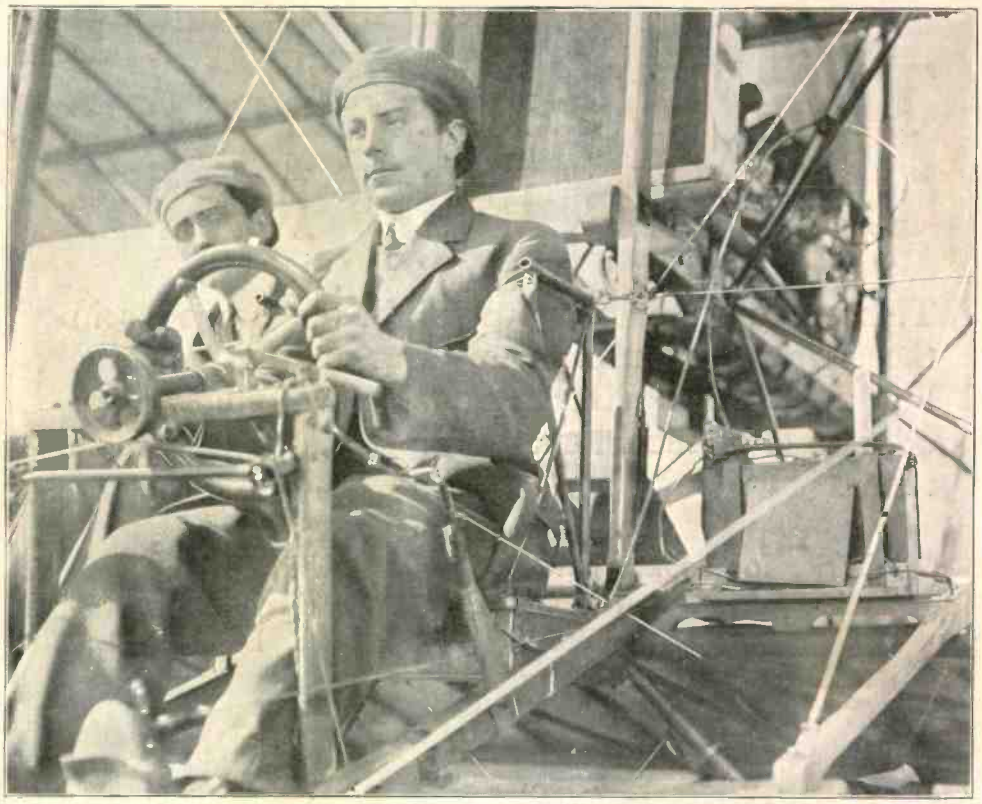
SKY SCOUTING WITH A WIRELESS SET

POPULAR ELECTRICITY MAGAZINE

IN PLAIN ENGLISH

(NON TECHNICAL)



AVIATOR JANNUS IN THE SIGNAL COEFS BIPLANE—WIRELESS OPERATOR BERMANN AT HIS RIGHT

See Page 193

Vol. IV JULY, 1911 No. 3

A MAGAZINE FOR EVERYBODY

10 Cents

P. S. & W. Guaranteed Pliers

include pliers for every use, box-joint or lap-joint—large or small.

Our Lap-joint Pliers are perfect in quality and construction—as perfect as a lap-joint plier can be made.

But our Box-joint Pliers are still better; for the P. S. & W. Box-Joint is the best possible type of plier-construction.

It can't work loose; it always works smoothly; the cutting *edges always meet with accuracy,* no matter how long used.

A Handy Book for the Handy Workman

Our "Mechanics' Handy List" shown above, not only lists the best pliers made, but has many pages of valuable shop-information and a catalog of over 200 Hand Tools for Electricians, Machinists, Carpenters and Tinsmiths. Every one of our Guaranteed Tools is branded with The MARK of the MAKER.

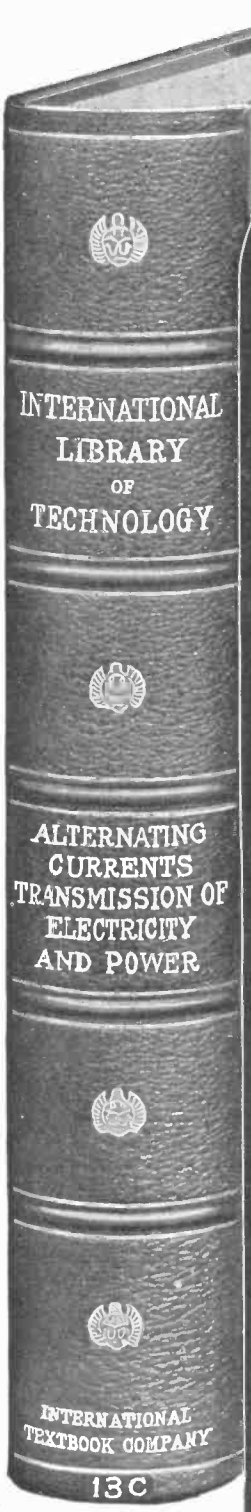
The Peck, Stow & Wilcox Co.

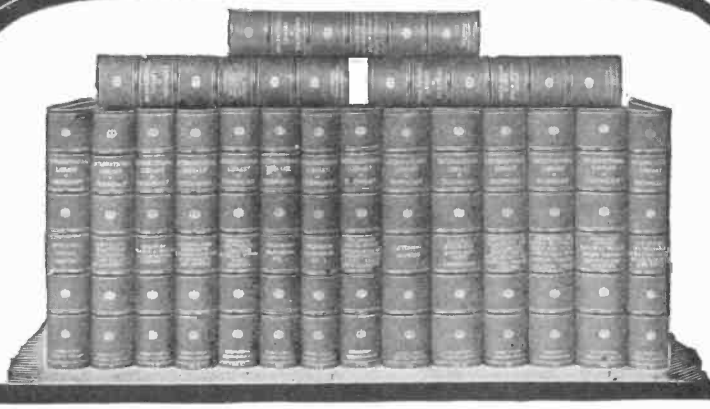
MANUF'RS of the Largest Line of Mechanics' Hand Tools Offered by Any Maker

Established 1819 **Five Large Factories**

Address Correspondence to 30 Murray St.

NEW YORK CITY





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.

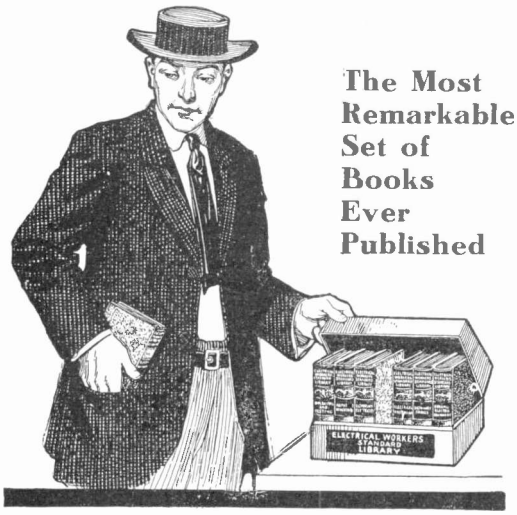
Please send, without further obligation to me, full particulars in regard to your Library of Technology, with special reference to the Electrical Library.

*Name*_____

*St. & No.*_____

*City*_____ *State*_____

A New Creation



The Most Remarkable Set of Books Ever Published

Electrical Workers Standard Library

FOR REFERENCE AND HOME STUDY

Practical—Authoritative—Comprehensive and Up-to-Date

Especially made Pocket Size Volumes. Books that you can carry on the job. A worker's series of practical every day helps for installing the work according to the safety rules of the National Board of Fire Underwriters.

By applying the practical problems contained in the books to any job, you may be sure that the work will bear the mark of the Electrical Inspector's "O. K." The purpose of this library is to provide the beginner or the working electrician a complete treatise on Electrical Construction work as a reliable, practical guide; one that tells him exactly how to install his work in accordance with the latest improved methods.

SEVEN handy pocket size volumes, size 4½ x 7, bound in full American Morocco, stamped in genuine gold leaf. 2500 pages. 1500 illustrations, including full page plates, working diagrams, etc. Hundreds of tables and formulas. Fully indexed for quick and easy reference. A thorough, practical authoritative Electrical Worker's up-to-date reference work for the home or shop study. For Electrical Engineers, Electricians. Railway Power Station Engineers, Linemen, Telephone or Telegraph Engineers, or for anyone engaged in electrical work.

WILL YOU EXAMINE THESE BOOKS FREE OF CHARGE?

If you are interested in Electricity, we know these books are just what you want. To convince you of this, we will send a complete set to you by prepaid express; keep them five days; examine them thoroughly and carefully; test them; apply the knowledge they contain to your every-day work. If you desire to keep them, send us $2.00 after five days and $2.00 a month until you have paid the special price of $14.00. The regular list price is $21.00. Just fill in the coupon below and mail it to us. The books will be sent you at once.

FREE EXAMINATION COUPON

National Institute of Practical Mechanics: (P. E.)

Please send Electrical Worker's Standard Library for FREE examination. I will send $2.00 within five days and $2.00 a month until I have paid $14.00; or notify you and hold the books subject to your order. Title not to pass until fully paid.

Name .....

Address .....

Occupation .....

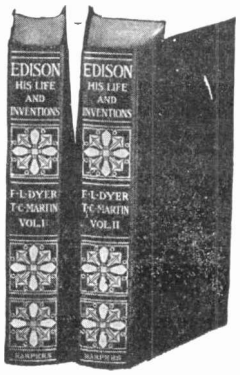
Employer .....

Sold only by subscription. For further information address

National Institute of Practical Mechanics
1325 Michigan Ave. Chicago, U. S. A.

EDISON

His Life and Inventions



By
Frank L. Dyer
and
Thomas C. Martin

988 PAGES

Two Volumes
$4.28 Postpaid

Practically a history of Electricity for the past fifty years.

Contains among other new material a complete list of the Edison Patents.

THE full and authoritative story of Edison's own life has never been written until now. The full story could only be given by Edison himself and his closest associates. One of the authors is his consel, as his father and brother were before him, and he practically shares Edison's daily life. The other, who has been in the confidence of the great inventor for a long time, is one of the leading electrical experts of our country. The entire manuscript has been read and revised by Edison himself.

Scene by scene the real life and work of the great inventor are unrolled before us, the days and nights spent in developing the electric railway and storage batteries, the growth of the phonograph industry, the ore-milling work, the application of Portland cement, with its large possibilities, and the development of a new phase of modern entertainment and education in the vast business of moving pictures.

How has it been done? What are the scenes in which the inventor works? What is his daily life? What are his methods? In this book there is pictured all this personal side. The evolution of his ideas is traced, his manner of working, the scenes in his laboratory, the enthusiastic co-operation of his assistants guided by the master's brain, and the persevering industry which leads to triumph over discouragements, mistakes and obstacles.

There is a long and full Technical Appendix, describing in detail the work Edison has done. This in itself is a long-needed book.

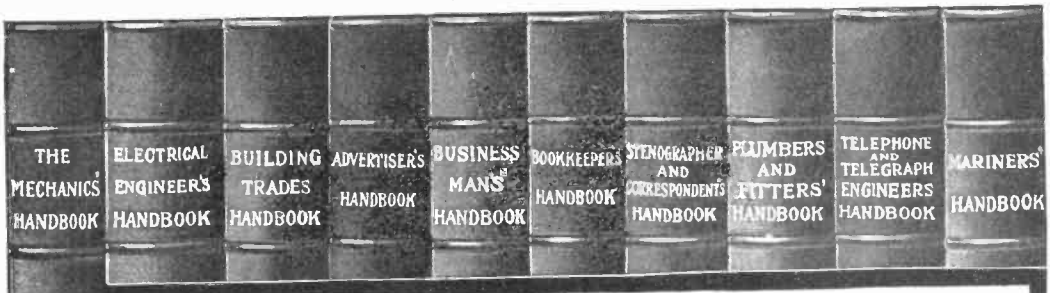
POPULAR ELECTRICITY BOOK DEPT.
54 W. Lake St.; Chicago, Ill.

Please send me post-paid the book entitled "Edison; His Life and Inventions," in two volumes, for which I enclose remittance for $4.28.

Name.....

St. and No......

City..... *State*.....



$1.25 Handbooks for 50c.

No books in existence contain in so small space as much information about the trades and professions of which they treat as do these Handbooks. They are little giant encyclopedias of practical knowledge giving data and information that is hard to find in ordinary books. These Handbooks have been prepared by the well-known textbook writers of the International Correspondence Schools whose textbooks are recognized the world over as the most practical treatises on applied sciences ever published. These Handbooks are consulting experts of the highest rank, and are the most powerful force in the world for the promotion of ambitious men. They are an indispensable help to quicker and better work that will command advancement. They are printed on a high-grade book paper in clear type, and durably and handsomely bound in cloth with gilt titles; contain on an average of 364 pages and 175 illustrations and are regularly sold for $1.25 each.

SPECIAL OFFER.—We are selling these Handbooks, durably bound in cloth with gilt titles, at a special price for each Handbook of 50 cents.

Mechanics'—Tables; formulas; measurements; belting; mechanical powers; hydromechanics; strength of materials; shafting; boiler design; care of boilers; power of boilers; chimneys; exhaust heating; machine design; machine tools; slide valve; pulleys; cylinders and steam chests; pistons; gearing; transit surveying; triangulation; curves; radii and deflections; earth work; track work; electricity; etc.

Electrical Engineer's—Mechanics; electricity; electrical units; symbols and quantities; physical and electrical properties of metals and alloys; wire gauges; magnetism; dynamos and motors; electric batteries; alternating current apparatus; alternators; transformers; wattmeters; electric transmission; electric lamps; wiring; electric heating and welding; electromagnets; controllers; car wiring; etc.

Building Trades—Loads and structures; strength of materials; properties of sections; strength of rivets and pins; materials of construction; footings and foundations; masonry construction; woods used in building; qualities of timbers; joinery; framing; estimating; elements of architectural design; drainage systems; plumbing fixtures; plumbers' tables; heating and ventilation; gas and gas-fitting; etc.

Advertiser's—How to plan and write an advertisement; type and type measurements; points on printing style; display; preparation of manuscript; proof reading; engraving and printing methods; electrotypes; matrices; advertisement illustrations; magazines; newspapers; retail, department-store, general, trade-paper, and mail-order advertising; trade marks; circulars; advertising agencies; etc.

Business Man's—Arithmetic; tables; business forms; card systems; measures of extension; weight and capacity; time; value of foreign coins; duties on imports; bookkeeping; stenography; correspondence; postal information; financial terms; money and the money market; brokers and brokerage; patents; copyright and trade marks; corporations; business law; publicity; etc.

Bookkeeper's—Arithmetic; formulas; tables; money; percentage; interest; equation of accounts; money and the money market; business law; financial terms; banks and banking; postal information; distances and time between various places; bookkeeping; business forms; card systems; modern office methods; cost accounting; bank bookkeeping; clearing house methods; etc.

Stenographer's & Correspondent's—Advice to beginners; shorthand speed; letters of application; punctuation; correct and faulty diction; business correspondence; typewriting; abbreviations; addressing; mailing; rates of postage; duplicating work; etc.

Plumbers and Fitters'—Arithmetic; involution and evolution; powers, roots, and reciprocals; circles; decimals; geometrical drawing; weights and measures; formulas; mensuration; mechanics; hydromechanics; building construction; heating and ventilation; gas-fitting; plumbing; etc.

Telephone and Telegraph—Useful tables; mechanics; electricity; magnetism; primary batteries; storage batteries; electrical measurements; telephony; tests with magneto-generator and bell; telegraphy; Morse telegraph systems; multiplex telegraphy; etc.

Mariners'—Logarithms; trigonometry; navigation; terrestrial navigation; celestial navigation; organization of a man of war; naval ordnance; explosives; torpedoes; ship building; speed, tonnage, and fuel consumption; ropes; wind and weather; signals; nautical memoranda; etc.

International Textbook Co.
Box 1102, SCRANTON, PA.

I enclose $_____ for which please send me the books **BEFORE** which I have marked **X**.

___ **Mechanics' Handbook**	___ **Advertiser's Handbook**
___ **Elect. Eng. Handbook**	___ **Business Handbook**
___ **Bldg. Trades Handbook**	___ **Bookk'per's Handbook**
___ **Plum. & Flt. Handbook**	___ **Sten. & Corr. Handbook**
___ **Tel. & Tel. Handbook**	___ **Mariners' Handbook**

*Name*_____

*St. and No.*_____

*City*_____ *State*_____

Electrical Talks—Flash No. 13

Most manufacturers of electrical devices, particularly if the latter appeal to the general public, are anxious to have the central stations help dispose of their products.

The reason is that the central stations have of necessity become also electrical jobbers.

It will be found that the central station sales agents and managers of new business departments are following ***Popular Electricity*** very closely. They hold their jobs by their ability to trail down every current consuming device and get it out on their lines. The magazine is therefore a great help to them.

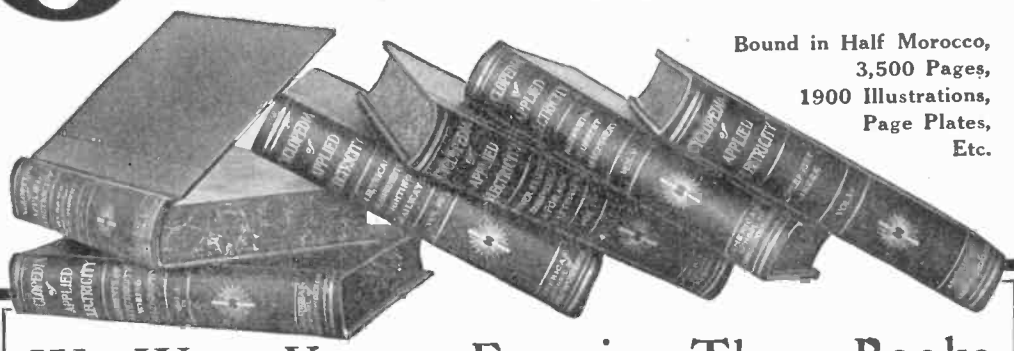
For instance, the assistant sales agent of the British Columbia Electric Railway Company, Limited, after inquiring where he can get a certain device recently described in ***Popular Electricity*** adds:

"In closing I would like to testify to the number of new ideas one finds in your popular magazine, proving especially useful, I should imagine, to the sales departments of electric power and supply companies."

An advertisement in ***Popular Electricity*** serves a double purpose. It brings the manufacturer's product to the attention of the central station sales agent. And besides it goes out among the people and helps that sales agent to sell the product.

POPULAR ELECTRICITY MAGAZINE

6 Important Books
For Electrical Men



Bound in Half Morocco,
3,500 Pages,
1900 Illustrations,
Page Plates,
Etc.

We Want You to Examine These Books FREE OF CHARGE

They are just what you want if interested in any branch of electrical engineering. We want you to examine the complete set at our expense.

This Great Cyclopedia of

Applied Electricity

is written by thirty expert electrical engineers—the biggest men in the profession. It is especially designed as a working guide for the student and ready reference for the expert. *Their reference value is guaranteed* because they are compiled from the regular text books used in the correspondence courses of the American School of Correspondence.

You Take No Risk. Examine the books five days at our expense. So confident are we that the books are just what you want, that we will send them to you by prepaid express. Keep them five days, test them—apply them to your every-day work. If satisfied that they are the most complete and comprehensive work ever published on Electricity, keep them and send us $2.00, then pay $2.00 a month until you have paid our special introductory price of $18.80. The regular price is $36.00. If the books do not satisfy you and are not just what we claim them to be, notify us and we will have them returned at our expense. Just fill in and send the coupon. *The books will be sent to you free.*

IMPORTANT SUBJECTS TREATED IN DETAIL

Electric Wiring—Electric Telegraph—Wireless Telegraphy—Telautograph—Theory, Calculation, Design and Construction of Generators and Motors—Types of Dynamos and Motors—Elevators—Direct Current Motors—Direct-Driven Machine Shop Tools—Electric Lighting—Electric Railways—Alternating Current Machinery—Single Phase Electric Railway—Management of Dynamos and Motors—Power Stations—Central Station Engineering—Storage Batteries—Power Transmission—Alternating Current Machinery—Telephony—Automatic Telephone—Wireless Telephony—Telegraphone, etc.

For a short time we will include, as a monthly supplement, for one year, the TECHNICAL WORLD MAGAZINE. This is a regular $1.50 monthly, full of Twentieth Century Scientific facts, written in popular form. Also contains the latest discussions on timely topics in invention, discovery, industry, etc.

AMERICAN SCHOOL OF CORRESPONDENCE
CHICAGO, U. S. A.

FREE EXAMINATION COUPON

Pop. Elect. 7-11.

A. S. of C.

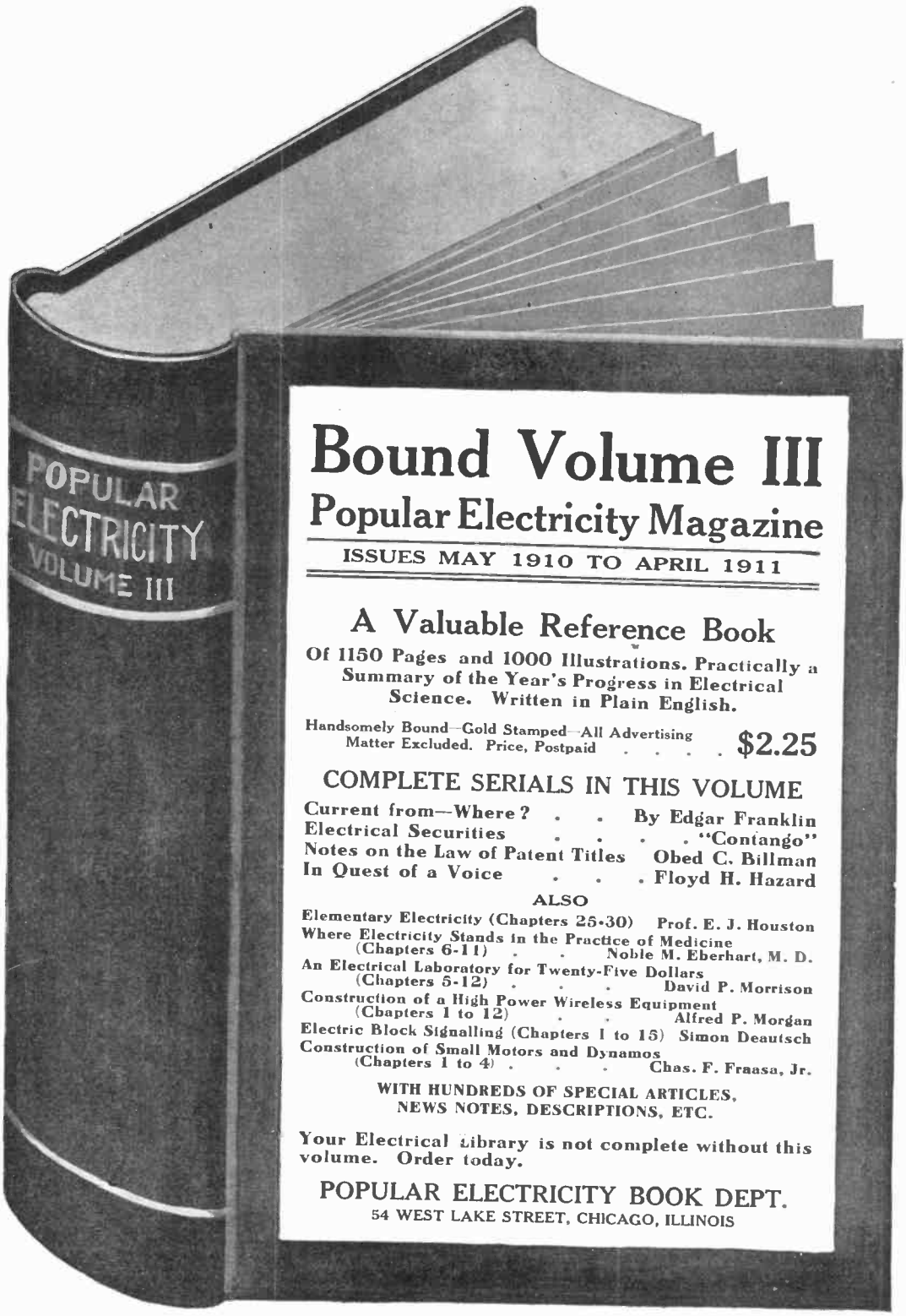
Please send me Cyclopedia of Applied Electricity for five days' free examination. Also T. W. for one year. I will send $2 within five days and $2 a month until I have paid $18.80 for books and magazine; otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

NAME .....

ADDRESS .....

OCCUPATION .....

EMPLOYER .....



Bound Volume III

Popular Electricity Magazine

ISSUES MAY 1910 TO APRIL 1911

A Valuable Reference Book

Of 1150 Pages and 1000 Illustrations. Practically a Summary of the Year's Progress in Electrical Science. Written in Plain English.

Handsomely Bound—Gold Stamped—All Advertising Matter Excluded. Price, Postpaid **$2.25**

COMPLETE SERIALS IN THIS VOLUME

Current from—Where? . . **By Edgar Franklin**
Electrical Securities . . . . **"Contango"**
Notes on the Law of Patent Titles **Obed C. Billman**
In Quest of a Voice . . . **Floyd H. Hazard**

ALSO

Elementary Electricity (Chapters 25-30) **Prof. E. J. Houston**
Where Electricity Stands in the Practice of Medicine (Chapters 6-11) . . **Noble M. Eberhart, M. D.**
An Electrical Laboratory for Twenty-Five Dollars (Chapters 5-12) . . . . **David P. Morrison**
Construction of a High Power Wireless Equipment (Chapters 1 to 12) . . **Alfred P. Morgan**
Electric Block Signalling (Chapters 1 to 15) **Simon Deautsch**
Construction of Small Motors and Dynamos (Chapters 1 to 4) . . . **Chas. F. Fraasa, Jr.**

WITH HUNDREDS OF SPECIAL ARTICLES, NEWS NOTES, DESCRIPTIONS, ETC.

Your Electrical Library is not complete without this volume. Order today.

POPULAR ELECTRICITY BOOK DEPT.

54 WEST LAKE STREET, CHICAGO, ILLINOIS

A Good Income from Ten Acres Pecos Land

$50 TO $100 PER MONTH FROM ALFALFA
$100 TO $150 PER MONTH FROM FRUIT

EVERY MAN should own ten acres of this rich irrigated land. Put it in alfalfa and get $100 to $150 an acre income annually. In peaches, ten acres properly cared for, should yield $500 an acre; pears have paid $1,000 an acre in this same valley. Grapes pay $150 to $300 an acre. ¶ Pecos Palisade soil is ideal for fruit and alfalfa. Pecos Valley is the greatest alfalfa district in America. ¶ Pecos Valley Pears have won prizes at the St. Louis Exposition. At the El Paso State Fair, Pecos Valley farm products captured 21 first prizes, winning over many older irrigated sections of California and Colorado. ¶ Buy this rich irrigated land now at one-tenth its actual value. Buy irrigated land in the famous Pecos Palisades, under a completed irrigation system, just ahead of construction of the Kansas City, Mexico and Orient Railway—building daily on shortest line between Kansas City and the Pacific coast of Old Mexico. ¶ Pecos Valley land today, before the railroad is built to it, offers you the same kind of an opportunity to provide for your old age that your father had forty years ago. ¶ $180 invested today will make you the owner of a ten-acre irrigable Pecos Valley farm—the same sort of land that sells for $900 an acre in other districts, balance on easy payments. But the railroad is already built to the $900-an-acre land, while the land in the Pecos Valley awaits the increase in land values that always follows the completion of a railroad. ¶ The irrigation system in the Pecos Valley is now completed. Water is ready to be turned on. The farmers are working the land and the K. C., M. & O. R. R. is growing closer to the land every day. ¶ The railroad gap between San Angelo and Fort Stockton is not yet closed. When it is, and the whistles of the locomotives are heard in this valley, land values will advance by leaps and bounds. ¶ Facts about the lower Pecos Valley are amazing. It is as good fruit and alfalfa land as in the country. Estimating on what land of the same nature in other irrigated districts has produced, ten acres in alfalfa will soon pay out your purchase. ¶ I have published for free distribution, a complete series consisting of several booklets and bulletins on Irrigation, Fruit- and Alfalfa-Growing for Profit in Lower Pecos Valley, Texas. Beautiful half-tone photographs illustrate this great series. Every detail is covered. Facts and figures in profusion. How to make money on the land. Experiences of other people, the best crops to raise, all the information you want to aid you in making money farming in Pecos Palisades—Pecos Valley, Texas. Now send me your name today and I will send you this series, which cost hundreds of dollars to prepare and distribute, without cost or obligation on your part. Just say: "Send me 'Pecos Series on Irrigation'" and read the fascinating story of the opportunity that beckons to you in the Pecos Valley. ¶ To develop the country and make business for the Railroad, I am interested in having the capitalists owning this land sell it to settling producers, who will make business for my road.

F. A. HORNBECK, LAND COMMISSIONER, KANSAS CITY, MEXICO & ORIENT RAILWAY
107 ORIENT BUILDING KANSAS CITY, MO.

THE HIGHEST AUTHORITIES ENDORSE THIS SECTION. READ!

W. L. Rockwell, Irrigation Manager, U. S. Department of Agriculture, Washington, D. C., writes F. A. Hornbeck, Land Commissioner:

"Dear Sir: I have lately visited the location of your contemplated irrigation system in Pecos Valley. I feel that you should congratulate yourselves and your engineer for finding such a *natural reservoir* so closely located to this *exceptionally fine body of land.* If you were to hunt the length and breadth of the arid West, *I doubt* if you *could find* so large a tract of land *lying so nearly ideal for irrigation.*"

F. C. Coburn, Secretary of Kansas State Board of Agriculture, says:

"The country I looked at especially was the lower Pecos Valley, in Pecos County, now about to be opened up to settlement. It will be made directly tributary to Kansas City by the Orient Railway. The best of the lands here are certainly *favorably situated for irrigation.* They are being disposed of at prices and on terms attracting purchasers from all parts of the Union. Land seekers are met on every train."

Your Office Has Plenty of Work,

besides straight correspondence that your own stenographer can do on the

L. C. Smith & Bros. Typewriter

(Ball-Bearing, Long Wearing)

in a way to save you a lot of time.

We'll prove it at your request and you'll incur no obligation. Wouldn't you like to get hold of some genuinely helpful typewriter methods? Then write today.

L. C. Smith & Bros. Typewriter Co.

Syracuse, N. Y., U. S. A.

Branches in all Large Cities.

My Magazine FREE Investing for Profit *For Six Months*

Send me your name and address right NOW and I will send you INVESTING FOR PROFIT magazine *absolutely free* for six months. It tells how to get the utmost earnings from your money—how to tell good investments—how to pick the most profitable of sound investments. It reveals how bankers and capitalists make $1000 grow to $22,000—in fact, gives you the vital investing information that should enable you to **make your money grow proportionately.** I have decided this month to give 500 six-month subscriptions to INVESTING FOR PROFIT **free.** Every copy is

Worth At Least $10

to every investor—perhaps a fortune. Send your name and address now, mention this paper and get a free introductory subscription. Conditions may prevent repeating this offer. Better take it now. You'll be willing to pay 10c a copy after you have read it six months.

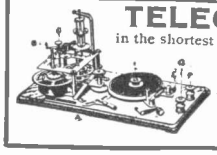
H. L. BARBER, Pub., R. 414, 30 Jackson Blvd., Chicago

LEARN WATCHMAKING

Engraving and Jewelry repairing. Earn while learning. Our school endorsed by leading jewelers. Positions secured for graduates. Send for Free catalogue.

CHICAGO SCHOOL OF WATCHMAKING,
Dept. 30, Bush Temple, Chicago.

WHEN desirous of information inquire at the information Dept. of Popular Electricity Pub. Co.



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

POPULAR ELECTRICITY
IN PLAIN ENGLISH

HENRY WALTER YOUNG, Editor

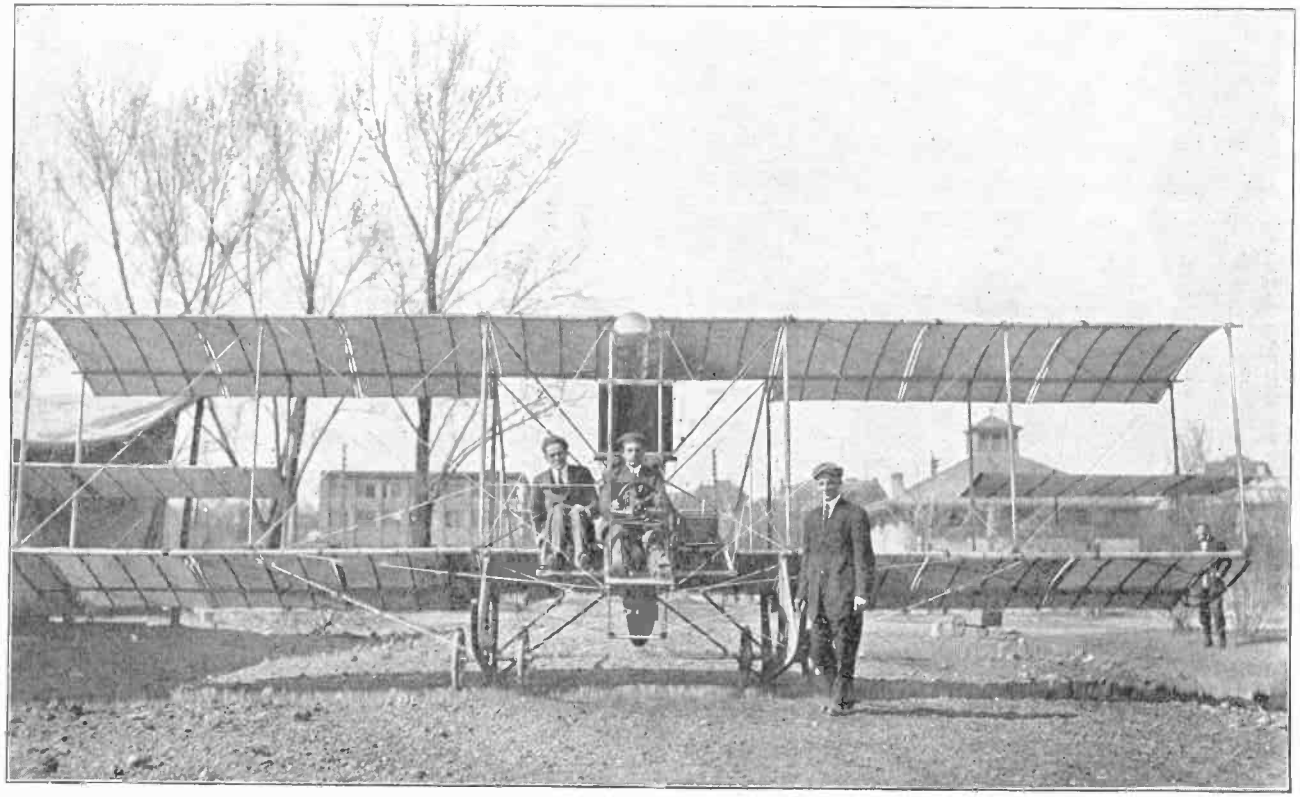
Vol. IV | July, 1911 | No. 3

CONTENTS

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.



BIPLANE WITH WIRELESS EQUIPMENT AND SIGNAL CORPS EXPERIMENTERS ABOARD, ABOUT TO START ON A FLIGHT

Popular Electricity
In Plain English

VOL. IV JULY 1911 No. 3

Sky Scouting with a Wireless Set

By WALDEN FAWCETT

The War Department of the United States has made preparations to conduct during the summer and autumn of 1911 a series of extensive tests and experiments in wireless telegraphy from aeroplanes. Investigation in this field, the importance of which is recognized by military officers not less than by electricians and aeronautical experts, is one of the first developments resultant from the broadened aeronautic policy of the United States Government. The lack of funds which for a long time proved a serious handicap to aeronautic work in the United States Army and Navy has been in a measure relieved and Uncle Sam's military and naval establishment is now in possession of several aeroplanes of the latest approved type, with the prospect of a number of additions to this aerial fleet in the near future.

Under the circumstances, therefore, it is highly significant that one of the first lines of investigation undertaken by the Government after acquiring a respectable array of aerial scouts looks to the development of wireless telegraphy in this sphere. The experiments will probably be carried on at several different points in the United States and possibly in connection with any extensive maneuvers in which the regular army may participate, but the chief seat of activities will be at the newly established center of Uncle Sam's aeronautic enterprises at College Park, Maryland.

It, of course, requires no further experiment to demonstrate the practicability of wireless telegraphy from aeroplanes. The feasibility of such communication in the elementary sense has already been demonstrated. About two years ago, when the War Department acquired its first and only dirigible balloon, the electrical experts of the United States Army Signal Corps designed a special light-weight wireless set (with special safeguards against the ignition of the explosive gas in the balloon bag) and conducted some experiments in communicative work between the war balloon in the air and a station on the ground. Latterly army officers operating the original Wright aeroplane purchased by the government and detailed to receive instruction from professional aviators have on their own initiative, made some fairly successful experiments with wireless telegraphy from flying machines.

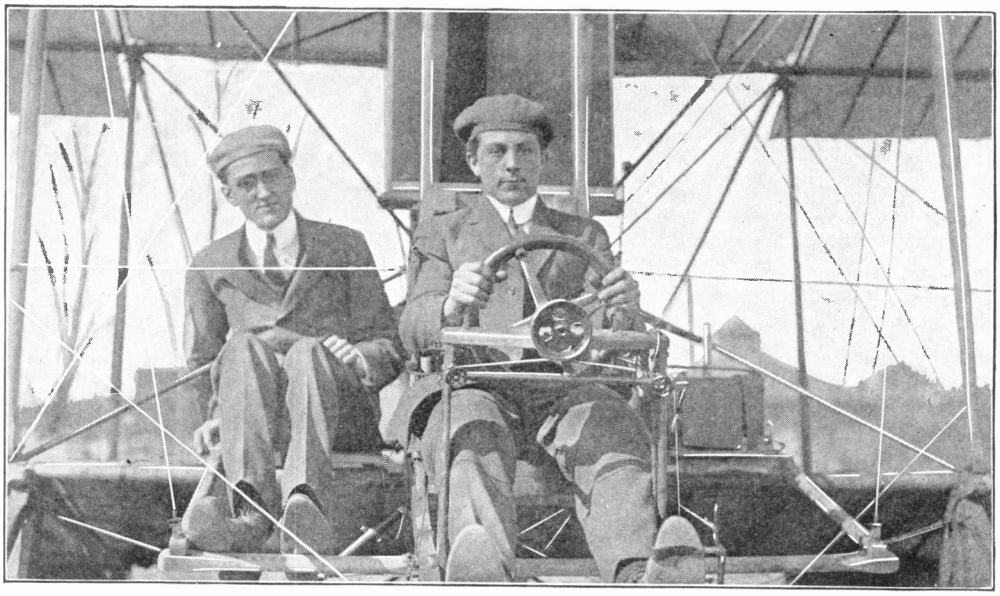
With so auspicious a prelude the military authorities feel assured of the practicability of wireless interchanges between aeroplanes in flight and military posts on the ground and they see no reason why development should not progress several steps farther and embrace the exchange of messages between aeroplanes in flight and warships at sea and finally inter-communication between two or more machines in simultaneous flight. Whereas there is every confidence in the complete triumph of wireless telegraphy via aeroplanes as one of the new aids of warfare there is engrossing attention just now a very interesting problem which has grown out of this prospect,—namely the invention of a special aerial wireless set, specifically intended for this class of aeronautic work. Apparatus vastly different from the ordinary commercial sets and likewise dis-

similar to the special equipment designed by Signal Corps experts for army use (as by troops in the field) is required, and so many requirements must be met and so many considerations taken into account that the situation presents a notable inventive problem.

Although this whole subject is so brand new to the general public it is one upon which the military sharps, with that forethought which must needs become second nature with them, have had in mind for some time past. For months past, indeed, Mr. Rufus R. Bermann, the wireless expert of the Signal Corps and his associates have studied the proposition and they have now evolved a special wireless set for aeroplanes that has proven its worth in several preliminary tests. The try-outs mentioned have disclosed opportunities for minor changes and improvements that will bring the new invention close to the point of perfection, but the interesting circumstance is that the riddle has been solved and the army has for the use of its scouts and observers aloft a feather-weight wireless outfit that ought to be worth its weight in gold under war conditions, and that is susceptible of advantageous use even if no further improvements are made in its design and construction.

Wireless Expert Bermann asked for a brief authoritative statement for POPULAR ELECTRICITY on the results attained said: "The application of wireless telegraphy to communication from airships is by no means the simple proposition that it might, at first thought, seem. An aeroplane offers so many restrictions in weight, space available, etc., that the designer of any apparatus to be taken up in one soon finds more than ordinary care in diminishing losses necessary to obtain even moderate efficiency.

"An extra half-dozen square feet of head resistance may cut the speed of the machine in half and an added weight of a hundred pounds may make the difference between successful flight and an indifferent attempt at it. Particularly does the wireless designer find difficulty in arranging for the antenna or aerial system. In land stations there is usually no difficulty in erecting towers as high as necessary, and it is easy to obtain a good connection with the ground. Of course there is no ground connection possible from an aeroplane except the so-called 'ground' of the limited framework of the motor, the guy wires, etc., and it is obviously impossible to have masts or supports extending any considerable distance from the machine. Even a hang-

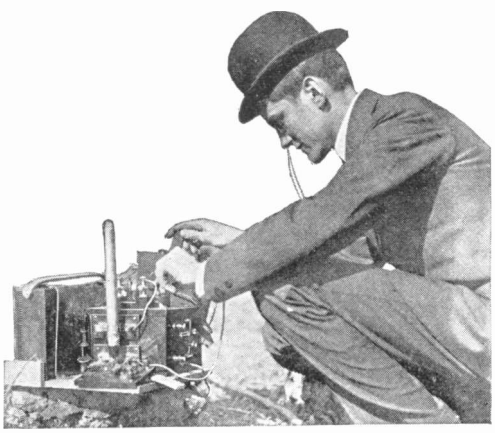


POSITION OF AVIATOR, WIRELESS OPERATOR AND WIRELESS SET IN THE ARMY BIPLANE

ing wire is objected to since it may cause trouble by becoming entangled with the propellor, or it might even wreck the machine in starting or descending.

"There is no difficulty, however, in obtaining all the power necessary, since most aeroplane motors are high power and have considerable surplus energy. A light dynamo, connected to the engine shaft may thus be used to operate the wireless transmitter, and will probably furnish more energy with less weight than a storage battery such as has been employed in the experiments up to date.

"In reception the noise of the motor interferes with the reading of the messages, although not so much as would be the case were it not for an odd characteristic of the conditions which is always a surprise to one who has never flown in an aeroplane. The motor, usually unmuffled and sounding like a Gatling gun to those on the ground is quite deafening while the machine is standing still, but as soon as it leaves the ground the noise is no longer noticed by those on board. To sum up the situation, however, I may say that all the difficulties connected with the use of wireless telegraphy on aeroplanes are purely engineering ones and quite



RUFUS R. BERMANN AND HIS NEWLY INVENTED WIRELESS SET

possible of solution. We may look forward to the time in the near future when the wireless will be considered as essential on touring aeroplanes as it is now on ocean-going vessels."

That he might have intimate knowledge of the exact conditions involved Mr. Bermann has himself acted as the aerial operator in the most important tests thus far undertaken. Aviator Jannus piloted the biplane which was of the type invented by Rex Smith and was loaned to the War Department in order that the wireless experiments need not be delayed, pending the delivery of the aeroplanes ordered by the government. In these first tests aerograms were transmitted from the machine in flight to receiving stations on the ground at varying distances up to ten or twelve miles. However, the Signal Corps officers are confident that it will be possible ere long to transmit messages a distance of 50 miles. As a matter of fact, though, the officials will be perfectly satisfied if they are able to exchange messages with military telegraphers soaring aloft at a distance of 30 miles from the Signal Corps base. It is estimated that not even under the most exacting war conditions would an aeroplane be called upon to make flights of more than 30 miles from the military base of supplies. Then, too, the average day's march of an army in the field does not exceed 20 to 30 miles and with the above-mentioned radius of action for the wireless on the aeroplanes it would be possible for the sky craft to carry on scouting work fully a day's march in advance of an army on the march, sending back reports as facts are ascertained.

RECEIVING A WIRELESS MESSAGE FROM AN AEROPLANE IN FLIGHT

Some question may naturally arise among laymen as to the exact functions of the wireless in conjunction with aeroplanes and the extent to which it will prove an ad-

vantage over all other methods of communication. In answer it may be said that military experts are unanimous in the opinion that it will prove of the greatest benefit if constant instantaneous communication can be maintained to and from military observers, reconnoitering from aeroplanes an enemy's country or the movements of a hostile force. Indeed without the aid of the wireless aeroplanists would be compelled to return to headquarters at more or less frequent intervals to report their discoveries,—a time consuming expedient.

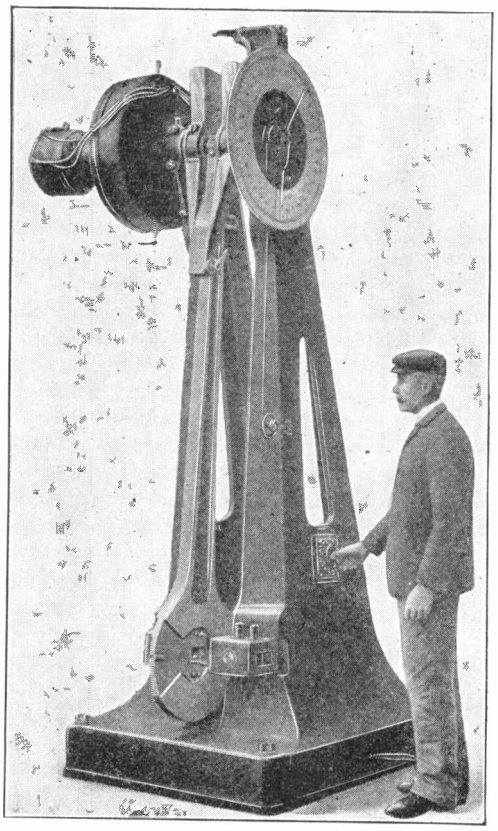
While scouting operations are obviously the especial forte of the aeroplane and its wireless adjunct, service scarcely less valuable can be rendered in reporting the effect of shots fired by batteries located out of sight of the objects which they are bombarding. Successfully to carry on such range-finding operations it would be necessary to transmit messages to the wireless operator aloft as well as to receive reports from him at the stations on the ground but it is believed that the one obstacle to the successful reception and reading of wireless messages aboard an aeroplane will be overcome by the invention, now in prospect, of a helmet to be worn by the operator on the aeroplane and which will shut out all noise of the motor and other disturbing influences.

The new aerial wireless set invented for the use of Signal Corps aeroplanists weighs about 40 pounds, but it has been figured out that a weight allowance of 50 pounds can be made on a standard size aeroplane if it is found necessary to slightly increase the weight of the wireless set in perfecting any improvements which may be made.

The new set differs from the average commercial wireless set chiefly in size and power. Most sets now on the market are of at least one or two horsepower, whereas this Signal Corps set has been operated by an ignition battery such as is supplied for automobiles. Although an aeroplane motor of the latest approved type would probably afford ample power for a one horsepower wireless set it is not anticipated that any apparatus more powerful than a one-half horsepower set will ever be employed. Under the plan thus far followed the wireless operator occupies a seat at the right of the aviator during an aeroplane flight while on the left of the aviator's seat is placed the small wireless set.

Testing the Strength of Bars

An interesting device shown at the World's Fair at Brussels, last year was a testing machine, built near Paris, for determining the strength of metal bars by



TESTING METAL BARS

measuring the power required to chop or break them into pieces. The principle of the machine, worked out by Prof. Charpy, is quite novel. If we take a long pendulum, draw it far to one side of the verticle and then release it, we will find that (barring a little shortage due to friction) it will swing the same distance to the other side of the vertical. But if the pendulum has to do some work during its swing, it will no longer go as far on the other side and the shortage of its swing will be a measure of the energy spent in doing this work.

Knowing the weight of the pendulum and the difference between the starting angle and the one to which the pendulum

swung after breaking the test piece, he could readily figure the power consumed in this breaking.

This method worked so well that the Compagnie des Forges at Chatillon built a large machine, shown in the picture, which has an electric motor for raising the pendulum. The operator starts the motor until the pendulum reaches the desired angle as shown on the dial and then shuts off the current, whereupon the pendulum delivers its powerful hammer blow to the test piece held in the clips at the bottom, and shows by another pointer on the same dial how far it was still able to swing after having performed this work.

Age of Electricity

By GEORGE WESTINGHOUSE

Had a Jules Verne sought to imagine some universal servant of mankind, he would well have depicted some magic agent which would apply Nature's forces to do man's work; which could take the energy of her hidden coal, of the air, or of her falling water, carry it by easy channels and cause it to give the light of a million candles, the power of a thousand men, or to move great loads faster than horses could travel, to produce heat without combustion, and to unlock chemical bonds and release new materials. No such wonder was pictured by the imagination of the seers of the past; and yet a subtle force which transcends the powers of the imagination is daily doing all these things—a vitalizing force, which is already stimulating the physical recovery of the South; and if we still think of the present as an era of steam and steel, unquestionably the coming epoch, whose dawn we are privileged to witness, will be known as the Age of Electricity. First the toy, and long the mystery of the scientist, electric power is now a familiar tool for the accomplishment of the work and the increase of the comfort and pleasure of mankind.

Although we may not know the ultimate nature of electricity, yet we do know some of its essentials laws and methods of controlling and using it.

During the 25 years in which I have been intimately interested in the electrical art, a development has been witnessed which has surpassed the most optimistic predictions. At the beginning of this period it was the general conviction that electricity would be limited to local use in the lighting of densely populated districts or the supply of power to adjacent factories. Indeed, there had been no developments to remotely foreshadow what has since been accomplished.

At that period, however, there had already been developed and operated electric arc lighting circuits of high voltage, extended over rather large areas, with the pressure upon the wires of from 2,000 to 7,000 volts, which practically demonstrated that considerable electric power could be cheaply transmitted if means could be found to utilize safely high-voltage electric current for power and light and for other purposes; but such means were not then known. It often happens, when something is greatly needed for any great purpose, that as a result of a lively appreciation by many of the existing need, there arises in due course invention or discovery which meets the demand, and so it was in the matter of invention and discovery which gave us a simple static device, consisting of two coils of copper wire surrounded by sheets of iron, which could, without an appreciable loss of energy transform alternating electric currents of high voltage and small quantity, dangerous to life, into low voltage currents of large quantity, safely available for all power, light, heat and other purposes.

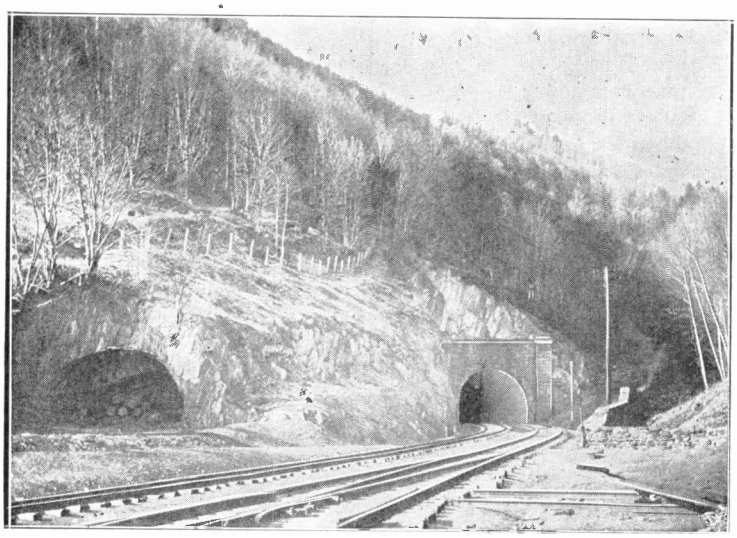
To the part I took in bringing forward in the '80s of the last century the alternating current system of electric generation and distribution, I owe much, if not all, of the reputation accorded to me as one of the many pioneers in what is now a great and important industry.

An excerpt from an address, "Electricity in the Development of the South and of the Nation," delivered before the Southern Commercial Congress at Atlanta, Ga., March 10th, 1911.

Electrifying the Hoosac Tunnel

By C. B. EDWARDS

There are, perhaps, few things which are more noteworthy from an electrical standpoint than the completion of the electrification of the Hoosac tunnel during the month of May. Not that electrification of steam railroads is anything exceptional today, but rather because the Hoosac tunnel in the year of 1874 was the greatest engineering task of its time and remains today the most noteworthy accomplishment of tunnel engineering on the continent. The boring of tunnels has not stood still since the Hoosac was completed, but there still remains the fact that, all points considered, the great double tracked shaft through almost solid rock connecting North Adams, Mass., and the Hoosac tunnel station remains today the most exemplary feat of American engineering. Abroad, the St. Gothard and Simplon tunnels, only, are mediums of comparison.

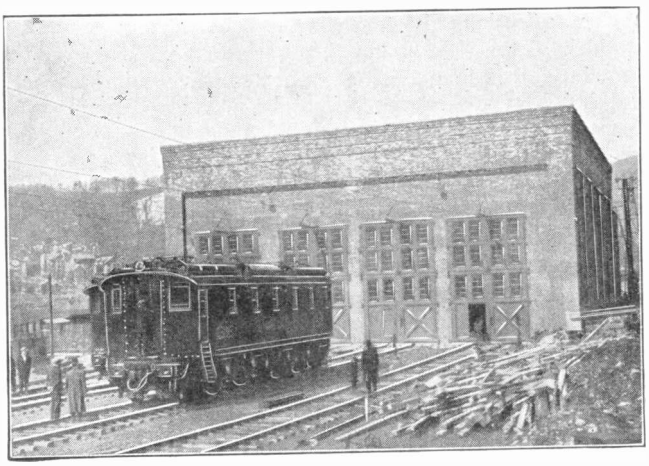


EAST PORTAL OF THE HOOSAC TUNNEL. AT THE LEFT IS WHERE THE "BULL HEADED ENGLISHMAN" TRIED TO BORE A TUNNEL WITH A HUGE AUGER

The construction of the Hoosac tunnel was popularly regarded as an impossibility at the time the work was commenced, and originally a crude invention consisting of an auger-like machine was tried at "boring" a hole through the mountains. Needless to say, the machine proved a failure but the shallow hole in the rocks to the left of the east portal still remains as mute testimony to the funeral of one "invention." This attempt was made by an Englishman, who invented the "auger," and hence the hole is termed the "bull headed Englishman's" tunnel.

Beginning in 1855, serious work on the Hoosac tunnel was undertaken by the Boston and Maine railroad. Two gangs of men were put to work, one at each terminus of the tunnel 4¾ miles apart on each side of the Green Mountains. A shaft was also sunk midway between the two portals 1028 feet deep and through this another gang of excavators was put to work. Thus the work was carried on intermittently, lack of funds frequently causing cessation of work for long periods at a time, until the completion of the tunnel proper, announced in 1873. The work was completed in 1874, and when the Boston and Maine looked over its expenditures it found that approximately $11,000,000.00 had been spent in driving the huge bore through almost solid rock. The central shaft was depended on for the ventilation of the tunnel and the comparatively small amount of traffic which went through the Green Mountains at that time was responsible for the belief that further provision for ventilation would be unnecessary. Within a few years after the opening of the bore for traffic the increasing number of freight and passenger trains kept the tunnel constantly filled with blinding smoke and choking gases. Not only did they ren-

der it impossible for the engineer to see ahead, but the reading of signals within the tunnel became an impossibility and the rapidly increasing traffic made matters worse.

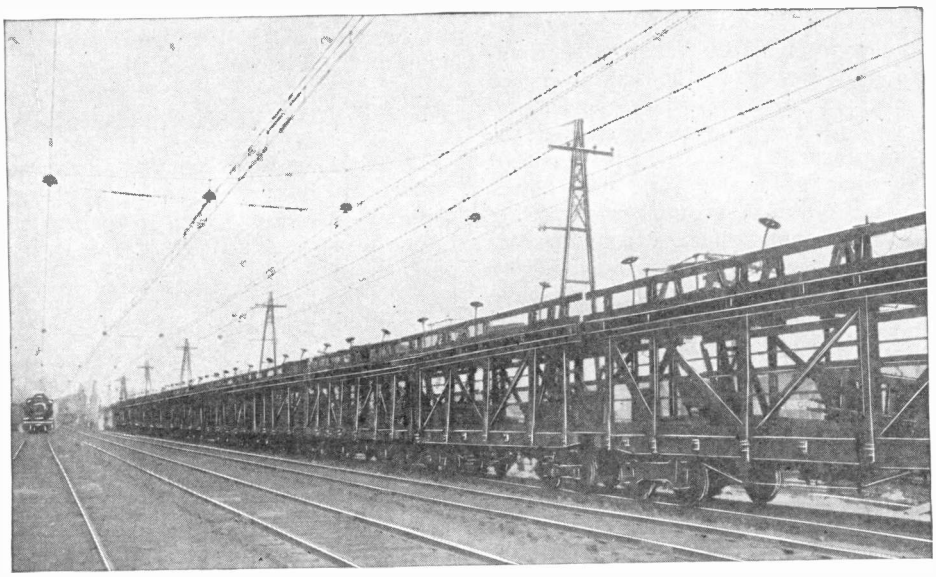


ONE OF THE HOOSAC TUNNEL LOCOMOTIVES

Thus the railroad officials realized that either another tunnel must be put through or some method of pulling the trains through adopted that would do away with smoke. The traffic limit of the tunnel was limited by the number of trains that could be run through without making the tunnel absolutely dangerous to the trainmen. An oil burning locomotive was put in service with somewhat better results but it by no means did away with the more serious aspect of the situation.

Electrification at last became the inevitable solution and once it was decided on, the railway officials took immediate action. The problem was without parallel. It was agreed that if the process of electrification caused the cessation of traffic it would defeat the very purpose for which it was adopted, temporarily. The traffic was the important consideration and how almost five miles of tunnel could be wired and the heavy traffic not interfered with was certainly a problem to the engineers involved.

Two work trains, each a little short of ¾ of a mile in length were employed at each end. These work trains were composed of hundreds of flat cars having a platform superstructure erected which would allow a man a comfortable space to work in between the tops of the cars and the roof of the tunnel. Men equipped with drills were placed on top of the cars and three clusters of electric lights on top of each car supplied the requisite light inside of the mountain depths. When all was ready and the tunnel clear the huge oil-burning loco-



WORK TRAIN USED IN THE HOOSAC TUNNEL IN PUTTING UP FEED WIRE SUPPORTS

motive, affectionately termed "Old Mut," would haul the long string of cars into the tunnel and, the lamps being connected, several hundred rock drills would be put in service at the same time and holes bored for the suspension of the trolley and feed wires. When a train was due the work train would back out and a momentary suspension of work would ensue as the construction train was side-tracked. Scarcely had the roar of the train subsided, however, before the workers were again taken into the smoky depths. As traffic is quite frequent, it is believed by construction engineers that scarcely three hours out of the nine the workers were on duty were consumed in actual work. Owing to this, and the fact that it took high wages to induce men to work in the gas-laden atmosphere at all, the labor has been very expensive.

Insulation has presented a difficulty in the Hoosac tunnel that has compelled the adoption of special insulators. The tunnel walls are constantly wet with water and the drains discharge 1,000 gallons of water a minute at the portals, thus making dampness, the greatest foe of efficient insulation, everywhere present. As the switching yards at the portals of the tunnel had to be equipped with the overhead wires the area of electrification extends over seven miles of track in all.

For generating the current, to supply the electrification equipment, a power house was necessary, at Zyolite, which is about four miles from North Adams. The situation for the new power house was chosen with a desire to centralize the power stations of both the Hoosac tunnel and the Berkshire Street Railways which are owned by the same syndicate. The new power plant, in itself, is a gigantic undertaking, and it is proposed to make it a hydro-electric plant, for which purpose hundreds of acres of land in the Deerfield valley have been optioned by the company. At present, however, the generating units installed are driven by steam turbines and each unit develops 5,000 electrical horsepower. Only one of these large units will be needed to furnish power for the Hoosac tunnel electrification, and the others will be required for street railways and probably electric lighting. The securing of water for the condensers of the turbines has been a problem for the railway officials in charge of the power house construction. One million gallons a month is required and the local town officials were staggered at furnishing this amount of water, consequently the company has had to sink artesian wells to great depths to secure the requisite supply.

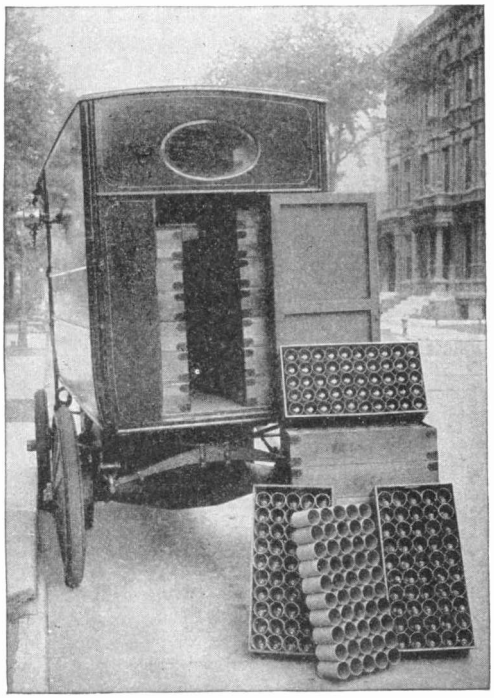
The electrified district begins at the North Adams station and ends on the other side of the Hoosac mountains within half a mile of the Hoosac tunnel station. The total length of the wire used in the project is estimated at 20 miles. The electric locomotives represent all that is new in the building of such engines and are patterned much after the type in daily use by the New York, New Haven & Hartford. Each locomotive carries its own transformers and takes its current from the high tension trolley wires overhead at a pressure of 11,000 volts. Any required voltage may then be secured from the transformers and fed at the discretion of the motorman to the motors of the electric locomotive. The motors are four in number and each gives 320 horse power using current at a pressure of 300 volts, making the engine exert a tractive effort of 1,200 horsepower. The motors are single phase and are bolted directly to the frame of the trucks and connected by flexible gears to the wheels. Two types of electric locomotives are used, one intended for freight hauling, having a maximum speed of 30 miles an hour and capable of hauling a train of 2,000 tons, and the other for passenger service, which will haul coaches through the tunnel at a speed of 50 miles an hour.

Electrification of German Railways

The German Government Railway management is experimenting with the electrical operation of freight and passenger trains in the Bitterfield district of the Prussian province of Saxony. About sixteen miles are now in operation. When completed the line will be 96 miles long and will form part of a through route between Madgeburg and Halle. It is intended to move all through traffic over this distance in order to test the difference between steam and electricity. At Bitterfield an electric locomotive was attached to the excursion train for the journey over the electrically controlled track as far as Dessau. The train attained a speed of 74 miles per hour with exceeding smoothness.

Lamp Renewal Wagon

During the last six months the method of handling incandescent lamps on the lamp renewal delivery wagons in Chicago has been entirely revolutionized, says the *Edison*



LAMP RENEWAL WAGON

Round Table. This has been done by the introduction of a system of carrying trays which reduces the amount of handling required on the new lamps and provides far better protection for the used lamps which are returned from the customers' premises.

Formerly it was customary to unpack the lamps from the shipping cases, etch them with the company's mark, repack them in the cardboard wrappers to be held in the storeroom until they were turned over to the wagons to be delivered to customers. Under the present method the lamps are unpacked, the wrappers removed, etching applied, and the lamps transferred to delivery trays which carry 50 lamps each.

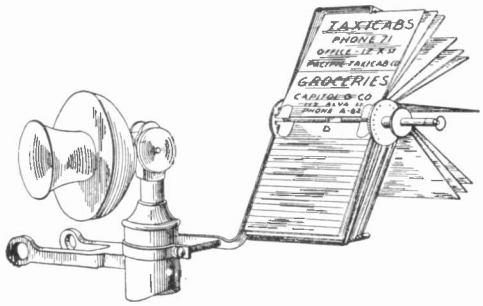
These trays consist of substantial oak boxes in which is carried a series of strawboard cylinders riveted together so that they can be removed from the box, as one piece. These cylinders are the proper size to take in any standard lamp up to 50 watts.

Esophagoscopy Saves Lives

Although it sounds like some terrible ailment, esophagoscopy is not the name of some virulent disease, but means looking into the esophagus, or gullet, through which the food passes from the mouth to the stomach. Statistics gathered by a St. Paul surgeon show that during the last ten years nine-tenths of the deaths caused by the swallowing of foreign objects (such as pins, needles, buttons, bones or tooth plates) were due to the perforating of the esophagus. Usually the object thus swallowed was quietly lodged in the gullet for some time before doing any harm, and if it had been carefully removed, there would have been no damage whatever. When thus caught in trying to pass to the stomach, the foreign objects cannot be seen by the physician without the use of a mirror device together with a miniature electric light, both being combined in the "esophagoscope." When thus lit up and viewed in the mirror, the bothersome object can easily be removed by means of elongated tweezers without injuring the membranes on which it is caught. Indeed, swallowed objects have thus been removed from patients as young as four days old.

Ready Telephone Directory

The illustration shows a device to be attached to a telephone transmitter or stand upon the sheets of which may be written names and telephone numbers most used.

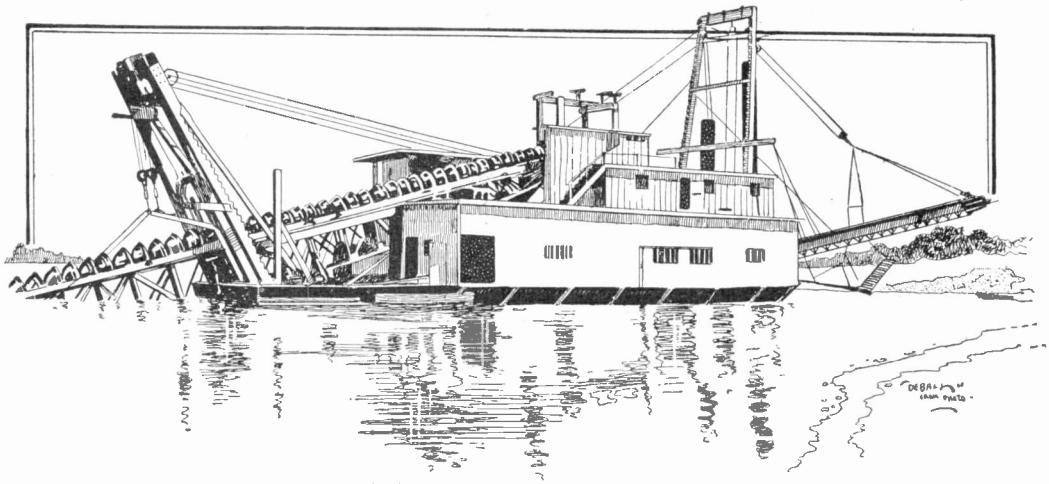


READY TELEPHONE DIRECTORY

New memorandum cards may be inserted in the clips and the cards can be turned by a handle at the right. Each card is lined and indexed on the front side and the back may carry an advertisement. A patent has been issued to Wallace G. French, Oakland, California.

Gold Dredging by Electricity

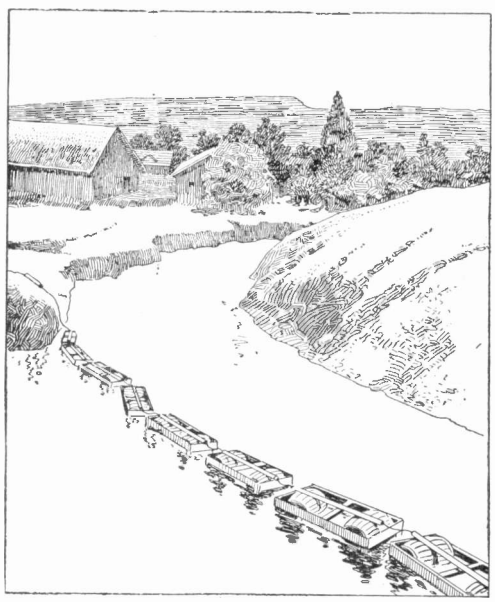
In the valley of the Feather River in California "hundred a day diggings" were not uncommon in the early years of gold mining. Indeed, gravels as rich as this had been worked right up to the water's edge. Rich deposits of the auriferous earth were also known to lie below the water level and thereafter, for half a century, men strove to find a means of reaching the lower stratum, but without avail, for the water drove them back.



ELECTRIC DREDGE AT WORK

When the dredge finally came, it followed closely and was, in large part, due to an attempt to mine with the aid of powerful pumps, which, although inadequate, were suggestive of a more highly satisfactory method.

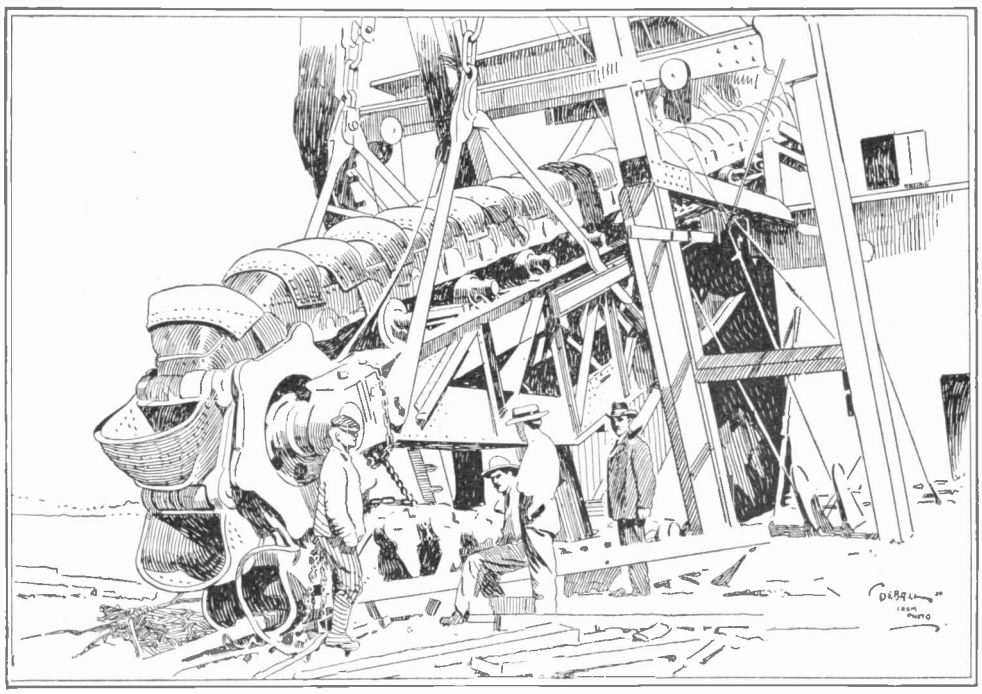
The story of its success is the old, old story of prospecting and perseverance. The pumps worked long enough and well enough to prove the wealth of the gravel, and subsequent prospecting by means of shafts sunk at intervals over a large area showed the gold to be evenly distributed. The first dredge demonstrated both the feasibility and the profit, and rapid development followed this initial success.



IN THE TRAIL OF THE DREDGE

The need of such a machine was long felt, and numerous attempts were made to develop it before success was finally achieved. Many abandoned hulks of dredges that were inoperative lay buried in the shifting sands of California's gold-bearing streams before the machinery was designed that would operate successfully. The type now employed was introduced from New Zealand, but its development to the present high state of efficiency has taken place in the California fields.

In commenting on this very interesting subject the *General*



THE "BUSINESS END" OF AN ELECTRIC DREDGE

Electric Review says: "With the rapid development of hydroelectric plants throughout the West, and the insurance of a continuous, economic power supply transmitted through great distances, the mining companies soon turned their attention to the electric motor for operating the dredges." Before this the usual type was driven by a 50-horsepower steam engine.

The gold dredge not only works in the stream bed but in the land. In the latter case the dredge is built in a dry pit dug for the purpose, and when the hull is completed, water is let in by a ditch or flume. In operation, it floats on water brought to it in this way, and its function is to dig up the soil and gravel and wash out the gold, moving forward as the ground is mined, and depositing the tailings behind.

In the most modern type of dredger there is a steel ladder of massive construction which supports a run-way for a line of traveling buckets. This bucket line constitutes the digger. The sharp bucket lips are of manganese steel; so are the rollers and bushings. These mechanical "rooters" run constantly and bring up the gold-bearing sand and gravel.

The speed of the bucket line varies from 50 to 75 feet per minute. For its operation and control a variable speed electric motor is used. The duty imposed upon this motor is very severe. It must operate under conditions calling for power varying from 75 per cent overload down to only 25 per cent of its rated capacity. Such conditions tax a motor to its utmost.

Not only is the digger operated by electric power, but water pumps, sand pumps, screens, tailings, stacker, winches, etc., all come in for their share of the current. In the small illustration, which shows the path of an electric dredge, is seen the method of bringing the power cable to the dredge on floats. The cable which is seen to be supported by flatboats carries current at a potential of 4,000 volts.

Parrot Talks Over Phone

A newspaper account states that a society woman of Atlanta, Ga., while visiting in Cincinnati wished to converse with her pet parrot, and the feat was accomplished by long-distance telephone. They held the receiver to Polly's ear. When her mistress spoke Polly responded. Both talked quite freely—in fact, became garrulous. The conversation cost $30.

All for a Pair of Spectacles

Speaking of long distance work, did you ever know the truth about it? That is, did you ever imagine it was "just as easy," or have you inside facts? I will cite an example and let you be the judge.

We were off the coast of Venezuela and the lady, Mrs. Lillian Stoker, lost her glasses overboard. Some one told her that the wireless man was the man to see in a case like that, and so she sought him in his office. I was "At Home" for the afternoon when she blew in. I asked her what I could do for her and she told me the sad story. They had slipped out of her hand a mile back—yes at least a mile—and she couldn't see a thing without them. She asked what I would advise he. to do.

She told me the sad story

I advised her to insert, primarily, an ad in the morning Aerogram (a daily newspaper published at sea), stating the facts in the case and offering a reward for their return. Secondarily, to aerograph her folks in New York to send her some new glasses to Havana, where we were due in about ten days. She seemed to think I was joking with her, but finally asked seriously if it were possible, to send a wireless message to New York, about 2,000 miles away. I assured her that it was (though in my heart I had my own doubts) and told her further that if I failed to land the message it wouldn't cost her anything. She wrote the message to her sister in New York asking that the glasses be sent to her at Havana.

All such long distance work is done nights, during the fall, winter or spring. On some nights it is not possible; on others, you can do almost inconceivable work in distance. I knew I was taking a chance.

I came on the job after dinner, and was determined to get that message through if it were possible. I hadn't been in the office fifteen minutes before the message reposed in New York. You may say "luck" and luck is right. Picked up Tampa, Fla., fully 900 miles away, shot him two messages, and heard him immediately shoot them to New York to Manhattan Beach Station. However, I could hardly hope for an answer that night. But I stayed on the job until 2 A. M. and hearing nothing more of Tampa, or any other station, went to bed.

The next night I intended to lay for that answer. It was the eve of our arrival at La Guaira, Venezuela. I went to work after dinner and tried in vain to pick up Tampa or Charleston or Cape Hatteras or some one on the coast and get that answer. After two hours of hard effort, I begun to think that it was a "bad night" when suddenly and faintly—extremely so—I could barely hear my call SK. I gripped my head phones closer and tried to push them into my ears where they would be closer to my drums. Very, very faintly I heard the call and then a sign, and I knew it was the SS. Carolina, somewhere between New York and San Juan, Porto Rico. I jumped up and slammed the door and jammed the windows down. I intended to get that message if such a thing was possible. I

answered the Carolina, but he didn't hear me. He persisted in calling and that was all. He was coming in good now—on a good streak of atmosphere. He begged me to answer. I answered with all my power, and all my tunes. I begged him to GA (go ahead) with his business. But he did not hear me at all. I ran up my voltage, opened up my spark to a dangerous point, and called him with all my might. Nothing doing! I could have sworn with vexation. Why didn't the plug send what business he had? Suddenly, as I mentally stormed and gritted my teeth, he began to call again, but his spark was weak again. I wished he would *just send* his stuff, I'd get it. Gee! there he was starting it and all I had to do was to listen good and copy. I didn't care whether he knew I had it or not. To get it was the main thing. Just as I was beginning to copy, however, listening to and straining to catch those minute sounds, some misguided pleasant passenger knocked at the door, drowning out the Carolina. I was holding my breath to be able to copy the Carolina. Probably some restless millionaire knocking to ask me about the weather. I decided to play dead. The Carolina was still sending, but I had no chance. My friend outside tried the knob again and finding he couldn't yank it off, retreated, humming a gay melody. Again I glued my attention on the Carolina, and copied thus: "G-l-a-s-s-e-s m-a-i-l-e-d H-a-v-a-n-a to-d-a-y. S-i-g P-e-a-r-l."

Gee! There he was starting it

How I blessed the fates for the considerate visit of the lone visitor! If it hadn't been for that mistake of Nature's call, I would have had the entire message! Listening again, and hardly breathing, I heard him begging it "blind" and he was now shooting it,—sending it as fast as he could all over again. I wanted the first part as far as "glasses." So I reached out in the atmosphere and broke off what I wanted from the streak he was sending and filled in my message to read:

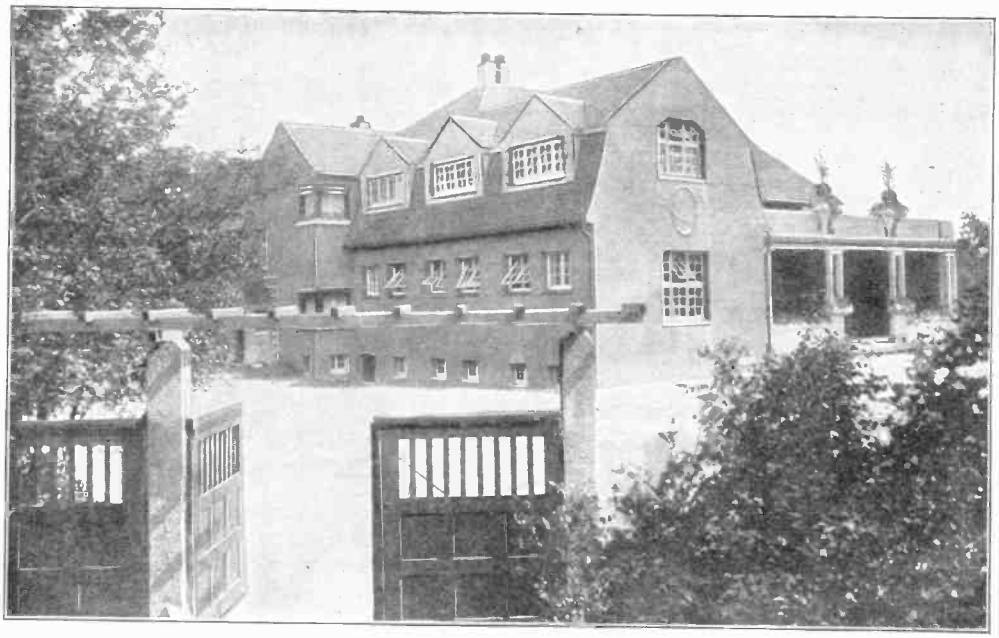
Paid & Paid. New York, March 19.
Mrs. Lillian Stoker,
SS. ————————, at sea:
Gave prescription Walter Mitchell. Glasses mailed Havana today. PEARL.

After getting this message I endeavored to get my O. K. to the Carolina, but was unable to do so. In fact, he did not hear me the entire evening. He called me, in hopes that I would hear and take the message, which he had picked up from New York. Not hearing me, he "shot the message blind," in hopes that I might be on the job and copy it. This proved to be the case, as he told me when we met in New York nearly a month later. We figured out that we were at least 1,000 miles apart that night.

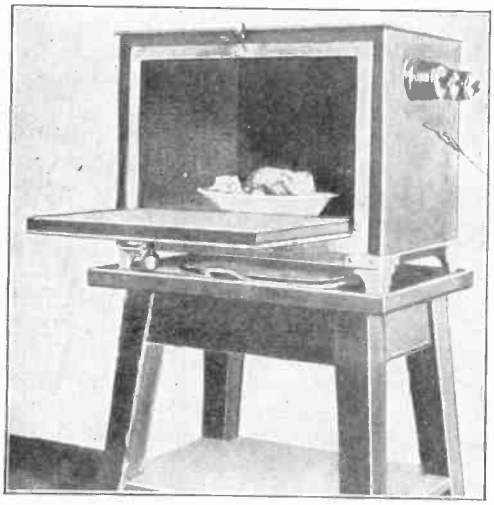
After tuning the Carolina in, it took over an hour to get the message from her at the distance, with interference intervening.

Mrs. Stoker, on receipt of the message, was very thankful, but she still cherished the idea that her family on board had given me the message for fun. However, when we arrived at Havana and she got her glasses, she came around and thanked me and passed out a genuine smile, saying, "I surely believe in wireless now."

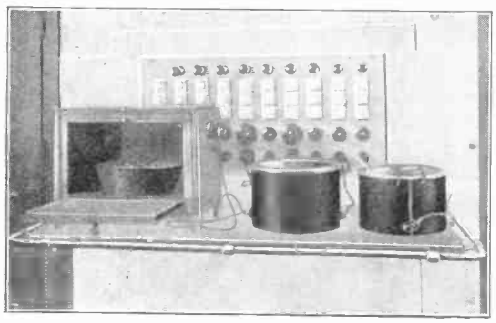
But she never knew how near she came to not getting that answer.



THE FOREST SANATORIUM



ELECTRIC OVEN



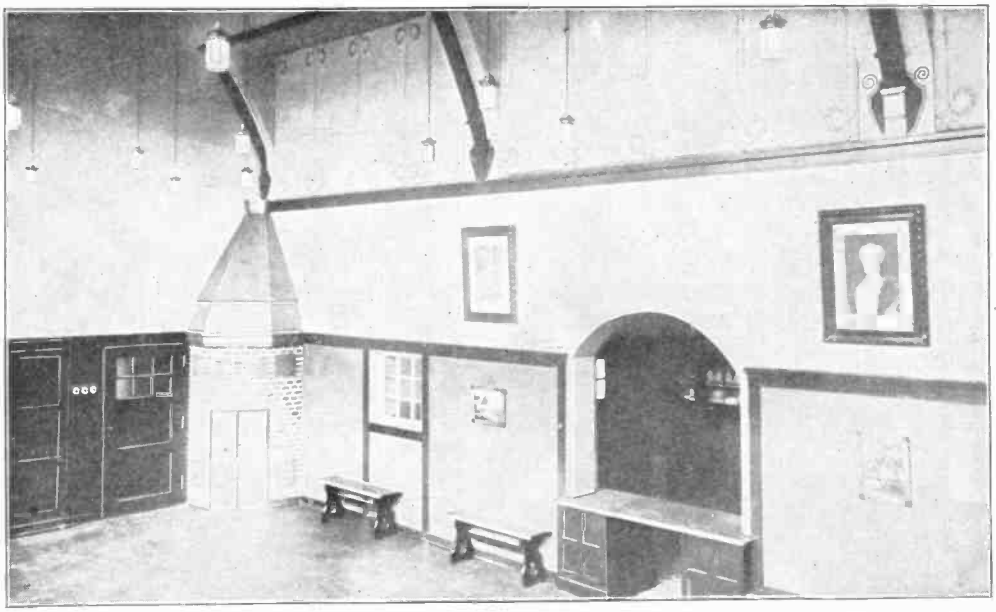
ELECTRIC HEARTH

A Sanatorium in

When a forest sanatorium destined to accommodate 30 convalescent children was erected in the municipal forest of Reydt (Germany) the important question arose as to how to provide for lighting and heating, the house being situated far from the town in a position accessible only along forest paths. As only arrangements entirely satisfactory from an hygienic point of view could be considered, electricity was eventually adopted as a source of energy, a low rate having been agreed upon with the Reydt municipal power station.

The sanatorium comprises housekeeping rooms, dormitories, a rest hall, a common room, dining rooms, bath rooms, nurses' rooms, sick rooms and meeting rooms, in addition to sufficient accommodations for the manager. The electric current which furnishes light and power to this forest retreat is brought from Reydt through a transmission line which is almost hidden among the great trees which for centuries have been the pride of the Germans.

Within the children's home all the ideals of "Spotless Town" prevail. The lighting equipment comprises metallic filament



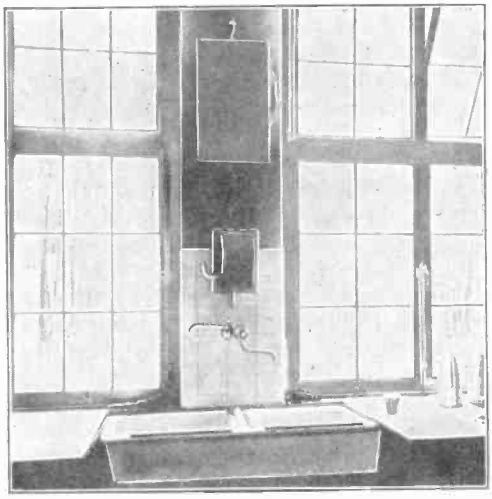
MAIN ASSEMBLY HALL

the Forest of Reydt

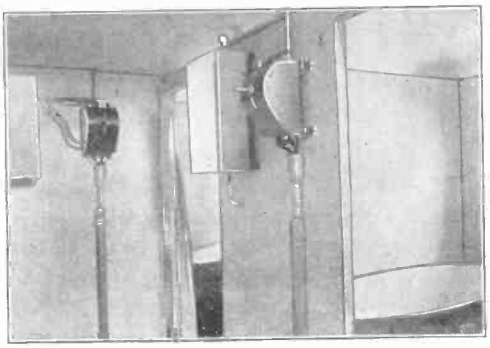
lamps only, and the bath and kitchen installations furnish agreeable surprises to the interested visitor.

Since provision had to be made for medical baths, impregnated wooden tubs were chosen. Each little private bath or cell is provided with a special electric flow heater, thus rendering the baths mutually independent. For the same reason each flow heater has a separate cable connection and switch, thus keeping the plant in working order even in case of failure of any one of the heaters.

The electric flow heater allows the water supply to be heated to a point 38° C. above its initial temperature. It allows ten liters to pass each minute. The bath heater is started by means of a lever actuating at the same time the electrical and water supplies. After pushing down the lever and thus actuating the water supply, the lever is thrown upward, thus starting the electric current as seen by the lighting of a signal lamp. In this operation the mutual connection of the water and electricity supplies is effected by a self-closing cock fixed to the extension of the switching lever. The flow-heaters are



ELECTRIC WATER HEATER



BATHROOMS AND HEATERS

located in massive polished nickel casings suspended from the wall.

In the kitchen the hot rinsing water is likewise obtained by electric heating. On top of the rinsing stone is arranged the supply cock which is actuated by a flow heater of the same type as in the bathing cells. The temperature, however, is adjusted by means of a special device to a number of different stages.

After careful consideration of the problem, the electric kitchen was designed for separate heating of each apparatus, the whole being arranged on the same lines as an elegant up-to-date kitchen range. The various utensils are located on a granite plate resting on a socle lined with white plates. Above this granite plate is fixed to the wall a marble switchboard containing all the switches, fuses, contact boxes and checking devices. The utensils are heated either from the side or from the bottom, these two stages being used simultaneously during the first heating of dishes. After this preliminary heating, the lateral heating (which is the more intense) is thrown out of circuit, continuing the cooking only with the bottom heating until the dishes are ready. The pots are well insulated outside, thus reducing as far as possible any heat losses. An interesting fact brought out in course of operation is that these utensils will also operate as fireless cookers. After interrupting the current the heat retained is sufficient for the dishes to undergo a continued cooking for another ten or fifteen minutes which, in case of proper care, allows a considerable saving in current to be obtained. This is especially striking in connection with rice dishes and puddings, which, after being prepared at noon, will keep warm in their pots until evening so as to be immediately ready for serving.

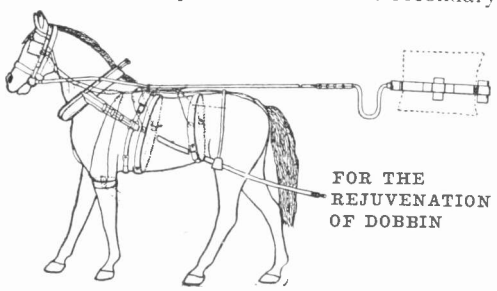
The most interesting piece of kitchen apparatus is an electric oven installed on a wooden frame which can be readily transported on castors. This oven is connected to the switchboard of the general kitchen range and comprises three heating stages, viz.: an intense and a weak bottom heating and a top heating. After being started in the lower heating compartment, frying is continued in the upper compartment which only uses up small amounts of current. The excellent heat insulation likewise produces similar effects to a fireless stove, thus allowing the accumulated heat to continue its action for some considerable time (e. g., in the baking of cakes, etc.).

The building contains no central heating plant, any heat required being generated by electric radiators. This scheme could be adopted only in view of the special conditions of operation. As the sanatorium is not occupied during the winter months proper, the heating plant will be resorted to only on cool spring and autumn days. Moreover, as the climate of the lower Rhine is a very mild one, any increases in temperature to be effected by the heating apparatus are relatively low, putting the apparatus to no excessive strain. Electric heating under these conditions was considered especially suitable.

DR. ALFRED GRADENWITZ.

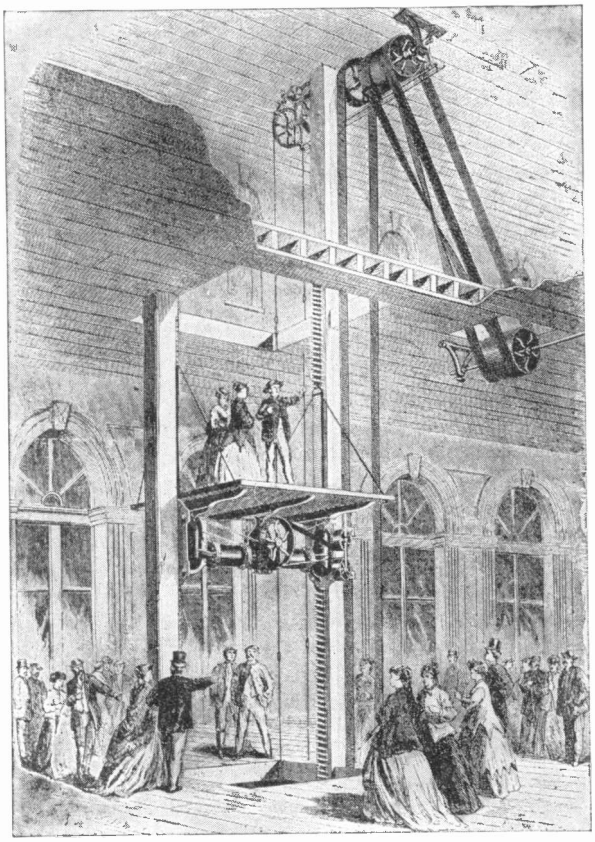
The Horse Trainer's Aid

The wonderful stories told by the village horse trainer at the cross-road grocery store of an evening may take a new turn. A patent has been granted to Asa F. Cogswell, Kirwin, Kan., on an electrical device for controlling unruly animals. The invention consists of a belt around the trainer's waist on which is carried a battery, an induction coil and a receptacle to which the secondary



FOR THE REJUVENATION OF DOBBIN

of the coil is connected. In the reins and harness are several wires running to metal terminals which are in contact with the animal's body. Push buttons controlling these circuits are located in the reins where the driver holds them in his hands. By inserting the pull-out plug on the rein circuits into the receptacle on the belt and turning on the battery current, the trainer may by pushing the proper button shock the animal through any pair of electrodes at any desired point. It is assumed that the appliance will stop horses from balking, running away, pulling backward, etc.

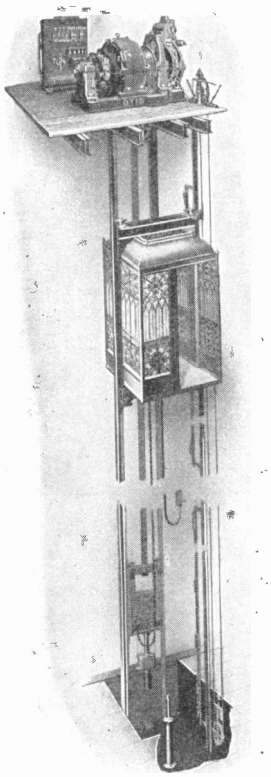


One of the cumbersome elevators or lifts which were used "back in war times"

Elevators, Ancient and Modern

In these days when we enter an office building and are whisked up 20 stories by an electric elevator, it is hard to imagine what elevator service was like back in the time of the Civil War. A picture of one of the outlandish contrivances used in those days is shown above. Yet 50 years ago this moving platform was considered to be a very fine elevator and one of the sights.

Today, if you go to the attic floor of a tall office building, you will very likely find an electric motor over each elevator shaft, quietly working away all by its lonesome. Hour after hour its revolving drum lets down and draws up the steel ropes by which the car is operated.



A modern Otis electric elevator suitable for the tallest sky-scrapers

The Tropical Trolley Trouble

By EDGAR FRANKLIN

III.

All of twenty minutes had passed when March returned from his frenzied dive to the telephone.

If his gloom had been deep before, it seemed bottomless now. He looked from Beston to Williams for a moment, and then sat down with a thud; and:

"The same old story in the same old way!"

"At—at the bridge again?" Williams gasped.

"I managed to get Jones on the wire," March said. "You know just what happened there twice before. It has happened in the same spot for the third time, identically in every detail. The power gave out suddenly and the wire was down at the bridge."

"And the winged demon had flown up to the skies again?" Beston smiled.

"There wasn't a soul about!" March muttered. "And old Salviera—millionaire, you know—is on that car and raising the dickens. We were depending on him for the choice pickings, when we're ready for the new line. Oh—Lord!"

His head dropped into his hands and he groaned aloud—and Beston stared at him in amazement.

"Good heavens!" he cried. "Why don't you set the local police to work? Haven't they detectives and secret service men here, and all that sort of thing?"

"They've got a Bureau of Public Safety that's looking for the right man to organize it." Williams said dryly. "Just at present there is no Minister of Safety, as they call him—"

"And you solve this thing, and we'll get you the job, Beston." March cried suddenly. "It's worth six thousand straight, and the Lord knows how much in perquisities."

Quite abruptly, Mr. Beston sat up straight.

"Is this—er—merely idle talk?" he inquired, pointedly.

"It's the flattest straight proposition you ever heard in your life," said March, with rather astonished enthusiasm at his own inspiration. "We're about as thick with the powers here as anybody could be. The powers are looking for the man to take charge of the national constabulary, secret and otherwise; and we could shoot you into the job in one week."

"And they'd be tickled to death to get a real American detective, too," Williams supplemented. "I never thought of that. I —"

"Well, think of it now and think hard," said Beston, as he rose. "Get your preliminary work done while I'm busy finding your winged criminal. It never occurred to me before, but I do need a six thousand dollar job." He straightened up and smiled briskly. "You communicate with the president, Williams, and have them clean out the Minister's office." He chuckled rather excitedly. "And as for you, March, lead me to this man Murdock once more, and—I suppose there's a car leaving shortly for the scene of this little unpleasantness?"

"We—we could send up a special, if you really want to—"

"Well, you telephone for the special and have it ready inside of ten minutes," Beston said astonishingly. "I really want to. Now, March, where's Murdock?"

It was the third day after when Mr. Beston appeared again at the hostelry.

He strolled in as March and Williams were arising from an early lunch; and while his quiet smile remained, the rest of him seemed to have seen hard usage. Beston's white clothes were gray and brown and yellow with dirt; and his linen had passed far beyond the time limit set by Bonhora's correct usage.

He escorted the pair from the house; and in the quiet of the street he addressed them crisply.

"I've taken the liberty of ordering a special car again," he stated. "It's due to leave in ten minutes."

"And you—"

"Wait a while. You're going along, you know." Beston glanced around cautiously. "These unlucky little accidents of yours have been taking place at Marosa at just fifteen minutes before three."

"Yes."

"Well, the car will land us at Marosa village by two o'clock, will it not?"

"Easily."

"Then just remember this: outside Marosa, there is a certain plantation owned by a nice, sleepy old man named Suarez. Never heard of him, did you?"

"Never."

"Well, happily, he never laid eyes on you, either. Therefore, I'm an American promotor—real estate—who has brought a couple of customers here. You're the customers, and you're going to buy a series of plantations hereabouts, and Suarez's will probably be the first. Understand? Now we're going up to see him, and he's going to have a couple of nice saddle horses ready, and I'm going to get astride his own nag and we're going to look over the whole property. Savvy?"

"I don't savvy what it has to do with falling wires," March said.

"You will savvy about fifteen minutes to three, when I show you how that wire's going to come down again at Marosa bridge," Beston stated. "Come on!"

With the hearty benediction of that pleased and elderly native, they rode away from Suarez's white home just past two.

And having done so, Mr. Beston disregarded the blast-furnace heat and drove in his spurs with:

"Saurez be hanged! We're right here without exciting anybody's suspicion. That's all I want. Up this way."

With remarkable familiarity, he struck into a by-road and led the way at a gallop. Twenty minutes of hard going and he pulled in suddenly and looked about. He seemed satisfied, for he nodded and slid from his horse with:

"Know where you are now?"

"Somewhere in the interior," March said intelligently.

"Exactly. You're about 300 yards from the mighty Marosa river, 20 feet wide and three deep! You are also about 300 yards from your bridge. And now we'll tie up Mr. Suarez's livery and go the rest of the way on foot."

He suited the action to the word and waited for them to follow suit; and when they had done so, he said softly:

"You will observe hereabouts something pretty thick in the way of tropical undergrowth. Well, we're going to strike right into it and make as little noise as possible. Stop when I tell you, and look where I tell you. That's all."

He plunged into the tangle of foliage with the happiest disregard of possible unfriendly animal life. Things rustled quickly out of the way, birds fluttered and chattered a little, and March and Williams, very warm and quickly breathless, plunged after him.

The way, it seemed, had been traveled before, and quite recently. There were fresh cuts on the small trees, and the bushes were trampled. Beston, eyes ahead, murmured a little ejaculation of satisfaction as he came to some half dozen uprooted bushes and stopped.

"My little tame clearing!" he explained. "Made it yesterday afternoon. Now! See the little path I've cut in that way? We're going to crawl down there, very quietly indeed; and when I get to the right spot, I'll point where you're to keep your eyes. Don't speak, by the way. I—"

He broke off suddenly.

From no distant point a sharp, metallic ping! had sounded. The partners stared—and as they did so there followed a light clang and a hiss and an explosion. And:

"He got here ahead of time!" Beston snarled. Wasn't that—"

"You bet it was!" exploded Mr. March.

IV.

Without comment, Beston dived at the rude path. With a great deal of comment, and that of unprintable character, March and Williams dived after him; and having listened to the torrent of profanity for some two minutes of quick traveling, Beston stopped for a minute and panted:

"Just cut that out, will you? You want the man that did it, don't you?"

"Do we—"

"Then shut up!" the detective said unceremoniously. "Even a coffee-colored crook might get the idea that someone was after him if he heard that. Be quiet!"

He raced ahead again. Breathing hard and perspiring profusely, they pounded after—and with startling suddenness they struck the blistering, dusty road. Beston laid a hand on the arm of each.

"There's a wagon and a team of mules just around that curve, or I'll eat your bridge, wires and all," he said. "We're

going just up to the curve. Then we're going to watch. Come along!"

Abreast, they took the two or three dozen paces in silence; Beston, then, drew them to a halt at the edge of the tall roadside growth. Alone, he leaned forward cautiously and peered about the angle. He smiled broadly and beckoned them. And as they craned forward beside him they saw an ancient and rickety native wagon, topped with canvas, hitched to a drowsy, dilapidated pair of mules.

Williams' lips opened for the first of the thousand and one questions he meant to whisper. They closed before a word had passed, for just beside the wagon the undergrowth was rustling and moving. Ten seconds, and a grinning, tremendously powerful, ragged native stepped forth.

There was a ball of something in his hand. He tossed it rapidly into the box under the seat. He stepped swiftly from hub to seat and gathered up his patched reins. He clucked and the mules took their slow way toward San Felipe, driver with head nodding.

As a picture it was perfect. The outfit might have been plodding and dozing along in precisely the same attitude for a dozen miles instead of a dozen feet.

To the picture was added suddenly Mr. Beston, revolver in hand. He gripped the bridles as they rounded the curve and sent the startled mules to their haunches. He covered the driver and, coming directly to the point, he yelled at that person:

"We got you that time, didn't we? Get down!"

The man stared hard.

"Tell him in his own tongue, March," said the detective.

March shouted a word or two. The driver descended, protesting loudly and, to Beston at least, meaninglessly. The detective grinned as he nodded to Williams.

AS THEY CRANED FORWARD BESIDE HIM THEY SAW AN ANCIENT AND RICKETY NATIVE WAGON

"Just fish under the seat and bring out that ball, old man, will you?"

Hastily, Williams complied. The detective laughed outright.

"Well, what would you call that?"

"Why, there must be a couple of hundred yards of the finest kind of linen rope here — braided stuff, too," said the trolley man, staring at the handful. "And there's a great iron hook on the end here that must belong to somebody's derrick, and ——"

"And that's all there is!" Beston chuckled cheerfully. "You just walk ahead of us now, little chocolate drop. We're go-

ing to get you a nice cavalry escort and take you to see Mr. Suarez and then we're going to telephone for the local equivalent of the police."

"It hurts me most awfully," Beston ruminated that evening, as they sat at dinner, "not to produce something in the way of a phantom airship or a boomerang thrower or a bolo artist or something like that—but that was really all there was to it."

"But I never heard of this infernal Oldado before." March submitted.

"Just the same, Mr. Oldado—hoping that he's comfortable in that third-rate jail—Mr. Oldado has been doing a mighty profitable second-class freight business between here and Querero for several years. From what I learned, he has been netting all of six or seven dollars a week, over and above all expenses of operating. You made him mighty sore when you took to carrying boxes and bundles each way for ten or fifteen cents! In fact, you've practically driven him out of business."

"But if we had ever suspected that he existed——" March began.

"Beston," Williams interrupted, "where in thunder did you ever get the clue?"

"Clue?" The detective stared at him a moment; then he snorted pure indignation. "Good Lord! If Bonhora has nothing better than that to offer in the way of a mystery, she doesn't need any police. Clue! Why, look here!" He leaned forward and smiled at them. "Your wire was being pulled down—so somebody must naturally be pulling it down. Next, the somebody must be an enemy, and one you knew nothing about, so far as I could ascertain. Pursuing this high-brow train of advanced deduction along the line of known facts, I concluded that it must be someone who found it thoroughly convenient to be at that Marosa bridge every other day at quarter of three. All these great facts I settled on the way up, day before yesterday.

"Well, once up there, I looked around. You were perfectly right. There were no footprints on the ground around the river, or anywhere in the neighborhood. That was because nobody walked there. I nosed around until I struck the road, and I found that somebody had been in the bushes. I followed what path there was, right to a certain nice spot where a man could stand—and had been standing—concealed by the bushes and with your overhead wire in plain sight. It's right at the edge of the undergrowth and about 200 feet from the wire. I looked at the said wire and thought profoundly, as usual. Then I walked out and found a nice little trail, where a light weight of some sort had been pulled along, straight to the spot where I had been standing. And gentlemen," he concluded, with mock impressiveness, "from that instant, I concluded that a mighty strong man had pitched a grappling iron of some kind over your wire and yanked it loose, the intermediate agency, so to speak, being a thundering strong rope. Further than this I deduced that the grappling iron must have been pretty heavy, because it evidently landed just about the same second that Mr. Murdock landed on the bridge, and knocked his esteemed senses out as it swung from the wire."

"But——"

"And the rest of the refined investigative work consisted in borrowing a horse from Suarez and galloping darned near all the way to San Felipe here before I overtook an extremely powerful man who looked suspicious. I spotted Mr. Oldado as a freighter of some sort, and a few questions settled his hash. You know the rest. Splendid work—yes?"

Beston leaned back and puffed his excellent cigar.

"Well, you've saved us," March began.

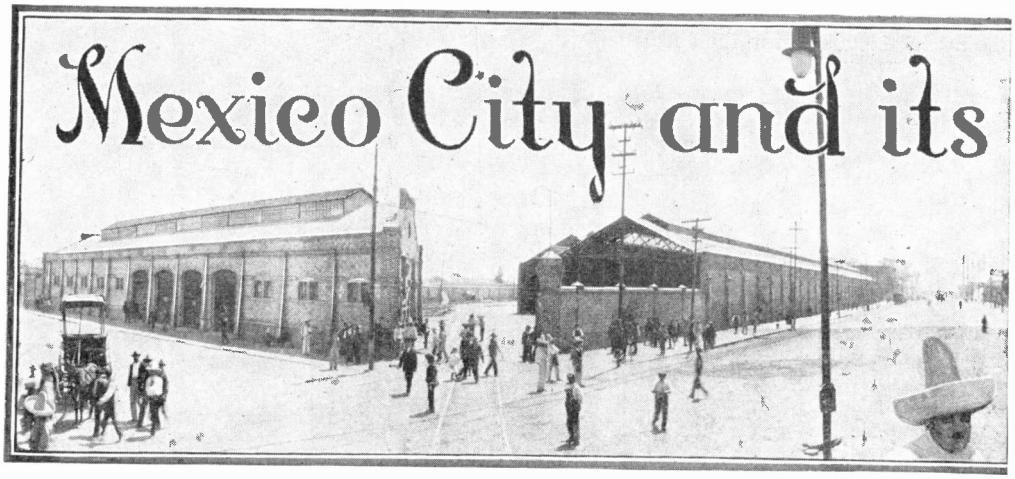
"Certainly." The detective grinned. Then the detective ceased grinning. "Say, I don't know how much on the level that remark of yours was—the one about the Minister of Safety job, and so on?"

"It's just this much on the level!" Williams said forcefully. "We're going to trot you up to the Executive Mansion tonight, and if we don't land you in the job——"

Beston held up a hand of protest.

"Enough. I understand," he smiled. And, picking up his glass, he concluded: "To me—the best chief of police Bonhora'll ever have!"

Mexico City and its



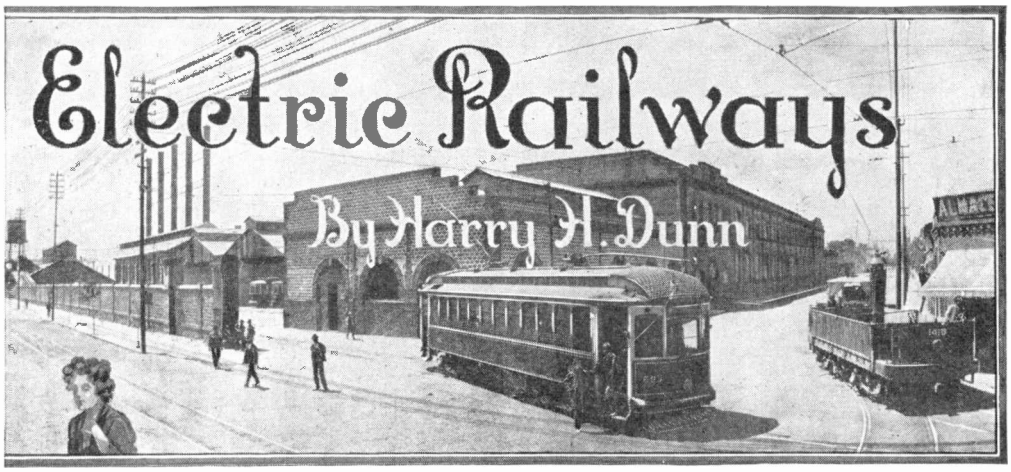
Seven thousand one hundred and forty feet above the level of the Gulf of Mexico at Veracruz or the white waves of the Pacific at Mazatlan, there stands a city, a capital of a growing republic, inhabited by near half a million souls. Ever since its founding, an event lost in the first shades of unwritten history, this city, now called La Ciudad de Mejico, has been a capital, first of an empire, then of a viceroyalty, then of a republic, again of an empire, and, for the past quarter of a century, or a few years more, a progressive commonwealth of states.

To its founders, the swarthy tribesmen of Montezuma, it was Tenochtitlan, a city as wonderful as ever was Thebes, as filled with temples as was Karnak. Today, known as Mexico City, it is the Paris of the New World. Yesterday, its rulers were borne in monstrous sedan chairs on the shoulders of slaves, while the mass of its people walked; horses even were unknown until Cortez and his handful of soldiers of fortune laid its barbaric splendor in the dust. Then came the day of the horse and the mule and the tiny burro as carriers of men and of burdens—and now has arrived the time when electric current, generated miles away in the mountain fastnesses of the Sierras, drives rushing cars hither and yon through almost every street of the most ancient capital of the two Americas, and even into its remotest suburbs.

From the great cathedral, which now stands upon the site of the greatest of the Aztec temples, to remote villages where even now the wolf-god of the Nahuatls is still worshiped as it was in Montezuma's day run the electric car lines of the system of Mexico City. From the $10,000,000 national theater, where will be sung the operas of Germany and Italy, where will be heard the masterpieces of drama of the English and French languages, to the brush jacales where no word of aught but the ancient Indian tongue of America's Egypt is heard, one may ride today in flying electric cars, as comfortable as any to be found in any city of the United States, where exist the most advanced interurban car systems in the world.

All this has been accomplished in less than ten years, and how it has been done, together with the results achieved, is told in the following lines:

The first street railway in Mexico was established in 1856, the system at that time consisting of two or three cars drawn by mules, which were operated from the central portion of the city through the business and residential sections, the entire round trip requiring about 20 minutes. Gradually, as the growth of the city warranted, additional horse-car lines were placed in operation. All of these lines were independent up to 1883, when they were consolidated in one miniature company, called the "Ferrocarriles del Distrito Federal" (The Railroads of the Federal District). It should be said here that the Federal District of Mexico corresponds to the District of Columbia in the United States. The company noted above made several extensions and secured a con-



cession giving it the right to operate street cars in the Federal District for 99 years.

This company operated in desultory fashion, altogether incompetent to meet the needs of the city, which then had something like 400,000 inhabitants, until 1900, when the Mexico Electric Tramways company, a British organization, took it over, and began the extension of lines to suburban districts and the betterment of the downtown service.

Powerhouses were installed under this regime, and the traction changed from mule to electric power. The real development of the car lines of Mexico City, however, did not begin until 1907, when Dr. F. S. Pearson, at the head of a Canadian company of large resources—the Mexican Tramways Company—purchased the entire property. Since that time, though only three years have passed, the growth of the service has been remarkable, probably faster than the growth of any similar service anywhere else in the world. Power was secured from the Mexican Light and Power Company, which operates a large plant at Necaxa, and, with this ample supply of hydro-electric energy, new lines have been constructed, reaching out into every section of the Federal District, while other lines, to reach even farther, have been planned.

The bringing of the great amount of power to Mexico City necessitates the building of sub and transformer stations in various parts of the town to insure the adequate distribution of the energy to the lines.

Indianilla is the location of the main offices, depots, car barns, shops, etc., covering an area of fifteen acres. The barns have a capacity of 500 cars, and at the shops new cars, equal to any built in the United States, are turned out as increased traffic demands them. A force of about 500 men is employed in these shops, all Mexicans with the exception of the master mechanic and his first assistant. Practically all these men have been trained by the company, and have developed into as good mechanics as are to be found in any car shops in the world.

At San Antonio Abad is located another depot and barn, with a capacity of 200 cars, and used principally for the storage of freight cars. The main storerooms of the company are at Indianilla, but about a mile from this point, the corporation has another six acre plant, where the heavy material is kept.

The track construction of the lines is among the best in the world. The company has adopted as a standard for city work 90 and 114 pound rails, all steel, with steel ties laid on a concrete bed, reinforced by expanded metal, the lighter rail being used on streets where the traffic is least heavy, while on the principal thoroughfares, where the heavy interurban cars pass, the 114-pound rails are used. All suburban lines are constructed with 70-pound steel, laid on creosoted wooden ties, with bearing plates and ballasted with rock.

It is interesting to note, in this connection, that the rock used for ballast is lava,

THE ZOCALO, MEXICO CITY—THE STARTING POINT OF THE CARS

taken from quarries owned by the company in the great petrified river of stone, which, ages and ages beyond the memory of man, flowed from Ajusco, now a dead volcanic cone, a few miles from the city of Mexico. The quarry, which is in a superficial lava wall some 30 or 40 feet in depth, miles long and miles wide, is located at Santa Ursula. Lines run to the quarry, and over these the stone is brought out on large flat cars for use in all parts of the system and for the building of the smaller edifices of the company as well.

The railway company gives employment, at the present time to about 1500 men, which means that the payrolls of the corporation probably support, at a low estimate, 5,000 men, women and children. Families are commonly large among these workmen, and the number so fed and housed by money earned from the company, may run to almost twice this figure.

One of the strange factors which has added materially to the growth of the street car system is the tendency of families to move farther from the heart of the city to make their homes. Ten years ago, every Mexican family of any importance lived in the house occupied as stores or offices by the head of the family. Necessarily, then, the families lived in the heart of the city. The American idea of living away from one's place of business, however, has struck Mexico at last, and suburban homes are rising like mushrooms all over the beautiful outlying portions of the city. It must be added, however, that the good suburban service offered by the street car lines, has contributed to this building up of the suburbs, as well as have the suburbs contributed to the upbuilding of the car lines.

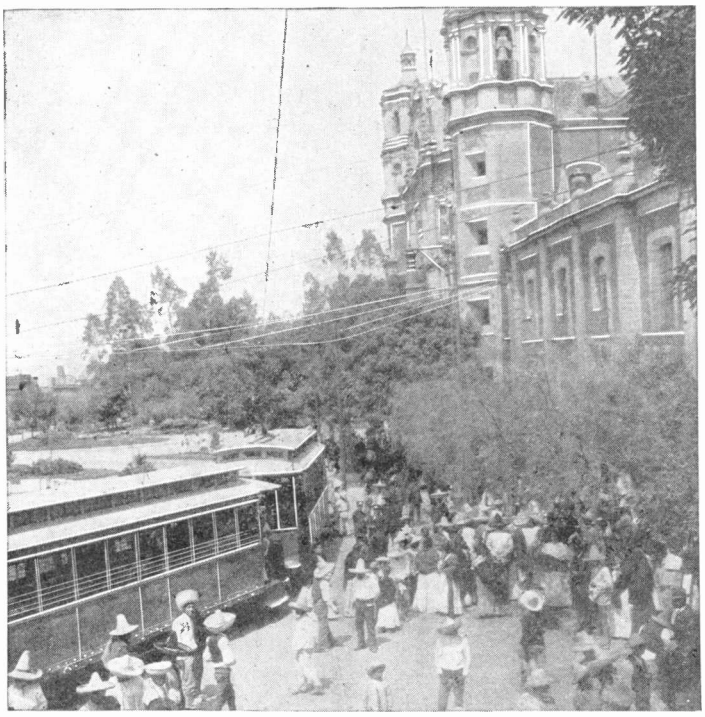
One hundred and fifty-nine miles of track, equipped with electric trolleys and 23 miles of track on which animal traction is used, gives the company a combined trackage of 182 miles, exclusive of freight sidings, lines into quarries, factories, and similar spurs. Extensions planned for the coming year probably will add ten or more miles to this amount.

The cars of all lines start from the heart of the city, where is located a square, popularly known as the "Zocalo," but officially named the Plaza Constitucional. This covers an area of about six acres, on the east side of which is the National Palace, on the north the world-renowned cathedral, on the south the Federal District Palace, and on the west some of the largest department stores of Mexico City.

Intervals between cars vary from three to six minutes, during the greater part of the day, with longer periods after nightfall. Service is maintained until two o'clock a. m., while cars start running at five o'clock in the morning. On all the city lines, a special type of double truck car, seating 36 passengers, is used. The fare within the city limits is six cents, silver, or, reduced to the terms of United States coin, three cents.

On suburban lines two-car trains are used, the first car seating 56 passengers

and the trailer, which carries second-class passengers, is 43 feet 8 inches over all, and has longitudinal seats, with an express compartment in the front third of the car. Fare prices on first-class suburban cars vary from ten to 40 cents, being based on a schedule of two cents, silver, a kilometer, which is a little less than three quarters of a mile. Second-class fare is usually about 60 per cent of the first-class. In the express compartment a charge is made for the carriage of parcels, depending upon the size of the package, and based on the second-class fare for the distance traveled.



GUADALUPE HIDALGO, TERMINOUS OF THE MOST IMPORTANT INTERURBAN LINES

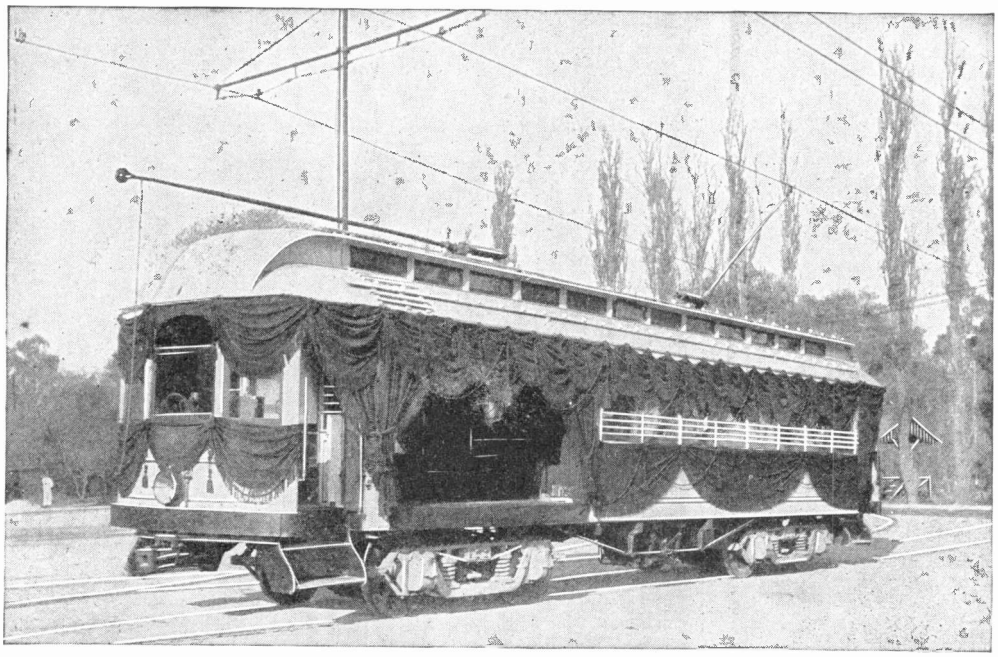
First and second-class monthly tickets, called "abonos," are sold at a reduced rate, and on these most of the suburban dwellers travel. The cost of these commutation tickets is from $4.50 to $10, silver, according to the distance traversed. The second-class tickets cost from $2.50 to $6.50, silver, also varying with the distance from Zocalo of the point to which they are sold.

Combined express and passenger train service is maintained from the suburban towns to the city at an early hour in the morning, so as to enable suburban residents to reach their offices before business hours. To these two factors of monthly tickets and early suburban express and passenger service, is attributed more than anything else the rapid growth of the outlying residence sections. In every manner possible the company has catered to suburban residents, and it is interesting to note that the heaviest travel over these lines is in June, July, August and September.

Possibly the most unique department of the entire corporation is the funeral car division, which also has grown into an important service. Every cemetery in and around the Federal District is reached by the lines of the company, and over these run special motors, black draped cars with stands for the coffins of the dead, and trailing a passenger car for the mourners. The car that carries the body is called a "carroza," and bears, besides, usually a wealth of floral offerings, beneath which the catafalque is often completely hidden. Rates for the use of these funeral trains vary from $3.75 for the very humblest to $150 for the palatial train of the wealthy mourner.

In Mexico city traffic regulations are strictly enforced. All cars must stop at the near side of streets, and passengers must enter the cars from the rear platform and pass out from the front. The motorman is fenced off by doors which are always kept closed, and no one is allowed to speak with him except the conductor and inspector, nor is any one allowed to ride on the front platform. Smoking is not allowed on the cars.

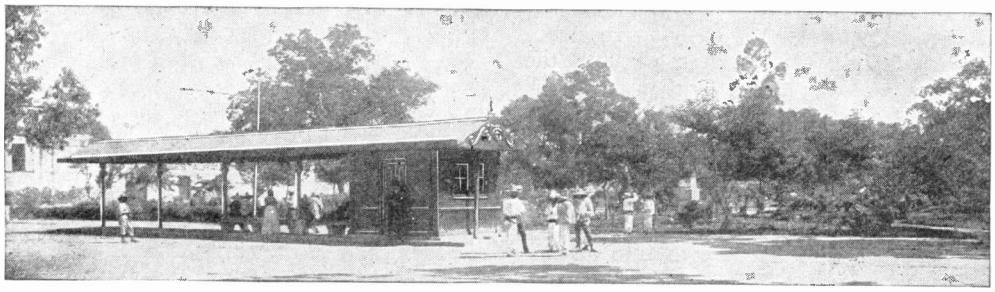
Scenic considerations have entered into the selection of routes to the suburban cities of Mexico. Many of these lines pass through historic spots, as, for instance, the Tlalpam line, which crosses the battlefield



FUNERAL CAR "TEPEYAC," THE FINEST CAR IN THE FUNERAL SERVICE OF THE MEXICO CITY LINES

of Churubusco; the Xochimilco line which skirts a great prehistoric mound, and ends near the floating garden whence Montezuma and his subjects brought their fruits and flowers to their palaces in ancient Tenochtitlan; the San Angel line, which passes the famous prison of Belem, and skirts the park of Chapultepec, in which is located the presidential residence of the same name. To Guadalupe Hidalgo, in whose ancient chapel is located the tilma on which was miraculously imprinted the Virgin of Guadalupe, at the time she appeared to an Indian boy on the slope of the hill whereon the chapel now stands. Here, too, are kept the crown jewels of the virgin, worth, at a low estimate $150,000, and made up from the donations of faithful Catholic women of Mexico City.

The tourist who comes direct to the capital of Mexico, and then returns to the United States without penetrating the outlying states, may see all ages of the development of Mexico. In the heart of the city he may be domiciled in as modern a hotel as exists in the New World, and, by taking almost any one of the suburban lines, he may spend a day in a village which is unchanged from the day that Cortez came. He may pass from the lobby where he hears as much English and French as he does Spanish, and ride on an electric car to a little hamlet where only the ancient tongue of the Aztecs is spoken.



TYPE OF SUBURBAN STATION HOUSE ON LINES RUNNING OUT OF MEXICO

Five Epoch-Making Electrical Inventions

By ELMER E. BURNS

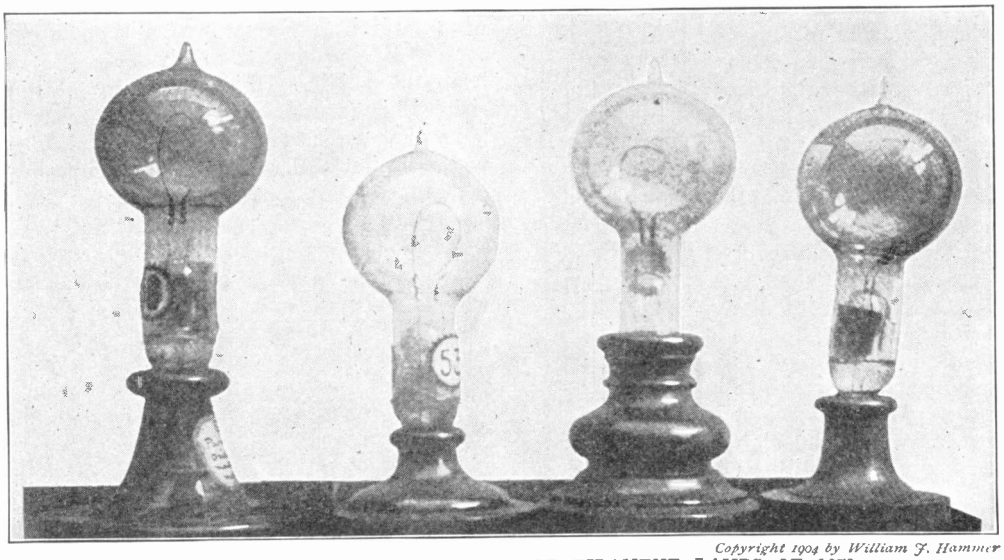
IV. THE INCANDESCENT LIGHT

At the time when Edison began his work on the incandescent light, such a light had been "proved" impossible. Sir William Preece, an eminent English scientist had proven that when the number of lamps in an electrical circuit is increased, the total light given out is rapidly diminished and the light given out by each lamp diminishes still more rapidly. The practical "subdivision of the electric light" he declared to be impossible. It was in 1879 that one American authority said "There are certain practical difficulties in dividing the electric current so as to produce a number of small lights by means of a single generator which have baffled the ingenuity of inventors so far, and which must effectually block progress in this direction unless some new principle is discovered." The same authority advised inventors to turn their attention to the production of small generators, one for each light, instead of to the subdivision of the lighting effect of one current.

In one instance the light from a single arc lamp was projected through a large pipe by means of lenses and mirrors like the beam of a search light. This light was taken out through smaller pipes a little at a time by means of small mirrors and used to light the rooms of a house or the corners of a street, for it was thought better to divide a large beam of light than to attempt to divide the electric current.

Nevertheless a few daring inventors persisted in their attempts to produce a small incandescent light suitable for running a large number of lights on a simple circuit. The first incandescent light was that of John W. Starr of Cincinnati who filed a caveat for a divisible light in 1845. Starr went to England to complete his invention. George Peabody agreed to furnish all the capital required provided the invention was approved by the best electrician in Europe. Faraday was chosen as the judge. Starr prepared a brilliant demonstration, lighting an artificial tree with 26 of his incandescent lights. Faraday pronounced it a success.

The next incandescent light of any importance was that of Jobart in Paris in 1858. This light was intended for lighting mines where there was danger from fire-

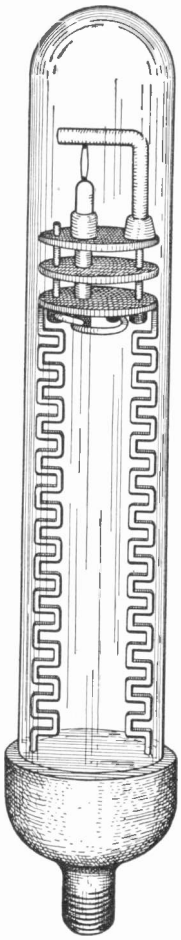


EDISON'S FAMOUS PAPER HORSESHOE FILAMENT LAMPS OF 1879

damp. In 1859, Moses G. Farmer of Salem, Massachusetts, lit his house every evening for a month with incandescent lights using a battery current. This was followed by the Sawyer-Mann lamp, after an interval of 20 years.

Starr had invented two kinds of incandescent lamp, one consisting of a piece of platinum foil placed under a glass cover without excluding the air, the other a carbon rod in a Torricellian vacuum.

In 1878, Sawyer and Mann exhibited a system of incandescent lighting, using lamps similar to one kind of lamp invented by Starr. The current passed through a small pencil of carbon in a sealed glass tube filled with nitrogen. Nitrogen being an inert gas it was thought that the carbon would not waste away. But it was found that the carbon would waste away almost as rapidly as in a Torricellian vacuum or a closed air chamber. The destruction of the carbon was not due to chemical action as was supposed. The presence of any gas was sufficient to destroy it. The high vacuum of the Edison lamp was essential. The Sawyer lamp was so made that it could be taken apart and a new carbon inserted.



THE SAWYER-MANN LAMP

All the elements of the incandescent lamp existed when Edison began his work. An air pump that would exhaust the air to a millionth part had been invented. The carbon burner and the glass globe with its leading-in conductors had been tried. But the elements had never been combined. Most of the lamps prior to Edison used an inert gas in which it was supposed the carbon would not burn. But the carbons wasted away rapidly, nevertheless, and complicated mechanism was introduced as we have seen, to adjust the carbons and to permit them to be replaced without destroying the lamp.

Edison at first worked along the old line. His platinum spiral lamp involved much complicated mechanism. It was necessary to heat the platinum almost to the melting point to secure the light desired. This made it necessary to devise a means of shunting the circuit promptly when the temperature had passed beyond a certain point.

Platinum and other metals failed because when heated to a white heat, as they must be to give out light, the metal was so near the melting point that it burned out with a slight increase in current.

The platinum lamp was disappointing even to Edison himself. He would not give it to the public. He waited even at the risk of his reputation until he had made a lamp that satisfied the rigorous conditions which he imposed. The public became impatient. A writer at that time said, "The world after waiting patiently for the public display of an invention which sent gas stocks down as soon as it was heralded, will be disposed, unless Mr. Edison shows his hand, to suspect that the Edison electric light and the Keely motor will have to be ranked together as enterprises which contained much more of promise than of performance."

After his first experiment Edison went to the root of the matter. Air or other gas in the globe was a hindrance and he got rid of it. The air was pumped out until only a millionth part remained. He found platinum and irridium wire unsuited to the purpose and turned to the carbon filament. He had tried a thread of lamp black and tar, carbonized thread, paper, wood—everything in fact that could be adapted to the purpose. A palm leaf fan suggested the idea of carbonizing bamboo fiber. It proved superior to the other substances tested.

The story of the search for the best form of carbon filament is a story of thrilling adventure. Men were sent to all parts of the world where the bamboo grows and at the risk of their lives secured specimens of every known variety. The search cost about a hundred thousand dollars and resulted in the adoption of a Japanese variety. For a number of years the carbonized fiber

of this bamboo was used and then replaced by the "squirted" filament.

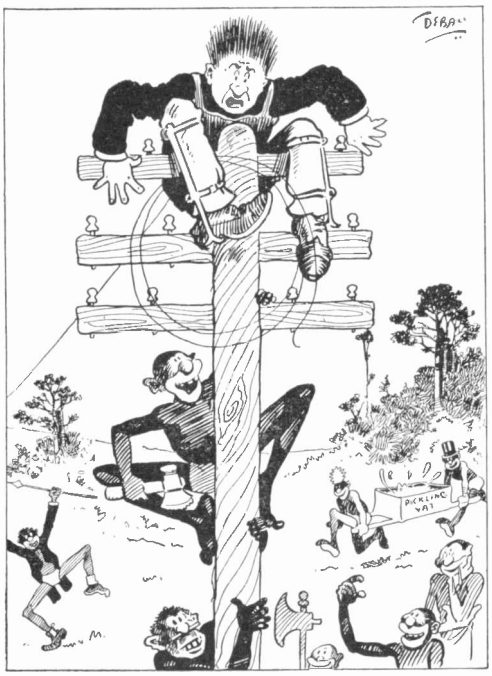
The vacuum lamp would not have been possible with the complicated mechanism of the lamps that preceded it. So all mechanism was left out and the simple glass globe with the sealed in wires connected to the carbon filament was used. This lamp could be made at so low a cost that it could be thrown away when the carbon burned out. The carbon burner in the exhausted globe with no mechanism was a new thing. It is only the genius who arrives at simplicity. The small-minded inventor cumbers his invention with all sorts of complicated and unnecessary mechanism. The history of great inventions is the story of progress from complexity to simplicity.

The lamp alone was not sufficient for a system of incandescent lighting. Improved methods of producing and distributing electric current were needed. In this sketch it is only necessary to mention the compound-wound dynamo, with its high voltage, the multiple arrangement of the lamps and the three-wire system of distributing the current. Edison's invention was more than a lamp. It was a system of electrical distribution, of subdividing the electric current, and of making the lamps independent of each other. In 1880 this system had been developed to an extent that justified its commercial application. It remains today the same in its essential elements, but with great improvement in detail and with lighting systems of greater capacity than were dreamed of in the earlier days.

Wireless Saves the Lineman

Some 2,500 miles from the mouth of the Amazon and situated on its tributary, the Madeira, is the little town of Porto Velho, whose inhabitants are employed in building a railway around the Falls of the Madeira to give an outlet for Bolivia to the Atlantic by way of the Amazon.

The people of the town are served with the doings of the outside world by a newspaper which obtains its news by wireless from Manaos on the Amazon over 500 miles of jungle. Imagine the pleasure of a lineman in maintaining an ordinary telegraph or telephone line where it is summer all the time and where head hunters are said to lurk and pursue their favorite pastime. Two races occupy the forest—one a kindly people who go quite naked, the other consisting of cannibals. The latter are the famous head hunters, whose secret of mummifying human heads—reducing the head in the process to the size of a doll's head, while preserving the features and expression—has created such a demand for these gruesome objects as curiosities that the Peruvian Government (their habitat extends to Peru) has been forced to make it a criminal offense for any person to have such a mummified head in his

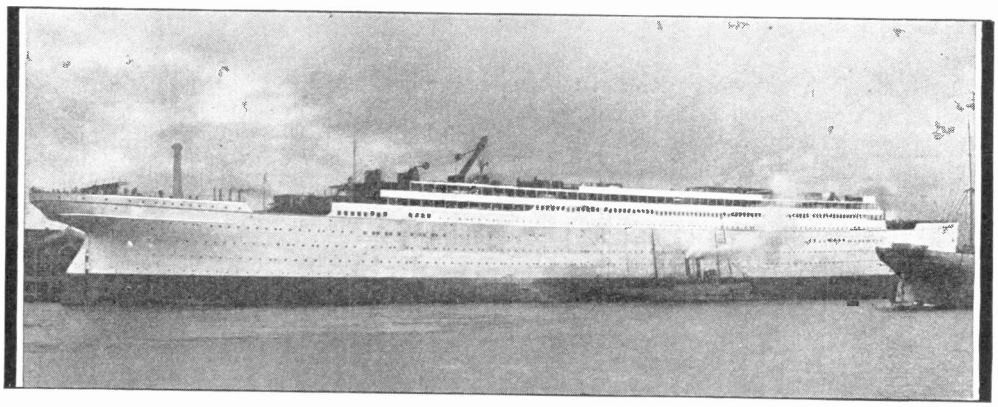


WIRELESS HAS SAVED THE LINEMAN THIS DISCOMFORT

possession. When the cannibals discovered the willingness of the white man to buy the heads they made a business of supplying the market, and were so enterprising that the margin of safety not only of the milder natives but of travelers was very materially reduced.

The head of an European, according to all accounts, brought even more than that of a native, perhaps because the purchaser could fancy that it had once belonged to some fierce blonde Castilian in the train of Pizarro and had lain in some fastness of the vanished Incas since the Spaniards overthrew the sun worshipers.

However, wireless has saved the lineman.



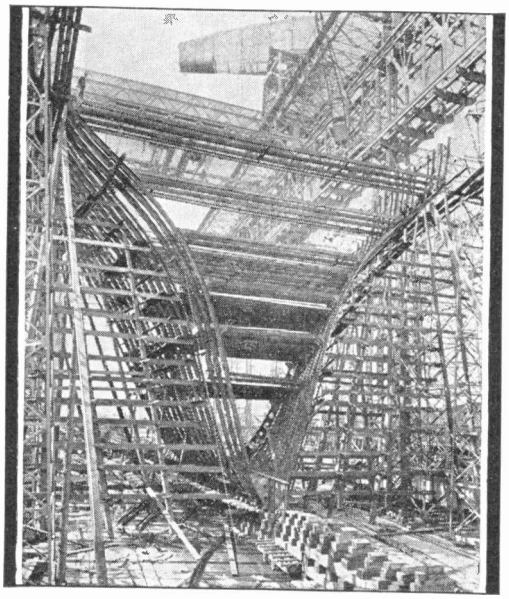
STEAMSHIP OLYMPIC RECEIVING THE FINISHING TOUCHES

The Latest Leviathan and Its Electrical Equipment

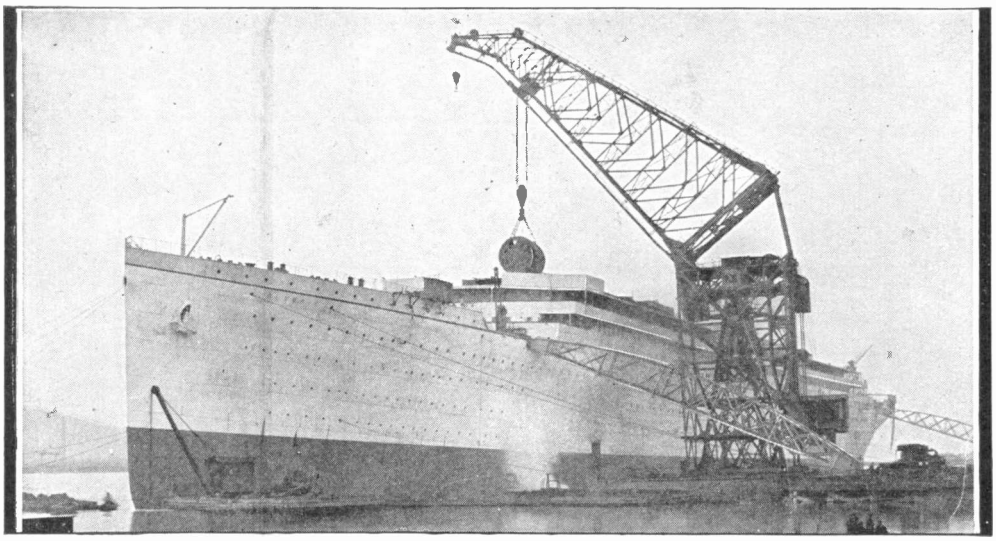
By C. B. EDWARDS

Thirty-one years ago, electricity made its first appearance as a marine illuminant when Thomas A. Edison personally superintended the installation of the "new incandescents" on the American steamer "Columbia." The whole lighting outfit comprised two dynamos driven by belts from the main shaft on the boat, and which furnished current for 115 ten-candlepower lamps.

Later, the Cunard steamer "Servia" was fitted out with electric lights at a cost of five thousand dollars and a year later put in service. The use of electricity in lighting these passenger steamers at once demonstrated that it was the only safe, convenient, and reliable illuminant for steamships and its extensive adoption proved to be only a matter of time. In 1906, the Cunard line placed a contract with a foreign firm of electricians to equip the Lusitania and Mauretania with every electrical appliance known to industrial electricity. The result was two steamships that are still considered marvels of electrical art and engineering. Art, because of the nicety with which the fixtures and appliances blend into inconspicuous harmony with the faultless polish of the mahogany and concealed wiring; and engineering, because of the enormity of details in such an installation. Now, even these steamships are outclassed as examples of what electricity is able to do for ocean travel. The Olympic, the largest vessel in the world is almost ready to leave her berth at Belfast. She is 812½ feet long, 94 feet broad and has a displace-



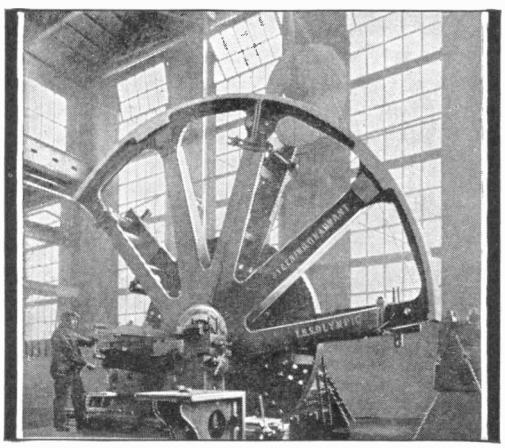
THE FIRST RIBS OF STEEL IN THE OLYMPIC



LOWERING A BOILER INTO THE HOLD WITH AN ELECTRIC CRANE

ment of 66,000 tons and when this new leviathan makes her first voyage she will take her place on record as having the largest electrical installation ever built into an ocean greyhound.

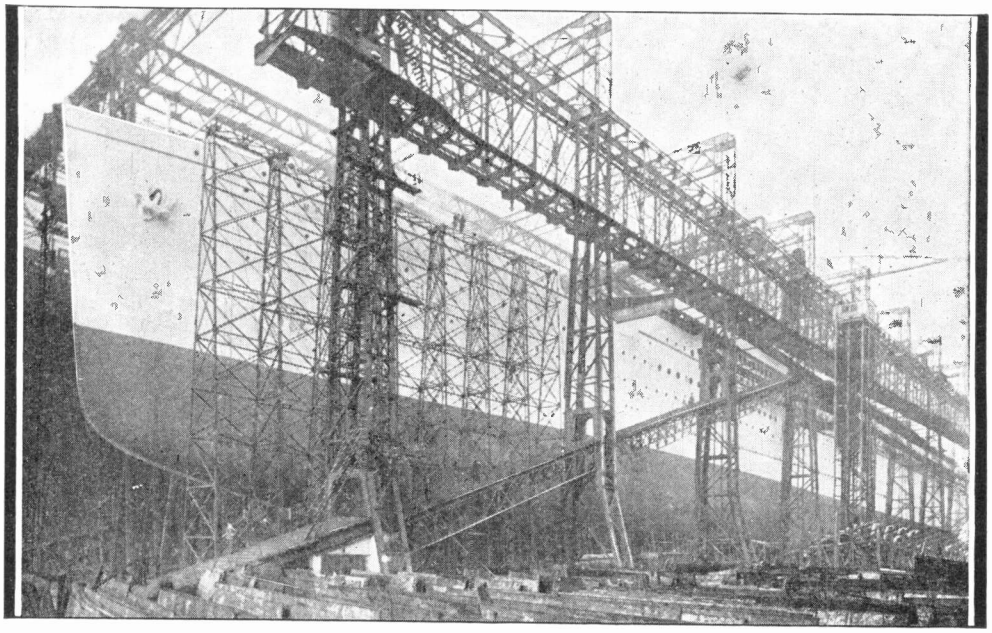
Electricity, always a most "modest" power, is especially so on ship. Few passengers realize that partitions, columns and baseboards on all of the steamships are pierced with innumerable interstices through which leads of all kinds and sizes convey both energy and intelligence. Everywhere, the invisible tentacles of electricity, cunningly hidden by cabinet makers, cross and recross to perform the arduous duties of caring for our "floating" population. Like the arms of a great devilfish, the wires emerge from the main power units and ramify throughout the structure, here cooling the food and drink of the multitude, there carrying on communication between pilot and engineer, everywhere transforming something that is to be done into a task completed.



THE GREAT STEERING QUADRANT IN COURSE OF CONSTRUCTION

The electric lighting units, always considered the most important auxiliary power aboard, are situated almost amidships on the Olympic and in a separate water-tight compartment in the rear of the turbine room. These units, four in number, consist of compound vertical engines having one high and two low pressure cylinders which admit of economy in the use of the expansive power of steam. The steam is taken from the boilers at a pressure of 185 pounds per square inch and used first in the high pressure cylinders and then in the low pressure cylinders. Each engine is directly connected on the same base to a dynamo, and the collective capacity of these dynamos is 2200 horsepower.

In addition to the four main generating units mentioned, there are two 40 horsepower engines and dynamos, placed in a recess off the turbine-room at the level of the saloon deck and well above the water line. These generating sets are patterned after the main sets and are only intended for use



DURING CONSTRUCTION THE OLYMPIC WAS ALMOST ENVELOPED IN STRUCTURAL STEEL

in case of emergency. The flooding of the lower sections of the ship would not put this emergency unit out of commission; at least not until the fires under the boilers themselves had been quenched.

The distribution of the electric current on the Olympic has offered some original problems. Taking into consideration the effect of the salt air and the high temperatures encountered, against which ordinary insulation is worthless, the engineers were compelled to use asbestos insulation at certain points as well as quantities of armored conduit. The main switchboard, where the electricity of the entire craft is controlled, is located in the gallery of the electric engine room and to it the main dynamo cables and feeders are connected. These pass up through port and starboard cable trunks to the various decks, radiating from thence to the master switch and fuse boxes grouped at convenient intervals in the machinery spaces. From these stations branches run to the distribution fuse-boxes scattered throughout the vessel and controlling both lamps and motors.

In the electric lighting of the Olympic over 200 miles of wire is used and about 8,000 sixteen candlepower lamps. Besides the ordinary incandescents, the lighting installation includes many novel lighting features in the illumination of the saloon deck. Other lighting equipment of a very important nature is that of the searchlights, two very powerful lamps being installed near the pilot house. An electric Morse signal lamp at the masthead is of unusual interest, for with it the wireless telegraph operator may signal at short range as easily as he does with the wireless equipment at greater distances.

In the navigation of a great passenger vessel of this type electricity is applied in many ways, probably chief of which is in the steering of the vessel. This is accomplished from the navigating house, where a small steering wheel is attached to an iron post protruding through the floor. At the point where the axis of the steering wheel enters the post there is an enlarged portion looking very much like a motorman's controller box. Through contacts in the box, the movement of the steering wheel actuates the motors controlling the steering engines, which in turn move the rudder itself through the medium of the great steering quadrant.

Other electrical devices of interest in the navigation house are the "loud speaking" telephones. By the aid of these it is unnecessary for the pilot in talking to the

engineer to clap a receiver to his ear or to talk directly into a transmitter. Both receivers and transmitters are fastened to the wall and the sound is amplified to many times that which we perceive in the ordinary telephone. It is possible to hear what the engineer is saying to the pilot anywhere in the navigating room and the natural tone of voice is all that is necessary to carry with great distinctness. This system of telephones is used in reaching all parts of the steamship from the bridge and is entirely separate from the system in general use on the passenger decks.

Besides the loud speaking telephones, a system of ship telegraphs is also provided for use in case of emergency. An electrically driven sounding machine on the bridge provides ready means for ascertaining the depth of water and three compasses keep the navigating officers informed as to their course. Besides these compasses a standard compass is placed on an isolated brasswork platform in the center of the ship and twelve feet above all iron work as a means of synchronizing the other three in case of error.

Attached to the wall of the navigating room a most important piece of apparatus is the electric indicator for the watertight bulkhead doors. This provides means of observing the closing of all the doors and stopping the inflow of water in case of collision. The doors are closed by hydraulic pressure and as they swing too, tiny electric lights within the indicator show exactly which doors are closed or open.

A complete fire alarm system is provided, with some 40 odd stations and two indicating boards, connected in parallel, one in the wheel house and the other in the engine room. These with the automatic electric smoke indicators complete the electrical fire alarm apparatus.

As the height of the Olympic is over 100 feet from keel to navigating bridge, elevators have been installed to carry passengers to the nine different decks. These are all four operated by small ten horsepower electric motors. Three elevators are provided communicating with the saloon deck and one with the second-class passenger decks.

There are 559 staterooms of all classes on the ship and each of the first-class staterooms is provided with a telephone. This telephone system is one of the most interesting features of the electrical installation. The telephone switchboard provides for 300 drops and although similar to those in general use has a few features that are somewhat unusual. No bells are used in calling, small 24-volt calling lamps located near the stateroom wall phones notifying the occupant that he is wanted. A like signal is in use at the main switchboard. The telephones are nickel plated and very neat in appearance and the receivers are hung on pivots which allow them to swing with the ship. Besides allowing the first-class cabin occupants to talk with others on the steamship a cable head at the wharves in New York and Liverpool will allow passengers to talk through the city exchanges while the steamship is in dock. The cable from the steamship is simply plugged into the cable head at the wharf and ten trunk lines are instantaneously connected with the ship's central board.

The ventilation of the steamship is accomplished with the aid of over 100 ventilating fans of various sizes, all actuated by electric motors. The usual electric baggage hoists are provided, also electric deck cranes and capstans. A large refrigerating plant is installed, the compressors all being operated by electricity. The kitchen is replete with electrical devices for removing the drudgery of dish washing, potato peeling and cleaning and sharpening table cutlery.

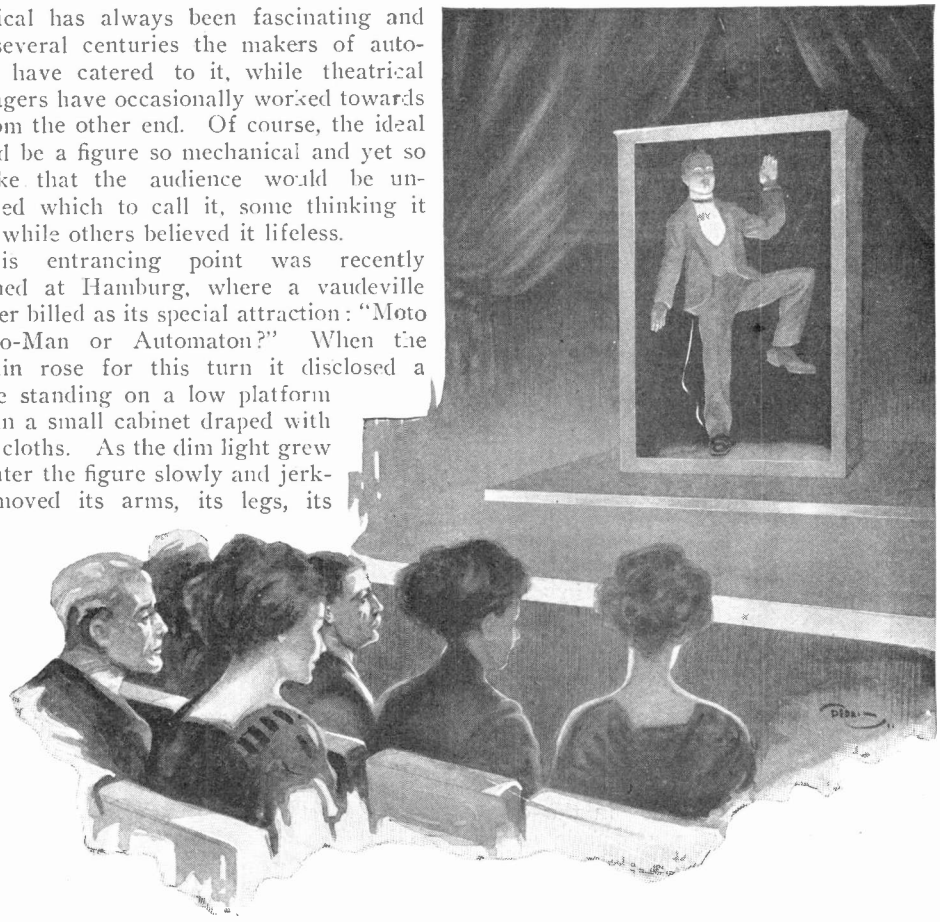
The Marconi wireless house is located on the highest point of the hurricane deck amidships and is of the most powerful type, the masts supporting the antennae rising 205 feet above the water line.

To give any adequate idea of the uses to which electricity is put in the engine and boiler rooms would be almost impossible. Coal handling, repairing, twirling turbine spindles and lifting turbine casings, are a few of the things accomplished on the Olympic by this indispensable power.

Automaton or Actor—Which?

With actors and actresses simulating the jerky movements and the rigid stare of dolls, and with the builders of mechanical figures copying the expression and motions of the live man or woman more and more closely, stage performances sometimes reach that interesting point where it is hard to distinguish between the two. This puzzling border line between the real and the mechanical has always been fascinating and for several centuries the makers of automata have catered to it, while theatrical managers have occasionally worked towards it from the other end. Of course, the ideal would be a figure so mechanical and yet so lifelike that the audience would be undecided which to call it, some thinking it real, while others believed it lifeless.

This entrancing point was recently reached at Hamburg, where a vaudeville theater billed as its special attraction: "Moto Phoso-Man or Automaton?" When the curtain rose for this turn it disclosed a figure standing on a low platform within a small cabinet draped with dark cloths. As the dim light grew brighter the figure slowly and jerkily moved its arms, its legs, its head, yes, even its eyes. Apparently the flexible cord running up to the figure conveyed the electric power for operating it, for the figure would raise its left leg and hold it up at angles that would unbalance any man, standing firmly all the while on its right foot. Then as the strenuously uplifted leg was jerkily lowered the lights grew dim, flickered and then grew bright again. There the figure stood as at first, now varying its jerky movements with more graceful ones, smiling and raising both legs alternately off the platform. All over the house there were whispers of "What did I tell you," or "I knew it was alive." But, lo! Again a dimming and flickering of the light, again the jerky raising of foot and arm into unstable positions, till at last the figure stands motionless, while the average spectator holds his breath and is more puzzled than ever when the curtain falls.

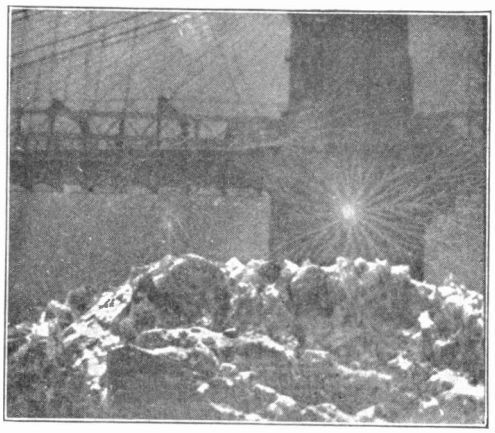


AUTOMATON OR ACTOR—WHICH?

Actor or automaton—which was it? Or were there both, with a quick interchange caused either by a revolving base, or by the use of reflected light as in certain trick cabinets? Naturally the producers do not answer their own question, but if this act comes to America we may have a chance next winter to decide this for ourselves.

Static Electricity in Photography

Perhaps the most easily generated form of electricity and at the same time the most annoying to the amateur photographer, is that known as static, the kind you get when rubbing a cat's fur on a cold day. The non-adept at photography enthusiastic over a



STATIC ELECTRICITY LEFT ITS MARK

snap-shot on some bright winter's day, is apt to hustle the winding of his film, and in so doing, to generate electricity within. A tiny spark is thus generated on the surface of the undeveloped film with disastrous results to the picture. Seldom, however, is the trace of the spark shown in such perfection as in the accompanying picture reproduced from a photograph of an Ohio river scene.

The Point of the Lightning Rod

Everybody knows in a general way that a lightning rod affords protection to a building, but many persons do not know why the rod has a sharp point, and why it is usually made of metal that does not easily corrode.

The object of the rod is to empty a cloud of its electricity noiselessly and harmlessly, and it must be pointed because a fine point offers no resistance to the discharge. The degree of resistance is in proportion to the surface of the object, and a point has the least possible surface. If the rod were topped by a ball or a knob, the discharge would be violent.

The difference between a point and a ball is shown in discharging a battery. The full charge from a large battery may be received quietly on a metal point, but a moderate charge from a small battery will explode with violence on a ball. It is said that a full charge may be passed harmlessly through a person's body if received on the point of a sewing needle, whereas the same charge received on a ball-tipped discharger, would cause instant death.

Non-corrosive metal is used for the point of the rod because corrosion makes resistance, and must therefore be provided against. Many a lightning-rod has received an electrical discharge when the occupants of the building whereon it was placed knew nothing about it.

Self-holding Telephone Receiver

The self-holding receiver telephone is an innovation in the field of telephone devices. The illustration shows the pivoted arm mounted at the top of the stand, thus relieving the user of the tiresome holding of the receiver and also eliminating the liability of breaking the receiver by a fall. Both hands are free to take notes. The receiver

SELF-HOLDING TELEPHONE RECEIVER

arm is pivoted so as to be turned and adjusted to either ear, and a button and sliding band on the stand take the place of the receiver hook for cutting in and out the talking service.

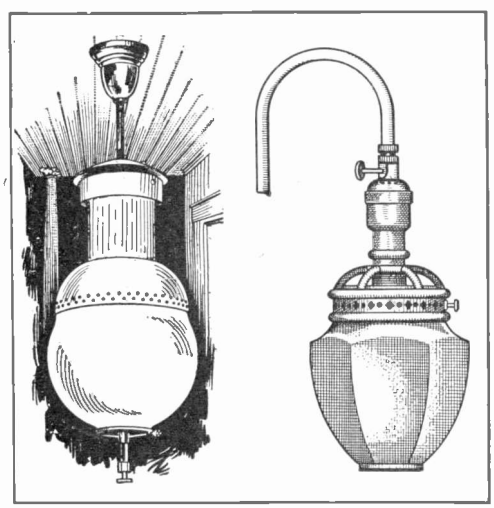
Magnetized by Lightning

Among the curious effects ascribed to lightning is the magnetization of parts of rocks struck by it. The existence of such magnetized rocks has long been known, but the supposition that their condition was due in many cases to lightning has only within recent years been confirmed by a curious observation among the walls of ancient buildings on the Campagna near Rome.

There were found strongly magnetic points and zones in the walls, precisely like those occasionally encountered in rocks. The fact that the magnetization often included more than one block of stone in the wall was regarded as proving that the magnetic property had been acquired after the building was erected, and the agency of lightning was indicated by neighboring cracks in the walls.

Mimicry in Gas Fixtures

"The public likes to be humbugged," said the celebrated Barnum and the wisdom of his saying might well be applied even to the field of lighting. The so-called "gas arcs"—the suspended gas stoves that make life miserable for many a storekeeper and his patrons during the summer—undoubtedly secured part of their hold by imitating the electric arc lamps in their shapes and designs. The electric lamps require a carbon-feeding mechanism which, when enclosed by a casing above the glass globe, produced the familiar shape. The gas lamp has no such mechanism, yet the common designs all are shaped as if they did have it, evidently proving Barnum's celebrated maxim.

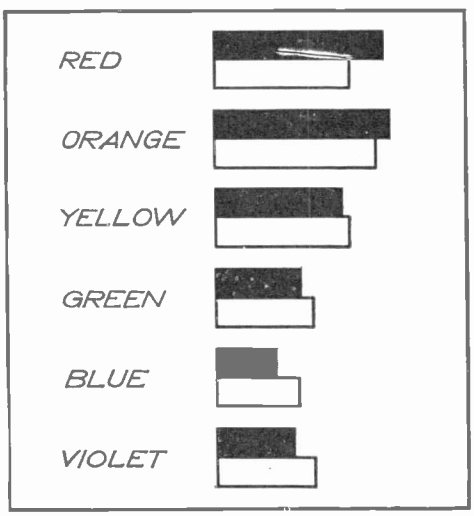


GAS FIXTURES MADE TO RESEMBLE ELECTRIC

When it comes to residence lamps, the deception has been less common, though by no means absent. Thus the burner holders for some gas fixtures are shaped in exact imitation of an incandescent lamp socket, the makers evidently assuming that the average housekeeper will be satisfied by the similarity in appearance. At any rate the old proverb still holds good: "Imitation is the sincerest flattery."

The Color of Electric Lights

The ordinary arc lamp appears to the eye as bluish white in color, while the mazda or tungsten lamp is slightly "warmer" or more reddish. The eye cannot detect minute differences, but by means of suitable screens it is possible to analyze a light source and find just what colors it is composed of.



THE COLOR OF ELECTRIC LIGHTS

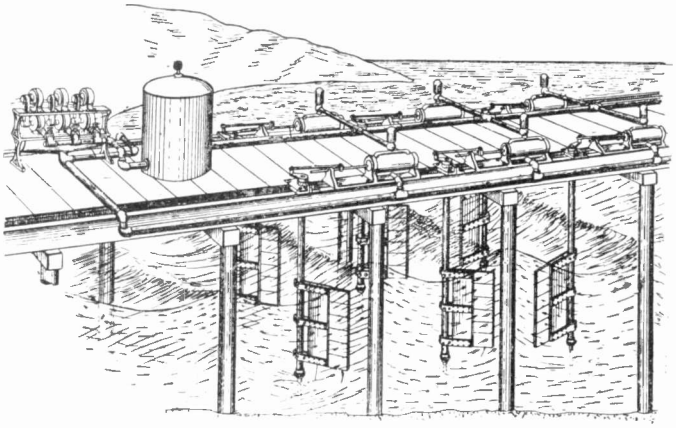
The diagram shows graphically the results of such an analysis. The black rectangles are the amounts of the various colors found in the tungsten lamp and the light rectangles the amounts in the arc lamp. It can be seen that the arc is deficient in red rays but stronger than the mazda in green. The purpose of making this comparison was

to show the superiority of the tungsten lamp colors for headlights. The chief objection to the electric headlight has been that it is reflected from the green signal rondels at the semaphores so that the engineer sees a "phantom" track clear—go ahead signal. Because the tungsten lamp gives off fewer green rays, it is thought that these reflections would not occur when it is used.

Another Wave Motor Idea

Few subjects aside from perpetual motion have received more thought without practical results than schemes for utilizing the power of ocean waves which energy is so great as to defy measurement.

A patent granted to Alva L. Reynolds, Huntington Beach, California, covers one of the latest inventions in this line. Vanes are employed to receive the force of the ocean waves, this energy being transmitted by a crank to the piston of a pump as illustrated, causing water to be pumped into a system in which water motors operate electric generators. A number of vanes are used, and these, during high wave activity, force water under pressure into a tank which at first contains air that is gradually crowded into smaller space by the water under pressure.



NEW IDEA FOR A WAVE MOTOR

The idea of the inventor is also to charge a storage battery during high wave activity, using current from the battery during calm weather when the energy from the waves is unsufficient to operate the electric generators.

The Chemical Elements

Chemical science has made great progress in recent years. Text-books on the subject become obsolete not many years after publication by reason of discoveries that change even the fundamentals of the science. The "atom," which by the very formation of the word means something that cannot be divided, is resolved into "corpuscles," of which there are hundreds —even thousands in some cases—in every atom, moving in orbits, like the planets of the solar system.

Now, it seems, the "elements" must go. An element is something that cannot be resolved by any known process into anything more simple. Fifteen years ago there were 68 known elements. Then came the discovery of argon, neon, xenon and krypton; of helium, which was recognized as a constituent of the sun, and named, more than fifteen years before it was found on the earth; and, finally, of radium.

But if the discovery of radium added one to our list of elements, the establishment of the fact of radio-activity, with which that discovery is closely connected, now threatens to demolish the whole theory which is based on the idea that there are many elements.

Sir William Ramsay, the discoverer of argon, has succeeded in producing traces of lithium by treating salts of copper with the emanations from radium. Moreover, it is inferred, with some reason, from experiments that have been made, that radium—an element,—is the result of the disintegration of another element, probably uranium; and that radium itself, by the loss of helium —another element,—finally transmutes itself into lead, still another element.

Yet again, helium is a product of the emanation from radium. But Sir William Ramsay finds that if the emanation is dissolved in water, neon is the result; if in copper sulphate, it is argon.

All these facts seem to tend in one direction, namely, to give support to the idea often advanced by theorists, that there is but one element, the ultimate particles of

which—whatever we may call them— are combined in various ways to make up the substances which we have called elements.

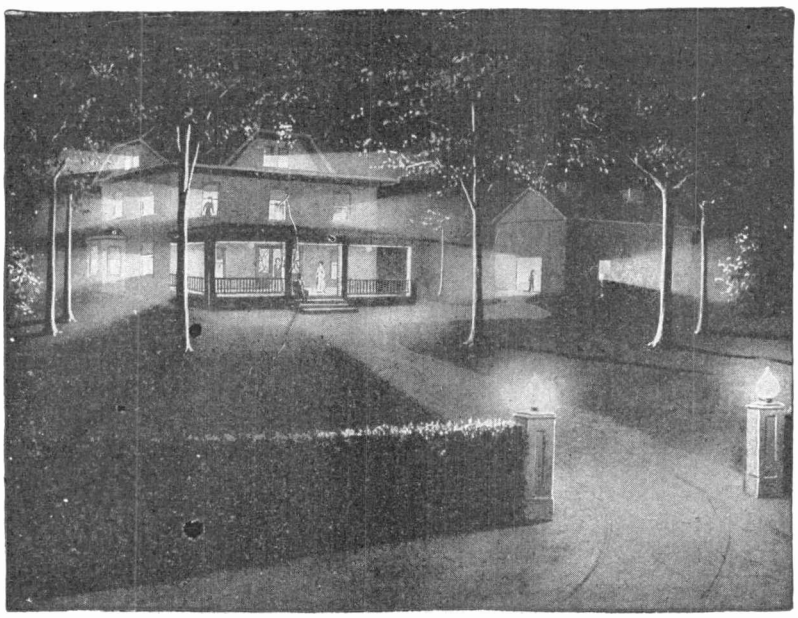
It is a homely figure, but we may liken the elements to a church, a bridge, a wall and a stable—all of which may be built of bricks alike in shape and size, but the structures differ in form and in use. The figure fails when we suppose the church to transform itself into a bridge by losing some of its bricks, as copper is degraded into lithium by losing some of its helium.

ELECTRICITY ENHANCES FARM VALUES

While farmers are considering ways to make country life more attractive and country homes more convenient, it is well to give thought to the advisability of installing electric systems for furnishing light and power.

In advertising a house for rent or for sale in the city papers, real estate men always tell of improvements. "City water and electric lights; modern plumbing and heating system," the advertisements read, and these advantages help to rent or sell the houses. How seldom does one see any such description of farm homes. If these things are necessary to make city homes attractive, why not have them in the country home?

With the development of the high efficiency tungsten lamp, usable on low voltage and requiring little current, small electric plants for the farm become entirely practicable. A "Dayton" farmhouse lighting outfit, as shown in the illustration, makes evident the space occupied, which may usually be arranged for in a dry basement, as well as the simplicity of the installation. Such a plant, consisting of a gasoline engine, dynamo, storage battery and a small switchboard, requires little attention and pays for itself over and over.



A MODERN COUNTRY HOME ILLUMINATED

The engine can be operated in the evening when the men folks are at home, and while part of the current is used to furnish lights, a portion can be turned into the storage battery for the women folks to use the next day to run a vacuum cleaner, a washing machine, a churn, a cream separator or a sewing machine.

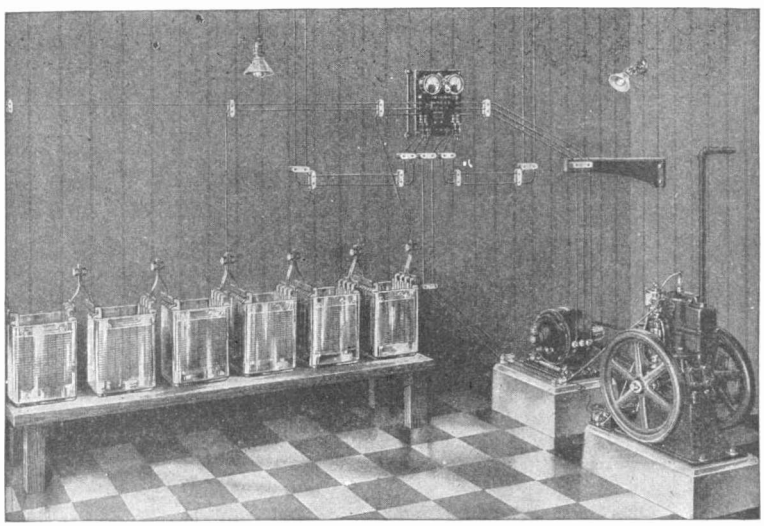
On the lawn, at the gates, and particularly in the barn are places where it is most convenient to have plenty of light, and it can be had by merely the turn of a switch on the farm having a plant like the one described.

A Lamp That Regulates Its Own Voltage

Everybody knows that an incandescent lamp must be burned at the voltage for which it is designed if it is to give satisfactory results. If the voltage is higher the lamp goes to pieces quickly although it gives out more light than it was intended to during its life. It the voltage is lower, the lamp is dim.

The German engineers have devised a lamp which actually regulates its own voltage. The current passing through this lamp is forced also to pass through an iron wire. When the voltage rises, more current flows. This current heats up the iron wire, and since the resistance of the iron increases as its temperature rises, the flow of destructive current through the lamp filament is prevented.

The tungsten filament, when cold, is brittle and subject to breakage. Realizing this, the engineer of an American railroad has perfected an arrangement whereby a small amount of current is kept constantly flowing through the lamps. This current heats the filaments sufficiently to prevent breakage, but not sufficiently to cause them to give out light. The scheme is known as the "hot wire" system.



GENERATOR AND STORAGE BATTERY PLANT FOR FARM USE

A Penny for the Speed

"Say, this train is traveling some. Wonder how fast we're going?"

How many times have you heard that curiosity expressed? It is a question that comes to the mind of the most seasoned traveler every time the clicks of the rail joints begin to come close together. Some people take out their watches and count the number of rail joints in twenty seconds, which is approximately the speed of the train in miles per hour. But this method is rather uncertain and unsatisfactory. An English inventor has patented a penny-in-the-slot indicator so placed in a railway car that anyone with the requisite copper can find out at any time just how fast he is getting over the ground.

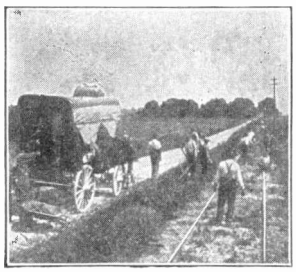
The arrangement is so constructed that when the button is pressed a clutch makes a connection with the pulley, which is belted to the axle. This clutch is connected to a flexible shaft leading to the instrument inside the car. The revolution of this flexible shaft is used to get us eddy currents in a disk between the poles of a permanent mag-

net. These eddy currents are used to throw an indicating needle on the dial. As the strength of these currents is directly proportional to the speed of rotation of the disk, the deflection of the needle is directly proportional to the speed of the train. The dial, of course, is calibrated to read in miles per hour.

As long as the button is held in, the needle will indicate the speed, but if it is released it cannot again be pressed until another penny is dropped in the slot, as in the case of the ordinary weighing slot machine.

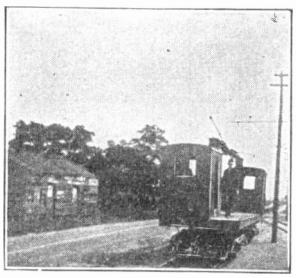
A Glimpse of Interurban Construction

Electric interurban lines are now so common that nearly everyone has taken a trip



CAMP WAGON

of some extent over them. Few, however, get out on the right of way while the electric road is in course of construction and the curious work cars, with the shed-like

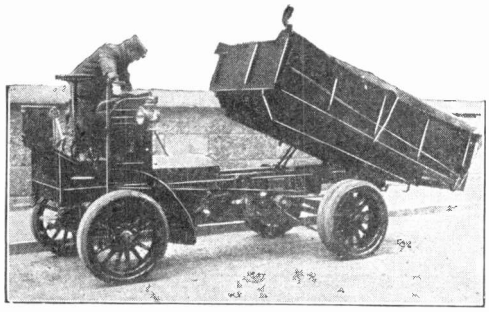


CONSTRUCTION CAR

pilot-house, are very seldom seen by the future commuter. Similarly the curious camp wagons, like those we associate with railway building on far western plains, come as a surprise when we see them for the first time. The photographs show a bit of traction construction near Lima, O., with the camp wagon and construction car in evidence.

Cincinnati's New Refuse Carts

The best way to gather up a city's ashes and garbage is by electricity. So decides authorities in Cincinnati and here is one of the big new electric ash and garbage gatherers. After years of experimenting the above up-to-date electric auto cart



ONE OF CINCINNATI'S NEW REFUSE CARTS

stood out above all other methods. It carries four times as much refuse as any horse wagon and makes three trips where the horses are making one. The motive power is derived from the well known type of storage battery. This current also controls the dumping device which is manipulated by a small lever from the seat of the driver. A twist of the wrist to the left on the lever starts the heavily loaded cart bed back to dump.

The mechanism is arranged to be always under control and the motor can be stopped when the bed is in any position, the picture shows the bed tilted half way. When the auto cart has dumped automatically a turn of the lever to the right sends the bed back into position again.

The speed of the vehicle averages eight miles per hour but it can make 20 miles per hour if necessary. The system will be permanently adopted in Cincinnati.

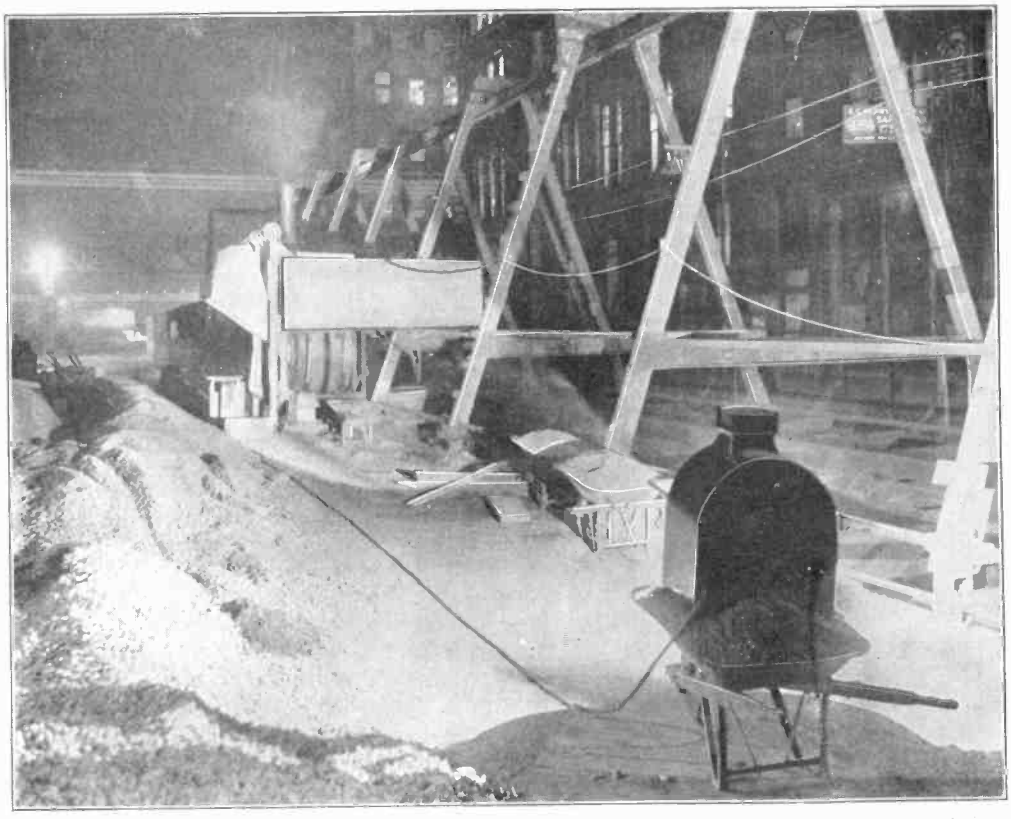
It has been proved that a thorough soaking in sea water lengthens the lives of telegraph poles. Some poles soaked during the winter of 1908 are found to be quite sound. The process is somewhat lengthy, but the results so far attained appear to be quite satisfactory.

Searchlight for Contractors

Night no longer means shutting down when it comes to a big piece of contract work. Every hour of the 24 is employed. Electric lights turn night into day and the work goes on without pause. Powerful searchlights with reflectors have come into use for this purpose and along with them have come small steam turbine generating sets to manufacture the electric current at the right voltage to be adaptable to the lamps. The whole outfit is portable.

The lamp is an open arc and its powerful rays are concentrated and multiplied by a parabolic reflector. It is so light that a man may pick it up while lit and still attached to its connecting cable and move it about to suit the requirements of the job. A singular feature in the mechanical makeup of the lamp is the reflector. It not only allows the light to be concentrated into a single beam but also makes it possible to secure diffused illumination over a wide field of operations. This is accomplished by having the lamp mechanism mounted on a movable base. The distance of the arc from the reflector thus being altered, its diffusion of

EXCAVATING BY SEARCHLIGHT



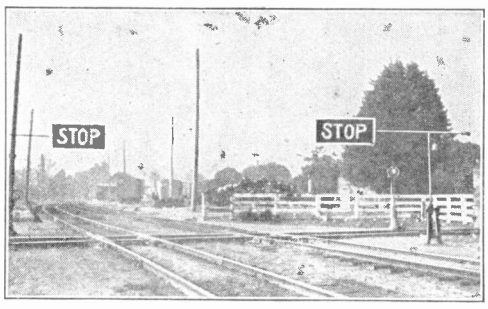
PORTABLE ELECTRIC LIGHTING OUTFIT USED IN TUNNEL EXCAVATION

light is also changed and it is thus possible to have a concrete mixer, for instance, lit up with a diffused light so that there is not the slightest difficulty in seeing the operations, or to have a single intense beam of light follow the movements of a grab bucket and give the engineer the advantages of daylight, with equal facility.

Fitted with the parabolic reflector, the rays from the light are equivalent to about 200,000 candlepower. When the reflector is arranged to diffuse the light, the whole area in front of it within a radius of about 150 feet is illuminated so that work can be handled with the same efficiency as in daylight. In addition the lamp really lights an area much larger than that mentioned, with better effect than is obtainable with any other means practical in field work The actual output of the dynamo is about 50 candlepower in excess of the requirements of the large arc, and this excess can be utilized in small incandescent lamps placed at convenient locations on a contract job. In this way provision may be made for lighting the pit around steam shovels, drag line excavators and other similar machines. The weatherproof case in which the arc is housed protects it effectually from wind and rain and the low voltage makes it unnecessary for special cables to connect lamp and generating set.

Sure-stop Danger Signal

A Los Angeles street railroad has adopted a danger signal at the intersection of its line with a steam railroad which

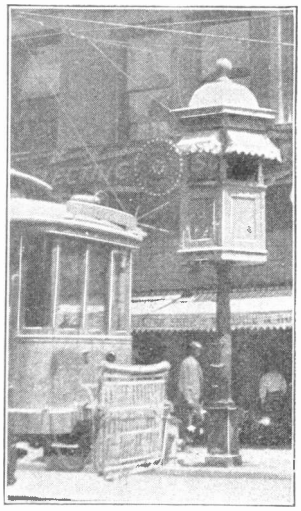


A SURE-STOP DANGER SIGNAL

no motorman can run by. It consists of an upright iron pole from which extends a metal arm bearing the word "Stop" painted on a red ground. This arm extends right across the track and is so heavy that if the motorman should try to pass it there would be a smash-up of the whole front of his car. Therefore it is impossible to evade the rule that the conductor shall go to the front of the car, where he can see up and down the railroad track and give the go-ahead signal, as he has to do this in order to turn the danger sign from the track. This is accomplished by a lever, which swings the sign on the steam railroad track, serving as a danger signal for any locomotive that might approach suddenly. The system is inexpensive to install and might prevent many wrecks if generally adopted.

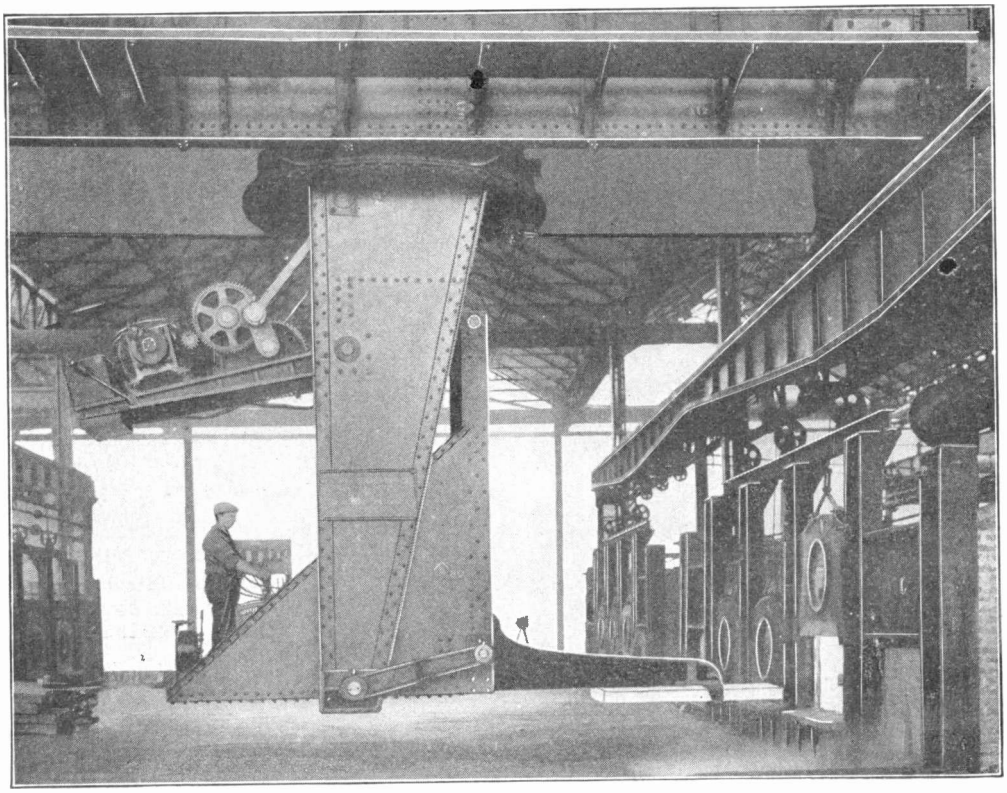
Semaphores for Street Cars

A western city trolley line, which is having difficulties with street congestion, partially solves the traffic problem by means of semaphores at the crowded intersections where there are dangerous curves.



SEMAPHORE TOWER ON A CITY CORNER

The semaphores are operated by men who occupy signal stations, one of which is shown in the picture. These resemble nothing so much as gigantic lamp-posts surmounted by the old-fashioned street lights. The boxes are set on heavy iron posts at the curb and really take up no more sidewalk space than a telegraph pole, as the floor of the little station is about twelve feet above the pavement. This system is especially valuable at intersections where there is a jog in the streets, and cars have to make a compound curve in passing the crossing. The semaphore shows the usual colored signals by day and red and green lights by night.



DRAWING A WHITE HOT INGOT FROM THE FURNACE

The Great Steel Hand

Those who have had occasion to visit a steel mill will no doubt remember the great furnaces in which the ingots are heated to a white-hot temperature preparatory to working them under the hammer. In all probability the method employed was to pick them up by a chain from an overhead crane and carry them in front of the glaring furnace, where several perspiring men at the end of a guiding rod would thrust them into the door.

A way has been found to thrust the ingots or slabs into the furnace and withdraw them again by means of what is known as an electric slab charger—and one man performs the work, well back from the heat of the furnace and slab. The picture makes clear the operation of the device. An immense traveling crane moves along over the furnaces. From it depends a steel structure carrying a sort of steel hand and arm which picks up the slab and thrusts it into the furnace or reaches in and draws it out, as the case may be. The man standing at the rear controls, by a few levers, the motors which operate the crane and the great steel hand.

A Mineral Sensitive to Colored Light

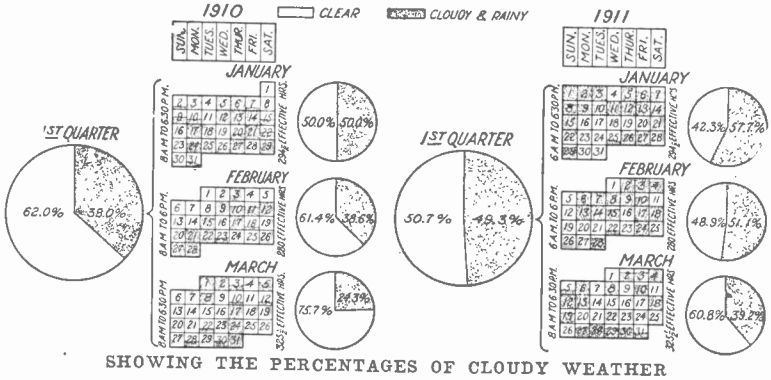
Ever since Professor Bell and his colleagues made it possible for us to telephone to distant points, experimenters have been striving to perfect some method of seeing over a wire, or at least of transmitting pictures over the latter. The one strong clew for such investigators has been the fact that the electrical resistance of the metal selenium varies with the intensity of the light falling on it, so that by using a number of little selenium parts successively in a circuit they can reproduce the light and shade effects at some distant point.

Crude as this basis may seem, it has already led to promising results, but even if developed in practice it could not transmit colors, as the selenium does not distinguish between them. Now Prof. Jaeger of Amsterdam has found a mineral which

also varies in its electrical conductivity with the light falling on it, but which does this in a much different degree according to the color of the light. Green has only a slight effect, red rays act much more strongly, while violet light reduces the electrical resistance to about one two-hundredth of what it was in the dark. Consequently, we not only have a substitute for the selenium but if we keep the intensity of the light the same, the use of stibnite may enable us to tell colors at a distance. Stibnite, by the way, is not a new mineral but is a common ore of antimony which was known even to the ancients, who used to color their eyebrows by rubbing this reddish grey mineral over them.

Why the Weather Costs Money

In addition to seasonal variations in the hours of lighting, there are variations caused by the weather. Every cloudy day means more lighting and bigger light bills. February one year may have 30 per cent more hours when lighting is required than the same month the previous year. But since weather makes little impression on the memory of an ordinary man, he will be astonished at the end of a cloudy month to find his light bill higher than for the same month last year.

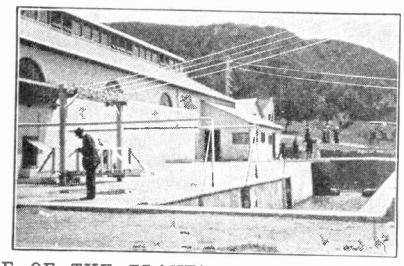


SHOWING THE PERCENTAGES OF CLOUDY WEATHER IN DIFFERENT YEARS

The largest illuminating company in the country has devised a graphic method of showing the customer why his bills are higher than he anticipated. It consists of a chart like that shown, drawn from data furnished by the government weather bureau. When the weather makes it advisable this chart is sent out to all the company's patrons. It is part of the general scheme of the company to maintain the friendliest possible relations with users of its service.

A California Hydroelectric Plant

The accompanying picture is one of the seven water-power plants owned by the Southern California Edison Company. This



ONE OF THE PLANTS OF THE SOUTHERN CALIFORNIA EDISON COMPANY

plant is located in Mill Creek Canyon, about ten miles from the city of Redlands and 75 miles from Los Angeles.

The plant is a combination of two separate power plants. One of these is operated on a head of 627 feet, while the other claims a head of 1,960 feet, which is next to the highest head in the world.

The generators of this plant are driven by two Doble and three Pelton water wheels. Current leaves this station at a pressure of 33,000 volts.

The picture shows the transmission line leaving the building and the horn-gap lightning arrestors, which are so common on high tension lines in southern California.

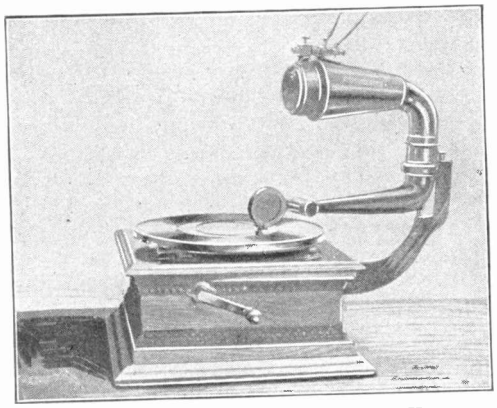
The Chicago City Railway Company has placed with the General Electric Company an order for $2,000,000 worth of railway equipment. This order, which includes complete equipment for nearly 1,000 cars, is the largest ever given to one concern.

A French "Telemicro-Phonograph"

A combination of the telephone, microphone and phonograph is said to be used quite extensively in Paris for rendering songs, band selections, speeches, etc., the advantage being that a large number of rooms can be furnished with the music from a single phonograph.

The phonograph is furnished with an odd horn or funnel, in the end of which is mounted an attachment similar to a microphone transmitter. This picks up the phonograph sounds and converts them into electrical impulses as in the ordinary telephone. These impulses are transmitted over wires to any desired location to devices similar to telephone receivers fitted with megaphone horns. Here the sounds are reproduced loudly enough to be easily heard by people sitting anywhere in the room.

This system, which is that of Gaillard-Ducretet, is also utilized to advantage for amusement on board steamships and in hotels, and is employed by the French navy and in the French military service for the transmission of orders, the apparatus being



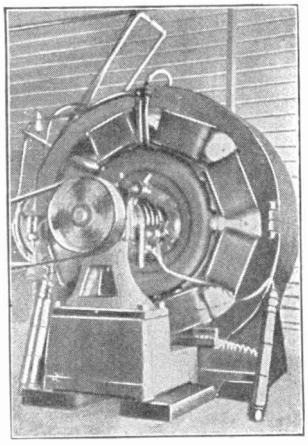
THE TELEMICRO-PHONOGRAPH

arranged as a loud speaking telephone. The attachment may be connected to the ordinary telephone as a loud speaking instrument for making announcements where a large number of people are congregated.

MUSIC TRANSMITTED TO THE HOTEL VERANDA

First Synchronous Motor

The picture shown here is that of the first commercial synchronous motor installed in the United States. This machine was first put in operation in 1892. It is now used in connection with the machinery of the Union Ice Company at Crafton, Cal.



FIRST SYNCHRONOUS MOTOR

The machine receives current at a pressure of 2,300 volts. Except for about two weeks during the year, this machine operates continually day and night. The two weeks are allowed for a shutdown, during which time the motor is given a complete cleaning up.

It is interesting to note that the machine is of the old revolving armature type; also, the heavy leads to the armature can be seen coming up through wooden posts and running to the brushes.

The Cost of Poor Light in Shops

By ALBERT SCHEIBLE

Of all the penny-wise and pound-foolish practices which still prevail in a surprising number of shops and factories, probably the most pernicious and least excusable is that of poor lighting. Even foremen who show good common sense and foresight in other matters often seem to have no conception of the extent to which their establishments are handicapped by insufficient or otherwise inadequate light. Indeed, many of them whose youth was spent in small shops that closed at sundown have no idea of how far reaching in its effects this lack of adequate and properly placed lighting can be. Too often they know that the lighting in their shops is far from ideal, but feel that any improvement in it would only add to the comfort of the workmen without bringing any additional returns to pay for an increase in the monthly bills for current. How far from true this is can be seen from the conclusions of some who have made a study of shop lighting from the manufacturer's standpoint and who find that inadequate

BAD ILLUMINATION MULTIPLIES UNPROFITABLE "SECONDS"

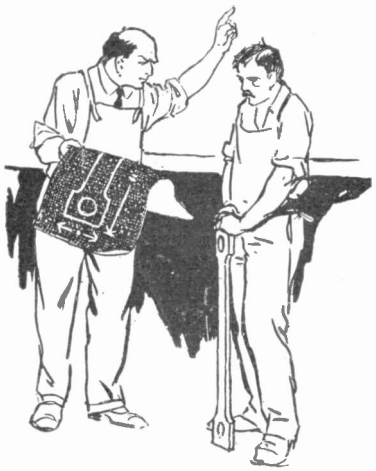
shop lighting is wasteful for at least four reasons, any one of which will usually be of sufficient importance to warrant an overhauling of the existing lighting methods or even an entirely new equipment of shop lights.

First, poor light wastes time. Even the naturally quick employee cannot work at his normal speed if dim light or misleading shadows make him uncertain as to what he is doing. Then if he has to go close to a window or a light when wanting to get an exact measurement, the employer has to pay for all the extra time spent in going back and forth. Compared with the depressiveness of the gloomy shop, there is a stimulating effect to a bright light, which in itself leads to more speedy work.

IT WASTES TIME TO GO TO THE LIGHT

At the same time poor lighting leads to less accurate work. Unless the workmen have ample light at all hours for clearly showing the state of their work at each step, irregularities and defects are sure to creep in. If the men are blamed, they grow restless, and if the defective goods are afterwards sorted out as "seconds," these never bring the margin of profit for which the manufacturer is striving. Besides, the closer inspection needed when the goods are likely to be faulty and the correcting of curable defects in them add items of expense which would be avoided by letter lighting.

Moreover, poor shop lighting is often responsible for accidents. Most men will move more slowly and cautiously in a dimly



BLAMING THE WORKMAN FOR DEFECTS CAUSES DISSATISFACTION

lighted shop than in a bright one (thereby wasting time), but even at that they will not always see boxes, metal bars or other dark objects that may accidentally be on the aisle floors or stretching across passage ways. Many of the heavy damages which manufacturers have had to pay in the past and which have been prompting them to ask for new employers' liability laws in

POOR LIGHT CAUSES ACCIDENTS

various states are really traceable to improper lighting, being cases where a few dollars a week of saving on the lighting bills has caused accidents for which juries bring verdicts running into thousands of dollars.

Under our present economic conditions, jurors are usually prejudiced in favor of the workingmen; yet it must be admitted that in cases involving liability for accidents they too often find no ameliorating circumstances, such as an evident endeavor on the part of the employer to safeguard his men from accidents. If the employer has to admit that a dangerous semi-darkness reigned in parts of his factory during the early morning or late afternoon hours, he robs himself of an effective means of influencing the jurors. And even where the accidents are not serious enough to lead

EYES OF THE BEST WORKMEN ARE INJURED BY POOR LIGHT

to litigation or heavy expenses, they may still prove costly by temporarily depriving the shop of an experienced worker whose absence may seriously interfere with the usual routine of the establishment.

Last, but not always least, poor light superannuates men before their time. A few years ago our daily papers by misquoting the famous Dr. Osler started an unfortunate movement towards crowding out even middle aged men, a tendency from which we have not yet recovered. Having learned from his own experience that men past the prime of life are no longer as receptive to new ideas, nor as original in their own conceptions, as they were in their earlier years, this Johns Hopkins University professor suggested that all college work involving original investigations should be

kept in the charge of men under 45, leaving their older colleagues to look after the less original and daring (though no less important) work for which their training and experience will have fitted them by the time they reached that age. Unfortunately, the newspapers misquoted Dr. Osler as advocating the retirement of all men at the age of 45. This may have had its effect in bringing about the attitude of some corporations to establish arbitrary age limits which do not allow for the fact that one man at 60 may be effectively younger than the next man at 50. As the result of this movement a good deal of work has been turned over to men who, while younger in years, had neither the experience nor the judgment of the men whom they replaced.

During the last year or two the folly of such an artificial standard has been realized by many, but there is a widespread tendency to crowd out men as soon as they show signs of age. In many lines this may be justified, but too often the tests used in determining when a man has exceeded the age of efficient usefulness for a given class of work are not entirely warranted. For instance, many shop superintendents judge largely from the workman's eyesight, which will make a poorer showing for him in an imperfectly lighted shop than in one that is well illuminated and in which machines and lights are so arranged that details in the material worked can be readily seen by workmen with only fair vision. Besides, the faulty lighting in itself helps to spoil the eyes of the men (particularly if flickering gas lamps are used), thereby tending to force out the very workers whose long experience, good memory and sound judgment make them exceptionally valuable to their employers.

In short, poor shop or factory lighting wastes time, causes defective and inaccurate work, leads to accidents and prematurely retires the more experienced workmen. And all for what? For a paltry saving each month in the cost of current—an amount often offset by the harm done in any single one of the above four ways.

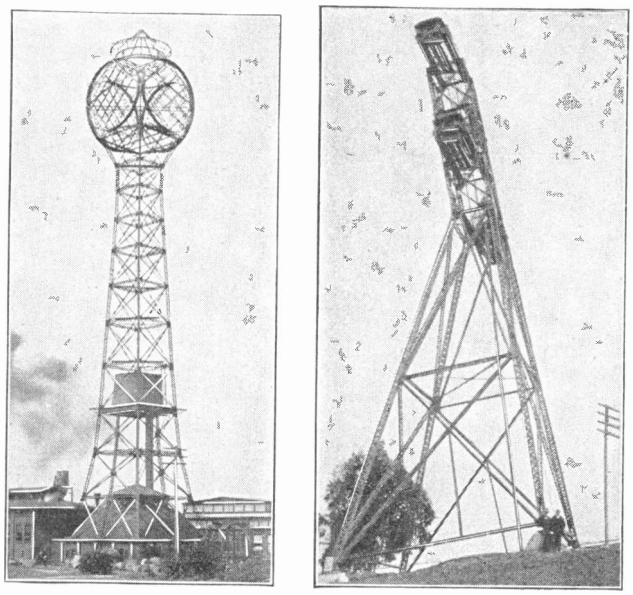
Figured merely in connection with its influence on the lighting bill, poor light may seem to save money. But reckoned by its results, who will say that it pays?

Odd Shaped Transmission Towers

The Bay Counties Power Company in California is famous for the wonderful systems of electrical transmission lines which have been built to transmit the power of mountain torrents to a large number of cities and towns. The topography of the country, as well as the intervention of navigable tide water along certain routes of the transmission lines, has made absolutely necessary long spans in some places, with correspondingly strong and ponderous steel towers.

Illustrations of two of these towers are presented herewith, by courtesy of *Graphite*, the publication of the Joseph Dixon Crucible Company, in which they appeared for the first time.

The main tower, for instance, is 225 feet high and has a base 68 by 90 feet. The leaning tower is also of a rather unusual type and is one of the "show" features of this system when engineers come to inspect the lines.



ODD SHAPED TRANSMISSION TOWERS

A House of Electrical Wonders

Many have had the desire to build and equip an "electrical house" in which the magic current should accomplish every task as far as human ingenuity could devise ways of using it. Some have accomplished astonishing results in this line. The very first electrical house was equipped by William J. Hammer, electrical engineer, of New York city. This was as far back as 1884, just a few years after the incandescent lamp was invented by Edison. Although the fund of electrical knowledge was then comparatively small, Mr. Hammer devised enough curious ways to use electricity to make this house not only the first but one of the most wonderful ever planned. When it was completed he tendered a dinner to the "Society of Seventy-Seven" of the N. P. H. S. of Newark, N. J. An account of this dinner appeared later in the New York *World* and is very interesting. It runs as follows:

"Some years ago (1884), on New Year's eve, an entertainment was given at the home of Mr. William J. Hammer, in Newark, N. J., which, for the display of the powers of electricity has seldom, if ever, been equaled. Mr. Hammer, who has for years been associated with Mr. Edison, desiring to give his old classmates, the 'Society of Seventy-Seven,' a lively and interesting time, invited them to 'an electric dinner' at his home. The invitations which were sent out were written upon Western Union telegraph blanks with an Edison electric pen.

"When the guests arrived and entered the gate, the house appeared dark, but as they placed a foot upon the lower step of the veranda a row of tiny electric lights blazed out over the door, and the number of the house appeared in bright relief. The next step taken rang the front door bell automatically, the third threw open the door, and at the same time made a connection which lit the gas in the hall by electricity.

"Upon entering the house the visitor was invited to divest himself of his coat and hat, and by placing his foot upon an odd little foot-rest near the door, and pressing a pear-shaped pendant hanging from the wall by a silken cord, revolving brushes attached to an electric motor brushed the mud and snow from his shoes and polished them by electricity. As he was about to let go of the switch or button, a contact in it connected with a shocking coil, caused him to drop it like a hot potato.

"Upstairs was a bedroom which would be a fortune to a lazy man; he had only to step on the door sill and the gas was instantly lighted. The ceiling was found to be covered with luminous stars, arranged to represent the principal constellations in the heavens—while comets, moons, etc., shone beautifully in the dark. By placing one's head on the pillow, the gas, fifteen feet away, would be extinguished and the phosphorescent stars on the ceiling would shine forth weirdly, and a phosphorescent moon rose from behind a cloud over the mantel and slowly describing a huge arch disappeared behind a bank of phosphorescent clouds on the other side of the room; by pressing the toe to the foot-board of the bed the gas could again be relit.

"Pouring a teacup of water into the water-clock on the mantel and setting the indicator would assure the awakening of the sleeper at whatever hour he might desire. There was also in the hall outside the room a large drum, which could be set to beat by electricity at the hour when the family wished to arise. The whole house was fitted throughout with electric bells, burglar alarms, fire alarms, telephones, electric cigar lighters, medical coils, phonographs, electric fans, thermostats, heat regulating devices, some seven musical instruments operated by electricity, etc.

"Upon the evening referred to nearly every piece of furniture in the parlors was arranged to play its part. Sit on one chair and out went the gas, take another seat and it would light again; sitting on an ottoman produced a mysterious rapping under the floor; pressure upon some chairs started off drums, triangles, tambourines, cymbals, chimes and other musical instruments; in fact, it seemed unsafe to sit down anywhere. The guests stood about in groups and whispered, each hoping to see his neighbor or a newcomer caught napping. One visitor (Brown) secured an apparently safe seat,

and was telling a funny story—he had left electricity far behind—but just as he reached the climax a pretty funnel-shaped Japanese affair like a big dunce cap, that seemed but a ceiling ornament which was held in place by an electro-magnet, dropped from overhead and quietly covered him up, thus silently extinguishing the story and the story-teller.

"A big easy chair placed invitingly between the folding doors joining the double parlors sent the unwary sitter flying out of its recesses by the sudden and deafening clamor of 21 electric bells hidden in folds of the draperies hanging in the doorway. In a convenient position stood the silver lemonade pitcher and cup; the former was filled with the tempting beverage, but no matter how much a guest might desire to imbibe one touch convinced him that the pitcher and cup were so heavily charged with electricity as to render it impossible for him to pour out a drink or even to let go until the electricity was switched off from the hidden induction coil.

"Some one proposed music, and half a selection had been enjoyed, when something seemed to give away inside the piano, and suddenly there emanated from that bewitched instrument a conglomeration of sounds that drowned the voices of the singers, and the keys seemed to beat upon a horrible jangle of drums, gongs and various noise-producing implements which were fastened inside of and underneath the piano.

"After the guests were treated to a beautiful display of electrical experiments, under the direction of Mr. Hammer, and Prof. George C. Sonn, they were escorted to the dining-room, where an electrical dinner had been prepared and was presided over by 'Jupiter,' who was in full dress, and sat at the head of the table, where by means of a small phonograph inside of his anatomy he shouted: 'Welcome, Society of Seventy-Seven and their friends to Jove's festive board.' The menu was as follows: 'Electric Toast,' 'Wizard Pie,' 'Sheol Pudding,' 'Magnetic Cake,' 'Telegraph Cake,' 'Telephone Pie,' 'Ohm-made Electric Current Pie,' 'Menlo Park Fruit,' 'Incandescent Lemonade,' 'Electric Coffee' and 'Cigars,' etc., and music by Professor Mephistopheles' Electric Orchestra.

"About the table were pretty bouquets, and among the flowers shone tiny incandescent lamps, while near the center of the table was placed an electric fan which kept the air cool and pure, and at each end was a tiny Christmas tree lighted with small incandescent lamps, planted in a huge dish of assorted nuts and raisins. Each lamp had a dainty piece of ribbon attached to it upon which the initials of the society and the date were painted, and each guest received a lamp to take away with him as a souvenir of the occasion. Plates of iced cakes made in the form of telephones, switches, bells, electric lamps, batteries, etc., stood on each side of the center piece. Promptly at 12 o'clock, as the chimes of the distant churches came softly to the ears of the assembled guests, pandemonium seemed to change places with the modest dining-room. A cannon on the porch, just outside the door, and another inside the chimney, were unexpectedly discharged; and at this sudden roar every man sprang back from the table; the lights disappeared; huge fire-gongs under each chair beat a tattoo. The concussion produced by the cannon in the fireplace caused several bricks to come crashing down the chimney, and as the year of 1884 faded away the table seemed bewitched.

"The 'Sheol Pudding' blazed forth, green and red flames illuminating the room, tiny tin boxes containing 'Greek' fire which had been placed over each window and door were electrically ignited by spirals of platinum iridium wire heated by a storage battery and blazed up suddenly; the 'Telegraph Cake' clicked forth messages said to be press reports of the proceedings (it was also utilized to count the guests and click off the answers to various questions put to it); bells rang inside the pastry; incandescent lamps burned underneath the colored lemonade; the thunderbolt pudding discharged its long black bolts all over the room (long steel spiral springs covered with black cloth), and loud spirit rapping occurred under the table. The silver knives, forks and spoons were charged with electricity from a shocking coil and could not be touched, while the coffee and toast (made by electricity) were rapidly absorbed; the 'Magnetic Cake' disappeared; the 'Wizard' and 'Current Pies' vanished, and 'Jupiter,' raising a glass to his lips, began to imbibe. The effect was astonishing! The gas instantly went out, a gigantic skeleton painted with luminous paint appeared and paraded about the room, while Jupiter's nose assumed the

color of a genuine toper! His green eyes twinkled, the electric diamonds in his shirt front (tiny lamps) blazed forth and twinkled like stars, as he phonographically shouted 'Happy New Year! Happy New Year!'

"This 'Master of Ceremonies,' now becoming more gentle, the guests turned their attention to the beautiful fruit piece, over four feet high, that stood in the center of the table. From the fruit hung tiny electric lamps, and the whole was surmounted by a bronze figure of Bartholdi's 'Statue of Liberty'; uplifted in 'Miss Liberty's' right hand burned an Edison lamp no larger than a bean. The dinner finished, and there was much that was good to eat, notwithstanding the 'magical' dishes which they were first invited to partake of, speeches were delivered by Messrs. Hammer, Rutan, McDougall, Brown, Duneka, and Dawson, and an original poem was read by Mr. Van Wyck.

"Not the least interesting display of electricity took place in front of the house, where a fine display of bombs, rockets, Roman candles, Greek fire and other fireworks were set off by electricity, which was, by the way, the first time this had been accomplished. The guests were requested to press button switches ranged along the front veranda railing, thus causing electricity from a storage battery to heat to a red heat tiny platinum iridium spirals attached to each fuse of the various pieces of fireworks, thus sending up rocket after rocket, as well as igniting the other pieces which had been placed in the roadway in front of the house.

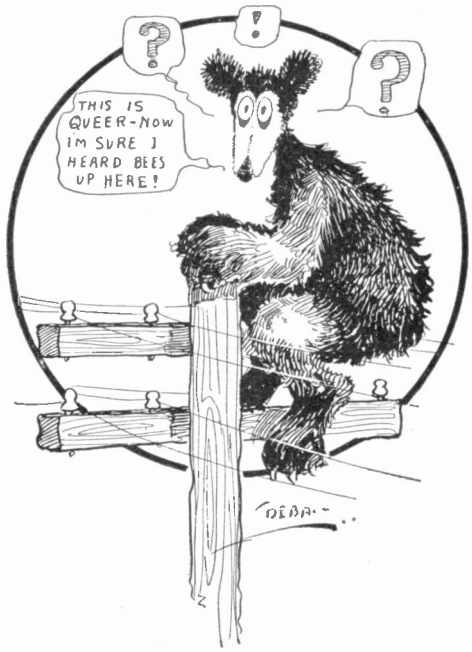
"An attempt was made to send up a large hot air balloon to which was attached a tiny storage battery and an incandescent signal lamp, but a sudden gust of wind caused the balloon to take fire as it rose from the ground. This constituted the only experiment made during the evening which was not an unqualified success.

"The innumerable electrical devices shown during the progress of the dinner were all operated by Mr. Hammer, who controlled various switches fastened to the under side of the table and attached to a switchboard which rested on his lap, while the two cannons were fired by lever switches on the floor, which he operated by the pressure of the foot.

"Electricity was supplied by primary and storage batteries placed under the table. After an exhibition of electrical apparatus and experiments with a large phonograph, the guests departed with a bewildered feeling that somehow they had been living half a century ahead of the new year."

The Investigations of Bruin

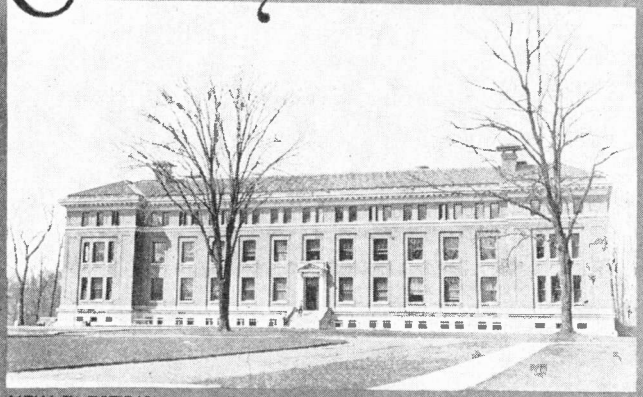
The bears in German forests for the most part lead contented lives. They have considerable time on their hands, and seemingly this time is spent in scientific observations of various kinds. A German bear, like a German scientist, is very painstaking, very careful and very exhaustive in



his researches. A while back a group of bears made a somewhat destructive series of tests on a telephone line, which was reported by the *Zeitschrift fur Post und Telegraphe* as follows:

"The humming of the wires led the bears to believe that the poles were the headquarters of bees, and they pursued that enticing goal. Their longing for honey gave rise to fresh destruction. But the shaggy dwellers in the forest learned by their disappointment; the number of attacks on lines decreased more and more, and eventually the humming of the wires lost its attractive power for Bruin."

The United States Government Bureau of Standards



NEW ELECTRICAL LABORATORY, BUREAU OF STANDARDS

By Waldon Fawcett

There is not on this continent any institution that is doing more for the whole broad cause of electrical progress and development than the United States Government Bureau of Standards. Furthermore, it is doubtful if there is anywhere in the world a group of laboratories where electricity is being utilized in so many ways or in such a varied and interesting manner for the purposes of scientific investigation and experiment. Some of the research work that is being carried on at this unique governmental institution is, of course, of a highly technical character. The benefits will redound only indirectly to the average citizen, or, indeed, to the average electrician by, as one official expressed it, "pushing back the boundaries of the unknown." But on the other hand the bureau is performing all the while service of immediate and tangible value to the present-day electrical engineer and electrical manufacturer.

Indeed, it is the purpose of the Bureau of Standards to build up a seat of scientific testing and measurement that will bear the same relation to the electrical and manufacturing interests of the country that the United States Department of Agriculture does to farming and stock raising activities. One marvels at what has already been accomplished when it is taken into consideration that the bureau is a comparatively new institution. It was so recently as 1901 that congress authorized the establishment of a national bureau of standards and it was three years later ere the new institution was so housed as to permit the undertaking of really important work. Now the bureau occupies three large laboratory buildings, with a fourth in prospect, in addition to several smaller structures, and has a scientific staff numbering about 140, chiefly physicists, chemists and engineers.

In one sense the development of electricity as expressed in its varied uses, was partly responsible for the establishment of this federal court of last resort. Originally the United States coast and geodetic survey had jurisdiction over all matters pertaining to standards in weights and measures and when it became necessary for Uncle Sam to exercise some control of electrical standards the determination and care of these was likewise intrusted to the same branch of the government. However, the appearance of the magic current as a distinctly new factor in the spheres of manufacturing, transportation and communication emphasized to what an extent new forces were capable of revolutionizing conditions and did more than anything else to induce the national legislature to create an establishment that could give a broader scope to tests and investigations than had heretofore been possible.

Generally speaking the purpose of the bureau that was authorized just a decade ago is to establish and maintain the standards of length and mass and such other standards as are necessary in exact measurements in electricity, heat, light, and other

departments of physics, chemistry and engineering. One important function is the testing of standard measuring apparatus and another is the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce and educational institutions with the standards adopted or recognized by the national government. Especially valuable to the electrical interests is the work of the bureau in determining the properties of materials. This busy branch of the United States Department of Commerce and Labor exercises its various functions not only for the national government but also for the benefit of the several states of the Union, municipalities, societies, corporations and individuals —in short, for any citizen of the republic.

The Bureau of Standards holds dual interest for all persons who are in any wise concerned with electrical matters. Not only is it performing important and significant work for the benefit of the whole electrical public, but it is carrying on its operations by electrical power—electrical power applied in many instances in unconventional ways and through the medium of electrical equipment that is always model in character and more often than not is distinctive in design. The power house is one of the principal buildings of brick and stone construction which occupies the site of the bureau in the outskirts of Washington, D. C.—suburban in order to insure freedom from street traffic vibrations or the magnetic effects caused by electric railways.

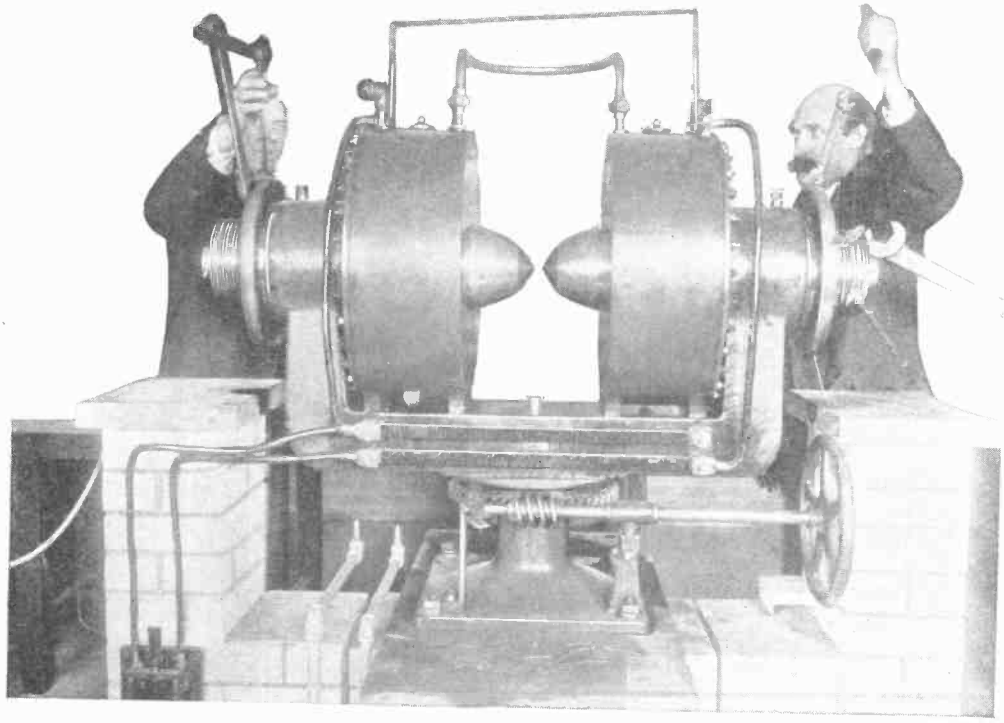
In the power house are engines of 120, 60 and 50 horse power, respectively, directly connected to direct current dynamos, each unit being mounted on a separate concrete foundation independent of the building. Current at 120 volts is distributed through a three-wire system for lighting the buildings, charging storage batteries, operating motors and other power purposes. Adjoining the generator are a number of alternators driven by motors on the main power circuit and furnishing single and polyphase current for experimental purposes. Yet another feature of the equipment is a large storage battery designed not only for experimental purposes but to carry the load when it is desired to shut down the engines from any cause.

The whole arrangement of the electrical resources of the bureau has been planned to allow every facility for experiments in any of the electrical laboratories which are distributed on the various floors of two large brick structures in addition to the power house, already mentioned. For instance, there is a small switchboard for each suite of two or three connecting rooms and the current can be led direct to any table where it may be desired to utilize it. The mains running through the building are, in turn, all connected with a switchboard on the ground floor and from this trunk lines run

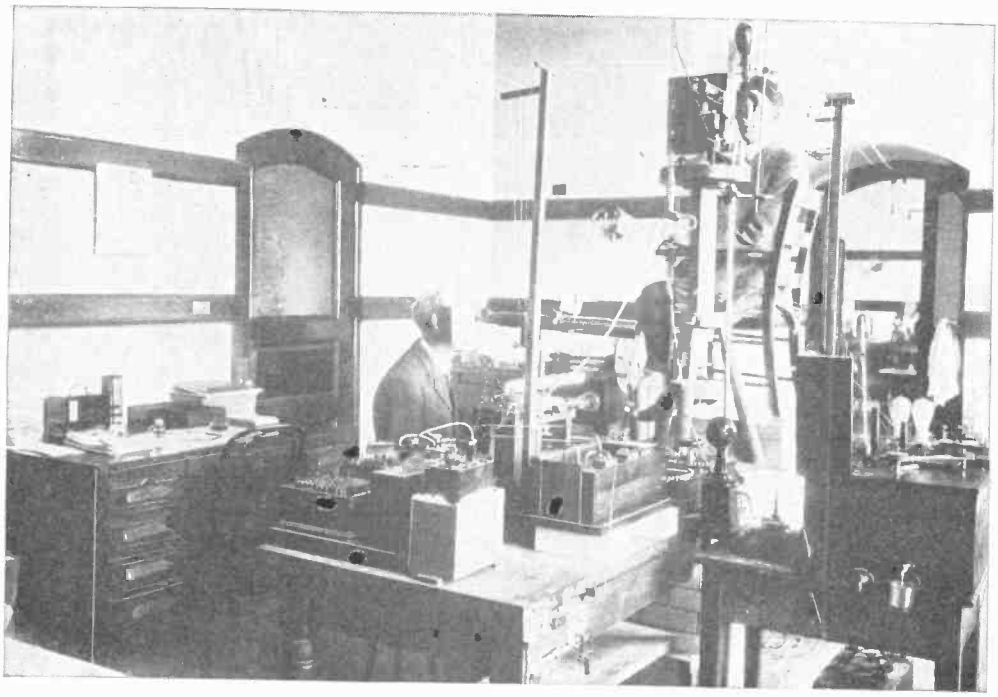
DR. EDWARD B. ROSA, IN CHARGE OF THE DEPARTMENT OF ELECTRICITY, U. S. BUREAU OF STANDARDS

to the main switchboard in the dynamo room. Such is the latitude of operation afforded by this arrangement that any current direct or alternating can be furnished without disarranging other circuits.

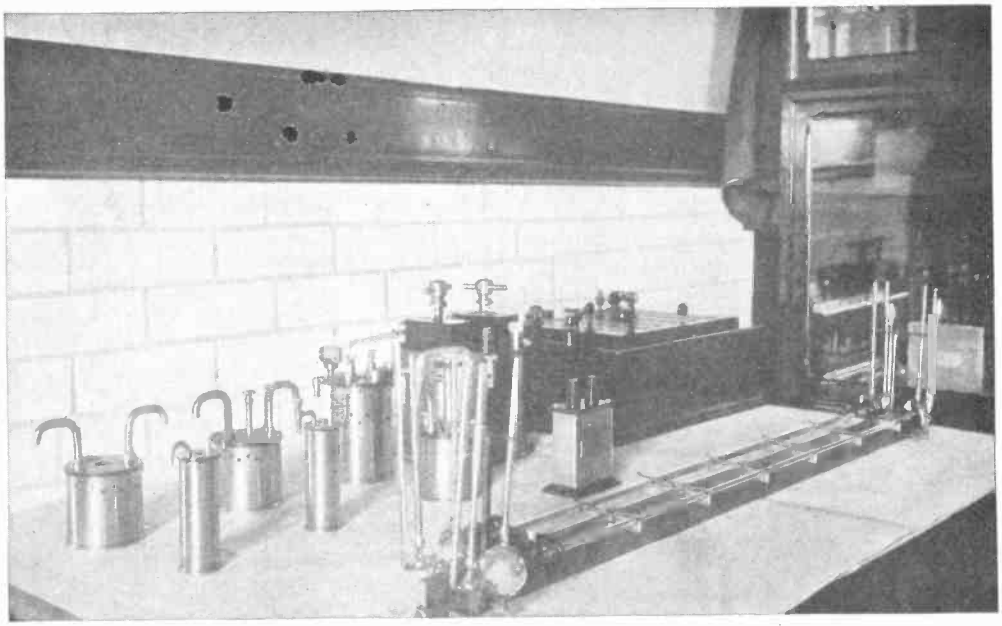
It is difficult to single out features for special mention in an institution where everything electrical savors so much of the unusual. However, there is no doubt that a large proportion of the visitors with electrical inclinations linger longest in the electrical instrument laboratory where just now important experimental work is in progress in connection with a new device for holding the power steady in electric meter testing. The heavy current panel is also notable. This panel is designed for a maximum current of 20,000 amperes at two volts, the current being used in testing large ammeters and watthour meters.



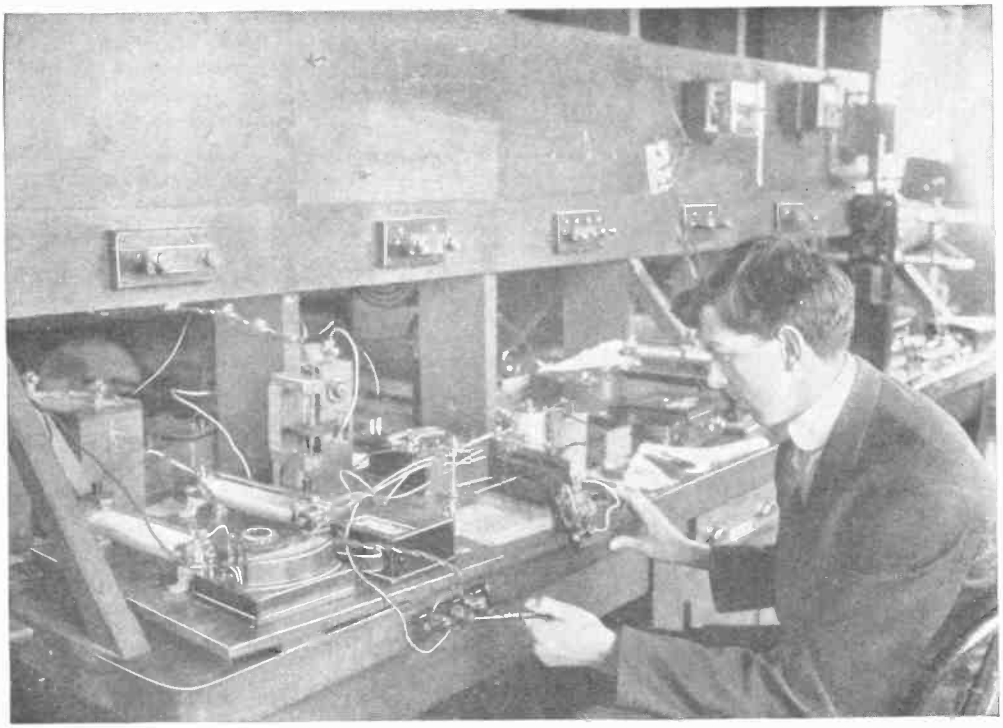
GIANT ELECTRO-MAGNET AT THE U. S. BUREAU OF STANDARDS



CURRENT BALANCE ROOM AT THE U. S. BUREAU OF STANDARDS



A CORNER IN THE ELECTRICAL LABORATORY, U. S. BUREAU OF STANDARDS. IN THE FOREGROUND ARE TWO MERCURY "OHMS"



AT WORK ON METER TESTING IN THE U. S. BUREAU OF STANDARDS

The "current balance room" is another show place at the bureau. On a long table the visitor sees the potentiometer and regulating resistances by means of which the electric current from the storage battery above mentioned (located in another building) is adjusted and maintained constant, to within a few parts of a million, at any desired value. On a small table near by is an oil tank in which are immersed the standard cells which serve as the standard of electromotive force. There is a glass enclosed balance and a station for the observer who reads the deflection of the balance by means of which the exact value of the current is determined.

To the popular mind the greatest appeal made by any of the electrical equipment is made by the most powerful electromagnet in the world. This piece of apparatus which is designed for work in magneto-optics and has but lately been installed, was constructed in Switzerland especially for the United States government at a cost of about $1,200. This magnet can be operated continuously with an electric current of 125 amperes. This is made possible by the substitution of copper tape in place of ordinary insulated wires. This copper tape is surrounded by insulating oil. Through the oil there are run coils of copper tubing of about one-half inch diameter and through this tubing cold water is circulated to carry off the enormous heat generated. The windings and cooling apparatus are enclosed in brass cases about two feet in diameter and the apparatus is mounted on a brick pedestal pier with an alberene stone slab.

In order to obtain magnetic fields of any desired intensity it is necessary to control the current in the coils, and this is done by means of a massive specially designed resistance or rheostat with a large number of steps. This rheostat permits the control of the current in the coils throughout a range of from 1-2 to 125 amperes. The distance between the pole pieces of this magnet can be varied accurately and readily by turning a hand wheel on the end of the magnet. Perhaps the most amazing revelation of the power of attraction exerted by this electromagnet is found in the ability of the "stray field," that is the leakage, away out at the end of the magnet, to support wrenches and other pieces of iron weighing as much as five or six pounds apiece and to hold suspended in a horizontal position series of wire nails placed end to end.

Dr. Edward Bennett Rosa is the physicist in charge of the special department of theoretical and applied electricity and electrical measurements of the United States Bureau of Standards and he has made a most creditable record in this field which has been so productive of important original work. Dr. Rosa, who is about 50 years of age, is a native of New York state and was a professor at Wesleyan University prior to taking up his present responsibilities. He has been for some time the secretary of the International Committee on Electrical Units and Standards.

In any enumeration of the achievements of the electrical division of the Bureau of Standards mention must be made of the testing of incandescent lamp standards for candlepower and distribution of light, the commercial testing of lamps as to life, candlepower and efficiency, and the study of special problems in photometry. Important work has been done in determining the temperatures of the arc and in studying the filaments of incandescent lamps in order to determine the cause of the efficiency of the new metal filament lamps such as the tungsten and the tantalum. By means of special apparatus a study has been made of the effect of the frosting of lamps on the mean candlepower and on the distribution of the light. Special equipment has also been provided for the rapid testing of incandescent lamps.

Much of the exceptional work which has been done in the department devoted to electrical measuring instruments has been made possible by the fact that the institution has facilities for handling and measuring alternating currents up to 1,000 amperes and direct currents of many thousand amperes. In a branch of the electrical division devoted to inductance, capacity and absolute measurements, extended investigations have been carried out in absolute measurements of the fundamental electrical units, namely, the ohm, the volt, and the ampere. Exhaustive investigations pertaining to the standard cell have also been carried on; an electrolytic method of preparing mercurous sulphate has been devised; and important tests have been made to determine the conductivity of copper and the electrical properties of various materials.

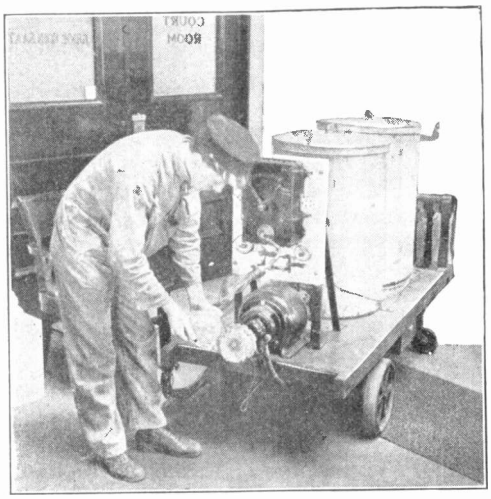
ELECTRIC CURRENT AT WORK

NEW DEVICES FOR APPLYING ELECTRICITY

Cleaning Glass Shades

Live business houses make a practice of having lamp reflectors cleaned say once a fortnight and in large establishments it pays to have a man do nothing else, owing to the greater efficiency of the lights.

In the Federal Building, Chicago, the chief electrician, Mr. W. A. Richardson has gone still further and is letting electricity do most of the work, thereby enabling a



CLEANING GLASS SHADES BY ELECTRICITY

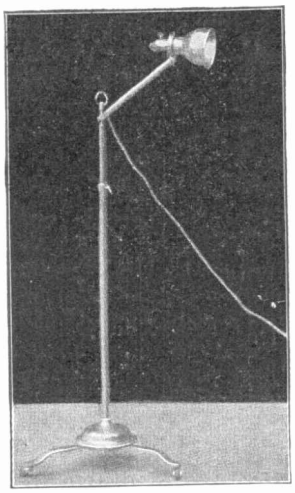
single man to keep nearly 3000 prismatic glass shades in good reflecting condition.

Mr. Richardson's shade cleaner consists of separate cleaning and drying tanks both mounted on a truck. One tank has at its bottom a propeller blade mounted on a vertical shaft and geared to a small motor. This tank is filled about half full of water to which a strong washing powder is added, the water being heated by an electrical coil. The glass shades are gathered in a large wire basket which slips down into the tank just above this propeller. Then the motor is started, churning the liquid violently and dashing it among the shades.

The attendant now goes after more shades and by the time he has gathered a basket full, the first lot is thoroughly cleaned. The heating coil keeps the suds so hot that the shades would readily dry in the air, but to speed the heating the whole basket full is lifted into the second tank which is empty except for a heating coil at its bottom. The attendant then takes the shades one by one and polishes them with a hemispherical buffing wheel on the shaft of the same motor that drives the churning wheel.

Physician's Searchlight

A lamp and reflector designed expressly for the use of physicians and surgeons is offered by a German firm. It consists of a suitably stable base, which may be moved



PHYSICIAN'S SEARCHLIGHT LAMP AND REFLECTOR

about on castors. This carries an upright with an adjustable arm, which supports the lamp and reflector. The latter is heavily nickle plated inside and out, and may be swung about to direct the beam of parallel rays in any direction, but screening them from the eyes of the operator. In fact, it is a complete miniature searchlight.

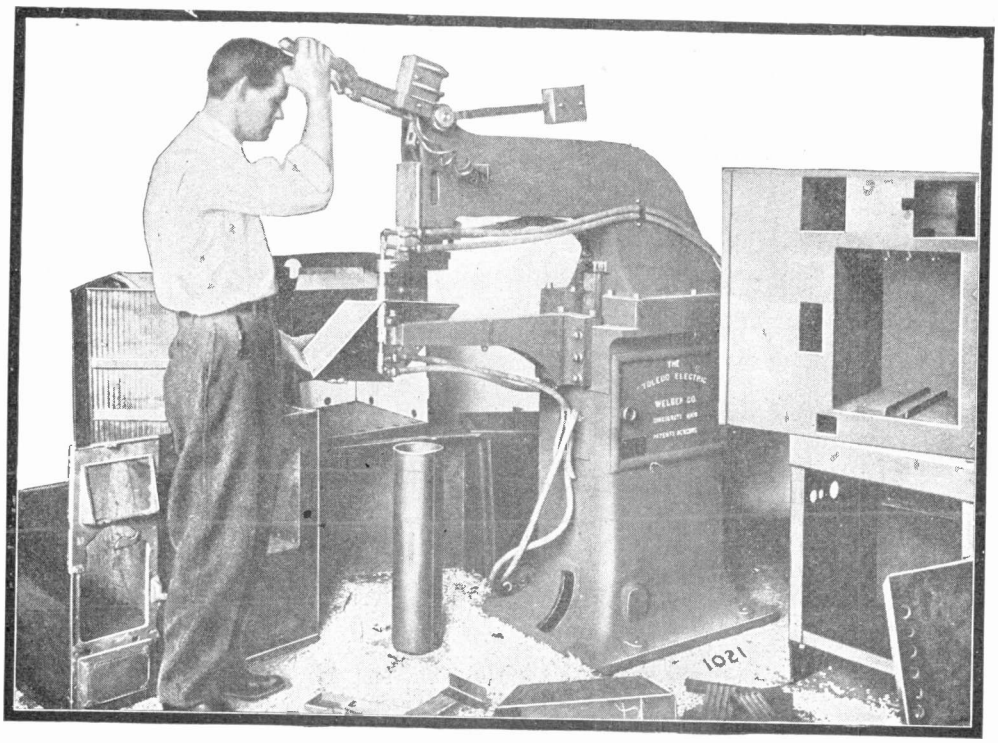
RIVETLESS RIVETING

By GEORGE F. WORTS

The simplest type of electric welder and the one designed for the lightest work will electrically "rivet" two pieces of sheet iron together in from one-half to three seconds, depending upon the thickness. Two pieces of the metal to be joined are placed on the horn or stake of a machine with an overhanging head. A lever is pulled, a switch touched, there is a sparkle of light as the unleashed electrical energy drives through the metal and a spot slightly larger than the tips of the jaws heats to a glowing red. The lever is then released and the result is a perfect weld no larger in diameter than a rivet and, by actual test, over twice as strong. The time required in the making is less than one-fifth of that of hand punching and riveting.

Alternating current at any voltage from 110 to 440 is introduced into the windings of a special transformer in the base of the machine from whence it issues at a reduced potential—usually three to five volts. This voltage is as harmless to the operator as the current from a couple of door bell batteries, in fact it cannot even be felt by the bare hand, but its power is herculanean. It seems remarkable that the combined strength of 20 horses can be concentrated in a spot no larger than the end of a lead pencil; or, that the same amount of current if expanded to produce mechanical energy would run a good sized street car. Yet, the current is easily controlled by a simple hand switch on the welder and there are no electrical "fire works" either as might be expected.

The underlying principle of the electric welder is an adaption of the well known fact that a poor conductor of electricity will offer so much resistance to the flow of current that heat will result. The electric lamp is a good illustration of this; the connecting wires in the base are good con-



ELECTRIC RIVETER AT WORK

ductors and remain cool, but the slender, metallic filament offers a resistance to the current flow and becomes white hot, or, reaches a state of incandescence.

It is practically the same with the electric welder only in vastly larger proportions. Whereas in the lamp the conductor wires to the filament are small, in the welder, copper cables of large cross section are employed to carry the current to the copper jaws or electrodes. Upon the current being turned on, the resistance of the metal between the jaws is great enough so that it instantly becomes heated in a small spot. For this reason the process is called spot welding.

The illustration shows the application of this welder to the joining of sheet metal range bodies and various other articles. These machines are made both hand operated as shown by the cut, or may be furnished to operate by a foot pedal, allowing both hands free to manipulate the stock, or can be power driven similar to a punch press. In making welds in 20 gauge stock, less than half a second is required. In stock as heavy as ten gauge—1¼ seconds are required.

Battery Cell Tester

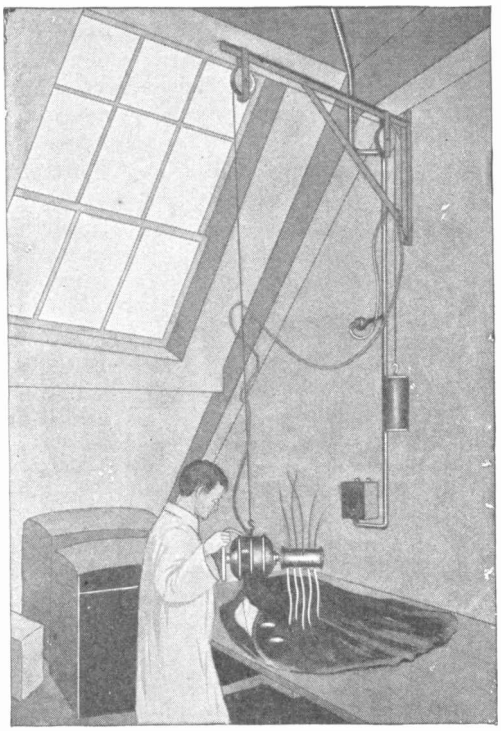
The illustration shows a device used in England for testing storage battery cells.

USING THE BATTERY CELL TESTER

It consists of a small portable voltmeter of the Evershed-Bignoles type, weighing 1½ pounds. The scale reads up to three volts, divided into tenths. The instrument is held in the hand and contact made to the two cell plates by "barbs"—small pointers with insulated handles. The tester passes around among the battery cells, touches the positives and negatives with the "barbs" and reads the voltages on the meter, which indications he enters on his record pad.

An Electric Fur Beater

German furriers now make use of a motor-driven machine for beating and renovating skins and pelts. It consists of a motor suspended from the ceiling by pulleys



ELECTRIC FUR BEATER

and a counter weight, so that it can easily be moved around over the table. On the shaft of the motor are a number of flexible rods which beat a lively tattoo on the unoffending hide.

Two large telegraphically regulated clocks have been installed at the Manhattan end of Brooklyn Bridge.

An Electric Gas Meter

That electricity should be called into service to measure gas, its colleague, and in many cases its rival, seems somewhat paradoxical, yet this is what is done in the Thomas gas meter. This meter, a radical

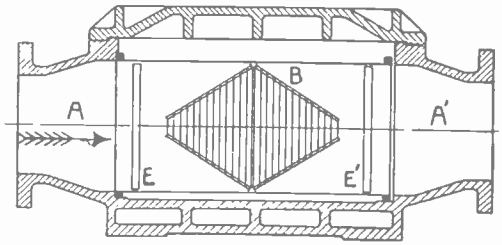


FIG. 1

departure from all present devices, measures the flow of gas in cubic feet and operates upon the easily understandable principle of adding by electricity a known quantity of heat to the gas and determining the rate of flow by the rise in temperature this heat produces in the gas as it flows from inlet to outlet of the meter. The meter is applicable only for measuring large gas services.

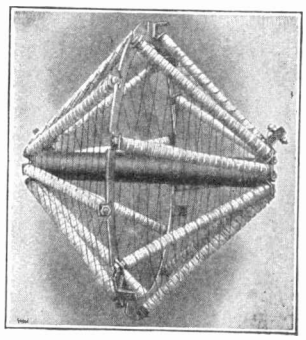


FIG. 2

The position of the parts of the meter will enable the reader to understand more readily the method of operation. A cross-sectional view of the meter casing is shown in Fig. 1. The gas enters at (A), flows through a screen (E), then about the elements of an electric heater (B), next through a second screen (E′) and out at (A′).

The arrangement of the heater wires, Fig. 2, is such as to distribute the heat all about the interior. At each end of the meter the screen of resistance wire, one of which is shown in Fig. 3, will, of course, have the same temperature as the gas passing through it. These screens are made of nickel wire, which changes its electrical resistance as the wire changes in temperature, and the flow of current is thus increased or diminished in the wire of the screens, thus making them serve in connection with a galvanometer as thermometers to show the temperature change in the gas from meter inlet to outlet.

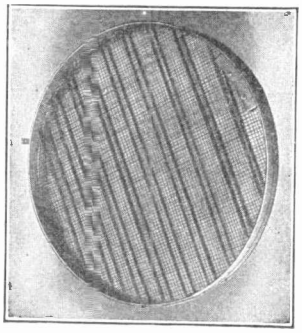


FIG. 3

The two screen-thermometers are so connected that as the difference in temperature between the two varies, this variation causes a galvanometer automatically to operate a controlling device regulating the current supplied to the heater, more or less heat being provided as more or less gas passes,

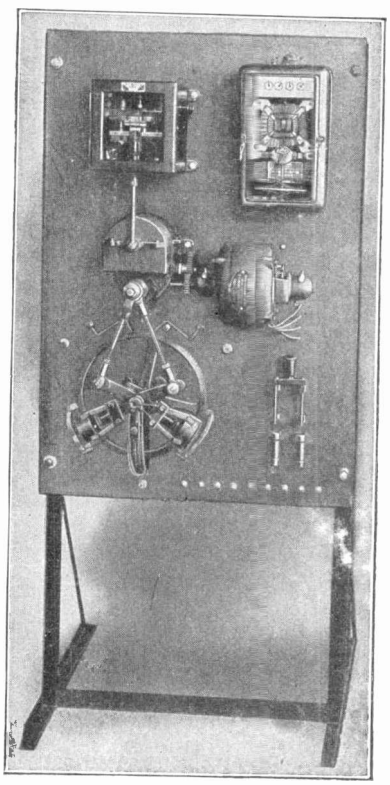


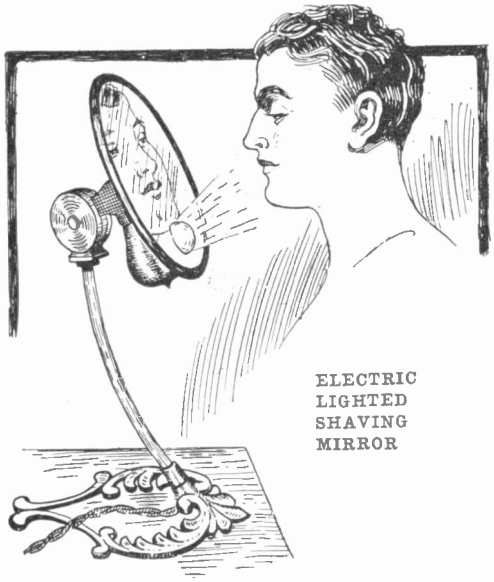
FIG. 4

but all the time keeping the difference in temperature between the screens constant, in this case the difference for test purposes being 2° F. It follows, then, that when

more gas flows through and must be warmed, a fixed number of degrees, more current must be supplied to the heater. If, then, a wattmeter registers the watts supplied, this wattmeter may be marked on the dial to read directly also in cubic feet of gas. The switchboard with the galvanometer, regulating device and wattmeter is shown in Fig. 4. It is evident that the accuracy of this meter is not affected by the pressure of the gas measured, since it is the weight or amount of gas in a given volume that determines the heat needed to cause a certain difference of temperature between the two screens. The energy necessary to run a sixteen-candlepower carbon lamp for one hour will measure nearly 7,000 feet of gas. The switchboard may be located at any point where it is convenient to take readings, electric wires being run from the gas meter to the board.

For the Man who Shaves Himself

An English electrical paper shows an ingenious arrangement to aid those addicted to the razor habit. An adjustable mirror

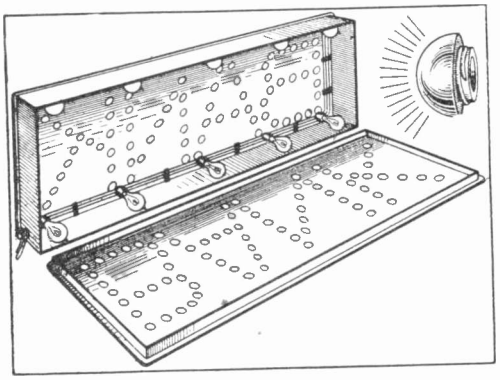


ELECTRIC LIGHTED SHAVING MIRROR

is mounted upon a metal standard, carrying also an incandescent lamp. The mirror has in its lower portion a glass lens similar to those used in a pocket flashlight. The lamp is so placed that its light passes through the lens and upon the lower portion of the shaver's face, while the mirror serves its intended purpose.

Sign with Searchlight Lenses

The American electric sign is built upon a principle quite different from the ordinary sign. It consists of a shallow sheet metal box around the inner edge of which are located a number of incandescent lamps. Through the sides of the box holes are punched outlining the letters of the sign.



ELECTRIC SIGN BUILT LIKE A SUIT CASE

In these holes are screwed glass lenses. These lenses are specially constructed to gather the light from the few lamps inside the box and project the beams outward. Very attractive signs are built up in this manner, and an advantage claimed is a considerable saving of current, as less lamps are required than where each part of the letter is represented by an individual lamp. The lenses can be colored as desired, and a simple flasher may be used to make the sign "wink."

Swiveled Headlights for Locomotives

In Germany, where the railroads are operated by the various state governments, the Hessian roads have lately been experimenting with electric headlights swiveled like the ordinary ship searchlight, so that the engineer can turn the beam far over towards one side or the other when rounding curves. The swivel support is said to be easily applied to the electric headlights already in service and to greatly increase the safety of operation when rounding curves, as the engineer can light up distant stretches of track no matter whether they are straight ahead of him or off to one side.

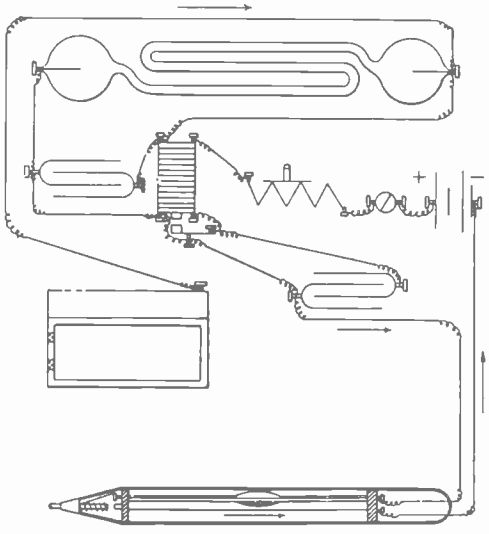
The One-hand Telephone Set

THE ONE-HAND TELEPHONE IN USE

A telephone set combining the transmitter and receiver in a convenient way for ready use is found in the handmicrophone. The Ericsson "handmike," as it is sometimes called, consists of a receiver and transmitter joined together so that when the handmike is held in the hand, the receiver being at the ear, the transmitter is just the proper distance from the lips for best results. Its weight is eighteen ounces, making it a popular device for the home, hospital or office where a telephone stand may be inconvenient.

An Electric Pen

Ink written documents may be tampered with and the writing changed or erased. A patent on a rather novel invention to produce writing that cannot be altered has been granted to Dinshah Pestanji Framji Ahadiali of Surat, British India, in which an electric pen does the writing. The device in general, as shown in the illustration, consists of a battery, induction coil, a

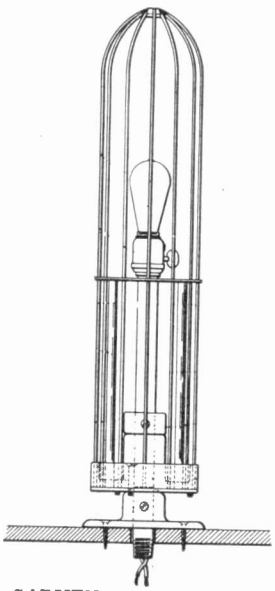


AN ELECTRIC PEN

vacuum tube, two condensers and an aluminum desk upon which the paper is placed, and a pen. The pen, which has a metal point, is so arranged at the tip that when the point is pressed against the paper upon the desk the tension of a spring is overcome and the circuit of the battery closed. A high tension spark then passes from the pen through the paper to the desk, carbonizing and perforating the paper as the pen moves over it. Raising the pen off the paper opens the circuit.

Factory Garment Inspection

In factories and shops where many garments are turned out in a single day by machines and rapid workers careful inspection of the goods for defects must be made before they are sent out. A patent issued to Jacob A. Snyder, Cincinnati, Ohio, covers a device which is designed to make this inspection take less time and to aid in bringing to notice any imperfections.



GARMENT INSPECTION LAMP

The device consists of a frame or form of vertical metal rods as shown, fastened into a ring at the bottom. The light within the form is turned on, a garment slipped on the form and this rotated upon the base to which it is attached until every part of the garment has been subjected to scrutiny by the aid of the electric light within, which, it is claimed, brings out any holes or defects in the goods.

FOR PRACTICAL ELECTRICAL WORKERS
HOW TO MAKE AND OPERATE ELECTRICAL DEVICES

ANALOGIES OF ELECTRICAL TERMS

By DALE S. COLE

VOLTS, AMPERES AND RESISTANCE.

It is surprising how confusing are the ideas concerning fundamental electrical terms among men in the work to-day. When asked by a layman what a volt or an ampere is, difficulty is often experienced in making it clear. Or, perhaps, the one to whom the question is addressed is not clear himself on the term.

Suppose we have two tanks of the same size and containing the same amount of

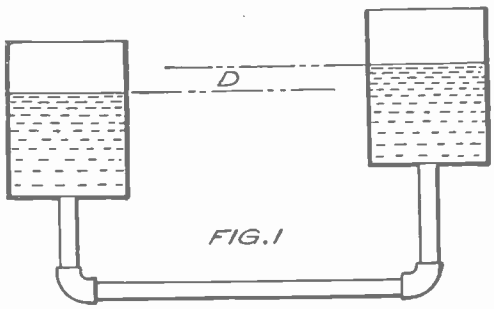


FIG. 1

water. Place one tank at a higher level than the other and connect the two by means of a pipe. Water will flow from the higher to the lower, for, as is generally stated, "water seeks its level." The water flows because there is a difference of potential energy. In other words, the higher tank holds energy stored in it by virtue of its position. In raising the tank to that position a certain amount of work had to be done. When we open the pipe this energy is given back in the flow of the water to the lower tank. The word "potential" has in it the idea of position, so we can say that there is a difference of "potential" between the two bodies of water.

This familiar example is almost analogous to the simple electrical current. The volt is a measure of potential difference or pressure. Thus, in Fig. 1, (D) represents the difference in level of the two surfaces of water. The water will flow until the level is the same in the two tanks, or until there is no difference of pressure or potential energy. When this has taken place the distance (D) will be reduced to zero, as shown in Fig. 2. Thus in the electrical circuit there is no flow of current when there is no difference in pressure between two points. In the case of the tanks, we can start the flow by raising one tank above the other. Work is done, and energy stored. In the electrical circuit we impress a pressure on a circuit and cause a current to flow.

We measure the flow or current in amperes. There is some resistance to the flow of water through pipes by reason of the

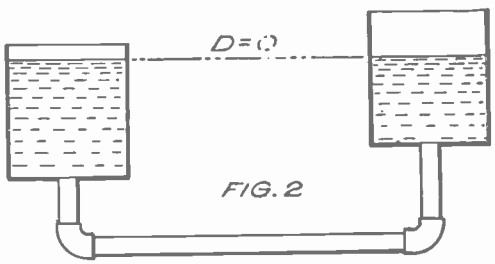


FIG. 2

friction. In this we have an analogy to resistance in the electrical sense.

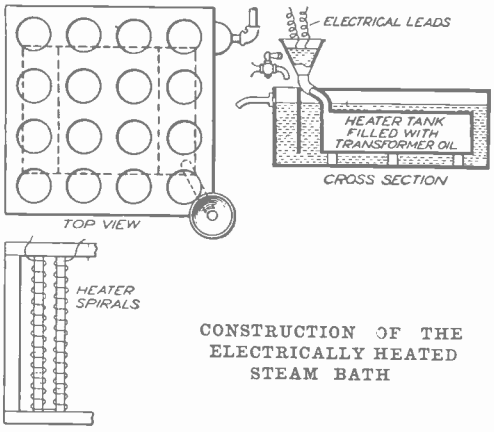
As the friction of the pipes impedes the flow of water so does resistance in the electrical circuit impede the flow of current.

Summing up our observations we have three clearly defined ideas to hold in mind. The difference in pressure in the two tanks of water is analogous to voltage, the flow of the water to the current, and the resistance of the pipes to the resistance of the

electric circuit. We measure difference of pressure in volts, flow of current in amperes, and resistance in ohms. Thus when we impress a pressure of one volt on a resistance of one ohm, one ampere of current will flow. Current will never flow between two points unless there is a potential difference, or difference of pressure. When a current does flow it goes from the point of higher potential to that of a lower potential.

Electrically Heated Steam Baths for Laboratories

The chemical manufacturing plant, where I am employed as electrician, having entirely replaced steam by electric power, found it necessary to provide an electrically heated steam bath for the laboratory. Instead of using a commercial immersion coil to heat



CONSTRUCTION OF THE ELECTRICALLY HEATED STEAM BATH

the bath, I designed and made one which is giving excellent results. The plans show the construction in detail.

The outside water box is 28 by 28 by 8 inches, made of eight-pound lead with the top having sixteen 4½-inch holes. The heater tank, also made of lead, is 21 by 25 by 3 inches. This contains the heating spirals, which are made of No. 18 tinned iron wire, wound on a mandril ⅝-inch in diameter. I put about 50 feet in each spiral, which wound tight takes about fourteen inches on the mandril. These coils were then stretched out on a wooden rod to 23 inches. I used ten of these spirals, held in place by a wooden frame, and placed inside of the heater tank, which was then sealed up, leaving only an opening for a one-inch lead pipe to bring the leads out through and also to allow for the expansion of the transformer oil with which the heater tank was then filled.

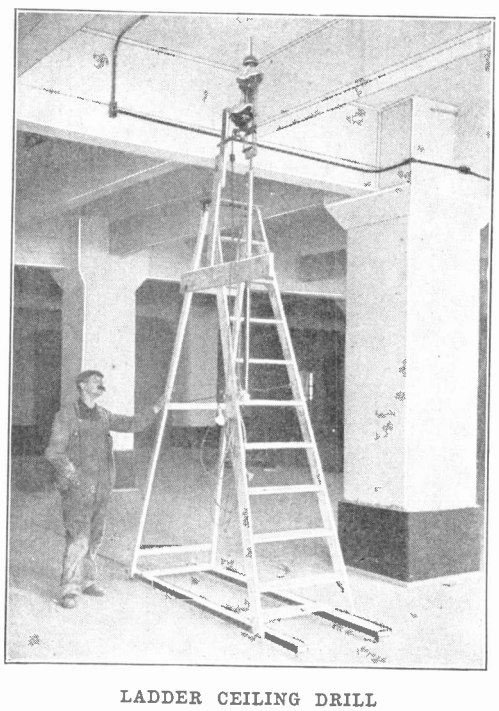
This tank was set on legs one inch high in the middle of the water box and the one-inch pipe brought out through the corner of the lid and terminated with a funnel-shaped end.

The water box was then filled to a level about one inch above the heater tank and kept so by a small, constant supply of running water into the inlet chamber, as shown in the sketch.

When the "juice" (250 volts A. C.) is turned on it holds the water in the bath at about 210° F. with the expenditure of less than one kilowatt. ELVIN F. BROUGH.

A Ladder Drill for Ceilings

A New York firm has mounted an electric drill on a step ladder, putting castors under the ladder so that it will slide easily. The workman shoves this to the right place, slides up the rod that holds the drill and turns the switch. Even on solid concrete ceilings a man with such a tool can bore 30 or more holes per hour without leaving the ground himself.



LADDER CEILING DRILL

How to Use an Equalizing Wire

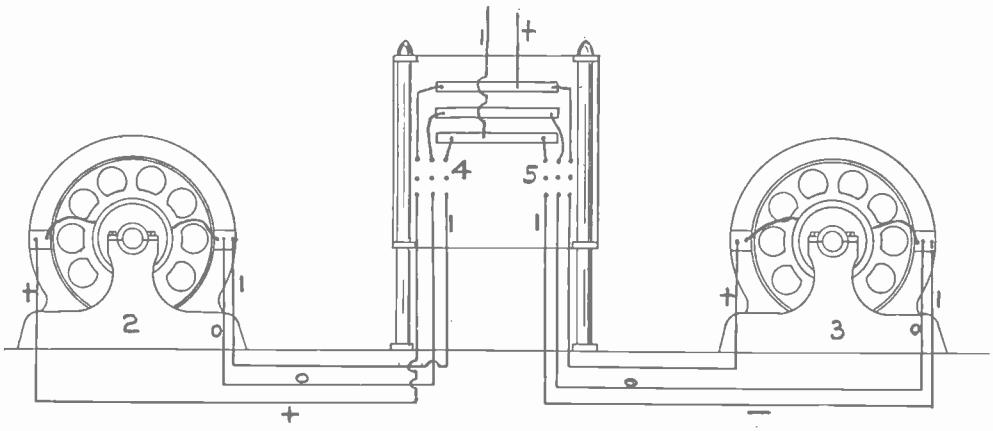
In many manufacturing plants one or more engines are used to operate generators which produce electricity, and it is transmitted by suitable wires to various motors, which drive certain machines by direct connection, known as "individual drive," or one motor may turn several short lengths of shafting, carrying suitable pulleys, each of which is belted to a machine, constituting what is known as "group drives."

In all such cases provision ought to be made for "emergency service," or in other words there should be more than one way provided for supplying electricity. The plant referred to in this article is located where central station service is not available at any price, therefore "emergency service" is provided for by the installation of duplicate machinery consisting of boilers, engines, and generators complete.

The generators are shown at (2) and (3) in the illustration, and although three wires appear as part of the circuit, it is strictly a two wire system, as follows: Both (2) and (3) discharge current through the (+) wires to the upper or positive bus bar, and it is sent out over the right hand wire to the motors. It is returned over the (—) wires to the generators. The back of this switchboard is shown for convenience, therefore the switches (with their fuse connections) at (4) and (5) do not appear, as they are located on the other side, but for present illustration these switches are supposed to be closed.

For several years this plant was operated under conditions, which made it impracticable to operate both generators, or in other words to run them in parallel, because the central wire was omitted. There was danger of reversing the current in one of the generators, and thus turning it into a motor which would be run by current from the other, especially as they were very different in design and construction.

This made it necessary to operate the plant as follows, bearing in mind that the wire (O) was not installed at the time. With switches (4) and (5) out, suppose



HOW TO USE AN EQUALIZING WIRE

that the engineer decided to use generator (2). This engine is started and when the desired voltage is secured, (4) is thrown in and the current is ready for use throughout the shop. If a bearing on the engine or the generator heats, it is very convenient to shut it down until the cause of trouble is removed. Under former conditions, with (O) omitted, all machinery in the shop must stop until the engine which drives (3) is started, and the desired voltage is secured. When (5) is thrown in, the motors may be started again. This not only causes loss of time for the shop hands, but it advertises the fact that there is trouble in the engineer's department, which is unnecessary.

Suppose that the same trouble appears with the equalizing wire (O) installed as shown. Current is supplied by (2) but it must be shut down. When (3) is started the voltage must be raised about one per cent higher than is already on the bus bars, then (5) is thrown in, causing both ma-

chines to operate alike, so far as outward appearances are concerned. Internally they may not be the same, because it is quite possible for one to generate more than the other, causing the surplus to go over the equalizing wire (O) to assist the other. By proper regulation of the rheostats, each machine is given a proper share of the load. After (3) has been in operation a few minutes, the switch (4) may be pulled out, causing the whole load to be taken by (3), and (2) is shut down for repairs. In the shop nobody has discovered that a change of supply has been made. When (2) is ready for service again, it may be started in the usual way, and (3) can then be shut down without disturbing anybody, or causing loss of valuable time.

W. H. WAKEMAN.

Treatment of Storage Cells

B. B. Boltwood writes as follows in a recent issue of *Nature* regarding the treatment of sulphated plates:

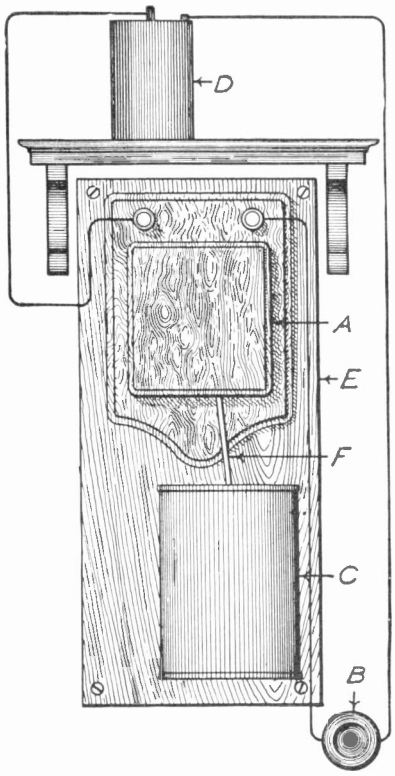
"A strong (30-40 per cent) solution of crude commercial sodium hydroxide solution is prepared in a large iron pot and is heated to boiling. The accumulator plates, previously washed thoroughly for several days in running water, are dipped into the boiling soda solution and allowed to remain for a period of from five to fifteen minutes, depending on the extent to which "sulphating" has taken place. They are then removed and washed for several days in fresh water, after which they are placed in the jars with fresh sulphuric acid solution and thoroughly charged.

"This treatment can be applied to any cells which have not undergone structural disintegration, and when properly carried out restores the cell to its full normal capacity. I have used it with complete success for treating a set of six large portable accumulators which had stood uncharged for nearly five years, during which period almost all the water had evaporated from the electrolyte, and the greater part of the sulphuric acid had combined with the plates. It is also a very effective remedy when applied to cells which show local action and continuously evolve gas from the plates after charging, with a corresponding more or less rapid loss of charge on standing. In treating such cells a more dilute solution (20 per cent)of sodium hydroxide can be used.

"I have never found a cell too completely 'sulphated' to be restored by this treatment."

An Electric Screecher

You may call it a "whistle" or a "screecher," for it makes a noise loud enough to be heard quite a distance. To build it, remove the gong and hammer from an electric bell. Straighten the hammer rod as shown at (F)



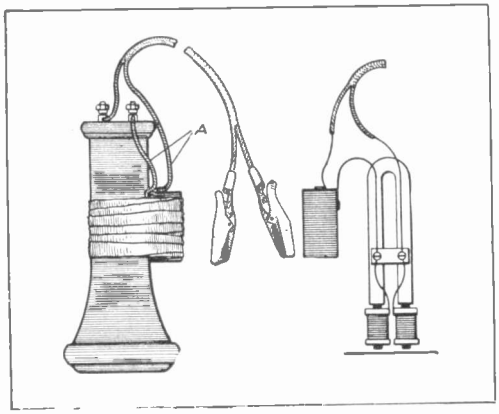
ELECTRIC SCREECHER

in the illustration. In the center of one end of a large-sized tin can make a hole slightly larger than the diameter of the hammer rod of the bell. Nail or screw the can (C) to a wooden board (E). Mount the bell (A) on a block of wood so that the hammer rod will vibrate in the hole in the can. It means the loss of a year's growth to any one who opens a door on which this outfit with a door switch (B) and battery (E) is installed.

C. M. CROUCH.

Ground Testing Outfit

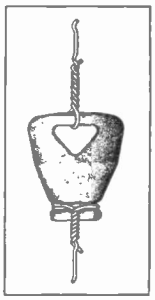
An inexpensive and compact equipment for testing for grounds can be easily made



GROUND TESTING OUTFIT

from a telephone receiver and a cell from a flashlight battery. Solder connections to the cell as shown in the illustration, then tape the cell securely to the receiver, using ordinary friction tape. On the ends of the flexible cord provide two clips. When one clip is connected to a conductor and the other clip attached to a water pipe or ground, the receiver will give a sharp click if the circuit is completed by a ground upon the wire tested. If the wire is perfectly insulated no sound will be heard in the receiver.—F. F. SENGSTOCK.

Inexpensive Insulator



Here is an idea I have followed in insulating my aerial on the spreader. From a beer or magnesia bottle I took the porcelain cap. The porcelain portion may be wired as shown. This way of insulating has been very satisfactory.

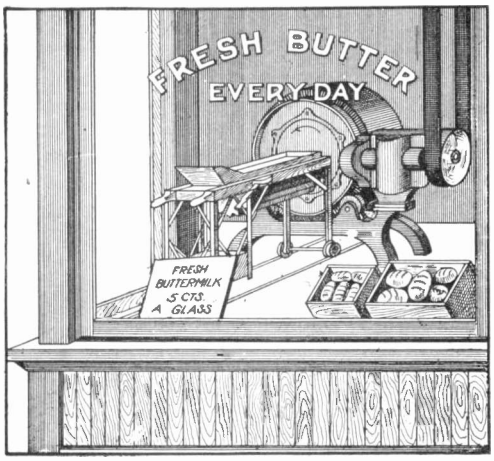
ANTHONY J. PERINA, JR.

Electricity the Silent Salesman

Some helpful hints on the use of electric current in getting up show window displays. The following schemes have all been used with remarkable success.

Exhibiting Dairy Products

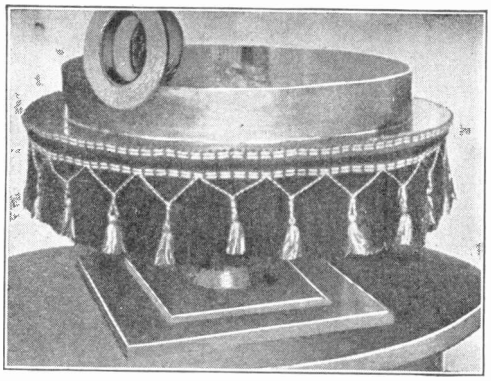
A motor driven barrel churn and hand operated butter-worker standing side by side in a butter-store window, with the churn in operation, is one method used to emphasize the proclamation, "Fresh Butter Every Day." A sign invites the observer to come in and get a drink of fresh buttermilk—"5 cents a glass." A motor situated on the second floor conveys power to the churn by a belt through the floor.



EXHIBITING DAIRY PRODUCTS

The Magnetic Table

The advertising device shown on the next page is a flat round table or disk, with a polished metal surface. By means of a magnet which travels around the inside of this table any object which has iron or steel concealed in it may be laid upon the table and it will immediately follow the hidden magnet, and the public will stop to guess what the mysterious motive power may be. One of the striking yet simple plans is to insert a strip of metal inside the sweat band of a hat. The hat may then be laid upon the outer edge of the disk with its band resting upon the surface. The magnet traveling beneath the surface will cause the hat to roll around the table as if it were bewitched. This is only one of many dis-

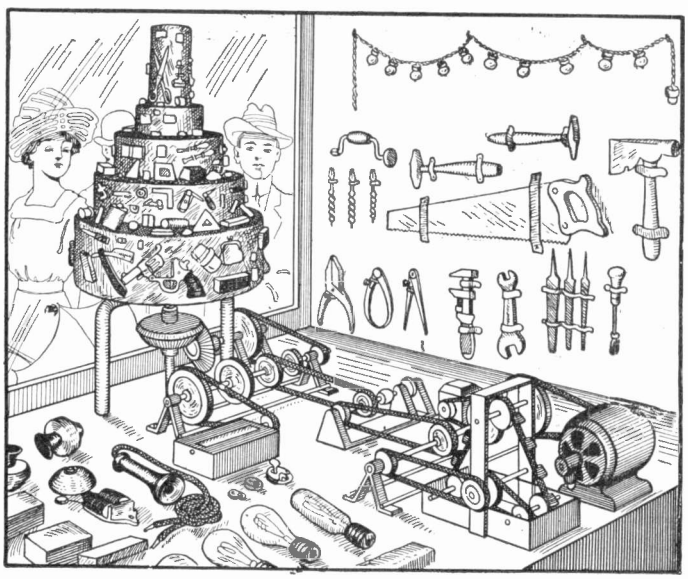


MAGNETIC WINDOW DISPLAY

plays that may be designed to draw a crowd to your window. A concealed cord attached to an electric light socket supplies the power for the motor which moves the magnet.

Revolving Pyramid Display

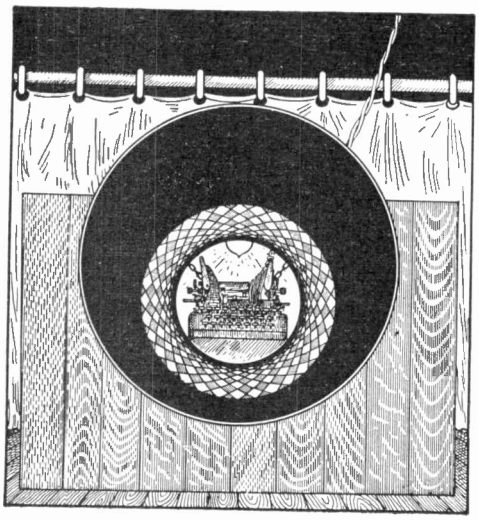
The manner in which one merchant displays a great number of small articles, using little space, is illustrated in the picture where a small electric motor revolves a terraced pyramid at slow speed. The speed of the device is regulated by a ball governor within the box. Countershafts carrying small wheels may be used to operate various mechanical toys, or even idler pulleys, people are mechanically inclined and will stop to see the "wheels go round."



REVOLVING PYRAMID DISPLAY

Makes Them See It

This picture illustrates an optical illusion as a show window attraction calling attention to the real thing—a typewriter—in the



UNIQUE METHOD OF DISPLAYING TYPEWRITER

background. The dark portion is a funnel lined with black velvet or other cloth, the smaller end terminating in a box enclosure, from the ceiling of which the typewriter is suspended.

The enclosure is well lighted by incandescent lamps. The illusion producer consists of two circular revolving disks of colored glass, upon each of which are drawn dark curved lines in opposite directions. At the center of the disks is an open circle bordered by a heavy black line. As the disks revolve in opposite directions, the dark spots move towards the black circle, the lines appearing to wind upon it. The rim of each disk runs in grooved rollers at its circumference, one roller on each disk being propelled by a small electric motor. The kaleidoscopic effect of the revolving disks will attract a crowd in no time.

Electrical Men of the Times

HENRY S. CARHART

The fast disappearing red country schoolhouse, with its hard bench seats, has been the starting place of many of the world's greatest men. It was in the environment of the district school that Professor Henry S. Carhart demonstrated his fitness for teaching and early showed the trend of a mind that is today erecting a monument to itself by successful researches into the field of physical science.

Born at Coeymans, Albany county, New York, March 27, 1844, he became a teacher at the early age of 16. At 19 he was the head of a Quaker school, thus securing the means to attend the Hudson River Institute. In 1865 he was admitted to Yale College, but in the fall entered Wesleyan University, Middleton, Conn., from which four years later he was graduated with the degree of B. A. and as valedictorian of his class. After two years of teaching Latin at the Hudson River Institute, he entered Yale Divinity School and while here was led through the Sheffield Scientific School to enter the field of science, where he has accomplished so much. Accepting, in 1872, the appointment as professor of physics at the Northwestern University, Evanston, Ill., he built up the physical laboratory from a very small beginning to one so excellent in every way that in 1886 he was called to a similar position at the University of Michigan, where under his direction a physical laboratory and a course was laid out which finally led, in 1889, to the establishment also of a course in electrical engineering. So strongly did these two courses and the men whom Professor Carhart gathered about him impress the engineering world, that their growth made necessary a new engineering building and a severing of the union between the physics and electrical engineering departments.

Previous to going to Michigan he gave himself to research work at Berlin in the laboratory of Professor von Helmholtz and here began experimental work on the standard cell for the measurement of electromotive force, regarding which today he is a world authority.

He is the author of several textbooks, a contributor to the scientific papers and an expert in suits involving the validity of electrical patents. He is a member of the American Institute of Engineers, Institution of Electrical Engineers of Great Britain, American Physical Society and of the American Electrochemical Society, of which he is past president. As marks of the esteem in which he is held by the scientific world, it may be noted that he was a member of the international jury of awards at the Paris Exposition in 1881, president of the board of judges in the Department of Electricity at the World's Fair in 1893, United States Delegate to the International Electrical Congress in Chicago in 1903, and member of the Berlin Conference on Electrical Units and Standards in 1905, and again in London in 1908. The degrees of M. A. and LL.D. were conferred upon him

by Wesleyan University in recognition of his eminence as a physicist and teacher.

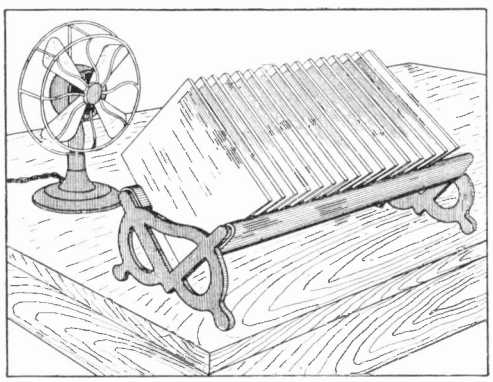
Upon his retirement from active teaching at Michigan University, he was made emeritus professor of physics and is now at the Bureau of Standards, Washington, D. C., carrying on investigations in connection with the standard cell.

Of him his close associate, Professor George W. Patterson, says: "How seldom it is that we find a man a great teacher and at the same time a productive scholar of world wide fame. His pupils will always remember his clearness as a lecturer and the uniform success of his experiments; but more than this, they will always be conscious of the impress that as a man he made upon them."

ELECTRIC IRON USED IN MOUNTING PRINTS

In the Photographer's Studio

While electricity has already entered the field of photography by making possible the taking and printing of pictures by artificial light, there are other time and labor-saving things it may do in the studio. The accompanying illustrations serve to point these out.

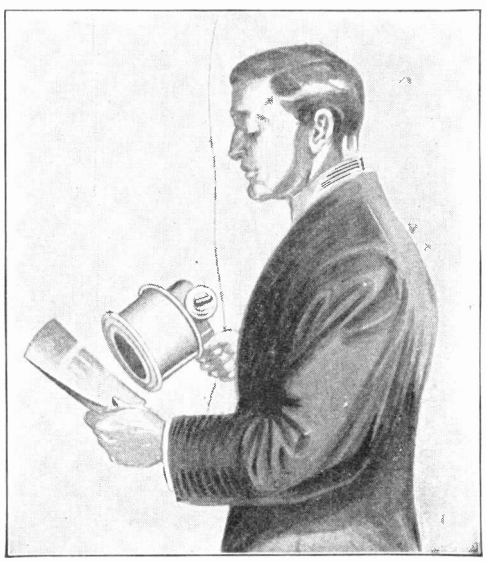


DRYING PLATES WITH AN ELECTRIC FAN

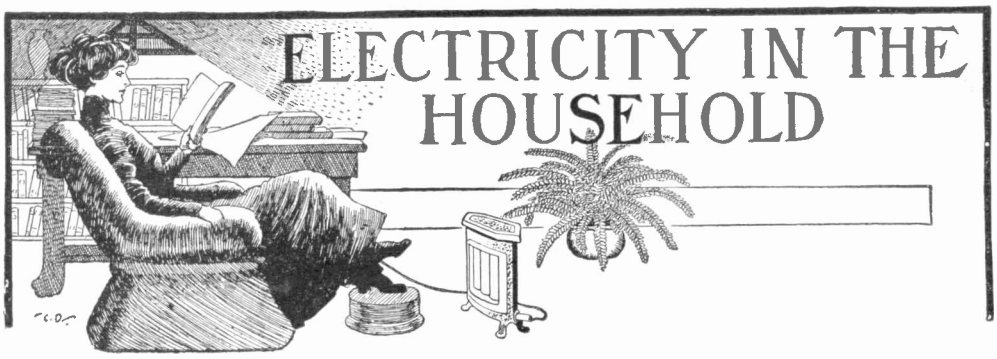
The drying of negatives after development may be accomplished in very quick time by the application of the already much used hair dryer, common in modern hair-dressing establishments. The air in passing through the dryer is heated by resistance coils. By drying the plates individually or arranging them on a rack in such a manner that the dryer may drive warm air between them, the negatives are soon ready for use in printing.

Some prefer, however, to use an ordinary electric fan for the drying process, using air at the ordinary room temperature.

The photographer may find use for the electric pressing iron in mounting prints, and with the use of "mounting tissue" the pressing iron is a necessity.



DRYING FILMS WITH AN ELECTRIC HAIR DRIER



Where Art and Science Meet

By T. VERNETTE MORSE

The question for discussion before one of Chicago's progressive woman's clubs was "What has been most helpful to me during the past year." Each representative was requested to give a three-minute talk on the subject.

One bright-faced happy woman arose and after addressing the chair said, "I do not require three minutes; one will be quite sufficient. The greatest help that has come to me during the year has been the installation of seven electric lights in as many formerly dark closets. The lights are so arranged that the switch for lighting is turned on every time the door is opened, and the circuit automatically opens with the closing of the door; consequently there is no danger of leaving the light turned on when it is not in use. When it is necessary to leave the doors of the closets open for any length of time the lights may be turned off permanently."

"For some months the subject had been discussed without arriving at any definite decision, until one morning my husband, after many frantic endeavors to find some article of clothing which had artfully hidden itself in the depths of the closet, bumped his head against a projecting hook. He then decided that there must be some way of installing those lights and so arranging them that they would not be forgotten and left to burn all day.

"Hereafter there will be no dark wardrobes in our home, and it will no longer be necessary to locate one's clothing by a sense of feeling.

"Every woman has more or less experience with dark closets, and I am sure you will all agree with me that plenty of light in closets, wardrobes and bathrooms is as great a help as anything that can come into the home."

The question of dark closets brought forth a spirited discussion from the women present, and all were fully agreed that some means should be invented whereby all closets and wardrobes might be perfectly ventilated as well as lighted. The question is not a new one, but it is one that has received but little consideration from architects and builders.

Not many years ago a noted millionaire bachelor erected a magnificent modern home, fully equipped with every convenience and comfort that money and good taste could suggest, but many of his friends smiled almost audibly when it was learned that the entire front of the second floor was fitted up as a luxurious bathroom and wardrobe, a smaller back room being used for sleeping purposes. Undoubtedly this fastidious bachelor had at some time in his life been the victim of dark closets and bathrooms.

The question of good lighting is a serious one, and is frequently the cause of much waste space, but the small electric wire may be run into all the little byways of darkness with the greatest ease, thus enabling us to utilize the most out of the way corners.

The arrangement of light for every room is one that should be carefully considered.

For all working purposes and for reading the best light is that which comes from the left side somewhat back of the reader.

Illuminating glass has reached such a degree of perfection that it reflects and softens both the day and artificial light; consequently we may now enjoy the privilege of perfect illumination without the slightest glare.

A very effective system of lighting rooms in which there is a white or very light ceiling is secured by the indirect system in which the light is thrown on the ceiling, the direct rays being screened from the eye by inverted bowls which contain the lamps, the diffused light thus obtained being most agreeable in large spaces.

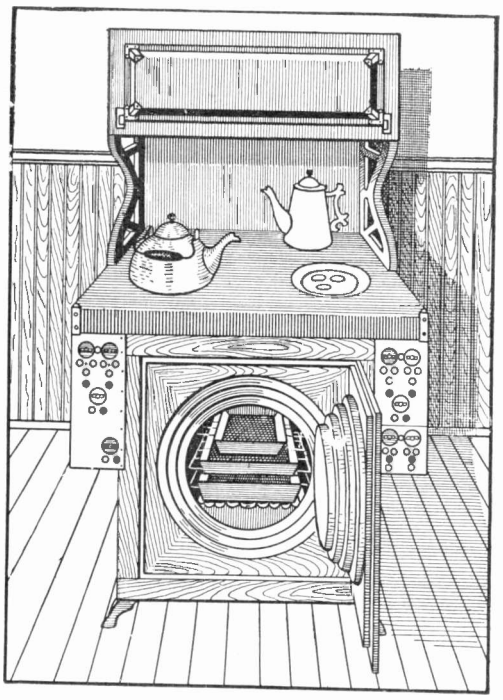
There is such a variety of artistic shades made to match every style of decoration that they require an article in which the value of good design and fine color combinations shall be the principal theme. With such a variety to select from the only question to be seriously considered is how to select the artistic from the inartistic.

The demand for devices to illuminate inaccessible dark places has been fully met by electricity, the great motive power of modern science, and there is no class of people to whom it appeals with greater force than the average housekeeper, who spends a great portion of her time in putting these little nooks and corners in order.

Keeping the Oven Always Hot

We all know from experience that very little heat is needed to keep water boiling or food cooking after it has been raised to the proper temperature, and those who believe that the acme of perfection has been reached in combining the fireless cooker principle with the electric cook stove are to be again treated to a surprise in the manner of using this economical household device.

The Cleveland Electric Illuminating Company is supplying fifteen "continuously connected" electric ranges like the one illustrated in which a cooking temperature of 400° F. is maintained in the oven of a fireless cooker night and day by a 150-watt heating element. With an oven *always* hot it is believed that the user will be lead to cook with the ready heat, rather than to turn on a plate requiring a lot of



AN OVEN THAT IS ALWAYS HOT

energy for a short time only, and for baking, boiling and roasting, 400° F. is ample. A broiler is provided and so arranged that when it is in place an "off" pushbutton opens the oven switch, thus preventing overheating. Pushbutton switches and indicating lamps give perfect control of every heater plate.

Lamp with Umbrella Shade

An original design of a French electric portable is shown in the cut. The base is of massive bronze of artistic design. The odd feature, however, is the shade, which is made of umbrella form, an adaptation of the utilitarian to the artistic which gives an effect not half bad.

UMBRELLA LAMP SHADE

Paris Beauty Secrets

By JEANNE ROGET

The quest of beauty appears to be the one thought among the fair Parisians, and explains why one sees no really plain women over there. Those already beautiful, however, are just as assiduous in their attention to the beauty shops as their plainer sisters.

One of the most popular of the high class beauty shops is owned by a Madame Marie V———, who has a big American following and who is really marvelously successful with her patrons. One time while in Paris I stepped into Madame V———'s with a little American arist. We were both awfully tired looking, and I must tell you of the wonderful process by which we weary dusty ones came forth as fresh as roses newly drenched with dew.

The treatment we were given was simple, and was based on principles of hygiene. In the facial massage we found both electricity and the electrical vibrator were used, although, in most cases, the vibrator only is employed.

First, our faces were thickly covered with a cream and the vibrator applied to forehead, cheeks, chin and nose, a rotary motion being used. This was followed by a roller, operated by the electric vibrator, and a good deal of work was done on the neck and chin, where signs of age are apt to show first. A roller of special shape was applied to the lower part of the face. All the time the electrical vibrator and roller were being used our faces were well covered with cream, the idea, the operator told me, being thoroughly to cleanse the pores with the cream, while the circulation and muscles were stimulated by vibration. After removing the cream with soft cloths, a second lot was applied and our faces were gently massaged by hand, to rub the cream in, but it was the electric vibrator that did the real rejuvenating.

When this second application of cream was rubbed in, a lotion having some carbolic acid in it was applied to heal and bleach the skin, and after this our faces were swathed in cloth and sprayed with an astringent cooling lotion. They were then gently dried, and a special cream which forms a basis, or holder for face powder was applied.

Of course the very first thing we both did on being released from our bondage was to look at each other to see if there was any change—and there was a magical one, well worth the price, which is even more than they ask at the best beauty shops in New York. I afterwards had a little chat with Madame V——— about the efficiency of her method, and she said there was really nothing like the electrical vibrator to rescue the tired muscles from flabbiness, and tone them up, and it was to it, primarily, that she owed her great success.

What an original idea, I thought, to have an electric vibrator of one's own. There are so many little impromptu affairs when one likes to look one's best, and very often, at the last minute, there is not time to secure a good masseuse. But with the electric vibrator one would be fortified against any such emergency. It seems my idea, which I thought so clever, was a belated one, however, for many women I find, are buying electric vibrators, with different attachments, for their own use, and find them indispensable in traveling about from place to place, or in the summer hotels. There is as a rule only one masseuse at a summer hotel, and if any large affair is planned she is so much in demand that it is often quite impossible to secure her services at the time needed. But the happy possessor of an electric vibrator is always secure.

A friend of mine who spends a great deal of time touring about both by motor and train, says, that when she arrives at her destination with her face grimy and lined with the stain and dust of travel, one of the greatest comforts she knows of is to use the vibrator and cold cream in a manner similar to that employed by Madame V———. So refreshed looking is she after a long and tiresome journey that she is quite a marvel to her friends. One little attachment, like a brush with rubber teeth is splendid for stimulating the scalp, and keeping the hair in good condition. This also often relieves those headaches that come from cold or nervousness.

A Champagne Stunt on a Beer Purse

We cannot all afford Tiffany glassware on our chandeliers and tables, with its iridescent display of color in red, blue, green, yellow and orange, but by means of a little ingenuity and colored tissue, effects in dining table illumination can easily be produced that are very similar.

Take an ordinary three-light electric fixture, cover the center light with red tissue, and the two side lights with yellow. The light from this combination becomes a very warm, soft, mellow tone that is most pleasing.

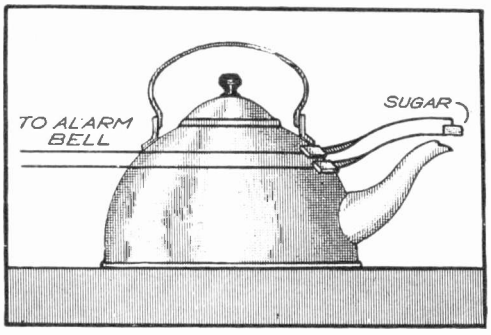
Every shadow cast by any object in this light has a fringe of red, yellow or green, which makes the silverware, china—in fact, the entire table—have the gorgeous effect of Tiffany glassware.

What might be termed the penumbra of every shadow from this combination becomes a solid band of green, yellow, red and in some cases brilliant red.

This combination will be found to be a very effective and pleasing one for any special home entertainment, such as Thanksgiving or Christmas dinner, tea parties, etc.

A Sugared Alarm for Tea Kettles

The secret of the delicious tea on which many housekeepers pride themselves lies in their pouring the hot water over the tea leaves just as soon as it has come to a



A SUGARED ALARM

boil, being sure not to let it boil first, as that would remove much of the air in the water, with a decided effect on the taste of the resulting tea. But, as the old saying goes, "a watched pot never boils," and any efficient cook wants to use her time to good advantage while waiting for the water to heat. To help her out, an inventor at Wermelskirchen, with the characteristic German for the smallest details, has taken out a patent on an alarm arrangement in which two metal contacts are held apart by a lump of ordinary sugar, over the spout of the tea kettle or other cooking apparatus. When the water boils, the steam quickly softens the sugar so that the contacts press through it and ring a bell to advise the cook.

Foot Control for Sewing Machine Motors

Individual motor-drive of sewing machines, when equipped with the proper controlling device (to easily start, stop and vary the speed), has every advantage over other methods. The illustration shows a motor-

FOOT CONTROL FOR SEWING MACHINE MOTOR

operated sewing machine in which the operator by a slight pressure on the treadle of the machine can vary the speed, and start and stop the motor at will. The controller here used is mounted in a neat case under the machine board, a rod connecting it to the toe of the machine foot treadle. A slight pressure on the treadle starts the motor while a further pressure moves the lever arm of the controller, which is concealed in the case, giving any speed desired. When pressure is released the motor stops, a pressure on the heel of the treadle will start the motor instantly.

JUNIOR SECTION

A wholesome, fascinating study is the study of electricity. No boy who spends his spare time and his spare money in making and learning to operate electrical apparatus will go far wrong. This department is for such boys.

Electrolytic Rectifier

A rectifier is quite necessary to those experimenters in electricity who have only alternating current available. With a transformer for reducing voltage from 110 to ten or twelve volts, the rectifier here described will work nicely to operate induction coils, small motors and miniature, low-voltage lamps.

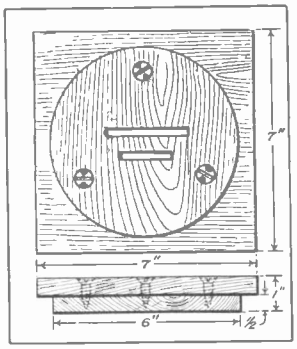


FIG. 1. COVER OF RECTIFIER JAR

Procure four gravity battery jars six inches in diameter and ten or twelve inches deep. Clean them thoroughly and dip the tops in melted paraffin to coat the inner and outer surfaces for a distance of one inch from the top. The paraffin will prevent the solution from "creeping."

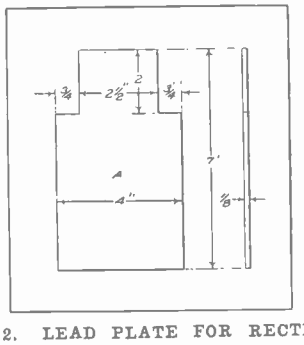


FIG. 2. LEAD PLATE FOR RECTIFIER

Cut four circular pieces of pine ½-inch thick and six inches in diameter, so that they will just go inside the mouth of the jars, and four pieces of the same material seven inches square. Glue or screw one round and one square piece together, and in this way make four lids like that shown in Fig. 1. These are the covers for the jars. The lids should be boiled in paraffin for at least one-half hour, and better for one hour.

Procure a piece of sheet lead at a plumber's shop or a hardware store, 16 by 7 by ⅛ inches, and cut it into four pieces each 4 by 7 inches. Cut a lug in the top of each plate ¾ inch wide and two inches deep, so that the plate when finished will look like Fig. 2. Cut all four pieces of lead the same size and shape.

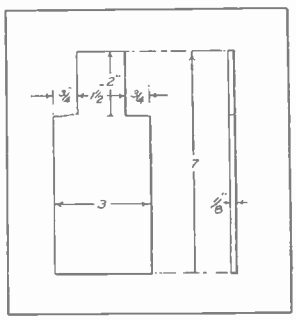


FIG. 3. ALUMINUM PLATE FOR RECTIFIER

Procure four pieces of aluminum plate each 7 by 3 by ⅛ inches. Cut a lug in the top of each four inches wide and two inches deep, so that each piece when finished will look like the illustration, Fig. 3. The aluminum plates when finished should all be the same size and shape.

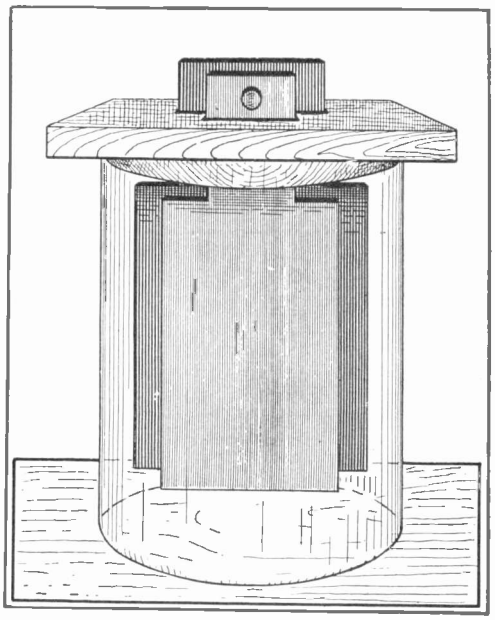


FIG. 4. JAR OF RECTIFIER

Cut two slots in the center of each cover. These should be ½ inch apart, parallel, and just long enough to allow the lugs on the aluminum and lead plates to pass through, Fig. 4. It is very important that the plates be ½ inch apart and parallel at all points. Put binding posts in each plate after it is passed through the cover.

The electrolyte is a saturated solution of sodium phosphate and one teaspoonful of sulphuric acid to each jar. By a saturated solution is meant water with all the sodium phosphate that can be made to dissolve in it. In case the teaspoonful of acid is too much to give proper results, add a little more sodium phosphate until exactly the right mixture is secured.

Connect up as shown in Fig. 5. This rectifier will work on a current of from 220 volts sixty cycles down to ten volts, more or less soda being used. HAROLD ARNTZEN.

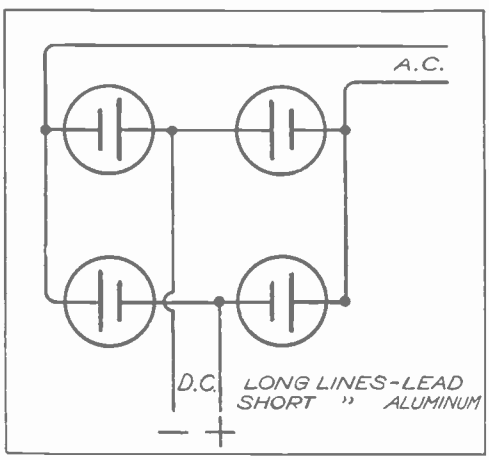
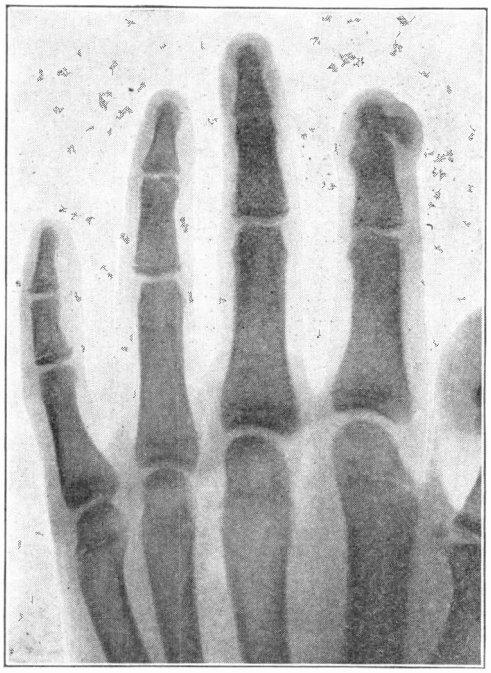


FIG. 5. CONNECTIONS OF RECTIFIER

Amateur X-Ray Photography

Being an electric enthusiast, I had the occasion some time ago to make an experiment with an X-ray outfit. I had access to a small Wimshurst static machine which sometimes gave a three-inch spark, also a two-inch induction coil, but neither seemed powerful enough to operate the 4½-inch X-ray bulb. Having a large open core transformer which was designed for a wireless telegraph outfit, I connected it up with the bulb and obtained excellent results.



HOW A "BASEBALL FINGER" LOOKS UNDER THE X-RAY

The transformer consisted of two layers of No .15 enameled copper wire, wound over an iron core one inch in diameter. Then several layers of empire cloth were placed on this to insulate it. The four secondary

coils each consisted of two pounds of No. 30 enameled copper wire wound on a section-former two inches wide, each layer of winding being separated by a thickness of paraffin paper. The coils were placed upon a primary winding, separated by fiber disks, and connected in series. They were then boiled in and molded in paraffin wax.

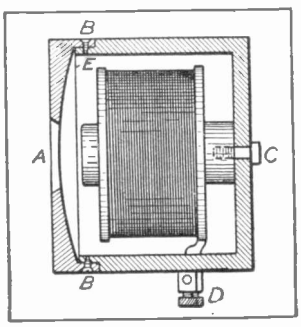
When this coil was connected to the 110-volt alternating current, lighting circuit with a variable impedance coil to regulate the current, it would give a heavy arc nearly an inch long. When I inserted an electrolytic interrupter in series and cut out the impedance coil entirely, I could get a more stringy but very hot spark nearly four inches long. With this I could operate the X-ray bulb to perfection.

After satisfying my curiosity by examining objects with a fluoroscope, I decided to make some shadow pictures. The plates were placed in a plate holder upon which the hand was held. The bulb was placed about ten inches above the hand. The plate was exposed from one to three minutes. The developer used was the standard Eikonogen. The picture shown is a very interesting example of dislocation, which was not attended to at the proper time and caused a permanent deformation so commonly seen on the hands of baseball players. The little bone at the end of the forefinger was turned over at right angles and allowed to set in that position, causing the characteristic blunt, baseball finger.

W. H. ROWAN.

Homemade Telephone Receiver

Secure a round wooden box with a cover, as in the illustration. An old silver-polish box will do. Cut a hole at (A) for the ear piece. From a small round bar magnet cut off with a hacksaw a piece of a length not quite equal to the depth of the box so that it will not quite touch the sheet of ferro-type (E) when in place. Drill and tap it with a ⅛-inch thread to take a screw as at (C). Put a fiber washer on at each end and wind the space between with Nos. 36 or 40 double covered copper wire. Attach the ends to binding posts (D) and secure the magnet in place. If it has lost any of its magnetism by sawing, it may be strengthened by rubbing on a more powerful magnet.



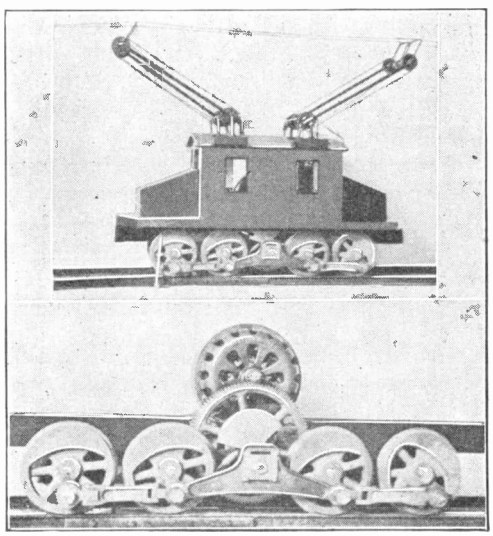
HOMEMADE TELEPHONE RECEIVER

From a photographer get a sheet of thin ferro-type and make it of a diameter to fit inside the cover of the box. Put on the cover and in holes at (B) place small screws to hold it on. The outside of the box may be sandpapered and varnished. This receiver will be found very sensitive and by winding on an extra large amount of wire may be made more so.

S. V. COOKE.

Electric Toy with a Useful Purpose

Although the size of the little electric locomotive shown in the picture is that of a toy, it is an exact model of larger loco-



MINIATURE ELECTRIC LOCOMOTIVE

motives in actual use hauling trains. It is not a plaything, but a part of the electrical laboratory equipment in one of the largest universities in the country. The trolleys are modeled after the latest European design,

and the connection between the motor and the drive wheels is the same as that used in the newest locomotives. As will be noticed from the two overhead wires, this is a three-phase locomotive. It is used to study the effects of various changes in design, the results with this small unit being exactly similar to those which would be obtained with larger and more practical machines.

The drive wheels are about six inches in diameter, and the total length of the locomotive is a little over three feet.

THE YOUNG EDISONS' CLUB

Under this heading will be published letters from readers of the Junior Department. These letters should describe briefly and accurately your experiences in the making and operation of electrical devices and in the performing of electrical experiments. See how good an "engineering report" you can make of your investigations.

The Young Edisons' Club:

My shop is upstairs in a room 15 by 14 feet. I am thirteen years old and in the eighth grade at school.

I first became interested in electricity in 1910 by purchasing an electric solenoid engine.

The second day I had it I burned it out by trying to run it on the 110 volt alternating lighting current. I rewound it and thus got started in the study of electricity.

I have an electric engine, a motor, telegraph instruments, magneto, telephone and an electro-plating outfit.

The magneto, telephone and electro-plating outfit I made myself; the first two were made out of "worthless junk," thrown out by the electrical stores.

Things that they throw away are often useful to the young electrician.

I renew old dry batteries by cutting down the zinc, scraping off the paper, replacing the zinc and putting the battery in water. I sometimes add a little salt or sal ammoniac, the latter being the better. In this way I furnish all my "juice" for running small motors, etc.

I have a hammer, saw, plane, draw knife, bits, chisels and other woodworking tools. My library consists of "Electrical Circuits and Diagrams," Nos. I. and II.; "The New Experimental Electricity," "Electricity for Beginners," "Modern Primary Batteries," "A B C of Electricity," "Questions and Answers About Electricity," Amateur Mechanics," Nos. I. and II.; "Mechanics for Young America," "I. C. S. Handbook on Electricity and Mechanics" and "Simple Chemical Experiments."

I have a stock of chemicals and soon expect to add a wireless to my shop.

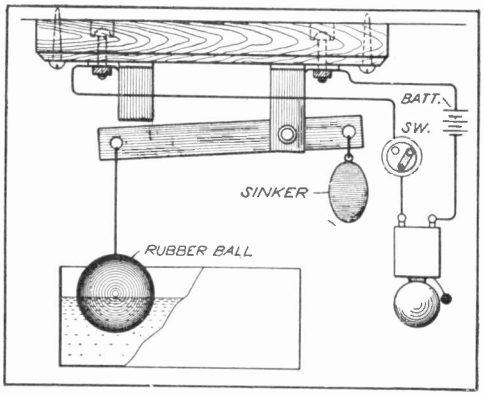
I would like to correspond with other amateurs. I am a subscriber to POPULAR ELECTRICITY, *Popular Mechanics* and *Electrician and Mechanic*.

CHARLES GINGRICH.

Malvern, Kan.

The Young Edisons' Club:

Enclosed find sketch of a tell-tale for the ice-box drip pan. I took one side of an old double-pole knife switch and mounted it on a small block of wood about three by four



TELL-TALE FOR THE ICE BOX DRIP PAN

inches, putting the hinge post a little off center on the blade. An ordinary small rubber ball is used for the float. The ball should be a little heavier than the counter balance, which is a small lead sinker. The whole thing can be mounted on the under side of the ice box by adjusting the rubber ball with the string on it until contact is made when the water is within an inch of overflowing. Once adjusted the pan can be pulled out and replaced without disturbing the device.

WM. HESS.

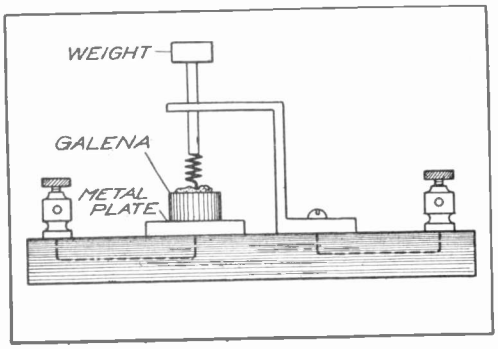
769 Monroe St., Brooklyn, N. Y.

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.

The Galena Detector

The galena detector is one of the most recently developed of this class of instruments. It is very sensitive, and is preferred by many operators to the silicon or even to the Perikon detectors for this reason. It is not influenced by the transmitting apparatus as much as most of the other crystal detectors, and is very easily adjusted.



THE GALENA DETECTOR

Galena, the essential part of the detector, is a natural mineral which is found extensively. It is a sulphide of lead and nearly always breaks into pieces resembling cubes. The surface of galena is generally smooth and bright, and looks very much like a metal.

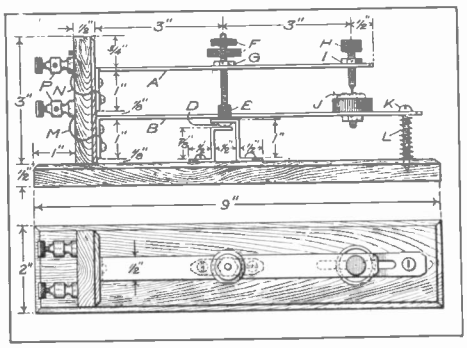
For best results a detector stand similar to that shown in the figure should be used, as it is necessary to have a very light pressure on the galena. The upright rod is free to move vertically through the hole in the horizontal part of the standard and is kept in contact with the surface of the galena by the pressure of the small weight at its top. The spiral, which should be soldered to the lower end of the rod, may be made of a No. 30 copper or phosphor bronze wire. The dimensions of the detector stand are not important, but it should be remembered that a very light contact of the spiral on the galena is essential.

The galena detector is used in the same way as the silicon detector, and no local battery in connection with the receivers is needed.

A. B. Cole.

Constructing a Silicon Detector

Any one can readily construct the silicon detector shown in the illustration. All dimensions are there given. The base and upright are of poplar. Any substantial wood will do. The brass strips (A) and (B) are 1-32 inch thick. The two pieces of No. 14 copper wire (N) and (M) may



THE SILICON DETECTOR

pass around or through the upright as preferred. (P), (G) and (I) are posts and nuts taken off an old dry cell. (G) and (I) are soldered to (A) exactly over holes drilled through it large enough to admit the threaded screws. A piece of hard rubber tubing (E) insulates (D) from (B). Locknuts (F) hold (A) in place after adjustment. The silicon (J) in the cup may be turned around or moved either to the right or left in the slot, while a spiral spring (L) aids in giving a delicate adjustment.

William G. Bursnall.

On Letter Writing

One of the requisites of the successful engineer is not only to be able to do things, but to be able to tell other people how he does them—and that in a concise, intelligible manner.

That is the reason courses in English composition are given in all the great engineering colleges. Young men who are studying the higher mathematics and learnedly discussing the profoundest theories of electricity, thermodynamics, etc., must put in a certain number of hours each week writing little themes and compositions—work which they supposed they had completed when they were in the grades and in high school.

This shows the importance attached to the ability to express oneself clearly.

In Popular Electricity Wireless Club there are hundreds of boys and young men who are able to build and operate complicated sets of apparatus. They know about resonance, wave length, impedance and that sort of thing, but when it comes to writing a simple, well connected letter some of them should be back in the primary department.

We have before us a letter from one young man which is a good example of what not to do.

In the first place, it is written on both sides of the sheet, which is bad.

He starts off by informing us that he is enclosing two application blanks—they were not enclosed.

Then he wants us to insert a notice concerning their local wireless club, but tells us absolutely nothing about it. Perhaps he expects us to make up a name and list of officers by exercise of intuitive, telepathetic reflection.

Next we learn that he is sending under separate cover a few hints on wireless which he hopes we will find available. Hints is a good word. We shudder even now to think of the "hints."

He runs on in the same paragraph to ask us if we want articles and photographs on certain subjects which he mentions. Then he throws in a few more lines, for good measure, to say over again that he is sending the wireless hints under separate cover.

The letter ends there, but a postscript begins, which rambles on telling what apparatus he is going to build this summer, and buried deep down in this postscript, carefully hidden, in fact, are several "Wireless Queries." Then it all ends an eighth of an inch from the bottom of the page.

Now, this criticism may seem harsh and look as if we do not care for letters from P. E. W. C. members. We *do* want letters, but good letters.

When you have questions to ask, put them in a separate letter, addressed to the Questions and Answers Department, and follow strictly the rules printed every month at the head of that department.

If you want Wireless Club blanks and information, write to the secretary of the Wireless Club on that subject alone.

If you want the editor to print an announcement of your wireless club, write to him and enclose on a separate sheet the information for such an announcement.

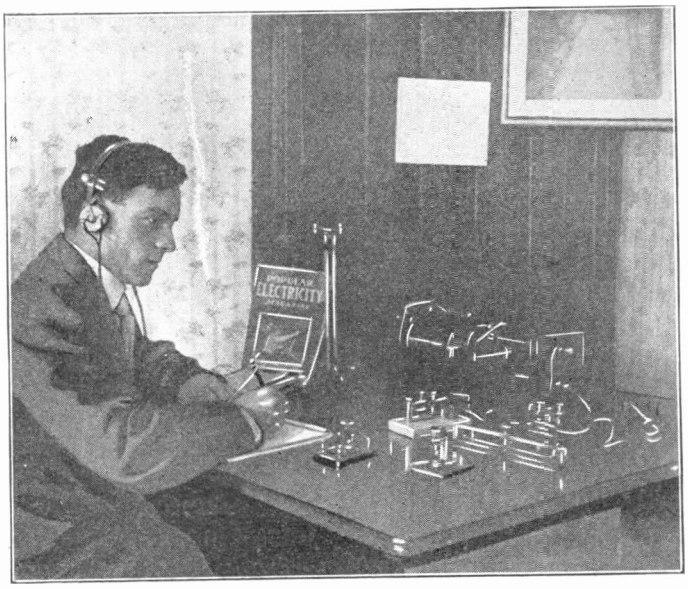
If you have an article, submit it carefully and neatly written with neat drawings on separate sheets, with stamp enclosed. If it comes in scrawled in lead pencil and with drawings like the discharge of a one K. W. transformer, it shall not survive.

Remember that all these different matters are handled by different people, and write separate letters for separate subjects.

A letter is usually a pretty fair index to character. A miserably written, jumbled-up letter indicates that you are inconsiderate of the feelings of the person to whom you are writing, that you are unmethodical, that you are careless and that you are not familiar with the first requisite of business courtesy (every boy expects to be a business man some day).

If your father expected to build a house and asked bids from several contractors, and one of them should sit down and on a piece of scrap paper spatter his figures and estimates all over both sides with a lead pencil, what would your father say? He would say: "This fellow writes a sloppy report. He will probably build me a sloppy house. I don't think I want him."

If each member of P. E. W. C. will read and digest the above it will do him as much good as to build twelve detectors and two helices.



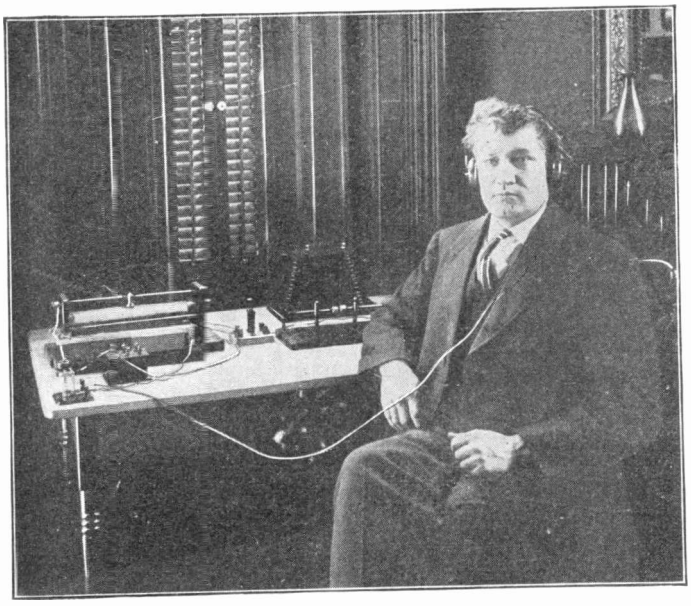
R. W. SHOUPE, WINNER OF THE FIRST PRIZE

Winners of the Wireless Club Contest

In this issue we are pleased to announce the winners of the P. E. W. C. contest, which ended April 30. The winner of the first prize, a gold watch, was Mr. R. W. Shoupe, of Findlay, Ohio. The second prize, a scarab scarf pin, was won by Mr. Ralph S. Wortley, Jr., Bedford School, Bedford, N. Y. The third prize, solid gold cuff links, was won by Mr. A. J. Lyons, 470 Bank street, Cincinnati, Ohio. The pictures of Messrs. Shoupe and Lyons, with their stations, are presented herewith. Unfortunately Mr. Wortley had dismantled his station preparatory to putting in a new one this summer.

Mr. Shoupe writes: "In the foreground you will see the detectors, electrolytic, silicon and 'ferron.' The ferron is the one I have been using exclusively. There is a potentiometer for the electrolytic with two small condensers in back for use in the detector circuit. I have a loose-coupler coil, Clapp-Eastham Company make, which does not show very good, and an extra two-slide tuning coil beside the magazine. Have no variable condenser at present, and am using 3,200-ohm receivers, which have given great satisfaction. My aerial is loop type, 80 feet high and 150 feet long, lower end about 30 feet high. I have been able to read clearly boats on Lakes, and all stations on Lakes as far as Buffalo and Chicago, but hear a great many other stations, but as yet I cannot find who they are. I think the POPULAR the only magazine which gives dependable information on wireless, and have gotten all I know from it, having been a reader for two years. I would not be without it."

In writing of his station Mr. Lyons says: "I use a two-inch spark coil, which I built myself; spark gap, also my own construction; variable condenser, tuning coil (double slide), electrolytic detector, fixed condenser, double phones (2,000 ohms) in series. My aerial is six wires, 55 feet high, 75 feet long. I am able to read stations

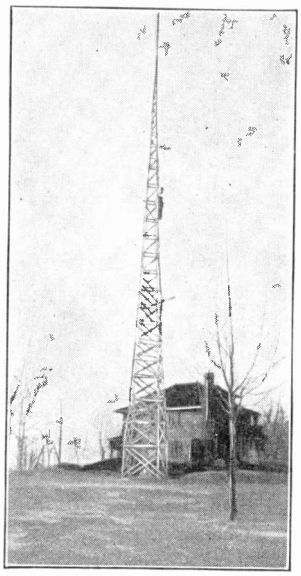


A. J. LYONS, WINNER OF THE THIRD PRIZE

situated in a radius of 100 miles with ease (high power stations). It was through the aid of POPULAR ELECTRICITY that I was able to construct the most of my instruments. I would rather build than buy, as it affords me much more pleasure."

Wireless Tower

Schuler Doron, of Hamilton, Ohio, sends the accompanying picture of his wireless tower. This is an elaborate piece of construction for an amateur, the tower being 94 feet high to the spreader and 104 feet to the top. It is built of two by twos, 20 feet long spliced together, with eighteen-inch laps. The cross braces are made of ¾ by 2½-inch stuff. The tower is seven feet square at the base. The top piece is a two by two, 25 feet long. No. 8 steel guy wires are attached every eighteen feet, four at each place. The top has four No. 12 steel wires to help support the aerial.



WIRELESS TOWER

The aerial, which is not shown in the picture, consists of six No. 10 copper wires 36 inches apart and 160 feet long, the total weight being 38 pounds. The two by twos are longleaf yellow pine and the cross-pieces of white pine. All joints are bolted with ¼-inch bolts. A No. 8 copper wire is run down from the top to ground for lightning protection. The tower has already been struck three times, but so far has been fully protected.

Bridgeton (N. J.) Wireless Club

Persons in and near Bridgeton who desire to join the Wireless Club of that place, address S. B. Ashmead, 275 Bank St., Bridgeton, New Jersey.

Conditions Good for Long Distance Work

Good conditions for the transmission of long distance wireless messages seem to have prevailed during the forepart of the month of January. In the May issue of POPULAR ELECTRICITY magazine, page 81, note is made of Julius Abercrombie of St. Joseph, Missouri, hearing the "skeeter" spark on the night of Jan. 9.

Lorne D. Beggs, 2421 So. Millard Ave., Chicago, writes: "On the night of Jan. 1 at 11:45 P. M. I heard NAR (Key West Fla. Naval Station) call NAX (Colon, Panama) and changing my tuning slightly I heard Colon answer. The height of my aerial is 100 feet at one end and 48 feet at the other. It consists of two strands of aluminum wire strung north and south and is 225 feet long. I use different kinds of crystals for detectors but for long distance receiving silicon serves me best. My head phones are each of 1000 ohms resistance."

Allegheny County (Pa.) Wireless Association

This association was recently organized for the purpose of studying wireless telegraphy and telephony among amateurs. Officers elected are as follows: George B. Richards, Jr., president; Lawrence Montgomery, vice-president; Burton P. Williams, secretary; Arthur O. Davis, treasurer.

Members must own and operate a wireless station and must live in Allegheny county. No charge for membership. Address the Secretary, 2321 Perryville Ave., N. S., Pittsburg, Pa.

Bronx (New York City) Wireless Association

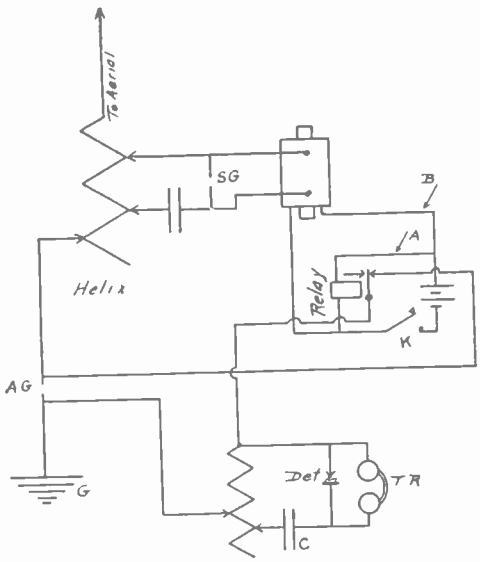
The Bronx Wireless Association recently organized, extends an invitation to those interested in wireless and living in the Borough of The Bronx to join. Address communications to Chas. F. White, 500 East 165th Street, New York City.

A "Break-in" System

The aerial switch as a device to disconnect the receiving instruments from the aerial while the transmitting apparatus is in operation and vice versa has two main disadvantages. One is that of inconvenience. Each time the operator wishes to send or receive it is necessary to throw the switch blades to the proper position.

The second and more important disadvantage of the aerial switch is that the operator has no means of determining whether the receiving operator is having difficulty in "copying" him.

Several systems of wiring have been devised to eliminate the aerial switch, and the



A "BREAK-IN" SYSTEM

main objection to some of them is that occasionally the high-voltage currents of the secondary of the transformer or coil finds its way into the receiving circuits. In other systems it is difficult to keep a mineral detector in a highly sensitive condition, due to high-voltage "kick-backs."

The system of wiring shown in the drawing has given the writer excellent results, and the detector always remains in adjustment. The ordinary wireless instruments will be recognized in the figure. A twenty-ohm Pony relay is used. The contact screws of the armature are reversed, so that when current flows through the electromagnets the circuit containing the armature will be broken instead of completed, as is ordinarily the case. In connecting up the relay it is important that the bridge holding the contact screws be connected to the high voltage side of (AG), a small spark gap, that is, to the side connected to the helix.

The small distance between the terminals of (AG) must be very small—smaller, in fact, than the distance between the relay armature and the metal contact point when the armature is drawn down on the electromagnets. A good way to set the gap is to insert a piece of thin paper between the spark gap terminals, and then clamp them down. (AG) must be placed close to the ground connection.

If the gap is too long, sparks will pass between the armature and the contact point, and high-tension currents will flow into the receiving circuits. If, on the other hand, the spark gap terminals are in contact, the receiving instruments will not operate, as the oscillations will be conducted directly to earth.

The operation of this system is as follows: When the key is depressed, current flows through the spark coil or transformer, and a certain amount also passes through the relay electromagnets, thereby energizing them and causing the armature to cut the receiving circuit off from the aerial. As the key is released and the coil ceases to operate the relay armature is drawn back by its spring, and the receiving instruments are again connected to the aerial. It will be seen that the operator can receive signals while he is sending, and can therefore determine whether the receiving operator is trying to stop or "break" him.

Every experimenter in wireless telegraphy should adopt a break-in system, for it is a great convenience, facilitates conversation by wireless, and what is more important, keeps the experimenter informed as to whether a government or commercial station is trying to work through his "interference."

In case 110-volt direct current is being used to operate the coil in series with an interrupter, a two-candlepower 110-volt lamp should be connected in series with the electromagnets of the relay at the point marked (A) in the drawing. The interrupter should be placed at (B).

Always be certain that the distance between the spark gap terminals (AG) is small and that the relay is operating properly, before using the receiving apparatus.

A High-Power Wireless Equipment

By ALFRED P. MORGAN

PART XV.—DIRECTIONS FOR OPERATING.

This series of articles would hardly be complete without some directions regarding the operation and the handling of the instruments after they have been built. Realizing this fact, I shall try to give as explicitly as possible in the following pages, instructions on how to erect and operate a station so as to secure the best results.

THE OPERATING ROOM.

The first matter requiring our attention after the erection of the aerial and its supporting masts is the arrangement of the operating room. The room should have at least 60 square feet of floor space available for wireless purposes. It should be well ventilated and lighted and as nearly sound proof as possible. It must be free from vibration. The room should preferably be located so that the leading-in wire will not come in the neighborhood of large conducting bodies. Where the station is isolated or a suitable operating room is not convenient, an automobile house of the portable type makes a very desirable room. The aerial lead-in should be carried over the ceiling and wall to the aerial switch on the operating bench.

The bench should be strongly built of dry, well-seasoned wood and given two coats of varnish. It should be about two and one-half feet wide, not less than seven feet long and of convenient height for working the sending key while sitting down in an ordinary chair.

WIRING THE INSTRUMENTS.

The aerial switch is mounted in about the centre of the table well toward the back, Fig. 164. The aerial is connected to the binding post marked (A), Fig. 165, at the back part of the switch. The post marked (D) is connected to the earth by a heavy rubber covered stranded wire equal at least a No. 8 gauge solid wire in conductivity.

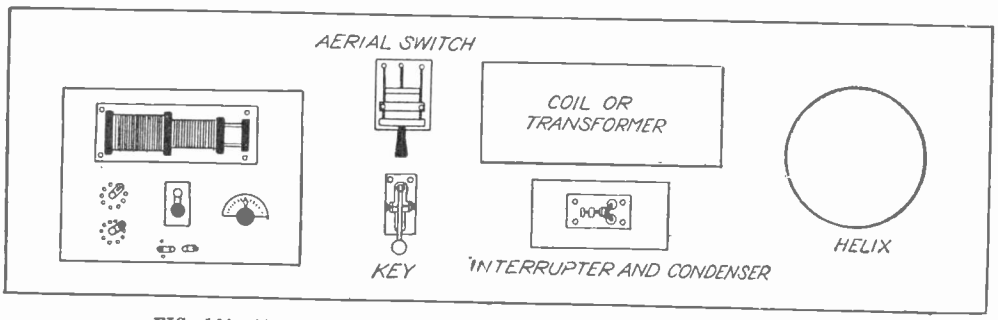


FIG. 164. ARRANGEMENT OF INSTRUMENTS ON OPERATING TABLE

It is a common fault of amateur wireless experimenters that they take great pains with the aerial and are very careful to use stranded wire of large surface area in this part of the work, but on the other hand employ a small solid wire for the ground, which in many cases is so small as to effectively choke off part of the ground current.

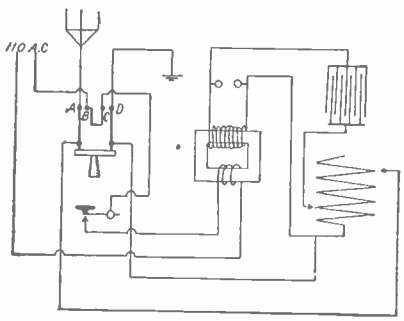


FIG. 165. WIRING OF TRANSMITTER WITH TRANSFORMER

The ground connection should be of the lowest possible resistance. Where connection can not be had to water pipes, at least two copper or zinc plates about three feet square should be buried five or six feet deep in moist earth. Temporary ground connections can be established by spreading a large area of wire netting over the earth and connecting to it.

The source of current supply for the operation of the transmitter should be provided with the customary fuses and switch. One side of the line is lead down to the post marked (B) of the aerial switch.

The transmitting key is mounted either directly in front of the aerial switch or slightly to the right and far enough back

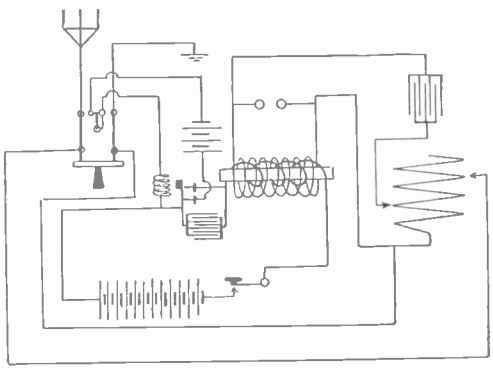


FIG. 166. WIRING OF TRANSMITTER WITH INDUCTION COIL

so that the operator can rest his arm comfortably on the table with his fingers on the key knob. One contact of the key is connected to the post (C) on the aerial switch.

The other key contact is connected to one terminal of the transformer, providing of course, that the source of current at hand is alternating. The other terminal of the transformer is connected to one side of the current mains. The primary circuit is then completed by throwing down the aerial switch and passing the key.

If the current supply is direct or if batteries are to be used the independent interrupter and the induction coil must be used. The wiring of the primary circuit must then be carried out in a different manner, as illustrated in Fig. 166. In this case, when the aerial switch is thrown down the armature of the independent interrupter is set into vibration. The primary circuit is completed by closing the key. The condenser shunted across the main contacts of the interrupter should be adjusted until the sparking is reduced to a minimum.

The secondary terminals of the induction coil or transformer are lead to the binding posts of the spark gap. One side of the spark gap is in turn connected with one terminal of the oscillation condenser. The other terminal of the condenser is led to one of the movable clips on the sending helix. The other side of the spark gap is connected to the lower end of the transmitting helix and then led to post (G) on the aerial switch. The other clip is connected to post (H). All wiring of the transmitter should be done with high tension rubber covered stranded wire. The oscillation condenser is so unwieldy and occupies so much room that it may best be set on the floor under the bench.

The receiving apparatus may be mounted on a cabinet or left so that it is movable and entirely separate. In the former case a hard wood case, Fig. 167, 16 by 18 inches and 5½ inches deep is necessary. The receiving transformer is mounted towards the back of the case, directly in the center. The detector is placed in front with the potentiometer on the left hand and the variable condenser on the right. When this arrangement is used the variable condenser case is not necessary and the unit is enclosed in the cabinet.

The fixed condenser is mounted on the front of the case. A three point single pole switch in front of the detector enables the number of cells in the detector circuit to be varied. The cells are placed inside of the case and secured in position by a couple of copper straps passing around them. A single point switch is connected directly across the terminals of the detector so that when the switch is closed the detector is short circuited and the spark of the transmitter when the latter is in operation, will not throw it out of adjustment.

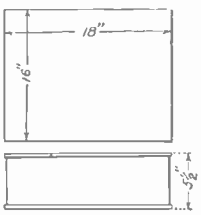


FIG. 167. RECEIVER CASE

The terminals of the telephone receiver cord are attached to a small attachment plug. The receptacle into which the plug fits is countersunk into the front of the case.

In choosing a pair of telephone receivers select those having consequent poles on

the permanent magnets, that is, the permanent magnets are ring shaped and the electromagnets are attached at diametrically opposite points. Choose a receiver built for wireless purposes and not merely a rewound telephone receiver. The resistances should be from 1000 to 1400 ohms each. Two receivers of the same resistance but of different makes will not give the same results. Resistance is merely arbitrary and

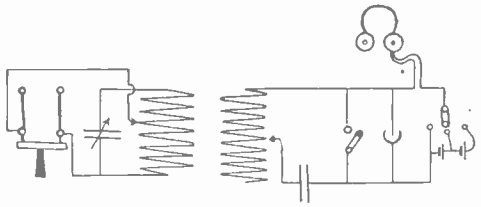


FIG. 168. WIRING DIAGRAM OF RECEIVING APPARATUS

does not indicate much. Even with two receivers of the same make and style it does not mean that a 2000 ohm receiver is necessarily more sensitive than one having a resistance of 1000 ohms. The 2000 ohm receiver would have the greatest number of turns but the turns might be carried so far as to produce too much impedance.

Neither can the strength of the permanent magnets be used as an indicator of the sensitiveness of a telephone receiver. It is possible for the magnets to be too strong, especially when the diaphragms are very thin. The diaphragms in that case are saturated with magnetism and will not tend to respond to the current impulses flowing through the electromagnets.

The complete wiring diagram of the receiving apparatus is shown in Fig. 168.

ADJUSTMENT.

The first adjustment to be made about the apparatus is to set the key points exactly true and square to each other. The amount of play allowed the key lever is variable and should be suited to the hand of the particular operator. The key points should be filed until they are perfectly flat across and their entire surfaces come into contact.

If the induction coil is to be used in place of the transformer, the interrupter will next require attention. After the adjusting screws have been set where the spark from the coil is regular and steady the condenser shunted across the main contacts should be adjusted until most of the sparking is eliminated.

Place the hot wire ammeter in the aerial circuit by connecting it as shown in Fig. 90 (Nov. 1910 issue). The method of adjusting the circuits so as to bring them into syntony has already been described in part VIII., in the above issue.

The oscillation condenser and the spark gap should be adjusted so that the spark is white and crackling. If insufficient condenser is used the spark will be red and flaming, while on the other hand if too much capacity is used the spark will be very irregular and intermittent. If the gap is too short the spark will be hissing and sound "mushy."

After the circuits are tuned the ammeter should be taken out of circuit.

Do not alter the helix or the condenser capacity, after the circuits have once been adjusted, without retuning them.

When the handle of the aerial switch is thrown downwards the transmitting circuits are connected to the aerial and ground in position for sending.

The receiving apparatus requires the most delicate adjustment but usually more easily handled since any changes instantly manifest themselves in the telephone receivers.

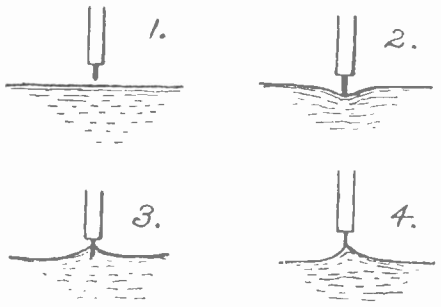


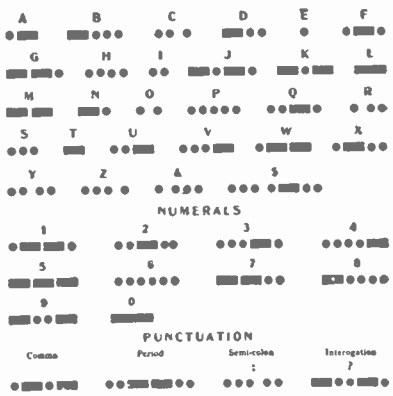
FIG. 169. SUCCESSIVE STAGES IN ADJUSTING ELECTROLYTIC DETECTOR

When the handle of the aerial switch is thrown up the aerial and ground are connected to the receiving apparatus.

The electrolytic detector is more sensitive than the mineral or crystal type but its sensitiveness depends upon its adjustment. The thumbscrew should be carefully lowered until the lower end of the Wollaston wire touches the surface of the acid electrolyte in the cup beneath and a distinct "click" is heard in the telephone receivers. A faint bubbling will also be audible. If the adjusting screw is now carefully and slowly turned so as to raise the Wollaston wire the

bubbling noise will change to a hiss. Fig. 169 shows the successive stages of adjustment. The potentiometer should now be adjusted until the hissing noise entirely disappears. It is always well to set the potentiometer on the last point so that the greatest amount of current flows through the detector and phones. Then reduce the current.

THE MORSE TELEGRAPH ALPHABET



In order to adjust a mineral detector merely twist the crystal about until the most sensitive spot is found, then adjust the pressure of the spring. Always be sure that the fingers are perfectly clean and free from oily matter before handling the crystal so as not to destroy its sensitiveness.

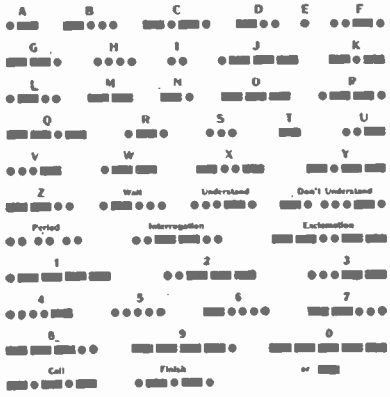
Efficiency in the handling of wireless instruments comes only with practice and experience. For convenience the two wireless codes are here shown. The method of procedure in the actual transmission and reception of wireless messages is too well known to readers of this magazine to bear repetition here.

In order to adjust the loose coupler first adjust the primary by moving the slider into the position where the desired signals are the loudest. Then adjust the secondary by pulling the slider handle in and out. As soon as the best position is found pull the secondary out of the primary until all undesirable signals disappear and only those which are to be read are distinct and clear. Further adjustments may be made by moving the handle of the variable condenser.

As soon as the message has been received the detector should be shunted by throwing the single point switch. The detector will then not be thrown out of adjustment by the operation of the transmitter.

Having worked all these weeks or months and finally produced with your own hands a set of instruments which will enable you to transmit and receive intelligible messages to and fro between yourself and some other worker, perhaps to you hitherto unknown, you sit down and with palpitating heart clamp the receivers to your ears. When

WIRELESS CONTINENTAL TELEGRAPH ALPHABET



suddenly, over unknown distances, there comes to you those unmistakable sounds which spell to you a message, and you are able to answer that message with your key —well, that is one kind of satisfaction; you will wait a long time for a greater.

(The End).

Music by Wireless

In this remarkable era of progressiveness, it is not unusual to hear of new and incredible things any time. The writer has an amateur wireless station and while listening one evening a short time ago, heard what appeared to be some one adjusting the vibrator on his spark coil. Listening attentively for a few minutes, musical sounds began to come, and then real music, "Yankee Doodle," "My Country 'Tis of Thee," "Nearer My God to Thee" and some popular airs being rendered by some one with a natural talent for music.

On inquiry I found out who it was, and he told me he made the various tones by simply changing the adjustment of the vibrator.

This should be an idea for some one to make a "wireless piano."

I. W. WHITMAN.

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.

Tuning Coil Shape; Buzzer Set; Operation of One-inch Coil

Questions.—(A) Would a tuning coil with a square core be as satisfactory as one with a round core? (B) Is No. 27 S. C. C. wire too fine for a tuning coil? (C) Recently you described a buzzer set to work three or four blocks. Would it be possible to send as far as one mile, using a buzzer four times as large? (D) Would it be better to connect a one-inch spark coil to 110-volt mains in series with lamps, or to build a small transformer to cut down the voltage for the coil?—O. M., Allegan, Mich.

Answers.—(A) For experimental purposes the former would be as good as the latter. If to be used for long-distance reception of signals, however, we should prefer to use a round core. The received oscillations are of comparatively high voltage and of high frequency, and it is therefore desirable to avoid all sharp corners or points on all apparatus.

(B) This wire would give good results, but we should recommend No. 20 wire as having less resistance.

(C) It is possible that a large buzzer could be used to do this work, but it would be necessary to use a large and high aerial.

(D) The use of a small transformer would give very much better results, since the voltage supplied to the coil would be nearer to that for which it was made. A voltage of from nine to twelve gives good results.

Binding Post Connections on Tuning Coil; Condenser Foil; Stations Near Niagara Falls

Questions.—(A) When done winding a single slide tuning coil, how are the binding posts connected to the wire? (B) What is the best kind of tinfoil for a fixed receiving condenser? (C) Where is the nearest high-power station to Niagara Falls?—R. Y., Niagara Falls, N. Y.

Answers.—(A) Connect each end of the wire to a binding post, and fasten a binding post to the slider rod.

(B) A fairly heavy foil is preferable, as it has greater strength to withstand bending and handling.

(C) There are two stations in Buffalo, call letters CB and BF.

Three Slide Tuner; Detector

Questions.—(A) What instruments and what height aerial should be used in connection with a three slide tuner wound with 500 feet of No. 20 enameled wire and electrolytic detector to receive from 500 to 600 miles? (B) Is there any detector which is more sensitive than the electrolytic?—D. C. F., Homer, N. Y.

Answers.—(A) If you also use a fixed condenser and a good pair of 500 or 1000 ohm wireless receivers, an aerial at least 60 feet high and 75 feet long should give satisfactory results.

(B) Yes, the perikon, composed of one metallic cup holding a crystal of chalcopyrite, pressing against another cup holding a crystal of zincite, in such a way that the minerals are in contact.

Detectors; Tuning Coil; Coil on 110 Volts

Questions.—(A) Should the brass piece which makes contact with the silicon of a silicon detector be sharp or round? (B) Of what does a perikon detector consist? (C) Has the variable coupling tuning coil, described in the January, 1910, issue, sufficient inductance to respond to commercial stations? (D) I have spoiled the condenser of my ¾-inch spark coil. Will the coil operate satisfactorily in connection with an electrolytic interrupter on 110 volts alternating current, without the condenser? (E) What flux can be used to make solder adhere to silicon? (F) Is there a better way to fasten silicon to a brass cup than by soldering it?—A. B., Iron Mountain, Mich.

Answers.—(A) The use of a sharp point is considered to make the detector more sensitive, but it will be found that a detector using a round or flat terminal will stay in adjustment longer.

(B) The perikon detector consists of a piece of zincite held in a metal cup and a piece of chalcopyrite or bornite held in a similar cup, one cup being so arranged that the mineral in it is pressed against the surface of the other mineral by the action of a spiral spring.

(C) Yes, it will respond to a maximum wave length of about 600 meters. For longer wave lengths use a single slide tuning coil connected in series with the primary.

(D) Yes, unless the high voltage produced by the rapid action of the electrolytic interrupter breaks down the insulation of the secondary winding. The interrupter of

the coil should be tightened so that it will not operate.

(E) No flux is needed. The cup is heated until it will melt solder, which is then placed in it. Remove the cup from the flame when nearly full of solder and just before this solidifies press the silicon into it and hold it in place until the solder cools.

(F) Yes, instead of solder use Wood's metal, composed of four parts bismuth, two of lead, one of tin, and one of cadmium.

A. C. Dynamo on Wireless Coil; Conductor for Transformer

Questions.—(A) I have an A. C. dynamo of 75 volts and 27 amperes capacity at 100 cycles. Will this operate the open-core transformer described in the December, 1910 issue, and what changes will be necessary in the transformer? (B) What number and what size glass plates should be used in a condenser for this transformer?—G. C. E., Arbuckle, Cal.

Answers.—(A) The generator will operate the transformer, and no changes will be necessary. The reactance coil will allow any adjustment of current which may be desired.

(B) The plate condenser described in the September, 1910, issue under a High-Power Wireless Equipment will give good results with this transformer.

Phosphor Bronze Aerial

Question.—Is a single strand of No. 14 phosphor bronze wire as satisfactory in an aerial as a No. 14 stranded phosphor bronze wire?—G. S., New York City.

Answer.—No; because the stranded wire has a much larger surface, and consequently offers less resistance to the high frequency currents.

Transformer Rating; Contacts for Crystal Detectors

Questions.—(A) One-half kilowatt wireless transformers are listed at $30 and upward, and are not guaranteed for over fifty miles at best, while one concern lists a ½ K. W. transformer coil with electrolytic interrupter at less than $10, and they guarantee it to send 100 miles with an aerial 100 feet high. How is this explained? (B) How far would the ½ K. W. transformer coil send with six-wire aerial fifty feet high? (C) What are the best contacts for silicon, carborundum and molybdenite?—F. G. A., Fayette, Mo.

Answers.—(A) The transformer is an instrument which is standard among the American commercial wireless telegraph companies, and, in general, is a well designed and well built instrument. The transformer coil is a spark coil without an interrupter, and was brought out to sell to a class of trade who prefer a cheap apparatus to an efficient one.

In regard to guarantees, it is merely necessary to look into the commercial standing of the guarantor to discover what the guarantee is worth.

(B) We have never heard an authoritative report of such a coil sending over fifteen miles under any conditions. It is not the length and size of the spark within the station that counts for transmitting. A spark ⅛ inch long might transmit three times as far as one two inches long.

(C) Carbon gives very good results with silicon and carborundum, and the molybdenite detector is made with a brass point.

Test Tube Condensers; Detector Trouble; Aerial

Questions.—(A) Are test-tube condensers satisfactory having tinfoil on the outside and a solution of salt in water inside? (B) I am using an electrolytic detector, but the acid eats up the wire as fast as I put it in. Why is this? (C) Will No. 16 copper wire, such as bought at hardware stores on spools, be all right for my aerial?—H. C. C., Gainesville, Fla.

Answers.—(A) Yes, for small coils. You would need ten of the standard size tubes for your one-inch spark coil.

(B) The Wollaston wire, which is used in these detectors, consists of a very fine platinum wire coated with silver. The platinum wire is so small that it is practically impossible to see it. You should lower the wire into the acid until you hear a click in the receivers, and then wait for three or four minutes until the acid dissolves the silver coating off the wire. The potentiometer should then be adjusted until a very slight hissing sound is heard, when the detector will be ready for use. If it is impossible to reduce the hissing to a low amount, use less battery on the potentiometer.

(C) Yes; it will give good results.

Tube Variable Condenser

Question.—(A) What should the clearance be between the two tubes of a variable condenser for receiving? Does the size of the tubes make any difference as to efficiency as long as the difference in diameter is correct?—R. D., Washburn, Wis.

Answer.—(A) The clearance should be as small as possible, so long as the tubes do not touch. All other conditions being the same, if the clearance is reduced one-half the capacity will be doubled.

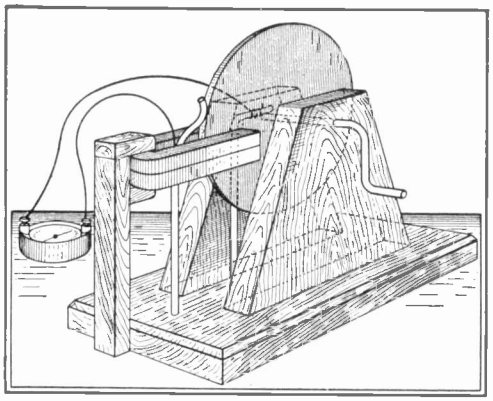
QUESTIONS AND ANSWERS

Rules:—Questions must be addressed to the "Question and Answer Department" and contain nothing for other departments. Full name and address of the writer must be given; only three questions may be sent at one time; 2-cent stamp must be enclosed for answer by mail. No attention will be paid to questions which do not comply with these rules.

First Electric Generator.

Question.—When and by whom was the electric generator invented? Was this machine a direct current machine or an alternator?—J. D. B., Rusellville, Ky.

Answers.—Faraday believed that Arago's disk of copper whirling near a magnet had a current induced in it. Accordingly Faraday set to work to collect this current and make it flow through a wire. He placed the copper disk between the poles of a magnet (see cut) and connected wires to a galvanometer. One wire from the galvanometer was connected to the shaft of the disk, while the end of the other wire was held against the disk as it was revolved. The galvanometer needle was deflected showing a current to be flowing and thus Faraday



FARADAY'S ELECTRIC GENERATOR

in 1831 took the first step towards establishing the principles involved in building the dynamo. In 1833 Saxton and Clarke placed bobbins of insulated wire on an axis and spun them in front of steel magnets and obtained alternating current. In 1867 Siemens and Wheatstone suggested a coil of wire rotating between the poles of an electro-magnet embodying the idea of the series dynamo. Gramme applied the idea of Siemens to Pacinotte's ring thus producing the first ring armature and also the first dynamo capable of giving strong current. This was in 1868.

Resistance of Various Metals; German Silver Wire

Questions.—(A) Please give the approximate electrical resistance of various metals as compared with copper. (B) When speaking of German silver wire which kind is referred to if the per cent is not mentioned?—B. L., Chicago.

Answers.—(A) Assume the resistance of copper to be represented by 1, the resistance of the following metals is indicated by comparison as follows: Aluminum, 1.5; platinum, 6; Norway iron, 7; pure nickel, 7; soft steel, 8; ferro-nickel, 17; 18-per-cent German silver, 19; manganin, 24; 30-per-cent German silver, 28; climax, 50; nichrome, 60.

(B) Eighteen-per-cent German silver wire.

Battery Terminals in Salt Water.

Question.—Which terminal or lead from a storage battery will give off bubbles when placed in a solution of salt water?—W. W. H., Clay Center, Kansas.

Answer.—The negative. The greatest number of bubbles collect on the electrode to which current is passing through the electrolyte, or at the kathode.

Magnets

Questions.—(A) What is a natural magnet? (B) A compound magnet?—C. S., Chicago.

Answers.—(A) A natural magnet is the name given to loadstone, a magnetic mineral found in the natural state.

(B) A compound magnet consists of a number of single magnets separately magnetized and bound together in a bundle.

Licenses Under Patents—Definition: Form and Execution; Implied License

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

LICENSES—*Definition.*—A license in patent law is a transfer of any interest in a patent less than that conveyed by an assignment; that is, any transfer which does not pass to the transferee either the entire monopoly under the patent or an undivided part thereof, or the entire monopoly within and throughout a specified territory. The owner of a patent has three distinct rights under it which he may dispose of either together or separately, namely: the right to make the patented article, the right to use, and the right to sell. A grant, although exclusive, which does not convey all these rights, is a license; as for example, a grant of the right to make only; or the right to use; or the right to sell; or the right to use and sell, but not to make; or the right to make and use and grant to others to make and use, but not to sell; or the right to make and sell, but not to use. So also the right to make, use, and sell the patented invention for a specified purpose only, or an exclusive right within certain territory, with a reservation to the grantor of the right to sell articles of his own manufacture therein, or to revoke the agreement, is a mere license.

A LICENSE IS A MERE WAIVER by the licensor of all claims for damages for what would otherwise be an infringement by the licensee.

FORM AND EXECUTION—*No Particular Form of Words is Necessary* to constitute a license; any act or language which confers upon the licensee the right to use the patent, which use would otherwise be unlawful, is sufficient.

WRITING OR RECORDING UNNECESSARY.—Licenses and contracts affecting patent rights not amounting to assignments need not be in writing, nor recorded.

IMPLIED LICENSE—*In General.*—A license under a patent need not be express, but may be implied or inferred from the relations and acts of the parties. Whether a license will be implied, or its extent if implied, will depend upon the peculiar facts of each case, the question being whether or not the circumstances are such as to estop the owner of the patent from asserting infringement. A license may be inferred from the acquiescence by the patentee in one use of the patent and his acceptance of compensation for such use.

LICENSE IMPLIED FROM LICENSE.—A license to make certain use of a patent may carry with it by implication the right to make other use not expressly granted. In general a license carries with it whatever further license may be necessary to make the license granted effectual. Thus the grant of a right to use a patented invention may carry the right to make the thing to be used. So where one sells a patented article which can be used only in connection or combination with another patented invention belonging to him, a license to make such use of the latter invention may be implied. But the sale of a patented article does not ordinarily import the vendor's permission to use it in such a way as to infringe another patent belonging to him.

LICENSE IMPLIED FROM SALE OF PATENTED ARTICLE.—The purchaser of a patented article from the patentee or other person authorized to sell ordinarily acquires by his purchase an unrestricted right to use or sell the patented article.

EXTENT OF RIGHT.—By such sale the specific article sold is wholly removed from the monopoly, and the purchaser, although from a territorial assignee or licensee, may use or sell the article anywhere. The purchaser acquires also the right to repair the article purchased, but not to construct a new one.

PURCHASER BOUND BY STIPULATION IN LICENSE.—It has been held that the purchaser of a patented machine from a licensee is bound by condition and restrictions as to the use of the machine contained in the license of which he had notice.

LICENSE BEFORE PATENT.—It is provided by statute that "every person who purchases of the inventor, or discoverer, or with his knowledge and consent constructs any newly invented or discovered machine, or other

patentable article, prior to the application by the inventor or discoverer for a patent, or sells or uses one so constructed, shall have the right to use and vend to others to be used, the specific thing so made or purchased, without liability therefor." In order to come within this provision the machine or other article must have been either purchased from the inventor or constructed with his knowledge and consent; a fraudulent or surreptitious purchase or construction is insufficient. But when purchased from or made with the consent of the inventor, the particular article is set free from the monopoly. The right may be exercised only in respect to the specific thing made or purchased, and does not include a general right to use the invention.

IN CASE OF INVENTIONS BY EMPLOYEES.—Where an employee makes an invention in the course of his employment and at the request and with the assistance of his employer, and permits the employer to use such invention without making any claim for compensation, a license for such use will be implied. On the other hand, an implied promise to pay a reasonable compensation for such license may also be inferred from circumstances.

EXTENT OF LICENSE.—The implied license to an employer, if it relates to a process, ordinarily authorizes him to practice the process during the whole period of the patent; but if the invention is of a machine, only the specific machines that have been set up during the period of the employment are covered by the license. If the patented article is a product, to be used in quantities, the unlimited use during the period of employment may raise an implication of an unlimited license, as in the case of a process.

INVENTION BY GOVERNMENT EMPLOYEES.—Where an invention is made by an officer or employee of the United States in the direct course of his employment and at government expense, the United States acquires the right to its use without liability to the inventor. In such case there is an implied license for such use, and no contract for compensation will be implied. It seems, however, that in such case the government acquires no further right to or interest in the invention than the right to manufacture and use it for its own purposes without liability.

NEW BOOKS

THINGS A BOY SHOULD KNOW ABOUT WIRELESS. By Thomas M. St. John. New York: Thomas M. St. John. 1910. 126 pages with 109 illustrations. Price, $1.00.

A book written to interest a boy in wireless by giving some of the theory and numerous drawings and diagrams to simplify the points discussed.

HOW TO USE THE ELECTRIC LIGHT WITH ECONOMY. By Frederic H. Taylor. New York: Spon and Chamberlain. 1910. 76 pages with fifteen illustrations. Price, 25 cents.

A handbook for users of electricity for lighting or heating, which gives in a non-technical way information and little points that mean economy and efficiency when observed.

THE ANSCHUTZ GYRO-COMPASS. Kiel, Germany: Anschutz & Co. 1910. 110 pages with 45 illustrations.

This book explains the principle, construction and practical use of the Auschutz gyro-compass. The opening pages are devoted to a history of gyroscope experiments, followed by a description of how a compass is made and operated on the gyroscope principle.

ELECTRICAL CONTRACTING. By Louis J. Auerbacher. New York: McGraw-Hill Book Company. 1910. 150 pages with 225 illustrations. Price, $2.00.

A book written for the wireman and contractor, giving him practical hints upon shop system, estimating, wiring construction and methods and hints on getting business. The author aims to follow underwriters' rules.

MATHEMATICS FOR THE PRACTICAL MAN. By George Howe. New York: D. Van Nostrand Company. 1911. 143 pages with 42 illustrations. Price, $1.25.

This work assumes that the mathematical knowledge possessed by those who study it extends only over the subject of arithmetic. It aims to give the student a fundamental notion of higher mathematics by beginning with algebra, then treating of the elements of geometry, the simplest elements of trigonometry, logarithms, coordinate geometry, and concludes with 25 pages of elementary calculus. The book may serve to show the earnest student or engineer what the higher branches are like and whet his appetite for more.

ON POLYPHASE SUBJECTS

From far off India comes a letter from Mr. Bhattacharya, of the city of Cuttack.

Popular Electricity Around the World

He had seen a copy of POPULAR ELECTRICITY MAGAZINE and wished to subscribe to it. "It is, indeed, a matter of great regret," he says, "that many useful American publications are not made known in India. I shall be glad to represent you in this part of India, and can devote a part of my time."

This letter suggests to us that possibly American readers of the magazine would be interested in knowing what foreign countries are represented on our subscription list. So we are giving the following list, which indicates that POPULAR ELECTRICITY is read pretty nearly all over the world.

The magazine reaches: Arabia, Australia, Bermuda, Brazil, British West India, Canaries, China, Canada, Cuba, East Indies, England, France, Germany, Greece, Holland, Hawaii, India, Ireland, Italy; Japan, Korea, Kusai, Mexico, Philippines, Porto Rico, Russia, South Australia, San Domingo, Spain, Switzerland and Turkey.

There have been made in France experiments in the distillation, with the electric arc, of various metals and metalloids.

Vaporizing Iron

One authority concludes, as the results of these researches, that there exists no known substance which cannot be distilled in our laboratories.

The ebullition of iron is very difficult to produce, yet one experimenter claims to have distilled 400 grams of iron in 20 minutes with an electric current of 1,000 amperes at a pressure of 110 volts. In all cases, it is said, the vapors of the metals condense in the form of a crystalline dust, possessing all the chemical properties of those metals when reduced to the form of powder.

The French experiments are thought to throw light on the probable temperature of the sun, where iron and the other chemical elements exist in a state of vapor. The maximum temperature of the electric arc is about 3,500° C. But, owing to the greater pressure produced by gravitation on the sun, it is probable that the temperature of ebullition of the elements there is higher than on the earth.

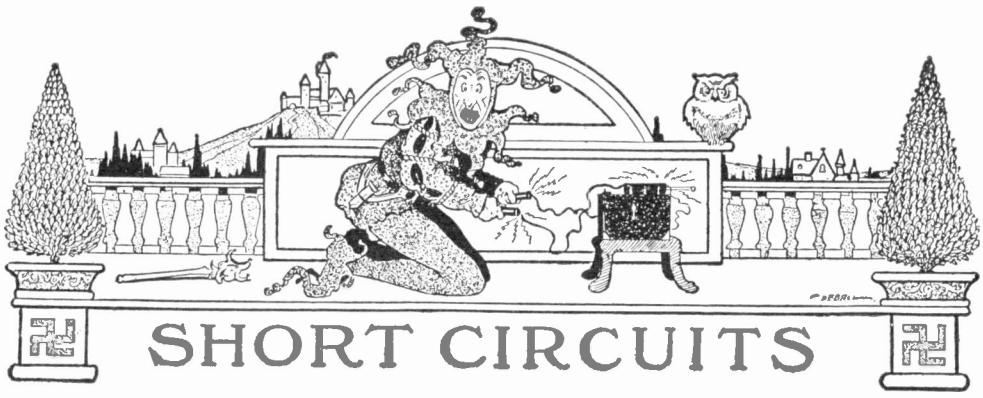
The fact that the effective life of incandescent electric lamps is much longer with clear than with ground glass bulbs may be explained as follows:

Why Clear Lamps Last Longest

A thin deposit of carbon is formed on the interior surface of the bulbs, and this absorbs a certain portion of the radiation from the filament. When the glass is clear the light passes straight through, suffering a definite loss from the carbon film. When the glass is frosted the light undergoes many reflections in the interior of the bulb from the innumerable facets, and at each reflection it loses something on account of the obstructing film. The consequence is that the total amount of loss is much greater with ground glass than with clear glass. One series of experiments showed that the filament lasts as long in the one kind of bulb as in the other.

The successful operation of an electric furnace, especially in a commercial process, where heat must be applied on a large scale, is not so easy as it might seem to be at first thought. The cost often makes the use of electricity prohibitive and this point is well illustrated in the matter of making electrodes for big furnaces. Arc lamp carbons are not hard to make, but the construction of an electrode 24 inches in diameter and 120 inches in length is costly, and under present methods requires a good knowledge of both mechanical and chemical engineering. The field is open for an inexpensive method for making large electrodes.

Furnace Electrodes Costly



SHORT CIRCUITS

Teacher (to new scholar)—"How does it happen that your name is Allen and your mother's name is Brown?"

Little Lad (after a moment's thought)—"Well, you see, it's this way. She married again and I didn't."

* * *

Here is one of Senator "Bob" Taylor's favorites: "A congressman named Johnson, from Indiana, called an Illinois representative a jackass. Called to order for an unparliamentary expression, he said: 'While I withdraw the unfortunate word, Mr. Speaker, I must insist that the gentleman from Illinois is out of order.' 'How am I out of order?' yelled the Illinois man. 'Probably a veterinary surgeon could tell you,' answered Johnson, and that stayed in the record."

* * *

Why is an aeroplane called "She?" was asked of Mr. G. S. Bennett, the secretary of the Kansas City Aviation School.

"I can guess several reasons," said Mr. Bennett, "one reason is that aeroplanes have wings and wings only grow on female angels." Another reason they are called 'She' is because aeroplanes have extra ribs and more ribs than a man. Then every aeroplane has 'stays,' and as men don't wear stays or corsets in this country, you see its furnishings are of the feminine type. All aeroplanes have to have a lot of cloth—high priced goods to get them up in the world and this is too true of the 'she' sex. Men are needed to care for and manage all aeroplanes as they are inclined to follow off some side wind fad, that they meet up in the air. The main reason that aeroplanes are called 'she,' however, is because of the way they act. Uncertain, contrary, obstinate at a time when you expect so much from them. Everything is most favorable—wind dies down—the motor runs smooth—a crowd out to see her go up—and she won't go up an inch, 'just because.'"

* * *

A Western physician received the following from a brother physician:

"Dear Dock: I have a pashunt whose physical sines shows that the windpipe has ulcerated off and his lungs have dropped into his stumick. I have given hym everything without effeckt his father is wealthy honable and influoenshial as he is a member of assembly and god nose I don't want to loss hym what shall I do ans by return male.

Yours frat,
"DOC TISHBEIN."

* * *

Jones: Can you imagine anything worse than to bite into an apple and see a worm?

Smith: Yes, to bite into an apple and see half a worm.

* * *

"How often, my good man," said the stranger at the wayside station, "do the trains stop here?"

"The trains stop here," said the sour station porter, "only once. After that they start."

"Since you got married you are late every morning," complained the boss.

"Well," explained the breathless clerk, "I have to button up the ashes and shake down a shirt-waist and carry out the furnace every morning."

* * *

"Beastly function, isn't it?"

"Yes."

"Our hostess is the limit, isn't she? Do you know her?"

"Yes; she's my wife."

* * *

The teacher had offered a prize for the best essay, the subject to be "The Reward of Laziness."

When the compositions were handed in it was found that one boy had submitted a sheet of blank paper. He won the prize.

* * *

Stewardess—Madam, I've attended to you the best I know how, supplied every want, but you are still unsatisfied. What do you want now?

Seasick Passenger—I want the earth.

* * *

"My husband is particularly liable to seasickness captain," remarked a lady passenger. "Could you tell him what to do in case of an attack?"

"'Tain't necessary, mum," replied the captain. "He'll do it."

* * *

A Londoner owning a country place near the capital engaged a stable boy. During his last stay at the place the owner did not see the boy for several days. Finally, however, having special need of the lad, it occurred to him that the stable hand was not exactly "on the job."

"Where the deuce do you keep yourself?" demanded the master of the place. "I don't believe I've seen you since you were engaged. Have you been asleep all this while?"

"Yes, sir," was the unexpected response. "I thought that was what you wanted, sir."

"What I wanted!" exclaimed the employer, amazed. "What are you driving at?"

"Well, sir," exclaimed the lad, "your advertisement said you wanted a boy of sixteen to sleep on the premises."

* * *

A weather-beaten damsel, somewhat over six feet in height and with a pair of shoulders proportionately broad, appeared at a back door in Wyoming and asked for light housework. She said that her name was Lizzie and explained that she had been ill with typhoid fever and was convalescing.

"Where did you come from, Lizzie?" inquired the woman of the house. "Where have you been?"

"I've been workin' out on Howell's ranch," replied Lizzie, "diggin' post holes while I was gittin' my strength back."


I NEVER COULD UNDER STAND WHY AN ELECTRIC DOOR BELL RINGS WHEN YOU PUSH THE BUTTON- WONT YOU EX- PLAIN IT OUT TO ME?
WE WERE SITTING IN THE CLUB ONE DAY WHEN THE JUDGE BROKE OUT INTO THIS
1
SAID I WITH A SMILE
REALLY JUDGE ITS A SIMPLE LITTLE THING— QUITE EASY TO UNDERSTAND ONCE YOU GET IT THROUGH YOUR HEAD - IN THE FIRST PLACE FORM A MENTAL IMAGE OF AN ORDINARY TANTALUM ARMATURE
2
NOW THE OSCILLATIONS OF THIS FORM WHAT IS KNOWN AS A DIALITIC INDUCTION WITH THE FILAMENTS OF THE INCANDESCENT GEN- ERATOR TO THE EX- TENT OF POSSIBLY SEVEN WATTS
3
THIS IS CONTROLLED BY A SNAP SWITCH CON- NECTED WITH A SAL AMONIAC CONTACT OF PHOSPHORESCENT SUL- PHIDE — OR RATHER A KNURLED COM- MUTATOR OF AN ELECTROLYTIC ARC
4
THAT IS TO SAY THE HYSTERESIS LAG OF THE GALVANOMETER—
5
MYSTERIOUS JAG OF YOUR GRAND-MOTHER?
C. DEBAL
6

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.

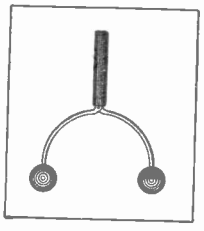
DIFFERENTIAL WINDING.—Two coils so wound that when the circuit is closed the two are in opposition, the current going through them in opposite directions.

DIMMER.—Either a rheostat or a choke coil used to control the brilliancy of the incandescent lights on a circuit. A rheostat is used on direct current circuits and a choke coil on alternating current systems. Dimmers are common in theatres where they are set up in a sort of bank with projecting handles each of which control a set of lights.

DIPPING NEEDLE.—A magnet mounted on a bearing in such a way that it will move vertically if set in the earth's magnet meridian and take the direction of the earth's magnetic lines of force.

DIRECT CURRENT.—An electric current which flows in one direction only.

DISCHARGE.—The equalization of the potential between the terminals of a condenser when the resistance of the air between breaks down or when a conductor is connected from one to the other. Applied also to the action of a storage battery while giving out current.



DISCHARGER

DISCHARGER.—A curved conductor with terminal knobs and an insulated handle, used to discharge a Leyden jar. Also called discharging tongs. (See cut.)

DISTORTION OF FIELD.—The lines of force from the field poles of a dynamo are bent out of their natural shape when the armature is revolved, because the armature on starting becomes itself a maker of lines of force which become a part of the field. The field of a motor is also bent out of shape or distorted when the motor is running.

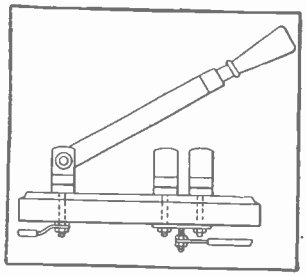
DISTRIBUTING BOARD.—A board usually of slate or marble to which electric mains are brought and from which branch circuits are taken off. Such a board has the necessary fuses and switches mounted upon it.

DISTRIBUTING BOX.—In an underground conduit system a street box into which the main line wires pass and from which service wires are taken off to supply nearby buildings.

DISTRIBUTING SWITCHES.—Switches in an electric power plant enabling the various busbars and machines to be connected up to supply different parts of the system as required.

DOUBLE BREAK SWITCH.—A knife switch in which contact is made by the blade swinging in between two pairs of springs. (See cut.)

DOUBLE CARBON ARC LAMP.—An arc lamp provided with two sets of carbons so that when one pair burn out the other pair are switched into service by the lamp mechanism.

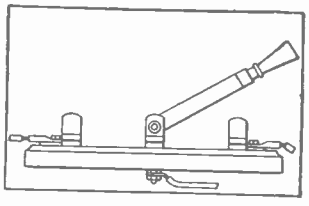


DOUBLE BREAK SWITCH

DOUBLE FLUID THEORY. A theory that electricity is a fluid.

DOUBLE POLE SWITCH.—A switch having two blades attached to one handle, and connected so that both sides of a circuit are opened or closed at the same instant.

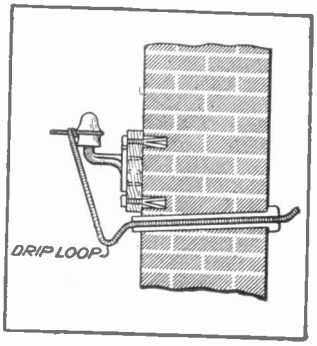
DOUBLE THROW SWITCH.—A switch having jaws for the blade so placed that by throwing the switch one way one circuit is closed, or by throwing the switch the other way a different circuit may be closed. (See cut.)



DOUBLE THROW SWITCH

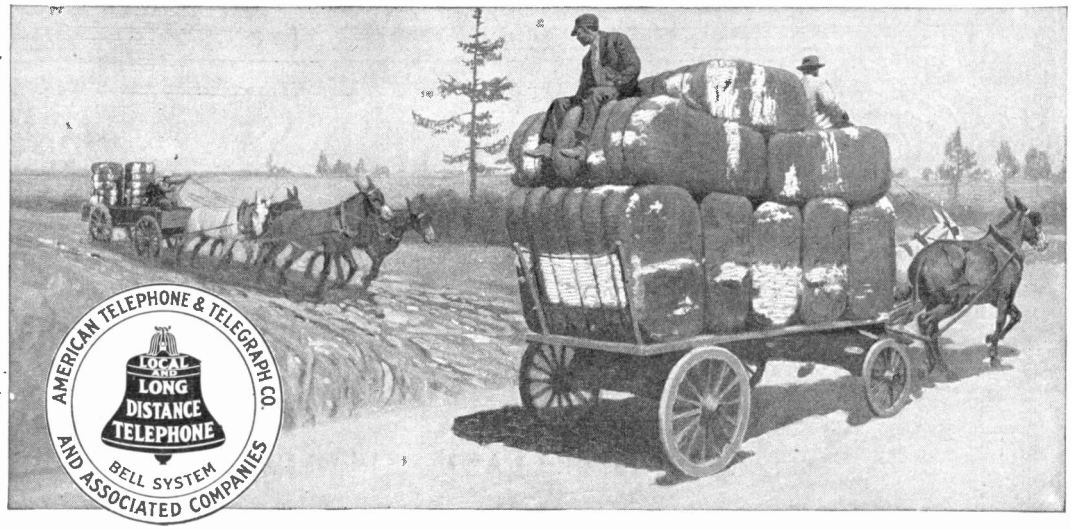
DRAG.—The pull exercised by a magnetic field upon a conductor moving through it or upon an armature revolving in it.

DRIP LOOP.—A looping down of the wires just as they enter a building so that rain will not be carried in but will flow to the lowest part of the loop and drip off. (See cut.)



DRIP LOOP

DUCT.—Used in referring to the compartments for carrying wire in a subway or tunnel.



The Good Road For Universal Service!

Every man's home faces on a road which connects with every other road and leads to every other home throughout the whole land.

Main highways connect with cross-roads so that a man can go where he chooses, easily and comfortably if conditions are favorable. But the going is not always the same; some roads are good—some are bad.

The experts in the South illustrate the difference by showing four mules drawing two bales of cotton slowly over a poor, muddy cross-road, and two mules drawing eight bales of cotton rapidly over a first-class macadam highway.

The Bell Telephone lines are the roads over which the speech of the nation passes.

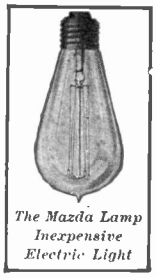
The highways and byways of personal communication are the 12,000,000 miles of wire connecting 6,000,000 telephones in homes on these highways. Steadily the lines are being extended to every man's home.

The public demands that all the roads of talk shall be good roads. It is not enough to have a system that is universal; there must be macadamized highways for talk all the way to every man's home. A single section of bad telephone line is enough to block communication or confine it to the immediate locality.

Good going on the telephone lines is only possible with one policy and one system. Good going everywhere, at all times, is the aim of the Bell system.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy ***One System*** ***Universal Service***



The Mazda Lamp Inexpensive Electric Light

Electric Light Is the Artistic Light

The Mazda Lamp Best Quality of Light

IT IS LEAST EXPENSIVE

WHAT is the magical something which makes a home inviting, interesting and "different"? A bit of color —the clever grouping of furniture or pictures, an antique or an unusual drapery, each have their part, but

Of what avail are color harmonies and artistic furnishings with garish, inappropriate lighting?

Craftsmen and designers have brought into being wonderful shades and fixtures. Electric bulbs are made in many sizes and so improved that electric light is cheaper than any other light.

The Mazda Lamp is a wonderful, current economizing electric lamp, which will produce 2½ times the light for the same current consumption as the old style lamp.

The Mazda Lamp is sold by dealers and lighting companies everywhere.

National Electric Lamp Association
CLEVELAND

Classified Advertisements

The cost of advertising in this section is 5 cents per word for one insertion, with
5% discount for 3 insertions
10% discount for 6 insertions
15% discount for 9 insertions
20% discount for 12 insertions within one year.
Remittance must accompany order, or advertisement will not be inserted. Forms for the August issue will close on July 1st.

AERONAUTICS

FLYING MACHINE SUCCESSFUL model air travelers of International reputation. Catalogue explains fully. American Flying Machine Company, Trial Grounds, Racine, Wis.

MAKE A REAL FLYING MACHINE of your bicycle for $10.00. Great sport. Blue prints sent for 50c. Leitner Co., 832 N. Paulina St., Chicago.

PROPELLERS FOR MODELS ALL DESIGNS, all prices, guaranteed satisfactory or money cheerfully refunded. Send for circular. Pollock Propeller Co., Longwood, Chicago.

16 . SQUARE FEET AEROPLANE. Correct in every detail; perfect flying machine; ready to set up. $2.00 prepaid. Aeroplane Manufacturing Co., 309 Fifteenth St., Brooklyn, N. Y.

AGENTS

2-TICLE-U, 3c. STIX, STOCKTON, CAL.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

"PERFECTION POCKET ADDING MAchine—lightning seller. Agents wanted. Cincinnati Specialty Mfg. Co., Dept. E, Cincinnati, Ohio.

DON'T ACCEPT AN AGENCY UNTIL you get my samples and particulars. Money makers. Address, SAYMAN, 706 Sayman Bldg., St. Louis, Mo.

A FEW GOOD STATES LEFT FOR first-class sales agencies. Exclusive contract for distribution of the Victor Furnace Tender. Write now. V. E. Cozine, Gloversville, N. Y.

BIG MONEY SELLING GOLD AND SILver glass window novelty and changeable signs; illustrated catalog. Climax Novelty Co., 301 Gay Bldg., St. Louis.

LIVE AGENTS WANTED—HUSTLERS to handle our attractive 1911 combination packages of soap and toilet articles with valuable premiums. One Michigan agent made $65 in 47 hrs., another $21 in 8 hrs., another $22.50 in 10 hrs. Write today. DAVIS SOAP WORKS, 263 Davis Building, 1429 Carroll Ave., Chicago.

AGENTS

IGNITERS, 10c POSTPAID, LIGHTS gas, gasolene or acetylene, 5,000 sparks. Dealers supplied. Jobber, 3525 Broadway, N. Y.

BIG CHANCE FOR HUSTLERS—OUR Salary Plan offers splendid opportunities for making money. Send stamp for particulars. Popular Electricity Magazine, Circulation Department, Commercial Bldg., Chicago.

AGENTS WANTED—SEND 15c FOR the smallest Bible in the world, and one of each of our catalogues, with terms to agents. A. S. Mankin & Co., Alexandria, Va.

CAPABLE AGENTS MAKE BIG MONEY handling our Electric Specialties. Presto Heater boils liquids in One Minute. P. E. Mfg. Co., 323 Geary, San Francisco, Cal.

NEW ARTICLES FOR HOUSEHOLD and Mechanical Trades. Quick sales, good profits. North Chicago Tool Works, North Chicago, Ill. 3 Broadway.

$DOLLAR$ ADDER: POCKET ADDING machine, adds and substracts quick; capacity $999,999.99. Sent prepaid for $1.00. Order now —today. Circular free. Agents wanted. Ellis Sales Co., 17 Leavenworth, Omaha, Neb.

EASY MONEY—LOTS OF IT. ALL OR spare time. Send stamp for particulars of our liberal Salary plan. Popular Electricity Magazine, Circulation Department, Commercial Bldg., Chicago.

BOKARA DIAMONDS—AGENTS, EVERYone wanted to wear and sell these Famous Gems. Big profits. Samples offer and catalogue free. Northwestern Jewelry Co., 80 Northwestern Bldg., Chicago.

AGENTS—MAKE 14c ON EVERY 25c bottle of "Suit-Cleaning Fluid" you sell. 1 bottle 25c, 6 bottles 66c, money order. Address Pacific Chemical Co., Box 583, Oakland, Cal.

MAKE $20.00 DAILY OPERATING OUR Minute Picture Machines. Experience unnecessary. Small investment; large profits. Free book, testimonials, etc. Write. American Minute Photo Co., Dept. 37, Chicago, Ill.

YOU CAN MAKE $$$$ AS OUR GENeral or local agent. Household necessity; saves 80 per cent. Permanent business; big profits; exclusive territory; free sample. Pitkin & Company, 96 Pitkin Block, Newark, N. Y.

AGENTS, $50 WEEKLY; WE MANUFACture the best needle case made; a wonderful seller; 500 easily carried; 200 to 400 per cent profit; talking unnecessary; our copyrighted "trust scheme" envelopes do the work; general agents can make over $100 weekly; send 10c. for a 25c. sample containing 115 needles; particulars free; buy direct from the factory. Paty Needle Co., 205 Union Square, Somerville, Mass.

AGENTS

THE HOME CLOTHES SPRINKLER—A new household necessity. Something every housekeeper will buy on sight. Made to fit pint or ½-pint bottles. Send 10c for sample and start now. Van Mfg. Co., 201 Franklin St., Boston, Mass.

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 BIBLE ON EARTH! Size of postage stamp; New Testament illustrated; 200 pages; sample 10c; dozen 75c. Agents Wanted. The biggest wonder of the Twentieth Century. Coin $5.00 daily selling them. Get busy NOW. Valan Supply House, Alaska, W. Va.

BE INDEPENDENT! START A MAIL order business in your own home. We tell you how and furnish everything needed wholesale. An honorable and profitable business for man or woman. Particulars free. Many make $3.000 a year. Murphy Mfg. Co., South Norwalk, Conn.

WE MANUFACTURE GLASS PAPER. Plain glass windows made to look like real stained glass. Easily applied and beautifies the home. Something new for agents. Two sheets of this glass paper sent as a sample with catalogue in colors and complete instructions on receipt of 10c. S. H. Parrish & Co., 202 S. Clark St., Chicago.

AGENTS—BIGGEST MONEY MAKER known. The new Canchester Incandescent Kerosene Lamp revolutionizes old lighting methods. Burns air, not money. Six times brighter than electricity, gas or acetylene at 1-10th 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. Cancester Light Co., Dept. P. E., 7, Chicago.

AUTOMOBILES

CARTERCAR, five-passenger, good as new, one-third price. Scrivens, Ashtabula, Ohio.

BARGAINS IN AUTO ACCESSORIES. IT will pay you to deal with us and save lots of money. Ask for our bargain sheet. Emden & Co., 1303 Michigan Blvd., Chicago.

28x3 $10.30 TUBE, $2.75; 30x3 $11.30 tube, $2.85; 30x3½ $15.45 tube, $3.75; 32x3½ $18.70 tube, $4.25; 34x4 $27.45 tube, $5.75. Send for list of all sizes. I ship allow tires to be examined on receipt of 10% amount of order. The largest tire dealer in the central states. W. Vanderpool, Springfield, Ohio.

AUTOMOBILES—OVER FOUR HUNdred bargains, $95.00 upward. All guaranteed! Freight prepaid! Write now for latest illustrated bulletin. Motor Car Exchange, Dept. A, 217 West 125th St., New York City.

AUTOMOBILES

CHAUFFEURS BLUE BOOK, 40 ILlustrations; shows how to drive, adjust and maintain automobile and pass examinations, 50c. License guaranteed. Chas. Milword, 1546 N. 60th, Phila., Pa.

BOOKS

STIX, STOCKTON, CAL.—MENDER, 3c.

CLASSY BOOKS! CATALOGUE FOR stamp. Paul Duff, E. 2713 Mozart St., Chicago.

WONDERS AND SECRETS OF HUMAN Magnetism. Startling Facts. 2 cents. New Man Publ. Co., Ravenna, Nebr.

PRACTICAL SCIENTIFIC BOOKS ON Modern Subjects, Trades, etc. Catalogue free. Clarence E. Hardage, Syracuse, N. Y.

INVENTORS POCKET LIBRARY (TEN Booklets 25c, Sample for Stamp)—Free with our "First Aid Outfit,"—$1 on approval. Catalog. Engineer Searching Co., Fleming Building, Washington, D. C.

"THREE LITTLE BOOKS FOR LAdies," postpaid in plain cover, 25c. (They tell what you want to know.) O. K. Pub. Co., Clerk 191, Decatur, Ill.

BOOKS LOANED FREE—BY MAIL—ON many subects; others rented and sold. Occultism, success, business, health, new thought, etc. For conditions, lists, Weekly Bulletin, full information and impartial advice, address Librarian Oriental Esoteric Society, 220 Washington, D. C.

FOUR TWENTY-FIVE-CENT BOOKS for 50 cents. Gouge Work and Indented Woodwork, Wood-carving for Beginners, Designing and Drawing. Dyes, Stains, Inks and Lacquers. Sampson Publishing Company, 1140 Beacon Bldg., Boston, Mass.

"WIRING A HOUSE," BY H. PRATT. Shows a house already built; tells you just how to start about wiring it; where to begin; what wire to use; how to run it according to insurance rules; in fact, all the information necessary for wiring a house and shop. Postpaid, 25c. Popular Electricity Book Department.

FOR FORTY CENTS WE WILL SEND our five excellent 10c books on Tempering Steel, Making and Fixing Electric Bells and Batteries, How to Grind and Set Edge Tools, How to Make an Annunciator, Small Electric Motor to be Built Without Castings, all practical and well illustrated. Sampson Publishing Company, 1140 Beacon Bldg., Boston, Mass.

ELECTRICAL CIRCUITS—100 SIMPLE and complex circuits of Telephone, Telegraph, Wireless, Lighting, Railway, Dynamo, Motor, Speaking Arc and private circuits not procurable elsewhere. $1.00. W. E. Smith, 55 W. Ontario St., Chicago, Ill.

BOOKS—I. C. S. and A. S. C. SETS, TECHnical books of all sorts—shopwork, electrical, mechanical, wireless, encyclopedias, dictionaries, medical, law, and standard fiction. New and second-hand. Get my prices. Geo. F. Williams, Box 408, New Orleans, La.

BOOKS

NINE DEGREE COURSE IN HYPNOtism—sold originally for $5—sent prepaid with year's subscription to Wheel of Life, the great "Cheer Up" monthly for 25c. Life Pub. Co., St. Louis.

BUSINESS OPPORTUNITIES

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

$100 MONTHLY AND EXPENSES TO trustworthy men and women to travel and distribute samples; big manufacturer. Steady work. S. Scheffer, Treas. M. R. Chicago.

"MONEY MAKING FACTS" OF INTEREST to everyone. Mining and Oil Finance analyzed and discussed. My booklet free upon request. Mark E. Davis, 1004 Broadway, Oakland, Cal.

57 MONEY MAKING OPPORTUNITIES. Guaranteed money-makers. 25c coin. No. Supply Co., Waukegan, Ill.

FREE! 100 envelopes printed with your return absolutely free. No fake. Write for particulars. Cutter Publishing Co., E-7, Atlanta, U. S. A.

FORM A CORPORATION — CONGRESS LAW for D. C. and all Sates; cheap. Raise money easily; advice free. U. S. Legal Corporation, Washington, D. C. Representing $1,225,000,000.

START A CANDY KITCHEN! A FULL $15.00 Course in Candy Making for only $1.00. You can earn $50 a week operating a Candy Kitchen. Write us for particulars. Allen & Co., 818 E. 47th Place, Chicago.

BIG PROFITS—SELLING VULCAN Fountain and Stylo Pens. Well advertised, easy to sell. Write for catalogue, liberal discounts. J. A. Ullrich & Company, 27 Thames Street, New York.

I WILL START ONE THOUSAND men in the manufacturing business, no capital required. Send 10 cents for particulars to Hugh L. Clark, Flora, Ill.

WE START YOU MANUFACTURING article which brings 1000% profit. No competition. Sample and particulars, 25c. "Tallala," Box 365, Talladege, Ala.

"WAY TO SUCCESS IN THE MAIL Order Business," tells how I made $18,000.00 in three years, exposes "outfit" scheme, etc. Worth DOLLARS to you. Free on request. H. System, 108, Marion Kentucky.

"HOW TO JUDGE A PATENT" contains the Patent claim of Selden Automobile, Morse Telegraph, and Bell Telephone. An "eye opener" to Inventors and Manufacturers. Obed Billman, Cleveland, Ohio. Author of "Notes on Patent Law," Popular Electricity.

BE INDEPENDENT—START MONEY Making. Mail Order Business at Home. New Plans. Everything furnished. Only small capital required. Free Booklet and Particulars tell how. W. E. Miller Co., Box 254, Muskegon, Mich.

BUSINESS OPPORTUNITIES

$5.00 MADE HONESTLY, EASILY—Everything necessary for 10c. Dixie Mailing Bureau, Memphis, Tenn., Station E-8.

TRAIN A SALES FORCE, IN EXCLUsive territory, on a universal demand, money back proposition. J. N. Webb, Arcade, Norfolk, Va.

HAVE YOU ANYTHING TO ADVERtise? Our Rate Book tells you all about Advertising Mediums, Rates, Circulation, Closing Dates, etc. Sent for 10c.; worth dollars. Folder free. Correspondence invited. Dearborn Advertising Agency, 452 Franklin Bldg., Chicago.

INCREASE YOUR INCOME—MAKE your spare time pay dividends. Send stamp today for particulars of our Salary Plan. Best chance you ever had to make money quickly and easily. Popular Electricity Magazine, Circulation Department, Commercial Bldg., Chicago.

LEARN THE SILVER PLATING BUSiness and be assured of a good living for life. C. R. Cable of Virginia earns $9.50 a day. You can do the same. Simple instructions. Write for free descriptive pamphlet. Humboldt Publishing Co., 4743 State St., Chicago, Ill.

BE YOUR OWN BOSS—OUR LIBeral Salary Plan offers a splendid opportunity to make money quickly and easily. Experience not essential. Need not interfere with present employment. Full details on receipt of stamp. Address, Popular Electricity Magazine, Circulation Department, Commercial Bldg., Chicago.

IF YOU HAVE ANY SPARE TIME, NO matter how little, and are honestly ambitious to make the most of it, write for our Salary Plan and learn how you can increase your income quickly and easily. Full particulars on receipt of stamp. Address, Popular Electricity Magazine, Circulation Department, Commercial Bldg., Chicago.

MOTION PICTURE MACHINES, FILM Views Magic Lanterns, Slides and similar Wonders for Sale. Catalogue free. We also buy Magic Machines, Films, Slides, etc. Harbach & Co., 809 Filbert St., Philadelphia, Pa.

START AN EASY AND LUCRATIVE business. We teach you how to establish a successful collection business and refer business to you. No capital required. Little competition. Rare opportunities. Write for Free pointers today. Am. Collection Service, 428 State St., Detroit, Mich.

MAKE MORE MONEY! START A MAIL business; operate a "SILENT SALESMAN" system; spare time; possibilities unlimited. The best money making propositions are in "BOOSTER." Get away from wage slavery! "BOOSTER" starts you in business for yourself with small investment. Send 10c for two months trial. Booster Magazine, Dept, PE, 208 N. Fifth, Chicago.

BUSINESS OPPORTUNITIES

MAKE MIRRORS AT HOME. BIG PROFits with little outlay. One 18x36 in. mirror costs $2.00 to $5.00. You can silver a glass this size for 20c. Send $1.00 in stamps or money order and we will send you EXPLICIT DIRECTIONS how to do it; also how to emboss, grind, foil, gold leaf, frost chip, and make imitation stained glass. How to transfer photos on glass, bore holes in glass and cut skylights. George L. Patterson & Co., Dept. 4, Brooksville, Ky.

EARN $10 TO $15 A WEEK AND HOLD your position besides. No Canvassing. We, as manufacturers, of patented just in season specialties have new easy mail order plans to keep our factories busy. We furnish everything. Large profits. Small capital. Experience unnecessary. If you are one of the want-to-go-ahead kind, write for our most modern plans. Sworn statement. J. M. Pease Mfg. Company, 170 Pease Bldg., Michigan St., Buffalo, N. Y.

INCORPORATE YOUR PATENTS AND business under Arizona Laws. No annual or franchise tax. Members exempt from corporate debts. No public statements required. Stock can be made non-assessable and full paid for anything of value. Charters cannot be repealed by subsequent laws. Hold meetings and do business anywhere. Capitalization does not effect cost. Cost very small. Particulars, laws and forms free. Southwestern Securities & Investment Co., Box D488, Phoenix, Arizona.

COINS AND STAMPS

10 DIFFERENT RARE COINS, 25c; 20 different, 50c; 50 different, $1.50; old paper money, 5 different bills, 25c; 10 different, 50c; 5 different foreign bills, 35c; premium book, 10c. Burgess Coin Co., 1018 Huron, Toledo, Ohio.

STAMPS, 100 ALL DIFFERENT, FREE. Postage 2c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

POSTSCRIPT STAMPS — PHENOMEnal success. Engraves five colors. Boosters, Knockers, Jokers, Mottos, etc. Sheet 25 diff., 10c; 3, 25c. All diff. J. Hellwig, 49 Clinton St., Albany, N. Y.

WE PAY CASH PREMIUMS ON THOUsands of rare coins, stamps, paper money. Send 10 cents for large coin value book. You may have coins we want. National Coin Exchange, Gunnison, Col.

FOREIGN STAMPS, 255 MIXED, 10c.; 255 old United States, 10c.; 1,000 United States, 25c. Stamps Bought List, 4c.; 50 different foreign or United States, 5c. each. Herman Kleinman, 3641 Marshall St., Philadelphia, Pa.

ELECTRICAL MATERIAL

MICA, WASHERS AND DISCS, MADE to order, also cut and uncut mica. Send us your order. The Otter Hill Mica Mines, Findlay, Ohio.

ELECTRICAL MATERIAL

"HI-LIFE" STORAGE BATTERIES. BEST for Automobile sparking and lighting. These are high grade batteries at a remarkably low price. Guaranteed. Give us a trial or write for particulars. Discounts to the trade. Northwest Mfg. Co., 1247 Wells St., Chicago, Ill.

FOR SALE

FOR SALE—MOVING PICTURE FILM, 1c. foot. H. Davis, Watertown, Wis.

WANTED—ALL KINDS OF MACHINERY for manufacturing shop. Fred. C. Dickow, 35 S. Desplaines St., Chicago.

FOR SALE—2½ H. P. MOTORCYCLE engine, price $14.00. Harold Hartzman, 1123 13 Ave., Moline, Ill.

FORMULA—FOR RENEWING OLD dry batteries at low cost, 15c. John L. Dickson, Mount Union, Pa.

COLUMBIA DISC AND CYLINDER Graphophones and Records, 40 per cent discount. Box 965, Ashtabula, Ohio.

BOOKS ON ALL ELECTRICAL SUBJECTS —Send for our free illustrated catalogue. Popular Electricity Book Department.

LUBRICATORS AND CUPS FOR SHAFTing and Loose Pulleys. No drip or dirt. Very economical. Swain Lubricator Co., New No. 328 W. Lake St., Chicago.

FOR SALE—WAVERLY ELECTRIC Stanhope, in good condition throughout; battery new last spring. A bargain, $350. A. S. Lee, 52 Richmond St., Providence, R. I.

FAN MOTORS FOR D. C., A. C., and BATteries, equal to new, 14 inch blade. $8.00; 12 inch, $7.00; 10 inch, $6.00; 8 inch, $5.00. Cosmos Electric Co., 136 Liberty St., New York.

NEARLY NEW $750 WURLITZER AUtomatic Harp, coin operated, $200. Will pay for itself in few months. Box 965, Ashtabula, Ohio.

LATHES—SEND FOR FREE CIRCULAR showing bargains on small Screw Cutting Engine Lathes. S. B. Tool Co., Dept. O, South Bend, Ind.

FOR SALE—COMPLETE SET OF CASTings, with blue prints of 3-4 H. P. gasoline stationary engine, includes governor and timer, screws, etc. $10.00. Comet Motor Works, 512 W. Monroe St., Chicago, Ill.

WILL SELL MY 20-ACRE FLORIDA Farm, $12.50 per acre; terms to suit; beautiful locality; can't occupy account illness. GEO. L. COLBURN, Care Buckingham Club, St. Louis, Mo.

WATER POWER AND LIGHTING Plant, located at Heuvelton, St. Lawrence County, New York, on N. Y. C. & H. R. R. R. Can develop 1,000 to 1,800 H. P. Write for particulars to Alonzo Thornton, Heuvelton, N. Y.

FORMULAS

ANY FORMULA, 10c. Zerba, Sacramento, Pa.

FREE! FOR A SHORT TIME, FIVE money-coining formulas, worth dollars, but they are free. Send 2 cents. M. W. Rand, Box 224, Spokane, Wash.

FOR THE PHOTOGRAPHER

FILMS, DEVELOPED, ANY SIZE 10c prints on post cards 3c each. Good work promptly finished. Chas. Hoffman, New Lexington, Ohio.

MAKE PHOTOS CHEAP! GET OUR catalog—cameras, supplies, developing, enlarging, exposure, meter included, 10c. Rex Bromide Co., E. Lincoln Park Sta., Chicago.

EVERY WORKER IN PHOTOGRAPHY should read THE CAMERA, $1.00 a year. Send twenty-five cents for three months' trial subscription. THE CAMERA, Philadelphia, Pa.

GAMES AND AMUSEMENTS

CACHOO—THE GENUINE SNEEZE powder. Sample 10c. Dozen 80c. Hundred $5.00. Percy Ewing, Decatur, Ill.

145 PARLOR GAMES, 10c. VENTRILOquism, 10c. Free catalogue. Barstow Co., 514 23d St., Oakland, Cal.

IGNITION

GASOLINE IGNITION. DRY CELL Batteries. Will demonstrate formula and process of manufacture to intending manufacturers only. J. Dougan, 234 Smith St., Winnipeg, Manitoba. References.

INSTRUCTIONS

FORMULAS FOR ANYTHING, 25c. Arthur Beers, Bradley Beach, N. J

CORRECT FORMULAS, 20c EACH. Malalane Co., 1411 Longfellow Ave., New York.

JIU JITSU TAUGHT BY MAIL. For particulars address The Kano School of Jiu Jitsu, 112 Woodland Ave., Oberlin, Ohio.

GO ON THE STAGE. WILL TELL you how. Write for descriptive matter. It is free! Percy Ewing, Decatur, Ill.

PLAYED OUT DRY CELL BATTERIES perfectly renewed; half cent each; directions easily followed; 25c coin. L. M. Burgess, Mondamin, Iowa.

HECTOGRAPH DUPLICATOR. MAKE one yourself. Saves money. Directions, including big formula book, only 25c. "BARSTOW," 514 23d St., Oakland, Cal.

GREAT ELECTRICAL EXPERIMENT. Electricity will produce cold and freeze water. Only an experiment, but worth your time and money. You may discover something and win fame and fortune. Send 25c stamps for diagrams and particulars. E. A. Martin, 907 S. 12th St., Springfield, Ill.

INSTRUCTIONS

BE PRACTICAL. BUILD A STEAM engine and boiler of your own. Blue prints showing construction of 1½x1¼-inch cylinder engine and boiler, 50 cents. L. A. Knutsen, R. 2, Box 44, Snohomish, Wash.

BE A TELEPHONE MAN—PERSONAL instruction and advice by mail. Qualifies you for position or helps you in your present work. Write for particulars. E. C. Sinclair, Cambridge A., Mass.

INVESTMENT

FREE—"INVESTING FOR PROFIT" MAGazine. Send me your name and I will mail you this magazine absolutely FREE. Before you invest a dollar anywhere, get this magazine; it is worth $10.00 a copy to any man who intends to invest $5.00 or more per month. Tells you how $1,000 can grow to $22,000; how to judge different classes of investments, the REAL EARNING POWER of your money. This magazine six months FREE if you write today. H. L. Barker, Publisher, R423 20 Jackson Blvd., Chicago.

MISCELLANEOUS

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

DIES, MODELS, SPECIAL MACHINery. Ask for estimates. Box 316, Fulton, Ill.

TELESCOPE WATCH CHARMS, 10c. Eagle Co., Quincy, Mass.

ACCOUNTS COLLECTED ANYWHERE —Fidelity Credit Co., 808 Clay, Richmond, Va.

THE NEW ERA MFG. CO., Fairfield, Iowa. Wood and metal patterns, models made.

3c A WORD GETS YOUR AD IN ENtire list 100 magazines including Wheel of Life. Life Pub. Co., St. Louis.

CLARK'S FLY EXIT AT TOP OF screen lets flies out. They can't return. Postpaid, 25c. Dr. L. W. Clark, Carterville, Mo.

LEGAL OPINIONS, REPORTS AND Collections in all states. Reasonable fee. Charles Fitzgerald, Attorney-at-Law, Roanoke Bldg., Chicago.

ANYBODY CAN MAKE GOOD CUTS with my simple zinc etching process; price, $1.00; specimens and particulars for stamp. T. M. Day, Box E., Windfall, Ind.

SIX MONTHS SUBSCRIPTION WITH three back numbers, for fifty cents. Special limited offer. All back numbers contain strong practical articles. Electrician and Mechanic, 1140 Beacon Bldg., Boston, Mass.

FORMULAS—500 SELECT FORMULAS for everything, (book form). All money makers. 25c. Globe N. Co., 17 Leavenworth, Omaha, Neb.

CIGARETTE MAKING MACHINES. Imported from Europe. Guaranteed perfect. 25c prepaid. Balritt Importing Co., 158 Lawrence St., Brooklyn, N. Y.

MISCELLANEOUS

SAVE THE PIECES—BROKEN CYLINders, crank cases, shafts, gears, and housings promptly repaired just like new, at one-third the cost and guaranteed. Address Welding Dept., Bertschy Motor Co., Council Bluffs, Ia.

I WILL START YOU EARNING $4.00 daily at home in spare time, silvering mirrors; no capital; send for free instructive Booklet, giving plans of operation. G. F. Redmond, Dept. H, Boston, Mass.

RAISE GINSENG—$1.00 PER SQUARE foot of ground. $25,000 on half acre. Grows anywhere; half city lot a bonanza. 10c. brings booklet. Sheboygan Ginseng Gardens, Sheboygan, Wis.

WILL SEND FREE SAMPLE OF Stocking's Foot Relief to anyone suffering with tender, aching, odorous feet. "It's wonderful." Absolutely harmless. Stocking Powder Co., Ashland, Ohio.

MOSKEETOPUNK IS THE LATEST, best and only sure cure for mosquito troubles. For the home or camp. No bad odor; no humbug. Guarantee in every box. 25c. Five for $1. Moskeetopunk Co., Pekin, Ill.

DON'T BE CROSS! IRRITABILITY, nervousness and insomnia are due to imbalance of the eye muscles. Gymnastic exercise produces harmony of movement (syntony), and relief to the brain and nervous system. Light is an electro-magnetic disturbance. Write for particulars. John J. Cluin Co., Opticians, Lowell, Mass.

MODEL BUILDER

INVENTORS—WE BUILD MODELS. Do experimental work, light manufacturing, dies and tools. Geo. Schwarz & Co., 123 Liberty St., New York.

MOTORCYCLES

MOTORCYCLES — M. M. TOURING model. Has more actual features than all others. Idler, free engine, roller bearings, etc. Get our proposition. M. M. Motor Works, Brockton, Mass.

NEW $225 GREYHOUND, $175; NEW $215 Emblem, $175; 1910 Reliance, $115; 1909 Indiana, $95. Second-hand machines taken toward 1911 models. Get our prices. Scrivens, Ashtabula, Ohio.

MOTORCYCLES—ENORMOUS VARIETY of American and imported makes—Indians, Marsh's, $35.00—hundreds of other bargains! Shipped freight prepaid! Write now! Large illustrated bulletin free! Motorcycle Exchange, Dept. B, 217 West 125th St., New York City.

MOTORCYCLES, NEW AND SECONDhand; motors, castings and accessories. Our Attachable Motor Outfit converts any bicycle into a motorcycle at small cost. Write for catalogue and bargain list. **Shaw Mfg. Co., Dept. 31, Galesburg, Kan.**

MOTORCYCLES

MOTORCYCLE CASES AND TUBES. New fresh stock, 28x2, corrugated, $5.00; Bailey $5.50 tube, $2.25; 28x2¼ corrugated, $5.25; Bailey $6.25 tube, $2.50; 28x2½ corrugated, $5.50; Bailey $7.00 nobby, $7.75 tube, $2.50; on receipt of 25%, I ship, allow examination. Wm. Vanderpool, Springfield, Ohio.

PATENTS

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

C. L. PARKER, PATENT ATTORNEY, ex-examiner U. S. Patent Office, 912 G St., Washington, D. C., Inventors' handbook, "Protecting, Exploiting and Selling Inventions" sent free upon request.

SEND FOR FREE BOOKLET, ALL About Patents and Their Cost. Shepherd & Campbell, 500 B, Victor Bldg., Washington, D. C.

PATENT—ADVICE AND BOOKS FREE. Highest references. Best results. I procure patents that protect. Watson E. Coleman, Patent Lawyer, 612 F St., N. W., Washington, D. C.

PATENTS PROCURED AND POSItively sold if the idea has merit; all countries; satisfied clients my best references; send sketch; book free. H. Sanders, Crilly Building, Chicago.

PICTURES AND POSTCARDS

25 ASSORTED POST CARDS WITH trick catalogue, dime. Y. Wesley, Aurora, Ill.

JUST GIRLS—20 POST CARDS OF girls, 25c. No trash or landscapes. O. K. Pub. Co., Decatur, Ill.

150 GOLD EMBOSSED POST CARDS free; send 10c for samples and instructions today. Samuel E. Collins, 600 Baxter, Louisville, Ky.

YOU'LL GET CARDS FROM EVERYWHERE. Membership 10c. Idaho Card Exchange, Dept. O., Box 906, Boise, Idaho.

MEXICAN INSURRECTION — PHOTOgraphs showing Madero and body guard, Garibaldi, other insurrecto leaders, and forces in camp scenes and field action; actual photographs from seat of war; set of ten different subjects sent prepaid for $1 cash, stamps or money order. G. A. Service, 428 Germain Bldg., Los Angeles, Cal.

PRINTING

SPECIAL IN PRINTING — 50 NOTE heads, envelopes and return envelopes, 50c postpaid. Samples for stamp. The Oak Press, 506 Fairview Ave., Dept. E, Seattle, Wash.

PRINTING PRESSES, TYPE & SUPplies. **Instruction book and catalog free. L. M. Carroll & Company, 168 Washington St., Chicago.**

TYPEWRITERS

GUARANTEED REBUILT TYPEWRITERS. Olivers, $25.00; Underwoods, $40.00 cash. Time. Rent applies. Catalogue. Knights, 275 Twelfth, St. Louis, Mo.

$10.00 FOR A REAL REMINGTON TYPEwriter. 5 per cent. discount for cash with order. Also have large stock of all other makes of typewriters. Donald Price, 40 Dearborn St., Chicago, Ill.

GENUINE TYPEWRITER BARGAINS—No matter what make, will quote you lower prices and easiest terms. Write for big bargain list and illustrated catalogue. L. J. Peabody, 364 Minot Bldg., Boston, Mass.

TYPEWRITER COVERS, 50c. MEIER, Russell, Kansas.

I WANT TO CORRESPOND WITH PERsons who are about to buy a high-grade typewriter, object to paying the high prices generally asked by manufacturers and dealers. Any make on approval. Catalogue, bargain list and valuable information sent free. A. E. Atchison, 4125 West 21st St., Chicago.

LARGEST STOCK OF TYPEWRITERS IN America. All makes: Underwoods, L. C. Smiths, Remingtons, etc.; one-quarter to one-half manufacturers' prices (many less). Rented anywhere, applying rent on price. Write for catalogue 102. Typewriter Emporium (Est. 1892), 92-94 Lake St., Chicago.

TYPEWRITERS: CALIGRAPH, $6.00; Hammond, Yost, Densmore, Williams, $10.00; Remington, $12.00; Smith Premier, $15.00; Oliver, $24.00; Underwood, $30.00; all makes on hand; fifteen days' trial allowed, and a year's guarantee. Send for catalogue. Harlem Typewriter Exchange, Dept. 89, 217 West 125th St., New York City.

WIRELESS

SPARK COILS, 1-INCH TO 8-INCHES, $7.50 up. Helices for same, $2.00 up. Plymouth Wireless Co., Box 402, Whitman, Mass.

WIRELESS—DON'T RUIN THAT crystal by holding it with solder, send 20 cents for a metal with a melting point of 143F, enough for one detector. R. R. Goldthorp, 60 Buckingham St., Hartford, Conn. (s)

OUR CATALOGUE TELLS WHY THE Alwico Sending Transformer is Positively the Best on the market. Prices of ½ K. W. size, with condenser and spark gap $35.00. Complete Receiving Set with 1000 ohm double-pole receiver $5.95. Guaranteed double- pole 1000-ohm receivers $1.75 each; pair with split head-band and six foot silk cord $5.25. Double-slide Tuning Coils wound with spaced bare wire $2.25. Slider rod $.10 foot; sliders $.23. Reliable apparatus and supplies of all kinds. Send stamp for catalogue. Alden Wireless Co., Dept. D, Campello, Mass.

WIRELESS

STOP—IF YOU ARE INTERESTED IN wireless you need a good book on the subject. "Wireless Telegraph Construction for Amateurs," by Alfred P. Morgan, is the most complete and up-to-date book published, containing detailed directions for the construction of outfits capable of sending 3 to 100 miles and of receiving 100 to 1,500 miles, also explaining clearly the workings and purpose of each part. 200 pages fully illustrated. Postpaid, $1.50. Popular Electricity Book Department.

HELP WANTED

CIRCULAR MAILERS WANTED EVERYWHERE. Write Walters Printery, Brooklyn, N. Y.

MAKE OFFER ON PATENT 966486, JUST issued. Must have help to handle. Fortune awaits hustler who will invest. R. W. Talley, Clarendon, Texas.

MOTION PICTURE PLAYS WANTED—you can write them. We teach you by mail. No experience necessary. Writers earn $50 a week. Demand increasing. For particulars address Ass'd M. P. Schools, 112 Clark St., Chicago, Ill.

WANTED—MEN TO LEARN WATCHmaking. Earn pay while you learn. Write for our free book "How to be a Watchmaker." Stone Watchmaking School, 908 Globe Bldg., St. Paul, Minn.

A COMPLETE COURSE IN PRACTICAL Automobile Engineering under experienced instructors, with all modern equipment and appliance. Our four-story building offers special accommodation to out-of-town students. Call or write for our liberal proposition on Resident or Home Courses. Automobile School of Chicago, 1339 Michigan Ave., Dept. P E

CIVIL SERVICE GOVERNMENT POSItions are very desirable for young people. Full information and questions recently used by the Civil Service Commission free. Columbian Correspondence College, Washington, D. C.

WANTED—ONE MAN OR WOMAN IN every locality to start a Candy Kitchen. Best paying small business on earth! Few dollars starts you. Get away from wage slavery! Write us for full particulars. Aspen Sales Co., 4320 Aspen St., Philadelphia.

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.

CIVIL SERVICE EXAMINATIONS. open the way to good Government positions. I can coach you by mail at small cost. Full particulars free to any American citizen of eighteen or over. Write today for Booklet E50, Earl Hopkins, Washington, D. C.

The Business of This Place is to Raise Salaries

From every section, and from all sorts and conditions of men, messages come to tell of earnings increased and futures brightened through study of I. C. S. Courses.

One letter gives the romance of a young man in California that began with little or no education; another tells the story of a high-school graduate in Maine that found himself educated for everything but to make a living. Here are the heart throbs of a fellow that toiled twelve hours a day and studied his Course as best he could; there is the experience of a clerk or office hand with plenty of spare time and the will to use it. Now we read of some one whose pay was a mere pittance; now of a foreman or superintendent that enrolled because his ambition aimed at bigger things.

All sought betterment through knowledge and found it. All are enthusiastic. All remember with pleasure the day they marked and mailed an I. C. S. Coupon.

I. C. S. Courses have made draftsmen, foremen, and superintendents of shop hands; building contractors, architects, structural and concrete engineers of carpenters and masons; advertising men, window trimmers, show-card writers, chemists, illustrators, and designers of clerks; electrical, mechanical, and steam engineers of laborers; mine inspectors, foremen, and mining engineers of mine workers; bridge engineers, surveyors and mappers, civil engineers, gas engineers, automobile runners, and civil service employes of young men willing to use their spare time to mold a career.

Mark and mail the coupon and learn how the I. C. S. can raise *your* salary.

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 Running	Civil Service Exams.

Name _____

St. and No. _____

City _____ *State* _____

Present Occupation _____

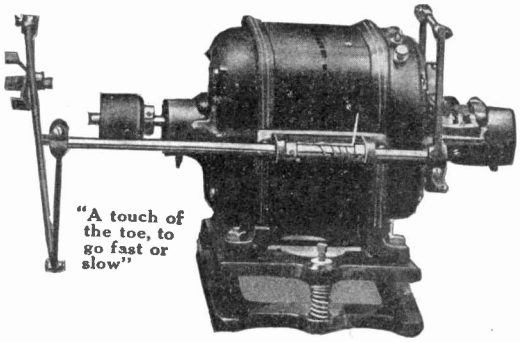
For our Mutual Advantage mention Popular Electricity when writing to Advertisers.

Every Printer Should Know

The Kimble A. C. Motor

EVERY Central Station Manager should make it his business to demonstrate this motor in every printing office in his city.

EVERY Demonstration means a sale of a "Kimble" equipment and a convert to electricity as against oil-throwing belts and smelly gas engines.



"A touch of the toe, to go fast or slow"

DOES the "Impossible." Starts, stops, reverses, accelerates or retards, all with one lever and without resistance-coils, starting-coils, compensating-coils or any other form of outside control.

MORE Power for Less Money than you get from any other form of A. C. motor, because all the current you buy is put to useful use.

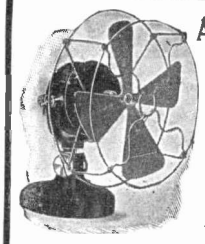
Sizes from ¼ H.P. to 10 H.P. Single Phase and Polyphase. Variable Speed and Constant Speed.

OTHER Uses. Not only for printing office machinery but for every kind of plant where VARIABLE SPEED are useful, where REVERSING is advantageous and where the load is approximately uniform. Kimble A. C. Motors are from 25% to 50% more economical and efficient than any other A. C. motors in existence.

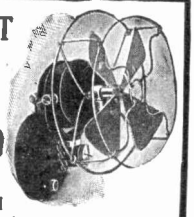
Sold under two years' guarantee. We take all the risk; yet we take no risk because the motor "makes good."

Send for Our Catalogue

Kimble Electric Company
1119 WASHINGTON BOULEVARD CHICAGO



A PERFECT 110 VOLT FAN FOR $6.50



Electrically, Mechanically and Aesthetically Perfect

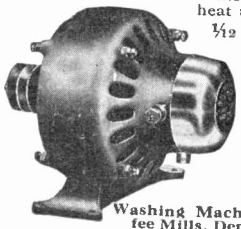
Finish, black enamel and nickel. Any adjustment for home and office, telephone booth, picture show, or where a ceiling fan is not needed. You can buy a larger or a higher priced fan but you **positively can not get a better one.** Noiseless and sparkless. Say whether for alternating or direct current, and give dealer's name. We **prepay express** and guarantee satisfaction.

Seven volt battery fan at same price.

The Carleton Company
178 Summer St., Boston, Mass.

Will Not Burn Out

An important feature of these motors is that they will not heat under any circumstances.



1/12 and 1/8 H.P. for A.C. and D.C. Finished in Black Enamel.

THE BARNES

VARIABLE SPEED AND REVERSIBLE

Are especially adapted for **Washing Machines, Printing Presses, Coffee Mills, Dental Apparatus, Vacuum Cleaners, Wireless Apparatus, etc.**

Let us figure on your requirements

BARNES MFG. CO., 107 Belmont Street Susquehanna, Pa.

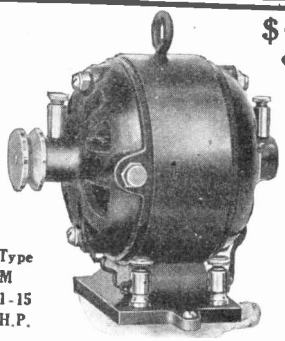
No More "Battery Trouble"

Cease sending for the electrician to "fix that bell." Let the electric light current ring your annunciators, burglar alarms, etc. Our

"Junior" Transformer

will do it more cheaply than any other way. Consumes no current, and can't be damaged by short circuits. Fireproof and durable. For alternating current only. **Price $3.00, at dealers or direct from us.**

THORDARSON ELECTRIC MFG. CO.
214 Jefferson Street CHICAGO



$3.50 for this HIGH GRADE MOTOR

Runs on a. c. and d. c current, two volts. Includes complete set of blue prints showing how to assemble. Has laminated field and armature, mica insulated commutator, 3-16 carbon brushes, bronze bearings, brass grease cups, pulley and terminals.

Assembled complete ready to run

$5.50

Set of blue prints showing motor in detail 12c. Catalogue 4c.

Type M 1-15 H.P.

JOSEPH WEIDENHOFF
1215 S. Ashland Ave. CHICAGO, ILL.

The only Solution:

Get a better job

Are you "trying to make both ends meet" on a small, unsatisfactory salary? Are you one of the thousands of energetic, capable men whose days are spent in work not suited to their natural talents?

No matter what your position is or where you live, if you are poorly paid, the American School can help you. Read this liberal offer.

If you lack the time and the means to stop work and take a course of training, the American School will **lend you the cost of the training** you need and let you make your own terms for repaying us.

This is the greatest offer ever made to men who have "got it in them to rise," and we are prepared to help everyone who comes to us in earnest.

Check the coupon, mail it to us, and we will explain fully our "Deferred Tuition" plan, how we will lend you the cost of the tuition, and allow you to pay us back when the increase in your yearly income equals the amount of the loan.

No Promotion — No Pay — that's what our "Deferred Tuition" Scholarship means. Send the coupon today and prepare for a better job.

AMERICAN SCHOOL OF CORRESPONDENCE
CHICAGO, U. S. A.

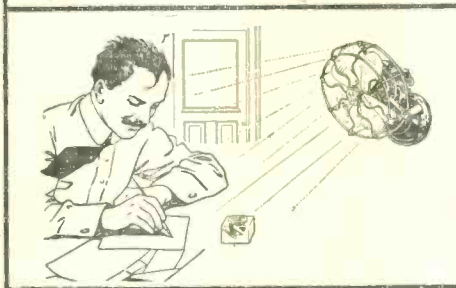
Opportunity Coupon

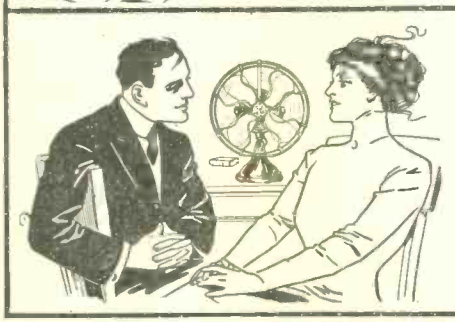
American School of Correspondence, Chicago, U. S. A.
Please send me your Bulletin and advise me how I can qualify for the position marked "X" Pop-Elec. 7-11.

.. Draftsman	.. Fire Ins. Engineer
.. Architect	.. Telephone Expert
.. Building Contractor	.. Moving Picture Op'r.
.. Structural Engineer	.. Bookkeeper
.. Civil Engineer	.. Stenographer
.. Electrical Engineer	.. Accountant
.. Electric Light & Power Supt.	.. Cost Accountant
.. Master Mechanic	.. Cert'f'd Public Acc'nt
.. Steam Engineer	.. Auditor
.. Sanitary Engineer	.. Business Manager
.. Reclamation Engineer	.. College Preparatory

Name .....

Address .....





Cool Comfort

For Half a Cent an Hour

For sultry summer nights and days in home, office, store or factory, General Electric Fans bring unvarying coolness and comfort.

Motionless air in summer often becomes stale and stifling but circulating air tends to purify and cool itself. The oscillating types of G-E Fans turn automatically from side to side and ventilate large rooms uniformly.

Electric Fans

With these portable "breeze-producers" attached to any convenient electric light socket, anything from a lulling zephyr to a "hard blow" follows the turn of a switch.

The cost of operation—a fraction of a cent an hour—is almost too small to notice.

The General Electric Company is the largest electrical manufacturer in the world. So many thousands of G-E motors turn the great wheels of modern factories that the General Electric name-plate on any motor is a universally recognized standard of quality. G-E Fan Motors are just as carefully designed for their purposes as are their "bigger brothers." Insist, therefore, on seeing the General Electric name-plate or the G-E monogram on every fan you buy.

G-E Fan Motors are made in all standard sizes and types, from the 8, 12 and 16 inch desk and bracket fans for home and office use, to the large 52 and 58 inch ceiling, counter column and floor column fans for use in restaurants, stores and other places of business.

Most lighting companies and electrical supply dealers sell G-E Fans but, if you cannot get them readily, write us and we will see that your wants are at once supplied.

General Electric Company

SCHENECTADY, N. Y.

Dept. 30-C **3099**

THE SILENT RUNNING

Federal Vacuum Cleaner

CLEANS QUICKLY
and EASILY WITHOUT
NOISE or VIBRATION

Simple
in
Construction
Easy to
Operate

See a
"Federal"
Before
You
Buy

WILL NOT GET OUT OF ORDER

Bulletin No. 1438 Sent Free Upon Request

Federal Sign System (Electric)

501 Home Insurance Building, Chicago