Practical Electrics

20 Cents

Over 100 Illustrations

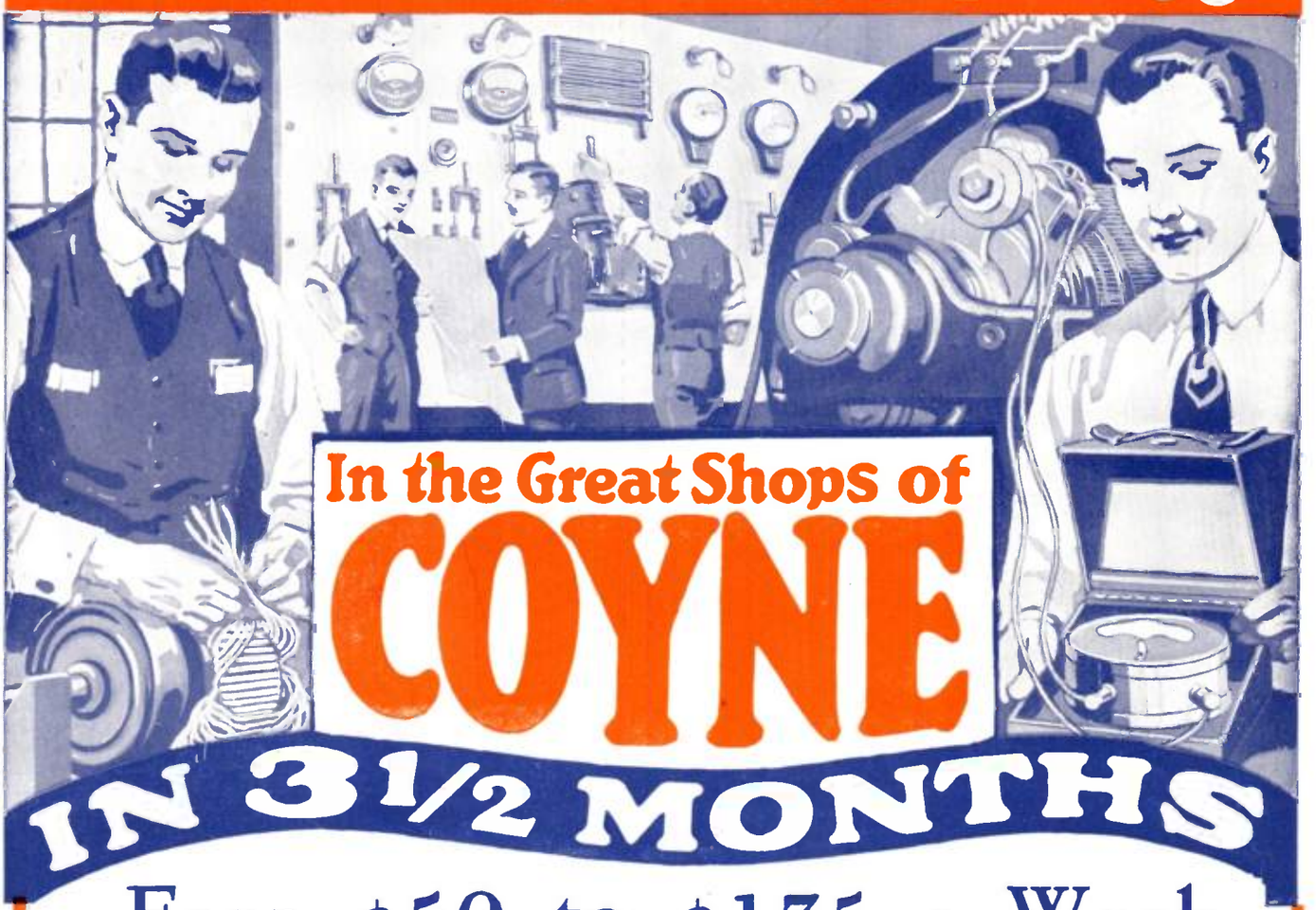
January 1922

EDITED BY H. GERNSBACK

VOL 1. No 3.

"Electrical Progress In Plain English"

Learn Electricity



In the Great Shops of COYNE IN 3½ MONTHS

Earn $50 to $175 a Week

Your future lies in the Electrical Field. The opportunities are limitless. This industry is growing faster than any other and attracting BILLIONS of capital. Get your share. The demand for trained men was never so urgent and the pay was never so large. Act—ACT NOW. Make a start in this wonderful calling.

Hundreds of our graduates are making big money as Power Plant Operators, Electrical Engineers, Telephone Men, Superintendents, Electro Auto Engineers, etc. Hundreds of others are in the electrical contracting business for themselves and making from $3,000 to $20,000 a year. I want you to drop your present line and come to Coyne now and let us prepare you for the big opportunities. Spend the next three and a half months in Chicago, the great electrical center of the world. Students taken on frequent inspection trips to the world's greatest electrical plants.

Come With Us For 98 Days!

I offer you EXCLUSIVE advantages here. **$100,000** worth of massive electrical apparatus is reserved for your special use. You learn quickly because you work—in a class of ONE—with a special instructor to help you—on our immense and modern equipment of dynamos, switchboards, generators, locomotives, etc. When you graduate you KNOW your business, for you have DONE everything in a practical way.

Earn While You Learn

Don't wait to save a lot of money. Our employment department places students in spare time jobs to earn their living expenses, or if they must earn all expenses it places them where they work days, generally at electrical work, and go to school evenings for a while, then later change to day school. Hundreds of our students have worked their way through, you can do the same. Make up your mind right now—send the coupon this very minute for our big free catalog and full information.

Business Management

A thorough training in business management is now given to you in America's greatest school of business, without an extra cent of cost. You are now technically trained, and in addition gain a thorough knowledge of business which enables you to apply your technical knowledge to much greater advantages. Instead of $200 to $450, you can command $500 to $800 a month and more in a business of your own. Write for further particulars about this wonderful offer.

Auto Electricity Course Free

We are able for a limited period to make you an astonishing offer—a complete course in Automobile Electricity. We have greatly enlarged and newly equipped our Auto Electrical Department with thousands of dollars worth of the latest apparatus and can give the finest training in America on batteries, ignition, lighting and starting systems, as used on autos, trucks, tractors, etc. To those enrolling in our complete electrical course now we offer you this entire Automobile Electricity course. The cost of this training would cost you more than we charge for our entire course—Write for particulars.

GET OUR CATALOGUE—Contains hundreds of large size photographs of our shops and our wonderful equipment. This is a very large and expensive book, but it's yours FREE for the asking. Get it now and learn all about the great opportunity we offer you. Send the coupon or a postal — TODAY.

BENNETT W. COOKE, President
Coyne Trade and Engineering Schools
Dept. 61 39-51 E. Illinois Street, CHICAGO, ILL.

MAIL THIS FOR QUICK ACTION ON OUR OFFER

B. W. Cooke, President, Coyne Trade & Engineering Schools, Dept. 61, 39-51 E. Illinois St., Chicago, Ill.
Sir: Send now—free—prepaid and without obligation to me—big catalog—reservation offer of a free course in Automotive Electrical Engineering, and full details of your Business management training.

Name .....

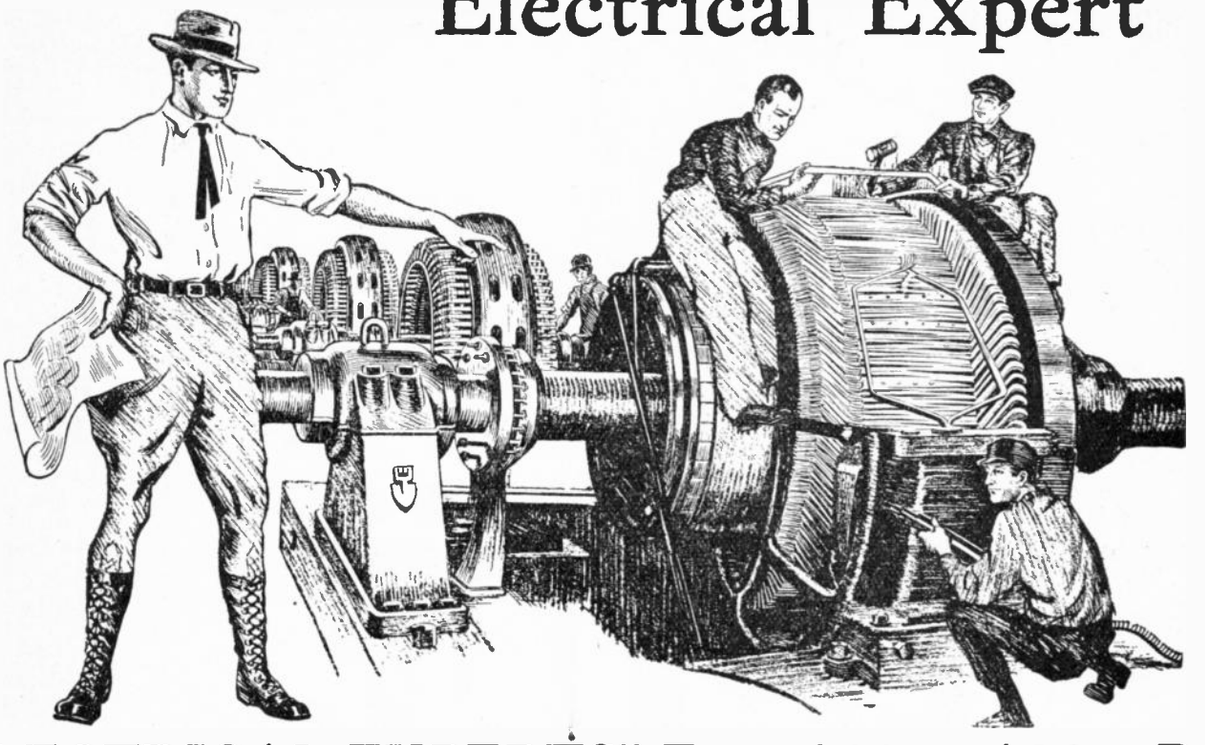
Street (R. R.) .....

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

MAIL COUPON FOR FREE BOOK NOW

BE A CERTIFICATED

"Electrical Expert"



"ELECTRICAL EXPERTS" Earn $12 to $30 a Day

What's *YOUR* Future?

Trained "Electrical Experts" are in great demand at the highest salaries, and the opportunities for advancement and a big success in this line are the greatest ever known.
"Electrical Experts" earn $70 to $200 a week. Fit yourself for one of these big paying positions.

Be An "Electrical Expert"

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the "Electrical Expert"—who is picked out to "boss" ordinary Electricans—to boss big Jobs—the jobs that pay.

$3,500 to 10,000 a Year

Get in line for one of these "Big Jobs" by enrolling now for my easily-learned, quickly-grasped, right-up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

Age or Lack of Experience No Draw-Back

You don't have to be a College Man; you don't have to be a High School-graduate. My Course in Electricity is the most simple, thorough and successful in existence, and offers every man, regardless of age, education, or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from $70 to $200 a week.

I Give You a Real Training

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to get the best positions at the highest salaries. Hundreds of my students are now earning $3,500 to $10,000.
Many are now successful ELECTRICAL CONTRACTORS.

Your Success Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you, *too,* can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition if, when you have finished my course, you are not satisfied it was the best investment you ever made.

FREE — Electrical Working Outfit — FREE

I give each student a Splendid Outfit of Electrical Tools, Materials and Measuring Instruments absolutely FREE. I also supply them with Drawing Outfit, examination paper, and many other things that other schools don't furnish. You do PRACTICAL work—AT HOME. You start right in after the first few lessons to WORK AT YOUR PROFESSION in a practical way.

SAVE $45.50 BY ENROLLING NOW

You can save $45.50 in tuition by enrolling now. Let me send you full particulars of my great Special Offer, and my Free booklet on "How to Become an Electrical Expert."

L. L. COOKE, Chief Engineer

CHICAGO ENGINEERING WORKS

Dept. 1121, 1918 Sunnyside Ave., Chicago, Ill.

YOU CAN DO IT

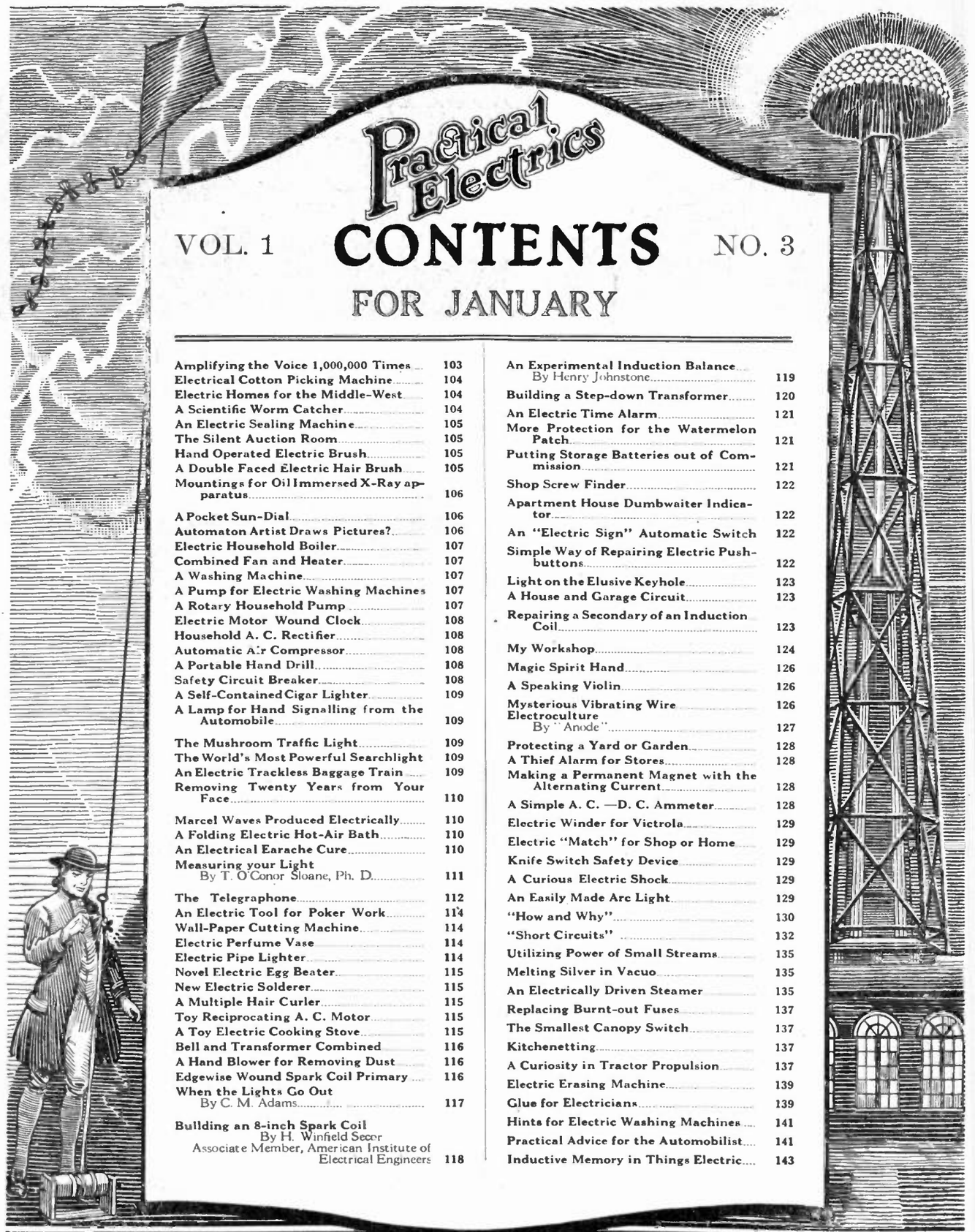
USE THIS "FREE OUTFIT" COUPON

L. L. COOKE
Chief Engineer
Chicago
Engineering Works
Dept. 1121
1918 Sunnyside Ave.
Chicago, Ill.

Dear Sir: Send me at once full particulars of your great Special Offer; also your Free booklet on "How to Become An Electrical Expert." No obligation on my part.

Name.....

Address.....



Practical Electrics

VOL. 1 **CONTENTS** NO. 3

FOR JANUARY

PRACTICAL ELECTRICS is published on the 15th of each month at 233 Fulton Street, New York. There are 12 numbers per year. Subscription price is $2.00 a year in U. S. and possessions. Canada and foreign countries $2.50 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies 20 cents each. A sample will be sent gratis on request. Checks and money orders should be drawn to order of PRACTICAL ELECTRICS CO. If you change your address notify us promptly, in order that copies are not miscarried or lost.

All communications and contributions to this journal should be addressed to: Editor, PRACTICAL ELECTRICS, 233 Fulton Street, New York. Unaccepted contributions cannot be returned unless full postage has been included. All accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

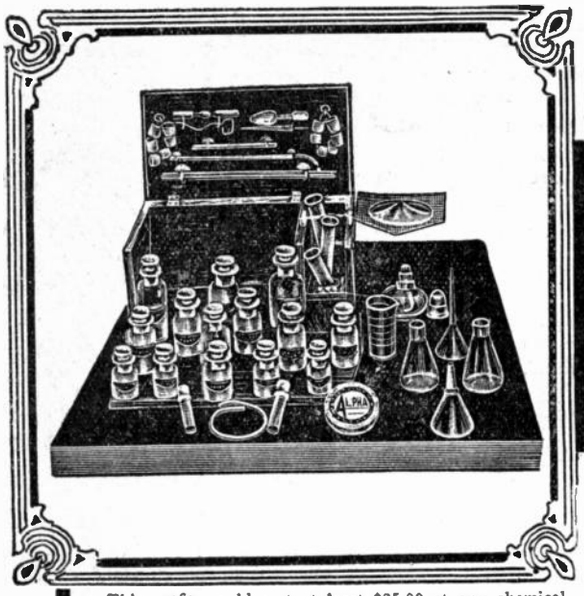
PRACTICAL ELECTRICS, MONTHLY Application entered as second-class matter at the New York Post Office under Act of Congress of March 3, 1879.

PRACTICAL ELECTRICS is for sale at all news stands in the United States and Canada; also at Brentanno's, 37 Avenue de l'Opera, Paris.

Published by EXPERIMENTER PUBLISHING CO., INC. (Practical Electrics Co., Inc., owner) **233 Fulton St., N. Y. City**

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

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



This outfit would cost at least $25.00 at any chemical supply house. It includes 42 pieces of laboratory apparatus and supplies and 18 chemicals and reagents. A fitted, heavy wooden box, hand finished, serves as a case for the outfit and as a laboratory accessory for chemical experiments.

This Valuable Chemistry Outfit GIVEN FREE To Every Student

TO every student enrolling for our home study course in chemistry, we furnish this big, complete chemistry outfit absolutely free of charge. We even pay the shipping charges no matter where you live. The outfit comes to you complete without one cent of expense on your part. With our course there are no extras to buy—no apparatus—we furnish, or teach you how to make, everything needed for the entire course. You know before you start just what it will cost to become a chemist.

Enter An Uncrowded Profession

Study Chemistry At Home

What Well-Known Authorities Say About Our Course

From Hudson Maxim,

"Dr. Sloane has done a much-needed work in a much better way than anything of the kind has, heretofore, been done.

"Dr. Sloane has a remarkable faculty of presenting Science for self-instruction of the student in such a clear and understandable way as to be most readily grasped and assimilated.

"I, therefore, unreservedly recommend and place my highest indorsement on his work."

From Dr. W. W. de Kerlor,

"I can not recommend your course too highly and I congratulate both you and Dr. Sloane on same."

From John A. Tennant,

"This is something which has long been needed. Your long experience in the teaching of chemistry . . . assurance that the course will be practical as well as plain to the untrained students."

What the Students Say:

"This is just like reading some fascinating fiction story."

"Your course is just what a person wants to start in the wonderful science of Chemistry."

"I am very well pleased with the two lessons of the course I have received."

"I find that your course is very interesting. I wait patiently for the next lesson."

"I find the study of chemistry more and more interesting at every lesson and you may be sure that I am getting into studying habit even more than I ever did even in my school days."

"I am well pleased with your course and I think, from the way it starts out, I have found a good teacher and school."

"Enclosed are my answers to lesson No. 2 of your excellent course in chemistry."

"Your course is sure wonderful, easy to understand, and so well laid out. I like it immensely."

"The lessons are fine and I like them."

"I have written to different people about your course and they speak very highly of same."

"If I don't learn it isn't your fault for I find that your lessons contain a whole lot"

(Names and addresses on request)

Chemistry offers greater opportunities today than any other vocation. The demand for trained chemists right now is tremendous and it is constantly increasing. The field offers wonderful possibilities for those who enter while it is still in its infancy. Everything today is chemistry—everyone is talking about the marvels of the science—the papers are full of the subject. Each day brings new discoveries and new announcements that presage greater things to come.

Many industrial processes are crude and wasteful—the world's supply of many necessities is running low. Fortunes and undying fame await the chemists who can devise new methods or discover synthetic products to take the place of the natural substances. The great aniline dye industry was started by a 17-year-old boy chemist who, as a result of his discovery, became rich and world-famous.

Big Salaries Paid Chemists In All Lines

The world has never seen such opportunities as today exist for chemists. Industrial plants of all kinds pay tempting salaries to their valued chemists whose work makes their existence and continued progress possible. Salaries of $10,000 to $15,000 a year are quite common. The Belgian Steel Works paid Mr. Anton Beran, its chief chemist, a salary of $20,000.

Learn Chemistry Under A Famous Chemist

Dr. T. O'Conor Sloane, one of the leading authorities on chemistry—a man whose books and writings are known all over the world, and a chemist of fifty years' practical experience and success, who has in addition taught chemistry for years at college, will personally train you if you enroll with the Chemical Institute of New York.

The United States Government, after many years of research work, has announced in a recent bulletin, that the home extension method of teaching is just as effective as the resident school method.

Our home study course is practical, logical and remarkably simple. No special education is required—if you can read and write plain English you can understand every word. Nothing has been overlooked, but all needless frills and superfluities have been eliminated. Dr. Sloane knows, through his years of experience, just what the student needs. Our method saves you weeks of time.

Easy Monthly Payments

The price of our course is very low, and includes everything. We give, at only a fraction of the cost, the same chemical education that you would receive at a University. You can pay in small monthly amounts as you go along. Our plan of monthly payments places a chemical education within the reach of everyone.

Special 30 Day Offer

For a short time only, we are making a special 30-day offer that will save you money. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

CHEMICAL INSTITUTE OF NEW YORK, Inc.
Home Extension Division
140—B LIBERTY ST. NEW YORK CITY

CHEMICAL INSTITUTE OF NEW YORK,
Home Extension Division,
140—B Liberty St., New York City

Please send me at once without any obligation on my part, your free Book "Opportunities for Chemists," and full particulars about the valuable chemistry outfit given free to every student. Also please tell me about your plan of payment and your special 30 day offer.

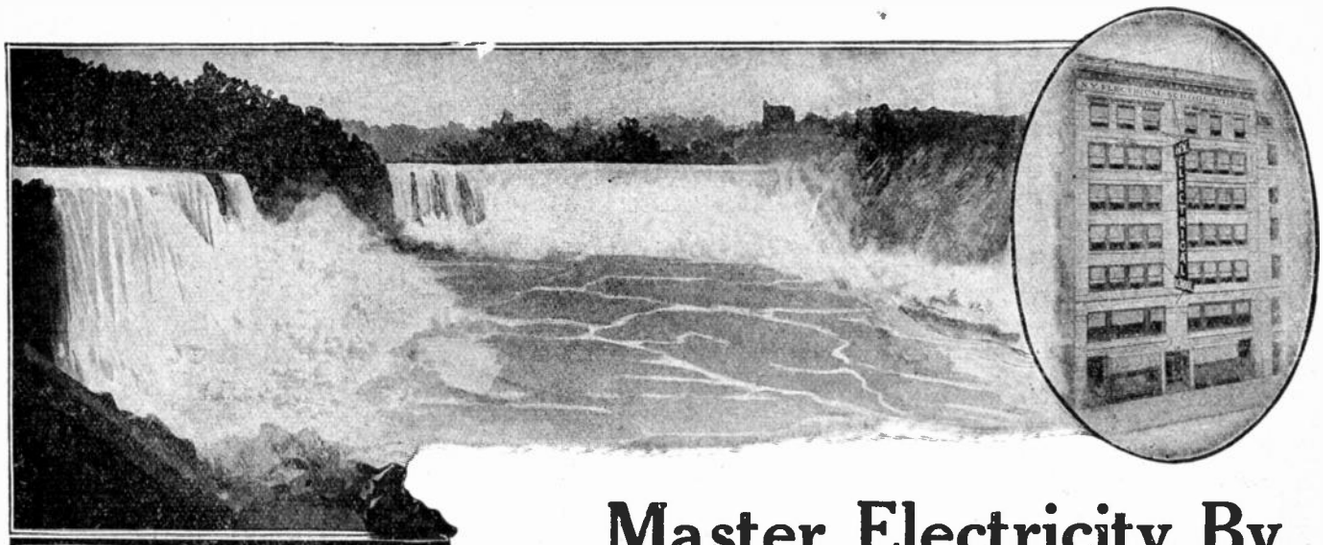
NAME .....

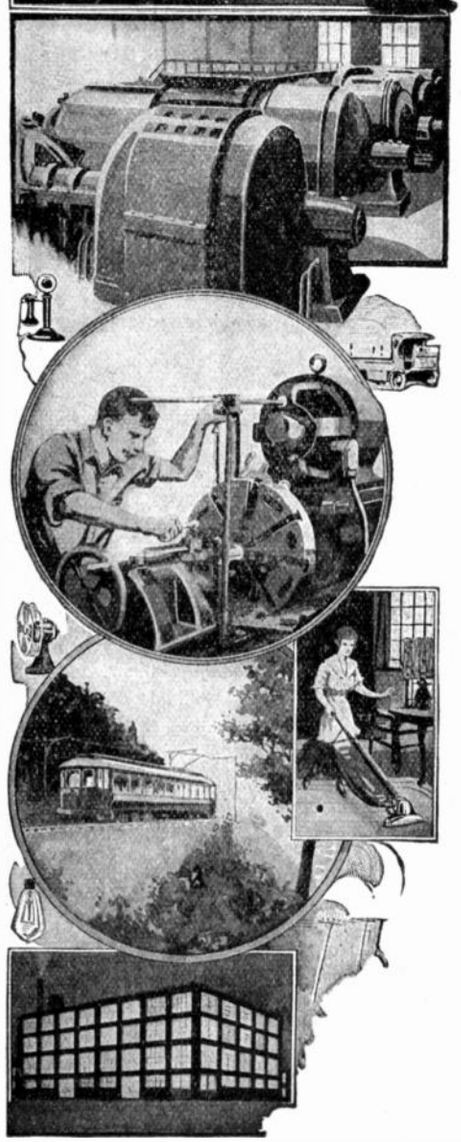
ADDRESS .....

CITY .....

STATE .....

P. E. Jan. '22





Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing.* That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business methods and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

Over 7,400 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

The N. Y. E. S. gives a ***special*** Automobile Ignition Course as an advanced training for Auto Mechanics, Garage Men and Car Owners. The course covers completely all Systems of Ignition, Starters, Lighting and other electrical equipment on automobiles, motor boats, airplanes, etc.

Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.

New York Electrical School
31 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... NAME

..... STREET

.....CITY .....STATE

New York Electrical School

31 West 17th Street, New York

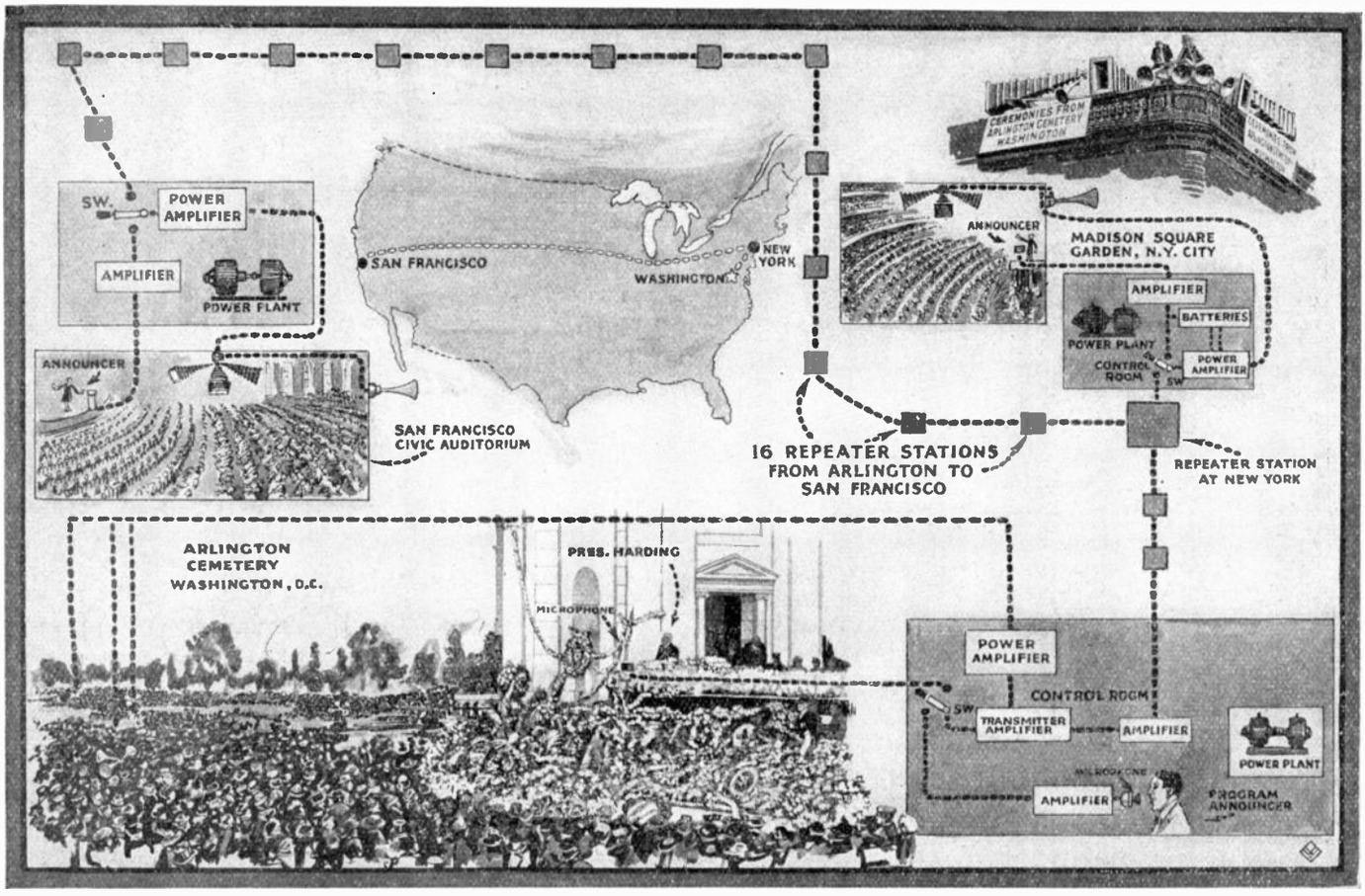
Volume 1
No. 3

Practical Electrics

January
1922

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

Amplifying The Voice One Million Times



This drawing shows the complete circuit, Washington—New York—San Francisco, through which President Harding's speech was transmitted from Coast to Coast. Powerful amplifiers used in conjunction with large telemegaphones made it possible for thousands of people in the cities mentioned above to hear the speech and to practically assist at the ceremony of the burial of the unknown soldier, which took place at the Arlington Cemetery. In transmission the voice of the speaker was amplified more than 1,000,000 times.

In the lower left-hand corner of the picture may be seen the President addressing the audience in Arlington, while the upper right-hand photograph shows some of the large horns which were installed at Madison Square Garden, in New York City.

ON Armistice Day, a very imposing ceremony took place in the Arlington Cemetery, Washington, D. C.; it was the burial of the unknown soldier. About 100,000 people were present, coming from distant parts of the country to listen to President Harding's address on this unforgettable day, and to watch the burial of the hero, who represented the thousands of others, who fell for the cause of humanity in the late War.

This ceremony was such a solemn event that the Government took steps to enable as many persons as possible to hear the President's address and the hymns which were sung. This was accomplished by means of huge amplifiers installed in Madison Square Garden in New York City and in the San Francisco Civic Auditorium. The audience in New York, inside as well as outside of the building, was estimated to be about 30,000, and the San Francisco audience was estimated at about 20,000. These Cities were connected with the Arlington Memorial by special land lines, with repeaters controlling the amplifiers and producing through the horns, such a volume of sound as to make the President's voice understandable several thousand feet from the points of location of the receiving and amplifying apparatus.

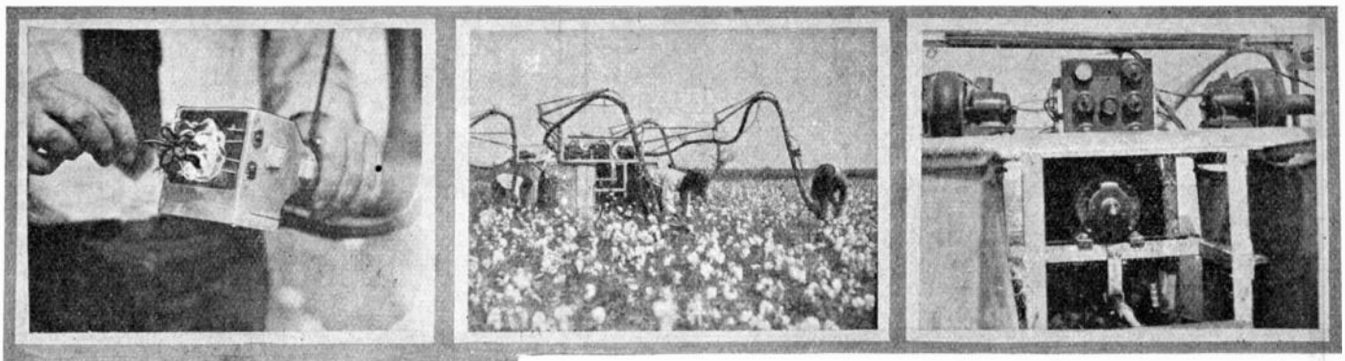
Repeater or relaying stations were installed between New York and San Francisco, amplifying along the line without any distortion, the weak currents travelling on the wires, and every word was heard on the Pacific Coast as clearly as if the President had been himself speaking in the Civic Auditorium. This achievement was the fruit of two years of preparation, for that time had elapsed from the first steps in the work before the device was brought to the present point of perfection. It is difficult to realize the amount of laborious research that this represents, as every detail had to be carefully planned in order to make this demonstration a success, and to insure smooth working and perfect operation of all the instruments used in the transmission across the country.

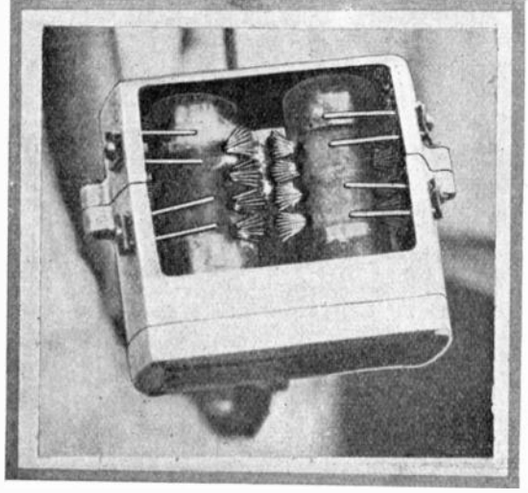
The complete installation was designed and supervised by Col. John J. Carty, Vice-President of the American Telephone and Telegraph Co., who went himself to the various points where amplifiers were installed to make sure that everything was in proper working order before the ceremonies. In the Stadium at Arlington, the catafalque stood before an apse in which the speakers were seated in a semi-circle; a special stand was installed, on which the speaker of the moment had to stand in order to be at the proper distance from the microphones, which picked up his voice and relayed it through a set of amplifiers to the huge horns installed inside and outside of the Stadium and to the lines connected to New York and San Francisco.

Similar arrangements were made at the grave and in front of the choir to pick up the

(*Continued on page 134*)

Electrical Cotton Picking Machine





The mouth of the cotton packing machine showing its relative size, compared to a boll of cotton.
The cotton picking machine at work; each tube detaches the cotton from the boll, and it is sucked into the receptacle of the machine.
A near view of the center of the machine with its motors and instrument board.
Enlarged view of the mouth of the machine, which picks the cotton from the boll and delivers it to the vacuum pipe.

Readers of "Uncle Tom's Cabin" will remember its dreary picture of the cotton picking in the fields of the far South. Again the use of electricity is on the side of efficiency, but where would the vivid scenes of the novel be, if the fields had their crops picked by electricity instead of by the weary negro slaves?

It is most interesting, however, to see the work of stripping the pods of their fleecy contents one by one—which on its face seems to be so slow and wearisome a process—done by the all-powerful electric installation. The illustrations speak for themselves. The machine with its three long tubular arms reaching over the surface of the plants, each arm handled by an operative, does the work of 15 men—that is to say, its efficiency is put at 5 to 1. From 500 to 800 pounds per day can be gathered with the electrical machine by each operative, but this is not all! The cotton so picked is said to be cleaner and softer than when removed by hand, and worth fifteen dollars more per single bale.

The picking units are shown in one of the illustrations. Revolving brushes pick the cotton from the plants in one section., stripping the pod or boll of its contents, and then the fibre enters one of the long suction tubes, shown in the illustrations, and is carried into the sacks as if by a vacuum cleaner.

It is said that it promises to revolutionize the cotton industry, for certainly in the production of cotton the expensive and wearisome hand picking of the great acreage of the plants was its worst feature. These machines are now in use at Little Rock, Ark., and their best guarantee perhaps is that they are electrically equipped by the General Electric Company. They are the invention of L. C. Stuckenberg of Tennessee. It is said that the action of the cow's tongue suggested the invention.

Electric Homes For the Middle West

FROM Salt Lake City, Utah, and from Denver, Colorado, comes news of electrical homes opened for demonstration purposes, to show what the complete electrical house is. In Denver a league was organized to develop the idea, and a house is to be erected in the mission style of architecture. It will have seven rooms in which there will be more than 100 outlets. It is hard to imagine that with this number of outlets, anything will be left undone to show the full possibilities of electricity in the domestic field.

In Salt Lake City a somewhat less characteristic house has been erected for the same purpose. This house has 150 outlets and 30 switches. It seems almost as if it would take a special education to learn to run it. In olden times when a landsman went aboard a ship to learn to be a sailor, he first had to learn the ropes. This meant to know every rope on the ship, sheets, halyards and tacks, without looking aloft. A housekeeper installed in the Salt Lake City or Denver home would have practically the same educational course to go through or at least an analogous one.

The extensive introduction of electricity in Western homes will give a new meaning to life there, for the servant question is somewhat acute. The bungalow districts in the cities of the Northwest are quite characteristic, and electricity would seem to fit in with bungalow life very well with its independence of servants.

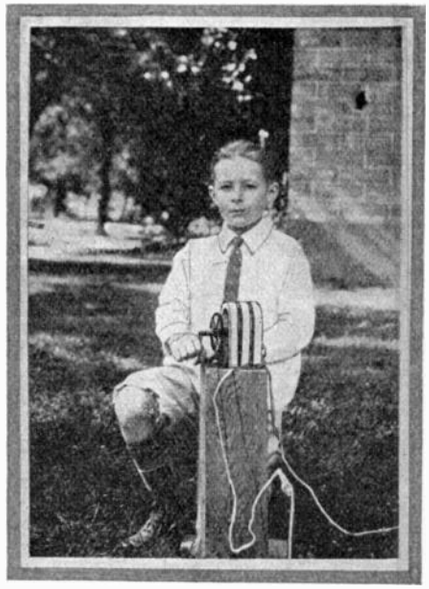
A Scientific Worm Catcher

OUR illustration shows a young electrician of Pasco, Washington, applying his electrical knowledge to the catching of angle worms. The father writes us as follows:

"A telephone magneto, capable of generating from 80 to 90 volts, is connected to two heavy wires forming terminals, which are forced into the ground to a depth of six to eight inches. The magneto is then operated, and, at the end of about one minute, the first worms appear at the surface of the ground. These are usually small, but within another half minute the large ones come. They seem to be in a hurry to escape from the electrified area and get away. I have seen some of the larger worms stand vertically from one to one and one half inches above the ground in order to escape the effects of the current. It might be interesting to note, that the boy discovered this curious effect of electric potential on worms, in attempting to drive ants out of the ground near some ant hills, and, while watching for the effects on the ants, he noticed the angle worms appear on the surface and try to get away."

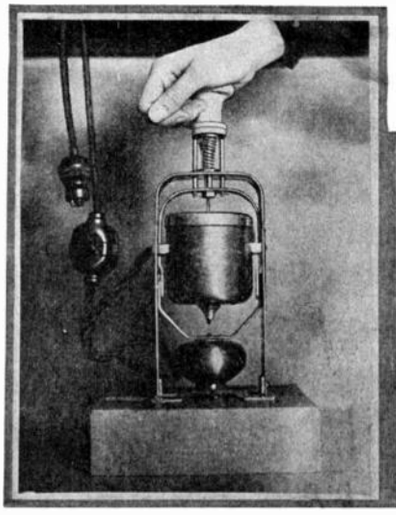
He has already done a quantity of construction work. He has wound his own motors, whose horse power, however, is not stated, has wound his own step-down transformer so as to get a manageable voltage for his work, and he received a prize at the Washington State Fair for an 18-inch electrically driven airoplane.

The proverb says the worm turns. The electrified one certainly does so.



It is said that the early bird catches the worm, but it is not on record that he used electricity to do it. This is what our young fisherman does. He next will be catching fish by electricity.

An Electric Sealing Machine



To left, an electric sealing apparatus, which keeps a supply of wax in a melted condition, to be released as required, to be impressed by the seal.

IN accordance with present day efficiency and safety an electrically operated sealing wax machine, made of heavy pressed steel, nickel plated, and constructed to meet the requirements of bankers, brokers, jewelers and large commercial institutions for sealing valuables, has just been invented and placed on the market. Burnt hands and fire hazard, through the old method of sealing, prompted the invention of this device, Not only does the machine, shown here with, eliminate the danger of fire and burnt hands, but it effects a saving of 50% in sealing wax, 50% in time, and a variable amount of postage through the saving of the weight of wax employed.

The machine works on the same principle as a numbering machine. It is capable of sealing ten letters or packages in one minute and costs one-half of a cent per hour to operate.

The sealing wax is placed in a vessel made of aluminum, which is detachable, and this pot fits inside of a receptacle of brass, to retain the heat of the wax. The inside pot holds enough wax for more than 200 seals.

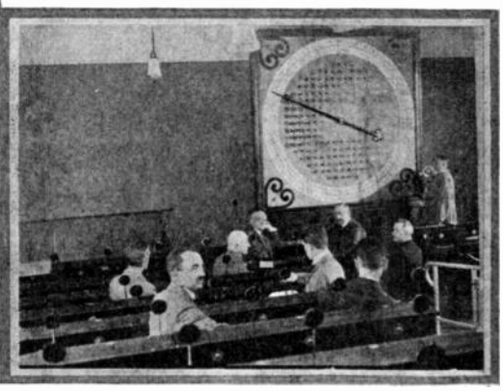
The heating coil is attached to the heating pot and the heat is controlled by a three-heat switch. When full heat is turned on, three minutes are required to melt the wax, but when the latter is melted, low heat keeps the wax at required temperature. The heating element is practically indestructible and works on direct or alternating current.

A private steel die is attached to the base of the stamping knob at the bottom of the device. Only two movements are required to make the seal. The wax is released by pressing the lever towards the handle. A small quantity of wax falls on the material, which is to be stamped. The swinging knob, holding the steel die, is brought into position and makes the imprint clearly, by pressing the handle at the top, in the same manner as a numbering machine.

One of the points made in connection with this machine is the use of the aluminum vessel for holding the melted sealing wax. It seems that aluminum is especially good material for this purpose, as the wax does not adhere to it with the same energy with which it sticks to other materials. Conflagrations from the use of wax lighted in a lamp flame, and burning as it drops the wax on the package , are on record. For some reason, when using stick wax, this seems to be the approved method of applying it, although other methods are used, where the work is to be done on a large scale.

Contributed by Alex. H. Kolbe.

The Silent Auction Room



The silent auction room. This does away with the historical voice of the auctioneer, and substitutes the indications of a pointer. Each bidder has his own dial by which he transmits his bid to the larger one.

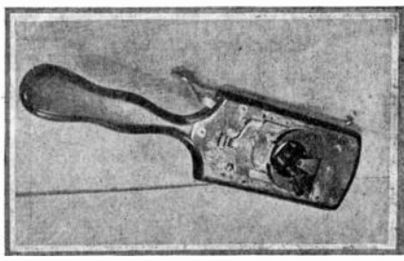
WE illustrate the invention of a Berlin engineer, the silent auction.

At one end of the auction room there is a large dial with an index hand moved by electricity. The hand points to different prices as it moves along, each price being, naturally, a little higher than the one preceding. In each of the seats occupied by the bidders there is a corresponding dial, very much smaller in size. If anybody wants to make a bid, he simply moves the hand on his personal dial to the figure, which he is willing to offer for anything exposed for sale, and the large hand in perfect synchronism registers on the large dial the figure he has turned his index to. In this way everybody sees what the bids are, and it is quite conceivable that the suppressed excitement of the silent auction room might be as tense, as when the old-fashioned call of the auctioneer was heard.

It may happen that none of the prices is sufficient, in other words, that there is an upset price which is not offered by anyone. When under such circumstances the highest bid has been reached and it has not attained the limiting amount, the auctioneer can turn a small lever which indicates by the movement of the hand on the dial, that there is no sale at that price.

It is said that the bidding can go on at the rate of one bid every second. This certainly is rapid enough to satisfy the most devoted habitue of auctions.

Hand Operated Electric Hair Brush



An electric hair brush with a little finger-piece projecting from its body, whose movements, when actuated by the user, produce the requisite electric excitation.

AN electric hair brush, in which the potential for producing the electric excitation on the skin is generated by the hand of the user, is shown.

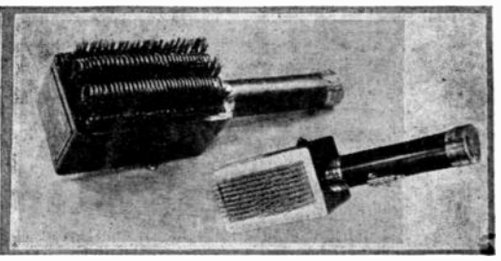
Within the body of the brush there is a bipolor magneto, whose motor is caused to whirl around by the action of a fingerpiece for actuating it, and a sliding shield is also to be seen, by operating which the field of force is modified, so as to give a greater or less electric potential. The brush is very compact and the mechanism which we show is enclosed by a case, which forms the back of the brush. It is hardly distinguishable from an ordinary hair brush.

The potential delivered is quite powerful, and the editor, who uses the brush, finds it very effective to stimulate the scalp.

Several appliances may be used with this brush for local application of electricity. and various electrodes for local applications of electricity are supplied, so that the brush may be used for the most varied effects, and the excitation regulated ad libitum may be caused to act upon any affected region.

An interesting contrast to this brush operated by the finger and with a single set of metallic bristles, is the one shown on the right, operating by a primary battery.

A Double Faced Electric Hair Brush



This hair brush has its own battery contained within the cylindrical handle. There are two faces, so as to get two different actions on the hair.

ABOVE are two views of a hair brush which is constructed so that the user not only benefits by the brushing action, agreeable in itself, but also gets a slight series of electric shocks, which are so gentle in nature as to be certainly pleasant, and in many cases, probably quite advantageous to the receiver.

Within the body of the brush there is an induction coil, and this induction coil is excited by a standard flashlight battery, which is contained in the cylindrical handle of the brush. When a switch on the handle is pushed so as to close the circuit, the make and break of the coil begins to operate, and can be heard, as it produces its humming noise.

The interesting feature of this hair brush is that it has two faces, one set with flexible wire representing metallic bristles,—while on the other surface there are ordinary hair bristles, and in among these hairs, two coils of copper wire are imbedded. The metallic brush wires on one side and the coils of copper wire in the other side, are connected to the secondary of the induction coil. Thus, a person can use the metallic bristles or the softer hairs for brushing; and in either case, by starting the induction coil, he will get electric excitation, in the one case through the wire coils, in the other case through what we have termed the metallic bristles.

Now, when the coil is working, if either side of the brush is used upon the hair or body, in addition to the friction, a good electric excitation will be felt which is quite agreeable. The brush is recommended by its manufacturers, naturally, for many of the troubles that human flesh is heir to. But the very least that can be said of it is that it is a very pleasant way of applying the combination of electric action and friction to the system.

The distinct action of the one face of the brush as contrasted with that of the other face, and the use of the regulation flash-light battery, are the distinguishing characteristics of this article.

New Oil-Immersed X-Ray Apparatus

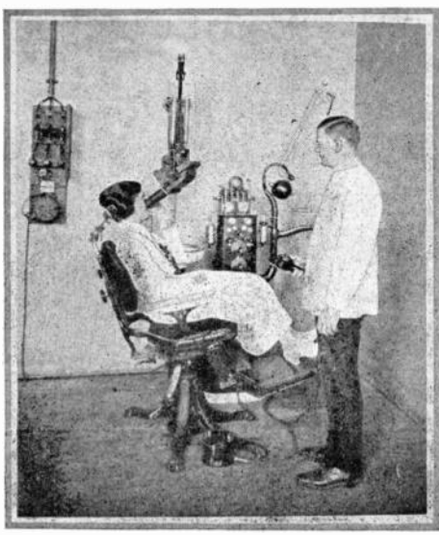
We show two interesting illustrations of the latest developments in oil immersed X-ray apparatus as constructed by the General Electric Co. for medical uses.

In one illustration its use is shown for taking dental radiographs. The convenience of its compact mounting, and the practical appearance, are quite impressive. The dentist operating it has a time watch, by which he regulates the exposure.

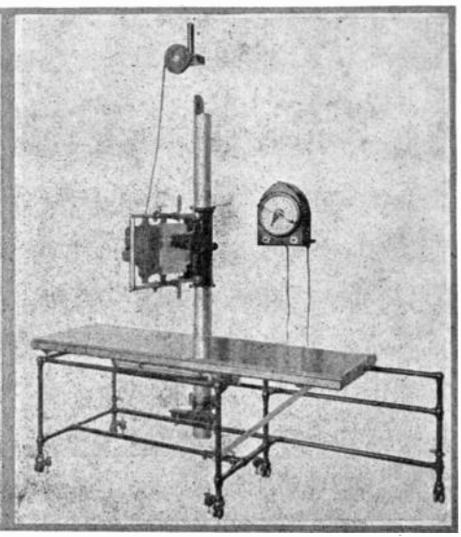
So much is now attributed to the teeth in the way of constitutional ailments, where formerly it was only the local troubles that were sought for, that the dental application of the X-ray has acquired new importance.

For taking radiographs of other parts of the body, a very complete apparatus, is shown in the other illustration. There is shown the radio-graph table mounted on casters, with a slide rest under each leg to fix it in position, if desired, and the wonderfully compact mounting of the X-ray bulb with its adjustments. On the wall is the instrument for controlling the action of the tube.

Dr. Coolidge has won great fame by his developments of the X-ray bulb, some of them with water cooled anode, and the mounts, which are illustrated here, certainly carry out the idea of high development of this great adjunct of the surgeon's work.



The use of the oil-immersed X-ray apparatus by the dentist. The application of the X-ray in dentistry, now that the role of the teeth in disease is better understood than formerly, is acquiring great importance. The compactness of the apparatus will be observed.



The oil immersed transformer X-ray tube on an adjustable standard over a special table, for surgical radiography. The convenient disposition of parts in this apparatus is quite striking, and its small size makes it almost a rival to the dental outfit in the other illustration.

A Pocket Sun Dial

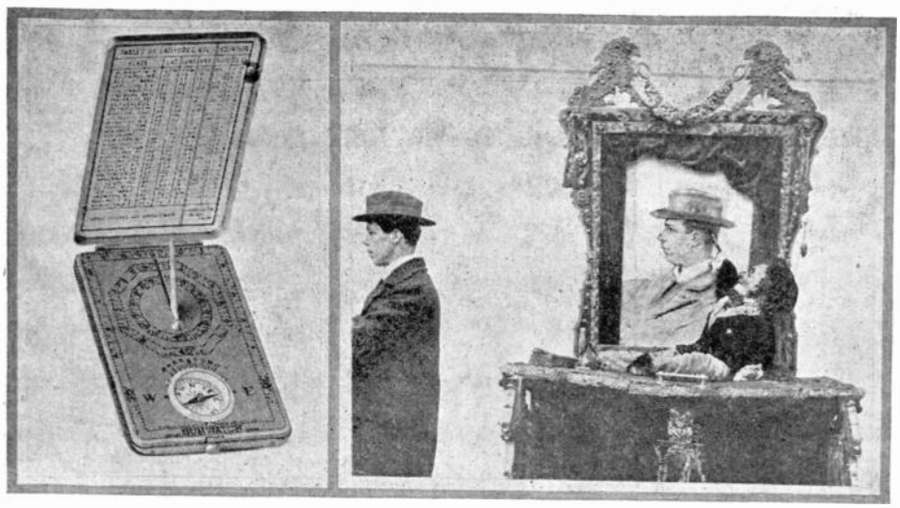
A very elegant little sun dial has been produced, which we illustrate with this article. A sun dial with adjustable stylus is the essential part of the apparatus, which is called a Sunwatch. The stylus is surrounded, not concentrically however, by three sets of figures. The stylus can be set at various angles, and on its side three of these angles are marked. If set at 35 degrees, the outer line of figures which runs around the edge of the case, is used. If set at 40 degrees, then the figures on the octagonal ring are used, and finally, those in the circle are used for 45 degrees.

Of course if the observer is at an intermediate latitude the reading of the stylus shadow on the two hour scales will give the basis for an average reading. The readings of a sun-dial at best are not so accurate, that this averaging system would be inadmissible.

A sun dial has to point north. The sunwatch is meridian provided with a compass, and the variation of the compass has to be taken into account, of course, in setting it. In use, the stylus is set to one of the three angles, according to the latitude of the place. In the cover of the box various latitudes are given, and also the variation of the compass; so that in setting the apparatus for reading the variation of the compass is allowed for.

An exceedingly interesting little pamphlet accompanies it, describing the equation of time and other features, such as standard time contrasted with mean time.

In former times far more interest was taken in sun-dials than at present. In the old time classic "Huttons' Recreations in Mathematics" a long section is devoted to the subjects of "Dialling", as it was called, calculations for the most curious shapes of dials being given.



On the left we see at last an accurately calculated, scientific sun-dial, which provides for different latitudes and for variation of the compass.

On the right, an alleged automaton with sundry wires in sight, which are presumably designed to induce the belief that it is operated by electricity. We doubt it.

Automaton Artist Draws Pictures?

IN past times Maelzel's automatic chess player won great fame with the public. Edgar Allen Poe wrote one of his best known articles upon the alleged automaton, his analytical mind tracing out how it was operated by a man concealed within the box, on which one of the chess boards rested.

Recently, New York has had an automatic checker player, which for many years operated at the Eden Musée, and of course it is definitely certain, that a man was concealed and in some way operated the mechanism.

From France comes another alleged automaton. This is an artist, who draws portraits of anybody who desires to sit for his picture. It is the invention of a Frenchman named Gillo. The illustration shows the automaton sketching the gentleman who is posing in the foreground.

Beginning the performance the dummy rises automatically from the box in which he is concealed; when not working he looks calmly around. He begins by conducting the orchestra with his baton, with great accuracy of gesture. After showing his musical ability, he then poses himself on one side of the easel and draws charcoal pictures of celebrities. He then offers to draw the portrait of anyone who cares to sit for him, and five minutes complete the picture, which, if our illustration is to be credited, is an unusually good portrait

Electric wires are seen leading to the mechanism, the idea of course being to impress upon the audience that it really is an automaton; but it is absurd to suppose that it is such.

It is quite conceivable that the hand of the artist could be guided electrically, by some sort of a pantagraph. One of the peculiarities of Maelzel's Chess Player was that he used his left hand to move the pieces. This gentleman uses the right hand for his operations, a more natural proceeding as most of us are constructed.

Electric Household Boiler

The hot water-back in the kitchen range with its tendencies to explosion is here abolished, and the quiet electric current warms the water for the entire household.

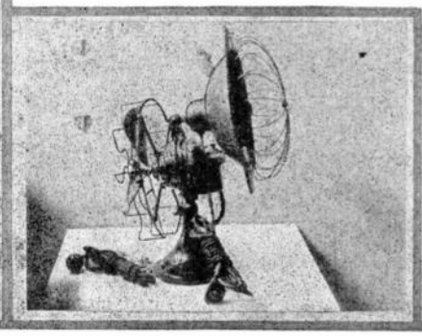
A WATER heater which keeps the kitchen boiler always at the same temperature, twenty-four hours a day and every day in the year, is the subject of the illustration. It is an electrical heater, automatically controlled, and is practical and economical wherever electricity can be had at the power rate of five cents a kilowatt-hour.

The indicator, as shown in the picture, is "set" at any temperature desired—generally at 150 degrees, Fahrenheit—and the electrical connections made. When the water reaches the predetermined temperature, a controller, acting as a thermostat, turns the current off. As water is drawn from the boiler, or when it cools a few degrees by radiation, the automatic switch "turns on" the electricity, until the water is again hot. and then turns it off. All day and all night this small and simple guardian of the electric current remains on duty, turning the current on when the content of the boiler cools and turning it off as soon as the boiler is brought to proper heat. The boiler never gets cool and never gets overheated; no one has to pay the slightest attention to it; hot water is always available and is always piping hot.

It is obvious that the boiler should be adequately lagged or protected from loss of heat by an asbestos or other non-conducting coating, and this is done by the makers, who also surround the coating with a sheet-metal covering. The interior arrangement of the boiler secures free circulation and delivers a current of hot water to the top.

Combined Fan and Heater

This apparatus combines the typical electric fan arranged to oscillate back and forth in the regular way with an electric heater. On the back, facing away from the fan, is a regular heating coil with reflector of the well known type. The fan motor is started, if one wishes circulation of air, and if heat is desired, heat is turned on, so that both are operating simultaneously. If the combination is not pleasing, either one may be turned off, and in Summer, of course, the heater may be entirely detached and put away. Thus we may have a fixed heater with a fan circulating the air while the heater radiates warmth. If desired, the fan maybe caused to oscillate, when the heater will oscillate along with it, waving, as it were, its beam of heat from left to right and from right to left.



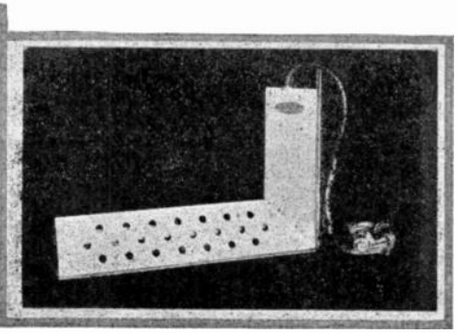
This is a new disposition of fan and heating coil, they being arranged to operate each one alone or both together as desired. Each part has its own flexible cord.

Simplified Washing Machine

IT has been our lot to illustrate various washing machines in this magazine, for electricity, it would seem, has relegated the old corrugated washboard to the region of discards.

Some of these washing machines are simpler than others. But here at last we have the acme of simplicity, nothing but a heating coil, submerged beneath a perforated screen in the bottom of the ordinary washtub. When current is turned on the coil is heated, and a strong ebullition starts in, with accompanying currents of water, that agitate the clothes and effectually clean them.

Certainly, a washing machine with no moving parts and no friction to wear out the clothes, indicates an important advance in the laundryman's art. At 7c. per kilowatt hour, it costs but 30c. for a full day's operation. The cover of the tub is put down when the current is passing, and the clothes are washing, thus concentrating the heat. The washing is to start with cold water and it is advised to use washing powder or soap dissolved in water so as to make a strong solution to be added to the water. Solid soap should not be put into the tub.



Electricity may be sometimes accused of increasing the complication of household work, even though it does make it easier; but no one could imagine anything simpler than this washing machine, whose distinctive peculiarity is that it is no machine at all.

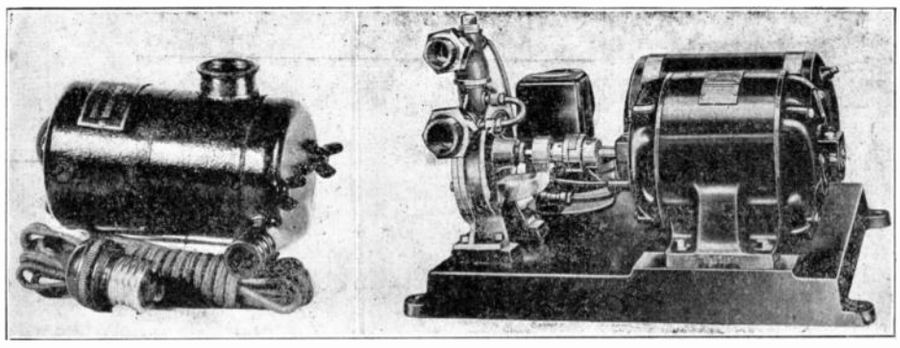
It undoubtedly seems that the present generation deserves great congratulation, for electricity is making life very easy.

In an appliance such as we describe, where the water operates by its own heat, it is rather important that no solid soap should be introduced, as the effect upon the articles might be too powerful. This accounts for the specific directions.

A Pump for Electric Washing Machines

ONE of the problems in using an electrical washing machine is getting rid of the water after the work is done; the machine being disconnected from the plumbing system, more or less of a problem is presented to the housekeeper.

The pump we illustrate, which is called a Washerpump, is supposed to be connected to the outlet plug on the bottom of the washing machine. Instead of the water running into a bucket, to be bucketed away, this pump draws it all out through a hose into the sink or stationary tub at the rate of eight gallons per minute, eight gallons representing more than a cubic foot of water. In this way it disposes of the most disagreeable part of the work incident to electrical washing. It works from a lamp socket, and it runs for a year without attention.



A neat little rotary pump is shown here, driven by electricity and which gets rid of the bucketing process incidental to the use of many washing machines.

An advanced electrically driven rotary pump, designed for use in the household to produce the requisite pressure directly in the supply pipes.

A Rotary Household Pump

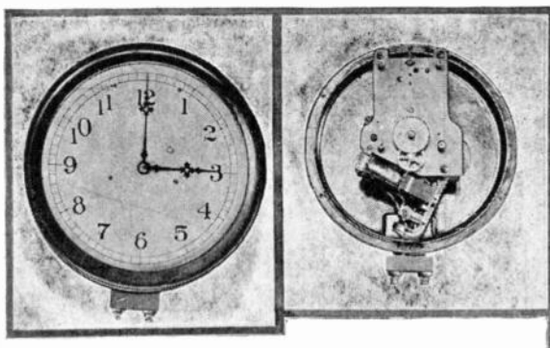
THE idea underlying the operation of the rotary pump driven by the electric motor, which we show in our illustration, is to pump water directly into the house system. The combined motor and rotary pump with a universal joint between them, are mounted on a single baseplate, as shown, and are quite small, being rated at only ¼ horse power. The rotary pump is distinctive, the suction pipe and outlet both opening into the periphery of the drum. Turning at a speed of from 1400 to 1800 revolutions per minute, it can supply two ½-inch faucets opened at the same time. It is specifically designed for smaller uses, although larger units can be supplied if needed.

The interesting feature is that there is only one moving part in the pump, which is the rotor, a disc with teeth or buckets on its circumference. The pump will give pressure up to a head of 200 pounds to the square inch, and it is said that some are built as small as a watch. Monel metal is used in the construction, and there really seems to be nothing about it to wear except the bearings.

The great point is that it provides a tankless system. It is an example of the domestic use of the rotary pump.

Electric Motor Wound Clock

THE accompanying illustration shows an electric, motor-wound clock built into a switchboard meter case. The escapement is of the familiar balance wheel type, but the main-spring, instead of being wound by hand, is automatically wound by a small electric motor. Every hour, as the hour hand revolves to a certain point, two contacts are closed, the motor spins around, and, through suitable gearing, winds the spring up to a certain tension, when the motor is automatically disconnected until the next winding period.



A clock wound by the electric current, designed especially for use on a switchboard, where current is at hand.

The motor takes about 30 watts for six seconds to wind. Figuring this out, it will be found that it takes less than 5c. per year to run it. In actual service, however, it is doubtful if it would even register on the electric meter at all.

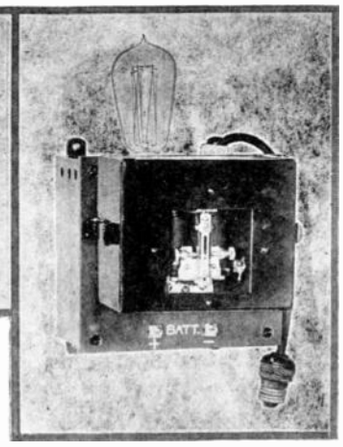
The point is that below a certain rate an electric meter will not register, and this arrangement seems to be a way of beating the game.

Contributed by V. H. Todd.

Household A. C. Rectifier

A very compact rectifier is shown in the illustration. It is adapted to charge a storage battery which may be from 2 to 60 volts potential difference and at a charging rate of 250 milliamperes or less.

This compact little apparatus is therefore only adapted for small work, and wireless telephone and telegraph operators are among those to whom it is specially recommended for maintaining their "B" batteries in condition. For skilled and amateur experimenters, and for doctors and dentists, this little apparatus is highly recommended. It certainly would seem as if the storage battery for small uses is not sufficiently appreciated by the public.



Light duty alternating current rectifier, especially adapted for radio use, and for the charging of small sized storage batteries.

Automatic Air Compressor

AN automatic air compressor is here illustrated. The compression tank is placed beneath the motor and the pump, the frame which carries them surroun ding the tank and holding it firmly in position. This is supposed to save floor space without exacting any exorbitant height. The motor runs on ball bearings and is of the slow-speed type. The shaft carries an eccentric which operates the pump. When starting the pump, a magnetic release automatically holds the air valve open, so that the pump reaches speed without absorbing much energy. The valve then automatically closes and the pump at once begins to compress air. It will be seen that there is no high starting torque, for the motor does not start its work of compressing air by means of the pump, until it gets to its full speed.

A Portable Hand Drill

WE illustrate a portable hand drill. This operates by an electric motor contained within its case, which is an aluminum alloy housing. The whole mechanism weighs only 5 pounds and can drive a quarter-inch drill. The gears run in a gear case full of grease, like the change gears in an automobile transmission. The appearance is quite distinctive, with its pistol grip and trigger for controlling the motor. The cable is clamped to the handle, so as to take the strain from its connections to the contacts within the case. A hole can be drilled within about an inch of any obstructions. It will be seen that the top of the grip is kept on a level with the top of the case, so that there is no trouble possible from the handle getting in the way of its operations.

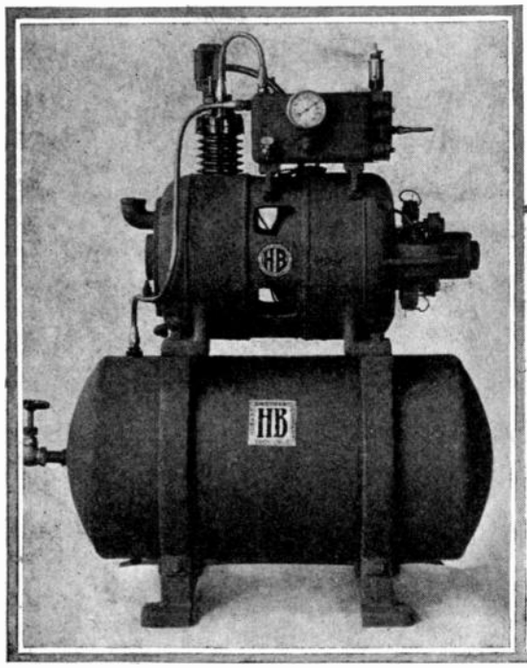
The extension of electricity to the actuating of hand-tools is one of the movements of the day. Before such implements as the one we illustrate, the old grinding of the breast-drill beats a welcome retreat, for few things tried the patience of the mechanic so severely as the slow progress of the hand driven drill.

Safety Circuit Breaker

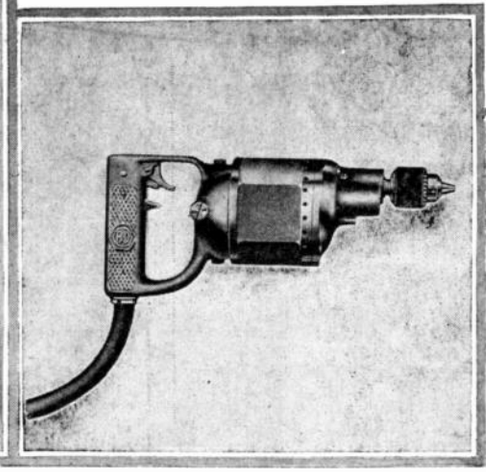
EVERY householder is now an expert in the insertion of fuses. But the insertion of a fuse takes time and may rightfully be listed in the category of nuisances.

The advantage of a magnetic circuit breaker is that there is no fuse to be replaced. When the current gets too strong the circuit breaker opens, protects the line and is ready for instant replacement, when the trouble has been removed.

The appliance we illustrate is termed a combined switch and circuit breaker, which naturally costs more in first expense than the installation of a corresponding fuse, but the annoyance of replacing blown-out fuses with new ones is completely done away with, and once installed there is an end to all expense for there are no fuses to be bought. The mechanism is enclosed in a steel box which takes the place of a pair of fuses and a double pole switch. The switch is set to open for an overload of any pre-determined amount and, of course, a short circuit will open the line instantly. Such a circuit breaker is adapted for lighting or power circuits and for household use also, all requirements being embodied in the combination of a pair of single pole circuit breakers. An overload will cause both sides of the circuit to open simultaneously and the resetting is a matter of a second or two. The movable parts are enclosed in a steel case, and are provided with padlocks.



The above air-compressor stops and starts depending on the pressure, as the electric motor is controlled by the compression. When the motor starts, the air valve is automatically held open, so as to reduce the starting torque, quite a valuable feature, operating to save the motor and ensure its starting.



A compact little hand drill operated by a self-contained electric motor, with a convenient pistol grip, and capable of being used in very confined positions.

A magnetic circuit breaker, which, while perfectly protecting the supply line, has no fuses to burn out, and when it opens can be instantly closed by anyone having the key of the case.

A Self-Contained Cigar Lighter

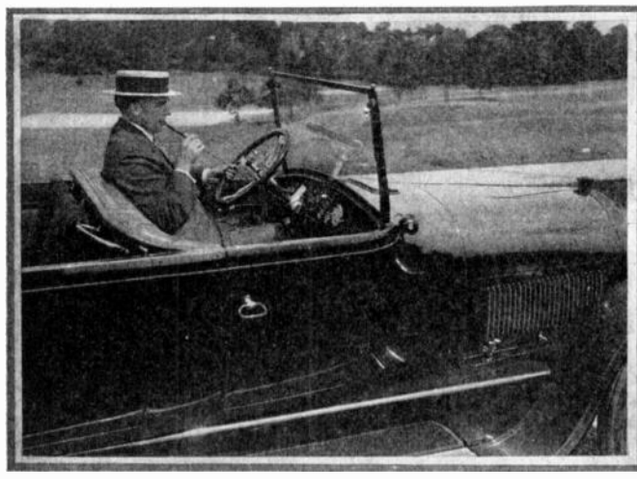
THE illustration shows a complete cigar lighter. Within the case there is a battery, and connected to the battery by a four-foot flexible cord there is a heating point for lighting cigars. Screw holes are provided so that the apparatus can be secured wherever desired.

A Lamp for Hand Signalling from the Automobile

THE hand-signal from the automobile, indicating that the driver is going to turn the car, is recognized as an important element in city work especially, and has a certain amount of legal recognition. Of course, it does not work in the dark.

The Mushroom Traffic Light

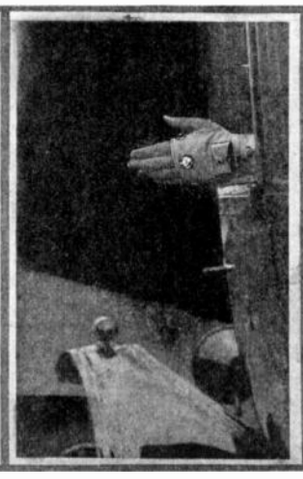
THE city of Milwaukee has installed in its streets a new form of traffic light. We do not know whether Milwaukee can appropriate it as one of the somewhat celebrated "Wisconsin Ideas," but it certainly is a very interesting development in the way of traffic signals.



The gentleman in the automobile is lighting his cigar, using an appliance on which the wind has no effect. It is a cigar lighter operated by an electric current from its own independent battery, so that it forms a complete unit.

The heating unit is held in place by a bayonet joint, so that it can be taken out whenever desired, and there is an automatic switch which is supposed to make the instrument trouble-proof. The cord works on a spring roller, so as to automatically rewind, after the lighter has been drawn out to do its work.

There are various shapes given to the installation, one being especially designed for use on the dashboard of an automobile. To thoroughly appreciate this invention, one should try to light a cigar in a moving automobile with a match. It will be found that electricity is master of the situation.



This hand is not exhibiting a ring, but something brighter, a little electric lamp supplied with current from a battery attached to the wristlet of the glove. With this an automobilist can signal turning at night.

By the arrangement shown in our illustration, electricity simplifies the problem of night work. A sort of mitt is worn upon the hand, the left hand in most automobiles, in the Rolls-Royce it is presumably the right one. In the center of the back of the mitt is a small electric light. The battery is contained in a little case which is attached to the wrist of the glove; it is quite tiny. Notwithstanding the small size of the battery, it is said that it will give 2,000 flashes before exhaustion.

The hand giving the signal works perfectly in the dark, the electric light giving a perfect signal.

A really admirable traffic signal, giving proper warning to the automobile driver and yet not exposing him to risk of injury, if he should happen to deviate a few inches from his proper course.

The plan is to give a traffic warning light on dangerous crossings, and in its installation some regard is had for the safety of the motorist, for if his wheel strikes it, it will run over the dome enclosing the warning light, doing no harm to anybody. It is certainly a very desirable thing, although some people may think that a signal, which will injure the car struck, is more advisable. But Milwaukee seems to be more liberal in its ideas than some communities, and has certainly introduced a very interesting improvement in this class of signals. No one will run over it on purpose, if forced against it, no harm is done.

The World's Most Powerful Search Light

THE twin lights at the entrance of New York Harbor on the Navesink Heights overlooking Sandy Hook, have for many years been celebrated as one of America's finest light-house installations.

Now on Staten Island there has been installed what is claimed to be the most powerful light of its kind in the world. The illuminating power is rated in excess of five billion candle power, and the light which it produces is supposed to be visible from 45 to 50 miles. It is reported that the light has been seen in the city of Philadelphia which would indicate certainly 70 or 80 miles.

Our picture shows one phase of the work in which the beam is shot in absolute parallelism into the zenith. The shaft of light thus produced can be seen from a long distance, and it will be observed that it overcomes the masking or screening by the curvature of the earth, because it penetrates with almost full intensity the region of the clouds. The effect of the vertical beam is greatly dependent on the atmospheric conditions.

The twentieth century pillar of fire. A great plume of light sent into the upper atmosphere so as to be independent for many miles of the curvature of the earth.

Various trials of this system of doing light-house work by a vertical beam of light have been conducted by the U. S. Lighthouse Board. The efficiency of the system is affected by the state of the atmosphere to a great extent, which is true also of the regular Fresnel lamp. Clouds give a sort of screen for its projection and may even help to make it visible. In clear air it may seem dim.

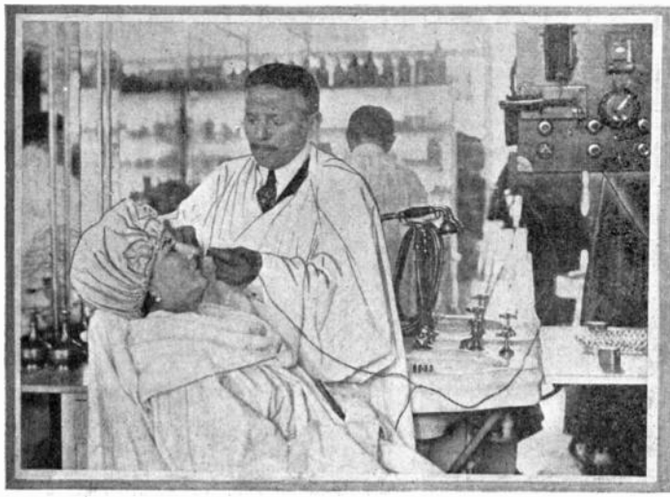
An Electric Trackless Baggage Train.

This is not a trackless trolley, but an electrically driven trackless train of cars, whose revolutions on the asphalt with an expert driver are quite astonishing in their accuracy.

ONE of the interesting sights to be seen along the water-fronts of our cities are the little electric baggage trains. These consist simply of a number of miniature trucks coupled to a very small storage battery tractor; on the tractor sits the driver and his little engine or motor pulls an astonishing load after him.

The trucks require an asphalt or concrete surface to run upon; they are quite helpless on stone. This, of course, restricts the range of their use. It is quite amusing, on a New York river front, to see long trains of this description winding about among packages of freight, in the most astonishing manner, skillfully driven by the engineer, the cars seeming to follow the path laid out for them by the tractor with great accuracy. Collisions with objects lining their path are very infrequent. The particular train shown in our illustration is in use on Ellis Island, the gateway for immigrants from Europe coming to the land of the Eighteenth Amendment.

Removing Twenty Years From Your Face



A rather severe surgical operation is resorted to in Paris to obtain the semblance of youth. The operation is only made possible by modern local anaesthetics. The fair sex will submit to anything for the semblance of youth.

PRACTICAL ELECTRICS cannot afford to neglect the fair sex. We have shown them how electricity can help them in household operations of all kinds, from beating eggs to washing clothes,—even transporting them to market in a nice little runabout—which, in these days of cash-and carry stores, will be a great assistance to the housekeeper.

In Paris there is an expert beauty specialist, M. Autard by name, who takes out definitely the wrinkles on the face, so that women of 60 years of age (if a woman ever is as old as that) are made to look as if they had seen but 30 years. He guarantees to take 20 years off any woman or man who has passed the half-century mark. His charge for the same is $1,000 or $50.00 per year! Is it worth it?

The first part of the process is to go over the face with a vibrating electric needle and mark all parts of the face where there are obnoxious wrinkles, which are to be annihilated. The outer cuticle is then removed by a cauterizing process, bringing to light the smooth, fresh under-skin. This he is said to model by special applications, in the words of one flowery description "thus ironing out all the wrinkles." Local anaesthesia is used to alleviate the pain, for the operation is severe.

Marcel Waves Produced Electrically

Now that we have shown our fair readers how to take twenty years off their age, we are pleased to tell them how to adorn their juvenile faces with a wreath of Marcels. An elaborate apparatus, operated by electricity, for this purpose, is shown here.

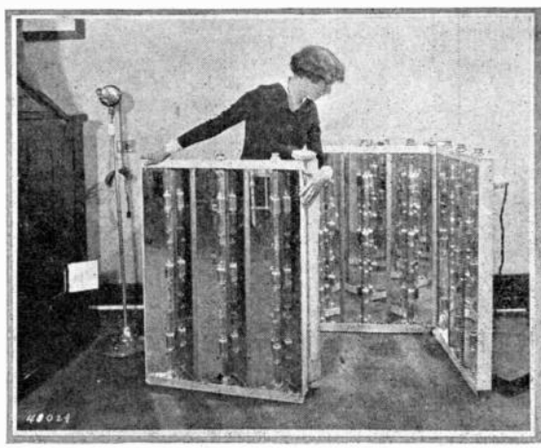
BUT now the beauty element comes in, and we illustrate a hair curling outfit. Every lady now wants to have marcelled waves and things of that sort. Various rods are seen in the outfit. Around these the hair is wound, then over the winding a pad saturated with solution furnished with the outfit is wrapped. There are large tubes into which the rod, hair, and pad are inserted, and these in turn go into the center of a heating coil. After an hour or hour and a half of patient waiting, a wave is secured, also for the "patient".

The appliances shown are unusually complete, and indicate that very superor results will be attained.

A Folding Electric Hot Air Bath

THE application of hot air to the luxurious human system has long been recognized as most beneficial and is used extensively in therapeutic baths.

Electricity enables us to do it at home. We illustrate an electric hot air bath, an apparently elaborate contrivance, but one really very simple to handle, which folds and unfolds. Folded up it takes so little room that it can be put behind a door like a bridge table. Swung around into position it can be made into a perfect hotair bath, in which the patients can sit and find their nerves calmed and their general system improved by the exactly regulated heat. The electric circuit is not affected by the folding, but remains intact.



A folding hot air bath to give one of the luxuries of a Turkish bath to the occupants of the most restricted flat.

The apparatus resembles a sectional spring bed, divided longitudinally by partitions, within which are installed the electric heating elements. Connected to the proper plug, the current is turned into the heating circuit in any desired way, so as to produce a greater or less intensity of heat. The installation in a way represents a large rheostat, and is to be put into shape to represent a small compartment, within which the patient can seat himself and have a true Turkish bath at home.

The size of the sections is indicated in the picture by the nurse, who is arranging them for a patient. It will be seen that a rather low chair placed within the hot walls of this bath would complete the appliance, and it would provide its owner with one of the great modern luxuries, at least modern in this part of the world.

The hot air bath has certainly been known for many ages, and it is curious to conjecture what its originators would have thought had they seen an electrically operated one such as we show our readers here.

We have folding baby wagons, folding card tables, and various folding things constructed for use in flats. But here we have the folding hot air bath for the flat dweller to use to his heart's content. Now for the folding flat!

An Electrical Ear Ache Cure

Here electricity comes to the aid of the sufferer and applies local heat to the ear, or it may be to some other part of the head and face.

WE are inclined to say that these illustrations speak for themselves. But it so happens that it is the auditory system that they apply to, so it ought to be a question of hearing, not of speaking.

The apparatus is a small pad, heated by electrical current, and arranged to be strapped over the head, so as to apply heat in the vicinity of the ear. The old remedies for carache are familiar to many, the clove from the interior of a hot onion, the bag of salt heated in the oven, or the hot water bag on which the patient uncomfortably rests the head—all these it is to be hoped, will be relegated to a still more remote past by our faithful servant, electricity. It is perfectly evident that if heat will cure the affliction, such an apparatus as the present will put the heat where it is needed, and if heat will cure in any case, it will have the best possible chance of doing so with this apparatus actuated by electricity.

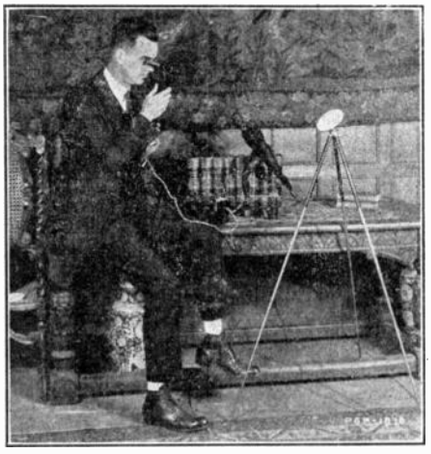
The great point about all the applications of electricity for local heat treatment is that the temperature can be maintained as long as desired, and the temporary feature of the hot water bag is replaced by constant action.

Measuring Your Light

By T. O'CONOR SLOANE, Ph. D.

THE illuminating power of the source of artificial light, such as a kerosene lamp, gas burner, or electric lamp of any description, has been expressed in various units. But at last a definite unit has been selected, known as the international candle. This is practically the sperm candle, burning 20 grains of sperm per minute.

In old times one candle or a pair were used as the standard in the photometer room.



How the Macbeth illuminometer is used to determine the illumination at any desired place. The illumination received by the little disc tells what is being received by that particular part of the room, and every corner and nook can be tested.

Now, a standard incandescent electric lamp takes their place, and the measuring of the candle power of electric lamps has given the science of photometry, as it is called, a new meaning. It is as essential as ever to know how many candle power a given lamp using a definite number of watts gives, but if anyone were to try the experiment of using an identical lamp in a room with dark walls, or in a room with light colored walls, he would probably be astonished at the different results obtained.

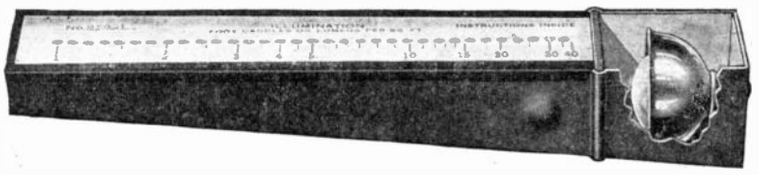
The new photometry, as we may call it, instead of concerning itself almost entirely with the light emanating from a burner, goes to the surface on which the light falls and determines how much light such surface receives and where it is to be used. The person reading fine print, the operative working on dark colored fabric, the machinist running a milling machine, are not greatly interested in how many candle power the lamp giving them light is rated at. But they are vitally interested in how much light is received by the object on which their work is being done, which is the light they work by.

Imagine the standard candle burning in the center of a sphere; we will assume that the candle is really a point of light casting no shadow whatever. This, of course, is theoretical. The area of a sphere one foot in radius is 12.57 square feet. If the sphere were one meter radius, the area would be 12.57 square meters. It is evident that no matter how large or how small the radius of the sphere may be, the total light received from a one candle power light in its center will be the same; and for every sphere, big or small, the light is rated at 12.57 lumens. In a sphere of one foot radius, therefore, each square foot receives one lumen of light. This is the illumination of one candle at a foot distance over an area of one square foot, and it is called one foot-candle.

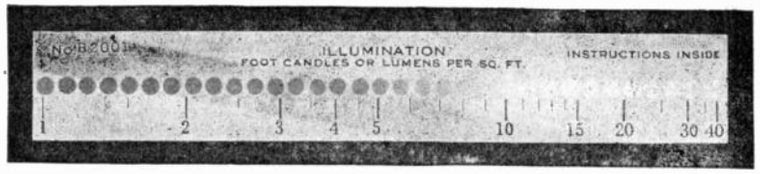
If our reader has followed us, it will be seen that the foot-candle is one lumen distributed over a foot square area. If the area is a square meter, and the candle is one meter distant, one lumen will be received by the area, and the illumination is called a lux.

In this country the work is principally referred to the foot-candle, and a very exhaustive determination of proper standards of illumination for all sorts of trades and occupations has been worked out. The same lamps in a room with white walls, will give widely different results from those, which would be attained in a room with dark colored walls. Various instruments have been devised for determining the foot-candles received by surfaces, which means the illumination given off by different surfaces. The Macbeth illuminometer is a very accurate apparatus for determining this factor, and its details have been worked out to such a degree of perfection that it is estimated to work as close as within 5% of the truth.

The observer looks through a species of telescope directly at the object, whose illumination is to be determined. The line of sight passes through what is known as a Lummer-Brodhun cube. A tube runs at right angles to the sighting tube, and within this is a standard dielectric lamp. This is the soul of the apparatus. The lamp must be accurate, must be standardized from time to time, and must be operated at exactly the proper wattage. The lamp can be drawn to and fro along the length of the tube containing it, by a rack and pinion movement. The Lummer-Brodhun cube comprises two segments of a glass sphere on the center of whose convex faces a smooth surface is ground and accurately polished. These surfaces are placed in contact in the mount. The plane of these surfaces is placed at 45 degrees to the axis of the lamp tube and consequently of the sighting tube. Light from the lamp is reflected from the area of contact to the eye of the observer. Light from the surface inspected is transmitted through the outer areas of the spherical surfaces, and if the lamp is set by the rack and pinion movement at a proper distance, the degree of illumination of the two areas will be exactly equal. The reading on the rack bar, which as seen in the illustration extends out from the lamp tube, gives directly the illumination in foot-candles of the surface inspected.



The foot-candle meter's essential part, the case holding the standard lamp, with the series of translucent apertures, whose brightness tells by simple inspection the illumination received at any place where the instrument is placed.



View of the scale of the foot-candle meter, indicating in this case an illumination of 10 foot-candles, quite a high illumination, as light is now distributed.

It may be that the illumination in some point in the middle of a room is desired. To get this measurement a test plate is used. This is placed at a known distance from the illuminometer, and its illumination is compared with that of a translucent screen within the instrument, through which screen the standard lamp rays pass.

Using the foot-candle meter to determine the illumination received by a screen or wall. This suggests its use for determining the illumination of the moving picture screen.

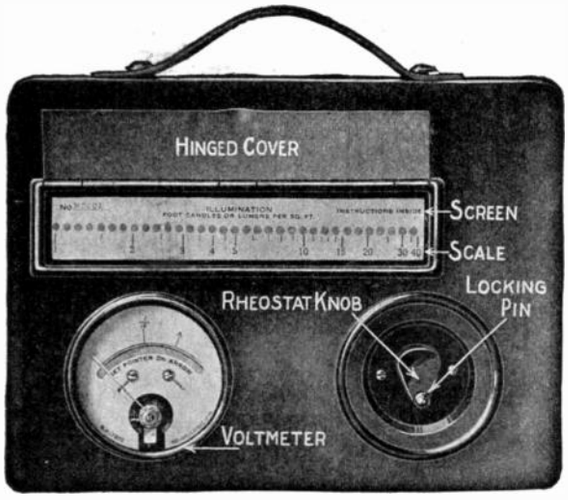
For fairly good approximate measurements, a simpler, lighter apparatus has been devised, which is based like the illuminometer on a standardized electric lamp. It is a long metal box in a compartment at one of whose ends is mounted the standard lamp. One side of the box is closed by a piece of clear glass on which are two thicknesses of paper. One piece is almost opaque and is perforated with a number of round holes ⅛ inch in diameter, arranged in a straight line. Over these holes there is fastened a translucent or thin piece of paper. If the lamp is lighted and kept at absolute amperage, this apparatus can be used for direct measurement of foot-candles received by any surface.

The lamp will be, of course, absolutely screened off by the box. If looked at in the dark, the holes will each show a little bright spot. If looked at in strong sunlight, the spots would appear dark but of graduated darkness. The ones furthest from the lamp would be darker than those close to it. If now this instrument is placed on any surface, the spot which is of equal illumination with the paper on each side of it, is practically eliminated from view; and it will be eliminated from view because the light given by the lamp, and that given by the external source of light-the lamp illuminating the spot from within, and the external light illuminating the area surrounding the spot—will be equal.

The result is that the illumination of the surface is read off at once, without having to do any adjusting whatever. The foot-candle meter is not nearly as accurate as the Macbeth illuminometer, but is lighter and simpler in operation, and can be carrie about in its own hand-bag.

This simple apparatus, light in weight and absolutely portable, has most extensive applications. Any fairly qualified person can use it, and in organizing the lighting of a factory, it is no longer necessary—literally as well as metaphorically—to go it blind. The meter proper weighs but 3 pounds and is used by operating the lamp at proper voltage and placing the foot-candle meter on any surface or in any place where the illumination is to be found. It can be used in factories of all classes, department stores, libraries and elsewhere, and an exhaustive table is given of recommended illuminations for over fifty different trades and functions, machine shops, boiler rooms, candle making, hat manufacturing, jewelry and watchmaking, and every conceivable kind of manufacturing process. Even department stores, where goods are to be exhibited to customers are open to its use. Its accuracy is within about 15%, definitely inferior to the Macbeth illuminometer, but it is lighter and of much simpler manipulation.

To an old time photometrist the modern development of the measuring and specification of light in its economic uses is very impressive. The light source was formerly all that was studied, now its effects on the surfaces it illuminates is the object of research.



On left the candle-power meter in its compact traveling case, ready for transportation to the scene of its operation. The light-box cover is raised to show the screen.

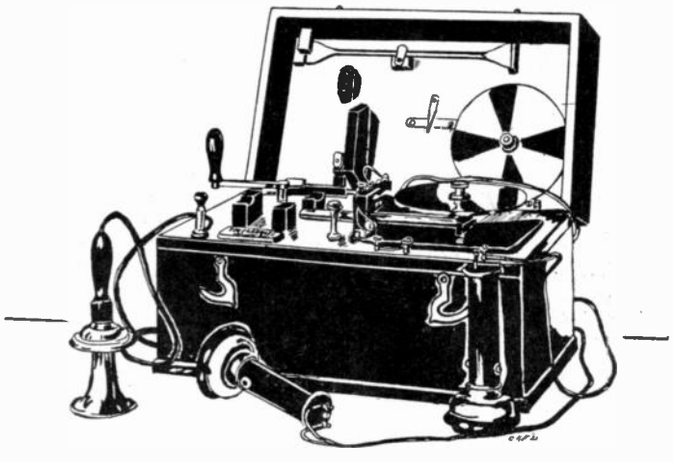
On the right the open case of the candle-power meter, showing the different pieces of apparatus in their places therein. The light box is broken open to show the position of the lamp.

The Telegraphone

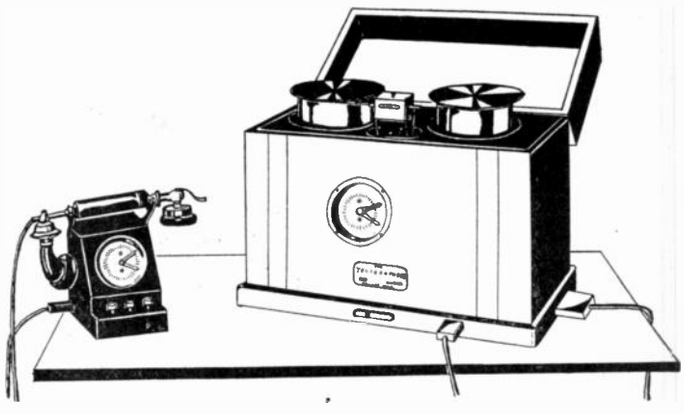
MUCH has been written of the wonders of the Telegraphone but few people know just how the marvelous machine actually records speech upon a fine steel wire or upon a steel disc.

of different signs in adjacent portions of its mass. Determining to make use of this principle he first began to experiment with a revolving steel disc, causing an electro-magnet to pass over it in a spiral course like that of the needle on a phonograph record. The

commercial use. Each disc was capable of receiving five minutes dictation and could be sent through the mails like a letter, being about six inches in diameter and very light. The record would last as long as the steel, being erased only by passing a strong magnet



The disc type telegraphone. The telephone message is impressed by magnetic polarity on a disc of steel, and is retained by it so that the disc can be sent away by mail or recurred to for reference. The steel retains the localized magnetic polarities for a long time.



The wire type of telegraphone, in which a steel wire does the work of the disc whose operations have just been spoken of. The message is impressed magnetically on the wire and is permanent for long periods of time.

Before discussing the operation of the device let us first review briefly the history of its discovery and development. Like a great many other inventions and discoveries, that of the principle involved in the Telegraphone was accidental. In 1900 Valdemar Poulsen, the Danish Edison, was experimenting with telephony with a view to photographing sound waves. In the course of his experiments he discovered that a mass of tempered steel could be impressed with and retain magnetic fluxes of varying density and intensity of magnetic flux was controlled by the use of a telephone transmitter. He found that the steel disc could be made to reproduce the words spoken into the transmitter, by substituting a telephone receiver and causing the pointed end of the electro-magnet core to again pass over its first course; and also that the record could be erased by passing a strong magnet over the surface of the disc.

After several years of experimenting, the disc machine was developed for across its surface.

Having applied the discovery successfully to a disc of steel, the idea was conceived of using a fine wire in order that longer records might be made. In developing the wire machine, however, many mechanical difficulties were encountered, and it was not until 1907 that a successful machine was constructed It was necessary to find a wire of very small diameter but of high tensile strength, and sufficiently susceptible to slightly varying magnetic fluxes to make a clear record. After

many trials the wire best suited for the purpose was found to be steel piano wire of 0.010 inch diameter (No. 30 B & S. gage) and having a carbon content of 1.20 to 1.30 per cent. Six miles of this wire, wound on two spools, Fig. 3., was capable of recording a thirty minute dictation.

The action of the wire machine is as follows:

A tempered steel wire is caused to pass at a uniform rate of speed successively before and in contact with the pole of a soft iron core electro-magnet, designated as the "erasing" magnet, and before and in contact with the pole of another similar electro-magnet designated as the "recording" magnet.

The winding of the "recording" magnet is also included in the secondary winding of an induction coil, the primary winding of which is in circuit with a battery and telephone transmitter.

Sound waves, as from spoken words, etc., impinging upon the transmitter diaphragm and through its vibration setting up corresponding current waves in the circuit of the secondary winding of the induction coil and "recording" magnet, will cause varying fluxes to traverse the magnetic circuit of the "recording" magnet, which will cause similar fluxes to be impressed upon successive portions of the steel wire as it passes before the pole of the "recording" magnet.

In reproducing the record, the current through the winding of the "erasing" magnet is discontinued and a telephone receiver is introduced into the circuit of the "recording" magnet winding.

Preece speaks of the minute energy of the telephone. Here it is beautifully illustrated.

Upon causing the steel wire carrying the magnetic record to again pass before the pole of the "recording" magnet at the same speed and in the same direction, as when making the record, the varying fluxes in the wire will set up corresponding fluxes in the magnetic circuit of the "recording" magnet, thus inducing current waves of similar value in the winding and circuit of the recording magnet and telephone receiver.

The receiver diaphragm vibrating in unison with these currents will set up sound waves similar to those acting upon the transmitter in making the record.

In perfecting the mechanical features of the wire machine great difficulty was encountered in devising a method of stopping and reversing the direction of the wire without breaking or tangling it. This was finally overcome by means of the mechanism shown in Fig. 3, which shows the complete driving mechanism of the wire machine.

The Telegraphone is operated by means of an external control set shown at A, Fig. 3, having three buttons, one forward, one stop, and one reverse. Motor A, (Fig. 3) drives shaft C carrying the spool K through friction clutch B. When it is desired to reverse the machine the other shaft L is connected by a cross belt H, operating on pulleys E and F. The two spools, K and T, carry the wire and are removable. They are driven by screws 1 and 1' which fit in slots in flanges on the spools. In order to prevent slackness of the wire it was necessary to provide a means of rotating either shaft, the driven one being that upon which the wire was winding. To do this the other spool is lifted from the friction clutch B, and allowed to run freely, a brake being automatically applied when stopping the machine..

This lifting is accomplished by the action magnets M and N, segment gear P, and pinion O, respectively. Pinion O is fastened to the end of shaft V, which has flattened surfaces carrying supports R and S for lower ends of spindles upon which the spools rest. Partial rotation of V lifts one or the other of the spools.

In operation, pressing one of the control buttons energizes a relay magnet from a cell. This magnet attracts an armature which closes a contact allowing alternating current to flow through coil M. M is instantly energized and attracts its armature, causing shaft V to rotate in a counter-clockwise direction. This raises spindle L, thus removing drum from friction clutch W and releasing spool T which is then held in that position by mechanical means. At the instant L is lifted, the motor A is connected with power and drives shaft C, pulley F and reel K..

To stop the machine another button is pressed which by means of a relay, opens the motor circuit. At the same time a friction brake is applied to the spool from which the wire is unwinding..

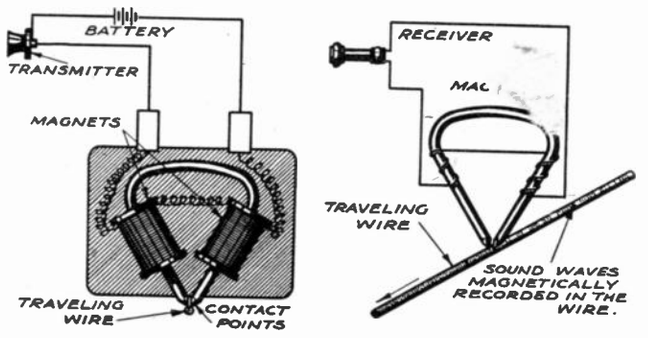
In reversing, the magnet N is energized, turning V in a clockwise direction. This lifts spindle C, removing reel K from driving pins I, and allows it to run freely. The reel T is still in contact with the friction drive W and driven by cross-belt on pulleys F and E. This causes the wire to unwind from K and rewind upon T.

The question is at least suggested of how long the magnetization will persist in the disc or wire. There would always seem to be grounds for a suspicion that by keeping the magnetized wire or disc for a long period the induced polarities would be obliterated and fade away, something as the magnetism of a permanent magnet is supposed to deteriorate in the absence of a keeper. It seems almost incredible that the successive impulses due to the human voice, occurring at such short intervals, perhaps running up to 100 or more to the second, should be so exactly induced upon the steel wire. But so it is. The fact that this problem of permanency is never discussed certainly indicates that it does not enter into the operation of the apparatus, and that the wire holds its polarity for a sufficient period.

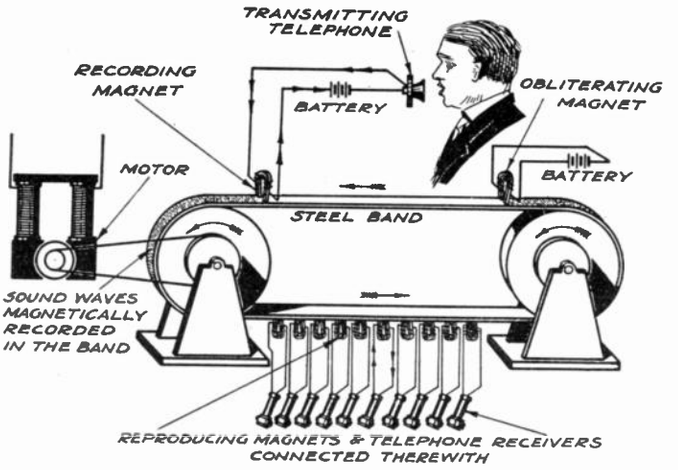
One of the most obvious suggestions is the applicability of this system to the phonograph, but of course there is no idea that the permanency is absolute, and it is quite essential for the phonograph that it should be so.

Yet taking it in the literal sense, we have here what is really and truly a phonograph. When Edison many years ago conceived his old tin foil phonograph, the story goes that he sent in to the laboratory and had

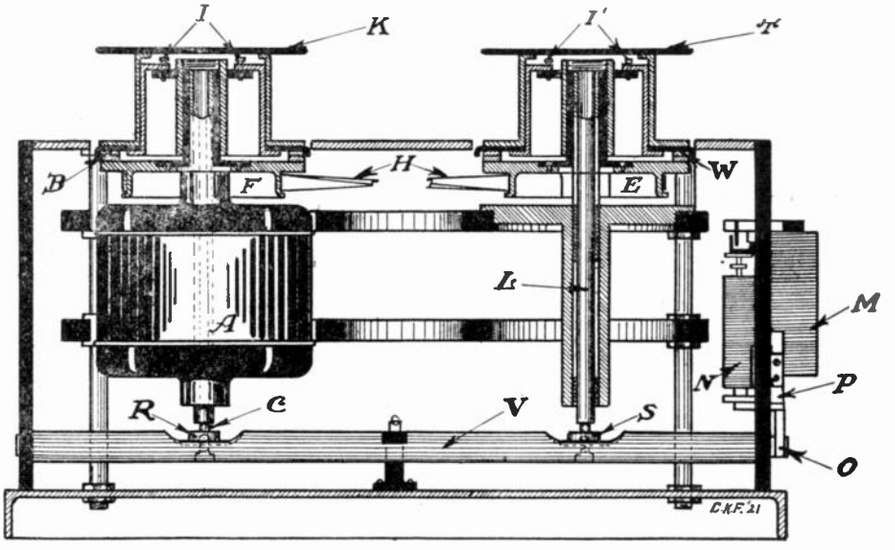
Cont. on Page 134



1. The principle of the transmitter and of the receiver of the wire actuated telegraphone. A message can be received in the absence of an operator and can be read at any time even after days have passed.



2. A diagram showing clearly the operation of the telegraphone, where it is used not to record a message, but to transmit it simultaneously to a number of receiving telephones.



3. The arrangement of parts in the wire telegraphone showing how it is used to register and transmit from the same wire.

New Things Electric

An Electric Tool for Poker Work

An electrically heated tool displaces the old-fashioned hot poker for the art of pyrography, as it is elaborately entitled. With this, fine line effects can be produced as well as blending, and it can be used in an emergency for a soldering iron. More cannot be asked.

The old art of pyrography, called by the more popular term of "poker-work," was done with a red hot poker; next as an advance a soldering iron was used. The next step was to use a platinum-pointed tool heated by an alcohol blast lamp embedded in the tool itself.

In the present electric pyrography tool we have another development. It is as near a stylographic pen in appearance and size as can be. Within it, there is a heating element which brings the metal point up to the charring temperature. Not only that, but there is a porcelain cap surrounding the metal point, and this too gets hot, so that it can be used in some phases of the work. Thus, for fine lines the metal point is used. But tilting it slightly to one side and using the smooth surface of the porcelain, sea and sky effects etc. for landscapes are obtained. The porcelain operates in obtaining a sort of water-color effect, superimposed, if desired, upon the fine outlines given by the metal point. Gold, silver and other tissues can be placed over the paper on which the design is to be produced, and their material burned into the paper.

It is even recommended as a check protector. It is hard to see that anything could be done by a counterfeiter to alter the figures charred into the very paper of a check. For fine soldering, and even for addressing wooden boxes, it is found to be quite valuable.

Wall Paper Cutting Machine

It often happens that wall paper borders have to be cut to an edge quite irregular in shape. Such borders are those in which there are leaves or flowers, and the paper is to be cut off following, perhaps, the contour of a continuous wreath, a border of leaves, or the like. Many other things can be thought of, in which this irregular kind of cutting must be done. If executed with ordinary shears, the operation is very long and tedious, and if the paper is cut by special machinery and then rolled up, damage is done to the sharp points of the paper.

The machine illustrated is small and light, and by the vertical reciprocation of a needle punches holes in the paper. The operator with this machine follows around the outline, wherever it is irregular. It uses an ordinary phonograph needle, so that one always has a sharp point to work with. The machine is so well balanced and so light that an irregular line can easily be followed, The slight roughness of the edge, which it leaves, is not considered at all injurious, and the principle is similar to the perforating of sheets of postage stamps.

This machine would seem to have many uses, besides that of cutting wall paper edges. We imagine that it might be of service for various kinds of paper patterns. Perhaps it will interest some of our feminine reade...

Electric Perfume Vase

This perfume vase is our selection from a number of designs, and we are confident that as an object of art it will meet our readers' approval. It addresses itself to another sense than the eye, however, and spreads perfume throughout the room.

THE vase which we illustrate is not a purely ornamental affair. An electric lamp is contained within each one of them, so as to warm the interior. Inside is water which may half fill them, and to that is to be added some drops of perfume; or else, toilet water is added to the container. The mild heat of the incandescent lamp causes the perfume to slowly disseminate, so that it is found that a single filling will last a long time and will give a delightful perfume of flowers to a whole apartment. The design of the vase speaks for itself. The principle is certainly a very interesting one, and we have already had occasion to illustrate a different apparatus of this character.

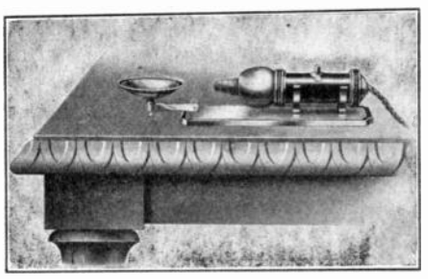
Electric Pipe Lighter

THE Englishman sticks to his pipe, so this very nice appliance, which is adapted for lighting cigars and cigarettes as well as pipes, is sold in England as an electric pipe lighter.

A cylindrical case contains a switch operated by the push-button seen projecting from its top in the illustration. On the right hand end, the end facing the ash tray, there is a porcelain cone, and this is wound with a coil of resistance wire, which when the current passes is heated to red heat. A touch of the pipe, cigar or cigarette, as the case may be, to the glowing wire on the porcelain cone, immediately lights it, and with the purest kind of heat. The tobacco is not contaminated by the fumes from alcohol or gasoline or illuminating gas.

The compact fixture on the table is exceedingly attractive in appearance, and the little ash container is a sensible addition to it. Another form is made in which the same apparatus is held vertically as a wall bracket with the cone downward and the ash tray under it.

The cone can be easily removed, as it is held by a bayonet joint in its position. It is found that 12 seconds is the average period required to light a pipe with the lighter. A curious calculation which is made by the manufacturers is, that it lights the pipes more cheaply than do matches. The expense of matches for lighting pipes is not usually considered, however, to be very large, particularly in America, where you are handed a box of matches with a nickel cigar.



An electric porcelain cone, heated electrically, lights your pipe or cigar. Immediately adjacent thereto is an ash pan, but electricity has nothing to do with this.

Novel Electric Egg Beater

WE illustrate an interesting development of the miniature electric motor. Here is a little mite of a machine which embodies an egg-beater carrying on its top a little motor, that is plugged into the lighting circuit. It is made both large and small, for domestic and for commercial use. There is nothing more aggravating than beating eggs on the not too rare occasions when they refuse to be beaten or at least do not improve by the treatment. But it would seem that the most obdurate kind of albumen would have to yield to the electrically actuated whirl of the beater-blades. The illustration shows the construction, but one point not brought out therein is that the electric motor can be detached from the beater by a simple movement. The beater can then be thoroughly washed without getting water into the motor.

An egg beater which carries its own motor and is to be connected by a flexible cord to the most convenient socket. The electric motor is readily detachable.

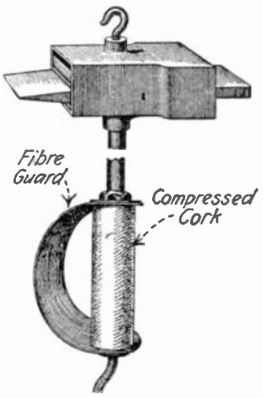
New Electric Solderer

It is always of interest to see what our cousins across the water are doing. There is usually a difference discernible in their idea of mechanics and ours.

The English soldering iron illustrated is designed especially for armature work. The copper bit has a chisel faced edge, but of course it can be filed up to any desired shape. It enters the socket to which the handle is attached and lies between two heaters, one above and one below the bit. Not only can the bit be taken out, but the heaters are also quickly and easily removable. There is a metal handle with the grip made of pressed cork, held firmly in its place by washers and jam nuts.

One very good feature is a wide guard, made of fibre, which is designed to protect the hand from dropping solder. There is a hook in the top to hang it up by, because when the supply wire is attached to a tool it is a poor plan to let the implement lie around on a bench. The flexible cord is pretty sure to be injured and possibly even to make a short circuit with the metal of the handle.

In the one we illustrate the bit is 2 inches wide, and 3/8 inch thick. It takes about 400 watts, to run it.



An English version of the electric soldering iron. While specially designed for armature work, it can be used for many other purposes.

A Multiple Hair Curler

THE hair-curler which we illustrate is a very convenient little device supplying a number of separate curlers to be applied to different parts of the hair as desired, and arranged for individual plugging-in on a circuit. A branched flexible cord with plug at the end for attaching to the regular socket, and small plugs for the individual curler, enable it to be used in any way desired, according to the fashion of the day and the nature of the hair.

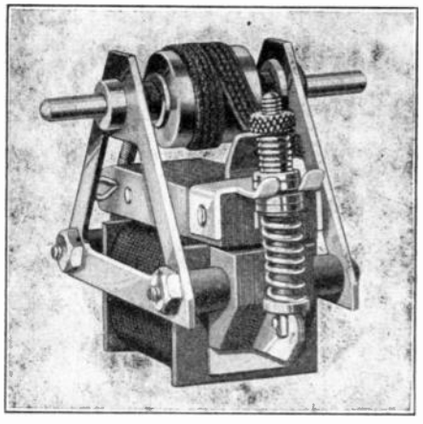
This hair curler enables the lady to put in a number of waves at once. It certainly will conduce to evenness of the hair dressing.

The device is intended to work on 110 volt circuits. One or any number of curlers can be put upon the hair as desired, there being branches enough provided in the flexible cord to accommodate the desires of the person using them. After the lady judges that the curlers have given sufficient heat, the main plug can be pulled out and the user can feel free to do other things while the curlers are cooling in contact with the hair.

Toy Reciprocating A. C. Motor

We present in the illustration accompanying this article a very ingenious alternating current motor, which is put forth as a toy motor. It will operate on the regular alternating current lighting circuit and has power enough to drive motor driven toys of any description. It is characterized by being of the reciprocating type, having no rotating parts except the shaft.

The motor proper is of a definitely reciprocating type. It contains a coil, through which the current passes, and above the coil a laminated iron armature is placed, free to vibrate in synchronism with the frequency of the current. A short belt is connected to a clutch pulley on the driving shaft above the motor. The other end of the belt, which is not a continuous one, is attached to the armature. As the armature vibrates up and down, it keeps jerking the belt forward as it descends, and as it rises the slack of the belt is taken up again by a spring in the clutch pulley. In this way what is called a "whipping" action is produced, so that the shaft continuously rotates. A counter electromotive force, incident to the alternating current, as it reacts upon an iron core, protects the winding from burning out. The motor, owing to the "whipping" action, despite the high number of cycles, is essentially a slow speed motor , which is the great thing desired; and the slow speed is attained without any gears. As will be seen from the illustration, there are no collecting rings; the electric contacts are fixed ones.



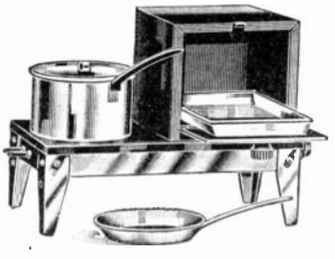
A most ingenious A. C. motor, working by a reciprocating armature and producing a continuous rotation without any crank.

The "whipping" action utilized in the operation of this motor recalls various applications of the string to machinery. The bow-drill and the reciprocating jewellers' hand drill are examples. Even comparatively heavy machinery has been driven by foot-power with an analogous pull and release action, the foot rising with the pedal on its return and pushing it down on the actuating stroke. Many examples could be found in old time tools, and in more recent days almost the same drive has been used on bicycles. The "Star" bicycle had a pumping action of this type and is one of the memories of old timers.

A Toy Electric Cooking Stove

This little stove is a charming plaything for a little girl of housekeeping ambitions; with sauce pan, frying pan and oven there is nothing that the owner cannot attempt and learn to do. Electricity enables children in comparative safety to play with fire, for the absence of flame undoubtedly conduces to the safety of a practical little toy like this one. The modern child has to be trained up for future housework, just as her ancestors were, but she is the manager of scientific electric apparatus, and should begin young.

There is one good thing about electric stoves; no impatient administrator of the culinary art will try to start them with kerosene. The child who uses this stove will never be tempted to employ the dangerous hydrocarbon to hurry the fire. The electric stove stands for safety first.



A nice little toy stove, but one on which some real cooking can be done. There is no flame to set on fire the dress of the little house keeper and little chance of injury to the juvenile owner.

Bell and Transformer Combined

There has recently been patented in Europe an apparatus which acts in the double rôle of bell and transformer, with the principal object of reducing the quantity of wire used for the windings, and thus making more economical the construction of an apparatus which is needed in every house.

When one realizes that, instead of a mean weight of about ten ounces, nine for the transformer and ten for the bell, in this bell only half the quantity of wire is used, it will be seen that the object could not be more successfully attained. The practical result is, that, while a bell with separate transformer today costs at least $4.40, an auto-transformer does not cost more than half the amount.

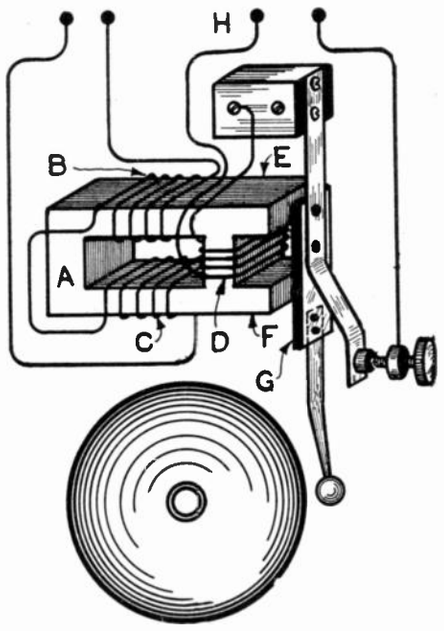
The consumption of current on open circuit, which may equal one watt with ordinary bells, in this one is half a watt , and perhaps less, and this is not a matter of minor importance, because one should be perfectly certain that when the bell is inactive, the watt-meter on the lighting circuit shall not show the least sign of passing current.

The rectangular core, A, of laminated iron, forms a closed magnetic circuit excited by two coils, B, and C, passing the alternating current, and placed on the long sides of the core. On the short side D, there is another coil of heavy wire, connecting with the supply line for the bells; thus the apparatus works normally like an ordinary transformer with rectangular core and separate coils, and the number of turns is calculated so that the potential difference at the terminals of the secondary, D, is only 5 or 6 volts.

It is now clear that as long as the secondary circuit, D, remains open, the magnetic flux, due to the magneto-motive force of the windings, B, and C, will circulate through the core, without creating magnetic poles. The polar extensions, E and F, situated on each side of the coil, D, exercise in this case no attractive force on the armature G. Now, if the coil D is closed through some external resistance, the induced current, circulating through it, reacts on the magnetic field, with the magneto-motive force of contrary direction to the preceding, tending to reverse its polarity. The portions of the core comprised between B and D and between D and C, become magnetic poles of opposite polarity; the polar extensions E and F and the armature G become in their turn seats of a magnetic flux, which is a shunt from the principal one passing through the coil. The armature is strongly attracted and if there is a buzzer in the secondary circuit as in ordinary bell systems, all the phases which the vibrations of the armature and bell hammer produce will be reproduced by it.

It will be seen that this simple arrangement utilizes a well known phenomenon which occurs in annular core transformers with separate coils, when the secondary circuit is closed. The invention does not consist then, in making the magnetic polarity appear in the closed magnetic circuit, but in having utilized the phenomenon by the happy addition of the two polar extensions E and F, which permit the apparatus to act as a real and true electro-magnet.

It is clear that if instead of adding the extensions to the core, they were placed on the armature, the same results would be obtained; and there are other forms of apparatus that make use of this interesting principle, with the view of obtaining mechanical movements by utilizing in a proper armature the magnetic polarity which lies in the core of a transformer, when the secondary circuit is closed. But the arrangement carried out with the electro-magnetic transformer described above, is certainly that, which solves this class of problem in the simplest way.



This is a most interesting example of an auto-transformer. The core of the apparatus is so shaped as to give two magnetic poles, which operate on an armature so as to ring a bell. Independent of its practical aspect, it is a most ingenious modification of the closed transformer core.

THE results of the "Household Wrinkle" contest, which has excited much interest and has brought us in many ingenious suggestions, will be announced in our February issue. —*EDITOR*

A Hand Blower for Removing Dust

WE hear a great deal about vacuum cleaners, which have supplanted to a great extent—especially for household use—the old-fashioned dust cloth and feather duster. Of course it is more logical and better practice to dispose of dust by vacuum process rather than to remove it from the article and disseminate it all through the air to be breathed by humanity.

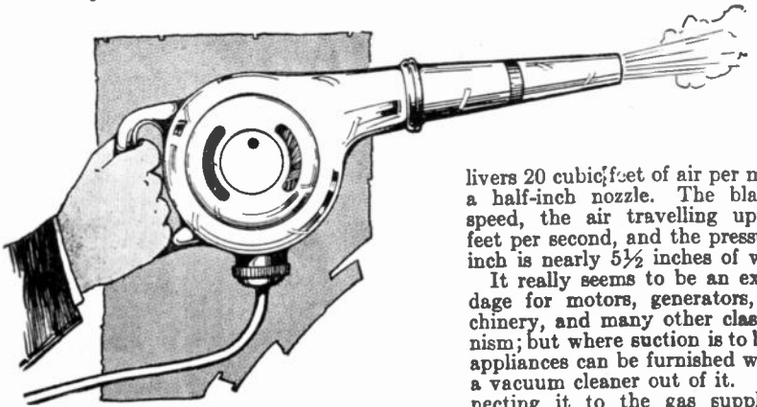
But it happens that sometimes there is nothing like the old-fashioned way, and for some kinds of cleaning a strong blast is still the thing.

We illustrate a hand blower driven by an electric motor, which produces a strong blast of air and which is particularly applicable to all classes of machinery and of course, to other uses. Dust and machinery do not harmonize, and motors and generators can be treated by the blast for the removal of dust, in many cases while they are still moving,—where, of course, a vacuum cleaner would be absolutely inapplicable.

The blower weighs but six pounds and delivers 20 cubic feet of air per minute through a half-inch nozzle. The blast is of high speed, the air travelling upwards of 250 feet per second, and the pressure per square inch is nearly 5½ inches of water.

It really seems to be an excellent appendage for motors, generators, spinning machinery, and many other classes of mechanism; but where suction is to be used, special appliances can be furnished which will make a vacuum cleaner out of it. Again, by connecting it to the gas supply, an electric blow-torch is produced, and parts are supplied to change it into this utensil. It seems very evident that the blower should have a wide range of use. In one case the blower is shown attached to an emery wheel, withdrawing the dust and discharging it into a pail of water so as to prevent its being inhaled by the workman.

It would seem that this blower does almost anything it is asked for. Its shape and compactness contribute to its usefulness, and where removal of dust from interior parts of moving machinery is to be effected, it will certainly do the work.

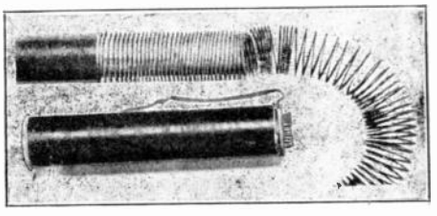


A vacuum cleaner does not always reach the spot, so here we have a hand blower which forces a strong blast of air into every corner and cleans most effectually; it is especially useful for cleaning machinery and automobiles.

Edgewise Wound Spark Coil Primary

IT has been said that efficiency is the conservation of time, energy, and space and the accompanying photograph shows how the conservation of space is met with in the primary of an automobile spark coil. It was found that the space left when round wires were wound together to form the primary coil, was only wasted, and if the winding was done with square wire, then there was space wasted between layers by using insulation. The result was to wind the coil with copper ribbon wound on edge. This ribbon is wound in a special machine, is then dipped in insulating enamel and baked, and then worked on to a micarta tube until it assumes the form shown. This gives a coil with the requisite number of turns, a minimum of insulation, and every bit of space utilized. It virtually gives a solid copper cylinder for the primary except for the lamination effect of the coiled ribbon.

Contributed by V. H. Todd.



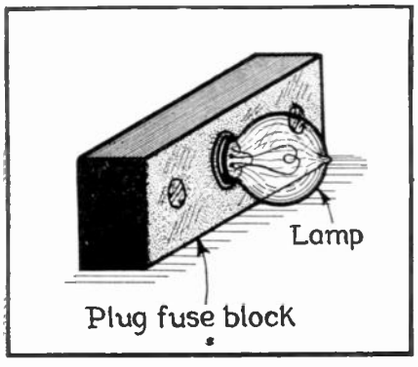
The great point in winding either element of an induction coil is to get as solid a disposition of the copper as possible, so as to avoid all air spaces. We show here how that is effected in the case illustrated, where the waste space due to the use of wire of round section is avoided by using a flat conductor wound edgewise.

When The Lights Go Out

Some Suggestions That Will Help the Amateur Electrician on His Trouble Shooting Jobs

By C. M. Adams

"WILLIAM, there's something wrong with these lights." "Bi-i-i-i-i-ill! I want a light! I must have a a light!" "Hey, Bill! What's the matter with your old juice?"

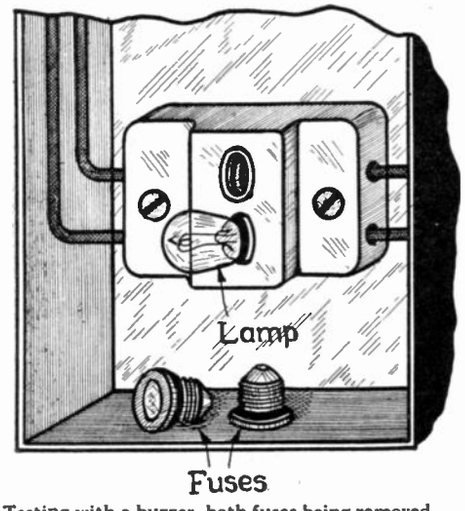


Testing for a short-circuit. The lamp is connected to the socket of one of the two fuses of the circuit.

From the suddenly black living room, where mother and dad had been reading, from the bedroom, where sister had been dressing for a date, from the dining room, where the kid brother had been occupying half the table with his evening's arithmetic battle, came the report of trouble and the demand for assistance, and Bill, caught on the point of seeing through a trig. problem, groped for his pocket lamp, and dutifully proceeded to hunt the trouble.

Every amateur electrician has been confronted with a situation like this. Whenever lights go out for even a moment, and for any cause whatever, he is the first to be summoned. He has a radio set and fixed the fan when it stopped last year. Therefore he is expected to know what makes lights go out and overcome it instantly, something that any amateur knows is usually far from possible, if he has ever been up against a real case of trouble, because so many, many things can make lights go out.

The first step to take, when they do go



Testing with a buzzer, both fuses being removed. This and the other method can be applied to cartridge type fuses.

out, is to be certain that the trouble is limited to the one house in particular.

Often a section of several blocks and sometimes an entire city may be left dark, due to an interruption of service, and in this case, of course, it is useless to look for the trouble in any particular house. So, before doing anything, it is always well to be certain that lights in neighboring houses are burning properly. If they are, the trouble is confined to the one house, and the first step toward locating it is to test the fuses.

There are usually two sets of these in every house; one at the main service switch, which controls the current for the whole house, and the other in the distribution box where the circuit divides into branches going to different parts of the house. These last should be the first tested, particularly if lights in only one part of the house have gone out.

Fuses, both the plug and cartridge type, are supposed to show a blackened spot under the mica cover when they have been "blown", that is, burned out. But when a fuse has been in service long or has become dirty, it will be difficult to tell by this method whether it is blown, and a test will have to be made.

For the plug type, the fuse can usually be removed and a lamp screwed into its socket. Then if the lamp lights dimly when lights are turned on, the fuse has been blown. The cartridge type will generally have to be removed from the holder, and the test carried out with a buzzer or some other similar

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.

device, connected in its place between the ends of the holder.

There are two usual causes for blown fuses; short circuits and grounds; and in either case both the branch and main fuses are likely to be blown.

To test for a short circuit, replace one fuse with a lamp and be sure that the other fuse is good. If the lamp burns at or near full brilliance, there is a short.

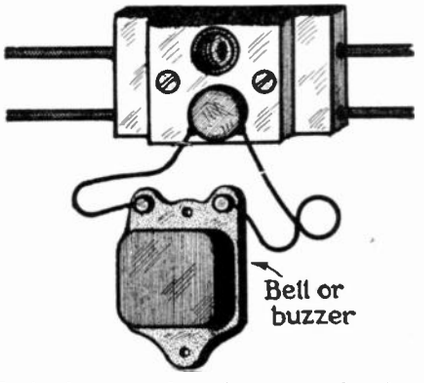
One of the most likely causes for a short is a defect in a household device, iron, toaster, cleaner, or radiator; a worn cord, bent contact, broken insulation, or other failure. So if a device which has given trouble or shown signs of trouble was operating on the circuit at the time lights went out, this should be disconnected and the circuit tried without it. Then, if lights burn satisfactorily, test the device for a short as just explained.

Short circuits may also develop in table-lamp cords, fixtures, wires, sockets, switches and other equipment. These should all be inspected if the trouble cannot be located otherwise.

To test for a ground, remove both fuses and replace one with a lamp. If this burns, there is a ground.

Defective devices are often the cause of grounds as well as short circuits. A grounded sad iron, for example, placed on a kitchen sink forms an excellent earth connection. Loosened joints, worn insulation, and like failures, may be the cause, particularly if the wiring is in an iron conduit, which itself is grounded.

But if only one fuse blows there is likely to be no short circuit or ground at all because fuses sometimes blow when not carrying an excessive current. High room-temperature often alters their rating. Mechanical shock or vibration will loosen the fine wire inside them, and often they blow simply because—So if only one is found blown it is



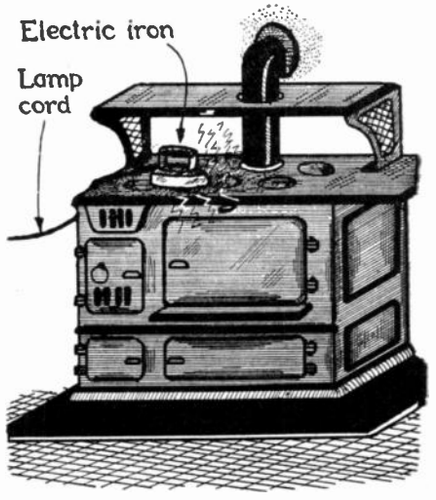
Testing for a ground, two fuses removed, and one replaced by a lamp.

usually safe simply to replace it and try the circuit.

Often plug fuses which have been screwed tightly into cutouts and left there for a long time are difficult to loosen because little space is available for using a wrench or pliers. In this case, wrapping the rim of the cap with a turn of friction tape will provide a dependable grip.

But fuses do not always blow when lights go out. Often the trouble is caused by an open circuit rather than a short or ground; a poor switch contact, broken wires, burned out or damaged meter, or open circuit at the pole, and in these latter cases the service company will have to be called because most companies maintain the line back of the customer's main fuses.

However, the most important thing for the amateur to keep in mind, the thing that will prove of more practical value than a thousand detailed directions, is that he can best locate and correct trouble by following some definite and reasonable method. Haphazard looking here and there, trying this and



How a flat-iron will make a ground. The flexible cord is apt to strip, so that it may come in contact with the metal of the iron or of the range, and ground the circuit.

that, may get results, but only accidentally. The sure way, the way that in the long run will most economize time and effort, is working along some logical outline such as has been suggested here.

Like many other things in this world system makes work easy and accelerates progress. Looking for trouble in the dark is a poor plan.

Experimental Electrics

Building An 8 Inch Spark Coil

By H. WINFIELD SECOR
Associate Member, American Institute of Electrical Engineers.

Part 2. (Concluded)

Operation of the Spark Coil

The diagrams in Fig. 5 show several ways of operating the 8 inch spark coil. At "A" the circuit is shown for utilizing an electrolytic interrupter; it will usually be found desirable to employ an adjustable choke coil in series with the interrupter to control the current more effectively. This coil will give a 6 inch to 7 inch heavy flame at the secondary terminals when operated with an electrolytic interrupter from 110 volts D. C. or A. C. It is not desirable to operate this coil from alternating current as an open-core transformer, for it is not designed for that purpose, but it can be experimented with by using the proper adjustable choke coils or auto-transformer in the primary circuit to control the amount of current consumed. It will give a very much shorter spark with 110 volts 60 cycle A. C. passing thru the primary of course, possibly an inch or so in length.

An interesting experiment may be tried out with this spark coil in connection with 110 volts A. C. 60 cycle service, using instead of an electrolytic interrupter, an electrolytic rectifier, composed of alternate aluminum or lead plates immersed in a glass jar containing a saturated solution of sodium bicarbonate. The closed core transformers as well as open core types used on many of the high voltage X-ray sets operate in this fashion. An adjustable choke coil or other means of control should be inserted in series with the rectifier and the primary of the spark coil. When using either the electrolytic interrupter or the rectifier, it should be noted that the usual primary condenser and vibrator are left out of circuit. The rectifier clips off the half-waves of the A. C. cycle. Fig. 5—D shows spark coil being operated from 110 volts D. C. by means of a potentiometer style resistance.

Fig. 5—B shows the 8 inch spark coil connected to a glass plate condenser and Tesla or Oudin high frequency coil, several excellent types suitable for this spark coil having been described in detail by the author in the last issue of PRACTICAL ELECTRICS. Fig. 5—C shows the spark coil connected to an X-ray tube. When using a spark coil for operating X-ray tubes to the highest efficiency, the inverse current is partially eliminated by placing rectifier tubes in series with the secondary lead wires, as shown. A short spark-gap in series with one of the leads also helps to eliminate the weaker or inverse wave.

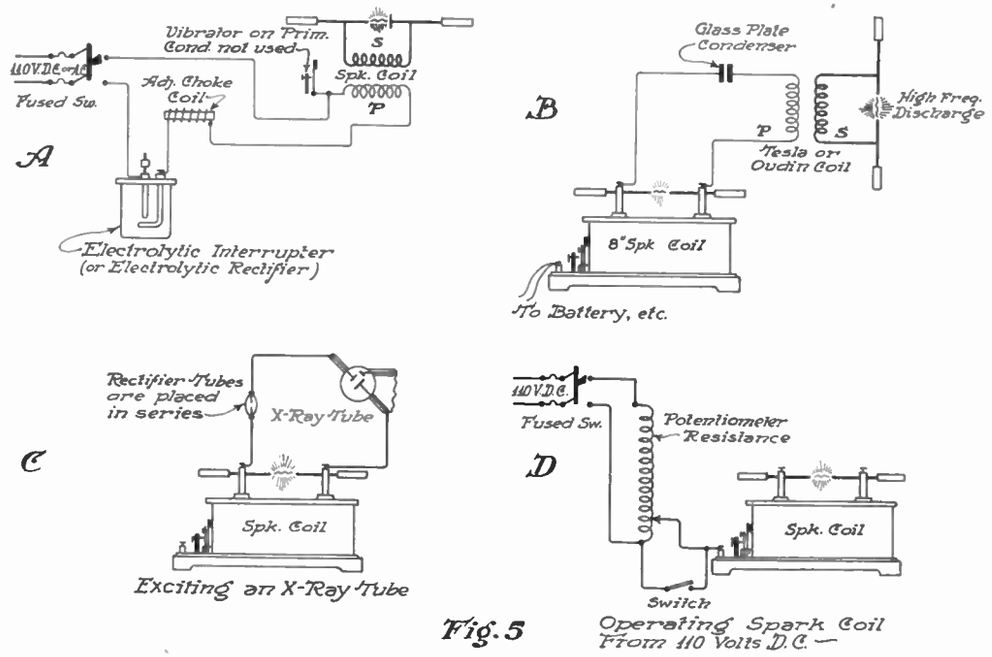
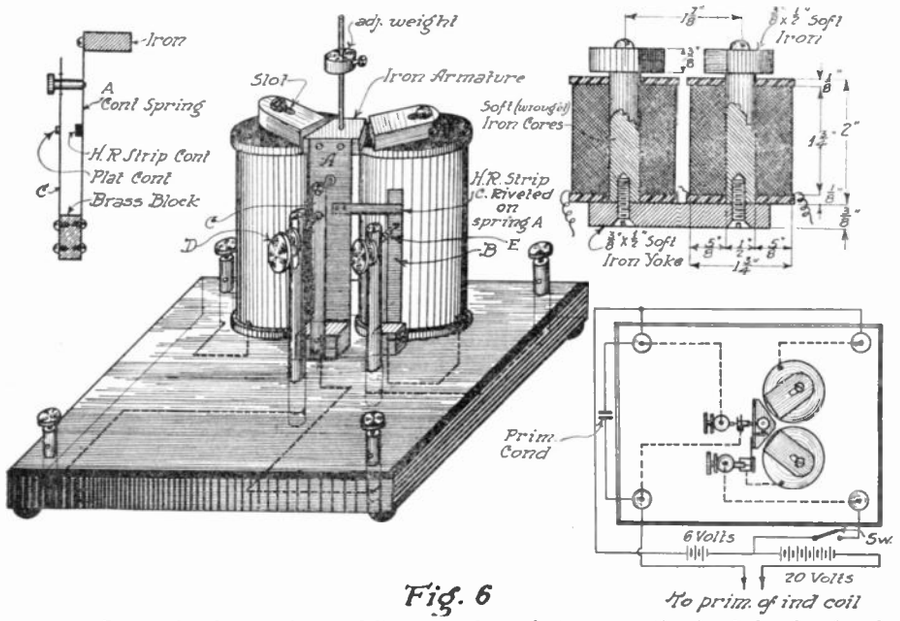


Fig. 5. Various details pertaining to the induction coil, the production of high frequency discharge, the use of an electrolytic interrupter. Its use for X-ray work and how it can be operated from 110 volt D. C. circuit.

In testing the length of spark from any induction coil, steel needle points should be used on both secondary terminals and care taken not to separate these beyond the sparking capacity of the coil or else the secondary will be under a severe strain and will possibly rupture its insulation. The polarity of the secondary current may be reversed with a double-pole, double-throw knife switch, or a double-pole drum controller connected in the primary circuit as shown in Fig. 2. By means of pole-test paper, commonly used for checking up the positive and negative wires on D. C. circuits, the polarity of the secondary terminals can be determined. Another way of testing the polarity of the secondary terminals is to attach two pieces of fine iron wire to the secondary terminals, and, when the spark passes between them, the one which remains cold is the positive terminal, while the one that becomes very hot is the negative. In operating X-ray tubes, the polarity will invariably be indicated at once, as, when the wrong terminal is connected to the anode of the tube, it will light up in different manner than formerly. The potential of the spark between needle points, with gap measuring 8.35 inches long is 90,000 volts. This value is for a sine wave form current such as is produced by the usual electric light and power alternator supplying current for lamps and motors. However, as the amplitude factor for the spark coil secondary current is approximately 3.23 the maximum potential of the 8.35 inch spark is approxi-



Perspective view, sections and diagrams of an electro-magnetic circuit breaker for the induction coil.

mately 290,700 volts; the value of 90,000 volts being the mean-square root value of a sine wave potential yielding a spark 8.35 inches long.

Building an Independent Magnetic Interrupter

Data is given herewith, as well as in the drawing, Fig. 6, for building an independent magnetic interrupter for those who may desire to operate the 8 inch spark coil in this fashion. The principal advantage of the independent interrupter is that you can adjust the speed of interruption and maintain it, which is not always the case with the spring interrupter fitted on the end of the induction coil itself, as the magnetic pull of the spark coil core acting on the vibrator will fluctuate with the changes in the secondary load.

The two magnet coils may be purchased or else made by the constructor himself. They should have a resistance of 3 to 4 ohms. The dimensions of the magnet coil bobbins are given in Fig. 6. Each bobbin is insulated with a piece of paper wrapped around the iron core between the fibre cheeks and 14 layers of No. 20 S. C. C. copper magnet wire is wound on each spool. They should be connected in series as shown, so as to give north and south poles at the pole-pieces. All iron parts for the magnet including the iron armature, are constructed of annealed wrought iron, which can be purchased at any blacksmith's or machine supply house. The electro-magnet here described is suited for operation on 6 to 8 volts, and the method of connecting the interrupter is shown in Fig. 6. The dimensions of the main spring ,A, supporting the iron armature as well as the lighter spring ,C, carrying the heavier platinum contact, are proportioned like those described for the interrupter built on the end of the coil, and shown in detail in Fig. 3. On the main steel or phosphor bronze spring, A, there is riveted or otherwise secured, a small 1/16 inch thick strip of hard rubber, bakelite, or fibre. This insulating strip breaks the auxiliary contacts for the magnet circuit, as the armature spring moves forward. The brass blocks, on which the springs are separately mounted, are secured to the base by machine screws passing up from underneath, threaded holes being tapped in the brass blocks to accommodate them. The main contacts on spring ,C, and screw, D, which may be of tungsten, platinum or even silver, should measure about ⅛ inch in diameter or more. The auxiliary contacts on spring ,B, and contact screw ,E, may be ordinary small size ones taken from an old electric bell.

The primary condenser is now connected to the binding post leading to the main contact post ,D, and the base of spring ,A. The shunt interrupter circuit is taken off at a sufficient number of cells to give 6 to 8 volts. These cells, in connection with additional ones, form the main battery energizing the primary circuit of the spark coil. If desired, a small condenser may be shunted across the auxiliary contacts of the interrupter to reduce sparking. The sliding weight on the armature rod permits the speed of the interrupter to be regulated very accurately. When the weight is clamped in a high position, the frequency of interruption is lowest; when the weight is clamped in a position near the armature or removed altogether, the rate of interruption is at a maximum.

An Experimental Induction Balance

BY HENRY JOHNSTONE

BEING interested in the large Hughes' induction balance recently described in SCIENCE AND INVENTION for locating underground masses of metals, pipes, ore deposits, etc., the writer made up a small induction balance from some old radio tuning coils which worked very nicely indeed. He has thought that the data on this balance would prove of interest to electrical students in general.

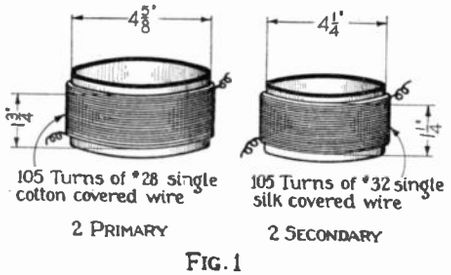


FIG. 1

This drawing shows how the single layer primary and secondary coils are built. Two primary and two secondary tubes are used in constructing this experimental Hughes induction balance, as shown in the assembly. Fig. 3.

An ordinary wire paper-clip when placed inside either coil, caused a distinct note to be heard in the telephone receiver, while large pieces of metal would indicate their presence by a sound in the 'phone, when they were held nearly a foot away. This refers to a metal encased voltmeter about 5" in diameter, etc., which happened to be handy on the test table. The balance was disturbed also by inserting or holding just over the coil a one cent piece, a dime and a quarter. A peculiar fact was noticed that when the operator moved his head toward the coils the approach of the metal encased telephone receiver and head-band worn on the head, caused a note to be heard in the 'phone, showing that the magnetic balance had been disturbed.

Many experimenters either have handy or can purchase at small cost, a tuning coil tube wound with a layer of insulated wire, or if wound with a layer of spaced bare wire, this will be all right. The writer cut two sections from each of two different diameter tuning coils. Two primary coils, which were excited by a buzzer, comprised exactly 105 turns each of No. 28 S. C. C. magnet wire in one even layer. The number of turns chosen were accurately counted off along the coil, and the wire then cut with a knife. Several turns of wire were next unwrapt beyond this section, which was to be used, and the cardboard tube carrying the 105 turns was cut off with a hack-saw, leaving ¼" of cardboard on either side of the winding. These coils had been shellaced and thus the wire remained in place without being tied with a string, while the cutting of the cardboard tube was being accomplished.

The two secondary coils were smaller than the primaries, and measured 4¼ inch as compared to 4⅝ inch in diameter of the primary units, these dimensions being over all. The two secondary units each comprised 105 turns of No. 32 S.C.C. magnet wire in one even layer, as shown in Fig. 1.

The diagram of connections, as successfully used with this induction balance, is given in Fig. 2. The coils were placed about 6 inches apart or about 11 inches apart center to center; the secondaries were supported just above the primaries by a piece of cardboard or two. The manner of connecting these coils is the important point to be watched. As Fig. 2 indicates, the two lower or primary coils are connected to produce north poles at their upper ends, while the

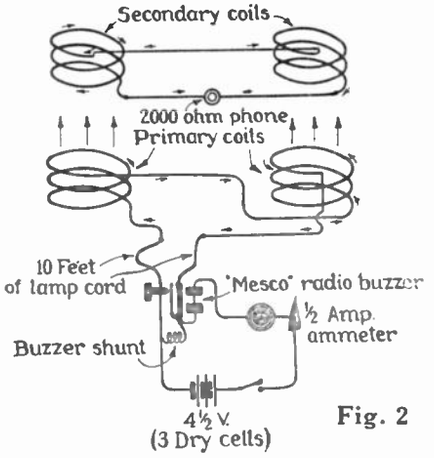


Fig. 2

Diagram of connections for experimental induction balance. Be careful to get the coils connected correctly with regard to their magnetic polarity. The author found it very desirable to place the buzzer exciter in a box filled with cotton to deaden the sound from it. A 75 ohm telephone receiver will give very good results in the secondary circuit.

two secondary coils are connected so as to produce north and south poles at their two upper ends. Thus the induced currents in each of the secondaries will oppose one another and no sound will be heard in the telephone receiver connected in series with the secondary coils. A 2,000 ohm radio receiver was used in the author's test, but a 75 ohm telephone receiver will serve the purpose admirably. The distance between the primary and secondary coils is adjusted until no sound whatever can be heard in the telephone receiver.

The primary coils were connected in series across the interrupter of a Mesco radio testing buzzer, which had a shunt coil across the vibrator to reduce sparking. The best results and the sharpest indications were obtained using this buzzer as the exciter,

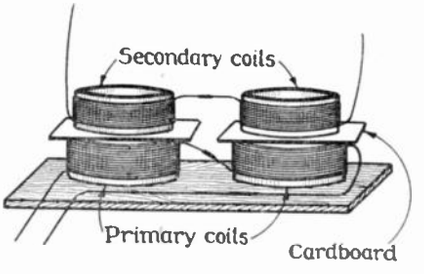


FIG. 3

Assembly of the Hughes induction balance here described. Different thicknesses of cardboard or other insulating material, are tried between the coils until "no sound" whatever is heard in the telephone receivers. Even a paper clip when placed within either secondary coil, will then cause a sound to be heard in the 'phone, and the difference between various coins as well as their counterfeits, is easily detected.

but it made so much noise that eventually a 10 ft. length of lamp cord was used, so that the buzzer could be placed in another room. It could also be silenced by placing the buzzer in a box with plenty of cotton around it.

The current in the buzzer circuit proper, using three dry cells, was found to be ½ ampere. Connecting a milliampere meter in the secondary circuit, the current was ascertained to be less than one milliampere. An interesting experiment was also tried in exciting the two primary coils in series, the same as in Fig. 2, but instead of the buzzer being used the two primary leads were connected to the terminals of an A. C. step-down transformer. Potentials as high as 18 to 20 volts were applied to the primaries until they started to heat up; in general it was found that the buzzer gave much more satisfactory indications.

The sensitivity of this induction balance could be increased by using more turns in both primary and secondary coils; by using a greater number of turns in the secondaries compared to the primaries; also by using a higher voltage in the primary circuit and by using a more sensitive indicator in the secondary circuit.

Building a Step-Down Transformer

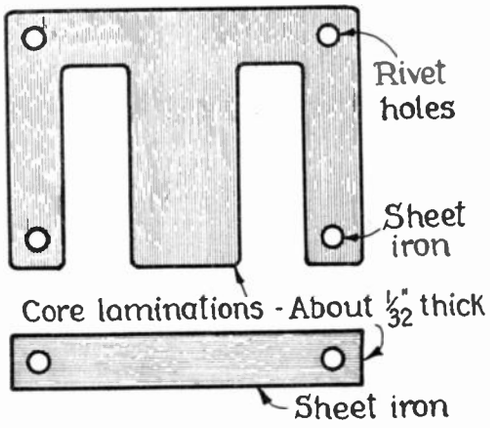


FIG. 1

Shape of the two kinds of laminations used in building up the core of this transformer. They interlace with one another, so as to build up a practically solid core, except for the laminations.

A small, step-down transformer is often needed by every experimenter, and the one here described can be easily made at little or no expense, and will be found to be of a very efficient type.

This transformer uses any 100 volt alternating current circuit, taking about 40 watts on full load, and gives voltages from 2½ to 27½ in steps of 2½ volts. This range of voltage will be found suitable for almost any kind of experimental work, such as operating small motors, lights, spark-coils etc. It gives ample current to operate a one inch coil.

The first step in construction is the core, which is made in laminations from soft sheet-iron. Ordinary stove pipe iron is just the right thing; you can get this from your tinner or hardware man. Have him cut the straight pieces to size, 2¾x7/16, and the other pieces are cut to 2¾x1⅞. You will have to finish cutting the larger pieces with a cold chisel. You will need about 45 of each of the pieces. After the sheets are all cut, give them a thin coat of shellac, each one separately, and lay aside to dry.

Next the 110 volt coil must be wound. This is wound with No. 30 enameled wire. Less than half an ounce will be needed. The coils are what is known as the form-wound type, so it will be necessary to make a wooden form on which to wind the coils. This is simply a square piece of wood a little larger than the center leg of the core on which the coils are to be placed. The coils are 1¼ inches long. Wrap a piece of cardboard of this width around the form and put a layer of tape over this. Then wind on 10 layers of the No. 30 wire, with a layer of insulating cloth between each layer. This cloth is generally known as "Empire cloth." In case this can not be had, tape can be used. When the ten layers are wound, put on a double layer of tape, and bring the ends out to be connected to the 110 Volt line.

The low-voltage coil is wound directly over this; No. 24 enameled wire is used. An ounce will be sufficient. This coil consists of three layers, or to be exact, 990 inches of wire are required to give 27½ volts. Five taps are brought out from this coil, starting 90 inches from either end of the wire used for the winding, the second tap being 90 inches from the first, and so on with the rest of the taps. Ninety inches of the wire are equal to 2½ volts, so any difference in the amount of wire used will make a difference in the voltage. If steps of 1¾ volts are wanted, the taps can be brought out at 45 inches and 10 taps used. After this coil is wound, it is taped securely, to protect both coils as shown in the drawing.

The core is then assembled by using the large pieces first and inserting the center part into the coil, first from one end of the coil and then from the other, until the coil is filled tight; then the straight pieces are put in and the core is completed. This style of core will be found to assemble very easily.

The transformer should now be mounted on some sort of base and the leads brought out to suitable binding posts, and the taps to a switch, and after being connected and tested, the case should be filled with wax, such as is used in storage batteries.

At the two terminals you will get 27½ volts, from posts 6 and 7 you will get voltages from 2½ to 12½, and from posts 7 and 8 you will get 25 to 15 volts.

Contributed by Harry L. Gray.

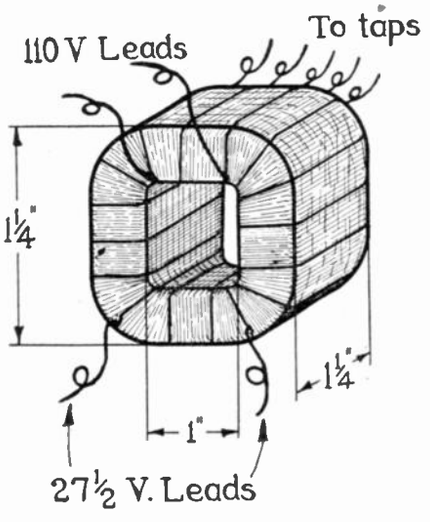
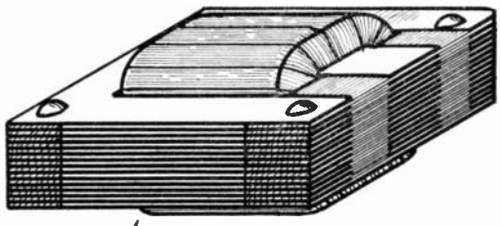


FIG. 2

The windings, complete in one compact coil, ready for insertion of the core. The laminations are inserted from each side alternately until the coil is filled with iron.



Method of assembling

FIG. 3

The coil in place, with the laminations inserted so as to build up a compact laminated core. If properly constructed it will be perfectly solid.

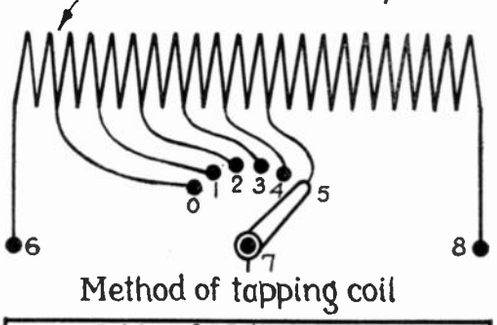
Having given an elaborate presentation of the step-down transformer question, we are glad to present from one of our contributors a simplification of the problem, and one which he himself has successfully tried and found to give good results. We are sure that this will interest many of our readers, and we commend it to their consideration, and hope that many of them will try it.

The general principles of a transformer are the following. There are the two windings, reciprocal to each other. Either one may be excited by an alternating current. The core of soft laminated iron, keeps the magnetic field in limits so that there is little waste of lines of force. The primary or actuating current, inducing lines of force, creates a current in the secondary coil. The potential difference between the terminals of each coil varies pretty closely as the turns of wire in each coil.

IF you ever want a small step-down transformer and have none, just take an old spark coil and connect the 110 volt circuit to the secondary leads, turn up the vibrator till it is right, and hitch your bell or whatever you wish to the primary wires, and there your have it.

I have tried this for some time and it uses very little electricity.

Contributed by Linwood Daniels



Method of tapping coil

Table of Voltages						
Terminal	Lever Positions					
	1	2	3	4	5	
6 & 7	2½	5	7½	10	12½	
7 & 8	25	22½	20	17½	15	
6 & 8						27½

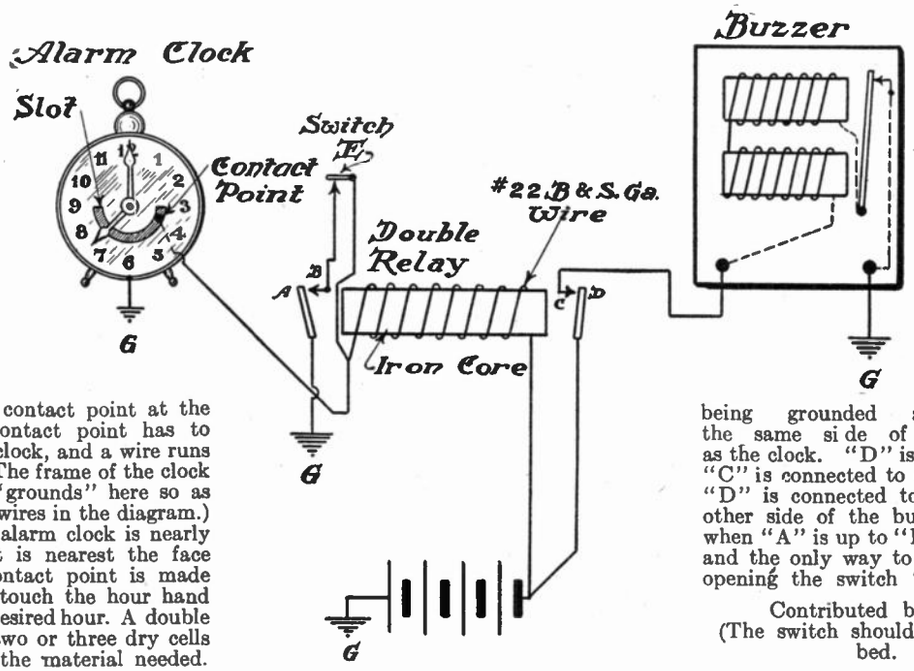
FIG. 4

The scheme of tapping the coil of the transformer so as to get different voltages from it with a multipolar switch.

An Electric Time Alarm

THE idea of this alarm clock is to keep ringing until someone shuts it off. An ordinary alarm clock will ring as long as the spring lasts, but this one will ring until the batteries die out. You will have to get up—its persuasion is irresistible.

The way to make it is to take an alarm clock, cut a slot, as indicated in the drawing, on the face of the clock. The purpose of this slot is to hold a contact point at the desired hour. This contact point has to be insulated from the clock, and a wire runs from it to the relay. The frame of the clock is grounded. (I use "grounds" here so as not to have too many wires in the diagram.) The hour-hand on an alarm clock is nearly always the hand that is nearest the face of the clock. The contact point is made so as to just slightly touch the hour hand when it passes by the desired hour. A double relay, a buzzer and two or three dry cells make up the rest of the material needed.



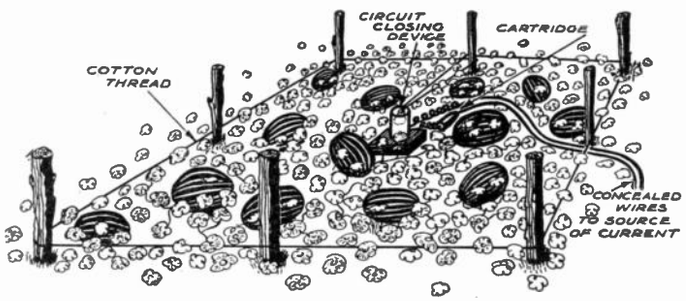
An irresistible alarm clock, one which is guaranteed to get you up in the morning by its persistent ringing.

The operation of the Electric Alarm Clock is as follows:—

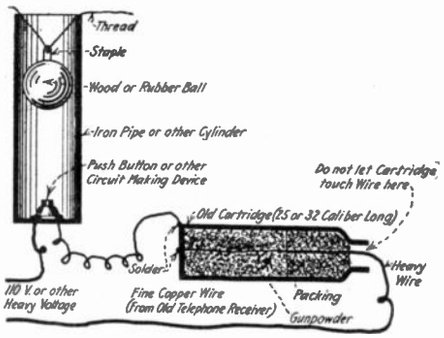
The switch "E" is closed, and the contact point placed at the desired hour. When the hour hand hits the contact point, the double relay is operated. "A" is drawn up to contact point "B" and takes the place of the clock when the hand passes by the contact point on the clock. It does this by contact 'A' being grounded and connected to the same side of the relay winding as the clock. "D" is also drawn up to "C" "C" is connected to one side of the buzzer. "D" is connected to the battery and the other side of the buzzer is grounded. So when "A" is up to "B" the circuit is locked and the only way to stop the buzzer is by opening the switch "E".

Contributed by Theodore H. Link.
(The switch should be far away from the bed. Ed.)

More Protection for the Watermelon Patch



A watermelon patch protected by a cotton thread.
How electricity gives the alarm if a trespasser enters the forbidden ground.



I herewith submit to you the details of an electrical attachment for a watermelon patch, which I positively guarantee will exterminate any and all melon thieves that may be in the surrounding country.

Set posts all around the patch as per illustration. Then drive a staple in each one about a foot from the ground. (If there are any dogs running loose in the vicinity you had better put them higher). String a black cotton thread through each staple and also through the circuit-closing device which should be located between two posts in an out-of-the-way corner of the patch. Any slack in the thread will be taken up by this device.

If you are a real "bug" the illustrations will be practically self-explanatory. When the guilty one steps inside the danger zone, he breaks the thread and the ball (d) drops, closing the circuit through the fine copper wire within the cartridge. Then this shell "comes apart," and removes the intruder from the vicinity. If there is danger of the shell becoming water-soaked it can be waterproofed by moulding it in paraffin.

A bell circuit can be substituted for the device shown and would be necessary in places where the lighting current is not available; but the above arrangement is better as it is entirely automatic.

It works fine, boys; try it next season.

Contributed by Orel Z. Burdick

Putting Storage Batteries Out of Commission

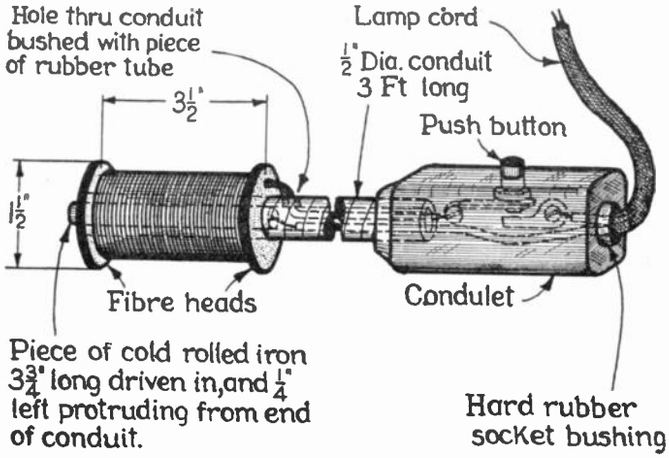
A very interesting innovation in the laying-up or putting out of commission of storage batteries has been experimented with in France, apparently with remarkably successful results.

There are two ways of putting a battery out of commission. One way is to charge it fully and replace the electrolyte by distilled water. The point is that a charged negative plate cannot be left exposed to the air if at all damp, beacuse it will heat and oxidize (sulfate). The finely divided lead gives up the water with which it is moistened with considerable difficulty, so to preserve it it is left immersed in water, thus keeping it out of the air. The other way of putting a battery out of commission is to discharge it completely, wash it out with distilled water, and leave it to become as dry as it will by natural evaporation.

Each of these methods has its objections; one involves the annoyance of emptying the battery before charging it with electrolyte; it also involves the annoyance of liquid in the battery if it is to be transported. If the battery is laid up dry, both these objections are disposed of, but a very long charging, three times the normal, is required.

The new process consists in completely drying the negative plates by artificial process. The drying may be done in a vacuum; the plates may be given successive baths of alcohol, which will remove eventually all the water; or the plates can be dried in a current of hot, inert gas. The perfectly dry negative plate will not oxidize in the air. That is the basis of the process. The result obtained was truly striking. A battery thus treated, after standing for three months and eight days, was filled with normal electrolyte and was found to be within ten percent of its full charge. Before drying, of course, it had been charged fully. This is really a very valuable innovation, if it proves practicable, as it gets rid of the annoyance of shipping batteries about in special boxes, as is now the general custom, adopted to prevent the spilling of the electrolyte.

Shop Screw Finder

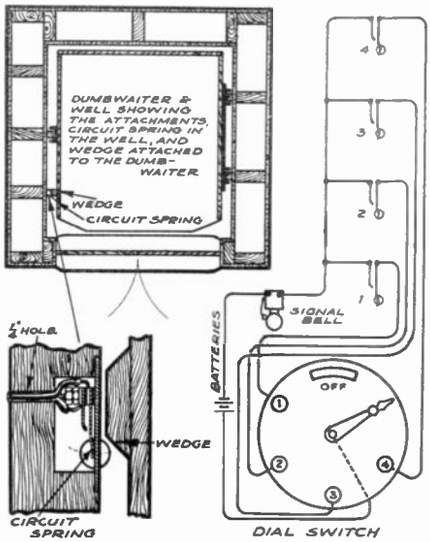


An electro-magnetic apparatus for picking up screws and the like from the floor of a workshop, only do not try it on brass screws.

WHO has not at the work bench dropped screws which even on the cleanest of floors, were never found? I stood this for a number of years and finally built this device, which has paid for itself over and over again in the recovery of valuable small steel parts and screws, which would never otherwise have been found. The "finder" I made and have used for five years, consists of a 3 foot length of ordinary ½ inch conduit, threaded at one end, on which is screwed a plain condulet equipped with a push button switch cover. This can be bought in any store handling conduit fittings. The open end of this condulet is threaded and will take any ordinary large size socket bushing. Two round fibre heads, 1½ inches diameter, are next "tight driven" over the smooth end of the conduit and spaced 3½ inches apart. This forms the magnet winding space. The space between these heads should be wrapped with 3 or 4 turns of good paper, fitting tight against the heads on each side. Two ⅛ inch holes are now drilled through the conduit—one just inside the inner head and the other just outside the inner head—as shown in the section. These holes should now be filled with a tight fitting rubber tube ¼ inch long. Next, a piece of soft iron 3¾ inches long should be driven tight into this magnet end of the conduit, until only ¼ inch of soft iron is left protruding. This forms the core. Now place this piece of conduit in a lathe or other revolving device and proceed to wind 14 layers number 22 enamel wire on the magnet for 110 volts A. C., or wind the magnet full of number 31 cotton enamel wire for 110 volts D. C., threading the ends through the ⅛ inch holes as shown and connecting to the push button contacts and lamp cord lead in conduit as shown. Of course it is understood that this device will operate only on steel and iron parts. Wound as specified it will easily pick up a ½ inch bolt. When a screw is dropped, by turning on the current and using the push button end as a handle and pushing the magnet into corners and cracks you'll be surprised at how quickly you will find the missing piece sticking to the end of your magnet. Four departments in the plant I am engaged in, have their screw "finders" made as above described.

Contributed by C. W. Warner.

Apartment House Dumbwaiter Indicator



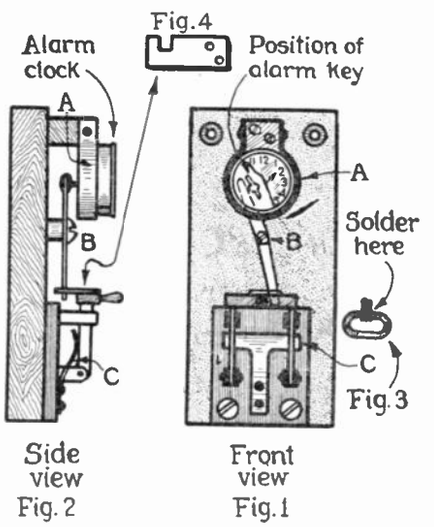
An indicator for a dumbwaiter, telling the person in the basement when the dumbwaiter reaches the desired floo

A dial with an electric connection for a spring-switch on each floor is placed at the bottom of the dumbwaiter shaft in an apartment house. On each floor there is a spring switch, normally open, except when pressed by a wedge on the dumbwaiter.

The dial is set to the floor number of the apartment desired, the dumbwaiter is sent up without looking up the shaft to see if it has reached the proper floor. When the dumbwaiter reaches the floor corresponding to the floor number set on the dial, the spring on that particular floor touches the wedge as indicated on the plan, the circuit is closed as the wedge presses the spring thus closing the circuit, so that as soon as the circuit spring is touched on that floor level by the wedge the person lifting the dumbwaiter down in the cellar is signalled by bell or buzzer. This notifies him that the elevator is at the desired floor; he then rings a common bell to the apartment.

Contributed by James J. Daidone

An "Electric Sign" Automatic Switch



An effective switch operated by an alarm clock, for opening a circuit at any desired time.

FIRST procure a piece of wood 11 inches long by 5 inches wide about ½ inch thick, cover it with asbestos. On this mount a knife switch. Under each blade place a spring strong enough to keep the switch open. C. fig. 2. On the piece of hard rubber just over the handle screw a piece of brass of the shape shown in fig. 4. Next procure an alarm clock, and solder the alarm key as in fig. 3; if the key is all in one piece, this of course is not necessary. Make a stand to hold the clock on the base; this can be done by bending two pieces of brass as A, fig. 1, and 2, and mounting them on a block which is screwed on the base. The last thing to do is to cut a piece of thick brass B, fig. 1 and 2, and to mount it on the base. It is pivoted in the center.

All is clearly shown in fig. 1 and 2.

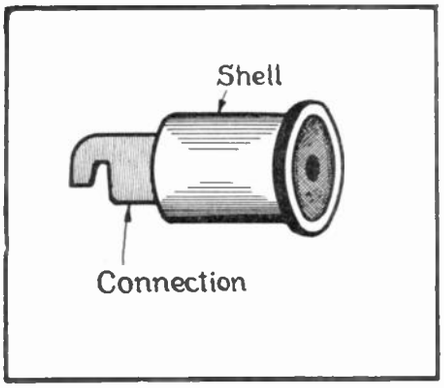
The two clock springs are wound up, the key of the alarm must be left with its handle in a vertical position. The upper end of the pivoted bar, B, rests against the lower end of the handle of the key. The other end of B enters the notch in the little brass piece, Fig. 4, thus holding the knife switch closed. The clock, of course, has been placed in the holder at A. When the alarm begins to ring the alarm key will turn. This will rotate the pivoted piece, B, on its center, will withdraw its lower end from the notch in the brass piece Fig. 4, and the knife switch, actuated by the springs, C, will fly out and open the circuit; thus the sign can be turned off, whenever desired, at any predetermined time. It is obvious this arrangement would operate successfully for many other things.

When an alarm clock rings its alarm bell, the fixed key by which the alarm bell spring is wound up begins to rotate and turns a considerable number of times before its motion ceases. It is this turning of the key, which is done with considerable force which is so often utilized for purposes similar to the above.

Contributed by H. Messier.

Simple Way of Repairing Electric Push Buttons

FREQUENTLY the electrical switches of the push button type become discarded because of the button being broken.



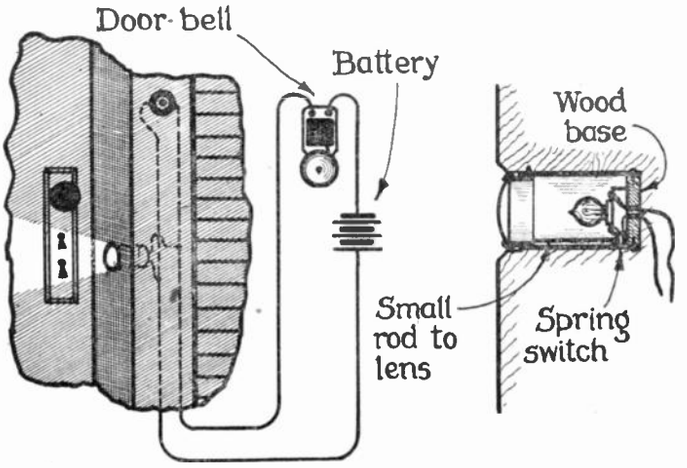
A cartridge shell used to repair a pushbutton switch. It is filled with sealing wax and cemented in place.

By taking an empty cartridge of 44 or 45 caliber and sawing it off at the proper length and filling it with sealing wax or other suitable substance and inserting the other member while the compound is soft, an excellent push button is provided. Allow the wax to cool and cut off the surplus and insert in the switch in the regular manner.

This applies particularly to snap switches used for electric lights in residences.

Contributed by Earl St. John.

Light on the Elusive Keyhole.



A flashlight arranged to throw a beam upon the keyhole of a hall door for the late incomer.

WHO has not had the experience of fumbling in the dark to find a key-hole and then, perhaps, discovering that it was the wrong one after all? This difficulty can be effectively eliminated by installing an inexpensive electric light in the door casing as shown in the diagram.

A shaving stick box with a screw lid, or an old flashlight case, can be used as a container for the light and connections. If the former is used, cut out the top of the lid and slip a convex lens in place. Leave the lid unscrewed just enough to allow about one-sixteenth inch play for the lens, which is used as a push button to flash the light. If a flashlight case is used, the same play is allowed.

Cut the container to the desired length and then shape a piece of wood to fit into the end. Bore a small hole in this wooden piece for the wires running to the battery. At one side of the socket, which is screwed in the center of the wooden piece, fasten a small push button switch used to connect the wires as shown in the diagram.

Fasten a small rod of the proper length to the inside of the container in a position to bring one end against the spring switch and the other against the lens. A loop of wire run through holes in the container and looped over the rod at either end will hold it in place. Then place the wooden block in the end of the container and secure it with screws driven through the side of the box.

When this is completed, bore a hole of the proper size in the door casing adjacent to the key-holes, and connect the light to the door bell circuit as shown, or, if desired, connect direct to the battery or transformer.

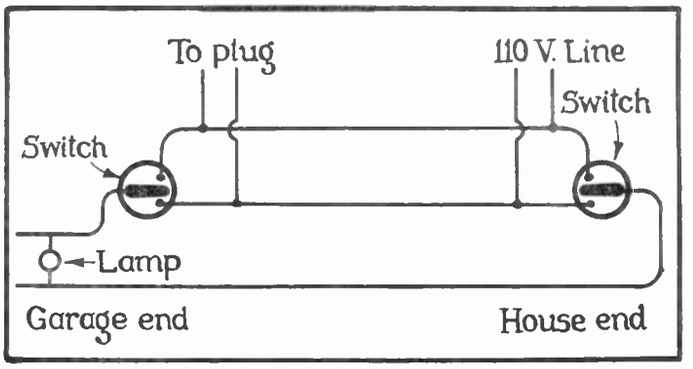
Then place the container in position. If the hole in the door casing is bored with an expansion bit, the inside portion may be bored the right size to admit the container but not the lid which holds the lens in place.

If this is not possible, a small projection may be fastened to the side of the container and an opening just large enough for the projection chiseled in the casing.

When entering after dark, press the edge of the lens and the keyhole will be made visible.

Contributed By Roy D. Hudson

A House & Garage Circuit.



A very simple and effective garage connection, so that you can light the garage from the house or put it out therefrom, without disturbing the battery charging connection.

I am sending a drawing of a three-way switch run from house to garage, using only three wires and at the same time giving a live pair of wires in the garage all the time, regardless of whether the switch controlling the light is on or off.

This is sometimes very handy to use for an extension cord or rectifier plug to run all night without keeping the garage lighted all the time.

If the above circuit is studied out, it will be seen that both switches must always be closed. When both are closed in one way, there will be no light in the garage. Then by changing either switch, the garage can be lighted. As the drawing shows it, the left hand switch should be down and the right hand switch up, to light the lamp or lamps. Moving either switch, to its other stud, would open the circuit, and the lamps would go out. Again , if the garage switch is up and the house switch down, the lights would burn. This gives an idea of how effective this very simple system is.

Contributed by G. E. Spofford

Repairing a Secondary of an Induction Coil

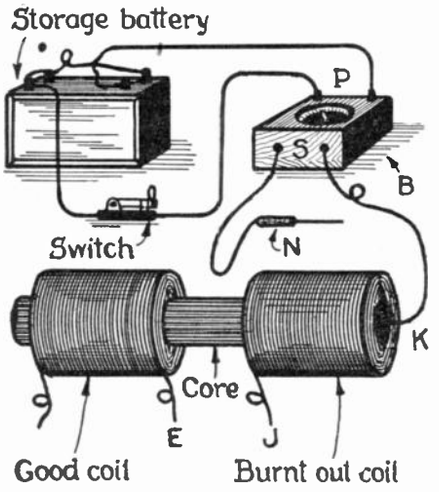


FIG. 1

The layout for finding defective places in a secondary of an induction coil.

THE coil is to be taken out of its casing and the wax should be melted off in a pan in the oven. Then, if it is a two section secondary, disconnect at the middle point as shown at E., for one section usually remains intact. The spark coil B used for tests should not give over ¼ inch spark. One secondary terminal of the testing coil, B, is fastened to a common sewing needle N, the other secondary terminal to the inner end of the coil, K, to be tested. The needle, M, operated by the coil B, is now touched to J—if the wire is unbroken from J to K, the vibrator on B will make a different sound and the section on test is O. K. Try short circuiting terminals of B several times and you will note and be able to identify this "different sound." But suppose that B makes a different sound when N touches J; then we know that this section somewhere within its layers is burned in two at least once and maybe more. Keeping S connected to K we now take N and stick the point of the needle, N, in between each two layers, commencing at the top, and traveling down as shown by dotted lines in 2. Some one of these layers when touched by N will produce the "different sound," indicating that the coil is good from that layer to K. We now pull out the end of this layer which we will say was the 30th layer, leaving 2 or 3 inches projecting from the end of the coil. Change now, S from K to J and with the needle travel upward on dotted line and we will so find another layer, which when touched will also give the "different sound." This we will call layer number 27 and we proceed to pull out a 3 or 4 inch length as we did on layer number 30, for the coil is good also from number 27 layer upward to J. We are now sure that the whole trouble lies in layer number 28 or number 29. You have your choice now of doing one of two things—you can pull out layer numbers 28-29 entirely and connect the projecting ends of numbers 27 and 30 together and shove them back in between the paper from which you pulled out numbers 28 and 29 or you can change S from J to ends of numbers 29 and 28 respectively and test right down by probing with the needle nearly to the very turn at which the wire is "burnt out;" then connecting ends together in their proper sequence, and shoving paper in between them, whichever you do your coil is good as new. When melted wax is poured back over coil replaced in case, it effectively closes in—hardens around—and insulates the reconnected layer ends.

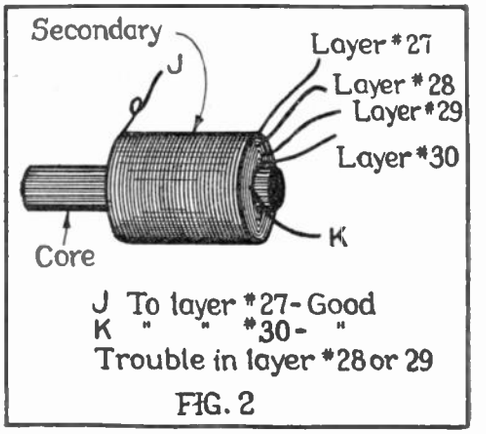
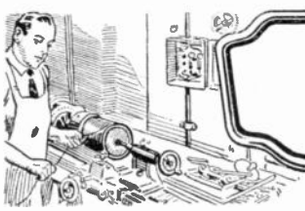


FIG. 2

Details of exploration of the coil with the needle. This system will save many a coil from being discarded.

Contributed by C. W. Warner.



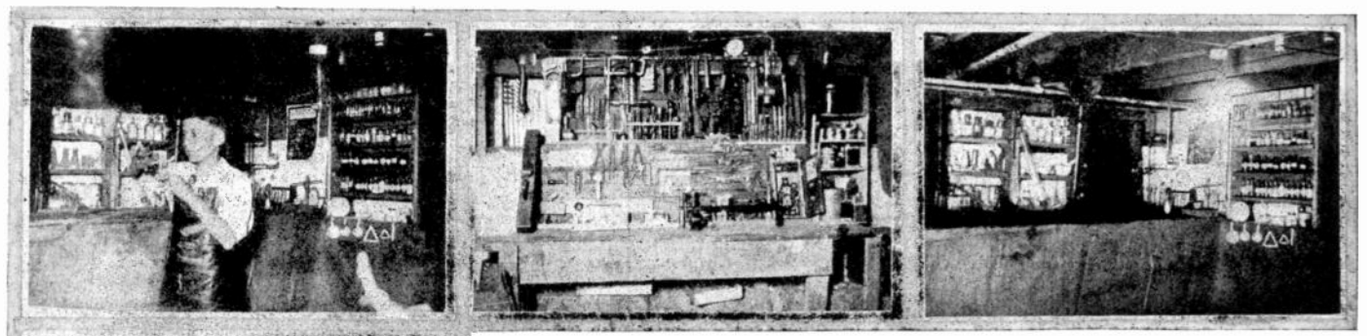
My Workshop

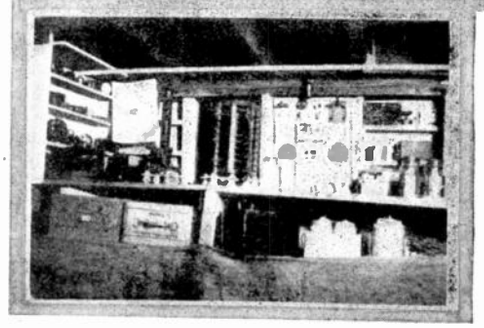
THIS department is open to all readers, whether subscribers or news-stand readers. We aim to show here for the benefit of others the best photographs of amateur work shops and laboratories. Nearly every experimenter has his own work shop, and we would like to receive photographs of all these. Photos are judged for best arrangements, and novelty of the apparatus, neatness of lay-out and arrangement, 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 unaccompanied by portraits of the owner.

We prefer dark photographs to light ones. Prize photographs must be on prints not smaller than 5 x 4½ inches. It is impossible to reproduce pictures smaller than 3½ x 3½ inches. All pictures must bear name and address written in ink on the back. A letter of not less than 100 words with full description of the shop must accompany the picture.

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

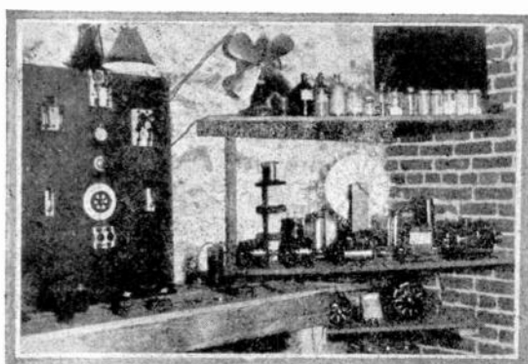


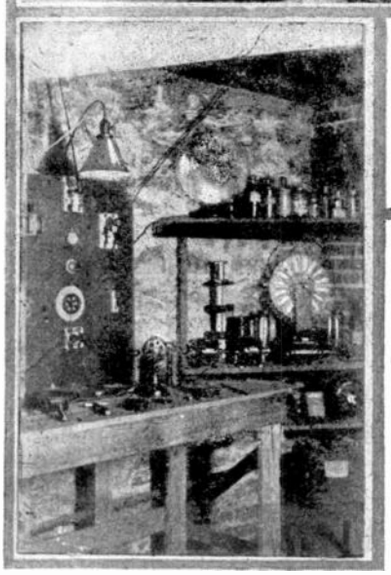


Quayle Laboratory

It will be hard to imagine a more complete presentation of a busy man's workshop than what is shown here. Chemistry, physics and mechanics seem to occupy the departments shown in the upper pictures, while his electric installation appears to the left. The energetic proprietor is shown working away in one of the rooms with his very workman-like apron. Incidentally, we quite admire his machine shop, with its nicely arranged tools, bench and lathe.

The division of the laboratory is to be especially commended. A mixture of chemistry, electricity and machine shop, in one crowded room, is a necessity in some instances but not a pleasant or advantageous one.





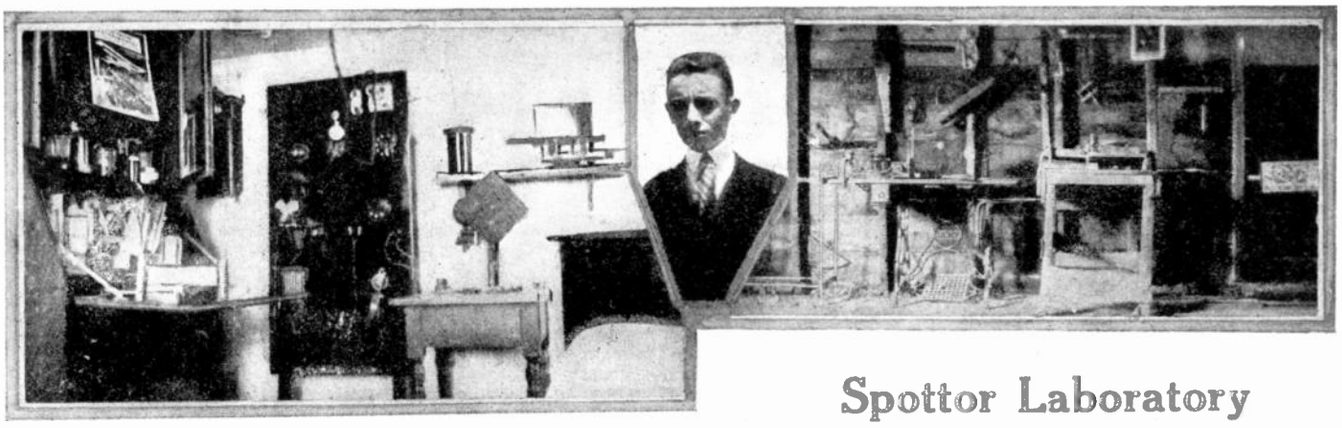
Rutenber Laboratory

Mr. E. O. Rutenber's laboratory is devoted largely to electricity. We recognize his Whimshurst machine, switchboard, spools of wire, and many odds and ends of interest to the working electrician. He has evidently made a long step on the road to success.

The influence machine shows that static work is not neglected, and the switchboard suggests heavy current work.

Choldin Laboratory

From Chicago comes this very nice presentation of a portion of Mr. S. L. Choldin's electrical laboratory, dry batteries, flashlight battery, and numerous appliances, all laid out on his working table. Mr. Choldin's portrait shows him to be one of our younger friends; he has made a good start.



Spottor Laboratory

Mr. John G. Spottor of Ontario, Canada, is evidently a home mechanic, for in his laboratory we can discern home articles which we are sure the family were only too glad to contribute to his work. Thus we see there the lower part of a sewing machine, which undoubtedly will form the basis for a coil winder, and in the office even the tables and desk have a homelike aspect. It would be a great privilege in all these cases of our younger electricians to be able to look into the future and see what the result of all the good well-applied energy which we have had the pleasure of illustrating in the last few months will have brought them.

Dittman Laboratory

Mr. Gerald Dittman of Chicago, Ill. Again gives us in juxtaposition the electrical laboratory surmounted by the chemi laboratory, as arranged in our illustration, although, of course, they are presumably on the same floor. It is well to notice in the chemical laboratory that there has been an influx of electrical apparatus, so it is evident that Mr. Dittman is sticking close to his guns, not abandoning the electrical science for the chemical end. His photograph shows in every line a worker.

The personality of the owner of a laboratory, especially if it is a laboratory of his own devising and constructing, is of interest, and the portrait which Mr. Dittman has sent us gives a good idea of what sort of a personality is his.

In the laboratory we also obtain a view of the workings of his mind and we would be very glad to know the history of the flag hanging in the corner.

There is a nice little row of chemicals, the ring stand, Bunsen burner ready to heat the flask, and the test tubes in their racks below it tell the story of active work. And to the eye of the laboratory worker, every little thing tells it story.

For many years past, the story has been that the technical developments of the world lay in the electrical field. Chemistry, physics and electricity were in practice, made three branches of natural science, now they are merging into unity.

We Pay a Cent a Word

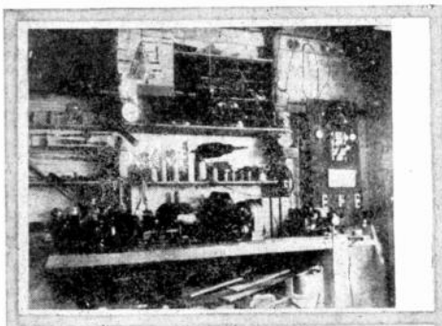
W E want good electrical articles on various subjects, and here is your chance to make some easy money. We will pay one cent a word upon publication for all accepted articles. If you have performed any novel experiments, if you see anything new electrical, if you know of some new electrical stunt, be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

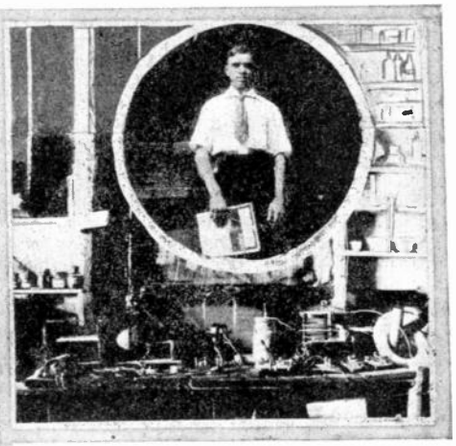
EDITOR.

Mag Laboratory

Mr. A. Mag who hails from Pittsburgh, Pa. has had the good taste to have a photograph taken, holding a representative electrical magazine in his hand, which magazine has a strangely familiar appearance to our editorial staff. His tables crowded with apparatus for electrical work, the shelves in his chemical department with the long rows of bottles, are certainly most attractive. He certainly has enough appliances to do a great variety of work. We are very sure that he makes the rather extensive laboratory give a good account of itself.

Order is the first law of heaven, so at first sight we may doubt whether Mr. Mag is following the celestial precept in his laboratory. But perhaps there is a method in his madness and the different articles and the innumerable bottles of the chemical department may be in apple-pie order, as far, at least, as the mental processes of the energetic proprietor are concerned. He must be energetic, or he would never have accumulated such a mass of material; and the general aspect is that every bit of it was accumulated for real work, none for the somewhat obscure joy of collecting. We also may be allowed to hope that studies physics. The movement of the day, however, has been to bring electricity and chemistry into closer relationship, and in many of the pictures of our working friends the chemical outfit and the electrical one will be found in close proximity.





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

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

MAGIC SPIRIT HAND

The magic hand made of wax is given to the audience for examination, also a board which is suspended by four pieces of common picture-frame wire. The hand is placed upon the board and answers, by rapping, any question asked by members of the audience. The hand and the board may be examined at any time and yet the rapping can be continued, though surrounded by the audience.

The Magic Wand, a London journal, gives the secret of this spirit hand as follows: The hand is prepared by concealing in the wrist a few soft iron plates, the wrist being afterwards bound with black velvet as shown in Fig. 1. The board is hollow, the top being made of thin veneer (Fig. 2). A small magnet, A, is connected to a small flat pocket lamp battery. B. The board is suspended by four lengths of picture-frame wire, one of which, E, is connected to the battery and

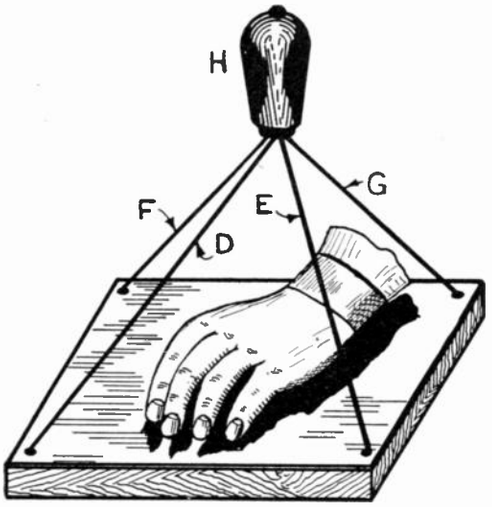


FIG. 1

A mysterious hand, which raps out its message at the will of the magician.

another, D, to the magnet. The other wires, F and G, are only holding-wires. All the wires are fastened to a small ornamental switch, H, which is fitted with a connection plug at the top. The plug can be taken out or put in as desired.

The top of the board must be made to open or slide off so that when the battery is exhausted a new one can be installed. Everything must be firmly fixed to the board and the hollow space filled in with wax, which will make the board sound solid when tapped.

In presenting the trick, the performer gives the hand and board with wires and switch for examination, keeping the plug concealed in his right hand. When receiving the board back, the plug is secretly pushed into the switch, which is held in the right hand. The hand is placed on the board over the magnet.

When the performer wishes the hand to move, he pushes the plug in, which turns on the current and causes the magnet to attract the iron in the wrist, and will, therefore, make the hand rap. The switch can be made similar to an ordinary push-button, so that the rapping may be easily controlled without detection by the audience.

The great point to be carried out is to have the hand so shaped on its lower surface that the attraction of its concealed armature will

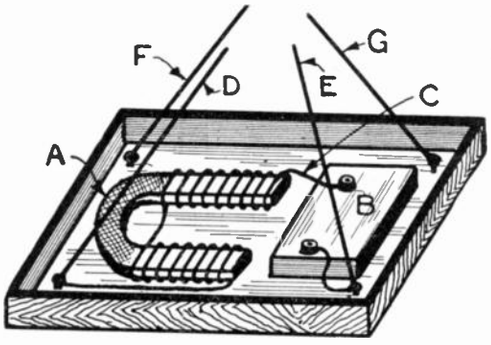


FIG. 2

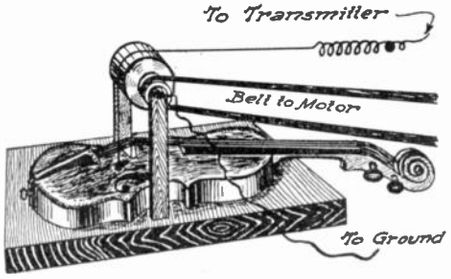
Details of the electrical connections for operating the magic hand.

make it move impressively. It must have a certain amount of weight, because the armature must be more or less massive to provide proper action, and the construction of the handle to which the four wires are attached must be such as to conceal the hole through which the rod is passed. It will also be very important for the hand to be placed with its armature over the poles of the magnet, because otherwise there will be very little attraction, and the action will be very slight.

A SPEAKING VIOLIN

IF a semi-conducting material is used as a dielectric between condenser plates, it is found, that when an electrostatic charge is applied, so as to obtain a suitable electric potential difference between the plates, they will adhere to the dielectric with considerable force. This principle has been employed in a very attractive demonstration, which we show in its essentials in the illustration accompanying this article. An agate cylinder, which represents a semi-conducting dielectric, is mounted above a violin, and is kept in rotation by an electric motor. A wire is carried over the upper surface of the rotating cylinder, one end descends therefrom and is attached to the sounding-board of the violin, while the other and horizontal part is attached to a spring, which keeps the wire in tension. Thus as the agate cylinder rotates, a constant strain is exercised by it upon the wire.

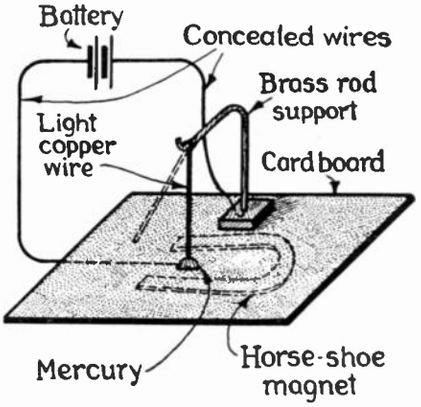
The agate cylinder is grounded by a wire. To the spring, keeping the other wire in tension, is connected a conductor leading to a telephone transmitter. If the transmitter



A very beautiful experiment in electricity, with a suggestion for its application to the magic art.

is spoken into, electrostatic charges and discharges are established at the agate cylinder, so that minute currents force their way through, and the friction between wire and agate varies with these little currents. The wire therefore is pulled with varying force by the rotating cylinder, so that the vibrations of the telephone transmitter, exciting potential differences, are transmitted to the sounding-board of the violin, and the instrument repeats with great accuracy and strength the telephonic vibrations, and the voice, or other sound actuating the transmitter, is enunciated with great clearness and loudness by the violin. The reproduction is said to be quite free from distortion.

To use this interesting experiment as a second magic, the cylinder should be placed out of sight of the audience, high up in the ceiling, so that the cylinder and its grounding wire and the belt driving it will be completely concealed from the audience. In this way the mystification will be complete, because there will be no trouble in using a wire connecting the violin with the cylinder, which will be quite invisible to the audience. The performance of the violin can thus be made utterly mysterious; the one trouble with it is that it impresses one as a little too much in the line of fine experimentation for an every-day magician, but it certainly would make a most impressive exhibit for anyone who would properly carry it out.



An experiment in the field of force, in its effect on the electric current, used as a magical performance.

MYSTERIOUS VIBRATING WIRE

THE following simple experiment can be made rather mysterious if the horse-shoe magnet, dry cell and wiring is concealed. A piece of No. 14 copper wire about a foot long is suspended with a loop on the end to a small copper wire with a dry cell making a circuit as shown in the diagram. A thin board or cardboard is placed over the horse-shoe, and a small dent made in it just between the poles of the magnet, in which a little mercury is placed. The heavy piece of copper wire should just touch the mercury when hanging at rest. The wiring should pass under and through the thin board making contact with the mercury.

When the circuit is closed the swinging wire will be repelled and swing away from the mercury. It then falls back and the process is repeated. It appears as though the drop of mercury is the cause of the repulsion.

Contributed by F. C. Hendershot.

Electroculture

By "ANODE"

A few years ago, several large experiments in electro-culture were carried out in various districts; while the results obtained were very encouraging, we have not been favoured by the authors of these experiments with any data on the subject of late, and this must serve as my apology for putting forward the results obtained by me in a small garden with apparatus within the reach of all, and, moreover, entirely independent of a generating station, perfectly safe, and productive of a large amount of pleasure and interesting incursions into other branches of science.

The apparatus consisted of a trembler coil capable of giving a 2-in. spark with a 6-volt accumulator, several bobbin insulators, some heavy gauge copper wire, and 2 oz. 24 S. W. G. S. C. C. copper wire.

The plot of garden was 30 ft. by 18 ft., and the heavy copper wire was strung from end to end both sides of the plot, insulated at each end, while the light wire was suspended across the plot from the heavy wire on bobbin insulators, at a height of about 4 ft.

This enabled me to move the overhead equipment up to one end for convenience in cultivation, digging, weeding, &c.

As the voltage was extremely high it was necessary to affix danger notices, and I soon found that a great deal of interest was taken in the experiment by all and sundry, but after a time the novelty wore off, and callers were few and far between; as I did not want any accidents, I did my best to discourage vistors.

A peculiar effect I noticed was that if you held the end of a dry walking stick near the high-pressure wire, a blue glow was seen round the ferrule, and, in fact, this constituted a very good way of finding out whether the conductor was continuous, as owing to the exposed situation of the garden, breakages were frequent.

What happened to the dog? When he captured the bone he broke the dangerous ground connection by jumping up into the air, indicating the high intelligence of the canine.

One night I landed home with a friend, to whom I was anxious to show the equipment; on the way up I mentioned the corona effect, and proceeded, on our arrival, to demonstrate it, but forgot for the moment that I was doing so with an umbrella with a steel stem. I was forcibly reminded of it by the ensuing shock, which afforded my friend considerable amusement.

The next sufferer was the dustman, whom I had warned of the great danger of getting too near the line, and really he had no right to say what he did, for he distinctly said: "That's all right, guv'nor, leave it to me, I know all abaht it." He did, and the cause of his enlightenment was, that, after taking the dustcan out, he returned with it on his shoulder and turned round to dump it in its accustomed place; he proceeded to lower it very carefully, and placed it on the live wire.

He kept on for at least five minutes, and never repeated himself. I never thought the English language was so rich in invective, and on my suggestion that he should enter for the Billingsgate championship, he went off again at synchronous speed till at last the fuses blew.

The poor ashman seems to have got it in perfection. The ashcan of metal certainly formed a very fine electrode, and our artist shows the results.

My wife was distinctly of the opinion that the largesse paid to this horny-handed son of toil should not be charged to the garden account; but women have no sense of perspective. Personally, I thought it cheap at the price.

Incidentally, the dustcan on reaching terra-firma flattened out a seed bed of onions, and carried away a portion of the overhead equipment, which dropped on to a promising row of peas and electrocuted them.

Sultan, a poodle of uncertain origin belonging to my neighbour, began to take a great deal of interest in the garden, and—evidently arrived at the conclusion that it was just the place to hoard his treasures, so one day I suspended a nice meaty bone from the wire just about a foot from the ground, and stationed myself at the switch inside the house and awaited developments. His lordship appeared, I switched off, he got the bone nicely in his jaws and I switched on. Sultan was immediately taken with a combined attack of lockjaw, locomotor ataxy, general paralysis, hemiplegia, and strychnine poisoning, and struck dumb into the bargain. The physiological effects were remarkable, and variegated displays were easily obtained by quickly switching off and on.

As he appeared to be suffering somewhat, I switched off, and he seemed to imagine that he was a series-wound motor running on no load; in his revolutions and evolutions round the garden, he shipwrecked everything that the dustman had missed.

His owner witnessed this interesting experiment, quite unknown to me, and was of the opinion that it savoured of vivisection with a dash of Bolshevism thrown in, but this I strenuously deny, and for my own part I consider that Claude Bernard was a back number in scientific researches of this nature.

It took me about a month to get things all square again, when we had a visitor, a young lady from the country, who was greatly interested in this latest method of food production. She was of the opinion that I greatly overestimated the danger of touching the line, and one day carried out the experiment on her own account.

As she had been brought up in a refined home, and carefully shielded from all worldly taint, she was at a loss what to say, but the Athanasian creed and extracts from the Psalms supplied the deficiency. She then entered into a searching and critical analysis of my past, and finished up with a lurid description of my future destination.

And there was silence for half an hour when my wife discovered that the accumulator was leaking, and had burnt a hole in the dining-room carpet.

On my return home next evening I found the whole outfit scrapped; but though my experiments did not lead to any new facts being discovered in the horticultural line, I have every confidence in recommending an electro-culture outfit to those in search of cheap and refined amusement.

(*The Electrical Review, London.*)

The Starting Motor Wire On Automobiles

THE current is so heavy and irregular on this wire that fuses are usually dispensed with. It is remarkable that the storage batteries in automobiles stand the strain to which they are subjected, especially by those who do not appreciate the limitations of the lead-plate cell. The current on the wire in question may, for a short time, run up to several hundred amperes. The insulation of the wire should be watched, and it should be protected from friction and rubbing. If it grounds through such causes, the battery will soon be exhausted; however large the current, there is no fuse to open the line. It is the one part of the various circuits in a car, which should be absolutely protected by its own insulation, and the insulation should be most carefully looked after.

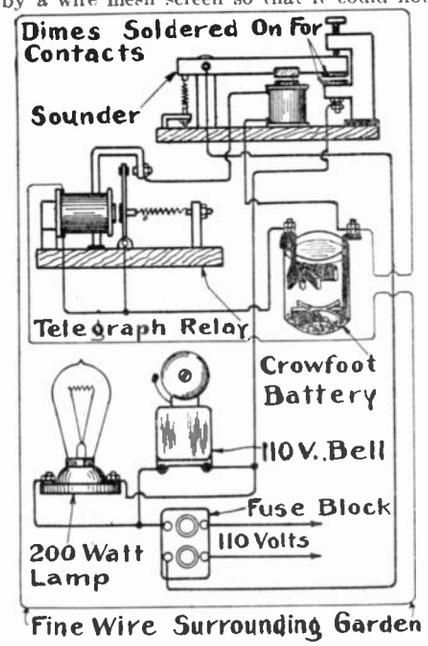
[It should be more carefully protected than "Anode's" horticultural wires were.]

IT being the policy of this publication not to publish the names of the various manufacturers of the apparatus and devices described in these pages, our service bureau will be glad to forward the required information upon receipt of a stamped envelope or stamped postal card.

Junior Electrician

Protecting A Yard Or Garden

TO protect my suburbanite garden I ran a fine copper wire (about 36 B. & S. gauge) around the whole place about 6 inches from the ground and around the top of the fence. This was connected in series in closed circuit with a crowfoot battery and telegraph-relay. The relay was connected in turn to a telegraph-sounder, to which two silver dimes were soldered to form contacts. These contacts closed a 110-volt circuit to a 200 watt nitrogen lamp, which was placed on top of a clothes-pole in the garden and surrounded by a wire mesh screen so that it could not



A well thought-out system of protecting a garden; the use of a relay for throwing in the full lighting circuit makes it possible to use a very powerful lamp to illuminate the whole district, while the apparatus proper is operated by a crow-foot battery.

be broken by stones. A big electric gong was also placed in parallel with it.

The first night after this was installed, the boys climbed the fence, broke the fine wire, which instantly caused the lamp to flood the garden with light and the gong to ring furiously. There was a wild scamper and the garden was not molested again.

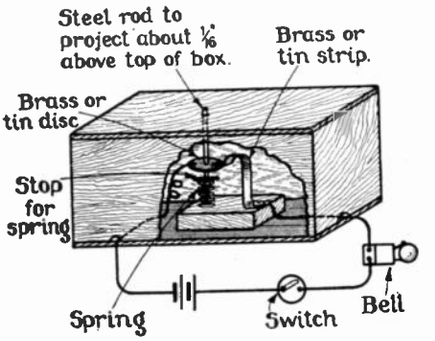
Of course, it is necessary to twist the broken wire together to reset, but the break indicates the point of entry, and any authorized person may enter or leave the garden at will by simply stepping over the wire.

Contributed By V. H. Todd.

A Thief Alarm For Stores

THE accompanying illustration shows a petty-thief alarm mounted in a display box or a cigar box. It does not cost anything to make and can be put together from odds and ends. It has been tried and found to be a very efficient help in a store where small articles on show-cases are displayed to the public. Many people have the habit of "taking things" from merchants' counters and this alarm sure does let the merchant know about it.

There is first a small block of wood in which a stiff wire, is placed. A piece of nail is soldered to the wire, to keep the



Here is another protection against thieves, this time against store thieves. An attempt to remove an object from the counter rings an alarm bell.

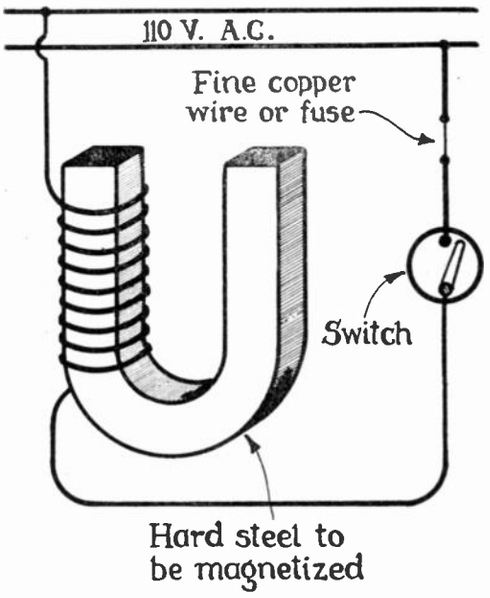
spring from slipping up. Also to the wire is soldered a tin disc to make the contact. (I used a disc so that if the wire should turn there would always be a good contact.) There is a strip of tin arranged so that when it touches the tin disc a contact will be made and the circuit closed.

When any article is placed upon the end of the wire that extends 1/16 of an inch through the hole in the cover, it will push down the wire and the spring and hold the contact open by its own weight. Just as soon as the article is moved the spring will come up and make a contact between the disc and tin strip, and ring a bell or light a lamp, and inform the merchant that there is something going on.

Contributed by Everett P. Inman

Making a Permanent Magnet with the Alternating Current

IN the amateur's laboratory it often happens that he desires permanently to magnetize steel parts, but is not able to do so without some means of rectifying the commonly used alternating current. This



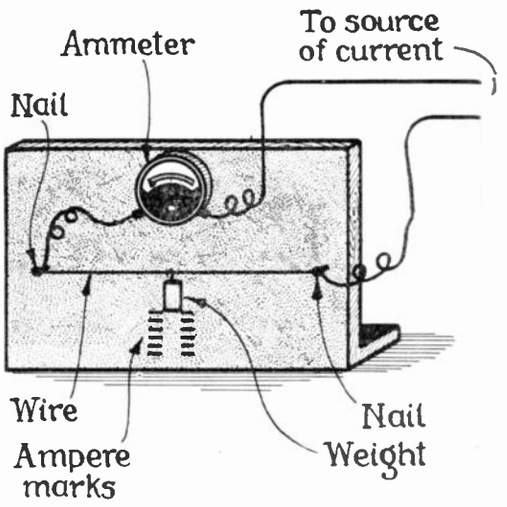
A most ingenious and simple way of magnetizing a bar or horse-shoe magnet, with an alternating current circuit for source of current. The essence of the method lies in the fuse, whose sudden parting at the right instant of time secures the magnetization.

difficulty can be easily overcome if the coil used to magnetize the parts is placed in circuit with a fairly heavy fuse, of 5 or 10 amperes, or with a piece of light copper wire, as shown in the sketch. Where the switch is closed, the fuse, of course, is blown, but the instantaneous surge of current in the coil is very great, and the break so sudden, that the steel is left magnetized. The result is secured only if the current happens to break near the peak of a wave, or alternation. If not successful the first time, try again.

Contributed by Ben Laden.

A Simple A. C.—D. C. Ammeter

THIS is a simple device for measuring an A. C. current when only a D. C. ammeter is available or vice versa. The



A hot wire ammeter. This instrument will interest all young experimenters. It has been found to be surprisingly accurate and its sensitiveness is due to the use of a horizontally stretched wire as the heated element.

wire is about 12 inches in length of 20 B. S. gauge copper; weight is about 4 oz., this is suitable for a capacity of 4 or 5 amperes.

The wire heats and expands, resulting in the weight lowering itself, thus different amount of current, will indicate different levels. This device can be used with any amount of current providing the wire is heavy enough to carry the current, otherwise overheating of the wire will produce a permanent sag in it. This device is surprisingly accurate. It is correct for both kinds of current on account of the fact that the A. C. current is measured by the virtual amperage, which is measured by heat value of D. C. current of same amperage.

Submitted by P. C. Leonhauser.

An Electric Warming Pan, and Substitute for the Hot Water Bag.

IN place of a hot water bag, an aluminum or tin case of somewhat the shape of one, perforated and containing a 2 candle power bulb, can be made. This is connected to the electric system, and the heat from the small bulb, which only costs a cent a day, is quite sufficient to take the place of the old time hot water bag or warming-pan.

For people having a penchant for sleeping on cold sleeping-porches, virtually out of doors, this would seem to be a great comfort for use in the mornings as a warming pan, when the rather dreadful getting-up ordeal has to be gone through with.

Electric Winder for Victrola

I am going to give a brief description of the electric winder used on my Victrola.

The crank, which is on the side of the machine, is taken off and a pulley, such as used on sewing machines, is put on the crank and held in place by a set screw. Figure 1 shows this.

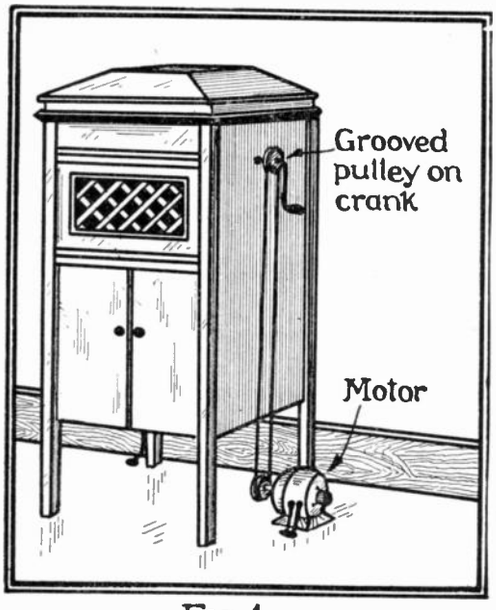


FIG. 1

A phonograph connected to an electric motor on the floor, by a belt, which winds it up, obviating the somew hat tiresome winding up feature of phonograph playing. The player throws a switch to make it operate.

A small 110 volt A. C. motor is bolted to the floor directly under the crank.

The belt used is a sewing machine belt.

A single pole single throw knife switch is mounted on the victrola near the needle box.

Where the machine is run down, the switch is thrown in and the motor re-winds the victrola until the sudden slowing down of the motor warns the music lover that the victrola is fully wound, the switch is thrown off and the machine is ready to play again.

Contributed by James Edwards.

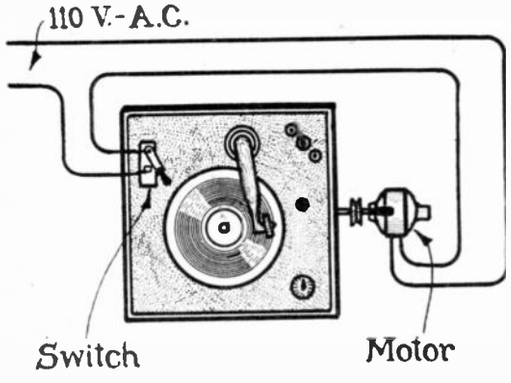


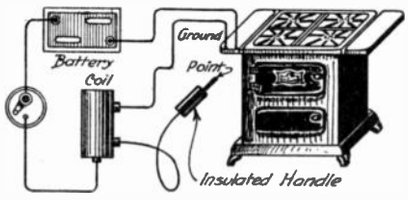
FIG. 2

A plan view of the phonograph with its top removed, showing where the switch is, and[the relative position of the motor.

An Electric "Match" for Shop or Home

ORDINARY matches are unsafe in a garage where there is gasoline about, with the ever present danger of fire. Beside this they are inconvenient, and are generally not to be had when needed.

An electric lighter that can be attached to a gas stove, or soldering furnace, is made of an old vibrating coil, of the type now in use on a popular make of auto.



With this arrangement of spark coil and battery, the gas stove can be lighted without the necessity of hunting for a box of matches.

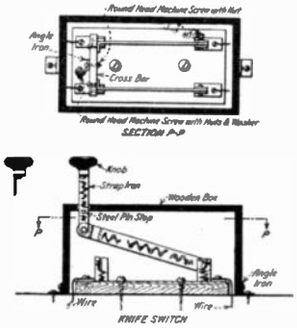
The wires are soldered to the three contact posts on the coil, and the wire on the bottom post, or battery lead, is attached to the positive, or negative side of two dry cells, or storage battery. The wire on the upper contact post is grounded on the stove, or furnace. The other side of the battery is likewise grounded. The wire from the middle post is heavily insulated, and forms the high tension lead, or sparking point. The end of this wire is attached to a short metal rod, with a wooden handle.

When this rod is held a quarter of an inch from the stove, and the battery circuit is closed, a fat continuous spark will jump from the sparking point to the stove, or furnace. The outfit should last a long time without attention, and will easily light paper, cigars, and cigarettes; in short it is an improvement on the ordinary match, in safety, convenience and economy.

Contributed by Glen F. Stillwell.

Knife Switch Safety Device

DANGER from shock through touching a knife switch can be avoided by covering the switch with a suitable wooden box fastened to the wall with angle irons and wood screws as shown in the illustration.



This is a contribution to safety. The knife switch is compactly boxed in so that the contents are inaccessible.

Discard the handle of the switch and fasten an angle iron to the cross-bar with a round head iron machine screw and nut as shown. A strap iron with a knob is then linked to the angle with a round head iron machine screw furnished with a washer and two nuts.

For appearance the wooden box may be given a coat of paint to match the color of the wall.

Contributed by Frank Harazins.

A Curious Electric Shock

By W. A. PARLIN

A NOVEL experiment in static electricity was brought to my mind and finger unexpectedly the other evening in the following manner:

My mother was sifting some flour to make bread. At this particular time she was using a small hand sieve and the sifted flour fell into a large tin bread pan. While she was sifting the flour I happened to touch the edge of the pan with the back of my hand. I jumped thinking that the pan was hot. When I touched the pan again to make sure a small spark jumped to my finger.

The bread-making stopped, at least for the time being, and the pan was insulated from the table by a plate of glass. This time strong stinging sparks about ¼ of an inch long were obtained as long as the flour fell into the pan.

My explanation of the above is that the fine particles were charged by the friction between them and the air, and that the particles gave up their charge to the pan which acted as a condenser, holding the charge until a circuit was formed which would permit its escape to the ground.

[*We are inclined to think that it was the action of the sieve on the flour, not that of the air, which produced the electric charge.*
Editor]

An Easily Made Arc Light

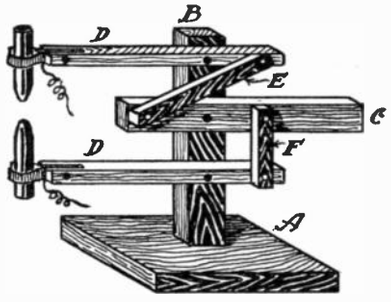


FIG. 1

A very primitive yet quite practical arc lamp. The illustration shows the complete mounting of the parts, whose dimensions are given in detail below.

I have seen descriptions of how to make several different kinds of arc lights in various magazines, but the one shown here is about the easest to make, that I have seen yet. Below is a list of material needed in the construction of one. The illustration speaks for itself.

1 hardwood base	7″x4½″x1″ thick	(A)
1 " standard	8″x1½″x¾″ "	(B)
1 " handle	9″x1″x¼″ "	(C)
2 Copper Arms	9″x½″x⅛″ "	(D)
1 " lever	6″x½″x⅛″ "	(E)
1 " "	2¾″x½″x⅛″ "	(F)

2 Battery Clips to hold Carbons.
2 Flashlight battery Carbons.

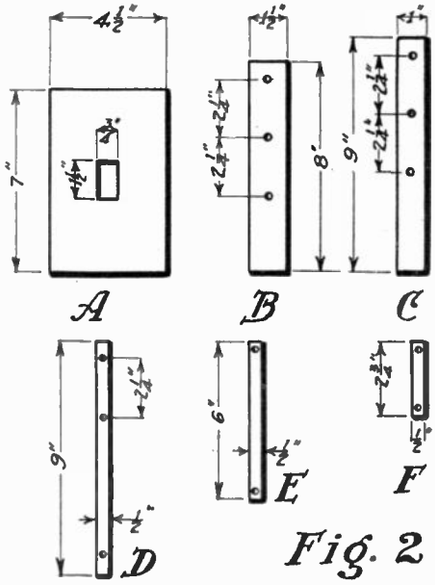


FIG. 2

Detail of the parts of the arc lamp shown above in elevation. Only six principal pieces are involved in its construction.

The copper arms are pivoted on the standard and it is a simple matter, by means of a a wing nut, to secure one or the other of them from moving. If it is a direct current arc, one carbon, the negative one, will have to move faster than the other, and this can be carried out by proper use of the wing nuts.

Contributed by John Gross.

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.

Choke Coil

(30). Ernest C. Taylor, New Haven, Conn., asks:

Q. 1. Please give data of choke coil for small induction motor.

A. 1. On an iron core 14 inches long and 1.4 inches in diameter, wind 4 layers of No. 13 D. C. C. wire, making 480 turns or 120 turns per layer. The space of the winding in inches upon this core will be about 10 inches. Six pounds of wire will be required.

Hughes Induction Balance

(31). Joseph P. Quinz, of Santa Barbara, Calif., asks:

Q. 1. In a recent issue of some magazine, I do not recall the name, a Hughes Induction Balance was used as a treasure locater. Can you give me the data and name of the publication?

A. 1. This locater appeared in the August issue of SCIENCE AND INVENTION MAGAZINE. Two large coils have 100 turns each of No. 14 B & S gauge enameled copper wire wound upon them. These coils are about 1½ feet in diameter. The transformer is similar to an induction coil with the primary wound on an iron core about 3 inches long and ½ inch in diameter. It consists of one layer of No. 14 B & S gauge enameled copper wire. This is so arranged that there are two wires of the same size in parallel.

The secondary is composed of about 10,000 turns of No. 36 B. & S gauge enameled copper wire. The inductor balances are made by winding twelve turns of No. 14 about a block ¾ of an inch, in diameter. For the rheostat 10 inches of No. 14 B & S gauge German Silver wire is employed. The battery is of the ordinary six volt type and one thousand ohm receivers are used.

Electromagnets, Spark Coils and Batteries

(32). Clifton O. Siegelin, of Plainfield, N. J., asks:

Q. 1. What are the constructional details of an electro-magnet enclosed in iron corrugated case, about 2½ inches or 3 inches in diameter, capable of supporting 100-150 pounds on two dry cells?

A. 1. A magnet capable of lifting 150 pounds on two dry cells, cannot possibly be constructed within the dimensions given by you. In our opinion, you would be fortunate indeed if you managed to design a magnet capable of lifting 10 pounds within the size allotted to it.

Q. 2. Please give me data on the construction of ¾ inch spark coil.

A. 2. With reference to the spark coil, we would advise that the standard dimensions are; length of core 7 inches, diameter of core ¾ inch, wound with two layers of No. 16 wire for the primary. The secondary is wound in four pies or sections; 1½ pounds of No. 34 single cotton covered wire will be necessary. The condenser is made by placing between paraffined paper sheets of tinfoil, size four by four inches; 80 sheets of tinfoil will be necessary.

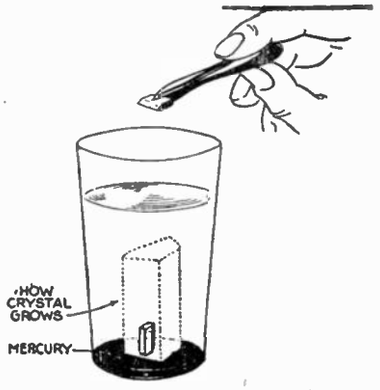
(34). Q. 3. What is the main difference between starting batteries, (storage), and those used for lighting, that is, does the thickness of the plates make any difference?

A. 3. The main difference between starting and lighting batteries is that the plates in the former are much heavier, and also greater in number. In this manner, the battery may be charged more rapidly, and incidentally give off a greater supply of energy for a longer period without danger of buckling the plates. The thick plates last longer.

Piezo Electric Effects

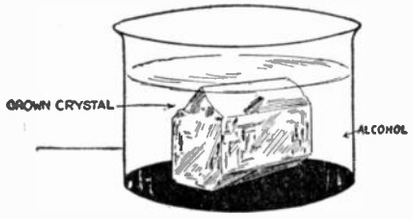
(33). Geo. Trudeau, of Hampton, Va., asks.

Q. 1. What is the action of the mercury used in growing Rochelle salt crystals for Piezo-Electric effects?



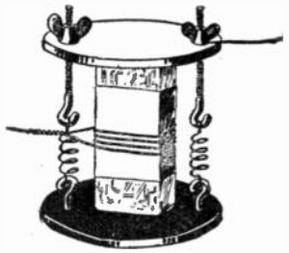
Dropping the seed crystal into the solution of Rochelle salts upon the mercury.

A. 1. The mercury used in the making of Rochelle salt crystals for the Piezo electric effect is simply for holding the crystal so that it will not rest on the bottom of the glass. A solution a little less concentrated than one



Dehydrating a crystal with alcohol. Three or four hours in 90%, and 20 minutes in absolute alcohol is needed.

used for growing the Rochelle salts, seed crystals is used. When the solution has cooled sufficiently, one or two seed crystals are dropped into it.



The crystal mounted for transmission, wrapped in goldbeater's skin.

These seed crystals in the course of a day or so (up to a week), will become sufficiently large to assist you in your further experiments.

Electro Plating Queries

(34). P. A. Thompson, of St. Johns, Newfoundland, asks:

Q. 1. Should distilled water be used in electroplating?

A. 1. In answer to your communication, we would state that in electroplating distilled water should be used almost exclusively. The reason for this is that other salts of metals are found in ordinary waters, which will be deposited on the article to be plated which might ruin or otherwise affect the deposit.

Q. 2. What apparatus must I have for a small electroplating outfit?

A. 2. A small electroplating outfit should not cost much, and might include a dynamo, a storage battery, and some method of charging the same by running the dynamo. A large tank, some nickel salts and of course, gold and silver salts, a portion of these same metals in a pure state, potash lye and acid for cleaning the articles to be plated, and a buff wheel with some rouge and talcum to polish up the articles after plating are suggestions. A little book on electroplating will answer all questions for you.

Ozonated Water

(35). B. J. Williams, of Oak Park, Ill., asks:

Q. 1. What effect has ozone (electrically produced) upon water?

A. 1. The bacteriological efficiency is marvelous. Within a few moments of actual contact with the ozone, cultures obtained from water have failed to reveal the presence of any microbes. Care must be exercised in bottling and delivering. The effect produced is sudden and rapid, but thorough in the extreme. Bear in mind however that only well designed apparatus have made such results possible.

Tesla Transformer and Incidentals

(36). Robert B. Withrow, of Cincinnati, Ohio, asks:

Q. 1. What are the proportions of all the apparatus and their construction, for giving high frequency currents, using a small transformer as the exciting means?

A. 1. As you are undoubtedly aware of the general principals of the Tesla transformer, we are giving you herewith the other information. The secondary is wound on a cardboard tube 3 inches in diameter, 15 inches long, wound with No. 30 enameled wire the turns separated from each other by the thickness of the wire itself. The primary is wound with No. 8 copper or aluminum wire, bare or rubber covered, 11 turns being employed and one half inch from each other. It is wound upon a drum 6 inches in diameter.

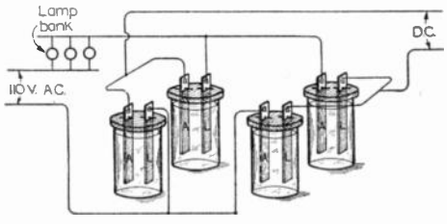
A condenser will comprise 20 plates, each 10 by 12 inches, with 8 by 10 inches tinfoil upon them, oil immersed. A quenched or pointed spark gap is used and a kick-back preventer should be placed in the circuit. Fuses should also be employed and although the secondary potential is not dangerous, the primary side of the Tesla should be avoided.

Electricity and The Selenium Cell

(37) Peter T. Ross, New York City, N. Y., asks several questions regarding the selenium cell and wants to know what the principal characteristics of the cell constructions are.

A. 1. Essentially a selenium cell consists of two electrodes of brass or copper separated by a thin layer of metallic selenium in such a manner that current flows from one electrode to the other through this selenium bridge, when a battery circuit connected to the respective wires is closed. If the layer of selenium is very thin, the resistance of the bridge will vary directly with the amount of light falling upon the cell, in that selenium has the peculiar property of lowering its electrical resistance in direct proportion to the quantity and quality of light falling upon it. The proposed electrical uses of these cells are many, such as the transmission of photos by wire, turning off street lights and advertising signs in the daytime, and on again at night, talking motion pictures, and other uses.

Another Rectifier Inquiry.



An electrolytic rectifier, receiving an alternating current and delivering a direct current.

(38) M. C. Clark, Kansas City, Mo., asks:-

Q. 1. Please explain the construction of an electrolytic rectifier and its action.

A. 1. Mount four aluminum and four lead plates, each measuring 4½ by 6 inches, in four jars, so that there will be one aluminum and one lead plate in each jar. Then connect the plates as shown in the accompanying diagram. From each of the A. C. mains the leads terminate in a lead plate and an aluminum plate. The two remaining aluminum plates are connected together and likewise the two remaining lead plates. These are the direct current leads. Note accompanying diagram. The aluminum plates are the positive leads for the D. C. circuit.

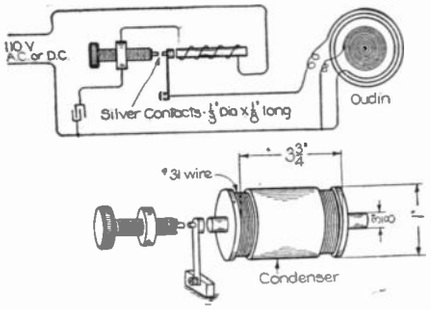
On studying out the connection of the battery, it will be seen that the idea is to obtain an alternating action for the alternating current rectifying plates, while for the direct current plates a uniform action is given by the connections clearly described in the article.

A Question and Correction

(39). Frank B. Dargue, of Kittanning, Pa. asks:

Q. 1. What is the construction of the core, vibrator, condenser, method of insulating the secondary turns and how to insulate the secondary from the primary connections, method of enclosing it in a tube and how is the Self-Contained Violet Ray Machine used?

A. 1. With reference to the violet ray machine described in the "How and Why" columns of our November issue, we would state that the core consists of iron wires bunched together, the vibrator is merely a piece of spring steel with an iron button and a contact point mounted thereon. The condenser—well, that was described thoroughly, as was the method of installing the secondary turns. The diagrams make everything clear.



Details of parts of a self-contained violet ray machine; the silver contacts and the wrapped condenser.

The primary is separated from the secondary by a fibre insulating tube, 1/16th of an inch in thickness. You surely have seen advertisements of violet ray machines, and anything that they can be used for, this device can be used for, provided of course, that you employ the necessary electrodes.

One of the diagrams omitted from that issue is published herewith and "5 oz. of No. 1 B & S gauge" wire so quoted is a misprint, and should have been "5 oz. of No. 13 B and S gauge enameled wire."

Insulating Bases for Electrical Apparatus

(40) Peter F. Haward, Chicago, Ill. sends the following query:

Q. 1. Please tell me how I can make moulded insulating bases that could be used for switches etc.

A. 1. If you wish to mould the bases you will require special metal moulds in which to subject them to pressure and heat. This is the case, if you wish to make them out of ebonite or hard vulcanized rubber. You can procure the proper mixed uncured rubber from dealers in such supplies. This material when exposed to heat first softens and will almost run, and will fill any mould. Longer heating hardens it. You must find out from the supply house how long and at what temperature their particular mixture should be heated; or if it is done by steam, they will probably give you the steam pressure. If they cannot give you these figures, three or four tests of your own will tell you what to do; how long to apply the heat and what degree of heat to apply. Steam vulcanizing is certainly to be recommended, although the electric vulcanizers are being used now a great deal, in which the temperature is regulated by the current test. If you only want a few of these bases, we would suggest that you turn them up out of vulcanized fibre or bakelite.

Oudin Coil

(41). O. A. Wheeler, of Oak Park, Ill., writes:

Q. 1. Please tell me how the Oudin coil (How and Why Dept., November issue) is made.

A. 1. The construction of the Oudin coil is rather simple. It starts with one layer of paper and mica; then comes one complete layer of wire; another layer of paper and mica follows through which this wire has been led; then only 1/3rd the length is wound with wire; another layer of paper and the second one-third distance is wound with wire; another layer of paper and the last third of the distance is wound with wire; then comes a layer of paper and mica, another complete layer of wire as in number one, and the same operations are repeated until the desired thickness of the Oudin coil has been reached.

High Frequency

(42). A. Walter Ward, of Hartford, Conn., asks:

Q. 1. I would like to develop current at frequencies of 1,000 or more. How can I do this, (10 to 15 watts is all I need)? No Tesla is to be employed.

A. 1. A frequency of 1,000 or more without the use of rotating, vibrating or moving parts whatever, can be obtained by the use of a Vreeland oscillator, or higher frequencies by the use of an oscillating audion.

Liberty Silver Wire

(43). R. H. Volkenburg, of Herkimer, N. Y., asks:

Q. 1. I have written to a concern for German silver Wire. They substituted liberty silver wire. Is this all right?

A. 1. Yes the wire is German silver wire, but some concerns have changed the name of German silver wire to Liberty silver Wire since the war. This policy is not observed now however.

Ford Spark Coils

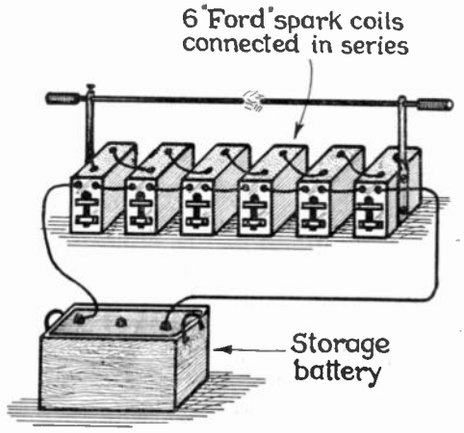
(44). Nick A. Doyak, of Cleveland, Ohio, asks:

Q. 1. How can I connect six Ford spark coils together:

A. 1. It is rather unusual to connect six Ford spark coils together, so as to get a result of one coil, but it can be done. Simply screw the vibrators of five of the coils down tight, the sixth one alone being free to vibrate for the entire lot. The primaries are then all connected in series, as are the secondaries.

Q. 2. Please give data on small welding transformer.

A. 2. On an iron core 15 inches long, 8¼ inches wide, and 2 inches square, made in the form of a picture frame, wind 344 turns of No. 10 D. C. wire, and on the secondary wind 31 turns of No. O. B. and S. gauge copper wire.



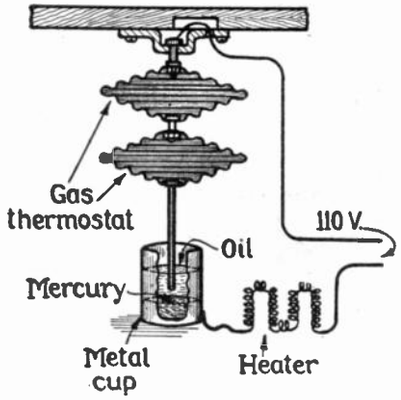
Connecting Ford spark coils in series, so as to obtain their cumulative secondary potential.

A Heat Controlling Device.

(45) Glen L. Newell, New York City, asks:-

Q. 1. I have a small chemical furnace in in which I intend to maintain a rather even temperature. In using the ordinary thermostats I have found that the contacts heat considerably. 550 watts are consumed by the heater.

A. 1. Herewith we show a diagram of a small gas thermostat similar to those used in chicken incubators, which are made of corrugated metal filled with ether or other gas. Extending from the bottom of two or three of these in series is a brass or other suitable rod. A metal cup containing a small quantity of mercury over which some paraffin oil has been poured, is placed upon a a table or suitable adjusting upright. When the thermostat expands the circuit through the mercury is closed, thus causing the heater to increase in temperature. If it is desired to cut off the heater when a certain temperature has been reached, it is merely necessary



A thermostat operating by the expansion of air or gas, with a heating coil and mercury cup contact.

Short-Circuits

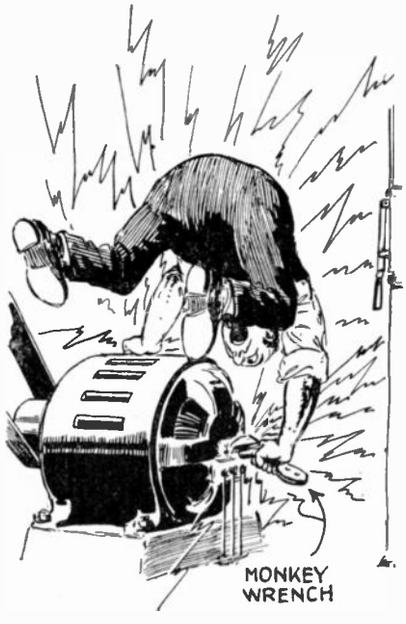
THE idea of this department is to present to the layman the dangers of the electrical current in a manner that can be understood by everyone, and that will be instructive too. There is a monthly prize of $3.00 for the best idea on "short-circuits." Look at the illustrations and then send us your own 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 sod
Rests Nathaniel Cole,
He touched the trolley wire
With his fishing pole.
—Charles Damick.

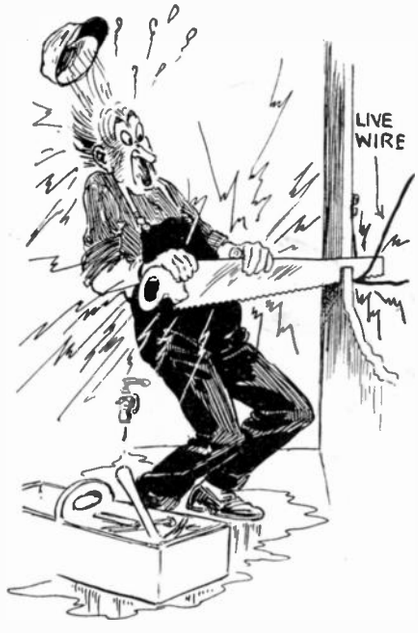
PRIZE WINNER
$3.00

This Garden Grave
Is for Mama's pet chow,
When chewing the lamp cord
He barked his last wow-wow.
—G. H. Pope.

Her husband mourns
Mrs. Aleck Wiener
She used the phone
And the vacuum cleaner.
—L. L. Rounds.



In state here lies
Bonehead Patrick McDuce
He monkeyed with the motor
But didn't shut off the juice
—Albert W. Meuer.



This modest grave
Holds Frederick Meyer
He cut the wall,
But didn't see the wire.
—T. S. Middlin.

This tombstone is
For young Josephus Day
He grounded himself
Using the Violet Ray.
—Ernin V. Oliver.

(*Continued from Page 131*)

to insert a lever into the system, so that an expansion of the thermostat will cause the circuit to open. In this case a lever of the first class could be used, a point projecting from one end, a fulcrum in the center, and the rod attached to the thermostat making contact with the other end of the lever; the point from the lever should be the one which will dip into the mercury and oil cup.

Atmospheric Electricity

(46). C. A. Carlson, of Los Angeles, Calif., asks:

Q. 1. Has electricity ever been produced directly from air?

A. 1. Several people claim to have secured electricity from the air. All of these ideas are rather far fetched, and we doubt very much if such electric current has ever been produced commercially, omitting of course power development due to winds, etc.

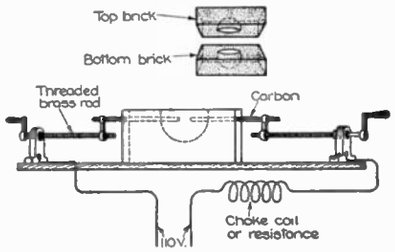
Q. 2. How besides batteries, acids, solutions, gases and generators, or magnetos can current electricity be produced?

A. 2. Current electricity may also be produced by heating and cooling alternate junctions between two dissimiliar metals, such as iron and nickel. This is known as thermo-electricity. In small quantities electricity may be produced by friction or pressure upon crystals, or by twisting them.

Electric Furnace

(47) G. H. Barton of Tacoma, Wash., asks:-

Q. 1. Please give me the construction of a small arc furnace in which I can treat various metals.



A Simple Home made Electric Furnace.

A. 1. The diagram is shown here. The entire outfit comprises two bricks, each being recessed, and the lower brick having grooves cut into it, or holes drilled through it laterally. These holes are for the insertion of carbons. Each carbon is clamped to a threaded rod mounted upon a suitable base so that the distance between the points of these carbon electrodes may be varied. A choke coil or suitable form of resistance is placed in series with one of the carbons.

Electrocuting Fish

(48) P. B. Pine, Detroit, Mich., asks:

Q. 1. How many volts are necessary to kill a fish 1 or 2 ft. long?

A. 1. On recent experimentation we have found that an eel could be subjected to a current of about one-half an ampere at a pressure of 110 volts which eventually killed it. Each time positive contact between the body of the eel was assured by spiking the fish with an improvised spear, thoroughly insulated except at its point. Each time the current was turned on, the eel gave a violent plunge. It was found that certain portions of the eel's body, particularly near the spine, were much more sensitive than others.

Q. 2. How many volts will affect smaller fishes?

A. 2. Smaller fishes respond differently to electrical stimulation. For instance, very slight currents passing through an aquarium containing gold fish will cause these fish to line up parallel with the current flow as demonstrated first by H. Gernsback. One dry cell is sufficient to successfully carry out this experiment.

Turbo-Generator

(49). Andrew W. Murray, Jersey City, N. J., submits a drawing of a turbine driven generator and asks, among other questions—:

Q. 1. Is this idea practicable?

A. 1. Your idea is quite feasible, but you will require a large water motor to operate a 110 volt generator for heavy amperage. These generators will range in price from $100.00 upward. We do not advise 40 volt motors in series on these lines. 110 volt are far more efficient and more adaptable to your work, and in addition will be considerably cheaper. Neither do we advise 10 volt lights. If only a small amount of light is desired, 10 watt bulbs operating on 110 volts will answer the purpose. Should this outfit be too high in voltage for storage battery systems, we would advise 32 volt generators, because standard machinery is made to operate on 110, 220 and 32 volt circuits.

Storage batteries for these units, inasmuch as they can be of the glass jar type, are much cheaper than those used in automobiles. They range in price from $10 to $12 up, for each 6 volt section. We do not know of the 22 volt storage battery referred to by you, capable of taking a very heavy charge.

Amplifying the Voice One Million Times

(*Continued from Page 103*)

hymns and transmit them in the same manner. At Madison Square Garden, in New York City, some amplifying horns were installed inside and outside, as shown in the photograph, so that a maximum number of people could hear the speeches at the same time.

The voice from the microphones was first amplified through a special instrument using vacuum tubes, then through a much larger apparatus of the same type, but boosting the current to such an extent, that all the reproducers fixed on each horn were supplied by poweful variations of current, which made the voice audible a great distance outdoors.

The voice, being reproduced in every City instantly, amplified a little more than 1,000,000 times, enabled the audiences listening to reproducers, to practically hear the speakers as though they were present in person; and if such amplifiers were installed in every city in the United States, President Harding or Government Officials could address almost the whole population. This statement was made by Colonel Carty himself.

The length of the line between the microphone and the point where the amplifiers are installed, has no effect on the quality of the voice, and the device comprising as many amplifying horns as necessary, may be installed at very distant points

The Telegraphone

(*Continued from Page 113*)

one constructed and that it at once operated. But when the Edison of Denmark, as Mr. Poulsen is characteristically called, developed the steel disc and steel wire apparatus, it was far more than sending directions for workmen, which was required to evolve its construction.

We have spoken of the impressive feature of the induction of so many closely placed magnetic poles on the wire and disc. Yet Edison had the same problem with his tin foil phonograph of former days, and he had to solve mechanically a similar problem to that which Poulsen has solved in his apparatus. The analogy between the two is certainly most interesting.

Utilizing Power of Small Streams

AT the last meeting of the British Association for the Advancement of Science, the subject of utilizing the small streams and water-falls and rivers of Scotland was taken up. The paper was presented by Professor F. G. Baily of Edinburgh. The idea is to harness all these elements of water flow by numerous small hydro-electric stations, so that rain-fall in the mountains in its descent would pass through a succession of turbines in its passage from the upland to the sea level.

It is considered that for the conditions of the case the stations would range from 50 horse power to 300 horse power units. There is nothing more impressive in the modern hydro-electric station than its automatic action. The great room is seen, filled with the turbines and generators whirling around with hardly a sound, generating hundreds of horse power, with only one or two men, perhaps, in sight. In some cases it is even proposed to establish power stations without any roofing.

Now, coming to Scotland, the idea would be that these little stations distributed all over the line of the water course would be automatic. An inspector would naturally have to go around among the stations up and down the lines, but the starting up and general control of each station would be done by a distant central point. A hut with a turbine and dynamo, it is said, would be sufficient for each station. The installation of dams and the impounding of water for times of drought would, of course, all require consideration. In a certain sense, there is a sort of ratio between the power requirements of humanity and the discovery and application of new sources of power to take care of the increased demand.

Melting Silver In Vacuo

THE "spurting" of silver is a phenomenon well known to all assayers. Melted silver absorbs oxygen and gives it out when it cools, with considerable violence, forming tubes projecting from the surface of the silver—a sort of dendridic formation. More or less silver is lost, of course, and if the amount melted is large, the loss may be considerable.

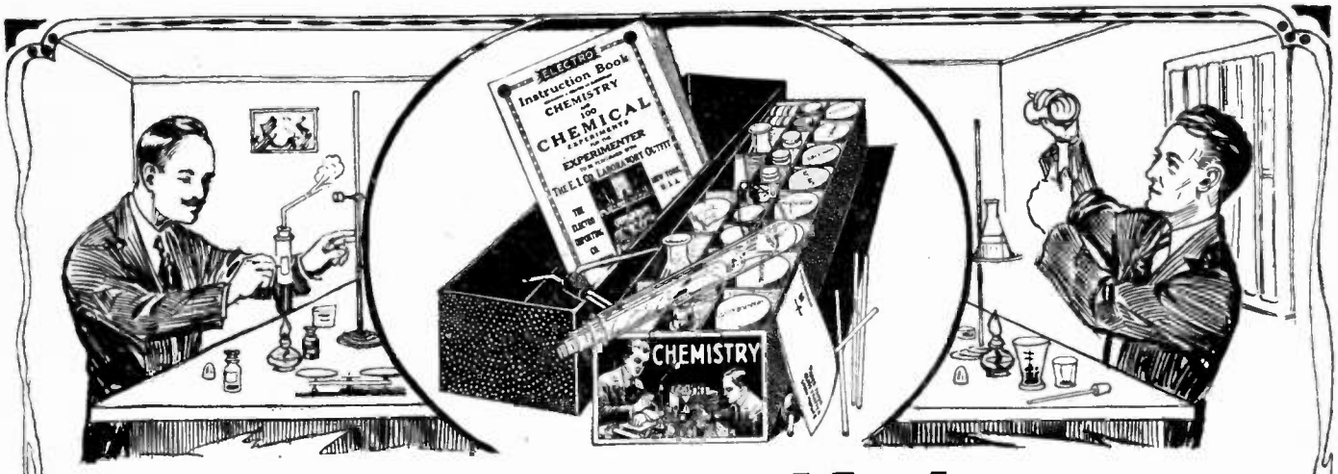
The electric furnace has been applied extensively in melting silver. In the Philadelphia mint there is a furnace which melts half a ton of silver at a charge. Now the idea is to make the furnace practically airtight, and this, of course, with the electric current, is an easy proposition. Then the silver would have no oxygen, or a very trifling amount, to absorb.

It is said, however, that even with the use of electricity as a heating agent, some air gets in. Sometimes wrought iron is placed in the crucible, which is relied on to absorb the oxygen, forming an iron oxide, and the iron itself will not alloy with silver.

An Electrically Driven Steamer

The Tampa, first electrically driven Coast Guard cutter, has been recently put through her sea-tests. The results showed the value of the electric drive and her captain and engineer were delighted with the new drive, which was described as little less than wonderful in reversing and stopping the cutter. From full speed ahead at better than 15 knots to a dead stop in less than the ship's length was her record. The best that any other cutter has done has been to stop within three ship-lengths.

Members of the crew pitched forward, so suddenly did the cutter come to a stop. Next to this feature that makes the Tampa a valuable addition to the Coast Guard fleet is her almost total lack of vibration, which is a great improvement over direct steam driven ships.



A *REAL* Chemical Laboratory

The new E. I. Co. Chemical Laboratory contains **real** chemicals and apparatus to perform **real** chemical experiments. This outfit is not a toy, put up merely to amuse, but a practical laboratory set, with all the chemicals, apparatus and reagents necessary to perform real work and to teach the beginner all the secrets of inorganic chemistry. With this outfit we give free a book containing a **Treatise in Elementary Chemistry, useful data and recipes, and 100 instructive and amusing experiments.**

Complete as shown

$7.50

DESCRIPTION OF THE OUTFIT

The outfit consists of forty-four (44) Chemicals and Reagents all C. P. (chemical pure) put up in appropriate wooden boxes, glass bottles, and hermetically closed jars. The acids are put up in glass bottles, with ground-in glass stoppers and there is a sufficient quantity of chemicals supplied (mostly one to two ounces) to make dozens of experiments with each.

The apparatus furnished are all of the best obtainable make and of standard laboratory size and shape.

The Instruction Book is a real Chemistry Course for the Beginner. Some of the Contents are: **Division of Matter:** This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. **Chemical Nomenclature:** This explains in simple language the derivation of the chemical names of the elements and their compounds. There is a chapter on **Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms,** etc.

A good part of the book is devoted to Weights and Measures. The Metric System, The English system and the U. S. System are fully explained.

The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; per Cent solutions; Conversion of Measure expressed in parts; poisons and their antidotes; Technical and common name of chemical substances; Formulas for Cleaning various substances, etc., etc.

Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to Make Chlorine Gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.

Contains the Following Chemicals and Apparatus:

Chemicals and Reagents

Alum $Al_2(SO_4)_3$, $(NH_4)_2SO_4$
Antimony (powdered) (Sb)
Ammonium Aqua (NH_3+H_2O)
Ammonium Carbonate $(NH_4)_2CO_3$
Ammonium Chloride (NH_4Cl)
Ammonium Sulphate $(NH_4)_2SO_4$
Barium Chloride ($BaCl_2$)
Boric Acid (H_3BO_3)
Brimstone (Sulphur) (S)
Calcium Chloride ($CaCl_2$)
Calcium Oxide (CaO)
Calcium Sulphate ($CaSO_4 2H_2O$)
Charcoal (Carbon) (C)
Chloride of Zinc ($ZnCl_2$)
Copper Sulphate ($CuSO_4$)
Ferrous Sulphate ($FeSO_4$)
Ferrous Sulphide (FeS)
Glycerol (Glycerine) $C_3H_5(OH)_3$
Hydrochloric Acid (HCl)
Iodine (I)
Iron Chloride ($FeCl_3$)
Iron Oxide (Fe_2O_3)
Lead Acetate Pb $(C_2H_3O_2)_2$
Litmus Paper
Magnesium Carbonate ($MgCO_3$)
Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
Nickel Chloride ($NiCl_2$)
Oxalic Acid ($H_2C_2O_4$)
Sodium Bicarbonate ($NaHCO_3$)
Sodium Borate ($NaBO_2$)
Sodium Carbonate (Na_2CO_3)
Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
Tin (Granulated) (Sn)
Zinc (Metal) (Zn)
Zinc Carbonate ($ZnCO_3$)

Apparatus

One Standard Washbottle
One Alcohol Lamp
One Conical Glass Measure
One Erlenmeyer Flask
One Glass Funnel
One Delivery Tube
Six Assorted Test-Tubes
One Test-Tube Holder
Ten Sheets of Filter Paper
One Glass Dropper
One Spoon Measure
Glass Tubing
One Book containing Treatise on Elementary Chemistry and 100 Chemical Experiments to be performed with this outfit.

Price Complete $7.50 **Shipping Weight 10 lbs.** **(Can be shipped by Express only)**

We guarantee shipment within 24 hours after your order is received.

JUST SIGN AND MAIL THE COUPON

Electro Importing Co.
231 Fulton St., New York City.

Please ship to me at once, C. O. D., the E. I. Co. Chemical Laboratory with privilege of examination. It is understood that I do not have to accept the outfit unless it pleases me.

Name.....

Address.....

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

P. E. 1-22

SEND NO MONEY

We have so much confidence in this set that we desire to ship it to you by express C.O.D. with the privilege of inspection. In other words, we practically ship the outfit on approval. It does not cost you one cent to take a good look at the outfit, and see if it comes up to your expectations. If it does, pay the express man $7.50, plus express charges. If you do not think that the outfit is all that we claim for it, you need not accept it, and we will pay the return charges as well.

Electro Importing Co., 231 Fulton St., N. Y. City

Replacing Burnt Out Fuses

By Yale Levinson

SEVERAL weeks ago I went on a motor trip with my brother in his car. As it was growing dark, we tried to light the lamps; they would not light. On inspection we found that the fuses were burnt out. We did not have any extras, and we did not know where we could obtain any. Finally I hit upon a plan.

Getting a piece of tin foil from a slab of gum, I cut out two pieces which would just cover each fuse. Then we placed the fuses back in place. When I turned on the lights, the ground before us was as bright as day. At the present time my brother is using these same fuses; only the silver paper is changed. He changes it every several days.

The Smallest Canopy Switch

THE little switch, illustrated here, is of interest from its small size and compactness. It is capable of serving a fairly strong current, and is in no sense a weakling. It has the usual snap action. It has a base of bakelite or corresponding material; the rest is of brass, screwed together, as regards the top parts, and clamped to the insulating base.

The smallest canopy switch. A very minute representation of this element of the electric installation.

It was designed for 110 volt circuits. It is five eighths of an inch in diameter and a little over one inch in height; it is quite a curiosity from its small size and good capacity.

Kitchenetting

ELECTRICITY in the household tends to the development of smaller articles of household utility. So a very general use of the kitchenette is developing, and that in its turn has produced a new word "kitchenetting," as if there were such a verb as "to kitchenette."

It is supposed to apply, for instance, to an electric stove which is described as doing everything for breakfast. While it is a kitchenette, which certainly expresses the diminutive, it uses up nearly a horse-power of current when in full tilt.

The modern electrical home, especially if the owner is of an ingenious and progressive disposition, becomes quite a complicated affair. But before that point is reached, there are all sorts of little things which could be done in the way of convenience, position of switches and lots of minor things. So for these cases another word has been invented, and allusion is made to the "Home of Small Conveniences," which is taken as being a good step on the way to acquiring the complete electrical home.

A Curiosity in Tractor Propulsion

TRACTORS of various kinds are being introduced, generally operated by gasoline engines. One more or less odd-appearing instance of tractor work is cited, where a gasoline machine was going ahead of a great gun caterpillar carriage, apparently towing it with a rope, but with the latter hanging slackly so as nearly to sweep along the ground. The incongruity is explained by the fact

(*Continued on page 139*)

(*Continued from page 137*)

that the little machine in front was not a tractor, but simply had on its chassis an electric generator, and the apparently slack towing rope was an electric conductor that carried current to an electric motor on the gun carriage—so that the latter, after all, was self-propelling.

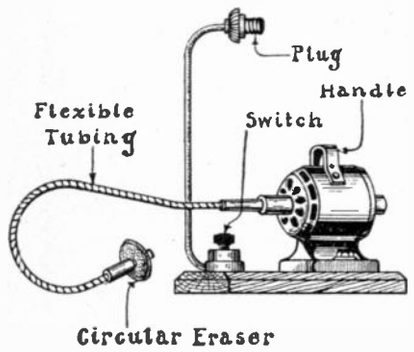
Now the question comes up, whether portable power houses will not go about the country supplying electric drive to farm machinery, which often is only required for a very short period of the year.

Electric Erasing Machine

Proabably the most disagreeable part of a draftsman's work is erasing, when a change is to be made in a tracing. It is very slow work and takes quite a bit of exertion.

But now comes the electrical erasing machine.

The machine is operated by a small electric motor fastened to a wooden base. The motor drives a jointed shaft which runs inside of a length of flexible tubing. At the end of the shafting is fastened a circular eraser. This eraser



An ingenious machine for erasing lines on drawings after inking in.

may be replaced with a regular five cent eraser when worn out. At the top of the motor is fastened a handle to carry the machine about.

When a person desires to use the apparatus he simply places it on his table, screws the plug into an electric light socket, grasps the tubing just back of the eraser and, after turning on the switch, touches the revolving eraser lightly to the lines to be erased and the work is done in a jiffy.

Contributed By Edward G. Gettings.

Glue for Electricians.

GLUE is a cheap enough material, but the writer has acquired considerable respect for it in the construction of some kinds of electrical apparatus. In winding coils with cotton covered wire, if they are given a coating of pretty thick, hot glue (not the liquid glue) it is quite astonishing, what a grip it takes on the wire. The cotton covering, of course, gives it something to stick to. It is especially nice for simple demonstration apparatus, and we recommend our younger readers to try it.

A magnetizing coil used to be quite a favorite piece of apparatus. It was simply a coil of wire about an inch high, and perhaps 2½" in diameter, adapted to be pushed over an iron core, when connected to a supply of current, to magnetize the core. If one of these is wound with cotton covered wire, and if glue is applied for each layer, when it gets pretty dry it can even be baked, it will be astonishingly solid; it may be secured from damp by giving it a final coat of varnish over the glue. Sometimes these are painted. Bundles of iron wire used for cores can be consolidated by spiral wrapping with brown

(*Continued from page 139*)

paper and plenty of glue. In this case as the glue dries, the paper shrinks, and takes a very strong grip upon the wires of the core. The same can be done for laminated cores. A very convenient thing to keep in the laboratory is a supply of what is known as printers' furniture. These are strips of wood three feet long and about ⅞ of an inch high, and of varying thickness. The trouble is that they split on the least provocation, but this can be overcome by using the thinner ones and gluing two or three together so as to get the proper thickness. This makes them comparatively unsplitable.

If a set screw is to work through a piece of wood there is always apprehension that it will wear out the thread in the wood. If the hole is given a good dose of glue and the screw is put in place and the glue allowed to dry, it gives a thread which will last indefinitely. All this applies to the extemporizing of electrical and other apparatus.

Hints for Electric Washing Machines

AS we have illustrated several electric washing machines, we append some hints from our housekeepers as to how to use them. The following are considered to be the true facts as tested by domestic science experts in the United States and in England.

1. The clothes do not need to soak over night. The machine will cleanse perfectly, if the clothes are put into the machine dry and better results, it is said, will thus be obtained.

2. The water in the machine should only be warm, *not very hot*. It is said that for domestic uses, warm water gives better results than very hot water, and of course, economy in hot water is to be desired.

3. A good soap should be dissolved in water before the clothes are put into the machine, and the housekeeper should be sure that there are no pieces of soap mixed in with the clothes. A little water softened, preferably with borax, is advised. Before the clothes are put in, if the water is properly softened, the water should be foamy when agitated.

4. Clothes should be sorted into loads for the machine. It is important not to give too much at once. Fifteen minutes is quite sufficient for a single installment. The clothes are to be rinsed in clean water, and for white clothes, it is said, scalding hot water should be used with a five minutes run; thus all boiling is dispensed with. Cloth materials, and silks need warm water for rinsing. Flannels and woolens need warm water also, but made slightly soapy.

The flexible cord is a wire conductor, and it should not be permitted to lie on the wet floor, and in pulling out the plug, this should be pulled out directly; the wire should not be used in pulling it, as this may drag the ends away from the connections with attending short-circuits. It is an excellent idea to run the connecting wire through a length of soft, pure, rubber tubing. The tube should fit nicely, water will then not affect the wire. Tie strong cord around the ends of the tube or wire it firmly to exclude water.

Practical Advice for The Automobilist

ALWAYS disconnect the wire from generator terminal, before disconnecting the battery, and reconnect the battery before reconnecting terminal. Otherwise the lamps may all be burned out if the engine should be started.

(*Continued on Page 143*)

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 March issue must reach us not later than February 1st.

The circulation of Practical Electrics is more than 25,000.

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

Automobile Accessories

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.

Business Opportunities

Are you in the proper financial position, to further your ambition? If not, we can supply you with profitable, honest, money-making plans, whereby you can gain a sufficient amount of money to start you toward success in the field your ambition lies. Plans sent on receipt of 25c. Baxter & Delaney Co., 299 Branch Ave., Providence, R. I.

Help Wanted

Detectives Make Big Money. Travel and be independent. Learn this fascinating profession by home study. We show you the way. Write today for free booklet. American School of Criminology, Scherer Bldg., Detroit, Mich.

Detectives Earn Big Money. Excellent opportunity. Travel. Great demand everywhere. Experience unnecessary. Particulars free. Write, American Detective System, 1968 Broadway, N. Y.

U. S. Government wants hundreds Railway Mail Clerks. $1600 first year. Quick raise to $2300. Vacation with full pay. Permanent—steady positions. No strikes or layoffs. Common education sufficient. Pull unnecessary. Every man or boy over 16 should become interested. Write immediately for list positions open. Franklin Institute, Dept. W 112, Rochester, N. Y.

Stop Daily Grind.—Start Silvering Mirrors, Auto headlights, tableware, etc. Plans free, Clarence Sprinkle, Dept. 65, Marion, Indiana.

Mail Order Business

$25,000.00 made with a small mail order business home evenings. I made it, started with $3.00. Booklet for stamp tells how or send 25c for sample of article and plan. Alpee Scott, Cohoes, N. Y.

Miscellaneous

Efficiency Chart. One side instantaneous stock ordering chart; other side, spark method of testing steel. Price, One Dollar, Cash. A.E. Wrigley, 225-90th Street, Brooklyn, New York.

Manufacturing

Patterns, Wood and Metal Models, Tools and Dies. Brass and Aluminum Castings, General Machine Work. Write Modern Machine & Pattern Co., Terre Haute, Ind.

Patents

Get your own Patent $35 complete. Application blanks and full instructions $1. Theodore Cutting. Cooper Bldg., Campbell, Cal.

Telegraphy

Telegraphy (Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalogue free. Dodge's Institute, 29th St., Valparaiso, Indiana.

Stamps & Coins

Universal Packet, 100 varieties, all over the world 10 cents. Cober Stamp, 39 State, Rochester, N. Y.

Exchange

For Sale Special A 7.—Grebe long wave receiver without tube unit or tube Central. Perfect condition. Price $80.00. Pyreloid Co., 279 Grove St., Jersey City, N. J.

Chemistry

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority will teach you. Our home study correspondence course is a real short cut. You can learn in half the usual time. Gives you the same education as you would get at a college or university. See our full page ad on page 99 of this issue for special 30-day offer. Chemical Institute of New York, 140-B Liberty Street, New York City.

Health

Pyorrhea (Rigg's Disease, Bleeding or Swollen Gums). Hundreds have been helped by "Pyorrdent," the successful home Pyrrohea treatment. Purifying, healing, preventative. Full month's treatment, consisting of a very beneficial massage paste and an antiseptic tooth-cleansing paste to be used in place of your ordinary dentifrice, together with full directions for treatment. $1 postpaid. Or write for free Booklet "P." Pyorrdent. Mfg. Co., 439 Seventh St., Brooklyn, N. Y.

Books

"Schemer Magazine," Alliance, Ohio, prints big profit schemes; one subscriber making $25,000 from three; another $10,000 from one. Try your luck. Year, only $1.00; three months, 25c.

What the World should know about Hun atrocities and their attacks on women and girls in Belgium, 50c. Belgian Specialty House, 6340 South Racine, Chicago.

Experimental Electricity Course in 20 Lessons. By S. Gernsback and H. W. Secor, E. E. A. course of the theory and practice of Electricity for the Experimenter. Every phase of experimental electricity is treated comprehensively in plain English. New experiments are described and explained and nearly every application of Electricity in modern life is given. 160 pages—400 illustrations. Flexible cloth cover, 75c. postpaid. Stiff cloth cover, $1.25 postpaid. Experimenter Publishing Co., Book Dept., 236 Fulton Street, New York.

Just off the Press—Design and Construction of Audion Amplifying Transformers (Radia and Audio-Frequency Types). By Edward T. Jones, late Associate Editor Radio Amateur News. The transformers shown in this book have never been described in print before and have usually been considered a manufacturer's secret. The designs are very rugged and simple. A book that every radio "bug" should have. Written so you will understand every word. Price 25c. postpaid. Experimenter Publishing Co., Book Dept., 236 Fulton St., New York City.

The How and Why of Radio Apparatus, by H. W. Secor, E. E. This newest book on radio matters fulfills, a distinct gap in wireless literature in that, while the treatment is made as understandable and as free from mathematics as possible, it at the same time incorporates a wealth of technique and instruction for the Radio Amateur—the Radio Operator—the Installation and Designing Expert—as well as teachers and students of the subject in general. A very broad field has been covered by the author, at the same time giving a great deal of information not found in other text books. If you are engaged in any branch of the Radio or allied arts at all, you will surely need this latest contribution to radio literature, which is destined to be found on every radio man's book shelf before long. This newest of Radio Works, cloth bound in Velum de luxe, Gold stamped and Hand Sewed, has 160 pages. Size of book 6x9 inches. "The How and Why of Radio Apparatus," postpaid, $1.75. Experimenter Publishing Co., Book Dept., 236A Fulton St., New York City.

Games & Entertainment

What makes it move? Mystify, baffle, and amaze your friends with a "Margo" psychic ball. Something new, novel, and entertaining. Descriptive circular free. James T. Herr, 2919 W. North Ave., Baltimore, Md.

Printing

Printing—the better kind. Special! 100 each of Letterheads, Envelopes, and Business or Calling Cards, prepaid, $1.75. The Olde Tye Press, PE 328 Richards Ave., Dover, N. J.