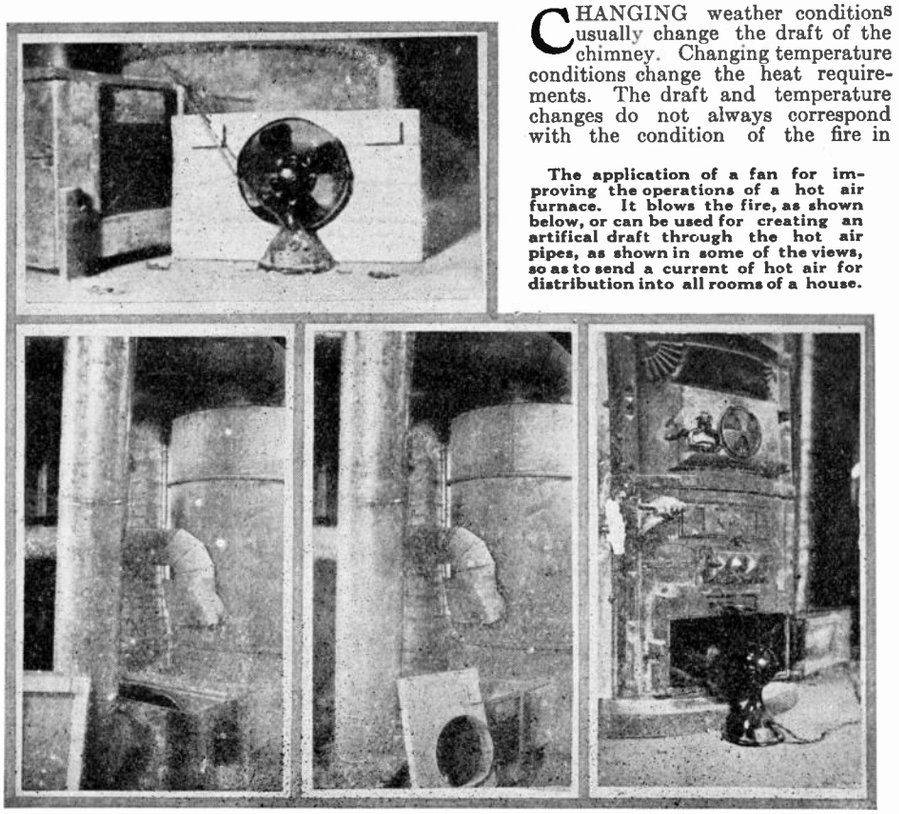
The Laryngaphone is now made up in several ways, one construction is adapted for attachment to the regular telephone system, whereas other constructions embody a complete system. It is stated that it is so efficient that it can be used in situations where the ordinary telephone would be practically useless. This apparatus figures, therefore, as an emergency instrument, for use in special situations. Although the proprietors do not speak of the feature mentioned here, it seems to our mind a hygienic improvement not to be compelled to place close to the mouth a receiver spoken into promiscuously. The combined pair of transmitter and receiver with hand piece carry out the English practice of telephone construction. In general it seems an advance on the clumsy desk telephone in use in this country. The American transmitter is made tostand permanently on a desk, or table, although the ponderous instrument is constantly held in the hand.



The Laryngaphone, showing the transmitter for application to the larynx. With this you can telephone in the midst of the loudest noise.

Controlling Furnace Fire Electrically

By J. E. Bullard



The application of a fan for improving the operations of a hot air furnace. It blows the fire, as shown below, or can be used for creating an artifical draft through the hot air pipes, as shown in some of the views, so as to send a current of hot air for distribution into all rooms of a house.

CHANGING weather conditions usually change the draft of the chimney. Changing temperature conditions change the heat requirements. The draft and temperature changes do not always correspond with the condition of the fire in the furnace. As a result, unless one is a very good fireman indeed, he is going to find that some mornings when he needs a hot fire there is very little in the furnace. As a matter of fact, there may seem to be no way of bringing the temperature of the house up to the right point before night, without drawing the old fire and building a new one.

I have found that a little eight-inch electric fan solves the problem admirably.

My furnace is too small for my house but by my method I get enough heat. In the morning, if the fire is low and the house cold, I throw on new coal and then start the fan going in front of the ash pit door.

This supplies draft enough to make the fire burn up quickly. I keep the fan in this position until the fire is burning as I wish it to burn. I regulate the forced draft supplied by the fan by the distance the fan is placed from the open door. The further back it is placed, the less will be the extra draft. The closer up to the ash pit it is placed, the greater is the draft.

This furnace is a hot-air one and there is not only the problem of getting the fire burning satisfactorily but also of speeding up the circulation of the hot air. Just as soon as the fire is right, I place the fan in what I call a fan box. This is a box built into the cold air intake close up to the furnace. The box is large enough so that the eight-inch fan can be placed in it, and has a removable slide through which a round hole has been cut. A piece of flue piping just large enough in diameter, so that the blades of the fan will rotate in it without hitting the sides, has been nailed in this slide in such a manner that

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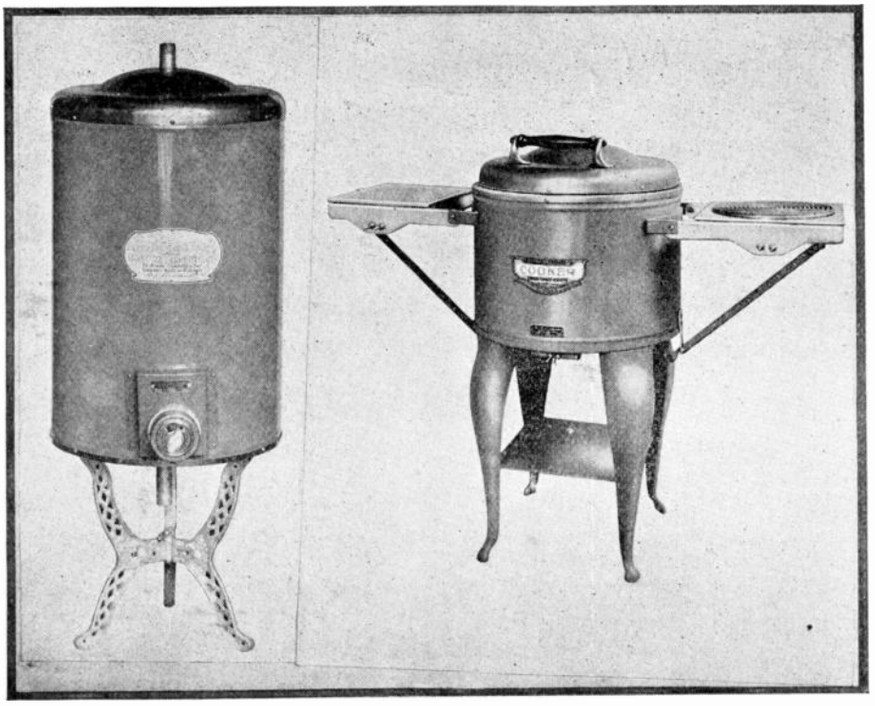
Electric Boiler



THE kitchen boiler which stands alongside the range, or else may be supported horizontally above it, properly speaking is not a boiler at all, but a receptacle for hot water. If it is a coal range the water is heated by the water-back; if it is a gas appliance it is heated by gas; if an electric boiler, by electricity. But in each case it is to be considered a hot water reservoir, which stores up a certain quantity of hot water, so that a considerable quantity is available at once, without waiting for the temperature of cold water to reach the desired height.

The electric boiler illustrated, for that is what it has to be called in deference to long usage, is of ten gallons' capacity, which is really a good family size. It is made of nickel alloy steel coated with rust-proof paint, and finished with gray enamel. It has a double steel wall and between the two walls are the heating elements. There is an insulation 2½ inches thick surrounding the hot water; so here we have the fireless cooker principle applied. Once the hot water is heated, the current can be turned off, and the heat we are told, will last 24 hours or more.

If the electric energy is supplied at 5c. per kilowatt hour, and this rate can be obtained in many places, it costs but 10c. to run the boiler for an hour. The fact, that the shifting of a switch cuts off electric current instantly, is the great reason for the economy of electric heat and power in the home. In this boiler the insulating feature operates in two ways:—it prevents the loss of heat while the water is being heated, and it retains the heat for many hours after the current is turned off. Twenty minutes suffices to heat the contents of the boiler to a proper temperature; then the circuit can be opened, the expenditure of current ceases, and the water is ready for use all day long.

Electric Fireless Cooker

Left—an electric house boiler. By thorough insulation, this becomes an economical way of heating water. The heaters immersed in the water impart all their energy in the shape of heat units to the water, none going up the chimney, as indeed there is no chimney by which the heat to escape.

Right—An electric fireless cooker. It will do everything by the watch, and when you have got the thing started, forget all about it till dinner time comes, when all will be ready for you.

THERE is one cooking appliance to which electricity lends itself with wonderful adaptation. This is the fireless cooker. Of course, electricity cooks without fire; but what we allude to is the non-conducting cooking receptacle, whose temperature and that of its contents is raised to the requisite degree by an electrical heating coil. Then when the heat has reached the cooking temperature, the food contained in the receptacle will be heated all through to the proper degree. If the current is now shut off, the fireless cooking operation, as we may term it, begins. The heat falling very slightly, continues to act upon the contents of the insulated vessel, and the cooking operation may be prolonged for as great a period as desired.

There are several interesting features about the one we illustrate. The lid of the receptacle is seated in a groove. Everything which is cooked in it is supposed to give off a certain amount of steam, and this condensing on the cover fills the groove and makes an air-tight seal. The general way of getting up the family meal is thus described by one who is presumed to have used it:

All the articles to be served are prepared some two hours ahead of time; the current is turned on for fifteen or twenty minutes, while the food is being prepared, and this brings the temperature of the oven up to the desired degree; the material is placed in the oven, and of course this reduces the temperature. The current is maintained for fifteen to twenty-five minutes more. As soon, however, as a slight evolution of steam is perceived, in the shape of a small wreath around the lid of the container, the current is turned off, and then everything can be forgotten for nearly an hour. Forty minutes is given as the minimum period of cooking after the current has been turned off; fifteen minutes to the pound is supposed to be a good allowance for a roast. The heat, of

(*Continued on Page 237*)

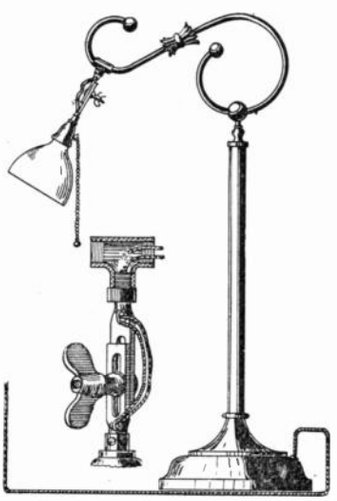
Electric Piano or Reading Lamp

A home-made standard electric lamp for use in reading or at the piano. Only easily found parts are used in its construction.

THIS lamp is easily constructed from parts that are to be found around any electric supply house, and may be built at a very moderate cost—especially if second-hand parts are obtained.

The base consists of a twelve inch ceiling plate, of a suitable design. Seven-eighths inch casing forms the stem, which should be about forty-six inches high. The arm is fashioned from parts taken from an old chandelier and the adjustable joint may be picked up among some junk that accumulates around any fixture department, or may easily be made from odd pieces of brass. A socket and shade holder complete the lamp. The shade may be made of silk, parchment or paper, or else may be purchased complete if desired. A length of eighth-inch pipe runs inside the casing, and is threaded into the arm at the top and into a crow-foot inside the base at the bottom. The base should be weighted with lead, or if more convenient, plaster of Paris, which was the material used in the lamp illustrated. A twelve-inch fiber chair seat can be fitted over the plaster at the bottom, being held in place with small brads through the edge of the plate. The lamp is finished in Roman gold or bronze enamel, or in polychrome effect.

Contributed by H. H. Houck.



Details of construction of the standard electric lamp which is of the home-made order-yet quite a useful as well as an attractive article.

Electric Kitchen Wizard

AN egg-beater is an egg-beater, and remains such even when whirled around by electricity. But those of us who have had the misfortune to expend our energy on hand-beating eggs, that stubbornly refused to rise to the occasion, will appreciate the merits of an electric kitchen appliance which will do this thing.

The beating of eggs, however, is but one of its varied achievements; and as the name indicates, the Electric Kitchen Wizard does many more things. Thus, it will grind coffee; it will chop ice; and will cut up meat to the consistency of sausage filling. It will strain soup, whip cream and mix mayonnaise.

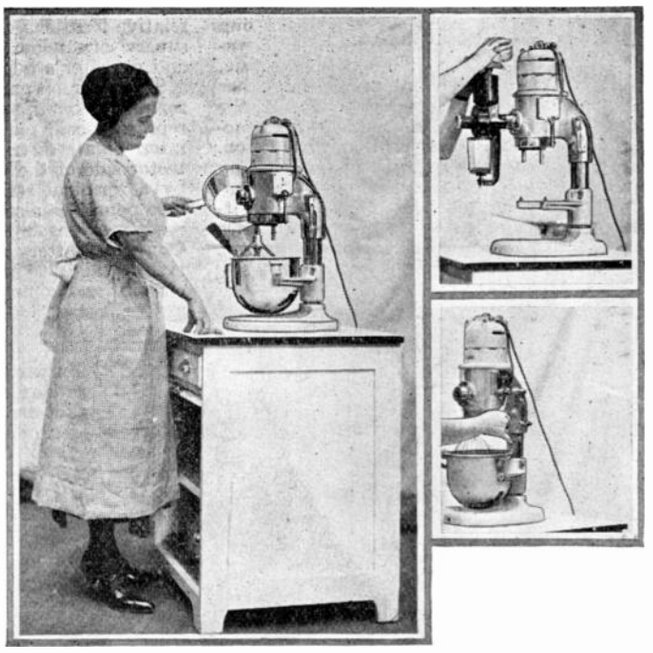
Outside the mixing vessel there is a chamber or jacket, which can be used to hold hot water or pounded ice as desired, so that an article can be treated hot or cold. Thus if hot mashed potatoes are required, as they are taken out of the pot they can be placed in the heated receptacle and be mashed without losing their original warmth.

In many cases, it is desirable to treat some kitchen mixture at a low temperature, and this feature also is provided for, as described.

To do these various things, the attachments have to be changed.

An interesting feature is that a horizontally directed socket is provided for receiving an apparatus for mixing on the small scale. Thus, a single tumbler of mixture can be treated at once.

In addition to the above work, it is said that this versatile apparatus will peel vegetables, and after successfully completing all the various operations involved in preparing the ingredients for a good meal, will buff the silverware into a highly polished state.

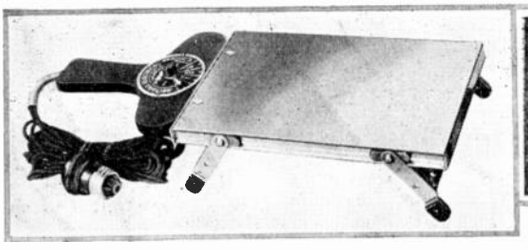


An appliance for use in a kitchen. The desire of the electric housekeeper of the day seems to be to possess something to stir up her mixtures.

The old system of beating eggs with a couple of forks until the arm was weary, the mashing of potatoes till no lump whatever remains, all these things the up-to-date housekeeper does by electricity.

The cut shows an interesting electric mechanism carrying out the kitchen operations. One of the characteristics the cut shows is that there are two separate rotating spindles, so that the rear spindle can be used for heavy and the other one for light work.

Combined Stove and Heating Pad



This is one of those convenient electric appliances which will do anything; after it has cooked your dinner down stairs, you can take it upstairs, curl your hair with it, and after you have come home from your evening-out, you can warm the bed with it.

COMBINATIONS of appliances are not always good, but electricity lends itself to almost anything, and we illustrate a combination of varied heating apparatus, which is quite interesting.

It is a metal case, containing within it a heating coil of resistance wire. Folding legs show that it can be supported above a table. Different amounts of heat can be given by a regulating switch. Resting on its four legs with full heat turned on, it is an electric stove. It will boil water and make toast. In one end is an aperture in which a curling iron can be inserted, which perhaps is bringing the kitchen and boudoir into rather close relationship.

Another useful function is to do the work of a heating pad.

The apparatus is very light, weighing but half a pound, and is entirely metallic. The adjustable supports and convenient shape, and the fact that there are three degrees of heat which can be given it, make it applicable for the last described purpose.

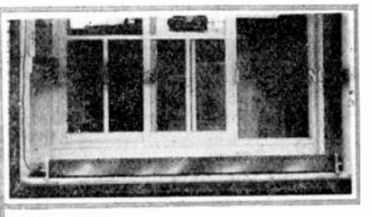
It seems quite likely that its possessor will find some other yet undiscovered purpose which it can be made to fullfill.

It seems to us that the question may arise as to whether anybody would want to use the same thing for such varied functions.

It is an interesting example of electric, **multum in parvo**, for it embodies within its small compass so many capabilities. Such appliance as these demonstrate the advantage of numerous connecting plugs in houses, so that the miniature cooking stove and general utility appliance can be put to work anywhere

There would even be a temptation to use it as a foot-warmer in limousines. Our ancestors used hot bricks and hot water bottles in their sleighs, but if the electric system of the automobile will stand the amperage another use would be suggested. It always seems as if the electric plant on an automobile could be made to do many things, it never is called upon to do.

Electric Window Radiator



An electric radiator which lies along the base of a window maintaining an ascending current of air, so that no frost will be deposited on the glass in the coldest weather.

It is particularily adapted for store windows to secure a view for the public.

THE frost-flowers deposited on window glass have excited much admiration, but are not very desirable from the practical standpoint, as they obscure the window and cut off the view through it.

Store windows are designed to display the goods within them, and when they become coated with frost, their functions are diminished or annihilated..

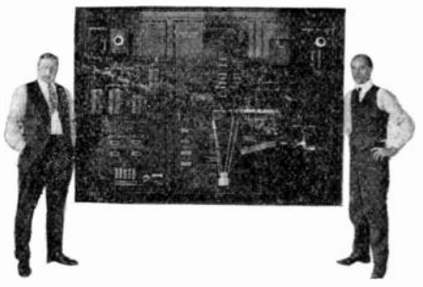
In Sweden, where the cold is quite intense, double windows are often used with a drying agent, such as calcium chloride, between the two glasses; this chemical by removing moisture from the air keeps the windows clear.

But electricity comes to the aid of the window dresser and a special electric radiator is manufactured to obviate the frosting of windows. This radiator includes a heating coil contained in a perforated case, which is placed at the base of the window along the sill and inside it. The effect of this is that there is a constantly ascending current of warm air, which by warming the glass, prevents it from condensing frost from the humidity of the air. The formation of frost on windows is due to the coldness of the glass, which chills the air so that the water vapor present is deposited, because cold air is saturated with a smaller percentage of water than is warm air. As glass is a very poor conductor of heat, its inner surface can be readily kept warm by such a current of air as will be produced by this heater. A very efficient way to utilize this heater would be to use double sashes or glasses, separated just far enough to let the heater operate between them.

Telephone Instruction Board

UNDER the auspices of Miss Edna Carter, Associate Professor of Physics at Vassar College, Poughkeepsie, N. Y., a model telephone switch-board has been installed for the instruction of the students in telephone engineering and practice. The board is shown in our illustration.

The backboard is finished in mahogany and is divided into panels by half-round moulding. The upper left panel, representing a subscriber's station, is equipped with a wall set and the upper right panel, representing station No. 2, is equipped with a desk set.



A model telephone switchboard recently installed in Vassar College for use in teaching the students how to do telephone work, which has become a great women's industry.

The large central panel represents the operating room and has a cross section of a standard No. 1 C. B. switchboard which contains two multiple jacks, two answering jacks with lamps, one pilot lamp and a complete cord circuit with supervisory lamps, ringing and listening keys, complete in detail. An operator's telephone set is also provided. In the "rear" of the switchboard, in the same relative locations as in a real board, are the supervisory relays, resistances, pilot relays and operator's telephone circuit apparatus.

The lower left panel represents the terminal room and contains the line and cut-off relays, repeating coil, main distributing frame and intermediate distributing frame. The protector side of the main frame is represented by a terminal strip. "Battery and ringing fuse panel" is also provided. This arrangement provides all the functions of a standard Common Battery system. All of the wiring is run straight to facilitate tracing the various circuits and a color scheme is used which makes it easy to identify the circuit being traced.

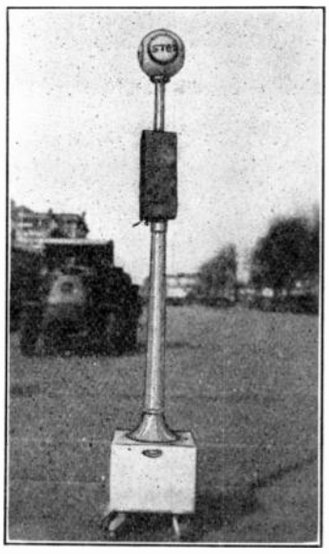
Automatic Traffic Guard

By A. Zarky

THE illustration shows an automatic policeman; an electrically controlled signal is arranged to direct traffic by intervals determined by a clock. There are those who think that an automatic policeman in many cases will be better than the real article, but it is said that this signal really has operated excellently in Los Angeles, in Pasadena, California, and elsewhere in that State.

A spherical glass globe with four rings of red and green at the four sides, and the words "Stop" and "Go" in corresponding colors inside the rings, is fastened to the shaft of an oscillating armature turning 90 degrees first one way and then the other, but not rotating. A light inside the globe illuminates the colors at night only.

A small box beneath the signal oscillator contains an ordinary clock-controlled timer for various intervals, either even or uneven, according to traffic conditions. Switches are provided for inserting each interval-contact in circuit, such as 10, 15, 20, 30 seconds. When the current is off, a spring pulls the oscillator to a neutral position, thus allowing traffic discretional right of way.



This may be termed an automatic policeman. It directs the traffic how to go and it only stops short when the question of arresting the violator comes up, which it cannot do.

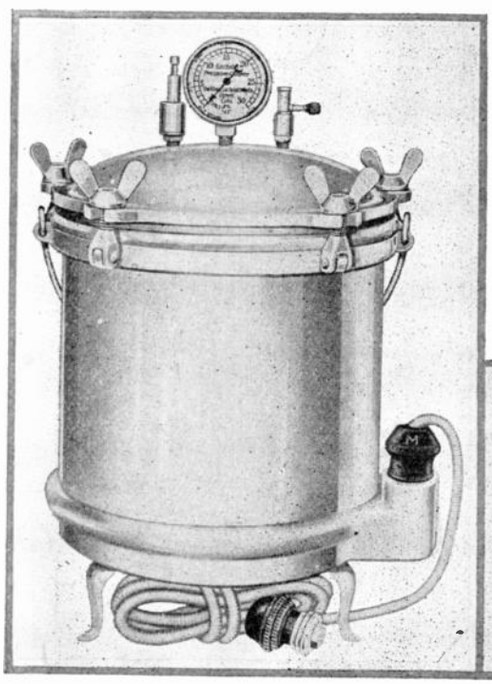
For trolley cars such as Mail or Depot, there are circuit-breakers on the trolley wire which come in contact with the trolley wheel, and which automatically reverse the signal from a Stop to a Go, until the privileged car has crossed, and the trolley wheel again comes in contact with a circuit-breaker.

Electric Pressure Cooker

MANY years ago much interest was excited by what was called the "Papin Digester". This was a predecessor of the high pressure steam boiler. Papin, who was an enthusiast on the idea of high temperature cooking, put his meat into vessels, which we would now call autoclaves, along with water. Heat was applied until the pressure rose far above the boiling point of water.

The illustration shows a return to good old methods, where electricity is made to operate the old high pressure digester or cooker. There is little to describe; it is a small, very strong case, with an electric resistance coil inside. In the operation of this appliance, the food is put into the receptacle, a little water may be added if steam cooking is desired, the top is sealed and the current turned on. Steam can be produced in four minutes, but to get up steam to the pressure of 20 pounds per square inch requires thirteen minutes. Ten minutes at the pressure of twenty pounds to the square inch will cook potatoes and carrots.

The apparatus is fitted with a pressure gauge and has an accurately fitting cover to retain the pressure, so that one knows exactly what is doing. It is small enough to be portable, and is provided with a handle, so that it can be carried about as needed.



The electric version of the famous Papin's Digester, which will interest the progressive housekeeper. It is of great use in the preparation of soup and other foods.

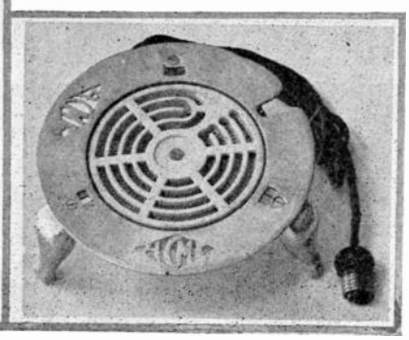
Electric Hot Plate

IN our last issue, the prize winner in the Household Wrinkles contest was a home-made hot plate, a most useful appliance for the housekeeper in the electrically wired house.

Electric hot plates, however, are made by manufacturers, and the one we illustrate is a good example of advanced practice.

The peculiar design of the grate, underlaid by a long resistance coil whose convolutions are such as to follow those of the grate, is a characteristic feature.

If the hot plate is not to be used electrically, the legs can be removed and it can be placed on a gas stove so as to derive its heat from the gas flame. The legs are readily removable and are easily replaced when the plate is to be heated by current. The apparatus consumes 660 watts on 110 volts potential. When packed and ready for shipment it weighs only 5 pounds.



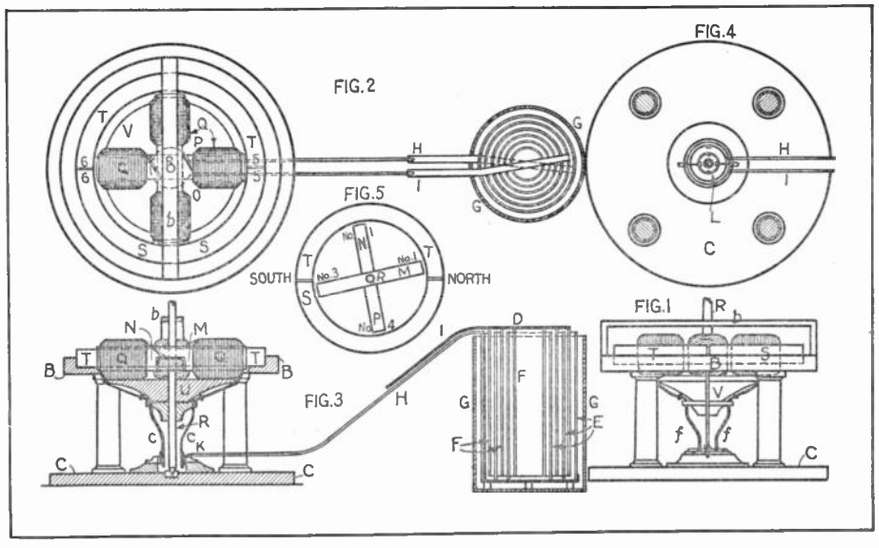
An electric hot plate, which is so constructed that when disconnected from the circuit it can be used on a regular gas range; the resistance coil is practically fire proof.

Antique Electric Motors

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

THERE is little doubt that the great imperfection of the early batteries operated greatly to the disadvantage of those investigators who were trying to develop electric motors.

In our last issue, in which was described the famous motor of Thomas Davenport, the first electric motor patented in the United States, reproductions of the drawings of his American patents were given. A most interesting thing in connection with the Davenport motor is that for the English patent more careful drawings were used, which were made to scale from the original working model. The construction, as our readers know is very simple, and it is interesting to see how the old-time electricians treated the battery as a part of the device. The pity of it is that electricians were so slow in discovering that the generator and motor were interchangeable The ignis fatuus which they pursued was always the battery-driven motor;—it never occurring to them that the true function of electricity in mechanics was the transmission of power.



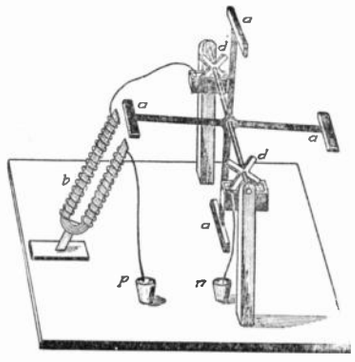
The drawings of the English patent of the Davenport motor are reproduced in this illustration, and they are supposed to represent the motor exactly as it was constructed.

The drawings of the English patent show quite an elegant construction, which certainly does credit to the inventor. His railroad is gone; it was put on board a ship to go to one of the Paris expositions and was lost at sea, but a photograph of it was taken and one of the illustrations show a reproduction from that photograph of the railroad. It ran, as will be seen, on a circular track. This railroad dates back to 1836-37.

From an old number of the American Journal of Science and Arts of the year 1835, a magazine often known as Silliman's Journal, we reproduce a curious old motor which shows how little was needed in those days to excite scientific interest. A wire cross mounted on a transverse journal with armatures at the ends of its arms, was kept whirling around by commutated current in the electromagnet. The commutation of current was effected by little stars mounted at each end of the axle. A favorite method of effecting electric contact in those days was to use mercury cups. Owing to its high surface tension, mercury in a cup can be brought up so as to stand above the level of the edge of the cup. Under the little stars there were two mercury cups, one for each; and in these the stars dipped their points, and so commutated the current as to produce changes in its direction and to keep the cross whirling around.

It is surprising to think that so crude and simple an affair should have been worthy of illustration and description in the leading scientific journal of America. These old investigators had trouble, however, with their mercury contacts. Their mercury got dirty or oxidized and did not work well, and complaints on this trouble are on record. Davenport seems to have been far-sighted enough to get away from this trouble.

About the time Davenport was doing his work, a European electrican, Jacobi, was working on the same problem, and developed quite an advanced multi-polar motor, an illustration of which is given here. This is supposed to date back to 1834. Professor Jacobi was the discoverer of the art of electroplating. The Emperor Nicholas of Russia was greatly interested in Professor Jacobi's motor and contributed $12,000 to the work of developing it for the purpose of propelling a boat. The motor used in the boat was somewhat more highly developed than the one of 1834, and this one dates to 1838. Alternate attraction and repulsion of the stator and rotor poles took place as the current was commutated. The motor was put in a boat and tried out on the River Neva in 1838. The experiments are considered historical. The boat was 28 feet long, 7 feet wide, and drew 2 feet 9 inches. It carried 14 passengers. Power was supplied by 320 Daniell cells. In 1839 the experiment was repeated, and this time 138 Grove cells were used. The Grove cells, with platinum negative plates, must have felt at home in Russia, which is the country from which most of that metal comes, as it is found in the Ural mountains.



A primitive motor, dating back to the year 1835. It shows how the old inventors stuck to the use of mercury cups for their connections.

About this time a Scotchman named Robert Davidson was using a motor to drive a lathe. He also had a small locomotive on which he used his electric motor. It is a great pity that no good representation of it is available. The battery was arranged in two sets, corresponding to the electro-magnets; of these there were eight, four on each side of the central axis of the car, and each set had its own battery. On the end of the longitudinal axis driven by the electro-magnets, were commutators of ivory and metal.

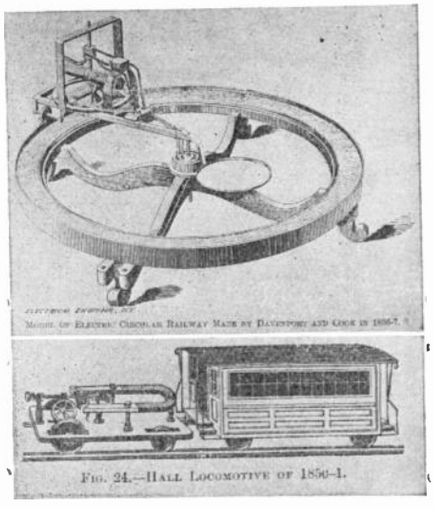


Fig. 24.—Hall Locomotive of 1850-1.

(Top)—The Davenport railroad as exhibited in Boston and elsewhere. It took its current from the center of the circle, evidently using mercury cups for connections.

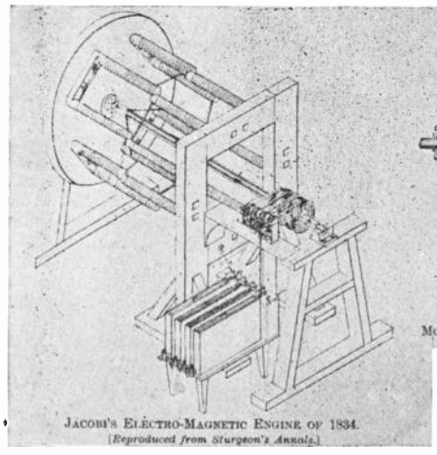
(Below)—A miniature railroad of the middle of the last century, which excited considerable attention in its day.

The car was no plaything; it was 16 feet long, 6 feet wide, and including the batteries weighed 5 tons. The battery contained iron and amalgamated zinc plates measuring 12 × 15 inches. It attained a speed of 4 miles an hour.

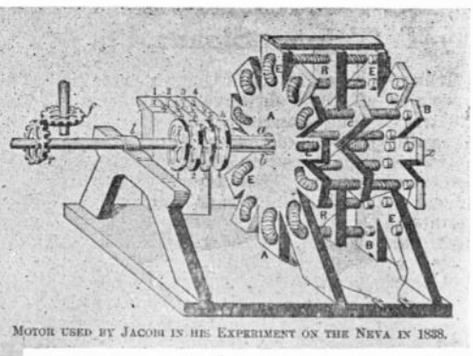
In 1847 Professor Moses G. Farmer constructed and exhibited an electro-magnetic-motor which carried two passengers on a track of 18 inches gauge. It was driven by 48 pint cells of Grove battery.

Professor Page also experimented with the electric railroad, and is said to have achieved a speed of 19 miles an hour. It was on Tuesday, April 29th, 1851, that his trial is recorded. The locomotive was of 15 horsepower, with 100 cells of Grove nitric acid battery, with platinum plates 11 inches square. He started off on the tracks of the Washington & Baltimore Railroad. For some reason his engine started off very slowly, but the speed soon increased and the first 5-1/4 miles, taking him to Bladensburg, was covered in 39 minutes. It was just before he reached Bladensburg that he got up to the highest speed of 19 miles an hour. After running at this rate for one mile one of the cells cracked open, and later two of them succumbed.

In 1851, the same year, Thomas Hall of Boston, who was then engaged by Daniel Davis, the electrical instrument maker, made a little electric engine, attached a car to it, and exhibited it at the Charitable Mechanics' Fair in Boston. It ran upon a 40 foot track of 5 inches gauge; as it reached the end a pole changer came into action, reversing the direction of rotation, and sending the whole little train back to its starting point, to repeat its journey, and this over and over again, as long as the current lasted. The



JACOBI'S ELECTRO-MAGNETIC ENGINE OF 1834.
[Reproduced from Sturgeon's Annals.]



MOTOR USED BY JACOBI IN HIS EXPERIMENT ON THE NEVA IN 1838.

A large motor, also of Jacobi's construction, which drove a boat on the Neva River, in Russia, before the days of the Soviets, in 1838.

Left An electric generator of 1834; it is reproduced from Sturgeons' Annals, the famous publication of the beginning of the last century.

interesting feature about it is that the current was conveyed to the engine through the rails. Two Grove cells supplied the electric power.

Daniel Davis, mentioned above, published a book descriptive of apparatus made by him, and shows in it a great number of very interesting and curious examples of the work of that day. He was an instrument maker by profession, and his "Manual of Magnetism" as he terms the book, is now considered a great curiosity.

The book is a unique presentation of the work of electricians in the last century. The copyright date is 1847. It is quite liberally illustrated with wood cuts and they present a most curious assortment of long stroke reciprocating electric motors and other apparatus.

It is interesting to observe that the early constructors adopted the reciprocating or solenoid type of motors, which now are definitely abandoned in favor of the rotor construction. The old inventors always had the steam engine in mind.

Artificial Lightning.

NATURE looked idly on recently, while man-made lightning worked destruction.

An indoor thunder storm was produced and controlled by man. Lightning without thunder clouds, but lightning nevertheless, flashed forth for an inconceivably short instant of time, caused damage, and vanished.

It splintered a large block of wood, scattering the pieces twenty-five feet in all directions. It struck the limb of a tree and shattered it completely. Some of the fragments were hurled half way across the room.

This laboratory lightning did everything that Nature's lightning does, behaved the same way, had the same characteristics—on a smaller scale, of course. But Nature had no hand in it. She was literally "on the outside looking in."

A student of lightning, Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, and his laboratory co-workers, J. L. R. Hayden and N. A. Lougee, have recently completed two years of experiments by producing the artificial lightning just described. In their laboratory at Schenectady, N. Y., they have constructed an actual lightning generator, with which they are testing lightning arresters in a more satisfactory manner than has ever before been possible. These tests are already showing how lightning arresters can be made more efficient.

Ever since lightning damaged his summer camp, on the Mohawk River, two years ago, Dr. Steinmetz has given considerable thought to means of reproducing the effects of the lighting flash, its characteristics, and its antics. He has formulated an exceedingly clear explanation of how a lightning discharge originates. He has estimated the value of the energy contained in a lightning flash, on the practical basis of its use to man if it could be set to work. He has shown that because of its short duration, its explosive force, it could not do much work for mankind in the fraction of a second that it lasts and that it therefore represents probably not much more than a few cents of usable energy.

The bolt that struck his camp gave Dr. Steinmetz and his assistants an excellent opportunity to study the effects of lightning. Arriving at the camp within 24 hours after the storm, he secured accurate records and photographs of the damage, this data proving of much value in laboratory work preceding the building of the lightning generator.

He found that the lightning had struck a tree overhanging the camp, tearing off some of the bark. It then jumped to the camp, where it divided. One division of the discharge passed to the ground through a post, from which large splinters were torn.

The other division shattered a window, then entered the camp's local lighting circuit and produced an oscillation, some of the lamps in the circuit being destroyed, while others which were located between these were undamaged. The lightning then followed several paths, shattering or splintering several supporting posts, a screen door, a bed and a mirror. The glass was shattered into many pieces, and the fragments were thrown across the room.

A careful study of what this bolt of lightning had done was in itself illuminating to the men of science. Now, however, Dr. Steinmetz and his assistants, Mr. Hayden and Mr. Lougee, have duplicated in miniature the energy and behavior of lightning.

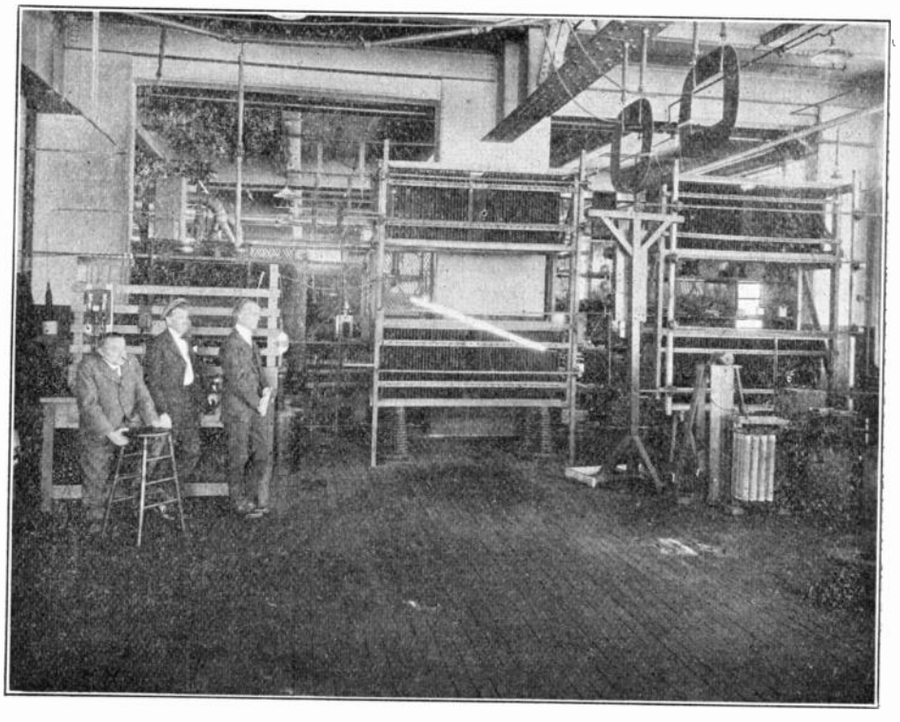
Differing only in magnitude, their lightning is just like Nature's article. Their lightning, like Nature's, can also splinter objects and throw the fragments across a room.

Their lightning generator does ingeniously just what the thunder cloud in the sky does during an electrical storm. It slowly generates electrical energy, storing it up gradually, until an overcharged condition is reached. Then, in a flash, the stored energy is discharged, and anything that is in its path is "struck by lightning."

In the artifical lightning stroke, a voltage of 120,000 volts was chosen as most convenient. The voltage of the lightning flash of a thunder storm has been estimated by Dr. Steinmetz at fifty million volts.

The artificial lightning represents, while it lasts, more than a million horsepower. The estimated horsepower of a natural lightning flash is given as 500 million horsepower. The million horsepower of the man-made lightning, like the 500 million horse-power in Nature's lightning, would not be very useful for practical purposes, because it lasts such a brief instant. It lasts about a hundred thousandth of a second.

It is true, the natural lightning flash has about 500 times as much horsepower. The difference in energy therefore appears colossal. But the difference in the nature of its action and effects is practically zero. Only, while Nature's lightning shatters and tears



The famous stroke of artificial lightning produced in the Schenectady Laboratory under the auspices of Dr. Steinmetz; the power of the stroke was enormous, its energy owing to its infinitesimal duration, was but slight.

the whole of a large tree, the man-made lightning does the same with a piece of a smaller tree.

There is the same flash and noise, only the flash is larger when Nature's lightning envelops an entire tree than when the laboratory lightning tears only a piece of a tree, and the noise is louder, though it is deafening enough in the laboratory lightning.

And yet, according to the laboratory specialists, it is theoretically possible to construct an apparatus which would reproduce Nature's lightning in all its magnitude. It would not be practical to do this, for it would mean apparatus of stupendous size and complexity; and it would not be desirable, as it would not be safe to approach near enough to watch it. But the same applied principle would operate as in the case of the lightning generator now in successful use.

This generator consists essentially of a high voltage condenser of large capacity in the form of 200 large glass plates. These are arranged in groups of fifty and in two banks or rows. The rectified direct current is stored up in these condensers, which are connected up so as to be capable of holding 120,000 volts.

One end of the double row of condensers corresponds to the thunder cloud in the sky, in which an electric charge is gradually stored up and increased by the conglomeration of the rain drops, as Dr. Steinmetz has shown. The other end of the condenser plates corresponds to the earth.

When the tension of the stored-up electric energy becomes greater than the lightning generator will hold—and the tension which it will hold is 120,000 volts—or, in the case of natural lightning, becomes greater than the thundercloud will hold, whatever that amount of tension may be, the discharge takes place. The lightning flash is seen, the thunder rolls—represented, in the case of the lightning generator, by a loud snapping sound, and the bolt strikes.

It is to be noted that the voltage in the artificial lightning flash is much smaller than the voltage produced in the now famous million volt tests performed last September at the Pittsfield, Mass., laboratories of the General Electric Company. Much talk of "artificial lightning" was heard when those tests were announced. Yet in reality the sole approach to actual lightning accomplished in those tests was that they contained a voltage estimated to be one-fiftieth of the voltage of a lightning flash.

"Higher voltages than we use in this generator have been produced", said Dr. Steinmetz," and have been talked about as lightning.' But mere high voltage is not lightning and has no similarity to lightning in its action and effects."

"The characteristic of lightning is high voltage backed by very large power, lasting for a very short time only, and so giving explosive effects."

"In the high frequency experiments of Prof. Thomson, Tesla and others, the voltage was very high, but with little power back of it; and even in the recent experiments with a million volts, at Pittsfield, the current was a fraction of an ampere. Thus the explosive effects characteristic of lightning were entirely absent."

"In our high lightning generator, we get a discharge of ten thousand amperes, at over a hundred thousand volts, that is, a power of over a million horsepower, lasting for a hundred thousandth of a second. This gives us the explosive, tearing and shattering effects of real lightning, so that, for instance, a piece of a small tree, exposed to the discharge, is mechanically torn to pieces by the flash. A piece of wire struck by it vanishes in dust."

"The difference is similar to that between a pound of dynamite and a pint of gasoline; the pint of gasoline contains more energy and can do more work than the pound of dynamite, but the pint of gasoline gives off its energy only slowly, at a moderate rate of power, while the pound of dynamite gives off its energy explosively, all at once, at an enormous rate of power, and thereby locally tears and destroys."

Valuable progress can now be made, it is predicted, in protecting electrical transmission lines and safeguarding buildings from lightning, since man can now make his own lightning and experiment with it at will. This has already been done as stated, in the testing of lightning arresters. Other electrical products can also be tested for their behavior during lightning. Later, it is stated, a larger artificial lightning flash will probably be produced.

The surprising advance of electrical science which these things indicate was pointed out by Dr. Steinmetz when he commented on the generation of a million volts. He said:

"When Edison ran his first circuits for electric lighting, in New York City, he used 220 volts. Today we are sending electric power across the country at 220,000 volts. Thus, in 40 years since Edison's first installation, we have increased the voltage in our electric circuits a thousand-fold; we have produced and played with over a million volts, and the voltage of the thunder cloud is only 50 times higher than what man has produced. So, you see, the step from the highest voltage now used to that of lightning is less than was the step which the electrical industry has taken in the last 40 years."

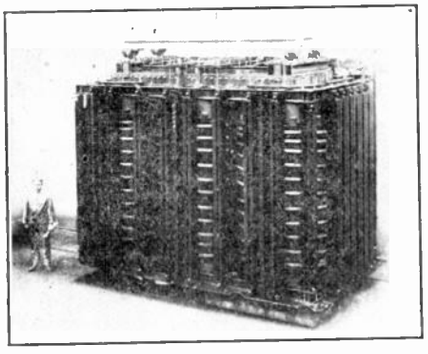
All of which would be rather fascinating news to sagacious Ben Franklin, first man to seek a speaking acquaintance with a flash of lightning.

The experiment has been followed in the line of elemental change. By dissipating a tungsten wire through such a discharge, evidences of the produetion of helium were obtained in other investigations. The production of gold from lead seems still in the remote future.

Monster Transformer

THE house of Siemens & Halske, like Brown-Boveri, of Switzerland, or the General Electric or the Westinghouse Companies of this country, is a by-word for all that is advanced and gigantic in the electrical engineering field.

It is unquestionable that the first person



A gigantic transformer. Its size is shown by contrast with the man standing by its side. This shows that our German competitors are still active in the electrical field.

who ever constructed a transformer by using a few turns of insulated wire for his primary, and a smaller or larger number of turns according to what he purposed to effect, for his secondary, never had the least idea of the great dimensions which would be ultimately given to these silent workers.

For they are truly "silent workers." They are perfectly immobile, no part of them moves, there is no wear or tear, no consumption beyond a small percentage of inefficiency —not even of lubricant—yet day in and day out they absorb electric energy at one potential, and deliver it at another. If they decrease the potential, a greater current will be delivered; if they increase it, a less current will be delivered. For the transformer is rigidly subject to the old and still respectable law of the conservation of energy; and except for waste, the product and potential at the intake must be pretty nearly equal to the product of the same factors delivered from the secondary terminals.

The reason that there is no moving part about a transformer is that it does nothing; if an alternating current with a definite potential difference passes through its primary, the secondary will obligingly deliver approximately the watts put into the primary, so that the watts in both will be almost the same, except for a slight loss. But it absorbs no energy, and develops none, except that by heating the coils and cores, it may be said to develop thermic energy. The less of this it develops, the better work it is doing, for this heating is what measures the waste. It simply passes energy along the line.

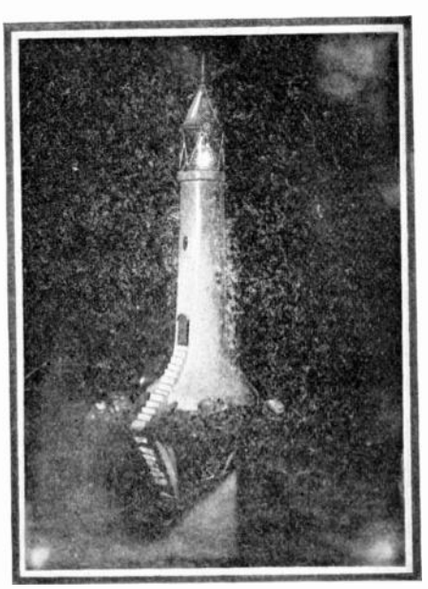
It is such transformers as this, which make the electric transfer of energy over small conductors possible. Such transformers in other words, can receive many horse power of energy at high potential, and can reduce the potential, so as to make it come within the limits of economic use, while on the transfer line running across the country, a potential difference of thousands of volts per mile may be maintained. The transformer cutting down this voltage, makes the induced potential sink to what may be termed economic limits.

Model Lighthouse

THE following is a description of a model lighthouse.

In its lamp house it carries an electric light which is flashed on by clock-work in the base. The constructor says that he happened to possess an old, unused alarm clock, so he made a wooden box for the base of this model, of proper depth to contain the works of the alarm clock, when lying on its back.

The box was covered, and a hole was cut in the top, 2 inches in diameter, which gave plenty of room to fish the electric wires through. The shaft of the lighthouse was turned out of wood, 13 inches long, 2 inches



A miniature toy lighthouse, which with a clock in its base, flashes periodically.

in diameter at the top, and 3 inches at the bottom, and the maker cut in the doors and windows to suit his ideas. A 1-inch hole was drilled through the center of the shaft.

The shaft was then fastened to the cover of the box, over the 2-inch hole. Putty was used liberally to cover the woodwork of the box, and was worked up around the base of the shaft to give the proper hyperboloid contour, which enables it to resist the action of

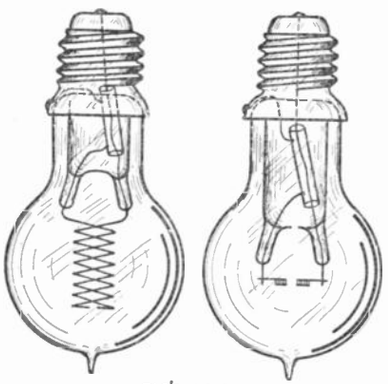
(*Continued on page 234*)

Self-Starting Neon Lamp

By D. McFarlan Moore

A QUARTER of a century ago, a lamp was conceived of that paralleled the then supreme 3-6-watt per candle carbon incandescent lamp, but the light of which was to radiate from a gas, in contra-distinction to radiating from a heated solid.

Such a lamp in a complete form has not yet been produced, but many new varieties of gaseous conduction lamps have been evolved, each one of which possesses one or more of the dozen or so most essential features, but usually in combination with some undesirable feature that in some instances was new. For example, high efficiency was obtained by resorting to vacuum tubes, several hundreds



FIGS. 1&2

Two forms of neon lamps. D. McFarland Moore will be rememberd as the originator of the cornice-tube system of lighting, and it is interesting to read his paper on his new neon lamps, of which two are shown in this illustration.

of feet long, such a lighting system or lamp being far from equivalent to a simple incandescent lamp bulb. Other interesting lamps of this character were objectionable in requiring either high voltage or high frequency or auxiliary apparatus, consisting of condensers, reactances, resistances, electrode heating circuits, etc., for either starting or normal operation. Other lamps had an objectional color, short life, poor efficiency or low intensity.

Figure 1 shows one of the many forms of what may be called a plain corona or cold-radiator lamp, 2¼ in. in diameter. It is the first commercial electric lamp whose radiating wires which correspond to the filament of an ordinary incandescent lamp, are "cold" (that is, they operate below red heat). Even though it is a gaseous-conduction lamp, (that is, there is not a continuous metallic circuit within the lamp) it operates on 110-volt circuits and has a power consumption as low as 0.25 watt from the supply system.

The light consists of a velvety pinkish glow or corona enveloping the paralleled wire helices. These helices are 0.75 in. in diameter and 1 in. long and are made of aluminum, iron or other metal.

A series resistance of several hundred ohms is placed in the base. The bulb contains about 30 mm pressure of neon gas. With less gas pressure and higher voltage, this lamp is ideal for signalling purposes, because it is entirely extinguished instantly, upon the opening of its supply circuit; no time is required for the radiators to cool, as proven by stroboscopic tests.

Its mechanical design is almost ideal as regards cheap construction but its specific consumption is high (about 15 watts per spherical candle-power) and it is difficult to obtain sufficient candle-power from a single bulb for most uses. When this is attempted by raising the voltage and lowering the value of the series resistance, destructive arcing discharges are liable to occur and the helices become red hot. This type of lamp lends itself for operation on either alternating or direct-current circuits; in the latter instance its appearance is good, although only one helix (the negative) glows.

If for the large helices there are substituted small ones of refractory material, like tungsten, as indicated in Fig. 2, a different type of lamp is evolved, which may be designated as an intense corona—because some of its light is due to radiations from hot solids. A power consumption of two or three watts from the supply system will cause a bombardment that results in an incandescence of properly designed electrodes or radiators, thus producing light at a specific consumption far better (about 3.0 watts per spherical candle-power) than when the radiators remained cold.

Upon closing the controlling switch of such a lamp, which has a series resistance of 624 ohms in its base, there first appears surrounding the electrodes a close fitting electric glow or corona discharge of light, having the characteristic reddish color of neon, and the current flowing is about 0.02 amperes with a power consumption of 5.5 watts, but the current steadily increases so that in a few seconds, it reaches stability, at 0.125 amp. (the consumption being 26.2 watts) and the dim reddish corona evolves into a horizontal cylinder of intense white light of about 7.1 spherical candles apparently about ⅜ in. in diameter and ½ in. long. That is, a bright and comparatively efficient gaseous conductor light has been produced on low voltage circuits, without the use of any starting auxiliary apparatus. This result has been accomplished by so constructing the electrodes that a greater current would flow.

In the specific instance of the lamp shown in Fig. 2, the electrodes consist of twenty turns of 0.0025 in. tungsten wire, wound on a mandrel 0.050 in. in diameter. The gap between the electrodes is 1/16 in. The helix form lends itself particularly well for using all of the energy of the corona glow. Heated helical and many other forms of radiators have been tried.

When higher amperes are desired proper provision must be made for using several electrodes or increasing the diameter of the electrode wire. Fig. 3 shows a lamp in which the electrodes consist of twelve turns of 0.010 in. tungsten wire on a 0.050 in. mandrel. In this instance the bulb contains 65 mm. of neon gas. A series resistance of 303 ohms is used on a 220-volt 60-cycle circuit. Upon closing the switch, the red corona glow appears over all of the electrodes at 0.06 amp., but quickly changes to a ball of white light about ⅝ in. in diameter at 0.32 amp. The output was 10.5 spherical candles and the power consumption was 85 watts, of which 31 watts was used in the resistance. Therefore, the 54 watts of the lamp at 128 volts on the lamp corresponded to 5.1 watts per spherical candle.

When highly efficient reactance is used to replace the ohmic resistance, the actual power consumption is correspondingly reduced. The evaporation of the tungsten is regulated by the current density and the gas pressure. Such lamps can be made in sizes from very low to very high wattages. When operated on direct current, only one electrode becomes incandescent, but the self-starting characteristics are the same.

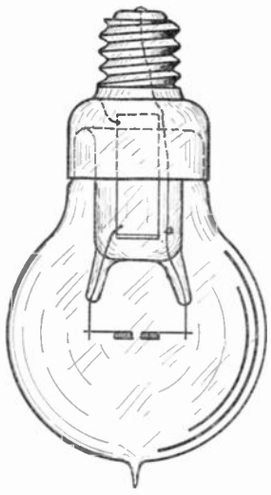


FIG. 3

A high powered neon lamp of approved construction, also due to the same investigator's work. The paper describing these lamps is of considerable importance, and deserves careful reading.

If the intense corona lamp, last above described, has its series resistance changed from 303 ohms to 40.0 ohms, the sudden change in phenomena is so marked that there is created a different class of lamp which can be designated as an "arc," or as the first low-voltage, self-starting, neon-tungsten-arc-incandescent lamp.

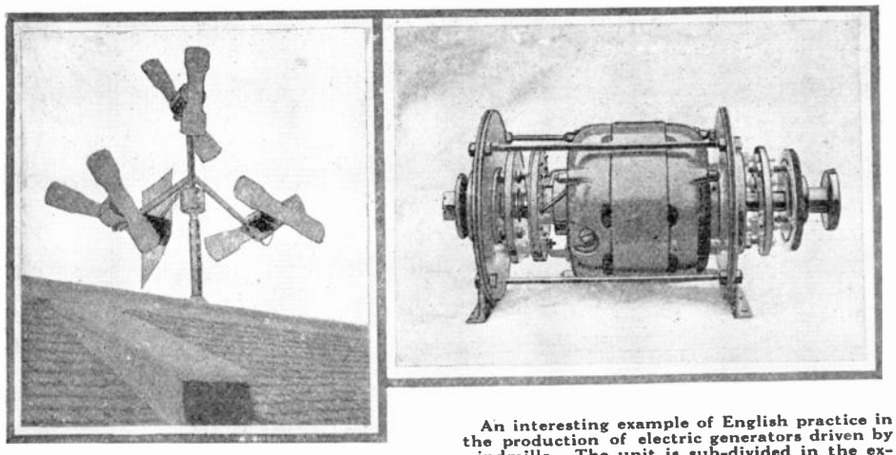
When the current is applied, the same phenomena as before occur, first the faint corona glow (cold electrodes) followed rapidly by the intense corona (hot electrodes) at 0.32 amp., but the current continues to rise to 4.45 amp., and the heads of the helical electrodes become much more highly heated and their tails cool to redness, while at the same time a very intense white arc appears in the gap between the electrodes. The voltage on the lamp terminals also falls from 128 volts to 42 volts. The output increases from 10.5 to 178 spherical candles and the specific consumption becomes 1.08 watts per spherical candle.

It is seen that very efficient and simple arc-incandescent lamps can be made for outputs from very low candle-powers to very high candle-powers.

The use of this simple progressive starting method is applicable to a large number of gaseous conductor devices, including rectifiers of all kinds. Lamps based on this principle can be used for many purposes, from general illumination to projection lantern service.

Abstract from Transactions of the Illuminating Engineering Society.

English Electric Wind-Mill



An interesting example of English practice in the production of electric generators driven by windmills. The unit is sub-divided in the example illustrated; there are three divisions, and for each of the three generators there are two wind mills, one turning the field and the other the armature in opposite directions, so that each generator has two rotors.

THE term which we have applied to this wind-mill does not mean that it is a wind-mill driven by electricity, but that it is a wind-mill generating electricity.

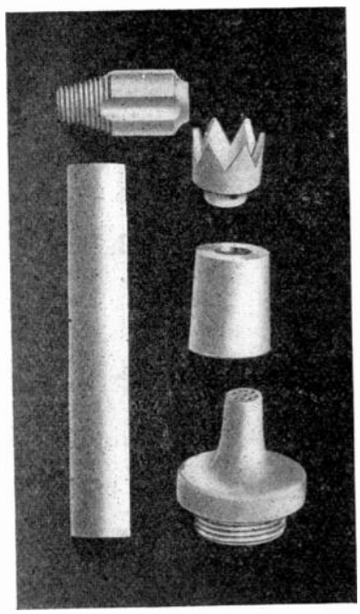
We have already had occasion to describe such a wind-mill with its accompanying plant, for use on farms and in isolated places, which mill, made in this country, represents American practice. The one we now illustrate comes from England, and it is very interesting to see how the problem of utilizing wind-power for generating electricity has been attacked by our cousins across the water. The English engineer has introduced into his appliance some very interesting features; he bases his operation on high speed and subdivides his mill into three separate and distinct units, or it might even be said into six. The idea is that during the last few years the power consumption of electricity in small installations in England, in homes and farms, has decreased. Daylight saving and what we call the Mazda lamp, the so-called "half-watt lamp" of England, and the economy which is now felt to be a necessity there, have reduced the consumption in the cases spoken of.

The system comprises a number of dynamos or generators with two direct coupled windmills for each. There is no gearing, the drive being absolutely direct. It is here that a peculiar feature comes in, which doubles the net speed of rotation. The mill wheels revolve in opposite directions; one is attached to a revolving field and the other to a revolving armature, so that one element of the dynamo turns clockwise, and the other anti-clockwise. The effect of this, of course, is to double the speed. The three mills are mounted as shown, on a three fold frame, and the direction vane keeps them pointed towards the wind.

Each generator is rated at 100 watts; the energy generated is devoted to charging a storage battery, and this charging begins as soon as the wind attains a velocity of 15 miles an hour. As the wind increases, output and speed of rotation also increase. Collecting rings are mounted on the shaft so that the the orientation does not affect transmission of the power. One of the generators is specially arranged to operate as a control mechanism; this it does automatically. A sleeve is mounted upon the control generator's shaft, free to move back and forth, so as to connect the generators to the battery when the speed is sufficient, and to cut the battery off when the speed falls too low. If it were not for this feature, the battery might exhaust itself through the generators, converting them into motors.

The apparatus is quite small and light, single generators with wings and attachments weighing less than fifty pounds. A set of three generators with accessories runs up to 225 pounds.

New Insulating Material



An interesting insulating material to take the place of common porcelain; one which can be worked by regular machine tools, such as lathes and drills, and to which great accuracy of size can be imparted. It also insulates in spite of moisture.

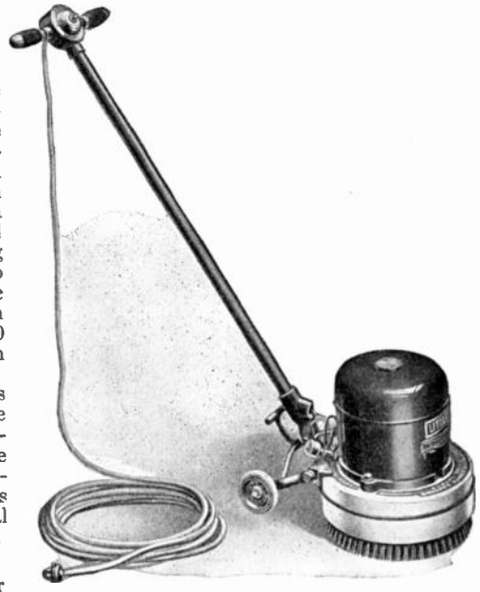
FROM Europe has come a new material, a type of porcelain, for insulating electric wires, taking the place of the every-day porcelain tubes, bushings and the like. The material is claimed to possess very remarkable qualities. It is unglazed ; yet it can be soaked in water without destroying its insulating qualities or even impairing them to a noticeable extent.

Being unglazed, this material can be put in a lathe and turned, or it can be drilled and otherwise treated as if it were metal. The great feature here is that special threads can be cut upon it, and that it can be turned down to exact sizes where requirements for such accuracy exist.

Recent tests of electric porcelain have shown that at 8000 volts per millimeter thickness of regular electric porcelain, a discharge will take place through the material. This figure comes from a report of the National Advisory Committee for Aeronautics. From another source, the statement comes that a ½ inch thickness of the best porcelain will stand 60,000 to 90,000 volts before permitting a spark to pass. These figures from two different authorities are fairly close. The material we describe, it is said, has shown a puncture resistance measured by 60,000 volts, for the thickness of one-tenth of an inch, whether wet or dry.

Mechanically speaking, the material is very strong, and our illustration shows some nice examples of its manufacture. It resembles ordinary porcelain. Insulators are being made now within a dimensional accuracy of 1/250-inch. The advantage of this is that the material can be used with metal fittings, where close dimensions are essential.

Electric Floor Cleaner



A machine for cleaning floors, waxing them, and even scrubbing them. Brushes are changed for the different requirements, and the brush itself acts to propel the machine.

THIS machine might be called a floor cleaner, were it not for the fact that it does a great deal more than merely clean. The present hygienic system of having perfect floors for our houses, with rugs distributed about which can be taken up and cleaned so readily, exacts attention in order to keep the wood beneath the rugs and bordering them, in good condition.

The machine which we illustrate is connected by a flexible cord to a convenient plug; and is guided about the floor by the operative, giving the wood or other surface all the different kinds of treatment required by modern standards of housekeeping. The weight of the machine when not in operation can be carried by a pair of rubber tired rollers directly back of it. Extending from the machine, a handle runs back, by which it is moved about or guided. Pushing down a pedal lifts the machine from the floor, so that the machine rests upon the wheels, and it can be pushed about without touching the wood.

In operation, the wheels are raised from the floor and the machine rests directly on the rotating brush, and the rotary motion of this brush acts to pull the machine about, so that the operator has nothing to do but to guide it.

This new appliance is said to scrub all classes of floor, wood, marble, tile and linoleum; there is supplied a special polishing brush attachment with which a floor can be highly polished; when this is to be done, the

(*Continued on page 237*)

Motor Electrics

Seeing Your Plug Spark

THIS very ingenious apparatus will commend itself to many automobile owners who carefully watch the action of their cars, while for garage work, where such is done intelligently, it would seem to be a most valuable appliance.

This is a very ingenicus appliance by which terminals of an automobile spark plug can be watched and the explosicn of the mixture can be seen.

A tubular receptacle for a spark plug is carried on the end of a short piece of pipe; the other end of the pipe is threaded to fit the spark plug hole. Going back now to the transverse pipe, which in the illustration is seen to be set at an angle of 45 degrees, its lower end is threaded for the reception of the regular spark plug. The upper end is closed by a thick piece of plate glass. When it is put in position and the engine started, the cylinder to which it is attached explodes regularly when its turn comes, and the observer can watch the plate glass and observe the nature of the explosion by the light given in the combustion of the mixture. There is no question here of an imperfect view such as has been given by glass spark plugs. These have been used for this purpose, but were not very satisfactory. Here there is a clear piece of plate glass and nothing else intervening between the explosion and the observer.

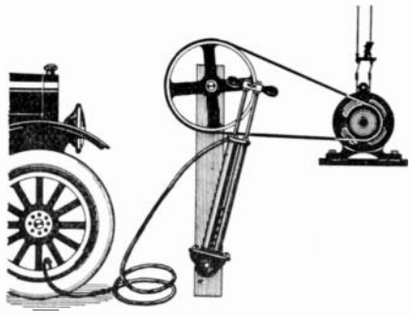
It sometimes happens that owing to bad rings or a scored cylinder, or one which is worn out of true, oil finds its way past the rings, oils up the plugs and interferes with the firing. Any process of this sort if it amounts to anything, will be revealed by the deposit of oil upon the plate glass, as well as by its effect upon the explosion.

The feature, that the engine is running with regularity and with the full number of plugs during the test, gives it particular value.

Tire Pump Operated by Motor

AN automobile tire pump can be operated by a small electric motor or gasoline engine by means of the simple arrangement shown in the drawing. All that is required is a pulley 12 inches x 4 inches x 36 inches, and a short belt.

The pulley is attached near one end of the wooden piece, so that it will turn freely. A good way to make a bearing for this wheel is to cut off a piece of gas pipe, that will just fit inside the hub of the pulley, and will be a little longer than the hub. Next take a bolt long enough to go through the wood and piece of pipe, with a washer on each side of the pulley. Then drill a ¼ inch hole through the handle of the pump, also in one of the spokes of the wheel, near the circumference, and fasten the handle to the spoke in the way shown. The distance from the center of the wheel to the hole in the spoke where the pump-handle is bolted, must be one half the stroke of the pump.



A tire pump of the foot description, operated by an electric motor. A very effective way of pumping up your tire.

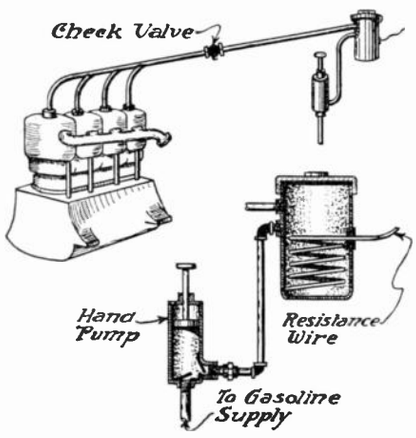
The foot of the pump is secured as clearly shown in the illustration. The whole apparatus is attached to the wall of the garage. A long hose is fastened to the pump so that all tires can be reached. A switch for starting and stopping is placed in a convenient place.

Contributed by Harold Jackson.

Cold Weather Starting Appliance

THE illustration shows a suggestion for a quick starting appliance for an automobile engine. A small cylindrical tank is connected to a very small hand pump, so that gasoline can be pumped into it if desired. Within it there is a heating coil; the tank is air-tight.

To start the car, especially in cold weather, the current is turned on to the heating coil for a few minutes. If any gasoline is in the tank it will be gasified. If the driver suspects that the tank is empty, a stroke or two of the pump will introduce sufficient gasoline. From the little tank a pipe with a check valve runs and is manifolded to the cylinders of the engine. The pressure produced by the gasifying of the gasoline forces it into the cylinder, giving a rich mixture for a quick start.



A simple and ingenious arrangement for priming an automobile engine with gasoline vapor; this will insure its starting easily in the coldest weather.

Magnetic Trouble Lamp

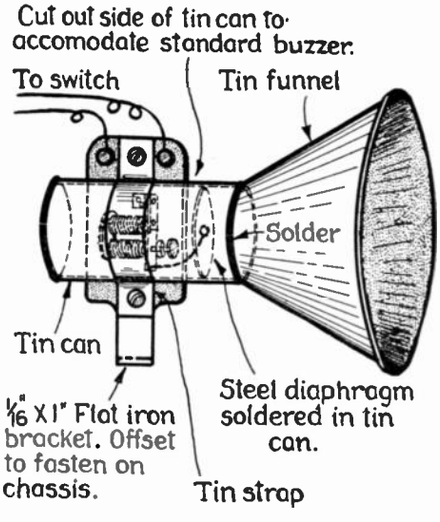
When using my trouble lamp around my car I found it very hard to place the light just where I wanted to use it. I tried hooks and all kinds of attachments and they all failed to give results. So I made a small horse-shoe magnet from a soft piece of iron and wound it to take about 1 ampere of current, and installed a lamp socket on the end of the magnet. I then connected my extension to the socket and magnet coil in multiple. When the current was turned on, the lamp lit, and the magnet was magnetized. It will stick to almost any part of the car, and will remain there until pulled off or until the current is turned off.

Contributed by C. H. Trimble.

Home Made Auto Horn

THIS simple alarm is made of a standard electric buzzer, set inside a tin can, such as used for domestic goods, and a tin funnel. A steel disc is cut to fit inside and all is rivetted or soldered tight. On the vibrator arm of the buzzer is rivetted a piece of bicycle spoke, attached to the end of which is an iron ball, which when the buzzer vibrates strikes against the steel diaphragm. The potential should not exceed four volts. A bandiron clamp is run around the can and connects by bolts (3/16 inch std.) through holes already in the buzzer frame. The wires are connected with a convenient switch, to a battery of 4 standard dry cells. You must give the horn a good coat of best air drying black enamel.

Contributed by O. P. Avery, Garfield, N.J.



An automobile horn made up from every day material, warranted to make a good noise, operated by current from the battery or generator of the car.

Electric Light Batteries

By P. Medinger, Luxembourg.

THE following device is designed for lighting bedrooms, staircases and places where small lamps of one to two candle power are sufficient. The "Central" is composed of a gravity or crowfoot battery of six (or seven)

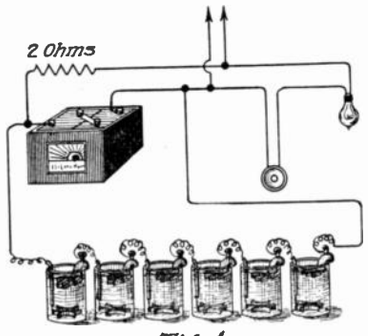


Fig. 1

Arrangement of gravity battery and storage battery for house lighting, showing an alternative arrangement of the connection.

cells and a storage battery of 4 volts. The gravity cells are of very easy maintenance. On the bottom of a jar put a copper foil (or lead foil) spiral, one or better two inches high. Fill the jar with a solution of 10% magnesium sulphate and hang on the upper part of the liquid the zinc plate (horizontally) or better a zinc foil spiral. To the upper spiral is fixed a wire passing through a glass tube or insulated with gutta percha or India rubber. Connect six of these cells in series and short-circuit them. Then throw into each some crystals of sulphate of copper (best, through a large glass tube placed and kept in the jar for this purpose). After some ten hours the battery will be ready for use, and is to be connected to the storage battery, the positive poles of the battery to the positive pole of the accumulator, and so for the negative poles. The gravity battery is now charging the accumulator day and night during all the year. All you have to do is to put into each jar some crystals of blue stone (copper sulphate) every few days. The liquid on the bottom must always be blue. If the blue liquid rises too high, something is wrong in the battery circuit; look at the binding posts. As the battery needs small, but constant attention, it must not be placed in an inaccessible dark corner.

As to the lamps to be employed, the 3.5 volt flashlight lamps are recommended for their cheapness, efficiency and economy. But as these lamps would be overvolted by the 4 volts of the storage battery, a two ohm resistance coil must be inserted into the line. Inserted near the storage battery Fig. 1, this resistance acts as a safeguard for the storage battery in case of a short-circuit in the line. But this disposition of the resistance will have the unpleasing effect that the brightness of the lamps will drop considerably when a second or third lamp is lighted. The average flash light lamp requires 0.25 ampere. If the resistance of your line including that of the storage battery is 0.5 ohm, that of the lamp bulb 13.5 ohms (as it is really) and the resistance coil 2 ohms, you will have for one burning lamp: Intensity of current $= \frac{4 \text{ (volt)}}{0.5+13.5+2} = 0.25$ amperes. Two lamps burning in parallel have a resistance of $\frac{13.5}{2}$ ohms or 6. 8 ohms and you will have $I = \frac{4}{0.5+6.8+2} = 0.43$ amperes; this gives for each lamp only 0.215 amperes instead of the required 0.25 ampere. It is therefore preferable to insert a 2 ohm resistance in each lamp-circuit. (Fig. 2).

In this case we have for two lamps burning $I = \frac{4}{0.5+6.8+1} = 0.488$ ampere or for each 0.244A. This arrangement has been in operation in the author's home for two years without any interruption and has given entire satisfaction. It has been designed to light three bedrooms, and especially to permit reading in bed. For this purpose the lamps are connected to a long flexible wire running

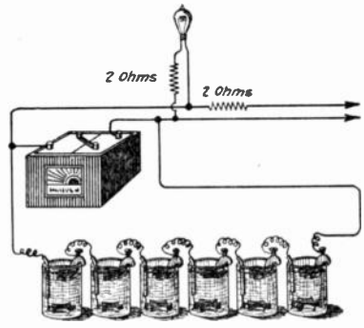


Fig. 2

Another arrangement of the connection for carrying out this interesting system, for which we are indebted to our Luxemburg correspondent.

along the wall cornice or baseboard. For reading in bed the lamps are simply placed on the pillow and give a light which is rather too bright. If the reader falls asleep and forgets to extinguish the lamp, there is no danger at all.

Here are some data of the plant.

My six gravity cells (jars 8 inches high and 5 inches in diameter) give a constant charging current of 0.065 amperes; it is for 24 hours; 1.56 ampere-hours or for each night 6 one-lamp lighting hours, which is much more than enough, so that the storage battery always has a good reserve in case of insomnia or illness. The consumption of zinc was about 5 pounds and that of copper sulphate about 10 pounds a year. The lamps had to be renewed on an average every four months.

Telegraphic And Telephonic Transmission Of Pictures

(*Continued from page 198*)

bromide paper, and the cylinder rotates in synchronism with the transmitting cylinder. This latter cylinder is carried by a special frame M, which opens as shown on the right. A cylindrical tube I, has its outer end closed by a silver plate, pierced by a hole of diameter equal to the longitudinal displacement of the cylinder for one revolution. With this arrangement, once the frame is in place, the light goes through a circular aper-

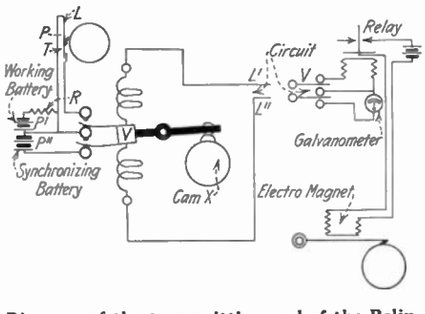


Diagram of the transmitting end of the Belin apparatus for transmitting pictures by telegraph or telephone line.

ture of diameter adapted to cover in its helical path the entire surface of the sensitized paper.

The receiving cylinder moves longitudinally, corresponding to the longitudinal movement of the transmitter at the transmitting station. Each time the current passes, the mirror of the galvanometer moves, and it is only when the current passes that the light falls upon the paper, but at all other times the reflected spot of light is deflected and falls upon a screen. This arrangement can be reversed, so that either a positive or a negative can be received as desired. The transmitting and receiving cylinders must turn in perfect synchronism.

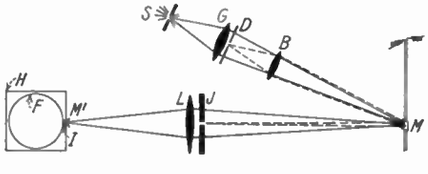
The receiving cylinder is made to turn very slightly faster than the first, and at the completion of each revolution it stops, until the transmitting cylinder has caught up to it. A fork-shaped arm V, with slightly flexible blades, establishes the connections between the telegraphic or telephonic lines and the apparatus. These two plates oscillate between three contacts, acting as a delicate current changer. The two first contacts are connected to the main battery, the second and third to a battery of polarity the reverse of that of the synchronizing battery.

The shaft which moves the cylinder carries the cam which makes the fork vibrate with proper frequency.

At the receiving station, the shaft of the cylinder carries an eccentric which at the end of each turn elevates the projection on the armature of the electro-magnet on the relay circuit. A friction drive on the electric motor permits it to continue its rotation, in spite of the sudden check of the cylinder. When the two cylinders begin to move again, the working current acts upon the oscillograph, and then the receiving cylinder suddenly stops when the eccentric on its shaft raises the projection on the armature. At this moment, the cam of the fork being diametrically opposite, the fork oscillates and substitutes for the oscillograph polarized relay currents. About 1/50th of a second after this, the vibrating fork at the transmitting station sends reverse current over the line. The relay closes the local circuit of the electro-magnet, which attracts its armature, and the motor shaft begins a new rotation, and so on until the entire image is transmitted.

To transmit a photograph on the telegraph line a proof of the original is taken on carbon paper transferred by the regular process to the copper cylinder, and after drying, an image in low relief is obtained. The transmission and reception goes on as has been already described.

Suppose, now, that someone is taking a picture with his kodak. He will take a proof in bichromated gelatin, which before drying he will place upon the cylinder of the Phototelegraph. Then he will go to the telephone booth, or to any private line, and will put his apparatus in communication with the line. At the other end his correspondent will connect his apparatus and receive the photograph. The operation is conducted



The receiving plant of the Belin apparatus, illustrated diagrammatically. The reflected light acts upon a photographic film and reproduces the picture.

without interfering with the use of the line for telephoning.

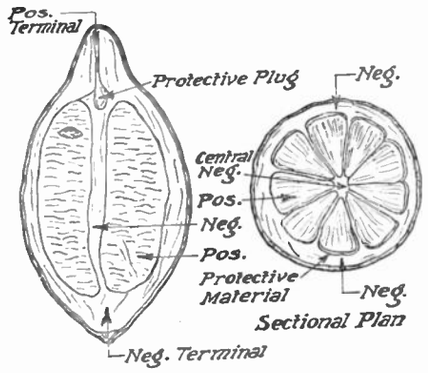
In the Summer and Autumn of 1921, Mr. Belin exchanged photographs and manuscript messages between offices of the "New York World" and the "Post Dispatch" of St. Louis. He also sent by telephone or radio, text and photographs from America to Europe. He has also adapted his apparatus for use with alternating current.

It is fair to call this one of the most important of recent developments in the electric transmission of intelligence, and one which may profoundly influence newspaper work.

Electricity From Fruit and Vegetables

By H. Winfield Secor
Associate Member, American Institute of Electrical Engineers.

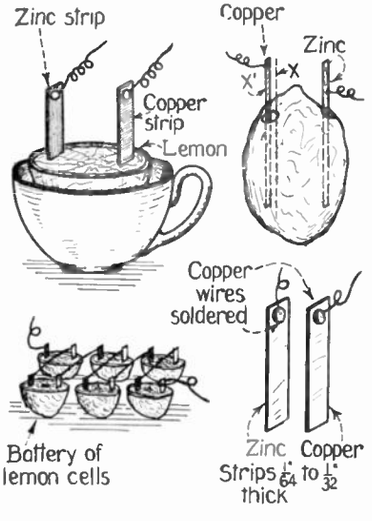
"SERMONS in stones, books in the running brooks, and good in everything," wrote Shakespeare a long time ago, and now we find that there is electricity in everything,



1. All about the electric relations of the favorite fruit termed the lemon, showing its positive and negative parts, electrically speaking.

or almost everything, for we learn that when a copper and a zinc rod are put into a lemon, potential difference is produced, and an electrical current may be caused to pass through an external circuit, which may include a telephone receiver, a milliammeter or a voltmeter. This current is produced due to the fact that we have set up a battery couple; copper—zinc—acid electrolyte, the juice in the lemon being mostly composed of water and a small amount of citric acid. Such a battery is useful for emergency tests where no other source of current is available, and when employed in connection with a telephone receiver or a sensitive low-reading volt meter, or else with a millivoltmeter or milliammeter, a very good testing set at once becomes available.

We give below more detailed data as well as an illustration of the lemon battery. Of course we can connect as many lemon cells in series or in parallel as desired; if a higher voltage is desired, the copper electrode of



2. How to make a battery out of a lemon, a piece of zinc, and piece of copper. Several very curious suggestions.

one cell is connected to the zinc electrode of the next, and so on through the series. The potential yielded by a lemon cell in favorable cases, has reached .5 to .7 volt. The amperage is naturally small but quite sufficient for testing circuits in connection with a suitable meter, as already mentioned, or else with a telephone receiver.

Potatoes Yield Electricity

Even the swarthy complexioned potato yields itself to the making of a freak battery. The writer has tested a number of lemons as batteries, and several other vegetables and fruits including potatoes, onions, bananas, grapes, etc.

Sometime ago, there appeared an article in the daily press with a beautiful photograph showing how a one volt lamp could be lighted from a potato battery, made by sticking a copper and zinc electrode into either end of a liberal sized potato, and then connecting two of these potato cells in series, as the accompanying diagram, Fig. 2, shows. Well, it may make some difference as to where the potatoes were grown; perhaps the gentleman who wrote the article referred to and who lighted the lamp so nicely, obtained some extra fine potato specimens grown in particularly well fertilized soil in some salubrious clime, but the writer was not able to light any lamps at all, and in a test on several

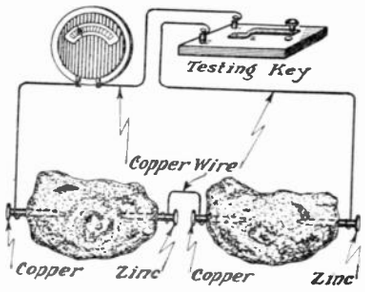
dozen potatoes, was not able to obtain a current greater than a few milliamperes, very careful tests being made with sensitive millivoltmeters and milliammeters.

For an ordinary emergency test and when only a potato is available, two pins, needles or nails, may be inserted into either end, but a piece of copper and a piece of zinc give the strongest current. A piece of carbon, such as that in a lead pencil, together with a piece of zinc for the second electrode. give a very good effect with less polarization and less consequent falling off of the current.

A Voltaic pile constructed from copper and zinc plates and a cup full of sliced potato, is shown at Fig. 4. This acts like a series battery and the more couples of copper and zinc we have, the greater the voltage. As many as five couples were tested in one battery in this fashion, the current being two to three milliamperes, or the same as that given by a single potato cell, while the voltage was equivalent to the number of cells in series multiplied by that of one cell. A single potato cell of the type shown in Fig. 3, i.e., with a zinc and copper plate or nail in either end, yielded three to four millivolts, and with the Voltaic pile arrangement, the potential was raised to five times this value.

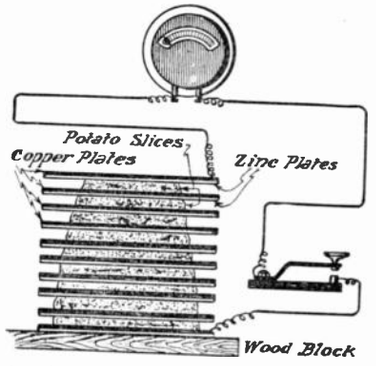
Onion Battery: Not Strong but Steady

Several tests were made on onions of different sizes and varieties and they yielded a current of a few milliamperes, with a potential of a few millivolts. The writer did not find anything particularly remarkable about the onion in spite of its great strength, odoriferously speaking, but Mr. Arthur E. Baines, a specialist in electro-physiology, in his very interesting book on the subject, entitled, "Studies in Electro-Physiology—Animal and Vegetable," states that he has



3. The potato battery, two couples in series, so as to double the voltage, only you won't get much current.

found the onion to be the basis for one of the most reliable cells for making a test, that one could want. Anyone interested in this subject of the electrical powers inherent in fruits and vegetables, should read this very interesting work by Mr. Baines. The experiments carried out by the present writer, and dwelt upon at length in this article, with respect to the potato and the lemon, are really of the nature of true battery experiments. Mr. Baines' work has been carried out with galvanometers and a pair of exploring electrodes formed of two steel sewing needles, in order to determine where the positive and negative charges in the various specimens lay. His theory, in general, considers the electrical action (when tests are made with the steel exploring needles connected to a sensitive galvanometer for inherent electrical charges in an onion or other specimen) as due to a natural or potential one; and furthermore that it is not due to polarization or other well-known effects, that the voltage falls off or drops as the test continues, as with the lemon cell, but that this is due to a temporary lowering or dissipation of the natural charge in the lemon, the same as when you discharge a Leyden jar. A diagram showing the positive and negative regions of an onion, as located by Mr. Baines, is shown in Fig. 5. "This is an unusually difficult vegetable to test, in that while the

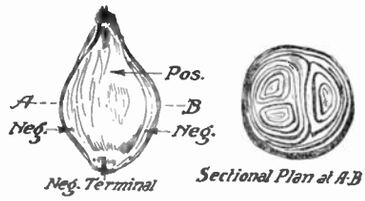


4. A voltaic pile built up of copper and zinc plates and slices of potato. This will give quite a reasonable voltage.

bulb appears to form a complex cell, the intermediate contact spaces are so narrow and the liability to diffusion so great, when the onion is divided, that I am unable to speak with certainty," says Mr. Baines. "Botanists, however, will readily solve the problem, which, from an electrical standpoint, is to differentiate the layers connected with the root from those in alignment with the tubular leaves. The former will be negative and the latter positive."

Fig. 4 depicts the structure of the onion as it is presented to the unaided eye and as Mr. Baines determined it galvanometrically. The negative system seems to extend from the root to the outer second and third layers of the bulb, between which and the central positive system there exists a membranous and probably protective lining. The contacts afforded by the poles are well defined, the absolute insulation is extraordinarily high, and altogether the onion is a vegetable cell of a very perfect description. Its electromotive force is, approximately, 0.086 volt; the current varying, of course, with the size. Such a cell is invaluable in the testing-room for such work as taking the constant of a sensitive galvanometer or comparing deflections from living muscle or tissue, instead of using for the purpose a standard cell liable to polarization when employed without very high resistance in circuit.

The author of this work on electrical charges in fruits and vegetables discovered some very remarkable effects; for instance, how the charges frequently reversed their polarity, in some cases, after the vegetable cells had been subjected to a small electromotive force. Mr. Baines states several times, after citing a number of tests to prove his point, that it appears, from the weight of the evidence, that the vegetable cells lose their electrical activity during the test, because of the loss in electrical capacity, and not because of the polarization of the electrodes. Of all the vegetables, says this expert, the onion has the highest and best absolute insulation, while among fruits, the apple, the pear and the quince are in the premier class. He short-circuited onion cells through one-tenth ohm resistance for many days at a time without finding in them any evidence of polarization or discharge, and as the voltage of them all is the same, the current varying only in accordance with Ohm's Law, the onion therefore represents an ideal standard cell of low electro-motive force for delicate galvanometer measurements. The apple and pear, offering as they do, smaller contacts and more liability to diffusion at the points of contact, are not to be so generally recommended, although with care they are reliable. Mr. Baines has observed in regard



A view of an onion or garlic bulb, to illustrate Mr. Secor's very interesting investigations on the potential of fruits, stems and vegetable products.

to plants, shrubs, and trees, however, that during such time as they are resting, as in the late autumn, winter, and early spring months, both the electro-motive force and current fall off, and this may be due to a deficiency in the quantity or flow of the sap, or both.

Details of the Lemon Battery

Further details are given below with regard to the lemon battery cell. With two electrodes, one zinc and one copper, each 2¾ by ¼ by 1/32 inch, an E. M. F. (voltage) of 7/10 volt was obtained. The current was a fraction of an ampere, but gave good strong signals in a telephone receiver, sufficient for any testing work. The zinc plate acts as the positive electrode in the cell (—terminal) and the copper as the negative electrode (+ terminal). When the external circuit is open no action ensues; when closed, citrate of zinc is formed at the zinc (+) electrode owing to the action of the citric acid. As the electrolyte is weak (about 5% citric acid, 95% water), no very powerful battery action takes place. Also the large amount of water, H_2O, present, causes pronounced polarization, the hydrogen gas bubbles soon covering the copper (—) electrode, preventing further action if the cell is fairly well loaded. Unless therefore, some highly-oxidized substance is added to the electrolyte to supply oxygen, which combines with the hydrogen, forming water, the citric acid will become weakened by its action on the zinc, and the zinc will be consumed in time. The copper electrode is not attacked, except when some impurity exists in the electrolyte; citrate of copper was formed in minute quantities in one of the tests.

It is interesting to note that in a chemical test on 8,000 healthy lemons, there was produced 600 liters of juice, which tested from 4.5 to 6% citric acid (the balance mostly water). For rough testing the lemon may be cut in half as shown at A. Best results were obtained by simply cutting two ¼-inch holes at the top (see B), about 1-inch apart, the zinc and copper electrodes (well scraped) being inserted the full depth of the lemon in these holes. To reduce the internal resistance and to mitigate the loss due to the cellular suspension of the electrolyte, the two electrodes were placed about ¼-inch apart with somwhat improved results.

If the potential falls considerably, due to polarization, it was found that it can be temporarily restored by moving the copper plate up and down, or by removing it and wiping off the hydrogen gas film.

A vinegar cell with zinc and copper electrodes is often used for test work. Here the zinc is converted into acetate of zinc and the copper (if attacked) into acetate of copper, as the solution is dilute acetic acid (with considerable water). A higher voltage and less polarization can be had by substituting a lead pencil for the copper. The softer the lead, the smaller the polarization. The amperage with pencil lead (due to the smaller area), is somewhat smaller than if copper is used.

Phone by Fence Wire

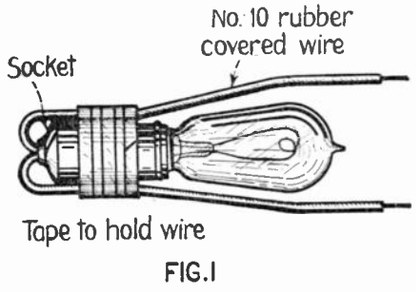
Barbed-wire fence telephones are being installed in two communities in South Dakota that have never had a telephone.

Corson County, eighty-seven miles long and sparsely settled, had little telephone service until the fence lines were pressed into service. Today most of its farmers are connected up.

Worn-out inner tubes have been utilized for insulation. The cost for each farm home for instruments and line averages about $20.

The community thus is able quickly to get in touch with the county agent in case of an outbreak of insect pests, such as army worms or grasshoppers.

Handy Circuit Tester



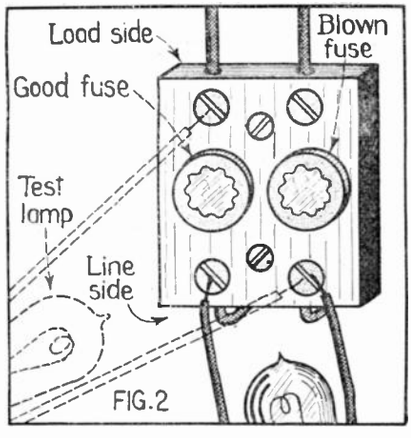
How to arrange an incandescent lamp for a circuit tester. The use of rubber covered wire held in place by tape, makes an exceedingly simple and compact apparatus.

ONE day when a short in a flat-iron cord blew the fuse, necessitating the removal of both fuses to determine which one was blown, the thought occurred to me how valuable would be some sort of a handy tester for such emergencies. After studying the problem for a while, I made the tester shown in Figure 1.

It is very easily made from an old keyless socket with two pieces of Number 10 rubber covered wire connected to it. Bend the wires down the sides of the socket and tape them securely to it. Put a ten-watt lamp in the socket and the tester is ready for business.

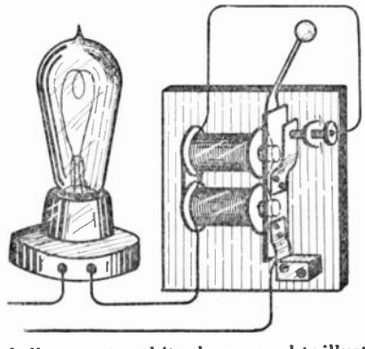
To use the tester grasp it by the taped part and place one of the wires on each side of the line, as shown in Figure 2 (full lines). Test first on the load side and then on the line side of the cutout. If there is juice on the line side, test diagonally across, one wire on the line side and one on the load side and vice versa. See Figure 2 (dotted lines). When the lamp does not light, the fuse being tested across is blown. The fuse being tested in Figure 2 is marked "Good Fuse".

Contributed by F. T. Jones.



Testing out some fuses, with the lamp tester described in the article. A good example of the work of the household electrical engineer.

An Experiment in Synchronism



A bell magnet and its clapper used to illustrate synchronism by being made to operate at the frequency of a commercial alternating current.

AN interesting experiment to show the alternations of the alternating current may be performed by connecting an ordinary door bell, with the gong removed, and a 40 or 50 watt lamp in series with the house current. At first a great deal of sparking will be observed at the contact points on the bell, but as the vibrations of the hammer on the bell gradually assume the frequency of the current, the sparking decreases and finally ceases entirely. The coarse rattling sound changes to a hum and the lamp flickers. Lamps of several different wattages may have to be tried and a slight tapping may be needed to get the right frequency.

Contributed by Gilbert S. Lowry.

Measuring High Altitude Air Currents

By Ph. Schereschewsky, Government Meteorologist

MODERN developments, especially in war, make it necessary to obtain the speed and direction of the wind at very high altitudes. Balloons have been used for this. They may be about 3 feet in diameter, and their movements were followed by theodolite, sighting angles being taken at regular intervals.

This, of course, could not be done except when the sky was clear. Even in good weather, the balloon was liable to enter a cloud, when of course, it would be lost to sight. The high elevation of modern artillery practice, and scientific investigations in peace time, are what require this sounding of the air, as it is called.

So anemometers and helical tachyometers are sent up on captive balloons or kites; sometimes good results are obtained by using clouds of smoke produced by exploding shells discharged by clockwork of time fuses at great elevations.

The latter methods have had extensive application, but here we shall describe a more general process of sound determination, which was employed on the French front regularly during the war, to the exclusion of all other methods when the sky was obscured. The principle of this method is as follows:

A balloon is sent up carrying a number of explosive shells. These shells explode at regular intervals, thus giving the trajectory of the balloon. Registering microphones are placed upon the ground and indicate the instant when the noise of each explosion reaches them. Knowing these periods and the position of the microphones, by descriptive geometry or trigonometry the position of the balloon at each explosion is determined. The trajectory of the balloon is then found by points, exactly as in the ordinary method, with theodolite. It might be said that optical vision has been replaced by sound vision.

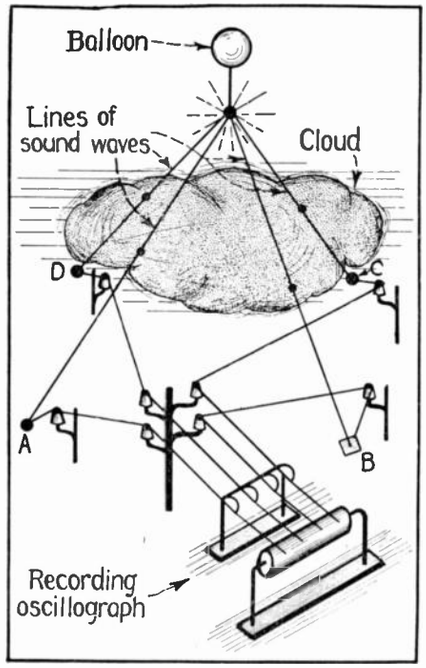


Diagram of the electrial connections of microphone and oscillograph for determining the positions of the balloon high in the air even though it is hidden by cloud or fog.

In certain respects this method is more accurate than that of following by a single theodolite, because the geometric construction gives all co-ordinates of the point of explosion in space, especially the height, and makes no use of any hypothetical speed of ascension of the balloon. It would otherwise be entirely out of the question to attribute to the balloon a constant speed of ascension, for this may be retarded by the deposition of moisture on the balloon in its passage through the cloud regions, and then may be increased again when it ascends into regions where the sun shines brightly. This method is superior, then, to all others, because it is completely independent of weather; as the balloons are not captive, they will go to far greater heights than tethered balloons, or kites could attain, and they can be used in the most tempestuous times. Captive balloons are sometimes sent up in tandem, and it is on record that heights of over 15,000 feet with wind of a velocity of over 100 miles per hour have been reached. It is true that kites have been used successfully in very high wind, but altitudes in excess of 30,000 feet have never been attained by these methods.

In the process we describe, balloons are sent off one after the other at very short intervals, about a minute apart, each carrying a single shell. It is assumed that the trajectories of these balloons will coincide exactly, and that all goes on as if a single balloon were used. The result of experience shows that the points of explosion of the different shells are distributed on a very regular curve. The ascensional force of each balloon is about 1¼ pounds, so to make the speed of ascension great enough, only a small shell is sent up with

Continued on Page 230.

$50.00 Prize Contest

WHEN the Editor gets up the usual monthly title for the magazine cover he does not, as a rule, find it difficult to locate one in short order. This month, however, when he conceived the idea of the cover, he completely forgot about the title, and when it came to naming the picture, the Editor for once was badly "stumped". Perhaps there was something wrong with his thinking machinery. At any rate, the title would not name itself, and what is more, after spending a bad night, the prospects of hitting upon a good title seemed exceedingly remote.

The Editor then thought it best to wash his hands of the affair, and put it up to our readers; and it was certainly worth $50.00 to retire from the job gracefully and "let George do it!"

The picture is, of course, self-explanatory; Jimmy, the young genius, has "swiped" the telephone receiver from the telephone and has appropriated it for his own ulterior motives and purposes, the uppermost idea in his young head being that Science must be served. With this, he is performing the ancient experiment of connecting the telephone receiver in series with the battery and two sticks of arc light carbons, across which another piece of carbon rests lightly; placed upon the box, the combination becomes a fine microphone, as we all know, and a watch put upon the box will tick loudly.

In our picture, we also see Pa and Ma very much vexed at the disappearance of the receiver, and the young rascal's substitution of and old horse shoe——which may be lucky at times, but certainly is not lucky for Jimmy, if we read Father's face rightly.

Now that we have told you all about the cover, it is "up to you" to furnish the title. In other words, we have written the words, and we want you to set them to music.

Prizes

First Prize	$25.00
Second Prize	$15.00
Third Prize	$ 5.00
Fourth Prize	$ 3.00
Fifth Prize	$ 2.00
Total	$50.00

A good title should not have more than six words, and must be descriptive. It goes without saying that the title must explain the picture in short and crisp terms. Remember, six words is the limit. Note that everybody can participate in this contest, and you may submit as many titles as your ingenuity permits. Only typewritten or penned manuscript can be entered in this contest; penciled matter cannot be considered.

If two contestants should send in the same title, in that case, both will receive the same prize. This contest will close on May 30th, 1922, at twelve o'clock, noon, by which time all manuscripts must have been received. Address all manuscripts to Editor Title Contest, care of this publication.

DUE to printing difficulties, it has be come necessary to combine two issues into one with the present issue. This issue, therefore, is the March-April number. The next number published will be the May issue.

In order that subscribers will receive twelve copies of their publication for which they have paid, all subscriptions on record have been lengthened by one month, which we trust will be satisfactory to all our readers.

THE PUBLISHERS.

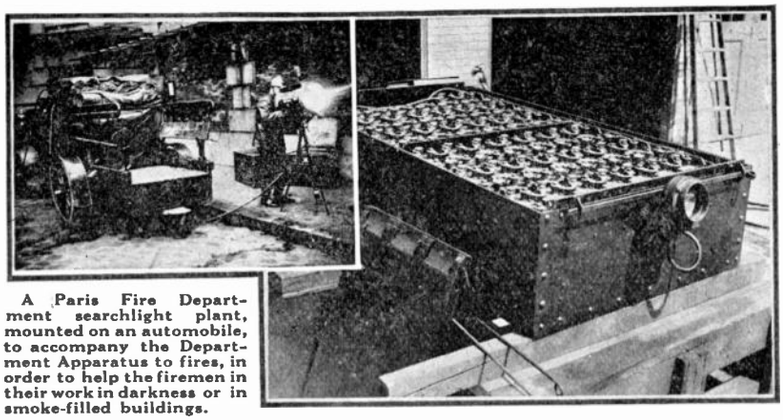
Testing Transformer For Water

WATER is the bugaboo of transformer oils, and can only be driven off by heating the oil to about 150 degrees over the boiling point of water. In this process, care should be taken not to heat the oil to a very high temperature, as flashing and a fire may occur.

To test for water in transformer oil, heat a few crystals of copper sulphate in a test tube until they become white and fall into a powder. If the slightest amount of moisture comes into contact with this white powder, or dehydrated copper sulphate, it will turn blue by taking up water of crystalization. Therefore, if the powder is mixed and shaken with the oil under test, the powder will assume its former blue color if water is present.

Contributed by R. B. Wailes.

Paris Fire Department Searchlight.



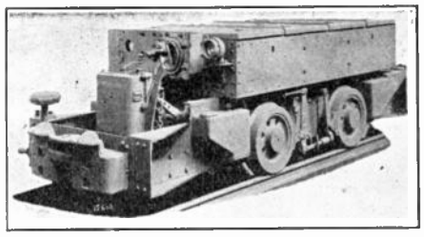
A Paris Fire Department searchlight plant, mounted on an automobile, to accompany the Department Apparatus to fires, in order to help the firemen in their work in darkness or in smoke-filled buildings.

The Fire Department of Paris has just added to its equipment a new apparatus comprising a strong portable electric searchlight which is so powerful that its rays will penetrate the thickest smoke clouds and thus enable the fire laddies at night to see how to go about their work no matter how bad the smoke conditions may be. It is also useful in lighting dark cellars and warehouses; this picture shows a fireman operating the light. To the left is the electric generator which furnishes the power to operate it.

In old times, fires were very frequent in New York because of the poor construction of the older buildings. The boast of Paris then was that they had very few fires, due to the type of construction of the buildings. The comparatively restricted use of wood, and the employment of plaster of Paris in partitions and the like, was supposed to conduce to comparative proof against fire.

But notwithstanding all this, there are fires in Paris. The positive statement that a plain searchlight will penetrate smoke is more or less to be doubted. It is almost surprising that nothing is said about the use of a colored glass to impart smoke penetrating quality to the beam of light.

Storage-Battery Locomotives in Gaseous Mines.



Above—View of mine locomotive driven by storage battery and approved as being safe in the presence of fire damp.

Left—Edison storage battery for actuating a mine locomotive, of type approved by the Government as being safe in gaseous mines.

THE first storage-battery locomotive for operation in gaseous sections of coal mines was recently approved by the United States Bureau of Mines, permit being issued to the George D. Whitcomb Company of Rochelle, Ill. The equipment consists of a six-ton locomotive, provided with a battery of either 80-G-14 Edison cells or 48-L-149-29 plate Gould cells. These are lead plate sulphuric acid batteries. Caustic potash is the electrolyte used in the Edison nickel-iron oxide battery. The coal-mine locomotive, as designed, rigidly conforms to a well-defined permissible schedule issued by the Government wherein safety precautions have been established.

The introduction of the storage-battery locomotive in the fire-evolving gas regions of the coal mines, is supposed to lessen the hazards incident to the prevailing system of locomotion, namely, the dangers of electric shock from contact with bare trolley wires. Wide-spread use of the storage-battery outfit would bring about the abandonment of the practice of extending trolley lines into sections of the mines where gas may be expected to be present. The exposed wiring with its attendant possibilities of arcing and exploding the gas and air mixture in the mines would be restricted to main haulage roads.

The storage-battery locomotive commonly operated may constitute a menace to safety where gases are present. The use of storage batteries has been considered and discussed in several conferences between Government officials, manufacturers of locomotives, and storage batteries for locomotives, and investigations covering a period of five years, have been conducted, looking to the modification of storage-battery locomotives in the interest of safety.

Specifications governing the issuance of permits for the operation of this type of locomotive in gaseous sections of mines include such obligations as the following: Battery inclosures are to be made of wood reinforced with steel or of steel with a lined cover of adequate quality, insulation, and dimensions; unless battery cells are insulated from containers, the latter shall be insulated from the battery box with porcelain or its equivalent; circuits are to leave the battery enclosed in a metal conduit; automatic circuit-breaking devices must be enclosed in permissible compartments, so designed that the fuses may be renewed

(*Continued on page 236*)

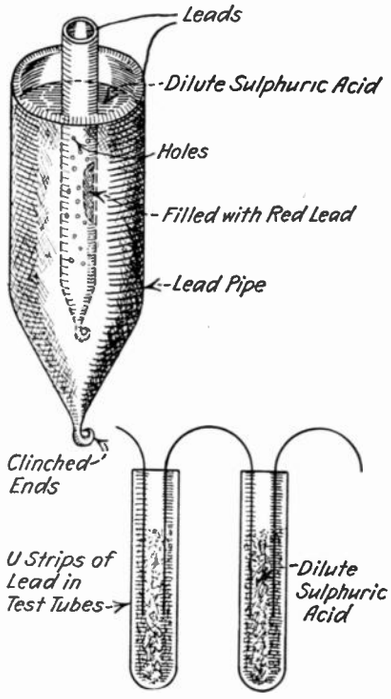
Miniature Storage Batteries

The illustration shows a very simple construction for a high potential storage battery, high potential in the sense, that each cell is so small that a large number can be contained in a small space. Even at that the resistance will be reasonably low. It will be safe to figure, on approximately standard potential or over two volts potential for each cell. While designed primarily for radio work, it contains a very good suggestion for the electric experimenter in general.

In one construction, two pieces of lead pipe are employed for each cell; the lower end of each is hammered practically shut, a drop of battery composition or sealing wax being used to complete the closing if necessary. Still better practice is to solder them autogenously.

The inner tube is punched full of holes and is packed with red lead, and dilute sulphuric acid of the regular battery strength is placed in the outer tube. The battery has to be formed by the regular charging and discharging process, and will be found a very interesting addition to the electrical laboratory.

The drawing does not show how the tubes are kept from touching each other, but this is simply effected by using a perforated cork, through which the smaller tube is thrust. The cork can fit the mouth of the large tube, which mouth can be spread a little by hammering so as to receive the cork more easily. The other cut shows the elements for a high potential battery contained in two test tubes, or better yet, specimen tubes,



Two constructions of small storage battery, which even for those not addicted to radio work, will be useful in the laboratory for experimental purposes.

as they are thicker. This last named battery must be formed without pasting, by the regular system used for unpasted plates.

An interesting thing to be observed is that these two miniature batteries exhibit on a small scale the two typical constructions of lead plate battery. The upper one is the pasted cell, and the lower one the unpasted cell.

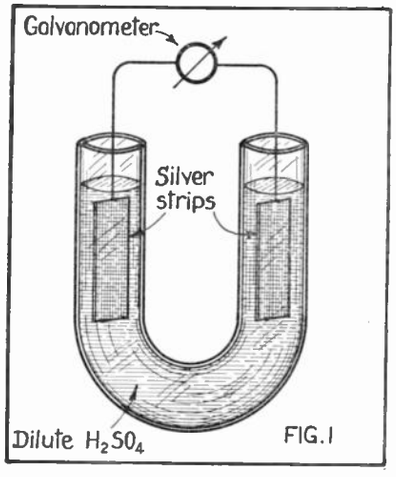
When the storage battery was first invented the idea of applying the coating of lead oxide, to the positive plate—as it is called—was accepted as a great improvement. Yet a good deal is to be said in favor of the solid lead plate with no thick composition to fall off from it and short-circuit the plates at the bottom of the cells.

It is further to be noted that in the lower battery, slips of fibre punched full of holes, or slips of wood also perforated, should be inserted between the plates, for if the two touch each other, the battery will be discharged and ruined. We cannot imagine a nicer way of practicing on storage batteries, especially on their construction, than along the lines here indicated. One thing is to be remembered, that if test tubes are used, they will be very apt to break. Specimen tubes are made of comparatively heavy glass and will be reasonably safe from breakage.

Experimental Electrics

Construction Of Photo-Electric Cells.

By Raymond B. Wailes.



A photo-electric cell, not using selenium, yet affected by light. A very satisfactory appliance for experimental work, as it is easily constructed out of everyday meterials, without the use of any rare element.

SELENIUM, the wonder element, is not the only substance which varies its resistance with light intensities. There are many substances and combinations which give an electric current upon insolation, or exposure to light, without the use of external batteries. Several types of these cells will be described here.

Borgmann's Photo-electric cell is shown in Figure 1. It consists of a U tube containing dilute sulphuric acid and thin sheet silver electrodes, the silver electrodes being coated with silver iodide. This is accomplished by cleaning the silver plates and after slightly heating, exposing them to the vapors of iodine formed by heating iodine crystals in a test tube. The iodine combines with the silver and forms silver iodide.

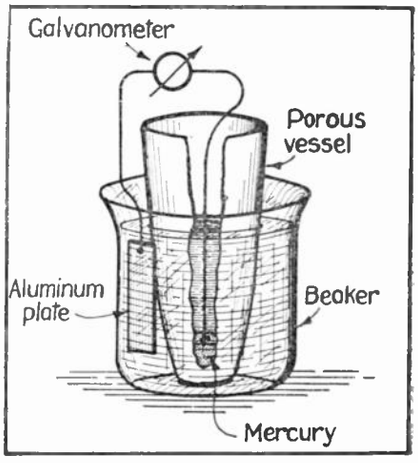
In using this type of cell, both arms of the U tube should be covered with a movable cap of black paper. On removing one of the caps and allowing one of the electrodes to become exposed to the light, an e. m. f. is generated, as shown by a suitable indicating instrument connected to the electrodes.

Our Figure 2 shows Saur's photo-electric cell. Here one electrode is always kept dark. This is accomplished by using a porous pot such as a sand crucible containing mercury at the bottom and a platinum wire dipping into it and connected with the indicating instrument. The porous pot or crucible is placed in a beaker or battery jar containing the following solution:

Water	100 parts
Sodium chloride (salt)	15 parts
Copper sulphate	7 parts

The beaker containing the above solution also contains a silver plate electrode coated with silver sulphide. This coating of silver sulphide is made by moistening a clean and bright sheet of silver and exposing the sheet to the action of hydrogen sulphide gas, formed by the action of sulphuric acid on ferrous sulphide. The coating is black. This silver sulphide coated electrode is also connected to the indicating instrument as shown.

On allowing light to fall upon the silver sulphide electrode, the copper chloride formed when the solution is mixed, forms a lower copper chloride (cuprous) because of the presence of the mercury, and the coating of silver sulphide reduces to metallic silver in the presence of light, and at the same time develops potential and produces an electric current. Recovery is also brought about by removing the light.



Another similar photo-electric cell, in which one of the electrodes is kept in darkness. Both of these cells are to be recommended to investigators who are studying photo-electric phenomena of resistance.

Other simple photo-electric cells can be made by using a sodium chloride solution as an electrolyte and an amalgamated zinc and a silver sulphide coated strip (made as above) as the two electrodes.

Increasing the Light of Incandescent Lamps

TO increase the candle power of electric lamps which have been dimmed from a too prolonged or severe, service put the dim lamp in circuit on an A. C. line. A lamp having a filament such as shown in the sketch, can be made to vibrate to such an extent by placing a large horse-shoe magnet near the bulb; that part of the loop can be cut out, thus reducing the resistance, but increasing the candle power, with but a slight increase in current consumption. The lamps furnished by electric companies are often 115 volts while the line voltage is usually 110 volts, so cutting out part of one loop brings it down to 110 volts.

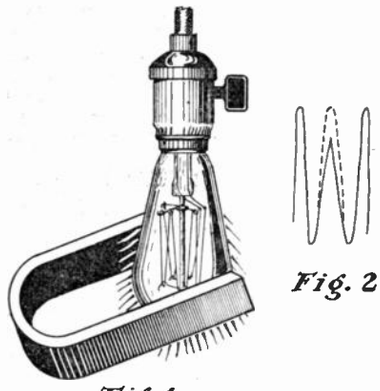


Fig. 1

Fig. 2

A method of permanently short-circuiting the filaments of an incandescent lamps, by welding some loops of the filament so as to reduce its resistance and increase the light which it gives.

Do not hold the magnet near the lamp too long, because if too many loops are cut out, the lamp will burn out.

Contributed by Ernest Roesch.

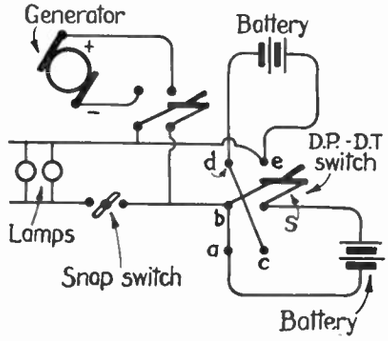
Connection For Two Storage Batteries

THE accompanying illustration shows a simple method for connecting two storage batteries either in "series" or "parallel", without making any changes in the wiring.

This is a convenient arrangement, where it is desired to have two intensities of light on a low voltage lamp; or, if it is desired to charge the batteries in series and discharge them in parallel.

A double pole, double throw knife-switch is necessary, and care must be taken in wiring to avoid having lines of opposite polarity joined together. Unless proper watch is kept on making the connections, this is likely to happen.

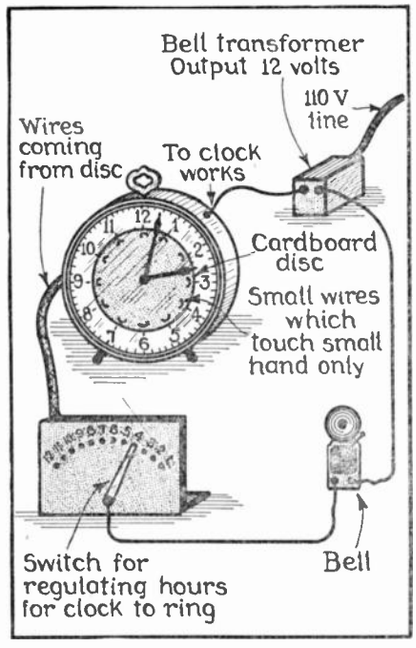
Referring to the illustration, a and c are connection points for the double pole switch. The point c is connected by a jumper to the upper point, d, and a and b are also connected by a jumper. When the switch is swung down, so that the knife bars enter the clips at a and c, a series connection is established. When the switch is swung upwards so as to enter the clips at d and e, a parallel connection is established. In all other respects the illustration is self-explanatory.



An ingenious connection for two storage batteries, so that they can be put in parallel or in series by throwing a single switch.

Contributed by Charles C. Setter

Electric Alarm Bell



The general layout of an alarm clock, which is operated from the lighting service line, the voltage being stepped down by a small transformer. A special switch is used to regulate the hour at which the ringing shall occur.

TO make this bell, take some bell wire, any kind of a bell, a cardboard disc, a transformer, and an alarm clock.

Cut the cardboard disc according to the size of the dial of the clock, enough smaller to avoid covering the numbers. At each hour number drill a hole for a wire to pass through, being careful not to make the hole too large for the wire. Now take twelve insulated wires each about 18 inches long, or perhaps longer. Scrape one end of each wire and pass it through a hole in the disc. Bend them into a hilly form as illustrated, so the small hand only can touch them.

Number each wire so that you can tell to which hour it belongs. A hole about ½ inch in diameter should be drilled between the ninth hour and the center, so that the wires from the disc may pass through without touching the clock works. Care should be taken that none of these wires make contact with the clock works in any way. The wires are passed down to the regulator, which can be made of some round-headed brass tacks, a copper rotating strip, and a piece of heavy cardboard. These wires must, of course, be placed in proper succession, from one to twelve o'clock.

If it is desired that the alarm-bell ring say at six o'clock in the morning, the copper strip is turned to the number 6 and the bell will ring. Now, take one wire and lead it from the copper strip to the bell. Then one wire from the transformer is led to the clock works, where the handle touches the wires and makes contact; the other wire is led to the bell, on which a switch can be put in order to stop the ringing. If the small hand of the clock is broad, it will ring for fully a half-hour.

Contributed by George J. Papulias.

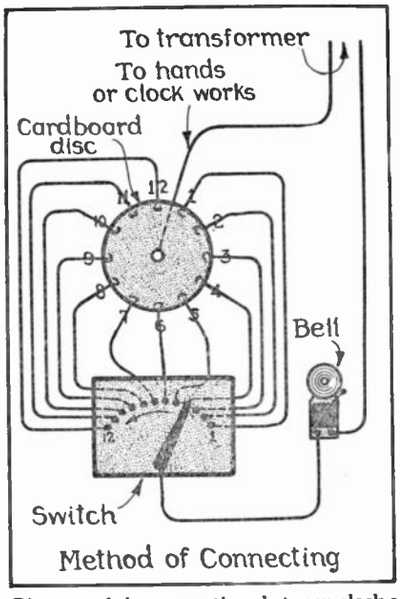


Diagram of the connections between clock and switchboard, so that the alarm can be given at any desired hour.

Circuit Breaker for Experimenters

TO avoid the expense of replacing fuses, which an experimenter burns out so frequently, the simple circuit breaker described below is recommended.

First, a solenoid, A, measuring 1¼ inches by 1¾ inches external dimensions from fibre end to fiber end, with a core opening and plunger, and having a protruding steel butt, B, measuring ½ inch x ½ inch, is wound full with 16 gauge D. C. C. or asbestos D. C. magnet wire, leaving connecting wires about 6 inches long. The hole in the center should be 5/16 inch in diameter, so that the plunger C, measuring 2¼ inches x ¼ inch, will move freely up and down.

The make-and-break is an ordinary single pole switch, H, and to connect the plunger, C, to the blade D, the lower end of the plunger is filed or forged flat for a space of ½ inch, then a small hole is drilled in the center of the flat part and another hole in the switch blade, D, about ½ inch from switch point. Fasten the two together with a small nut and bolt or rivet, putting a washer between plunger and blade, and one on the side of each (L).

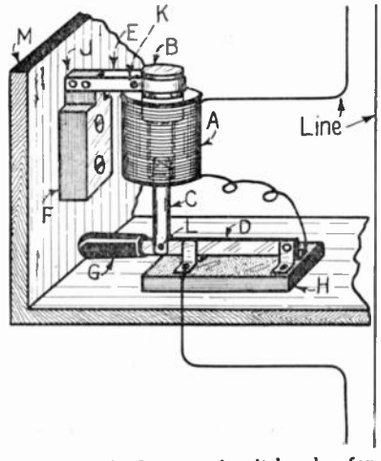
To fasten the solenoid above the blade and so that it will work freely with the opening and closing of the switch, two pieces of metal strip will be required (F and E).

One piece is bent around the steel butt, B, and the ends should protrude out far enough to clear the solenoid. Drill four holes into this strip, two near the solenoid at K and two so that the supporting strip F may be fastened at J. The strip F is 2½ inches long; at each end drill a small hole. One end of the strip is to be used as explained above; the other is bent so that the strip may be fastened to the box M by a wood block and screw.

With the working parts complete, you can now make a cover or box for the breaker, which may be of wood lined with insulating material. The bottom should be a little longer than the switch and a little wider than the solenoid. The sides and top should be made to correspond with the bottom. Be sure to leave a slot in the side, along which the handle will move.

With the circuit breaker complete, just hook it to the line, shorten your wires with the breaker in circuit, and you will have no more fuses to replace.

Contributed by Thomas Ensall.



A simple and adequate circuit breaker for experimenters. The idea is that as laboratory workers are liable to put a somewhat heavy draft on the circuit, there is always danger of their burning out a fuse.

Electric Weeder

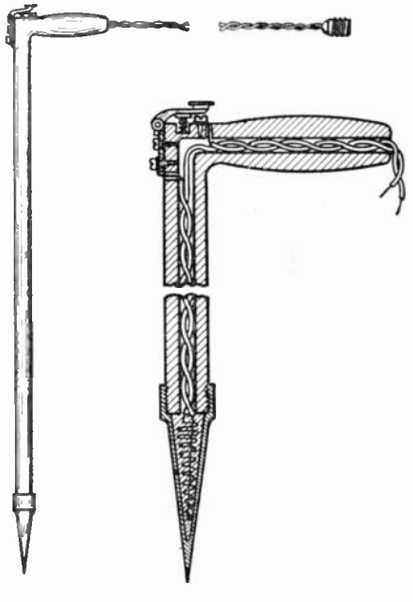
SOME months ago we published an account of the effect of electrical excitation on earthworms, as carried out by a very young electrician of the State of Washington.

The illustration which we now present shows a recent invention, but this time for the destruction of weeds, also by electricity.

A cane with a switch or cut-off on the handle is provided, which is to be connected at the handle end to an electric line. The wiring of the cane, which consists of two leads, goes through the center of the cane to the bottom, where it is connected to a heating coil in a sharp, cone-shaped metallic end. The idea is that when the switch is pressed down by the finger, current will pass and heat this conical point. The point is to be poked in amongst the weeds, down among their roots, and the strong heat will destroy and eradicate them.

It would be considerable labor to go over a large area of ground by this method; but for flower bed culture, the electric weeder might save many a weary back, as it is to be used without stooping.

One advantage of this implement is that it obviates leaning over. Many of us have sad memories of weeding in the garden, but here both the stooping and soiling of hands are avoided, and certain death awaits the vegetable intruders. The point can be inserted cold or hot as desired, on account of the convenient position of the switch on the handle.



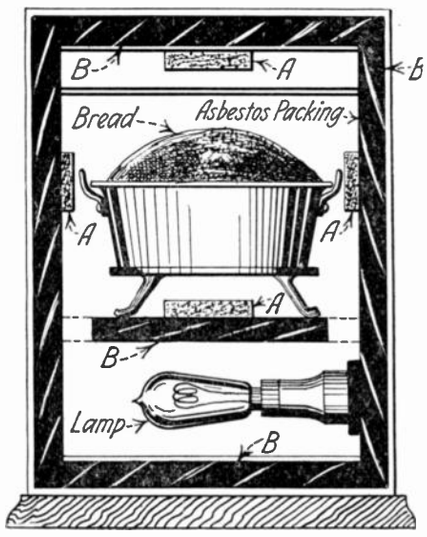
An electrically heated cane for destroying weeds. All that is necessary is to connect it to a circuit which will heat the end, and this is poked among the weeds, effectually killing them.

Tom Reed Withdraws the Bread-Raiser

HERE is something for the "Household Wrinkle" contest—an electric bread raiser. It might be called a "safety raiser" because it aims to afford such accuracy in the matter of temperature that the most timid and apprehensive batch of bread can go to sleep in it, with the assurance that it will awake arisen the following morning.

The device speaks for itself,—simply an enclosed cabinet, packed with heat-insulating material and provided with thermostats and an incandescent lamp. The thermostats having been set for the temperature conducive to the yeast crop, and the dough enclosed in the cabinet, the batch will be maintained at the correct warmth as long as desired, and what they call in the stock market a "substantial rise" may be expected with confidence. If the machine *could* be adapted to produce the same effect on stocks, I have no doubt it would fill a long felt want and be a ready seller on State and Wall Streets. As the present contest is strictly for household appliances, however, I omit, by advice of counsel and for other reasons, any ideas I may have concerning its use in finance, and merely observe that no really happy home in the future will be without it.

But wait! a fatal objection occurs to me. Does anyone make bread in the home in these days? Bread raising used to be mother's pride and the test of the young girl's fitness for matrimony. The inference was that if she could raise bread, she could raise anything, including a family; which was about the right dope, since bread in the rising stage, as I remember it, has about all the different kinds of cussedness inherent in a large family, and then some. Many a time on bread-raising evenings in zero weather, I have seen Mother wrap the bread up and give it a place over the only "register" in the house that was working, while we children could go to bed or go to....well, any old place that promised warming facilities. But now, I understand the Mother of the family doesn't raise bread any more. Father raises the money to buy it, Johnny raises the dust going to the bakery after it, and Mother raises Cain if he doesn't get back with it in time for supper. In this way the bread is raised, but I sadly admit that the process doesn't require my arrangement of padded cells and thermostats or any other **restraining** influence. The more pep those concerned put into the raising, the better.



The above suggestion of an oven with insulating walls, B, and ingeniously distributed thermostats A, comes from a very eminent personage. We firmly believe the idea is a good one, but the author seems to think the device is a very weak reed to lean on.

Heck, I think I will withdraw my Bread Raiser from the contest before it gets thrown down. Come, Raiser, come home with papa. We are too many flights up, here, the window is open, and the surface of Fulton Street looks hard.

Contributed By Thomas Reed

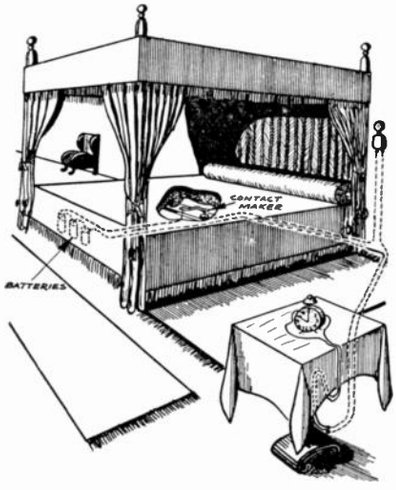
Early Rising Alarm

WE believe that in this contribution quite an original idea is embodied. It is an apparatus for ringing an alarm bell in the morning, which alarm will persist in ringing until the unhappy person gets up.

The apparatus includes as part of its connection, a spring mattress, which, as we know, are now in universal use. The familiar clock and bell circuit is there, and the clock is arranged to close the circuit at any desired hour. All this is simple enough.

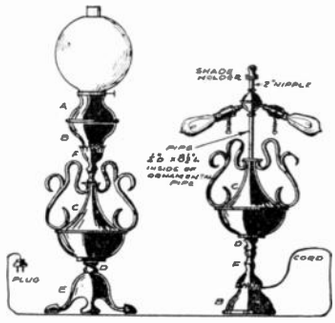
But now comes the distinguishing feature of this ingenious invention. Resting on a spring mattress depresses the springs. A connection is so arranged that when the springs are forced down by the weight of the sleeper, the circuit is closed. This is all shown in the illustration. Then when the clock reaches the fatal hour, the alarm bell rings and will continue to do so as long as the circuit is closed and the batteries do not run down. The only way to open the circuit is for the occupant of the bed to jump out; then the bed-springs rise, the circuit is opened, and the bell ceases ringing. The late occupant of the bed is now guaranteed to be fully awake.

Contributed by Fred B. Tickner.



It is believed that this arrangement of a circuit which will not cease ringing until the occupant of the bed, by relieving it of his weight opens the circuit, will meet with general approval as solving the getting-up question.

Converting Kerosene Lamp to Electricity



The demolishing of a rather top-heavy, old-fashioned kerosene lamp and removing the oil font to make a more modern appearing structure, in which the kerosene burner is replaced by electric lamps.

AN ordinary table lamp for burning kerosene oil can be taken to pieces and very easily rebuilt so as to produce an electric table lamp.

On the left of the illustration is shown the original lamp with the oil font in place. The first step is to take off the top part marked A, and the lower part E, as neither of these is used in the electric lamp. The part B which comes off is to be used at the bottom as the stand, in place of the part E which has been discarded. A ¼-inch hole is drilled through its center for the electric cord to pass through.

The illustration shows clearly what is done with a lamp of this specific construction. Of course, the method will vary slightly for other lamps. F and D screw down upon the part B, and a tube of ¼ inch internal diameter and 8-½ inches long, is tapped into D. Over the tube the part C is passed and secured to D. The upper end of the tube will project about an inch above the top of C. The upper end of this tube is threaded, a washer is dropped over it, and a nut screwed down on the washer, binding everything firmly together. In many lamps, this washer will be found in the bottom section, and will come away when the lamp is taken apart. The wires from the two electric lamps shown are carried down through the tube, and the lamp socket is screwed to the tube.

The lamp is now about completed, with the exception of the shade. Three small chains, about 5 inches long, are connected to the hooks on the shade, and the ends are connected to a washer with three small holes corresponding, or a triangular piece of brass may be used. After the chains are fitted to this, place the washer over the 3/16 inch by 2 inch screw, and fit the cap over this tightly, so that the shade will not swing or rattle. Connect the ends of the wires to a plug terminal, and the electric lamp is complete, ready for use.

This class of kerosene lamp, in all its representatives, follows about the same line of construction. So there will be no difficulty whatever in carrying out the directions given by the author, who submits a photograph of the result of his work.

It will be seen that the removal of the oil font takes away the top-heavy appearance common to so many oil lamps. The importance of having the oil near the burner brought about the position of the font near the top as necessary practice. But the electric installation not only improves the appearance of the lamp, but makes it less liable to upset, and diminishes its weight so that it can be shifted about as desired

Contributed by Frank B. Pawlowski

The finished lamp, taken from an actual photograph, bringing out its improved proportions and up-to-date appearance.

Uses for the Electric Bell and Buzzer

By Victor Carl

WE are sure that the simple application of the common electric bell and buzzer will interest our readers, even those of more

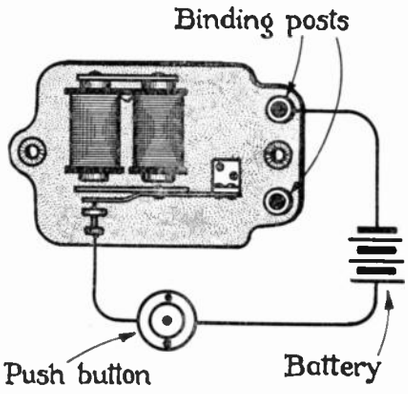


FIG. 1

The regular buzzer connection with push-button is modified to give a single alarm or single tap for each pressure of the button.

mature years, though the simplicity of the suggestions certainly commends them to our younger readers as well.

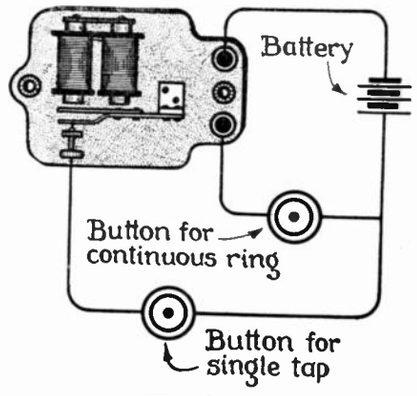


FIG. 2

A double push-button connection, one for a single alarm or a single tap, as shown in Figure 1, and the other for the ordinary continuous ring or buzz.

The simplicity and obviousness of the connections shown, is really in their favor,

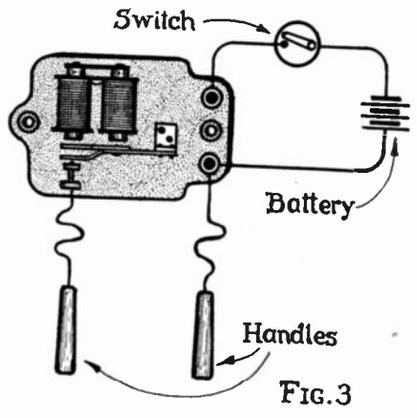


FIG. 3

The buzzer provided with handles, becomes a shocking machine to administer electricity to any nervous person desiring it.

and help make them doubly interesting, even to the professional electrician.

In the first illustration, the wire is shown disconnected from the regular binding post and attached to the contact post of the buzzer. By means of this connection, when the push-button is depressed, the electro-magnet is excited and attracts the armature, giving a single click instead of the ordinary buzz. This may prove in some cases quite a useful arrangement. The connection shown here makes it possible to give a set of single taps and a code system of signals can be used upon the circuit. The total supression of the buzzer is sometimes most desirable, and this change of a single connection abolishes it absolutely.

In the next illustration is shown a double connection with two push-buttons. One push-button gives the continuous ring or buzz, and the other gives, as before, the single tap. It is quite obvious how useful such an arrangement might be, and the possibility of using either a buzzer or the single tap as desired, is quite a feature. The buzzer may call the attention of an attendant, while the single tap may give a specific call for some individual whose presence is required.

Again, there is shown a connection of two handles, one with the regular binding post and the other with the contact post, so that an electric excitation may be taken from the buzzer, the only danger being, of course, that there may be too much electricity, for the comfort of the patient.

EXPERIMENTERS and amateurs, we want your ideas. Tell us about that new electrical stunt you have meant to write up right along, but never got to. Perhaps you have a new idea, perhaps you have seen some new electrically arranged "do-funny," —we want these ideas, all of them. For all such contributed articles that are accepted, we will pay one cent a word upon publication. The shorter the article, and the better the illustration—whether it is a sketch or photograph—the better we like it. Why not get busy at once?

EDITOR.

It will be observed that there is no arrangement for modifying the effect. It is a case of all or none, and it highly probable that in many cases the all would be far too much.

An induction coil may be thrown into very active operation by connecting it as shown in the fourth illustration. Care must be taken not to give the coil too heavy a load, for the buzzer may cause various things to happen in a small induction coil.

It is interesting to connect it to a simple spark coil or choke coil, and to see what the result will be if the circuit is opened by a small gap.

Next we come to the drollest suggestion of all, for here there is connected a little motor with a crank-shaft and fly-wheel, mounted in journals, so as to be operated by the reciprocations of the armature of the buzzer. This suggestion we are sure will be attractive to our juvenile readers.

The late sleeper is well taken care of. A switch upon the buzzer circuit is connected to the alarm bell key of an alarm clock by a string. The clock is set to any hour, according to the needs of the case, and when it starts to give the alarm the string is pulled by the clock key. The switch is closed and the buzzer circuit becomes active. The buzzer is mounted on the bedpost, and will buzz until the switch is opened. The switch

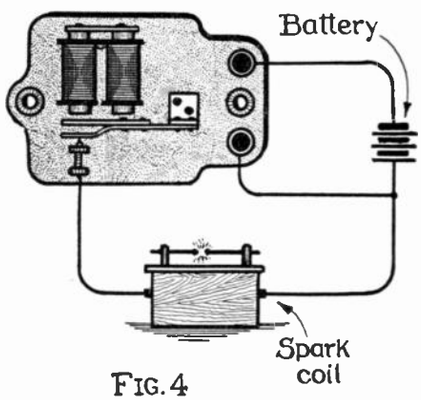


FIG. 4

The operation of a spark coil, producing a continuous discharge between electrodes, is carried out by the use of the buzzer and its battery.

should be at the other end of the room naturally. It is believed that the occupant of the room will never sleep at the switch.

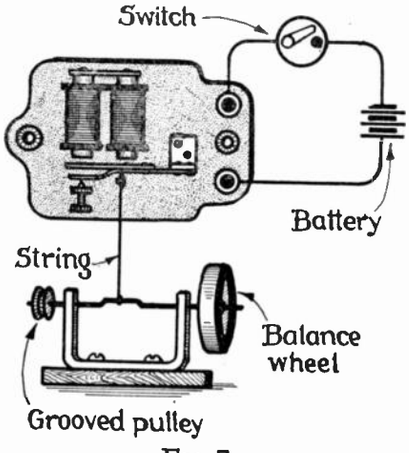


FIG. 5

A very amusing use of the buzzer, where it is made to perform as an electric motor.

It will be observed that the bell has been removed from the clock, the author believ-

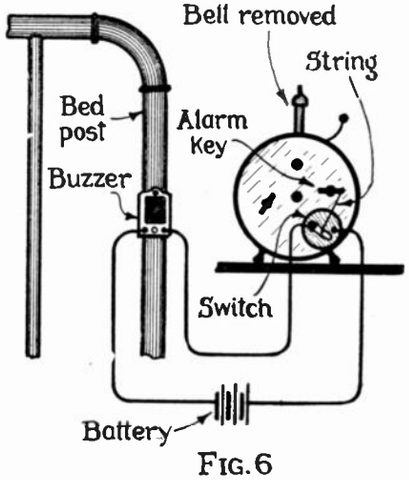


FIG. 6

The buzzer connected to an alarm clock, so as to wake the late riser.

ing, evidently, that the buzzer will do the work of waking the soundest sleeper.

Induction Tester For Locating Armature Troubles

IT is well known that a "growler" is the quickest and most accurate thing for testing automobile generator and starting motor armatures, and as the cost is considerable, the following was made from the laminated field of an Auto-Lite Generator.

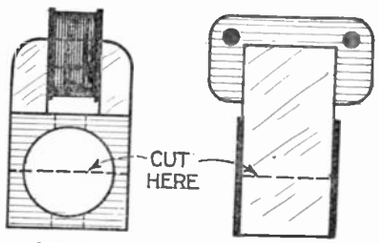


FIG. 1 FIG. 2

F Views of field magnet, for an induction tester, showing where it is to be cut across and where fibre is to be applied to produce the very effectual apparatus for locating faults in armatures.

Referring to the illustration, Fig. 1 shows the field core with armature removed. Pole pieces should be sawed off on dotted line.

The wiring should then be removed and replaced by No. 22 magnet wire.

The apparatus can then be mounted as shown in Fig. 4 and a lamp should be added as shown, to test for grounds. A coil is connected to a 110 volt A. C. line and the armature to be tested is placed between the poles.

The coil forms the primary of an A. C. transformer, while the armature forms the secondary. If all the coils are clear, a spark should be seen when two adjacent segments are shorted.

This induction form of test is employed quite extensively in repair shops and on railway motor testing. In making a test for a grounded coil or wire on the armature, the two test tips "DD", Fig. 4, are utilized, placing one of the tips on the shaft and running the other around the commutator segments slowly. If grounded, that is if a false connection between the insulated wire and the iron core of the armature itself is present, the light will indicate this trouble by flashing up. If there are no short-circuits in the armature, particularly at the commutator, then a spark will be seen when any two adjacent commutator segments are short-circuited by a piece of metal or wire.

There are many other modifications of this test which can be carried out in further detail. If an A. C. voltmeter with a low reading scale or a low reading A. C. ammeter is available, either of these instruments may be connected with two test tips, or better still to a couple of nails driven into a block of wood, as shown in the illustration, so that the meter may be connected across any two adjacent segments, and the current flowing in the successive armature coils can thus be read off directly for comparison. If the armature is in perfect condition, the successive readings obtained by this bar-to-bar test should correspond very closely. If a coil is partly short-circuited, a lower reading will result on the meter, or if a telephone receiver is used instead of a meter, a decreased sound or hum will be noted.

If a total short circuit is present, such as often happens when a commutator has been machined in a lathe, due to the copper in two segments being drawn over with the cutting tool, such a condition will manifest itself by practically no sound being heard in the telephone receiver; or else a zero indication or nearly so on the volt meter or ammeter. A 75 ohm watch case telephone receiver of the cheapest pattern available, will be thoroughly satisfactory for all of these tests.

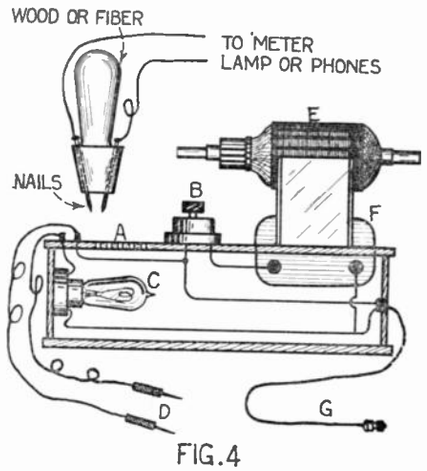


FIG. 4

The connections employed in testing out an armature, showing the armature in position for the work, and the various leads of wires.

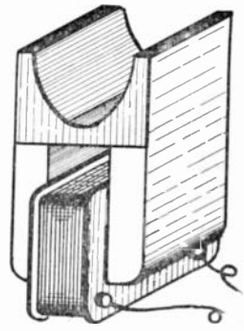


FIG. 3

The field magnet after it has been cut and the fibre pieces applied, all ready for work.

When one is accustomed to the telephone receiver test, he will appreciate it very much. In most cases, the armature will have to be shifted or turned slowly as the test is made, unless it is a very small one compared to the polar opening in which it rests. In applying this form of test to large railway motor armatures, etc., the presence of a short-circuited coil is indicated by that particular coil becoming warm, which condition is readily felt with the hand. When making the test with the telephone receiver or meter, an open circuited coil will make its presence known by a very loud humming note in the 'phone or else by an extra high reading on the meter.

As a possible refinement in this particular testing outfit here shown, and which provides an idea for those who like to experiment, it is possible to indicate these different armature troubles with a sufficiently sensitive A. C. ammeter connected in series with the exciting coil on the laminated iron magnet frame. In other words, the ammeter is connected in series with one of the A. C. supply wires. If a short-circuited coil for example, should exist on an armature, with such a testing arrangement, this would act as a closed secondary to the transformer, which we virtually now have; and this would cause an increased current to flow in the primary winding, which would indicate its presence by higher reading of the ammeter.

Basement Lighting Switch

THE two illustrations show clearly an arrangement for making a basement light switch, which works automatically as you go up and down the stairs.

The effect of this arrangement is that your weight closes the switch as you go down the stairs, so as to light up the basement. Then when you go up, your weight opens the switch and extinguishes the light.

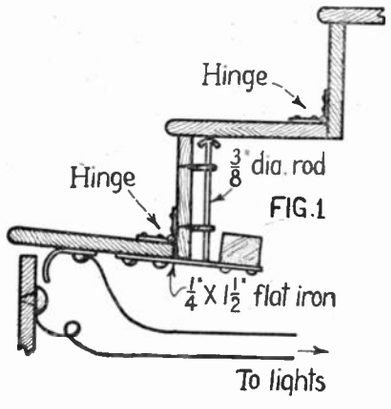


FIG. 1

A switch operated by going up and down stairs. Going down stairs, now open, the lower step, is closed by the weight of the person, and the lamp lights.

All that is necessary to construct this apparatus are two pairs of hinges, a couple of screw eyes, a 3/8-inch iron rod about an inch longer than the height of one step of the stairs, and a few pieces of iron and brass whose uses will appear in the description.

Two treads of the stairs near the top are first removed, and the nails are all extracted; the treads are then hinged at the back, as shown in the illustration. Before replacing the treads on the stairs, a strip of brass is screwed to the inside of the lower riser. This piece of brass connects to one of the wires of the circuit. On the lower surface of the lower tread, another bent piece of brass is screwed, so as to make a spring contact with the piece on the riser when the tread is depressed. This spring contact connects with the other wire of the lamp circuit. To the back of the lower tread, and underneath it so as to extend backwards horizontally, a piece of flat iron 1/4-inch thick is fastened. Next, the rod is put in place with two screw eyes directly behind the upper riser, and a bit of iron or other metal is screwed directly above it on the upper tread, simply to prevent wear.

Fig. 1 of the illustrations shows the switch open, which is its normal position. When you go down the stairs, the lower tread is pushed down by your weight, and it closes the lighting circuit and lights the lamp.

(*Cont. on Page 234*)

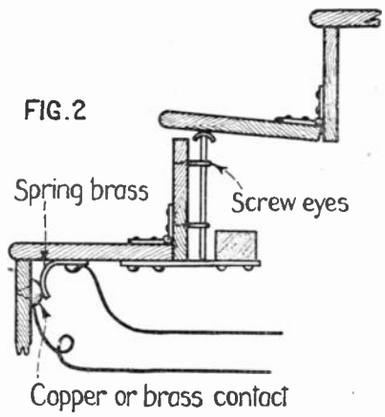


FIG. 2

The circuit is now closed and the lamp lighted. on going up stairs, the upper step is depressed, which opens the switch and puts out the light.

Homemade Electric Forge Blower

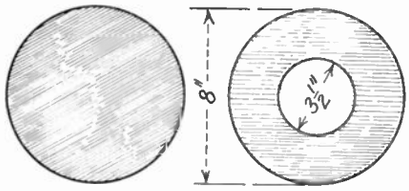


FIG. 1

Side plates of the electric driven fan; the perforated one provides the air inlet.

ONE of the most tedious operations necessary around the average small shop is blowing the forge fire by hand. As an improvement, the writer devised the following comparatively inexpensive method of using power for this purpose, evolving the device shown in the accompanying explanatory illustrations.

The rotating part of the fan is shown in Figures 1, 2, and 3, in which Figure 1 represents the two circular sides of the rotor. These should be made of galvanized iron, of from twenty to twenty-four gauge. One, as illustrated, is solid, while the other has a 3½ inch hole in it. The six wings are made as shown in Figure 2, being cut 2¼ inches x 3 inches with a ⅜ inch edge turned up on two sides in order to make them 2¼ inches square; they are riveted and soldered to the two side pieces, Figure 1, as shown in Figure 3, in order to make a fan wheel of six blades enclosed between the two side-pieces as shown.

The case is made as illustrated in Figures 5 and 6, in which 5 is a side view and 6 an elevation of the complete blower and motor. The case is 10 inches high, has 3½ inches inlet as shown on one side, this opening being cut ½ inch off center toward the top, as the fan wheel runs eccentric to the case. The method of draft regulation is illustrated in Figure 5, being a circular piece 4 inches in diameter, mounted on a swinging arm and

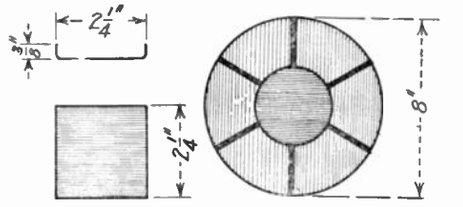


FIG. 2 FIG. 3

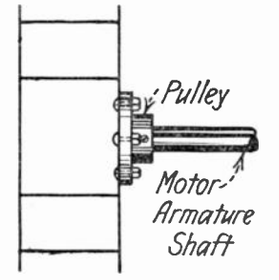
Layout of the rotating member of the fan showing the six wings equally spaced in radial position.

adapted to swing across the inlet opening, thus throttling the air supply and regulating the blast.

The fan wheel is mounted on an extension of the motor shaft by means of a small pulley with a flat side, the pulley being a snug fit on the motor armature shaft. It is essential that the fan wheel be mounted truly and well balanced. It is mounted with four ⅛ inch bolts to hold the fan wheel and pulley together.

In the side of the case where the off-set hub of the little pulley passes through the case, the hole is cut about ¼ inches large and a piece of canvas pasted on the case with a hole just large enough to snugly fit the pulley hub in order to be nearly air tight.

The motor and fan casing are mounted on a base made of 4 inches x 3/16 inch sheet steel bent as shown in Figure 6, and with two



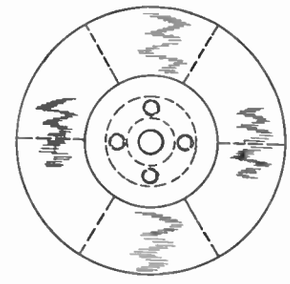


FIG. 7

Connection of the motor shaft to the rotating fan by flange and bushing.

small braces on the side of the case as shown.

Fig. 7 shows the fan wheel and pulley assembly and shows how the fan wheel is mounted upon the small offset pulley. It will be seen that the side of fan wheel which is solid has a hole through it the same size as the motor armature shaft, the fan wheel being mounted upon the shaft and against the face of the pulley, to which it is attached with bolts as illustrated. The motor we use is a 1/30 horse power constant speed motor which

FIG. 4

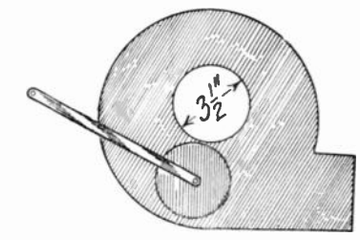


FIG. 5

Side view of the fan case and cross-section of the fan. The circular piece acts as the throttle to cut down the blast.

makes the air regulation we have described necessary. If the builder happens to possess a variable speed motor, it will be all the better, as it will be a trifle more economical of current to regulate the speed instead of the inlet opening, although a 1/30 horse power motor does not consume enough current to prove expensive in any case. The motor we use is speeded 1800 revolutions and gives ample blast for one portable forge fire, in fact we often use it with the draft about seven-eighths closed.

Contributed by Edwin Kilburn.

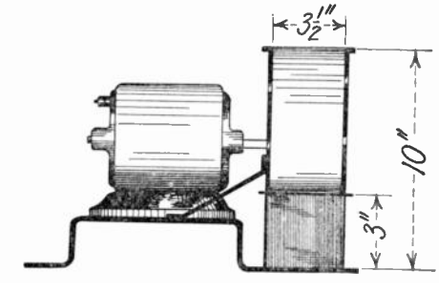


FIG. 6

Fan and motor set up in running order. Notice the diagonal brace used to prevent shaking.

Electrically Welded Steel Boats

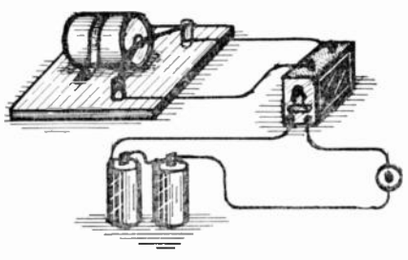
A. Legane, the author, advocates the use of electric welding instead of riveting for the steel hulls of boats. As examples of accomplished jobs, a 65 foot boat over 12 feet wide and 8 feet deep and a 500-ton cargo boat are given. The former had to be transported on land for a distance of 3 miles before it was launched, subjecting all welds to a very abnormal stress, but no damage to the welded joints resulted.—*Revue Generale de l' Electricite.*

Electric Cannon

LAST Independence Day I did not have enough money for fire crackers so I made an Electric Cannon.

The articles needed are:—An old spark coil, a push button, an old spark gap, a dry cell or two, an empty tin can, such as used for karo syrup, carbide and some wire. If you have the coil and some wire a noisy "Fourth" may be had for less than fifty cents.

A karo syrup can with flush lid is fitted with cover and a nail hole punched in center of the bottom of can. The spark gap is placed so the gap is just behind the hole. In the can is placed a piece of carbide such as is used in bicycle lamps; ½ pound costing thirty five cents is enough for 2 celebration days. A drop of water is put on the carbide, the lid is replaced, and the can laid on its side with the hole at the spark gap. The button is pressed and a report as loud as any



The fourth of July cannon, actuated by acetylene and warranted to give a satisfactory explosion without danger to operator or spectator. Carbide of calcium forms a safe source for a detonator.

toy cannon is heard. Reload and fire until the piece of carbide is used up, then put in another piece. The can may be fastened to a board by curtain rod hooks so as to be removed easily by turning the hooks. The cannon may be fastened to a board a foot square.

Contributed by Joel B. Ennis.

As an additional attraction to this Big Bertha a projectile in the shape of a tennis ball may be introduced into the mouth. This will be thrown a considerable distance by the explosion, which may be quite strong. Some years ago acetylene gas was used as a primer for starting automobiles but it was considered too violent in its action. So there is considerable to be hoped for if this cannon is made to exert its propulsive power on a light rubber ball, but don't point it at the window, as glass is brittle and the ball may be of power enough to do considerable breaking of glass if it really tries.

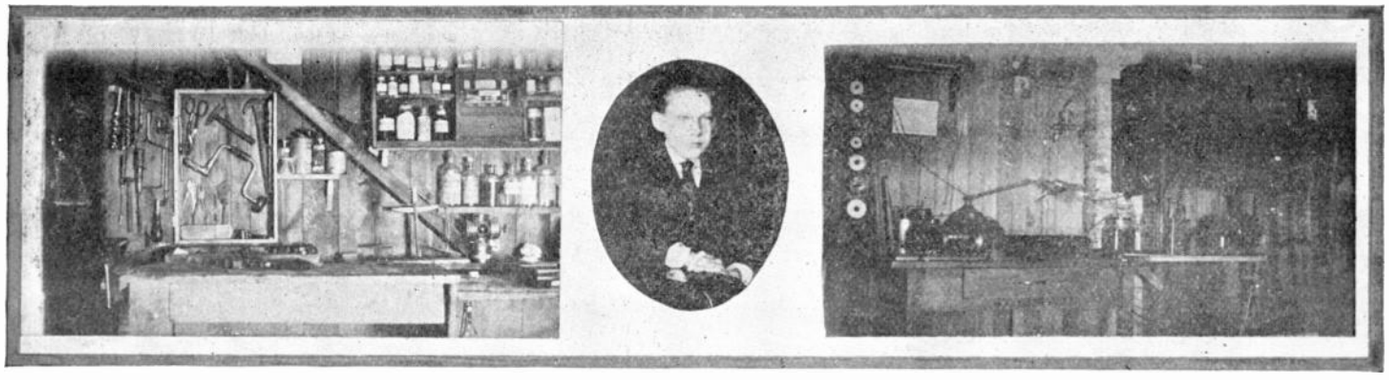
My Workshop

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 assortment, 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 4⅕ inches. It is impossible to reproduce pictures smaller than 3⅗ x 3⅗ 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.

Swanson Laboratory



MR. ABNER SWANSON, Chicago, Ill. sends us a description of his laboratory workshop, and we agree with him that for a boy of only 17, it shows great promise of future achievements.

"The accompanying photographs show my electrical and chemical laboratory. The first photograph illustrates my experimenting table, so called, because I use it to carry on my electrical work. This table contains my Tesla outfit (which is my own make except one Leyden jar) and a double row of binding posts. Here I get the following voltages, in A. C., 110, 80, 60, 45, 30 and then down to 1½ volts in 1½ volt steps. In D. C. I get 10 volts, 2 volts and a high voltage from an electrolytic rectifier, also my own make. A dynamo, storage cell and three transformers, supply the other voltages.

Along side my experimenting table is a switch-board containing thirteen (13) switches, three rheostats, two ammeters and one voltmeter. Under my switch board can be seen a rectifier, storage cell and a one-quarter horse power motor. The motor is the latest addition to my laboratory, and is intended to run a small lathe and my dynamo, which is on the floor.

Over my experimenting table is a rheostat, a shelf containing electrical and chemical books, and a small shelf on which is a torch, solderall, solder and flux.

My work bench is on the opposite side of my shop; here I have also my chemical laboratory. The workshop contains a fair assortment of tools, paints, stains and varnishes.

My chemical laboratory is not very impressive, but I am waiting for a chemical set which I ordered from the Electro Importing Co. I have about fifty chemicals and little apparatus, but when the set comes I will have a fair laboratory for one who is just beginning chemistry.

A large bureau contains my electrical apparatus and junk, which does not take long to accumulate as we all know. I have quite a little apparatus such as two spark-coils, a Wheatstone bridge, Leyden jars, motors, a nearly finished Wimshurst machine, etc.

I buy your magazine regularly.

My laboratory is not so bad when you consider I am only 17 and attending high school."

Russell Laboratory

MR. L. S. RUSSELL, Calgary, Canada, submits this interesting description of his Workshop Laboratory:

"It gives me great pleasure to present the accompanying photographs. My laboratory, besides the chemical and electrical apparatus, possesses a large amount of material for the study of biology and this latter material includes a small museum.

The first picture shows my chemical apparatus, with which I am able to make qualitative and quantitative analyses. The outfit includes two hundred and twenty three chemicals, some of which are visible on the left of the picture, and forty-five other solutions. Principal among the apparatus, are a home made Liebig condenser, a pair of platinum electrodes for electro-chemical work, and a gas burette.

The next picture shows the electrical apparatus, mainly intended for the study of static, high tension and high frequency. The

apparatus on the left is a home made electric furnace, very simple in design, but which has enabled me to manufacture carborundum and calcium carbide.

The third picture shows the biological laboratory. The case in the foreground contains a complete set of dissecting instruments, while to the left of the picture, may be seen various apparatus employed in dissection. The shelf above contains the specimen.

Part of my laboratory serves as a museum, and houses a collection of mounted specimens —insects, birds and animals. As a fitting guardian of this animal kingdom, I have a fretful porcupine on view. I do all the necessary taxidermy. This section of the workshop also devotes some space to a mineral, rock and fossil collection.

I read your paper regularly and I might state that I am very much pleased with it.

Green Laboratory-Complete Electrical Workshop.

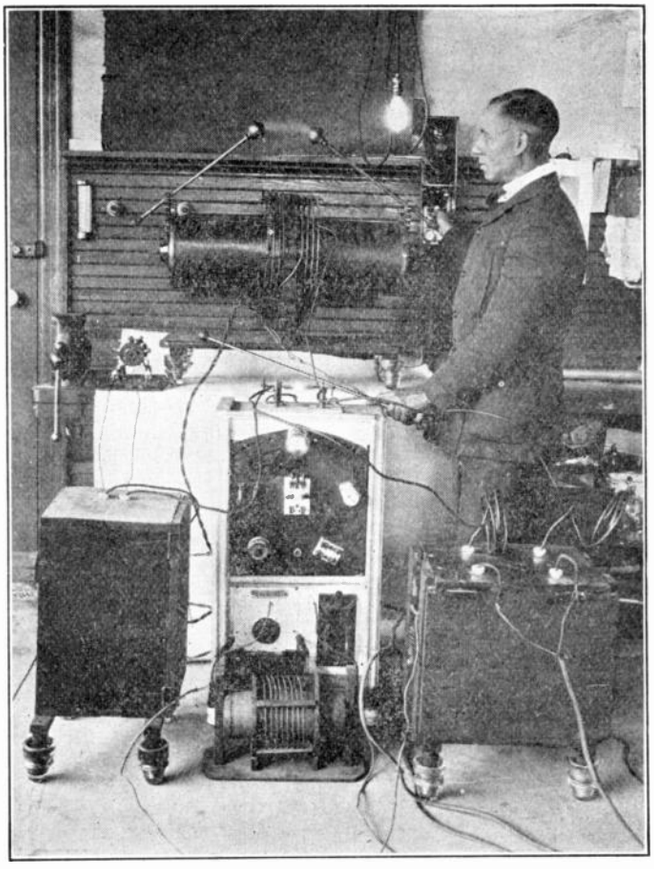
MR. CLARENCE L. GREEN describes his work shop which is also illustrated herewith·

"I am sending you a photograph of my High Frequency outfit, most of which I have built myself, at night, and from valued instructions found in your excellent magazine which I value very highly. Go on with the good work. I buy a copy each month and am always eager for the next issue.

My apparatus consists of a ¾ K. W. Transformer, a 1 K.W. oil immersed condenser, a 1 K.W. Tesla Coil, also a small Tesla Coil, all hand-wound; also a 110 volt rotary spark gap, and zinc gap of ¾ capacity, air cooled by blast from fan in switch control panel, panel shown at centre, upon which is mounted a large fused 250 volt knife switch, 1-30 ampere cartridge fuse block, 1 snap switch to control rotary gap, 1 double pole porcelain switch to control oscillating current, also connecting plug and red pilot light. I have besides this outfit a lot of junk so dear to the heart of every amateur as follows: 1-110 volt D.C. motor, 1-6 volt motor, an electrolytic interrupter, 2 perfect violet ray apparatuses, all home made, 3 spark coils and 1 rheostat, and parts too numerous to mention.

I am now building a 150 mile radio telephone set, and will send you a photo, and sketch of hook-up later. I'll say that I get more real fun out of this, then going to a circus, for experimenting is real sport."

Contributed by Clarence L. Green.



NEW TELEGRAPHONE EXPERIMENTS

In the "telegraphone," devised many years ago by Poulsen, a telephonic conversation was "fixed" by magnetic action upon a steel ribbon or a steel wire, and could be reproduced later by passing this ribbon again over a small electromagnet, in the winding of which a fluctuating voltage was set up, which in turn energized a telephone receiver. The results obtained with this apparatus did not warrant its more general use, on account of the faintness of the reproduction. Since, however, the modern vacuum tube came into vogue, it has been possible to amplify the sound to any degree, and A. Nasari [Schwily has built an electromagnetic phonograph on the combined principles of the telegraphone and the amplifying tube. He shows that with this method a message may be "spoken into" a rail and may be picked up by the engineer of the train following. Here is a suggestion that might be of great value for railway signaling purposes.—*Elektrolechnische Zeitschrift.*

FILTHY LUCRE CLEANSED

The Grand Rapids National Bank of Minneapolis recently had $12,000 in "dirty money" washed and ironed in an electric ironer. The bills emerged clean and entirely uninjured.

Stillwell and Choldeck Laboratory

FROM far off South Dakota comes the following description of the laboratory built up by Mr. John A. Stilwell and Joseph Choldeck:

"Our laboratory, photos of which we present herewith, devotes a portion of its area to chemistry; the chemical laboratory contains a Gilbert chemical stand, about 160 chemicals, and miscellaneous chemical apparatus; a distilling apparatus is seen in the foreground, a mortar and pestle, etc.

"The electrical section of the Laboratory contains a 110 volt A. C. transformer, a small wireless sending set, a Leyden jar and ⅛ spark coil and a key. There is a receiving set consisting of an automatic detector and a crystal detector, a tuning coil, and a pair of 100 ohm telephones.

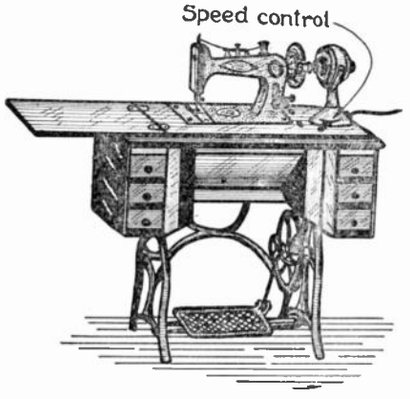
"We have a code practice set and a telegraph line, also a switchboard, which are not seen in the photographs. To run our telegraph line we have four Columbia dry cells, and several small but powerful motors.

"There is also a lathe and tools for woodworking."

It is a very pleasant thought to have these two young men working in association with each other in a laboratory. Perhaps this enthusiasm for science will hold them together for many years, as joint interest and effort lend zest to study.

Junior Electrician

Simplest Electric Fan Driver for Sewing Machine.



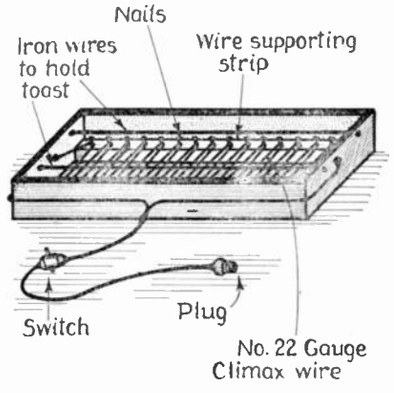
A fan motor is made to drive a sewing machine by the simple addition of a spool attached to its shaft and pressing against the edge of the hand-wheel at the side of the machine.

THE illustration shows what may be considered the simplest application of a fan motor for driving the sewing machine. Here we have neither belt nor other drive beyond a simple friction between a spool on the motor spindle, and the periphery of the upper wheel of the sewing machine. The reduction of speed which is necessary is effected very nicely by the small diameter of the spool compared with the diameter of the wheel it drives. Incident to this, our contributor says that he has used the same spool connection as a sort of drill-chuck, which will hold a drill so that he can drill holes with great rapidity—at least we so understand from his description.

Comtributed by James T. Fischer.

How to Make an Electric Toaster

THE toaster should not cost sixty cents. Make a shallow wooden box 12 inches long, 4¾ inches wide and 2 inches deep, all measurements taken inside. It should be made of wood that is ⅝ inch. thick. From a piece of wood ⅝ inch by 1 inch, cut 2 pieces, each 12 inches long. Nail them upright against the sides (and firmly against the bottom, too) of the box.



A strictly home-made electric toaster. This will work as well as the best and you can construct it yourself.

Line the inside of the box with asbestos board ⅛ inch thick.

Along the top and in the center of the two narrow strips last mentioned, drive 15 shingle nails, 4/5 of an inch apart, their heads projecting ⅛ of an inch above the wood.

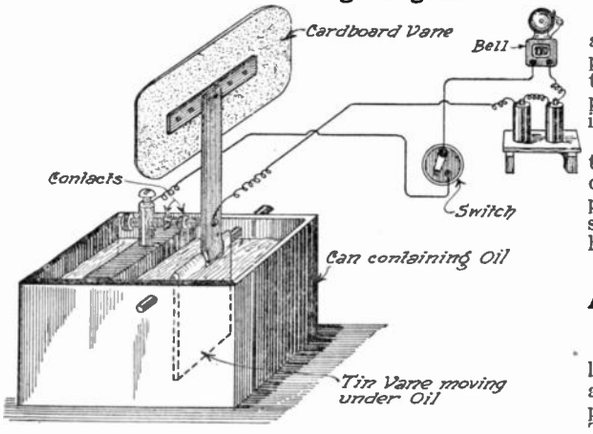
At an electrical store get about 9½ feet of No. 22 gauge Climax wire. Wind this quite tightly back and forth, from one nail on one side to the next nail on the other side. Do not twist the wire around the nails, just loop it over. Also be sure that no two wires touch each other. If made right the wires will be about ⅝ of an inch from the top of the box.

Bore a hole ⅛ of an inch in diameter in the center of each of the ends. Put one wire of an extension cord through this hole and twist it very tightly to connect with one of the ends of the Climax wire. Do the same at the other end.

Stretch some iron wires across the top to hold the toast. Toaster will take about 5½ amperes and 100 volts on alternating current.

Contributed by Cameron MacCulloch.

Draft of Air Rings Signal



An automatic draft regulator. This rings an alarm bell, if a wind comes up during the night and blows through an open window upon the sleeper. Little puffs of air do not affect it, but a steady draft does.

MANY people like to sleep in a room with the windows open, but fear to do so because the wind might rise during the night, causing a draft and giving them a severe cold. The following simple apparatus may be easily constructed and will ring a bell, should a draft occur.

Get an old oblong can (such as a cocoa can) and punch two holes on opposite sides near the top to act as bearings for the fan shaped moving element, as shown in the illustration. The shaft and the bottom vane are of tin. It should be as large as possible without rubbing on the sides. Then nail a little stick of wood parallel to the shaft and arrange two contacts, one on the wood and one on the movement, so they touch, when the vane is tipped over. Very fine flexible wire must be used to connect to the moving contact.

Set the device in the open window, fill the can with oil, (or water in warm weather) and connect with a battery and bell.

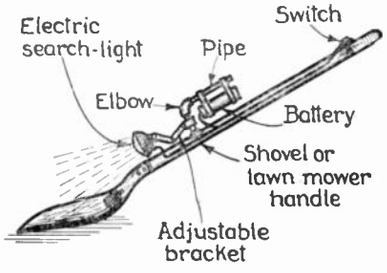
A quick puff of air will not close the contacts as the oil makes the motion very sluggish, but a steady breeze, or a number of closely following heavy puffs will do so, thereby ringing the bell.

Contributed by V. H. Todd.

A Electric Light For The Coal Shovel

MOST coal bins are quite in the dark For those coal bins not having an electric light to light them up a common bicycle searchlight fastened to the handle of the shovel is just the thing.

Set a pipe flange on the handle half way up. Screw a 6 inch nipple into that



When you go down cellar to shovel coal in the dark, the shovel itself supplies the light, as a flashlight battery and flashlight are all secured to the handle above the blade.

and an elbow on the top of the nipple pointing back towards the end of the handle. Then set a horizontal piece of pipe in the elbow about 12 in. long.

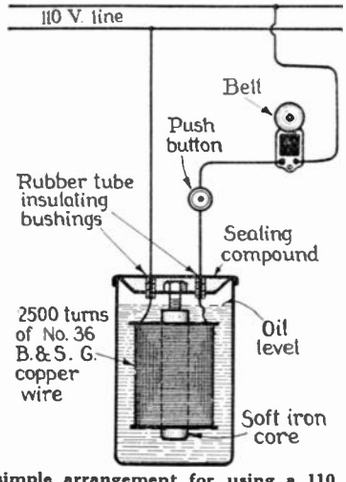
The light bracket can be attached to the upright nipple and the battery can be suspended from the horizontal piece, as on a bicycle frame. The switch can be carried up to the handle at top.

Contributed by Herschel Richey.

A Bell Ringing Choke Coil

THIS is a choke coil designed to operate on the usual 110 volt city lighting circuit for ringing a door bell, and besides it takes or consumes practically no current.

The coil is wound on an electro-magnet core, and is composed of 2500 turns of No. 36 B. and S. copper wire. The terminals are brought out of the case as shown and the cover is made oil tight by use of sealing compound such as is used in the manufacture of storage batteries. One of these contrivances has been in use for more than a year, and has developed good results.

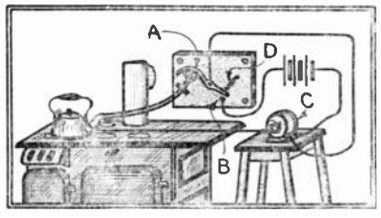


A simple arrangement for using a 110 volt circuit for the ringing of a bell. It avoids the troubles incident to the use of dry cells.

Contributed by Carroll Moeschler.

Saving Your Kettle from Boiling Over

THE object of this apparatus is to remove a tea kettle, the water in which is boiling, to the colder part of a stove by means of a motor. When the water boils steam is given off which is passed through an india rubber tube, which is attached to the spout of the kettle. When steam reaches the wooden block on which is mounted a piece of tin in the shape of the letter S, the force of steam pushes it and it makes contact with the point B, closing the electric circuit, and the motor C begins to revolve and pulls the kettle by winding up a chain attached to it, away from the hot part of the stove. When pulled away the water stops boiling, there is no steam to force the lever A to point B, and the lever is pulled back by a light spring D; thus it opens the circuit and the motor stops revolving.



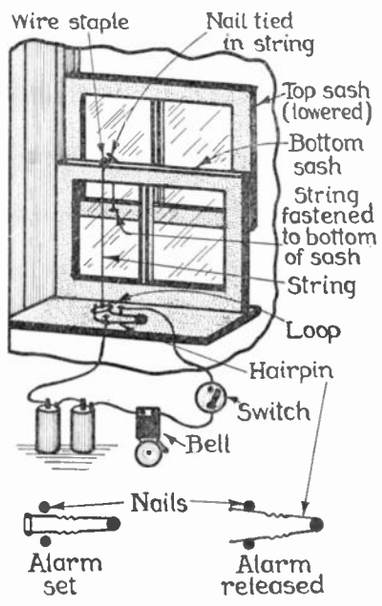
The electric motor is caused to act by the escape of steam from the boiling kettel. When the kettle boils too hard, the motor draws it away from the hot part to the cooler part of the range.

Contributed by M. Cohen.

Hairpin Burglar Alarm

MANY people like to sleep with their bed-room windows partly opened, but fear to do so on account of the temptation an open window offers to sneak thieves. A simple alarm may be constructed from a hairpin, two nails and some string. The alarm is arranged to close the circuit to an electric bell and battery. As shown in the attached drawing, the hairpin is screwed to the window sill, and the ends bent up. Then two nails are driven in so that the hairpin presses against both. These are connected to the battery and bell.

To set the alarm, tie a little loop of string to hold the hair-pins away from the nails and lead the string over the top of the lower sash, through a wire staple, and fasten it to the bottom of the top sash which is lowered to the desired position. If the top sash is lowered further or if the bottom sash is raised, the loop is pulled off the bent hairpin, which immediately flies against the nails, closes the circuit and rings the bell, which, unlike regular alarms will not reset should the intruder hear the bell and quickly close the window, but will ring until the alarm is reset or the circuit opened.



A simple hairpin is the actuating element in this burglar alarm. When the window is tampered with, it springs open, closes the circuit and rings the bell.

As the string passes the top of the lower sash, a nail or matchstick should be tied in the string so that even though the top sash be closed (thereby making the string slack) the nail will catch on the wire staple and leave the alarm intact for the lower sash. Be sure that the enamel is removed from enameled hairpins.

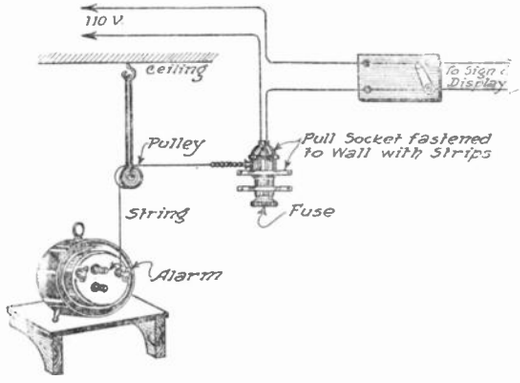
Of course, if an intruder knows of the presence of this alarm, it is easy to beat it by clipping the string, but then too, good alarms are easily beaten if their presence is known.

Contributed by V. H. Todd.

Automatic Light Switch

A PERSON may have a clock that does not keep accurate time and therefore have no use for it. If he is the proprietor of some shop this would prove a saving device.

The clock could be wound just before leaving the store and then the lights would be turned out at a reasonable time although not at an exact time. This would save a great deal of money, especially on display signs and windows. The clock being set at a given time for the alarm to go off, thus the lights would be turned off.



The alarm in this arrangement winds the string around the spindle of the alarm winder; it pulls the chain out from a chain-switch secured to the wall, thereby cutting off current at the hour for which it is set.

The switch used is the regular chain switch lamp socket, and as the string is wound up the chain is pulled and the circuit opened at a predetermined time.

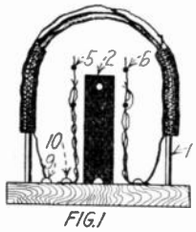
A Genuine "Rinktum" Motor

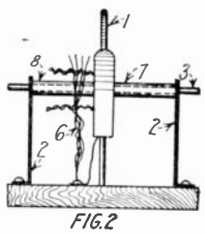
ONE of the junior members of the club brought forth an original idea in building motors of scrap, and with the exception of the bearing standards it was all made of wire. A piece of No. 6 iron wire was bent into a U about two inches high; this was set ¼ inch into a small block of wood as Fig. 1. The wire of a telephone induction coil primary was obtained and cut in two pieces; one piece was wound on U for field coils; that completed the field assembly.

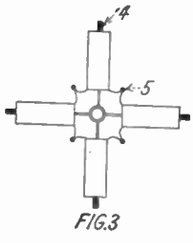
A piece of No. 10 was used as a shaft; on this, four pieces of No. 14 iron were wound and bent for armature poles as illustrated in Fig. 4; the remaining half of the 22 gauge was wound on these for armature coils. It will be noticed that the connections between armature coils are brought out and bent in such a manner as illustrated in all figures: these constitute the commutator. This finished the armature.

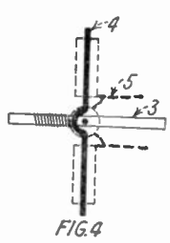
Next two scraps of tin were made and two holes punched in each, one for a screw and the other for bearing, No. 2; when they were put in proper place, two short tubes of brass, or fibre No. 7, No. 8, are put on shaft to keep armature located right. The brushes No. 6, Fig. 2, are made of four short pieces No. 22 or smaller twisted together and fanned out as illustrated. A series connection was made and motor developed high speed on one dry cell. I claim this is the simplest motor containing all the parts of standard practice I have ever seen or heard of.

Contributed by C. R. Mullins.









A curious motor, almost as curious as its very appropriate name. It is made out of regular scrap.

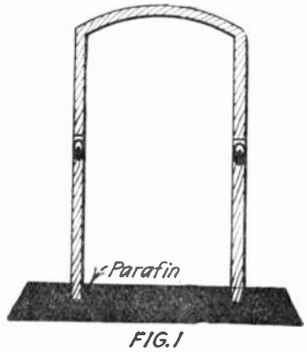
A Measuring Electroscope

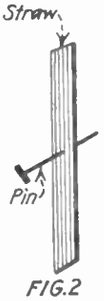
A VERY curious electroscope can be made in the following manner: Bend a piece of wire in U shape and insert it in a block of paraffin wax so as to make a support, Fig. 1. In the center of each of the two legs of the wire attach a little hook in order to support the axis of the instrument, which is an ordinary pin.

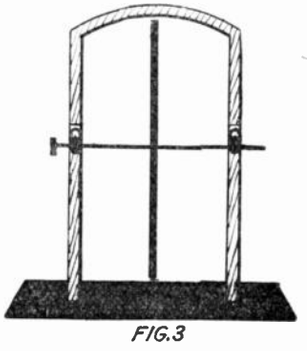
The moving part of the instrument consists of a piece of straw or a sheet of light paper rolled and pasted, which is balanced in the center by the pin, Fig. 2, which passes through it. Now you can attach to the base a scale, so the deflection of the straw can be observed.

Fig. 3 shows the completed instrument. If we touch the U shaped wire with an electrified glass rod, the straw will move.

Contributed by E. Alvarado, Jr.





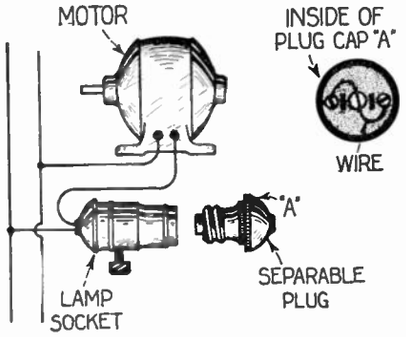


A simple electroscope, which anybody can construct, out of common materials in a few minutes.

Electric Switch From Lamp Socket

THE writer was in need of an electric switch for a small motor and made one in the following manner:

A common electric light socket was tapped directly to the house wires and the motor as indicated.



A very simple and efficacious way of making a switch from a discarded lamp base. Our contributor used one for several years with great success.

Then a separable attachment plug was obtained and the cap pulled out. By observing the sketch it will be seen that a piece of bare 14 gauge wire was connected between the two terminals of the cap, so that when the cap was re-inserted in the plug, it formed a complete circuit when the switch-key of the socket was turned "on."

This made just as good a switch as could be desired and has been in use for several years.

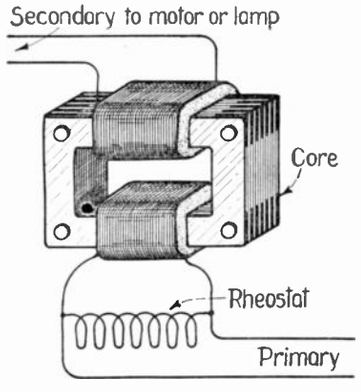
It will be observed that the key in the electric light socket is to be turned off when the plug is being screwed into place.

Contributed by L. B. Robbins

Fan Motor Regulator

A SMALL battery rheostat and toy transformer may be used to regulate the speed of fan motors, 110 volt lamps etc., in the following manner.

The rheostat is connected directly across the primary winding of the transformer, and the motor or lamp is placed in series with



A simple suggestion for regulating the action of a transformer, capable of still further modification as described in the article.

the secondary of the transformer and the house current. This arrangement permits fine regulation, especially if the rheostat is of the variable type.

Darning Wrinkle

MOTHER long ago discovered that the worn-out electric light bulb made an ideal darning egg. For years she used one for that purpose.

Darning stockings and socks at night, which is her favorite time for such work, had come to be a dread.

Then one night when she was straining eyes and patience on a pile of black hose, a happy thought came to her. Why not slip a lighted electric bulb into the stocking?

An extension cord made this possible and Mother was overjoyed with the result.

Needless to say, the old darning egg has been discarded. With the glowing one Mother can see every stitch, and darning at night is a pleasure.

Contributed by Mrs. Ida M. Kier

There are two kinds of electric lamps made, some having a sharp little projection at the top of the bulb; while others are smooth all the way over the contour of the glass. It is hardly necessary to say that for use as a darning egg, which we believe is the correct expression, the smooth type of bulb be used, otherwise the little projecting point of glass will interfere materially with the work. It must also be remembered that as a matter of perhaps trifling economy, as well as of personal comfort, too strong a light should not be used. The tendency of the day is to use very powerful electric lamps; it is probable that a 3 or 4 watt lamp would answer every purpose of the busy housewife.

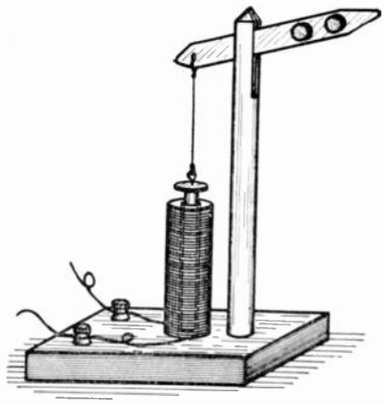
(Editor)

How to darn stockings in the dark, by using a smooth bulb electric lamp for the darning egg.

Electric Semaphore for Toy in Railroad

AS our young people are now operating their toy railroads by electricity instead of by the old-fashioned spring actuated locomotives, the semaphore shown here, we are sure will interest them. The semaphore proper is pivoted on top of a post and its one end carries the armature or plunger of a solenoid coil by a string as shown. The other end may be weighted with solder to compensate for the plunger. At both ends of a paper tube are fibre discs, ⅞ inch diameter. Between the discs is the winding of No. 22 S. C. C. wire, of which two layers are sufficient. A nail 2¼ inches long constitutes the core, and its point of suspension must be accurately in its center, to avoid its rubbing against the aperture. The semaphore arm is 3 inches long and it works on a finishing nail, which may be hacksawed off to match the thickness of the post and rivetted or upset to secure it. The wires from the solenoid are connected according to the views of the young engineer. One wire may be connected to the third rail and the other to a shoe alongside the track, so placed that the wheels of the train will touch it.

A block of wood for the base, is ½-inch thick and about 3 inches square. The standard may be ½-inch square and a little over 6 inches long. On its top is mounted the pivoted semaphore and on the same base is carried the paper tube, or preferably one of



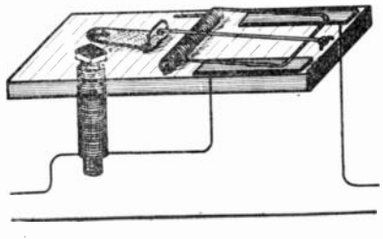
A toy semaphore for use upon a model electric railroad, something which we are sure will interest many of our younger readers.

pasteboard, around which is wound the magnetizing wire. From the left hand end of the semaphore hangs the iron core that fits within the paper tube. The semaphore is so balanced that it tends to descend. When the current is passed through the solenoid winding, the core is drawn down, thus raising the signal end of the semaphore.

Contributed by George E. Bidwell.

Electric Cut-Out

A serviceable cut-out for experimental purposes can be made out of a mouse trap. The variety of mouse trap required can be purchased at any hardware store for three cents; a ¼ inch iron bolt two inches long, fitted with washers (fibre preferred) is the next thing needed. A hole must be drilled through the trap exactly under the bait holder, and the bolt must be slipped through this hole, head up. Around the bolt two layers of No. 20 enameled wire is wound. The contacts are made from pieces of spring brass, or clock spring, and of this two pieces 1½ inches long are placed one on each side of the trap and tacked or screwed down. These are arranged so that, when the trap is set as if for catching a mouse, contact is made at both points. Wires are attached to



A mouse-trap cutout. Our readers have had various examples of the usefulness of a mouse-trap in electrical work, and here is a very nice example of how it can be used to prevent burning out of fuses.

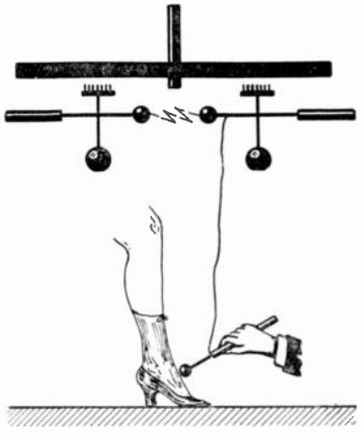
the contacts. In connecting up, the two leads of the solenoid coil are connected to bring the coil in series with one of the line wires. The contact leads are connected in series with the other line wire.

The under side of the bait holder is covered with a thin sheet of iron. When an excess amount of current flows, the electro-magnet pulls down the bait holder, releasing the lever and breaking the circuit. The bow of the trap flies over, striking and resting on the side of the trap opposite the contacts, thus opening the circuit.

Contributed by Louis C. Miller

A New Phenomenon of Electric Attraction

CONSIDERABLE interest has lately been excited by the so-called Franklinique electrostatic currents, the wave currents of Morton, which are produced by



The attraction developed by static electricity for the body. A foot attracts the electrode connected with the prime conductor of a Wimshurst machine.

Holtz or Wimshurst machines.

The illustration depicts the attraction exercised by a sphere attached to the prime conductor of a static machine, and the surface of a foot. This foot is covered by a semi-conducting substance, the leather of the shoe. As long as the spark discharge is maintained between the electrodes a strong attraction will be exerted between the ball attached to the conductor and the foot.

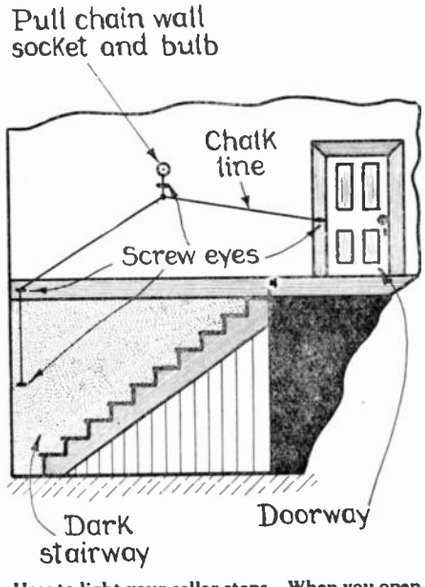
It is immaterial whether the person submitted to the experiment is insulated on a glass-leg stool, or stands upon the ground. The Franklinique circuit is completed between the prime conductor and the shoe by the air surrounding the person.

Virgilio Machado in La Nature.

Light on Cellar Steps

HAVING a dark stairway leading from basement to living rooms and not wishing to go to the expense of concealed wiring and a 3 way switch, I put up a pull chain socket and by using screw eyes and a chalk line as per illustration was able to light or extinguish the lamp from either top or bottom of the stairway. It has been in daily use for 2 years and has given no trouble.

Submitted by S. D. Alexander.



How to light your cellar steps. When you open the door the light is turned on; when you close the door the light is extinguished; you have nothing to think about except to pull a string.

Current Reversers

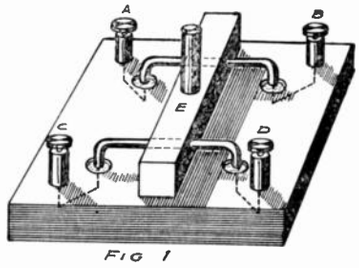


FIG 1

A pole changer, making connection with the circuit by four mercury cups. The movable piece is turned through 90 degrees and put back in the new position to change the polarity.

The simplest form of commutator is shown in Fig. 1. A piece of wood about four inches square and 1½ inches thick is required for the base. Four holes ¼ inch in diameter and ⅜ inch deep are bored in the base. Four binding posts are then screwed to the board a short distance from each hole and a short strip of copper run from each binding post into the holes. These holes are to be filled with mercury. A short strip of wood (E) is needed next, and pieces of heavy copper wire are passed through holes to this and are bent as shown. A

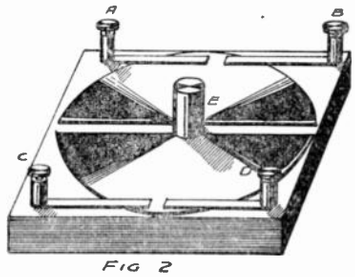


FIG 2

A pole changer working by rotation. The desired change is effected by turning the disc.

round piece of wood can be secured to the center of this for lifting it from the mercury cups.

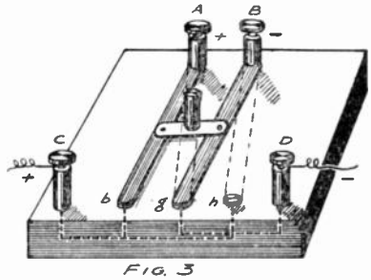


FIG. 3

A simply constructed pole changing switch. A third way of effecting the reversal of pole connections.

The battery is connected to the binding posts A and D and the wires to the instrument joined to the posts B and C. The current is reversed by lifting E and turning it 90 degrees and placing it again in the mercury cups.

Another form of current reverser is shown in Fig. 2. Mercury cups are not required in this arrangement. A block of wood of the same dimensions as shown in Fig. 1 can be used. To each binding post copper strips are secured. The part in the center consists of a round piece of thin wood with a wooden peg fastened to it. Also to this round piece of wood secure with small tacks or glue two semi-circular pieces of copper as shown in the diagram. Turning the center part through 90 degrees reverses the current. The battery is connected to binding posts A and D.

(*Continued on Page 237*)

Electric Soldering Iron

THE soldering iron shown is one which I have constructed myself and used for some time with considerable satisfaction. The heating unit consists of thirty

An electric soldering iron. You do not have to go to the stove or gas burner for heating this iron; electricity does it.

inches of No. 24 resistance wire, which is wound between layers of asbestos. One end of this wire is grounded in the copper; a hole is drilled therein for its reception and it can be brazed there; even if the spelter does not take hold of the resistance wire, it will operate to secure it in the copper. Two inches of the other end of the wire after it has been wound around the copper, is bedded in plaster of Paris, a cylinder of which is cast around the shank of the iron and which plaster holds one of the binding posts. The other binding post is fastened to the shank proper. This gives a closed circuit. The iron heats surprisingly well on a potential of 110 volts.

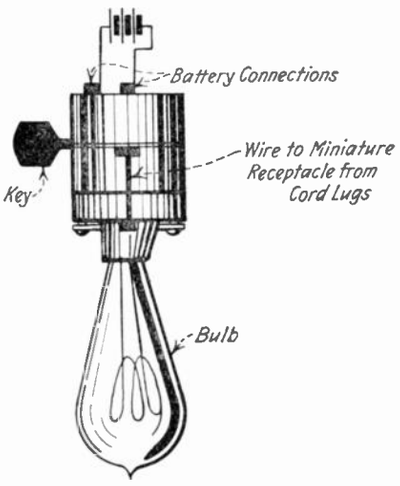
Contributed by Charles Warren Wilman, Jr.

Key Switch For Miniature Lights

MANY times a small bulb and a couple of dry cells are used to light an attic or small closet, but the switch can not always be placed near the bulb and more wire is used than necessary. Pendant sockets with switch for miniature bulbs are sometimes hard to secure, but this difficulty may be overcome as follows:

An old key socket of the 110 volt variety has all the unnecessary parts taken off and the brass threaded portion removed. To

(*Continued on page 237*)

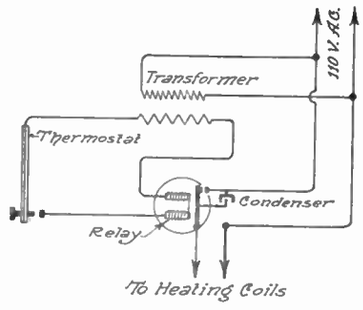


How to adapt a regular lamp socket to a miniature lamp, so that the original snap key will turn he new lamp on and off.

Improved Electric Incubator

IN practically all electric incubators, the heat is regulated by a thermostat which automatically cuts off the current when the heat becomes too great.

A serious handicap is the arc formed between the contact points, despite the fact that a large capacity condenser is shunted across them. This arcing is practically constant and after having known a friend to lose an entire hatch through failure of the contact points to separate properly, I evolved



A simple connection operated by a thermostatic bar to regulate the temperature at .

the following plan, using an old telegraph relay and a bell transformer.

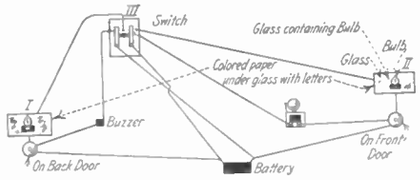
Not only does this method eliminate arcing entirely, but the apparatus regulates much better and operates with less electricity.

The condenser C is made of about ½ pound tinfoil between heavy waxed paper. The diagram is self-explanatory.

Contributed by L. C. Denio.

Hall Door Bell and Signal Connections.

THE approved idea for wiring hall doors is to have some device to indicate that no one is in the house; at least such a system is useful for smaller houses, where there is not always someone at hand to answer the bell. The illustration shows a connection, by which, in one position of the main switch, a buzzer is in circuit with the push button for the back door and a bell is in circuit for the front door. All circuits are operated from the one battery. As the switch is shown in the diagram, the buzzer and bell being in circuit, the bell will ring for an applicant at the front door and a buzzer will sound for an applicant at the back door. If the house is to be empty, the last person to leave it pushes the switch over to the other two connections. This throws out the circuits for bell and buzzer and brings into circuit two electric light bulbs which are placed back of translucent signs, with the word "Out" upon them. One of these signs is at the front door and one is at the back door. Now, if the buzzer is pressed at the front door, the bell will not ring, but the lamp behind its sign will be



Connections with thermostat and condenser for regulating the heating coils in an incubator. There is a condenser to obviate the destructive sparking at the make-and-break contacts.

lighted and the word "Out" will be shown for the enlightenment of the visitor. At the back door the same arrangement is provided, and with the switch in the position last stated, if the button at the back door is pushed in, the word "Out" will be displayed upon its screen. Only the one lamp is lighted by pushing either button.

Contributed by Leonard Rexin.

Magnetic Rectifier

By Raymond Roof

IN these days of high vacuum tubes, both transmitting and receiving, a high voltage B battery is essential to satisfactory and efficient results. This voltage can, of course, be made up of standard block B batteries, but the number necessary to attain a voltage of 200 or more for transmitting, represents an outlay of money that few of us care to contemplate. A motor-generator can be used, in fact is necessary for high powers, but to the average user, its cost is prohibitive. There remains, then, the home-made primary battery or the storage battery. The storage battery will generally be found more reliable and satisfactory providing that a convenient means of charging it can be found.

It was to fill this need that the writer designed the following magnetic rectifier. This differs from the ordinary rectifier in that no step-down transformer is necessary for its operation, and it rectifies but one half of the cycle. The description and operation is as follows:

A spark coil is connected directly across the line. The core of the coil is made up of soft iron wires to which is fastened a thin piece of tin projecting in line with the axis of the core. A permanent maget's poles are placed over the end of this as shown. A piece of clock spring is riveted to the top, bent as shown, and a piece of copper is riveted on the end of the spring. This is one contact. The other is a block of carbon, which is made adjustable.

Referring to the left end of the cut, a double connection is seen. One of the connections goes to the end of the core; the other goes to the terminal of the coil.

The current passes through the coil magnetizing the tin strip B so that end F is North for one half of the cycle and South for the other. When it is North, then by the laws of magnetism, N repels F and S attracts it. (See diagram). This separates the contacts and no current flows through the core, the path of the direct current. When, however, F is South, N attracts F and S repels it. The contacts are brought together and current flows in the direct current circuit. Thus it will be seen that a pulsating direct current can be drawn from the apparatus.

The D. C. voltage will be very nearly 110 during the half cycle that current is flowing. The storage battery can therefore be made in about 80 volt sections and connected in parallel for charging, and then changed to series for use. The charging rate is regulated by a lamp bank, thus making the apparatus extremely flexible.

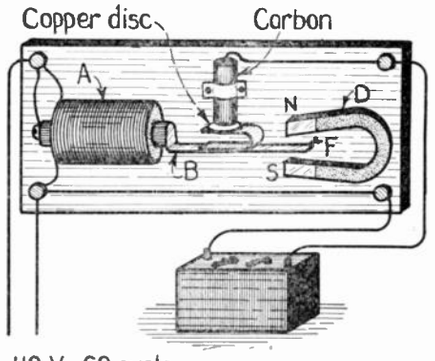
It might be thought that the spark coil secondary, being directly connected to the line, would draw an abnormal amount of current. However, the resistance is so extremely high that no appreciable amount of current flows. While it rectifies but one-half of the cycle, there is no current flowing during the other half, so its efficiency will be nearly the same as the ordinary rectifier employing a step-down transformer. The efficiency is highest when the D. C. voltage is nearly 110. On lower voltages the lamp bank takes the major portion of the power.

The tin strip should be of such length that its rate of vibration is the same as the alternations of the current. This can be found by experiment; cutting off small pieces until the widest swing is obtained, or a small weight can be placed on it and made adjustable, this being moved until the widest swing is obtained when the current is turned through the coil.

No dimensions can be given because of the variation in size of the different parts. However, for currents of two or three amperes, the contacts should be in the neighborhood of one-half an inch square, and should be adjusted so that they make a full area contact, and deliver the maximum amount of current with minimum sparking.

The polarity of the apparatus can best be determined by experiment.

If the spark coil secondary shows any tendency to heat, another should be connected in series with it, using only one, however, to polarize the tin strip. The strip should



A home-made magnetic rectifier with copper and carbon contact operated by a coil and a permanent magnet.

not be heavy, as the magnetic flux is not very strong.

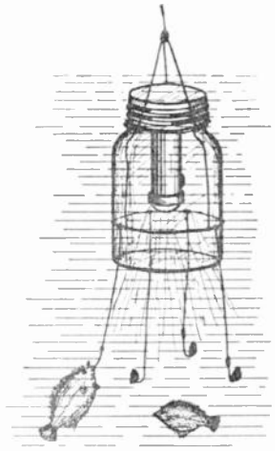
The storage battery can best be made from test tubes using plain lead plates, formed by repeated charges and discharges. The writer recently ran across a formula in a dependable book on storage batteries, which will form the plates much more rapidly. It is as follows:

One part sodium nitrate; two parts sulphuric acid; ten parts distilled water.

This solution should be placed in the tubes and the plates inserted. The forming process will take one hundred hours. The plates should then be removed and thoroughly washed in clean water, after which a 20% sulphuric acid solution in water is put in the tubes and the charging current turned on. The rate should not be over ¼ ampere for such small cells.

Mazda Fish Catcher

We have previously illustrated a method of catching angle worms by electricity. When you have caught your worms by electricity, you can continue the good work and use an electric light to show the fish where the worms are. It is known that animals



An electrically lighted fixture. The light is maintained by an ordinary flashlight battery, only you must be sure to bait your hooks.

are variously affected by light; eels are supposed to be attracted by light, held above the surface of the water; but here, where a flashlight is lowered into the depths of the water, it is fair to assume that the fishes will be still more easily enticed.

Why light attracts animated beings is an unsolved problem; birds and insects are especially drawn to a flame.

Short-Circuits

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

Beneath this soil lies
Old Artemus McNeil.
By accident he hooked
An Electric Eel.
—John J. Pascik.

Here rests in peace
Jimmy McGill.
His dentist used
A "shorted" drill.
—G. Lloga

This stone is in honor
Of Jim McGuire.
Who tried to drag his pal
From a live wire.
—Lionel Hunt.

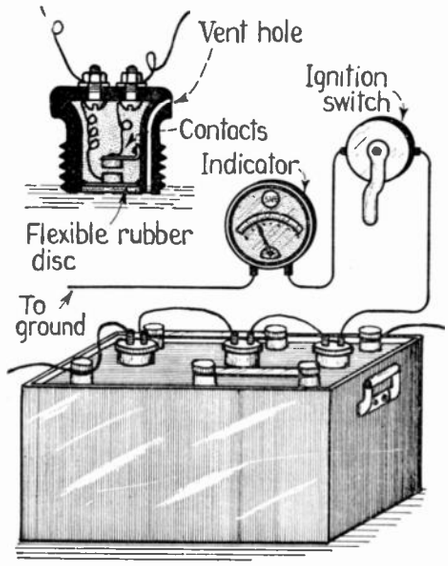
Lies resting here
One Jeremiah Fox.
He turned the hose
On the live fuse box.
—Samuel Richman.

This sod now covers
Poor Annabelle Boker.
She opened the switch
With an iron poker.
—Ewart Boring.

This monument's for
Nathaniel McSlater.
He tried to fix the motor
With hands on radiator.
—Thomas J. Totten

An Electrolyte Level Indicator

THERE are perhaps more storage batteries ruined through low electrolyte than from any other cause. As almost everyone knows, the electric storage battery contains two or more lead plates supposed to be wholly immersed in a solution of sulphuric acid, called the electrolyte. When the battery is charging, and has reached a high voltage, this electrolyte "boils" or "gases," owing to the evolution of hydrogen, and the water slowly evaporates until finally it gets below the top of the plates. The evolution of hydrogen also involves the exhaustion of the water. Then, as charging continues, only the lower portion which is covered by electrolyte becomes charged, while the uncovered portion stays uncharged.



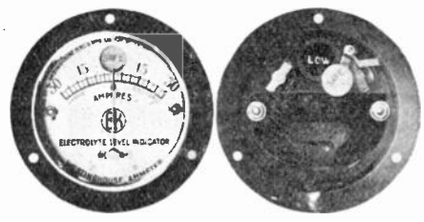
Make and Break contact operated by the level of the solution in a storage battery.

Now if water or electrolyte is added, the top and bottom parts of the plate are at different potentials, thus resulting in a heavy "local" current which discharges the active plate at a high rate and eventually ruins the battery.

The remedy is to add pure, distilled, (never simply boiled) water before the electrolyte gets below the top of the plates. In the past, this has meant a daily inspection of each cell by removing the vent plug. Now, however, the automobile driver can remain in the seat, and a casual glance at this ammeter will indicate whether the electroyte is getting low. A front view of this ingenious arrangement is shown and an interior view of the plug is also given. It will be noted that in addition to the standard ammeter movement, there is a little shutter which may move up and cover the hole in the dial. This shutter is actuated by a small electro-magnet, the end of which is painted red and marked "LOW." The little shutter is painted white and is marked "SAFE." When the electromagnet is energized as will be described later, the shutter is attracted so that it covers the red end of the magnet and the word "SAFE," appears. When this magnet is de-energized the shutter falls down and the word "LOW" appears in the dial hole, on the magnet pole.

The novelty lies in the method used to energize and de-energize the electromagnet. In each vent plug there is a hollow space as shown in the cross section, the lower end of which is closed with a piece of thin flexible rubber, which presses against the lower arm of a little platinum contact. This lower contact arm is connected to a binding post by means of a flexible wire. The other contact is stationary and is connected to the other binding posts. The vent plugs are connected in series as shown and run through the switch to the indicator.

It will be readily apparent that when the battery is full of electrolyte, the flexible rubber is pressed upwards and the contacts are closed. Then when the ignition switch is closed, the little electro-magnet is energized from the battery and the shutter jumps up, thus showing "SAFE."



Battery Signal to tell when more distilled water is needed in the battery.

Now should the electrolyte in any one of the cells fall below a predetermined level, the contacts open and the shutter falls, thus showing "LOW."

It is safe to say that this simple device will add several years to the life of many thousands of batteries.

Measuring High Altitude Air Currents

(*Continued from page 214*)

each balloon. Fortunately, the propagation of sound in the upper air is much superior to what it is on the surface of the ground. Keeping the charges down to ¼ pound, excellent microphonic registry, quite satisfactory in all respects, will be obtained when the shells explode at a distance of 12 miles from the the receiving apparatus. When this experiment was tried, the wind blew against the direction of propagation of the sound.

The microphonic stations are distributed over the region, so as to be all in the same horizontal plane, and on two rectangular axes—one station being at the point of intersection of the two axes. This arrangement makes the calculation of the location of the points where the explosions occur, much simpler and quicker than with any other disposition. The microphonic stations are connected by electric circuits to a central station, where registering galvanometers give their indications on a single sheet of smoked paper. The clock-stylus keeps on this same sheet of paper a record of the time; the speed of the motion of the paper is such that .005 second can easily be read on it. Each interval of time represents a motion of about 6 feet of the sound waves. This degree of precision is quite enough.

It is readily shown that to determine the point of explosion in space, it is enough to know the instant, when the noise of the explosion reaches four of the microphones; but in practice it is not enough to use only four microphones. If one of them works badly by any accident, the problem will become indeterminate. If any observer commits an error in reading, then the four numbers which he calls out will determine a point. But this point eventually will not be on the trajectory of the balloon. It is evident that the number of microphones should be increased so as to control all possible errors and guard against defects in their registrations. Generally seven are used, so for each calculation there are three verifications, under the most favorable circumstances.

On the other hand, it is necessary to make corrections the instant when the sound reaches the microphones. The wind is the cause of this. The sound waves propagate themselves in concentric spheres, with the point of the explosion as the center. This starting point is determined with regard to the air, but this air is in motion and carries along with it the wave and the sound of explosion, and with the sound wave reaching the microphone they seem to come from a point through which the wind has carried their sound.

Now, what is to be determined is not this point, but the point where the explosion really and actually took place in space above the earth.

The correction which has to be made seems difficult to calculate, because it assumes that the movement of the air is known, and this movement is exactly the thing which the observer is trying to measure. It shows in an interesting way that it is not necessary for calculating the correction to know the wind at the altitude of the explosion. It is even possible to make this calculation a **priori**, before the explosion has been registered.

Outside the correction for the wind, we must remember that sound does not radiate in rigorously straight lines. The slight curvature has two causes, inequality of speed of the wind at different latitudes, and variations in the temperature of the air. A general allowance for all these points, and practically sufficient, is made by assuming an approximate variation of temperature. Within the three miles elevation this variation differs very little from a progressive fall of temperature, a degree for every 600 feet.

Experience shows that the principles which we have described are very satisfactory; the lines which determine by their intersection the horizontal projection of the point of explosion, ought, of course, to meet in a single point, which is the point sought for. In fact, they really determine a small area which the topographers call a **chapeau** (hat).

Now, when all corrections are made, this area determines the point of explosion with an approximation of 30 feet, which corresponds in normal conditions to an error of less than a foot in the speed of the wind, and less than 2 degrees in its direction. These quantities are far inferior to the accidental variation to which wind is subjected in every instance, referred to as its mean velocity.

During the war the increased use of high, trajectories and constantly of great ranges made it necessary for artillerists to get from the meteorologists the speed of the wind at elevations regularly reaching 2½ miles.

These figures could be obtained definitely by the method described above. The method succeeded even with wind blowing at the rate of over 100 miles an hour, and in some cases the wind was measured at an altitude of about 6 miles.

It seems extremely probable that the method here briefly described will put in the hands of meterologists a reliable method of exploring aerial currents up to an altitude of 6 miles. This altitude, as our readers know, is a critical level in the structure of the atmosphere, for here is the area of separation of the troposphere and stratosphere. The letter is the part of the atmosphere which is affected by contact with the surface of the earth. It is subject to vertical movements, and the clouds float within its limits. The troposphere on the contrary, is exempt from vertical movements, and is cloudless. This method of sounding by sound, improved in details, will permit the compete exploration of the region containing all the clouds, which directly influences the weather.

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.

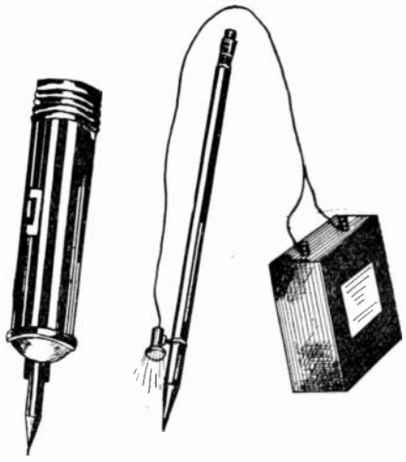
Kindly oblige us by making your letter as short as possible.

Pencil Light

(60) (Edward Holmes, Wilmington, Del., asks:

Q. 1—I have attached a small pencil rigidly to the end of a flash-light, which enables me to write in the dark. Do you think this device has any practical value?

A. 1—This question should have been sent to SCIENCE AND INVENTION Patent Advice Department, which department in that publication is used expressly for answering such queries. The idea is very old and was published in 1914 in a magazine then called MODERN ELECTRICS. It is not as valuable as those small clips which may be attached to pen and pencil and which contain a tiny flash-light bulb and communicate with a battery placed in the vest pocket, the wires of which may lead down the arm for continuous service or be brought out when necessary for temporary use.



An electrically lighted pencil, such as anyone can arrange for their own use.

Powdered Carbon and Rods

(61) Mr. Chas. Van Dunker asks:

Q. 1—Where can I secure powdered carbon?

A. 1—Send stamped self-addressed envelope for this information.

Q. 2—How is powdered carbon moulded?

A. 2—The adhesive for moulding carbons into shape is some carbonaceous cementing material, such as molasses, sugar solution, pitch or tar; in some instances wax is used as the adhesive.

The rods are then moulded into shape and baked for a long time at a red heat, all air being excluded. No other ingredients are used in making carbons. Sometimes the carbon is subjected also to hydraulic pressure.

In making electric light carbons, it is fair to assume that there are certain details of manipulation which are not revealed, in other words, which are trade secrets. One great point is in the case of electric light carbons to get them of uniform quality and absolutely straight. Frequently they are made of two materials, a softer one in the center, when they are called cored carbons. Battery carbons in various shapes can readily be made on these lines; in baking them they are enclosed in an iron case and bedded in powdered charcoal so as to prevent oxidization or burning. We will be glad to give you more information if you wish it.

Electricity

(62) George B. Saeliville, Halifax, N. S. asks:

Q. 1. What is the latest thing that has been discovered in regard to what electricity is?

A. 1. Little can be definitely stated in answer to this question. The investigations in radio activity are steps in the right direction. Bnt it is a curious fact that no good definition of the word electricity has been as yet evolved.

Dielectric Constants of Rubber

(63) J. D. Strong, Riverdale, Kansas, asks:

Q. 1—What is the dielectric constant of rubber?

A. 1—The dielectric constant of India Rubber is from 2.22 to 2.497; hard rubber 2.05 to 3.15. Air at ordinary pressure is used as a standard, its inductivity value being 1.000.

Arc Lamp Resistance

(64) John A. Smith, Hopewell, Va., asks:

Q. 1—How can I make a resistance for starting a heavy electric arc?

A. 1—We would advise that you use a choke coil composed of six layers of No. 14 double cotton covered wire wound on an iron core eleven inches long and one and one-half inches in diamenter, with a tap taken off in each layer as a resistance for striking the arc. If you are using direct current a water rheostat which may be shorted after the arc is running, may be employed.

Electric Lights On Trains

(65) Henry F. Snyder, Englewood, N. J. asks:

Q. 1—How are trains lighted? I have noticed that electric lights are used on railroads, but often wondered how steam roads obtained the energy for these lights.

A. 1. The trains when running drive a dynamo which in turn supplies enough energy to feed the lights and also to charge storage batteries. Recently, in order to eliminate the storage battery a turbine drive which makes use of waste steam has been introduced. This is on top of the engine, just back of the smoke stack. At times when the train is stationary, a small by-pass to supply steam is used which continues to actuate the turbine generator.

Synchronous Lamp Glow

(66). Geo. Woest, of Lodi, Calif., says:

Q. 1. I would like to make a lamp glow in synchronism with voice vibrations. How can this be done?

A. 1. It takes a lamp some time before it heats up, and also some time before it cools, and therefore, the filament could hardly be made to glow in synchronism with the incoming voice sounds of high frequency.

Q. 2. Can I patent a selemium cell and amplifier for talking moving pictures?

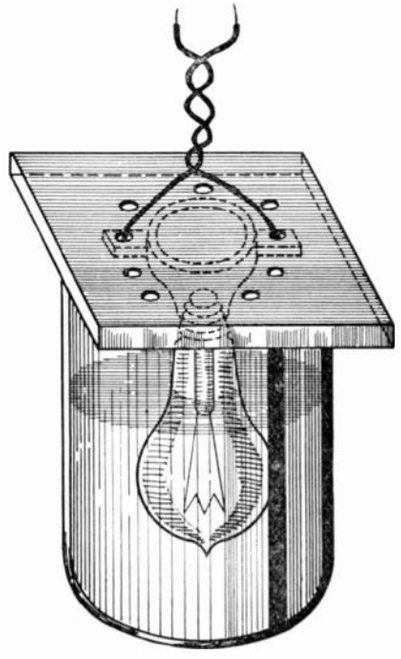
A. The selenium cell and amplifier for receiving is a very old feature, and has likewise proved to be operative in one type of talking motion picture, patented twenty years ago. Yet your device may be patentable.

Electric Humidor

(67) Barnard Sack, Alberquerque, N. M., asks:

Q. 1 In a cigar store where I am employed we have trouble in keeping our cigars moist in that the humidors are not very well arranged. Perhaps some electric device would answer the purpose.

A. 1 The simplest device which you could use is shown above. It consists essentially of an incandescent lamp hanging downward



An electrically operated humidor for keeping cigars and tobacco at a proper degree of moisture.

in a jar of water. The cover of the jar is perforated. Motor driven devices could likewise be constructed but we believe these would cause considerable vibration in the cigar case.

Spark Intensifiers

(68) Edwin Metler, Cleveland, Ohio, asks:

Q. 1—What forms of spark-amplifiers are used for automobile ignition systems?

A. 1—There are several attachments to spark plugs which claim to improve the quality of a spark and also the heat it produces. The first is an ordinary transformer, the second is a condenser, and the third is an auxiliary gap. Tests prove each of these to be very efficient, but in the long run we believe that the regular ignition rendered by the ordinary coil or magneto is as serviceable as any of the newer and alleged improved forms.

Sometimes a simple break in the high tension line is used, but it is very doubtful if any good is done to the ignition by such devices. They do however show a spark, so that a certain amount of comfort may be felt by the trusting motorist.

Light Switch Opener

(69) Robert Lamia, Philadelphia, Pa., asks:

Q. 1 On leaving the store at night, I find it advisable to have the lights burning until one or two in the morning as an advertising feature. I have had great difficulty in turning off the lights by an ordinary alarm clock, which is not powerful enough to open the heavy main switch at all times. When it does, there is terrific arcing at the contacts. Will you kindly give me the details for a device which will serve my purpose.

A. 1 There are no details necessary. If you will purchase a rat trap from your local hardware store and arrange it as shown in the illustration elsewhere, you will find that it will answer your purpose exceptionally well. A ring is placed around the handle of the switch so that it will fall off when the circuit is opened or may be removed when desired.

You will find elsewhere in this issue a description and diagram of such a switch.

Reverse Switch

(70) J. B. Hurr, Cincinnati, Ohio, asks:

Q. 1 How can I make a simple reverse switch for a motor?

A. 1 We would refer you to the last issue of this magazine.

Q. 2 I would like to make a bed warmer for an invalid to be placed at his feet. How can this be simply constructed?

A. 2 The easiest method is to purchase one of the old style carbon lamps and mount this in a fruit jar or metal pan. A thin layer of absestos could be placed around the jar or asbestos cloth wrapped around it, and if desired two openings may be cut in the top to permit an access of air. It is advisable to have a small opening in the fruit jar top at all times so that the expansion of the air in the bottle would not make it dangerous.

We have described in our January issue exactly such a lamp heating pad as you ask about. The non-conducting quality of bedclothes as far as heat is concerned is such that a 2 candle power lamp, which of course consumes a small amount of current, is quite sufficient for the purpose of warming the bed as for an invalid.

Static Electricity

(71) Mr. James P. Woodward, Shreveport, La., asks:

Q. 1—Please give several methods of generating static electricity simply.

A. 1—Static electricty can be generated by the following methods; but in very small quantity.

1—Comb the hair with a rubber comb. On a cold night or day considerable electric excitation will be produced.

2—Stroke the back of a cat on a cold evening. In the dark you will notice sparks.

3—Rub your fountain pen with a piece of wool.

4—Rub a piece of sealing wax with a piece of silk.

5—Rub a glass rod with a piece of silk.

6—Stroke a piece of paper, briskly, while it is on your lap; you will notice that it will then stick to the wall-papered wall.

For generating larger amounts of static electricity, a Wimshurst machine is advisable. Of course, all the above methods are in the line of amusement. Everybody has rubbed his sealing wax on his coat or the amber mouth-piece of his pipe and picked up little scraps of paper with it, but all this is for entertainment rather than practicability. Quite frequently, sparks can be drawn from the person by walking, when electric excitation is produced by rubbing the soles of the shoes against the carpet or mats in a steam heated house when the air is dry. It is possible to light gas with the finger-tips in this way. You can produce static electricity in any amount by a Wimshurst electric machine. We have described in our November issue a simple Wimshurst machine in which phonograph records were used for the plates.

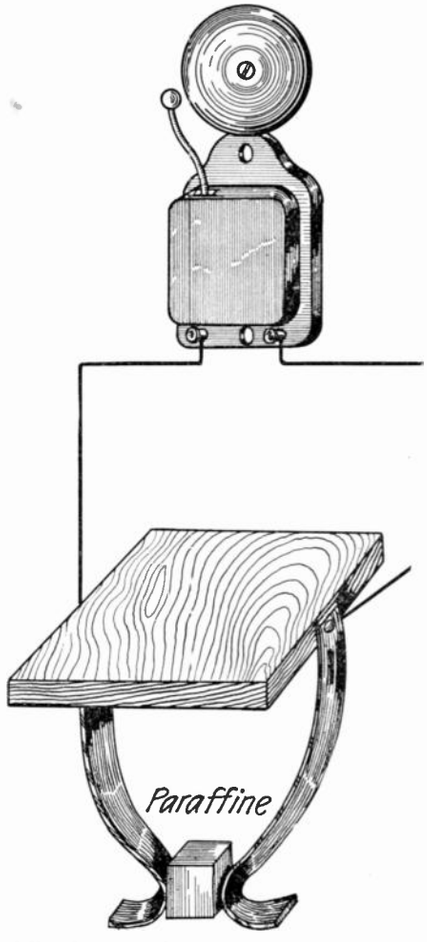
Then there is also the electrophorus, which you will find described in any text book on electricity.

Fire Alarm

(72) J. Burgess, New Orleans, La., asks:

Q. 1. How can I make a simple fire alarm which will register as soon as the temperature in the room rises to a little above the melting point of butter?

A. 1. By constructing a fire alarm as shown



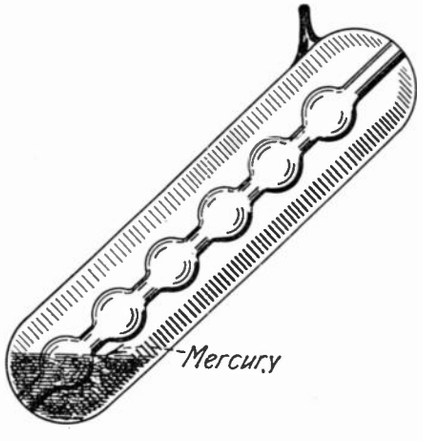
A fire alarm switch, depending for its operation on the melting of paraffin by the incipient heat of the flames.

in the illustration wherein two spring bar clips are separated by a small plug of paraffin, your problem is solved.

Astral Tube

(73) William Howard, Sacramento, Cal., asks:

Q. 1.—Does an astral tube have anything



An astral tube, producing a very pretty Geissler tube effect, when shaken.

to do with astral bodies or does it indicate their presence?

A. 1—No, neither.

Q. 2. What is this?

A. 2.—An astral tube is a simple long glass tube in which there is another bulbous portion. This makes the tube look very much like a Geissler tube. Between the inner and outer parts of this tube is a small quantity of mercury. By shaking the tube vigorously it glows in the dark.

6 volts to 110 Volts

(74) E. D. McGurry, Ardmoro, Okla., asks:

Q. 1—I want to make a transformer which will transform 6 volts 20 amperes direct current to 110 volts, to give me sufficient power to light 15-110 volt lamps.

A. 1—Twenty amperes at six volts are 120 watts. It will therefore be impossible for you to obtain, even under the most efficient methods, much more than one ampere at 110 volts from the secondary of a transformer; this is assuming that there are no losses in the transformer.

The efficiency of the best designed transformer is about 94%. It is necessary also to make allowance for an alternator or vibrator in order to produce the alternating current supply for your transformer.

Here again losses will be found. Eventually you will discover that a maximum output from the secondary of the transformer will be about .5 ampere at 110 volts pressure. Thus, under no conditions could you get sufficient current from such a source to light 15-110 volt standard lamps which may, of course, range in amperage consumption anywhere from one quarter to one ampere. This arrangment has simplicity to recommend it but is very inefficient and will give an irregular current.

You are starting with 6 volts and 20 amperes, which give you 120 watts. A first class lamp uses 1 watt to a candle power, so that you can figure that you have power enough to maintain 120 candle power, possibly a little more with specially good lamps The ½ watt to the candle power, which is so favorite a term in England, is quite too high to be admitted as a criterion of general practice. The transformer for you to use is a rotary one, which can deliver direct or alternating current according to its construction, and can step the voltage up or down according to the way it is wound. You are working on so small a scale that if you get the 100 watts out of your converter you will do well. If these watts are delivered at 110 watts potential, you will have about 9/10 of an ampere. If this 9/10 ampere is delivered to fifteen lamps in parallel, each lamp will get 6/100 of an ampere, which would give you about four or five candles probably to the lamp, because high efficiency would hardly be expected from such small lamps. You had better be more generous in your original electric power, or be content with fewer lamps.

Permanent Magnet Inquiries

(75) H. W. Miller, Bloomington, Ill., says:

I have heated a steel U shaped magnet and bent it into a different form. I find I cannot remagnetize it.

Q. 1—How do you account for it?

A. 1.—When heating a magnet of either the "U" shape or bar type to a red heat or a white heat, you destroy immediately the molecular arrangement within the iron, and therefore the iron loses its magnetism.

Q. 2—How can I remagnetize it?

A. 2—One way to remagnetize it is to temper it glass hard at first, then to place one of its poles in contact with the north pole of a powerful electro-magnet and the other pole in contact with the south pole of a similar magnet, and then to make and break the current intermittently for a few minutes, or else to tap the magnet with a piece of brass while the current is turned on. We would advise that you take this steel piece to one of of the firms who specialize in remagnetising the magnets of generators and let them magnetize it.

Another way of magnetizing a steel bar is to coil a wire around it and pass a good strong current through the wire, tapping the steel if you wish, as this is supposed to facilitate taking on polarity. Sometimes a short

Continued on Page 236

"RASCO HAS IT!"

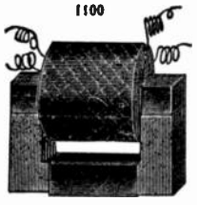
THE Radio Specialty Co.--*"Rasco"* for short—is probably the most unique supply house in the United States, if not in the world to-day. This company makes a specialty of small orders, no order being too small to get immediate and prompt attention for the simple reason that most of our orders are small.

The reputation of this house was built upon service. Ask any of your acquaintances what they think of *Rasco* goods, *Rasco* service, *Rasco* promptness! Thousands of unsolicited testimonials on file to prove that we serve the public best!

Be sure to get our great catalogue, containing several hundred different parts, which is illustrated below.

ORDER DIRECT FROM THIS PAGE. ALL GOODS SENT PREPAID IN 24 HOURS

1100



"RASCO" AUDIO FREQUENCY TRANSFORMER

We have compared many of the present transformers on the market but have finally decided upon a type that is the most efficient one we have seen so far. The best amplifying transformer is that in which the impedance of its primary is equal to or exceeds the impedance of the plate-to-filament circuit of the tube in which it is connected.

We guarantee this transformer to equal any one on the market.

No. 1100 "Rasco" Audio Frequency Transformer (not assembled) each prepaid.....$2.65

ANTENNA CONNECTOR

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, ⅝" thick.

No. 999, Connector, each..$0.35

999

PANEL KNOBS

6241

838

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

No. 6241, Knob, each.....$0.06

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

RASCO POSTS

202 201

030 029

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.

650 651

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

BRASS NICKEL POSTS

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

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

RASCO SWITCH POINTS

75 1 2 3 4 5 6 7 77 76

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

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, ⅛" 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 ⅛" dia. x 3/16" thick, ea., $0.03½, doz., 40c.

THE RASCO BABY DETECTOR

1898

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 flutted hard rubber knob with its sliding rod member.

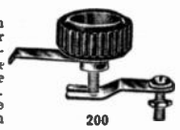
The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cap unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary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

323

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.

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

343

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. 3⅝".

No. 343 Variocoupler Rotor, each $0.75

"RASCO" NAME PLATES

827

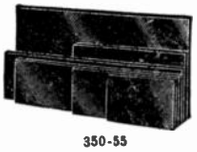
839

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"	$0.0f
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 "Parallel"	$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"

BAKELITE PANELS



350-55

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

1921

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.

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

KNOBS

199

4451

These knobs are favorites with all experimenters The size of both is: dia. 1½", height ⅝". No. 4453 comes with 8/32 and 10/32 bushing.

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

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

NAVY KEY KNOB

748

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.

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

THREADED BRASS ROD

8032

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 audio-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

The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

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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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98 S PARK PLACE, NEW YORK CITY

Factories Brooklyn, N Y.—Elkridge, Md.

Farm Light and Power Plant.

(*Continued from Page 200*)

varies for different fuels so a standardization has to be determined for each fuel. The graduations which the stem on the float in the engine fuel tank indicate, correspond in their numbers to those on the hydrometer of the battery. If the battery is weak and reads perhaps eight or nine, fuel is added to the fuel tank until the same reading is shown by the fuel gauge. Suppose that the hydrometer reads eight; the person managing the engine simply pours in oil until the fuel gauge also reads eight; this means that sufficient fuel has been added to keep the engine going hours enough to charge the battery until the float rises so as to read 1 or zero as the case may be — at any rate to fully charge the battery. Nothing could be simpler or more practical. This is one of the cases where a machine can be started and forgotten about.

Model Lighthouse

(*Continued from Page 207*)

the sea. Waves striking such a base have the best chance of having their force broken without destroying the structure.

A picturesque effect was produced by embedding bits of rock in the putty.

There is a switch outside the box to turn the current on and off, and the connections were so arranged as to be closed through the works of the clock. As one of the wheels of the clock revolved, each time a spoke upon it touched a certain wire, the circuit was closed, and the lights flashed; as the wire left the spoke the light went out.

The lighthouse constructed by our contributor flashed every fifteen seconds, with a duration of light of five seconds. An 8 volt automobile headlight bulb was used and a piece of lamp chimney, 2 inches long and 2 inches in diameter, was employed to represent the glass of the lighthouse. As a realistic touch, a railing was placed around the summit of the structure, made up with some pins and wire.

Contributed by F. Barker.

Basement Lighting Switch

(*Continued from Page 220*)

Then when you return, your weight upon the upper tread pushes down the iron rod and opens the lighting switch, thus extinguishing the light.

The piece of iron that is secured horizontally to the lower tread is prolonged towards the rear, and if necessary is counter-weighted, so as to almost equalize the weight of the lower tread, yet leaving a slight excess there. By this counterweighting, whichever tread is raised will stay raised.

The convenience of this automatic lighting arrangement will be greatly appreciated.

Contributed by E. Hendricks, Jr.

Controlling Furnace Fire Electrically

(*Continued from Page 201*)

when the slide is in place and the fan placed in position in the box, the fan blades revolves in this piece of pipe.

(*Cont. on Page 236*)

How and Why

(*Continued from Page 232*)

while a current is passing through it. This can be repeated as often as it seems to increase the magnetization. The size of coil, number of turns and size of wire are very simply calculated by the voltage of your circuit, and consultation of a table of carrying capacity of wires. The wire must be long enough to give adequate resistance to keep everything within safe limits, and must be of low enough resistance, or in other words short enough to take all the current it can without getting too hot.

Simply putting the one pole of the magnet against the pole of an active dynamo and then the other pole against the other pole of the dynamo, taking care of course to use north and south poles if it is a multi-polar dynamo, may give you very satisfactory magnetzation.

Controlling Furnace Fire Electrically

(*Continued from Page 234*)

With the slide in place, no air can enter the hot air part of the furnace except through this hole. The rotating fan forces the air through rapidly and the slide prevents the air eddying back. The air can be taken from the cellar, the outside, or if desired from the hall, by having different pipe connections.

As soon as I start the fan in this position, the air rushes up around the fire pot of the furnace, it is heated and enters the rooms above. With a good fire going, one can actually see the thermometer rising after the fan has been set in motion.

Storage Batteries Locomotives in Gaseous Mines.

(*Continued from Page 215*)

speedily or the breaker closed without lessening the effectiveness of the permissible features of the locomotive; the headlight is so protected as to guarantee freedom of the bulb from danger of mechanical injury and the same headlight circuit must be equipped with switch and fuses, sandwiched between the battery and controller It is prescribed that there shall be a double-pole main switch and fuses equal to the task of preventing overheating of the conductors carrying the power involved, the units being installed together or separately in permissible compartments; wiring not incorporated in locked or permissible compartments shall be in metal conduits. The term "permissible," as here frequently employed, indicates approval by the Bureau of Mines for use in gaseous mines, and is responsible for the designation of the first approved outfit as "Whitcomb Permissible Locomotive."

The officials of the Bureau of Mines voice the belief that storage-battery locomotives conforming to specifications outlined by the Government will largely eliminate the hazards of the trolley locomotive and of the old types of storage-battery locomotive. Manufacturers desirous of submitting their storage-battery locomotive to Government tests for possible use in gas-charged areas of fuel beds must apply to the Director of the Bureau of Mines, Washington, D. C.,

Inspection and seventy-five specific tests are specified for each complete outfit, the work being conducted at the Pittsburgh Station.

Contributed by S. W. Winters.

Electric Floor Cleaner

(*Continued from page 209*)

brush is given a high speed of rotation. Linoleum, it is stated, can be polished with particularly good results. Waxing of floors can also be accomplished with efficiency, and we are told that by the superior action of the machine, there is a saving of from ½ to ¾ of the amount of wax which would ordinarily be used by other methods of application. Of course, this is not so much a matter of economy, as of good work, for nothing is more annoying than a floor over which too thick a coating of wax has been distributed. Generally speaking, the less wax used the better is the work, if the proper finish is obtained.

Electric Fireless Cooker

(*Continued from Page 202*)

course, falls all the time, so there is but little danger of over-cooking. It is said that after two hours in the oven, the food will come out in good condition.

A peculiar thing about vegetables is that almost all of them, even potatoes, and sweet corn, which certainly seem dry, can be cooked without adding any water. The natural juices of the vegetables supply all the moisture required. So you do not boil your potatoes, spinach or corn, but simply cook the members of the vegetables kingdom.

Current Reversers

(*Continued from page 227*)

A third form is shown in Fig. 3. The battery is connected to binding posts A and B. The copper strips M and N are joined by a piece of wood with handle E, and can be moved to right or left to reverse the current. F, G. and H can be made of large, brass headed upholstery tacks. This form can also be used as a switch to break the circuit.

Contributed by F. C. Hendershot.

Key Switch for Miniature Lights

(*Continued from page 227*)

the two screws shown, the line wires from the battery are led. A miniature receptacle is now fastened to the top (now the bottom) of the switch, it being held in place by two wires led from the lugs on each side of the switch, where the lead wires are ordinarily fastened to the connectors on the miniature receptacle. All openings can be sealed with sealing wax or with insulating compound taken from a discarded dry cell. This type of miniature drop light will find favor at once, for they are turned on or off in the same manner as the lights connected to the regular service mains. I have used such a drop light in an attic for the past two years and it has always given good service and avoids confusion due to unfamiliar switches.

Contributed by George E. Perkins.

OPPORTUNITY AD-LETS

You can place your ad in these columns for only 2c. a word. It will pay you to read and investigate the offerings made from month to month in these columns, by reliable firms, dealers and individuals from all over the country. You are reading them now—others will read yours. Ad-lets for the June issue must reach us not later than May 1st.

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Practical Electrics Company, Inc., 233-236 Fulton Street, New York, N. Y.

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Shoes Wear twice as long when given one application of SHOEWEAR. SHOEWEAR gives a PERMAMENT SHINE and makes shoes wear twice as long Will not hurt the finest shoes. It makes new shoes wear-proof and old shoes new. Cost twenty cents to make enough for a family for one year. AGENTS also are making big money selling SHOEWEAR. Receipt sent for 25c. coin. Lester Fawcett, Eleven North Jackson, Janesville, Wis.

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Master Electricity in shortest time possible. Home study course scientifically taught. My system used by U. S. Government during world war. F. M. Manuel, E. E. South Connellsville, Pa.

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Typewriter wanted. Have the following goods to trade. New auto storage batteries. 1/6 H. P. A. C. Motor (used) Battery chargers Electric supplies. Write me your wants. Howard Hunt, Box 108, Macedonia, O.

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Make your old dry batteries good as new; last twice as long. Formula for most practical method yet discovered sent for 40c. stamp or coin. Morris Thomas, B210-R2 Duluth, Minn.

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Used Correspondence Courses wanted. All schools; all subjects. Courses bought, sold, exchanged. Bulletin 1071 free. Instruction Correspondence Exchange, 1966 Broadway, N. Y.

Wanted—Platinum Magneto Points, old or new-We pay full value, mail or express. Packages returned if our offer is not satisfactory. Highest cash prices paid for old Gold, Silver, Watches, Platinum, Crowns and Bridges, Diamonds, War Bonds and Stamps. United States Smelting Works. (The Old Reliable) Dept. 12, Chicago, Ill.

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Record Time Signals as shown in February E. E.; with Weston Model 30 Galvanometer Relay—$12.50 150 ohm Pony Telegraph Relay $2.25; W. E. Aeroplane Microphones $4.00. Western Instrument Repair, 314 N. Fairfield, Chicago, Ill.

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Choice Minnesota wild land, at sacrifice for cash. P. Fonos, New Richmond, Wis.

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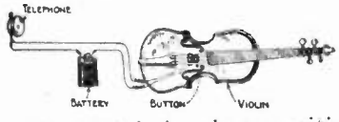
You can install an outfit in your home and hear the conversation being held all over the house. You can connect up different rooms of a hotel. *This outfit was used by secret service operatives during the War. It is being used on the stage.*

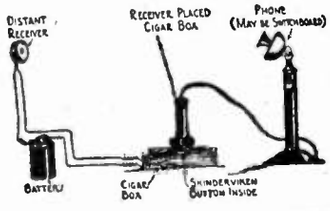
So much for its commercial adaptations! *You* can procure apparatus of the same type.


Actual size.



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.

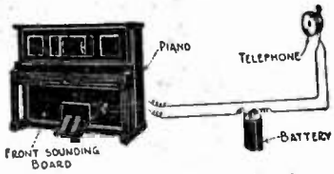
The only instruments needed to complete a detectophone outfit, in addition to a Skinderviken Transmitter Button are a receiver, battery, and, if desired, an induction coil.



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 effieient 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.



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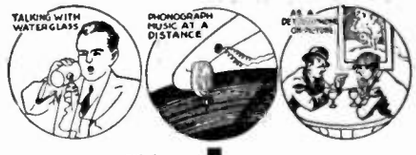
—o—



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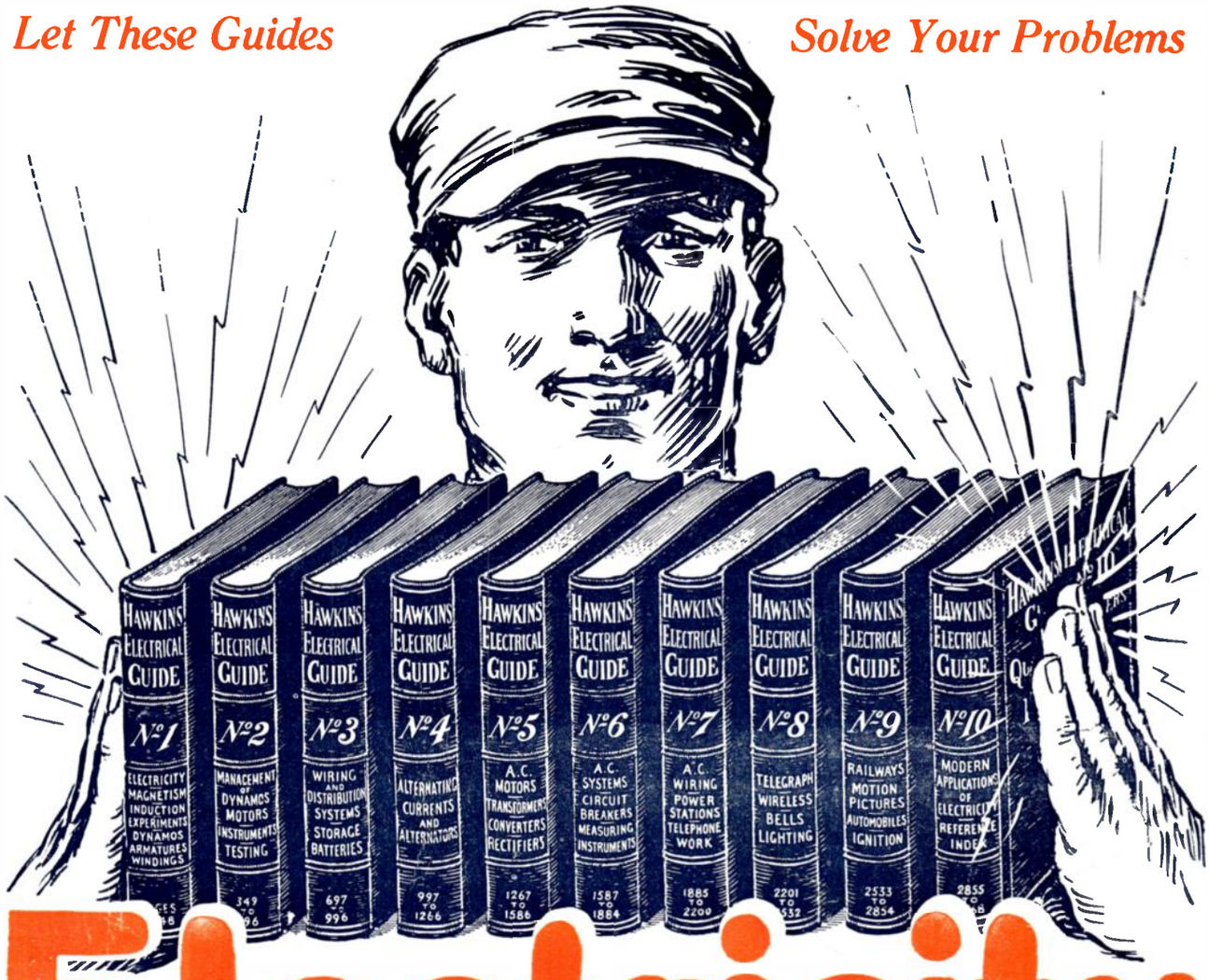

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