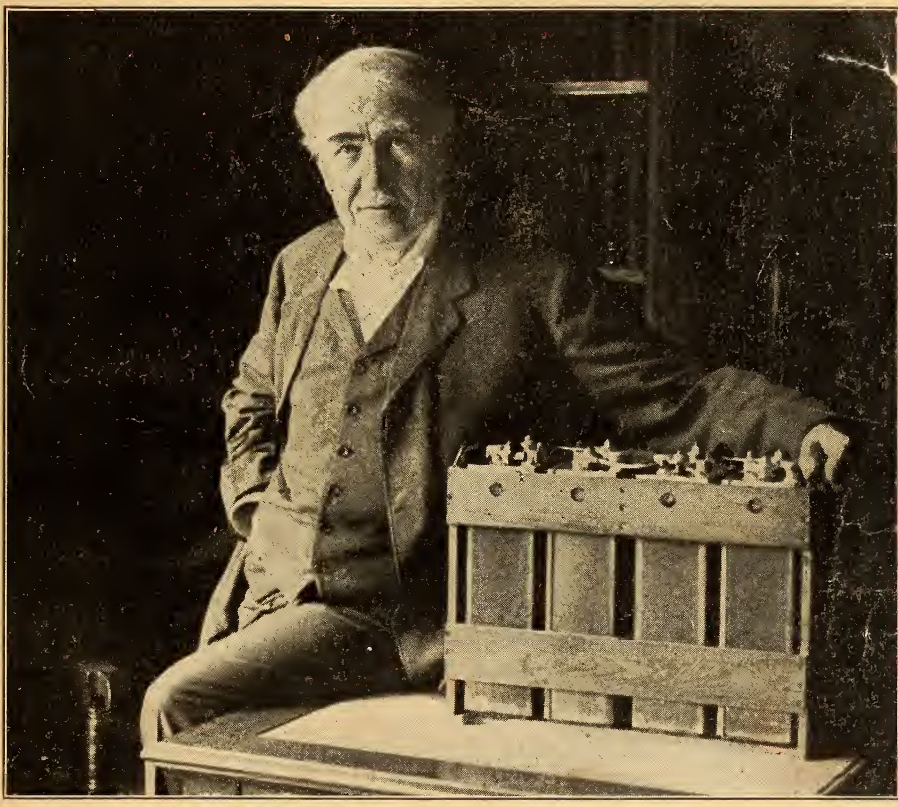
EDISON TELLS OF HIS NEW BATTERY

POPULAR ELECTRICITY MAGAZINE

IN PLAIN ENGLISH

(NON TECHNICAL)



Copyright by Underwood & Underwood, N. Y.

THOMAS A. EDISON WITH HIS LATEST "PET"

Vol. III NOVEMBER, 1910 No. 7

A MAGAZINE FOR EVERYBODY

10 Cents

30653

P.S.&W. Pliers Are Guaranteed

They are also backed by over ninety years of successful and progressive tool-making.

They are backed by thousands of satisfied users all over the world.

They are backed by the prestige, reputation and responsibility of

The MARK of the MAKER

When you see that Trade-mark on a P. S. & W. Box Joint Plier, you know that it is made for use and not just to sell. You know that the jaws meet accurately and cut evenly, no matter how long used.

You know that we stand back of the tool to guarantee your satisfaction.

This is true of every item in our four large lines of Guaranteed Hand Tools.

Write today for our free "Mechanics' Handy List," a 165-page book, now in its third edition. Over thirty pages of valuable information and a catalog of over 200 Guaranteed Hand Tools for Electricians, Machinists, Carpenters, Tinsmiths, etc.

The Peck, Stow & Wilcox Co.

MANUF'RS of the Largest Line of Mechanics' Hand Tools offered by Any Maker

Address Correspondence to 30 Murray St., New York City

Established 1819
Five Large Factories

List of P. S. & W. Guaranteed Box-Joint Pliers.

No. 30. Side Cutting, Black Finish
No. 130. Side Cutting, Nickel-plated
No. 300 Side Cutting, Insulated Handles
No. 50. Side Cutting with Splicing Device
No. 9. Side Cutting, Extra-heavy—9-inch
No. 20. Flat Nose, Black Finish
No. 120. Flat Nose, Nickel-plated
No. 25. Round Nose, Black Finish
No. 125. Round Nose, Nickel-plated
No. 27. Diag'l Cutting, Black Finish
No. 127. Diag'l Cutting, Nickel-plated
No. 37. Diag'l Cutting, Raised Cutters—Black
No. 137. Diag'l Cutting, Raised Cutters—Nickel
No. 43. Chain Nose, Black Finish
No. 143. Chain Nose, Nickel-plated
No. 31. Opticians,' Round and Flat Jaws—Black
No. 131. Opticians,' Round and Flat Jaws Nickel
No. 33. Opticians,' Concave and Convex Jaws—Black
No. 133. Opticians' Concave and Convex Jaws—Nickel

Also a full line of Lap Joint Pliers and Splicing Clamps

A Chance to Make $100.00

For $1.00 you will get 12 issues of

THE STUDENTS ART MAGAZINE

and a chance to work on over $100 worth of cash art assignments. The magazine publishes and criticises students' work, gives lessons in Cartooning, Designing, Illustrating, Lettering and Chalk-talking. Especially valuable to correspondence art students It stands for a clean life, a clean art and a square deal. If not satisfied your money refunded. Address the editor.

G. H. Lockwood
Dep. 73 Kalamazoo, Michigan

SAY BOYS!

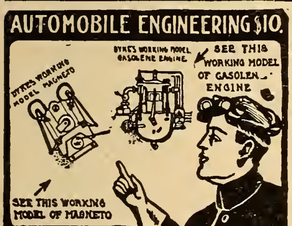
A postal card will bring you our circular on spark coils, transformers and rectifier parts. Also ask for our circular on coil trouble.

ELECTRIC TESTING CO. - Peoria, Ill.

CALIFORNIA OIL JOURNAL

FREE TRIAL SUBSCRIPTION ON REQUEST

Send us your name and address and we will have sent to you the oilj urnal, "California Oil Fields." for three months trial without charge. Oil is now California's biggest industry and pays millions in monthly dividends. Write **SAGAR-LOOMIS CO., 918 Phelan Building, San Francisco, California.**



Learn to Drive and Repair Automobiles with Dyke's Working Models and Home Study Course

PRACTICE WHILE YOU STUDY.
IT IS THE ONLY WAY TO MASTER THE SUBJECT BY MAIL.

Barney Oldfield says: "If a person cannot learn with this instruction then he cannot learn at all."

May we send you photos, testimonials of young men who are now drawing good salaries driving cars, and Proprietors of Repair Shops.

May we show you hundreds of testimonial letters?

You can't lose a cent. Two days' trial inspection allowed.

Special price right now of only $10 for the complete course, including Working Models of Engine, Magneto and Carburettor; 36 Charts and 24 Instruction Books, all sent to you at one time. Diploma when you answer the questions.

FILL IN BLANK—MAIL TODAY

Dyke's Correspondence School of Motoring
3947 PE. Washington Ave., St. Louis, Mo.
Kindly send me a 24-page Catalogue by mail FREE, in plain wrapper.

Name..

Street..

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

State if you want to be a chauffeur or repairman.
Or if you intend to buy an auto or if you own one.
A. L. Dyke originated the first Auto Supply Company in America

---

UNCLE SAM WANTS YOU

Over 15,000 Appointments to be Made During 1911

Railway Mail Clerk Examinations Everywhere Nov. 12th.
Customs and Internal Revenue Examinations Everywhere Feb. 4
Common education sufficient—political influence unnecessary

No "layoffs" without pay, because of strikes, financial flurries or the whims of some petty boss. Exeellent opportunities for quick advancement to Higher Government Positions. If you want immediate appointment, send **TODAY** for our schedule showing locations of Nov. examinations. Any delay means the loss of just so much time in preparing yourself fo examination.

We Prepare Candidates Free.

Send THIS COUPON

Franklin Institute
Dept. C 124. Rochester, N. Y.

This coupon, filled out as directed, entitles the sender to a free copy of our book, "Government Positions and How to Obtain Them," and to consideration for Free Coaching for the examination here checked.

...Railway Mail Clerk	[$800 to $1400]	...Customs Positions	[$600 to $1500]
...Postoffice Clerk	[$600 to $1200]	...Internal Revenue	[$700 to $1800]
...Postoffice Carrier	[$600 to $1200]	...Stenographer	[$600 to $1500]
...Rural Mail Carrier	[$500 to $900]	...Clerk in the Departments at Washington	[$500 to $1500]
...Bookkeeper	[$900 to $1800]		

Name..

Address..

Write Plainly

Here's a Good JOB

YOUNG MEN

EARN $25 TO $50 WEEKLY In Automobile Business

Chauffeurs, Automobile Salesmen, Demonstrators and Repairmen are in big demand everywhere. The field is new, work pleasant, and anyone can learn. We teach you in 10 weeks of study during spare time to become thoroughly efficient. Our course of instruction by mail is simple, practical, and very interesting. Free model of automobile. Besides, we assist you to secure a good position.

First Lesson Sent Free—Write Now

Don't miss this offer. Send us a postal today.

Empire Auto. Institute, 201 Empire Bldg.
The Original Automobile School Rochester, N. Y.

Chauffeurs and competent men supplied owners and garages.

Electrical Talks—Flash No. 5

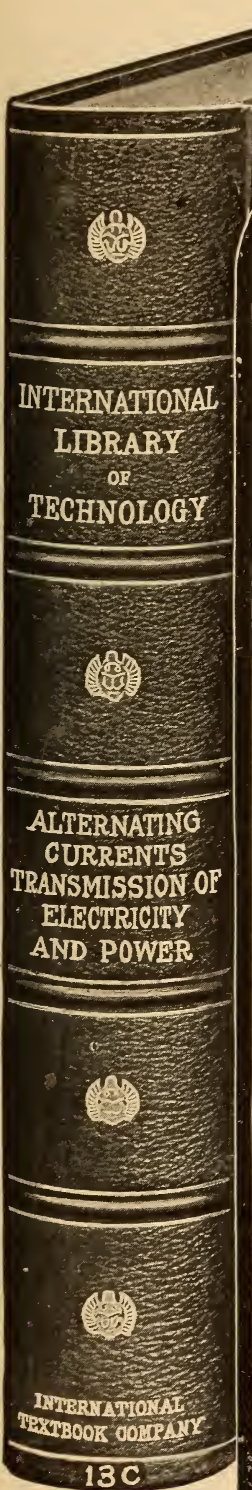
WHEN an advertiser uses a class publication that is sold on the news-stands where the circulation runs up into the hundreds of thousands, he is purchasing a circulation that is very beneficial for the sale of his product.

People do not buy a class publication of a general character unless they are particularly interested in the exploitation of the field which that magazine covers.

A person might go to a news-stand to buy any one of the leading magazines. If that particular one isn't there, he can use another one which satisfies him just as well, it being along the lines of general reading matter.

But when you go to buy a class publication and you cannot secure it, there is no other medium which will satisfy you and give you the information which you desire. This goes to show that advertising placed in a publication of our character is received by the reader in a more receptive mood than if the advertisement was placed in a general medium which, though his friend, is not his "intimate friend" as is the publication which gives him the specialized information he requires.

POPULAR ELECTRICITY.



The Greatest Electrical Library in the World

The Electrical Engineering Library is part of the International Library of Technology that cost $1,500,000 in its original preparation. It contains the knowledge given from the life experience of some of the best electrical engineering experts in the country, edited in a style that nineteen years of experience in publishing home-study textbooks has proved easiest to learn, to remember, and to apply. There is no other reference work in the world that so completely meets the needs of the electrician as the Electrical Engineering Library. The volumes are recommended by the highest authorities and are used in nearly all the leading universities and colleges. They treat of practical electrical methods, starting from the simplest problems and comprehensively covering every branch of the work. Not only can they be used to great advantage by superintendents, foremen, and engineers as an authoritative guide in their work, but since they can be so clearly understood, even by persons having no knowledge of higher mathematics, they can be used by all classes of electricians that are desirous of advancing to higher positions. The Electrical Library contains 17 volumes durably and handsomely bound in three-fourths red morocco, stamped and numbered in gold. The books are printed on a high-grade book paper, and the type is large and easy to read. Each volume is 6 by 9 inches in size. If you wish to know more about the most practical electrical library in the world, **send the coupon NOW.**

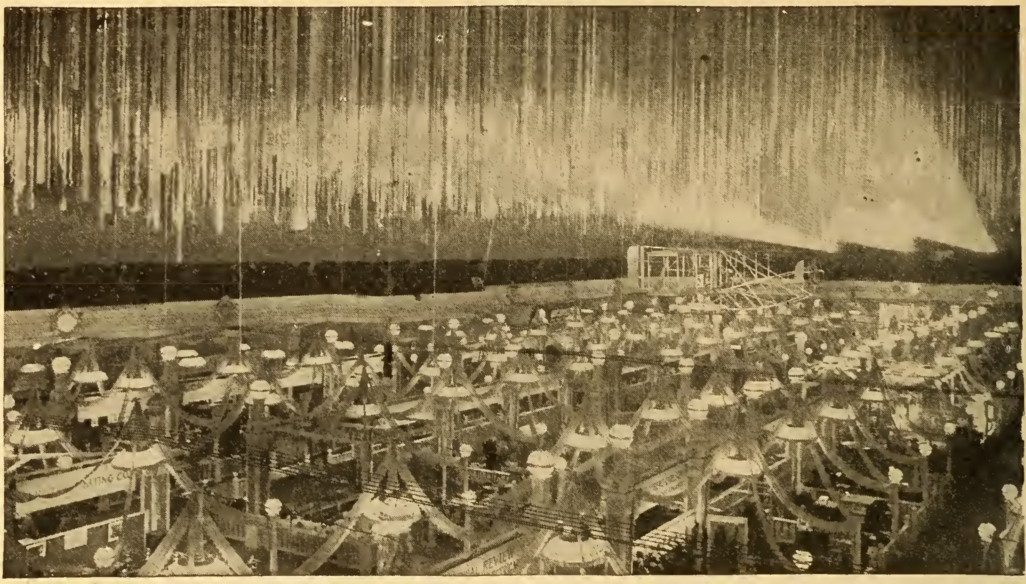
International Textbook Co.
Box 1102, Scranton, Pa.

Please send, without further obligation to me, full particulars in regard to your Library of Technology, with special reference to the Electrical Library.

Name ____________________

St. & No. ____________________

City ____________________ *State* ____________________



Chicago's Electrical Show

Each year the greatest Electrical show of the season is held in the Coliseum, which is one of the largest Exhibition Halls in the world. Here thousands of people come from all parts of the country and have ample room to inspect the products of numerous manufacturers and dealers of electrical devices which could not be so prominently displayed in any other place or manner.

The exhibitors who have been present at this show for the past few years and who are convinced that it is to their best interests have already made reservations for the next year's space. Have you?

Address

Electrical Trades Exposition Company

115 Dearborn St., Chicago, Ill.

Marketing Your Goods

is fully as difficult as making them. May be more so.

Advertising is modern marketing machinery.

You can buy this machinery—can you operate it?

Have you analyzed your selling problem?

Do you know where a demand exists for your goods—the geography of distribution?

Do you know how to reach, at lowest cost, your possible customers—mediums of advertising?

Do you know how to prove the fitness of your goods to supply existing demand, how to describe them so as to create demand—effective copy?

If these questions suggest the need of outside help, get in touch with us.

WM. D. McJUNKIN
Advertising Agency
167 Dearborn Street, Chicago

Flying Machines

CONSTRUCTION—OPERATION

BY

W. S. Jackman
Thos. H. Russell
Octave Chanute

A "Show How" Book

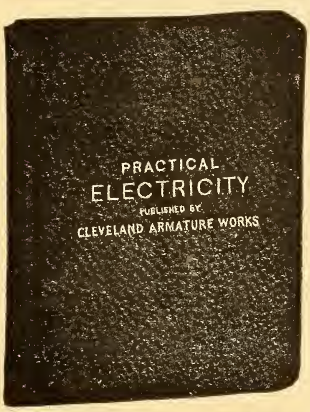
Writen for the novice in aviation—the man who seeks practical information as to the theory, construction and operation of all modern flying machines. Also contains detailed instructions for the construction of a Biplane Glider, complete with working drawings and diagrams.

Pocket size, 250 pages fully illustrated.

Price: **Flexible Leather $1.50**
Cloth Binding $1.00

POPULAR ELECTRICITY BOOK DEPT.
100 Lake Street, CHICAGO, ILL,

A School Within Itself



There are XX chapters in all, XIX carrying you from the fundamental principles of electricity on through the various branches to a point where the careful student comprehends the complete designing, care and operation of a dynamo or motor, and I chapter on electric automobiles, outlining their construction, care and operation, and all about storage batteries and how to handle them. Each subject is carefully written and to the point. After a student studies a subject, he is questioned on that subject in such a manner as to bring clearly to his mind the points he needs to know regarding same. A DICTIONARY in back of book will enable him to learn the meaning of any electrical word, term or phrase used in this book, as well as hundreds of others in common use. All required tables necessary in the study are in it.

TABLE OF SUBJECTS:

Chapter
I—Wiring.
II—Electric Batteries, Electro Plating.
III—Magnetism.
IV—The Magnetic Circuit.
V—Magnetic Traction.
VI—Magnetic Leakage.
VII—Energy in Electric Circuit.
VIII—Calculation of Size of Wire for Magnetizing Coils.
IX—Calculation of EMF's in Electric Machines.
X—Counter EMF.
XI—Hysteresis and Eddy Currents.

Chapter
XII—Armature Reaction.
XIII—Sparking.
XIV—Winding of Dynamos and Motors
XV—Proper Method of connecting Dynamos and Motors—Self Excitation.
XVI—Diseases of Dynamos and Motors, their symptoms and how to Cure Them.
XVII—Arc and Incandescent Lamps.
XVIII—Measuring Instruments.
XIX—Alternating Current.
XX—Automobiles.

A Dictionary of over 1500 Electrical Words, Terms and Phrases, giving a brief meaning of all which are in common use.

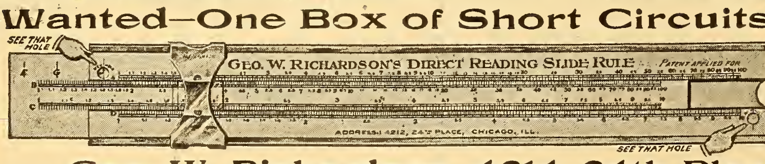
$2.00 PER COPY—FIFTH EDITION—24,000 COPIES SOLD

The offer we make of refunding money if book is not satisfactory upon examination is AN UNUSUAL ONE in connection with the sale of a book. But we have no fear of its return. Your decision will be what thousands of others have been. Money would not buy it if it could not be duplicated. We could print testimonials by the hundreds. It is best to order and be your own judge of its merits.

CLEVELAND ARMATURE WORKS, 4730 St. Clair Ave., Cleveland, Ohio. Armatures and Fields Wound, Commutators Filled
AMERICA'S GREATEST REPAIR WORKS

ELECTRICIANS

Wanted—One Box of Short Circuits



That the Richardson Direct Reading Slide Rule cannot solve. Any person can learn how to multiply, divide, extract square, and cube root, and proportion. Tells if Recording Wattmeter is slow or fast and 44 other problems. Aluminum Stock $2.00 with instruction book.

Geo. W. Richardson, 4214 24th Place, Chicago.

For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

A COMPLETE

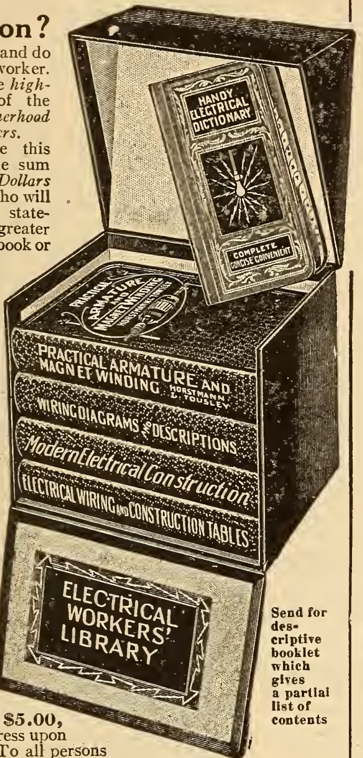
Electrical Workers' Library

By HENRY C. HORSTMANN and VICTOR H. TOUSLEY

Positively up-to-date and written for the men who do the work

We defy any publisher in the world to produce a more practical collection of books for the electrical worker than this series. The immense sale of these popular books since date of publication has been greater than any electrical books ever sold to working electricians.

The Reason?



They are *practical* and do not confuse the worker. They also have the *highest endorsement* of the *International Brotherhood of Electrical Workers.*

To substantiate this claim we offer the sum of *One Hundred Dollars* to any publisher who will produce a sworn statement showing a greater sale of any similar book or books treating on the subject matter that these do, for the length of time they have been on the market.

As to our reputation for keeping business promises, we will refer you to any bank or business house in Chicago.

For the next ninety days we are making a special introductory offer of the complete set of four volumes, neatly cased **(regular price $6.00).**

Our special introductory price to electrical workers $5.00, prepaid to any address upon receipt of price. To all persons ordering this set by return mail, we will present, free of charge, our *Handy Electrical Dictionary* for the Vest Pocket, bound in red Russia Leather, gold edges, indexed, 224 pages, illustrated. If the books ordered are not found entirely satisfactory in every way, they may be returned and your money will be cheerfully refunded. To electrical workers already having any of the below enumerated volumes, we will supply single copies of any one or more books at **$1.50** each, postpaid to any address in the world.

Send for descriptive booklet which gives a partial list of contents

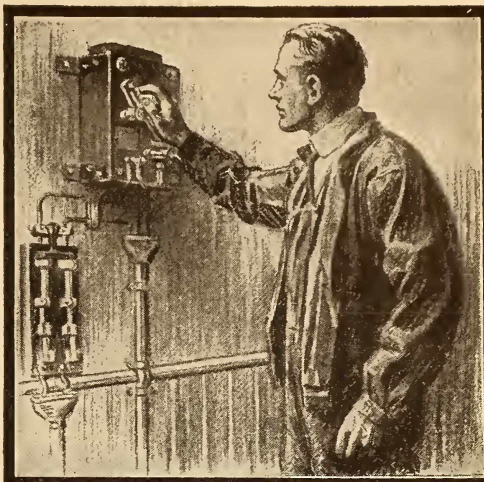
Electrical Wiring and Construction Tables	**120 pages 70 diagrams**
Modern Electrical Construction	**340 pages 173 diagrams**
Modern Wiring Diagrams and Descriptions	**250 pages 200 diagrams**
Practical Armature and Magnet Winding	**232 pages 128 diagrams**

Each volume is substantially bound in full Persian Seal Grain Morocco Leather, stamped on the outside covers in genuine gold leaf, round corners, red edges, pocket size, printed on super-calendered book paper.

Address all Orders to the Publishers

Frederick J. Drake & Company

222-1325 Michigan Avenue CHICAGO, U. S. A.



Become An Expert Electrician In Spare Time

Never has there been such a demand for technically trained electrical men as at present. The great expansion of the electrical field in all its branches is responsible for this. The trained electrical man is always sure of a good position at a good salary.

The International Correspondence Schools have made the mastery of any electrical course easy. Any ambitious man can learn ***in spare time*** to become an expert electrician. ***You*** can.

Courses cover Electrical Engineering, Lighting and Railways, Interior Wiring, Dynamo Running, Electric Car Running, Heavy Electric Traction, Telephone Engineering and Telegraph Engineering. Everything made clear and simple. Courses conducted by experts. No hurry or delay. The I. C. S. stands by you until you are through.

It costs you nothing and puts you under no obligation to learn ***how*** the I. C. S. can help you. Simply fill in and mail the attached coupon to-day. Do it ***now.***

International Correspondence Schools
Box 1102, Scranton, Pa.

Please explain, without further obligation on my part, how I can qualify for a good position in the line of electrical work indicated in the attached coupon:

Position...

Name...

Street and No...

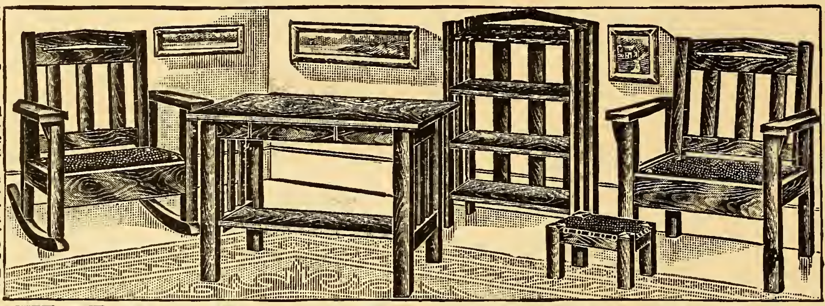
City..............................State..............................

This 5-Piece Mission Set SENT FOR ONLY $2.50

Credit to Every-body

This beautiful five piece Mission Set, made of solid oak throughout, early English finish, upholstered imitation Spanish leather, only **$14.50**

Pay $2.50 Cash $1.25 Monthly



Credit to Every-body

This set consists of **Rocker, Arm Chair, Library Table, Foot Stool and Book Rack,** complete for only **$14.50**

Pay $2.50 Cash $1.25 Monthly

FREE Six Great Buy-On-Credit Catalogs

Our Great Catalog A—Furniture and Housefurnishings—Positively saves you money, shows you exact reproductions of Carpets, Rugs, Portieres, Oilcloth and Linoleums in their actual colors, also illustrates and describes Furniture, Curtains, Crockery, Silverware, Baby Carriages, Washing Machines, Sewing Machines, Office Desks.

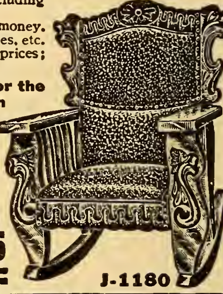
Catalog B—Gives complete descriptions and illustrations of the **World's Best Stoves and Ranges.**

Catalog C—Illustrates, describes and gives lowest prices on **Musical Instruments,** including **Pianos and Organs.**

Catalog D—Great Watch and Jewelry guide; illustrates, describes and tells how to save money.

Clothing for Men—Ask for Style Book No. 48—it tells all about the latest styles, prices, etc.

Clothing for Women and Children—Complete book of latest styles and lowest prices; ask for No. 24.



One or all of these elegant money saving books are yours simply for the asking—say which you want. This great mail order credit institution is the original concern to ship goods any place in America—and **allow the use of the goods while paying for them.** Thousands of satisfied customers, and a successful record of over 25 years—write now, this very minute, for our catalogs.

J-4833—This elegant **Reversible Brussels Rug,** extra heavy, no seams, colors green and tan. Extra big value, latest pattern and colors. Size, 9x12 feet.

1.75 cash, **One Dollar** monthly payments. Total price......**$9.50.**

J-1180—This **Handsome Rocker,** American quarter sawed oak finish, nicely carved, upholstered with genuine chase leather, spring construction. **$1.00** cash, **50 Cents** monthly payments. Total price...... **5.25**

J-4833

J-1180

STRAUS & SCHRAM, Inc.
1092 35th Street :: CHICAGO, ILL.

DIAMONDS WATCHES ON CREDIT

For Christmas Presents—Make Your Selections Now

Write For Our Handsome Christmas Catalog filled with beautiful photographic illustrations of Diamonds, Watches, solid gold Jewelry, Silverware and Novelties for Christmas presents. Select any article you would like to own or present to a loved one; it will be sent on approval to your home, place of business or express office, without any obligation whatever on your part. If satisfactory in every way, pay one-fifth down and keep it, balance in eight equal monthly amounts. If not satisfactory, return it. We pay all charges and take all risks. Every honest person's credit is good with us. **Diamonds** increase in value 15 to 20% each year. A Diamond is the ideal gift for a loved one; it lasts forever, and every day reminds the wearer of your regard and good judgment. **Our prices** are 10 to 15 per cent lower than those of the ordinary cash retail jeweler, and our terms are easiest.

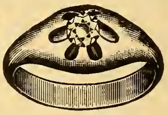
$10.65

FULL JEWELED WALTHAM

In Fine 20-Year Gold-filled Case. Guaranteed to keep Accurate Time

SENT ON FREE TRIAL, ALL CHARGES PREPAID.

You do not pay one penny until you have seen and examined this High-Grade, Full Jeweled Waltham Watch, with Patent Hairspring, in any style hand-engraved Case, right in your own hands.



No. 102—Men's Round Belcher Ring. Fine brilliant white Diamond..... **$38**

$7.60 Down, $3.80 a Month.

GREATEST BARGAIN EVER OFFERED

$1 a MONTH.

No.1221—Ladies' Loftis "Perfection" Ring. Fine brilliant white Diamond.................... **$50**

$10 Down, $5 a Month.

We trust every honest person. No matter how far away you live, or how small your salary or income **we will trust you** for a high-grade adjusted Waltham Watch, in gold case, warranted for 25 years, and guaranteed to pass any Railroad inspection. **Our big free Watch and Diamond Catalog** tells all about our Easy Payment Plan —the "Loftis System"—and how we send Waltham, Elgin and Illinois Watches, 18, 16, 12, and "O" sizes, 19, 21, and 23 Jewel, anywhere without security or one cent deposit. Bargains in ladies' and men's solid gold and gold-filled Watches for Christmas gifts. We give better values and easier terms than any house in America. Write for our new, handsomely illustrated booklet, "Historic Diamonds."

LOFTIS BROS & CO. EST'D 1858

THE OLD RELIABLE ORIGINAL DIAMOND AND WATCH CREDIT HOUSE

Dept. M 685, 92 to 98 STATE STREET, CHICAGO, ILL.

Branch Stores: Pittsburg, Pa., and St. Louis, Mo.

CHIEF DRAFTSMAN

Will INSTRUCT PERSONALLY a limited number selected, ambitious men in

Practical Drafting, Detailing, Designing

Draftsmen Drawing $125-$150 Monthly

Are NOT MADE in Schoolrooms,
Are NOT MADE by Reading Books,
Are NOT MADE by making Copies,
Are NOT MADE at home drawing pictures from printed book lesson.

LET ME TELL YOU:

It requires actual, practical, up-to-date DRAFTING-ROOM WORK to train YOU to gain the PRACTICAL EXPERIENCE that your employer will demand of you.

FREE

This $13.85

DRAWING OUTFIT

and Free Position

As Chief Draftsman of Engineering firm I know exactly the Quality and Quantity of PRACTICAL training, knowledge and actual up-to-date experience (not school knowledge) you must have, in order to obtain a good position and advance to highest salary.

I give **INSTRUCTIONS UNTIL COMPETENT and PLACED in POSITION at above Salary**

DON'T waste TIME and MONEY trying to learn from books or printed "STUFF" you can only learn on PRACTICAL WORK which I furnish you.

Address **CHIEF DRAFTSMAN**

Div. 10, Eng's Equip't Co. (Inc.), Chicago

POPULAR ELECTRICITY
IN PLAIN ENGLISH

HENRY WALTER YOUNG, Editor

Vol. III November, 1910 No. 7

CONTENTS

RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return same with remittance at once, to avoid missing a number. Positively no copies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows the issue with which your subscription ends.

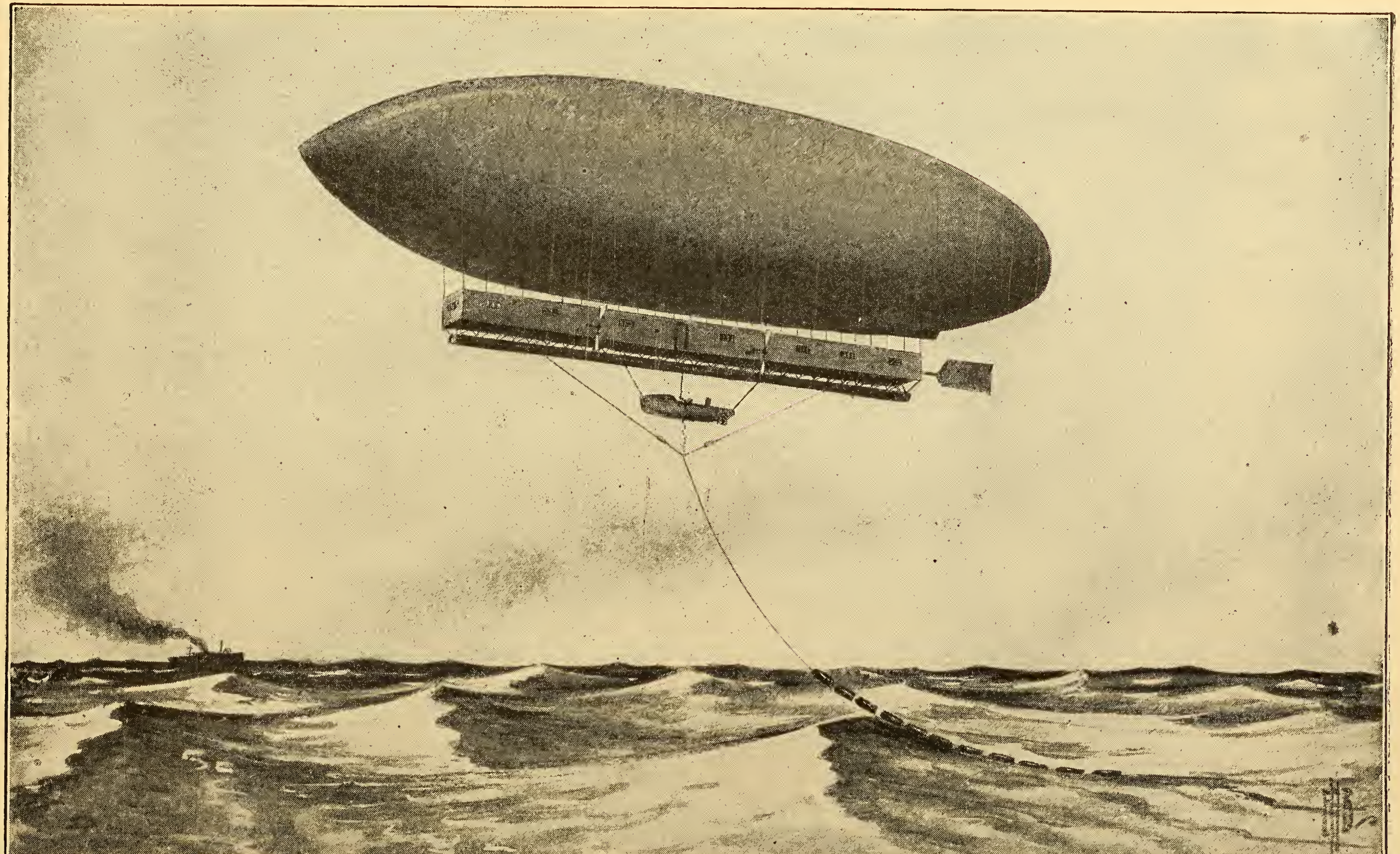
CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since each issue is printed a month before the date it bears, we should be notified at least four weeks in advance, in order to make the necessary change in our records.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.

YEARLY SUBSCRIPTION, $1.00; CANADIAN, $1.35; FOREIGN, $1.50; SINGLE COPY, 10 CENTS

No additional copies will be sent after expiration of subscription except upon renewal

Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.



See page 570.

WELLMAN'S LATEST DIRIGIBLE BALLOON WITH WHICH AN ATTEMPT WILL BE MADE TO CROSS THE ATLANTIC

Popular Electricity
In Plain English

VOL. III NOVEMBER 1910 No. 7

Edison Tells of His New Battery

Editorial Note.—The article which follows is based on an interview with Thomas A. Edison secured for Popular Electricity by Mr. C. V. Tevis In this interview Mr. Edison consented to explain, in the terse but interesting way in which he always expresses himself, how he came to invent the storage battery which bears his name.

Nine years ago there was begun the working out of an idea which had been long incubating in a master mind. Within a few months its feasibility had been demonstrated; within two years it was a completed and successfully working mechanism. But the master was not satisfied, and back to the shop it went. Another year and another, until six had passed—and the idea remained to the public but an idea. Then one day it re-appeared.

After nine thousand experiments, a thousand to a year, Thomas A. Edison finally said, "It is finished"; and his storage battery was given to the world.

"The Wizard's Pet" is what those who work in the great Edison laboratories in Orange, N. J., call this latest product of his brain, and the inventor does not deny the allegation. Since the production of the electric lamp, Mr. Edison has done nothing that has so satisfied him. And the possibilities of the storage battery which continued experiments are making plain to him are such that the result of the nine long years of labor promises to be the crowning achievement of the great inventor's life work.

Mr. Edison consented to explain his new marvel.

"It's a simple thing, isn't it?" he said, as he took from a rectangular can two slides each about fourteen inches long and five wide. One was covered with little corrugated pockets and the other looked like a tray of steel lead pencils. There were five of one and four of the other, in the can.

"That is all there is to the battery, with the exception of water and a little caustic potash. This is one complete cell. I can run a big truck a mile or an ordinary sized vehicle four miles with this and nothing else. And for the next ten or fifteen years I can use the same cell. Pretty good battery, don't you think?

"That is what people are finding out, at any rate. Since I put it on the market less than a year ago it has been remarkably successful. We cannot fill orders fast enough now. Big mercantile houses in New York, Chicago and several other of the large cities are using the batteries on their wagons altogether. Express companies, railroads, steamship lines, factories, all sorts and sizes of industries, have the battery on trucks, wagons, small cars, etc. It is more than making good.

"The problem of traffic, a most important one in this day, is being solved beyond a doubt. This matter first caused me to start work on better, cheaper, more reliable locomotion. I took a trip about New York. From the Battery up to Forty-second Street we were stalled many times. I got out of my automobile and, standing on corners, counted and timed different kinds of vehicles. I even followed one truck from the minute it left a wholesale house on its way to a pier until it finally returned. The speed of the truck was one mile in one hour and a half. From these investigations I found that while fifteen years ago a truck could make seven trips for the house, today it can make only four, and within ten years it will have a hard time to make two, if conditions are not bettered.

"I began work at once on my battery. What I perfected costs very much less than the old lead battery. It weighs just one-half as much and gives twice as much speed. Already there is very evident relief from traffic congestions in many places where the battery has been widely adopted. Give me a few years more and I'll show the last of the horse in the cities. I'll show clean streets and noiseless business districts. I'll show a doubled amount of business for less cost than the present volume.

"But that is only one phase of usefulness of the battery. We are experimenting with it in all sorts of small boats, as a system of car lighting, as a sparking battery, in locomotives, in coal mines, on dock trucks, in every conceivable way. Why, I even can work all the farms in the country with it.

"Its use on a rotary plow is now being worked out. On all farming implements, however, it will be as practical. All that is needed is a ten-horse-power windmill to generate and store the power, then the agriculturist will not really have to work, as he calls work now. He may sit at a switchboard and read his paper a good part of the time. Give him windmills and storage batteries and he will work harder cutting coupons than he will in his corn fields.

"When he can get a battery for from $200 to $600 which will last him for many years, there will be a considerable saving to him in the way of help. The farmers in the West are always short handed now, and the men they do get they have to pay big wages. This eats into their profits to a considerable extent. Anybody can run one of the batteries; the farmer would not have to employ skilled workmen.

"The weight of the battery is about all there is that is holding us back from doing almost anything with it. The battery that I say will go 100 miles on one charge weighs with the wagon, a ton and a quarter. You could not very well carry one of this size in an aeroplane, for instance. But it is just to such ends that we are hard at work. I have no doubt whatever that before very long we will have devised and perfected a high power, durable battery that will weigh no more than a gasoline engine. The business of flying will then be a much safer one, because my electric storage battery is reliable.

"It was, indeed, the fact of the unreliability of gasoline and gasoline engines that convinced me early that electric power was what I must utilize; that a storage battery instead of a motor was what I must invent. A street car company could put gasoline power to its cars for a few hundred thousands, but it dares not take the chance. It prefers to spend several millions for an electric service to being bothered with all the break downs, stalls and repairs of the complicated gasoline engine mechanism. In the long run the gasoline would be as expensive as the electricity, and exceedingly more troublesome.

"In my battery the active materials are oxides of nickel and of iron, respectively, in the positive and negative electrodes; the electrolyte, the liquid in which the electrodes are immersed, being a solution of caustic potash in water. The retaining cans are of sheet metal, electro-plated with nickel, fused so that they are practically one metal. The battery is almost unlimited in life. As only the water in the potash solution evaporates, so only water need be added to keep the electrolyte in the right condition.

"There are no acid fumes to destroy the iron work of a truck or wagon and eat it away, as in the old styled batteries where sulphuric acid is used. For the same output the battery weighs about half as much as a lead battery and, in addition to this, it will save about 50 per cent of its weight in the construction of the truck itself. It cannot be injured by overcharging, does not deteriorate when left discharged, offers accessibility to each cell, makes it possible for any cell to be removed and gives nearly twice the output of mileage of a lead battery of the same weight.

"Keep the water in it and it will do the work, today, next month, in five years from now. There are no repairs to be made; as it doesn't get out of repair it always goes.

"I have just received a number of reports from firms of wagon, truck and pleasure vehicles. Here is one: 'Wagon A—weight with battery one and one-quarter tons; 132.5 miles on one charge; manufacturer's guarantee, 100 miles.' And another: 'Wagon C—weight 100 pounds less than A; 146 miles on one charge; manufacturer's guarantee, 100.' These figures speak for themselves.

"Two months ago one of the big firms in New York made a test of one of their trucks which I had equipped with storage batteries. They found it 50 per cent higher than I had rated it. This truck has the longest delivery route in the city, making 63 miles every day. At the time of the test it had just completed 1,500 miles.

"The storage battery street car, which was put in experimental operation on the Twenty-eighth Street line in New York this year, is another striking efficiency proof. At an expense of about 35 cents a day this car is kept in continual service. Its batteries are good for many years, too, and there is never any chance of it getting stalled or out of repair, so long as a little water is freely used every day.

"In this last particular the advantage of this car over the others using electricity is plainly to be seen; traffic in all the big cities is going to double in the next few years and the problem of public transportation will become very complicated. More lines will have to be built and all this additional hauling will necessitate the erection of more power houses at enormous expense. Even then the uncertainty of a short circuit, or some trouble in the plant, of a dozen or more contingencies, will work against the service, just as it does today.

"With my batteries, as I have said, there is no chance of a delay for any reason. There would be no stalled cars. And—this is the biggest feature—it would not be necessary to erect any new power plants. Those that are now busy but one-half of the time in 24 hours could be utilized on double time. While the great number of the cars were in the shops at night their batteries could be recharged. This would last them throughout the next day.

"I feel sure that we have solved the problem of cheap, reliable power. There is really no end to the uses of it.

"The upkeep is very inexpensive; the batteries consume nothing while idle; they have a longer life than a horse; they provide more speed and need no rest; they do not balk at any sort of weather.

"I did not get my battery just where I wanted it without hard pulling, I tell you. It was like the electric light, only 'never giving up' got the result. The patience required to make the experiments and tests necessary was enormous.

"Two of the best men I had gave it up in despair and resigned. They were paid good salaries, but the work got upon their nerves. They were like the man who was employed to carry a brick from one spot to another—it was easy work, but he went crazy, almost, before he had completed his task. It was the same with the storage battery experiments. Night and day, never stopping, we kept at it for many years. And we finally won.

"Just imagine the picture. The rattle and jar of heavy traffic in the cities all hushed—towns on rubber tires; little or no dirt in the streets; no congestion and delay at the busy corners; speed, safe and reliable, in the vehicles carrying on the day commerce; then the farm lands—windmill tilled—where after half of his former day's work, the farmer joins his family, free of care by reason of his silent, electrical helper.

"I am sure that all of these pictures are quite faithful to the future. Cheap power will paint them. And I have furnished that."

Across the Atlantic by Airship

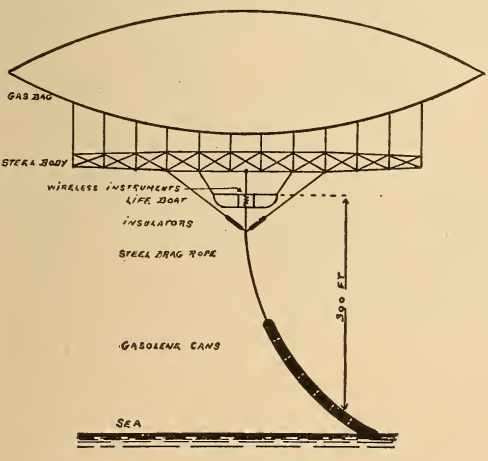
By F. M. SAMMIS, Chief Engineer of the Marconi Wireless Telegraph Company of America

As this issue of Popular Electricity goes to press an interesting and daring experiment is about to be made by a party of men headed by Walter Wellman, the well known balloonist. This experiment is nothing less than an endeavor to pilot a dirigible balloon of the latest type across three thousand miles of the Atlantic Ocean. While the object of this article is primarily a description of the wireless equipment on this great airship, it may be of interest to turn aside for a few minutes in order to give some idea of the expedition in general and the apparatus employed in fitting out the airship.

At Atlantic City, N. J., there has been erected a large shed or aerodome in which is housed the great dirigible balloon that perhaps is destined to mark a new era in the conquering of the air. The huge balloon is a masterpiece of strength attained with minimum weight. In order to provide even the essentials of possible success for this expedition it was necessary that the balloon should have immense lifting capacity, consequently the cigar-shaped envelope was constructed so as to have a total gas capacity of 345,000 cubic feet. Hydrogen gas, being twelve times lighter than air, the lifting force

OPERATOR IRWIN OVERHAULING THE WIRELESS APPARATUS IN THE BALLOON SHED AT ATLANTIC CITY is therefore the difference between the total weight of the gas and the weight of a similar quantity of air, or 23,650 pounds. To the lay mind this would seem ample, but the grand total weight of machinery necessary for the driving of this aerial craft at the speed of 25 miles an hour, together with the enormous supply of gasoline, provisions, etc., to say nothing of the life boat and its emergency outfit, was so great that it was found necessary to reduce to a minimum all these parts, in order to keep within the required limit. The gas for filling the balloon is generated by combining 80 tons of sulphuric acid with some 60 tons of iron turnings. It is expected that once the envelope is filled the gas will be so perfectly contained as to last the entire voyage.

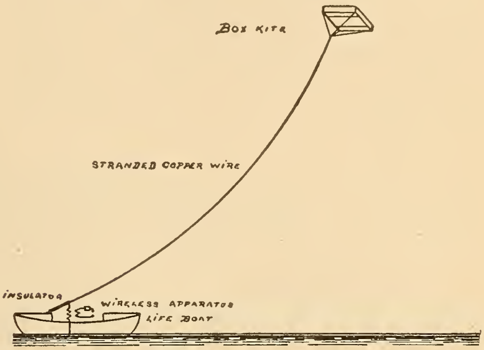
Contrary to the natural assumption, the problem is not so much to maintain sufficient lifting capacity, and therefore keep the balloon up, as to so regulate the lifting power as to keep the balloon down. Gasoline and supplies will be used up at the rate of 50 pounds per hour while the lifting power of the gas bag remains constant. It will thus be seen that some provision must



SHOWING THE DIRIGIBLE WITH ITS "DRAG"

be made to equalize these forces. The man in the street would say, "Why not let out some of the gas?" But while this seems logical, it is impracticable for the reason that any reduction in the amount of gas in the envelope below its full capacity would immediately weaken its backbone and destroy its normally rigid cigar shape.

Two devices have been provided to overcome this very considerable difficulty, one of which is called an equilibrator. This device is a steel cable some 40 feet long, over which are slipped some 30 gasoline cans of special design, each having a capacity of approximately a barrel of gasoline. This equilibrator, more commonly termed a drag rope, is suspended from the body of the car, as shown in the diagram and in the



HOW WIRELESS MESSAGES COULD BE SENT FROM THE LIFE BOAT

frontispiece, by special insulators, the purpose of the insulators being to allow the wireless apparatus to be electrically connected in between the steel frame and the drag rope. Since the lifting power of the hydrogen gas is a variable quantity, depending upon the effect of sunlight or the lack of it, the balloon rises correspondingly, and the drag rope therefore is lifted more or less out of the ocean through which it trails, thus balancing to a very fair degree the lifting power of the gas bag.

Still another device is provided in order to preserve the rigid nature of the balloon should it become necessary to release some of the gas or should any considerable amount be lost by leakage. This device is nothing more than a sort of pocket or second balloon contained within the first. This second and smaller compartment may be filled with air and as the section containing the gas becomes more or less expanded, the second compartment may be more or less filled with air by means of auxiliary pumps and exhaust valves.

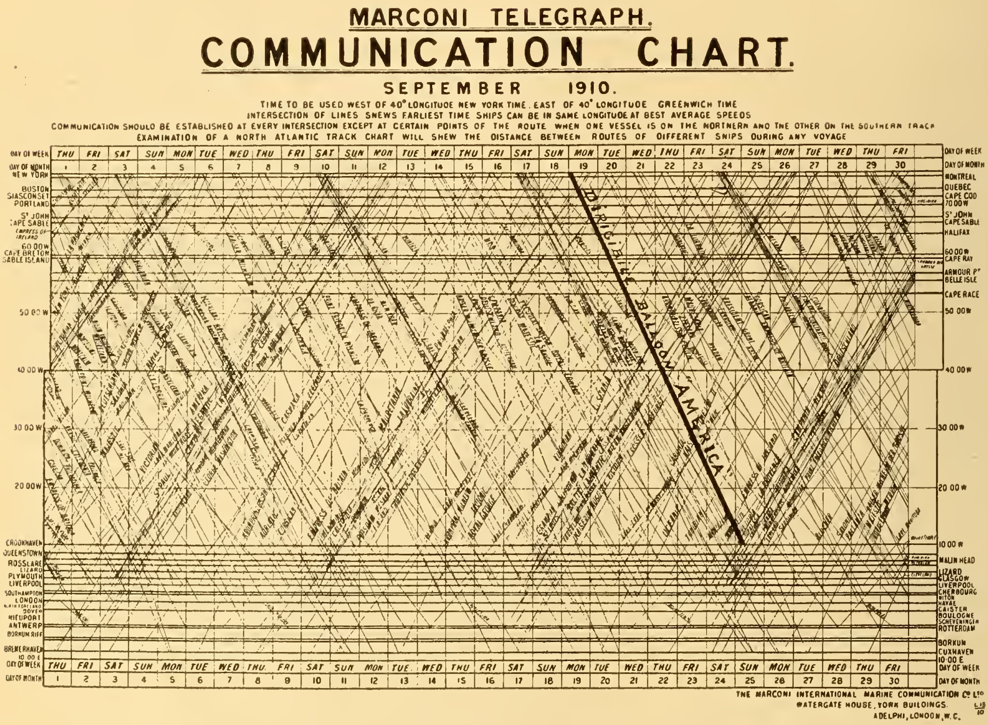
Suspended from the balloon by means of manila ropes and steel wire is a long tubular steel frame braced and counter braced with slender steel rods and turn buckles. The main body of this steel frame consists of a tank running its entire length, made of riveted sheet steel, and in this the main supply of gasoline is carried. The tubular steel frame above referred to is bolted to this tank in much the same manner as the ribs of a vessel are fastened to the keel and at one end is placed a great rudder built up of canvas on a tubular steel frame. This rudder is used in the same manner as a ship's helm, while two especially designed propellers, driven by one of the main engines, are so arranged that their plane may be tilted so as to cause the craft to rise or descend. Underneath the tubular steel car is swung an unsinkable life boat stored with supplies for 30 days. This little craft is a marvel of lightness, weighing less than 1,000 pounds.

The motive power of the airship will be two four-cylinder gasoline engines developing 80 horse-power apiece, each engine driving a pair of wooden propellers eight feet in diameter. A smaller engine is also provided for auxiliary work.

The crew will consist of six men all told, including the wireless operator. Canvas bunks have been arranged along either side of the steel frame of the car to provide resting places for the crew during the long voyage.

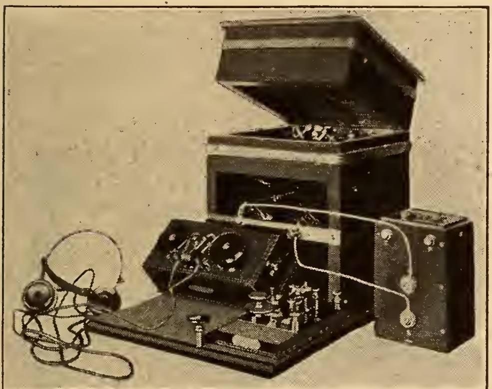
It is expected that if the favorable trade winds are encountered that are prevalent at this time of year, the crossing of the Atlantic will be accomplished in five or six days, and even though ideal conditions may not exist after the start is made, it is expected that the airship will be able to stay aloft for a much greater period of time than this.

While the prime object of this expedition is the crossing of the Atlantic Ocean, a not unimportant essential is the sending of news of the expedition to several of the newspapers in New York City, Chicago and London, and the transmission of this news enroute could, of course, be accomplished only by a modern equipment of wireless telegraph apparatus. It was essential that it be Marconi apparatus, owing to the fact that the entire North Atlantic is constantly dotted with ships carrying this type of apparatus. The communication chart here reproduced will give the reader some idea of the extent to which this is true. Upon this chart will also be noted the line designating the course of the airship America, and from which the operator will be able to



THE ATLANTIC IS CRISS-CROSSED WITH LINES ALONG WHICH WIRELESS COMMUNICATION IS NOW POSSIBLE learn the vessels with which he is likely to communicate. It will be readily understood by the reader that the lines slanting downward from left to right are eastbound ships and the intersecting lines are westbound ships. The section between vertical lines represents 24 hours of time, and the space between horizontal lines ten degrees of longitude, or approximately 600 miles.

By means of these numerous ships the airship America will be able to have retransmitted such news bulletins as may be



THE MARCONI WIRELESS EQUIPMENT TO BE CARRIED BY THE "AMERICA"

sent to any one of them. Such news items as are sent, reporting the progress of the airship, its position, rate of speed, etc., will be transmitted directly ashore as long as the balloon remains in touch therewith. But after direct touch is lost the messages will be handled by means of ships carrying more powerful apparatus and within working range of the dirigible.

The route of the airship is practically parallel to the east-bound steamer lane, so that constant communication may be had, and there is also the quite evident advantage of being near this track in case of disaster. In order to show the practicability of the retransmission of daily news messages from the America, the reader will note upon the communication chart all vessels fitted with Marconi apparatus, their positions being shown on any given day.

Since the America is designed to travel at a speed closely approximating that of a modern ocean passenger vessel, it will be readily understood that when the airship starts, she will remain in close company and constant good wireless communication with vessels sailing eastward from New York on the same date, or a day or two previous. There is no reason, should Navigator Wellman desire, why his craft should not be convoyed by any one of the liners sailing on the same date, having a rate of speed similar to that of his own vessel. The communication chart shows the September sailing dates of eight or ten vessels, from which he would have been able to select at least one or two were the start made in September.

The wireless equipment of this balloon is unique in several respects. It was especially designed so that danger from sparking would be negligible. This was important owing to the presence of the huge supply of gasoline, and also of hydrogen gas. Power is supplied from a 24-volt accumulator battery which, in addition to furnishing power for the Marconi equipment, lights the craft by means of incandescent lamps. The wireless instruments have been placed in a forward locker of the life-boat. The storage battery is also carried in this compartment. Thus, if it becomes necessary to launch the craft the wireless equipment will be where it will be most useful. The general method of connecting and operating is the standard one with Marconi equipments.

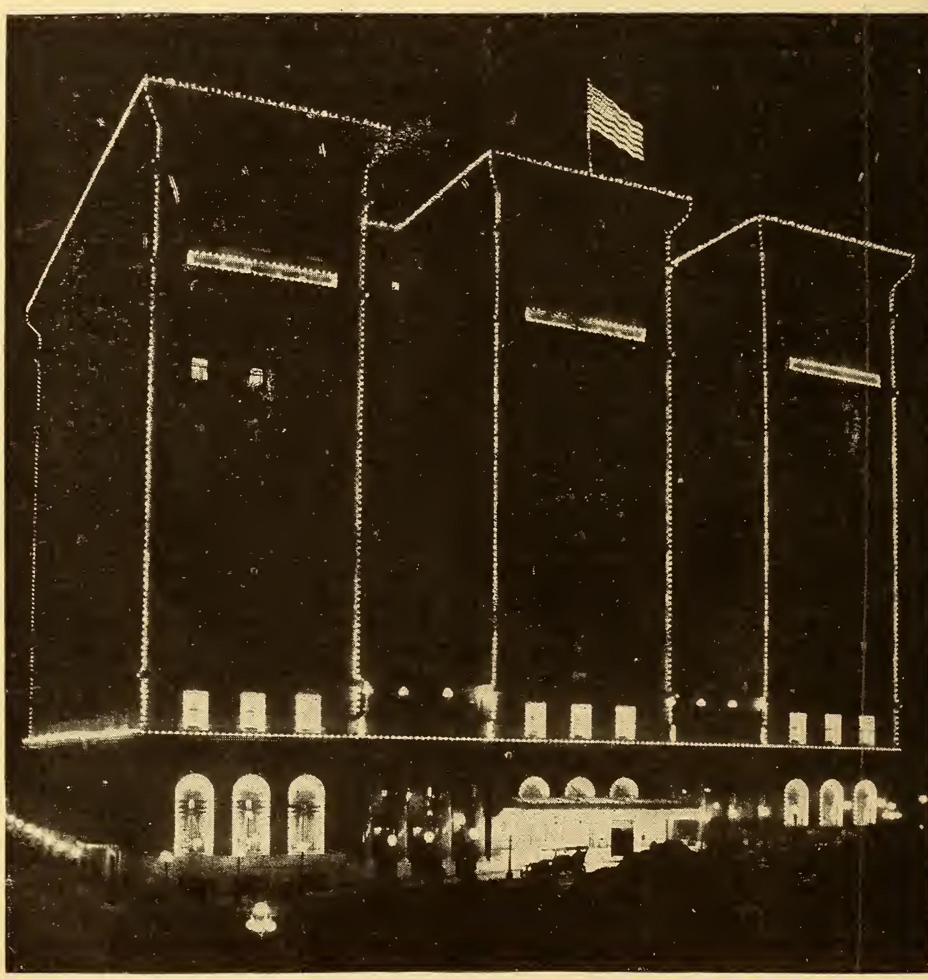
The Marconi Company asked for a volunteer to operate its apparatus on the America, during the transatlantic voyage, and it was immediately swamped with offers from the men of its large staff of operators. Of the many who volunteered J. R. Irwin was considered as possessing the necessary qualifications, and was therefore placed in charge. Mr. Irwin, better known as Jack Irwin, is one of the original C. Q. D. heroes, having received the famous distress call from the sinking Republic, while on duty at the Marconi Station on Nantucket Island.

In order to be prepared for any emergency, Operator Irwin is taking with him a supply of special stranded copper wire and a large kite. Should it become necessary to take to the life boat the kite will be raised, the copper wire being attached in lieu of the cord. The lower end of this wire will be connected to the wireless transmitter in the life boat, as shown in the diagram, and once more a C. Q. D. will be sent broadcast, with its appeal for help.

In Palaces of the "Well-to-Do"

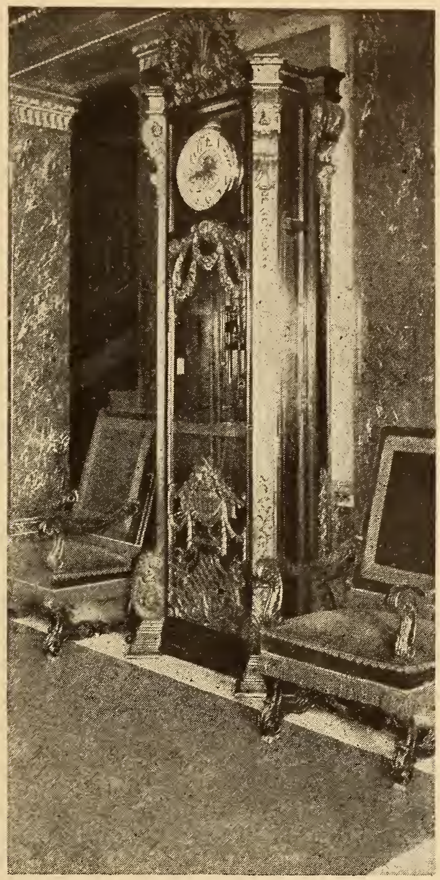
When a millionaire or a near millionaire makes his home in a hotel in these days he is not following out a whim or a fad. Nor is he seeking to build up a reputation for eccentricity. He follows this manner of living because his money will buy him every comfort and every luxury that his senses may crave. His wants are administered to by a retinue of servants that is more than kingly. Almost before a desire is expressed its fulfillment is accomplished. And he may say without stretching the facts: "My home is my palace."

Palace is a term that may well be applied to the modern hotel in a large city, which caters to the best class of trade. While some may seek to obtain the more wealthy of the tourist class there are others adapted to meeting the wants of families who desire to rid themselves of the care of a home and the annoyance attendant upon the direction of a staff of servants. And this acme of perfection in comfort and homelike atmosphere is to all appearances attained alone by the American hotel. Joseph Reichi, manager of the Alexandria Hotel of Los Angeles,



THE ST. FRANCIS HOTEL, SAN FRANCISCO, AT NIGHT who has just completed a tour of inspection among the leading hostelries of England and the Continent, says: "There are just two hotels in Europe which compare with the best of our American hotels, and these are patterned after American ideas. It is a fact that many of Europe's best hotels still use the old push button system and refuse to install telephones."

In considering such notable hostelries as the Hotel St. Francis of San Francisco and The Blackstone of Chicago, we are brought face to face with the problem of how these immense institutions cater to the wants of their guests with such promptness and without hurry or bustle, for one cannot step inside either of these great buildings without noting their richness and feeling their restfulness.



MASTER CLOCK WHICH OPERATES ALL THE CLOCKS IN THE ST. FRANCIS

Even the casual observer soon appreciates the fact that electricity is doing every conceivable task that can well be imposed upon it, from lighting the building to making a copy of your message at the clerk's desk on the first floor as you write it on the telautograph on some upper floor.

Located in the heart of the down-town district, yet affording a beautiful panorama of the Bay, Hotel St. Francis symbolizes better than anything else the triumph of San Francisco over adversity, the opening night being just nineteen months after the fire.

There is an old and trite saying that the civilization of a nation may be measured by the amount of soap it uses. Replacing the word "soap" by "electricity," and the proverb applies well to present day industries and institutions. The illumination of the exterior of Hotel St. Francis during a festival or special occasion, the means for doing which is a permanent installation, gives but an inkling of the varied uses of current in the interior.

Entering the lobby, illuminated by massive cut glass electroliers hung from a ceiling of gold and walled by beautiful dark marble, one feels himself in a place of "magnificent distances." Yonder is the cafe with its ceiling patterned after the Chateau Brissac in France, and over here the White and Gold Room with its massive columns like the ball room in a king's palace; then passing through the ladies' reception room we enter the Tapestry Room, wonderful because the greatest mural decorators in America placed within its walls designs representing an outlay of $100,000. One cannot help noting, also, the beautiful clocks placed in the various rooms. Each clock is automatically controlled electrically from a master clock which stands in the lobby. This masterpiece of mechanism was made in Saxony and is said to be the first of its kind in the West.

Those who remember Hotel St. Francis before the fire will be glad to find still looking like the same old place, one spot, the Rathskeller. There are a few changes, of course, and among them the use of an electric grill that cooks a steak in five minutes, which will tickle the palate of the most

HYDRO- AND ELECTRO-THERAPEUTIC BATHS, HOTEL ST. FRANCIS

fastidious of epicures. Located also in the basement is the electric grill room. A display case fitted with a cold storage appliance affords the patrons the unique privilege of choosing the particular article they desire cooked and its preparation requires less than one-half the time which would be taken if coal or gas were employed. Petrified wood was largely used in finishing this room and the lighting fixtures of stag's horns add decidedly to the attractiveness, reminding one of the interior of a hunting lodge.

The hotel has its own electric lighting plant with a capacity sufficient to supply 30,000 incandescent lamps. Also its own cold storage, tailor shop and laundry. This latter with a view to light and cleanliness is located on the fourteenth floor. It has a capacity of 40,000 pieces daily and from its washing machines and driers to the ironers is electrically operated.

HOW ELECTRICITY IS USED IN THE LAUNDRY OF THE HOTEL ST. FRANCIS

Mention should also be made of the electro-therapeutic baths, the cabinets of which are finely finished in enamel and heated by incandescent lamps on the interior.

An elaborate pneumatic tube plant aids the management in caring for the 750 rooms and guests with facility. In this plant are over 30 stations of $2\frac{1}{4}$-inch pneumatic tubes, giving communication between the several departments throughout the building. Lines radiate from a central desk in the main office to each of the cashiers in each of the dining rooms, to the chef, pantry, barber shop, wine room, bar, baggage room, laundry, linen room, steward, as well as a line from the chef and chief operator to each of the floors. This equipment does the work which would otherwise be done by a small army of messengers. The plant can do the work of fifty messengers and do it quickly, noiselessly and efficiently. All portions of the apparatus are concealed in the floors or partitions so that nothing is visible except the ornamental terminals, where carriers are dispatched or received. The plant is operated by a small motor and blower, located in the engine room, and is entirely automatic in its operation, in that the dispatching of a carrier starts the machinery and its discharge from the tube automatically stops the consumption of power.

The Blackstone Hotel has been referred to as "Chicago's Diadem," and the Drake Brothers spared nothing that an expenditure of $3,000,000 would make possible Located on Michigan Avenue, it affords an unobstructed view of the boulevard and Lake Michigan. By daylight the magnificent outside architectural design piled up to a height of 20 stories, yet symmetrical throughout, creates in one an admiration for the engineering skill which made it possible, while at night it offers a picture in exterior electric lighting not soon forgotten. On the French mansard roof 30 pillars carry each a 60-watt tungsten lamp enclosed in an opal glass ball globe. The white terra cotta facing at the third story level is illuminated in a similar way with 36 pillars and lamps. Four flaming arc-lamps enclosed in huge bronze lantern fixtures light the sidewalk from bracket suspensions, while the entrance on Hubbard Court is bordered by 84 25-watt tantalum lamps and lighted by twelve-lamp clusters.

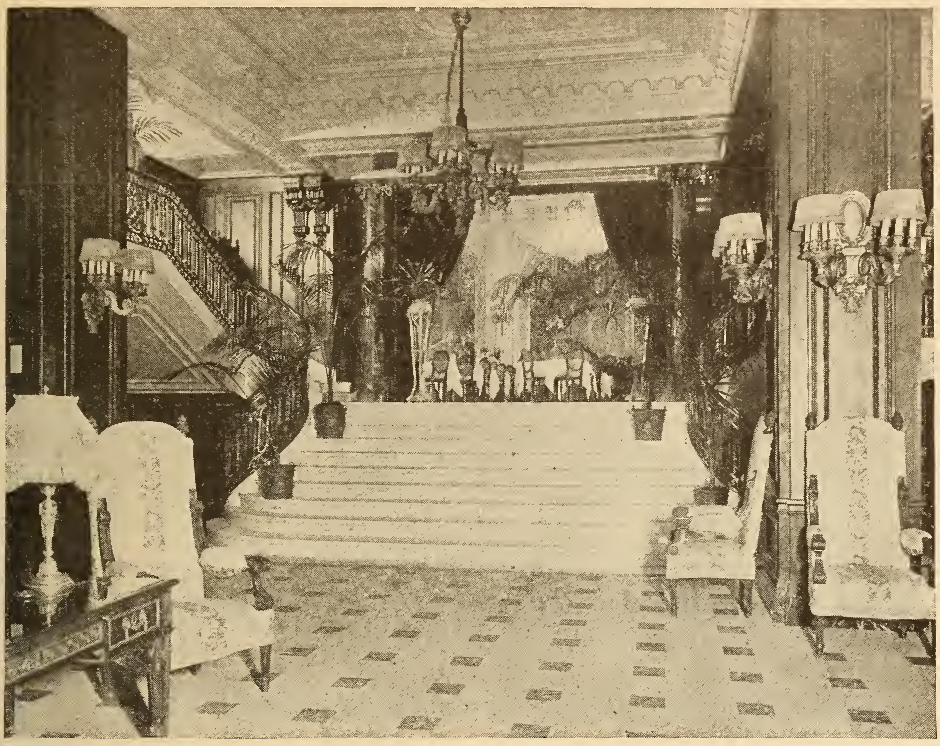
ELECTRIC GRILL ROOM IN THE HOTEL ST. FRANCIS

Carried out with greater care and in a more elaborate manner if possible is the arrangement of the interior illumination and electrical equipment. A total of 9,000 incandescent lamps of which 4,000 are tungstens, 2,000 are tantalum and 3,000 are carbon-filament, make up the lighting installation, the last named being used in side brackets about the rooms and the tantalums in portables. On entering the hotel, in anticipation of what is yet to come, the attendant at the door presses a push button and a small motor over the doorway revolves the door for your admission. At your right and up a few steps is the main dining room, impressive because of its size, the five massive electroliers carrying tiny lamps reflect by hundreds of crystal glass pendants upon them. On each table is an electric "candle" and examination will reveal a small storage battery for these "candles' mounted underneath. The art electroliers of the dining room and the ball room dazzle one so that a startling contrast is found on entering the Grecian marble cafe at the left of the lobby. Here not a light is visible, the indirect system of illumination being employed. This system is also used in the kitchen, buffet, and barber shop. This last has been pronounced the finest and handsomest shop in the world, the pale blue ceiling and the mirrored walls lending themselves well to indirect lighting. The chef as we passed through the kitchen remarked, "We have daylight here 24 hours in the day."

Private dining rooms large and small and gorgeously furnished afford means of entertaining friends and in whatever style one desires. Dumbwaiters operated by push buttons assist this service and by the aid of the pneumatic tube system eliminate to a great degree the hurry and scurry of bell boys and messengers.

Coming down to the facilities guests are afforded for the direct use of electricity in helping them selves we note that on entering any

THE BLACKSTONE HOTEL, CHICAGO

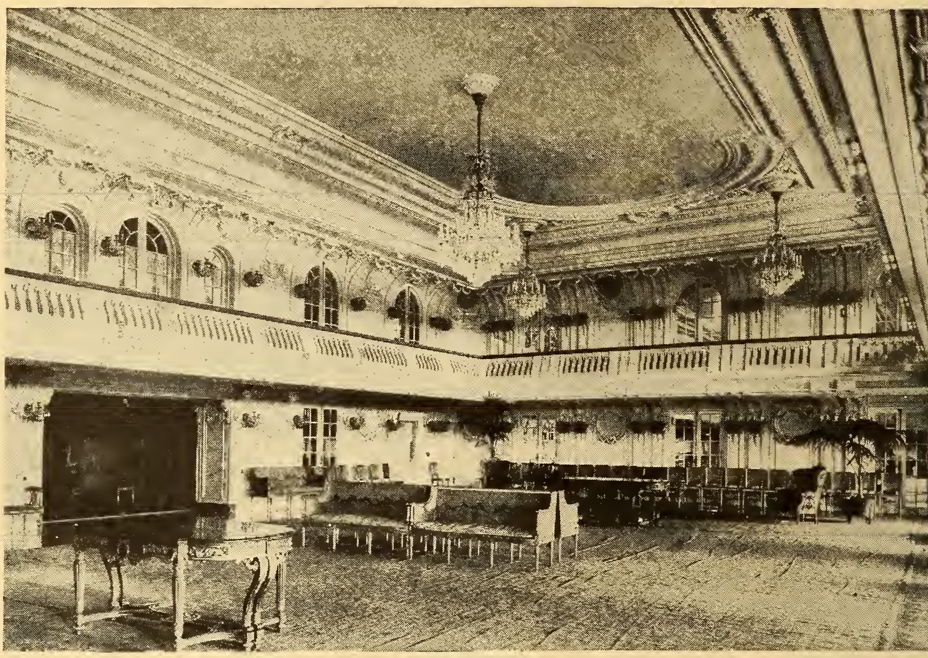


ENTRANCE TO THE MAIN DINING ROOM IN THE BLACKSTONE

room the lights are turned on by the operation of unlocking the door. These lights are controlled by a magnetically operated switch inside the room. On locking the door from the outside all lights in the room are turned out. Provisions are also made for connecting curling irons, and electric fans are furnished on request. In the baseboard in each room outlets are provided for reading lamps and fans. Of the 450 rooms there is not an inside guest room, all having outside exposures, and this is true also of the 350 bathrooms.

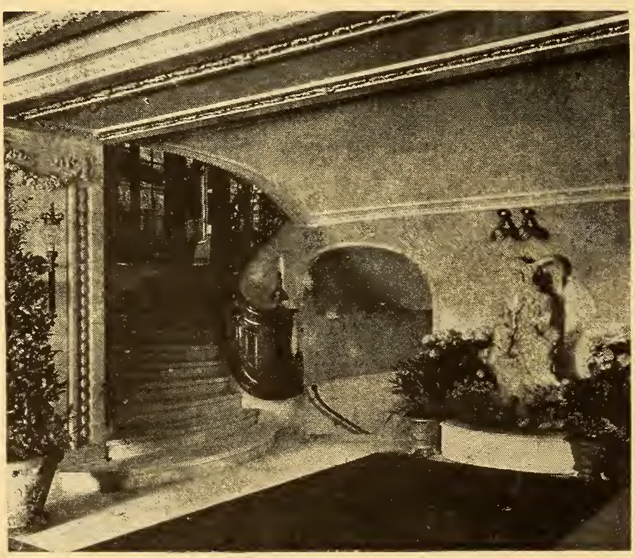
The exacting bachelor or business man will be pleased with the furnishings of his room and bath, mahogany predominating. On arising he may take his sponge or shower with water at any desired temperature, and then proceed to his morning shave aided by two adjustable electric lights, one on each side of the mirror. If he wishes a cigar

ART HALL, BLACKSTONE HOTEL



THE BEAUTIFUL BANQUET AND BALL ROOM OF THE BLACKSTONE

or paper he reaches for the telephone, calls a desk clerk, one being located on each floor, and as the order is given it is written by the clerk on a telautograph which re-writes the message under the eyes of a bell boy on the first floor, and almost before the order is finished his paper and cigars are on their way.



A HALL AND STAIRWAY IN THE BLACKSTONE

If the guest is a broker, a "ticker" wire may be drawn in through a special conduit run to each room for this purpose, and business conducted in private. A call for a carriage transmitted to the clerk's desk is immediately transferred to a switchboard with keys on it located in the lobby. By pushing these keys numbers are flashed through a glass sign on Hubbard court and by the time the guest has reached the lobby a carriage or automobile is in waiting.

The private telephone exchange should also be

ONE OF THE BATH ROOMS IN THE BLACKSTONE

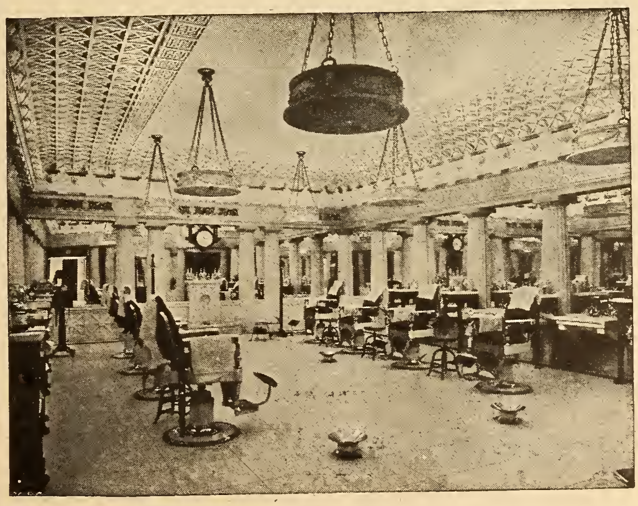
a revolving "spit" for carrying a delicious steak before a grate of hot coals in the grill-room kitchen.

Besides doing the work in the laundry electricity propels the dish-hoist, buffs the silver, washes the dishes, sifts the flour, mixes the dough, peels the potatoes, operates the ice-cream freezers, and by motors connected to centrifugal pumps circulates the brine in the refrigerating system. All the public rooms are arranged so that artificially cooled air may be supplied to them and all rooms have an entire change of air at certain intervals by means of an extensive ventilating system.

The fire alarm system is of the best. Each floor and corridor is provided with boxes. By breaking a glass and turning in an alarm the location of the trouble is registered at once in the clerk's office and also in Chief Engineer Boomhower's office. At the same time electric lights outside at the landings of the fire escapes are automatically turned on. This feature for safety was given special attention, the lights being alternately taken from two circuits so that should one circuit fail every other light is left burning along the fire escapes from the top of the building to the sidewalk. Space forbids a detailed description of the plant behind this extensive electrical equipment, but it should be said that it is in keeping with the switchboard, which consists of fourteen panels of pink Tennessee marble

mentioned. It consists of 450 instruments, four operators, 30 outgoing and 30 incoming lines. The telautograph system is made up of 28 transmitting and 32 recording instruments. Every order given is stamped with the time to a second by a time stamp system.

The fact that in all there are 72 motors ranging from one-fourth to 40 horse-power and totalling 500 horse-power, tells somewhat clearly how electric current is at work in the Blackstone, and probably one of the most peculiar uses for one of the small motors is that of turning



BLACKSTONE BARBER SHOP LIGHTED BY THE INDIRECT SYSTEM two inches thick, provided with the latest controlling apparatus. In all its completeness in other ways not touched upon The Blackstone has been proclaimed by managers and proprietors the finest hotel establishment in America.

The "Inside" of Moving Pictures

By ARNEY H. RITCHIE

THE mission of this article is twofold. Its prime motive is to explain to the patron of a moving picture show why the exhibition may suddenly stop in the middle of a picture and what has happened, and what is going on up in the operator's booth while the audience is waiting for things to continue. The other is to explain a few of the freakish things which are witnessed in some pictures.

Many there are, who have never been fortunate enough to examine closely a machine and its accessories, but who have experienced some of the exasperating difficulties of the operator, who labors with perspiring face while the anxious spectators crane their necks up at him, stamp their feet impatiently and wonder what is delaying the exhibition. It is to these that it is hoped this article will be of interest.

To describe in detail the operator's booth, the machine and the film used in producing the pictures, would require so much time and space that it wouldn't be interesting to the average reader. However, a brief description follows, which will be supplemented later on by describing several different parts of the machine whenever it becomes necessary to do so, that the reader may understand some of the operator's perplexities

The operator's booth is a small, hot, stuffy place. It is generally made of sheet iron, asbestos lined, and scarcely high enough to stand up in.

The moving picture machine gets its light from an electric arc, which is focused by means of lenses, on a thin celluloid film or ribbon about 1½ inches wide, on which the pictures are developed. This film, which is usually 1,000 feet long, contains about fourteen pictures per running foot, and when run through the moving picture machine, is pulled down, a picture at a time, from a reel on which it is wound, so that the pictures pass upside down through the focus of the arc light.

Each picture as it passes down into the focus of the light, stops there for an instant and is reproduced right side up on the screen, or curtain, as it is often called. Then the light is cut off for a similar interval by means of a shutter, during which interval the picture just shown is pulled down and the next picture is pulled into the focus. The next or second picture is in turn reproduced as the shutter again opens and allows the light to shine upon it for an instant, and so on. If it were not for the shutter, the spectator would see, instead of moving pictures, a continuous blur in which nothing could be distinguished.

The mechanical movement which pulls down the film and at the same time manipulates the shutter, is operated by turning a crank by hand. To turn the crank is one of the duties of the operator—the machine is not driven by an electric motor, as many imagine, except in a very few theatres.

These films which are so necessary to the operation of the moving picture theatre, are rented from film exchanges. The exchanges purchase their films from the film manufacturers, who make a business of taking moving pictures, and hire high-priced actors, acrobats and comedians for that purpose.

The film which the operator runs through the moving picture machine is not the original picture that was taken with the moving picture camera by the manufacturer. The cost of taking the first or original film is so great, ranging from $1,000.00 to $10,000.00, that the film rental would be too high for the picture shows to pay. Furthermore, by the time one-tenth of the shows in the country had used it, it would be worn out. The original or first film is

THOMAS A. EDISON AND ONE OF HIS GREATEST INVENTIONS, THE CINEMATOGRAPH OR MOVING PICTURE MACHINE

therefore used as a negative from which any number of similar films may be printed. In this way the price of a film is very much reduced, averaging $125.00 per film. The film exchanges buy the films from the maker at this price, and rent them to the theatre owners at prices ranging from $25.00 to $150.00 per week for fourteen reels a week (a change a day). A new film is more valuable than an old one, not only because it is clearer, but because it is "first run" film, and has not been shown by other competitors.

The average five-cent theatre shows two reels or approximately 2,000 feet of pictures during one complete show. The morning after the show, the two reels are returned to the Film Service from which that particular theatre rents its films, and two more are secured for the next evening. If the theatre is located in a country town, it will be necessary to return the films to the exchange by the first express. It would not do to get a week's supply of films at one time in order to save express, as the value of the rental of each film for the six days it would be standing idle, is worth many times more than the express charges saved by having one express fee to pay instead of seven.

Now that we have some idea of the machine and film, let us investigate some of the difficulties the operator has to contend with. It often happens that the electric arc, which is generally the source of light in a picture machine, gets out of adjustment. If it does, he has to keep turning the crank while he adjusts it. Frequently one of the carbons in the arc light slides past the other, cutting off the light and making the picture dim. The operator then has to remedy this, and do it, if possible, without stopping the machine and disappointing the audience. This necessitates his turning a crank while he fixes the obstinate carbon.

To do this, he first opens the door of the lamp-house which contains the electric arc light. This door is kept shut by a strong spring, and if no catch is provided to hold it open, he has to hook it to his trousers leg with a piece of wire, or put a large weight on it to keep it open. Then he reaches for his rubber-insulated pliers, which are always lying near the machine. Meanwhile, he is turning the crank with his right hand, and as his left will not quite reach the pliers the way he is sitting, it is necessary for him to shift hands, and turn the crank with the left while he gets the pliers with his right. After he has secured them, he can't put them in his other hand, because it is now engaged in turning the crank of the machine. If he lets go for the tiniest instant, the machine will stop or slow down so much that the highly inflammable celluloid film, instead of moving through the hot rays from the arc light which are focused upon it, will come to a standstill and take fire, causing panic and disaster. There is no alternative but to put the pliers between his teeth, in order to change them from one hand to the other. After having accomplished this, he resumes turning the crank with his right hand and proceeds to pull the carbon back into place with the pliers which he has finally succeeded in placing in his left. All this is the work of a moment and must be done while he keeps the crank turning at a uniform speed, and reaches into a lamp-house that is hotter than the hottest bake oven, taking, at the same time, a chance of burning his wrist on the hot door, or of getting a good "jar" from the electric lamp which he is fixing. Many are the burns an operator receives in this way, just to keep the thoughtless audience interested in the picture that is before them, whereas if he could stop the machine for a few seconds, he could adjust his troubles in one-third the time, and do it with no discomfort to himself. But this is only one of his troubles.

Perhaps the most frequent cause of trouble is the unsplicing or breaking of a film. It is very seldom that a complete film of 1,000 feet or even much less, is composed of one unbroken film, even though it contains but one subject. When pictures of parades, and scenic pictures are taken, several thousand feet of film are used. It is then developed and the clearest and most interesting and prominent parts are selected, spliced together in the order in which they belong and made into a 1,000-foot reel. This accounts for some of the occasional changes of location or viewpoint in such pictures, but it doesn't account for the jumps in some other pictures, as we shall see later.

But to return to the operator, however, he may be running a picture, let us say of the Knights Templar parade. Everything is going along nicely and he is watching the screen through his "peephole" to see that the picture is clear. Suddenly he sees a white flash on the screen. He knows something has happened to the film, and instantly releases his foot from a cut-off, which he holds down all the time the machine is in operation. By so doing, he cuts off the hot rays of light from the film so it won't catch fire. An examination of the film shows that it has parted at one of the places where it was spliced. The audience is waiting, meanwhile, and he must hurry. He snatches up a pair of scissors (which he has on a shelf in front of him), seizes the upper part of the broken film and cuts off the old edge where it was spliced, gauging it so that he cuts off about a quarter of an inch more than one of the complete pictures. This extra quarter inch of film he moistens with the tongue and scrapes clean with the scissors blade, thus removing the portion of the picture which was on it.

Next the lower end of the film is found and the old splice cut out in such a manner that the film is cut exactly on the line of a complete picture. He then applies a little transparent, quick drying film paste which he has in front of him in a handy place, and blows on it to make it congeal more quickly, then applies a trifle more paste. Now grasping the lower end of the film which he has been holding between his knees, he takes the upper part bearing the paste, and holds both up to the light to be sure he is splicing the negative or picture bearing side of the upper end of the film to the corresponding side of the lower, then puts them together, and holds them firmly for about ten seconds until the cement has set.

This has to be done in such a manner that the one-quarter inch of film on the upper end which was scraped to make it transparent, will lap over the lower end and allow the light to shine through the picture over which it is spliced. It requires but a second to "thread" the film in the machine and he is off again. The relating of this in words takes a long time, but if the operator is an experienced one, he can mend a broken film in the manner just described, in three minutes or even less, if everything goes well. But everything doesn't always go well.

On some machines the film is rewound on a "take-up" reel which is similar to the upper or "feeding" reel and is located under the base of the machine. This reel takes up the film as fast as it runs through the machine. When this is used, and the film breaks, it is easy to find both ends.

Other machines are fitted with a sheet iron box about three feet long, a foot and a half wide and two feet high, closed at the top except for a trap door about four inches square, through which the film enters the box. When the film breaks, the lower end falls into the box and if there is much film in the box, a great deal of time is consumed in trying to find that end.

One would think that cutting a piece out of a film when making a splice, would make a jump in the picture. So it would if very much film were cut out. As many as three complete pictures may be removed from the film without making any perceptible difference in the picture on the screen, although a good operator removes as little film as possible when he makes a splice.

It often happens that an inexperienced operator while adjusting the carbons in his lamp, will forget to keep turning the crank, and slow down so much that the film is scorched for a number of feet. Before he can make the next run, he will have to cut out the scorched portion and make a patch, otherwise the next time he runs the film, the audience will see a dark, blurry picture as the scorched place passes through the machine. This scorched place has to be removed, and so much generally has to be taken out that it causes a "jump" in the picture at that juncture.

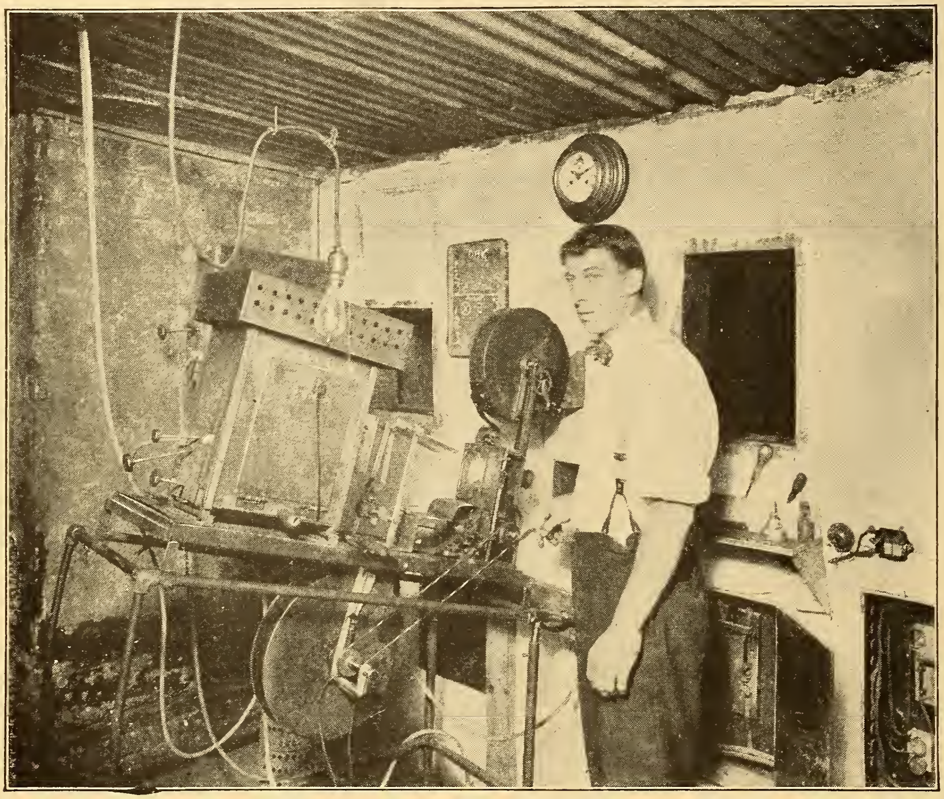
After a film is run through the machine, it has to be rewound before it can be shown again. During this process, it often becomes unspliced, and very frequently torn, especially if it is wound from one of the metal boxes previously mentioned. When the film is rewound from the box, into which it falls loosely, it snarls very easily, and comes up in big bunches clogging the hole. Before the operator can check the re-winder, which he turns at a fair speed, the tender celluloid ribbon is pulled so tight that it breaks. That means more patching.

Another bugbear of the operator comes in the form of worn sprocket holes. In order that the film may be pulled down through the rays of light, little oval shaped sprocket holes are punched in both edges of the film, into which little teeth on either side of a small revolving cylinder fit, and pull down the film. As the film gets old, these sprocket holes are worn into each other by the constant friction of the sprocket teeth on the cylinder, until finally there are no holes at all in some places, but instead, a long slit on either side of the film. When this slit in the film reaches the sprockets and is about to be passed through the machine, the film comes to a standstill, as there are no holes for the sprocket teeth to fit into. If the operator isn't minding his business, the film will scorch, and take fire unless he immediately cuts off the light from the now motionless film.

Using an electric light as most machines do, results in another source of trouble for the man behind the picture. The heat from the arc light is so intense that it melts off the wires which are connected to the lamp arms which hold the carbons, even though the wires are as large in diameter as a lead pencil, and asbestos covered. When a wire burns off, the show has simply got to stop until the lamp can be removed from the lamp house, and the wire again fastened. The lamp, which of course is almost red hot, is hard to handle, and for that reason it takes some time to fasten the wire to it, especially if it is found that the thumb screw to which the wire is fastened, has melted and refuses to turn. Under such circumstances the operator has to bend the stiff, heavy wire around the metal arm which holds the carbon the best way he can and trust to luck that he will get a good contact and plenty of light till the show is over.

Among the things which annoy the visitor at a picture show, is the lack of a title to a film. The picture starts off without a title or name, so that one really doesn't get any idea of what is going on until the picture is over. This is due to the fact that the many operators who have run the same film, have been careless in rewinding, and have torn off little pieces from the title (which is usually two or three feet long), until there is little or no title left. As there are fourteen pictures per running foot on the film, so there are fourteen titles per foot. If there was but one title, it would flash on the screen but once, and as it would remain there but a small fraction of a second, the spectators wouldn't have time to read it.

Rainy films spoil many pictures. The appearance of rain in a picture is a sure sign that the picture is an old one. The effect of rain seen in the picture is the result of very fine scratches on the film which are highly magnified when they are projected on the screen. The film becomes scratched as it travels down through the machine and passes over dusty or gritty places. It is further scratched in rewinding by the operator, who holds the film between his fingers to guide it. If his fingers are sweaty or oily, they will pick up dirt and carbon ash (the latter from the burning carbons). This dirt will scratch the film, and give a rainy appearance to the picture.



VIEW INSIDE OF A TYPICAL MOVING PICTURE OPERATING ROOM

Another thing which puzzles many who are not familiar with moving picture apparatus, is why a picture runs along nicely, then suddenly jumps out of place so that the upper half of the subjects in the pictures are seen, while there is a black line above their heads, above which their feet are moving around. This is because some careless or inexperienced operator has improperly mended a film, the result being that the pictures are thrown out of alignment so that each picture does not come squarely over the aperture hole in the machine which is exactly the size of one picture, and through which the light must shine. Instead, the last half of one picture covers part of the aperture hole, while the first half of the next picture covers the remainder of the hole. Thus portions of two consecutive pictures are shown at the same time.

As soon as the operator sees that the picture on the screen is "out of frame," as it is then said to be, he proceeds to "frame up" by turning a little lever which will so move the aperture hole up and down that it will exactly cover a complete picture. Then the picture looks natural as before.

A picture which is nice and bright is sometimes seen to go dim for an instant; sometimes for a number of seconds. This is the result of the operator "freezing" the carbons in the arc lamp. The arc lamp of a moving picture machine is not automatically fed as are those which are seen on the streets and boulevards, but has to be fed by the operator who slowly turns a little knob which brings the carbons together as they burn apart. He has to learn to gauge just how much to turn the knob, otherwise he will turn it so much that the carbons touch each other, and extinguish the arc. They are then said to be "frozen." By turning the knob back a trifle, the carbons separate, the electric current jumps from one carbon to the other, and the arc is again formed.

The show to which the patron's nickel admits him does not consist entirely of annoying incidents. Very amusing, and seemingly impossible things are seen on the moving-picture screen. Many of them, which baffle the wisest to explain, are very simple when understood.

The one most met with is the disappearing of imps and devils who turn handsprings and disappear in a cloud of smoke. These are acrobats dressed as imps. They wait on some fairy queen, then bow obeisance to her and turn a handspring or back somersault; all this while the man with the moving-picture camera takes the picture. Just as the imp turns the handspring, the operator of the camera, who we will call the "camera man," stops his machine and allows the imp to walk out of range of the camera. Then through a steam pipe which is located right where the imp turned the somersault, a spurt of steam is ejected. The camera man instantly resumes turning the crank of his machine, takes the picture of the steam, and continues with the rest of the picture from which the imp is excluded. In place of steam, electrically ignited smoke pots are sometimes used, giving practically the same result.

Then there are pictures in which furniture, including bedding and dishes, move from one house to another, money counts itself, shoes give themselves a shine, and so on. These are called stop-work pictures, and are very tedious to make. Take, for example, the picture of a shoe being automatically shined. A brush is set on a shoe, and the man who takes the picture turns the crank just enough to expose one picture. Then while the camera is closed, his assistant moves the shoe brush a little further over on the shoe. As soon as the assistant has receded from the range of the camera, the crank is again turned just enough to make one more exposure. By moving the brush a trifle at a time from the shoe to the blacking, and alternately taking a single picture of the brush and shoe in their different positions, the complete picture is obtained. When this is reproduced in rapid succession on the screen, it looks as though the brush were actually shining the shoe without any aid. All pictures of this nature are taken in a similar way, including pictures where the subjects get to waltzing around fast enough to make one dizzy.

Visions are made by exposing the film twice before developing it. For example, a picture is taken of Johnny going to bed. The man operating the camera machine so calculates the picture that he gets a sufficiently long picture of Johnny in a sleeping posture, to last during the vision which he intends to make. Then he rewinds the film back to the place where he would imagine Johnny fell asleep. After he has ascertained this, he takes a picture of a girl dressed as an angel, on the same film, posing her in such a manner that when the film is developed, she will appear to be standing in the air above Johnny's bed.

In another class of pictures where a very serious accident occurs to one or more of the subjects, dummies are used, as in pictures where someone falls from a window, or from a scaffold. Let us take the case of a carpenter going to work on a high building. We see him ascend a ladder, reach the scaffolding and begin his work. He walks out on a narrow place, loses his balance and falls, and is picked up dead—that is, most of the audience think so. As a matter of fact, the picture is really taken of the man until he slips. Just as he loses his foothold, the camera is stopped. The carpenter either catches on something to keep from falling, or jumps only a few feet to a platform below which is out of the camera's range. All of this is not shown in the picture because the camera is not being operated.

At this juncture, a dummy which is an exact duplicate of the workman, is put in the same position as that in which the man was last seen at the time he lost his foothold. The dummy is then dropped and the camera again operated, showing the man falling until he strikes the ground, when the camera is again stopped, and the dummy carried away. Then the man who is supposed to have fallen, lies down in exactly the same place where the dummy struck, and assumes a lifeless attitude. He is picked up and carried home to his family, who grieve terribly over his sham death.

Everyone who has witnessed the picture of an automobile or carriage, has seen the wheels revolve naturally as the machine starts slowly. But as soon as the machine gets under way, the wheels go backward. This is rather difficult to explain in words, but perhaps the majority of the readers will catch the idea from the following explanation.

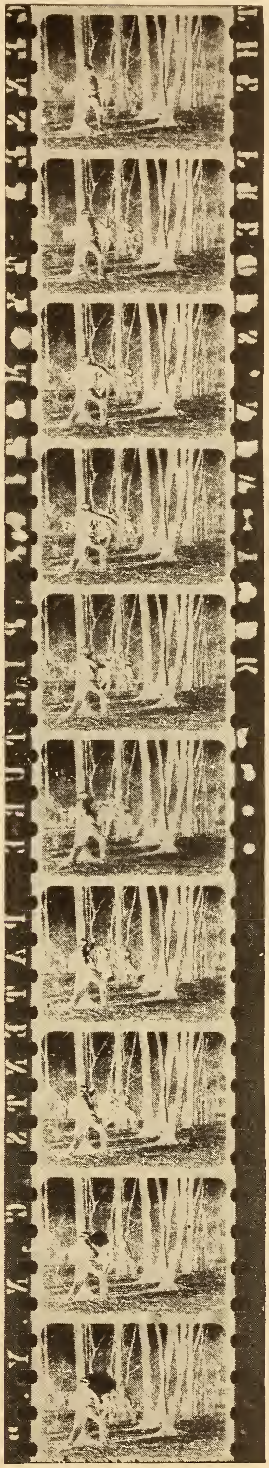
In the first place, let us suppose there was only one spoke in the wheel, and that it travelled clockwise and made two revolutions per second, while the shutter of the camera machine opened and closed five times per second, taking five separate and distinct pictures of the spoke in motion. If the spoke were vertical when the first picture were taken, the second picture would show the spoke one-fourth the way round, the third would show it one-half way round, the fourth would show it three-fourths the way round, etc. These pictures when reproduced successively, would show the spoke as turning around in the same direction as it did when its picture was taken.

Now suppose that the spoke goes faster and faster until the number of revolutions it makes is greater than the number of pictures the machine takes per second; say it makes six revolutions per second, while the camera takes but five pictures in the same time. Assuming that the first picture showed the spoke vertical as in the former case, the second picture would show it at three-fourths revolution, or one-fourth revolution back of the starting point, and as there have been no intermediate pictures showing how the spoke got around so fast, it presents to the eye the appearance of going backwards as the next picture will show it just three-fourths of a revolution from the last place, which would be just half way round, or one-half revolution back of the starting point. Thus instead of appearing to travel clockwise, it appears to travel the opposite direction, or counterclockwise.

One very pleasing sight witnessed in some picture theatres is that of the dissolving song slides. By the use of the "dissolving stereopticon" one picture melts away into another by which it is gradually replaced. The "dissolving stereopticon" consists of two separate stereopticons, one above the other, each of which has its own individual arc light, and set of lenses. They are so arranged that when one is in focus, that is, capable of producing a clear picture on the screen, the other is out of focus. As soon as the operator has shown the full reel of moving pictures, he turns out the light on the machine, and either he or an assistant lights both the arc lamps of the double stereopticons, and inserts the title slide of the song into the stereopticon which is in focus. He then inserts the first of the series of colored song slides into the other stereopticon, and proceeds to bring it into focus by sliding it forward. As he does so, the colored picture becomes faintly visible, while the title begins to grow dim—dimmer—then vanishes completely and is swallowed up by the clear picture of the colored slide. When the title slide is drawn out of focus, it is taken out and the next colored slide inserted, then brought into focus, and so on till all the slides have been shown. It might be well to add that the dissolving stereopticon is too expensive for the ordinary theatre and that most theatres use a single stereopticon which comes with the machine, and is operated much after the fashion of the old magic lanterns which are so familiar to all.

From some of the foregoing statements, the reader is apt to get the impression that the moving picture show is a dangerous place to be in, owing to the inflammability of the films used in connection with the exhibition. This was so in the early history of moving pictures, especially two or three years ago at the time they became so popular. Now, however, with the use of special fire protection devices which are used in connection with the machines, it is only occasionally that a theatre burns, and then the fires are the result of pure carelessness or ignorance.

The reel of film which is being run, fits into a circular metal, close jointed, fireproof box, just large enough to accommodate it. The film is fed out to the machine through two rollers. The "take up" reel, if one is used, is also fitted in the same way. Thus if the film catches fire from any cause whatever, it will burn but about two feet of film, there being about that much film between the upper or feeding reel, and the lower or take up reel. Repeated experiment has proved that the film will not burn past the rollers because the fire is smothered at that point. Where the heavy iron box, before mentioned, is used in place of a take-up reel, in case of fire, the trap door is shut by a spring. As the door flies shut it tears the film in two.



SECTION OF A MOVING PICTURE FILM

This prevents the film in the box from taking fire.

But of still more value is the late discovery of a transparent, non-combustible composition to take the place of the inflammable and dangerous celluloid used in the manufacture of films. Films of this material have been in use for more than a year, and are gradually supplanting the celluloid ones and reducing liability of fire from that cause. Thus on the whole, a properly conducted moving picture show is safe.

Before concluding this article, a word about trade marks will undoubtedly prove interesting, as they are often the topic of discussion among moving picture theatre goers. The one most indelibly impressed on the memory of all, is that of a red rooster. This is the trademark of Pathé Freres (Pathé Brothers), France. Another often seen is Selig's diamond. The Selig Polyscope Company makes a specialty of Western and Indian pictures, and this trade mark is generally seen in a conspicuous place on a hunter's cabin, a prominent tree or a large boulder. Other trade marks are, the Essenay Company's Indian head, the Edison Company's E inscribed in a circle, and the Biograph Company's monogram AB, while the Vitagraph Company's eagle and Lubin & Company's shield are others often seen.

In conclusion it is hoped that the next time the reader visits a moving picture theatre, he will feel that he is in close touch with what is going on, both in the operator's booth and on the screen. It is also hoped that this article has sufficiently initiated him into the mysteries of the realm of moving pictures, to make the show far more interesting than ever before.

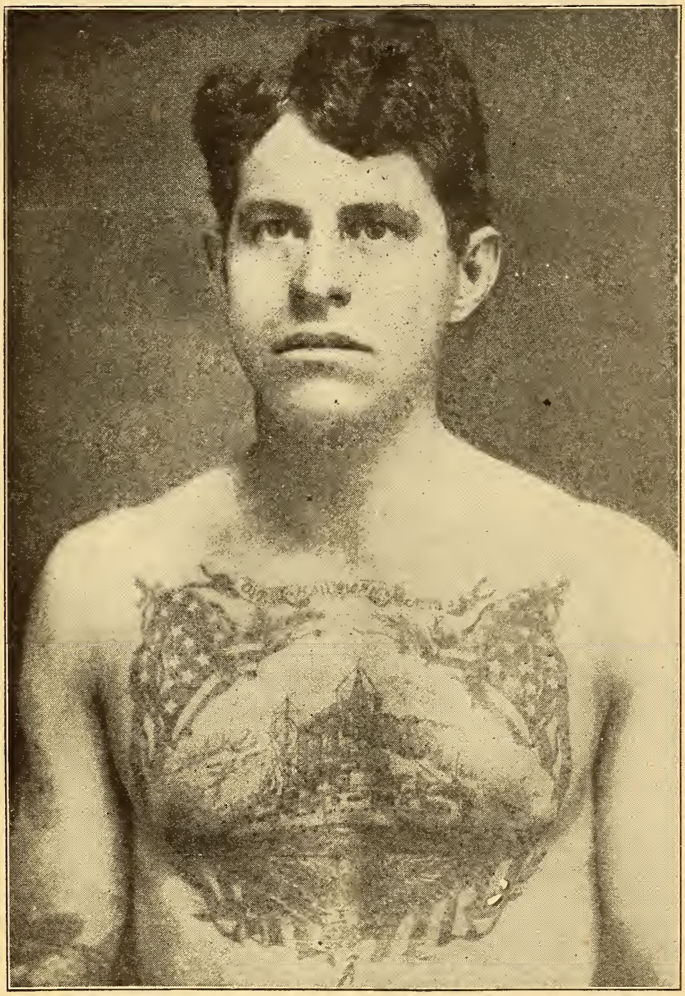
The Lure of the Tattoo

Curious Fad Which Has Spread From Seamen to Landsmen, and Once Begun Knows No Bounds

By FELIX J. KOCH

Those of us who have looked with silent envy at the decorated arm or breast of a sailor on the liner's deck, or who have wondered what strange fancy drove the tattooed man of the circus tent to decorate his hide after such wise, had best take the advice of one who knows, and never yield to the lure of the first tattoo. If they do so yield, as sure as time rolls on, they will not pass a tattoer's stand without dropping in and securing further decoration.

Tattooing is by no means a passing art Where the shooting galleries and the five cent theatres and the carousals thrive, there look for the tattooer. He is chatting with one of the tattoo fiends, for such they grow to be, just as do cocaine and morphine and tobacco fiends, and as they talk you note a part of this one's adornment. See there on the wrist there has been done a band, as an imitation of a bracelet. Above this there is a rose, with a butterfly nestling upon it. The rose branch ends in a leaf with a caterpillar, and to this there come, as a crown, three other leaves and a bud. Higher up still, remark that dragon-head, which runs into the bottom. And above it, still, is a globe, and, finally, a Japanese design.



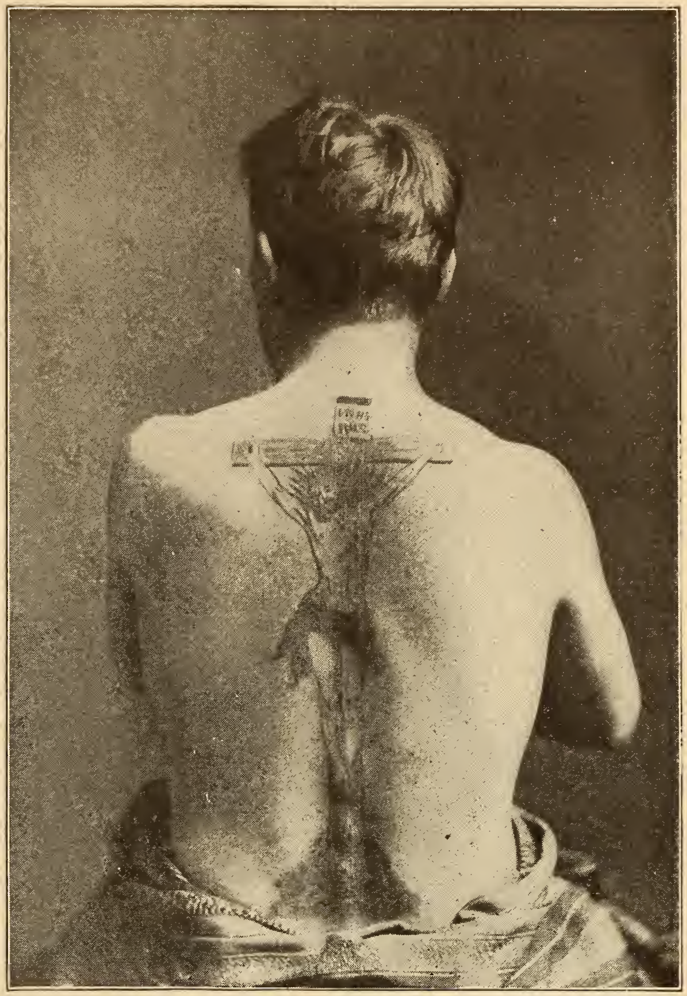
ELECTRICALLY TATTOOED DESIGN, FOURTEEN INCHES SQUARE, WHICH RESEMBLES AN OIL PAINTING IN COLOR AND DETAIL. REQUIRED THREE SITTINGS OF TWO HOURS EACH

Now this is but a sample of what you will find about town, and it is by no means an exceptional specimen.

When a novitiate comes, with the usual bare arm, he is asked to select a design from a book of these, or from patterns on the wall. Of these designs each tattooer has his own, or again several will exchange, passing patterns from hand to hand. Each operator makes designs as well and has these put into books for sale. The designs appear in colors. There are seventeen colors or shades that can be made. The only basic color which can't be used is white, while green, black, red, brown and blue predominate. Nothing is made in white, it seems, as there is a top layer of skin whch grows over the tattoo, and this eventually gives a dirty color to the effect. There is no white that proves practicable in the work against this growth. Barber, the noted Ohio tattooist, tells us that he has worked on white several times, but not yet has produced results.

In tattooing, the price varies with the amount of work done, rather than with the size of the design. Jobs will range from 50 cents up. Nothing under half a dollar is accepted, and such a job will occupy ten or twelve minutes.

Meanwhile, on the wall, you are searching the designs. Some are indeed unique. Yonder is the photograph of August Pefferman, a drummer on the road. who has a crucifix upon his back. Another photo is of a boilermaker, who has an American battleship on the breast, with American flags about, the flags being at the top; the new Maine in the center; the American eagle beneath, making the whole almost like an oil painting. That was a 35-dollar job and occupied three sittings of two hours and a half each to cover it, and it was all done by electricity.



DESIGN IN SEVEN COLORS TATTOOED BY THE ELECTRICAL PROCESS IN ONE SITTING OF 3½ HOURS. LENGTH OF DESIGN 19 INCHES

In contrast to the new electrical method, the old method was to do the tattooing by a hand operated needle. Seven very fine needles were set, as a brush, in an ivory holder. The design was drawn on the skin with a toothpick by the tramp artist and then cut in in this wise. The design was first made in outline. It was then gone over a second time, to fill up the spaces, and then the design was carefully shaded in. The most popular color formerly was some shade of red.

The old method was very painful; the present one is not. In fact, a man may sit two and a half hours a day, being tattooed, and work at his bench next morning. There is just a burning sensation at the start, much like that which a hot needle will produce. In about three minutes' time the skin is dead, as it were (unless the subject be a very nervous one), and one then pays no attention to the feeling.

Stencils are now made of any design. They are cut into celluloid, so as to leave a rough design. Once you have picked out the design desired, the operator brings out this celluloid pattern. A powder is rubbed on this, the celluloid is pressed on the arm and the outline of the pattern is left on the skin. At once the operator proceeds to follow this. He always works from the bottom up, so that the ink will not run. These inks are of a special sort and guaranteed pure colors. In fact, they are hardly used for any coloring but tattooing.

The outline is first put on in black. This is all gone over until it is as near perfect as possible. Then the operator takes a shading machine for the blending of the black. Then he puts in all the black shades, and leaves all the spots reserved for other colors, as blanks.

After the black, he puts in green or brown, filling in these spaces. Then comes the red, then the yellow. Lastly the blue, which is one of the hardest colors to put in, due to the difference in the way the pigment is ground. If a color be dainty, one can't tell how much of it has been worked in and so results are uncertain. Red and yellow and black, on the other hand, work in easily.

Little blood is drawn as the work goes on, though this depends on the person, just as in a surgical operation. Different persons bleed in varying amounts. Bleeding does not affect the work, the arm being washed off clean again and again, so that all blood and all loose color are removed.

Next an antiseptic solution is wiped over the whole, and it burns for five or ten minutes. The design sweats, and so it is covered with a cloth for an hour or so.

By and by one finds a gummy substance formed on the top of the skin, and in a short time the whole has healed.

One day after it is done, the tattooed section of the arm appears to be covered with water blisters in places. There is but little swelling. The third day these blisters dry up, and the skin is tighter and firmer. On the fourth and fifth day the skin grows white, and then one finds the scale hardening, cracking and drying up. By the eighth day the top-skin scales off, leaving the bright tattoo design. This is the design which is on to stay.

As the years go by, gradually a very thin layer of skin grows over this, but if this top layer is scalded the tattooing comes out bright once more. Tattooing can be done right over scars and vaccination marks so as to cover these up.

Curious indeed are some of the patterns put on the skin by Barber. Yonder is a sketch of "Aurora, Queen of the Dawn," in her chariot, with her angels about. He put that on the back of a man in Columbus, in two sittings, one of five hours and one of four, these sittings a week apart. Another notable pattern is of the Liberty Queen, seated on an eagle, with ribbons all about her. Still another is of a cowboy, on a bucking broncho. One design reveals the "Birth of Bacchus," another "Siegfried and the Dragon."

In the mid-west patriotic designs are most popular, these often being added after the initial or the name.

The basis of electrical tattooing is vibration. The electric current does not, as many suppose, have any effect upon the skin, the pigment being simply forced in by electrically operated needles. The vibration is secured by the same principle as that of an electric bell, the needle bar being attached to an armature bar which crosses the magnet. This bar causes the needles to vibrate up and down over a distance of from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch. These vibrations are estimated to be at the rate of 1,000 a minute. As to the apparatus, the needle bar goes down into a tube, shaped much like a lead pencil, the point being very fine, just allowing a single needle to protrude $\frac{1}{8}$ inch. This makes the outlining and is attached to the machine for outlining purpose only. For shading and coloring work a pencil-shaped tube, flattened at the end so as to allow eight to ten needles to come out is employed. This pencil-like holder is attached to the electric coils, which in their turn are set in a frame.

Even as we are chatting with the tattooist the young fellow who dropped in a moment before has made his choice, a girl in a red design; 75 cents it will be. He takes his seat at the table by the electric light and says nothing. The artist, the while, picks out the needed stencil. The stencil is rubbed in a black powder in order that the relief design may print. Then the arm is set on a buck of black oil cloth. It is washed with a sponge and then shaved with a razor, to take off any hair, which will grow out again over tattooed spots. Meanwhile, he is taking a solution and making the skin perfectly free from any grease and the like which the soap does not wash out. Then the design is laid on. There is a Japanese bowl of metal containing antiseptic, and in this lies one end of the machine. It is applied and you see the boy wince.

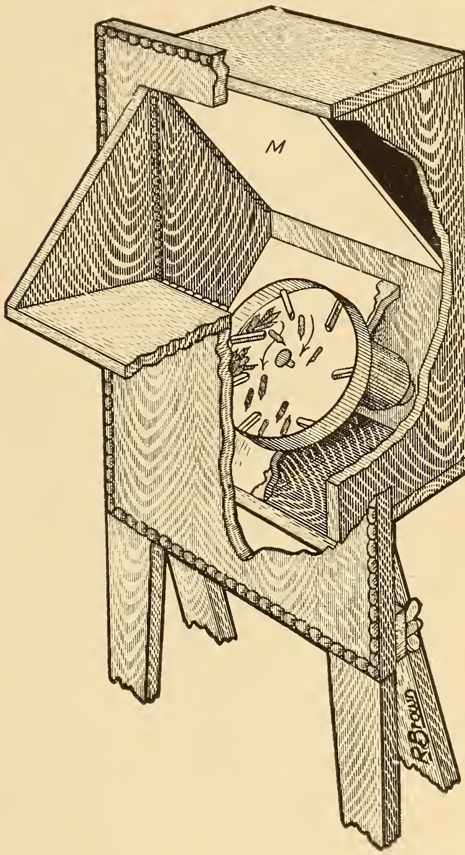
The artist dips the needle into a little glass vial of black ink and traces the outline. He is holding the arm in one hand, with the other he plies this needle. You see the design grow in the black ink, till gradually you have the entire outline. Children peer in at the door, and you hear the reports in the shooting gallery. The outline done and the ink washed off with a sponge, you see the artist going about putting in the little details. There is a bit of blood which he brushes away with his finger.

"This ain't the first time," the victim says. "The more you get on you, the more you want."

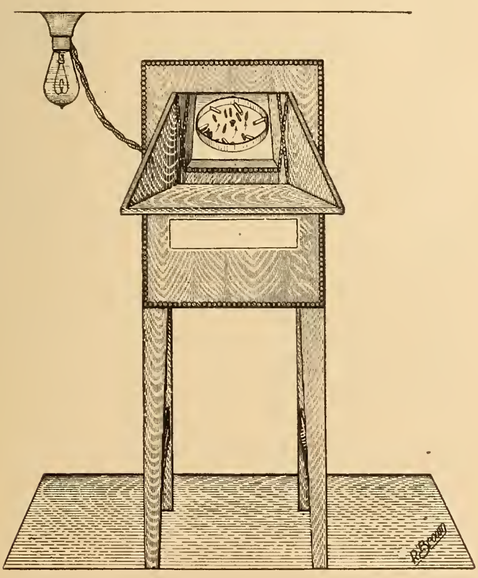
By and by it is done, the mark is on, and the victim departs. Next week he'll be back for another design, and then, ere long, for another.

Seeing is Believing

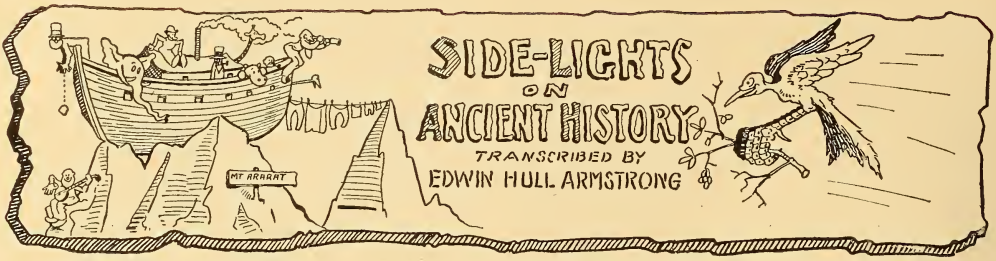
Even if "seeing is believing," "things are not always what they seem." Jones, who is an electrician and a positive sort of fellow, didn't believe the latter proverb until recently. With a friend he chanced to stand in front of a show window gazing at a revolving flat-bottomed glass dish as shown in the first picture. In the dish were steel pens which on reaching the lower side as the dish turned, immediately slid over the glass to the upper edge of the dish. Jones, seeing the lamp and flexible cord, immediately explained to his friend that a strong magnet placed beneath the upper edge of the dish attracted the pens. The next day Jones took another look and standing on his tip toes saw on looking down into the cabinet a revolving dish just like the one above but with the pens dropping down by gravity, while closer inspection revealed a perfect mirror (M), the arrangement being as shown in the second picture. Jones now says, "Look twice before you speak." The device is run by a small electro-magnetic engine, the lamp being in series with it.



HOW IT REALLY WAS



HOW IT APPEARED



Recently some copies of some old publications have fallen into our hands (it matters not how, except that we came by them honestly). Thinking that some of these ancient writings may be of interest to the readers of Popular Electricity we take the liberty of reproducing some clippings from them. In producing this diversion for the magazine's readers, we have been careful to select those items that bear particularly on electricity and its manifestation and uses.

◇

For a long time Noah felt that something was bound to happen. He thought first of earthquakes, and then of famine and finally became convinced that there was to be a flood. He told his fears to but few of his friends. Those to whom he confided coughed, shook their heads and winked at one another. Then they met outside and said:

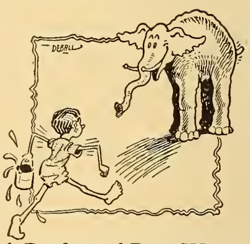
"It's too bad. He's growing old."

The novelty of the view, however, was such that becoming known, the big dailies sent reporters to interview Noah, and the Sunday editions were full of his predictions and plans. For about fifty years the public had heard occasionally of Noah and his projected Ark and the voyage he expected to make. During all this time he refused, though pressed to do so by all the sensational sheets, to indicate a time when the flood was to come. As Noah's grandfather Methuselah was still alive, and past his nine hundredth year, and as there were no indications of a flood, Noah's predictions became to be regarded as visionary, and emanating from a member of a family that was inclined to be freaky.

In building the Ark, it was Noah's first idea to save all the people in town from a watery grave. Finding, as time passed, that his ideas were held lightly, he proclaimed that only his own family, his sons with their wives and children, should go aboard the Ark. This is the truth about the matter and just how it happened.—*Deluge News.*

Some idea of the inner life of those who made the voyage on that celebrated vessel, the Ark, may be gleaned from the following clipping from the *Deluge News:*

They sat huddled together on the upper deck, a cheerless group of men and women. The moist skies continued to weep. They had been weeping in precisely the same fashion for the last three weeks. For the fifty-seventh time the eyes of those present looked at the gloomy skies, wondering if ever it would quit raining. Suddenly an "Oh-eee-oou" sounded from below and a small boy came bounding up the stairs and fell on the deck, writhing in agony.



A Bucket of Rain Water for the Elephant

"What's the'matter?" came in a chorus from the women.

At that moment Ham came out of the office. "I sent that boy down with a bucket of rain-water for the elephant," he said. "He is usually gone two or three hours, so I insulated the monkey cage the other day, and this morning I turned the current onto the bars."

As the boy gradually recovered and limped away, Noah remarked to the women:

"Hammy will kill that boy with these new fangled litnin' fixen's of his," and shaking his head thoughtfully he made his way to the greenhouse to pull a few stalks of pie plant for dinner.

◇

Ham's youngest child cried all night. Occasionally it would get to feeling kind of comfortable. Then a fresh spasm of pain would grasp it and it would yell louder than ever. The mother was asleep, but the other women were sympathetic and helpful, all but Shem's wife. She was mad. After breakfast she made her way to Noah's office.

"I want another room," she demanded sharply. The old man pushed back his glasses and looked at her in surprise.

"W'y what's the matter, Agnes," he asked with a trace of concern in his tone, "Oh, Ham is always so busy with his electrical devices he has no time to look after his family. Now his wife is so careless," she said, wearily, "she lets those children of hers eat any old thing, and at night she tells them they oughtn't to have eaten such stuff. Then she goes to sleep and the rest of us are kept awake. I wish there were no children aboard," she said with a shrug of her aristocratic shoulders.

"But you know," said Noah, elevating his eyebrows, "this voyage is to preserve worthy remnants of the race, a kind of an anti-race-suicide project."

With that she bridled up and said:

"Look here, I'm a republican and have the utmost respect for Mr. Roosvent's views, but when it comes to being kept awake half the night by a couple of brass-lunged youngsters, I say no squalling brats for me."

Noah gave her another room.—*Ark Record.*

◇

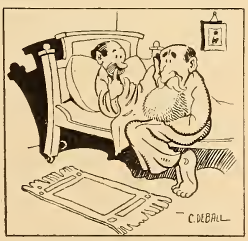
Noah sat in the dining room looking over the Sunday school lesson, by the light of a cotton rag floating in a saucer of lard. As he grew sleepy the head of the old patriarch drooped lower. Finally he blew out the light and shuffled off to bed. As the light went out a small boy called up the stairs jubilantly:

"He's gone!"

Ham touched a button and the effect was marvelous. The old water-logged craft was transformed to a thing of beauty, and as the electric piano pealed forth the gay crowd went skimming over the floor inspired by that famous modern melody, "Waltz me around again, Willie." Every night after Noah retired, there was a continual round of gayety at the Ark.—*Ark Record.*

◇

It had been an active day for Ham. While Noah had been busy in the horticultural department, Ham had insulated all the animal cages, completing the circuit by placing strips of tin on the floors. He had the wires connected to the one in his bedroom. So Ham was tired. He lay in his bed listening to the rain patter on the shingles above his head. Occasionally he heard a commotion among the animals, far below in the hold. Old Madge the hippopotamus would give a grunt, which would be taken up by Bess, the elephant, and the lions would join in, followed by the lesser fry. To Ham, young and healthy as he was, the noise was more pleasing than otherwise, and he was just falling into a doze when a light tapping at the door aroused him.



"Hammy, my boy, I can't sleep"

"Come in," he said cheerily, and Noah entered.

"Hammy, my boy, I can't sleep," said the old man, seating himself on the bed and rubbing his jaw with his bony hand. "The animals haven't got used to their quarters yet and that old snag of a tooth is bothering me again. I should have had that tooth out 220 years ago.

"Don't let little things like those bother you," said Ham, touching a button, whereupon the cries of the animals instantly ceased. Applying the battery to Noah's tooth, the pain quickly subsided.

"That 'lectricity is wonderful stuff," said Noah as he made his way to his bedroom below.

—*Ark Record.*

◇

The very night Noah put an advertisement into the daily papers for carpenters, Ham took up the study of electricity.—*Deluge News.*

◇

Those who think Noah had an easy time of it, and had nothing to contend with, are away off their base. From the very beginning of the work, a gang of loafers swarmed about the site of the vessel, making mean remarks. As Noah was inclined to be mild, and was much absorbed in his work, they got to betting that there would be no flood. Methuselah, who was always the center of a crowd, to whom he would relate past experiences, treated these remarks in silence. But when the loafers grew bolder, and offered to bet, three to one, that it would be as dry as August all the time, he grew interested. Once when Noah was at camp meeting, he took Ham to one side and told him it was a shame for money to go begging at those odds. Especially as it was a sure thing. Ham took all the bets that were offered, Methuselah furnishing the money. When the time came, and it was seen that the flood was no spring freshet, there was a rush to see Ham and square up. The crowd thought that by paying promptly an invitation aboard might be secured. Ham took all the money offered and then told the fellows that he had nothing to do with the transportation department, but that he knew where they could get some good life preservers. "You'll have to hurry," he said, "there is to be a combination and the price will go up next week."

Told Him it was a Shame

This is how our well-known citizen got his start.—*Mt. Ararat Daily News.*

Where Electricity Stands in the Practice of Medicine

By NOBLE M. EBERHART, A. M., M. S., M. D.

CHAPTER XI.—ELECTRICAL FAKERS; MEDICAL ETHICS; ETHICAL MANUFACTURERS, ETC.

As I have remarked in previous chapters one of the greatest drawbacks to the advancement of medical electricity has been the disrepute cast upon it through its extensive use by charlatans and fakers.

The mysteriousness of electricity and the surprising phenomena produced by it have lent themselves to this purpose, coupled with the general ignorance of the subject on the part of the people at large and their ready acceptance of any claim made for it, however extravagant it might be.

Ignorance of the properties and uses of electricity, especially forms other than galvanism or faradism, was not limited to the laity, but extended also to the majority of the medical profession.

This was due primarily to the neglect of the subject in the medical colleges where little or no time was devoted to teaching electricity. It was augmented by the natural resentment the legitimate practitioner felt on account of the extravagant claims of those physicians outside of the fold, who advertised it as a "cure-all."

The ethical doctors knew it could not do what these men claimed for it and were prejudiced to the degree that few cared even to ascertain just how far this force was capable of conquering disease.

Had it not been for the discovery of the X-ray I think this condition would still prevail, but so great was the interest aroused in this branch that in the fifteen years that have elapsed since that time, more physicians have come through it to know and to use electricity in their practice than in a whole century previous.

When carefully and intelligently studied in its various phases it is found to be the same as other methods or remedies; successful in certain cases; useful in others, and worthless in many.

That this force is closely akin to the life principle itself, is an opinion shared by many of its advocates and thus we hear the expression "Electricity is Life." Certainly one of its most prominent therapeutical properties is its power to stimulate nutrition and other vital processes.

On account of its successful use in some conditions not otherwise considered curable, it is not surprising that even a doctor possessed of good judgment and common sense should be carried away by the resultant enthusiasm to the point where his claims are almost as extravagant as those of the charlatan.

Electricity has no firmer friend nor stauncher adherent than I am, but I welcome this opportunity to counsel the medical readers of Popular Electricity to remember that whatever the future may hold, at present it still has its limitations and must not be exploited as a cure for all ills.

Again there are many conditions curable by electricity that are equally amenable to other measures. The conscientious physician should be careful about advising electrical treatment for some trouble that might be more easily cured by other means, or with less delay and less expense to the patient.

While I have the opportunity of addressing so large an audience outside of the medical profession as I am able to reach through the medium of this magazine, I am going to devote a little space to the consideration of a point or two coming under the heading of "medical ethics," a subject entirely misunderstood outside of the profession and upon many phases of which even insiders are occasionally inclined to cavil.

The average business man looks upon the physician who has a successful remedy or treatment as a fool for not exploiting it by means of the newspapers and thus reaping the financial reward which the former knows comes from judicious advertising. Furthermore the average man does not know that newspaper advertising is forbidden to the ethical physician and that those thus exploiting their services are outside of the pale of the medical societies and classed by the remainder of the medical world as "unethical;" which carries with it an opprobrium similar to that of a worker who does not belong to the union composed of his fellows.

That a doctor is foolish from a financial standpoint to be bound by a code of ethics essentially unchanged for decades, undoubtedly is true, but there is more than dollars and cents in the practice of medicine, however necessary the latter may be. To place the saving of life and the curing of disease solely upon a money basis would be an unwise procedure, to say the least, and if the physician were permitted to advertise, how could general fraud be prevented?

Material products, such as drygoods, groceries, hardware, etc., can be judged of by the purchaser, but in the case of professional services they must be taken on the claims of the vendor, if advertised.

What an opportunity for the unscrupulous! I have known even some conscientious physicians who really believe they had "sure cures" for certain diseases (cancer or consumption, for instance), and always found some apparently good reason for their failures, which were never the result of the inadequacy of their treatment! What then of those who intended to deceive?

Without further discussing this phase of existing medical ethics I make the point which the lay reader should bear in mind, that the physician who advertises is without standing in the medical profession.

There is another point which is lost sight of frequently which is brought out by asking one question. "Who pays for this advertising?" It must eventually come out of the patient's pocket.

Furthermore, the doctor who advertises has not the incentive for the highest grade of work, because his practice does not depend upon his praises being sounded by satisfied patients, but upon his shrewdness as an advertiser.

At the same time, in all fairness, it should be stated that occasionally capable physicians have been lured from the ethical field by the financial attractiveness of the advertising game, or have left because they rebelled against the restrictions of the code of ethics; and there are advertising physicians that are undoubtedly as well qualified and trying as hard to cure their patients as their ethical brethren, but they are woefully in the minority.

The ethics of the profession binds not only the physician but also manufacturers making apparatus or drugs used by them. These manufacturers are supposed to limit their advertisements strictly to the medical journals and not go into general publications. They must advertise only to physicians. Technical journals might be considered an exception; for obvious reasons.

Thus the ethical manufacturer is bound as closely as the ethical physician, and is not supposed to sell his goods to the layman unless authorized to do so by a physician.

One of the most widely advertised methods of faking the public by means of extravagant claims where only a slight amount of electricity existed is in the sale of electric belts.

All of the possible therapeutic properties of electricity and then some additional ones have been ascribed to these belts, which are in reality capable of developing only a slight amount of galvanic current, far less than the average home battery.

It is strange how many people have the idea that rings and other devices are capable of generating sufficient electricity or magnetism to ward off rheumatism.

I have been assured positively that the wearing of a small metal ring has cured rheumatism, and not so very long ago a physician in this city came to me to consult me concerning his rheumatism, and I found when he took off his clothing that he was wearing two or three turns of copper wire around his waist, under the impression that he was producing an electric current that would benefit his case.

Frequently we see magnetic insoles advertised for rheumatism and other troubles. Another machine is on the market that is attached to the ankle or wrist at night, while the apparatus is placed in a vessel of water alongside the bed and is supposed to entirely rejuvenate the individual over night. None of these things possess enough electricity or magnetism to be of any real curative value.

The reason that the manufacturers obtain honest testimonials for these fakes is that many people suffer from imaginary ailments, and any application often convinces them they have been cured by it; furthermore, the large majority of acute ailments are self-limited and tend toward a restoration to health whether or not any form of treatment is employed.

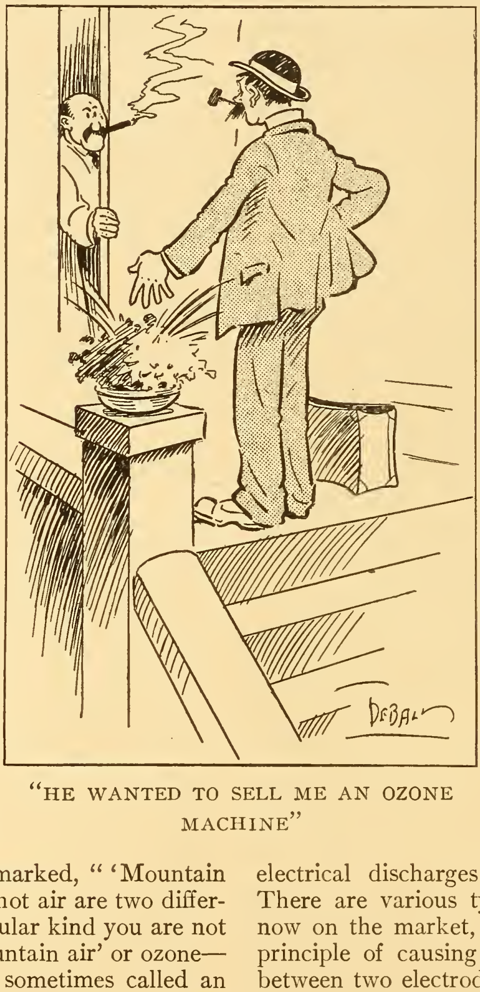
(The End.)

Talks With the Judge

HE SEEKS INFORMATION ON OZONE

The judge yawned rather heavily and seemed at a loss to collect his thoughts sufficiently to start one of his long-winded stories. He had just come out of the pool room at the club, where he had failed to clean up at a game of Kelley. The room had been close and he was depressed.

"I guess what I need is ozone," he said. "And, by the way, I have wanted to ask you about it. The other day an agent was up at my house and wanted to sell me an electrical ozone machine. He told me if I were to put one in my bedroom I would have 'mountain air' all night. I would never have hay fever; would sleep like a log, and feel like a lion all the time. It sounded all right, but you know me. I put a great many things over, myself, by conversation and I wouldn't buy any ozone machine until I at least knew what ozone was. What is it? How do they make it?"

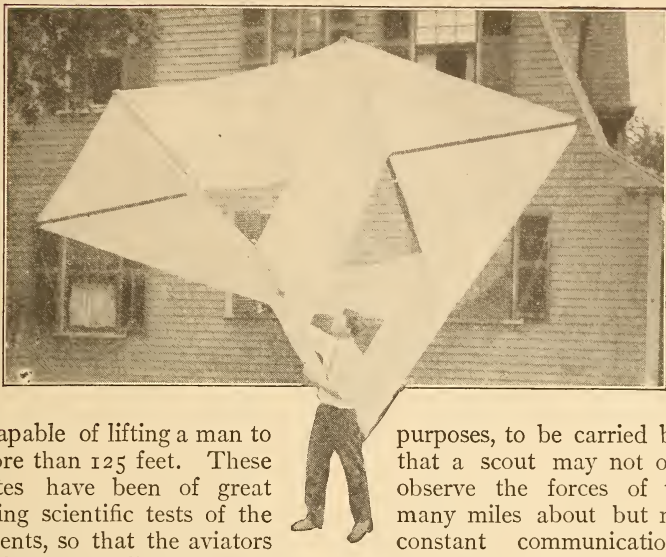


"HE WANTED TO SELL ME AN OZONE MACHINE"

"Well, Judge," I remarked, " 'Mountain air', as they call it and hot air are two different things. The particular kind you are not familiar with—the 'mountain air' or ozone—is what chemists have sometimes called an allotropic form of oxygen. Ordinary oxygen in its free state has its molecules made up of two atoms of oxygen which cling together forming a fairly 'stable' gas. By certain processes, however, the atoms of oxygen may be made to combine in threes to form a molecule and the molecule so formed is a molecule of ozone. Ozone is a very unstable gas and will not last long without combining with some other substance. That third atom in the molecule doesn't seem to be wanted there and it has a little feeler out ready to grab onto some other atom. This is what gives ozone its germicidal properties. Bacteria are made up of carbon principally. Turn some ozone loose in a flock of germs and the molecules of ozone readily break down, one of the oxygen atoms combining with a carbon atom in a bacterium and oxidizing the carbon as the chemists say—literally burning it up. In this way germ life is destroyed by ozone.

"Now ozone can be made in various ways, but the best way is by an electrical discharge. That is the reason the air is so peculiarly fresh and invigorating after a thunder storm—the lightning flashes have created ozone in the atmosphere. The artificial way of making ozone by electricity is to make miniature electrical discharges by a small machine. There are various types of these machines now on the market, but they all follow the principle of causing an electrical discharge between two electrodes or sets of electrodes. A high voltage is first created sufficient to make the current jump from one electrode to the other in the form of a silent or 'brush' discharge. The air is drawn through this discharge area and then blown out into the room, and it is decidedly invigorating."

MAN-LIFTING KITES



At the Boston-Harvard aero meet a number of man-lifting kites of the Perkins type were utilized. Some of these kites were as high as fifteen and eighteen feet, the latter leviathans of the air being capable of lifting a man to a height of more than 125 feet. These man-lifting kites have been of great value in making scientific tests of the upper air currents, so that the aviators may know just how to handle their machines, the aeroplane operator being able to note with assurance the direction and force of the upper atmospheric current.

A wireless telegraph equipment has been devised for war purposes, to be carried by the kites, so that a scout may not only be able to observe the forces of the enemy for many miles about but may also be in constant communication with the military headquarters.

Modernizing the City of Damascus

As a rule, the Orientals have showed themselves unfavorable to the progress of our scientific discoveries. This is especially the case in Turkey—or at least it was so under the old regime. The telephone and such things were not to be heard of, and the introduction of electric appliances was often resisted by force.

It is, therefore, an irony of fate that in one of the oldest cities of the Orient, Damascus, electricity has triumphed most decidedly, and is used not only for street lighting, but for street railways, the current being taken from an electric central station plant lying a few miles above the city on the Barada River.

When the opening of the electric street railway was celebrated, the governor-general of the province and the commanding general of the Fifth Army Corps were present, together with the heads of the civil and military bodies, the principal men of the city and the consuls of the sovereign powers, as guests of honor. A special representative was also present from the Turkish imperial government. The electrical company in Damascus is called the Société Ottomane des Tramways et d'Eclairage électriques des Damas," and its lines extend from Salhyeh to Meidan, uniting these two suburbs, which are at a distance of about five miles apart.

In the meantime Damascus has introduced electric light also. The city government itself has 1,000 electric lamps on the street, paying therefor about $12,500 a year. But the municipal government is not the only customer for electric light; many private individuals—not only Europeans but also numerous Orientals—have had the lights installed. Today, even the great Mosque is lighted electrically.

The stock company that serves Damascus with electric light and railway is of Belgian origin. Some of the machinery was brought from Germany, England, and France; but all the electric cars, motors and dynamos are of Belgian manufacture.

"Strong" on Electrics

In the little city of Rockford, Illinois, with 50,000 inhabitants, there are 145 electric vehicles in daily use. That means 3.5 electrics to every 100 people, and some of these cars have been in service for over ten years. Probably there is no other city in the country so "strong" on electrics.

Time Signals Aid Mariners

The thought of checking one's watch at sea by signals from the wireless station on the Eiffel Tower even though several thousand miles from the latter, is interesting to the layman, but also has a decidedly practical value to the navigator. The reason for this is that in determining the position of the vessel by means of a sextant, the observer must be sure of the exact time at which he measures the elevation of the sun (or of certain stars) above the horizon, otherwise his deductions will be out of the way. Thus in latitude 55 an error of one minute in the chronometer will make a difference of a quarter of a degree or about ten miles in the calculated longitude. The error increases steadily as we approach the equator and may make an appreciable difference in the ship's course or even be a source of danger when nearing islands or reefs. For this reason the time signals from the Eiffel Tower are not only sent out exactly at midnight (for a period of one-tenth of a second) but are repeated at two-minute intervals for the benefit of vessels which may not have caught the midnight signal. To distinguish the later signals the one sent out at two minutes past twelve is preceded by the Morse signs — · · while the one sent out at 12:04 is preceded by — · · · ·

American Engineering for Russia

"Only in the United States can I see these things. In Europe we have short electric lines, and while they are well equipped and have very good machinery, they are so very small that they do not meet Russian conditions, and so I came to the only country in which these are approximated."

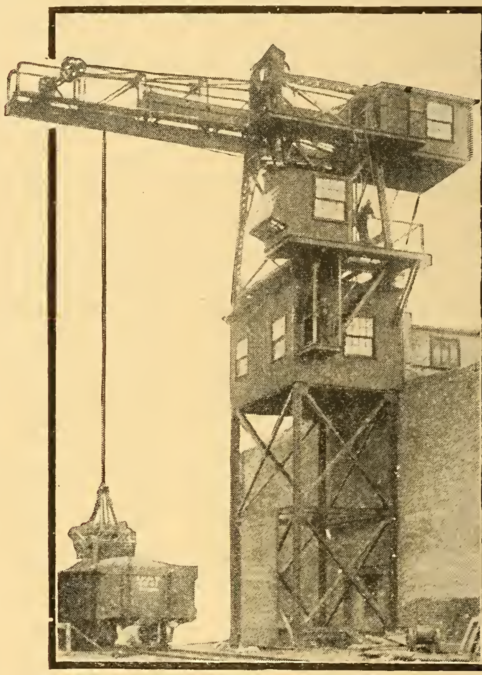
This compliment to American electrical engineering was paid by M. de Chatelain, professor in the Polytechnical Institute of St. Petersburg, who has been sent to this country by the Russian government to gather information as to the best methods of producing electricity by water power.

Steam-producing coal in St. Petersburg is about twice as expensive as here; this is an argument for electricity derived from water power. The problem which M. de Chatelain will try to solve after his visit in this country is that of electrifying the seven double-track roads within a radius of 60 miles of St. Petersburg.

Feeding the Furnaces

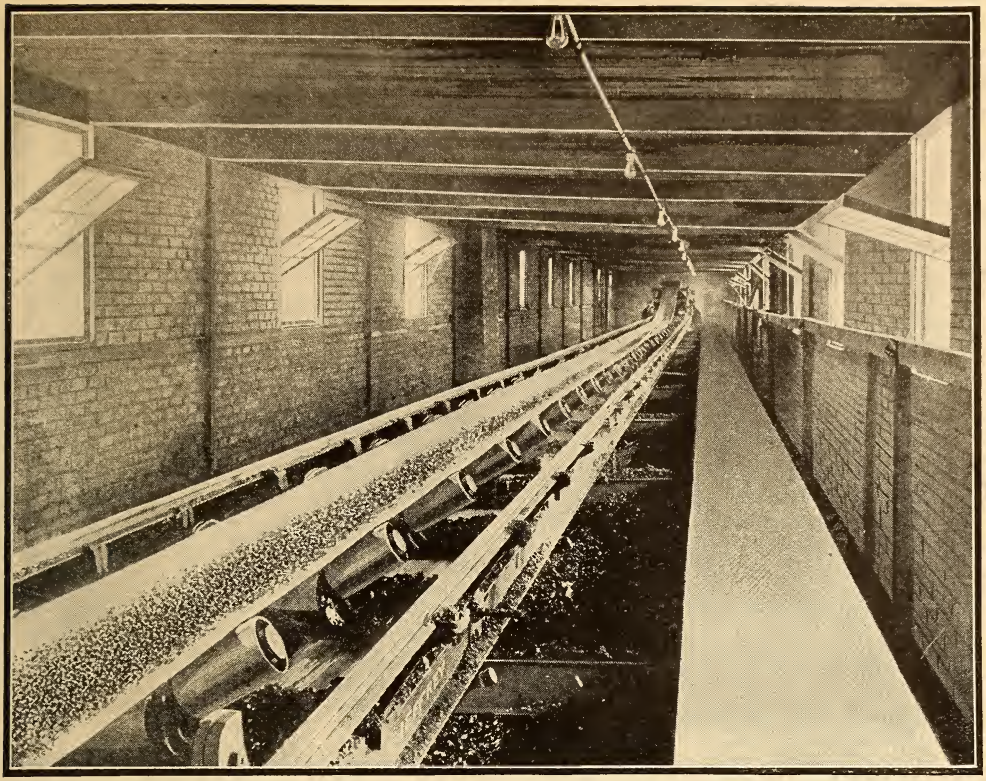
In the August issue of Popular Electricity was shown a modern boiler room where not a pound of coal is ever handled by the old laborious methods, but entirely by mechanical means. A somewhat different way of doing the work is illustrated by the accompanying pictures taken at the plant of the Peoria (Ill.) Gas and Electric Company. As in the previous instance, from the time the coal arrives at the plant in cars until it is fed into the grates hardly a turn of hand labor is required.

The cars arrive at the plant and are run up beside the cantilever tower. The coal is what is known as "mine run" and is of all sizes from fine dust, almost, up to pieces of large size. When the car is in place a little motor driven truck runs out on the



CANTILEVER TOWER AND GRAB BUCKET FOR UNLOADING COAL

cantilever until it is directly over the car and then drops a "clam shell" grab bucket attached to a long steel cable. The bucket automatically grabs a mouthful of the coal and is drawn up, again by motors, almost to the cantilever crane. The cantilever then swings around and the coal is dropped into a receiving hopper and from there



SIX-PLY CANVAS CONVEYOR BELT WHICH TRAVELS OVER THE COAL BUNKERS

passes by gravity to a crusher. Before it drops into the hopper, however, it passes through a reciprocating spout-like arrangement with perforated bottom, through which all the small coal and dust falls and is by-passed around the hopper.

The large pieces pass from the hopper into a crusher and are broken up into small, uniformly sized pieces which are delivered onto a great six-ply canvas belt which is constantly traveling along over the coal bunkers.

By an ingenious arrangement of "trippers" the coal may be delivered from the belt to any one of the bunkers under its 225 feet of travel. These bunkers are above the boilers of the plant, and coal from them is easily led down through spouts to the automatic stokers which feed the furnaces.

It is stated that not more than 1,000 pounds of coal will remain in the car, the grab buckets handling nearly every particle of the fuel, a single laborer only being necessary to clean up each car.

An extremely simple method of handling the ashes coming from the ten fires has been adopted, the waste material being dropped into deep steel barrows which are taken to the pit and are loaded into the cars by the grab bucket.

X-Ray Moving Pictures

Just as it took the camera to show us the true motions of a trotting horse, so it may be that X-ray pictures showing the motions of our internal organs will throw new light on the same and perhaps correct some of our present assumptions regarding them. With that in view Drs. Rieder and Rosenthal of Munich have been testing an outfit which takes a dozen radiographs in quick succession, each exposure requiring only a fraction of a second. Reports from Munich state that they have already succeeded in thus recording the motions of the human stomach. As the rays only show the presence of metallic, or at least very dense bodies, it is customary in experiments of this kind to give the subject a "bismuth meal," as described in Dr. Eberhart's article in the October issue.

Old Time Electric Machines

The only means of producing an electrical charge known at the beginning of the Seventeenth Century was the simple method of rubbing one substance against another:

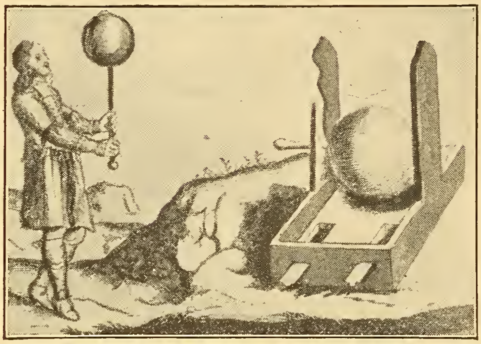


FIG. I. VON GUERICKE'S MACHINE

a piece of sulphur with the hand; a cake of resin with fur. The first arrangement that could really be called an electrical machine

FIG. 2. THE PHENOMENON OF THE ELECTRIFIED BOY

was built by von Guericke as shown in Fig. 1. He filled a large glass bulb with molten sulphur and after this had cooled broke off the glass. An iron rod was then heated and passed through the ball of sulphur for use as an axle about which it could be rotated when suspended as shown. On pressing the hand or cloth against it while being rotated, it became charged and could then be removed as shown at the left.

Many machines were made of rotating spheres or cylinders of sulphur or glass; but these were eventually displaced by glass disks. The friction of the glass plate

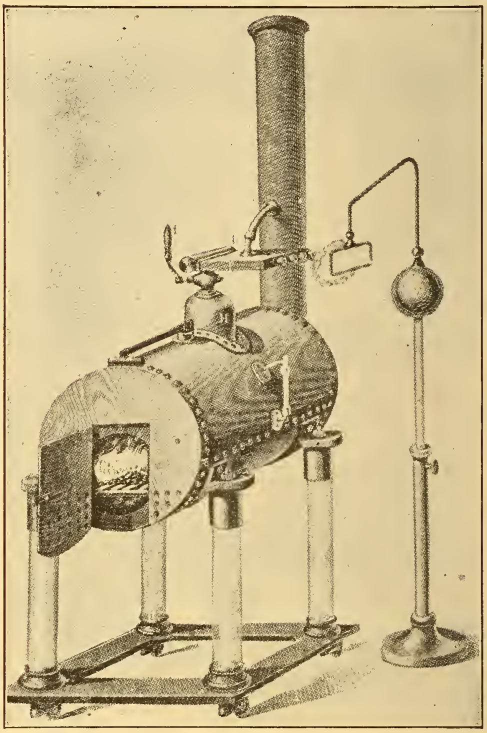


FIG. 3. THE ARMSTRONG MACHINE

against a leather pad underneath it produced the charge, which was collected by a ring. The latter was made of wood covered with a strip of metal holding metallic points which faced the glass and conducted the charge to the insulated sphere. The leather pad at the bottom was coated with zinc amalgam which was connected to earth by the chain. An improved type of this machine was used by Nollet when he demonstrated the phenomenon of the electrified boy as illustrated in Fig. 2. The boy was suspended by silken cords and charged with electricity. Sparks could then be drawn from him by extending a finger Likewise it was found that pith balls could be attracted and repelled in a merry dance.

Probably the most curious of all electrical machines was that of Armstrong, built about the middle of the last century and illustrated in Fig. 3.

Faraday in his experiments had found that electrification was produced on the passage of air or steam through tubes of various kinds, provided liquid particles were present; but there was no electrification on the passage of dry air or steam through the pipes. In an Armstrong machine this can be accomplished by condensing some of the steam in the pipes before it issues. The steam in the cylinder (bc) passes out through four pipes which pass through the water cooler (F). The tubes are made of brass with an interference at the outer end so that the condensed steam is not all blown out. The tips of the brass pipes are made of hardwood.

The steam upon issuing from the brass pipes strikes the wire gauze and imparts to it a positive charge, while the insulated boiler becomes charged negatively. The electrification produced in this way increases as the pressure of the steam increases; under a steam pressure of six atmospheres considerable quantities can be generated.

A Far Sighted Scientist

Those who imagine college professors to be impractical theorists who would be unlikely to see phenomena in their practical bearings, may do well to scan a little book issued just 20 years ago by the London Society for Promoting Christian Knowledge, entitled "Spinning Tops." It was written by Professor John Perry as a popular presentation of a lecture which this well known English electrician had delivered before the British Association for the Advancement of Science while in session at Leeds. Note what Prof. Perry said, back in September of 1890:

"If more attention were paid to the intelligent examination of the behavior of tops, there would be greater advances in mechanical engineering and in a great many industries."

From that point then he proceeds to show the principle by which ordinary spinning tops balance themselves and from that the principle of the gyroscope which tends continually to stay in one plane when once started rotating at high speed. Had his hint been heeded, would we have needed to wait nearly a score of years for Brennan (or his German rival Scherl) to develop gyroscopic balancing devices for vehicles and steamers?

Again he says—20 years ago, mind you: "We now know from the work of Prof. Hertz in the last two years that Maxwell's theory is correct and that light is an electromagnetic disturbance. And what is more, we know that this now recognized kind of radiation may be reflected and refracted and yet will pass through brick and stone walls and foggy atmospheres where light cannot pass; that possibly all military and marine and lighthouse signalling may be conducted in the future through the agency of this new and wonderful kind of radiation. Why, at this present moment, for all I know, two citizens of Leeds may be signaling to each other in this way through half a mile of houses, including this hall in which we are present."

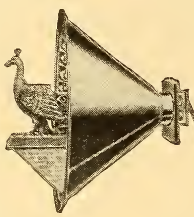
That was seven years before Marconi organized his wireless telegraph company. Since then the sending of aerograms has made rapid progress, yet the utilizing of the spinning tops whose principles were so clearly set forth by Prof. Perry in 1890, is still to come.

Another year may bring the top principle into use and perhaps still another will show the logic of two questions which the same British scientist propounded 20 years ago, pretending then to quote them from school examination papers of the year 2090: "Can you account for the crass ignorance of our forefathers in not being able to see from England what their friends were doing in Australia? Messages are being received every minute from our friends on the planet Mars and are now being answered: how do you account for our ancestors being utterly ignorant that these messages were occasionally sent to them?"

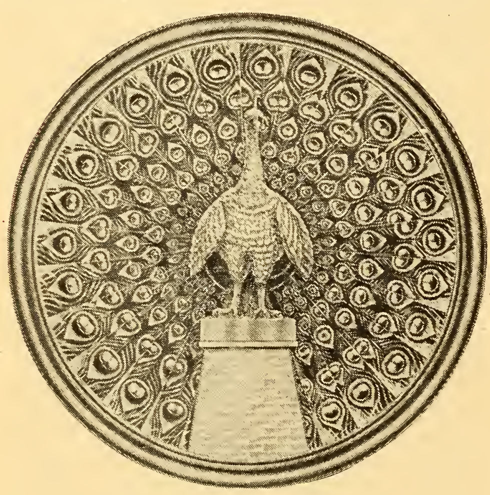
With a score of years elapsed since these questions were asked, ought we not to be half ashamed at our slowness in living up to Prof. Perry's veiled predictions, even though we may be proud that America is contributing its share towards utilizing such of these possibilities as have so far been turned into realities for the good of the human race.

An Electric Peacock

Only the color blind could fail to be fascinated by the gorgeous play of colors in the tail of the peacock when he spreads it into a disk and waves it in the sun. This same effect in a show window may seem even more fascinating and certainly cannot fail to attract and hold the attention of those passing the window. Particularly is this true when the wheel of feathers is brightly lighted in the evening and the play of colors continually shifts from feather to feather, as it does in the so-called color-mirroring peacock made for show-window purposes by Ludwig Bracker of Hanan in Germany.



This consists of a conical reflector say about two feet in diameter and one foot deep, studded on its surface with about 25 mirrored imitation peacock feathers slightly raised on the surface of the glass. In front of the reflector, as if walking out of it, is the body of a peacock nicely modeled in zinc and colored true to nature but cut off at the back



ELECTRIC PEACOCK

so as to hide an incandescent lamp and a color changing screen. The latter is slowly rotated by an electric motor belted to a small pulley just outside the tip of the reflector, and its slow motion produces the shifting play of colors on the feathers which is so true to nature and so fascinating to the eye. Of course the current required for both lamp and motor would be very small, hence the cost of operating would be only nominal although so unusual a window novelty might well repay a heavy running expense.

A Suspended Figure

The hum of busy machinery was growing steadily louder as we approached the rows of factory buildings that stretched along the tracks and occasionally our words were drowned out by a loud rumbling and jangling as of mingled bells and bricks tumbled on each other. Coming nearer we found the cause of this noise in an electric traveling crane that was unloading some cars of pig iron with an electro-magnet, letting each ton of bars drop suddenly when the current was shut off. The November mist made a haze through which the cars and crane stood out as vague silhouettes against the strip of sky between two of the buildings and as the magnet rose again its load of bars clinging to each other looked almost like the figure of a woman.

"Shades of Bulfinch Emmons!" exclaimed my companion. "How he would leap for joy if he could see that!"

"Emmons? Who is he?"

"Who was he, rather," answered my literary friend. "Come up to my room after supper and I will show you. Why, he would want to rise from his grave to see this."

Vivid indeed were my dreams that night, after an evening spent in poring over the book by Emmons which my friend delighted in showing me—one of those works which thrilled the speculatively minded of fifty years ago. It was a volume entitled "Popular Superstitions," full of tales of ghosts, haunted houses and so-called animal magnetism, all told in language that was far more vivid than scientific. One of these accounts was of a German peasant girl, Frederica Hauffe, who was described as so magnetic that the nails in the wall affected her nerves, and whose face could be distorted by passing a magnet near it. Among the tests said to have been made on her by her physician is one in which he "placed his fingers against hers and by extending his hand upwards, he raised her clear from the ground; thus she was suspended by her fingertips as a magnet suspends a piece of iron; and afterwards his wife did quite the same thing."

When I came to this passage I understood why my friend had been thrilled at the foggy spectacle of a woman raised high in air, a sight that would have started a whole series of uncanny reports in the minds of our credulous ancestors. And knowing that we both understood the science of what we had seen I felt grateful that while we may actually behold far greater wonders than the people of 1850 imagined they saw, we live in an age where we do not have to resort to the realms of the uncanny for our explanations.

Lights for a Penny

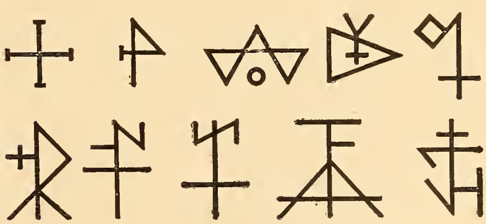
The inhabitants of Zargau, Austria, are not haunted by the colloquialism "afraid to go home in the dark." The village owns the electric light plant and at ten o'clock the street lamps are turned out and connected to an automatic system. In case a villager on his way home after this hour desires the street lighted he deposits a "pfennig" in a box mounted on an iron post at the street curb. Immediately the lamps for several blocks are lighted up and burn for twelve minutes, long enough for the late comer to reach his door.

HE DEPOSITS A PFENNIG IN THE BOX

Fifteenth Century Trade Marks

Now that the use of electrically heated branding irons makes it easier than ever to stamp a distinctive mark on boxes, bags or bales, there seems to be an increased tendency towards returning to this time-honored form of marking. This early form of "trademark" dates back at least seven centuries, for in the Thirteenth Century European merchants began to mark their shipments with distinctive signs by which they could claim them, if lost or if recovered from highwaymen. As the number of traders grew the marks became more complex, a fact readily shown by the adjoining ten which have come down in the Fifteenth Century records of the city library at Cassel. Even stencils were then unknown, hence these symbols had to be laboriously marked with a brush by hand, a task which may easily have taken 50 times as long as the

TWENTIETH CENTURY BRANDING IRON



SOME FIFTEENTH CENTURY TRADE MARKS

modern electric branding. How the markers of those days would open their eyes if they could see the shipper of today simply slap his branding tool against the case and push the button for a few seconds, only to leave a mark far more intricate than any they thought of using and many times as compact.

Magnetic Divining Rods

Few superstitions have had more ardent supporters through the centuries than those connected with the divining rod, the simple fork which was so long supposed to indicate the hidden location of water, ore or other treasure. Even Paracelsus who did so much to improve therapeutics four centuries ago strongly believed in it and the Cornish miners who still try it occasionally are not the only remaining ones who marvel at its alleged effectiveness. For water hunting it was usually made of a sprig of hazelwood, freshly cut, the idea being that somehow the sap in it had an affinity for the water underground and would point to the same if the fork was balanced in the hands of a kindly minded person.

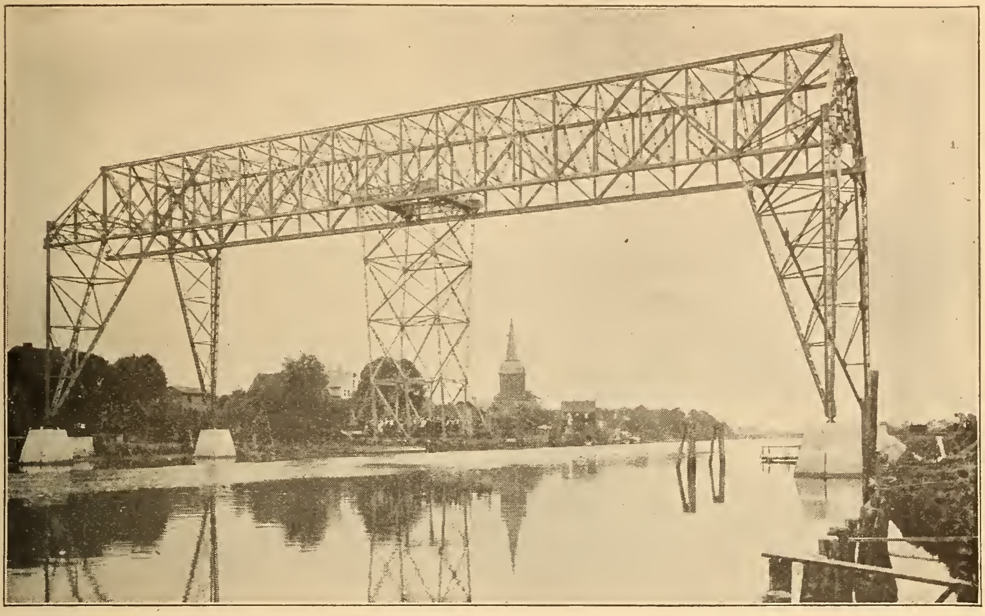
TREASURE HUNTING WITH DIVINING RODS. FROM AGRICOLA'S BOOK OF MINING (1550)

For ore or treasure hunting, the fork was often made of iron so as to allow of some assumed magnetic action. Even Agricola who founded the sciences of mining and mineralogy, believed that some supernatural influence guided this magic wand, so that it would point to ores, as it undoubtedly did when used in districts replete with them. In 1692 it was even used at Lyons in France for tracing a trio of alleged murderers, one of whom was executed largely because the divining rod had pointed in his direction. Later on, the diviner responsible for this peculiar detective work was put to various tests but failed utterly to locate water or ores when secreted near him; neither could his magic wand point out thieves whose whereabouts were known to the police but not to him. This gave a decided setback to the use of the forked wands, from which they have never recovered. Even at that time the wise Father Lebrun, disregarding the claims that magnetism moved the rod, held that the motion of the twig was due either to conscious knavery or to the the unconscious thought of the person holding it; or as a more recent writer has expressed it, to "a strong impression on the mind acting through the agency of the nerves and muscles." This explanation has been so clearly demonstrated by recent physiologists, beginning with Chevreul in 1854, that a continued belief in the alleged magnetic fork must be mere superstition, and yet there are those even in our own country who are still sixty years behind the onward march of science.

An Imbedded Lightning Rod

Instead of erecting a separate lightning rod to protect the 200-foot chimney of a new cement mill at Obercassel in Germany, the builders have utilized the steel rods which run all the way up the concrete of the chimney to reinforce the same. These rods were spliced to each other with special care, connected to a good grounded conductor at the bottom and to exposed iron terminals at the top.

With the present remarkable growth of reinforced concrete construction, this method of using the imbedded steel rods as conductors may easily become a general practice.



SUSPENDED ELECTRIC FERRY AT OSTEN, GERMANY

Suspended Electric Ferry

Given a city where the river traffic must not be cut off by a low bridge and where the cost of either a high bridge or of one that would open for vessels is out of reach of the available funds: what is to be done? This was the problem that confronted the little town of Osten in Germany and the illustration shows the answer worked out by the Maschinenfabrik Augsburg-Nuernberg, it being a suspended electric ferry which can carry two teams and 25 foot passengers across the stream in three minutes. The girder on which the ferry travels is 80 feet above the water, easily clearing the highest masts without shutting off the view as would be done on each side of the picturesque stream by the approaches to even a low bridge. A toll of a cent per foot-passenger and from ten to fifteen cents for teams helps to defray the running expenses and the interest on the investment.

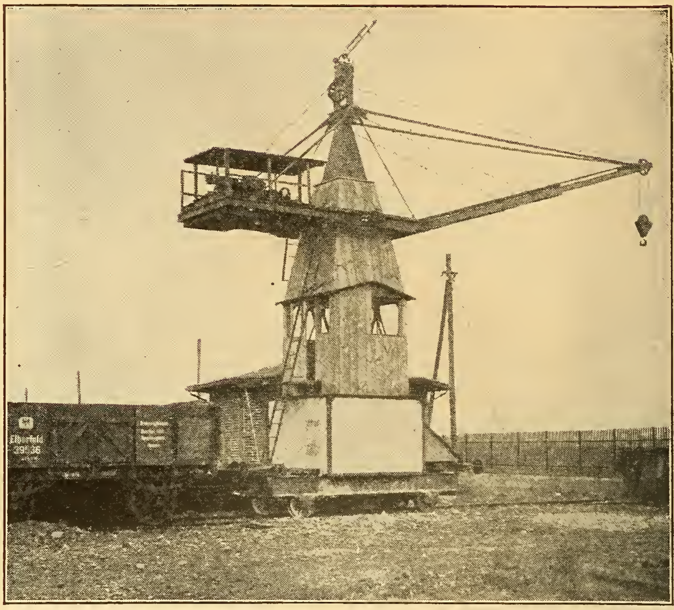
Distributing Morning Papers by Street Car

A mail car is now in use in Chicago to deliver the morning papers to the South and West sides. Just before three o'clock any morning this car may be seen at Clark and Washington streets ready for the trip. The interior of the mail car was altered by removing the mail bag racks and pigeon holes so as to afford plenty of room for piling the papers.

Are Wave Motors Feasible?

Who that has watched the waves swell and break on the open sea, or beat wildly against the shore, has not wished for some way of utilizing this evidently tremendous power? Many indeed are the inventors who have tried to do so in practice, but so far without appreciable success. Now an Italian electrical engineer, R. Salvadori, in an address before the Electrotechnical Society of Italy, makes the claim that wave motors will not pay. He reasons that the number of days on which the waves would swell to a height of even a yard would be less than 180 in a year and that to utilize them and pay interest on the investment would make the power cost much higher than that from fuel. Therefore he thinks it absurd that men should spend any more time in trying to devise a practical means of obtaining power from the waves. Perhaps he is right; but have not similar predictions been made in times past (and often by eminent engineers) to prove the commercial impossibility of the locomotive, the steam engine, the dirigible balloon and the airship?

An Odd Looking Derrick



GERMAN TROLLEY CAR DERRICK

If some of the early Dutch settlers of the Hudson River districts could come to life today and see this electric tower crane, they probably would raise a cry of "plagiarism," for the body of the structure certainly looks as if it had been stolen from an old Dutch windmill. The tower rotates, too, as did the windmills of old, but the twin trolley arms at the top show that wind is not the motive power. It is electricity, taken from two wires stretched above the railway track that operates the motor on the raised platform, thereby lifting and swinging the arm of the derrick. This has a reach of 30 feet and can lift a two-ton load eighteen feet high, so that it could readily load and unload gondola freight cars even if they were American eight wheelers instead of the little German four-wheeled car shown in the illustration.

Emergency Battery for Ships

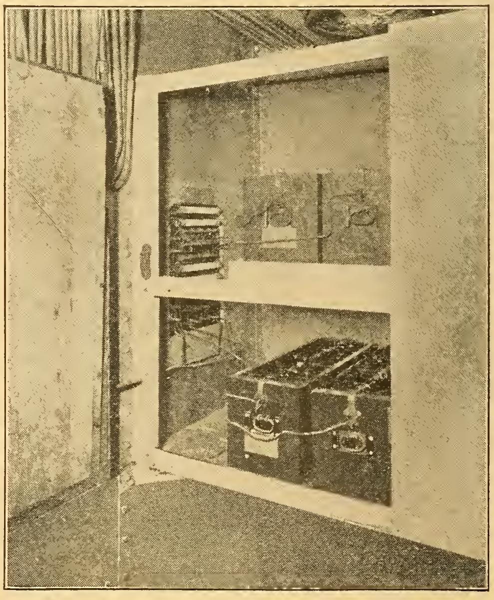
A storage battery for a rather unusual purpose has been made a permanent part of the electric lighting system of the steamship Alabama of the Goodrich line, plying between Chicago and Muskegon, Michigan.

In case of accident to the dynamo or of the sinking of the vessel, the battery is connected to the lights in the corridors and stairways by throwing switches on the small switchboard, the back of which is shown in the battery enclosure in the picture.

The battery, shown opposite, is located at a high point of one of the upper decks so as to remain in service as long as possible should the worst happen.

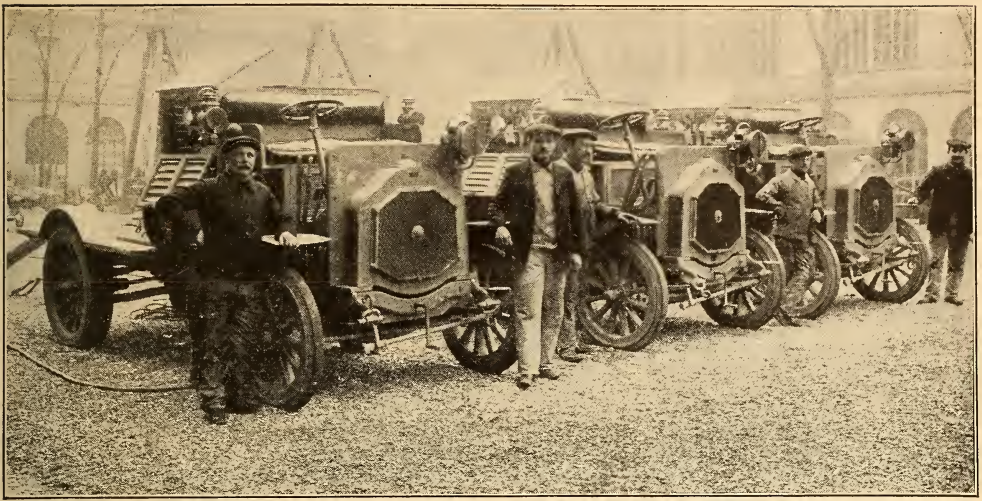
The battery is charged during the day and used for lighting after the generators are shut down at night. The installation consists of 56 cells which on one charge will supply current enough to keep the 25 four-candle-power 110-volt carbon lamps here used burning for ten hours.

The Electric Storage Battery Company, which installed the system, rates the output of this installation as 4.5 amperes for eight hours.



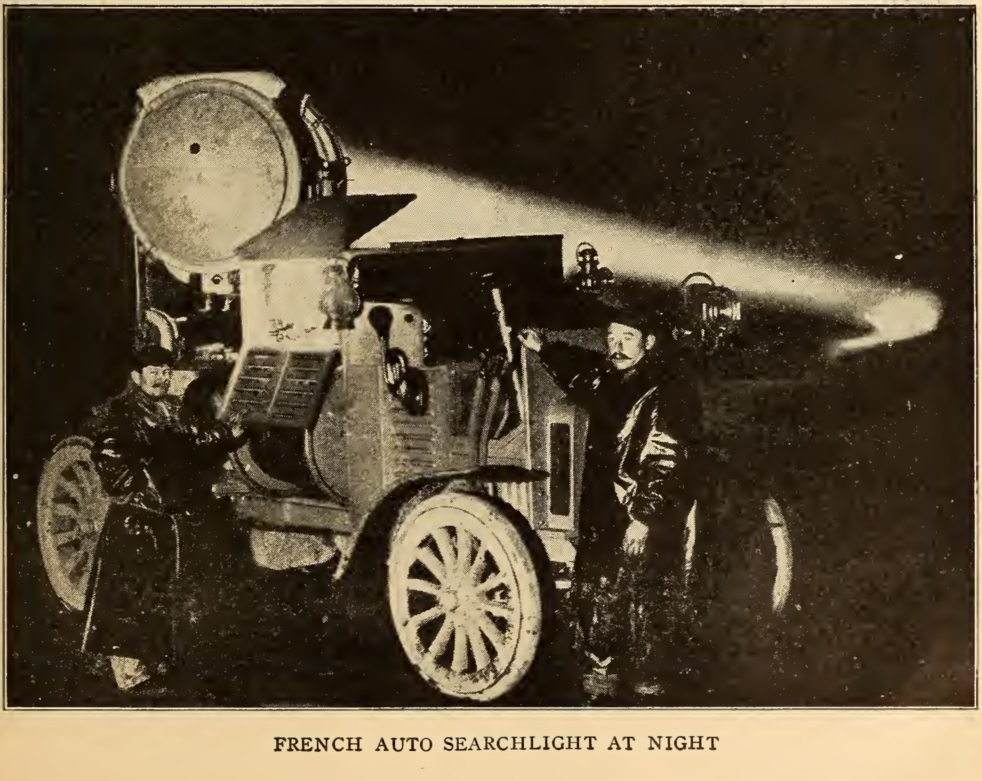
EMERGENCY BATTERY FOR SHIPS

AUTO SEARCHLIGHTS IN FRANCE



THREE OF THE FRENCH AUTO SEARCHLIGHTS READY FOR ACTION

In the September issue of Popular Electricity was shown an automobile searchlight which is being tried out in the United States Army. The French are also experimenting along the same lines, and the upper illustration shows three of their electric searchlight autos ready for the field. What they are able to do with



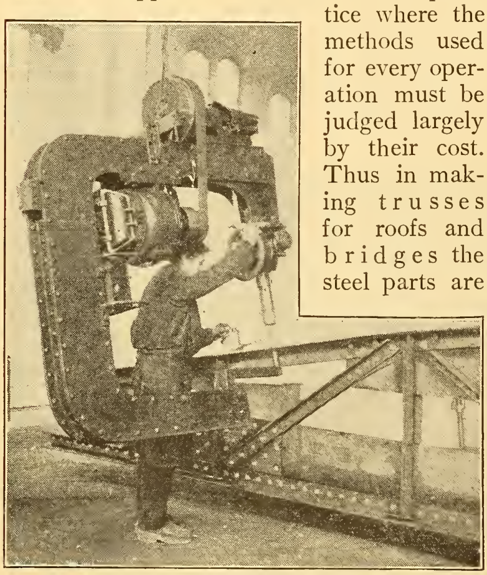
FRENCH AUTO SEARCHLIGHT AT NIGHT

it in the night may be judged by the lower picture.

Each of these automobiles is equipped with a gasoline motor of eighteen horse-power capacity capable of driving the vehicle at a speed of eighteen miles per hour, and is able to climb grades of twelve to fifteen per cent without difficulty. A separate gasoline motor on the car drives the dynamo which furnishes current to the searchlight arc lamp. These lights are very powerful, several thousand candle-power in fact. They are carried on separate trucks and can be operated at a distance from the main automobile by means of long insulated cables which bring the current to them.

Suspended Electric Drill

"If the mountain will not come to Mohammed, the prophet must go to the mountain." The same applies to tools in modern practice where the methods used for every operation must be judged largely by their cost. Thus in making trusses for roofs and bridges the steel parts are

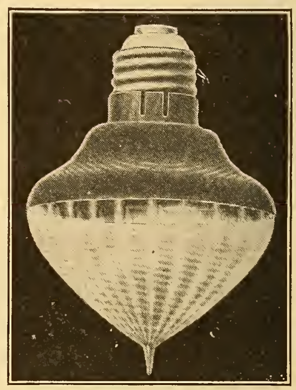


SUSPENDED ELECTRIC DRILL

secured to each other by a large number of rivets for each of which rivets a hole must be bored through two or three different pieces. To mark the location of the holes in each piece accurately and drill each separately is a tedious job. Assembling them first and drilling through the adjacent steel parts at one operation would save a good deal of time, but this usually means too heavy a mass of metal to move along the drill press from hole to hole. If the drill could be moved instead the problem would be solved and indeed is solved, even to boring through sloping plates, as shown in the illustration. This pictures a massive portable drill weighing nearly a ton and fully as powerful as stationary machines for this class of work, yet readily shifted about by the traveling crane from which it is hung. The heavy soles of the workman show that this a German shop, and even among the stolid Germans such labor-saving electric devices are appreciated and used to good advantage.

A Jewel-shaped Lamp

The ease with which glass may be blown into any desired shape makes it possible to produce lamp bulbs in a never ending variety of fantastic as well as ornamental designs. One of these, originating in Holland, has a bulb with facets imitating those of a cut jewel. The metal mirror which slips over the neck of the bulb can be striped to accentuate this facet effect.



LAMP THAT LOOKS LIKE A JEWEL

Glass Not Always Insulating

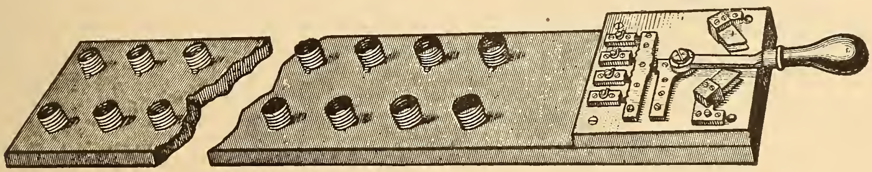
The common use of glass for the petticoat insulators which are seen on electric light, telegraph and telephone poles shows that glass is one of the best of the inexpensive insulating materials. But those versed in electrical practice know that only certain mixtures of ingredients will produce a glass of high insulating quality. Particularly must lead be avoided, else the insulation may be considerably reduced. How much this can be done has been shown by E. S. Philipps who finds that by adding both oxide of lead and antimoniate of soda to the ordinary ingredients (borax and silicate of soda) he can produce a glass a thousand times as poor in insulation as that commonly used in electrical practice.

Testing Electrical Apparatus a Quarter of a Century Ago

By W. S. ANDREWS

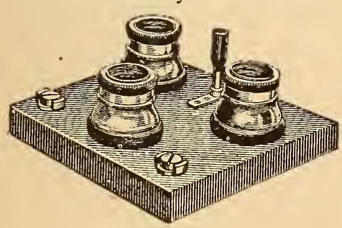
It may be interesting to look back about 25 years and briefly review some of the facilities which were then available for the electrical testing of dynamos and incandescent lamps.

The writer was superintendent of the testing department of the Edison Electric Light Company in New York from 1881 to 1883, with headquarters at the Edison Machine Works in Goerck street, and the present paper will refer chiefly to the means and methods which were in common use there during that period.



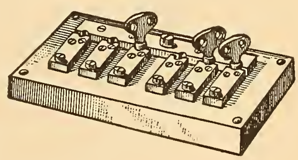
TEST BANK OF 50 SOCKETS FOR INCANDESCENT LAMPS

Only low tension direct current bipolar dynamos were made at that time for incandescent lighting service, and their capacity was indicated by the number of 16 candle-power incandescent lamps they could carry without undue heating. Thus the Edison bipolar dynamo was styled a 60-light machine, the "L" a 120-light machine, the "K" a 240-lighter, and so on. In testing these machines, they were connected to the proper number of lamps, and operated at normal voltage for a specified time. The 16-candle-power incandescent lamp of that period dissipated about 80 watts.



GROUND DETECTOR

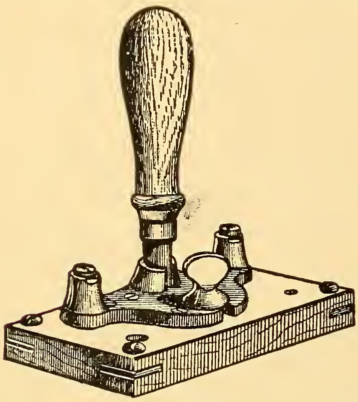
A "standard battery" consisting of about 50 cells containing copper-zinc couples was used to determine the voltage. The copper strips were immersed in a saturated solution of chemically pure copper sulphate in distilled water and contained in porous cells, and the zinc strips were amalgamated and immersed in a saturated solution of chemically pure zinc sulphate in distilled water placed in the outer containing jars. The theoretical electro-motive force of this couple when newly charged and in good condition was rated at 1.079 volts, so a battery of 50 couples developed about 54 volts. This battery was connected in series with a "Thompson" reflecting galvanometer and an adjustable high resistance of about 100,000 ohms, the resistance being regulated until the battery produced a deflection of 54 or 108 degrees, or one volt for one or two de-



LIGHTNING ARRESTER SWITCH

grees on the galvanometer scale as the case might be. The galvanometer, with high resistance in series with it was then switched over from the standard battery to the dynamo, the potential of which was read off directly in volts. There was also a heavy and roughly made Deprez galvanometer in the testing room, but it was found necessary to re-calibrate this instrument frequently with the standard battery and reflecting galvanometer, in order to insure correct readings, so that its use was limited to rough work.

The candle power of the incandescent lamps was found by comparing the light



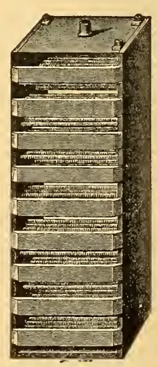
OLD STYLE PLUG SWITCH FOR "FEEDERS"

of a lamp at normal voltage with that of a standard candle in a Bunsen "grease-spot" photometer. The standard candle was rated theoretically to burn 120 grains of tallow per hour and the candles were occasionally weighed to see that they actually consumed the proper amount of tallow.

In the early 80's of the last century the unit of current was termed a "weber," this name being changed to ampere about 1885-6. Later on the electrical unit of power became popularized. It was named the "volt-ampere," and afterwards changed to the "watt." Edison dynamos were rated in 16 candle-power lamps, however, as late as 1890, but in this year it became common practice to rate them in watts or kilowatts. At that time (1880-83) we had no instrument equivalent to the modern ammeter, and the process for determining the "webers" involved the use of the reflecting galvanometer. A strip of metal, generally German silver, of measured resistance, was interpolated in the circuit, and the drop in volts across its terminals was read in the usual way on the scale of the reflecting galvanometer. The resistance of the shunt and the drop in volts being thus known, the webers were calculated. To save time and labor, it was usual to calibrate the reflecting galvanometer in connection with the German silver shunt so that webers could be read directly on the galvanometer scale without any calculation. A "shunt-box," containing a dozen large sheets of German silver, was used for measuring heavy currents. This box was about 40 inches long by 15 inches wide and 12 inches deep. The German silver sheets were stretched from end to end and means were provided for connecting them singly or in multiple so as to obtain various resistances and current carrying capacities.

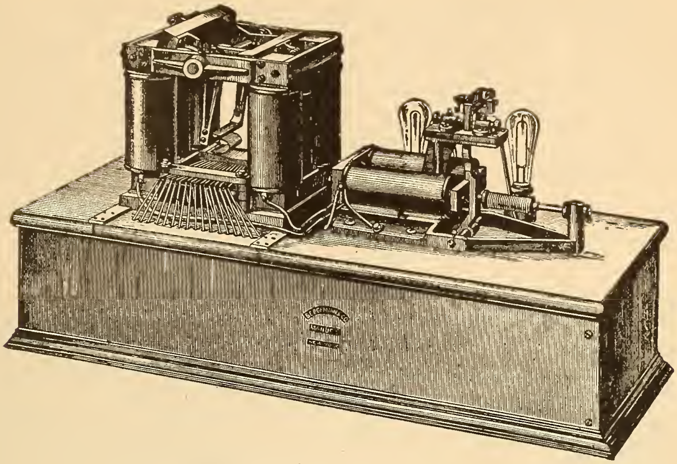
I am not aware that any particular improvememt has been made since these pioneer times in the measurement of electrical resistance. We had then, as now, the reflecting galvanometer, and the Wheatstone bridge made by first-class firms, such as Elliott Brothers, London, and Bergmann & Co., New York, so that electrical resistance could be readily and accurately measured. We were, however, as before stated, woefully lacking in handy and convenient devices for indicating current and potential. In view of this fact inquiry may very naturally be raised concerning the regulation of voltage and life of lamps in small isolated plants and central stations at that time.

Strange as it will appear in the light of all our modern refinements, the only means of maintaining normal voltage in many small isolated plants was observing the so-called "pilot-lamp," which was located on the head-board of the dynamo. The attendant was primarily instructed as to the normal brightness of this lamp and told to maintain it as nearly as possible to proper incandescence by regulating the field excitation.



LIGHTNING ARRESTER

In larger plants, "pressure indicators" were used. These devices were so constructed that the lighting up of a red or a blue lamp indicated "high" or "low" volts respectively, voltage being normal when neither lamp was lighted. I believe that the voltage in the Pearl Street Station of the New York Edison Company was regulated for some time by these red and blue lamp indicators, and a gentleman now prominent in electrical circles may possibly remember carrying the heavy Deprez galvanometer on his shoulders from the Goerck Street testing room to the Pearl Street Station once or twice a week, by which to set the indicators above referred to. It was not considered safe to transport the Deprez galvanometer in a vehicle as the slightest jar might put it out of adjustment.



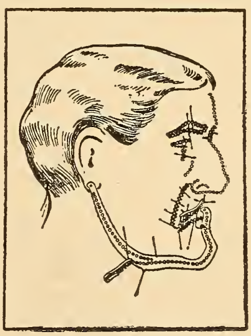
EDISON AUTOMATIC REGULATOR

In large isolated plants "Edison automatic regulators" were sometimes used, but these devices often did more harm than good, as they lifted a certain amount of responsibility from the shoulders of the attendant, and thus tended to make him less watchful. This automatic regulator was also a very expensive device and in small plants it sometimes cost as much as the dynamo.

In 1883 the writer was appointed by Mr. Edison to superintend the installation of electric apparatus in the Edison three-wire central stations, which were then in process of construction in different parts of the country. The only indicating devices used in the first of these stations were two-volt indicators, which had to be frequently standardized, and an ammeter in the neutral bus-bars to indicate if the system was out of balance and to what extent. The above equipment, with slight variations, was copied in most of the small stations, about twelve of which were installed during the year following July 1st, 1883. Most of these small stations were furnished with one pair of dynamos to operate on the three-wire system. The extension of the lighting business, as time went on, naturally led to the use of more dynamos, which were connected in multiple with those already in service. The necessity of individual ammeters for each dynamo was brought forcibly into notice by the burning out of armatures from excessive overload, there being no visible means for correctly distributing the total load. This necessity led to the development of the so-called "pendulum" ammeter, and the first six instruments of this class were set up in the Edison Station in Cumberland, Maryland, in 1885-6. After this date, central station indicating devices were improved and multiplied from time to time as new requirements developed.

Facial Expression Electric Sign

A most ingenious use of lines of lights for changing the expression of the human face in an illuminated sign is the invention of a New Jersey man. The sign as a whole consists of incandescent lights forming a human face and the lamps are so arranged that they can be moved independently of each other. In this way joy, sorrow or anger may be expressed by moving the eyebrow and mouth lamps and at the same time the position of the lines of the face as from the nose down may be altered. This idea developed into commercial use would probably be in demand as a decidedly effective "Before" and "After Taking" advertisement for Jag's Whiskey, or Gump's Gum.

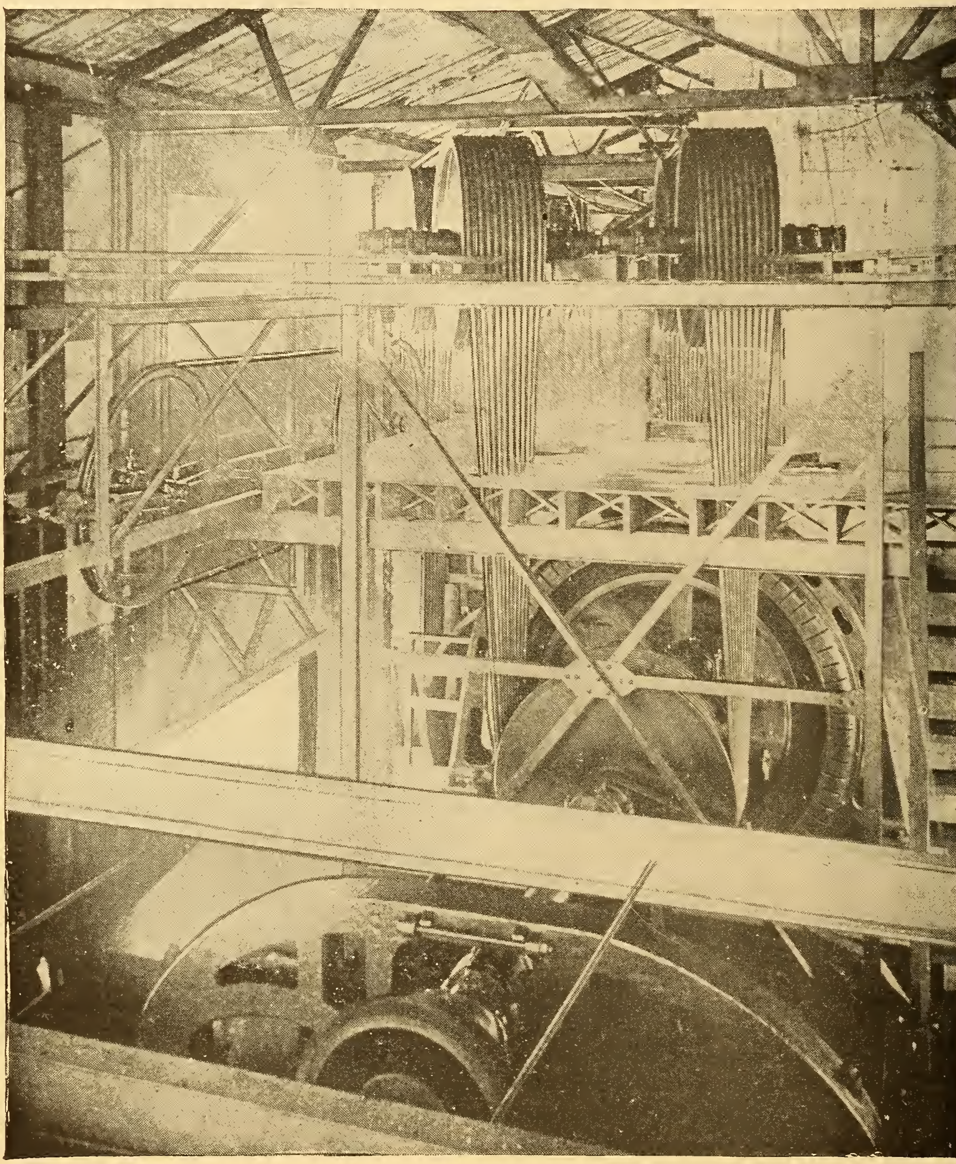


ELECTRIC SIGN

How a Dynamo is Driven by Ropes

It may almost be said that the Economy Light and Power Co. of Joilet, Ill., makes electricity out of the sewage of the City of Chicago. Surely, if this be so, it is entitled to the "Economy" part of its corporate title. The plant is located on the Illinois river, into which the Chicago drainage canal conducts the sewage of the city diluted with water from Lake Michigan

The Economy plant had its inception many years ago and has grown to great size by occasional extensions as power and lighting loads have increased. The company now carries practically the entire lighting load of Joliet and vicinity, and drives the machinery in many of the large industries of that district. Constant growth of business



DYNAMO OPERATED BY ROPE DRIVE AT JOLIET, ILL., POWER PLANT having increased the total load beyond the limits of the water power available, the company has installed an auxiliary steam plant, using steam turbine-generators.

In the down-stream end of the long main building of the water power plant is the equipment for generating direct current. In an extension at this end of the plant was installed some years ago a 375-kilowatt (500 horse-power) alternating current dynamo driven by two 200-horse-power water wheels. This unit was entirely independent of the equipment in the main building adjoining. The two water wheels have a combined horse-power rating of 400, whereas the generator requires 500 horse-power to develop the full rated capacity of 375 kilowatts. The water wheels, therefore, are insufficient to drive the generator up to full load, to say nothing of carrying overloads.

In recent years the direct current load has decreased and the alternating current load has increased. Increase of the alternating current load has made it desirable that this 375-kilowatt generator be operated up to capacity and be made to assume its share of overload when required. The decrease of direct current load fortunately made available a surplus of power in the main plant. To utilize the surplus of power from the main line to assist the two water wheels in driving the alternator, naturally suggested itself as a way out of the difficulty.

But this "way out of the difficulty" imposed difficulties of its own—difficulties which to some folks would seem practically insurmountable.

There appeared to be little in common between the main line and the generator line. They seemed to be different in every possible way. The shafts differed in line and level; they differed in diameter; they differed in speed; they differed in direction of motion.

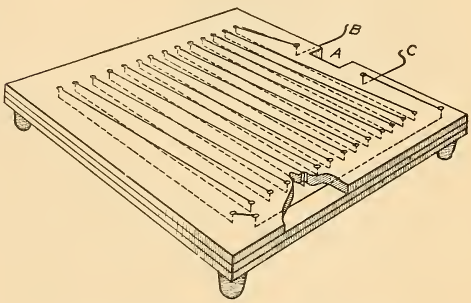
The problem was however solved by driving the dynamo with ropes, upon the Dodge American system. A driving sheave was fitted to the main line, extended into the dynamo room. From this driver the ropes lead upward, over suitably placed idlers, and thence down directly to the driven sheave on the dynamo shaft. The tension equipment is nicely accommodated on a horizontal track, conveniently placed along the side of the room, quite out of the way. Thus sufficient power could be brought by the rope from the main shaft in the power plant to the isolated dynamo, which, in addition to the power already there could drive the dynamo up to 40 per cent overload.

Portable Electric Heater

The electric heater here described by the builder was found useful in heating the shaving water and keeping dishes hot on the tea table. The material necessary is as follows:

Two pieces ¼-inch asbestos, 6 by 6 inches.
One piece of mica, 6 by 6 inches.
One piece of asbestos board, 6 by 6 by ¼ inches.
Twelve feet No. 20 Climax resistance wire.
One piece of sheet brass, 8 by 8 inches.
Four feet of heater cord.
One attachment plug.
Four hard rubber knobs for base.

On one of the pieces of asbestos draw a five-inch square, leaving a margin of half an inch as in the sketch. On two opposite sides punch fine holes about ⅜ inch apart and



PORTABLE ELECTRIC HEATER

string Climax wire as shown. At (A) cut out both pieces of asbestos so that the cord may be inserted. On the bottom of this place the other piece of asbestos and below that the asbestos board, while on top of the asbestos containing the wire place the six-inch square of mica. The sheet brass may then be placed on top and drawn over the side and tacked to the asbestos board.

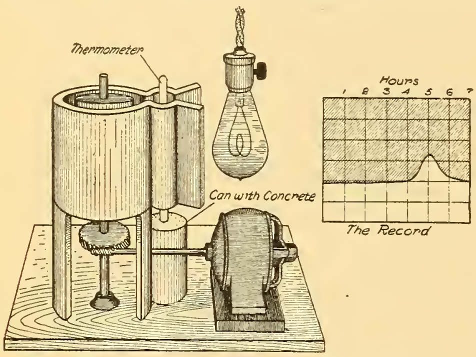
At the end (A) cut the brass and insert a bushing. Through the bushing run the heater cord and solder its ends to those of the iron wire, while on the other end place an attachment plug. On each of the underneath corners tack a rubber-headed tack and the heater is ready for use.

—THERON P. FOOTE.

Timing Concrete Electrically

While it is important that the moulds used in structural concrete work shall not be disturbed until the concrete has thoroughly set, it is also important that no time shall be wasted after the mixture has thoroughly hardened. To judge this time safely requires a knowledge of the time required for each mixture to set. Guess work might be costly and misleading, and the actual time can now be recorded photographically by the simple device shown in our cut.

This is based on the fact that when concrete "sets" there is a sudden rise in its



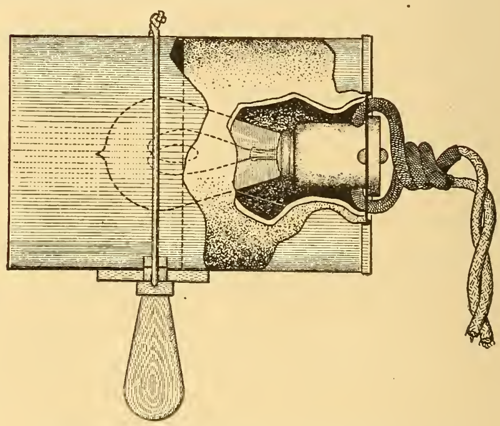
APPARATUS FOR TIMING CONCRETE

temperature. If a thermometer is inserted in the mixture, the mercury will suddenly jump up when the concrete hardens, hence an easily timed photographic record of the temperature will tell us the "speed" of the concrete. To get this, a sheet of photographic printing paper is wrapped on a drum which is very slowly rotated by an electric motor. Surrounding the drum is a cylindrical casing having a narrow opening at one edge through which the light of an incandescent lamp can shine on the sensitive paper. This slot is so narrow that the mercury in a thermometer tube will close it against the light, so that the paper will record only the light passing through the glass tube above the top of the mercury. In practice, the bulb of the thermometer is set into a small can of the concrete mixture which is to be tested, the bulb being first coated with several layers of wax dissolved in benzine, which allows it to be removed after the concrete sets. Then the motor is started and the hourly time marked through the slot with a pencil. The result is a record of the hourly time and of a sudden temperature variation which tells when the concrete sets. By placing the lamp in series with the motor its normal speed is greatly reduced, thereby adapting it better to the slow pace needed for this purpose.

Earache Cured by Lamp

In the early days when such a thing as an electric warming pad or an incandescent lamp was a curiosity, father's pipe served often to ease the pain of an earache. A cloth was placed over the bowl of the pipe and the stem directed into the ear. By blowing through the cloth he was able to force the smoke and hot air into the ear, often allaying the pain.

The illustration shows how to build a simple home made device, using an electric lamp, for the same purpose; that is, to convey warmth to the ear. In the bottom ot a tin can large enough to hold an electric lamp and socket, make two holes about $1\frac{1}{2}$ inches apart and large enough to pass wires through,



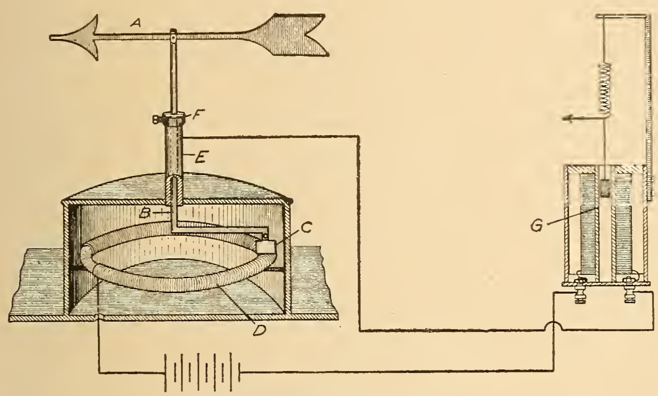
ELECTRICAL DEVICE TO CURE EARACHE

having "loom," an insulating material, upon them. A hole may also be cut out for the base of the porcelain socket to project through, or this base may be held against the bottom of the can by drawing the wires tight on the outside. A circle of asbestos as shown may be placed in the lower half of the can and a wooden handle secured perpendicularly to the side by a bare No. 14 copper wire. By connecting the device to a lamp socket with an attachment plug and holding the open end of the can over the ear the afflicted member will usually soon yield to the confined warmth.

HORACE A. WEDDELL.

Wind Vane Indicator

I submit the following sketch and suggestions for making an electrical wind vane. Referring to the illustration, (A) is the vane proper, which should be about six feet long. (B) is a small shaft or axle which revolves when the vane turns around, and on the end of the arm of which is a copper or brass brush (C). The brush is so arranged that it is always in contact with (D), which is a circular



WIND VANE INDICATOR

piece of wood wound with German silver wire and supported by hard rubber or wooden pins. A small pipe (E) which just fits the shaft (B) is provided with a brass collar (F) which keeps the shaft in the proper position.

Referring to the indicator, (G) is a tube of thin brass about ¼ inch in diameter and four inches long. This is wound with ten layers of fine copper wire with the terminals attached to binding posts. A plunger is made of a piece of soft iron and soldered to a piece of copper wire having a spring soldered to its upper end. The spring is secured to a support as shown. A small pointer is soldered to the copper wire. The whole may be put in a neat case in which there is a slot through which the pointer extends.

When connected up, the device is calibrated by moving the vane to the different points of the compass and marking on a scale the places where the pointer comes to rest each time. The action is as follows: When the brush moves over the resistance wire it allows more or less current to flow by varying the amount of wire in the circuit, and this current in passing through the coil pulls the core with more or less strength, on the principle of the solenoid, moving the pointer up and down the scale.
—Dallas Wood.

Utilizing Old Dry Batteries

As I am a young student of electricity and chemistry I know the ever present desire of most experimenters to construct things just for the fun and experience they can derive from them. For their benefit I describe an easy method of utilizing old dry batteries so as to obtain more current from them. These can often be procured from the telephone man for a few cents or for the asking.

Remove the outside paper covering from battery and with a knife and a small hammer separate the zinc where it is soldered. Carefully remove the zinc from the outside paper cover which contains the carbon element. Wrap a strong cord around the carbon and case to prevent spilling. Straighten the zinc out flat and scrape most of the deposit off, then curl the zinc up so it will fit the carbon element just as it did at first, then set the whole thing in a jar that will contain about a pint of water after the battery has been placed therein. After the battery has been in the water about ten minutes it is ready for use.

No chemicals are put in the water because they were in the original battery and from lack of moisture became inactive. For the jar I find a wide-mouthed fruit jar to be the best.

Roy A. Bradt.

Dry Battery Paste

To make a dry battery paste use plaster of paris, one pound; oxide of zinc, one-quarter pound; saturated solution of chloride of zinc, sufficient with the above material to make a thick paste. Provide a carbon stick (arc lamp carbon) to place in the center of a zinc box, insulating the carbon from the bottom by a piece of fiber. Around the carbon fill in with closely packed paste. The zinc forms one pole of the cell and the carbon the other pole.

Fifty Kilowatts of Water Power

By WARREN H. MILLER

It was more years ago than I care to remember, that the construction and layout of that little hydro-electric plant, with its half mile of transmission out of the virgin forest, was one of the most enjoyable experiences that any budding young electrical engineer could wish for. My field headquarters was a large tree, out in the middle of the construction line—a blessed relief from the grime and noise of the works—and the job itself gave one a virtual holiday of three or four weeks out in the green woods and along the brawling banks of the river.

Most industrial companies have an astonishing way of growing. One no sooner gets enough power provided for them than a new shop is run up, and the already overloaded powerhouse is either called on for more, and yet more, or else power must be brought in from somewhere else.

Now our powerhouse was already groaning under its burdens, and had been for several years, and every boiler was being pushed to the utmost; yet there would be at least a hundred more horsepower needed for heating with the coming of winter. So that, when the new forge-shop was built and about 50 horse power of motors installed, it was the last straw to the camel's back. It was possible to worry along through the summer, but with the arrival of cold weather, something would have to shut down unless more power was miraculously produced.

It happened that the company owned an old mill, down along the river about a quarter of a mile in a direct line from the power house, and, as a last forlorn hope, the writer was sent as a scout to report on what the possibilities were of using any part of its water-power equipment to help out. The old place was utterly given over to Nature when I penetrated through the briers and weeds of its abandoned penstock. Some former extra-high spring freshet of the river had swept away the dam, every vestige of the old overshot water wheel and all the big timbers and underpinning of the mill. About all there was left to report on was nine feet of available head and a volume of about 6000 cubic feet per minute pouring through the ruins of the dam. The penstock was also in pretty fair shape, as it had simply acted as an immense trough during the flood.

Now 6000 cubic feet a minute is roughly 100 horsepower, falling through nine feet, a figure not to be sneezed at. Any good turbine will realize some 85 per cent of this theoretical horse power, and we had in our power stock an extra 40-inch wheel, which would deliver 78.8 horse power on a nine foot head.

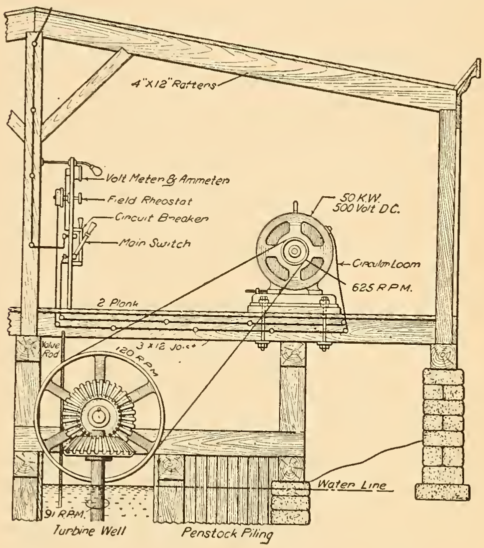
To repair the dam meant simply closing the upper race gate, putting some new planking in the breach and teaming in gravel enough to bring the earth fill back to equal the original section of the rest of the dam. From the electrical department of the works could be had a 50-kilowatt, 500-volt direct current dynamo at cost price, transferred on the company's books, so the real expense of getting the power question solved would not run into any great figure. The writer was ordered to get out an estimate and figure up a little transmission line to deliver 50 kilowatts at the main switchboard at 500 volts. It should be explained right here that such current could not be put in on the main bus bars of the power house dynamos, for these were all compound-wound machines, with the series coils of the fields connected by equalizers. As the equalizer must at times carry the full output in amperes of the machine, this would mean, not two wires, but *three* of full size on the transmission. So a separate lead always had to be found for the new dynamo, which was easily done, one double-throw switch giving us the choice of two shops.

The first care was the repair of the dam and the building of a turbine-well below the old penstock. The well was simply a large wooden box with the turbine at the bottom of it, sheathing of 4 by 12 inch yellow pine, and timbers figured to stand the static pressure of nine feet of water. The turbine was of the inward-flow type, with a vertical shaft turning at 91 revolutions per minute. It discharged out of the bottom of the box directly into the tail-race, and the admission was controlled by a sliding gate-ring that simultaneously closed all the inlet ports to the turbine vanes, shutting them all off in about three inches of travel. This gate was manipulated by a rack-and-pinion with vertical valve-rod on one side of the turbine, and a turbine governor.

With the turbine were two main bevel gear-wheels of cast iron with hard maple teeth, the one on the vertical turbine shaft having 54 teeth and the other having 40. This would make the revolutions of the main jack-shaft 120 revolutions per minute. Now, as the speed of the dynamo was 625 revolutions per minute, a pretty slow speed for that size machine, but the slowest obtainable in stock sizes, the problem would be how to best get from the 110 revolutions of the jackshaft to the 625 of the dynamo. Naturally the best way would be to belt direct to the dynamo, because the belt in any event would have to be not much less than 14 inches wide, and a countershaft-rig with such large belts could hardly be located anywhere on the mill timbers without building a special trestle for it. The main jackshaft would also have to go on the strong 16 inch timbers which formed the heavy foundation-work of both mill and penstock, and these with rigid pillow-blocks would bring the main shaft about 37 inches above the surface of the water in the turbine well. This would permit a 72-inch wheel on the jackshaft and would therefore call for a 14 inch pulley on the dynamo. Such a pulley, going at 625 revolutions, or 35 feet a second, would have to be fifteen inches wide since a double leather belt at that speed will transmit approximately seven horsepower per inch of width; and therefore a fourteen inch belt would give 98 horse power. This would develop the full strength of the wheel and allow something for overloading the dynamo, say 25 per cent.

Following this line in preference to any countershaft alternative, the dynamo was located, as shown, on the main floor of the old mill, the belt passing through the floor to the 72 inch wheel below, the distance between centers being fifteen feet.

It is essential to keep the speed of the dynamo constant, because the steadiness of the voltage depends in a great measure on the speed, and it must remain the same whether the load is light or heavy. Now the waterwheel tends to race on light loads and slow down to its normal on heavy ones, so it must have a governor to close its gates as the load gets less, and thus hold the speed steady. The one shown on the next page is what is known as a compensating governor. In order to make it delicate enough, the valve-turning mechanism must be governed by the small balls which change their position due to variations of the speed. It will not do to have the centrifugal ball mechanism act directly on the valve rod, and as it has but a very small travel for the minute changes in load. Therefore the governor balls simply alter the vertical position of the two cup-shaped friction discs (A). Inside of them rotates a solid disk driven by the large twelve inch pulley, and there is a scant 32 inch

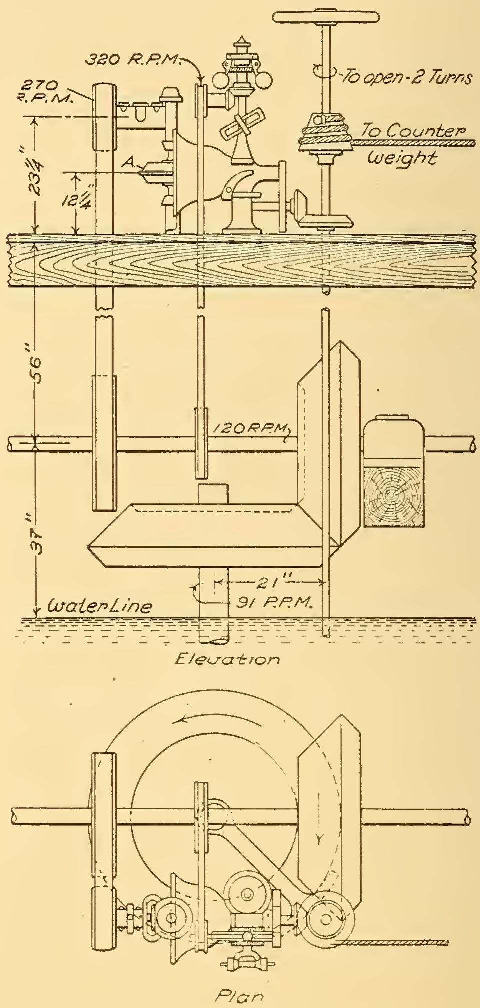


POWER PLANT SHOWN IN ELEVATION

clearance between the faces of this disk and the cups which enclose it. If the governor ball mechanism raises the lower cup ever so little, it at once comes in contact with the interior disk, which is always spinning around, and so it goes around with it and thus turns the gate-valve rod by the gears shown on the rod. If, on the other hand, the governor ball mechanism lowers the upper cup a very little, *it* comes in contact with the interior disk and thus actuates the valve-rod in the opposite direction. So therefore there is only one position in which the valve-rod is left alone, and this is at the normal voltage-speed of the dynamo. The least variation from this speed calls the disks into play and the gates are opened or closed a trifle. With steady loads there is little for the governor to do, but with constant variations, such as with certain shop loads, the governor is incessantly making slight changes in the position of the gates.

With a steady run of five teams building up the dam, and all orders placed for governors, dynamo, pulleys and belts, the next thing to go at was the transmission. Actual measurement of the distance showed it to be 1400 feet from the mill to the central power-house. At 50 kilowatts the amperage would be 90 for 550 volts. To arrive at the most economical size of wire to get this 90 amperes over to the central power house, you must realize that in any transmission there are *two* losses—the horse-power loss, due to line-drop, and the interest on the money invested in the wire. Obviously the wire in which the sum of these two losses is the least is the size we want. For instance let us assume a line loss of ten percent. As a kilowatt is worth roughly $20 a year, the power loss would then be 5 K W, x $20, or $100. Figuring the wire for this loss, we use the well-known wiring formula: Circular mils $= \frac{10.8 \times 2\,d \times A}{v}$ where v is the drop in volts, A the amperes, 10.8 the resistance of a mil-foot of copper wire, and 2d twice the distance in feet. This gives 101, 000 circular mils, or No. 0 wire, weighing 319 pounds per 1000 feet. The total weight would then be 900 pounds, which at 20 cts. a pound would amount to $180, and the interest on this at 12 percent would be $21. You see, the interest is taken at what the same capital is worth on manufacturing account to the works, not at six percent, the amount it would command in a bank. So the total loss per year for this size wire would be $121. Suppose we halve the power loss and double the size of wire to No. 4-0. The yearly power loss would then be $50 and the interest loss $42, making the total $92, a saving of $29 a year. But it would involve heavier poles, heavier bracing, more construction expense and double the drain on the amount of money the works cared to spend on the plant, so that the $29 stood in good chance of being wiped out. As we already had in stock over 1500 feet of bare No. 0 which might never otherwise be used, the whole line was put up in this size.

The poles were spaced 125 feet and were all of western cedar, eight inches at the top and fifteen inches at the butt. It is essential to get as few and as straight ones as possible, for every pole out of line requires guying. Selecting the poles with this consideration in mind, they were all tarred for seven feet from the butt, and set six feet in the ground, the total length being 35 feet. A gang of six polemen set them all in one day. One man attended to the butt, guiding it down into the hole with a stout plank set in the hole, another managed the "jenney" or mule, a cross-shaped rest on which the pole could rest as the men stopped to get a



THE GOVERNING ARRANGEMENT

fresh hold on it; two men had twelve foot pikes and two eighteen foot. Before raising, the poles were all gained with two notches ⅝ inch deep, and the two-pin cross-arms bolted on, one eighteen inches below the other, each having two 22 inch flat galvanized iron braces. The pins were the standard 1½ by 9 inch locust pin for extra heavy cable insulators. They are stiffer than wrought iron pins, and will break off short instead of bending over if too heavy a strain is put on them.

To get No. 0 solid wire up straight and smooth, it is first payed out along the ground beside the poles. It will be found to be full of dog-tails and kinks, due to so much handling. Secure one end of it to the butt of the first pole and stretch about two poles of it with heavy tackle with all the gang pulling on it. They will not only straighten it out but put a set in it. A climber on each pole then lets down a hand line and hauls it up and over the saddle of the insulators. It can then be tautened with a cable-grip and tied in with about No. 6 ties. The poles will not stand the strain of attempting to take out the kinks up on top of the pole, and if you do the line will look amateurish.

The come-along for use up the poles was a No. 0 Buffalo grip, but, without it, simply braiding the handline over the wire to form a "slip" will answer. At all corners the poles must be guyed with ⅜ inch galvanized iron stranded guy-wire. For anchors we used short billets of wood, buried four feet in the ground with a ¾ inch rod and eye coming up out of the earth to take the end of the guy wire. At both ends of the line the cross-arms were doubled and the wire terminated around both insulators, and taps taken off for the mill and power house.

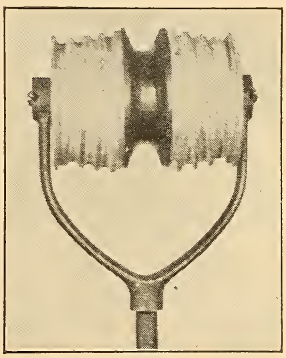
On crossing into the works, we had first to go over the Michigan Central tracks, and then a four-foot water-wheel race 150 feet wide. To go over the tracks, one would have to "sky" the line six feet over the telegraph lines on both sides of the tracks, and the 150 foot stretch over the race was rather long for comfort, so I avoided them both by going down the last pole beyond the tracks with a lead-sheathed twin-cable into a three-inch drain tile conduit laid in the railroad ballast. This cable crossed on the bed of the race, being iron-armoured while under water, as the ordinary lead cable will soon get full of pinholes and grounds under water. The reason we could not cross on posts driven into the race was because of the winter ice, which will pull up any pole. At night the water is low and still, so it will freeze around the posts and bring them up next day when the race is full.

The final point to be constructed was the switchboard at the mill end. This needed a 600 volt voltmeter, a 150 ampere ammeter, a 100 ampere double-pole circuit-breaker, a 150 ampere double-pole knife-switch and a 300-ohm field rheostat. We had in stock an old two inch slate panel, 30 by 72 inches and as full of holes as a sieve. For all that, it was plenty good enough. We filled all the old holes with neat cement and gave it a coat of black shellac—"satin finish" the switchboard people call it—drilled new holes for our instruments with an ordinary brace and twist-drill, and soon had it set up and connected to dynamo and line. The plant went off very nicely, and is running yet for all I know. We had to build a sort of boat under the big pulley on the jackshaft. It only cleared the water by an inch, and the foam and vapor from the turbine well soon began to warp it, being a built-up wooden pulley. But, with the sheet iron guard there was no trouble.

With the arrival of the following spring we had to protect the line with ironclad, line lightning arrestors at every fourth pole, grounding to an iron pipe by a No. 6 ground.

New Device Keeps Trolley On

The exclamation "trolley's off" may be relegated to the back of the dictionary with the terms marked "obsolete" if the device here shown accomplishes all that is claimed for it. The device consists of a sort of right and left-handed threaded roller placed on each side of the trolley wheel. In case the trolley leaves the wire the latter is caught in one of the spiral grooves and returned to the trolley wheel, the current being on during this time. Many accidents and collisions have occurred with sometimes injury and loss of life when the trolley leaves the wire. The Universal trolley retriever is intended to prevent all such accidents and is made so that it may be applied to old trolley wheels on any system.



A TROLLEY WHEEL WHICH IS EASILY KEPT ON THE WIRE

Insulating Materials

CAOUTCHOUC (INDIA RUBBER)

Ordinary india rubber is a very good insulating material, its very large elasticity gives to india rubber great mechanical advantages over other insulating materials It can be easily shaped to the form of the conductor on which it is employed, when used in the form of thin ribbons. In the open air it alters at 167° F. and starts fusing at 248° F. At 150 F° it hardens and gets to be fragile.

Owing to its large degree of inflammability a very careful supervision must be exerted in the manufacturing of cables insulated with india rubber, and to avoid scratches on the insulating covering, only first class and recently manufactured material must be used. It is used also for making insulating tubes.

Vulcanized India rubber is caoutchouc mixed with two per cent of sulphur. Its elasticity keeps up to 356° F. when it begins to fuse. It cannot be applied directly on copper wire as the sulphur it contains would combine with the copper. The wire must be tinned beforehand. It must contain less than five per cent resin and from 30 to 32 per cent pure Para to give good results. India rubber which has lost most of its insulating and mechanical properties can be regenerated by special processes and made to reacquire, at least in part, its good qualities.

EBONITE

This is nothing more than vulcanized india rubber in which the sulphur is brought up to 25 per cent or over instead of being kept down to two per cent. In cooling a dark mass is obtained. It is rigid and at the same time slightly flexible. Its dielectric power is very high unless some defect comes on the surface of the ebonite sheet—then it breaks down very easily. The same result obtains if oil or wax is put on the sheet.

It must not contain more than 30 per cent of sulphur and from 70 to 72 per cent of pure Para and its texture must be very homogeneous. It may be regenerated in the same manner as vulcanized rubber.

GUTTA PERCHA

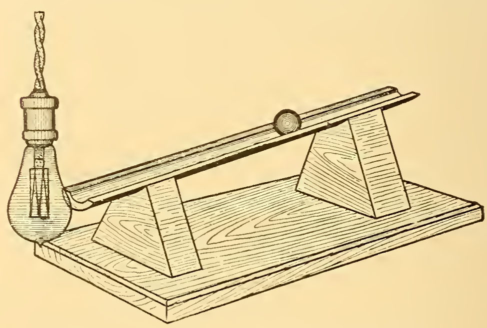
Gutta percha which is the milky juice exuding from some Chinese trees is the insulator par excellence. A gutta percha sheet 3-1000 inch in thickness breaks down only under a pressure of 15,000 volts. Its qualities depend upon the proportion of resins it contains and its insulating resistance varies with the temperature, the length of electrification and the pressure to which it is subjected. Its best property is of being impervious to the chemical action of water which makes it the material more adapted for submarine cable insulation.

SHELLAC

This is a kind of resin given out by branches of young trees under the secretions of some insects which are principally found in India. It is obtained commercially most generally in the form of rods or large flakes and is used when dissolved in alcohol. It is very easily affected by the humidity of the surrounding atmosphere and to avoid this it must be covered with paraffine. Practically all the different kinds of insulating cloths are made with shellac.

Jar Tests of Tungsten Lamps

If incandescent lamps are to be used where they will be subject to jarring, they should have the mechanical strength to withstand the jars even when the lamps are cold, otherwise the normal life of the filaments will never be reached. This is particularly true of tungsten lamps, which at first were rather frail, but which have been much improved as to the mechanical strength of their filaments during the last year or two. The processes of filament making



APPARATUS FOR JARRING TUNGSTEN LAMPS

and the methods of fastening the filaments vary with different manufacturers, making it difficult for the buyer to judge of the comparative qualities. To ascertain these in a practical way, the telegraph inspection bureau of the Swiss governmental railways has developed a testing apparatus which is at once simple and effective.

It consists of a trough, graduated to show its length and inclined at a grade of ten per cent, with the lamp hung so as to rest against the lower end, and a rubber ball about an inch and a half in diameter, loaded with lead to make its weight a quarter of a pound. By starting the ball near the lamp and gradually increasing the distance through which it gathers momentum before striking the bulb, it is easy to tell how strong a blow it requires to snap a given filament. The first series of such comparative tests as recently made at Bern showed a wide variation in the mechanical strength of lamps of different makes.

How Tungsten Filaments are Squirted

In the making of the filaments for tungsten lamps pure metallic tungsten is first secured by a long process of refining. This tungsten metal, which is then in a finely divided form, is mixed with a binding material to form a plastic mass which may be squirted in fine thread-like filaments. The process of making the filaments, as described by G. S. Merrill before the American Institute of Electrical Engineers, is an interesting one.

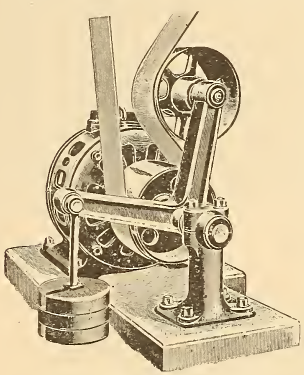
The paste, as it is called, is placed in a small steel cylinder and forced by a pressure of about 32,000 pounds per square inch through a small diamond die.

The die used in squirting tungsten filaments consists of a suitably mounted diamond of from one-half to one carat in weight through which a very minute hole has been drilled. In the smaller dies used today this hole is only about 0.0014 inch in diameter, which is smaller than an ordinary hair. The hole is drilled in the diamond with a steel needle, ground down so fine that it is as flexible as a hair and, as can be imagined, the drilling requires considerable time and patience. The stone when drilled is mounted in a steel casting in order to hold it against the enormous pressure used in squirting the filament.

Under such pressure the abrasion of the die even by the smooth tungsten paste is very rapid. This abrasion is a serious matter, as the diameter of the hole, and consequently that of the filament squirted, constantly increases. Moreover, the abrasion is not uniform, so that the hole enlarges more rapidly in the direction of one diameter than of the other, assuming when worn an elliptical shape. After enough filament for about 1,500 lamps has been squirted, it is necessary to have the die rebored, an operation which costs almost as much as the original die. A die cannot be rebored more than twice before it develops cracks or fissures which cause it to break. The next hardest material, sapphire, has been experimented with as a material for these dies, but it is found that such a die is very liable to split and that it will hardly make 100 lamps before it needs redrilling.

Belt-tightening Idler

Sometimes the easiest way of adapting an electric motor to the driving of a given machine implies the use of a short belt, too short or too nearly vertical to allow the weight of the belt itself to give the needed pull on the pulleys. In such cases the adhesion of the belt to the pulleys may be increased by having an idler press sideways against the belt. This idler may even be carried by a weighted arm mounted on the shaft of the motor, making a compact outfit and one which adjusts itself to make up for the stretching of the belt.



BELT TIGHTENING IDLER

Changing Dry Cells to Wet

The following method I have found useful in reviving old dry batteries: Take a clean glass jar and stand in it a worn-out dry battery. Around the battery place one-half pound of blue vitriol and then pour on water enough to come at least half way up the side of the dry battery. In an hour the cell will be ready for use again and will give service for some time.

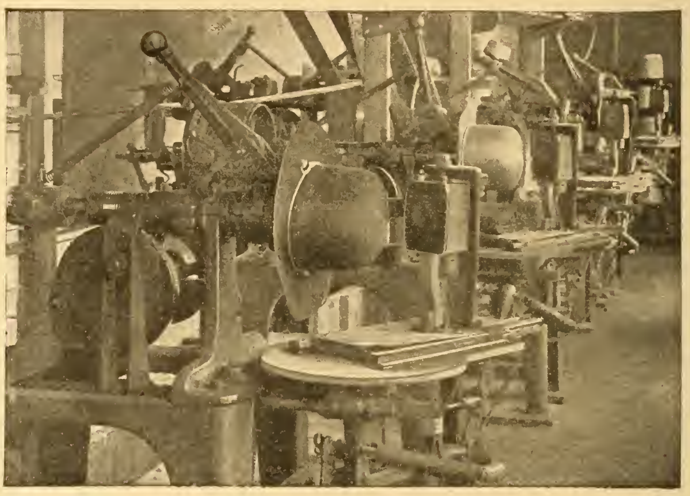
J. W. Stover.

ELECTRIC CURRENT AT WORK

NEW DEVICES FOR APPLYING ELECTRICITY

Electric Heat in Hat Manufacturing

A hat is about the most simple thing imaginable—speaking now of a man's hat—yet few realize what an amount of complicated machinery and how many separate operations are required to make one. In the production of a finished hat from the raw materials power is required to operate the machinery, heat is required for sizing, coloring and drying, and heated tools are necessary for the finishing processes, so it is reasonable to suppose that electricity will be found right at home in a hat factory, and so it proves.



HAT IRONING MACHINES WITH ELECTRICALLY HEATED IRONS

A FEW DEFT PASSES OF THE "HAND SHELL" FLANGE AND CURL THE BRIM

For generations back the journeyman hatter has used what is called "hand shell" for ironing out the familiar soft felt hat. These hand shells or irons are of peculiar shape exactly fitted for the work in hand. He holds the hat, covered with a cloth, in his left hand and with a few deft

ELECTRICALLY HEATED FLANGING BAGS

THE "LURING OFF" PROCESS, SHOWING THE ELECTRICAL VELOURING STOVE

manner similar to the ordinary electric flat iron.

But in some factories even this method is considered slow and electrically operated and electrically heated machines have displaced the "human

"HAND FLATS" USED IN MAKING STRAW HATS

passes of the iron smoothes it out, flanges it and curls the brim. In the modern factory this hand shell is heated by electricity in a element" in this phase of the work. In one of the illustrations a row of hat ironing machines is shown in operation. The heaters used with them, as well as with the other devices which will be described, are of the Westinghouse pattern. The hat is thrust onto a revolving chuck. Right in front of the nearest hat you will see a block-like object which is the electric heater. It is arranged so that it can be pressed against the crown or brim as the hat is revolved.

ELECTRICALLY HEATED OVEN

Before the hats are finally shipped they go through a last finishing process called "luring off," to make them smooth and glossy. The hat is placed on a "pouncing block" and the finisher uses a heated tool in each hand for smoothing out the fibers and making

USING THE "SHACKLE IRON" TO CURVE THE BRIM

like arrangements containing hot sand, where the hat goes through another baking process and the brim at the same time is heated and pressed out flat by an electrical heater in the form of a flat plate. The sand also is brought to the high temperature necessary by electrical heating elements buried in it.

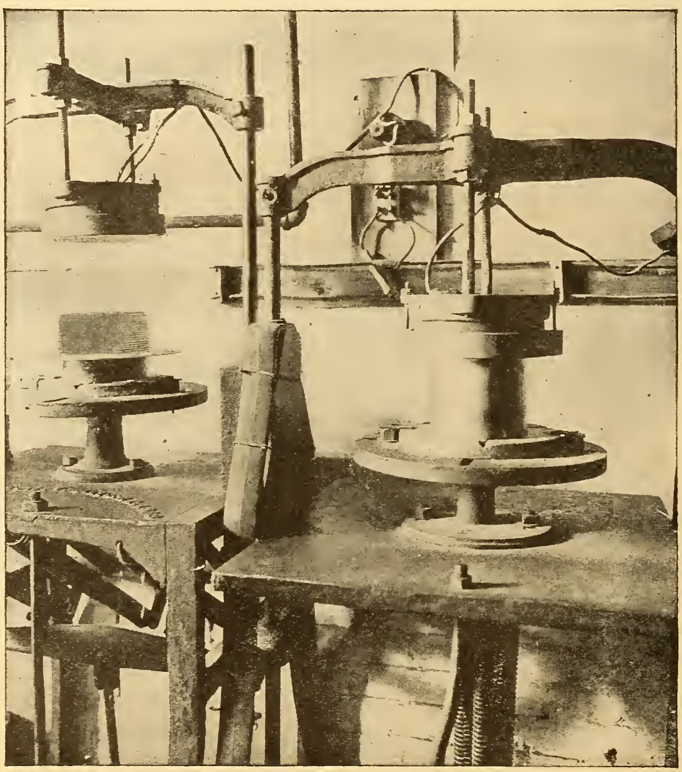
Now comes the curling of the brims, which is done by a "shackle iron." These are similar to the hand shells and are adapted to give a curl of from $\frac{1}{4}$ inch to one inch.

In the making of straw hats electrically heated tools are also widely employed. Principal among these is the "hand flat,"

them lay all in the same direction and giving the "whirl" to the crown fibers. For supplying the heat necessary in this process what is known as an electrical "velouring stove" is used. It is made in the shape of a truncated pyramid with a smooth top on which the tools are heated.

The ordinary stiff hat or derby in the beginning does not appear much different from the soft felt. In this stage it goes through a baking process in an electrically heated oven to prepare it for the hydraulic press where it is formed. The baking ovens are of heavy sheet steel covered with a heat-insulating material.

After pressing into shape approximately correct the hats go from the hydraulic presses to what are known as flanging bags. These are mould-



STRAW HATS IN THE PRESSING MACHINES

a device with two handles like a rolling pin. In the production of high grade straw hats absolute cleanliness is necessary in this process in order to turn out a spotless product. This is almost impossible in a room where the air is charged with fine flecks of soot from gas-heated irons, so here electrically heated "flats" have a marked advantage. When not in use the tools are laid on pedestal-like stands as shown in the illustration.

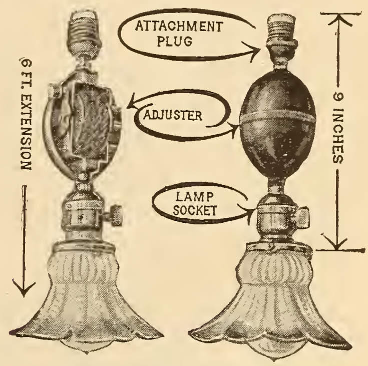
In forming the straw hats they are pressed into shape by dies which operate under great pressure. These dies must be heated at the same time and the heating is accomplished by imbedding an electrical heating element in the die itself.

Besides the machines above enumerated the hat factory of today is also equipped with electrically heated glue pots, electrically heated irons for cementing the tips to the light linings and for embossing and printing hat bands and labels, leather shapers and various other devices.

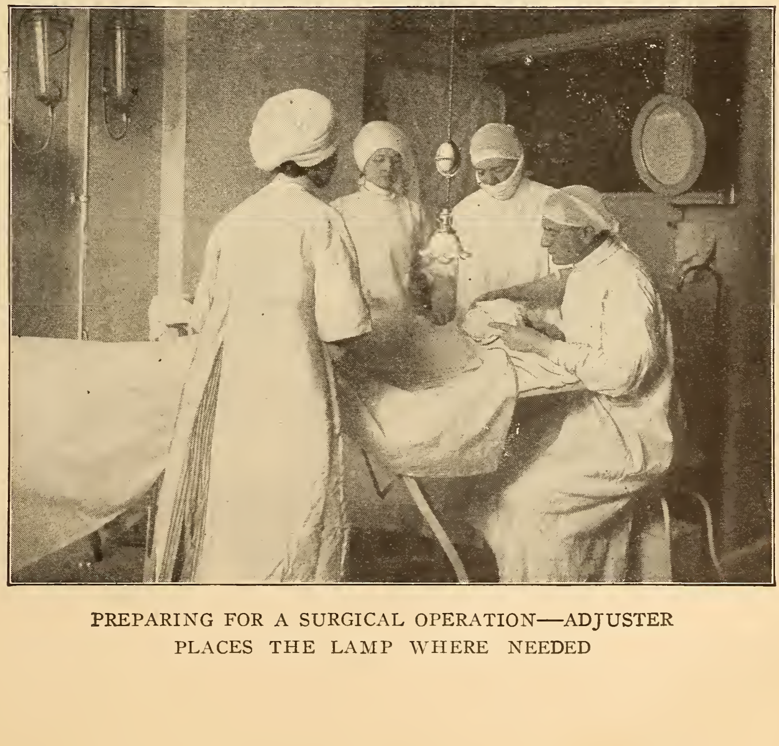
Adjuster for Lamp Cords

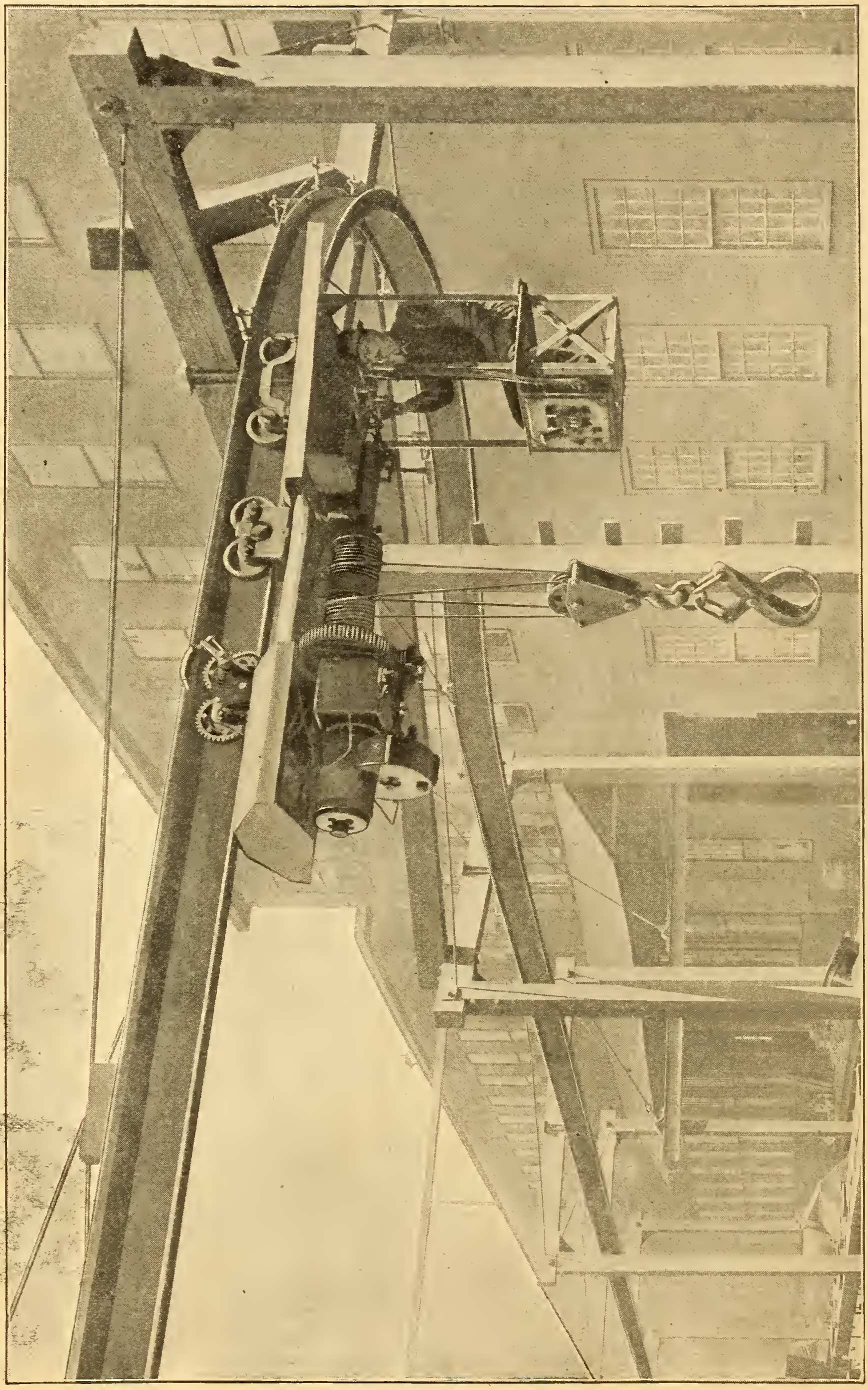
Eyesight is too great a blessing to be trifled with, but the majority of us go on day after day apparently trying to see just how much our eyes will stand. A strong light shining directly into the eyes weakens them. Light that is too weak is just as bad.

The ordinary electric drop light offers no means of adjustment except perhaps by a cumbersome loop arrangement passing through two holes in a wooden ball. You tug and strain on your tip toes to do something with it and then give up in disgust. In the new Hagstrom electric cord adjuster a remedy has, however, been supplied and the lamp can be raised or lowered more easily than a window shade. Or the cord may be extended to great length and the lamp carried to any part of the room to be returned again to its original length by pushing a button on the adjuster. That is, to lengthen the cord you pull upon it and to shorten it you push the button. The detail picture shows more plainly than words how the device operates. The picture in the operating room of a hospital indicates one application of the adjuster.



LAMP CORD ADJUSTER


PREPARING FOR A SURGICAL OPERATION—ADJUSTER PLACES THE LAMP WHERE NEEDED



A TRAVELING ELECTRIC HOIST

Electric Traveling Hoists

The time is past when manual labor by sheer muscle must lift, pile, load or unload iron, lumber or other heavy stock in a big industrial plant. Traveling electric hoists do this work at small cost as compared to the wages of a laborer and more quickly and satisfactorily. Every business has its own special requirements and builders of electric traveling hoists are ready to go on the ground and build machines adapted to almost any purpose. The illustration opposite shows a Pawling and Harnischfeger traveling hoist for service about the yard of a manufacturing plant. The heavy I-beam track from which the two-motor hoist is suspended allows heavy loads to be lifted and carried from one end of the yard to the other.

Magnets Instead of Tongs

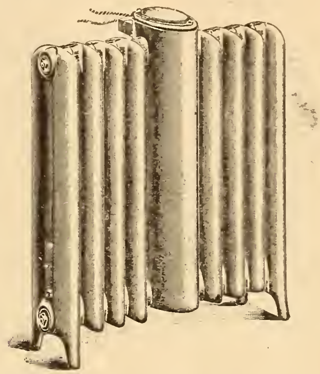
The ordinary blacksmith's tongs of our forefathers' time are still generally used for tightly gripping steel or iron while the same is being shaped on an anvil. But when it comes to taking pieces out of the fire and dipping them into oil or water to harden them, these same tongs are wasteful of time, particularly if the pieces are small or round in section.

A MAGNET USED INSTEAD OF TONGS

Where such hardening or tempering is done in quantities, much time is saved by using a long handled electromagnet to which the piece of steel will cling even while hot and by means of which it can be plunged into the hardening bath in less time than it often would take to grip it with tongs. To release the lifted piece, a push button on the farther side of the handle shuts off the current, which is the same as for a six-candle-power lamp. Of course the device is both water-proof and fire-proof. For tempering purposes it is usually fitted with a 20-inch stem, thus allowing the operator to reach well into the furnace without burning his hands.

Electrically Heated Hot Water Radiator

No serious thinker can use a hot water bag to warm his feet on a cold winter night without being impressed with the capacity of water for holding heat. This unusual facility for storing heat is due to the fact that it takes a comparatively large



ELECTRICALLY HEATED RADIATOR

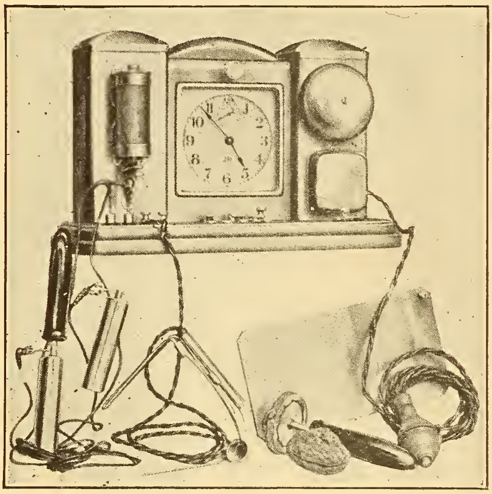
amount of heat for every degree that the water is warmed. Pound for pound, water will require about eight times as much heat to warm it a given number of degrees as iron, five times as much as stone and about thirty times as much as lead, gold or mercury. Therefore, when any quantity of water has been warmed, it has a large amount of heat stored up in it which it can radiate slowly after the supply of heat is removed.

This accounts for the satisfaction given by hot water radiators, to which the hot water is generally supplied from a boiler or a furnace coil. Owing to the needed piping, such radiators are necessarily fixed in position and suitable for use only where a boiler or furnace is close at hand. If we omit the piping and heat the water in the radiator electrically, the radiator can be placed anywhere and moved at will, as long as it is connected to the current by flexible cords. Moreover, each radiator can be controlled entirely independent of all others, which is hard to do with many hot water systems.

The British type which we picture is one of five sizes, holding from 4½ to 10½ gallons, of which the smallest takes a maximum of 800 and the largest 2,400 watts at the start. This consumption of current gradually decreases, as the water warms, so that the maximum after an hour's use is only three quarters of what it was at first.

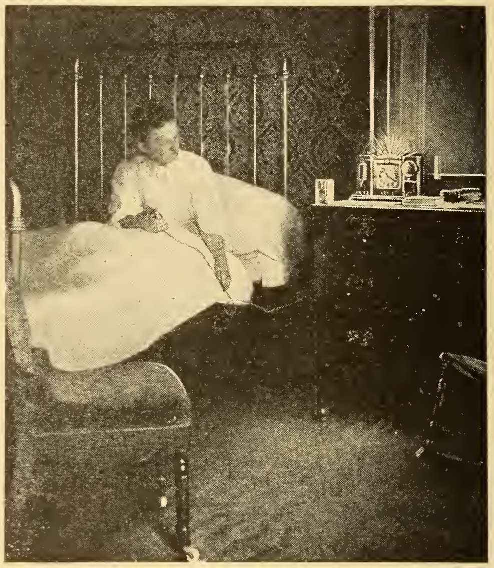
The Electric Utility Clock

The tendency nowadays is to make electricity our servant in every way possible, even going so far as to make it our personal attendant, so to speak. It is a very common thing to find in homes an electric alarm clock, electrically lighted clocks, medical batteries and coils, flashlights, etc. Going one step farther, it has been the aim of the Darche Manufacturing Company to combine as many of these little aids and conveniences as possible into one compact set. How well they have succeeded will be seen from the following description of the utility clock and medical battery outfit.



ELECTRIC UTILITY CLOCK

In the first place there is embodied in the outfit a reliable and at the same time artistic timepiece. Right above it is an electric lamp. A cord and handle, with push button, makes it possible to flash the lamp from any part of a room. Hang the cord and push button over the head of the bed and you can very conveniently ascertain the time at night, or if you are one of the kind that "hear things at night," you may very easily satisfy your curiosity in the same manner.



TO ASCERTAIN THE TIME, SIMPLY PUSH THE BUTTON

THE LAMP IS LIGHTED AUTOMATICALLY WHEN IT IS TIME TO GIVE MEDICINE

At the right of the clock is an electric alarm which can be set to go off at any predetermined time. At the same instant the lamp lights—all automatically. If the clock is being used in a sick room and a "silent" alarm is desired the bell circuit may be switched off and the light, only, arranged to appear at the given moment, as, for in-

EASY TO EXAMINE A CHILD'S THROAT

ordinary faradic current is obtained through cords and hand electrodes. The strength of this current may be regulated by raising or lowering a hollow metal core within the coil.

Another useful feature is the surgical and dental attachment. You feel perhaps that there is something the matter with one of your teeth, but you wish to examine it yourself before going to the dentist. In that case it is customary to take a small pocket mirror, put it in your mouth, stand up before a large mirror and crane your neck trying to look inside your own head. With this outfit, however, goes a little attachment which makes the operation a simple matter. It consists of a tiny incandescent lamp such as dentists use, mounted in the end of a thin tube which may be readily placed in the mouth or throat. With it goes an instrument for holding down the tongue, also a little dental mirror. With these instruments it is possible to examine your own teeth or throat, or examine a child's throat and even the in-

stance, to notify the nurse when medicine is to be given. The batteries which accomplish all this are concealed in the cases on each side the clock case.

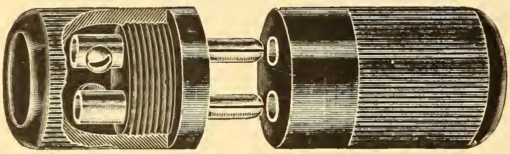
The medical attachment is operated by simply placing the controlling switch on a special contact point which immediately directs the current from the batteries into the medical induction coil seen at the left of the clock. From this coil the

YOU BECOME YOUR OWN DENTAL EXAMINER

A STIMULATING CURRENT FROM THE MEDICAL INDUCTION COIL side of the nose and ear. The apparatus complete is ready for use at any time without making special connections, and ordinary dry batteries are used which are readily replaced at any time.

Midget Separable Connectors

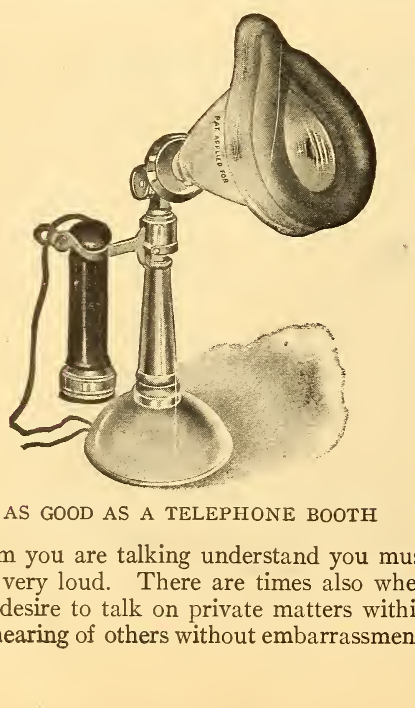
Here is a connector that will appeal to every automobile user who lights with electricity. The connector is made of hard rubber so that the user is protected from shock and when in service has no exposed metal parts. The cord is attached within the connector as shown. The device is very handy for connecting battery lamps to the circuit and in other places where a quick connector is desired.



MIDGET SEPARABLE CONNECTOR

Telephone Attachment for Noisy Places

Your office is located perhaps at a noisy street corner so that to make the listener to whom you are talking understand you must talk very loud. There are times also when you desire to talk on private matters within the hearing of others without embarrassment. You may prevent these annoyances by the use of the Rochester telephone muffler, much less expensive than a booth and always within reach on your desk.

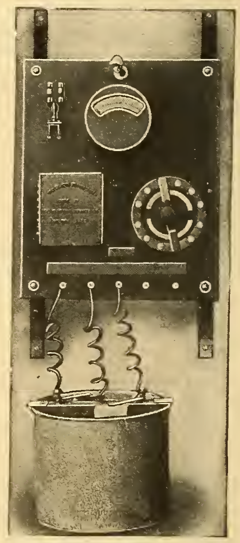


AS GOOD AS A TELEPHONE BOOTH

The device is made of glass with a detachable rubber mask as illustrated and can be readily attached to any telephone.

Rectifier for Obtaining Direct Current

When direct current is not available some rectifying means is necessary to change the ordinary alternating lighting current in order to charge storage batteries. The Economy rectifier presents one way of doing the trick. The set consists of a small transformer to reduce the voltage of the alternating current somewhat; an electrolytic rectifier, sometimes known as an "electric check valve," into which the transformer feeds the current and from which the current comes out as direct current, that is, flowing continuously in the same direction; and finally a little switchboard with the necessary switches and an ammeter for measuring the current.



ALTERNATING CURRENT RECTIFIER

The electric rectifier is the most distinctively new element in the whole set. It consists of a large agate-ware pail, with three electrodes, one of lead and two of aluminum, immersed in an electrolyte solution, and mounted upon a strip of slate with binding posts attached.

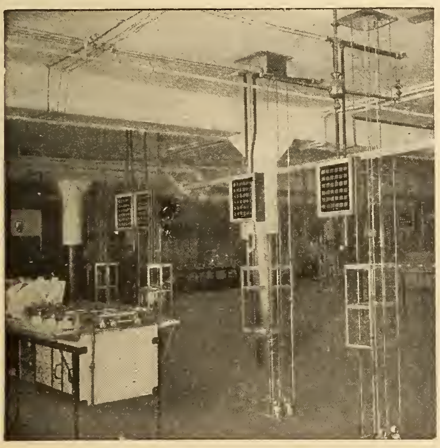
The current supplied from the transformer flows through the solution from the lead plate alternately to either aluminum. Owing to a remarkable electrochemical property of aluminum, it cannot flow in the opposite direction. Hence the alternating current is changed to a one-direction pulsating current, perfectly adapted for charging storage batteries.

Serving a Quick Lunch Quicker

In some of the quick lunch establishments of the larger cities the number of patrons served between the hours of 12 and 2 o'clock may pass the thousand mark. Each bill is small, and so it is only by providing for a very large number that the establishment

LUNCH COUNTER WITH BUTTON PLATES

is able to pay the enormous rent of a good location in the down-town district and make a profit besides. Therefore every little refinement in operation is employed to save



SERVING ROOM ANNUNCIATORS

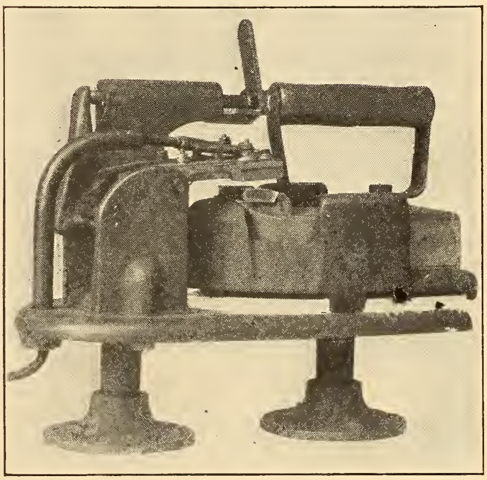
a minute or a few seconds, even, in serving a patron.

The latest aid to such restaurants is the Holtzer-Cabot electric restaurant call system which furnishes a means of instant and silent communication between lunch counter and serving room, by means of which the waitress at the counter can communicate the most frequent and simple orders to the serving room.

At the counter are arranged a number of panels of push buttons placed as shown in one of the pictures. Suppose the order is "coffee and sinkers." The waitress pushes the proper button and instantly an annunciator drop on a panel in the serving room falls and exposes a number which means to the chef at the serving table "coffee and sinkers." He then fills the order and everything is ready for the waitress as soon as she arrives at the serving room.

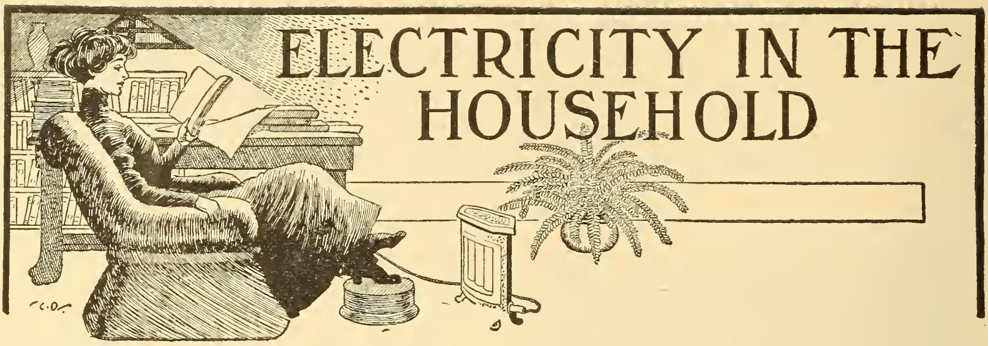
Pressing Iron of New Design

The tailor's electric iron here shown is somewhat unusual in design in having the flexible cord attached to the stand rather than to the iron. The general construction is similar to that of irons with the cord attached except that the terminals of the



ELECTRIC TAILOR'S IRON WITH AUTOMATIC STAND

heating element within the iron are brought out at the toe, so that by operating the lever at the top, the iron, when placed on the stand, may be connected to the flexible cord circuit or not as desired. By the use of this type of stand and iron the Westinghouse company seeks to obtain a better use of the flexible cord and provide for greater convenience.



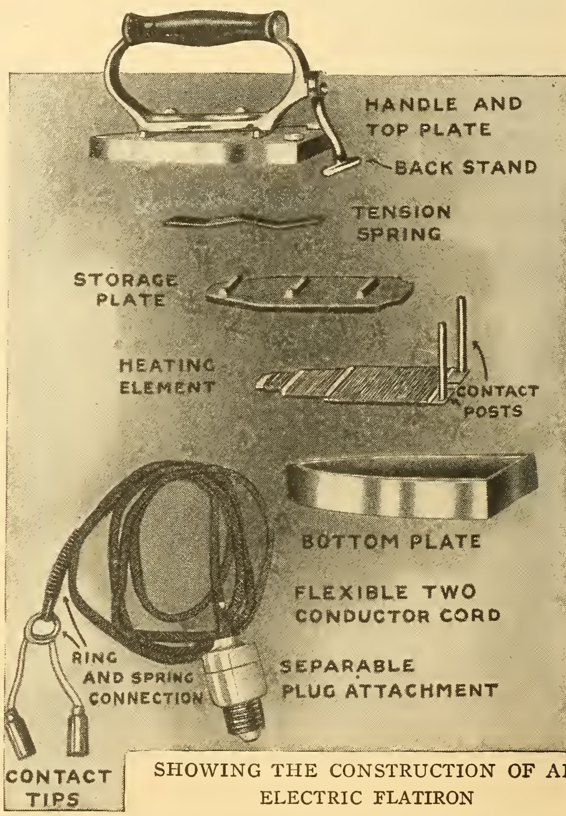
How Electricity is Turned to Heat

Heat—where you want it, when you want it and at any degree you want it; without waste, without smoke and soot and without consumption of oxygen. These are the overwhelming advantages that have made electricity the factor which it is today in domestic science and which in a few short years will make it the essential agent, not an adjunct, in the conduct of every well regulated household.

From month to month there have been described in this department a great many types and makes of electrically heated utensils to lighten the tasks of housekeeping —it seemed that we had described them all. But an entirely new set of brains has been at work on the problems of electric heat and an entirely new set of electrical household utensils has been developed as a consequence. They were all designed, built, experimented with and tested in every conceivable way before being placed before the public.

Up in Milwaukee, Wis., there is a firm by the name of Cutler-Hammer. The name is known to every electrical engineer, but for a product which is so removed from household affairs that it is very seldom heard in the home. But this firm has seen the great possibilities in the new field of electric heating and cooking and has set out quietly to see what it can do in the way of making a name in this line. The devices here described bear the name of Cutler-Hammer and employ electric heat for purposes outside of cooking. A complete line of electric cooking utensils is to be exploited later, and will be described in this department in a future issue.

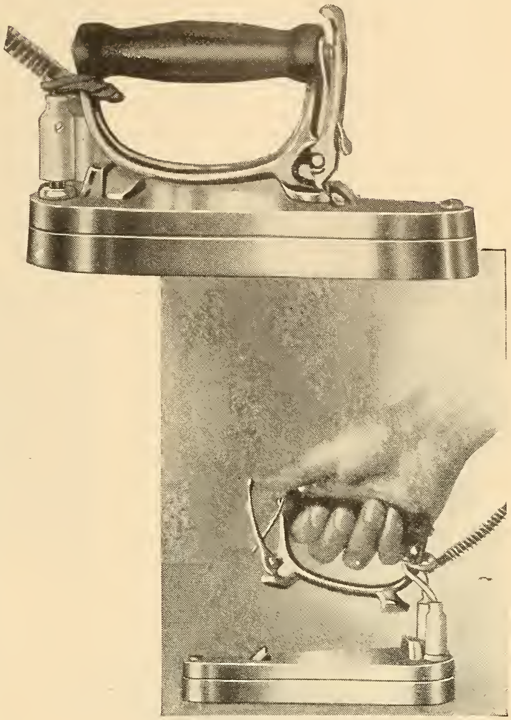
First, of course, comes the electric iron and for the sake of those who have often wished to know what is inside of such an iron, a picture is shown of one of them taken



SHOWING THE CONSTRUCTION OF AN ELECTRIC FLATIRON apart. The most important feature of all, in any type of iron, is the heating element shown in the middle of the picture. The electric current comes in at one of the upright contact posts, flows around the flat coil of wire and out at the other post. In its passage through the fine wire the latter is heated, which heat is conveyed to the bottom plate and also to the storage plate. In this iron the arrangement of the heating element is such that all parts of the face of the iron—point, heel and edges—are equally heated, while the storage plate "soaks" up the excess heat like a sponge, to be given to the iron after current has been shut off.

A rest is provided which consists of a back stand—a T-shaped bar attached to the heel of the iron. When not in use the iron is turned up on end, the back stand or T-bar holding it clear of the ironing board. This renders unnecessary the use of a metal stand, which tends to draw the heat out of an iron. The back stand may also be adjusted to support the iron face upwards, and in this position the iron may be used as an electric stove for heating water, milk, etc.

The "ring and spring" connection is another feature to merit attention. All users of electric irons know that the wear on the cord is greatest at the point where the cord is attached to the iron. Kinking and chafing at this point soon wears out the stoutest cord. The ring and spring connection prevents this, forming a flexible (instead of a rigid) connection, thus allowing the iron to be turned in any direction without wear on the cord.



FOR IRONING SLEEVES

ELECTRIC LAVATORY HEATER

The iron which is shown complete in the illustration above is for ironing sleeves. It has a long narrow body and weighs only four pounds. The handle is detachable, making it convenient for traveling.

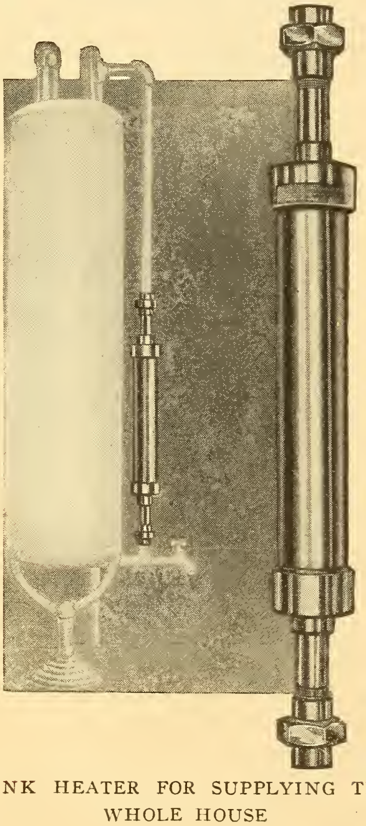
Probably the most novel feature of this new line of heating apparatus is embodied in the water heaters. You will be surprised, when you see absolutely cold water turned to hot and from that to steam in a minute's time, to find out that the water itself forms the resistance to the electric current and develops within itself the heat which performs the seeming miracle. In ordinary electric water heaters there are coils of resistance wires which are heated by the passage of the current exactly in the same manner as in the electric flatiron. In these new heaters, however, what are known as carbon electrodes are used.

There are two sets of these electrodes in each heater, placed at a little distance apart.

One set of electrodes is connected to one terminal of the electric circuit and the other set to the other—this being accomplished by the ordinary cord and plug. Now you might turn on the switch and no harm would be done to the heater because no current is flowing through it. Suppose, however, you let water into the heater—cold water right out of the piping system. The water surrounds the two sets of electrodes and water being a slight conductor of electricity, current begins to flow through the water from one electrode to the other. The resistance is so great however, that heat is generated, which warms the water.

By letting the water run quite fast through the heater you get a continuous supply of hot water—even boiling. Shut off the water so only a little goes through and you get steam for sterilizing purposes, etc. Now shut off the water altogether and go away and forget to shut off the current. The little water that remains will be turned into steam and escape. Then the heater is dead because current cannot flow through it when it contains no water. There can be no explosion through forgetfulness, because there is always an outlet for the steam to escape. There can be no burned out heater because there is nothing to burn out and besides, the current is automatically shut off when the water is gone.

BATH HEATER



TANK HEATER FOR SUPPLYING THE WHOLE HOUSE

In houses possessing no hot water system, the lavatory heater will furnish a copious supply of hot water at any hour of the day or night. In houses in which furnace heat is used to supply hot water this heater will be found a great convenience in the summer months when there is no furnace fire and consequently no hot water supply.

The lavatory heater is provided with a regulating device which enables the temperature of the water to be varied from luke warm to scalding hot.

The bath heater is similar to the lavatory heater, but is of much larger size. It is furnished mounted on a marble panel measuring thirteen and one-half by eighteen inches, this panel carrying a main line knife switch to turn on the current and a little "pilot" lamp to show at a glance when the current is on and the heater in operation. A regulating device, similar to that of the lavatory heater, is provided whereby the heat of the water flowing from the bath heater can be varied through a wide range of temperatures.

The tank heater is an electrical device for heating the contents of hot water tanks. It consists of a metal cylinder somewhat more

PORTABLE WATER HEATER

than two feet in length by three inches in diameter. It is easily installed, is of sufficient capacity to furnish a plentiful supply of hot water for household use and is free from the objectionable odors and dangerous eminations sometimes generated by gas heaters.

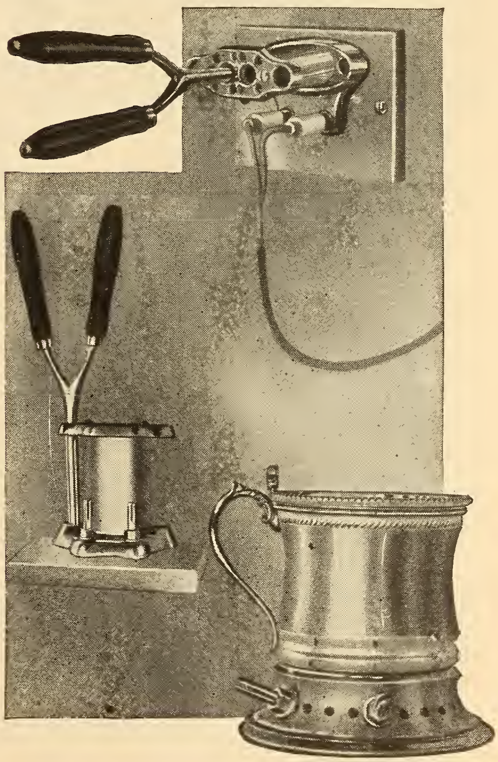
The three types just described are all of the carbon type. There is besides a portable heater built upon a somewhat different principle; that is, the heating element is composed of wire and is contained in the base of the heater. The arrangement is such that the cold water must pass down through a tube, which is surrounded by the heating coil and then upward again into the glass jar, from which it is drawn through a faucet. The instantaneous heater for household use will hold three quarts. Starting cold, the first glassful of steaming hot water can be drawn in 45 seconds after the current is turned on. A second glassful can be drawn fifteen seconds later and so on until the globe is emptied.

Then, too, there are some electrically heated toilet devices. For instance, the curling iron heater, consisting of a metal casting mounted on a marble or slate base, may be used either on the dressing table or may be fastened by two screws to the wall, holes being drilled in the base for this purpose.

The metal casting is nickel plated and has a top plate provided with four openings, the two outer ones being designed to hold the curling iron when not in use. The two inner openings (both of which may be used should it be necessary to heat two irons at one time) lead to the heating chamber in which is an automatic switch which admits current to the heating element as soon as the iron is thrust into either of the openings. On withdrawing the iron this switch automatically cuts off the current until the curling iron is again inserted in the heater.

When used on a dressing table note that the thrust of the iron is downward, not sidewise, this making it unnecessary to hold the heater with one hand while the iron is inserted or removed with the other.

The electric shaving mug stands five inches high and is nickel plated inside and



CURLING IRON HEATER AND SHAVING MUG

out. The heating element is contained in the bottom of the mug. Above this is a water chamber holding about one-half pint, and inserted in the top of the mug is a removable soap tray.

During the chilly days of late fall or early spring, before the furnace fire is started, or after it has been permitted to go out, the portable electric radiator will prove a real comfort.

Nearly every household has at least one room that is "hard to heat" and is therefore

COMFORT BY THE ELECTRIC RADIATOR

often unoccupied even when the furnace is in operation. The electric radiator makes such rooms habitable.

The radiator illustrated, which is made in three sizes, has three switches, in the case of the largest size and gives three degrees of heat. These radiators may be used in any room in the house by providing suitable connections to the electric mains. There are no odors, no open flame, no muss, as in the case of oil and gas heaters,—nothing but "clean heat" and plenty of it.

One Electric Stove Cooks for Eighteen

Is it possible to provide economically for a large family by making use of an electric cook stove alone? Some scout the idea, but the following test which was made recently in the Electric Shop, Chicago, is convincing.

A party of guests, eighteen in number, was to be served with a full dinner prepared on a single electric stove, and the Hughes type of stove was selected upon which to do the cooking.

The dinner served consisted of consomme, roast beef, lima beans, potatoes, a salad, peach shortcake and coffee. The meal was cooked in two hours' time at a current consumption of 2074 watt hours, which shows a current consumption per person of 115 watts. Figuring this on a basis of ten cents per kilowatt hour shows that the current cost of feeding each person was one and fifteen-hundredths cents. The current consumption in cooking the consomme was 176 watt hours; the roast, 1,318 watt hours; lima beans, 219 watt hours; shortcake, 146 watt hours, and the coffee 255 watt hours.

In the preparation the consomme, of which there was two quarts, the 880 watt burner was brought into use and was run at full heat for five minutes, after which time the current was turned off, and the storage heat in the burner finished it. The roast was cooked in the oven, which has a total capacity of 1,760 watts. The oven was turned on for ten minutes before the roast was put in; after the roast was in ten minutes the current was turned down to the next to low heat, or medium heat, which consumes 440 watts; this was left on for one hour and forty minutes, at the end of which time the roast was taken out.

Immediately upon removing the roast from the oven, the pastry of the shortcake was put in, the oven being turned to high heat for five minutes, after which the oven was turned off and the cake left in for three minutes, in which time it was cooked perfectly.

The potatoes, of which there were half a peck, were put on the 880-watt burner, and run for fifteen minutes, after which it was turned to the 220 and run for 30 minutes, giving a current consumption of 293 watt hours. The coffee was the only thing not made on the stove. It was made in individual electric coffee percolators of 500 watts each, which were run for ten minutes, showing a total current consumption of 250 watt hours.

The range was primarily designed for taking caie of the requirements of a family of not to exceed eight people, but the above shows what can be done when it becomes necessary to use the range for a more elaborate dinner.

A Little Motor for the Home

A small electric motor which may be put to several uses with very little bother is an exceedingly welcome addition to the household equipment. It is hard to appreciate, except by actual experience, how much a little electric current rightly applied can do to help out with the work.

The Westinghouse general utility motor here illustrated is provided with a number of easily changeable attachments adapting it to various purposes about the house. A handle is arranged on top for convenience in lifting the device about. The motor can be attached to the sewing machine by detaching the base and setting on the machine in a base containing a pedal attachment for starting and stopping.

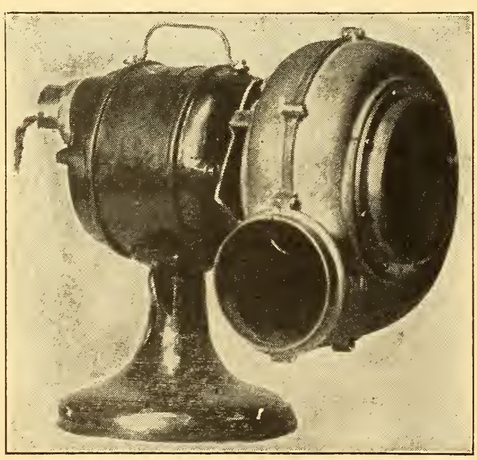
A small blower attachment for supplying air to the kitchen, reviving the furnace fire, or ventilating a sick room is provided. It is surprising how quickly a blower of this type will change the air in a room when properly

UTILITY MOTOR FOR GRINDING CUTLERY AND POLISHING TABLE WARE

UTILITY MOTOR ATTACHED TO SEWING MACHINE

placed so as to blow the impure air out of a window or door.

Two other attachments for the motor which are of great assistance in the kitchen are a buffer and grinder which may be attached to the shaft in a moment.



UTILITY MOTOR WITH EXHAUST FAN ATTACHMENT

Flatirons as Sterilizers

In Bohemia it has recently been demonstrated that ironing has a sterilizing effect.

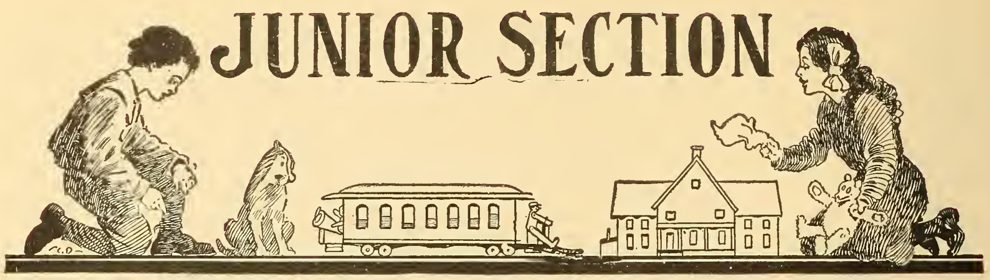
The proof came about in this way: Being eager to avoid carrying any infection from homes in which his graduates were treating contagious diseases, Prof. K. Svehla of the Czech University at Prague insisted that the doctors should wear special linen cloaks These were to be left at the house of the patient to be sterilized. But Prof. Svehla found that the average Prague household did not offer proper facilities for this sterilizing. He therefore experimented as to the simplest method of accomplishing this and found that the ordinary process of ironing a moistened material serves to sterilize it. With thin fabrics like handkerchiefs, which had been purposely loaded with micro-organisms, a single ironing proved sufficient.

A happy young couple in Nome
From cafe to cafe did roam
When she told him he oughter
A toast stove he bought 'er
And now they have breakfast at home.

Mrs. Murphy up north in Racine
On wash day was a sight to be seen
When her back nearly broke
She made a bold stroke
And bought an electric machine.

And there was sweet Kitty LaPearl
Whose hair wouldn't stay in a curl
But after some thought
A curler she bought
And now she is a contented young girl.

Last summer Miss Maggie Odell
In her white dress appeared very swell
An electric iron was the reason
She made the hit of the season
While her friends worked around hot as
blazes.



An Electrical Laboratory for Twenty-Five Dollars

By DAVID P. MORRISON

PART XI.—CONSTRUCTION OF A SMALL MOTOR

The following description is of a motor that has been constructed and found to give very good results. The field and armature of this machine are made from sheets of soft iron cut to certain dimensions and then assembled, instead of making them from cast iron. Cut from some sheet iron such as is used in making stove pipe, or you can use old tin cans, as they are nothing more than sheet iron with a thin coat of tin over

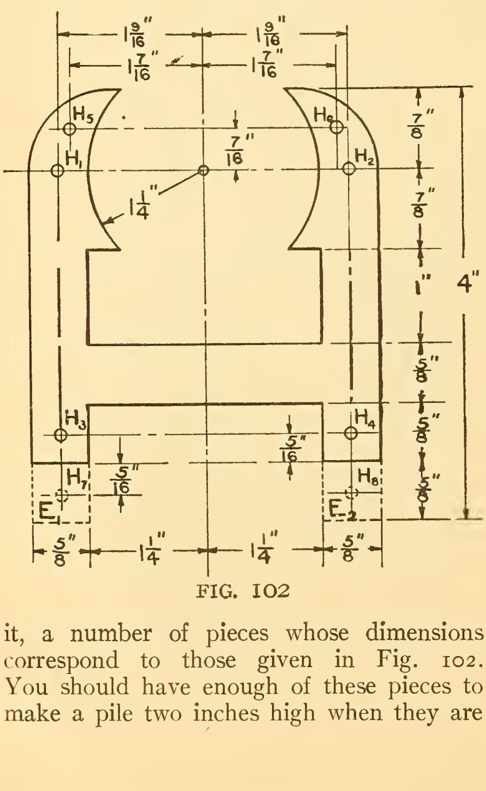


FIG. 102

it, a number of pieces whose dimensions correspond to those given in Fig. 102. You should have enough of these pieces to make a pile two inches high when they are placed on top of each other and firmly clamped. Drill six 1-8-inch holes in each of these pieces as shown at (H1), (H2), (H3), (H4), (H5), and (H6). These holes are to be used in clamping the various pieces of iron together as follows: Cut from some heavy sheet iron two pieces whose dimensions are identical to those given in Fig. 102 with the exception that they are $\frac{5}{8}$ inch longer than the other iron pieces as shown by the dotted lines. These pieces should each have holes drilled in them to correspond to those drilled in the thinner pieces, and in addition two $\frac{1}{8}$-inch holes (H7) and (H8) to be used in mounting the motor. Now bend the lower ends (E1) and (E2) over at right angles and you are ready to assemble the frame. Obtain six $\frac{1}{8}$-inch bolts, four $2\frac{1}{4}$ inches long and two $2\frac{1}{2}$ inches long. Put the four shorter bolts through the holes (H3), (H4), (H5), and (H6), in one of the thick pieces of iron with the heads on the same side as the projections (E1) and (E2). Lay this piece on a board with the heads on the underside and place the thin sheets of iron over the bolts, one at a time. Examine each of these pieces to see that its dimensions correspond to the one just below it. You will find the work in cutting these pieces out greatly simplified if you first cut out one of the heavy pieces and use it as a pattern in cutting the remaining ones. This suggestion should be used in drilling the holes, if not in cutting out the pieces, as these holes must all be in line when the pieces are in a pile. When all of the thin sheets are in place the remaining heavy one can be put on and the bolts drawn up. You may have to use a vice or clamp of some kind in forcing the last few pieces down on the bolts, due to their spring, unless they are perfectly flat.

The armature of the motor is to be built up in the same say. Cut from some thin iron the same number of pieces you cut for the field, whose dimensions correspond to those given in Fig. 103. Drill a $\frac{1}{4}$-inch hole in the center of each of these pieces and three 3-64-inch holes (H1), (H2), and (H3), one in each projecting arm. Cut two pieces from heavy iron to the same dimensions and file a small groove in one side of the hole in the center of them as shown by the dotted lines. These pieces should now all be fastened together by means of three rivets passing through the holes in the projecting arms.

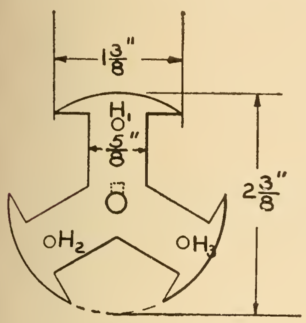


FIG. 103

The shaft that is to support this armature should be made from some $\frac{1}{4}$-inch iron rod, or brass will do, but it is not so good as the iron. Take a piece $4\frac{1}{2}$ inches long and turn down each end to a diameter of $\frac{1}{8}$ inch, as shown in Fig. 104. Now thread the ends of the larger part of the shaft, to take a small $\frac{1}{8}$-inch nut, to a distance of $1\frac{1}{8}$ inches on one end and $\frac{5}{8}$ inch on the other end. Slip the armature core on the shaft and mark the shaft where the grooves in the end pieces of the core come and then drill two $\frac{1}{8}$-inch holes about half way through the shaft. Place a small pin in one of these holes, then put the core in place and the second pin can then be put in its hole. The nuts on the end of the shaft should now be drawn up and the core will be held rigidly to the shaft. The core should be $1\frac{3}{4}$ inches from one end of the shaft and $\frac{3}{4}$ inch from the other end.

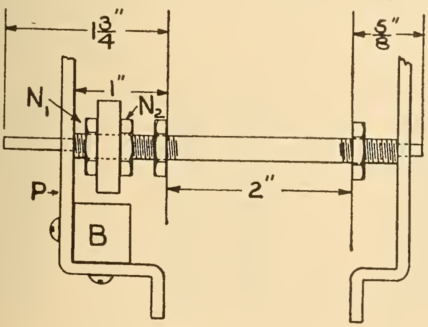


FIG. 104

The bearings for this shaft and armature are shown in Fig. 105. Cut from some $\frac{1}{8}$-inch sheet brass two pieces about six inches long and bend them into the forms shown at (A) and (B). Drill six $\frac{1}{8}$-inch holes in these pieces as shown at (H1), (H2), (H3), (H4), (H5), and (H6). The two holes (H3) and (H4) are to carry the armature shaft, while the remaining ones are to be used in mounting the pieces on the frame of the machine shown in Fig. 102. The two long $\frac{1}{8}$-inch brass bolts can be used in holding these pieces in place with the bolts through the holes (H1) and (H2).

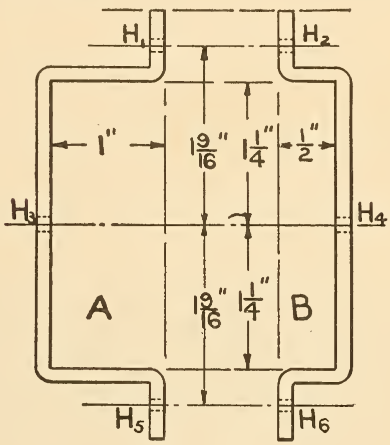


FIG. 105

Before the last support is put in place put the armature in position and then fasten the supports rigidly. The armature should revolve clear of the frame provided the construction of the various parts has been properly taken care of.

Assuming the armature and field work as they should you can now take up the construction of the brushes and commutator. Turn from a piece of $\frac{1}{4}$-inch hardwood a piece one inch in diameter. Now cut from some 1-16-inch brass a piece whose dimensions correspond to those given in Fig. 106. This piece can now be bent around the edge of the wooden disk and the projecting arms (A1), (A2), etc., bent down along the side and fastened to the disk with small screws or brads through the holes in them. The arms (C1), (C2), and (C3) should not be bent down, as they are to be used in connecting the armature winding to the commutator. After the brass has been fastened in place saw it into three equal pieces. The space separating the pieces should be about 1-16 inch. Drill a $\frac{1}{4}$-inch hole in the center of the disk and slip it in place on the shaft

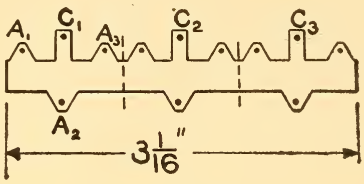


FIG. 106

as shown in Fig. 104, fastening it with two lock nuts.

The brushes should be mounted on a wooden block $\frac{5}{8}$ inch square and $1\frac{1}{8}$ inches long. This block should be fastened in the corner of the support (P), Fig. 104, with two brass screws that pass through the support and into the block. Cut from some 1-16-inch spring brass two pieces whose dimensions correspond to those given at (A), Fig. 107, and bend them into the form shown at (B). These two pieces should now be mounted on the opposite ends of the wooden block with binding posts that have a small wooden screw in them.

The motor is now complete with the exception of the winding. Wind on each leg of the armature in regular order about 80 turns of No. 20 double cotton covered copper wire. These legs should all be wound in the same direction and the inside end of one winding connected to the outside end of the next. This connection can be made at the commutator segments. Insulate the core well with some paper before you attempt to wind it. The field should be wound with about $\frac{1}{2}$ pound of No. 18 B. and S. gauge, double cotton-covered, copper wire. Insulate the core well before winding and cover the completed winding with tape. One end of this winding should be connected to the lower brush and the other end to a binding post mounted on the wooden base for your motor. A second binding post on the base should be connected to the upper brush.

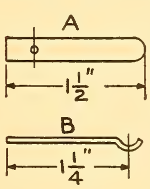


FIG. 107

A small metal or wooden pulley can be made and fastened to the projecting end of the shaft.

A few cells of battery will be ample to run this motor at a good speed and its operation will be found to be very satisfactory.

(To be concluded)

A Step Down Transformer

Those who wish to use a heavy low-voltage alternating current can accomplish this by constructing a step down transformer.

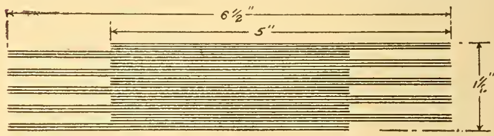


FIG. 1. MANNER OF BUILDING UP THE CORES

It is made from material readily procured without much expense.

Cut from the softest sheet iron, as thin as possible, strips $1\frac{1}{2}$x$3\frac{1}{4}$ inches sufficient to

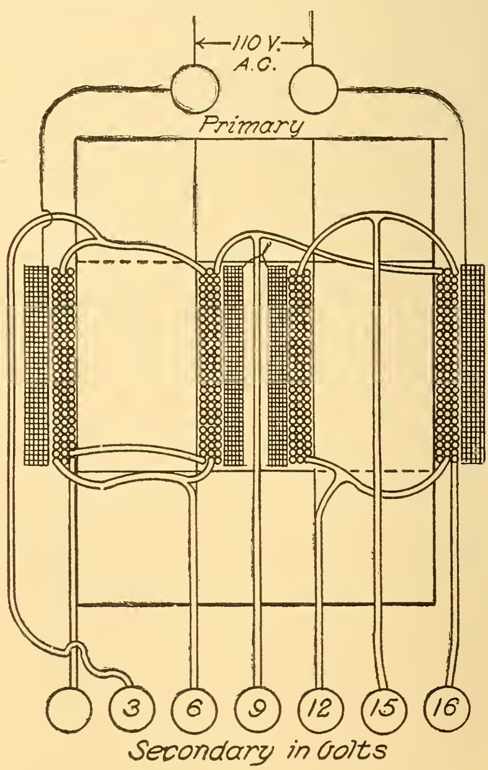


FIG. 2. HOW THE COILS ARE WOUND

make a mass three inches thick, and also more strips 1½x5 inches and sufficient to make a mass three inches thick.

Of the five-inch strips build two cores in the manner shown in Fig. 1.

When assembled clamp tightly in a vise and wrap with at least three layers of good friction tape.

Wrap each core very evenly with three layers or 2¼ pounds of No. 12 double cotton covered copper wire, 25 turns to the layer.

At the end of each layer make a tap to the binding posts as follows: The wire at the start is connected to the post not marked in Fig. 2, the end of the first layer to post marked (3) and the next layer to post marked (6), and so on consecutively.

The wire should be in one continuous piece, tappings being made to the binding posts.

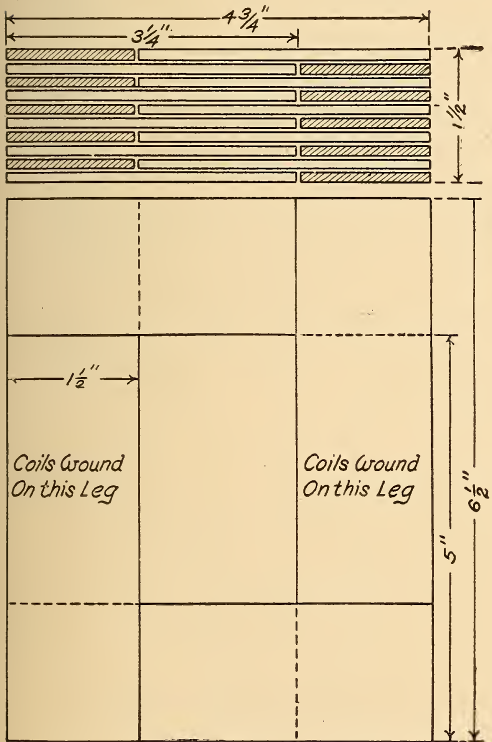


FIG. 3. METHOD OF ASSEMBLING THE CORE

Observe the direction of the winding so that it will be correct (Fig. 2).

Now over the heavy wire on each core wind six layers or 1½ pounds of No. 22 single cotton covered copper wire, 67 turns to each layer, a good bond paper being used between each layer and also between them and the heavy wire. The last layer should then be shellaced with orange shellac.

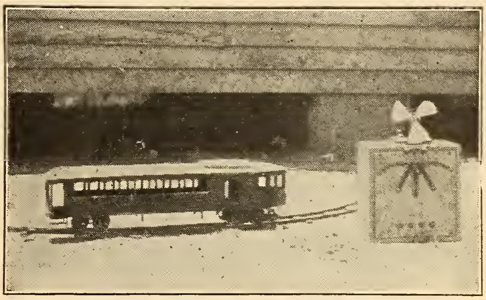
The core as seen in Fig. 1 is built up in groups of three sheets, although it is not essential, but more convenient and quicker.

Place the 3¼ inch strips in the spaces left on the two core pieces forming the rectangle shown in Fig. 3.

Across the ends of the rectangle place binding boards six inches long and 1½ inches wide by ¾ inch thick. Four of these are used, two on each end. Bolts are used to clamp them together.

Miniature Car and Controller

The accompanying picture is from a photograph of a miniature car and controller built by J. M. Ravenna of Houston, Tex. The car is built for a track of two-inch gauge, and the current which operates it is delivered at a pressure of ten to twelve



MINIATURE ELECTRIC CAR AND CONTROLLER

volts. The axles are insulated in the wheels and the motor takes its current from three brushes on the wheels. By the use of the rheostat and transformer shown at the right it is possible to get current from the lighting circuit at anywhere from two to 60 volts.

Solder for Aluminum

This formula for soldering aluminum has been found to be a very good one: Take an alloy composed of 6 parts of aluminum, 2 parts of zinc and 4 parts of phosphor tin. stearic acid is used as a flux, and the sluggish solder is pushed along the seams by means of an iron wire.

POPULAR ELECTRICITY WIRELESS CLUB

Membership in Popular Electricity Wireless Club is made up of readers of this magazine who have constructed or are operating wireless apparatus or systems. Membership blanks will be sent upon request. This department of the magazine will be devoted to the interests of the Club, and members are invited to assist in making it as valuable and interesting as possible, by sending in descriptions and photographs of their equipments.

A High-Power Wireless Equipment

By ALFRED P. MORGAN

CHAPTER VII.—HOT-WIRE AMMETER

Some means must be employed to determine when the current flowing out through the aerial is at a maximum. Advantage is taken of an instrument called a hot-wire ammeter which depends for its operation upon the expansion of a conductor when heated by a passing current of electricity.

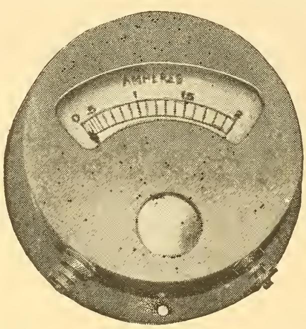


FIG. 77. HOT-WIRE AMMETER

Fig. 77 is from a photograph of a hot-wire ammeter for measuring high frequency currents. A short length of platinum iridium wire or an alloy known as platinoid is stretched tightly between two posts so arranged that practically all the current surging through the aerial passes through the wire and generates heat in proportion to the amount of current flowing. The heat expands the wire and causes it to become slack. The wire is connected to a silk thread which passes around a spindle bearing a pointer at its upper end. A spring is placed on the spindle to draw the silk thread taut. When the tension of the silk thread is relaxed through the expansion of the wire, the tension of the spring turns the spindle and moves the pointer across the scale.

Figures 78, 79 and 80 are detailed drawings of the case of the instrument. The base is a circular brass casting five inches in diameter and 1-16 of an inch thick. A ring, four inches in diameter and $\frac{1}{4}$ inch thick, is cast on the base to furnish support for the side. The two small raised portions (RR) are about $\frac{1}{8}$ inch high and are for the purpose

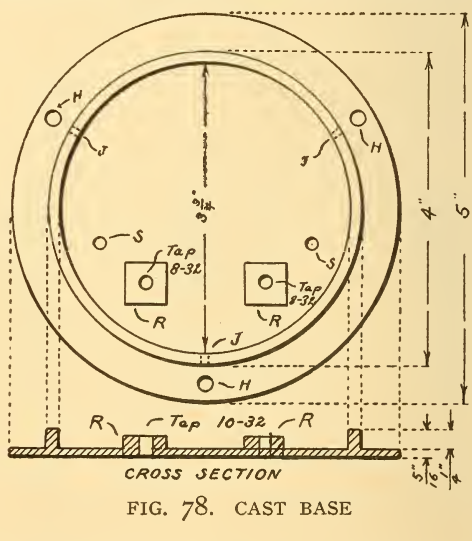


FIG. 78. CAST BASE

of raising the working parts of the instrument clear from the base. The holes in the centre are threaded with an 8-32 tap. The holes (SS) serve to fasten the dial supports to the base. The meter may be mounted on a switchboard if three holes (HHH) are bored equidistantly around the rim. The small holes (JJJ) bored in the ring immediately opposite (HHH) are threaded with a 4-36 tap to receive the screws which hold the case together.

The sides of the case are formed by a circular piece of brass tubing four inches in diameter and $1\frac{1}{2}$ inches high.

The cover is a casting somewhat similar to the base in that it has a similar ring of

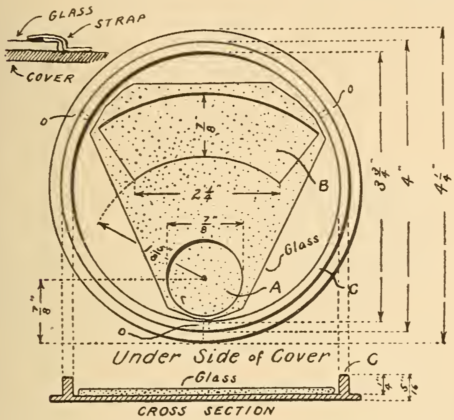


FIG. 79. DETAILS OF COVER

the same diameter. A long curved opening $\frac{7}{8}$ inch wide is cut out in the position indicated in Fig. 79 so that the graduations on the scale may be seen. A circular opening $\frac{7}{8}$ inch in diameter immediately above the hairspring adds considerably to the appearance of the instrument but is of no real value. Three small holes (OOO) are bored in the ring and threaded with a 4-36 tap immediately opposite those in the side of the case near the upper edge so that the cover can be fastened firmly in position by means of three small screws.

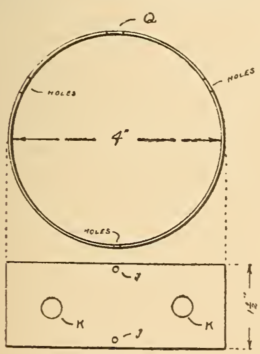


FIG. 80. CASE

A triangular shaped piece of glass is fastened to the under side of the cover below the openings so as to exclude dust and prevent injury to the working parts. It is held in place by three strips of copper soldered to the under side of the cover and then bent down against the glass. A few dabs of sealing wax or jeweler's cement judiciously placed will prevent the glass from rattling.

A top view of the working parts of the instrument is shown in Fig. 81. The body is made up of two brass castings (E) and

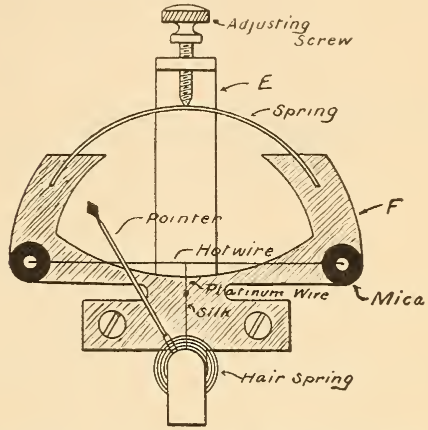


FIG. 81. TOP VIEW OF WORKING PARTS

(F). It is not necessary, however, that these parts shall be castings, and if desirable they may be cut out of sheet brass and bent. The details and dimensions of (F) are clearly understood from Fig. 82. Two

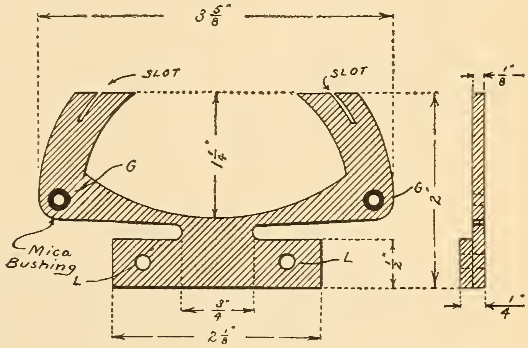


FIG. 82. DETAILS OF CASTING

slots are cut with a hacksaw into the arms of the casting to permit the insertion of a piece of flat steel clock spring. The two holes (GG) provide for the support of the pillars (RR) to which the "hot wire" is fastened. The other two holes (LL) permit two screws to pass through and clamp the casting to the base.

The hot wire is a piece of No. 28 B. & S. gauge platinum iridium wire or platinoid about $3\frac{1}{4}$ inches long. It is stretched tightly between the two pillars (RR) and soldered. The pillars (Figs. 81 and 83) are two 8-32 round headed brass machine screws ⅝ inch long under the head. The threads are cut off for a distance of 5-16 inch on each. Some mica washers ½ inch in diameter are placed over each of the pillars which are

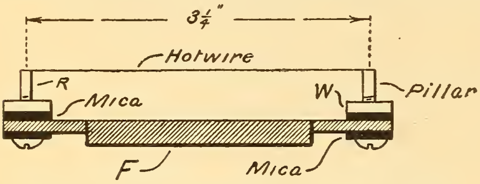


FIG. 83. ARRANGEMENT OF HOT WIRE

then slipped into the holes (GG) in the casting (F). The holes (GG) are lined with mica bushings which insulate the pillars. More mica washers are placed around the pillars between the casting and the threaded washer (W) which may then be screwed down tight.

A piece of fine platinum wire (No. 36 B. & S. gauge) is fastened to the centre of the wire and connected to a silk thread.

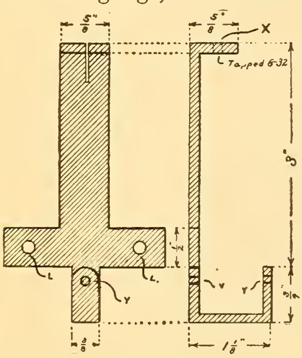


FIG. 84. DETAILS OF CASTING "E"

In case it is desirable to make the range of the instrument greater and increase the reading do not use wire larger than No. 28 B. & S. gauge or the resistance offered to high frequency currents will be greater than the resistance of the same wire to continuous currents and it will be difficult accurately to calibrate the scale. Instead of a single wire of large diameter use a number of fine wires in parallel.

The brass casting (E) (Figs. 81 and 84) is 3⅝ inches long and 2⅛ inches wide at the widest point. The holes (YY) are bored and threaded to receive two small bearing screws having a conical depression bored in the end of each to receive the tapered ends of the shaft or spindle.

The hole (X) is threaded to receive a thumb screw (T). A piece of flat steel spring is fitted into the slots in the ends of the casting (F). The thumb screw presses against the centre of the spring which in turn varies the distance between the ends of the casting where the hot wire is supported by the pillars. When the thumbscrew is turned so as to increase the tension of the spring the ends of the latter press on the casting and force them apart. Vice versa, when the tension is relaxed the ends of the casting are brought closer together. Thus the tension of the hot wire may be varied at will and any expansion or con-

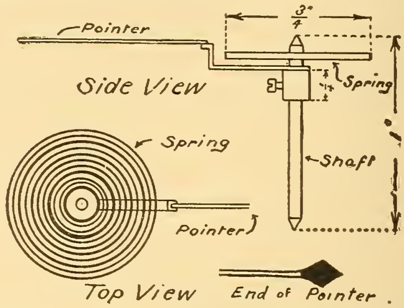


FIG. 85. DETAILS OF HAIRSPRING. ETC.

traction due to atmospheric temperature changes provided for.

The details of the moving parts are shown in Fig. 85. The hairspring is ¾ inch in diameter and must be powerful enough to keep the thread and wire perfectly tight. The spring is mounted on the upper end of a spindle one inch long. The ends of the spindle are pointed so as to reduce friction as much as possible. The pointer is a piece of No. 22 B. & S. gauge aluminum wire having one end flattened and shaped like an arrow head. The top side of the pointer near the end is blackened so that it will contrast with the white paper scale and may be easily seen. The pointer is held in position by riveting to a small brass strap carried on the spindle. The outside end of the hairspring is soldered to a small pin on the casting at the point (Z). The strap to which the aluminum pointer is riveted is carried by a brass collar fitting around the spindle and held in position by a small set screw. The pointer may thereby be moved and set at any position on the scale to one side of centre where it may be desirable to have zero. The silk thread connecting with the hot wire is wrapped once or twice around the scale and fastened to the set screw. The parts should move easily and without friction.

The dial is formed by a piece of linen paper pasted on a piece of No. 22 B. & S.

gauge sheet brass cut to the dimensions and shape indicated in Fig. 86. The dial is supported on two brass pillars (P) (Fig. 86) ¼ inch in diameter and 1¼ inches long. The ends are bored out and threaded with a 4-36 tap. The lower ends are fastened to the base by means of two screws passing through the holes (SS), Fig. 78. The scale is fastened to the pillars by two 4-36 round-headed brass machine screws passing through the holes (M) and (N), Fig. 87.

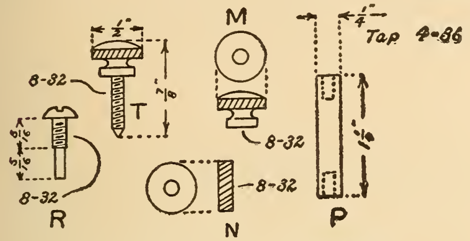


FIG. 86. DETAILS OF PARTS

The binding posts are illustrated in Fig. 86. The screws pass through the holes (KK) in the side of the case (see Fig. 80). The posts must be very carefully and thoroughly insulated from the case of the instrument by means of mica washers and bushings. A flexible stranded wire is soldered to each of the binding post screws and then led to the ends of the hot wire, where it is soldered to the washer (W).

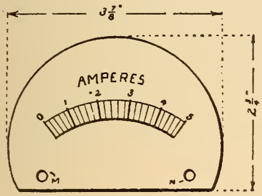


FIG. 87. DIAL

Before putting on the cover and fastening it in position it is necessary to graduate or calibrate the scale. This is accomplished by connecting the meter in series with a rheostat and another instrument which is a standard or has previously been calibrated. By sending a current through the meters the value can be determined by reading the standard and marking the divisions on the other with a pen and ink.

The scale may be given almost any desired range by placing shunts in parallel with the hot wire. For instance, the meter without any shunt has a range of only one ampere. That is, a current of one ampere passed through the meter will move the needle all the way across the scale. The meter should, however, have a range of at least five amperes since it is to be used in tuning the station under description. This is accomplished by coiling up some No. 20 B. & S. gauge enameled wire around a pencil to form a sort of spring. This is placed in parallel with the hot wire by connecting to the washers (W). The amount of wire is regulated until it takes about five amperes to move the needle all the way across the scale. Then solder the wire to the washers so as to make the connections permanent. Fig. 88, which is from a photograph of the parts of the instrument, shows the shunt very plainly. Fig. 89 shows a side view of the movement.

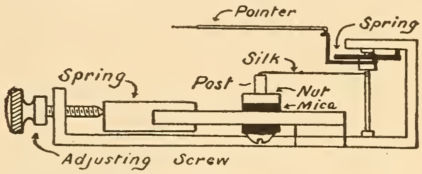


FIG. 89. SIDE VIEW OF MOVEMENT

The case of the instrument may be finished by polishing and lacquering or by oxidizing.

Fig. 90 shows the position of the hot wire ammeter in the circuit. To adjust the circuits, set both of the movable helix clips (A) and (B) on a turn of wire near the centre of the helix. Press the key and watch the needle on the meter. It will probably move very slightly. Then move both contacts together to a new spot, press the key and watch the meter. After trying the various turns of wire fasten the contact (A) at the spot which gives the highest reading on the meter and move the contact (B) alone until the reading is still higher and the

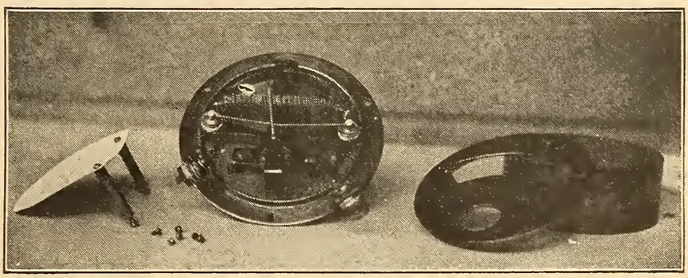


FIG. 88. HOT-WIRE AMMETER DISSECTED

maximum amount of current is shown to be passing out through the aerial. The circuits are now in tune with the exception of the spark gap which may need some adjustment. The proper gap length will readily be shown on the meter.

Unless the shunt on a hot-wire ammeter is fairly heavy it is not advisable to leave it continuously in circuit. Such is the case in this instance.

After once adjusting the circuits do not alter the amount of condenser capacity or

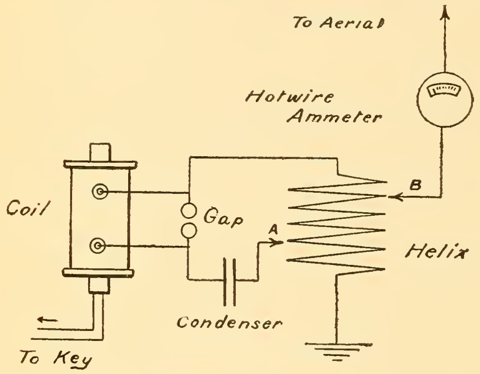


FIG. 90. CIRCUIT

the length of the leads, etc., without returning.

[Note: My attention has been called to an apparent error in Part III, describing the construction of the induction coil secondary. In the text it is stated that "about fifteen pounds of No. 28 B. & S. gauge silk covered wire is required to wind the 50 sections." By calculating the space to be occupied by the wire it would appear that very much more than fifteen pounds of the wire would go in the space. But I have taken the coil, which was used as the basis of my figures, apart and find that the secondary, with the separators and wax weighs 26½ pounds. It is very probable that the separators and wax weigh 11½ pounds, so that the actual weight of the wire is about 15 pounds, as my notes show; although it was about three years ago that I wound this particular coil. I find also that in making the coil I placed a blotting paper separator next to each flange, which cut the apparent space in half. Also the wire, being passed through an impregnating bath, is heavily coated with wax, so that in actual practice much less wire could be wound in a given space than theoretically would go in.—Author.]

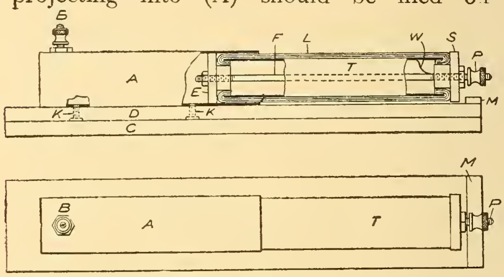
(To be continued.)

High Tension Variable Condenser

By A. B. COLE

It is well known that the proper capacity is essential in obtaining the highest efficiency from a given transmitting outfit, and it is practically impossible to vary capacity gradually with the ordinary types of condensers. The writer has therefore designed a variable high tension condenser suitable for sets from the smallest up to those using a two-inch spark coil. This form of condenser may be employed in stations of higher ratings by increasing the thickness of the insulating material, and increasing the length and cross section of the tubing.

The base of the condenser is made of wood, fibre or hard rubber, and is composed of two pieces (C) and (D), each 13 by 2½ by ⅜ inches. A square brass tube (A), 6 by 1½ inches (outside measurement) by 1-16 inch thick, which can be supplied by large hardware houses, is fastened to (D) by two 8-32 screws (K), which pass through threaded holes in (A). The ends of (K) projecting into (A) should be filed off



HIGH TENSION VARIABLE CONDENSER

flush as shown in the figure. The screws of ordinary dry battery binding posts may be used for this purpose. The lower base (C) may then be nailed or screwed to upper base (D). A double base of this kind is employed so that there will be no opportunity for the high tension currents to pass from (K) to any material upon which the condenser may rest.

Another dry battery binding post (B) is soldered to (A) as shown in the figure.

(T) is a square brass tube 6 by 1⅛ inches (outside) by 1-16 inch thick. Eight layers of Empire cloth, sometimes called "oiled muslin," are wound tightly around this tube, and the ends are pushed into the ends of the tube. The Empire cloth should be procured in one piece 1-64 inch thick, seven inches wide, and 42 inches long. (E) is a wood, fibre, or hard rubber block, $1\frac{1}{8}$ inches square, with a square projection $\frac{5}{8}$ inch square and $\frac{3}{4}$ inch long, which fits into (T) over the Empire cloth which has been bent in. (S) is a block similar to (E). A round brass rod (F) passes through a hole in the center of (E) and of (S). This rod is threaded at each end, 8-32. At (E) a nut from a dry battery binding post is screwed on (F). One end of a short wire (W) is soldered inside (T), the other end being soldered to (F). This wire connects electrically (T) and (F). A binding post (P), screwed on (F), clamps blocks (E) and (S) so that the Empire cloth cannot move along (T), and also serves as a binding post to which a wire may be connected, so that a circuit may be made from the transmitting apparatus to (F), and from (F) to (T) through wire (W). A wood strip (M) prevents (T) from being entirely withdrawn from (A).

When (T) is entirely within tube (A) the condenser has a maximum capacity, and when withdrawn entirely from (A) the capacity is zero. At any intermediate point the capacity is directly proportional to the distance (T) has moved from the zero position. The spark gap should never be more than one inch long when this condenser is connected, as the high voltage of a longer gap might break down the resistance of the Empire cloth. Since, however, the gap should always be shorter than this in small stations, the above is not a disadvantage.

Wireless Messages at Chickamauga

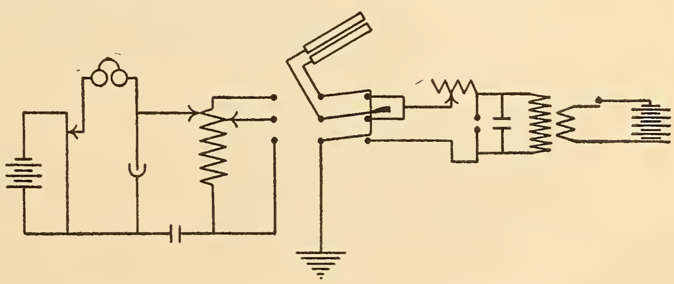
Times have changed at Chattanooga since the days of Grant, Sherman, and Fighting Joe Hooker. Where forty-seven years ago messengers picked their way carefully from hill to hill at the very peril of their lives, today wireless messages are flashed over historic valleys while war maneuvres are at their height. The July encampment of soldiers from several southern states who gathered at Chickamauga, was marked by many brilliant movements, the combined success of which depended in no small degree on the efficiency of the wireless apparatus. The illustration shows a wireless squad of today at work on the historic battlefield. The receiving instruments are contained in a compact case and the aerial is a portable one.

A WIRELESS SQUAD AT WORK DURING THE CHICKAMAUGA MANEUVRES

Anchor Gaps and Sending

Many wireless amateurs use the looped aerial with good results in receiving, but find it not satisfactory in the matter of sending on account of the anchor gap. I use the following connections to eliminate this gap and still keep the looped aerial. A three-pole double-throw switch is attached to the aerial as shown.

—B. FRANCIS DASHIELL.



CONNECTIONS OF RECEIVING INSTRUMENTS

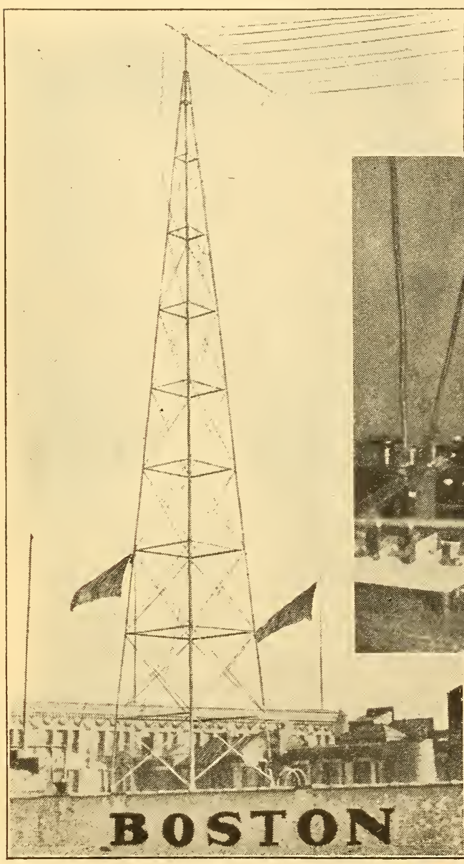
Wireless in Modern Journalism

By C. B. EDWARDS

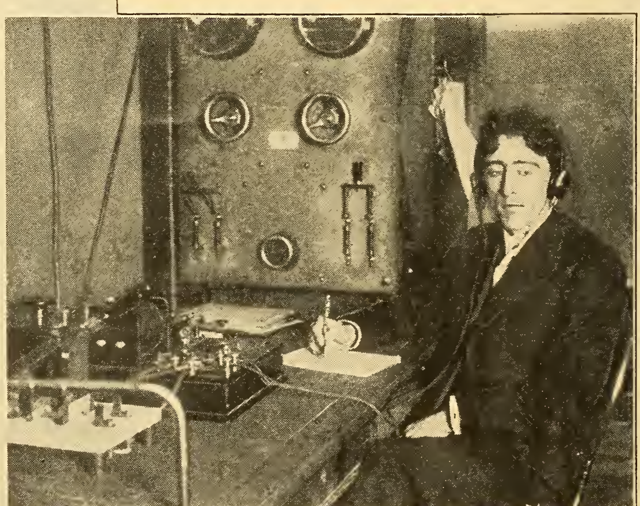
The Boston Herald was the first newspaper in New England to install wireless telegraph apparatus for use in connection with its news gathering service. This innovation in modern journalism was first adopted by the Herald in May, 1909, and quickly developed into one of the most useful features of the publication. Recently, in order to widen the range of the service, the instruments were removed from the rear or mechanical building of the Herald's plant into the front or business building, the height of the tower increased to 97 feet and the transmitting apparatus given two kilowatt strength, resulting in a marked extension of the range of the plant's activities.

With the new apparatus it is possible for the Herald operator to send and receive messages over distances as great as two thousand miles under the most favorable conditions. The Isthmus of Panama is within the sweep of the powerful waves of ether, and all shipping within 1,000 miles of the station, if equipped with the apparatus for sending wireless waves, can communicate with the Herald's operator. Cold winter nights present the best conditions for extreme distance work, and as a general rule the results in the night time are better than in the day time. In conjunction with the more than 500 existing wireless stations the Herald's plant has direct or indirect connection with the whole world. In straight lines or zigzags, from Cape Cod to Poldu, in Cornwall, England; from Scandinavia to Zanzibar; from India to China and Australia, and thence to Japan, Hawaii and California, the wireless waves can encircle the planet. About 120 transatlantic ships carry the wireless equipment and fully 350 ships of the mercantile marine are similarly equipped.

In the Herald apparatus, the highest possible degree of electrical output and receptivity is accomplished by means of



BOSTON HERALD'S WIRELESS ANTENNA


BOSTON HERALD OPERATOR AT STATION

T-shaped antennæ 220 feet long erected on the top of the Herald building. When these antennæ are charged with high voltage current the impulses strike the ether into vibratory waves which, varying from 100 yards to about six miles in length, which rush out, expanding as they go, at the rate of 186,000 miles a second—the speed of light itself. The tremors produced are practically simultaneous everywhere as hemispheric waves. If enough energy could be used a wireless impulse from the Herald would reach Newfoundland, and Bermuda about the same instant, 1-270th of a second after it was emitted. Cuba and the coast of Greenland would be reached about 2-270ths of a second from the time the operator discharged the current. England, Alaska, the Pacific Coast, Norway, France, Spain, Morocco and the coast of Brazil would receive the impulse 4-270ths of a second after it was given, and in double that period it would be received in Japan, Thibet, Persia, Egypt, the Gold Coast, Argentina and Peru. In 1-30th of a second the energy would travel from Boston to the Equator.

The receiving apparatus has been improved upon greatly in the recent changes made in the Herald's plant, especially in connection with the detector. In the most sensitive receiver known, advantage has been taken of the fact that the arriving ether waves can be made to break down the polarization in a tiny electrolytic cell as they pass through it, and thus increase its conductivity, which falls to normal when there is an intermission in the wireless pulses. The receiver includes a cell, shaped like a diminutive glass tumbler, half-filled with dilute acid. Two exceedingly fine, glass-coated platinum wires, in contact with the solution at their extremities, dip into the cell. The fluid between them forms part of a local circuit in which a telephone is included. A feeble battery current is kept moving through the circuit, but as the current is steady, the telephone gives no sound. When a wireless wave strikes the antennæ, its oscillating current passes through the receiver and breaks down the polarization between the ends of the platinum wire, increasing the conductivity, allowing the flow of an increased amount of current through the local circuit and reproducing the sound in the telephone.

The Herald operators use both the American and Continental Morse codes. The American code is shorter in sending English by about five per cent, but the difference in speed does not seem to some operators a perceptible factor. American coastwise steamers use the American code; transatlantic ships use the Continental code. It is impossible for operators acquainted with only one of the codes to receive messages in the other.

There are three operators in the Herald's wireless room. The first reports for duty at six a. m. and remains at his table until two p. m. The second man then takes charge of the instruments and remains until midnight. After that one of the Herald's regular telegraphers handles the wireless instruments until four a. m., after which the room is closed until six a. m. The first duty of the operator is to put on his telephones, open his switch and listen for calls. Maybe he will hear a fruit steamer calling for Manhattan Beach, or a transatlantic liner striving to get into communication with Sandy Hook, or a battleship coding a message to Charlestown Navy yard. Or maybe the first interruption to the silence will be from some Back Bay amateur. By and by, when the call for "B. H." comes, the operator is all attention, as that is the wireless code address of the Boston Herald. About the middle of the afternoon ships begin to report, and with these the operator is busily engaged a large part of his time.

When the baseball season is well under way, every steamer within hailing distance of the Herald office wants the baseball scores. On board the battleships, especially, is there great interest in this feature of the daily news and eager queries from the jackies are received by the Herald's operator within a quarter of an hour after the games are concluded.

Some idea of the wide range covered by the Herald's wireless service may be obtained by a half hour's stay in the room with the operator. One moment the operator is carrying on a conversation with a Hamburg American steamer bound south from New York to Kingston; later a string of messages may come from a Savannah Line steamer; then may follow communications from boats of the Eastern steamship line or from the oil steamers or the boats of the American Mail Company. A short time ago the Herald operator got into communication with the Scandinavian American line steamer Heligolav, 800 miles at sea. Early afternoon reports are received from steamers leaving

Boston Harbor and constant communication is maintained with the steamers between New York and Portland. In the summer season the steamers Harvard and Yale between New York and Boston have had continual wireless communication with the Herald.

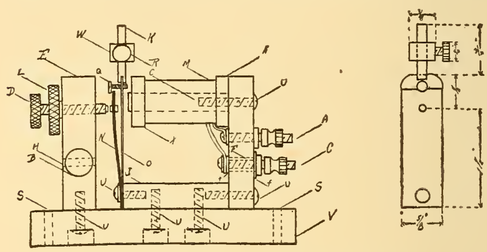
Between Boston, Providence and New York the number of wireless messages is constantly increasing. The great advantage of wireless communication between Boston and New York was picturesquely shown during the great blizzards of Christmas and mid-January. With miles of wires down in every direction and the utmost difficulty being experienced in handling telegraphic business by the old methods, the Herald operators quadrupled their daily quantity of messages and experienced no trouble in maintaining uninterrupted communication between the two cities.

In so far as possible the operator works directly with points for which he has messages. If, for instance, he receives a message addressed to a steamer off Cape Hatteras, he arranges the selectivity of his apparatus and then sends off into the air a 60,000 volt call. If he has a fairly good idea of the location of the desired steamer, he generally has little difficulty in reaching her within a few minutes. His apparatus is so delicately adjusted that he can practically make certain of his direction without resorting to many preliminaries. As soon as he receives the steamer's acknowledgement he proceeds to send the message. A system of relays is used for points beyond the practical and usual range of the Herald's plant. Messages for Kingston, Jamaica, for instance, are sent to the United Wireless station at Cape Hatteras, thence relayed to Tampa and from that point to Kingston. Notice of the arrival of such a message at its destination is usually received within fifteen minutes from the time it is sent.

The greatest long distance record made by the Herald's wireless apparatus is described in the February "log." About three a. m., on the 14th of February, Operator Brown, after arranging the "selectivity" with especial regard for long distance, was amazed to find himself listening to the dot and dash call of the station at San Juan, Porto Rico. For a quarter of an hour or more he had no difficulty in deciphering the words. With the approach of dawn the sounds became faint and finally ceased.

An Independent Interrupter

It is often desirable to have the coil of a wireless outfit at some distance from the key which controls it, and as the interrupter should be readily accessible for adjustment at all times, an independent interrupter, which takes up little space, and can therefore be placed near the key, is a very useful part of a wireless equipment. Small spark coils, as furnished by the manufacturers, have the distinctive interrupters of the makers, and all these have one fixed speed of vibration, and adjustment for high



INDEPENDENT INTERRUPTER

or low notes is almost impossible. The interrupter described in the present article may be adjusted for all speeds within wide ranges, and so will prove very satisfactory to owners of coils who wish to experiment with various frequencies.

The base (V) may be made of wood, hard rubber, slate or marble. Slate answers the purpose well, and is easily worked with the tools at the disposal of the average experimenter. (V) is four inches long by 2½ inches wide by ½ inch thick. The standard (E), which is made from brass rod, ½ inch square and two inches long, holds the adjusting screw (D). The center of the hole for the adjusting screw is 1½ inches from the lower end. This hole, which is ⅛ inch in diameter, is tapped with an 8-40 thread. The hole (H) may be drilled at any convenient place. Set screw (B) is arranged to clamp a wire in (H), and has an 8-32 thread. (J) is of brass, ⅜ inch square, and supports the vibrator springs, (N) and (O), and also the brass upright, ⅜ inch square, which in turn supports electromagnet (M). The 8-32 machine screws (U) hold the various parts together as shown in the drawing.

The core (C) of electromagnet (M) is ¼ inch in diameter, and 1½ inches long, and is tapped with an 8-32 thread, at one end to hold screw (U). (C) is made of soft iron, and may be made from the core of an old electromagnet. The heads, (X), of (M) are of fibre, 3-16 inch thick, and ¾ inch in diameter. (M) is wound with two layers of No. 14 D. C. C. magnet wire. One end of this winding leads to binding post (A), which is connected to the brass upright, and the other end leads to binding post (C), which is insulated from this upright by means of the fibre tube (F) and the fibre washers (f). Both (A) and (C) are binding posts from the carbon terminals of old dry batteries, and have an 8-32 thread.

The vibrator consists of two springs (N) and (O), each having a thickness of about 1-32 inch. (O) is made of steel or iron, and (N) is of brass. A small machine screw (Q) is set 3-16 inch from the end of (O). This screw has a 2-56 thread. An aluminum weight (W), provided with a set screw (R), is supported by a brass rod (K), ⅛ inch in diameter, which is soldered to (O). The dimensions of the weight and rod are given in the drawing at the right of that of the interrupter. The contact points of the adjusting screw (D) and the spring (N) are of platinum or better, platinum-iridium, 3-32 inch in diameter. The points should be bought, already fastened to these parts, from a dealer in platinum. (D) is provided with a lock nut (L) as shown. (L) is about ¾ inch in diameter. The thread of (D) is 8-40. The holes (S) are for screws to hold the interrupter to the table or box on which it may be mounted.

When in operation the wire from the battery is connected to (E) at (H), and (C) is connected to one terminal of the primary winding of the coil. The regular interrupter of the coil is, of course, screwed down tight, so that it will not operate. A condenser of the same capacity as that of the coil is connected to (H) and (C).

When the key is depressed, the battery current flows from (H) across the contact points, down (N), around (J) to (A), and from (A) through electromagnet (M), back to (C), and from (C) to the coil. The passage of the current through (M) magnetizes core (C), which draws (O) toward (M). Screw (Q) strikes (N), and draws (N) away from the contact point of (D), thereby breaking the circuit. Breaking the circuit demagnetizes (M), and (O) and (N) return to their former positions, and the circuit is again completed. The same action continues as long as the key remains depressed.

The speed at which the interrupter will break the circuit may be regulated by moving (W) up or down rod (K). The duration of the contact between (N) and (D) depends on the length of the screw between (O) and (N). Thus by screwing (Q) down quite tight, a very short duration of contact may be obtained.

This interrupter will give a very wide range of adjustment, and will be found to be a desirable instrument in many experiments. It is suitable for use with coils from one-inch spark to four-inch spark.

WIRELESS QUERIES

Answered by A. B. Cole

Questions sent in to this department must comply with the same requirements that are specified in the case of the questions and answers on general electrical subjects. See "Questions and Answers" department.

One Mile Equipment

Questions.—(A) Would an ordinary telephone receiver work all right up to a distance of one mile? If so, what kind of detector would work best? (B) Could I string my aerial in the garret of my home, which is 24 feet long and 25 feet high, and get good results up to one mile? How many strands should I have for a one-inch coil, and what type should I use? (C) Which is the best way to connect the following instruments: one-inch coil, sending helix, spark gap, sending condenser, variable condenser, fixed condenser, single slide tuning coil, potentiometer, electrolytic detector, microphone detector, telephone.—G. C., Waukon, Ia.

Answers.—(A) An ordinary telephone receiver will work very satisfactorily to receive up to one mile from even a small station. We recommend a silicon detector for this purpose.

(B) In making an indoor aerial such as you describe, we should advise you to use not less than ten parallel wires at least as large as No. 18 B. & S., and to connect all the wires at each end, so that they will act as one wire. The lead in wire may be connected either at one end of the aerial, or at the center. We have received over a distance of about a half mile from a station using such an aerial in connection with a one-half inch coil. Of course an indoor aerial is not nearly so satisfactory as one outside the building, but it will do if nothing better is to be had.

(C) See diagrams (1) for sending and (5) for receiving, pp. 552 and 553 Oct. 1910 issue.

QUESTIONS AND ANSWERS

Use of this department is free to readers of Popular Electricity, but attention will not be given to questions which do not comply with the following rules: All questions must be written in the form of a letter addressed to the Questions and Answers Department and containing nothing for the other departments of the magazine; two-cent stamp must be enclosed for answer by mail, for space will not permit of printing all answers; the full name and address of the writer must be given.

Magnet and Pole Strengths; Transformer Ratio

Questions.—(A) Why is a piece of tempered steel or a nail put across the poles of a horseshoe magnet when not in use? (B) Is the north pole of a magnet stronger than the south pole? (C) Please explain what is meant by "ratio" when applied to transformers.—W. C. S., Biloxi, Miss.

Answers.—(A) By placing a nail or other magnetic metal in contact with both poles of a horseshoe magnet an easy path is afforded for the lines of force, thus preventing a certain amount of leakage. The magnet will therefore retain its magnetism longer with this armature in place than without it.

(B) No. This may be shown by floating a magnet needle on a piece of cork on the surface of a dish of water. The needle will arrange itself in a north and south position, but since there is no further motion imparted to the needle we must infer that the earth's magnetism has no greater effect on the north-pointing pole than upon the south-pointing pole.

(C) The relation between the primary and secondary turns or between the primary and secondary voltages of a transformer is referred to as the ratio of a transformer. To illustrate, assume a transformer having 100 turns of wire on the primary coil and ten turns on the secondary. It has a ratio of ten to one. Ten volts impressed on the primary would be stepped down to one volt, 1,000 volts to 100 volts, etc.

Drop in Voltage; Temperature and Resistance

Questions.—(A) Current is supplied to 200 16-candle-power, 110-volt lamps situated 100 feet from the center of distribution. Calculate the voltage drop between the center of distribution and the lamps. (B) If the resistance of 1,000 feet of copper wire at 90° F. is 100 ohms, what will be its resistance per foot at 75° F.?—F. E. K., Asbury Park, N. J.

Answers.—(A) One hundred amperes will be needed and No. 1 B. & S. gauge wire required by the code. The resistance of 200 feet of this wire is .0258 ohm. The formula for drop in voltage is:

$$E = I\ R$$

substituting, $E = 100 \times .0258$

$= 2.58$ volts drop.

(B) Probably the most simple formula for solving your problem is:

$R_t = R_o\ (1 + .004t)$ in which

R_t = resistance of a conductor at a given temperature, t.

R_o = conductor's resistance at 0° C.

Reducing Fahrenheit temperatures to degrees Centigrade:

90° F. = 32.2° C.

75° F. = 23.8° C.

Applying the formula

$$R_o = \frac{100}{(1 + .004 \times 32.2)}$$

$= 88.5$ ohms at 0° C.

Again $R_t = R_o\ (1 + .004t)$

$= 88.5\ (1 + .004 \times 23.8)$

$= 96.9$ ohms, resistance of conductor at 75° F. or 23.8° C.

Decomposition of Water

Questions.—(A) How can I figure the amount of hydrogen and oxygen set free from water by a certain current? (B) Is water more readily decomposed by adding an acid or an alkali to it?—F. A. L., Valier, Mont.

Answers.—(A) One ampere-hour of current will set free 12.8 cubic inches of oxygen and 16.3 cubic inches of hydrogen.

(B) Electrolysis cannot easily take place unless the electrolyte is a conductor. Slightly acidulated water decomposes more readily than the water only.

Remedies for Patent Infringement

By OBED C. BILLMAN, LL. B., M. P. L.

Who may sue; Who liable to be sued; Evidence.

—

WHO MAY SUE.—The right of persons interested as patentees, assignees, or grantees to bring an action at law for damages or to file a bill for an injunction to prevent the violation of any right secured by a patent is expressly provided for by federal legislation.

Assignees.—A transfer of either, first, the whole patent, comprising the exclusive right to make, use, and vend the invention throughout the United States, or second, an undivided part or share of that exclusive right, or third, the exclusive right under a patent within and throughout a specified part of the United States, is an assignment, properly speaking, and vests in the assignee a title in so much of the patent itself with a right to sue the infringers, in the second case jointly with the assignor, and in the first and third cases in the name of the assignee alone. Any assignment or transfer short of one of these is a mere license, giving to the licensee no title in the patent and no right to sue at law in his own name for an infringement.

Personal Representatives and Trustees.—A suit for an infringement of a patent may be brought by a personal representative or trustee.

Licensees.—In equity, as at law, when a transfer amounts to a license only, the title remains in the owner of the patent, and suit must be brought in his name and never in the name of the licensee alone, unless that is necessary to prevent an absolute failure of justice, as where the patentee is the infringer and cannot sue himself. Any rights of the licensee must be enforced through or in the name of the owner of the patent, and perhaps, if necessary to protect the rights of all parties, joining the licensee with him as plaintiff.

WHO LIABLE TO BE SUED.—A discussion of the question who are the proper parties to be made defendants is not properly within the scope of a treatment of the substantive law of patents, and may be found in full elsewhere. As to the question who is liable for an infringement, the general rule is that any one who has infringed a patent may be sued by the patentee, grantee, or assignee.

Personal Representative.—An action for the infringement of a patent survives and may be brought against the personal representative of the infringer.

Principal and Agent.—A principal may be liable for an infringement committed by his agent, in accordance with the general rule making a principal liable for the torts of his agent. The general rule is that both agents and servants are liable for infringements committed by them. It has been said, however, that a mere workman or servant who makes, uses, or vends for another, under his immediate supervision, a patented article, is not liable in an action at law for damages which may have been sustained by the patentee by reason thereof.

Officers and Agents of Private Corporations.—The general principles governing the liability of the officers and agents of private corporations for torts has been stated elsewhere. The decisions as to their individual liability for infringing patent rights are somewhat conflicting. The rule deducible from the best-considered cases seems to be that the officers, directors, and stockholders of a corporation who have the management and superintendence of its business, or its agents who are concerned in conducting its business, are individually liable for the infringement of a patent.

County or Municipal Corporation.—A county or municipal corporation may be liable for the infringement of a patent.

The United States is not liable to a suit for the infringement of a patent, this being an action sounding in tort, and the United States not having consented to be liable in tort. But officers or agents of the United States, although acting under the authority of the government, are personally liable for their own infringement of patents. So a private person or contractor supplying the government with articles embodying the patented invention may be sued for infringement.

EVIDENCE.—*Questions of Law and Fact.*—The question of identity between the patented device and the alleged infringing device is one of fact for the jury, under proper instructions from the court, except where it turns upon the construction of the specifications and claims, in which case it is one of law for the court.

Presumptions and Burden of Proof.—Upon the issue of infringement, the burden of proof is upon the complainant. To sustain this burden of proof, the evidence must, of course, show the existence of facts constituting infringement. What these facts are has been already treated. The evidence will, of course, vary according to the circumstances and the nature of the infringement, and is subject to the usual rules of evidence. A comparison of the models or devices themselves is the best mode of determining the question of identity or infringement. The presumptions and burden of proof as to the validity of letters patent have been considered in the various sections of this title dealing with the particular questions upon which the validity of a patent may be assailed.

Expert and Opinion Evidence.—Expert evidence is admissible upon the question of infringement or identity where the question turns upon scientific principles or the meaning of technical terms. This class of evidence is subject to the usual considerations applicable in other classes of cases. The opinion of an expert does not necessarily require the submission of the question to a jury where the matter is otherwise plain. Facts are entitled to more weight than opinions. The jury is not bound by the opinions of mechanical experts upon a question of identity of improvement or construction.

Documentary Evidence.—Certified copies of patents and of other papers in the patent office are evidence in the same manner as the originals would be. In the case of other documents the usual rules of evidence apply.

THE WIRELESS TELEPHONE. By H. Gernsback. New York: modern Electrics Publication. 1910. 78 pages with 52 illustrations.

This little volume is intended for the experimenter doing research work in wireless telephony. It takes up briefly the theory of the wireless telephone and the early experiments and then outlines the operation of some of the systems such as the Armstrong and Orling; spark system; McCarthy; Fessenden, Missbaumer Bathrick, multiple spark system, Majoranna, etc.

HIGH FREQUENCY ELECTRIC CURRENTS IN MEDICINE AND DENTISTRY. By S. H. Monell, M. D. New York: William R. Jenkins Company. 1910. 465 pages with 30 illustrations. Price $4.00.

A wonder book of simple things; interest begins at once in the first chapter, in which electricity and its mysteries are defined. This particularly is conspicuous in the section, "Life Phenomena and Electricity," which tells what science has found out about how Nature works in the human body, all explained in the most interesting manner. Then follow two chapters on physiologic-medical properties of high-frequency currents, including a wonderful mass of convincing facts. And the section following these chapters concerning what others are doing with high-frequency currents will prove astonishing. Word pictures of treatment follow, and then twenty of the most absorbing chapters teaching in detail the advancement in treatment of various stages of diseases in which high-frequency currents can be made of benefit to patients. Every one of these twenty chapters is built on the physiologic foundation of the preceding sections.

CHATS ON ELECTRICITY. By Frank Broadbent, M. I. E. E. London: J. B. Lippincott Company. 1910. 192 pages with 25 illustrations. Price, $1.25.

Bearing in mind the rapid development of the electrical art and the difficulty most people find in even keeping up with its phraseology, the author has written this interesting and instructive book treating the subject in a non-technical manner to enable those who specialize to obtain a general idea of the whole field.

The first three chapters treat of the fundamental principles of electricity and electrical current and its measurements. The chapters following are devoted to the subject of electricity as a motive power and of the application to the many practical uses to which it is now put in the office and home. Wireless telegraphy is also considered. The author has evidently had much experience with both the theoretical and practical sides of the subject and in consequence has stated many useful facts and illustrated them with diagrams.

ON POLYPHASE SUBJECTS

The First Central Station

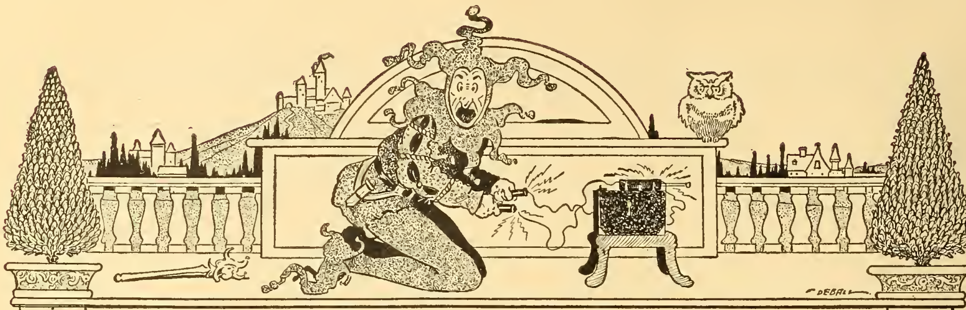
History, as relating to the development of incandescent electric lighting, does not date back very far in years but a great way when measured by results accomplished. It was only about 30 years ago that Edison was making the first incandescent lamps, easily within the remembrance of many of the readers of this magazine. But so wonderful have been the changes wrought since those first experiments that to the majority of people today their significance has been lost in the "light" of present-day achievements. It is, therefore, our pleasure from time to time to set down in lasting form such of those historical incidents relating to the beginnings of the present great billion-dollar industry as will be of particular interest to the general public. A start was made in this direction in the issue of last January, when we printed Mr. Hinds' notable article, "In the Beginning," telling of the first commercial electric lighting plant in the world. Later, in the September issue, appeared "The Story of the Sunbury Station," by W. S. Andrews, followed, in this issue, by another by the same author on "Testing Electrical Apparatus a Quarter of a Century Ago." Mr. Andrews is not only the possessor of a pleasing style, but he also writes from personal experience, for as a young man he obtained employment in the Edison works, led on by the stories he had heard of the *wonderful electric lamp*.

In the December issue another of Mr. Andrews' entertaining articles will appear, entitled, "Some Account of the First Edison Central Station at Menlo Park, N. J., 1880-1881." He was able to write this interesting bit of history from his own personal notes and recollections. The article will be illustrated by a number of old halftones and zinc etchings, only one set of which is in existence. When you read this account you will be reading the true history of the first practical application of an epoch-making invention, written by a man who was there and helped in the work and read over and approved by no less a man than the great inventor himself—Thomas A. Edison.

A Hundred Years of Tin Cans

Judging from the savings effected by its use and from the greater healthfulness due to the avoiding of chemical preservatives, the tin can might well have been entitled to an elaborate celebration of its recent hundredth anniversary. For it was in 1810 that Francois Appert, after six years of experimenting, introduced the method of preserving food by heating it in a can and then sealing the can. The French government promptly showed its appreciation by voting Appert a prize of $2,400—and the whole civilized world has profited by his plan ever since.

Now after a whole century the only notable improvements are in details of construction of the cans used for this purpose and in the methods of manufacturing the same. Thirty years ago automatic machinery for making and filling cans was introduced by the Norton Brothers of Chicago. But only during the last few years has electricity come into service, partly for heating soldering tools in the can factories and canneries and partly for driving the can-filling machines in the scattered canneries. Recently a number of canneries have also adopted electrically operated machines for pasting labels on the cans after they have been sealed. Besides, a number of plants have been experimenting with electrical methods of reclaiming the tin both from old cans and from the scraps left in making them. So while the first century of the tin can has been almost non-electrical, its second hundred years starts out with a modest use of electricity which may develop into an important factor before many more years have passed.



SHORT CIRCUITS

A young man called on a doctor, complaining of pains in his stomach. The doctor diagnosed the case as dyspepsia, and advised the patient to go home and try a dill pickle. If he could keep that on his stomach, he was to report to the doctor in the morning. The next day the patient returned, and when the doctor asked him if he could keep the pickle on his stomach, he replied, "I could as long as I stayed awake, but when I fell asleep, it rolled off."

* * *

A well-known French actor became involved in a discussion with an American, grew heated, drew his card from his pocket, threw it on the table with a tragic air and stalked out. The American regarded the card for some moments, then took out his fountain pen, wrote "Admit bearer" above the engraved line and went off to the theater.

* * *

At the first meal on board the ocean liner, Smythe was beginning to feel like casting his bread upon the waters. His friends had told him that when he began to feel that way he should stuff himself. He tackled a cutlet first, but it didn't taste right. He observed to the waiter, "Waiter, this cutlet isn't very good."

The waiter looked at his whitening face, then replied, "Yes, sir; but for the length of time you'll 'ave h'it, sir, h'it won't matter, sir."

* * *

Guest—Got any ham?
Girl (after looking at bill of fare)—Ain't got any.
Guest —Got any eggs?
Girl (looking again)—Ain't got any.
Guest—Well, what have you got?
Girl (looking once more)—Ham-and-eggs.

* * *

C. M. Paxton, general manager of the Dayton & Troy Electric Railway in Ohio, is a steam road graduate, but he has recently changed his views on the efficiency of steam road trainmen. He believes that the green man from the farm, properly instructed, makes the best trainman. Other able managers share this view. The other day on Paxton's road, a conductor gave the stop signal, but the car pulled a short distance beyond the road crossing. The conductor saw that the alighting passenger would have to step in the mud and poking his head out the door he yelled to the motorman, "Whoa, thar, back up about a hoe handle length."

* * *

Madge—She said I put rouge on my face to deceive people. Wasn't that mean?

Marjorie—It was, indeed, dear. The way you put it on doesn't deceive anybody.

* * *

The editor who gave up his seat to a lady on the train said he "was crowded out to make room for more interesting matter."

* * *

"The sea resort you were speaking of is a pretty gay place, isn't it?"

"I should say so! The only thing there that isn't dissipated is the fog."

* * *

They were heckling him at a political meeting. At last he could stand it no longer.

"Who brayed there?" he cried out sarcastically.

"It was only an echo," retorted somebody amid much laughter.

The teacher asked the boys if they could take off their overcoats. "Yes, sir," came the answer. "Can the bear take off his coat?" Silence. Then up spoke Willie. "Please, sir, no." "Why?" "Cause only God knows where the buttons are."

* * *

He was very bashful and she tried to make it easy for him. They were driving along the seashore and she became silent for a time. "What's the matter?" he asked. "O, I feel blue," she replied. "Nobody loves me and my hands are cold."

"You should not say that," was his word of consolation, "for God loves you, and your mother loves you, and you can sit on your hands."

* * *

A medical professor asked his class "if a patient swallowed a heavy dose of oxalic acid what would you administer?"

There was silence and finally one of the younger students murmured in answer, "spiritual consolation."

* * *

Diner—Change that chicken soup to turtle.
Waiter (shouting)—Make that chicken turn turtle!

* * *

Lives of humorists remind us
Gags that are the most sublime
Are the ones that limp behind us
Covered with the moss of time.

Jokelets that perhaps another
Sailing o'er life's solemn main,
A forlorn and half-wit brother,
Seeing, shall revamp again.

Let us then begin perusing
Almanacs of ancient date,
Still a-seizing, still a-choosing
Chestnuts that have learned to wait.

* * *

Neal Ball, the only ball player in the major baseball leagues who ever made a triple play unassisted—that is, put out three men in one play—is convinced that women are more intelligent on the average than men. He is equally convinced, however, that they don't understand baseball. Accordingly, when he talks baseball to a woman, he adopts a light, facetious tone.

"A woman once said to me," he tells the story, " 'I love baseball, Mr. Ball. I love especially to watch the man at the bat. It is so cute, too, the way be keeps hitting the ground gently with the bat's end. Why does he do that, though?' 'Well, you see, madam,' I said, 'the worms have an annoying habit of coming up to see who's batting, and that naturally puts a man out a bit; so he just taps them on the head lightly and down they go'."

* * *

Minister—"And how did Noah spend his time in the ark?"

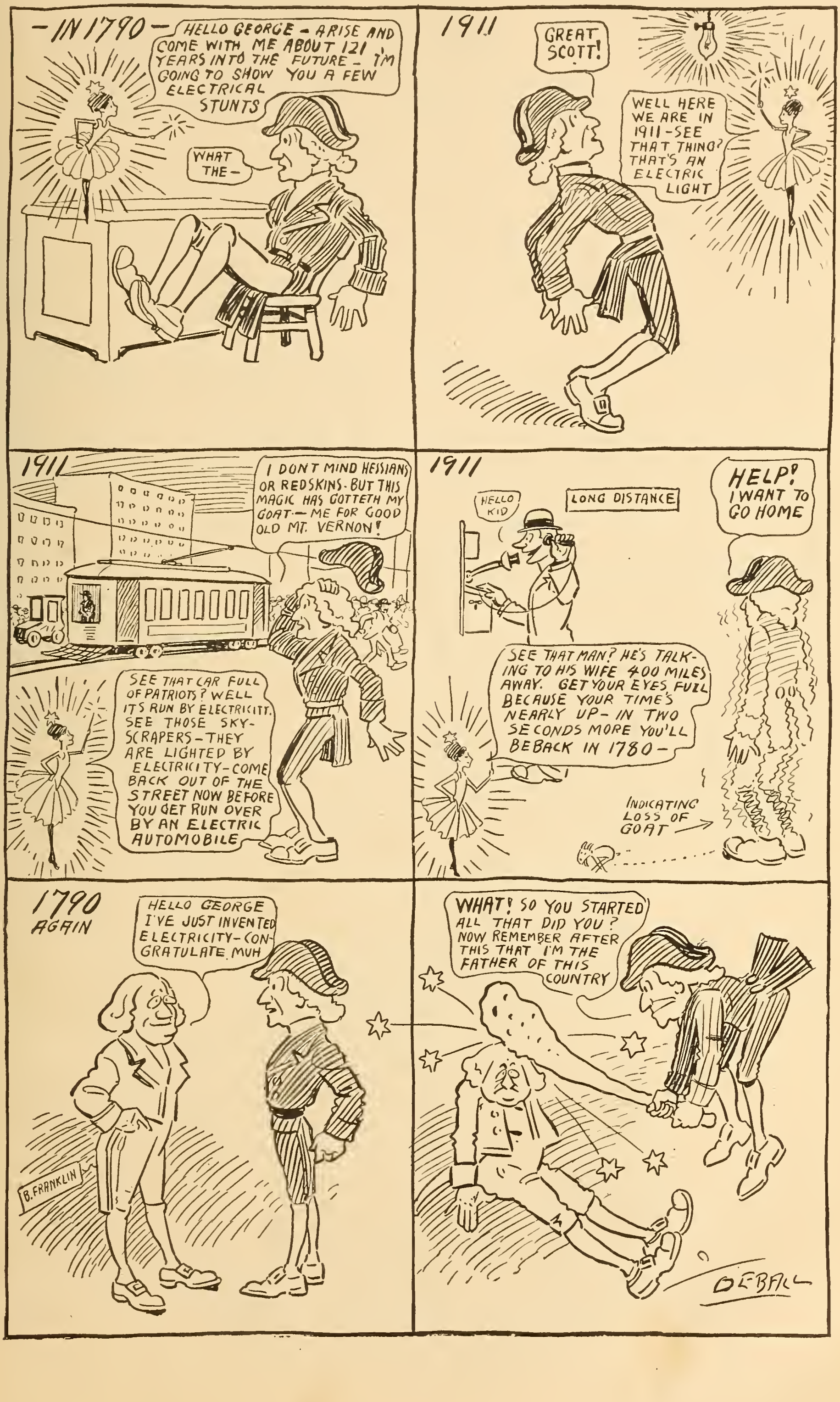
Small Boy—"Fishin'."

Minister—"A vera reasonable suggestion, my laddie."

Small Boy (guardedly)—"But he wouldna catch muckle."

Minister (surprised)—"What makes ye think that?'

Small Boy (knowingly)—"Because, ye see, he had only twa wir-rms!"


-IN 1790-
HELLO GEORGE - ARISE AND COME WITH ME ABOUT 121 YEARS INTO THE FUTURE - I'M GOING TO SHOW YOU A FEW ELECTRICAL STUNTS
WHAT THE-
1911
GREAT SCOTT!
WELL HERE WE ARE IN 1911-SEE THAT THING? THAT'S AN ELECTRIC LIGHT
1911
I DONT MIND HESSIANS OR REDSKINS-BUT THIS MAGIC HAS GOTTETH MY GOAT.-ME FOR GOOD OLD MT. VERNON!
SEE THAT CAR FULL OF PATRIOTS? WELL ITS RUN BY ELECTRICITY. SEE THOSE SKY-SCRAPERS-THEY ARE LIGHTED BY ELECTRICITY-COME BACK OUT OF THE STREET NOW BEFORE YOU GET RUN OVER BY AN ELECTRIC AUTOMOBILE
1911
HELLO KID
LONG DISTANCE
HELP! I WANT TO GO HOME
SEE THAT MAN? HE'S TALKING TO HIS WIFE 400 MILES AWAY. GET YOUR EYES FULL BECAUSE YOUR TIME'S NEARLY UP-IN TWO SECONDS MORE YOU'LL BE BACK IN 1780-
INDICATING LOSS OF GOAT
1790 AGAIN
HELLO GEORGE I'VE JUST INVENTED ELECTRICITY-CONGRATULATE MUH
B. FRANKLIN
WHAT! SO YOU STARTED ALL THAT DID YOU? NOW REMEMBER AFTER THIS THAT I'M THE FATHER OF THIS COUNTRY
DE BALL

COMMON ELECTRICAL TERMS DEFINED

In this age of electricity everyone should be versed in its phraseology. By studying this page from month to month a working knowledge of the most commonly employed electrical terms may be obtained.

CALLING DROP.—The shutter or armature which on a telephone switchboard drops and informs the operator that a subscriber is calling. In the earlier types the operator restored the drop by hand after getting the person called for. This required so much time that drops are now arranged so that when the operator makes the connection by plugging in on the board a spring is operated which throws the shutter into place.

CALORIE.—The name of two different units of heat. By the greater calorie we mean the quantity of heat necessary to raise one kilogram or .45 pounds of water 1° C. The lesser calorie is the quantity of heat needed to raise one gram of water 1° C.

CANDLE-FOOT.—The light thrown upon a surface by a standard candle one foot away. The American and English standard is a sperm candle which burns two grains a minute. Must be burned ten minutes before it is used as a measure in order to secure accuracy.

CANDLE POWER.—The amount of light given out by a standard English sperm candle. (See Candle-foot.)

CANDLE, STANDARD.—A candle of specified construction burning a specified amount of sperm per minute. (See Candle-foot.)

CANOPY.—The metal shell placed at the base of a fixture to cover the insulating joint, outlet box and screws necessary in securing the fixture in place.

CANOPY SWITCH.—Applied to the switch used in street railway cars to cut off the current from controllers and motors. One switch is located in each end of the car. Sometimes used to designate a small snap switch within the canopy of a chandelier operated by a pull chain or cord from below.

CAOUTCHOUC.—The substance obtained by coagulation and drying the juice obtained from certain trees in the tropics. Commonly called India rubber, or rubber, the latter name being due to the fact that one of its first uses was for erasing pencil marks by rubbing. Of high value in the electrical field as an insulator.

CAPACITY, DIELECTRIC.—In a condenser each pair of conducting surfaces is separated by an insulator or dielectric. The capacity of the condenser when so insulated as compared to its capacity when the conducting surfaces are insulated by air only is called its dielectric capacity.

CAPACITY, ELECTROSTATIC.—The quantity of electricity it is necessary to give to a body to raise its potential from zero to one is the measure of its electrostatic capacity. A crude comparison is found in the quantity of air needed in a bottle to raise its pressure a stated amount.

CAPACITY OF CABLE.—A cable like a Leyden jar or condenser has an electrostatic capacity. The armor or sheathing of the cable represents one coat, the wire conductors the other, and the insulator is the dielectric corresponding to the glass of the Leyden jar. The capacity is usually expressed in the unit of micro-farads per mile.

CAPACITY, STORAGE.—Applied to the number of ampere-hours of current a storage battery will furnish after being fully charged. More commonly known as the rating of a storage battery.

CARBON.—An element existing in three forms: charcoal, graphite and diamond. Graphite is the form most used in the electrical field. Its applications are numerous, as in batteries, in lamps as electrodes, in the carbon lamp as a filament, as contactors on motor-starters and circuit-breakers, etc. Because it does not melt except at an extremely high temperature, it is frequently used as a resistance in an electrical circuit.

CARBON, CORED.—An arc lamp carbon with a core of softer material than that on the outside. This kind of a carbon is believed to give a steadier light than a solid carbon.

CARBON, TELEPHONE.—A telephone transmitter using carbon as a material whose resistance is varied by the varying diaphragm pressure. The Blake transmitter is constructed on this principle.

CARBON, TRANSMITTER.—See Carbon, Telephone.

CARBON, VOLATILIZATION OF.—The high temperature in the carbon arc causes the positive carbon to be vaporized and span the space between the two, moving from the positive to the negative. The temperature at which this occurs is supposed to be near 3500° C. This oval shaped vapor formation may be observed by projecting the image of the carbon tips upon a white screen by means of a lens.

CARDEW VOLTMETER.—An instrument made by Capt. R. E. Cardew. In its operation a current is passed through a fine wire, heating it and causing it to expand. This wire is so connected to a drum and gears that any movement in it due to expansion or contraction is transmitted to an index needle. As the current passed through the wire will be proportional to the voltage the instrument is calibrated to read the voltage direct. This voltmeter is unaffected by magnetic fields but cannot be used to measure very small differences of potential.

CARRYING CAPACITY.—The number of amperes of electric current a wire will carry without becoming unduly heated.

CATHODE.—The plate by way of which the current leaves a voltaic cell.

CAUTERY, ELECTRIC.—The use of a fine platinum wire heated to whiteness by an electric current to take the place of the surgeon's knife. Its use hastens the healing of the wound after the operation and in some cases operations have been performed with it when the use of the knife would not be possible.

CEILING BLOCK.—A block of insulating material usually of porcelain placed on the ceiling as a support from which a drop cord may be suspended. It is arranged to contain fuses. Called also a ceiling rosette.

CEILING BUTTON.—A block of insulating material like a ceiling rosette but containing no fuses, placed on the ceiling as a pendant cord support.

CEILING ROSETTE.—See Ceiling Block.

May We Send You Free Samples

To Prove That You Can Artistically Color and Finish Any Kind of Wood About the Home

YOU can produce any desired shade and effect. The expense is slight—the work easy and simple. First apply Johnson's Wood Dye—made in 14 shades as listed below. Over the Dye lightly apply Johnson's Prepared Wax—and you have a beautiful, rich, subdued finish that will not mar or show scratches.

Johnson's Wood Dye must not be confused with colored varnishes or stains, which merely coat the surface of the wood hiding the natural grain beauty. Johnson's Wood Dye is not a mere stain—not merely a surface dressing—it is a deep-seated dye which goes to the very heart of the wood and stays there, fixing a rich and permanent color.

Johnson's Wood Dye

is made in fourteen attractive shades, as follows:

No. 126 *Light Oak*
No. 123 *Dark Oak*
No. 125 *Mission Oak*
No. 140 *Manilla Oak*
No. 110 *Bog Oak*
No. 128 *Light Mahogany*
No. 129 *Dark Mahogany*
No. 130 *Weathered Oak*
No. 131 *Brown Weathered Oak*
No. 132 *Green Weathered Oak*
No. 121 *Moss Green*
No. 122 *Forest Green*
No. 172 *Flemish Oak*
No. 178 *Brown Flemish Oak*

Pints, 50 *cents each*

Johnson's Prepared Wax

dries quickly over Dye or any other finish so that it may be brought to a beautiful, dull, artistic finish. It should be used for all woodwork, floors and furniture including pianos and is just the preparation for Mission furniture.

Johnson's Under-Lac

is not a common varnish—but a thin, elastic spirit preparation superior to shellac or ordinary varnish, and is to be used over Wood Dye where a higher gloss than a wax finish is desired, drying hard in half an hour. Best preparation for linoleum and oilcloth, bringing out the pattern as glossy as new. Gallons $2.50—smaller sizes down to half pints.

Fill out the coupon for free samples and booklet

S. C. Johnson & Son
"The Wood Finishing Authorities"
Racine, Wisconsin

Free Sample Coupon

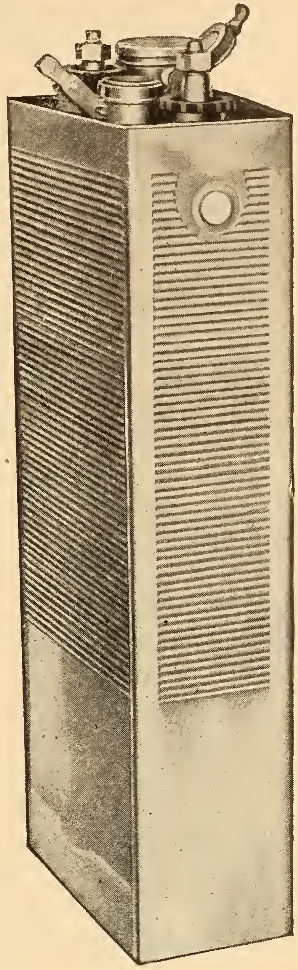
Please send me free samples of Wood Dye, Shade No.................. Prepared Wax and Under-Lac—also Booklet. If samples are found satisfactory will ask my dealer to supply me.

Name..

Address..

P. E-11

This is the Type A6 Cell of the New Edison Storage Battery



There is no lead or acid in its construction. The plates are nickel and iron in an alkaline (potash) solution.

No rubber or glass jars to crack or leak. The container is welded, fluted, rigid nickeled steel.

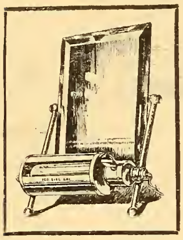
The only care that the Edison requires is to keep the cells clean externally and filled with *distilled* water. There is no constant renewal expense.

No matter what storage battery you are now using, the new Edison Storage battery will do your work better and far more economically.

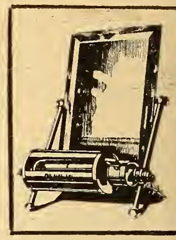
Write us for full particulars today

THE EDISON STORAGE BATTERY CO.

117 Lakeside Ave., ORANGE, N. J.



Most Men Shave By Artificial Light



In the morning before the day's work begins or at night when it is over.

The ordinary lighting fixture is placed with no reference to the needs of shaving.

Price $3.75 Each

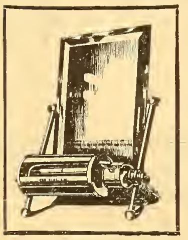
At Any Dealers

The Perfect Light for Shaving

Federal Electric Shaving Mirror

This mirror has an adjustable cylindrical reflector so placed that the light is cast upon the face and neck but not in the eyes. Shaving is made a quick and comfortable operation because you can see what you are doing.

Each mirror has six feet of silk cord and plug for attaching to any light socket. It is so compact that it can be put in your suit case for traveling.

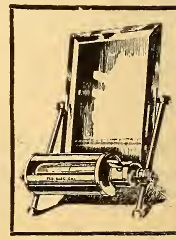


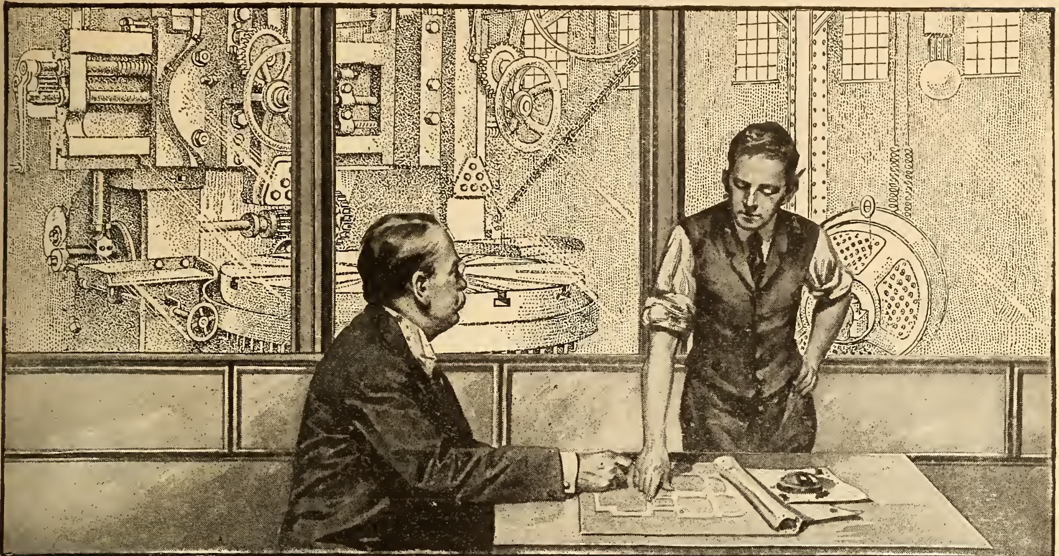
Write for our free booklet "Federalettes" describing many new and novel electric conveniences for the home

FEDERAL ELECTRIC COMPANY

MANUFACTURERS

Lake and Desplaines Streets, Chicago





Have YOU Salary-Raising Ability?

That's the kind of ability that brings promotion, keeps positions safe in time of trouble, and wins success. That's the kind of ability the International Correspondence Schools can give to you—whether you're a young man or an old man, an office man or an outside man, a day worker or a night worker—and no matter where you live nor how little spare time you have.

You will never gain a salary-raising ability by sitting still and thinking what you could do if you only had the other fellow's chance. You must **make** the chance by learning to do some one thing better than the other fellow. And the best way to do this is through the help of the I. C. S.—an institution that will make you an expert in the occupation of your own choice without requiring you to leave home, and without interfering with your regular work.

The trained man has the advantage every time.

As surely as the I. C. S. have raised the salaries of tens of thousands of others, they can raise your salary. It costs you nothing to find out how. Read the list of positions in the attached coupon, mark the one you like best, and mail the coupon to the I. C. S. Doing so places you under no obligation.

Send the coupon NOW.

International Correspondence Schools
Box 1102, Scranton, Pa.

Please explain, without further obligation on my part, how I can qualify for a larger salary and advancement to the position, trade, or profession before which I have marked **X**.

Electrical Engineering	Mechanical Engineer
Electric Lighting	Mechanical Draftsman
Electric Railways	R. R. Constructing
Electrician	Concrete Construction
Electric Car Running	Architect
Dynamo Foreman	Contracting & Building
Dynamo Tender	Architectural Draftsman
Wireman	Plumbing & Heating
Mining Engineer	Chemist
Telephone Expert	Bookkeeper
Civil Engineer	Advertising Man
Automobile Operator	Civil Service Exams.

Name ______________________

St. & No. ______________________

City ______________ *State* ________

CLASSIFIED ADVERTISING

¶ Advertisements in this section of Popular Electricity will cost 5 cents per word with 5% off for 3 times, 10% off for 6 times, 15% off for 9 times and 20% off for 12 times, cash with order.

¶ In order to secure the proper classification, advertisements must be in this office the first of each month preceding date of issue.

AERONAUTICS

MODEL AEROPLANE—INSTRUCTIVE TO-experimenters Self-propelled. Flies considerable distance. 50c prepaid. Agents wanted. AEROPLANE MFG. CO., 309 15th St., Brooklyn, N. Y.

BUILD AN AEROPLANE. SEND US $1.00 and we will send you blueprints and full directions for building a 3-ft. model Wright biplane or a 2-ft. model Bleriot monoplane. Both fly 200 feet by own power. Or blueprints and directions for a 20-ft. glider. Chicago Aeronautic Supply Co., Room 131, 5602 Drexel Ave., Chicago, Ill.

AGENTS

See what I say under "Typewriters." ATCHISON

AGENTS—SEE OUR AD UNDER "ELECTRIC Material." Weissgerber.

READ "PRINTING OUTFITS" ADV. C. P. & T. Co.

"PERFECTION POCKET ADDING MA-chine—Lightning seller. Agents wanted. Cincinnati Specialty Mfg. Co., Dept. E, Cincinnati, Ohio.

AGENTS: EVERYONE; TO WEAR AND SELL our famous Bokara Diamonds. Write for free sample offer and catalogue. Northwestern Jewelry Co., 55 Northwestern Bldg., Chicago.

AGENTS WANTED—TO SELL TREES AND plants. Steady work. Highest commissions payable weekly. Clean straightforward proposition. Write for free outfit. Perry Nurseries, Rochester, New York.

LIVE AGENTS WANTED—TO SELL FINEST light on market. $1.00 profit on each. Business buy at sight. Send for free proposition. P. O. Box 2089, Bridgeport, Conn.

MAN AND BOYS; SCHOOL BOYS ARE EARN-ing $2.00 and $3.00 per day selling "Plantlife". We have the goods. YOU show it. IT sells itself. Sample and full particulars 10c (silver). Plantlife, 6614 Honore St., Chicago, Ill.

WIDOWS, LADIES, MEN. NEW, INTEREST-ing. Profitable, easy work. Spare time or permanent. Sell our useful specialties. Our original selling plan will double your sales. Particulars and $2.00 premium offer free. Fair Mfg. Co., FM 60, Racine, Wis.

IMPROVED KEROSENE MANTLE LAMP! 100 Candle-Power! ½ coal-oil used! Best on American market! greatest campaign bargains ever offered! Get our prices! Establish business! Control territory! large profits! Webster Specialty Co., Waterbury, Conn.

LIVE AGENTS WANTED—HUSTLERS TO handle our 6 new catchy Xmas packages. Our "Baby Package" is a winner. Many are making as high as $20 per day. Big rush on. Start now with us and get in right for 1911. Write today for catalog of complete line including Xmas Specials. Davis Soap Co., 27 Union Park Ct., Chicago.

AGENTS

AGENTS—90 CENTS ON THE $1.00 PROFIT. Send 25 cents for sample and plan. Address S. E. James, Weisburg, Ind.

AGENTS: NEW BOOK. GREATEST BO-nanza ever offered. Complete story of Aviation; conquest of the Air, by Wright Brothers, Curtis, Paulham, Brookins and others. How to build and sail an aeroplane. Hundreds of illustrations. Only $1.50. Best terms. Outfit free. J. S. Ziegler Co., Chicago.

AGENTS MAKE BIG MONEY SELLING OUR new gold letters for office windows, store fronts and glass signs. Any one can put them on. Write today for a free sample and full particulars. Metallic Sign Letter Co., 400 N. Clark St., Chicago, Ill.

SMALLEST ALARM CLOCK AND SMALLEST Bible in the world 10c each prepaid. Mahomet Alis Oriental dream book a wonderful volume correctly interpreting dreams, fortunes, lucky days and numbers, 25c prepaid. W. H. Garner, 119 South Lafayette St., Evansville, Ind.

AGENTS—THE BIGGEST MONEY MAKER ever known. The new Canchester Incandescent Kerosene Lamp revolutionizes old lighting methods. Burns air instead of money. Six times brighter than electricity, gas, or acetylene at one-tenth cost. Burns with or without mantle. Burner fits any lamp. Saves 75 per cent oil. No trimming wicks. Showing means selling. Territory going fast. Write today. Handsome outfit furnished. Canchester Light Co., Dept. P. E., 26 State St., Chicago.

$25 TO $40 A WEEK AT HOME OR TRAVEL-ing. If you are making less than $25 to $40 a week, sit right down and write to the American Woolen Mills Co. for the most amazing money-making proposition of the a e. This concern is the largest mail-order tailoring establishment in America, with immense capital and resources. They make the finest made-to-measure suits at prices that defy competition. Suits $7.50 and up. Pants $2.25 and up. All their vast business is done through agents. They start any ambitious man in the tailoring business, furnishing everything required, at their own expense. Men without any previous experience can make $25 to $40 a week, right from the start. Many of their salesmen make as high as $200 a week. The American Woolen Mills Co. produces its own cloth. This is the secret of the low prices its agents are able to offer on finest made-to-measure suits. With its own great tailoring shops, skilled tailors and finishers, it gives more style, better quality, greater value than any similar concern in existence. Best of all, it supplies its agents with handsome suits, at cost, and turns over to them all inquiries received from their territory. If any of our readers are looking for easy work, big pay and independence, we advise them to write to the American Woolen Mills Co., Dept. 496, Chicago, Ill., at once, for their wonderful proposition.

WANTED!

Business Experts

The great complaint in business life to-day is that there are not enough big men to fill the big positions. Opportunity *awaits* the *trained* man—the *expert.*

The Commercial Course of the International Correspondence Schools will enable *you* to advance in your position. You can qualify while going right on working. The training *comes to you*, in your own home and spare time.

Whether you wish to qualify as an expert bookkeeper, accountant, stenographer, correspondent, or to specialize in banking or in business law, this is the one thorough, *practical* way by which you can do it. Thousands of well-paid office men owe their success in life to the *personal* help given by the I. C. S. through this same Commercial Course.

The way is open to *you.* The I. C. S. will send you full particulars without placing you under any obligation, if you will fill in and mail the attached coupon now.

Get in the *expert* class and earn more. Mail the coupon.

International Correspondence Schools,
Box 1102, Scranton, Pa.

Please send, without obligation to me, complete description of your Commercial Course.

Name ....

Street and No..

City..............................*State*..............................

HELP WANTED

HELP WANTED—$70.00 MONTH TO COMMENCE. Railway Mail Clerks. Examinations everywhere November 12th. If you want appointment, write immediately, Franklin Institute, Dept C-54, Rochester, N. Y.

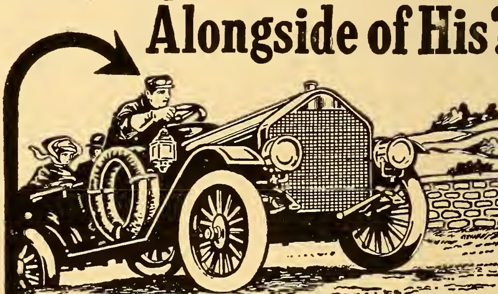
WANTED—A MAN OR WOMAN TO ACT AS our information reporter. All or spare time. No experience necessary. $50 to $300 per month. Nothing to sell. Send stamp for particulars. Sales Association 611 Association Building, Indianapolis, Ind.

WANTED—MEN BY LARGE CONTRACTING company. Can learn trade of plumbing, electricity, bricklaying, automobiles, in few months. No apprentice or helper's work and no expense. $20,000.00 contract work going. Catalogue free. United Trade School Contracting Co., Los Angeles.

WANTED—A LARGE NUMBER OF COMPETENT specialty salesmen or saleswomen to demonstrate and sell our electric Fireless Cookstoves and Electrical appliances in the U. S., Canada and Foreign Countries. Fifteen styles of Stoves ranging in price from $19.00 to $75.00, using the Principle of Heat Conservation, guaranteed to cost less for Cooking and Baking than Gas, Wood, Coal or Gasoline, with the endorsement today of a large number of Central stations (Electric Lighting Plants) on their efficiency, economy, safety and attractive appearance, paves the way for resourceful men or women to sell many of our stoves and make much money. Commission and Salary. The Electric Fireless Cookstove Co., Buchanan, Mich., U. S. A.

MAGIC POCKET TRICK FREE Catalog included, send 4c stamp Dept. 17 270 W. 39th St., NEW YORK

How's your Job Alongside of His?



You can take his place

He earns mighty big money—works very short hours—and his "work" is certainly a cinch. But, remember, he's an EXPERT driver. Such experts earn all the way

FROM $35 TO $50 A WEEK

Let us train you right in your own home, with very few hours' effort on your part (while you keep your present job), to become an expert Chauffeur, Demonstrator, Repairman, etc. There are not, today, enough competent men to fill the demand. A Small Down Payment Starts You. Ask for our free prospectus with Samples of our Lessons.

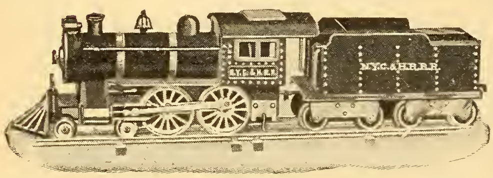
We are constantly in touch with owners and garages that require competent men.

BUFFALO AUTOMOBILE SCHOOL
34 Franklin Street BUFFALO, N. Y.
The Auto School That Comes to You

Electric Mechanical Toys for Holiday Gifts

In the operating of these electrical toys there is something that makes them quite as fascinating to grown-ups as to children. The secret (if it be such) probably lies in the fact that the toys are *instructive*; that they develop ingenuity and mechanical knowledge wholly aside from being especially entertaining.

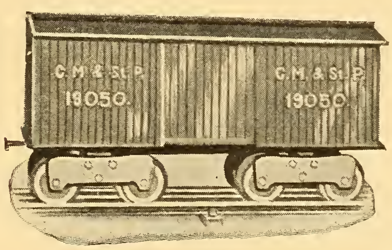
We can illustrate only a few toys here. But we carry a complete line of the auxilliary railroad equipment—tracks, switches, stations, tunnels, cars, signals, etc. Descriptions and prices will be promptly supplied on request.



No. 6—Express Locomotive; sheet steel construction; working parts and trimmings highly nickel-plated; length of engine, 13½ in.; height above rails, 5½ in.; the tender measures 9x4x3½ in.; equipped with a four wheel pilot truck, so constructed as to assure perfect action and flexibility; also an electric headlight, with a miniature incandescent bulb; weight, 7 lbs.; without track. Each............................**$11.25**

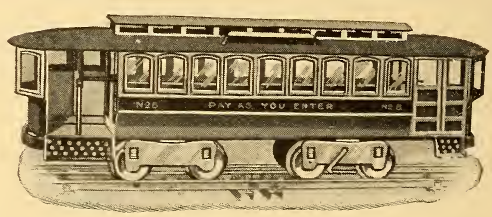
No. 18—Pullman; sheet steel construction; built with vestibules on each end; imitation leaded glass windows; two four-wheeled trucks; interior fitted with seats; beautifully decorated in colors; length, 16 in.; height from tracks, 6½ in.; weight, 2½ lbs Each **$4.15**

This is the most perfect miniature Pullman Car ever designed as a toy. It has every appearance of the regular Pullman Passenger car and is of substantial construction.



No. 14—Box Car; sheet steel construction; sliding doors and roof; equipped with hand brakes and couplers; two four-wheeled nickel-plated flexible trucks; length, 11 in.; height, 4 inches.; weight, 1 lb. Each................................**$2.20**

These Box Cars are neatly decorated and lettered, and represent the freight cars now in use by modern railways. No train equipment is complete without a few of these Box Cars.



No. 8—Pay-As-You-Enter Car; sheet steel construction; handsomely decorated in three colors, with appropriate lettering in gold; equipped with two four-wheeled trucks and automatic reverser; furnished with eight curved sections of track and ten straight sections, making 23 feet of track in all; length, 18 in.; height, 6 in. above rails; complete as described, with an attractively decorated fender; weight, 8½ lbs. Each **$11.65**

These toys may be operated from the regular lighting circuit by using a Toy Transformer, which reduces the 110 volt circuit to 3, 5 or 8 volts. Or they may be operated by batteries. We sell all the best Transformers and Batteries and will furnish descriptions and prices on request. A booklet—"Experimental Electrical Outfits" is free for the asking. :: :: :: ::

ELECTRIC SHOP MICHIGAN AND JACKSON BLVDS. **CHICAGO**

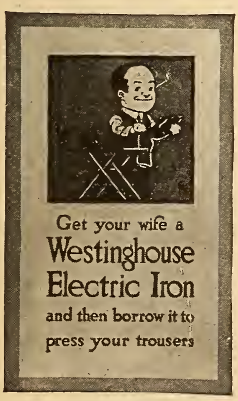
Luxuries no longer— They are now household necessities

The Westinghouse Electric Iron

occupies a place in the home which nothing else can fill. Think of the many steps it saves, to and from the hot stove, and the advantage of being able to iron or press in any part of the house. Only one iron is required. It is heated by attaching the flexible cord to the lighting socket and turning on the current. The iron will maintain the proper working temperature as long as desired.

The Westinghouse Toaster-Stove

may be used for light cooking operations such as toasting bread, frying eggs, bacon, baking griddle cakes, etc. The heat is confined to the working surface over which it is evenly distributed. Only three minutes are required to attain the proper toasting temperature. This little device can be used right on the dining table without danger of marring the surface, or burning the cloth.



Descriptive Folders---do you want them?

Folder No. 4175 describes the electric iron, and Folder No. 4135 the toaster-stove. Either, or both will be sent you upon request.

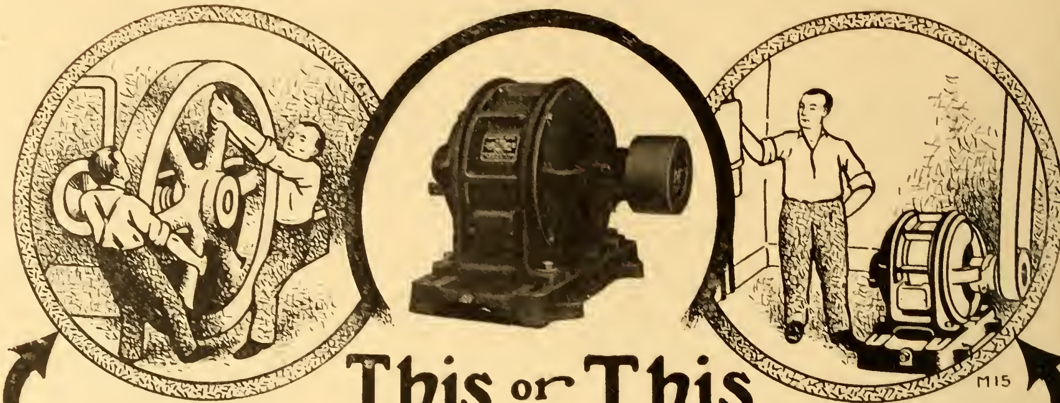
Westinghouse Electric & Mfg. Co.

Atlanta	Chicago	Detroit	New York	Salt Lake City
Baltimore	Cincinnati	Kansas City	Philadelphia	San Francisco
Boston	Cleveland	Los Angeles	Pittsburg	Seattle
Buffalo	Denver	New Orleans	St. Louis	

Westinghouse Electric & Mfg. Co. of Texas, Dallas, and El Paso, Texas

Canada: Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Mexico: G. & O. Braniff & Co., City of Mexico



This or This

Electric power is always ready—it can be started or stopped almost instantly.

No matter what you use power for, or how much of it you use—from the smallest machine to the largest factory—it will pay you to install and try a

Fort Wayne Electric Motor

The amount you will save—not to mention the convenience—will decide your future power problem.

All the power you pay for then, is delivered directly to the machine—you don't lose 30% to 50% on flapping belts, line shafts or pulleys.

Motors need no fireman or engineer—only an occasional oiling—and they supply each tool with just the right power and speed to secure its maximum output.

We make motors of all sizes from $^1/_{100}$ horsepower up, and can furnish you the kind especially suited to your needs.

Our bulletin "Motor Drives" (sent free on request) explains and illustrates some 40 of their many applications. Send for it today.

FORT WAYNE ELECTRIC WORKS

"Wood" Systems

1603 Broadway — **FORT WAYNE, IND.**

BRANCH OFFICES: MOST LARGE CITIES

(M-15)

Every room in any home can be made more livable by better lighting.

Next to daylight electric light is best—

and now

G-E Mazda Lamps

make electric lighting better and cheaper than ever before

Don't ignore—investigate. Old ideas of what electric light costs have been overturned. These new lamps deliver over twice as much light for every dollar's worth of electricity.

Electric light users find their lighting more than doubled with no increase in their "electric light" bills. That is what G-E Mazda lamps do for thousands today. They will do as much for you.

Ask your electric light man or dealer to furnish you the proper sizes. Begin with the rooms you want brightest. Get ready now for the long winter evenings.

His Only Rival
G-E MAZDA LAMP

General Electric Company
Dept. 30 **Schenectady, N. Y.**

We have prepared for you a helpful little booklet on the question of better lighting. Includes suggestions for wiring and lighting an eight-room house, cost of lighting, cost of lamps and the best ways to use them. Send for your copy today.

One Dollar
Puts the "RICHMOND" Suction Cleaner in Your Home

ONE Dollar forever frees you from brooms, mops and dusters—and the backaches and drudgery they bring.

One Dollar forever stops the expense and the nuisance of Spring and Fall housecleaning.

One Dollar enables you to do, *easily*, by electricity, the *worst work* a woman has to do.

And One Dollar is the only cash outlay.

It will bring you the "RICHMOND" Suction Cleaner complete—ready for instant use.

The balance you pay for month by month out *of the actual money you save.*

For Vacuum Cleaning is the greatest of all household economies.

You are paying the price of a suction cleaner, *right now*—whether you have one or not.

You are paying its price out in twice-a-year house cleaning alone—for a "RICHMOND" makes housecleaning needless.

You are paying its price out—many times over—in the hard labor of sweeping and dusting which the "RICHMOND" makes unnecessary.

You are paying its price out again and again in the damage which dust does to your furniture, to your carpets, to your hangings, to your clothing—to YOU.

You are paying the price of a "RICHMOND" when a single dollar would save the waste.

This is a reduced reproduction to show detail. The actual height of the machine is 12 inches.

YOU see here the lightest and simplest suction cleaner *ever designed.*

1—is the motor—not a "stock" motor, but one built expressly to operate the powerful suction fan to which it is directly connected, under

2.—a suction fan which embodies the best of all that was learned in two years of steady, scientific experiment.

3.—is the suction nozzle which is pushed over the surfaces to be cleaned or to which can be attached a twelve-foot hose for high wall, drapery and upholstery cleaning.

The "RICHMOND" Suction Cleaner enables you, now for the first time, to clean by electricity without lugging a 60 to 80 pound machine from room to room—upstairs and down

It represents as great an advance over heavy weight vacuum cleaners as these cleaners represented over brooms and carpet sweepers.

But light weight and easy operation are but two of the "RICHMOND'S" exclusive superiorities. There are many more.

The vibrating brush, which taps the caked dirt out of otherwise uncleanable rugs and carpets—the hair-drying and pillow-renovating attachments—the seven special tools which make the "RICHMOND" the most complete cleaner ever offered.

Manufactured exclusively for the RICHMOND SALES CO. by

THE McCRUM-HOWELL CO.

Park Ave. and 41st St., New York

Five Factories: Two at Uniontown, Pa.—One at Norwich, Conn. One at Racine, Wis.—One at Chicago, Ill.

MANUFACTURERS OF "RICHMOND" Boilers and Radiators, "RICHMOND" Enameled Ware, Bath Tubs, Sinks, Lavatories, "RICHMOND" Suds Makers, "RICHMOND" Concealed Transom Lifts, and "RICHMOND" Stationary Vacuum Cleaning Systems

Inquiries regarding built-in-the-house Vacuum Cleaning systems should be addressed to The McCrum-Howell Co., New York and Chicago.

Limited Offer

The Dollar Offer is limited. It is made to show our unbounded confidence in the "RICHMOND"

But by its very liberality, it is bound to swamp the factory. And when the limit of factory output is reached, the offer must be withdrawn.

So send the coupon today while the opportunity is still yours! Don't wait. Do it NOW.

THE RICHMOND SALES CO.
Dept. 49, 160 Broadway, New York

DOLLAR COUPON

THE RICHMOND SALES CO., Dept. 49, 160 Broadway, N. Y. City

I hereby order one "RICHMOND" Suction Cleaner, complete with the following attachments: 1 Hose Attachment Shoe; 1 12-ft. covered Suction Hose; 1 Book and Wall Brush; 1 10-in. Drapery Tool; 1 3-in. Suction Tool; 1 Felt-Faced Floor Tool; 1 Adjustable Wall Brush; 1 30-ft. Electrical Cord; 1 Complete Hair Drying Attachment—for which I agree to pay to your order, $1.00 herewith, and $6.00 on the first day of each of the next 12 consecutive months. Title to be given me when full amount is paid.

Name..

Address..

325,000 Escape Curse of Deafness

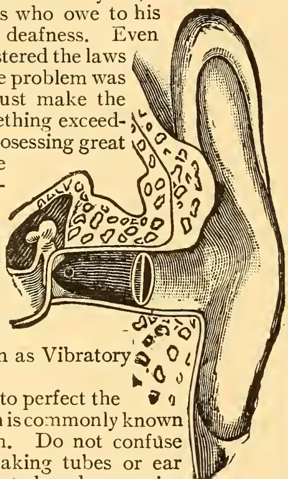
Little Invisible Sound Transmitter Does Wonders for the Deaf

Nearly half a million victims of Deafness have escaped from the Prison of Silence.

How did they do it?

By the use of a marvelous little Sound Transmitter, made of Vibratory Rubber.

Nobody but a deaf man would have had the infinite patience and dogged determination to study and experiment for years—to perfect the tiny Transmitter. That deaf man was Geo. H. Wilson.



Today he can hear as well as anyone, and is almost idolized by the thousands who owe to his genius their escape from deafness. Even after Mr. Wilson had mastered the laws of sound transmission, the problem was far from solved. He must make the Transmitter out of something exceedingly soft and light, yet posessing great vibratory power. The use of metal was impossible in so delicate a device. Ordinary rubber did not possess the necessary vibratory qualities. Mr. Wilson began experiments with rubber and finally succeeded in producing what is known as Vibratory Rubber.

This made it possible to perfect the Sound Transmitter which is commonly known as the Wilson Ear Drum. Do not confuse this device with the speaking tubes or ear trumpets, or the complicated and expensive portable telephones which make the wearer look conspicuous and feel ridiculous. The Wilson Sound Transmitter or ear drum is so small that it rests completely **out of sight** in the ear holes.

So soft and comfortable that the wearer forgets all about it. So magical in its results that it makes the deaf hear distinctly, **and instantly.** So many deaf people have written to Mr. Wilson for information in regard to the Sound Transmitter that he has written a little book about it. And just to make the story complete, he has put in several hundred letters from people of every station in life who are using his Sound Transmitters.

Copies of this facinatingly interesting book are now being mailed. If you wish one, simply write a post card immediately to the Wilson Ear Drum Co., 106 Todd Bldg., Louisville, Ky. (9)

Autology

Body and Brain Perfection

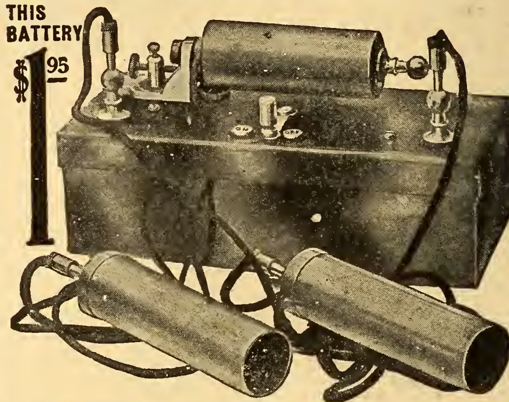
DR. MORAS has written a Commonsense Book on Autology, and by so doing placed the Standard of the Creed of Health Farther to the Front than any man who has lived for a thousand years—**Elbert Hubbard.** So you may see for yourself. Send for FREE "Guide to Autology." Address **E. R. MORAS, M. D., Dept. 12, Highland Park, Ill.**

"CURE YOURSELF BY ELECTRICITY"

New Book—Illustrated from Life—Sent FREE to all who write.

Write to-day for our new **Free Book—"Cure Yourself by Electricity"**—Illustrated with photos from life. Shows how the New Home Batteries cure **Rheumatism, Neuralgia, Lumbago, Headache, Insomnia, Constipation** and all nerve affections and diseases arising from sluggish circulation; also how they afford **electric baths and beauty massage without cost at home.**

THIS BATTERY $1.95



Every Home Should Have a Home Battery.

We send our batteries without a cent in advance (prices $1.95 and up) and allow **10 DAYS' FREE TRIAL.** Write for our Book.

DETROIT MEDICAL BATTERY CO.,
1199 Majestic Bldg., Detroit, Mich.

For Father, Son, Brother, Uncle, Nephew or Grandpa

$5.00 Safety Razor for Only 97 Cents

Beautiful silver plated, with stropper, handle and holder, a full set of Grains' Celebrated Wafer Blades, all in a handsome lined leather case, just like the high grade $5.00 outfits sold in stores. Remember this Special Advertising Offer is for a short time only in order to introduce in every city, town and hamlet in the United States.

All you need to do is to refer to this ad, enclosing **ninety-seven cents,** with your name and full address and the complete Grains' Safety Outfit exactly as described will be sent at once fully prepaid.

L. C. GRAINS COMPANY
184 Pulsifer Bldg. Chicago, Ill.

CHARCO-DENTO

TRADE MARK

TOOTH PASTE AND TOOTH POWDER

are improvements in dentifrice making as they contain charcoal, a natural absorbent, which will take up and carry away the acids and decayed matter which destroy the teeth. CHARCO-DENTO has every ingredient necessary to clean, preserve and beautify teeth and heal and harden gums. Your druggist has it or can order it for you. Price 25c in paste or powder form. Send 10c for a month's supply and booklet. GOE & CO., 1 GOLANE BUILDING, RIDGEWOOD, N. J.

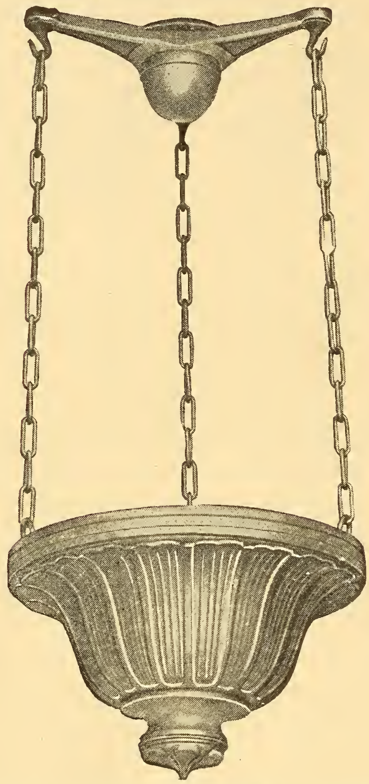
CHARCO-DENTO will remove tobacco and all other stains from the teeth

THE

EYE COMFORT

System of Indirect Illumination

The Great Success for Lighting Interiors



One of the notable recent successes in the lighting field is that of the **EYE COMFORT SYSTEM** of indirect illumination. By the use of this system it is possible to receive an even distribution of light which is reflected from the ceiling. This source of light is entirely out of view; as a result the eyes are protected from the intensity of illuminant.

Thousands of these installations are being made in residences, offices, hotels, restaurants, churches, clubs, hospitals, etc., etc.

Illuminating Engineering Advice Free

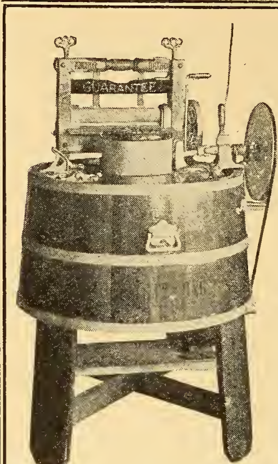
Write our Engineering Department your difficulties about your lighting problems and they will solve them free of cost.

We Sell Through the Electrical Trade Only

If your dealer does not handle, send to us for booklets and full information.

Lighting units of sufficient efficiency to make Indirect Illumination a success, are only possible by combining with the Mazda (tungsten lamps) the reflectors of greatest efficiency, especially designed for the purpose by the

NATIONAL X-RAY REFLECTOR CO.
257 Jackson Boulevard **CHICAGO**



The Perfect Electric Washer

Built to Wash the Woman's Way

Investigation of the Perfect Electric Washing Machine will show that it is the ultimate result of five years experimenting. Every fault that has accompanied all other electric machines of this kind has been eliminated. This machine is absolutely safe, all mechanical parts being enclosed. Its mechanical construction is such that the greatest amount of work is secured from the lowest cost of operation. It is durable, practical and superior to all other washing machines in ease of operation. The gearing used is simple and unique as well as noiseless. The lid can be raised at any time without turning off the power—simply moving a clutch. It is not necessary to stop the machine. **Wringer attachment is entirely new and the smallest articles of clothing can and will not wrap around the rollers.**

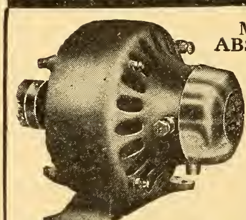
GAS ENGINE WASHER

We also furnish gas engine attachment for customers not having current available.

DEALERS, CENTRAL STATIONS AND JOBBERS write immediately for our prices.

THOMPSON BROS.
815 Second Nat'l Bank Bldg. **Cincinnati, O.**

1/12 AND 1/8 Direct and Alternating Current Motors
VARIABLE SPEED - SINGLE PHASE



MOTORS THAT WILL ABSOLUTELY NOT HEAT

"The Barnes Motors" are especially adapted for Washing Machines, Vacuum Cleaners, Air Purifiers, Ventilating Devices, Coffee Mills, Meat Choppers, Printing Presses, etc., etc. —Dental and Medical work a specialty. Positively the best motor for use where motor driven work is necessary —greatest power, highest efficiency. We want Reliable Agents everywhere —write at once for prices and catalog. Let us figure on your requirements.

BARNES MFG. CO., SUSQUEHANNA, PA.

VICTOR ELECTRIC CO.

Manufacturers of

APPARATUS ELECTROTHERAPEUTICAL

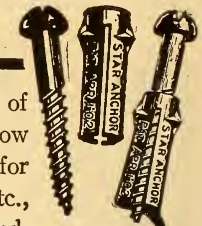
Our line includes the highest quality of

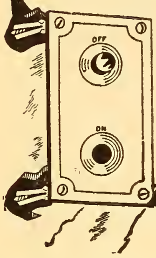
X-Ray Apparatus — **High Frequency Apparatus**
Therapeutic Lamps — **Sinusoidal Apparatus**
Giant Eye Magnets — **Diagnostic Lamps**
Wall Plates — **Air Compressors**
Cautery Transformers — **Bone Surgery Outfits**
Electric Sterilizers — **Vibrators**
Air Heaters — **Faradic Coils**

Correspondence of Physicians and Surgeons and Hospitals solicited.

55-61 Market Street, CHICAGO

Let Us Mail You Some Samples





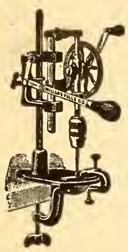
If you will simply send us your name and address, we will mail some samples of the Star Screw Anchor free of all cost to you. We want you to know the advantages of this wonderful time, labor and cost saving device for attaching electrical and other fixtures to walls of tile, brick, stone, etc., and name of dealer in your city from whom they may be purchased.

A POSTAL RIGHT NOW

STAR EXPANSION BOLT CO.

Catalogue Dept. 10, 147 Cedar St., NEW YORK

Our Drill Press No. 23



will be found an exceedingly useful and convenient tool for light work. The frame is made of steel and iron japanned. The feed is supplied by a compound lever, which is convenient, sensitive and effective. The chuck holds drills from 0 to $\frac{3}{8}$ of an inch. The distance from chuck to table with sliding frame at highest point is $6\frac{1}{2}$ inches Weight $8\frac{1}{2}$ pounds. Price each $3.50..

ASK FOR CATALOGUE

Millers Falls Co., 28 Warren St., New York, N. Y.

(5)

EVERYWHERE ON THE GLOBE, ON LAND AND ON SHIPS, WILL BE FOUND Klein Tools

WHY?

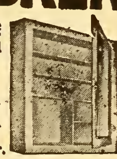
QUALITY COUNTS

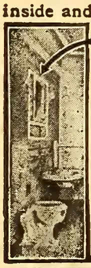
Send 3 cts. in stamps for Mailing Catalog.

Mathias Klein & Sons
Station U-3, Chicago, Ill.

HESS SANITARY MEDICINE CABINET LOCKER

THE only modern Sanitary Steel Medicine Cabinet or Locker. Handsome beveled mirror door. Snow white, everlasting enamel, inside and out.





FOR YOUR BATHROOM

Costs less than wood and is better.

Should be in every bathroom. Is dust, germ and vermin proof and easily cleaned with warm water.

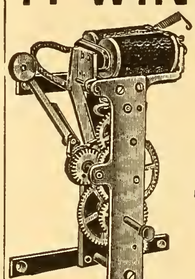
Made in four styles and three sizes. Price $7.00 and up.

Send for illustrated circular.

HESS, 912 L Tacoma Bld., Chicago

Makers of the Hess Steel Furnace
Sold on approval. Free Booklet

IT WINDS ITSELF



YOU CAN BE

ON TIME

WITH ONE OF OUR

SELF WINDING CLOCKS

FOR HOME AND OFFICE

SEND FOR LITERATURE

IMPERIAL CLOCK CO., GRANITE CITY, ILL.

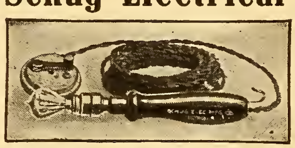
MAKE MONEY TATTOOING WITH AN Electric Tattooing Machine

This machine can be operated on any 5-volt battery circuit (four or five dry cells give plenty of current) and anyone can become an expert at the art by using my machine and methods.

Write today now for particulars and information regarding this money-making proposition.

J. F. BARBER, 1019 VINE STREET, CINCINNATI, OHIO

Schug Electrical Specialties



Spark Coils, Spark Plugs, Storage Batteries, Electric Lighting outfits.

BEST BY EVERY TEST

Send 4c postage for our illustrated catalog; free to dealers. Write us today.

SCHUG ELECTRIC MFG. CO.
Detroit, Mich. "Dept. W."

30 DAYS FREE TRIAL
ORDER TODAY—NOW

The Waage Electric Soldering Tool is absolutely the most perfect Soldering Iron made, "it stands up all the time," "doesn't burn out," does everything that any soldering iron will do and more besides. Lowest cost of operation. The direct heat application method together with the new heat unit construction makes it the most economical Iron manufactured—save its cost in 30 days. Heat where it is needed **at the point.** Consumes 40% less current than other irons—The price less than others—**AGENTS WANTED NOW.** Send at once for prices—better send for an iron today—now.

ILLINOIS APPLIANCE CO., 611 Crilly Building, CHICAGO, ILL.

The 1900 Dry Battery

for **Wireless Telephone and Telegraph,** experimental and research work, has proven itself to be the best dry battery you can possibly purchase because of its high electro-motive force as well as its great efficiency—both of these features being necessary when battery current is required to produce satisfactory results.

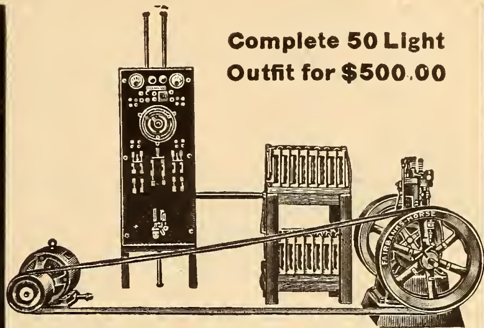
The Known Quality

of the 1900 dry cells also recommends its use for automobiles, motor boats and all applications of gas engine ignition.
Write today for our catalog and circular which gives full information and particulars.

The Nungesser Electric Battery Co.
CLEVELAND, OHIO

General Sales Office:—128 West Jackson Blvd., CHICAGO

Electric Light



Complete 50 Light Outfit for $500.00

including FAIRBANKS-MORSE Special Electric Engine and Dynamo, Storage Battery and Switchboard, fixtures and Tungsten Lamps.

This outfit will operate as steady and reliably as a city plant. It offers a relief from the dirt, danger and unsanitary conditions arising from old methods of illumination, and gives an economical light that is both safe, convenient and healthful; in fact, there is no substitute for the soft, white light diffused by Tungsten Lamps; it is even said to rival day light.

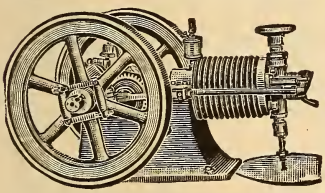
Same engine can be used for operating pumping plant or other machinery. Engine operates on gas, gasoline, kerosene or distillate.

Larger plants in proportion up to 500 H. P.

Mention this publication and send for descriptive catalog No. 1163 CB.

Fairbanks, Morse & Co.
481 Wabash Ave. Chicago, Ill.

We Will Send You THIS ENGINE FREE



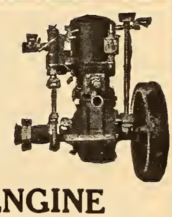
FOR 30 DAYS so you can test it out and prove to yourself it's the best little all-around gasoline engine ever produced. It is adapted for all uses in Shop, Farm and Home. We ship complete—all set up and connected—ready for use. It's so simple a woman can run it—simply fill in the gasoline—give it a turn and away it goes.

Thompson Gasoline Engines

are built on correct lines. Piston and rings are of special design, like those in the finest motor car engines. Let us send you free book and tell you all about our wonderful 30-Day Free Trial Offer. **Write today.**

J. THOMPSON & SONS MANUFACTURING CO.
41 Oak Street, BELOIT, WIS.

CUT DOWN YOUR MOTOR-BOAT EXPENSE



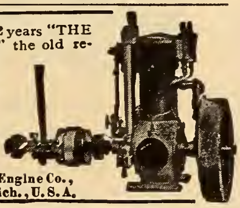
And add to your boating pleasure. You can do it easily and surely. Just get rid of that old time-killing, money-wasting, rattle-trap of a motor and install a

PERFECTION ENGINE

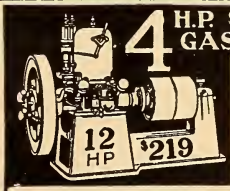
Simple, efficient, thoroughly reliable and wonderfully durable. Easy to start and to run. So accurately built, it can't get out of order. No money wasted on repairs: saves on fuel and oil every day. **Write us today** for our handsome engine book, proof of perfection, economy and other valuable information of vital interest to every boat owner.

THE CAILLE PERFECTION MOTOR CO.
22 Amsterdam Avenue DETROIT, MICHIGAN

"The Strelinger" For more than 12 years "THE STRELINGER," the old reliable 4-cycle Marine Motor, has stood for the best in Marine Gasoline Engines. The Most Reliable, Durable and Economical Marine Motor made. January, 1910, we purchased the United Manufacturing Co.'s Plant and will continue the manufacture of the "Little Giant" 2-Cycle Marine Motors. We can furnish you engines from 1 1-2 to 60 H.P. Agents wanted. The Strelinger Marine Engine Co., 171-175 Woodbridge St., W., E. Detroit, Mich., U. S. A.

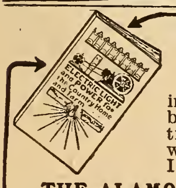


4 H.P. STATIONARY GASOLINE ENGINE COMPLETE $76.00



For Farmwork, Irrigation or Pumping, Factory use and Electric Lighting.
3 to 20 h.p.—perfectly governed—guaranteed by a responsible firm. Write for full description.

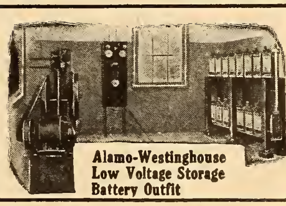
GRAY MOTOR CO., 128 Leib St., DETROIT, MICH.



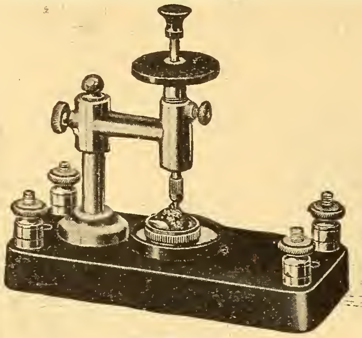
Do You Want Electric Light or Power for Your Country Home or Farm?

If you are out of reach of central station current and wish to install a gas engine electric outfit, either with or without storage battery, write for our Handbook, here illustrated. Alamo Electric outfits are standard. Our prices are as low as consistent with high-grade machines suitable for permanent installations. Investigate our proposition, it places you under no obligation.

THE ALAMO MANUFACTURING CO., 73 South St., Hillsdale, Mich.



Alamo-Westinghouse Low Voltage Storage Battery Outfit



$15.00

Murdock Wireless Apparatus

What Everybody Knows

is that without a good detector, wireless is a failure. We offer to experimenters

A Guaranteed Silicon Detector

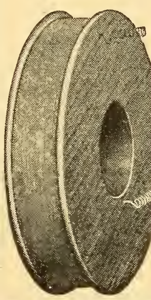
protected by patent and positively the best manufactured. You *need* the guaranteed, genuine silicon.

Wireless Sets for Schools and Colleges

WM. J. MURDOCK CO.

162 Minna St. SAN FRANCISCO | **50 Carter St. CHELSEA, MASS.** | **221 S. Clinton St. CHICAGO**

SECONDARY "UNITS"



Been having trouble winding your Secondary for your Induction Coil or Transformer? Why not put your worries on our shoulders? The winding is not a WORRY to us, as we have the equipment, and winding coils is a part of our BUSINESS.

Our Secondary "UNITS" are wood spool sections wound, parafined, etc., and all ready to connect up. You can buy a spool at a time or as many as you want, and they will cost you but little more than the wire alone,

Send 2-cent stamp for our large catalogue which tells all about it and many other things "WIRELESS" besides

Dawson & Winger Electric Co.

429 Dearborn Street: Chicago, Ill.

ENAMEL INSULATED FRENCH *Feval* PROCESS **MAGNET WIRE**

ENAMEL WIRE is supplanting silk and cotton covered because **The Insulation is better, because It requires less space, because It is cheaper.**

FEVAL WIRE has a dielectric strength in excess of 75 volts per .0001 inch of insulation. The evenly distributed enamel covering adheres tenaciously yet is resistant and elastic, never cracking. No change at 400° to 500° F. All sizes, Nos. 16 to 40.

MANUFACTURERS: We have an attractive contract proposal to offer covering your requirements for 12 months.

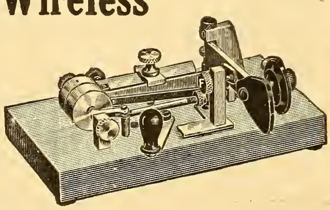
INDIVIDUALS: We will furnish small quantities for spark coils and magnets.

FEVAL ENAMEL INSULATED WIRE CO.

129 N. Curtis Street CHICAGO

MECOGRAPH

Superb for Wireless



The Best Telegraphic Transmitter in the World.

More MECOGRAPHS are in use than all other automatic transmitters combined.

BECAUSE—

Over 60 percent more movements required to send on a Morse key than on a MECOGRAPH.

Holds best records for speed and long distance sending.

All expert telegraphers and all bonus men use sending machines.

Operators everywhere are improving their efficiency by adopting the use of the MECOGRAPH. Fall in line now. Eliminates glass arm.

Price $7.50. **After Nov. 1, 1910, price goes to $8.00**

Carrying Case $1.00 extra

N. Y. Agent, D. A. MAHONEY, Rooms 90-91, No. 50 Broadway

COUPON

MECOGRAPH CO., 321 Frankfort Ave., CLEVELAND, O.

Please send me descriptive literature of the Mecograph.

Name.........................

Address.........................

PE

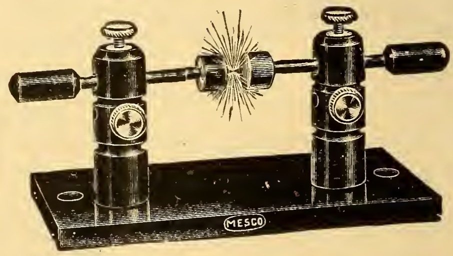
Sign and Mail Us Coupon for Our

Free Catalogue

MECOGRAPH

321 Frankfort Ave., CLEVELAND, O.

WIRELESS TELEGRAPHY



We have published a Manual of Wireless Telegraphy, describing the art and the best known methods of erecting stations for both short and long lines. This 80 page Manual No. 1E will be mailed on application.

Catalogue No 24B 180 pages of general electrical supplies mailed on request.

Manhattan Electrical Supply Co.,

New York, 17 Park Place | **Chicago, 188 Fifth Ave.**

Electrical Experimental Outfit for $5.00

With blue prints, instruction sheets and all goods mentioned in the coupon

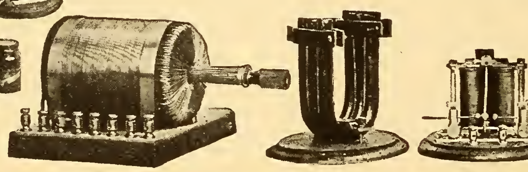
1. Generator-weight five pounds, has bronze bearings, brass gear drive, silk wound armature and handle.
2. Polorized Interuptor Set.
3. Three Bar Magnetic Set.
4. Ten Brass Binding Posts.
5. Polorized Ringer Set.
6. Three Pounds Iron Core.
7. Magnet Wire for Spark Coil.
8. Compass and Iron Filings.
9. Induction Coil and Interupter.
10. Two Pair Electro-Magnets.
11. Solenoid Magnet.
12. Relay for Signal.
13. Solenoid Ball Set.
14. Two Small Lamps.
15. Large 110-Volt Lamp for Generator.
16. Three Lamp Sockets.
17. Material for making bell transformer.
18. Raw material such as sheets fibre, brass tube, rod and sheet, rubber, contacts, and shellac, mica and tin foil.
19. Three stamped envelopes addressed to our instructor.
20. All goods listed in coupon.

Free Auto Transformer

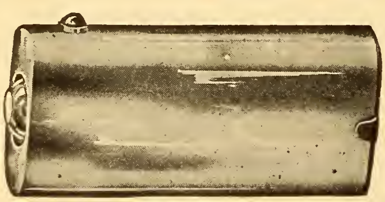
CUT OUT THIS COUPON and send it with your order and we will send you free, a 250-page electrical instruction book, six blue prints of things you can do with our outfit, and an unassembled auto transformer. Send order ***NOW.***

WESTERN ELECTRIC SALVAGE CO.

1224 So. Washtenaw Ave., Chicago, Ill.



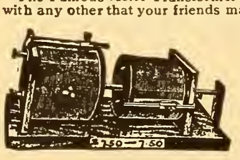
SPECIAL



$1.00

The Famous Pocket two-cell Esram Tungsten Lamp complete, postpaid to any address for the small sum of **$1.00.** Three-cell Tungsten Lamps, postpaid for **35 cents.** Three-cell Esram Tungsten Lamp, postpaid for **35 cents.** Complete Pocket Lamp, postpaid for **45 cents.** 4 1-2 Volt Lamp and Socket, postpaid for **25 cents.** We can save you money on all the wireless telegraph and electrieal supplies. Send for **Our Free Catalogue.**

The Famous $15.00 Transformer for **$8.00.** Get it and compare with any other that your friends may have. A double pole, single throw switch, porcelain base, regular price 35 cents, this month, postpaid for **25 cts.** Our Double Pole Wireless Receivers. special this month, complete with headband and cord, postpaid, for **$4.00. We allow 10 per cent discount** on our catalogue price on all goods bought before December 1st, 1910. We want to show you our goods and the promptness of shipping orders. **Take the advantage of the 10 per cent discount, We urge you.** Money **refunded** if you are not satisfied with the goods.



Write today for our Free, Free, Free Catalogue

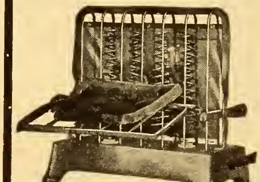
WOODS ALLIS COMPANY, Inc.

24 Exchange Street **BOSTON, MASS.**

Electric Toaster

Attach to any Electric Lamp socket and use it on the table.

Toasts one slice of bread per minute. Costs 1-12 of a cent per slice. Handsome and durable.



Brings comfort into your home. Always have fresh hot toast. Complete with attaching cord and plug $2.75 express prepaid.

ELECTRIC TOASTER COMPANY

52 Brush St., Detroit, U. S. A.

AUTOMATIC ELECTRIC WASHER

Is the simplest machine to operate you can possibly imagine, as all parts are very accessible.

We guarantee this machine to be the most substantial in construction, and by far the most convenient for its user.

Send to day for our booklet of information.

Automatic Electric Washer Co., - Newton, Ia.

30653

A Live Boy's Choice for Christmas

THORDARSON'S TOY TRANSFORMERS

Attach to any alternating current lamp socket and have a miniature Power Plant of your own. Operates any class of electrical toys, rings bells, lights small lamps and does any of the dozens of things you want to do. **Indestructible.** Besides the fun you get you learn the fundamental working principles of electricity—no more battery trouble. Show this to your father.

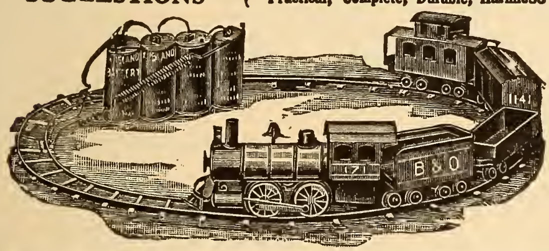
Write us for descriptive circular

Thordarson Electric Mfg. Company

220 So. Jefferson St., Chicago

ELECTRICAL TOYS FOR BOYS

SOME CHRISTMAS SUGGESTIONS } **SCIENTIFIC ELECTRICAL NOVELTIES** Practical, Complete, Durable, Harmless



EVERY boy in the country can easily *own* a railroad. Costs little and pays big dividends in fun. Our Models of Locomotives, Trains, Trolley Cars, Dynamos, Lamps, etc. are practicable and durable inventions. Equipped with dry batteries, no acids or liquids used, perfectly safe and harmless. Electrical toys instruct as well as amuse.

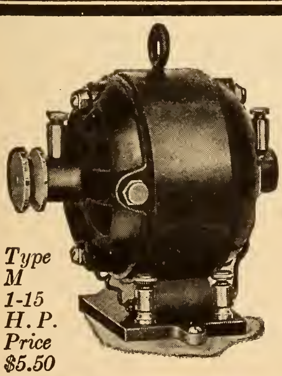
Catalog B, fully illustrated, quoting low prices—SENT FREE.

THE CARLISLE & FINCH CO.

264 E. Clifton Ave., Cincinnati, Ohio

Largest Manufacturers Electrical Novelties in the World.

New Toy Motors For Boys



Type M 1-15 H. P. Price $5.50

WITH ALL THE LATEST IMPROVEMENTS

WOUND FOR 110 VOLTS BOTH ALTERNATING AND DIRECT CURRENT

No more trouble or expense with batteries. Simply use an attachment cord connected to any lamp socket. The best motors made for operating mechanical toys, models, advertising devices, 8-inch fan blades, etc. No boy's experimental laboratory complete without one of these motors. *Exact reproductions of large commercial motors* beautifully finished in black enamel; brass parts polished.

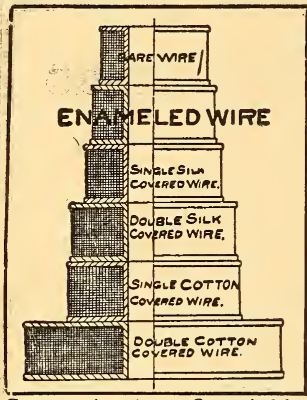
TYPE C.	1-30 H. P.	WEIGHS	2 1-4	LBS.	$3.50
" D.	1-25 "	"	3	"	4.50
" M.	1-15 "	"	4	"	5.50

Type C. and D have field ring made in one piece. Type M. has laminated field and armature built of the best grade of electric sheet steel, 3-16-inch self-adjusting carbon brushes, mica insulated commutator, long bronze bearings, brass oilers, large brass pulley and brass terminals. This is the most efficient small motor on the market. Positively will not run hot.

Special for the Electrical Student—These motors complete, in parts, ready to assemble, with blue prints: Type C. $2. Type D. $2.50, Type M. $4.00 Special offer for a limited time only. A chance for the ambitious boy to perform numerous experiments to which he can point with pride and say: "I did it."

Send Express or P. O. Money Order

JOSEPH WEIDENHOFF, Manufacturer of Electrical Specialties, 1215 SOUTH ASHLAND AVENUE, CHICAGO



Comparative Space Occupied by Enamel and Fabric Insulations.

Is it a MATTER of COST?

By using

AMERICAN ENAMELED MAGNET WIRE

You can get the same results for

25% to 50%

LESS MONEY

And you get better wire and better service
Ask for **BULLETIN 311**

AMERICAN ELECTRIC FUSE CO.

Dept. W, Muskegon, Mich.

It Pays To Use This Battery

IT is necessary to have a DEPENDABLE Dry Cell in all ignition work and the

ROCK ISLAND

gives the spark needed to insure greatest satisfaction. Best for all purposes.

Price 25 Cents

Write today for Battery Booklet N. "Best on Every Test."

R·I BAT

The Rock Island Battery Co.

Winton Place Station **Cincinnati, Ohio**

TESTED APPARATUS Means the Elimination of Faults in Your Product.

Electrical and photometrical tests of every description.
Checking electrical instruments of all kinds and classes.
Inspecting and testing new electrical machinery, apparatus and material at factories and after installation.
Tests on any electrical machinery and apparatus made anywhere.
Arc and incandescent lamp tests, either electric, gas, acetylene or oil.
Illumination tests made anywhere.
Secondary standards of candle-power furnished.
Facilities furnished to experimenters and investigators.

We have recently added to the above, coal testing, and are now prepared to make proximate analyses and calorific determinations on samples of coal, promptly and accurately.

ELECTRICAL TESTING LABORATORIES

80th Street and East End Avenue **NEW YORK, N. Y.**

Cook Your Meals by ELECTRICITY ECONOMICALLY. Use The QUAD ELECTRIC STOVE AND FIRELESS COOKER to do it.

The "QUAD" is the most perfect Electric Cooker made. It will cook an entire Dinner—better, cheaper and with greater economy than by any other method, as after the stove is thoroughly hot, you can turn off the current (saving fuel) and it will finish cooking the meal without further trouble.

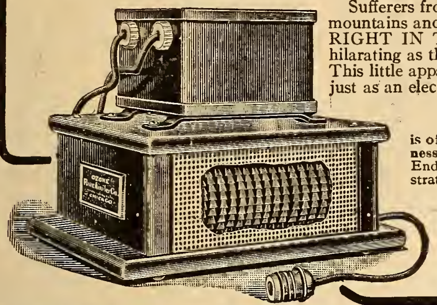
No hot kitchen, no dirt, everything absolutely sanitary and clean. In every Home where Electricity is, there should be a **QUAD** Electric Cooker.

Let us send you our circular which explains in full what the **QUAD** will do—the current it consumes—and the delicious way it cooks the food.

If you cannot obtain one from the Electric Light Company, write us direct.

A. L. SYKES MFG. CO., 129 E. Pearl St., CINCINNATI, O.

Let Electricity Make Pure Air for You



Sufferers from many ailments travel thousands of miles to breathe the OZONE of the mountains and pine forests. Yet a recent scientific invention enables everyone to have—RIGHT IN THEIR OWN BEDROOM—air constantly as pure, refreshing and exhilarating as the purest oxygen-filled atmosphere of the piny woods and mountain peaks. This little apparatus is operated by electricity and "ozonizes" the air of the closest room just as an electric storm purifies the out-door air. The

OZONE PURE AIRIFIER

is of greatest benefit in the treatment of Asthma, Hay Fever, Catarrh, Insomnia, Nervousness, Pneumonia, Typhoid and Scarlet Fevers, Diphtheria, Bronchitis, Tuberculosis, etc. Endorsed by highest medical and scientific authoritiesa thoroughly tested and demonstrated success.

Central Station, Electric Jobber and Dealer, this is the latest Electrical Appliance on the market. Write now for illustrated catalogue, price list and descriptive matter and plan of placing for liberal trial.

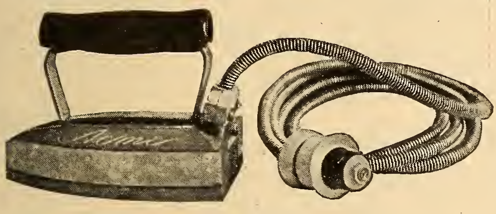
We want distribution throughout the United States in Every Place Where Electrical Appliances are Sold.

OZONE PURE AIRIFIER COMPANY

307-314 Rand McNally Bldg. CHICAGO, ILL.

The Acme Armored Iron

Built to Perform the Work as Demanded by the Central Station .. And Here's Why



ARMORED CORD—Don't kink, twist, snarl or break; cannot burn or interfere with the iron or its operator. Absolutely trouble-proof and lasts a life time.

THE IRON—Not all units, but lots of iron to retain the heat; lowest amount of radiation; guaranteed to sizzle in two minutes. Consumes not more than 2 cents per hour. Units renewed at home—the elements can be quickly and easily renewed without the use of tools.

It's a Woman's Iron—built along the housewife's idea—will withstand absolutely the hardest usage under all conditions.

Not a Trouble Maker, but a trouble saver for the Central Station. You cannot understand why we named it "A C M E" unless you see the Iron, or ask about it.

ACME ELECTRIC HEATER CO., 807 Scotten Ave., DETROIT, MICH.

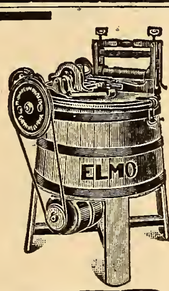
Protected Gears

of

This Washing Machine

Save

Fingers and Clothes



No danger of anything catching in the cogs or gearing of the Elmo—a big advantage to the user. In addition

THE ELMO

has positive action wringer, easy opening lid, noiseless back gear drive, reversible wringer and many other exclusive features. WRITE FOR BOOKLET that describes them all in detail.

Grinnell Washing Machine Co.

GRINNELL, IA.

Canadian Trade Supplied by the Gem Motor Co

419 Portage Ave. :: Winnipeg, Man.

An Electric Cook Stove

That is Practical and Reasonable

Two kinds of stoves—Electric and Fireless—for the price of one.

Ask About It

The Comet Electric Stove is designed to save fuel. It does a day's cooking at the cost of burning an ordinary electric light less than one hour.

Reasonable to buy—convenient to use—economical for the Home, Camp, Motor Boat, or Automobile. You don't have to depend on electricity alone—it's a fireless cooker as well.

Ask us more about it now—today. Special prices to Central Stations and Dealers.

COMET ELECTRIC STOVE CO.

37 19th Street DETROIT, MICH.

BUY YOUR PLUMBING AT WHOLESALE PRICES

DOING BUSINESS FOR 25 YEARS AT SAME ADDRESS.

$24.95 for complete bath room outfit. Five foot roll rim porcelain enameled bath, porcelain enameled lavatory, low pattern syphonic closet, $39.00. Hardin's warranty beats any other guarantee.

Save 35 to 70%

Complete Heating Plants and Water Systems for Country Homes. Get our 150-page Money-Saving Catalog No. 9, Free. Write today.

JOHN HARDIN CO., 4553 Cottage Grove Avenue CHICAGO, ILL.

Washing Dishes

is the bugbear of every housewife and half the servant problem.

THE SANITARY DISHWASHER FOR FAMILY USE

Washes, rinses, dries and polishes in 3 to 5 minutes. Cleanses and sterilizes dishes with scalding soap-suds and rinses them, completely removing all traces of food, grease, etc. Hands do not touch water. Saves labor, time, towels, breakage. All metal—compact—strong—lasts a lifetime.

Sold on Trial — Why Not

escape the drudgery of dish-washing, as hundreds of women have. Read their letters in our booklet. Write today.

National Machine & Stamping Co
1526 Chamber of Commerce, Detroit, Mich

IRONING MADE EASY

Your bed and table linen, plain clothes, flat pieces, 80 per cent of family wash, can be ironed **Easier** (no backache or tired feet), **Quicker** (in 1-5 the time), **Better,** with finish far superior to hand work. by using the

SIMPLEX IRONER
"THE BEST IRONER"

1½ ct. per hour to heat by gas or gasoline. **Price within reach of all.** Sizes for small homes and large; operate by hand, or small washing machine motor. **Illustrated booklet** sent **free** on request.
Write for our **30 day free trial offer** and nearest dealer.

American Ironing Machine Co., 25 E. Lake St., Chicago

Big Mail FREE

Your **NAME PRINTED** in our Mailing Directory and sent to 10,000 firms all over the world so they can send you **FREE Samples, Catalogs, Books, Papers, Magazines, etc., etc.** Send 20c to cover cost of printing your name and you will receive a big mail **Free.**

Ingram, Va., Jan. 7, 1910. Mr. Anderson, I have already received more than 2,000 parcels of mail, and still they come, scores of papers, samples, magazines, etc., for which I had often paid 10 to 25c each. R. T. James,

Send to ANDERSON, The Mail Man, 565B, Jamestown, N. Y.

EVERY BOY HIS OWN TOYMAKER

GREATEST BOYS BOOK EVER WRITTEN.
Tells how to make a STEAM ENGINE. CAMERA. WINDMILL. MICROSCOPE. ELECTRIC TELEGRAPH. TELEPHONE. MAGIC LANTERN. BOATS of every kind. KITES. BALLOONS. TOYS. WAGONS. BOWS and ARROWS. STILTS. ANIMAL TRAPS. etc.
OVER 200 PICTURES. THIS BOOK and CATALOGUE ONLY 10 cents. POSTPAID.
ELECTRIC FUN MAKERS
Dept. 29. KEWANEE. ILL.

BYSTROM LIGHT — GOOD AGENTS WANTED

Great Money-Making Opportunity. Bystrom lights most up-to-date on market. Convenient as gas or electricity, brighter, safer, cheaper. Endorsed by insurance companies. Burn 96% air, 4% gasoline. 500 C. P. light costs ⅓ cent an hour. **Write today for free booklet. THE BYSTROM GAS LAMP CO., Dept. K Defiance, Ohio.**

NULITE GASOLINE TABLE LAMP

A beautiful lamp for homes, hotels, offices, stores, banks, cafes. Portable, safe; can be turned upside down or rolled on floor without danger or affecting the light. 300 C. P. of soft, brilliant light; one-third cent per hour.

Agents—We want town, county and travelling salesmen. Best proposition ever offered. Sells everywhere. No experience necessary. Write for Special Offer.

CHICAGO SOLAR LIGHT COMPANY
219 South Jefferson Street CHICAGO

The Thor Electric Home Laundry Machine

This cut shows the Thor washing and wringing clothes at the same time.

Write for catalog.

HurleyMachineCo.
29 S. Clinton St.
CHICAGO
1010 Flat Iron Bldg.
NEW YORK

HESS — Sent on Approval — FURNACE

No.45 "Leader" Hess Steel Furnace Price $49
Delivered East of Omaha and North of Ohio River
Pipes and Registers Extra

We will deliver a complete heating equipment at your station at factory prices and wait for our pay while you test it during 60 days of winter weather.

The entire outfit **must satisfy you** or you pay nothing. Isn't this worth looking into? Could we offer such liberal terms if we didn't know that the **Hess Furnace** excels in service, simplicity, efficiency, economy?

We are makers—not dealers—and will save you all middlemens' profits. No room for more details here. Write today for free 48-page booklet which tells all about it.

Your name and address on a post card is sufficient.

HESS,* 912 *Tacoma Bldg., Chicago

FURNITURE ON MONTHLY PAYMENTS

Just a small remittance each month—whatever you can conveniently spare—and the beautiful homefurnishings that you select are easily paid for. Just consider what a convenience this would be to *you.* It would give you immediate use of the furnishings you order to enjoy in your own home while paying for them in small amounts from month to month as you earn the money. It's by far the most generous credit service offered by any homefurnishing institution in America. We charge absolutely nothing for this credit accommodation—no interest—no extras of any kind.

CATALOG No. 19 FREE

It is full of information that is of deepest importance to every householder—contains many valuable suggestions on furnishing and beautifying the home. It's a big buyer's guide—explains relative values—describes economies in furniture manufacture and tells of a great modern method of merchandising that is proving a blessing to thousands of families of moderate income all over the United States. Write for the catalog and learn how easy we'll make it for you—no matter what your income may be—to have everything you want for your home. This great catalog is beautifully illustrated, a considerable portion of it being reproduced in colors. It quotes factory prices on Furniture, Stoves, Rugs, Carpets, Pianos, Go-Carts, Refrigerators, Silverware, Sewing Machines, Crockery, Lamps, Clocks, etc., etc. Write for this great catalog at once—write for it today.

OAK HEATER

75c Cash with your order

Balance 50c per month until purchase price is paid; a handsome heater, elegant nickel trimmings; heavy castings, extra durable.

Oak Heater

No. S 9205 10-in. firepot $5.69
No. S 9206 12-in. firepot 7.25
No. S 9207 14-in. firepot 9.15

Screw draft register

HARTMAN FURNITURE & CARPET CO.

Dept. A6 223 to 229 WABASH AVE., CHICAGO, U. S. A.

Largest, oldest and best known homefurnishing concern in America—established 1855—55 years of success—22 great stores—over 2,000,000 homes furnished—over 700,000 customers—capital and resources greater than that of any similar concern in the country.

Get the Book

AGENTS

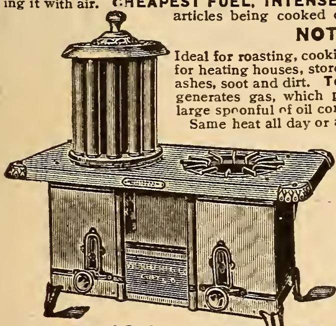
SPEND 1 CENT Earn $6 to $12 a Day!

FREE FUEL—AIR BURNER!

Remarkable Patented Stove, Heating or Cooking—Consumes 395 Barrels Air to One Gallon Common Coal Oil.

Air now burned in this wonderful Stove is free to rich and poor alike. No trust in control. **This VALVELESS, WICKLESS, AUTOMATIC OIL-GAS and AIR-BURNER STOVE,** automatically generates gas from kerosene oil, mixing it with air. **CHEAPEST FUEL, INTENSE HEAT, Heat concentrated** under cooking vessels and absorbed by articles being cooked or concentrated under Radiator and distributed throughout **room.**

NOT LIKE THOSE SOLD IN STORES



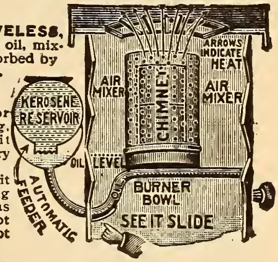
Heater and Cooker or Heating Exclusively.

Ideal for roasting, cooking, baking, ironing, canning fruit, etc. **In winter** use Radiator for heating houses, stores, rooms, etc.—always ready. No more carrying coal, kindling, ashes, soot and dirt. **To operate**—turn knob—oil runs into burner—touch a match; it generates gas, which passes through air mixer, drawing in about a barrel of air to every large spoonful of oil consumed. **That's all.** It is self-regulating, no more attention.

Same heat all day or all night. For more or less heat, simply turn the knob. There it remains until you come again. To put fire out, turn knob, raising burner—oil runs back into can, fire's out. As near perfection as anything in the world. Not dangerous like gasoline. No dirt, soot or ashes. No leaks, nothing to clog or close up. No wick—**not** even a valve, yet heat is under perfect control.

D. CARN, IND., writes: "It costs only **4 1-2 cents a day for fuel.**" **L. NORRIS, VT.,** writes: "The Harrison Oil-Gas Generators are wonderful savers of fuel, at least **50 to 75 per cent** over wood and coal." **E. ARNOLD, NEB.,** writes: "Saved **$4.25 a month for fuel** by using the Harrison Oil-Gas Stove. My range costs me $5 50 per month, the Harrison **$1.25** per month." **WM. BAERING, IND.,** writes: "We warmed a room when it was 10 below zero with one Radiator." **Rev. WM. TEARN, ME.,** writes: "This morning 16 below zero—soon after lighting Harrison Oil Gas Stove temperature rose to summer heat.

Absolutely safe from explosion. Not dangerous like gasoline. Simple, durable—lasts for years. Saves expense, drudgery, fuel bills.



Sectional Cut of Generator

Give this Stove a trial. Send no money—only send your name and address. Write to-day for full description, thousands of testimonials. **Our 1910 Proposition. Circulars FREE.**

Exciting Business for Agents

Salesmen, Managers—Men or Women, at home or traveling, all or part time—showing—taking orders appointing agents, etc. **Messrs Head & Grazer, Texas,** write: "Enclosed find order for $81. Rush. Sell like hot cakes. **Sold 50 stoves in our town.**" **B. L. Heusted, Mich.,** writes: "**Been out 1 day and sold 11 stoves.**" This patent new. **Nothing like it.** Demand enormous Agents reaping great harvest. Where operated people stop, look, get interested, want to buy at once. Show doze., sell ten. **Write to-day for special Agents' new plan. Send no money.** World unsupplied. Get in early for territory.

All Sizes. Prices Low, $3.25 and up. Sent to any Address.

THE WORLD MANUFACTURING CO.

833 World Bldg., CINCINNATI, O.

IDEAL CHRISTMAS GIFTS

ELECTRICITY VOLTAMP

The most wonderful and fascinating scientific study of the age. Every Boy, Girl and Grown-up should know about it. The new "VOLTAMP ELECTRICAL PRODUCTS"—our 112 Page Catalog now ready, the most complete and interesting book ever issued—is full of illustrations and descriptions of the latest VOLTAMP Electrical Novelties—Motors, Dynamos, Toys, Machine Models, Telegraph and "Wireless" Instruments, Ruhmkorff Coils, Spark Coils, Geissler Tubes, Switches, Meters, Lamps, Flashlights, Transformers, Tools, etc. The greatest line of Miniature Electric Railways ever shown. Anything Electrical for Anybody. Prices consistently low.

Send for this Catalog—6 cents in stamps or coin, which will be refunded on first order of 50 cents or over. No postals answered.

VOLTAMP ELECTRIC MFG. CO., Park Bldg., Baltimore, Md.

H. M. Byllesby & Company
ENGINEERS

Examinations and Reports

218 La Salle Street
Chicago

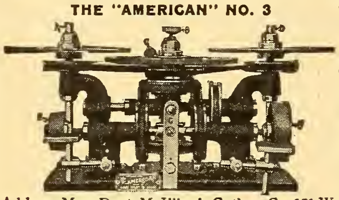
FOOT AND ELECTRICAL DRIVEN
Power and Turret Lathes, Planers, Sharpeners, and Drill Presses.
Write today for our Complete Catalog.
Shepard Lathe Co.
B. 131 W. 2nd St., Cincinnati, Ohio

VACUUM Washer 30 Day Trial

To prove to every reader of this magazine that she can wash clothes with least work and wear with
Syracuse "EASY" Washer
we will ship one on 30 days' trial and pay freight both ways if you do not find it far better than any you ever tried. Easy pumping motion. Water heated in rust-proof tub. Cleanses laces, clothes, carpets. *Write for free booklet; valuable recipes and trial offer.*
DODGE & ZUILL
539 C Dillaye Bldg., Syracuse, N. Y.
Toronto Branch, L. G. Beebe, Mgr., 92 Olive Ave.

$5.00 TO $10.00 A DAY MADE EASY

THE "AMERICAN" NO. 3

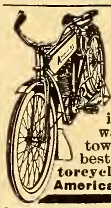


The "American" Machine

Hones razors, sharpens all kinds of safety razor blades, clippers, scissors, etc. No makebelieve, but the real thing. Complete outfits furnished with instructions how to do the work. No previous experience required.

Address Mgr. Dept. M, Illinois Cutlery Co, 171 Washington St., Chicago

---



We Will Sell You At Wholesale
Agents' Price, One
AMERICAN MOTORCYCLE or BICYCLE

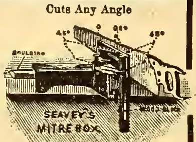
if we haven't an agent in your city. We want our machine introduced in every town. We also want live agents and offer the best moneymaking proposition on American Motorcycles and American Bicycles. Write us—do it now.
American Motorcycle Co., 1438 Wells St., Chicago, Ill

"SEAVEY" MITRE BOX
MEETS EVERY REQUIREMENT

Special Offer: On return of this "Ad" and $2.00 one of these Mitre Boxes will be shipped to any reader of "Popular Electricity." Offer good for 30 days from date of issue.

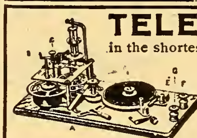
PORTABLE CAN BE CARRIED IN THE TOOL KIT

Cuts Any Angle

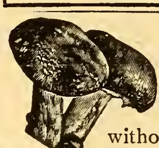


Weighs 2 Pounds

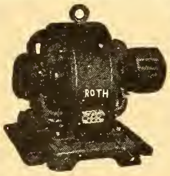
SMITH & HEMENWAY CO., 108 Duane Street, NEW YORK CITY



TELEGRAPHY TAUGHT
in the shortest possible time. The Omnigragh Automatic Transmitter combined with standard key and sounder. Sends you telegraph messages at any speed just as an expert operator would. Five styles, $2 up; circular free.
OMNIGRAPH MFG. CO.
39 H Cortlandt Street New York



Grow Mushrooms
For Big and Quick Profits.
Ten years' experience enables me to give practical instructions that will add $5 to $60 per week to your income without interfering with regular occupation. For full particulars and free book, address **JACKSON MUSHROOM FARM,**
5860 N. Western Ave., Chicago, Ills.

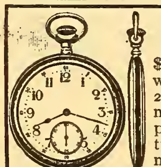


ROTH
ELECTRIC MOTORS
POLISHING LATHES
FORGE BLOWERS
SPECIAL MACHINERY

ROTH BROS. & CO.
1358 W. Adams St. Chicago, Ill.
136 Liberty St. New York City

Remoh Gems

Looks like a diamond—wears like a diamond—brilliancy guaranteed forever—stands filing and fire like a diamond—has no paste, foil or artificial backing. Set only in 14k. solid gold mountings. 1-20th the cost of diamonds. A marvelously reconstructed gem. Not an imitation. Guaranteed to contain no glass. Sent on approval. Write for catalog, it's free.
REMOH JEWELRY CO., 515 N. Bdway, St. Louis



ELECTRICIAN'S WATCH—NON MAGNETIC

Send now for my non-magnetic watch, only $5.00 (delivered). This watch will positively withstand all magnetic attractions. Tested to 2000 volts, absolutely guaranteed to keep the most accurate time under all conditions. Approved by everybody in the Electrical Industry. Stem wind and set; dust proof; thin model.

E. KIRCHBERG 76 State Street CHICAGO.

VENTRILOQUISM
Learned by any Man or Boy at Home. Small cost. Send today 2-cent stamp for particulars and proof.
O. A. SMITH, Room 1432, 823 Bigelow St., PEORIA, ILL.

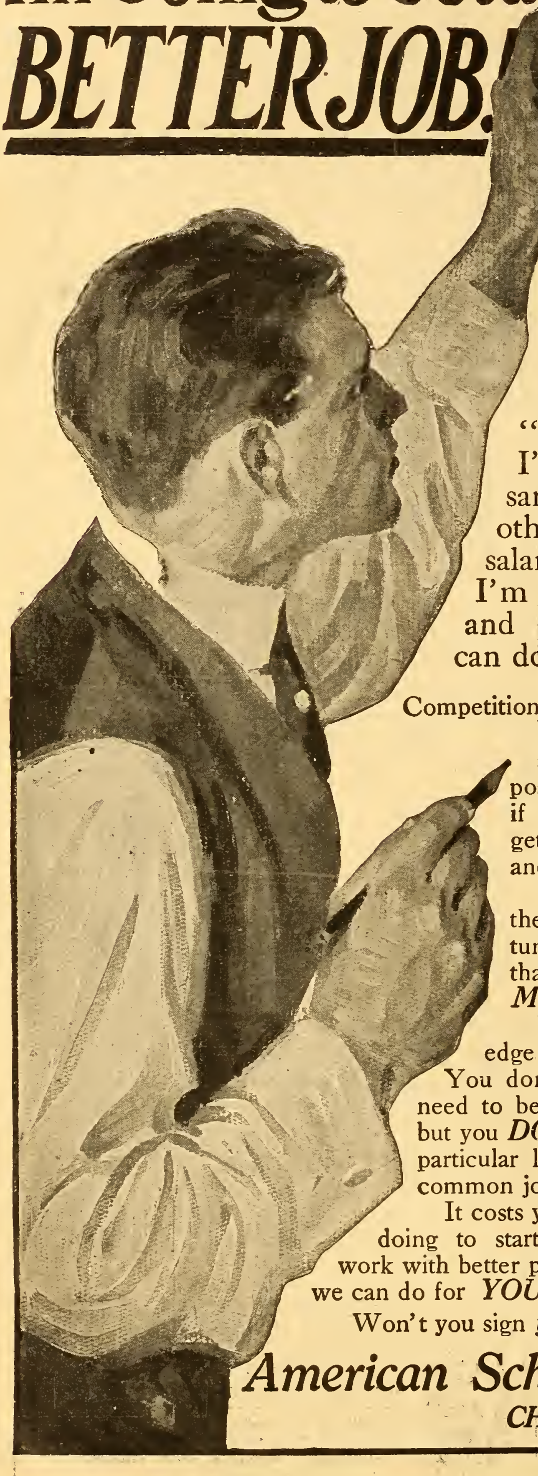
BIG PROFITS
For Men of Moderate Means

THE NEW ADVERTIGRAPH

The ADVERTIGRAPH is an Automatic Advertising Stereopticon, showing advertisements brilliantly in Store, Show-window, Street or Theatre. Any man with $300 can double his money every month with the ADVERTIGRAPH, at odd times or evenings. No experience necessary—we tell you how. Write today for full information. Others do it—why don't you.

WILLIAMS, BROWN & EARLE, Inc., Dept. 43, 918 Chestnut St., Philadelphia, Pa.

I'm Going to Get a BETTER JOB!



Opportunity Coupon

AMERICAN SCHOOL of CORRESPONDENCE

Please send me your Bulletin and advise me how I can qualify for the position marked "X."

..Book-keeper	......Draftsman
..Stenographer	......Architect
..Accountant	......Civil Engineer
..Cost Accountant	......Automobile Engineer
..Systematizer	......Electrical Engineer
..Cert'f'd Pub. Acc'nt	......Mechanical Engineer
..Auditor	......Sanitary Engineer
..Business Manager	......Steam Engineer
..Commercial Law	......Fire Insurance Eng'r
..Reclamation Eng'r	......College Preparatory

NAME________________

ADDRESS________________

OCCUPATION________________

Pop. Elect. 11-10

"I'm *tired* of earning a small salary. I'm *tired* of sticking along at the same old job. I'm *TIRED* of seeing other men get good positions and good salaries while I keep tagging behind. I'm going to sign this coupon *NOW* and *SEE* what the American School can do for me."

Competition is keener in every line than ever before. Every man should take stock of himself and see what he's going to do to improve his position, to figure out what chance he'll have if hundreds of other young men around him get *special knowledge* and *special training* and he does not.

These are the richest, most prosperous days the world has known — there are greater opportunities for men with backbone and ambition than ever before — opportunities for *Trained Men,* not untrained.

You've got to have more than average knowledge if you want to get more than an average job. You don't need to be a college graduate, you don't need to be a Bachelor of Arts or a Doctor of Laws, but you *DO* need to *BE AN EXPERT* in your own particular line, if you want something better than a common job and common pay.

It costs you ***nothing*** to find out exactly what we are doing to start thousands of men into more congenial work with better pay. It costs you ***nothing*** to find out what we can do for *YOU.*

Won't you sign ***your Opportunity Coupon*** today?

American School of Correspondence

CHICAGO, U. S. A.

"A Central Station plant ought to be busy 24 hours. It doesn't have to sleep."
—THOMAS A. EDISON.

THERE is about $6,000,000,000—about $75 for every man, woman and child in the United States—invested in the electrical business in the United States. And that investment has been made in the last 30 years. Truly this is the "age of electricity."

Thirty years ago electric lighting was a marvel—today it is in nearly every modern home. Every day sees some new application of electricity adding to the comfort of the home or the easier and more economic transaction of business.

The Central stations that supply current to the home, the factory and the railway, can hardly increase their equipment fast enough.

The biggest of these in the world, the **Commonwealth Edison Company,** Chicago, had in 1887 only $500,000 invested in its business; to day it has nearly $60,000,000.

Its business has increased in the last twelve years something like 4000%. And the limits of growth are not even within sight.

It supplies electricity at retail in an area of 200 square miles, but as yet does not supply more than one-third of the possible demand within that area. And Chicago is growing and growing—destined, as shrewd observers believe, to become the greatest city in the United States. Yet the retail service of the Company is only one-third of its total business.

The outlook of stockholders in the **Commonwealth Edison Company** is the brightest possible and there is every reason to expect that the 6% dividend, which the stock now pays, will be maintained or increased.

If you would like to own an interest in this gigantic enterprise, we will be glad to supply you with full information about the stock, which is listed on the Chicago Stock Exchange; also to answer any inquiries you may wish to make. Fill out and mail us this coupon.

CUT OUT AND MAIL THIS COUPON TODAY

Name..............................

Street..............................

City..............................

State..............................

RUSSELL, BREWSTER & CO.,
137 Adams St., Chicago, Ill.
Please send without charge to me information regarding this stock.

Russell, Brewster & Company

Members:
New York Stock Exchange
Chicago Stock Exchange

**137 Adams Street,
Chicago, Ill.**