Popular Electricity Magazine

February 1912

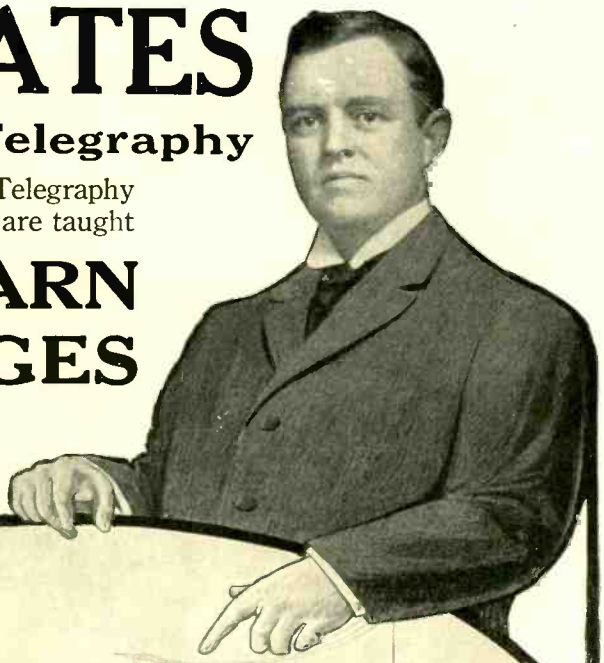
FIFTEEN CENTS

GRADUATES

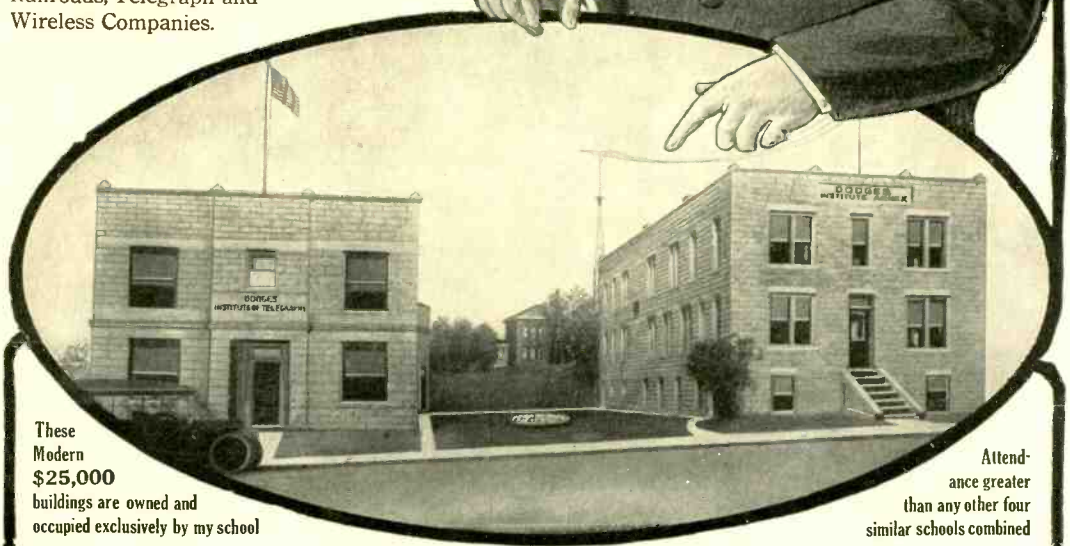
Of My School of Telegraphy

Where Wire and Wireless Telegraphy
and Station Agency Work are taught

ALWAYS EARN GOOD WAGES



because they are thoroughly proficient **when they finish my course of instruction** and are invariably given **immediate employment** by Railroads, Telegraph and Wireless Companies.



These Modern **$25,000** buildings are owned and occupied exclusively by my school

Attendance greater than any other four similar schools combined

The opportunities for rapid advancement are greater now than ever before—**because there is a splendid demand for competent telegraphers, aerographers and station agents.** My Institution is the only one in which students can become entirely qualified.

If you desire a Good Salary,

Easy Work and a Bright Future

Write me **now!** I offer the following unequaled advantages:—Most practical and efficient instruction, Best Equipment (Largest and finest buildings of the kind in the world, equipped with R. R. Dispatcher's and Western Union wires, and Complete High Power Wireless Station), Oldest and most successful Telegraph School in the world, Endorsed by Railroad Wireless and Western Union Officials. My new Station Agency Department is in charge of a practical, expert railway agent and accountant with many years' experience. Expert instructors in all departments. Low Rates (Easy Payments). Living expenses earned while learning. Graduates assisted to good positions. Correspondence courses if desired. **FREE**—Large illustrated catalog and interesting testimonials **Address me personally—**

GEO. M. DODGE, Pres.

DODGE'S INSTITUTE OF TELEGRAPHY

21st Street, VALPARAISO, IND.

Bellevue-Stratford, Philadelphia — Martinique, N. Y. — Iroquois, Buffalo — Portland, Portland — Majestic, N. Y.
Delmonico's, N. Y. — Savoy, N. Y. — Onondaga, Syracuse — Ritz-Carlton, N. Y. — Bellevue, San Francisco — Knickerbocker, N. Y. — Marie Antoinette, N. Y.

The HOTEL DISTRICT of the City of

Edison-Mazda-Light

If all the buildings lighted by Edison Mazda Lamps could be grouped together, the result would be a city composed of the leading hotels, stores, office buildings, banks, theatres, schools, museums, hospitals, factories, railroad stations, municipal buildings and thousands of homes.

Only a small part of the hotel district of this city can be shown here. In this dozen hotels there are 80,000 Edison Mazda Lamps giving a total light of 2,000,000 candle-power.

Begin today to use the sturdy Edison Mazda Lamp that gives nearly three times as much light as the ordinary carbon filament lamp consuming the same amount of current. Your lighting company or electrical supply dealer will furnish any size from 25 to 500 watts.

Which of the following 20 to 40 page, illustrated pamphlets shall we send:

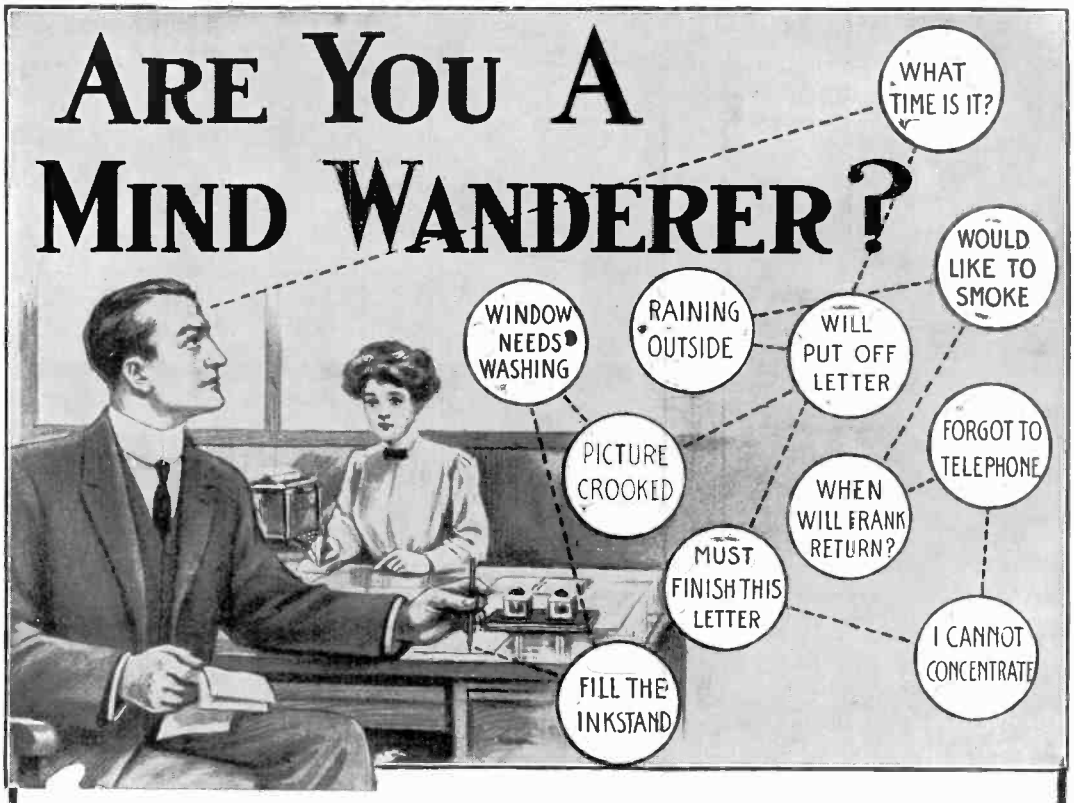
"The Lighting of Hotels and Cafes."
"The Lighting of Office and Public Buildings."
"The Lighting of Iron and Steel Works."
"The Lighting of Textile Factories."
"A New Era in Lighting" (*Homes, Etc*).

General Electric Company

Dept. 30, Schenectady, N. Y. **Branch Offices in Over 40 Cities**

This Trade Mark is a Guarantee of Excellence on Goods Electrical 3342

ARE YOU A MIND WANDERER?



A YOUNG MAN was recently selected for promotion to the managership of his firm's Pacific Coast branch. At a directors' meeting he was called in and introduced by the President. Twelve pairs of sharp eyes took his measure. His personality was distinctive. The first impression was a favorable one.

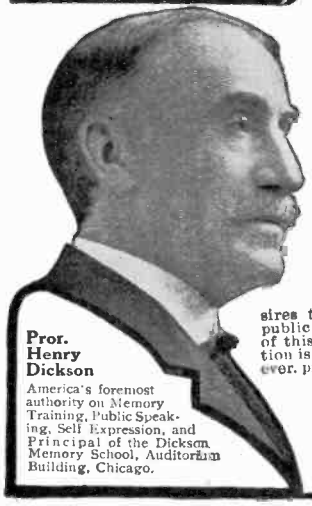
"How much business did we do on the Coast last year," he was asked by the Chairman.

"About,—er—well, I can't exactly remember," was the answer.

Another man whose memory was better got the position.

Now Memory is not a Gift, it is an Accomplishment. You are not born with a good or a bad memory. You are endowed with latent powers, it rests with you whether you let them lie dormant —or develop them to the degree that will make you a man way above the Common Herd. The **big men** everywhere, in Business, Science, Religion, Literature, Law or any other vocation are the ones who have **developed** their powers of Concentration, Attention, and Retention. Their minds are not garbaged with rambling, unrelated, disconnected ideas. They have learned to direct and control their thoughts, **and so can you.**

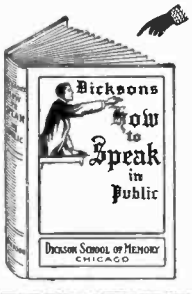
Memory Training is not for a select few, it is for YOU. Let this thought encourage you, that YOU can attain your highest aims *if you wish.* HOW? Write NOW for my free booklet, "How to Remember," using coupon below, or drop a postal card.



Pror. Henry Dickson

America's foremost authority on Memory Training, Public Speaking, Self Expression, and Principal of the Dickson Memory School, Auditorium Building, Chicago.

De luxe edition handsomely illustrated, richly bound. Is exactly suited to meet the needs of the man or woman who desires to be a successful public speaker. The price of this 1911 de luxe edition is $2.00. I will, however, present a copy absolutely FREE to every student who enrolls for my course of memory training within ten days after reading this offer.



How to get a FREE copy of this book

PROF. HENRY DICKSON
Principal, Dickson School of Memory
929 Auditorium Bldg., CHICAGO, ILL.

Send me free Booklet, "How to Remember," also full particulars how to obtain a free copy of "Dickson's How to Speak in Public."

Name _____

Street _____

City _____ State _____

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 March issue close on Feb. 1st.

AERONAUTICS

BLERIOT MONOPLANE—A COMPLETE, simple model of this famous machine Flies long distances under own power, 30c. prepaid. "Gearhart," Box 12, Fresno, Cal.

COMPLETE PLAN DRAWN TO SCALE with full instructions for building the only Wright 3-ft. Bi-plane Model that positively flies. 25 cents postpaid. Drawing and directions for three-foot model Bleriot Monoplane, 15 cents. Stamp brings most complete, interesting and instructive catalogue published. Ideal Aeroplane & Supply Co., 86½ W. Broadway, New York City.

AGENTS WANTED

AGENTS—$1,000 TO $2,500 PER YEAR PAY weekly. C. Phillips Co., Joplin, Mo., 259A.

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

PERFECTION POCKET ADDING MAchine—lightning seller. Agents wanted. Cincinnati Specialty Mfg. Co., Dept. E, Cincinnati, Ohio.

EARN $25 TO $50 WEEKLY, SPARE TIME; no canvassing; repeat orders; sample 10c; write now. Berner, 333 Washington St., Boston, Mass.

AGENTS MAKE $30.00 WEEKLY SELLing our 500 Handy Household Articles; catalogue free. Scheff Company, 1631 Wells St., Chicago.

WANTED—AGENTS TO SELL TEAS AND coffees. Burns & Reed, 209 Hudson St., New York.

AGENTS WANTED TO INTRODUCE high grade specialties into every home. Quick sales; big profits. Dixie Specialty Co., Shelby, N. C.

STAMP AND ENVELOPE MOISTENER. Self-selling; sample and terms to agents 15c coin. Arthur R. Johnson, 4725 Magellan St., Duluth, Minn.

INCREASE YOUR KNOWLEDGE OF electricity. Send for our illustrated catalog of electrical books. It's free. Popular Electricity Book Department.

ONE MILLION AGENTS WANTED—FAST seller costs 5c, sells 50c. Every firm needs. Orders to $50. Postal brings samples. Embossed Co., 2497 Milwaukee Ave., Chicago.

AGENTS—PORTRAITS 30C, FRAMES 15C, pillow tops 30c, sheet pictures 1c; best work and service; catalogue free. Central Portrait Co., 2609 Wilcox Ave., Chicago, Ill.

AGENTS WANTED

DON'T ACCEPT AN AGENCY UNTIL you get my samples and particulars. Money makers. Address, SAYMAN, 706 Sayman Bldg., St. Louis, Mo.

AGENTS—EXTRAORDINARY; HOUSEhold specialties; great demand; large commissions; particulars free. Brilliant Finish Products Company, Cincinnati, Ohio.

ENVELOPE MOISTENER, NO-WHITTLE Pencil! Self selling. Sample, terms, 10c coin. Apex Sales Company, 1224-1226 17th St., Denver, Colo.

MALE AGENTS—ANY KIND—THIS space is too small to tell how good our proposition is. Write. Novelty Fifty-Nine Co., 2561 Milwaukee Ave., Chicago.

AGENTS, PORTRAITS 35c, FRAMES 15c, Sheet Pictures 1c. Stereoscopes 25c. Views 1c. 30 days' credit. Samples and catalogue free. Consolidated Portrait Co., Dept. 1402, 1027 W. Adams St., Chicago.

SIGN PAINTING AGENTS—1,000 PER cent profit; best and cheapest window letters made. Easiest mounted; outfit free; success positively guaranteed. Embossed Letter Co., 2493 Milwaukee Ave., Chicago.

QUALIFIED MEN AND WOMEN, HIGH grade educational specialty, travel in south during winter, work backed by twenty-five years' success. Write today. Lewis E. Myers, Chautauqua Park, Valparaiso, Ind.

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.

AGENTS—BIG MONEY, 20x24, FRAMED religious, art and largest selling Negro pictures, completely framed, 12c; portraits, frames, pillow tops; lowest prices; 30 days' credit. Catalogue free. Peoples Portrait Co., Dept. F, 710 W. Madison St., Chicago, Ill.

AGENTS WANTED—TO SELL THE NEW 3 in 1 Scrub Brush, Floor Mop and Wringer, combined; also 8 other original styles; $5 profit ½ day's work. Send name on postal to Hilker Mop Co., 1185 Grand Ave., Chicago. Free catalog and sample.

PEERLESS AUTOMATIC DRAFT REGUlator puts on draft while you sleep insures warm house when you arise. Price $5.00. Write for circular D. Liberal Discount to agents. O. K. Landis, 423 Charlotte St., Lancaster, Pa.

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

BIG WINNER FOR AGENTS — 7-IN-1 nickel plated steel combination tool key ring; screw driver, can top opener, bottle cap opener, cigar cutter, pipe cleaner, nail cleaner; most useful pocket novelty invented; sells itself. Sample, postpaid, 10 cents. Joseph Matthieu, 203 Court St., Brockton, Mass.

AGENTS WANTED

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.

BIG PROFIT—TO SELL A COMPOUND that cleans and makes silverware as bright as new by dipping article once in solution; just the thing for every household and hotels. Sample package with agents' terms, 10c (silver). A. Lagerstrom Supply Co., Room 1, Cannon Falls, Minn.

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

AMAZING INVENTION — ENTIRELY new lamp burner. Changes common kerosene light into large brilliant, white flame. Rivals gas or electricity. Odorless, smokeless. Not a mantle. Can't break. Wonderful, Different. Irresistible selling proposition. Experience unnecessary. Show one; sale made. Sample outfit, 35c prepaid, will start you. Radiolite, 378 Colonnade, Toledo, O.

10,000,000 U. S. HOMES NEED THE Aladdin Mantle Lamp because they burn kerosene. Using less oil than ordinary lamps, the Aladdin outshines gas or electricity. Sells itself on overnight trial. Ball sold 850 on money back guarantee. Not one returned. Sample lamp furnished. Write quick for agency proposition. Mantle Lamp Company, Dept. 141-P, Chicago.

AGENTS—DROP DEAD ONES. AWAKE! Grab this new invention; low priced, waterpower home massage machine; magical, marvelous, mysterious; new field; big profits; sold on money back guarantee. "Margwarth sold 5 in 10 minutes; 31 in 2 days." "Parker sells 8 first day." Vaughn: "Your machine has merit; express 6 dozen." Free information. Blackstone Co., 306 Meredith, Toledo, O.

GENERAL AND LOCAL AGENTS, HERE is your opportunity. Energetic men can make $2,500 yearly and up. THE IMPROVED CANCHESTER KEROSENE MANTLE LAMP revolutionizes old methods. Far superior to electricity, gas, acetylene or gasoline at 1/10 the cost. BURNER FITS ALL LAMPS. Safe, clear, odorless. BURNS WITH OR WITHOUT MANTLE. Tested and pronounced by state of Pennsylvania. "Most efficient light found." Greatest seller known. WE WANT A FEW MORE LIVE MEN IN OPEN TERRITORY. Canchester Light Company, Dept. P. E., 204 N. State St., Chicago.

AGENTS WANTED

LIVE AGENTS WANTED—HUSTLERS to handle our attractive 1912 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, Chicago.

AGENTS—TO SELL THE NEWEST ELECtric appliance on the market; sold everywhere there is electricity, in the home and office; liberal profit; sales-driving sample, weighs a pound; no experience or knowledge of electricity required. It shows how to use one light instead of two and get the same results; sells for $3.50 and saves the purchaser an investment of $25; write for particulars. The Handy Light Co., 723 East Eighth Av., Cincinnati, Ohio.

AUTOMOBILES

WINTON — ELEGANTLY EQUIPPED; good as new; four-cylinder touring car, $350. G. Hilpolsteiner, No. 1314 Stebbins Ave., Bronx.

MAXWELL — FIVE-PASSENGER TOURing, elegantly and completely equipped; $225. W. Hoey, No. 3163 Broadway, N. Y. City.

FORD—FOUR-CYLINDER RUNABOUT; top, windshield, gas lamps, etc.; runs and looks like new; $200. Wilson, 2230 7th Ave., N. Y. City.

REO 5-PASSENGER TOURING; PERFECT in every way; $175.00. Room 79, 219 West 125th St., New York City.

BUICK 5-PASSENGER TOURING CAR; top, full equipment. Excellent condition, $150.00. Dr. Spillane, 248 East 119th St., New York City.

WANTED—AUTOMOBILES, ANY MAKE, year or condition; what have you? Room 73, 211 West 125th St., New York City.

FOR SALE—AUTOMOBILE 2-CYLINDER Holsman. Air-cooled 12 h. p., buggy type; good running order; bargain price, $60. R. Roth, 1423 North Ave., Bridgeport, Conn.

POPE-TOLEDO 60 H. P. SEVEN-PASsenger touring, elegant condition; $300. Typewriter Exchange, 220 W. 125th St., N. Y. City.

FORD—"1911" FIVE-PASSENGER, FOURcylinder touring car, completely and elegantly equipped; must sacrifice for $400. Miss Stern, No. 1 W. 131st St., N. Y. City.

FORD—SIX-CYLINDER, SEVEN-PASsenger touring car; elegantly equipped. Cost $2,500, sell $360. M. McDonough, No. 147 Morningside Ave., N. Y. City.

FORD—"1910" FOUR-CYLINDER TOURing car, completely and elegantly equipped, as good as new, $300. C. Kokesch, No. 2537 Belmont Ave., Bronx.

AUTOMOBILES—SAVE DEALERS' PROFits; buy direct from the owners. I have all makes runabouts from $50.00 up. Touring cars from $100.00. Don't purchase any car until you get my prices; all guaranteed for one year. King, Automobile Broker, 213-217 West 125th St., N. Y. City.

BUSINESS OPPORTUNITIES

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

MAKE $4 DAILY SILVERING MIRRORS at home. Complete $5 course, 50c. C. Kroll & Co., 495½ N. Dale St., St. Paul, Minn.

COMPLETE M. O. BUSINESS 10 CENTS. Everything furnished. No advertising. Benson, 3515 Adams, Chicago.

FOUR GOOD MONEY-MAKING PLANS, 25 cents. T. Marnix, 1429 Helena Ave., Helena, Mont.

BIG PROFITS—OPEN A DYEING AND cleaning establishment; little capital needed; we teach by mail. Booklet free. Ben-Vonde System, Dept. A-D, Charlotte, N. C.

$100 MONTHLY AND EXPENSES TO trustworthy men and women to travel and distribute samples; big manufacturer. Steady work. S. Scheffer, Treas., MY, Chicago.

GO IN BUSINESS FOR YOURSELF—Small capital; re-orders; unlimited field; particulars free. Winslow W. Chase, Dept. 10, Washington, D. C.

PATENTS BRING WEALTH; PROOF ON request; $58,000 offered for an idea; advice free; highest references. Alexander Wedderburn, Patent Attorney, Department 43, Washington, D. C.

BE INDEPENDENT; START MONEYmaking 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.

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.,

SAVE MONEY ON SUBSCRIPTIONS. Send me a list of magazines or periodicals in which you are interested and I will quote you lowest subscription prices. John Hanrey, 4652 Hazel Ave.

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.

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.

$50 PER WEEK AND UP, HOW FAR UP depends on you; $21,500 in 3 years by one Mgr.; $6,000 in one year by another; $4,000 by another in 6 months, must have $500 to invest. Western Oxygenator Co., Beatrice, Neb.

MAKE MIRRORS AT HOME. BIG PROFits with little outlay. One 18x36 in. mirror costs $2.00 to $5.00. You can silvc 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.

BUSINESS OPPORTUNITIES

A BIT SHY ON SALARY? I PICK UP $1,500 yearly additional from newspaper correspondence. My book tells what's news, how to get it, where to sell. Newspaper directory included. No correspondence school expense; only 50 cents. First sale returns investment. Morris White, 701 Oneida, Detroit, Mich.

WE START YOU IN BUSINESS, WHOLEsale or retail, furnishing everything. Men and women, $30.00 to $200.00 weekly operating our original "New System Specialty Candy Factories," home or small room anywhere; opportunity lifetime; booklet free. H. Ragsdale Co., East Orange, N. J.

HAVE YOU READ THIS? SOMETHING new. A first-class scheme. Can be worked in spare time. No stock or catalogues needed. Can be started on a few dollars. Will give very large profits. Only a few sets of plans for sale. Will send complete scheme for $1 if sent in the next ten days if you mention Popular Electricity. J. F. Sheridan, 417 E. 151st St., New York City.

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 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 (copyrighted) plans. Sworn statement. J. M. Pease Mfg. Co., 550 Pease Bldg., Michigan St., Buffalo, N. Y.

START A NEW BUSINESS—THE "AMERican" razor honing and safety blade sharpening machine earns $5 to $10 a day. We furnish the outfit and teach you how. No previous experience required. Illinois Cutlery Co., Dept. 4, 184 Washington St., Chicago. Note the "American" is the only machine that sharpens hones and strops. Safety razor blades sharpened, 2½ cents each. Razors honed, 15 cents; work guaranteed. Inclose return postage.

BOOKS

ANY BOOK IN PRINT. STATE SUBJECT wanted. Antlers, 1707 Tremont St., Denver, Colo.

BOOKS ON ALL ELECTRICAL SUBJECTS —Send for our free illustrated catalogue. Popular Electricity Book Department.

MY BOOK OF OVER 300 FORMULAS will help you make money. Sent postpaid for 10c. H. Jacobus, 214 Avon Ave., Newark, N. J.

3,000 RECIPES, FORMULAS AND TRADE secrets, 25c. Book catalog free. Scientific Book Shop, Syracuse, N. Y.

MECHANICAL BOOKS, ALL TRADES, catalogue for stamp. Crescent Book Store, 329 S. Halsted St., Chicago.

THREE LITTLE BOOKS FOR LADIES, postpaid, in plain cover, for 25c. (Tell what you want to know.) O. K. Pub. Co., Decatur, Ill.

HAVE YOU READ "HOW TO SUCCEED?" It is the greatest satire ever written on the get-rich-quick mania; 15 cents per copy, postpaid. A. A. Ruhnau, Dept. 40, 280 Columbus Ave., New York.

BOOKS

IMMORTALITY CERTAIN — SWEDENborg's great work, "Heaven and Hell," 400 pages; only 15 cents, postpaid. Pastor Landenberger, Windsor Pl., St. Louis, Mo.

NEW BOOK CONTAINING LIQUID court plaster, polishing cloth, gold plating,and 98 other secret formulas, 35c. Armstrong Sales Co., Springfield, Ohio.

STEEL TEMPERING BOOK FOR MEchanics and Mechanical Digest one year special offer, 25c. Mechanical Digest, Grand Rapids, Mich.

MECHANICALISM — A complete religious theology, based upon the indisputable laws of mechanics and biology, with unique evidences of individual immortality, 30 cents. Socrates Scholfield, Providence, R. I.

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.

MY TREATISE, ILLUSTRATED, ON deafness and head noises, explains how complete, lasting relief may be effected without drugs or batteries. Experience 32 years. Book sent free by author. Geo. E. Coutant, M. D., 97B, Sta. E., New York, N. Y.

"WIRELESS TELEPHONES AND HOW They Work," by J. E. Murray. Shows how wireless telephones work; also a number of interesting experiments for the amateurs, 68 pages, fully illustrated. Price, $1.00. Popular Electricity Book Department.

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.

"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.

"HOW TO BECOME A SUCCESSFUL Electrician," by Prof. T. O'Conor Sloane. Every young man who wishes to become a successful electrician should read this book. It tells in simple language the easiest and surest way the studies to be followed, methods of work and field of employment. 202 pages. Postpaid, $1.00. Popular Electricity Book Department.

STANDARD BUSINESS BOOKS LOANED by mail, for return or purchase at option. Advice on short reading courses free. Personal training; salesmanship; advertising; bookkeeping; banking; investments; choosing a career; system and efficiency; agriculture; popular law; business letter writing; speakers' and writers' books, etc. Also health, house and home; public quetsions; occultism; science; religion. Ask for lists and Library Critic. Oriental Esoteric Library, 220 Washington, D. C.

BOOKS

HYDE'S TELEPHONE TROUBLES AND How to Find Them. Price 25 cents. Hyde Pub. Co., Telephone Bldg., 133 5th St., Milwaukee, Wis.

COINS AND STAMPS

STAMPS, 100 ALL DIFFERENT, FREE. Postage 2c. Mention paper. Quaker Stamp Co., Toledo, Ohio.

OLD COINS BOUGHT AND SOLD—MY new 50-page coin selling catalogue just out, free. Buying coin catalogues sent on receipt of 10c in stamps. William Hesslein, Malley Bldg., New Haven, Conn.

OLD COINS. $7.75 PAID FOR RARE dates 1853 quarters; $20 for half dollars; we pay a cash premium on hundreds of coins; keep all money dated before 1884 and send 10 cents at once for our illustrated coin value book, size 4 by 7; it may mean your fortune. C. F. Clarke & Co., Coin Dealers, Dept. 83, LeRoy, N. Y.

ELECTRICAL MATERIAL

METERS, MAGNET AND REACTANCE coils, magnet wire and numerous things electrical; will sell cheap. C. J. Brown, 3631 Honore St., Chicago.

FOR SALE

FOR SALE—MOVING PICTURE FILM 1 cent foot. H. Davis, Watertown, Wis.

TATTOOING MACHINES. F.. BARBER, 1019 Vine St., Cincinnati, Ohio.

GUMMED LABELS, 3,000, $1.00. 2 COLORS. Catalog free. MacTaggart, 709 N. 19th St., Philadelphia, Pa.

CASTINGS FOR A 2 H. P. STATIONARY gas or gasoline engine; suitable for experimental work, $5.00. R. H. Bowersox, Hanover, Pa.

YALE POCKET ADDING MACHINE, 30 cents prepaid; no stamp. Yale Mfg. Co., Dept. H, Newark, N. J.

FOR SALE—BIG MOOSE HEAD, NEWLY mounted, $25. Deer head, $10. R. Sayler & Son, 497 South Broadway, Dayton, Ohio.

SET A. S. C. CYCLOPEDIA OF ELECTRICity. 5 volumes, $2.50 per volume. C. J. Brown, 3631 Honore St., Chicago.

MATCHLESS POCKET LIGHTER SENT postpaid to any sender upon receipt of 35c. Lowe Novelty Co., 5727 Lowe Ave., Dept. A12, Chicago.

BLACK ORPINGTON AND ANCONA chickens. None better. Price reasonable. Ellis Foster, Caldwell, Ohio.

PRINTING INKS ANY COLOR 10c. Bronzes, Cards, Type, etc. Amateur Printers Exchange, 958 Harrison, Chicago.

VERTICAL STEAM ENGINES, 2 TO 25 HP. Send for circular. E. T. Frank & Son, 642 W. Pratt St., Baltimore, Md.

WOODS ELECTRIC AUTOMOBILE, less batteries, $75.00. Will consider 2 H. P. motor as part payment Box 275, Burlington, Wis.

COMPLETE ELECTRICAL ENGINEERing correspondence scholarship and drafting outfit; merely started; cost $135.00; bid quick. Chas. Dodge, Albany, Wis.

FOR SALE

FOR SALE—I. C. S. ELECTRIC RAILways and lighting course; also back numbers Popular Electricity and Popular Mechanics. R. Wittig, 2217 Cherry St., Milwaukee, Wis.

LUBRICATORS AND CUPS FOR SHAFTing and Loose Pulleys. No drip or dirt. Very economical. Swain Lubricator Co., New No. 328 W. Lake St., Chicago.

WE BUY, SELL AND EXCHANGE—BARgains in Microscopes, Telescopes, Field Glasses, Cameras, etc. Catalogue and Bargain List free. Kahn & Co., Established 1850, 26 John St., New York.

FOR SALE, COMPLETE SET OF CASTings for ¾ h. p. gasoline stationary engine, also 3 h. p. motor cycle engine set and one and 2-cylinder marine engine sets. Comet Motor Wks., 564 Jackson Blvd., Chicago.

100 SOLID STEEL 14 POUND VISES, 3-inch jaws, $1.50. Also 500 guaranteed pocket ammeters for testing batteries, with chamois leather case, 25c. postpaid. Auto Repair Co., 521-23 West 144th St., N. Y.

FOR SALE—ONE WAVERLEY ELECTRIC Runabout in fine condition $300.00. One four-passenger Waverley Surrey, in excellent condition, with new batteries, cost new $1,900.00, will sell for $650.00. Lucia Bros. Motor Car Co., Green Bay Wis.

JUST OFF THE PRESS—"PRACTICAL Applied Electricity," by David P. Moreton. A book written for practical electrical workers and presented in a practical manner in plain English. Unusually complete, containing 450 pages and 300 illustrations. Price, $2.00. Send for complete description. Popular Electricity Book Department.

FOR MEN

SEND US $1 AND WE WILL MAIL YOU, postpaid, five "Egypto" triple service four-in-hand or bow ties, full reversible. Equal in appearance to any 50-cent tie made and will outwear any three 50-cent ties. State colors desired. Your money back by return mail if not satisfied. Keokuk Neckwear Company, Keokuk, Iowa.

FOR THE HOME

50 CENTS to $5.00 SAVED ON YOUR GAS bill every month with our governor. A great invention; send for free circular today. Specialty Supply Co., Manager's Office, Kewanee, Ill.

FOR THE PHOTOGRAPHER

FILMS DEVELOPED, 9c A ROLL, ANY size prints, 2¼x3¼; 3¼x4¼; 4x5, at 3c. 8x10 enlargements, 25c. each. King, 2230 Seventh Ave., New York City.

FORMULAS

FORMULAS—SIX MONEY-MAKERS, $1. Warren Stewart, Hope, Ind.

FORMULA—FOR DUPLICATOR 10 CTS. Easy to make, costs trifle, guaranteed for pen or typewriter copy. H. Hamblett, 8 Ellingsburg St., Lowell, Mass.

GAMES AND AMUSEMENTS

MAGIC GHOST—VERY MYSTIFYING, 10 cents. Klein, 1193 Broadway, N. Y.

FREE — VENTRILOQUIST'S WHISTLE free. Tricks, jokes, novelty lists. Send 6c. Wm. Fisher Co., Harrisburg, Pa.

MAKE-UPS—GENUINE HAIR MUStaches, 35c; gentleman's bald or dress wigs, $3.25; ladies' wigs, $4.25; all characters; beards, 60c and $1.00; Imperials, 20c; Van Dykes, 50c; all postpaid. Percy Ewing, Decatur, Ill.

VENTRILOQUISM, 700 TOASTS, 1,000 conundrums, dancing instructor, dictionary, 153 tricks, home toy-maker, coon jokes, 84 card tricks, etc. 10c per book. Circulars free. "Barstow," 514 23rd St., Oakland, Cal.

PLAYS, VAUDEVILLE SKETCHES, MONologues, Dialogues, Speakers' Minstrel Material, Jokes Recitations, Tableaux, Drills, Musical Pieces, Entertainments, Make Up Goods. Large Catalog Free. T. S. Denison & Company, Dept. 26, Chicago.

IGNITION

GASOLINE IGNITION. DRY CELL Batteries. Will demonstrate formula and process of manufacture to intending manufacturers only. J. Dougan, 234 Smith St., Winnipeg, Canada. References.

INSTRUCTION

LEARN VENTRILOQUISM AT HOME. Particulars for stamp. M. Bailey, Box 253, St. Paul, Minn.

INCREASE YOUR KNOWLEDGE OF electricity. Send for our illustrated catalog of electrical books. It's free. Popular Electricity Book Department.

LEARN TO PAINT BEAUTIFUL ART glass pictures. Inexpensive. Easily learned. Big profits. Particulars for dime. L. A. Bowes, Bluefield, West Va.

METALIZE FLOWERS, INSECTS, ETC., for jewelry. Pleasant home employment. Send stamp for free sample and booklet. A. Benson, Stewartville, Minn.

BUILD YOURSELF A TWO-HORSE POWer motorcycle engine at a cost of only $3; complete instructions with drawings 50c (coin). A. Weaver, Clemmons, N. C.

BECOME STAGE ELECTRICIANS—SALaries $25-$50 weekly, guaranteed. Five sample lessons revealing stage secrets, 10c. Address Shubert's Theater "E", Denver, Colorado.

AMERICA'S FINEST PENMAN TEACHES rapid, tireless business writing by mail; small cost; illustrated journal free. Francis B. Courtney, Cedar Rapids, Iowa.

QUESTIONS — RELIABLE ANSWERS. Estimates for stamp. Manufacturers' addresses, 15 cents. Electrical Engineer, 3957 Fullerton Ave., Chicago.

BOY MECHANICS AND ELECTRICIANS. Wood turning without lathe. Pulleys, commutators, handles, etc. Instructions and drawings 15c (coin). Inexpensive, valuable. L. King, Tomah, Wis.

REAL ESTATE

FARMS BOUGHT AND SOLD. NO MATter where located. Write Chas. A. Phildius, 388 Pleasant Ave., New York.

SCHOOLS

SEE WHAT I SAY UNDER "TYPEwriters." ATCHISON.

LEARN PEN LETTERING AND DESIGNing by mail. Send stamp for circulars. Artist, 28 Main St., Tarrytown, N. Y.

WE TRAIN DETECTIVES. YOU CAN BE one. Splendid opportunities. Travel. Earn $100 to $300 monthly. This fascinating profession taught practically and scientifically by mail at a nominal cost. American School of Criminology, Dept. G, Detroit, Mich.

TELEPHONE PRACTICE—COMPLETE instruction by mail, qualifies men for quick advancement to high positions; write for particulars. The Sinclair School of Telephony, Cambridgeport, Mass.

FREE TUITION BY MAIL: CIVIL SERVice, Drawing, Engineering, Electric Wiring, Agricultural, Poultry, Normal, Academic, Bookkeeping, Shorthand Courses. Matriculation $5. Tuition free to first applicants. Apply to Carnegie College, Rogers, Ohio.

AUTOMOBILE SCHOOL—LEARN THE automobile business, repairing and driving, in which you can earn good wages and have healthful and pleasant work. We give a thorough and practical course in road work and repairing. For full particulars address Academy of Automobile Engineering, 1420 Michigan Ave., Dept. "C," Chicago, Ill.

TELEGRAPHY

TELEGRAPHY—WIRE AND WIRELESS—taught quickly. Train dispatchers' wire and wireless station; station agency; positions secured; catalog free. Eastern Telegraph School, Box 2, Lebanon, Pa. Established 1896.

TELEGRAPHY—MORSE AND WIRELESS; Railway Accounting (Station Agency) taught quickly. R. R. Dispatchers and Western Union Wires and complete Wireless Station in school. Splendid opportunities. Graduates assisted. Living expenses low—may be earned. Largest and oldest school—established 37 years. Investment $25,000.00. Correspondence courses also. Catalogue FREE. DODGE'S TELEGRAPH & RAILWAY INSTITUTE, 16th St., Valparaiso, Ind.

TYPEWRITERS

HAVE ELEGANT REMINGTON TYPEwriter, No. 6, for $15.00. Also Smith-Premier, No. 2, $15.00. F. Theim, 3945 Prairie Ave., Chicago.

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.

TYPEWRITERS

STENOGRAPHER MUST SELL HER REMington typewriter, $9.00. Miss King, 2230 Seventh Ave., New York City.

SURPRISING TYPEWRITER BARGAINS —No matter what make, will quote you lowest prices and easiest terms, or rent, allowing rental on price. Write for big bargain list and catalogue 14. L. J. Peabody, 278 Devonshire St., Boston, Mass.

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

MINERAL DETECTOR, 25 CENTS, POSTpaid, silicon crystal free with each. E. Ferguson, 11 Fillmore pl., Brooklyn, N. Y.

SPECIAL OFFERS — DETECTOR FOR portable outfits. Very compact and sensitive, $1. Leyden jar condensers for coils under 2 inch, 25 cents. Helix clip, 5 cents. Detector cups, 5 cents. Central Electric Co., Marshalltown, Ia.

WIRELESS APPARATUS — WE CARRY the largest line of wireless apparatus in Western Pennsylvania; special prices; loose-coupler, $8.50; 2,000 ohm head set, $4.00. Send 2c stamp for catalog. The Merker-Flocker Electric Co., 957 Liberty Ave., Pittsburgh, Pa.

CLOSED-CORE TRANSFORMERS. SELFcontrolling, four variations. ¼ K. W., $10; ½ K. W., $15; 1 K. W., $25. Guaranteed. Sent on trial. Send for particulars. Phillips Roadhouse, Shelby, Mich.

NOW IS THE TIME—YOU ARE INTERested in raw materials and articles such as every experimenter needs. Low prices. Send stamp for price list. No postals answered. The Experimenters' Supply Co., 2205 Belmont Ave., Chicago, Ill.

WIRELESS OPERATORS! MY NEW Speed Chart will teach you to receive from the fastest operators. Morse, Continental and Navy codes on one chart, 50 cents. No stamps. Fred Fulgora, Box 356, North Diamond Station, Pittsburg, Pa.

FOR WIRELESS APPARATUS GO TO Chambers & Co. Every instrument guaranteed to be first-class; parts sold separately; special 7-stranded aerial wire, 60c per 100 ft. Send 2c stamp for our new illustrated catalogue of commercial and amateur instruments. Estimates cheerfully furnished for either large or small stations. Visitors are welcome at our Test Station, which is the largest in the city. F. B. Chambers & Co., 217 N. 9th St., Philadelphia, Pa.

HELP WANTED

BIG MONEY WRITING SONGS. SEND for free booklet. Tells how. Conway, 49 Tuscola St., Detroit, Mich.

EARN GOOD PAY COPYING. Addresses; particulars six stamps. Hinshey, 167, Middleport, N. Y.

EITHER SEX, DISTRIBUTE ADVERTISing literature, spare time; no canvassing; remunerative opportunity; stamp for particulars. Roberts, 5615 Hazel, Philadelphia.

U. S. CLERKS, $30 WEEKLY; SEND FOR free booklet (E), "Government Positions, How to Get Them." Clerk Agency, 260, Providence, R. I.

$25 WEEKLY AND EXPENSES TO MEN and women to collect names, distribute samples and advertise. Steady work. C. H. Emery, Chicago, Ill.

CAN FURNISH PERMANENT EMPLOYment to three educated, Christian men, organizing ability necessary. State age and former occupation. Address, L. S. Higley, Valparaiso, Ind.

WANTED—YOUNG MEN TO LEARN AUtomobile business; big pay, demand greater than supply; make you expert in ten weeks; automobile model free; interesting booklet free. Box 998, American Automobile Institute, Rochester, N. Y.

WANTED—INEXPERIENCED MEN TO work on actual contract jobs for small pay; electricity, plumbing, bricklaying, automobiles; must first finish short correspondence course but there is no expense; catalogs free. United Trade School Contracting Co., Los Angeles.

MEN AND BOYS TO LEARN AUTOMObile repairing, driving on up-to-date cars; electrical, civil engineering, surveying, in most practical way. Room and board while learning. Positions secured; satisfaction guaranteed; catalog free. National School of Engineering, 2110 West 7th, Los Angeles.

FREE ILLUSTRATED BOOK TELLS about over 360,000 protected positions in U. S. service. More than 40,000 vacancies every year. There is a big chance here for you, sure and generous pay, lifetime employment. Easy to get. Just ask for booklet A50. No obligation. Earl Hopkins, Washington, D. C.

BIG MONEY WRITING SONGS—THOUsands of dollars for anyone who can write successful words or music. Past experience unnecessary. Send us your song poems, with or without music, or write for free particulars. Acceptance guaranteed if available. Washington only place to secure copyright. H. Kirkus Dugdale Co., Dept 13, Washington, D. C.

LOCAL REPRESENTATIVE WANTED—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, President The National Co-Operative Real Estate Company, L604 Marden Building, Washington, D. C.

HELP WANTED

SIDE LINE—COMMISSION 20 PER CENT—Electrical salesman can easily sell new device, large possibilities; easy to sell; demonstrates itself; good profit. Manufactured by an old reliable manufacturer. Address, Electrik, care of Popular Electricity.

SALESMEN AND BRANCH MANAGERS everywhere to handle best selling proposition known. Experience unnecessary. Legitimate, permanent and commands instant attention. Big commissions. Exceptional opportunity. W. E. Bryan & Co., Cincinnati, Ohio.

YOU ARE WANTED FOR GOVERNMENT positions; $80.00 month to commence; annual vacations; short hours; no "layoff." Common education sufficient; over 12,000 appointments coming; influence unnecessary. Send postal immediately for free list of positions open, with description. Franklin Institute, Dept. S54, Rochester, N. Y.

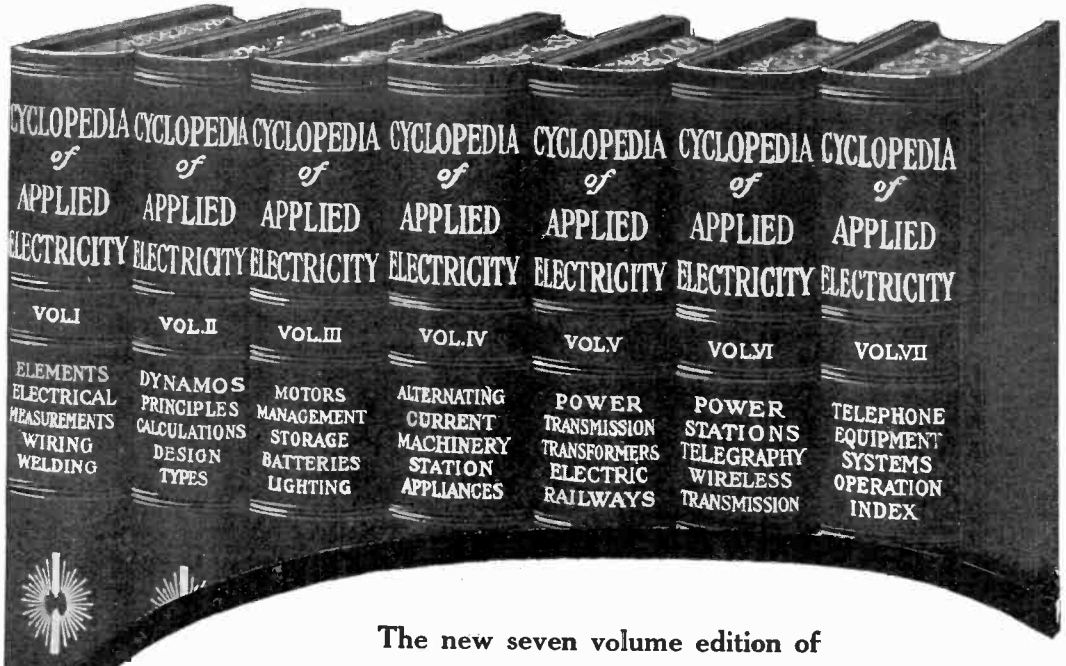
BE AN ELECTRICAL METERMAN—PAYS $900 to $1,800 a year. New field. Demand for competent metermen, created by rapid introduction of electricity; greater than supply. Our personal, practical instruction by mail quickly qualifies you for splendid position as meterman. Graduates assisted. Write for particulars. Fort Wayne Correspondence Schools, Dept. 30, Fort Wayne, Ind.

TRAVELING SALESMEN EARN FROM $2,000 to $5,000 a year and are in great demand. If you want to become a traveling salesman and earn while you learn, write at once for particulars of our system. Bradstreet System, Dept. 21, Rochester, N. Y.

THE NEW STATE AUTOMOBILE LAWS make it impossible for incompetent or untrained persons to hold a chauffeur's license and at the same time makes it possible for properly registered and licensed chauffeurs to demand higher wages. Don't waste your time and money in small, new, or poorly equipped schools, but come direct to the largest in the business. WE GUARANTEE A MAN HOLDING OUR DIPLOMA to pass state examination. GREER COLLEGE OF MOTORING, 1459 Wabash Avenue, Chicago, Illinois. THE ONLY SCHOOL CARRYING THE ENDORSEMENT OF THE TRADE.

MAGIC POCKET TRICK FREE
Catalog included, send 6c stamp.
Dept. 17 270 W. 39th St. New York

YOU CAN BE AN AUTO EXPERT
We teach you the entire subject by mail in 10 weeks' spare time, and assist you to secure good position. Demand for trained men can't be filled. Simple, practical and personal instruction.
FREE AUTO MODEL TO EACH STUDENT
FIRST LESSON FREE WRITE FOR IT NOW
OWNERS—we supply competent men
Empire Auto Institute, 803 Empire Bldg., Rochester, N. Y.
The Original Automobile School



The new seven volume edition of

ELECTRICAL KNOWLEDGE

This is the greatest electrical reference library, for the expert and student. These books are published especially for the ambitious man who is training himself for advancement—for the wide-awake man who is likely to be called upon for work outside of his regular line—for the man who needs at his elbow, for ready reference, an accurate down-to-date work on electricity. Seven volumes, 3,200 pages with over 2,600 full page illustrations, diagrams, formulas, etc., printed in large, clear type on special quality paper.

Read What This Great

CYCLOPEDIA OF APPLIED ELECTRICITY CONTAINS

Theory, Calculation, Design and Construction of Generators and Motors—Electrical Measurements—Electric Wiring—Electric Welding—Types of Generators and Motors—Management of Generators and Motors—Storage Batteries—Electric Lighting—Alternating-Current Machinery—Station Appliances—Power Stations—Power Transmission—Central Station Engineering—Electric Railways, including Single-Phase—The Electric Telegraph—Telephone Equipment, Systems and Operation—Wireless Telegraph and Telephone—Telautograph—Telegraphone, etc.

EXAMINE THIS GREAT CYCLOPEDIA FREE OF CHARGE

The complete seven volumes, not a sample volume, will be sent, express prepaid, for seven days' free examination; returnable at our expense if the books do not contain the information you want. If you keep the books, pay $1.80 seven days after receipt and then $2.00 a month until you have paid the special introductory price of $19.80.

The Table of Contents above will give you some idea of the tremendous scope of this work, but only an examination of the books will reveal their full value to you.

Just fill in and mail the coupon. It won't cost you a cent to examine the books. We know they'll be worth many times their cost to you. Mail the coupon now before the busy season begins and you will receive your books promptly.

Free With Every Order Received Before March 1, 1912

With every set is included a year's Consulting Membership entitling you to the advice of our business and engineering experts free. This will give you practical help in handling working problems which are too specific to be taken up in detail in the Cyclopedia. There will be no limit to this service. A single problem solved for you might be worth more than the first cost of the books.

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

FREE EXAMINATION COUPON

Popular Elect. 2-12

A. S. of C.

Please send me Cyclopedia of Applied Electricity for seven days' free examination. I will send $1.80 within seven days and $2 a month until I have paid $19.80; otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

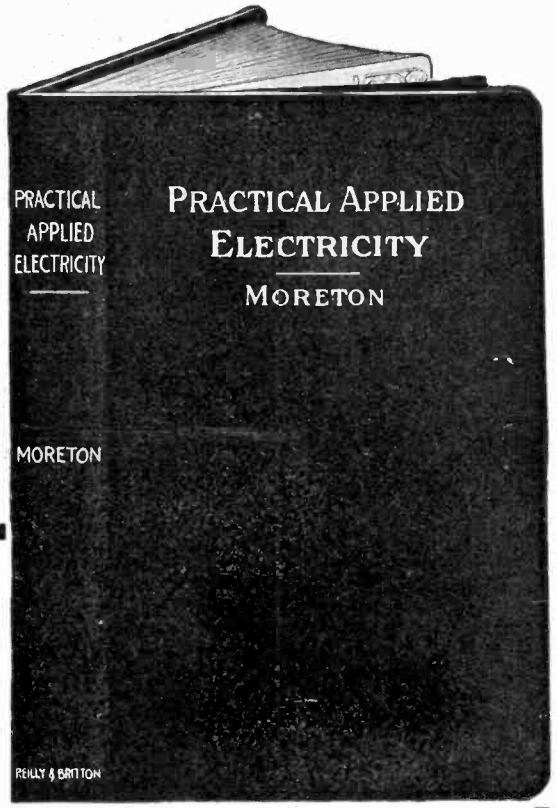
Employer.....

A Complete Course in Applied Electricity

Practical Applied Electricity

By DAVID PENN MORETON, B. S. E. E.

Covering every line of electrical work as taught in the Armour Institute of Technology, an institution of world wide fame.



Practical Applied Electricity is the outgrowth of actual work combined with classroom experience. The author is Associate Professor of Electrical Engineering at the Armour Institute of Technology. Most of the students taking the electrical course attend the evening classes, being employed at electrical work through the day. The problems which confront these students are embodied in this book—one reason for its being so practical and up-to-date. To illustrate this valuable information, careful detailed drawings have been made under the personal supervision of the author. In plain words, this book contains the experience of a large number of ambitious electrical workers, gathered together by a recognized authority on the subject.

CONTENTS:

The Electrical Circuit and Electrical Terms Explained by Means of the Water Analogy; Ohm's Law; Series and Divided Circuits; Calculation of the Resistance of Various Circuits and Conductors; Primary Batteries; Dry and Wet Cells; Voltage; Internal Resistance and Polarization; How to Renew; Series and Parallel Connections; Tables of Data of Commercial Types of Cells; Magnetism; Permanent Magnets; Electromagnets; The Magnetic Circuit and Quantities Involved; Magnetic Properties of Various Materials; Magnetic Calculations; Instruments; Construction of Various Types of Ammeters, Voltmeters, Wattmeters, Galvonmeters, etc.; Calibration of Instruments; The Dynamo; Fundamental Principle; The Magnetic Field; Commutation; Armature Reaction; Characteristics of the Series, Shunt and Compound Types of Generators; Motors, Fundamental Principle; Various Types and Their Application to Different Kinds of Work; Motor Speed Control; Variable Speed Motors; Railway Motors, Elevator Motors, etc.; Storage Battery; Fundamental Principle; Commercial Types; Application; Care of; Systems of Power Distribution; Two and Three Wires; Balancers; Motor Generator Sets, etc.; Practical Operation of Electrical Machinery; Connections in Series and Parallel; Motor and Generator Troubles, How to Locate and Remedy Them; Electrical Lighting; Various Types of Incandescent and Arc Lamps, Application of Various Types; Photometry of Lamps; The Nernst Lamp; Moore Tube; Mercury Vapor Lamp; Electrical Wiring; Calculation of Conductors; How to do Exposed Moulding and Conduit Work; How to Install and Connect Heaters, Motors, Generators, Fixtures, Arc Lamps, etc.; Wiring Tables for Different Classes of Work; Alternating Current Circuit; Comparison of the Direct and Alternating Current Circuits; Quantities Involved; Series and Divided Circuits; Measurements of Power; Alternating Current Generators and Motors; Resuscitation; Numerous Miscellaneous Reference Tables.

The language is so plain, and the mathematics so simple that no one can fail to understand. Questions and answers given at the end of each chapter, impress upon the mind of the reader the more important points to be remembered.

450 PAGES 323 ILLUSTRATIONS
BLACK FLEXIBLE LEATHER BINDING **Price $2.00 Postpaid**

All interested in electricity, old or young--artisan or amateur--expert or experimenter--should own this absolute authority. Money refunded if you are not satisfied.

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

Popular Electricity
In Plain English
Henry Walter Young, Editor

Vol. IV | February, 1912 | No. 10

CONTENTS

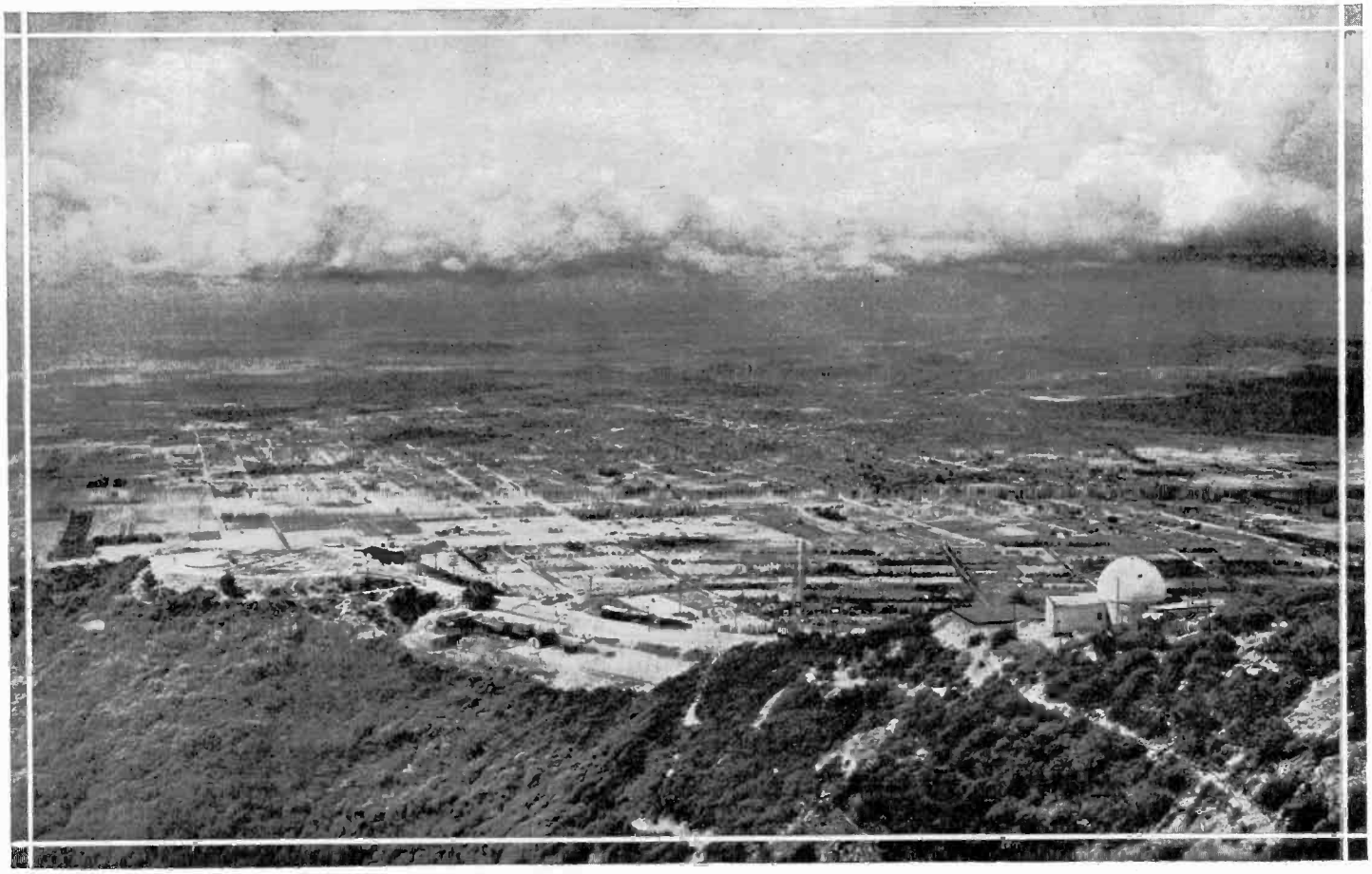
RENEWALS When your subscription expires, you will find a renewal blank enclosed here. You should fill out and return same with remittance at once to avoid missing a number. Positively nocopies will be mailed on any subscription after same expires unless renewed, and we cannot agree to begin subscriptions with back numbers. The date on wrapper of your magazine shows issue with which your subscription ends. The extension on this date to period covered by renewal is sufficient receipt. If any other is desired it should be requested at time of renewal.

CHANGE OF ADDRESS Notify us promptly of any change in your address, giving both the old and new location. Since our mailing list for each issue closes the 5th of the preceding month (i. e., list for February closes January 5th), changes received after the 5th must necessarily take effect with issue for second month following. Postmaster as well as Publisher should always be notified of changes in order to forward mail sent to old address.

ISSUED MONTHLY BY POPULAR ELECTRICITY PUBLISHING CO., Commercial Bldg., Chicago, Ill.
YEARLY SUBSCRIPTION, $1.50; CANADIAN, $1.85; FOREIGN, $2.25; SINGLE COPY, 15 CENTS

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

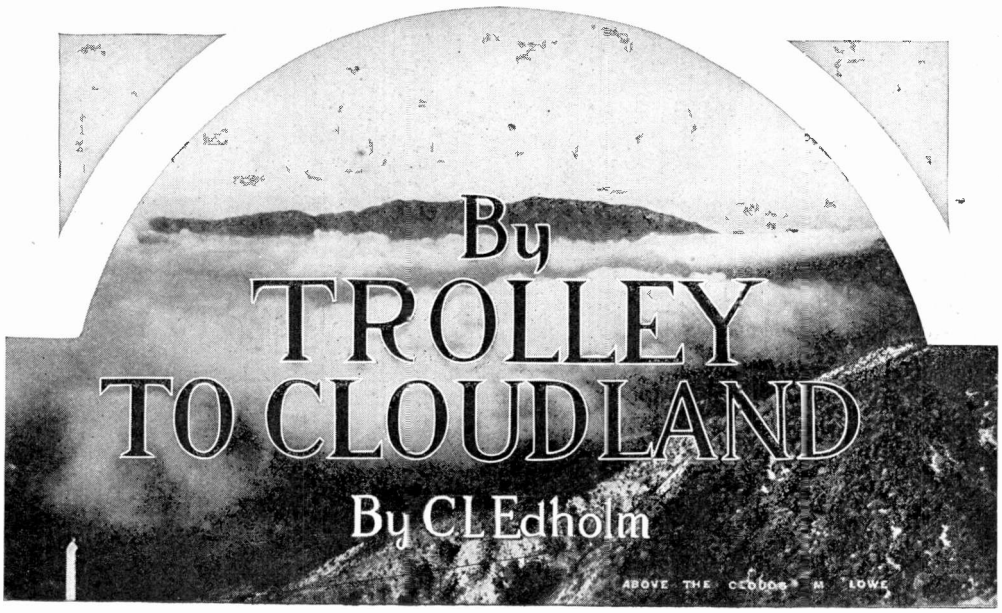
Entered as Second Class Matter April 14, 1908, at the Post Office at Chicago. Under Act of March 3, 1879.



VIEW FROM MT. LOWE, PASADENA IN THE DISTANCE

Popular Electricity
In Plain English

VOL. IV FEBRUARY 1912 No. 10



The most beautiful trolley trip in the world is the 25 mile journey from the heart of Los Angeles to the Alpine Tavern which stands high up on the side of Mount Lowe at an altitude of 5,000 feet above sea level.

The trip is divided into three parts, the first and longest lap being from the Pacific Electric depot, said to be the largest terminal of its sort in the world, through Los Angeles, Pasadena and a number of smaller towns, and so on up into the foothills to Rubio Canyon, where a change is made to the cars of the incline railroad. This is one of the most interesting divisions of the trip, as the incline runs apparently "straight up." It is more than 3,000 feet long and for the greater part of its length runs on grades of 60 to 62 per cent. It is an electrically operated cable road, which utilizes two cars with a capacity of 28 persons each, and the cars are built on an incline so that the seats are arranged in tiers, giving a splendid view over the mountains and valley to every passenger.

While the steel cables are tested to withstand a strain of 100 tons, the cars when loaded never exceed five tons in weight, and in addition to this precaution there are safety devices to be used in case of an accident.

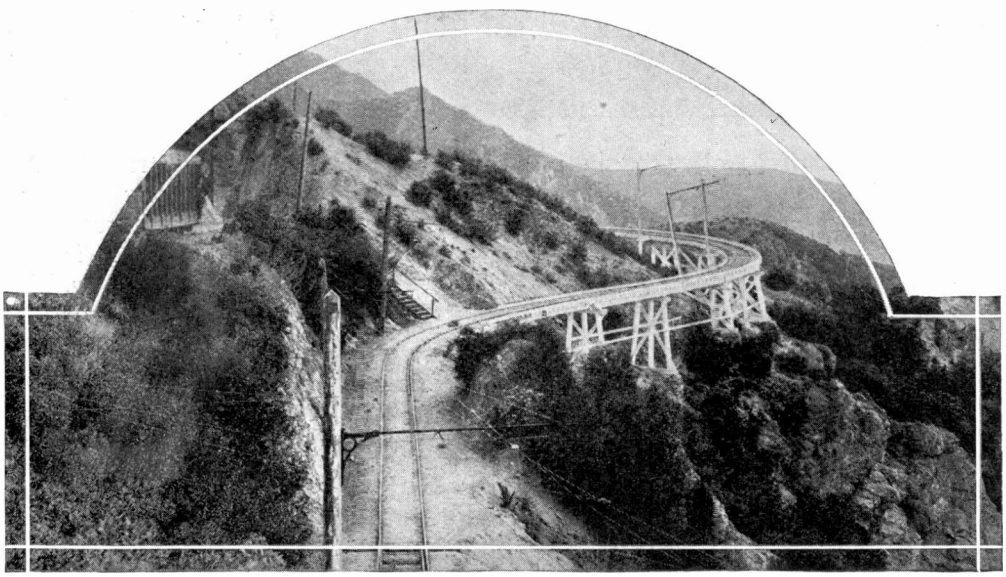
Half way up the incline is a "turnout" where the ascending and descending cars pass.

At the top is found the mechanism for operating the incline railroad, and in fact there is quite a little settlement there known as Echo Mountain Post Office. The great searchlight from the Chicago World's Fair has been set up on the top of the station and by night it throws its rays far out over the foothills and slightly rolling country, which extends to the Pacific, about 50 miles away.

GLIMPSE OF MT. LOWE OBSERVATORY

Here at Echo Mountain is the Mount Lowe observatory, to which the traveling public is made welcome. The astronomer in charge of this institution is Professor Edwin Lucius Larkin, who is well-known for his scientific articles, and this genial old gentleman explains the use of the various scientific instruments and permits his guests to get a glimpse of the stars through the telescope.

The most remarkable part of the trip and by far the finest from a scenic standpoint is to be found in the trolley ride from Echo Mountain to the Alpine Tavern. This division of the road is blasted out of the mountain side for a distance of eight miles and is run on a seven per cent grade. The horseshoe and hairpin bridges which extend along some of the difficult points are calculated to make the timid passenger hold his breath, as the car rounds curves over precipitous crags and apparently hangs in midair. This feeling of being suspended in space is emphasized when the trip is taken on a cloudy day and the

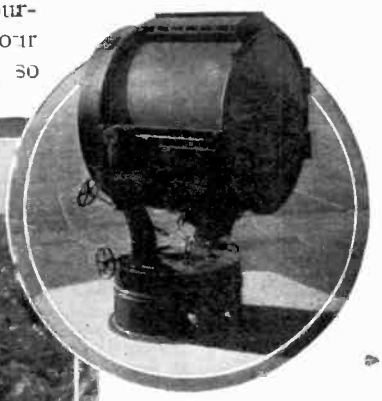


HORSESHOE CURVE ON THE ELECTRIC RAILWAY UP MT. LOWE

curling mists half obscure the tree tops far below. The scene is one of rare beauty during the winter, for while the lowlands about Los Angeles never receive a flake of snow, the mountains are covered every year with an immaculate garment and a trip through the mountain passes at this time between snow encrusted trees is of the most delicate and ravishing beauty.

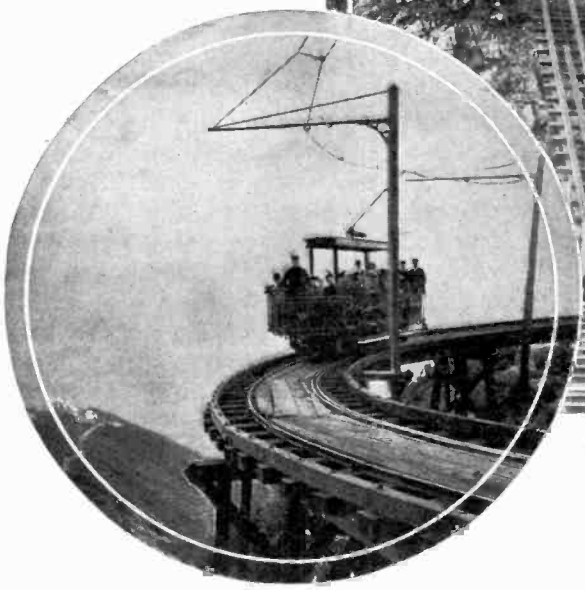
Almost a mile above sea level the trolley halts at a comfortable resting place known as Alpine Tavern, which is built in a rustic style in keeping with its surroundings and yet is conducted as a first-class hotel.

This terminus of the electric road is only 1,100 feet below the summit of Mount Lowe and a three mile trail winds about its slopes making an easy ascent for the amateur mountain climber. Most travelers, however, prefer to continue their journey on four legs and so when they bid goodbye to the modern electric car they adopt the mode of conveyance used by the earliest pioneers in these parts, the sturdy, sure-footed and patient little burden bearer of the southwest, the burro.



SEARCHLIGHT ON THE SUMMIT OF MT. LOWE

THREE THOUSAND FOOT INCLINE



THE PASSENGER FEELS AS IF HANGING IN MID-AIR

Bringing Electricity to the Farm

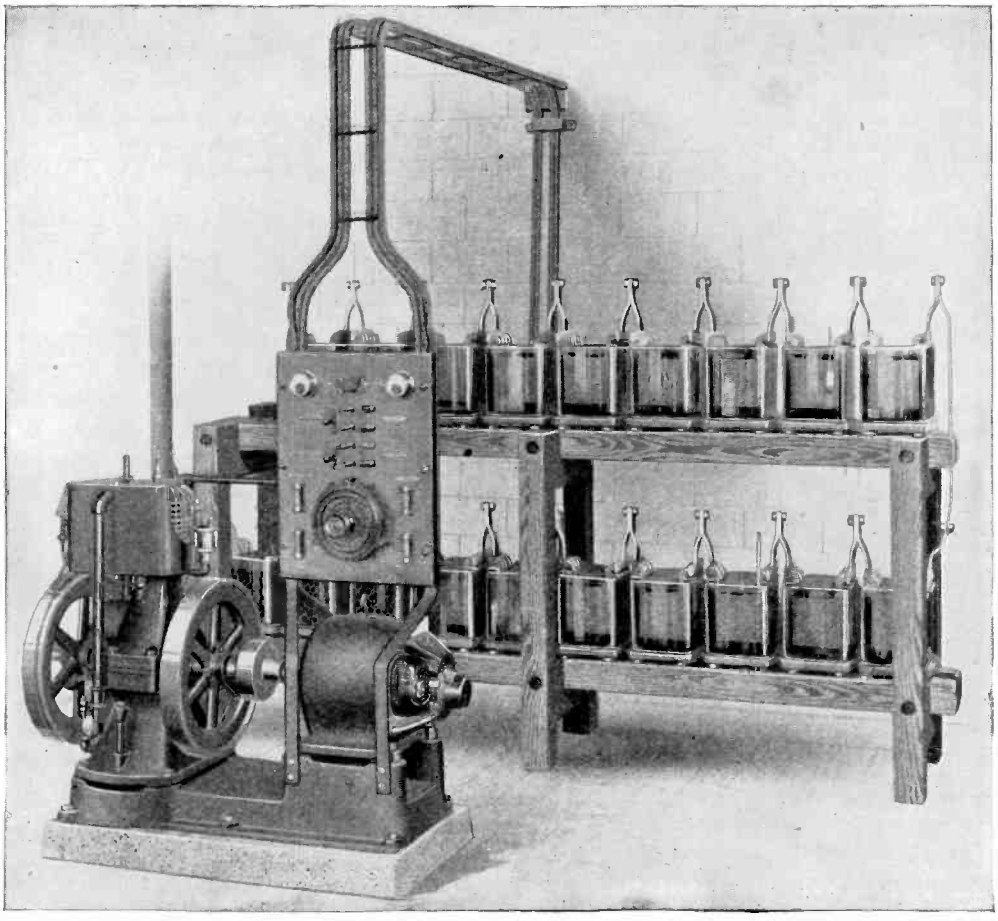
A small gasoline engine driving a dynamo, which in its turn furnishes current for motors and lamps or to a storage battery, constitute the remarkably simple system which is to-day bringing the city's greatest convenience—electricity—into the homes of country dwellers. Where the current from a central lighting station is not available, the small isolated plant of this type has established a very firm footing and, now that thousands are in daily operation, can be considered in no sense an experiment.

Taking as an example the Dean home lighting system shown in the large illustration, the prime mover is the gasoline engine, correctly designed for such work. Directly connected to its shaft is the dynamo which generates direct current suitable either for light and power or for charging the storage battery mounted at the rear. Above the dynamo is the switchboard containing a few simple switches and instruments the operation of which may be learned in a few moments.

The use of the storage battery adds flexibility to the system. The dynamo alone might furnish the current for the usual number of lights and motors but in that case the engine would be required to run even to supply a single porch light. But with the battery to act as a reservoir of energy, so to speak, the engine and dynamo need be operated only at specified intervals and current then taken from the battery at any time and in such quantities as desired.

Again, there may be special occasions, as for unusual illuminations or for threshing or sawing, when an amount of current is required which neither the dynamo nor the battery can alone supply. In such cases the battery is fully charged beforehand and then both battery and dynamo thrown onto the circuit easily caring for the load and giving the system double capacity for a short time.

What is known as the low voltage system is employed; that is, the current is supplied at a pressure of 30 volts, so low that hardly any sensation could be felt if one were to touch the two sides of a circuit, and absolutely harmless to human beings or animals. Neither is there any danger of fire so constantly a menace when the old forms of lighting such as kerosene and acetylene are employed.



A VIEW OF THE DEAN HOME LIGHTING PLANT

A Test for Street Lighting

It has always been a much discussed question as to which is the better way to light streets, whether by gas or by electricity. It is a question which has come up some time in the history of perhaps every town.

The same old problem has bobbed up in Manchester, England. There seemed to be so many good things to be said for each that they could not make up their minds which to adopt. But the English are a methodical people and like to solve all their problems at first hand. So they resolved to give both systems a fair and impartial test, and from the results then decide upon the one that makes the best showing.

To each system has been allotted a certain section of the city for experimental purposes. The competition will be conducted by the city itself and will be entirely unbiased. Each faction must light the section which has been assigned to it, to the best of its ability, all the while keeping a close tab on costs, for the best system wins. An independent committee of experts has been engaged to carry out periodical tests and to check over the comparative costs. In making the final decision, the city council will take into account the initial expenditure, cost of maintenance, and quality of illumination. The result of such a thorough test will undoubtedly have an important bearing on the old controversy of gas vs. electricity.

Electrical Securities

The Value of Consolidations and Mergers and the Saving to the Public It Is Possible to Effect Thereby—In Particular the Positive Need for Such Centralization in so Far as Public Utility or Service Companies Are Concerned

By "CONTANGO"

"THE BEST SERVICE MEANS THE BEST EARNINGS."

Not so long ago a determined effort was made in these pages to make clear and put in plain English the financial terms and expressions used in describing the various stocks and bonds likely to be offered to the investing public, and in particular as they might refer to investment in electrical enterprises. Step by step the usual methods of company formation were described and the more common kinds of stocks and bonds named and explained. Simplicity was the keynote. Finally, definite examples of the various classes of electrical and kindred undertakings were given. The position of the small plant and its necessary and gradual absorption into the larger "system" of a parent controlling company was explained. Due attention was also directed to the absolute necessity for full information to the public in the case of all public service or utility corporations. Frank information as to rates, frank acceptance of the principle of the lowest possible charge for current commensurate with a fair return on the money invested in each particular enterprise, and after allowing for all legitimate expenditures, was insisted on. In this latter particular the economy derived from centralization and consolidation was clearly shown.

Since then the process of linking up small plants and businesses has gone systematically and steadily forward in all parts of the country.

It is now the purpose here to explain somewhat more in detail the financial reasons for such consolidations and mergers, the style in which they are most likely to appear, the best types and the reasons justifying their appeal to public confidence and public support.

At a time when so much is heard by the public of the dissolution of this or that "trust" or system, particularly of those concerned in the distribution of human necessities, such as food products and the like, it is certainly opportune to note that, in special directions at any rate, people are now alive to the positive advantages of, indeed necessity for, the existence of certain forms of public service consolidation. Thus the advantage of consolidating the street railway systems of any given town is scarcely a matter for argument, and it is to a great extent the same with the telephone and, most certainly, with the water and lighting service. It is recognized on all sides that the prime reasons for oneness, or centralization, in such service are efficiency, economy, the "lowest rates commensurate with fair returns on investment" and a policy of consideration and conciliation on the part of both the company serving and the public served. Thus the public is ready to go a long way in the acceptance of the theory and practise of consolidation provided the corporations interested recognize their obligations, and as a result those investing in the stocks or bonds of such concerns have practically a double guarantee of security.

It is not the intention to discuss the question as to what extent the big consolidations such as the Standard Oil or Steel corporations have or have not been of general benefit to the public. It is, however, worth remarking, that oil could certainly not be obtained for the low

price it is to-day had it not been for the Standard Oil Company and its wonderful business organization. And even now there are being formed in all parts of the country organizations or clubs which contemplate the production, sale and distribution of foodstuffs on a co-operative basis. This is but a general combination—combination on a very extensive scale—and to a fair degree defines the position of a public utility corporation conducted with any show of wisdom—viz., combination by coöperation—with the further point that it is the policy of nearly all such public utility companies to ask the public to participate in a common ownership by offering them the free opportunity to invest in their stocks and securities.

There is then established this most welcome and striking fact that anyone who wants to do so, and has the money, can buy the shares or invest in the securities of all these great consolidations and mergers now so usual in all the large and progressive centers of population. The vital point is to know how to pick out the best and most substantial.

The first answer is that by the names at the head of such enterprises, by the management and by the bankers and brokers offering such investment opportunities they should be easily placed by those in the least familiar with their local surroundings and who take an interest in the men prominent in them. To consult a reputable banker is always a safe course. Granting this, there must come a second question as to the nature and value of the different stocks and bonds formed by such mergers and consolidations. The merger is, of course, the mingling or sinking of one company in another, the sinking sometimes of the smaller concern in the larger, sometimes of concerns of almost equal size, but in this latter case it is usually termed a consolidation, but to all intents and purposes they are one and the same thing. Then a merger or consolidation having been effected one usually hears of consolidated bonds or of refunding issues and other such financial terms. Probably nearly everybody has heard at some time or another of government bonds. We speak of a thing being as safe as a government bond, that is to say the securities issued by "Uncle Sam" and based on the credit of the United States government. Then, too, likely a good many readers have heard of English "consols," the securities issued by "John Bull" and based on the credit of the British government. "Consols," it may be observed, derive their name from the fact that they represent consolidations of former securities with later ones, this abbreviation of the word "consolidated" giving the name by which these world famous securities are generally known. "Refunding" is the name given to bonds or securities issued to take up one set and replace them either by another set issued by the same company, bearing perhaps a different rate of interest and to a larger amount for the purpose of getting additional funds for improvements, extensions and the development of the business, or they may merely pay off the old issue, or again may be part of an issue made by the new and larger company formed by the union of small concerns and for the purpose of getting rid of all or part of the securities of the combining companies. In this latter case there would probably then be issued in their place bonds all of the same denomination and bearing the same rate of interest with the property of the whole combination behind them as security.

Now it is right here that stress should be placed on the advantage and economy in having just one set of bonds issued on the security of the whole property. This is the simplest, not always the easiest, but always the best form of financing. To arrive at this desirable condition often takes time. So it happens that those who arrange and manage these combinations and mergers always look to the ultimate consolidating of the different kinds of stocks and bonds in

uniform designation and amount where possible and as soon as possible. This is the true object of consolidation or merger as far as securities are concerned, just as economy in cost of management and lower cost of production is the reason from a business standpoint. So, too, if rightly conducted the consolidation of securities should mean economy in interest payments, better security and greater simplicity in termination or maturity.

If then your attention is drawn to an announcement of a new consolidation or merger of certain electrical companies:

First consider with whom the management is to be:

Then consider the brokerage or banking firms offering the stock or securities:

Then, as to the actual securities themselves, consider their character as to amount, what they represent and the rate of interest: Ask for particulars on these points if you do not understand them.

There is in this connection one fact to be kept in mind, that there is at this time a great deal of "pyramiding" of the securities of companies going on. Piling *Ossa* on *Pelion,* mountain on mountain, so to speak, and rolling up vast sums of indebtedness without need, and without proper physical assets to secure them. It may be the adding of one company to another and then another to the two, or adding one set of securities to others, and yet again to others. Hence it is essential to see that refunding actually means refunding, or the retiring of one set of securities without undue increase in the total amount outstanding, or that consolidation actually does mean the consolidation of two sets of stock or securities into one, without undue or unwarranted increase in the amount.

A corporation is, as things are at the present, as much privileged to buy the securities of other corporations as is the individual to use his credit to purchase property from other individuals. That in this process on the part of the corporations there often is the creation of considerable of what is termed "water;" meaning an undue and extra amount of stock or bonds not based on tangible physical assets, nobody denies. The only way to overcome this is by the enactment of laws restricting corporations or companies—call them how you will—in the issuance of new securities by the actual outlay of the proceeds realized from the sale of such stock or bonds, less of course reasonable expenses for the disposal of the securities to the public, announcements, advertisements, brokers fees, commissions, circulars and the like.

To show the proper and opposite policy—while no particular company shall be mentioned here, yet many of the readers of POPULAR ELECTRICITY are more or less familiar with the fact that there have been consolidations and mergers of traction (street railway and elevated) properties in divers and quite important centers in the past year. In all such instances the effort made was in the direction of lopping off excessive outstanding obligations or debts, simplification of all classes of the securities and economy in management and operation. Now, directly there is concentration in management in the form of consolidation of the many departments of several companies into the few departments of one parent company, there is reduction in the cost of operation, or in the case of electrical undertakings, reduction in the cost of producing electricity.

The beauty of an electrical combination or consolidation is that, above all others, this union of small companies saves waste and, in proportion as its business grows, lowers the cost of production and therefore as a matter of common sense the cost to the consumer, thus indeed becoming a matter of community interest. It is this fact that gives such substantial value to the securities of a properly managed public utility undertaking. The public, too, insists on proper service and that means more and better business, and thus the sensible investing public is at once interested in

the stocks and bonds of such a corporation.

It may be suggested here that toward the close of last year a most important step in the consolidation of the traffic facilities of one of the world's great cities involved a capitalization, in the companies merged, amounting to the sum of $160,000,000.

Coördination in the traffic arrangements of all large cities is one of the slogans of the day. And when it is remembered that to-day the mainstay of most all urban, interurban and suburban transportation is a low-priced and absolutely dependable supply of electric power, it can readily be seen how important is the position of the electrical power supply company. And it is certain that in the consolidation and centralization of such undertakings that the determining factor in the ultimate, and certainly logical, conclusion of "lowest possible rates and greatest possible efficiency" will be found. And so with the lighting plants, the small one has to make way for the combination of small ones into a large central company.

It is the realization of this natural trend of the times that is bringing about the mergers and consolidations of all the properly managed public service or utility concerns of the day. It is indeed combination by enforced coöperation. And the greater the electrical enterprise the more certain it is to be engaged in the production and sale of all the three utilities, that is to say, of power, light and transportation.

The amount of capital involved in such undertakings is not the point, provided it is fully accounted for by physical and tangible assets. To quote Mr. Frank A. Vanderlip, president of the National City Bank of New York, *"All that is needed is proper publicity of accounts and the wise control of capital issues."* And these words practically convey the essentials necessary to public confidence.

One other point: It will probably interest the reader to know that not only is the public invited to be part owners in most of these great developments of the day, or at any rate holders of their securities, but that in most of the large public service corporations employés are also urged to become stockholders and thus partners in properties, which earn the best returns by best serving the public.

Of the future, these words by a well known authority on what has been accomplished in the past may, with advantage, be quoted:

"What has been achieved so far in the direction of massing the production and distribution of electric energy, and reducing its cost as a result, and of giving the smallest customer and the largest industrial corporation, and the largest transportation companies the advantage of very cheap power, is but a start toward the ultimate results that may be achieved in the production of energy for all kinds of purposes, domestic, commercial, industrial and transportation, whether that transportation be urban, interurban or even interstate transportation.

"The work already done in the direction of massing, that is, consolidating and centralizing production shows most clearly that the wheels of industry—whether they be as the permanent way of a great trunk line railway, or in some great hotel building, or some great industry—will be turned by the production of energy at a relatively few central points, when the vast territory to be covered is taken into consideration."

Bearing in mind then the fact that there is nothing like the securities of a company whose business consists in supplying something needed and used by the public day in and day out, he will be a wise investor indeed, who puts his money into these growing mergers and consolidations now so prominent a feature of the electrical industry.

[*To be continued.*]

ELECTRIC VEHICLES

FOR BUSINESS AND PLEASURE

by

W.C. JENKINS

PART I.—HISTORICAL AND GENERAL FACTS CONCERNING ELECTRICS

The marvelous development of the vehicle during the last century is indeed a tribute to modern genius. In view of recent improvements whereby the gasoline and electric auto and truck have revolutionized the vehicle industry a brief historical glance cannot fail to be of interest.

Doubtless the first form of transportation was by the boat in the form of a float. The earliest and simplest conception is a man astride a log, the power being created by his feet and hands.

The most primitive form of wheel was a roller made from a tree trunk and afterwards differentiated into a pair of fixed wheels by trimming down the middle portion of the cylinder in such a manner as to leave the center of the trunk as a fixed rotating axle.

The Assyrian Empire, although founded prior to the Egyptian, did not produce marked improvement in the art of vehicle construction, and history gives full credit to the Egyptians for the greater development and for the origin of the chariot, which vehicle for centuries was allied with all undertakings and progress.

The strength of a nation in the ancient days, as now, was largely determined by its munitions of war and the chariot with the Egyptians may be regarded as filling the place of heavy artillery of modern times.

The first reference to a chariot for a warlike purpose is in Exodus when Pharoah took 600 chariots with him, all of which were destroyed in the Red Sea. The Philistines in Saul's time had 30,000 chariots. From Egypt the use of the chariot gradually spread to other countries. There was little of a business nature in the vehicle of the ancients, but as the world progressed so did the vehicle.

At first the roads were narrow and contracted, rough and uneven. No care was given to them until 313 B. C., when the Appian Way, that masterpiece of ancient highways, was begun by Claudius and which, to the present day, is one of the noted sights of Rome. Over this great thoroughfare the ancient nobles sent their steeds at a terrific pace and over this road the rulers of the world have passed and bordering upon it are many of their tombs.

When Julius Cæsar returned from a triumphant visit to Britain, B. C. 55, he brought back a chariot that surpassed any he had seen before. The British

chariots were heavier than those of the Romans and had a seat.

The Egyptians with all their learning made practically no changes in their vehicle during their history; as it was at the beginning so it was at the end. The Persians and the Hindoos used luxurious vehicles and secluded their women in curtained carriages. The early models of the Greeks were so satisfactory that improvement was considered unnecessary and their primitive vehicles were identical in principle and structure with those of the present day. The Romans, however, gathered ideas from every nation and utilized the best designs they found.

From the ruins of Pompeii many interesting specimens of the early work of man have been taken. A wheel of particular interest taken from the ruins is now on exhibition in a New York museum. It shows an advanced idea of that early period, the wheel being dished.

When the world awakened from its apparent long sleep of the Middle Ages, during which the art of vehicle construction like all other arts sank into oblivion, manufacturing was revived, and from the awakening very marked improvements followed.

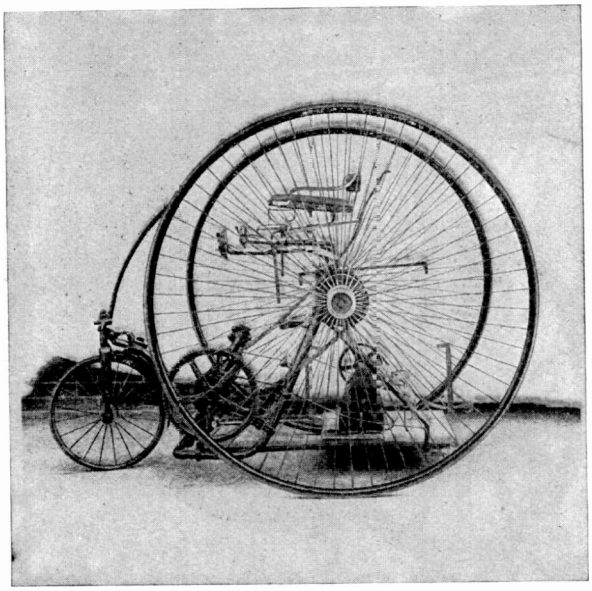
In 1550 A. D. it is recorded that there were only three coaches in Paris.

The first coach built in England was manufactured in 1555. This was the beginning of an epidemic of coach making in Europe, and in 1560 Antwerp had over 500 coaches. The coach craze at that time was similar to the bicycle craze in this country a few years ago.

It was more than a hundred years after coaches were considered a necessary utility that any one conceived the idea of using steel springs. While the first vehicle to which springs were applied was built in Paris in 1670, the progress was very slow. One hundred years later M. Roubo in a published treatise on coach building, stated that the use of springs was still in an experimental stage and he expressed considerable doubt regarding their ultimate success.

The Collinge axle was patented in 1792 and has since remained in use throughout the civilized world.

The Hansom cab was invented by James Hansom, who took out his first patent in 1834. Originally it was a square body hung in the center of a square frame, with two wheels, seven feet six inches in diameter.



FIRST ELECTRIC VEHICLE—BUILT IN 1889. AT ONE TIME AN ATTRACTION ON THE BOARD WALK AT ATLANTIC CITY

More development took place in the vehicle during the Nineteenth Century than in all history. From the very beginning of the century inventions and improvements came rapidly. In 1804 the elliptical spring suspension was first employed. In 1816 Dr. Edgewood of Dublin demonstrated the difference in draft effected by large and small wheels and the effect of springs placed between the axles and the body.

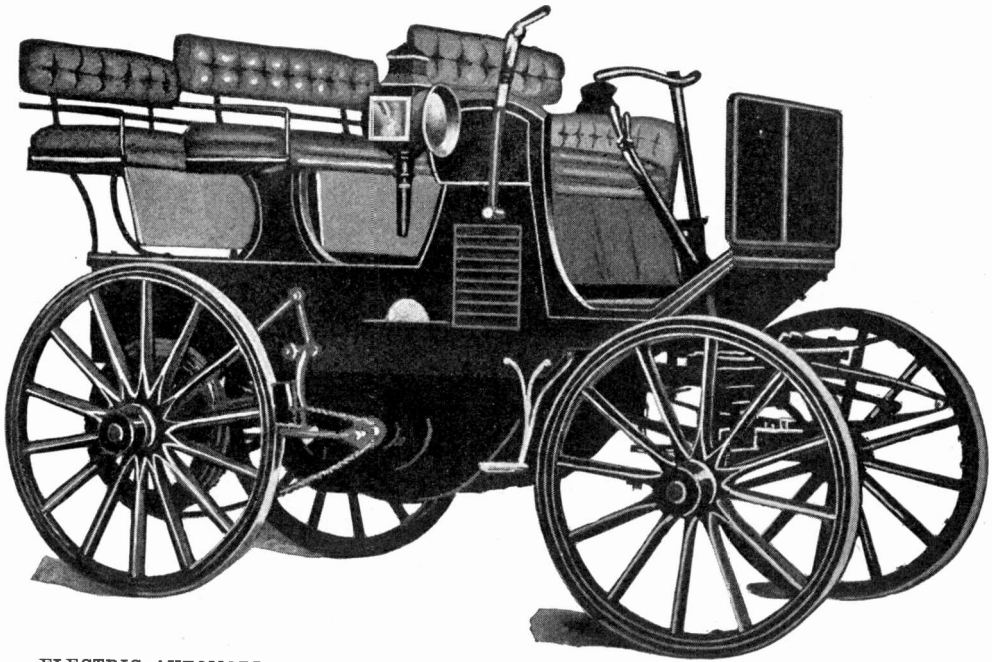
Although rubber was first used in the industries in 1745, it was not applied as

tires in the United States until 1847. Its use for this purpose, however, was very limited until 1896-7, when Michelin the well known manufacturer of rubber tires made important improvements.

The self-propelled vehicle had its birth when James Watt invented the steam engine. One of Watt's assistants immediately built a model engine on wheels for road travel.

In 1763 and 1788, respectively, model steam automobiles were built in France and England. Shortly afterwards a vehicle of this character was designed in the United States. Within a few years at least a dozen inventors had turned out successful models of steam propelled road vehicles, but mechanical road locomotion was almost entirely suppressed by the contemporary interest engaged in promoting railway developments.

There was practically no interest taken in any form of an automobile until 1891, when a revival of the previous century's efforts was stimulated by the more forceful effect of modern genius. For the solution of important problems, such as transmission, steering gear and brake mechanism and in overcoming the early difficulties, credit is due to Selden and Ford in America, Thorneycraft, Wellessley and Mandslay in England, Diamler in Germany and De Dion Bouton and Serpolet in France. From 1891 the development of the automobile has been rapid and the results achieved have exceeded the wildest dreams of the early promoters.



ELECTRIC AUTOMOBILE BUILT BY THE HOLTZER-CABOT ELECTRIC COMPANY 20 YEARS AGO. THE FIRST REAL ELECTRIC AUTOMOBILE IN THE UNITED STATES AND NOW CONSIDERED A CURIOSITY

The greatest development in electric machines was when the motors and gearing parts were removed from the axles and mounted on the chassis above the vehicle springs so that these parts received the cushioning benefits from the springs. The development of solid rubber tires, rubber compound, better steel and the knowledge of proper proportions obtained from experience has developed the modern machine.

The electric pleasure vehicle is not intended to displace the gasoline car; it has a position of its own—a position

which the gasoline car can never invade. Only the family carriage can be considered a competitor, and when the difference in comfort, cost of keeping and instant service is considered the conclusion can be easily reached that the family carriage must very shortly give way to the electric vehicle.

hill or in plowing through snow, but will continue the work mapped out for it as long as there is power in the battery.

Most of the first-class electric coupés bear the names of well known carriage manufacturers; their horse drawn carriage business is gone. Their factories have undergone many changes, but they

A MODERN ELECTRIC PLEASURE VEHICLE IN STRIKING CONTRAST TO THE ONE ON THE OPPOSITE PAGE

The types of electric autos for service about town are not in any sense touring cars. They take the place of the family carriage but give better satisfaction and service. In winter their superiority is particularly noticeable. There is nothing to freeze about the electric; it can stand in the coldest weather and is ready to start instantly at the will of the driver; it will not slow up in climbing a steep

are doing a larger business in the manufacture of autos than they did in carriages. In the electric coupé the lady still has her luxurious carriage and in its present form it is so easy to control that the younger members of the family can drive it with safety. It is much more reliable than the horse which may become frightened with disastrous consequences. The electric will do nothing that

is not directed by the will of the driver. The lady who owns an electric coupé can ride from 50 to 60 miles a day with pleasure and comfort. She is absolutely independent of the petty annoyance connected with the chauffeur and coachman and she enjoys the sensation of driving her own machine. The electric can be easily charged and cared for and this feature commends it strongly to the ladies.

The first popular misconception—the belief that the electric vehicle was intended as a substitute for the touring car—contributed a great deal to retard a general appreciation of its sterling qualities. Surrounded by this cloud of misconception the manufacturers were unable to command public attention and it was not until the mist had blown away that the electric was understood. It may be truthfully stated that not a single manufacturer advanced the claim that the electric was intended for cross-country service. It was simply stated that the electric auto was a safe and simple convenience for the family and the logical equipage for social calls, marketing and the many events that mark the day of the average family in the city. It means independence of trolley cars and freedom from the chauffeur with his ponderous gasoline machine.

If a person does not wish to travel faster than 20 miles an hour, nor further than 60 miles in any one day, the electric has advantages over every other vehicle. Beyond these limits conscientious manufacturers will not recommend their general adoption. There is not one lady in ten thousand whose demands ever exceed the speed limits of the electric vehicle of today.

It should not be understood that speed and longer runs cannot be accomplished by the electric. Recently there have been several remarkable records made. But their advertised mileage and speed tests were made under ideal conditions, with experts in the drivers' seats. Except as a matter of curiosity these tests do not interest the general public.

The average electric auto has great possibilities, but it also has its limitations, and it is well to know what the safe limitations are. In the level city like Chicago a machine that will not run from 60 to 75 miles in a single charge may be considered of inferior manufacture; yet in a hilly city like Kansas City, an electric that will run from 40 to 45 miles may be considered among the best in the market. Hence, the topography of a city governs, to considerable extent, the possibilities of the electric.

Inasmuch as the electric vehicle is intended almost exclusively for city use, criticism because a speed of 50 to 60 miles an hour cannot be made is wholly unjustifiable. The electric auto has no need for speed in excess of 20 miles an hour, and even that is much in excess of what the law allows. If it were desired any of our manufacturers could produce a car capable of making speed and mileage of double the present limit, but in doing so they would not serve the best interests of people to whom they apply for patronage.

The early electric vehicle, it must be admitted, was clearly at a disadvantage. It was clumsy, inefficient and expensive. The first storage batteries were heavy and good for but short distances and required careful attention and expert handling. Then again, the earlier models were too high and clumsy, and their appearance in the city streets attracted but little admiration or interest. The tendency on the part of the gasoline auto manufacturers was to make lower vehicles. The low design seemed to meet the public requirements and it was not until the electric auto manufacturers realized this fact that any substantial progress was made in the electric.

As a result of an aggressive and costly campaign of education carried on by manufacturers of gasoline cars, the feeble efforts which were at first put forth by the electric auto men to popularize their product attracted little attention. At first the electric vehicle manu-

facturers failed to give the public the facts concerning the electric auto. The battery manufacturers were too busy perfecting their batteries to undertake any campaign of education, and the electric light companies did not realize the possibilities in this branch of their business which was within their reach. Hence, until recently the electric auto has not received the friendly support that it should—not even from its best friends.

In telling the story of the electric auto and truck, exaggerations are unnecessary. Vehicles of this character will not climb a tree or carry as much merchandise as a freight train. They have great possibilities, but, as already stated, they also have their limitations. Enough can be said, however, to convince any fair-minded person that in their field they are vastly superior to any other form of vehicle which has been devised.

The operation of an electric carriage is, under proper conditions, so simple that few owners take the trouble to understand the requirements. The difference between the gasoline and electric car is that the trouble of the gasoline cars are those of the road, while the principal troubles of the electric car are those of the garage. A very simple but regular inspection, not daily but weekly or bi-weekly, will keep an electric carriage going indefinitely with all the reliability of other electrical apparatus.

The general substitution of the automobile for the horse is partly a psychological question and the only obstacle that prevents its rapid accomplishment is that peculiar bias of the human mind which, since the world began, has opposed or retarded commercial and human progress.

No doubt this illogical attitude has its benefits in that it prevents instantaneous or hysterical transition from one practice to another, but it not infrequently operates to retard unduly changes long after the changes have been shown to be meritorious and needy.

The electric vehicle has now been brought to a high state of technical development and passed entirely beyond the experimental stage and its widespread use appears only as a matter of future economical exploitation. It has made substantial progress particularly in the way of establishing a firm basis for future development. The ill-advised spirit of ten years ago which has left as an evil effect suspicion regarding the actual merits of the electric vehicle may now be said to have disappeared from the minds of the people who have had occasion to study the problem.

It is true there have been defects of construction and mistakes of operation. Then there has been misconception regarding its distinction from a horse-drawn vehicle. The original idea in the minds of many people was that an electric vehicle was a modified type of the common horse-drawn wagon—a vehicle without shafts but with something else added for generating motive power. At any rate it did not seem to be realized that it required a different knowledge of conditions to operate an electric vehicle than it does to drive a horse, and hence the results were not always of a satisfactory nature.

Contemplate for a moment the original perceptions of the manufacturer, far-seeing enough to be convinced of the eventual success of the automobile as a necessity, and plucky enough to venture enormous investments and at the same time patient enough to encounter the exasperating trials of development over a long period. Consider the concentrated engineering talent engaged in the production of the various parts of the machine, all combining to evolve one harmonious whole, and then reflect how ridiculous it is to place this production under the care of a teamster whose previous knowledge of machinery is limited to a wagon or a wheelbarrow, without instructing him in the elementary principles of its care and operation. In the ruin certain to follow the work of years and the advantage

gained by scientific experiment is likely to be discredited.

As a matter of fact, the electric vehicle, at first glance a somewhat complicated piece of electrical apparatus, when understood is very simple. It must be cared for by someone who is familiar with batteries and motors and especially with instruments for measuring electricity, but this knowledge is easily obtained by any one of ordinary intelligence, and the owner, even if a woman, can acquire it.

The battery being the all-important part of the electric vehicle it is manifest that a knowledge of its principles is essential in order to get the best results. This subject will be taken up in the following chapter.

(*To be continued.*)

MIND READING BY WIRELESS TELEPHONE

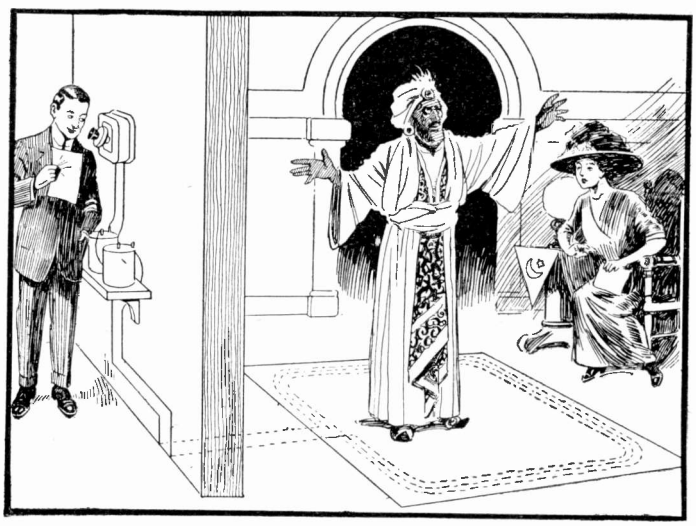
A Hindoo mind reader found his "outfit" in bad shape one day and was obliged to enlist the services of a telephone man to again place him on "speaking terms" with the occult world. What the electrician found was as follows:

On the floor of the room where the confiding victim handed over the "necessary" in order to know the future was an ordinary looking rug. To the under side of the rug eighteen turns of No. 19 B and S gauge copper wire in the form of a coil were carefully sewed, the two ends passing through the wall at the floor and into the next room. Here a few dry cells and a telephone transmitter were connected to the circuit.

The Hindoo professor could never "concentrate his mind" without wearing his turban, for concealed in this was an ordinary telephone head set from which wires ran down in his clothing and connected with a coil of No. 19 wire about the professor's waist, and held up by his suspenders.

After money matters had been attended to, the victim, in most cases a woman, was asked to write her name, age and questions she desired to have answered upon a slip of paper which she deposited in a velvet bag on a nearby table, without having it read or touched by the Hindoo.

An assistant, who always managed to be busy near by, secured the bag, retired to the next room and repeated the name, age, questions, etc., into the telephone transmitter and the professor pacing about upon the rug received the information by induction and soon had his victim's confidence to such an extent that any answers were satisfactory. The break with the occult world was due to a poor joint in the wiring.



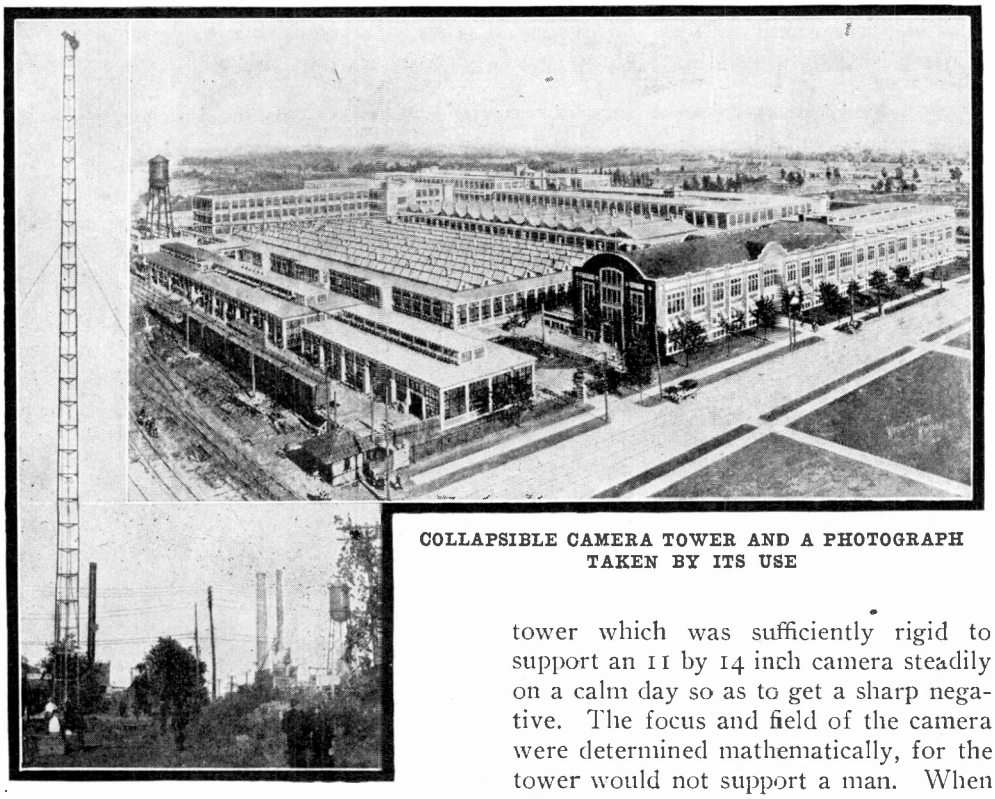
THE PROFESSOR RECEIVED THE INFORMATION BY INDUCTION

Taking Bird's-Eye Views of Factories

In picturing a manufacturing plant, a really good photograph is for many purposes to be preferred to the usual wash drawing. Most plant owners start the artist to work on such a drawing with the very best of intentions, but as the work progresses a chimney is added here, a proposed addition there, a little park or a fountain in another place, and so on, until, when the work is finally completed, the place looks more like a spic and span sanitarium than a factory. Owing to this tendency most people in looking at such a picture take the story which it is intended to tell with the proverbial grain of salt.

When a factory owner, however, has a really first class plant of which he is proud in every detail he would rather show it by a photograph so that people may see it as it really is. Such photographs are, however, not always easily obtained. One unique method of aerial photography is shown in the picture, together with a reproduction of the photograph taken.

The camera was hoisted 125 feet above the ground on a light, collapsible steel tower which was sufficiently rigid to support an 11 by 14 inch camera steadily on a calm day so as to get a sharp negative. The focus and field of the camera were determined mathematically, for the tower would not support a man. When all was ready an electrical arrangement, controlled from the ground was used to operate the shutter.



COLLAPSIBLE CAMERA TOWER AND A PHOTOGRAPH TAKEN BY ITS USE

This collapsible outfit is owned by a photographing concern and is attracting considerable attention from manufacturers all over the country.

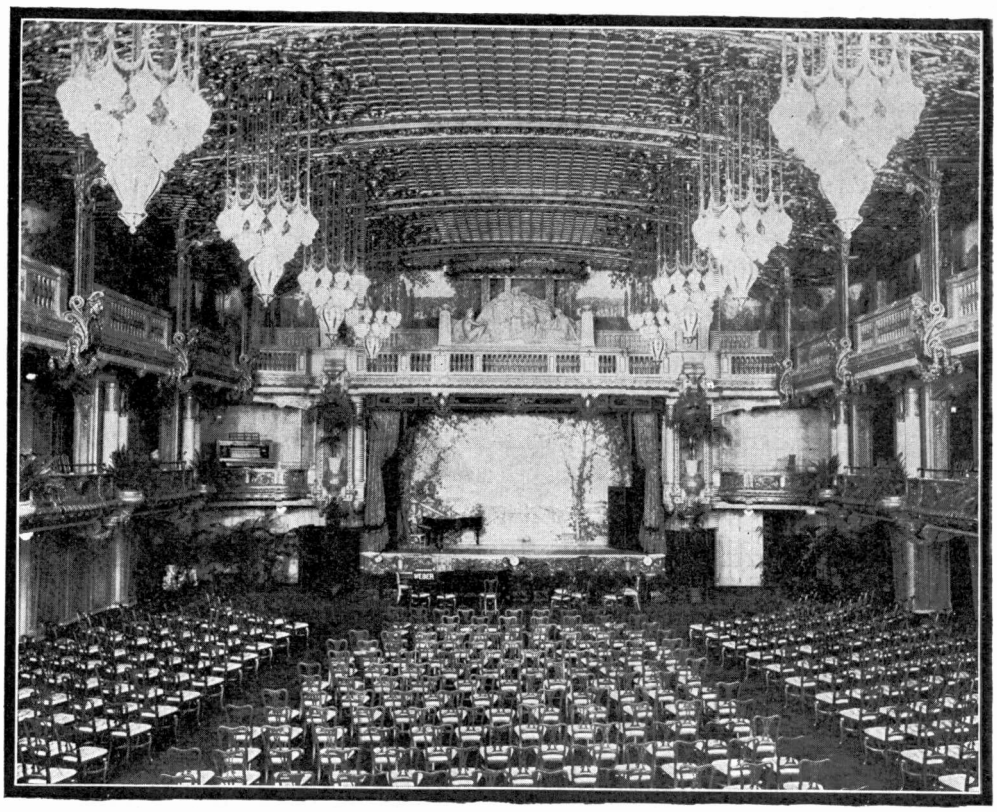
To Protect Linemen from Bullets

A telephone lineman working out of Port Townsend, Wash., was mistaken recently for a cougar and killed by a careless hunter.

To protect themselves the linemen have adopted a bright red uniform which is readily discernible for some distance.

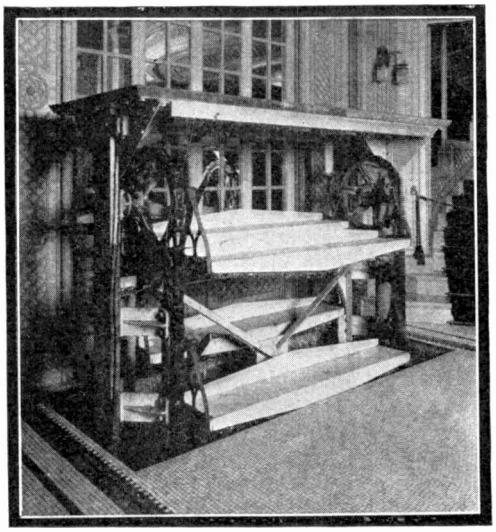
The Ball Room of the Hotel Astor

When a hotel can boast of over 2,200 electric motors, novel features may well be expected within it. Such innovations abound in the new Hotel Astor in New York and probably none of them has attracted more attention than the way in which electricity is used in the grand ball room, which also serves on special occasions as a theatre or as a banquet hall. No less than 2,800 tungsten lamps are used to provide the flood of light which makes this one of the most attractive ball rooms in the world. Most of the lamps are grouped in chandeliers but instead of being held by arms, they are separately supported so as to give a pendant effect in harmony with the general design. The apparent arched roof is really only a bronze lacework, revealing a lighted ceiling above it and giving the effect of increased height. The lights are so wired that one-third, two-thirds or all of the total intensity can be obtained, and in connection with theatricals they can be dimmed very gradually. Dimmers installed at twelve stations around the room are all operated by electric motors controlled from master stations in the gallery, so that the electrician can view and control the lighting from any part of the balcony.



BALL ROOM OF THE HOTEL ASTOR CONVERTED INTO A THEATRE

When the room is to be used as a theatre, electric motors connected to one section of the end balcony lower it to the proper level to form a stage, thus creating a beautiful theatre, but without having the stage front interfere with the harmonious furnishing of the place when used for other purposes. When the play is over and the scenery has been removed, the simple throwing of a switch restores that section of the balcony to its usual



ELECTRIC DUMB WAITER ON A LARGE SCALE

functions, during which it matches the rest of the room so harmoniously that no one would ever dream of its being movable.

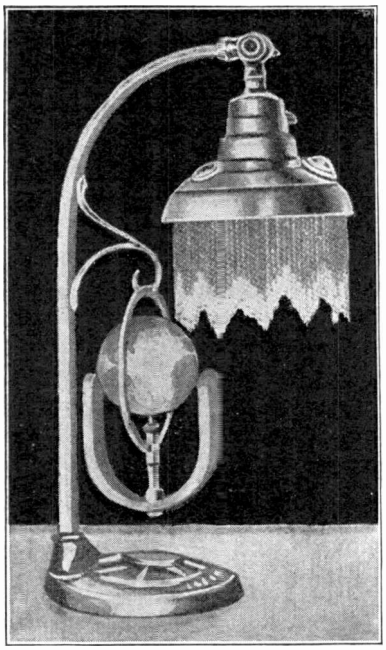
A similar movable feature is used on a smaller scale to speed the supplying of eatables when the room is used for banquets. On throwing a switch, a section of the floor in an adjoining corridor rises to a height of some seven feet, exposing an electric dumb waiter which speedily transports the food from the floor below and likewise returns the dishes after they have been used.

Incidentally, the Hotel Astor is noted as a striking example of the saving effected by the introduction of highly efficient lamps. When the hotel was originally built, no expense was spared in equipping it with all electrical conveniences and the total consumption of current was sufficient for lighting the average small town. The new section, of which this wonderful ball room forms a part, increased the hotel accommodations about 80 per cent and added greatly to the number of lamps and motors. But, in the meantime, the tungsten lamps had been developed and by substituting them for all the carbon filament lamps originally installed, the needed current was reduced so much that the total electric load now has turned out to be no greater than that contemplated for the original hotel alone.

The Rotating Globe

A model prepared by Peter W. Sothman illustrates one theory which might account for the rotation of the earth and other celestial bodies. It consists of a globe made up of two metals in which thermoelectric currents are caused to circulate when one side of the globe is heated.

The necessary heating effect is produced by the presence of a lamp whose radiation takes the place of sunlight. A magnetic field is necessary to produce motion on this hypothesis and it is supplied in the model by a U-shaped magnet.



SOTHMAN'S ROTATING GLOBE

The magnetic field thus produced is approximately horizontal while the motion takes place around the vertical axis. The permanent magnet and the thermoelectric currents provide the two necessary requisites of an electric motor. The model ordinarily makes about four revolutions per minute.

"Unit No. 8"

By HERBERT ALDEN SEYMOUR

IV.

Some one or something had slipped, and the hose had got away from the pipemen. The turbine, being in a new offset, or bay, got none of it, but units Nos. 6 and 7 were drenched, and fire flashed from every collector ring on each generator.

Never before had these staid and dignified prime movers been so convulsed. They writhed and leaped in their bearings, every fibre strained to the breaking point. The engine room foundation shook with it. And suddenly, the water finding a crack in the old insulation of No. 7, the high tension grounded through the frame with a flash and a big puff of smoke. In less time than it takes to tell it these two biggest machines which had been operating in parallel on the traction load, had dropped it and revolved aimlessly, while half the street cars in the city came to a standstill.

For a moment MacHugh, Holroy, and the rest of them in the engine room stood petrified with amazement—appalled.

"Shut it off! Shut it off!" screamed MacHugh at the roof as he tore through the deluge toward the damaged machines.

Just then the cause of the flood disappeared, dragged back through the hole and subdued by main force.

MacHugh and two of the oilers were frantically wiping No. 6 generator with rags and waste.

"This one is all right," shouted the former to the switchboard operator, "but No. 7 is out of it. Tie the whole damn system together. It's sink or swim. And I think a whale could swim in this engine room," he added.

Presently the motormen on the stalled cars felt the power again, and thousands of wearied Christmas shoppers were once more moving forward.

Meantime there had been the painful thought in MacHugh's mind that he had jeopardized his own Christmas and that of his wife and girls. Why had he permitted the use of the engine room roof for the Department men with the Siamese nozzle? It couldn't save the factory. They shouldn't have been up there.

The General Manager was about to leave, when a clerk summoned him hurriedly to the telephone

What would Walker say? Yet he must be told of the situation and at once.

MacHugh grabbed the receiver of his telephone off the hook savagely and called the City Hall. With the peak of the demand for current yet to come, the crippled station was already overloaded.

The committee meeting was just over and the general manager was gathering up his papers and about to leave, when a clerk summoned him hurriedly to the telephone booth.

"What the devil can Mack be calling up for?" he wondered. "Has anything happened?"

One minute later he knew all about the catastrophe at the power house. It was all he could do to appear calm during the brief formalities of departure that had

been thus interrupted, until he could jump into his automobile. He ordered the driver to make all speed to the station.

The general manager had gone to the City Hall primed to controvert the committee's expert on the few points remaining at issue. The chairman had been conscientiously bent on driving a hard bargain. Keen as the expert's analysis was, Walker's splendid grasp of detail and his deeper practical knowledge of the business enabled him to wage a successful fight. For twenty minutes he summed up the case in a manner so masterly that the stenographer's notes might have been sold as a text book on the broad subject of supplying electric energy to a modern city. And with a reference to his company's excellent service record, the popular favor it had earned, and the improvements made and planned, he closed his effort.

It was, however, almost more than he had hoped for when the chairman after a brief cross questioning, named a compromise figure on compensation and the committeemen refused to debate it further, ordering a recommendation on that basis.

And now, even as he won his fight in committee, a new enemy had appeared in his own engine room to smite him with irretrievable disaster—breakdown, overload, interrupted service, indignation instead of favor in the fickle public mind. And the franchise ordinance was coming up that night in the Council. The opposition might now be great enough to throw it back into committee and lose him all he had gained. It was maddening.

"Faster!" he cried to his driver, cursing the delays of street traffic. Would he never reach the power house? But at length he was there.

V.

"Mack!" he bawled, interrupting a heated conversation between the chief engineer and Holroy. "Why in hell aren't you busy fixing up No. 7? How did it happen? Why aren't you doing something about it?"

"No. 7 is useless," snapped MacHugh. "I tried it with the damaged coils cut out, but it won't work with two collector rings burned half through in a dozen places. I'm telling Holroy we've got to use this turbine."

"Infernal spinning jinney!" he muttered under his breath. But he would not now have scorned to make use of a battery of tomcats had that been a practicable resource.

"But the armature is 'green,'" cried the erecting engineer. "Green as grass! We haven't even got the machine balanced yet."

"Hold on, Holroy," said Walker. "We need only about 3,000 kilowatts. It ought to be good for that if it can run at full speed at all."

"It shouldn't be done," expostulated the other. "I refuse to be responsible for the result."

"Look here, Holroy. The big stores are crowded with women shoppers. If the overload busts us up further so that their lights fail, you know as well as I do what will happen. We're only wasting time here. We've got to try to use that turbine."

Holroy threw up his hands.

"You're the doctor," he said. "Give me a letter releasing us from all responsibility and saying why, and I'll give you the machine."

"You shall have it."

MacHugh wasn't waiting for any instructions. He had already removed the testing short from the turbine armature and it was now apparently ready to operate.

Walker finished an autograph release and looked at his watch as he handed it to Holroy. It was half past three.

"The turbine is yours," said Holroy. "Hope you come through all right."

As MacHugh opened the throttle of Unit No. 8 he himself felt that it was an unfair thing that they were about to ask

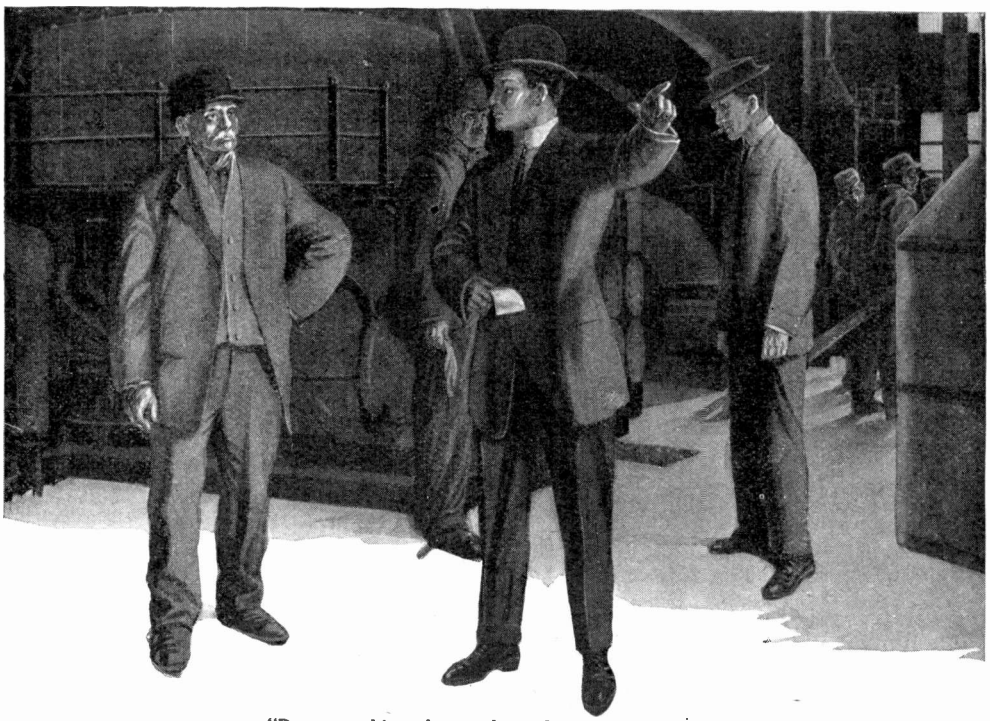
of it. The big machine responded easily and quickly reached 400 revolutions, steady as a rock. A little more steam and the speed passed 500. But now a vibration was noticeable. At 550 it seemed serious and MacHugh hesitated.

"O, give it steam!" exclaimed Holroy. "Jump to full speed and it may steady. I've known 'em to do it."

ernor mechanism that only for an instant did he quiver or give a sign of slowing down. Sensitive as a live thing, he merely opened more of his steam nozzles and kept the pace.

"Jove!" exclaimed Walker. "That's regulation for you!"

It was done barely in time. The storm had already doubled the usual



"Put everything else on the turbine and do it quick"

MacHugh opened the throttle still wider and Unit No. 8 shook its foundations as it raced through the 600s; and then, at 750 r. p. m., it settled down to an almost perfect spin, with hardly a trace of tremor.

Everybody grinned. Walker mopped his forehead. "I'm going to put the traction load on this machine," said he.

Unit No. 8 was spinning just like a big top—that is, his 75 tons of revolving parts were—when the switches were closed that tied him to the traction bus. Instantly a load of 3,000 horsepower gripped him, but so perfect was the gov-

traction load for that time of day, the power demand from the factories was as high as ever, and every light in the city seemed to be in use on account of the holiday crowds and early darkness.

Minute by minute the peak climbed ever higher. The relief afforded by the transfer of the traction load was being lost again, and this time in a different way, as trouble advanced from another quarter. The boiler room foreman interrupted an antiphonal paean in praise of turbines by Walker and Holroy to say that steam was at the maximum and could not go any higher.

Walker glanced at the load bulletin which now indicated 11,000 kilowatts, and shook his forefinger under the man's nose.

"Look here, Joe! There isn't a weak tube in the plant. You go back and keep things sizzling if you love your wife and family."

"I'd give a thousand dollars," he added, "if that new boiler section was ready and working today."

MacHugh strode toward the boiler room, muttering. Returning presently he said to Walker, "Well, sir, I can't get an ounce more steam. We're helpless."

"And Norton says the pressure in the customers' premises is five volts too low now," groaned Walker.

The trouble was now noticeable outside. Little Mrs. Walker had called up her husband again at his office, not having heard from him about the committee meeting, and the office had told her of the station trouble. Rather than bother him by calling him there she sat anxiously in their little home with all the lights turned off but one, and watched with dread as that one burned more red and dim.

In the big stores women complained of the bad light. Floor walkers ran to department managers, important with the news of which the latter were already too well aware. Store superintendents swore fluently at Norton's not over-confident assurances. Tired saleswomen and wrappers found a new interest in speculating on the cause of the trouble and the evident effect on the shoppers, and revived enough to converse slangily, as usual, on the subject. In ten minutes a bad situation had developed, and it was growing worse.

At the station the load now amounted to 11,500 kilowatts and was still rising. The clock stood at only ten minutes past four.

"Everything electric in town must be in use!" exclaimed Walker.

And still the insatiable demand for current grew momentarily larger.

"It's no use," said MacHugh. "We had better telephone the traction people that we will cut off our share of their load till the factories close. It will only be for 20 minutes or so."

"Good heavens, Mack! Haven't I told you that our ordinance will be recommended tonight? Why every man in the Council has some woman relative who's trying to get home with Christmas packages in this storm right now. And you want to stall the cars for half an hour!"

He stared at the load bulletin almost despairingly, his face drawn and haggard in the glare of the station arc lamps. He had made a good fight for months past to meet the exigencies of the politico-economic situation. Had the directors not taken so long to decide the matter of the new prime mover, the turbine would now be ready and well served with steam from the new boiler section; but everything had hung fire and this crisis was the result. He reflected bitterly that blind circumstances were combining cruelly this day to beat him; to discredit him; to injure the company.

"Steam! Steam! Steam!" he muttered. "If I only had steam!"

Holroy was sympathetic. He glanced at Unit No. 8 and opened his mouth to speak; then concluded not to say anything and stuck a cigar into it instead. But his thought had jarred the strained mental atmosphere and Walker got the inspiration. He turned to MacHugh with savage eagerness.

"How many pounds of steam per kilowatt hour do those old machines take?" he demanded. "Over 20, isn't it?"

"Yes, sir."

"Holroy, isn't this turbine guaranteed to operate on sixteen pounds, flat?"

Holroy nodded, chewing his cigar.

"Mr. Walker!" cried MacHugh. "Remember that 'green' armature."

The general manager silenced him with an impatient gesture. "Your job is

safe if you do as I tell you. I'm going to stake mine and the turbine against the situation. Leave the arc circuit on No. 1 and put everything else on the turbine, and do it quick!"

He strode over to the feeder-end pressure indicator to watch the result. Even he was startled to see how low the voltage was at the street intersections. Suddenly a marked improvement showed the effect of the load transfer as Units No. 2, 3, 4, 5 and 6 were quickly throttled and the turbine got their steam.

And straightway the engine room was filled with a deep-toned, yet piercing roar, the sound of mighty elements contending; a siren song of energy incarnate, the grand harmonic of steam, metal and air; steam dashed against and tearing its way between the bronze blades; metal resounding with the intense vibratory life of the most compact type of prime mover that has ever seen service; air caught up and whirled through the flying field segments and forced through the hot armature windings—air shredded and far flung with its burden of excess heat—the voice of the turbine, the triumph song of Unit No. 8.

And the men stood and watched him carry 11,800 kilowatts, and Unit No. 1 was still going with nearly a thousand more.

"How's the pressure now?" cried Walker.

"Still a bit low."

Every volt meant many candlepower in the big stores. MacHugh had been standing before the turbine, oblivious of everything else, lost in sheer amazement and admiration for the machine, whose tremendous performance had stamped out the last vestige of his prejudice. Now he turned to Walker.

"The factories shut down in ten minutes," said he. "This machine can carry *everything* for that length of time, and give the pressure."

Walker nodded.

"Shut down that toy!" roared MacHugh, indicating Corliss No. 1, his engineer's soul expansive with a new sense of power.

It had been a bad fifteen minutes, but except for the temporarily poor pressure they had not fallen down. And the storm was enough to excuse a great deal. The franchise was safe!

A man came to report that the fire in the furniture factory was now under control. The press next day credited the victory to "the heroic fight made by the firemen from the roof of the power house, for two hours, in the teeth of the blizzard."

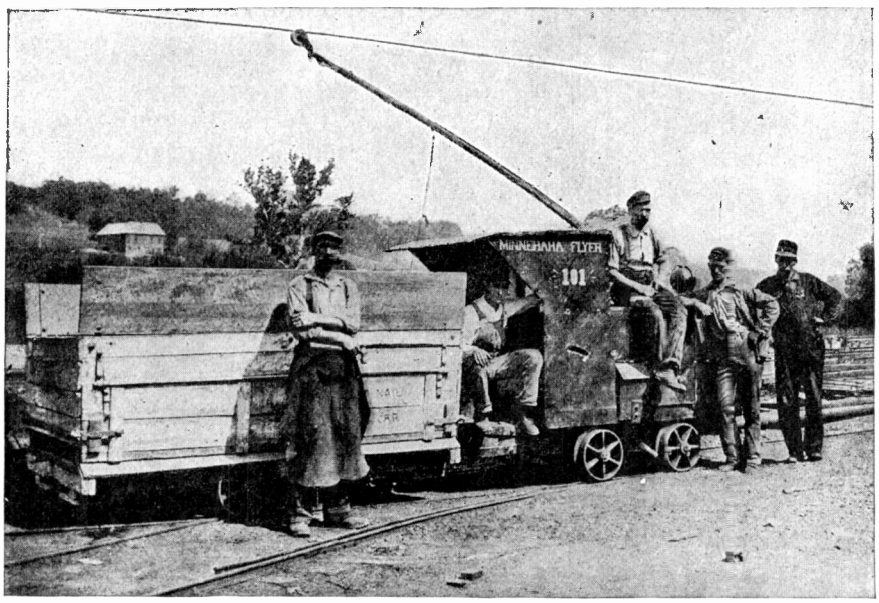
But until the present, no public recognition has been given another hero of that same hour, known simply to the men of that power station as Unit No. 8. So let it be here recorded that he is the legitimate and distinguished successor of the little steam machine invented by Hero, the Alexandrian philosopher, 130 years before the dawn of Christianity; for by virtue of his breeding and capacity he carried, with a "green" armature, the entire station load—the heaviest in its history—absolutely alone in a great emergency.

And today, if you inspect that engine room, MacHugh, chief engineer, will himself escort you proudly into the turbine bay, and you may note an appreciative twinkle in his eye as you read that apparently irrelevant legend on the name plate, which says, in part: "Licensed ....to be used for all purposes except as a prime mover for....aerial craft."

(*The End.*)

The Minnehaha Flyer

The "Minnehaha Flyer," as shown in the illustration, is a mine locomotive, designed and constructed at the repair shops of the National Coal Company, Byesville, Ohio, by Mr. H. B. Potts, the electrical engineer and his assistants during the summer of 1909, for the purpose of hauling ashes from their boiler house and timber from their lumber yards.



THE MINNEHAHA FLYER *By Courtesy of the O. B. Bulletin*

As this mine is operated entirely by electricity there are no mules or live stock utilized and the "Flyer" comes in very handy for the above work.

It was constructed from scrap gears, odds and ends, with a wood frame, Portland cement ballast, sheet iron covering, etc. It was designed with a view of making it "fool proof" as it was to be handled by any one who had use for it about the outside of the mine.

The "Flyer" has been in operation for over two years and is standing its wear and tear very nicely and has cost very little for repairs. Its speed is about 2½ miles per hour.

Electrical Protection of Lock Gates

Active preparations have been going on for some time past at Lock No. 2 on the Monongahela River in Pennsylvania to install an electric plant for the purpose of charging the steel gates in order to overcome the action of the acid in the river, which has been proving very disastrous to the gates and other parts of the workings of the lock. A plant has been completed and installed for the purpose of experimenting. The original plans and ideas were suggested by the Bureau of Mines. At present one gate is entirely charged with electricity from a set of storage batteries which in turn are charged from the dynamo used in generating the light system. In addition to this two large plates of steel have been placed on each of two of the gates. One will be kept charged for a stated period while the other one will not be, but left to the action of the acid for the same length of time, when an examination will be made by chemical experts to find what effect, if any, the electricity has had on the plates thus charged.

The Story of the Wall Street Girl

As Told by Blanche Ring

I think I never worked quite so hard in my life as I did in preparing for "The Wall Street Girl."

Those who sit out in front and enjoy a smooth running performance of a musical comedy haven't the faintest realization of the agonies of protracted rehearsal both before and after the first production. Frequent changes of song and incident are necessary even with the most successful libretto and score.

When rehearsals were in progress in New York I would steal away while the members of the chorus were being taught their dancing steps and go down to Wall Street to imbibe the atmosphere of the Stock Exchange.

One day I had a card to J. Pierpont Morgan's banking establishment and was shown through his beautiful offices. It was the Stock Exchange, though, that interested me most. I had been there before, but I saw it all from a different point of view when seeking material for my musical comedy.

When we first opened with the play we had a scene representing the gallery of the Wall Street Stock Exchange. It was beautifully painted and must have cost hundreds of dollars and yet we had to abandon it at Scranton, Pa. It took too long to set, and with it the performance ran close to midnight.

In Pittsburg we left behind us an elaborate mechanical lifting device whereby twelve chorus girls were shot into the air as the climax of the second act. The contrivance always worked perfectly at rehearsal, but refused to behave at the regular performance.

In one of the songs portable trees were introduced, the girls carrying them on and off the stage. These trees proved to be excess baggage and are now resting on the bottom of Lake Erie, for we threw them overboard on the boat trip from Cleveland to Detroit.

But your readers are probably most interested in the electrical things of the play. I often wonder what musical comedies would be without electricity. It is not so many, many years ago that oil lamps were used for footlights.

In the "Wall Street Girl" we have one electrical number that always occasions generous applause. It is in connection with the song "Every Day," sung by Mr. Carleton and myself. During the refrain the stage is in darkness when 24 girls clad in black pass diagonally across it, their illuminated faces only being seen by the audience. At first each

girl carried a pocket light directed toward her face. The difficulty with this was that often one or more of the lights would be dim or fail and the effect was spoiled. Our electrician has now hit upon a scheme which is most effective. Small bulbs with reflectors are attached to a cable and the cable to a storage battery. Cable and battery are carried on by the girls and there are no missing faces.

Another pleasing effect is produced at the close of the first act when each girl of the chorus carries on a suitcase. After the march three rows are formed, the one at the back standing, the second a little lower and the front row sitting. The suitcases in each row are held end

BLANCHE RING IN "THE WALL STREET GIRL"

to end. The stage is darkened and at the same instant electric lamps are lighted within the suitcases. Each case has a passenger coach painted on its transparent front, the transparency at one end of each row being a locomotive. The effect is that of looking at night at three illuminated passenger trains, one above the other.

Then again we use electricity in connection with the stock ticker. This ticker is the real article and not a stage "prop." In Pittsburg we subscribed for the telegraphic service and had the ticker connected. This was all right until the baseball scores began to figure on the tape. It was surprising then to see how popular that little machine was. When the members of the company were not clustered around it, the stage hands were and it became necessary to dispense with this service.

Cheapening Gold Production

In extracting gold from certain ores by the so-called cyanide process, the ore is separated into some of its constituents when the process is carried on in the presence of oxygen. To supply the needed oxygen it has long been customary to pump air through the solution, though sometimes chemicals have been used which would liberate the proper amount of oxygen.

But with some ores, as those containing amorphous iron sulphides, even a liberal supply of air has not been found sufficient to aid the cyanide in reclaiming nearly all of the gold. A few years ago it occurred to Mr. T. H. Aldrich, Jr., that by substituting free oxygen for the air in which the oxygen is mixed with other elements, he might improve on the action of the cyanide solution. He therefore tried the experiment of passing a current of electricity through the solution so as to decompose part of the moisture, leaving the free oxygen available in it.

The result was found immediately successful. Instead of requiring 48 hours for extracting seven-tenths of the gold from a given ore, the same solution with the aid of a slight current was found to extract nine-tenths of the gold in two and one-half hours.

Successful Experiment in Electrical Farming

MR. STAHL IN HIS ELECTRIFIED CORN FIELD. CROP PLANTED JUNE 8TH. PHOTO TAKEN AUGUST 15TH

A notably successful experiment in electrical farming has been made by Mr. William Stahl of Evanston, Ill., on his farm adjoining the Northwestern University athletic field, and the results more than justify the added trouble and expense.

The arrangement of the wiring for electrifying the soil and plants is made quite clear in the picture of a section of the farm. Substantial posts eight feet in height are set at intervals and upon these are placed porcelain insulators from which a network of wires is supported. This network is one side of a high voltage direct current circuit. For the other side of the circuit a conductor is buried every 30 feet in the soil, the assumption being that with the overhead network a single grounded conductor would take care of an area of soil 30 by 30 feet.

At the power house, as the building containing the apparatus is called, current is taken from the alternating current lines of the lighting company and before being rectified is stepped up to 200,000 volts or more and sent out to produce its magical growth effects.

A double throw switch enables the gardener to change the polarity, that is, make the overhead network positive a portion of the time and then by throwing over the switch make the soil the positive terminal.

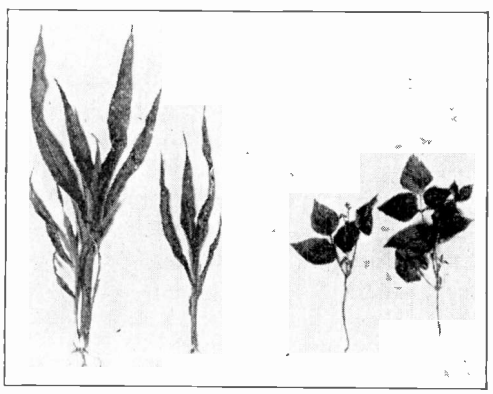
The results achieved if told in words or written might cause the credulous to doubt, but Mr. Stahl has taken numerous comparison photographs of the crops on his farm. These comparison pictures are of plants grown under the same moisture and soil conditions except that the plants are electrically treated in one case and not in the other.

The corn field, which shows a good healthy growth, was planted June 8th and the picture taken August 15th. An

ARRANGEMENT OF THE WIRES IN ELECTRO-CULTURE

area 30 by 20 feet planted to melons yielded 360 sweet, juicy Rockyford melons.

One striking observation made was that the foliage of all the crops presented a rich, healthy color and in no case could



SHOWING RELATIVE GROWTH OF CORN AND BEANS WITH AND WITHOUT ELECTRICAL INFLUENCE

a fungus growth of any kind be found upon it.

The farm is devoted to the raising of beets, tomatoes, potatoes, corn, beans and other truck garden products. Although the planting was done weeks after other farmers had finished planting, the crops on the electrical farm were harvested quite as soon as those on farms planted earlier.

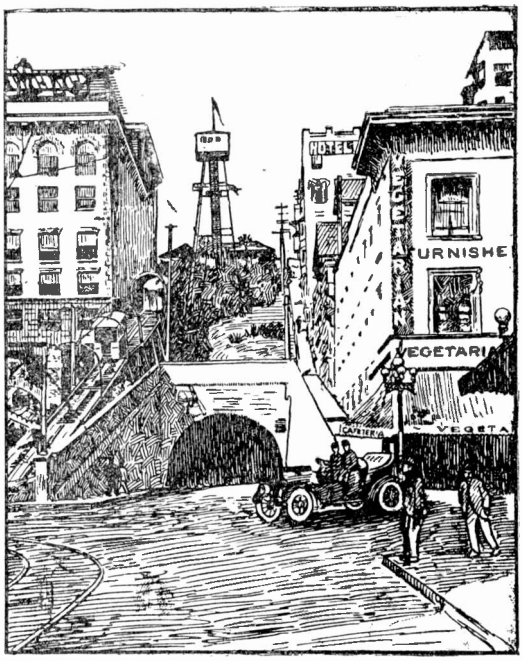
Mr. Stahl, who is both an electrical man and a farmer, believes that electric farming holds a great future and states that the original cost of the needed machinery is more than paid for by the increased income derived from the larger yield of the electrically grown crops.

Sow Wheat by Electric Light

An unusual sight recently witnessed at Cheyenne Wells, Col., was the seeding of a large acreage of land with winter wheat, the seeding being done at night. Light was furnished by electric lamps supplied with energy from a dynamo driven by a traction engine used to drag the seeders.

Electric Incline Railway

Los Angeles, which has a very large local and interurban electric railway system, can also boast of the shortest, which goes by the picturesque name of Angel's Flight. It is only a few hundred feet long, the length of a city block, yet it is said to be a very good dividend payer, proportionately to the capital invested. It runs on an incline of about 30 degrees and operates two cars, the "Sinai" and "Zion," which run by an electric cable system. In order to secure an uninterrupted supply of current, the power is se-

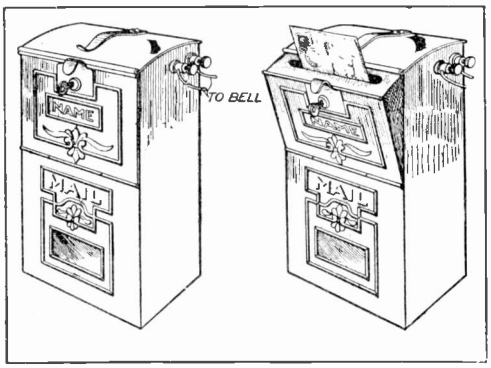


SHORTEST ELECTRIC LINE IN THE WORLD

cured from two independent companies, each supplying the current on alternate months. The advantage of this is that in case of any trouble in the power plant of one company, the current of the other can be switched on at once. This inclined railway serves thousands of patrons daily, as it runs from the business center of Los Angeles to a compactly built apartment house district on the hill. An observation tower and rest pavilion make the hill attractive to tourists.

Mail Box Alarm

A mail box arranged to ring a bell when the postman deposits a letter is an addition to the uses of electricity for signalling. Besides notifying that mail is being dropped into the box the bell



MAIL BOX ALARM

will also ring should any one attempt to open the box and remove the mail. A battery in the box supplies the current and the bell may be located where necessary in order to be heard. Opening the box closes the battery and bell circuit.

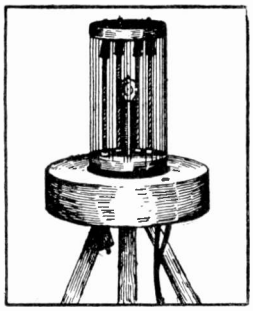
Electrocuting House and Garden Insects

The disease carrying fly, the mosquito and the gnat are disturbers of human comfort, while codling moths and similar pests infest orchards and gardens. Various means of exterminating these insects are being sought and tried out.

That electricity may step in as a benefactor in this field is quite possible, for successful tests with various devices are pointing the way.

The Frost electric insect exterminator is simple in principle, consisting for outdoor use of an insulating cylinder upon which fine wires are strung so close together that insects in alighting upon them will come in contact with at least two charged wires. To attract insects at night a light is placed within the cylinder. Moths and other insects fly against

the netting, complete the electric circuit and drop dead. The wires are charged from an induction coil operated from a six volt battery.

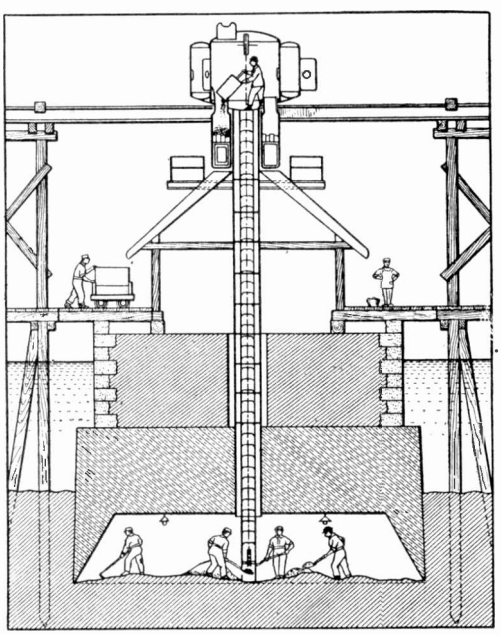


INSECT DESTROYER

Regarding the application of a modified form of the device to homes Mr. Frost says: "I have used it on my house for two years. The forms carrying the wires are placed in windows and doors, taking the place of ordinary screens."

Sinking Bridge Foundations

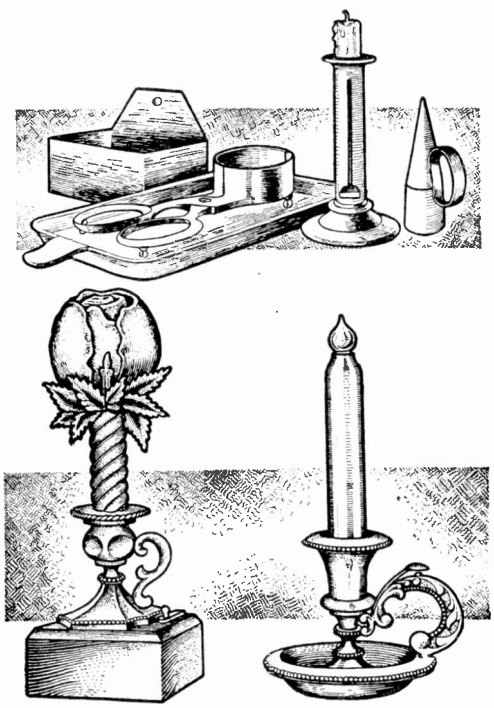
The common plan of boring into the soil under a river and lowering an enclosing tube or caisson inside of which the men build the foundation, is not the only method now used. An interesting variation is that in which the lower section for each pier is made on dry land out of concrete and then lowered into place in the river. By hollowing out the bottom of this artificial foundation stone on top of which the pier is built, the chamber formed between it and the river bed gives room for the men to work in digging down into the soil so that the massive stone can gradually be lowered until it strikes rock bottom. The excavated soil and gravel are hoisted by an electrically driven conveyor, while an air-pump (also operated by an electric motor) supplies the chamber with air. The illumination is by incandescent lamps.



METHOD OF SINKING BRIDGE FOUNDATION

The Old and the New

In the days of our colonial grandparents tallow candles were the standard light and the young girls of the household were carefully instructed in the details of their manufacture.



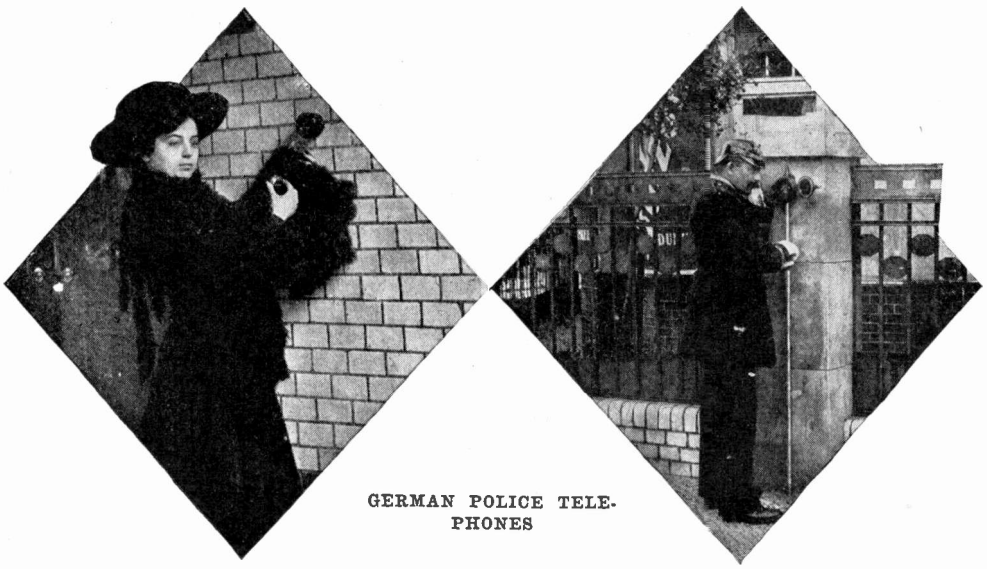
ILLUSTRATING THE OLD AND THE NEW

While we have retained the form of the old iron candlestick with its tallow candle rod, the matchbox, snuffers, extinguishers and tray are gone. In their place we have in the base of the candle-

stick a small electric battery with wires taking the place of the wick running up to a tiny lamp with a tungsten filament capable of giving an intensely bright light. On the candlestick handle or base is a small switch for turning on the light which may be subdued or hidden if desired by having the lamp at the center of an artificial flower, as shown in the illustration.

German Police Telephones

In consequence of the enormous expansion of the German capital, Berlin, proper policing in the outer districts is quite hard to maintain, as a sufficient number of policemen could hardly be employed. It was therefore a necessity to give the patrolman on duty an aid, by means of which he could communicate at any time directly with headquarters, and thus get help when necessary, in the shortest time possible.



GERMAN POLICE TELEPHONES

A German firm manufacturing the smallest telephone ever constructed, secured an order from the city for a large number of the instruments to be used by the police.

The parts of this unique telephone are made so compact that it can be carried in the vest pocket. Both parts, the telephone and the microphone, are enclosed in small nickel cases which can be closed tightly if put one upon the other and then turned around to an angle of 45 degrees.

Contact cases, into which are led the main circuit wires through inconspicuous metallic conduit, are provided at a very short distance along the streets and are fastened to walls, doors, etc., and are closed tightly so that no humidity can do any damage to them, and a good insulation is thus obtained. All the members of the force are provided with a key which fits every contact case. In parks these cases are fastened on convenient trees.

If there are a number of lines running to one station, this station is provided with a switch which enables it to connect the man at the end of the wire with the headquarters and public telephone system.

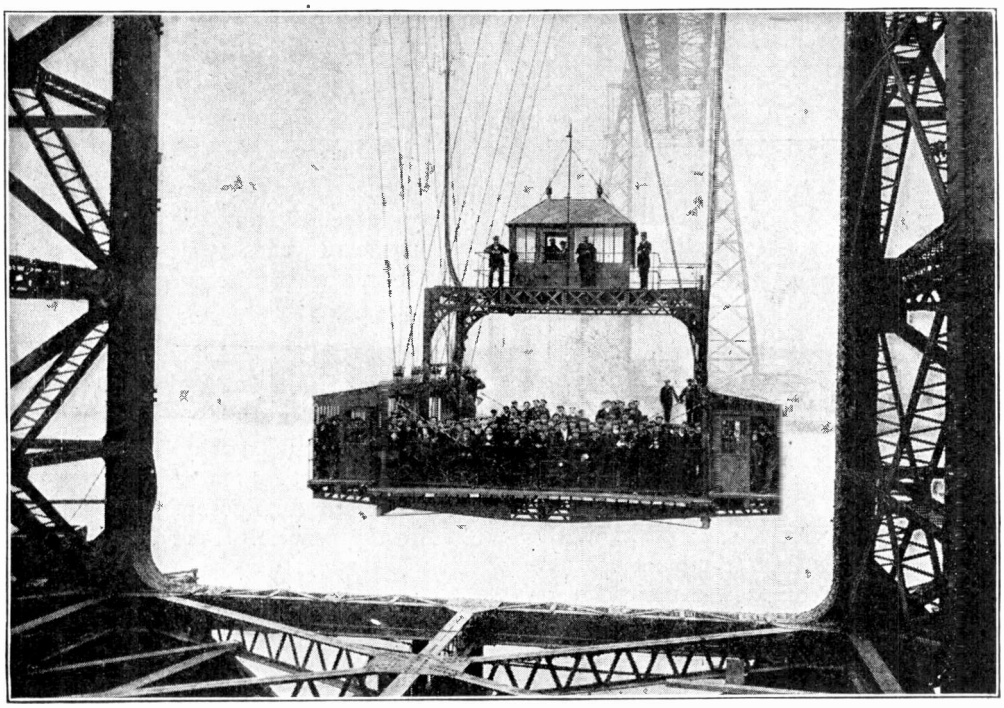
Female members of the secret service force are equipped just as well as the men with this new device, and one of the pictures shows a female detective ringing up headquarters for a patrol wagon to remove an insane woman to the station.

Transporter Bridge Over the River Tees

Recently the great transporter bridge over the river Tees, the most important waterway in northeastern England, was formally opened by Prince Arthur of Connaught.

This bridge is supported by two groups of piers on each side of the river and connected by a pair of lattice type girders of 570 foot span, with depths varying from 65 feet over the towers to 20 feet at the center. The under part of these girders is 160 feet above the high water mark and they carry on their lower flange two lines of rails and are placed at a distance of 35 feet from center to center. A travelling platform is supported by the four rails from which a travelling car, 44 by 39 feet, is suspended. This car is provided on each side with passenger accommodations and its floor is level with the roadway on each side of the river. About 600 passengers and six wagons can be carried at one time.

The moving of the platform to and from the landing places is carried out by an endless ropeway and winch, driven by two 60 horsepower motors. The river is crossed in less than two minutes. The car can be operated from the pilot's bridge, placed on top of the passenger car, but in case of emergency also from the winch house about 150 feet away from the main tower of the bridge. In the most severe gale one motor is estimated to be sufficient to propel the traveling platform.



TRANSPORTER BRIDGE APPROACHING A LANDING

The total length of the bridge and approach span is 850 feet, the length of each overhanging cantilever girder on the landward side is 140 feet. The base girders on which the towers are built, have a length of 98 feet, a depth of sixteen feet and a weight of 163 tons. The total amount of steelwork in the bridge is 2,600 tons and there are 600 tons of steelwork in the caisson foundations.

The total cost of the bridge is estimated to be about $408,660.

Bell's First Telephone

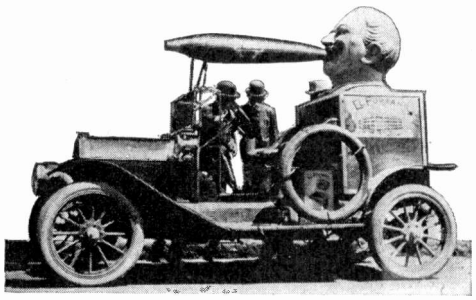
In 1876 Bell exhibited at the Centennial Exposition in Philadelphia a telephone, which, though not commercial in the accepted sense of the word, was practical and could be used for the transmission of speech. The accompanying illustration, the original of which is in the archives of the Western Electric

BELL'S FIRST TELEPHONE

Company, will give a conception of the crudity of Bell's first telephone as compared with the compact, commercial instruments of to-day. Nevertheless, though the physical aspect has been changed materially, the principles which made it possible have not.

The Electrical Smoker

An automatic cigar smoker operated by electricity is a clever advertising device used by a Los Angeles cigar dealer. The head of a man of gigantic proportions appears to be enjoying a four-foot cigar, the whole design being mounted upon a motor car which is used for delivery purposes. The electrical part of the mechanism is concealed in a model of a cigar box below the smoker's head. It consists of a motor operating a bellows. This sends the smoke from a small brazier full of damp straw up through a tube that has two branches; one terminating at the cigar tip, the other at the smoker's mouth. Every time the motor causes the bellows to close, a puff of

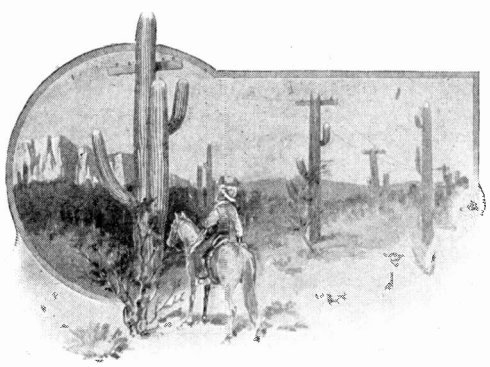


THE ELECTRICAL SMOKER

smoke issues from the mouth and a curl of vapor ascends from the ash. Meanwhile the head wears a satisfied smile as if the cigar which he advertises were just to his taste.

Giant Cacti for Pole Line

A telephone and a telegraph line that will use poles set by Nature years ago is to be built out of Tucson, Arizona, for the forestry service. Part of the route

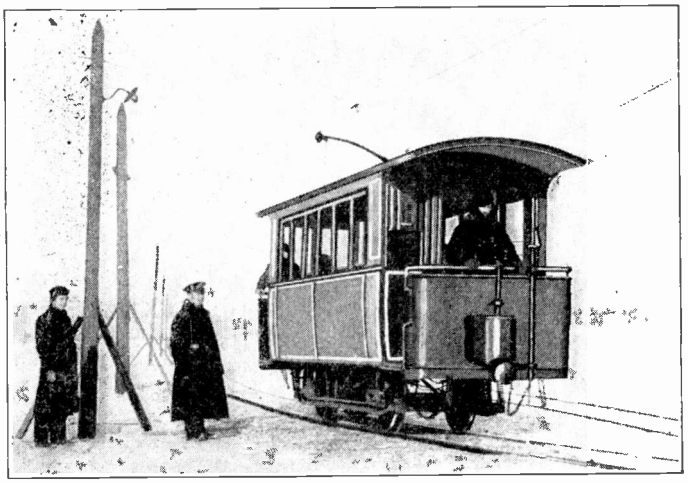


AN ODD POLE LINE

is through rocky canons where it would be impossible to set a pole and a task to bring it there, but along the proposed line are giant cacti numerous enough to be used as supports for cross arms to carry the wires. These natural poles will be economical in requiring no replacement or guying.

Electric Railway on Ice

This is a view of an electric railway and one of the cars operating in winter over the frozen surface of Lake Baikal in Siberia. Just before the ice breaks



RAILWAY ON ICE IN SIBERIA

up for the short summer season the line is hurriedly taken down to be rebuilt again the next winter.

Our Wasted Water Power

There are in the United States available water powers capable of producing not less than 37,000,000 horse power; probably very much more. Water powers already developed produce less than 6,000,000 horse power. At least 31,000,000 horse power remain undeveloped, the water running idly away. Competent estimates place the motor energy for all industries now in operation in the United States at a little less than 30,000,000 horse power, including all known sources of power. It follows that we are permitting the non-use and waste of available energy more than capable of providing motor power for all our industries.

This waste is irretrievable, absolute. Water power cannot be retained or stored. Running water must be utilized as it flows. Future generations may profit from the coal, oil, natural gas and other fuel which, by a conservative policy, we save for their use. But we cannot by denying ourselves, or in any other way, save water power for them. To conserve water power is to utilize it.

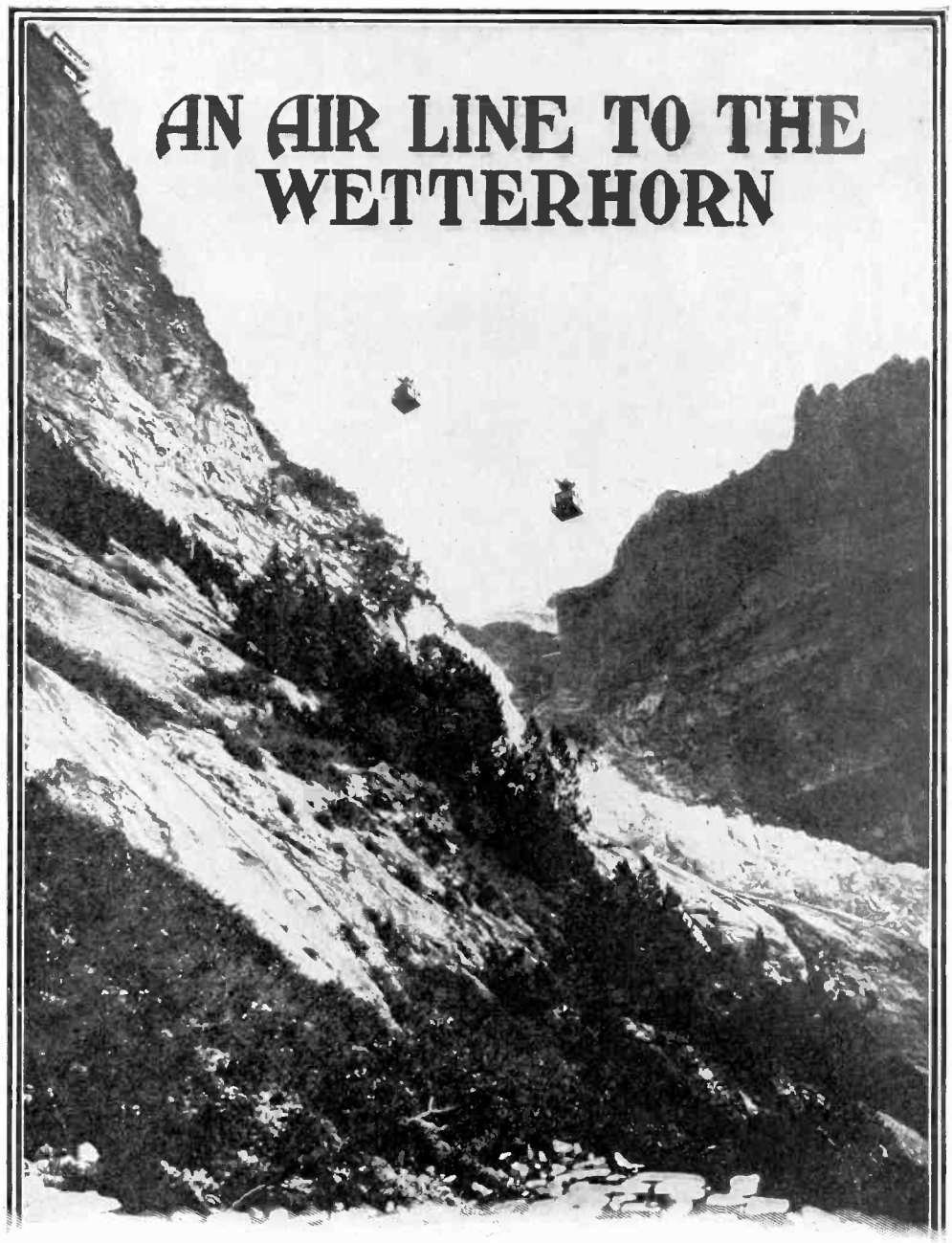
Failure adequately to develop this idle water power means an unnecessary annual consumption of exhaustible fuel supply. Where power is developed from combustible coal, wood, oil or gas, these natural resources are destroyed. They cannot be replaced, except to a limited extent in the case of wood. The period when exhaustion will be reached is already being estimated by serious men. Some place it near, others more distant; but all agree that fuel cost must steadily increase because of diminishing supply. Such estimates generally assume a rate of fuel consumption based on present experience. But fuel production increases annually by geometrical ratio.

With adequate water power development fuel production could at least be reduced to a constant figure without checking a spindle or silencing a wheel. Yet the consumption of exhaustible fuel goes on and increases, while 31,000,000 horse power of available energy runs unutilized into the sea.—*Josiah T. Newcomb* in the *Public Service Journal.*

Young Heroine Rewarded

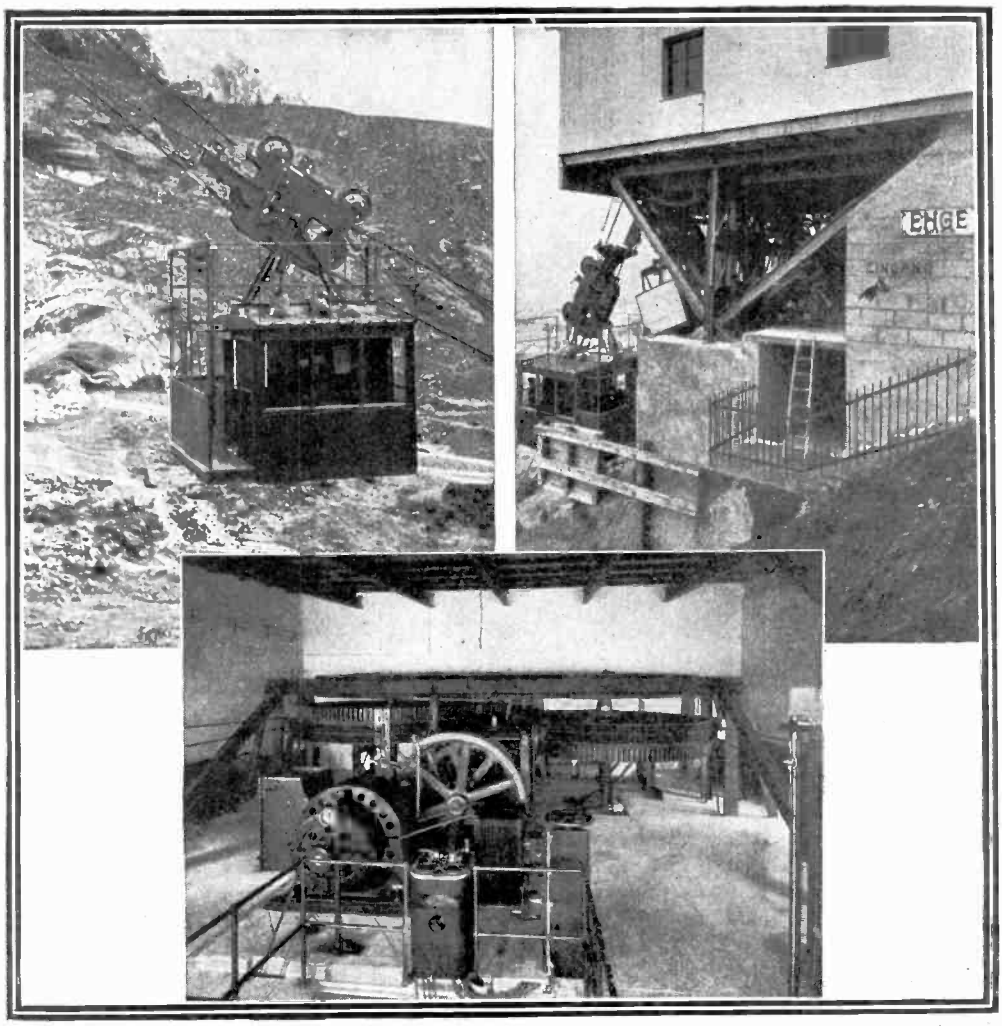
Kathleen Lyon, the sixteen-year-old operator who risked her life to warn people of Austin, Pa., of the approach of the recent flood, has been rewarded by the telephone company. As long as she remains in the company's employ her pay will be at least double that which she was receiving before the disaster.

AN AIR LINE TO THE WETTERHORN



In the January issue of this magazine mention was made of the unique suspended railway now operating to give easy access to that famous Alpine peak, the Wetterhorn, a similar installation being now under way for making the ascent of Mount Blanc. Since then some exceptional views have been received of the Wetterhorn railway, which are here reproduced.

The topographical features were such that the construction of a surface rail-



THE ELECTRIC AERIAL CAR

POWER APPARATUS AT THE HEAD OF THE AERIAL LINE

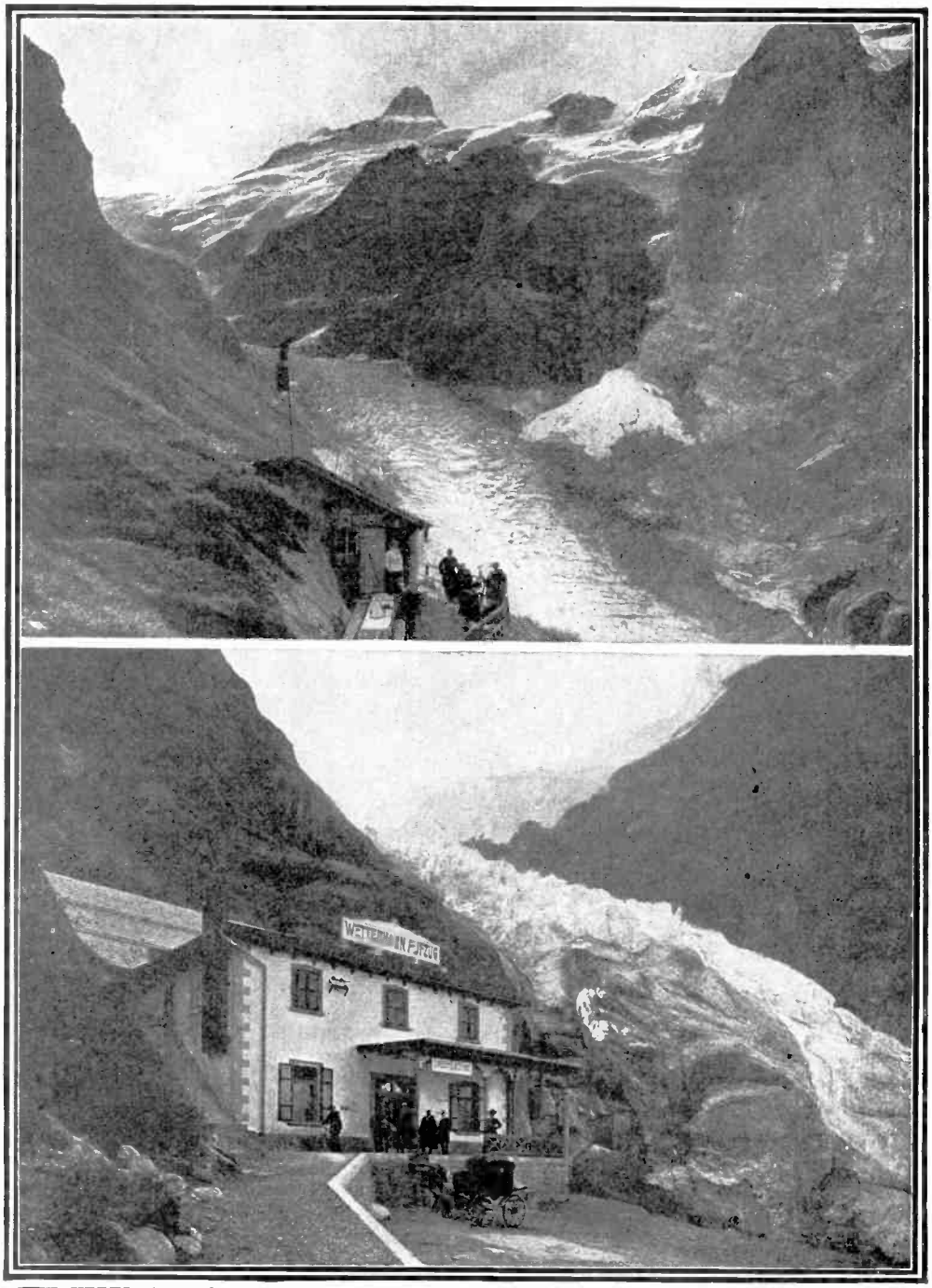
POWER STATION

road was out of the question except at enormous expense, while the route would have been tortuous and lengthy, winding up the mountain face and entailing the cutting of the galleries and tunnels for the laying of the track.

Under these circumstances the promoters of this enterprise decided to adopt an aerial system comprising two sets of cables each carrying a car and disposed to work in alternate directions simultaneously so as to secure a counterbalancing system.

The car itself is supported from the trolley, being hung from a transverse axle passing through the center of the trolley body, and in such a manner that it is quite free, so that the car can always maintain an absolutely perpendicular position irrespective of the gradient.

By means of this railway the traveler is hoisted through the air to a height of some 5,250 feet above sea level to Enge station, a halting point perched on a ledge on the face of the mountain. At this point is located the electrically oper-



THE UPPER STATION OF THE AERIAL RAILWAY. BACK OF THIS IS TO BE SEEN THE GRINDEL-WALD GLACIER

LOWER STATION OF THE AERIAL RAILWAY

ated cable drum. The lower or departure station is at the foot of the mountain some 4,000 feet above sea level at the snout of the Grindel-wald Upper Glacier.

An Early Electric Magician: Robert Houdin

Seventy-five years ago almost any of our present familiar applications of electricity would have entitled the maker and user to be known as a wizard or conjurer, for even so simple a device as an electric bell was then unknown to the general public. In those days any one capable of installing and mysteriously using ever so simple an electrical contrivance was hailed as a magician. Little wonder, then, that such devices should have played an important role in the career of that prince of European conjurers, Robert Houdin.

Just what part electricity played in Houdin's public performances may never be known. In writing his famous memoirs he hinted at publishing a later volume on his magical arts, but the action of an assistant who sold some of Houdin's secrets to others after having been with him for seven years, rather soured the famous conjurer, and even the imprisonment to which the betrayer was sentenced did not reconcile Houdin. But a liberal use of electromagnetic circuits at his successive dwellings, including the beautiful mansion to which he retired at St. Gervais, would imply that batteries and magnets may have been responsible for many of his illusions.

Writing about his earlier quarters, he himself says: "When some one rang at my door, an electric communication struck a bell in my workroom. I was thus warned and put on my guard. My servant opened the door and, as is customary, inquired the visitor's name while I laid my ear to a tube which conveyed to me every word. If I thought it as well not to receive him, I pressed a button, and a white mark that appeared in a certain part of the hall announced that I was not at home to him."

Although thus able to keep out many undesirable visitors, he soon found that his judging by the name was not always safe, and hence devised a method of shortening the visit of those whom he considered bores: "I had placed behind the sofa on which I sat an electric spring, communicating with a bell which my servant could hear. In case of need I threw my arm carelessly over the back of the sofa, touched the spring and the bell rang. Then my servant, playing a little farce, opened the front door, rang the bell (which could be heard from where we sat) and came to tell me that Mr. X (a name invented for the occasion) wished to speak to me. It was very rarely that my bore did not raise the siege. No one can form an idea how much time I gained by this happy arrangement, or how many times I blessed the celebrated savant to whom the discovery of galvanism is due."

In his later residence, Houdin modified the equipment, but evidently continued to use magnetic means for mystifying his visitors. The stranger coming to his house found an uncommonly small gilt knocker at the door. When he raised this and thrust it home, there was only a feeble knock, but simultaneous with it a jingling of nicely tuned bells. Just as he showed his surprise at the unexpected chime, the gilt name plate beside the door, labeled "Robert Houdin," slid out of sight and in its place appeared another plate with the single word "Entrez"—the French for "walk in." Pushing the door open he entered, only to have the door close behind him with a spring so that he could not go back through it if he wanted to.

As the door closed, the wizard seated in his study might comment to those in the room with him, telling them whether

more than one had entered the hall far from his sight, or whether it was only one of his servants. The explanation was quite simple: Houdin had arranged the door so that while it was being opened it would close contacts for ringing a bell four times in slow succession. If one of his servants had done the rapping, she would walk in at once and the door would only be open long enough for a single stroke of the bell, while a stranger would pause at sight of the changed name plate, giving the bell time for another stroke. Then, if there were several persons, the door would be held open so much longer, hence the faint jingle of the electric bell gave Houdin the information with which he often astounded his guests.

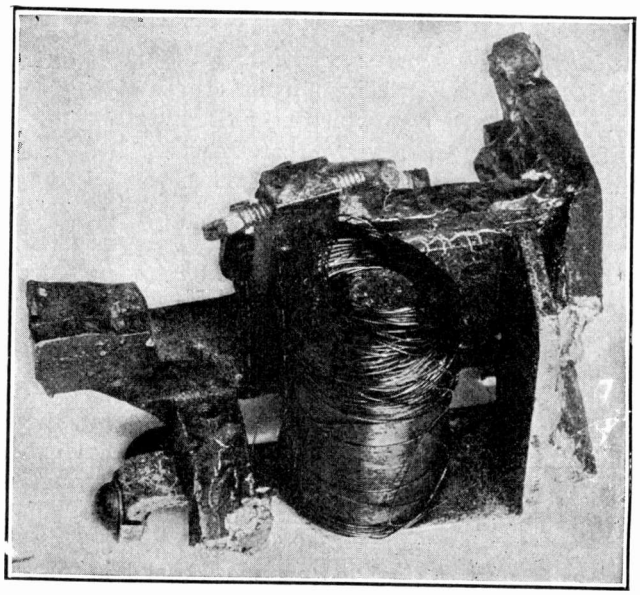
At one time, Houdin even equipped the feed trough of his stable with an electric trip. It seems that his hostler had acquired the habit of removing part of the horse's regular allotment of oats and of trading this off for a glass or two at a neighboring inn. Learning of this Houdin fitted the bin with a trip door which could be opened only by an electromagnet when he pushed a button in his house. For a time that saved the oats, but the craving for drink soon got the better of the hostler who found that he could abstract part of the oats while the feed trough was open if he managed to be in the barn at the right time. To cure him of this, Houdin arranged a new set of wires so that opening the barn door would give him a signal. This measure is said to have been effective. Incidentally, it also is one of the first records of a practical electric door alarm which history has given us, dating back some 60 years.

Had Houdin added a third volume to his partial autobiography, he probably would be hailed today as the pioneer in introducing many another simple application of electricity. However, he only foreshadowed any work of his later years in the closing lines of his memoirs, lines coming most appropriately from such an electrical wonder worker: "Henceforth I intend to devote myself to my darling study, the application of electricity to mechanism. For I must confess—if my readers have not already guessed it—that electricity played an important part in many of my experiments."

Enameled Wire Runs the Gauntlet

Just what enameled wire will do under the most trying condition that it can be subject to — heating — is graphically shown in the accompanying illustration of a burned coil.

A relay coil had suffered exposure to fire. The brass surrounding it was melted, the fibre heads burned, the insulating paper around the core carbonized. But the enamel insulation except in the case of the outer layer, which came in direct contact with the flames, remained absolutely unharmed and in suitable condition to be used over again.



ENAMELED WIRE COIL AFTER FIRE

The Big Bottle

High up on the top of one of Baltimore's newest and tallest skyscrapers, the Bromo Seltzer Tower Building, 300 feet above the perpetually moving mass of humanity, is a bottle which bears the

BOTTLE SIGN IN BALTIMORE

label of the well known headache remedy. From the sides of this bottle brilliantly blaze forth at night the rays from 554 sixteen candlepower incandescent lights formed into flaming letters ten feet in height and six feet in width. The bottle makes one revolution in 35 seconds and is driven by a series of gears which are connected direct to a ten horsepower motor.

It has been calculated the bottle would hold 623,276 pounds of Bromo or 54,536,750 doses. Just how many headaches this would cure would be hard to figure.

The clock, which is located on the seventeenth floor, is a Seth Thomas movement and is run by a gravity weight, weighing 300 pounds. A small motor is connected to it, which automatically rewinds it every six hours. The pendulum, fifteen feet long, weighs 475 pounds.

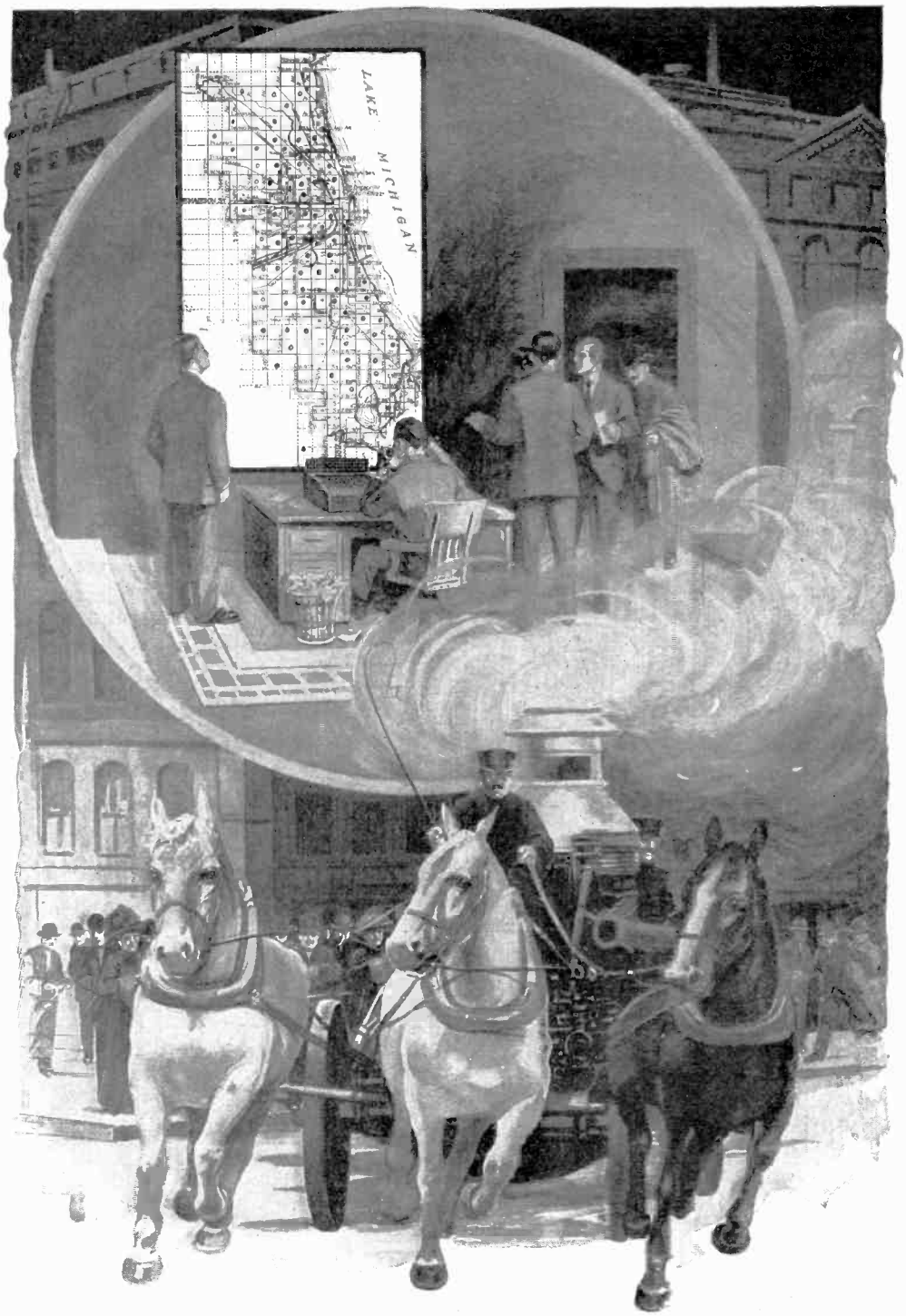
The clock has four glass dials, each one fifteen feet in diameter. The outside circle is 24 feet in diameter. The minute hand is eleven feet eight inches long, from center of shaft to tip, and weighs 175 pounds. The hour hand is eight feet two inches from center to tip and weighs 145 pounds.

Each dial is illuminated by twelve 40 watt lamps around the figures and four 40 watt lamps in the center. The lamps are controlled by a time switch which turns them on at a regular time in the evening and off in the morning.

The Greedy Kerosene Lamp

The frugal Germans recognize the fact that it costs more to obtain a given illumination with kerosene than with in-

candescent lamps at the rates charged by most electric light companies. The difference in actual coin may not be quite as great as would appear from the popular cartoon which is here reproduced, but the added cost and annoyance of the labor, smell and smoke may make up for any apparent exaggeration.



ILLUSTRATING THE USE OF THE FIRE DEPARTMENT MAP

Lamp Map for Fire Department

The City of Chicago has an area of approximately 190 square miles within the boundaries of which are business and residence properties that must be constantly protected from fire. When a big fire occurs in the loop district or stock yards, fire apparatus is called from adjoining territory, often making it a problem to distribute the remaining engine and ladder companies to the best advantage.

To enable such a situation to be more readily handled and to assist every day service, a large map of Chicago has recently been installed on the wall in the fire alarm office at the City Hall. Each fire engine house is designated on this map by a small incandescent lamp. From each lamp wires run to a desk-like switchboard on a table, from which movements of the fire companies are directed by telephone.

When fire apparatus is sent out of an engine house, a plug bearing the proper number is removed from the desk board and this turns out the light corresponding to the fire engine house on the map so that at a glance the map shows the dark or unprotected territory.

The Ethics of Electrical Engineering

To the layman, the professional engineer is a vague somebody who uses mechanisms to achieve results. Definitions of the term engineering vary greatly and probably always will do so, as the field is one in which there must be a continual growth—growth of the kind that implies expanding, diversifying and changing. But however vague the general conception of an engineer may be, he is generally conceded to be a strong factor in industrial and commercial progress. Indeed, most people assume him to be one of those whose work is governed chiefly (if not wholly) by the profits involved in his work either for himself or for his clients, and not by altruistic motives such as frequently actuate physicians, lawyers or teachers. The fact that even engineers of high standing are rarely conspicuous in civic or political activities has probably been responsible for the current impression that the work of an engineer, while admittedly not for his own interest, is still only a part of the decidedly selfish interests of individuals and corporations whom he is serving.

Such, at least, is the prevailing opinion. And yet those who are really in touch with the engineering professions know that this is far from true, for instead of striving after purely selfish results the high class engineer is continually utilizing opportunities which conduce to the general welfare of cities, counties, and even whole nations. Indeed, the general range of engineering is well summed up in one of the common definitions which speak of it as "the art of directing the great forces of nature for the use and convenience of man." Surely that is a high mission and one easily substantiated by a glance over the various branches of engineering activity, not the least of which is that of the electrical engineer, whose range of human helpfulness alone is most remarkable. Every day we find him helping us to produce and effectively direct light and power as a product of energy which nature stored in her underground coal piles; or carrying the sound of our voices across the space of scores of miles; or, as in the Cuban war, where many attribute all of the real victories to the work of engineers—delivering orders and reports where they will be most helpful.

Many still assume that, primarily, it takes mathematics to make a successful engineer, or perhaps mathematics plus mechanical aptitude; but those familiar with the profession know that it requires far more. Many of our ablest engineers could not qualify either as good mathematicians or as expert mechanics, though they undoubtedly have the keen sense of exactness and of proper re-

lations which characterize both the mathematician and the mechanician. It is this sense of preciseness, of unswerving laws and their logical consequences that really characterizes the engineer and that places him in some respects even on a higher plane than most professions.

For instance, a lawyer intent on winning a case may distort both the law and the evidence, well knowing that after the case is once decided the particulars will rarely be examined. But the work of the engineer must stand the test of time, of critical inspection years or even decades after each particular task is completed. The politician may hide real conditions or magnify facts all out of their actual significance and importance, but the engineer must present things exactly as they are. The physician may prescribe on the strength of rash guesswork or mere intuition, for if he errs he can justify himself by speaking of the case as a complex and mystifying one. But the engineer must diagnose openly and correctly, no matter how complex the conditions of the case may be, else his reputation will not survive.

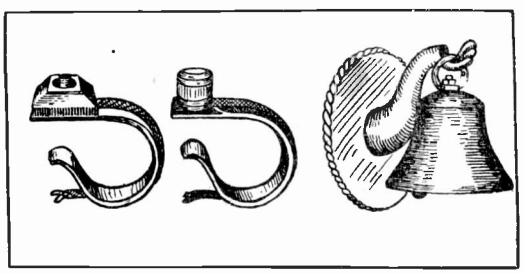
Thus the demands upon the engineer and particularly of the electrical engineer, are in many respects far more severe than those upon the other and older professions; and from their very nature these demands not only imply a high character in the man but tend to maintain a high standard. The man who is not uniformly dependable, who occasionally lapses into carelessness, who tries in any way to get something for nothing, who has a tendency to cover up defects or to palm off imperfections—such a man can never get far in the engineering profession.

Nowhere is this more evident than in the electrical branches in which modern practice demands an exactness not yet reached in other lines, for this very training in exactness and in the unfailing laws of cause and effect, is but a reflection of the higher laws which govern our daily life and which are equally unalterable as to their results. Consequently, the biographies of the men who have become prominent in the engineering lines are those of men of character, men with a code of ethics far above that of the politicians and novelists into whose regular work the inflexibility of Nature's laws does not enter as a persistent factor.

Unfortunately, the complexity of the engineering lines and the large amount of technical reading required for keeping up with the rapid progress in the same, has prevented many from taking that active part in civic life which the community has a right to expect of men of such high character. But with the increasing amount of public utility work, the professional engineers, and particularly the electrical engineers, are sure to become more active in those non-professional capacities.

Odd Bell and Push Buttons

For the same reason that the old-fashioned knocker is still retained in many modern houses, the old form of bell but electrically operated appeals to the artistic sense of some. Such a bell is



ODD BELL AND PUSH BUTTON

on the market and operates in the same manner as the vibrating type.

A push button for operating an electric bell is made in a convenient form, being attached to a spring clip. By the use of the clip the button may be fastened to a table, desk, bed, or chair without the use of nails or screws and the attendant marring of furniture, the cord running to the battery and bell in any desired location.

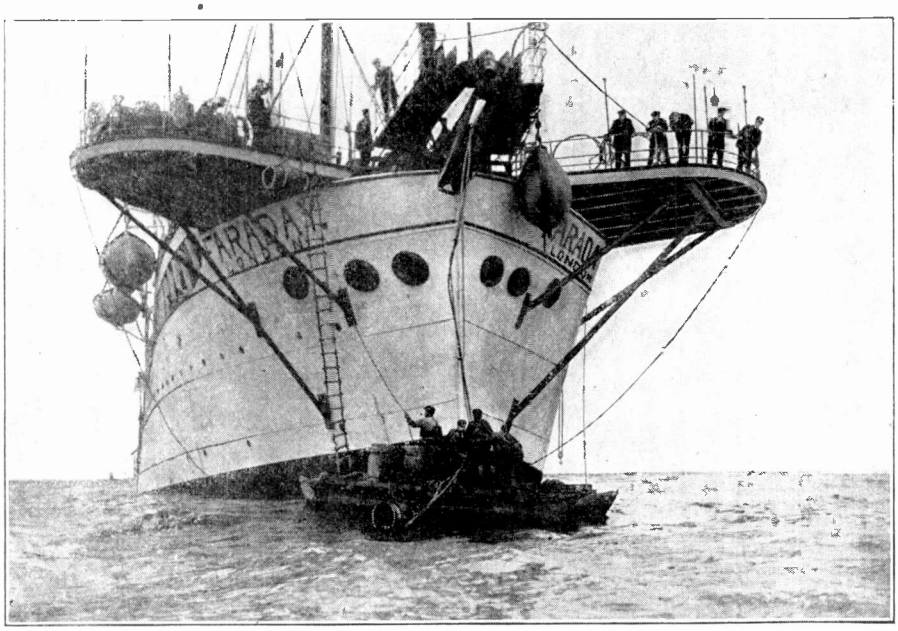
The Automotoneer

When a street car starts with a jerk, too much current is sent too suddenly into the motors. When that blinding flash occurs above the motorman's head the circuit-breaker has opened to stop the excessive flow of current to the motors and thus prevents serious arcing or damage in the way of a burnout.

The "controller" handle which the motorman operates with his left hand regulates a number of resistances within the metal enclosure under the handle and these resistances govern the amount of current that will flow into the motors. To prevent too much current from entering the motors the controller handle should be operated slowly from the "off" to the "on" position, but motormen are human and mistakes will happen with damaging arcing and serious burnouts.

With these things in mind a device called the Automotoneer, which enforces a slight stop of the controller handle on every point between the "off" and "on" positions is now made. It is located on the controller and while regulating the rapidity with which the controller can be thrown on it does not prevent the power from being thrown off instantly when necessary.

The Automotoneer is made also for use on controllers of cranes, hoists, derricks, etc.



THE FAMOUS CABLE SHIP "FARADAY"

This odd looking vessel is the famous cable steamer "Faraday" built in 1874 at Walker-on-Tyne, England. The platforms projecting over the water enable the cable to be observed as it is paid out and disappears in the deep. The picture was taken off the Northumberland coast of England while laying a cable from England to Norway.

Artificial Daylight

We live a great deal of our time in daylight and our criteria are those which are formed under the influence of natural light. Artificial light sources are of such recent development compared with the age of the human race that they can not be considered as having had any influence in the development of our optical organs.

Aside from the distribution and diffusion of natural daylight there is one great consideration, and that is the ability accurately to match colors in daylight. All luminous sources emit some or all of the following colors: violet, blue, green, yellow, orange and red. The color of the light which we see on viewing the source is the sum of the various amounts of colors present. In daylight these colors are present in nearly equal amounts. This is not true of most artificial sources.

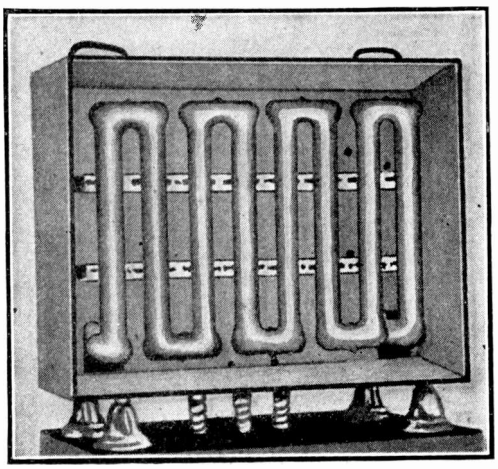
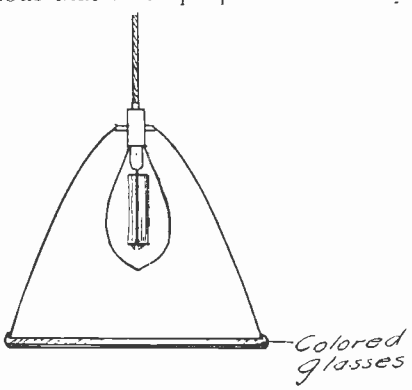


FIG. 1. MOORE TUBE FOR MATCHING DAYLIGHT

We see a red paper as a red color only when the light falling on it contains red rays. This is the reason why a red paper appears black (absence of color) when viewed by the light of a mercury vapor lamp. In other words, there is no red light emitted by such a lamp. While daylight or white light consists of the proper proportions of all colors of light, yet white light may be made by various combinations of two or more colors. For instance yellow and blue when mixed in proper proportions make white. In such a light there is no red light and red-colored objects would appear black. A common experience is the difficulty in distinguishing blue cloth from black cloth. This is because of the scanty supply of blue light in most artificial sources.

For the accurate matching of colors a light source which has all the colors present in the proper proportions is essential. One simple example will suffice to illustrate the point. Purple consists of a mixture of red and blue. It is obvious that when purple is viewed by a light source deficient in blue rays it will appear red. That is, only the red is reflected to the eye because there is present no blue light to be sent back to the eye. On the other hand, if the purple cloth is viewed by mercury-vapor light it appears blue because red rays are absent.



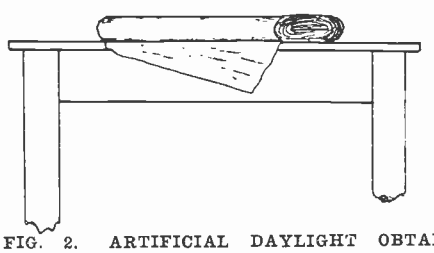


FIG. 2. ARTIFICIAL DAYLIGHT OBTAINED THROUGH A COLORED GLASS SCREEN

Only two artificial sources are available for comparing colors with the same exactness as in daylight. The first is the Moore tube. This is a long tube, sometimes in the shape of a grid, as shown in Fig. 1, which is filled with carbon dioxide gas at low pressure. The discharge through the tube is between electrodes in the ends of the tube. This vacuum discharge requires a thousand volts or more to obtain high efficiency. The character of the light emitted is closely approximate to daylight. The second source has been perfected by H. E. Ives and M. Luckiesh. This consists of a proper arrangement of colored glasses which are to be used with incandescent lamps. These lamps have an over supply of red rays, and the function of the glasses, which have been prepared with great care, is to absorb this excess and transmit only light which is of the same composition as daylight. These glasses can be attached to any tungsten lamp and are convenient and useful. Of course there is a loss of light, but when accurate color matching is to be done a proper source is desired at almost any sacrifice. These devices are of special importance in dye works, print shops and dry goods departments. Fig. 2 shows the latter arrangement in one possible form.

Thermit Rail Welding

Ordinarily the rails of an electric car line are "bonded" together by a heavy wire from one rail to the next, thus making the rails a continuous return circuit.

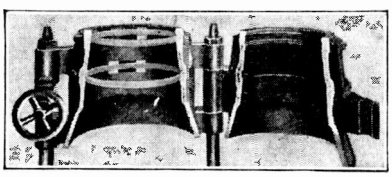
In place of wire bonds, a process of Thermit welding is being used with good results. In this method a space of about ¾ inch between the ends of the rails is provided and an earth mold made around them. After bringing the rail ends to a good red heat with a gasoline compressed air torch a tap is made in the crucible which sets over the rail ends. The aluminum and iron oxide contained in the crucible are then ignited and burn

THERMIT RAIL WELDING

with an intense heat (5400 deg. F), forming a steel which flows from the tap and around the rail ends forming a weld. The excess steel is removed by a blowpipe and a rail grinder fits the top of the rail for service.

Putting Hoops on Barrels

Have you ever watched a cooper assemble the staves of a barrel and drive the hoops over them, one after another, with a series of taps given while he walks around the cask? This hand hooping is much more interesting to watch than the modern barrel making machine which slides each hoop into place with a single, powerful thrust. But even the latter is



BARREL HOOP SETTER

wasteful of time as it has to be reset for each hoop. Now, magnetism has been called into service to reduce the time required for assembling the casks. The hoops for each end are slipped into a "trussing bell" and are held in place by magnets so that they will not tilt and catch on the ends of the staves while the bell is being forced down over the assembled staves. The result is a saving of nearly two-thirds of the time formerly required for setting up and hooping.

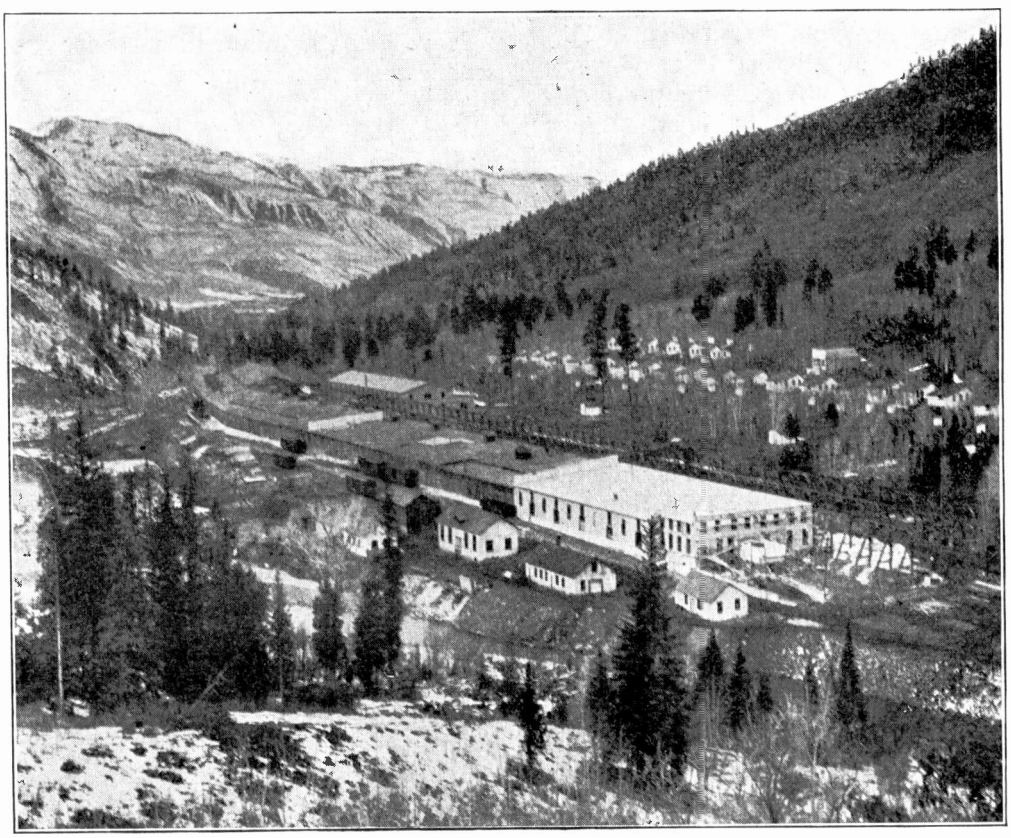
Five Years of Electricity at "Marble"

By FLORENCE L. CLARK

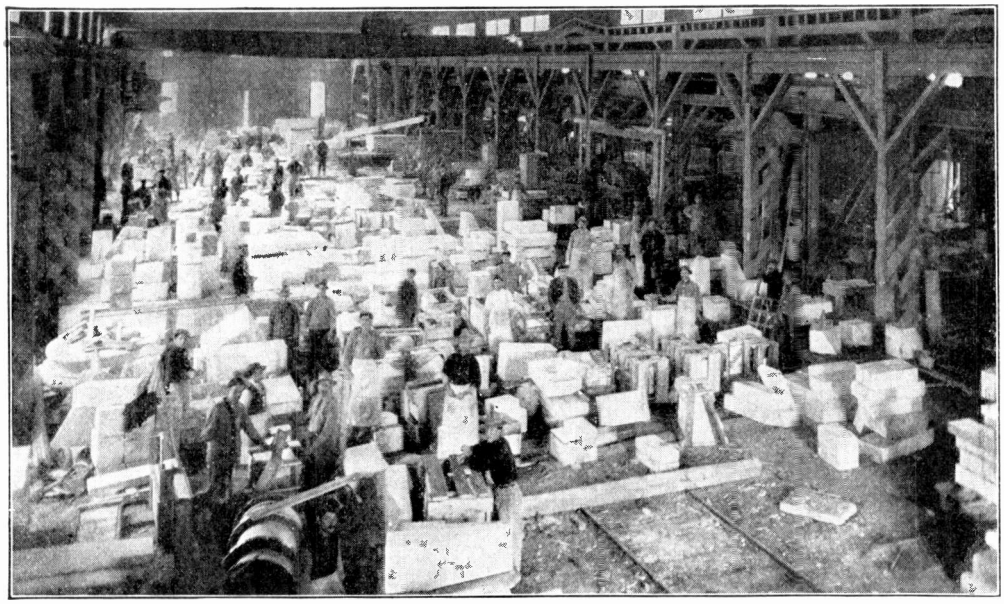
Up at Marble, Colo., way up, 10,000 feet on the Divide between the Gunnison and Crystal rivers, in a place just about as accessible as an eagle's eyrie, they are sawing into blocks, with wonderful machinery, a whole mountain of the rarest, purest, whitest marble. Down 2,000 feet in the canon below, the best equipped, largest and most complete marble mill in the world (the statement is truth, not fiction) is in operation making statuary, columns and architraves out of these blocks.

A town of nearly 2,000 Greeks, Italians, Bulgarians and Americans plays hide and seek with itself among the spruces and quaking aspens close to the mill; a power plant hums at the foot of a cataract; a trolley line reaches up three miles to the quarry; a saw mill hangs from the mountain's edge; beds of trickling snow glisten in the July sun, and the white waters of the Crystal river race by en route to Roaring Fork in a 4,000 foot tumble. The Crystal River and San Juan railroad twists along beside these waters and over its tracks day by day long strings of flat cars pass, loaded with finished marble for distant cities.

And, in truth, there would still be no "Marble" if electricity had not entered into a combination with unusual execu-



MOST COMPLETE MARBLE MILL IN THE WORLD, LOCATED AMONG THE MOUNTAINS OF COLORADO



ELECTRICALLY DRIVEN BARREL SAWS AND FLUTING MACHINES GETTING OUT MARBLE FOR THE DENVER FEDERAL BUILDING

tive ability, indomitable will and unlimited capital to provide the open sesame.

Such in the essentials is Marble, Colo. Don't try to find it on the map. It isn't there in all likelihood, because as late as five years ago there was no "Marble."

The outcropping of marble which resulted in the town of the same name was discovered by a party of prospectors as long as 25 years ago while they were working along the Divide at the headwaters of the Crystal. On investigation the find proved to be of remarkable importance. The marble for the most part was purest white without stratification, and the extent of the outcropping indicated an almost inexhaustible supply. It seemed a veritable gold mine, but to quarry it and get it on the market a prodigious undertaking on the very face of it.

The mountain rose up perpendicularly hundreds of feet above the canon, and the marble, as Nature had ordained it, was at the top. The mere quarrying of the rock hence meant the solving of no small engineering problem. That done, there remained a railroad to be built up through one of the wildest regions in the Rockies, power to be supplied remote from coal fields at a cost less than prohibitive, the labor question to be handled amid the unfavorable climatic conditions and the isolation; and last but by no means least, the problem of how to meet all these expenditures, pay the cost of the long haul to market and then sell the product at prices low enough to bring it into successful competition with eastern marbles.

For 20 years different parties attempted to solve these problems, and in each instance failed utterly. Then six years ago a man came who had managed a transcontinental railroad for 20 years and had arrived by the self-made route from the salary of a despatcher to the income of a multimillionaire. Perforce, he was a man who saw things, and having once seen and put his hand to the task knew no "can'ts."

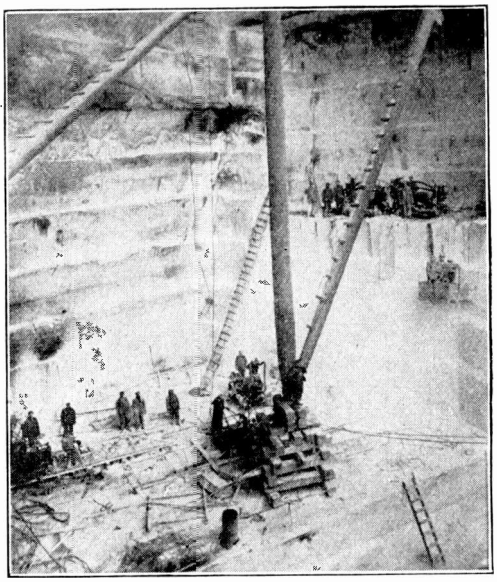
At Marble, Colo., Meeks perceived not merely the mountain of marble but also raging, roaring Yule creek, which plunged by the mountain to join Crystal river in the canon below. When he organized a company, and this he did immediately, he named it the Yule-Marble

Company, because the Yule was to feature in operations no less than the marble.

A power plant was built straightway at the base of one of the steeps in the canon. The Yule was diverted above it into two immense pipes and brought racing down through them to the plant. Eighteen thousand horsepower was easily generated—more than enough to do all of the work of the camp. In the astonishing short time of a little more than a year afterwards, the quarry had been opened, the mill built, the railroad constructed, a trolley line put in between the quarry and mill, a town of homes built, a lumber mill erected, and a thousand saws and wonderful machines, by electrical power transmitted from the plant, were quarrying, lifting, carrying, sawing, polishing and chiseling the marble into beautiful designs. Three million dollars were spent before one dollar was earned.

The first quarrying was done by men hung in "riggers," chairs from the top of the mountain. As soon as their drilling had made possible the dynamiting of enough marble to get a floor to work on, saws and channeling machines were installed and electricity set to doing the work of quarrying. In order to take care of the immense blocks of marble, ten to 20 tons in weight, after they are squared out of the floor of the quarry by the channeling machines, a cable was stretched from the perpendicular side of the mountain over Yule creek. Derricks lift the blocks of marble up to this cable and so carry them out over the canon. When about midway above the abyss the marble is lowered several hundred feet to the trolley cars waiting below.

It is carried on these cars down the mountain three miles over an electric railroad which is nearly 2,000 feet higher at the top than it is at its lower terminus in the yards of the mill. An overhead "traveler," as it is called, lifting capacity 50,000 pounds, operated by a man who hangs in a little car from it, comes gliding down to them. When it reaches a point just above the block of marble it halts, two great steel arms spread out, drop down noiselessly, clasp themselves silently about the marble and lift it as gently and easily as a sack of feathers. With the great white burden the "traveler" then slips back down the yard to the mill, an immense white structure something less than a quarter of a mile in length.



CHANNELING MACHINES AND DERRICK AT WORK IN THE MARBLE QUARRIES

In the mill the blocks are sawed into slabs by diamond saws and steel belts moving over chilled shot. After that they are smoothed on the planing boards by emery disks and polished on the steel tables before they are ready for cutting into the various designs. The cutting as well as the sawing, planing and polishing is all done by machinery run by electricity. The only hand work done in the mill is the final chiseling in close adherence to the lines of the patterns.

The first shipment of marble was made four years ago. Brief as the time has been since, one contract has already been filled for as remote a place as New Zealand. The first large work was the Cheeseman Memorial at Denver. At

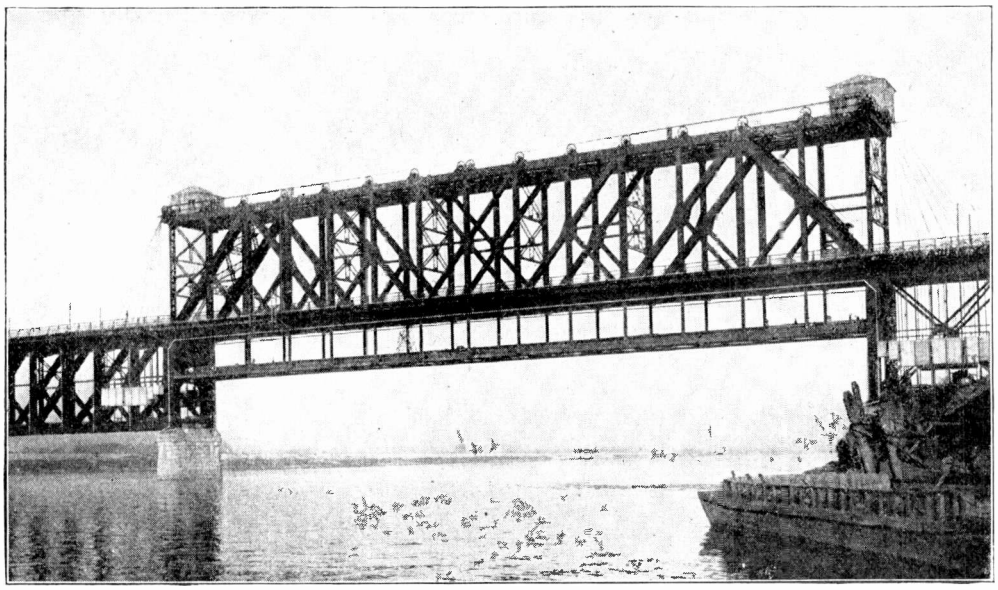
present the quarries and mill are turning out all the stock for the million dollar Federal building at Denver. In making the disks for the 44 beautiful columns of the structure, barrel saws and fluting machines specially devised for the purpose and unlike any others in use in the world are used.

As quarrying deepens the marble grows continually purer. Veins of blue, golden-veined and grained marbles have been opened as well as those of the white. The camp is growing at a remarkable rate. Just now a marvelous wire saw, run by an immense amount of electrical power, is cutting out a block of marble 200 feet long, 110 feet wide and 50 feet deep. When the sawing is completed the two quarries now in operation will become one immense one, permitting the company to double present operations at both mill and quarry.

"Marble," wonderful as it is, is but one of many isolated places in the mountain fastnesses of Colorado and elsewhere in the West where the cost of bringing up coal has made the use of steam power in development work absolutely prohibitive and hydro-electricity has been responsible in large part for adding an immense new resource to the nation's wealth.

Kansas City's New Bridge

Next summer Kansas City will dedicate a new bridge across the Missouri River, which will be remarkable not only for its size (having the longest riveted span yet built) but even more so for the quickness with which it can be placed in position to allow vessels to pass. The upper deck is wide enough for two street



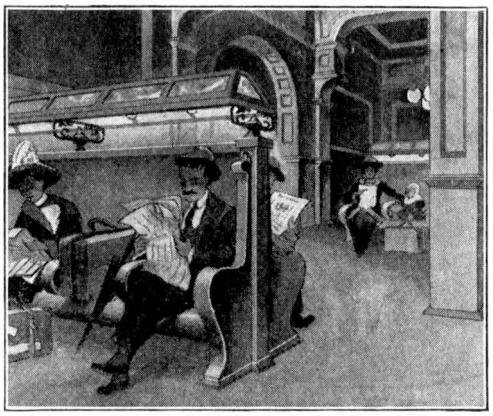
ELECTRIC LIFT BRIDGE AT KANSAS CITY

cars, two teams and two walks abreast each other, and is stationary. Below it is a double tracked railroad deck which can be raised by means of electric motors so as to clear the river steamers.

This movable deck weighs 1,500,000 pounds, but the counterweighting and the lifting apparatus has been so cleverly designed by the engineers, Waddell & Harrington, that it will only take 50 seconds to raise or lower this deck. Even at high water, the bridge will give a clearance height of 55 feet when the lower deck is raised, and the delaying of trains by their being bridged will be reduced to an almost negligible amount.

Seat Lighting in Railroad Stations

Long, tedious hours of waiting at a railroad station are made bearable if one can sit and read comfortably. But a great many railroad terminals and way stations. otherwise admirably equipped, are



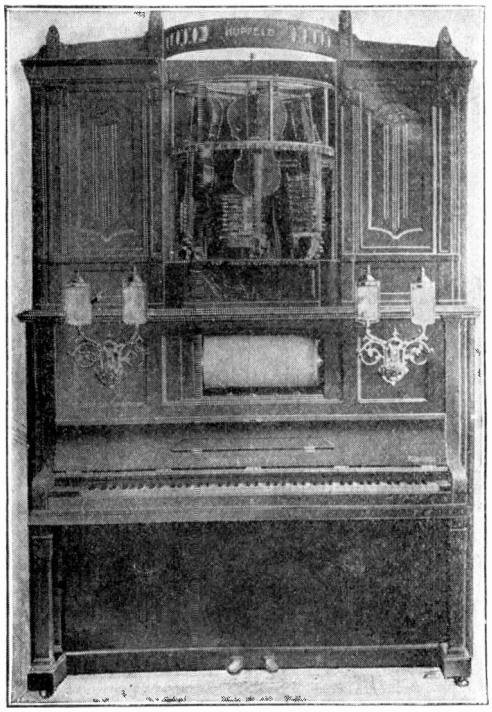
EFFICIENT METHOD OF SEAT LIGHTING

poorly illuminated in this respect. This is not the case, however, in the new station of the Santa Fe at Houston, Tex. Here special facilities have been provided for those who desire to read. In the main waiting room each row of seats is provided with twelve sixteen candlepower lamps arranged beneath an inverted trough of translucent glass, mounted on the backs of the seats and about five feet above the floor level. The absence of glare is most striking and the comfort with which the waiting patrons may read is more than appreciated.

Combined Violin and Piano

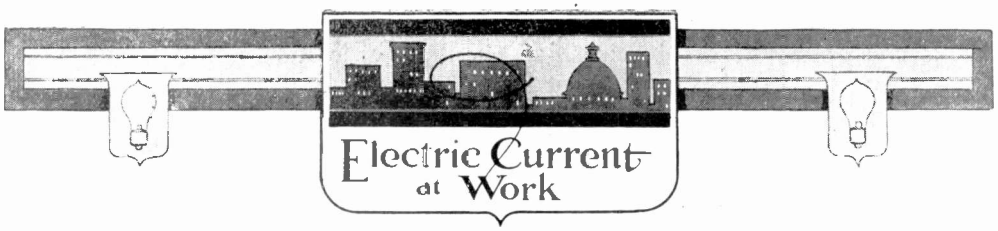
A new device, called the Phonolizt Violina has been turned out by a Leipzig firm, which combines an automatic piano and a set of automatic violins, the whole being operated by an electric motor and compressed air system. The ordinary perforated roll and pneumatic system causes the piano hammers to respond to the desired notes. If the violins are to play a button is pressed and a small motor sets another roll in operation and an auxiliary pneumatic system plays the latter instruments, three in number. A fiddlebow, common to all three violins, moving in a circle, bears on any one of the twelve strings.

Plungers like human fingers, each operated by compressed air controlled by the perforated roll, do the fingering on the violin strings. The violins themselves are moved forward more or less while the revolving bow has a fixed course and thus various sounds are obtained and it is astonishing what fine modulation is secured by purely mechan-



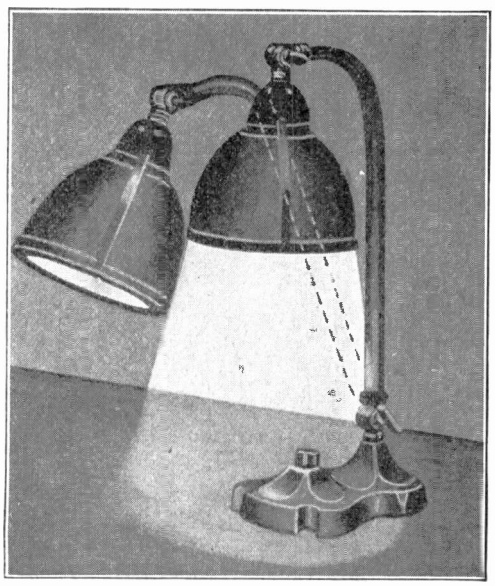
COMBINED VIOLIN AND PIANO

ical means. It seems that human hands touch the violins. Numerous features are patented and musical experts and the German emperor and his family have expressed their admiration at the quality of the machine made music. Though musicians may laugh at the idea of a violin bow being operated by other than the human hand, nevertheless the music is said to be very satisfying.



Portable Lamp with Base Switch

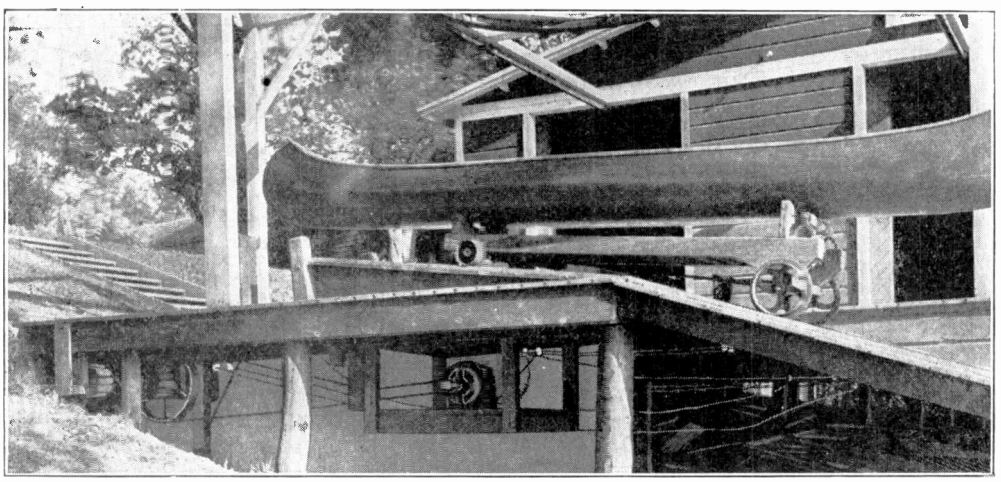
A lamp which will appeal to those who desire a neat adjustable desk light is here illustrated. The lamp and support are arranged to be used in any position, the base being heavily weighted. The snap switch placed in the base, though an unusual arrangement, is most conveniently located.



PORTABLE WITH SWITCH IN THE BASE

Novel Boat Haul

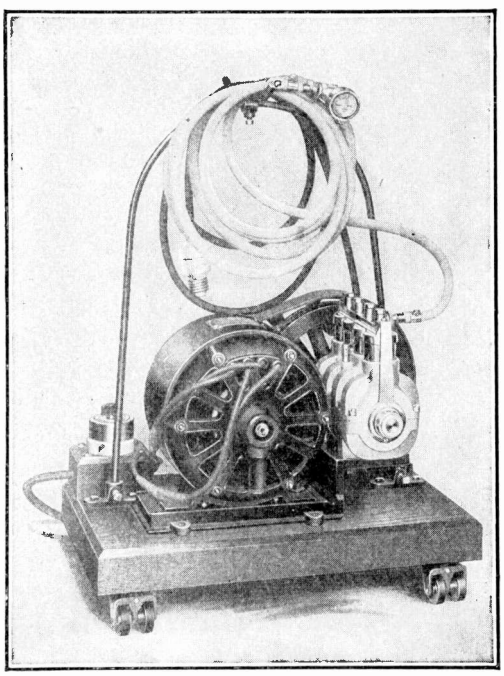
The boat house of the Edison Club, Schenectady, N. Y., is located on an arm of the Mohawk river. On account of high water and ice in the spring it was necessary to build the boathouse 25 feet above and 50 feet back from the water's edge at normal level. To save the labor of dragging the boats and canoes up to the house by hand an electric boat haul was constructed as shown in the picture. A little car running on an inclined plane carries the boat and a two horsepower motor belted to a drum winds up the cable which draws the car.



ELECTRICALLY OPERATED BOAT HAUL

Automobile Air Pump

It is much easier to move a machine occupying 10 by 15 inches of floor space around a garage than to run an automobile about in such a place. The Kellogg four cylinder air pump takes the air to the automobile and does away with the air storage tank and the moving of automobiles up to the tank and back into place.

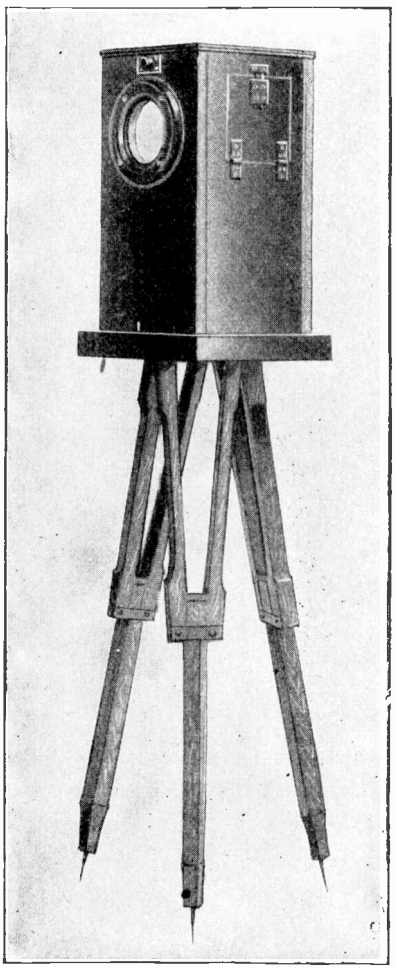


AUTOMOBILE TIRE PUMP

Having four cylinders the pump keeps up a steady flow of air. The outfit is mounted on a stand provided with rollers and takes current through a cord and plug from the nearest lamp socket. The total weight is only 70 pounds.

An Automatic Water Finder

Where will we strike water in boring for it? The haphazard plan of drilling wells has never been satisfactory and some means of determining the presence of underground water before boring into the soil have been sought ever since wells have been in general use. Instead of trusting to luck, many of the British contractors in India are using an "Automatic Water Finder" made at Liverpool, in which the makers have such faith that they offer to bore on the condition of "no water no pay."



AUTOMATIC WATER FINDER

The instrument used depends on the fact that earth currents will choose the paths of least resistance. Water being a good conductor as compared with the average soil, any subterranean stream will carry the currents along a definite channel in sufficient strength to deflect, or at least agitate, a sensitive magnetic needle. Wooden pegs are driven into the ground at intervals of about 50 feet

in a direction usually S.E. to N.W. Then the tripod supporting the instrument is set over each peg in turn and if the needle moves when over a peg, tests are made all around it to find the spot where the greatest movement is obtained. Of course the sensitiveness of the water finder must be increased in proportion to the depth at which the water is to be located, hence one for use at depths up to 3,500 feet costs about six times as much as one good for only 200 feet. The observations must be taken on calm, clear days and are usually made between eight and twelve in the morning or between two and five in the afternoon, as the vertical earth-air currents are said to be most active at those hours.

The Double-Phone

Nearly every one has dropped a penny in the slot of the automatic phonograph and knows how distinct the rubber tubes

THE DOUBLE-PHONE IN USE

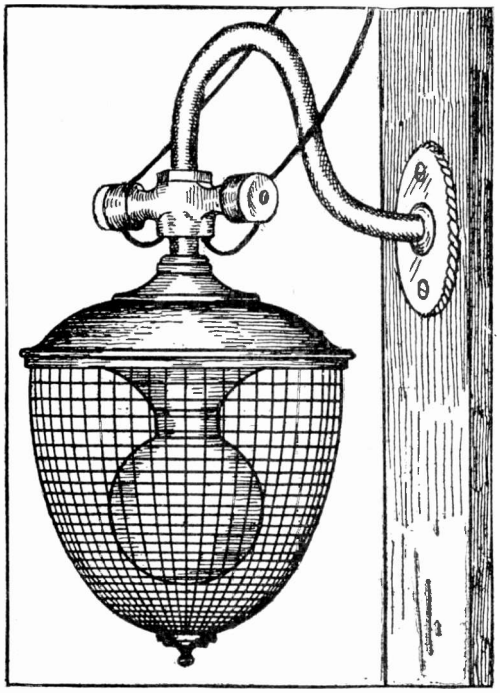
placed at the ears make the sounds. Using such a tube, connected to a special sound chamber attached to the telephone transmitter makes it possible for two people to listen to a telephone conversation.

This device is an aid in long distance conversation to those who have difficulty in hearing, either because of slight deafness or because noise drowns the telephonic conversation. It also makes possible the recording of important conversations regarding market and stock quotations or contracts, by a stenographer or any other person at the receiving end, without the conversation of the two original parties being interrupted.

The Double-Phone is light, and is easily attached to the receiver, as shown in the illustration.

To Call the Patrolman

This picture illustrates the way police signal lights are installed in Toronto and



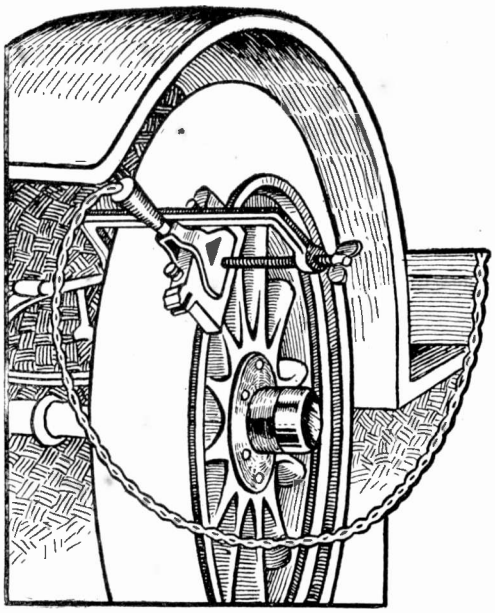
POLICE SIGNAL LIGHT

several other Canadian cities to enable the stations to get into almost instant touch with patrolmen on the beat.

Closing a switch on the station operator's desk turns on the light which is red and rings gongs on one beat or over a wide area as desired. The attention of the officer on the beat is at once attracted; he opens his box with a special key, answers the telephone call and receives his instructions.

For Repairing Automobile Tires

The dread of being stranded or delayed on account of a cut or punctured



TIRE VULCANIZER IN USE

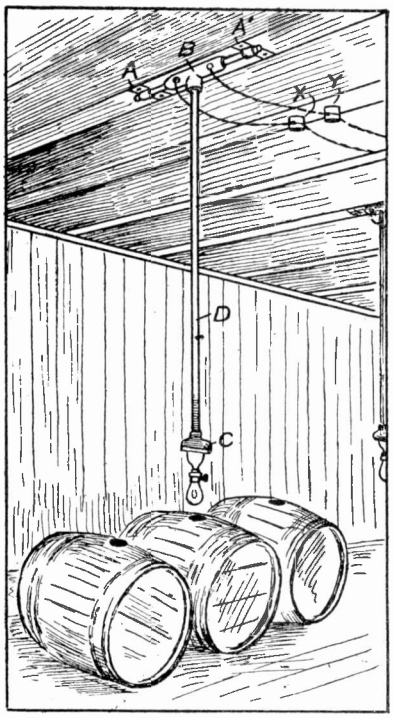
tire is done away with to a certain extent by the use of an electric vulcanizer.

The Shaler vulcanizer applied to the defective tire, repairs without removing the tire from the rim and is also a much better way to mend an inner tube than patching. A plug and cord for connecting to an electric lighting circuit and a rheostat for controlling the heat go with the outfit.

Swivel Extension Lamp

The following device suspended from the ceiling is used in many places where barrels lying side by side on the floor are to be filled.

The parts necessary to make it are: Three lengths of conduit (A), (A′) and (D), two condulet fittings (B) and (C), two straps for fastening (A) and (A′) to the ceiling, a weatherproof socket and a length of double braid duplex No. 14 wire to run inside the pipe (D). The whole thing swings on the bearings at (AA′) and the light serves the attendant better than an ordinary extension which he would have to lay on the barrel to be filled or hold with one hand, thus allowing only one free hand. This device he simply swings over to a point



SWIVEL EXTENSION LAMP

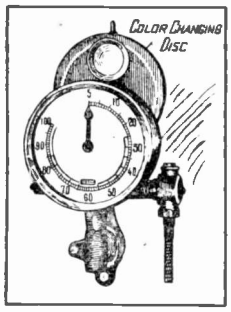
directly above the barrel to be filled and it remains in that position until adjusted to suit some other position. The straps are pulled very snug against the bearings (A) and (A′) thus making the device almost rigid. F. F. SENGSTOCK.

Colors Tell Auto Speeds

How fast are we speeding? Even the chauffeur with an accurate speedometer before him cannot tell offhand, for the simple reason that he cannot sharply see both the instrument and the roadway at the same time. In looking at a distant object, the lens in the eye changes its shape accordingly, and it takes an appre-

ciable interval of time for it to change back so as to discern a nearer object.

But, if the dial of the speedometer were to change in color, the eye could

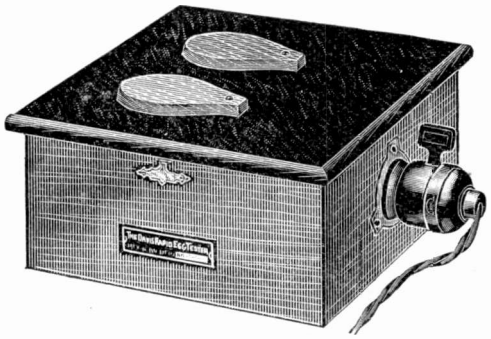


SPEED INDICATOR

perceive this without taking its focus off the distant roadway, and a series of color changes could thus be made to indicate the approximate speed of the car. This is done in the speedometer invented by Prof. Hans Dahl, which has an extra dial with white, green, red and yellow sections which are shifted before an incandescent lamp as the speed changes.

An Indicator of Bad Eggs

An egg "candler" for use at soda fountains is on the market and consists

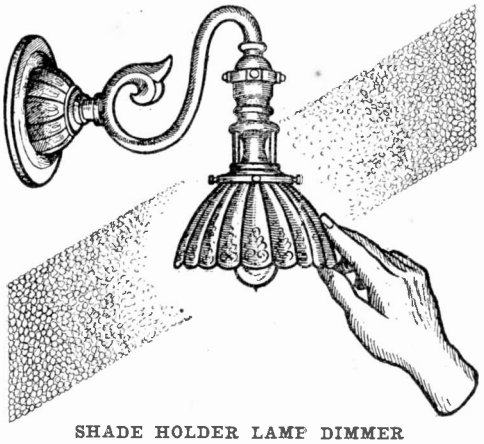


ELECTRIC EGG CANDLER

of an oak cabinet 6½ by 6 by 3 inches lined with asbestos and containing a sixteen candlepower lamp. Two openings in the top covered with adjustable slides are provided. Pushing aside a slide an egg is placed in the opening and the light shining through indicates its condition.

Shade Holder Lamp Dimmer

Changing the brightness of an incandescent lamp by turning the shade is one of the recent innovations in connection with lighting fixtures. The Wirt dim-

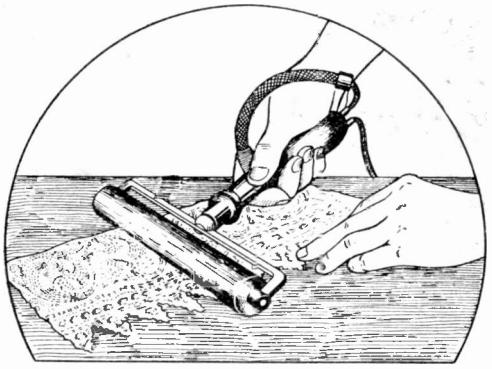


SHADE HOLDER LAMP DIMMER

mer is readily attachable to any fixture and by moving the shade the light may be made to burn full, dim, low, night light or be turned out.

A Roller Electric Iron

A dainty electric iron for pressing delicate laces and other fabrics is much used in England. The iron is a highly polished steel roller within which are the resistances for obtaining the heat. The

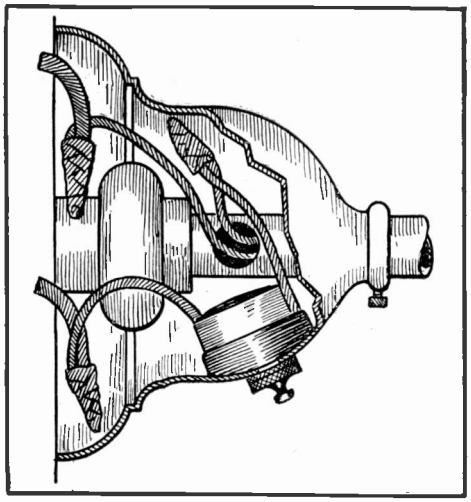


ROLLER ELECTRIC IRON

wooden handle is always cool and by turning it the current is switched on or off.

A New Fixture Switch

Usually a key socket is placed in a wall bracket light or a circuit is run to a wall switch. The C-H canopy switch may be installed in the bottom shell of a ceiling

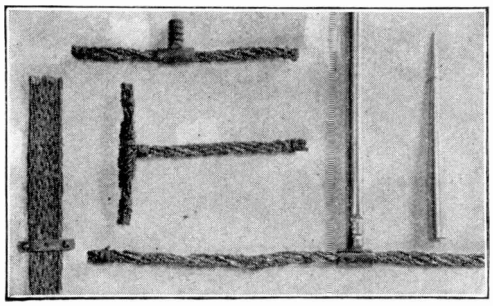


FIXTURE SWITCH

fixture or in the canopy of a wall light, thus doing away with the wall switch and wiring thereto.

New Type of Lightning Rod

The old style iron or copper rod used for lightning protection may be replaced with something believed to be better.



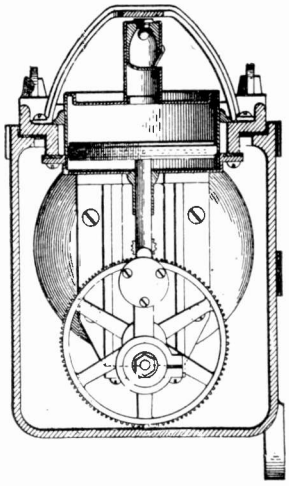
NEW TYPE OF LIGHTNING ROD

The new conductor is made of 30 small copper wires, No. 19 B. & S. gauge, woven into a loose braid about one inch wide and 1/8 inch thick. This braid is fastened to the building with flat brass straps, particular attention being paid to the proper grounding of this system.

The theory is that the lightning discharge uses the surface of the wire rather than the cross section, so this wire braid presents a very large surface with a minimum cross section. The pointed rods used on the roof with this system are about six inches in height.

Motor Blows Whistle

A whistle which depends upon a motor driven piston to furnish compressed air



A MOTOR BLOWN WHISTLE

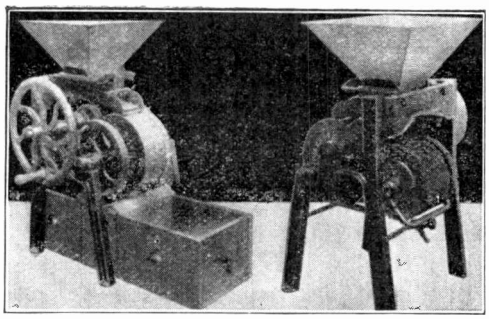
for its operation is the subject of a patent issued to George F. Atwood, Chicago, Ill.

The device is designed particularly for use on warships in giving warning before the closing of the bulkhead doors.

Magnetic Separator for Shops

This machine is for separating iron and steel filings from brass, emery, rubber and other non-magnetic materials and will be found to be an economy in metal working establishments.

The material to be separated is placed in the hopper and is then shaken automatically onto the magnetic cylinder, which is composed of 300 small mag-



TWO VIEWS OF THE MAGNETIC SEPARATOR

nets, each capable of lifting sixteen ounces. These are set in cement, and the face of the cylinder covered with brass.

There is an iron head on either side, and the shaft passes through all three pieces. The magnets retain their power for three or four years and longer according to use. There hangs on the back of the separator a circular bristle brush, which comes in contact with the cylinder, and cleans off the particles of steel which have been reclaimed, and sweeps them into the last of the three boxes set under the machine. The other two boxes catch the other materials and the brass.

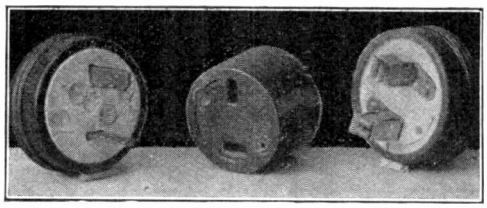
Woven Resistances

If fine wires can be woven into sieves or screens, why not interweave them with threads of non-conducting material to make resistances? If a pure asbestos fibre is used for the insulating web, the warp of wire might even stand a high enough temperature to serve as the heating element of electric stoves.

Both resistance boxes for motor starters, as shown in the illustration at the bottom of the page, and electric heaters are now made in this way and are said to prove quite durable in their practical applications.

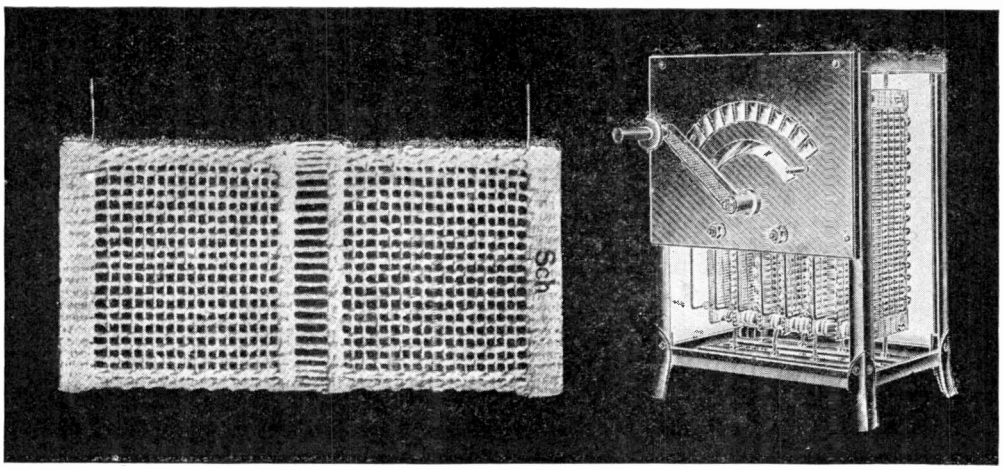
To Prevent Changing the Polarity

This picture shows how the connecting clips of a plug are arranged so that the polarity of the device it supplies cannot be changed by placing the plug in the receptacle the wrong way, which would result in reversing the current.



PLUG THAT CANNOT BE INSERTED WRONGLY

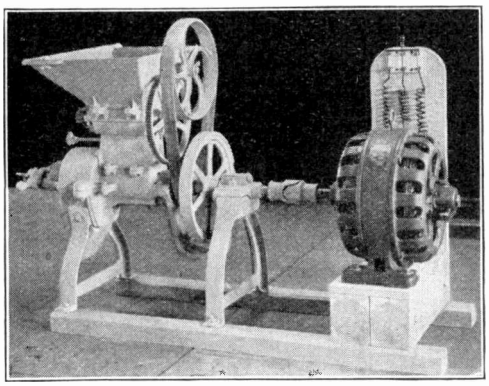
Such a plug and receptacle are serviceable in running small direct current motors and other apparatus where the polarity must remain the same.



WOVEN RESISTANCE AND ONE OF ITS APPLICATIONS

Electric Power Grinder for Farm Use

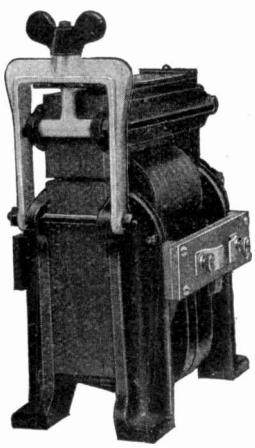
The picture illustrates a very compact electrically driven grinding outfit for



ELECTRIC POWER GRINDER

farm use. An extension to the motor shaft drives the grinding burrs direct. A double set of cutters or revolving knives, one driven by the lower gear wheel and the other by the main shaft, prepare the corn, even with the husks on, peas with vines, alfalfa, sheaf oats, etc., ready for the grinding burrs, grinding the coarse materials and the grain all up at one operation.

High Potential Transformer

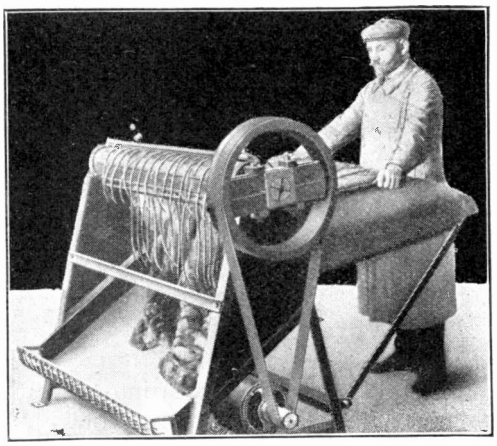


HIGH POTENTIAL TRANSFORMER

The use of high potential transformers for commercial purposes is increasing and up-to-date electrical factories, large or small, find innumerable uses for them in testing their product. The Thordarson transformer shown in the illustration may be used for all manner of testing where voltages up to 10,000 and 20,000 are required, and it may also be used for electrostatic separation, wireless telephony and telegraphy, etc. It is designed to be connected directly to any alternating current circuit without the use of impedance coils or resistances. It consumes no more current than is actually required to produce the best results at the desired regulation; in other words, it is self regulating as far as current consumption is concerned. More power or capacity is obtained by simply turning the thumbscrew.

Carpet and Clothing Beater

In Germany a great many clothiers, furriers, dry goods stores, carpet stores and hotels have one or more of these



CARPET AND CLOTHING BEATER

electrically operated carpet beaters; even families use them where current is available. In a medium family say of five members the amount of wardrobe, dresses, suits, coats, trousers, carpets, curtains, cushions and the like is sufficient to warrant the purchase of such a machine. The large model shown in the picture is for big carpets, but of course smaller pieces can also be beaten. The object is placed upon the leather cushion and the rotating shaft causes the straps to give it a thorough beating. As many as 14,000 blows are struck per minute with one model in common use.

Electrical Men of the Times

RALPH DAVENPORT MERSHON

In this day when electric power transmission lines hundreds of miles in length are common, it is hard to realize that it was only about 20 years ago that the first work in this direction was being done, and engineers were waiting with almost breathless suspense for the outcome of the famous Telluride power transmission experiment in Colorado. One of the men intimately acquainted with the details of this undertaking was Ralph D. Mershon, then a young engineer in the employment of the Westinghouse company.

In 1893-95 he had charge of certain work being done by the Westinghouse company in connection with the extension of the Telluride transmission plant, and later in 1896-97 he carried on at Telluride, for his own company and for the power company, an investigation of the phenomena which occur between conductors at high voltages. This investigation was carried out on a transmission line about 2½ miles long, and was the first investigation ever made in which quantitative measurements were obtained of the ionization and other atmospheric losses occurring between conductors at high voltages.

Securing leave of absence from the Westinghouse company in 1897-98, he acted as chief engineer of the Colorado Electric Power Company.

By this time Mr. Mershon was considered an authority in all problems of electric power transmission and in 1900 he decided to turn his knowledge and reputation to account by entering business for himself as consulting engineer, opening his offices in New York. Among the many important pieces of work successfully undertaken by him was the design and supervision of the transmission plant of the Niagara, Lockport and Ontario Power Company for transmitting power at 60,000 volts from Niagara Falls to various points in New York State. This plant is the largest transmission plant ever undertaken anywhere, in point of capacity, and is one of the most important in point of distance of transmission. Its present capacity is 60,000 horsepower, and it is laid out for an increase to 180,000 horsepower. Its longer feeder is, at present, 160 miles.

We often hear of American engineers being called into service by foreign governments and industrial concerns when some particularly difficult problem arises, and Mr. Mershon was one so honored. Some years ago, at the request of the British South Africa Company, which is

largely interested in the Victoria Falls Power Company, he made an investigation of the problem which confronted them. The object was to advise the Victoria Falls Power Company with reference to the steam electric power stations they were then installing on the Witwatersrand to supply power to the gold mining industries there; to examine Victoria Falls with reference to the development and utilization of them for the generation of hydro-electric power, and to inspect the country between the Falls and Johannesburg relative to the transmission line, 600 to 700 miles in length, which it was proposed to construct between these two points. It was originally the intention of the Victoria Falls Power Company to develop the Falls immediately and transmit power therefrom to Johannesburg and the Witwatersrand for use in the mines. But the Transvaal Government refused to give the company the right of way across the Transvaal for its transmission lines, because of its fear that the power from the Falls would seriously diminish the demand for coal brought to the Rand over the government railways, from the carriage of which the railways derived most of their income. Partly in view of this fact, and partly on the advice of Mr. Mershon, the company adopted the policy of first establishing steam stations on the Rand and, by means of them, building up a market which would be all ready to absorb a large amount of power when it should be brought from the Falls.

The British South Africa Company was founded by Cecil Rhodes to take over and administer the Province of Rhodesia. The experiences which Mr. Mershon had while in this province were very interesting. For a few days after arriving at Cape Town, and for a few days before leaving there on the trip back, he was entertained by Dr. Jamieson (of Jamieson's raid fame), at that time Premier of Cape Colony, at the house of the Premier. This house was built by Cecil Rhodes and was his residence until his death. It is a beautiful house on a magnificent estate in the outskirts of Cape Town. It, with the estate, was left by Rhodes to Cape Colony to be the residence of the Premier.

From Cape Town he went to Johannesburg, and after spending some weeks in that vicinity, including a visit to Pretoria, at which time he met General Botha, the Premier of the Transvaal Government, proceeded to Bulawayo, one of the capitals of Rhodesia, and thence to Victoria Falls, 1,640 miles north of Cape Town.

Several days were spent at Victoria Falls, at which place there was then a rude but comfortable hotel capable of accommodating two or three hundred people. The stay at Victoria Falls was spent largely in the examination of the Falls with reference to the feasibility of their development, though several pleasure trips were made on the Zambesi River above the Falls, one to Kandahar Island, 20 miles above.

The Falls themselves are about a mile wide and 400 feet high, that is, two and a half times as high as Niagara. In some ways they are more impressive than Niagara, but in general are not so impressive for the reason that they are not easily seen. This is due to the fact that the Falls are caused by the Zambesi River dropping over the lip of a narrow canyon, 400 feet deep, the length of which is approximately at right angles to the river. Near one end of this narrow canyon is its outlet, consisting of another narrow canyon approximately at right angles to the first. It is extremely difficult, therefore, to find a point at which the whole height of the Falls can be seen, except looking through the narrow outlet canyon, through which a greatly restricted view can be had by standing on the steel arch bridge of the Rhodesian Railways, spanning the outlet canyon or gorge some distance below the Falls.

When the river is at a high stage the spray from the Falls is very great in volume and so dense that it is impossible

to see the Falls themselves. The engineers who erected the steel arch bridge across the gorge triangulated to the top of the plume of the spray rising, at time of high water, and found it to be over 3,000 feet high.

In the trip to the Falls Mr. Mershon was, during the most of the time, in the company of a number of the directors of the British South Africa Company, the party having its own special train for the purpose of the trip. At other times when traveling on the Rhodesian Railways, a private car was at the disposal of himself and the representative of the Victoria Falls Power Company accompanying him. The whole trip from Cape Town to Victoria Falls, and beyond, can be made very comfortably in a sleeping car on a train carrying a diner. When one considers it was at the Falls in the heart of "Darkest Africa" that Stanley rescued Livingston not many years ago, the ease and comfort with which the journey can be now made is rather startling.

Mr. Mershon was born in Zanesville, Ohio, July 14, 1868. He was educated in the public schools of his native place and later in Ohio State University, graduating in 1890 with the degree of Mechanical Engineer. For one year he was instructor in electrical engineering at the University and then went with the Westinghouse company as previously stated.

Double Ignition

The delivering of two sparks at the same moment at different positions in the cylinder of a T-head type of gas or gasoline engine increases the power from fifteen to twenty per cent. In the L type of engine the increase is from eight to fifteen per cent. The increase in power is due to the fact that the charge is ignited more quickly and the explosion takes place more rapidly when two sparks are delivered at two different points. This mode of ignition has been employed on racing cars for some time past.

Advantage has been taken of this fact by an enterprising manufacturer and the latest thing in ignition apparatus is a magneto so designed and constructed as to deliver two sparks simultaneously in each cylinder at the firing point. It is absolutely necessary that both sparks should take place at the same time. This result has been accomplished by using the same breaker for both plugs.

This form of ignition increases the necessity of the excessive spark advance necessary with the single type of ignition in order to secure the maximum power.

The double sparks working together burn up the compressed charge much more rapidly than if one spark was used. This gives a maximum pressure in the cylinder with the piston at dead center with a much shorter advance on the piston travel than is needed with the single system.

In the new system the sparks take place either exactly on or just past center, the result being more power with less strain on the crank shaft and connecting rod and longer life for the engine. The decreased cost of operation of the engine is a further evidence of considerable advantage in favor of the double system over the single.

Following the Scent

A shrewd candy dealer conceived the idea of using the sweet perfume of his candies to tempt passers-by. His scheme called for an electric fan which he placed at a circular hole cut in a window and a little smaller in diameter than the fan. When the fan was started the atmosphere of the store was wafted out upon the street. The fan was deftly concealed as the candy man reasoned that people breathing the odor of the sweets without knowing the cause would unconsciously yield to the aroused desire and buy. And according to his statement the idea worked out successfully, well repaying him for his experiment.

Electricity in the Household

EDITED BY GRACE T. HADLEY

Mrs. McGinnis Entertains a Celebrity

Mrs. McGinnis was in a perfect flutter of excitement. The famous English actor, J. E. Dobson, who was appearing at one of the local theaters in "The Cottage Across the Street," had accepted an invitation to appear at a social function in her own home. She had previously met him in another city and she thought how delightful it would be to entertain him when he played in her own home city. When she asked Mr. Dobson what form of entertainment he would prefer he had said, unhesitatingly, "Bridge!"

"Then I shall invite six ladies to meet you and we will make up just two tables for a good game," said Mrs. McGinnis. Her heart was beating high with anticipation as she called up six of her most intimate friends and set them in a flutter of excitement by informing them of the honor that was to be theirs by reason of their friendship for her.

"Tuesday afternoon at 3 o'clock without fail. Now I can count on you, can I not?"

"Indeed, you can count on me," said Mrs. Flannerty. "I think it will be perfectly grand to meet a real live actor off the stage. My, but you are lucky, Mrs. McGinnis."

Since Mr. Arnold's talk before the Elektron, Mrs. McGinnis had given some time and thought to the decoration and illumination of her dining room. The ponderous, old-fashioned art glass dome, formerly suspended over the dining room table and leaving the guests in semi-darkness, had been replaced by an artistic lighting fixture with bowl and frosted globes.

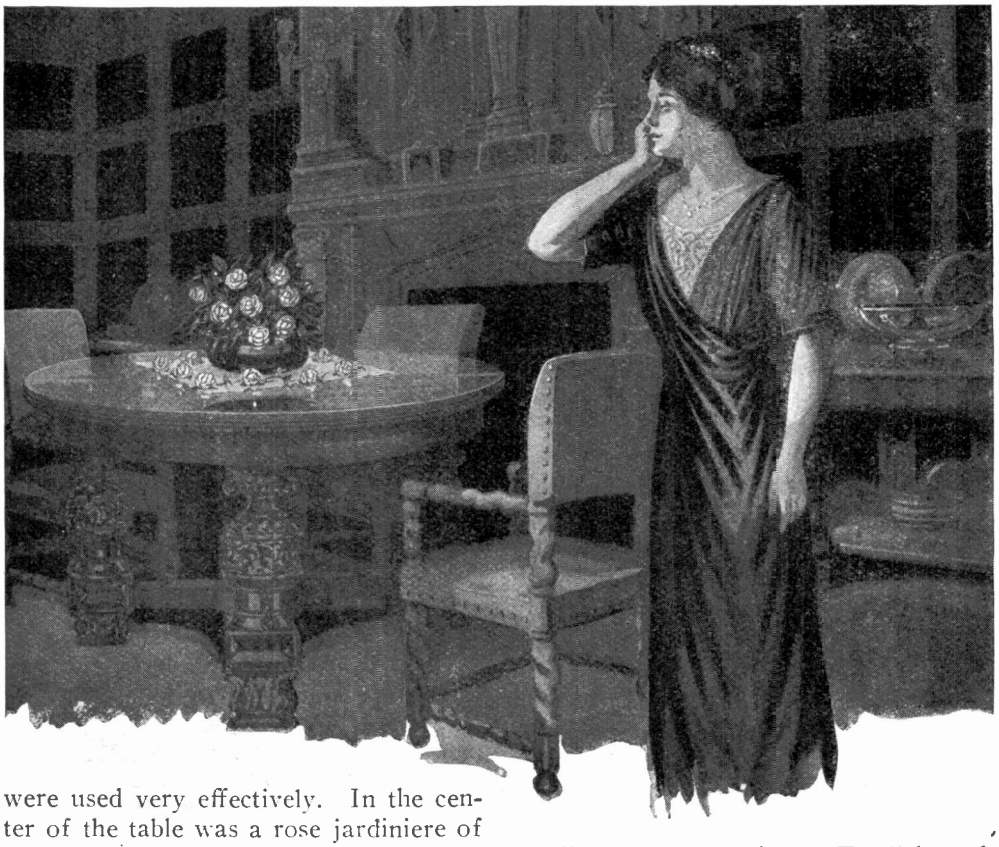
"Time was," reflected Mrs. McGinnis, "when I studied the three R's at school, but now I am observing the three C's—composition, color and congruity. Dear, dear, when I finished school I thought I had finished my education, but some one is always thinking up something new that women ought to know, so that one has hardly enough time to master auction bridge."

Harmony is the keynote of any scheme of house furnishing and decoration. If a well-furnished room is considered as a picture, the element of composition will enter into it as it does in the arrangement of the picture where the parts are so combined as to produce a harmonious whole. One should also be a colorist and have a right understanding of the effect of color upon the feelings. Red has a warm effect, blue is cold and yellow is an intermediate color. In decorative art the element of color is more important than that of form. It is essential that the lines be graceful and show fancy or even poetic feeling, but they need not be expressive of form in a realistic sense. The reverse is true of a painting, for here color is subordinate to form. Constant study of color

in nature and the work of the great colorists will assist one very greatly in mastering the poetry of color.

Mrs. McGinnis had furnished her living room, library and dining room in warm tones. The table was the raison d'etre of the dining room, and radiantly attractive electric lighted specialties, the newest form of decoration, a last critical survey before the arrival of her guests.

Now the entertainment of the distinguished actor and the electra-flora display seemed to fit in very nicely. In honor of the guest Mrs. McGinnis had decided that refreshments with an Englishy flavor would be the proper thing, so she had ordered English tea



were used very effectively. In the center of the table was a rose jardiniere of hammered Russian brass, containing electrically lighted roses of red tints with silken petals, each blossom concealing a tiny illuminated bulb. The subdued glow imparted a charming effect to the well appointed table and afforded a delightful restfulness to the eyes. Surrounding the jardiniere upon the imported centerpiece was an electric rose garland, with a miniature lamp in the center of each large rose.

"Yes, I think it will do," murmured Mrs. McGinnis, as she gave the room

muffins toasted and tea, English walnuts and English hothouse grapes at a fabulous price. Then there were some wonderful little English tea cakes.

Long before three o'clock the six specially favored women were playing bridge with more than usual zest. Their minds were keen with anticipation and each one wondered who would draw Him first as a partner.

"I'm so excited I can scarcely wait!" exclaimed Mrs. Patrick Flannerty, who had never met a real actor. "I think it is

remarkable how Mrs. McGinnis contrives to make everything and everybody come her way. I always did tell her she was born under a lucky star."

Mrs. Norman Van Ess, who had just dealt the cards, raised her aristocratic brows ever so slightly and debated which kind of a hand would be most likely to make Mrs. Flannerty wish herself off the earth entirely, then she declared: "No trumps!" Her hand contained two aces, a protected king and queen. When little Mrs. Watson inquired timidly of her partner if she should play to a "No trump," Mrs. Flannerty snapped rather than said: "Pray do!" Miss Lillian Lindsey, who was playing opposite Mrs. Van Ess, promptly laid down her cards face upward upon the table after Mrs. Watson's lead. Miss Lindsey's hand showed one ace, two kings, two guarded queens backed up by other fairly good cards.

"Have you seen Mr. Arnold lately?" asked Mrs. Van Ess sweetly, as she contemplated the layout with infinite satisfaction.

"Oh, yes, he calls occasionally and I am gradually mastering the aesthetical considerations of illumination," replied Miss Lindsey.

Mrs. Flannerty had played and Mrs. Van Ess finished her nefarious task as dealer by calmly sweeping in the first trick.

"Mr. Arnold is certainly an interesting character, but doubtless Mr. Dobson, the actor, will eclipse him in your estimation. I wonder why he does not come?" Mrs. Van Ess consulted a tiny jeweled watch and exclaimed: "Why, it is half after three."

Mrs. McGinnis was getting very nervous, so she excused herself and hurried upstairs to the telephone. She had decided to call up the hotel where Mr. Dobson was stopping.

"Mr. Dobson has retired to his room, and he left word that he was not to be disturbed until twelve o'clock the next day," was the amazing message that drifted back to her straining ears. Mrs. McGinnis could not believe this.

"Oh, there must be some mistake," she protested, with sinking heart. "It is Mr. J. E. Dobson, the actor, that I want. I must speak to him. He accepted my invitation to attend a game of bridge at my home this afternoon."

The polite clerk said he would see what he could do, and presently his voice reassured her with "That Mr. Dobson we mentioned was another party. Mr. Dobson, the actor, is in his room. Wait a minute and we will give you the connection."

"There you are," interrupted the voice of the operator.

Mrs. McGinnis suddenly revived and she said very sweetly: "Mr. J. E. Dobson? This is Mrs. McGinnis. You accepted an invitation to play bridge at my home today. The ladies are here and waiting for you to come. They are exceedingly anxious to meet you."

The distinguished actor had just been awakened from a nap. He endeavored to collect his sleep laden thoughts.

"Oh, so I did—" a stifled, sleepy yawn undulated into Mrs. McGinnis' unbelieving ears, "but I thought, let me see, I thought I sent you a message."

"But I didn't get any message," protested Mrs. McGinnis faintly, "and the ladies are all here this minute, waiting for you."

"Well, I'm indisposed today," said the distinguished actor. "Tell the ladies I will meet them Thursday afternoon."

The Modern Fireplace

A hole or pit in the ground for the fire and a hole in the roof of a primeval hut for the escape of the smoke, constituted the simple arrangement for a fireplace in the earliest ages. After the fire was put out a cover of wood was used to protect the aperture. This was called a couvre-feu or curfew. William the Conqueror had his own ideas regarding his subjects. Among other things he thought it best for them to be in bed rather than creating disturbances abroad and he required this cover for the fire to be applied at an early hour, and a bell called the curfew gave timely warning to his subjects to cover their fire.

The hearth slab succeeded the pit for fire with possibly a bank of clay or brick to partly enclose the fuel and afford some convenience for cooking. A couple of iron bars turned so as to be supported above the ground were the forerunners of the andirons and the firedogs of a later date which were used to support the logs and burning wood. A notable advance in the history of the fireplace was its removal from the center of the dwelling to a position against the wall, and a slanting aperture was then contrived for the escape of the smoke to the outer air. This indicates by what means the idea of a chimney was gradually developed.

Gradually for purposes of avoiding lateral currents of air, jambs were built on each side of the fire to direct air upon the fuel and the chimney flue was brought down to within a few feet of the fire. As wealth increased and manners improved in England the houses were better built, upper stories were provided and more than one fireplace was necessary. Thus the recessed fireplace and chimney gradually replaced the central hearth.

Viollet-le-Duc in his "Habitations of Man" portrays fireplaces of the Fourteenth and Fifteenth Centuries with huge hoods projecting boldly into the room and placed at a considerable height above the hearth, and he draws an interesting picture of the imposing and noble effects produced: "When the counts of Poitiers in their grand robes of state, enthroned in their halls surrounded by officers and when behind the feudal court blazed three fires on three hearths, with assistants seated before the gorgeous windows above the mantel, it was a scene of nobility and grandeur, well calculated to fill the hearts of retainers and vassals with a proper amount of awe."

The modern fireplace is a modification of the French Renaissance constructed on simple lines, with brick in-

THE MODERN FIREPLACE

terior and very handsome and ornamental firedogs. Instead of the ruddy blaze radiated by the huge logs of olden time, the modern fireplace is flanked by two floor standards elaborately carved and diffusing a subdued radiance from electric candelabra.

The modern fireplace is chiefly ornamental in itself as it no longer furnishes the main source of heat for the home. It retains, however, its original significance as a gathering place for the family on chilly evenings. Surrounded with every accessory of modern luxury.

Electric Table Grill

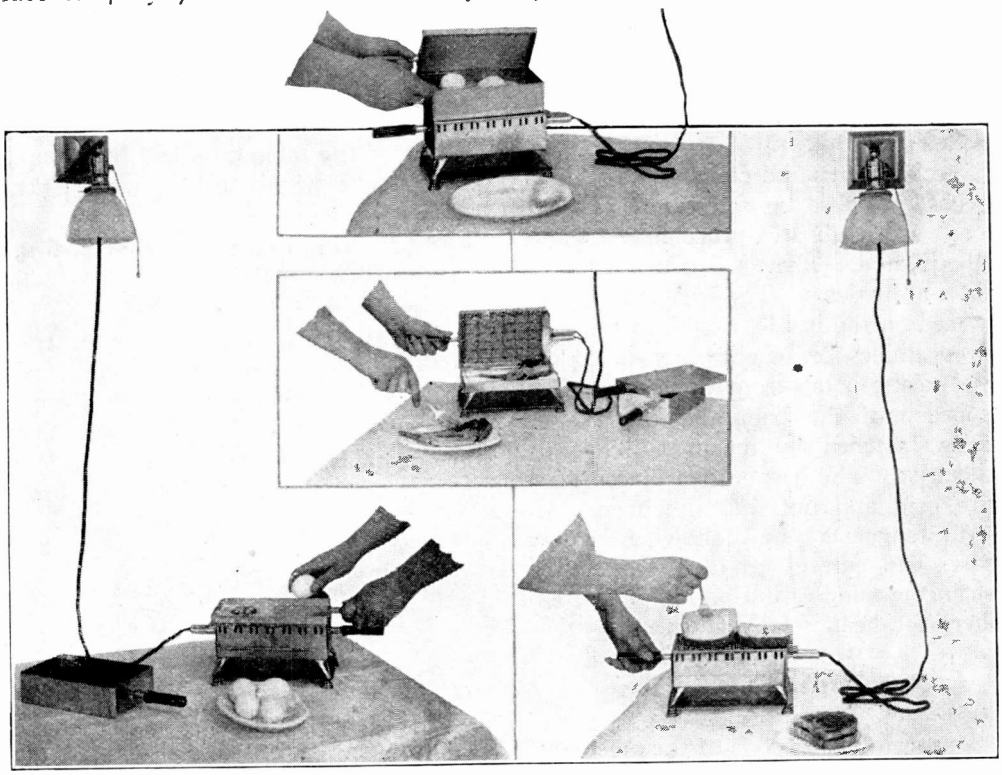
Dining table cooking in lieu of kitchen cooking is further popularized by the table grill recently developed. This table grill represents the latest form of electric cooking convenience. The device is a combination of the frier, broiler, toaster and hot plate. The heating surface is 4 by 7 inches and food may be cooked above or below it or in both places at the same time. A suitable vessel is supplied for boiling water or for steaming eggs. The cover of this vessel when inverted forms the frying pan. The compartment under the heater coils is used in broiling. At the same time bread may be toasted on the grating over the coils.

The entire device is finished in polished nickel and it makes a pleasing addition to other electrical table devices. It may be operated from the ordinary lighting circuit.

Paper Bag Cooking

The new system of cooking in paper bags discovered and perfected by M. Soyer, chef of Brooks Club, London, has been commanding the attention of scientific cooks throughout the country. Mrs. T. Vernette Morse of the Arteraft Institute was one of the first in Chicago to try out this method. Mrs. Morse experimented with paper bag cooking in an electric fireless cooker. She states that meat roasted in a paper bag does not dry up but retains all of its juices and browns perfectly. Bread and cake can be successfully baked, even Boston baked beans are as delicious as when baked in the old time brick oven.

Fireless cooking is still in its infancy and many scientific facts regarding its possibilities are yet to be demonstrated. The paper bag as an accessory of the cooker will expedite a new era in the preparation of foods. The difference in



SHOWING THE VARIOUS USES OF THE ELECTRIC TABLE GRILL

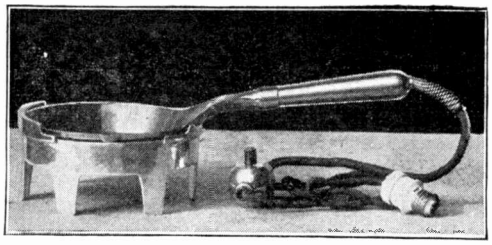
flavor makes food palatable but when these flavors are lost in cooking, the most attractive food becomes insipid and tasteless. With the introduction of electrical cooking devices and paper bag cookery there can be no excuse for serving unsavory foods. The paper bags retain flavor of foods, and prevent evaporation. For example, meats may be seasoned in the usual manner and cooked in paper bags in a slow oven. They require no basting as the bag retains all of the heat, prevents evaporation of nourishing elements and the meats are cooked in their own juices.

Specially prepared cellulose bags must be used. Those on sale at department stores are made of spruce fiber chemically treated. They are odorless, sanitary and hygienic. The bags are slightly greased on the inside, except in the case of vegetables or when water is added. The meats, potatoes or apples are then slipped into the bag, and the bag is firmly fastened by means of clips or otherwise. The bag is then placed on a wire grid and put into the oven. M. Soyer suggests the following order: roasts and entrees on the lower shelf; fish in the middle, and pastry on the top where the heat is most intense.

New Type of Frying Pan

The frying pan is one of the most convenient cooking utensils for use in homes, restaurants and hotels. The pan illustrated herewith is not only a complete frying pan capable of cooking everything that can be fried in the ordinary manner, but it can be turned into an electric disk stove by simply inverting it and it is then suitable for light cooking of all kinds.

It is made of sheet steel and has a polished metal handle. The heating element is in the bottom of the pan and hermetically sealed between steel walls. The pan heats very quickly and can be run at three temperatures, high, medium and low. The desired temperature is obtained by means of an indicating push-button switch.



A NEW FRYING PAN

The stand is made of aluminum and is so designed that the frying pan can be run at full heat without injuring the surface of the table on which it is supported. The whole outfit is very light.

Candy Making in an Electric Chafing Dish

Chocolate Fudge.—Boil together two cups sugar, two ounces chocolate, and two-thirds cup milk to the soft ball stage (238 deg. F.). Remove from the fire and add one tablespoon butter. When cool add one teaspoon vanilla and stir until

the mixture begins to stiffen. Pour quickly into a buttered pan and cut into squares. Nuts may be added if desired.

Note: Sweet or sour cream may be used in place of the milk and butter.

Divinity Candy.—Boil together three cups sugar, one cup corn syrup and one-half cup water to the crack stage (270 deg. F.). Pour over the beaten whites of three eggs and beat rapidly. As it thickens add one teaspoon vanilla and one cup chopped nuts. Pour onto a greased plate and cut into squares, or mould in a box lined with oiled paper.

The above recipes are from Lessons in Cooking by Home Economics Association of Chicago.

Electric Luminous Radiator

The twin glower with four heater bulb radiators is one of the newest forms of the electric luminous radiator. First, there was the twin glower, then the three heater bulb and now the four heater bulb radiator. They are suitable for heating the bathroom, bedroom or any room where it is only necessary to take the chill out of the air. They are designed to take the place of the open fire or gas log fire with none of the disadvantages of the latter as to dirt, smoke, ashes, injurious gases or fire risk. They are light and portable and are of great comfort and convenience.

LUMINOUS RADIATOR WITH FOUR BULBS

The heater bulbs are of frosted tubular glass about three inches in diameter and ten inches long and they contain the filaments of heating elements. The latter operate at a temperature much lower than that of the ordinary incandescent lamp filaments and therefore have longer life. They are highly efficient because there is practically no storage of heat other than that due to the glass walls of the bulbs; while the highly polished copper reflectors placed behind and underneath the bulbs serve to throw practically all the heat toward objects in front and at the same time a soft and cheerful glow is emitted.

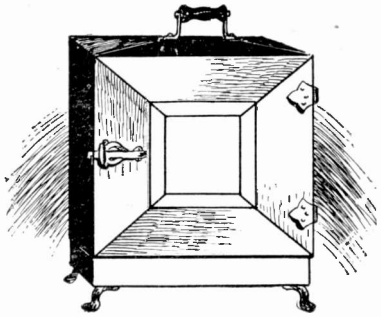
Requirements of Good Toast Making

The proper making of toast involves the conversion of starch into dextrine. To do this the heat should be given time to penetrate to the center of the slice before the outside has begun to change color. If the outside sears over at once the middle of the slice will not be heated sufficiently to change the starch. Toast that is clammy in the middle is less wholesome than untoasted bread.

Perfectly toasted bread is crisp and golden throughout and the electric toaster is built to make toast in this way.

Portable Plate Warmers

Plate warmers are fast becoming popular in the home as well as in the hotel. This plate warmer is especially adapted for use in small families and for private service in hotels. The body is of Russian iron with trimmings of polished brass. It is fitted with a strong wood



PORTABLE PLATE WARMER

gripped handle on the top, making it convenient to carry or to move about. The space between the lining and outside shell in the walls and door is insulated with asbestos to prevent the escape of heat. The electric heaters for these portable warmers are placed under the bottom shelf and consist of enameled iron plates and are therefore of the most reliable and durable construction.

Making Good in a Strange Land

By THEODORE VLADEMIROFF

II.

The studies were hard. I had to carry on experiments for my thesis. Many things had to be done so that at commencement my records would be all closed so that I could receive my diploma. My money not only completely gave out, but I had fallen behind in payments for my board. I was very politely requested to either pay a certain amount on my board or else make other arrangements. I was pressed for time more than I was for money, and goodness knows, that in itself was bad enough. The bitter disappointment that at this, the eleventh hour, I must admit my defeat, overwhelmed me. While on my way to the class room one of my classmates took me to one side and asked me what had happened. I did not wish to reveal my predicament, but he prevailed upon me and I told him. He gave me one of his characteristic kindly smiles and told me to go and attend to my work for he would advance me the sum desired. My spirits jumped at once and they remained at the high water mark until I walked upon the platform on that bright commencement day and took my diploma. I am sure that my diploma meant more to me than it did to any one of the students who graduated that year, for in spite of all the obstacles which I had to overcome, I graduated with the class with which I entered the University.

A university graduate is very much like a ship that has been just launched. She is all there, but in the words of Kipling she has yet to find herself. A graduate is fairly well equipped with fundamental principles, but he knows little or nothing of the vast amount of detail work in the practical life of which he has heard little while in college.

One of the hardest things on leaving college is to make a place for one's self in the world's work. A large per cent of the young technical graduates (myself included) work for a place with some one of the large corporations. In one way this is a mistake for one becomes as an atom of our body—a very infinitesimal part. Your interests, your hardships, your likes and dislikes are of little or no interest to the corporation. I had started with a corporation at $7.50 per week, but with such a salary I felt that I was becoming a human squirrel in a squirrel cage—always running but never getting anywhere.

When the Maine blew up in Havana harbor, from the public state of mind at the time I knew that there would be war. I sent my application to Washington, asking for an appointment in the U. S. Navy, but a reply stated that over 25,000 applications had been made which could not all be accepted, as there were only a limited number of positions to be had. In a very short time, however, an opportunity presented itself and I entered the electrical service of the Navy as chief electrician on the U. S. S. Helena.

The duties of a chief electrician in the Navy are in proportion to the size of the

battleship and on a modern battleship everything possible is done by electricity. Besides the lighting to look after there are electric searchlights, night signaling apparatus, a telephone system far more complicated than ordinarily (because the captain must be in touch by bells and telephone with almost every part of the vessel), wireless apparatus, motors for turning the turrets of the big guns, motors for pointing them, motors for ramming, motors for hoisting powder, etc. In fact, electric wires on a battleship are as numerous and important as the nerves in one's body.

The chief electrician is responsible for his equipment to the chief engineer and he to the captain. In time of action the chief electrician must be everywhere. A crippling of any part of the electrical service at such a time would be as serious as an apoplectic stroke to a human being.

Under ordinary and favorable circumstances, the duties of a chief electrician are not very hard, for with his corps of assistants he can take care of his plant without any hardships to himself or his men. There are times and circumstances, however, when his lot is anything but enviable.

One experience in particular comes to my mind. During a very heavy storm in the Gulf Stream one of our generator units developed a serious hot box, which in turn caused the breaking of one of the engine's high pressure piston rings, fragments of which were caught between the cylinder and piston, cutting the inside of the cylinder very badly. This particular dynamo room was immediately above the boilers. The steel deck was so hot that it was impossible to remain on it for more than a few minutes at a time. Wooden grates were installed in order to make things more endurable. With the temperature of the room 120° F., and the clinometer showing that the vessel was rolling from 35 to 45 degrees, we had to overhaul the engine in order to give the other unit a rest. This experience impressed itself upon my mind because it was on a Thanksgiving day. I could not leave my work at mess time and when I did finish and had everything ready to run, I went up to find the only thing left was bean soup! I could not eat. There was a lump in my throat, and I had visions of Thanksgiving dinners gone by. It is in times like this that the chief electrician more than earns his salary.

If I may digress a bit, one of the most useful pieces of apparatus on board a man-of-war is the searchlight. Before the days of wireless telegraphy I have known vessels to signal each other with it when 50 or 60 miles apart. I have given signals—a ray of hope as it were—to a shipwrecked crew on a lovely island in the Pacific Ocean at a distance of 40 miles or more, nearly three hours before we could get to them. As a shock to blockade runers there is nothing like it. We chased blockade runners in the dark of night with all lights out—just barely able to make out their shadow in the dark, and when we were within gun shot a sudden stream of light upon their decks was followed by a most amusing scramble for shelter. Many a Filipino during the war found a watery grave by trying to pass from the enemy's line into the city of Manila with small boats either by hugging the shore or by trying to skirt outside of our position and then slipping into the city between blockading vessels which were stationed from three to five miles apart.

There are several benefits which I derived from my experience, the greatest of which was "stick-to-itiveness." A second was that of becoming very much at home with machinery. One gets to know what is the matter with it by just listening. By the sound one can tell whether all is well or not.

So in less than three years' time I had traveled around the world. I had seen proud old Spain vanquished, the old Chinese dragon humiliated, and Aguinaldo's forces defeated and dispersed. My vessel had taken a prominent part in at least

six engagements with Aguinaldo's land forces. I have seen the U. S. S. Charlton stranded upon the rocks and sent to the bottom of the Pacific Ocean by one of the worst typhoons I ever experienced in the three years' time, having been typhoon bound no less than five times. I had gone through experiences in that brief time, one-half of which do not happen in the natural life of a sailor. Except for a stiff southwest monsoon in the Indian Ocean from Ceylon to the Straits of Bab el Mandeb, we had as beautiful a 15,000 mile voyage as one could wish.

Thus ended my naval adventure. It was full of storms, sunshines, calms. Baptized in a score of battles which brought joy to some, sorrow, desolation and destruction to others, all these events crowded into the very short space of three years.

Since my return I have dropped my anchor in Chicago. Here it has been my good fortune to have been connected with a prominent engineering firm where I have taken an active part in the electric and mechanical equipment of some of the largest, if not the largest buildings in Kansas City, Omaha, Chicago and elsewhere, and am trying to do my best to climb the ladder of success.

Shortly before Fred Douglas died in 1893, I heard him speak on the progress the colored race has made in this country since their emancipation. He made a statement then which I have never been able to forget: "You can not stand on the very top of civilization and look down when you wish to judge of their success. Rather you should put yourself in the place which they first started from and then look up in order to judge justly of their progress." This I think is a very fair way of measuring success.

(The End.)

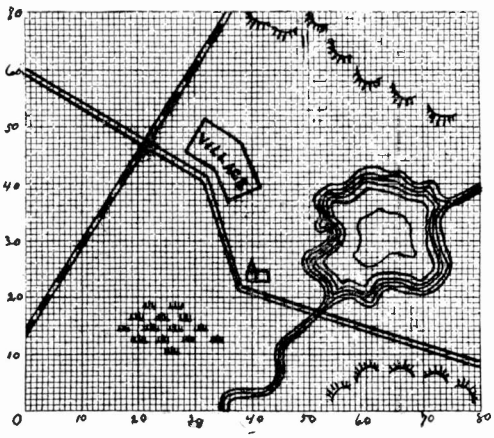
Sending Sketches by Wire

The thought of transmitting diagrams or drawings by wire naturally calls to one's mind a picture of a complicated mechanism at each end of the line with a long haired scientist working over it. And the idea of anyone's sending diagrams over an ordinary telephone or telegraph wire, with no special apparatus, sounds absurd, nevertheless it can be done. It has been done numerous times by certain signal officers of the United States army and the method was described and discussed some time ago in the *Journal of the U. S. Cavalry*.

The diagram or sketch is drawn upon coördinate or double crossed-ruled paper. Now each point on this paper can be determined by a pair of numbers. These numbers, which are called the coordinates, are derived in this way: Each vertical line is numbered, starting from the lower left hand corner of the paper. Starting from the same point, each horizontal line is also numbered. The intersections of the lines can then be determined simply by giving the numbers of the intersecting lines, the first number given being for the vertical line. The numbers are written with a comma or a dash separating them. Thus the pair 20, 13 means the point of intersection of the two lines, one of which is 20 units to the right and the other 13 units above the lower left hand corner. In a similar way any point on the paper can be located, and located very rapidly, for a little practice in this work gives one remarkable facility.

The location of a shed, a house, a tree, or any comparatively small single object on the sketch is designated by a single word and a pair of numbers, as "barn 3, 17." Objects liks roads, fences, streams and shore lines, are easily deter-

mined by giving the coördinates of successive points. Straight sections of roads or fences require only the co-ordinates of the extremities, as the straight line can be supplied. The width of a river can be determined by expressing its width as it appears on the sketch in cross section units, as "river 4 wide," followed by the series of numbers which indicate



MAP PLOTTED FROM A TELEGRAPH MESSAGE

the course of its middle line. Areas like lakes, marshes, or wooded tracts, are determined by giving the numbers which indicate their boundaries.

The map, or sketch, or diagram, then is drawn upon this paper and a supply of the same kind of paper is in the hands of the man at the other end of the line. To transmit the sketch the features are transcribed as has been shown, and this data is sent by telegraph, telephone or wireless to the destination. By platting from this data on the same kind of paper the sketch can be reproduced most accurately, the degrees of exactness depending only upon the number of points which have been furnished. To one who has never done this kind of work, it would appear a slow and tedious task. As a matter of fact, it is remarkably swift in its operation, as an ordinary field map, such for instance as would be drawn by a scouting party, can be transmitted and reproduced, exactly to scale, in about a half hour.

A Trick with Static

Static electricity around moving belts in some plants is so pronounced that it is necessary to provide means for carrying it to the ground.

The following is an amusing trick to play on the uninitiated: Hold the base of an electric light bulb close to a moving belt which is generating static. Now approach the innocent victim and offer him the lamp, of course extending the base. The moment he touches the base he will receive a surprise in the nature of a harmless shock.

The explanation of this phenomena is simple. The lamp acts as a condenser, the hand holding the lamp being one plate and the lamp filament the other, with the glass globe as the dielectric. In a tinfoil condenser the two sheets of tinfoil correspond to the hand and the filament respectively. When the base of the lamp is touched a circuit is completed and the condenser discharged.

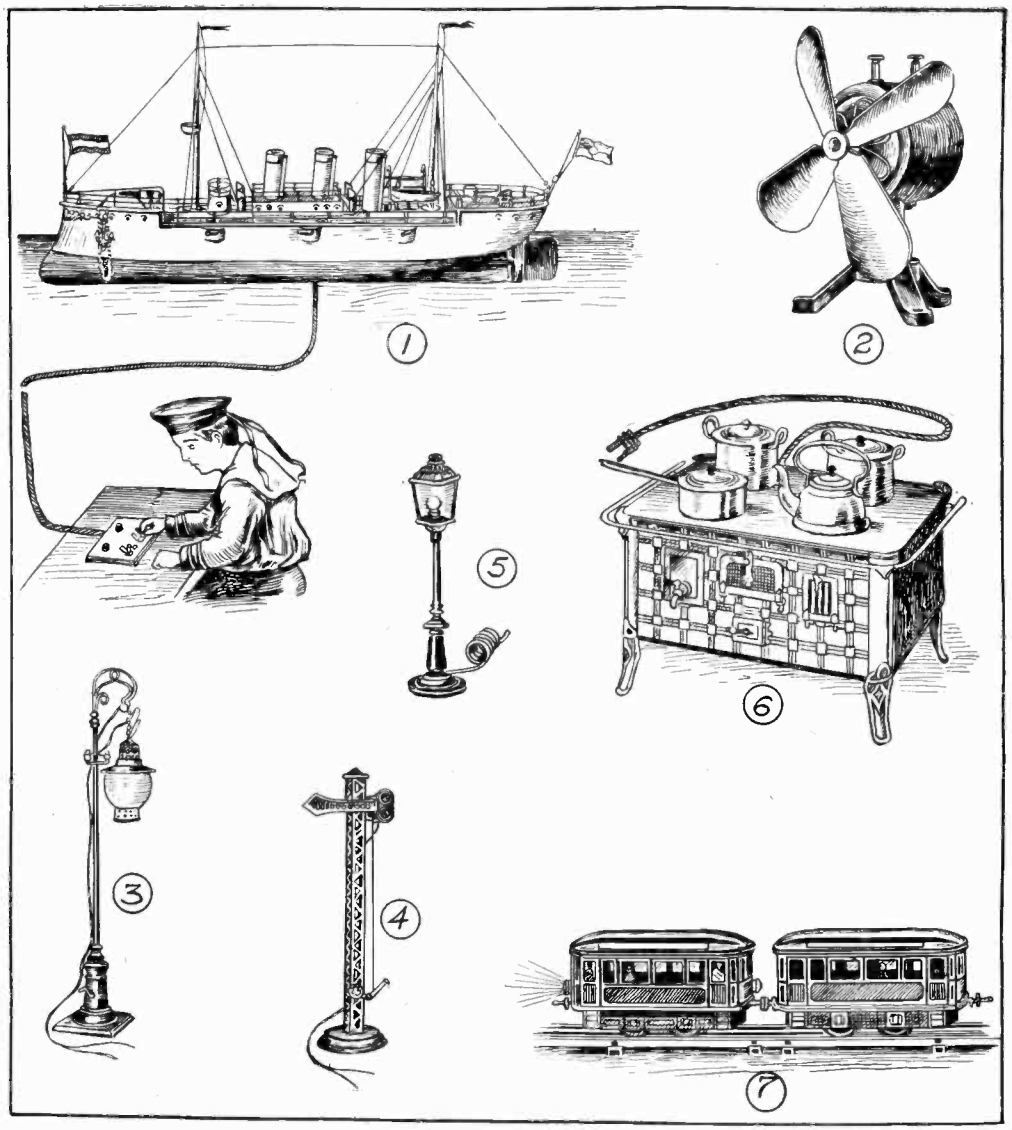
JOHN P. KOBROCK.

Electric Toys That Are Wonders

Some of the electrical toys now on the market are actual wonders—working models in reality of the big electrical equipments seen all about us. Here are a few examples which will prove to be eye openers to a great many boys who are not in a position to visit the large electrical supply stores where such things are on exhibition.

For instance there is a little steamship (1) complete in all its outward details, which is driven by a battery and motor concealed in its hull. It may be started, stopped or reversed from a small switchboard through a waterproof connecting cable.

Then there is a small electric fan (2) which is not a mere toy, but which will give a good stiff breeze. It is run by a substantial motor suitable for other purposes.



Street lamps with real lights (3) and (5) operate from a battery.

Complete electrically operated street cars (7), with electric headlight and any desired amount of track, are obtainable, and if desired this track may be protected by electric block signals (4).

The girls have also been remembered, and one of the things which interests them most is a complete electric range with cooking utensils which operates from the lighting circuit and which is capable of doing real cooking.

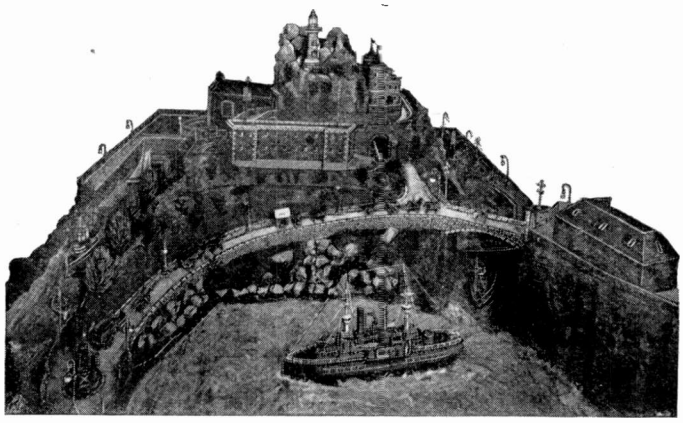
A Mountain Fortress

For the entertainment of the children Marshall Field and Company have placed in the children's play room on the eighth floor of their Chicago store a toy mountain fortress imported from Germany.

This picture gives only a partial idea of the complicated display which speaks for the genius and patience of German electricians.

Situated on a mountain by the sea is a miniature fortress above which and at

the highest point on the mountain is a lighthouse, equipped with a small but strong electric light. Revolving shore



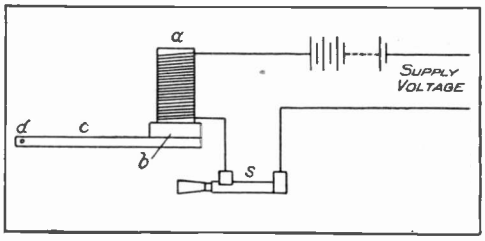
A TOY MOUNTAIN FORTRESS

batteries are situated near the fort while in the harbor is a miniature modern battleship manned with tiny guns. In the mouths of the guns, both on land and sea, are the smallest of electric lamps which light up intermittently, giving the appearance of a battle in progress. The battleship rests in a sea of green cloth made to undulate like sea waves by a motor driven device beneath. An armored train moves into the tunnel on one side of the fortress and a company of artillery is seen climbing the hill to the fort. Many small electric lights illuminate the mimic battle scene.

A Simple Circuit-Breaker

A simple circuit-breaker which is very convenient for certain cases can be very easily constructed as shown in the accompanying sketch. It is often advantageous in charging storage batteries to have a device to break the circuit when the batteries become fully charged. When batteries are first put on the charging circuit the charging current is large. As the batteries become charged their voltage increases and because of the opposition of this voltage to that of the charging voltage the current diminishes. When the batteries are sufficiently charged the current reaches a small value at which the circuit-breaker can be made to automatically operate.

On a soft iron core (a) are wound a hundred or more turns of insulated wire. The terminals of this coil are connected in series with a switch (S) (which for simplicity is shown as a single pole switch), and the batteries to be charged. A soft iron block (b) is fastened to the end of an arm (c) which is pivoted at (d). The number of turns and the weight of the iron block can be adjusted so that the electromagnet will cease to hold the block against the pull of gravitation when the current reaches a certain minimum value. When the block is released it strikes the



SIMPLE CIRCUIT-BREAKER

handle of the switch (S) and opens the circuit.

In some cases in operating motors it is advantageous to use this device so that when the supply voltage is shut off for a moment the circuit-breaker operates, thus eliminating any danger to the motor if the power should be turned on again. The device is very positive in its action and therefore effective.

In the early experiments with lightning, following Franklin's kite test serious accidents often resulted. Franklin himself in trying to kill a bird with a spark, said, "I came near killing a goose."

Popular Electricity Wireless Club

The Function of Crystal Detectors

By CLAYTON I. HOPPOUGH, Dean Dodge's Telegraph and Wireless Institute

A misconception exists among many amateur and professional wireless operators regarding the use of detectors for receiving wireless signals. The misconception is that the detector itself is more sensitive than the ordinary current detecting devices such as delicate galvanometers, relays, telephone receivers and the like. This is an error in belief, and has probably been brought about by a lack of knowledge regarding the conditions under which the detector operates, and the exact manner in which it performs its duty.

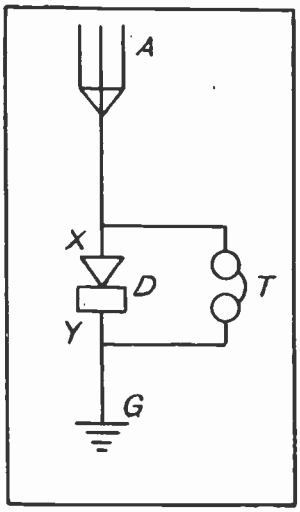


FIG. 1

It must first be remembered that in receiving signals we are handling currents of very high frequency. If a telephone receiver be connected to a tuning device as in Fig. 3 (the condensers and tuning coils being adjusted to a wave length of 300 meters) and we are to expect the reception of signals to result from the use of such a "hook-up," it would necessitate the diaphragm moving back and forth at the rate of 2,000,000 vibrations per second. For the diaphragm to accomplish this is mechanically impossible. Furthermore, as the telephone receiver is wound with many turns of fine wire, its self-induction is relatively great, and thus, the high frequency electromotive force generated by the action of the waves in cutting the conductors of the aerial would produce a very weak current flow through the telephone receiver. Even if the telephone diaphragm did vibrate at the rate of 2,000,000 per second, our sense of hearing would not detect the vibrations, as the greatest number of air vibrations which the ear is capable of detecting is somewhere between 30,000 and 40,000 per second. It is therefore necessary to use some appliance which will transform these rapidly reversing currents into an effect that will cause the telephone to set in motion air vibrations whose number per second are within the limits of audibility.

Probably one of the most common devices accomplishing this transformation is the carborundum detector, and as the principles governing the action of other common mineral detectors such as silicon, perikon, molybdenite, ferron and pyron coincide with those of carborundum, the statement of a few facts regarding the action of the latter may assist in understanding the action of most crystal detectors.

In 1906, General H. H. C. Dunwoody of the United States Army, discovered that crystals of carborundum, whose chemical name is carbide of silicon, possessed the property of detecting elec-

tromagnetic waves In the description contained in his patent application, there seems to be no explanation of why the crystals of carborundum act as a detector. Mr. G. W. Pickard in 1906 ascribed to carborundum crystals the property of unilateral conductivity; that is, that current could be made to flow freely through the crystal in one direction but encountered great resistance when the crystal was reversed and current made to flow through it in the opposite direction. It was found also that a current passing through a carborundum crystal does not obey Ohm's law. This later characteristic was found by F. Braun in 1874 to be possessed by various minerals, such as copper pyrites, iron pyrites, galena, and copper sulphide

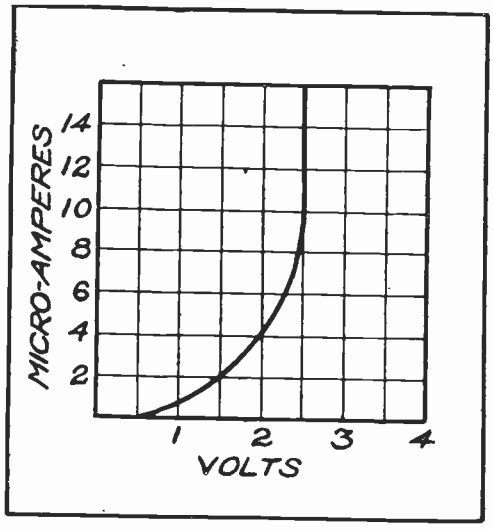


FIG. 2

showing traces of antimony in combination.

It is, however, to Professor Pierce of Harvard University that we are indebted for a consistent explanation of the reason for the wave detecting properties of most mineral detectors. After Professor Pierce had published the results of some of his experiments, the writer collected a quantity of carborundum crystals at random, and with the aid of delicate instruments obtained a current voltage curve shown in Fig. 2 which was approximately the same for seven crystals compared. In doing this each crystal was clamped between two spring electrodes and the surfaces offered for contact as well as the contact pressure was maintained as nearly constant in all cases as possible. It will be seen by the curve in Fig. 2 that the current obtained at two volts constant electromotive force through the crystal was about four micro-amperes. However, the resistance of the crystals varied greatly, and three specimens, hereinafter designated as (A), (B) and (C) measured 101,790, 21,900 and 992 ohms one way respectively, and 31,960, 12,910 and 490 ohms when the current was reversed.

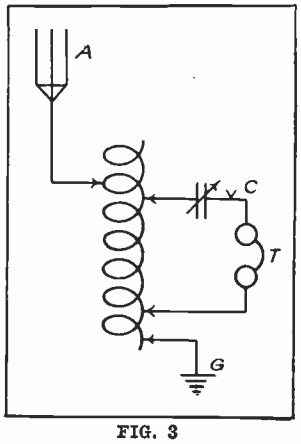


FIG. 3

Attention is now invited to a brief consideration of the currents from the aerial upon a wireless receiver. They are alternating in character, flowing one way, then changing and flowing in exactly the opposite direction. Also, as has been previously stated, they are of high frequency. Now considering Fig. 1, assume that an alternating current is attempting to flow through the carborundum crystal from (X) to (Y). As already noted from the results obtained with the seven crystals, conditions remaining the same, more current will flow from (X) to (Y) than from (Y) to (X). Accordingly the resultant current will partake more of the nature of a pulsating direct current than of an alternating current. These pulsating currents will cause the diaphragm of the telephone receiver shunted about the de-

tector to be continuously pulled in the direction of the telephone magnets, because, although the pulsations may be at the rate of perhaps a million a second, the inductance of the telephone circuit changes the whole number into an effect similar to that produced by a continuous direct current. The energy of each wave train after it has been transformed by the detector will cause one pull only upon the diaphragm, thus causing a click for each wave train, a succession of clicks forming the characters of the telegraphic code. It must not be understood from the last statement that one wave train would necessarily correspond to a dot of the code, as the whole number of wave trains per signal depends upon the rate of sending, the length of spark, the capacity of the condensers and the frequency of the current upon the primary circuit of the wireless transformer.

We have, then, by the use of a carborundum crystal obtained the desired result; that is, transformed a train of oscillations into a pulsating direct current which produces audible air vibrations. The whole action is due to the fact that the crystal is a partial rectifier of alternating current. It is from the later fact that mineral detectors are nearly all termed "crystal rectifiers."

In the foregoing experiments by the writer an interesting comparison between the sensitiveness and resistance of the crystals was developed. Crystal (A) whose resistance was 101,790 and 31,960 ohms developed a good buzzer test, and was not sensitive enough to detect signals from a two K. W. commercial station situated about 40 miles from the receiving aerial. Crystal (B) whose resistance was 29,900 and 12,910 ohms did not prove as sensitive to a buzzer test as (A) yet detected signals from the same station weakly. Crystal (C) measuring 992 and 490 ohms resistance was weakly sensitive to a buzzer test, while the signals from the commercial station were very clear and loud.

It will be noted that although the measured two-way, ohmic resistance of crystal (A) was in a ratio of 3.14 to 1, the ratio of crystal (B), which fell to 1.69 to 1 was a more sensitive detector of electromagnetic waves. It would seem from this that a great difference of the two-way, ohmic resistance of a particular crystal is not always a safe prediction of the sensitiveness of the crystal, and that a good buzzer test does not always signify that the crystal is most sensitively adjusted for wave detection.

The above results would indicate that if we could obtain a crystal in which the resistance offered to a current flowing through it one way would be equal to the resistance offered to a current passing through it in the opposite direction, it would be a more sensitive detector of electromagnetic waves than either (A) or (B) cited above. However this is only true within certain limits, as the author, by additional experiments with other crystals than those mentioned, found that when the two-way, ohmic resistances differed by less than 20 per cent, the crystals possessed indifferent detecting qualities, regardless of contact surface, contact pressure or size of crystals.

The most sensitive carborundum crystal examined had a two-way resistance of 1212 and 461 ohms, was about the size of a pea and jet black.

Owing to the difficulty of keeping the silicon and perikon detectors in adjustment during the application of an electromotive force sufficient to measure their resistances using the instruments at hand, no accurate curves or resistance measurements were obtained, but a specimen of silicon with a fine steel wire contact delicately adjusted measured about 54,000 and 710,000 ohms. In the same manner, a perikon detector consisting of a piece of zincite in contact with bornite measured approximately 61,290

and 11,212 ohms resistance. The silicon firmly clamped and held in heavy contact as was the carborundum showed only 21 ohms resistance both ways, and a non-sensitive, heavy contact perikon detector offered 32 ohms resistance to a current flowing through it either way, showing that at last with the silicon and perikon detectors it is the contact rectification phenomena with which we have to deal.

In conclusion the perikon was found to be the most sensitive of all mineral detectors named in this article. However, it is very susceptible to burnouts from heavy signals or static and will easily jar out of adjustment. For general all around wireless work, the carborundum detector when assisted by about 0.3 volts external electromotive force is probably the most reliable. Although less sensitive than either the silicon or perikon, its ease of adjustment and permanent qualities when adjusted compensate for its lack of sensitiveness.

For the amateur, whose chief concern is to hear far distant stations and whose aerial is comparatively low, the perikon or silicon detectors present possibilities of wave detection not found in the carborundum. Any crystal rectifying detector is more efficient if assisted by an external electromotive force of small value. The perikon or silicon is far more sensitive than the carborundum when no external electromotive force is applied.

Oscillation Transformer

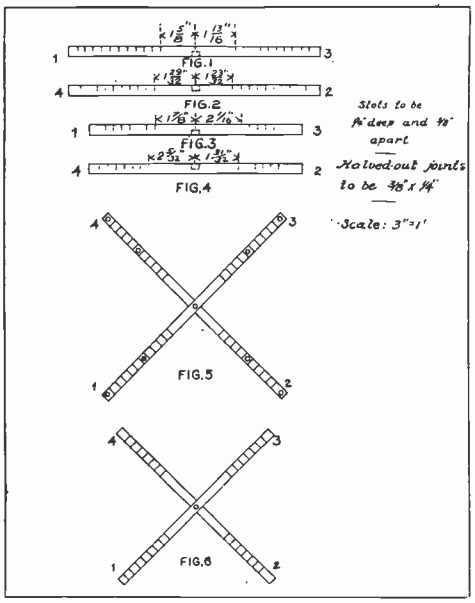
By EDWIN L. POWELL

The inductive helix described below will give excellent results on coils up to 75 watts power. It takes up very little space on the back of the table and presents quite a professional appearance, if made carefully.

I will first give a list of the materials needed, which are as follows: One 12-inch phonograph disk record, two strips of hard rubber, size 11½ by ½ by ⅜ inches, two strips of hard rubber, size 9¾ by ½ by ⅜ inches, 40 feet of hard drawn brass ribbon ¼ inch wide, one piece of 7-32-inch round brass rod six inches long, eight round head brass wood screws 1¼ inches long, four round head brass wood screws ⅜ inch long, four hexagonal brass nuts to fit 12-24 machine screw, five brass washers with 7-32-inch hole, four electrose knobs, four contact clips taken from an old fifteen ampere D. P. D. T. switch, four round head brass 8-32 machine screws ¼ inch long, one round brass ball about ½ inch in diameter with hole tapped for 12-24 thread. (This last item is sold by most hardware dealers, in the size given above.)

The four rubber strips should be milled down to the size given above and polished. In most cases, you will be able to have this done at the supply house where you purchase the rubber. The first step is to lay off the strips for the positions of the halved-together joints and the slots into which the brass spiral is to be fitted. This should be done in accordance with Figs. 1, 2, 3 and 4, using the dimensions given. Do not forget to number each end of each strip with a lead pencil as shown in the drawings.

When you have all four strips laid off as shown, cut in on all the lines with either a foot-power scroll saw or coping saw. Be careful to use a size of blade which will cut a slot just broad enough to make a snug fit for the brass ribbon. If the fit is too tight it will bow the rubber strips. Now fit the four strips together at the halved out places in the center, making one large and one small cross. Fit these crosses together in such

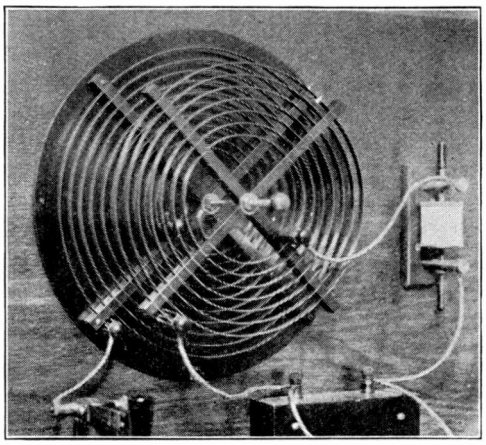


a manner that the numbers read 1, 2, 3, 4 when reading in an anti-clockwise direction, as shown in Figs. 5 and 6. Find the exact center of each cross, and drill a 7-32-inch hole.

Now fasten each cross down to a convenient spot on the work bench by means of a screw driven through the center hole. Then drill eight 9-16 inch holes in the larger cross in the positions shown in Fig. 5, but do not put any in the smaller one. Wind a spiral on each cross by pressing the brass ribbon into the slots cut in the rubber. Begin at the inside cut of arm No. 1 on each cross, and wind toward the outside in an anti-clockwise direction, using great care to make the curves as nearly a perfect circle as possible. When you have finished the spirals, cut the ends off smooth and bend them out at a slightly greater angle than the rest of the coil.

Next take the brass rod and thread the entire length with a 12-24 die. Select the center of the space on the back board of the table where you wish to place the helix and drill a 7-32 inch hole through same. Take the long screw and put a washer and a nut on the extreme end of it and pass it through the hole in the board, letting the screw project forward with the washer and nut in the rear. Put on another washer, and then the phonograph record with the blank side out. It is best to use a Victor record, as it is the only one without an advertisement on the back. Over the record place the large spiral and secure same by means of another washer and nut. The eight holes in the cross can now be continued through the plate and the 1¼ inch screws fastened in them. The four small screws should be driven through the outer edge of the record midway between the ends of the rubber strips, to keep the plate from warping. Next place the following on the long screw in the order mentioned: A nut, then a washer, the small spiral, a washer, another nut, and last of all the brass ball.

Connect the two ends of the large spiral to the aerial and ground by means of clips made from the switch contacts, 8-32 screws and the rubber knobs. The



THE OSCILLATION TRANSFORMER

smaller spiral is then connected in series with the spark gap and secondary of the coil with the condenser shunted around the secondary.

If you can not obtain a hot wire meter to tune with, use about a six to ten volt light (according to the power of the coil used) in series with the aerial. In tuning vary the number of active turns in the small coil and its distance from the

large one by sliding it back and forth on the rod until the brightest light is obtained. When you have found the correct position for it, secure it with the two loose washers and nuts.

An inductance built on this plan will radiate much more power with a sharper tuned wave than can be obtained from any closed circuit helix. The picture is of one I made for my own outfit exactly as described. I am able to send about 20 or 25 miles with this helix in connection with a 75 foot aerial, 25 watt coil, and a twelve volt storage battery.

Oddities in Aerials

An aerial for experimental purposes need not necessarily consist of one or more wires suspended from insulators. Wireless messages sent out from commercial stations may be received by means of many kinds of conductors acting as aerials. One enterprising experimenter found it impossible to place an aerial above the apartment house in which he lived and so he dropped a wire from his window to one three stories below and obtained fair results with this as an aerial. Later on when he became dissatisfied with the comparatively short receiving radius thus obtained, he connected a small wire to the steel frame of another apartment house which was in the course of erection next door, and by inserting a condenser in series with his instruments and his ground connection he was able to increase his receiving radius to a considerable extent. The frame of the new building was grounded and consequently acted as one side of a loop aerial, his ground wire, or water pipe, acting as the other side.

Messages can be received over considerable distances by using the tin roofs of country homes as aerials. Leader pipes and metal gutters which are to be found on nearly every house in the country can be used in the same way. The writer has received almost 50 miles with such aerials. In all cases where the improvised aerial is grounded a condenser should be connected in series with the instruments and the ground.

Wire netting suspended from trees or poles gives good results for experimental purposes, even for transmitting, if well insulated and the "lead in" wire is composed of several strands.

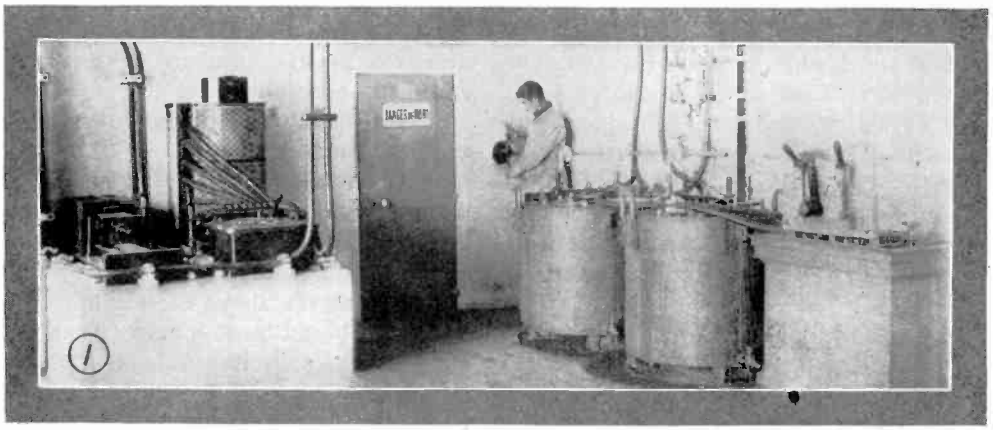
Where it is not possible to place an aerial outside the house, very fair distances can be covered by suspending a large number of parallel wires in the attic or some other convenient place inside the house. Such an aerial should be placed as far above the earth as possible and should be as long as space permits, within a limit of about 150 feet. If such an aerial is used the ground wire should be composed of many strands to decrease its high frequency resistance.

In cities where there are several high power stations within a few miles it is quite possible to make the frame of a bed serve as an aerial, although it does not have a large metal surface.

Telegraph and telephone wires often act as aerials. Wireless messages have been heard on ordinary telephone lines, where the transmitter acted as a detector. In one case the writer had just obtained a telephone connection between New York City and Jersey City through a cable under the Hudson river when a ship called the 42 Broadway station and sent in a report. The station answered sending the operator's O. K., when the party called on the telephone line answered and thereby put an end to our reception of wireless messages with a telephone cable aerial.

In an experiment in signalling by wireless from an aeroplane in flight on August 27, 1910, we used the steel wires of the frame of the machine as an aerial and allowed a flexible copper cord to drag behind the machine. Messages were sent from the aeroplane to the station on the earth over a distance of almost one-half mile with a two inch coil at the transmitting end. A. B. COLE.

Details of the Eiffel Tower Station



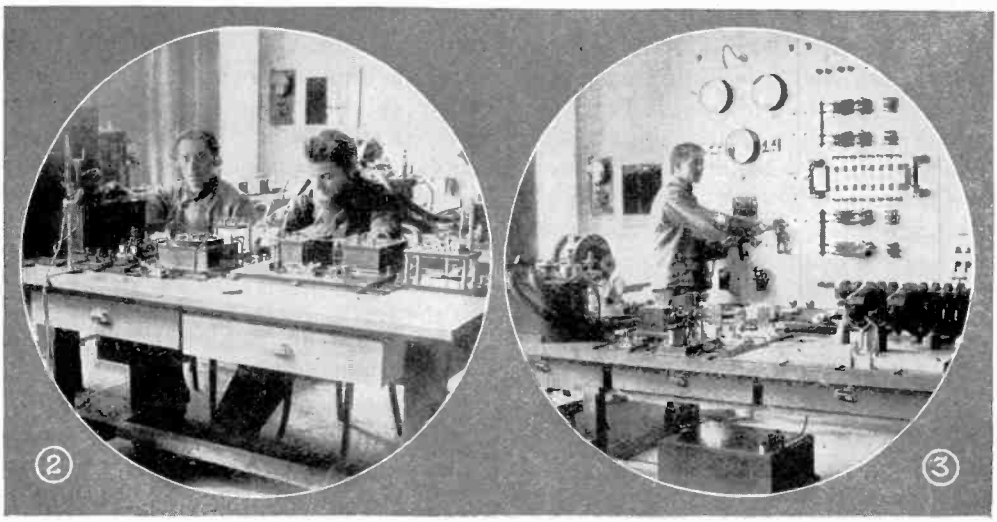
(1)

At various times we have printed references to the Eiffel Tower wireless equipment in Paris. The very latest photographs of this wonderful station of the French Army, which we reproduce herewith, show some of the details heretofore unavailable.

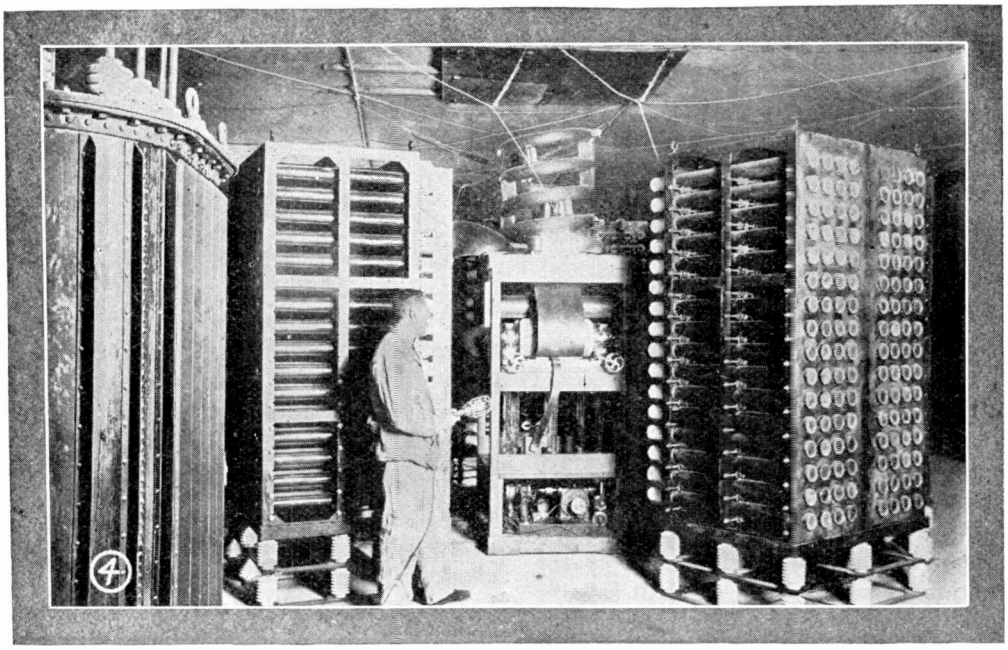
This plant is one of the most powerful in the world, and was installed at a cost of several hundred thousands of dollars. It is located at the top of the tower, 1,000 feet above the surface of the earth. It has power sufficient to communicate with the Marconi Station at Glace Bay, Nova Scotia, about 7,500 miles away across the Atlantic.

In Fig. 1 we have an interior view of the high tension chamber in which the 100,000 volt transformers are located. The walls of the chamber are covered with a thick layer of felt in order to deaden the terrific sounds of the spark discharges.

In Fig. 2 is shown a part of the receiving room. A wireless message may here be received by four different operators, giving a very good check as to accuracy. The receiving apparatus is of



(2) (3)



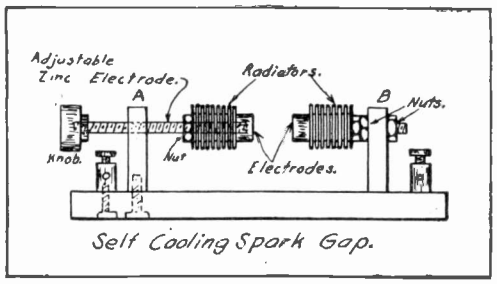
special design, the invention of the military commander at this post. In Fig. 3 the action of turning on the current for telegraphing is shown, while in Fig. 4 are to be seen the apparatus and accessories of the high tension chamber.

A Self Cooling Spark Gap

Before an oscillation takes place across the gap the air is highly resistant, but after the first oscillations take place the air is a better conductor, due to zinc vapor liberated. This formation of zinc vapor and heat causes a loss of energy, and it is to the experimenter's advantage to keep the temperature low. This can be done by having a gap with a large cooling surface. The following explains how to construct a simple gap fitted with radiators, for use with sets, up to ½ K. W. in power.

The base can be made of either hard rubber, fiber or well seasoned hardwood. The dimensions are 6 by 3 by ½ inches.

(A) and (B) are two pieces of ¼-inch square brass rod, each two inches long and are drilled and tapped with an 8-32 thread. They are mounted four inches apart on the base, and are connected to the binding posts by wires under the base. The zinc electrodes are pieces of wet cell zinc each one-half inch long, and drilled and tapped. Two pieces of threaded brass rod are needed. One should be two inches long and the other 3½ inches.



Self Cooling Spark Gap.

Next get eighteen brass washers ¾-inch in diameter, and sixteen more are ⅜ inch in diameter. Screw on the zinc electrodes and put eight large washers separated by seven small ones on each electrode. A small brass nut clamps the washers tight against the zinc. The short electrode is stationary.

A hard rubber knob is screwed on the long electrode, to adjust by. The illustration shows the assembled parts.

B. FRANCIS DASHIELL.

Questions and Answers on Wireless

By A. B. COLE

18. *Show how the act of swinging a pendulum may be compared with the setting up of electrical oscillations in an aerial system.*

The bob of a heavy pendulum may be set swinging in at least two ways; it may be raised to the side in one motion by exerting a force approximately equal to the weight of the bob, and may then be allowed to drop, or it may be set in motion as follows: If the bob is struck a blow with a light hammer, it will move slightly. Let us suppose that its first motion is toward the right side of the position of rest, which we shall call the zero position. It will then swing back past the zero position to a point at the left, when it will start back toward the zero position again. If now it is struck a second blow with the hammer, it will swing a little further to the right than before. If this process is repeated several times the bob will be finally swinging as far past the zero position as it was in the first instance cited above. In either case the total energy expended in causing the bob to swing a given distance past the zero position will be the same as in the other.

The act of setting the bob in motion as in the first instance corresponds to the method of setting up electrical oscillations in an aerial system where the ordinary "spark" outfit is used. The energy in this case is held by the aerial system until the spark passes across the gap, when it is all set free.

Setting the pendulum in motion by light blows corresponds to the action of an "undamped" or "singing spark" system, in which the aerial and all other circuits are exactly in resonance with each other, and the rate of spark discharge is exactly proportioned to the proper period of oscillation of these circuits. This method of setting up oscillations is known to the Germans as "Stosserregung," or "excitation by impulse."

19. *How are electrical oscillations similar to those of light?*

They have the same velocity in air of the same temperature and pressure, and can be reflected, refracted and polarized. Electrical oscillations have, however, a longer wave length, and consequently a lower frequency.

AERIALS AND GROUNDS

20.—*How high should the aerial be above the ground?*

The height of the top of the aerial above the ground must be governed by at least two factors: (1) the number and height of objects between stations, and (2) the distance over which the stations are to operate. A long aerial is to be preferred to a short one. The height of the tops of commercial wireless stations ranges from about 100 to 400 feet, the average being about 200 feet. The tops of the aerials of amateur wireless stations are on the average about 50 feet above surrounding objects.

21.—*How long should the aerial be?*

The length of commercial aerials is usually from 100 to 1,000 feet; that of amateur aerials is from 50 to 200 feet. By the length we mean the effective length, which in the various types of aerials is as follows: straightaway vertical, horizontal, or inclined—the length of one wire; loop aerials—the sum of the lengths of all the sides of one loop; T aerial—the sum of the vertical part and one-half the horizontal part; inverted L aerial—the sum of the vertical and horizontal parts.

22.—*Of how many wires should the aerial be made?*

An aerial made of many parallel wires is a much better radiator of electrical energy than one of a single wire, all

other conditions being the same. Two reasons for this fact are: (1) the former has less resistance, and (2) it has also a greater capacity as a condenser. An aerial of one or two wires has been found to be of little service in transmission of more than a few miles over land, although several hundred miles have been "worked" over water with commercial sets. An amateur station should have an aerial of not less than three wires to insure good all around working.

23.—*How should the aerial be insulated?*

The aerial should not be allowed to touch any objects which are not very good insulators of electricity, except, of course, the receiving and transmitting instruments, and the same applies to the wires connecting the aerial wires to the instruments. Beginners sometimes believe that ordinary rubber covered wire, such as is used for electric light work, is suitably insulated for wireless purposes. This is true to a slight extent, where the station is to be used for receiving only, but if it is to be used for long distance receiving or for transmitting, this wire must be considered as uninsulated, and must be supported on glass or porcelain insulators, or materials of the highest insulating properties. A good cheap insulator for small amateur stations is the ordinary two wire porcelain cleat illustrated in Fig. 7. The supporting wire or rope is passed through one of the two holes, and the wire to be insulated is passed through the other. Since the holes are 1½ inches apart, the insulation is 1½ inches of porcelain. This is sufficient for receiving purposes, and for transmitting where an induction coil giving not more than a one-inch spark is used. If the oscillations are produced by larger coils or transformers,

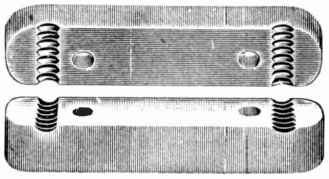


FIG. 7

two or more of the cleats should be joined in series. These cleats are made in two finishes, glazed and unglazed. The former is better for wireless purposes, since it will shed water from its surface more readily and will not accumulate dust and other foreign substances so quickly. Corrugated porcelain insulators are also made, and their general shape is the same as that of the Electrose insulator shown in Fig. 8.

FIG. 8

Glass insulators are sometimes used to support aerials, but we do not know of one designed especially for this purpose. Hard rubber insulators of the form shown in Fig. 9 have been used by commercial wireless concerns, notably the Marconi company, and they have given satisfaction.

One of the best, if not the best, of aerial insulators is the Electrose strain

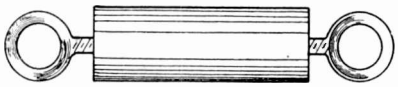


FIG. 9

insulator, one form of which is illustrated in Fig. 10. Insulators of this material are not affected by ordinary degrees of heat and cold, are moisture proof, and will stand high differences of potential. It will be observed that both the insulator shown in Fig. 8 and that

FIG. 10

of Fig. 10 are corrugated. This is done for two purposes: to make the surface between the ends of the insulator as long as possible, and to allow the water to run from the surface easily.

The "leading in" wire should be provided with a suitable insulator to prevent it from touching the material of the building as it passes through the wall. In small stations, up to ½ K. W. capacity, a

glass or hard rubber tube may be used for the purpose. For the leading-in insulator of large stations the Electrose in-

FIG. 11

sulator does very well. This form is illustrated in Fig. 11. Hard rubber insulators are also made for the same purpose. If convenient the leading-in wire may be passed through a small hole in a glass window.

Directory of Wireless Clubs

This directory of amateur wireless clubs and associations will be published each month. When a new club is formed the names of the officers, also the street address of the secretary, should be forwarded to us at once. Any changes that should be made in the directory, when designated by an official of a club, will be made in the next issue, after receipt of such advice.

Amateur Experimental Wireless Association.—David Kirk, President; Cornelius Hobbs, Vice President and Librarian; Lewis Kobie, Spokane, Wash., Secretary and Treasurer.

Allegheny County (Pa.) Wireless Association.—Arthur O. Davis, President; Theodore D. Richardson, Vice President; James Seamon, Leetsdale, Pa., Secretary and Treasurer.

Amateur Wireless Association of Schenectady, N. Y.—L. Uphoff, President; L. Beebe, Vice President; L. Pohlman, Treasurer; D. F. Crawford, 405 Lennox Rd., Schenectady, N. Y., Secretary.

Amateur Wireless Club of Geneva (N. Y.).—H. B. Graves, Jr., President; C. Hartman, Vice-President; L. Reid, Treasurer; Benj. Merry, 448 Castle St., Geneva, N. Y., Secretary.

Bridgeton (N. J.) Wireless Club.—Joseph P. Cox, President; Arthur Riley, Vice President; S. B. Ashmead, 275 Bank St., Bridgeton, N. J., Secretary and Treasurer.

Bronx (New York City) Wireless Association.—500 East 165th St., New York City.

Canadian Central Wireless Club.—Alexander Polson, President; Stewart Scorer, Vice-President; Benj. Lazarus, P. O. Box 1115, Winnipeg, Manitoba, Can., Secretary.

Chicago Wireless Club.—R. C. Dickson, President; John Hair, Vice President; H. S. Ayers, Treasurer; Seldon Stebbins, Recording Secretary; E. W. Muellner, 6603 Langley Ave., Chicago, Ill., Corresponding Secretary.

Central California Wireless Association.—G. DeYoung, President; B. K. Leach, 860 Callish St., Fresno, Cal., Secretary.

Cincinnati Wireless Signal Club.—A. J. Lyons, President; E. D. Achor, Vice President; J. L. Anderson, 1839 Hopkins St., Cincinnati, O., Secretary and Treasurer.

East Buffalo Wireless Club.—Bernhardt M. Zeufle, President; Arthur H. Benzec, 701 Walden Ave., Buffalo, N. Y., Secretary and Treasurer.

Gramercy Wireless Club.—Walter Merrill, 121 E. 103d St., New York, N. Y., Secretary.

Guilford County (N. C.) Wireless Association.—Hermon Cone, President; Ralph Lewis, Vice President; Robins Tilden, Treasurer; Theodore Mans, Greensboro, N. C., Secretary.

Hartford (Conn.) Wireless Association.—P. S. Southworth, President; W. I. Hickmott, Treasurer; H. E. Chapman, 320 Wethersfield Ave., Hartford, Conn., Secretary.

Haverhill (Mass.) Wireless Association.—Wilfred Vigneault, President; Riedel G. Sprague, Vice President; Leon R. Westbrook, Haverhill, Mass., Secretary.

Hannibal (Mo.) Amateur Wireless Club.—Charles A. Cruickshank, President; J. C. Rowland, Vice President; William Nouse, Treasurer; G. G. Owens, 1306 Hill St., Hannibal, Mo., Secretary.

Inter-Mountain Wireless Association.—E. L. Bourne, President; D. McNichol, Secretary; J. G. McCullom, 219-5 East St., Salt Lake City, Treasurer.

Manchester (N. H.) Radio Club.—Earl D. F. McKewin, President; Clarence Campbell, Vice President; Earle Freeman, 759 Pine St., Manchester, N. H., Secretary and Treasurer.

Progressive Wireless Club.—George Holt, President; Silas Pace, Vice President; T. E. Story, Poplar Bluff, Mo., Secretary and Treasurer.

Rockland County (N. Y.) Wireless Association.—W. F. Crosby, President; Tracey Sherman, Vice President; Marquis Bryant, Secretary; Erskine Van Houten, 24 De Pew Ave., Nyack, N. Y., Corresponding Secretary.

Roslindale (Mass.) Wireless Association.—O. Gilus, President; E. T. McKay, Treasurer; Fred C. Fruth, 962 South St., Roslindale, Mass., Secretary.

Rochester (N. Y.) Wireless Association.—Edward T. Eastman, President; Merritt D. Mosher, Vice President; Lawrence Hickson, Treasurer; Arthur F. Wright, Secretary; Floyd E. Wright, Rochester, N. Y., Corresponding Secretary.

Springfield (Mass.) Wireless Association.—A. C. Gravel, President; C. K. Seely, Vice President and Treasurer; D. W. Martenson, 323 King St., Springfield, Mass., Secretary.

Sacramento Wireless Signal Club.—F. Strader, President; L. C. Huber, Vice President; G. B. Vard, Treasurer; E. Ratcliffe, 2119 H St., Sacramento, Cal., Secretary.

Southern Wireless Association.—B. M. Oppenheim, President; J. Fishel, 1435 Henry Clay Ave., New Orleans, La., Secretary and Treasurer.

Tri-State Wireless Association.—C. B. DeLaHunt, President; O. F. Lyons, Vice President; T. J. Daily, Treasurer; C. T. Cowan, Memphis, Tenn., Secretary.

Westchester (N. Y.) Wireless Association.—Stanley R. Maning, President; E. D. Moorhouse, 37 W. Main St., Tarrytown, N. Y., Secretary.

Wireless Association of Montana.—Roy Tysel, President; Elliot Gillie, Vice President; Harold Satter, 309 S. Ohio St., Butte, Mont., Secretary.

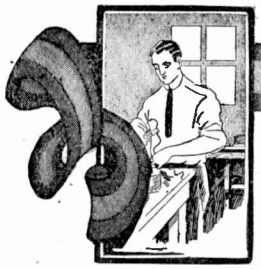
Wireless Club of Baltimore.—Harry Richards, President; William Pules, Vice President; Curtis Garret, Treasurer; Winters Jones, 728 N. Monroe St., Baltimore, Md., Secretary.

Waynesburg (Pa.) College Wireless Club.—C. W. Frietage, President; James D. Thomas, Chief Engineer; John Meighn, Waynesburg, College, Pa., Secretary.

Wireless Association of Easton, Pa.—W. Ballentine, President; John Q. Adams, Vice President; Weikel Jordan, Treasurer; E. J. Sortor, Recording Secretary; James Smith, Jr., 123 North Main St., Phillipsburg, N. J., Corresponding Secretary.

Wireless Association of British Columbia.—Clifford C. Watson, President; J. Arnott, Vice President; A. H. Mackay, Secretary; C. Roesterer, 1934 William St., Vancouver, B. C., Corresponding Secretary.

Wireless Association of Vancouver, B. C.—Cliff C. Watson, President; J. Arnott, Vice President; R. C. Bodie, Treasurer; A. H. Mackay, Secretary; C. Riesterer, 1934 William St., Vancouver, B. C., Corresponding Secretary.



For Practical Electrical Workers

Electrical Machine Foundations

By C. V. DAVIS

Foundations are necessary to support and maintain in alignment motors, generators and other electrical machines of any considerable size and are made of masonry. Brick or stone set in mortar (preferably cement mortar) will do, but concrete is almost universally used now, because it is the cheapest. A one-three-six mixture (one part cement, three parts crushed stone or gravel and six parts sand, all by volume) or even a one-three-seven mixture of concrete will give excellent results. Brick or stone for foundations can be set in a one part cement and three parts sand mortar.

The size of a foundation is determined by the size of the machine supported and by the stresses imposed by the machine. The area of the base of any foundation must be great enough so that its weight and the weight of the machine supported will not cause it to sink into the soil. The safe bearing power of soils is given in Table I.

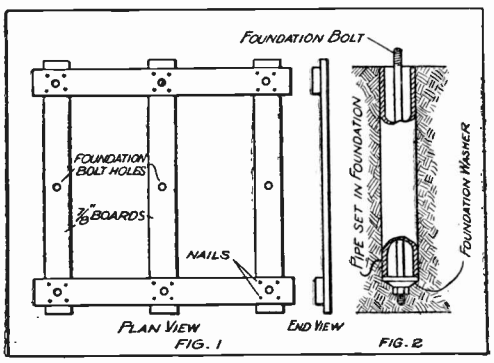
Where a machine is not subjected to any external forces; that is, where it is self-contained, the only requirement for the foundation, provided the machine does not vibrate excessively, is to keep it from sinking into the ground. The lightest possible foundation that will do this will be satisfactory.

Motor-generators and rotary converters do not require heavy foundations. Machines that are driven by, or that drive external apparatus require foundations heavy enough to resist the tendency of the external apparatus to tip or to displace the foundation. No rule can be given for determining the proper weight for a foundation in such a case. However, it is usually true with a solid foundation that if the foundation is large enough to include all of the foundation bolts of the machine and to extend to good bottom it is sufficiently heavy. Experience is required to enable one to design the lightest safe foundation that will do, so it is well for the beginner to be sure that a foundation is heavy enough.

TABLE I. SAFE BEARING POWER OF SOILS

SOIL	TONS PER SQ. FT.	AUTHORITY
Good, solid, natural earth	4.0	New York building laws
Pure clay, 15 ft. thick, no admixture of foreign substances except gravel	1.75	Chicago building ordinances
Dry sand, 15 ft. thick, no admixture of foreign substances	2.0	Chicago building ordinances
Clay and sand mixed	1.5	Chicago building ordinances
Hard rock on native bed	250.0	Richey
Ledge rock	36.0	"
Hard pan	8.0	"
Gravel	5.0	"
Clean sand	4.0	"
Dry clay	3.0	"
Wet clay	2.0	"
Loam	1.0	"

Foundations for machinery should be entirely distinct from those that support the building. Foundations themselves must be stable and care should be taken to so arrange them that vibrations, if there are any, will not be transmitted through the soil to parts of the building. Solid earth and rock transmit vibrations very well indeed, but a loose or sandy soil does not. Cushions are used under and around foundations where there is likelihood of vibrations being transmitted. Materials that can be used for



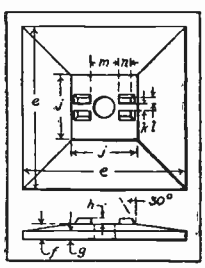
such cushions are asphalting, concrete, sand, mineral wool and hair felt. In arranging a foundation cushion the excavation is made about two feet wider, longer and deeper than is required for the foundation itself, and the cushioning material is used for filling in the extra space.

A template, Fig. 1, having holes in it corresponding to the holes in the bedplate of the machine to be supported is used for properly locating the holding-down bolts in the foundation. It is convenient to arrange the bolts in iron pipes, Fig. 2, having internal diameters somewhat greater than those of the bolts. This allows some play and permits the bedplate to be set over the bolts even if they have not been set quite accurately or if the holes in the bedplate are not quite accurately spaced. Bolts are sometimes cast solid in the foundation. Templates for foundation bolts can be made from 7/8 inch boards. The bolts are supported in the templet while the concrete is being poured. Fig. 1 is an example of a simple templet.

The templet is supported while the foundation is under construction by the wooden form for the foundation or by stakes driven into the ground for the purpose.

Foundation bolts are usually mild steel rods threaded for nuts on both ends and of such diameter that they will readily pass through the holes in the machine bedplate. For small machines, ordinary machine bolts will do. Bolts should always extend nearly to the bottom of the foundation as in Fig. 2.

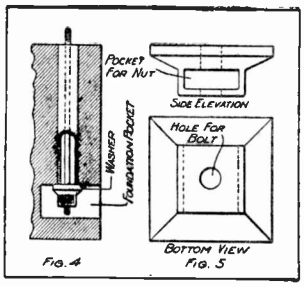
Foundation bolt washers are used on the lower end of the bolts to retain them in the foundations. Ordinary round building washers, pieces of steel plate with holes punched in their centers, pieces of angle iron or old rails are sometimes used for foundation washers. The form of cast iron washer shown in Fig. 3 is probably the best that can be used where a foundation is not pocketed. Table II shows the dimensions.



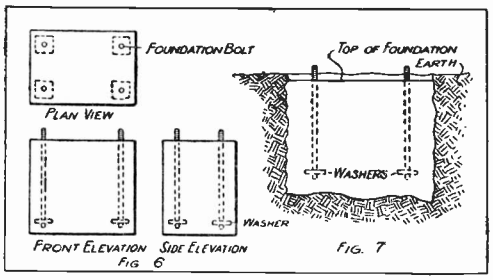
Foundation bolt pockets, Fig. 4, are provided in foundations where it is desirable to have the bolts removable. A pocket is a hole in the side of a foundation arranged so that the nut on the lower end of a foundation bolt can be reached. Ordinarily foundations are

TABLE II. DIMENSIONS OF FOUNDATION WASHERS

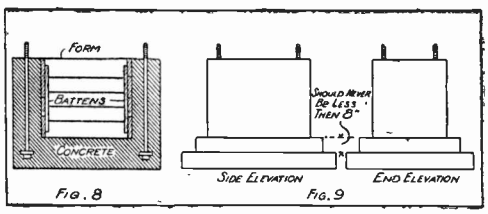
BOLT DIA.	HOLE	E	F	G	H	J	K	L	M	N
7/8	1 1/8	6	3/8	1/2	1/2	3 1/2	3/8	3/8	1 5/8	1/2
1	1 3/8	8	3/8	5/8	1/2	4 1/4	1/2	3/8	1 3/4	1/2
1 1/4	1 5/8	10	3/4	3/4	1/2	4 1/2	3/4	1/2	2 1/8	5/8
1 1/2	1 7/8	12	5/8	7/8	1/2	5 1/2	7/8	1/2	2 1/2	3/4
1 3/4	2 1/8	14	1/2	1	1/2	5 1/2	1	5/8	2 7/8	1
2	2 3/8	16	7/8	1 1/8	1/2	6	1	5/8	3 1/4	1 1/8
2 1/4	2 5/8	18	3/4	1 1/4	1/2	7	1 1/8	3/4	3 5/8	1 1/4
2 1/2	2 7/8	20	1	1	1/2	9	1 1/8	1	4	1 1/4



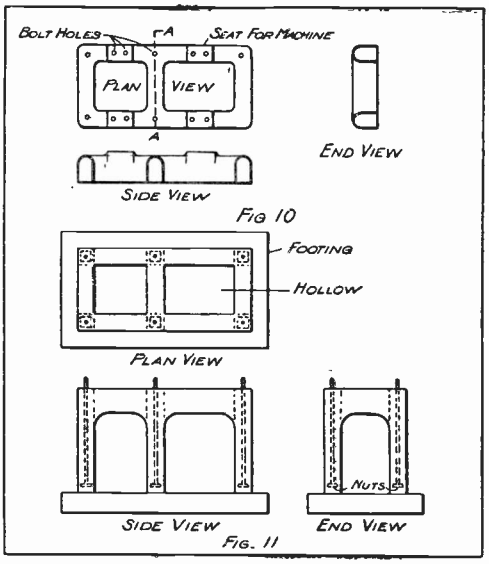
not pocketed. The bolts are usually cast in solid. If bolts are removable it is not necessary to raise the bedplate of a machine up over them to mount it as is necessary where bolts are cast in solid. Where bolts are removable the bedplate is shifted to position and then the bolts are dropped in through the bedplate holes and into the holes provided for them in the foundation. Washers similar to the one shown in Fig. 5 and having a pocket for the nut are preferable for pocketed foundations.



Where feasible a simple design like that shown in Fig. 6 should be made. The form for such a foundation consists of a substantial box having no bottom. Where the earth is self sustaining such a foundation can be made by throwing the concrete into a hole of proper proportions, Fig. 7. The sides of the

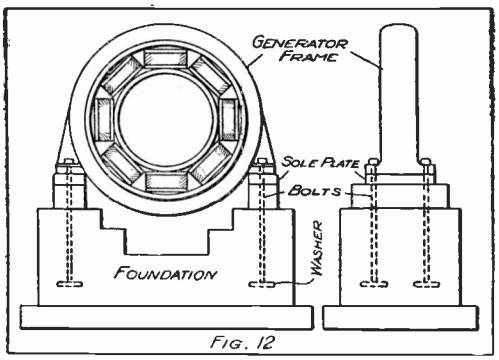


hole constitute the form. Foundations of this type can be used for machines that have solid bedplates; that is, for bedplates through which air for ventilating the machine is not expected to



pass. Where such a foundation if cast solid would be unnecessarily heavy, it can be hollowed out as suggested in Fig. 8.

Where considerable area of base is required a solid foundation can be made, as suggested in Fig. 9, with an extended footing. The footing may consist of one or more steps. No step should be less than eight inches thick. The rise and width of each step should be about equal.



Where machines have open bedplates similar to that shown in Fig. 10 provision should be made for ventilating the machine. Fig. 11 shows one type of ventilated foundation which is designed for the bedplate of Fig. 10. A foundation for an engine driven generator may be made as suggested in Fig. 12. This

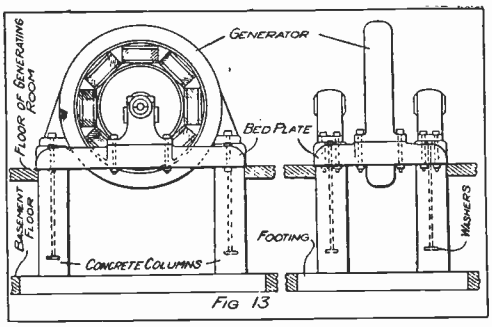


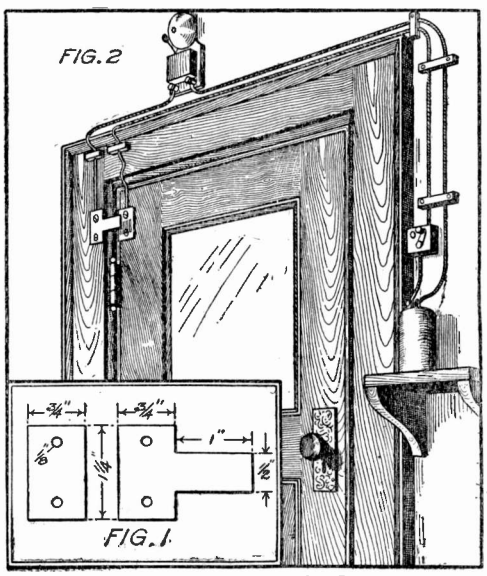
FIG 13

design affords ample ventilation. A machine with an open bedplate may be supported on foundation columns as indicated in Fig. 13, a design used for water wheel generators, but probably a design similar to that of Fig. 11 is better in that it provides a support under the entire bedplate. Undrained pits under machines should be avoided because they collect dirt and oil.

A machine not exceeding 65 horsepower in capacity may be supported by a framework of timber bolted to the floor or other support. Larger machines require masonry foundations.

Open Door Alarm

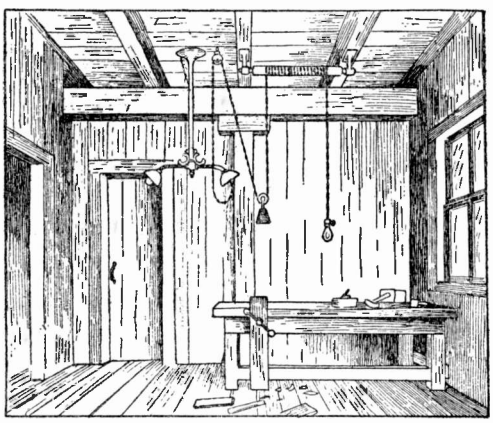
Secure a small piece of thin copper ¾ by 1¼ inches. Drill ⅛-inch holes in this as shown in Fig. 1, then fasten the piece of copper with small screws at the top of the door on the hinge side. When putting the top screw in, fasten the end of a short piece of bell wire under it. Now get a T-shaped piece of springy copper or brass of the dimensions shown in Fig. 1. Fasten this on the door frame, also securing under a screw a piece of bell wire. So place this last copper piece that it will touch the copper on the door when the door is open two or three inches. A bell, two dry cells, a single pole switch and enough bell wire to reach the location of the bell and battery and the alarm may be completed according to Fig. 2. CARROLL P. SCHMAND.



OPEN DOOR ALARM

Roller Lamp Cord Adjuster

A very convenient device for adjusting the height of an incandescent lamp


ROLLER LAMP CORD ADJUSTER

over a workbench, lathe, etc., may be made using a wooden roller at the ceiling.

Referring to the illustration, provide hangers at the ceiling for the roller. Using reinforced cord, wind enough around the roller to allow the desired up and down movement of the lamp. Fasten the cord to the roller at about the middle, using rubber and friction tape. Continue the winding of the cord about the roller providing a sufficient length to permit the suspension of a pulley and

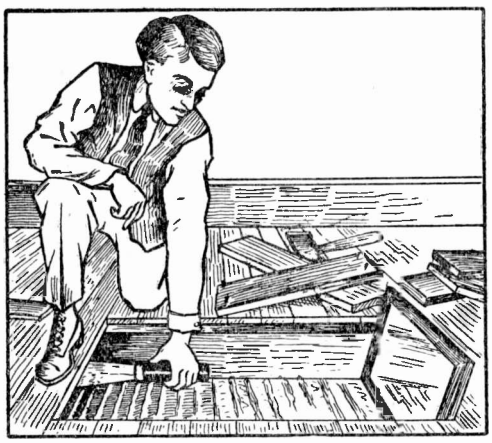
weight to counterbalance the lamp. From a ceiling rosette the cord with a plug may be connected to the nearest fixture.

A spring curtain roller may be used in place of the ordinary roller and the weight made only enough to keep the cord in slight tension.

F. F. SENGSTOCK.

Wireman Explores by Reflection

In wiring an old building or house where the wires must be "fished," the wireman often encounters some obstruction in the walls or ceiling. The method



EXPLORING BY REFLECTION

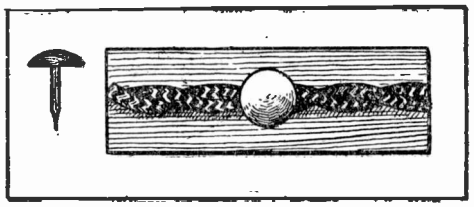
of exploring here illustrated, using a flashlight and mirror, I have found very serviceable, the hidden parts showing up in good shape in the mirror when lighted up by a strong flashlight.

CHAS. OLSSON.

Insulated Wiring Nail

An objection to the unsightliness of bell wiring is to some extent overcome by the Milonite insulated nail used in place of the old insulated staples.

This nail is manufactured with differently colored heads to match either the wire or wall and with nails and heads of various lengths and diameters to meet different conditions. The head is of a



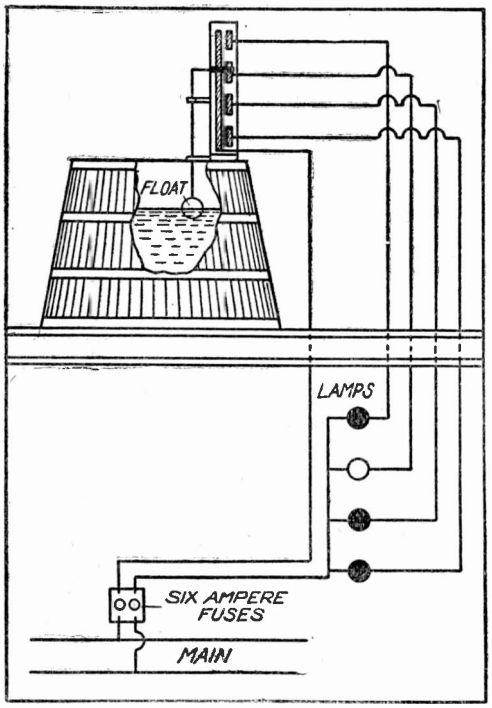
INSULATED WIRING NAIL

composition resembling hard rubber and the metal part is coated with enamel.

A Water Level Indicator

This plan for saving steps and telling the depth of the water in a tank on the roof of a building is a time saver.

The lamps are wired as shown and located in the engine room. Upon a slate slab on the tank is a row of four contacts and one long brass strip. Over this



ELECTRIC LIGHT INDICATOR

moves a copper slider controlled by guides and fastened by a rod to a ball float in the water. As the water rises and falls the slider moves up and down lighting the proper lamp to show the water level.

Safe Electric Wiring

A few years ago and even now when a building burns and no apparent cause for the fire can be found, it is a very general custom to say, "defective electric wiring," and let it pass. While there are undoubtedly some fires caused by careless electric wiring, there are still many fires which certainly are due to other causes than defective wiring. In fact, the accounts of some of these attempts to blame electricity are really absurd. Vague reasons, such as "rats gnawing on wires" are advanced and accepted.

Just or unjust as some of these accounts may be, one lasting benefit has resulted. This is the safeguarding of all electric wiring. Some readers may have wondered why the words "Underwriters inspected or approved," or some such phrase, is so conspicuously placed on familiar electrical apparatus and accessories. It means that the material or instrument has been tested out by the Underwriters' Laboratories and that it complies with the Code requirements. This standardization of materials and parts makes for the safety of electric wiring. But safe materials in unsafe or inexperienced hands would be a poor combination, so a still further precaution is taken. Electricians who do this work are in many cases licensed and the work is checked up by inspectors as a final precaution. Electrical inspection is very rigidly enforced in large cities and towns, while its severity is lessened elsewhere, there being no inspection except by the lighting company in many small towns.

The installing electrician's work has reached a point where it may be classed as an art. With modern methods and skill the electrician can wire an old house with concealed safe wiring using such simple tools as a brace and bit and a "snake." This last is a long wire or ribbon for "fishing" the wire through between the walls or above the ceiling. The electrician works without causing any "muss" and scarcely needs to tear up more than a few boards. Of course, it would be unsafe to use ordinary wire alone in this particular class of wiring, so a convenient flexible secondary coating called "loom" is employed. Another material is often used in spite of the greater expense. This last is a steel armored flexible cable. Special care is taken by the skilled electrician to properly join and insulate the connections and various types of metallic outlet boxes and similar fireproof parts are employed.

Ordinary house wiring is doubly protected by fuses. At the main or service box where the wires enter the building fuses slightly heavier than necessary to carry the current are used and the branch circuits to which the lights are connected are protected by six ampere fuses. The wire used is No. 14 for the branch circuits, as this is the smallest allowed by the Code for safety and mechanical strength except in fixtures or as drop light cord.

At the fixture either No. 16 or No. 18 rubber covered wire is used. If the fixture is attached to gas piping an insulating joint is provided so that should the wire within the fixture become defective, it may touch the fixture metal without being grounded. The small space in the fixture makes it difficult to properly place even the special small wire, and this is particularly the case when multiple fixtures are wired, that is, fixtures carrying a group of lights.

The man who does fixture wiring must use much care in the work. The method employed in wiring a fixture is generally a modification of the one employed in ordinary concealed wiring. The fixture wire is bent into a loop and pulled through the fixture with a miniature "snake." In a large part of these fixtures the space left for the wires is very small. The wire can barely be forced through some of them.

But accidents do happen. These are sometimes caused by the fixture being poorly constructed or installed in a loose manner. If a fixture is loose and free

to move about even a little each time it is used, as when a person turns the key of the socket or pulls the switch, the slight movement causes the wire in the fixture to move about. Repeated operations will soon cause the wire in the fixture to fray and the insulation will wear off. The result is perhaps a short circuit in the fixture, which results, however, in nothing more serious than a blown fuse. The usual place of wear is at the point where the socket is joined to the rest of the fixture. If the socket is left loose, it will turn and twist the wires about.

The most modern method of installing wiring in buildings under construction is to place the wiring in metal pipe or conduit. This form of installation can be placed in reinforced concrete and left firmly embedded. Outlets are provided where desired and the wires are pulled in after the rough work about the building is finished. Wiring thus installed is well protected, and even though a short circuit occur, there is little chance of it doing any damage. However, there must and always will be exposed wires to a certain extent from outlets to various electrical devices.

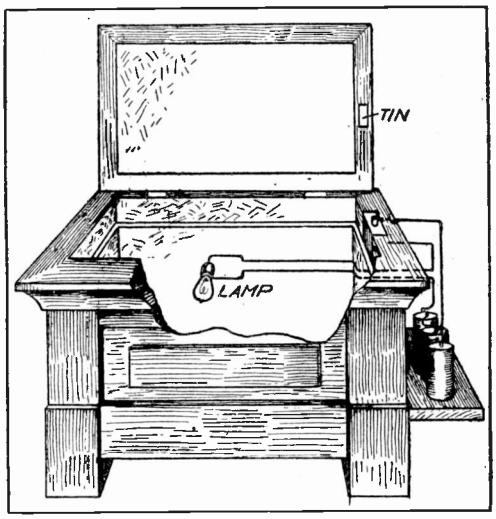
It would seem that a building wired with conduit would receive special low insurance rates, but the fact is that higher rates are brought to bear only when the wiring is not in accordance with the Code rules whether it be open work or conduit. From the standpoint of fire, however, the building with standard wiring using electricity exclusively for light and power is considered a good risk.

The system of licenses for electricians and the inspection of work is undoubtedly a good one. There are, to be sure, a few disagreeable features about such a plan. A certain inspector may have a particular dislike for a certain individual or firm and by reason of his position he can cause them a good deal of trouble if he refuses to put his O.K. on work with promptness. There have been cases in which this has been done in a spiteful manner upon petty unimportant grounds, but generally the inspector is fair and efficient, and exercises "horse sense." The inspector who does this is welcomed by both building owner and honest contractor. PHILIP EDELMAN.

Lighting the Refrigerator

In homes where the old fashioned type of refrigerator having a lid instead of a door is used the refrigerator is often in such a position that not enough light enters the box when the lid is raised.

The illustration shows a very simple arrangement by which this difficulty may



REFRIGERATOR LAMP

be overcome. A door switch costing only a few cents, a shelf to hold three dry batteries, a four volt lamp and about eight feet of rubber covered wire is all that is needed.

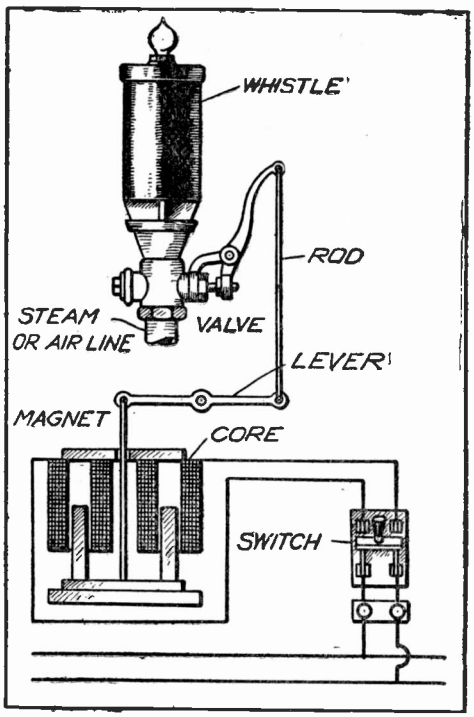
With drill and chisel make an opening in the edge of the box large enough to accommodate the switch. On the lid directly over the switch tack a strip of tin to keep the button from wearing the wood. After fastening the wires to the switch run them through a small hole in the wall of the refrigerator.

Connect to batteries and then to the lamp which is firmly secured on the back

wall of the refrigerator. The weight of the lid presses the button down and opens the circuit. Lifting the lid allows the switch to close the circuit and light the lamp. STANLEY HELVERSON.

Blowing the Whistle

Where hundreds of employees are at work in a factory it is quite necessary that the whistle blow on time.



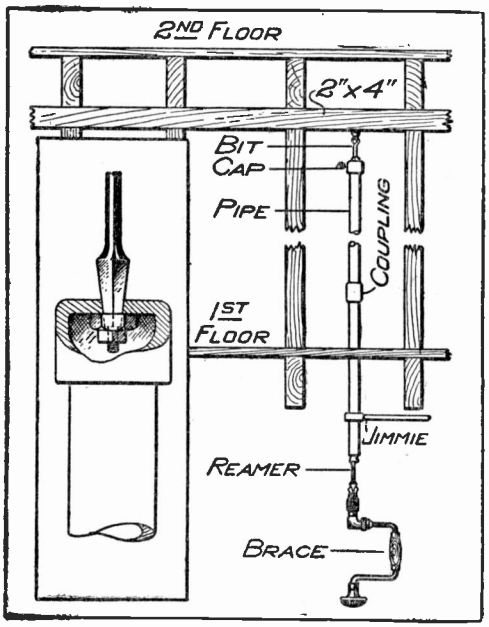
ELECTRIC WHISTLE BLOWER

The ingenious device here described enables the regular timekeeper to operate the whistle from his office by simply throwing an electric switch. The diagram showing the arrangement of the switch, magnet coils, soft iron plungers, bell crank and rod is practically self explanatory. When the switch is closed the magnet cores are pulled up, which movement through the bell crank opens the valve to the whistle. When the switch is opened the weight of the soft iron cores is sufficient to close the valve.

H. G. WILSON.

A Difficult Drilling Job

While installing a piece of conduit for electric wires in an old house I found that up in the partition through which



AN EXTENSION DRILL

the conduit had to pass from the basement was a two-by-four. The scheme used to drill through is here shown.

A one-inch cap was drilled and filed out square at one end to fit the shank of an expansion bit. The bit was turned down for a length of ½ inch and threaded. A nut that will slip over the threaded part was put on and then a properly fitted nut was turned on to hold the bit in the cap. A piece of one-inch pipe five feet long, a coupling and a short piece of pipe were provided. The cap which was threaded was screwed onto the end of the threaded pipe which was then lengthened by screwing the short piece into the coupling at the lower end. To do the drilling a reamer was placed in a brace, and held in the lower end of the pipe, and one side of the ratchet loosened so that the brace would not turn, the pipe being turned with jimmies.

EDGAR C. ARNOLD.

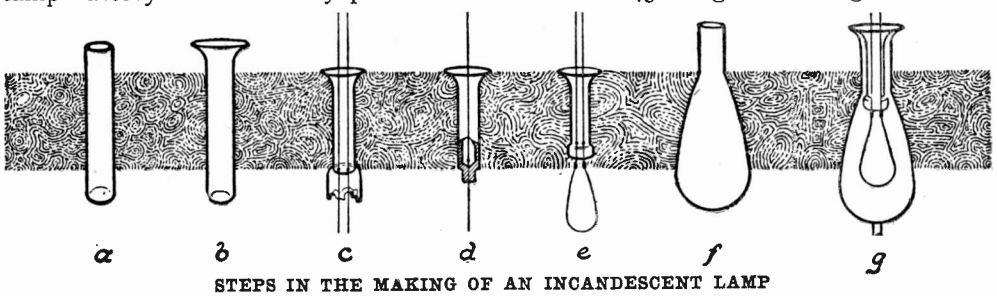
Making an Incandescent Lamp

By ALBERT A. SOMERVILLE

Being given all the needed materials, one skilled glass blower could probably complete a lamp in 30 minutes or an hour.

Ten girls, each being able to do but one small part of the whole process, can, by working together, finish about 100 lamps an hour. This is system and co-operation. Therein lie the profits.

A stranger can go through a small lamp factory and see every part of the process carried on in making a lamp, in less time than is needed to describe it afterwards. Twenty minutes is ample time to see the complete evolution from glass rods, bulbs, paste, platinum and copper wires, carbon or metallic filaments, solder and brass bases to finished lamps. On the other hand, interest in some simple little operation may hold one's attention for hours.



STEPS IN THE MAKING OF AN INCANDESCENT LAMP

For the first part, the glass is to be had in the shape of tubes several feet in length and about one-fourth inch internal diameter with walls less than one-sixteenth of an inch in thickness. This is to be cut into pieces 1¾ inches long. It is done on a high speed emery wheel, just barely touching the glass rod to the wheel thereby making a scratch, and the jar on making contact is insufficient to cause the end of the rod to drop off. The glass rod is then moved along just the right distance to make the next cut and so on almost as fast as one can count.

These short glass tubes as in (a) are now started through a round of operations, the first of which is flaring one of the ends. This is done by heating the glass in a gas flame and rotating the glass slowly but constantly so that it will be heated evenly, until it is plastic when the proper shaped iron tool is pressed against the end of the glass, causing it to flare out as in (b).

The temperature at which this occurs is about 450 degrees Centigrade. The gas flame is from a blast lamp. The added pressure of air used to make the blast makes the flame much hotter than an ordinary gas flame and also enables the operator to concentrate the flame to a small point.

A rotating wheel carries several of these short pieces of glass tube on its circumference. The large wheel rotates slowly and each piece goes through a cycle of operations as the large wheel rotates. First the tube is brought into the preliminary warming flame to prevent cracking the glass, then it is carried around to the hotter flame and then to the punch which flares the end of the glass. The girl operator simply places the tubes in position on the wheel and rotates it by hand, operating the punch at the proper time and removing the flared piece of glass when it gets around to her, which interval of time is sufficient to allow it to cool.

In the meanwhile another girl has been fusing copper lead wires onto short pieces of platinum. The platinum is

very expensive but since that is the only metal which has the same coefficient of expansion as glass it must be used where a metal is sealed into glass or alternate heating and cooling will cause the glass to crack. Due to its cost only a short piece of platinum is used.

A girl takes a bundle of probably 100 copper wires about three inches long in one hand, and with a pair of pincers in the other hand picks up a piece of platinum half an inch in length holding it in a small flame which quickly brings it to a red heat that will not melt it and then bringing the bundle of copper wires near the flame catches the tip of one of them with the red hot platinum which conducts enough heat to the copper to melt it and fuse it about the platinum. She completes the operation in two seconds' time.

Two of these platinum tipped copper leads are now inserted in one of the flared glass tubes which is rotated on a wheel through a gas flame until the end of the glass tube is soft enough to be squeezed together on the platinum tips, thereby sealing them into the glass. A pair of vise-like pliers close on the end of the glass, making a perfect seal. Two views of the wires sealed into the glass tube are shown by (c) and (d).

If carbon filaments are used they are pasted onto the platinum wires with an adhesive material made of graphite mixed with some binding agent such as fire clay. The filament may be made by squirting the plastic material through a small hole by means of a high pressure and then bending the filaments into shape before they harden.

In order that the lamp may have a certain candle power, say 32 or 16, and be used on a 110 volt circuit, the filament must have such a resistance that just enough current will flow to give the necessary temperature upon which candle power is greatly dependent. Ordinarily the resistance of the filament is made too high as it can be decreased easier than it can be increased. When connected as in (e) it is placed in a bottle or enclosure containing an illuminating gas rich in hydrocarbons. Current is turned on to heat the filament and when it is heated, carbon from the gas is deposited which reduces the resistance of the filament. This allows the current to increase gradusally and when it reaches a certain value it automatically throws a circuit breaker, the resistance of the filament at that time being the proper value. This is called "flashing" the filament. The filament is now ready to insert in the bulb.

The bulb (f), however, is perfectly smooth and must be worked upon first. A hole must be blown in that round end of the bulb and a small tube sealed on so that the bulb may later be exhausted or evacuated. The neck of the bulb is inserted into a rubber stopper which connects to air pressure which blows a hole in the base when the tip of a flame is brought to bear on the spot. At the same time a very small glass tube about two inches long has been heated in another flame. This tube is quickly brought over the hole down in the bulb and sealed on.

The top or neck of this bulb is also slightly flared out by the same process as shown in (b).

The filament mounted as in (e) is now inserted in the bulb as in (g) and a flame plays on the neck of the same until the two pieces of glass are completely sealed together and a slight neck is left to go into the brass base.

The air is then pumped out of the bulb, connection to the exhaust pump being made by means of the small tube sealed on at the bottom for this purpose. A manometer or "U" tube closed at one end and nearly full of mercury shows when the pressure in the bulb is nearly zero. A small flame then softens the small tube close to the bulb and the outside air pressure acts to cave in the walls of the tube and so seal it, after which the other end of the tube may be pulled off, leaving simply a short sharp tit on the end of the bulb.

It is then necessary to ascertain whether or not good work has been done in making the three seals necessary in the glass and if these are air tight. If air is leaking into the bulb it can be shown by a high voltage test. A bunch of the lamps may be laid on a table forming one terminal of a high voltage induction coil and if a metal plate connected to the other terminal is brought over or near the lamps, those into which air is leaking will show it by lighting up similar to tubes used for partial vacuum lighting. These lamps are thrown out as they would blacken and the filament soon break or burn out. Those that do not light up when this test is applied are presumably good.

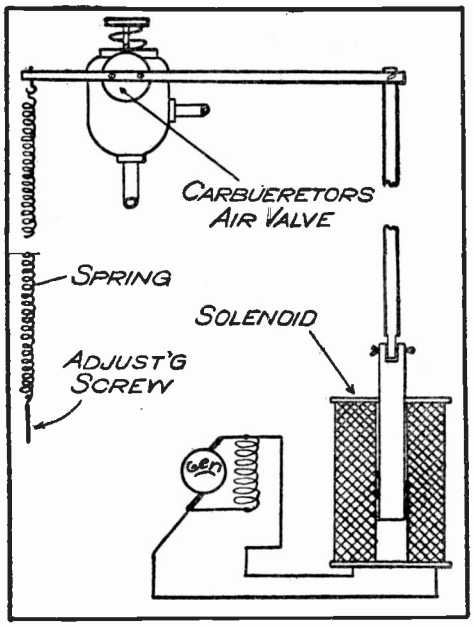
Asbestos or mineral wool is then pushed in between the lead wires to prevent short circuiting and a brass screw base connected to the wires by soldering. The two parts of the base are insulated from each other and fastened firmly to the glass bulb with cement made principally of plaster of Paris.

They are now complete and a certain proportion of them are "photometered." That is, the candlepower is measured when they are run at the voltage at which they are to be used. A Bunson photometer is used as it is considered accurate enough for commercial work. The process consists of comparing a lamp with a standard lamp, the candle power of which is known. A screen of greased paper is moved between the two lamps until a balance of light is obtained on the two sides of the screen. The position of the screen then enables one to determine the candle power of the new or unknown lamp. A scale may be placed on the sliding bar of the photometer so that the variation of the lamp from the intended candle power may be read directly in percentage.

If we take a lot consisting of 100 lamps made to give sixteen candle power, the average deviation will probably be not more than two per cent, and the maximum deviation not over six per cent.

Novel Voltage Regulator

It is a well known fact that lights supplied by gasoline engine driven generators, unless the prime mover has been especially built for that service, are often



VOLTAGE REGULATOR

subject to bad flickering due to unsteady speed. The writer hit upon the following happy expedient:

A solenoid consisting of 1,000 turns of No. 34 single cotton covered wire was wound on a brass tube with fibre ends and working loosely in this was placed a rod of soft iron. This was in turn connected as shown to the engine's air inlet valve. Its operation may be described as follows:

When the voltage begins to decrease the solenoid exerts a weaker pull on the rod and the spring is thus enabled to pull it up slightly and thus partly throttle the air supplied to the carburetor. This results in a richer mixture which in turn increases the speed and raises the voltage. The device though a very simple one has been found in practice to serve its purpose admirably.

L. H. HARDIN.

NEW BOOKS

PRACTICAL APPLIED ELECTRICITY. By David Penn Moreton. Chicago: The Reilly and Britton Company. 1911. 414 pages with 323 illustrations. Regular edition, $2.00. Workers' pocket edition, $2.50.

A book intended primarily for those who are desirous of obtaining a practical knowledge of electricity but are unable to take a course in electrical engineering. Numerous examples illustrate the application of laws and principles. Various subjects are quite exhaustively treated giving the reader plain up-to-date information.

SIMPLE SOLDERING BOTH HARD AND SOFT. By Edward Thatcher. New York: Spon and Chamberlain. 1910. 76 pages with 52 illustrations.

The author states that there are many books written on the "why" of soldering processes, but that more might be written of "how." The object of this book is to tell as clearly as possible how to obtain the best results on various kinds of work.

ELECTRICAL IGNITION. By M. A. Codd. New York: Spon and Chamberlain. 1911. 161 pages with 109 illustrations. Price, $1.25.

This book is offered as a working manual for automobile drivers and owners and is not put forward as a technical treatise on the theory of ignition apparatus.

ELECTRICAL TRADES DIRECTORY AND HANDBOOK. London (Salisbury Court and Fleet Street): Electrician Printing and Publishing Company. 1912. Price, $3.60 (plus 84 cents postage to the United States).

This book contains the names and addresses of electrical manufacturing concerns and allied industries in England and her colonies, Europe, United States, South American republics, Africa, Japan and the far East.

THE COPPER HANDBOOK. VOL. X. By Horace J. Stevens. Houghton, Mich.: Horace J. Stevens. 1911. 1902 pages. Price, $5.00 cloth, $7.50 full library morocco.

This is considered standard authority on the subject of copper and copper mines of the entire world; lists and describes 8,130 copper mines and copper mining companies; chapters also on the history, chemistry, mineralogy, metallurgy, brands and grades, alloys and substitutes for copper.

THE BOY'S LIFE OF EDISON. By William H. Meadowcroft. New York: Harper & Brothers. 1911. 326 pages with eight illustrations. Price, $1.25.

This story of the life of the great wizard of science will fascinate the imagination of every boy. The author has been connected with Mr. Edison and his work for nearly 31 years and is at present his assistant. The story is thus largely biography, the material having been obtained a little at a time from the inventor's own narratives and reminiscences. It is written in simple language—intensely interesting from start to finish.

WESTINGHOUSE AIR BRAKE SYSTEM. Chicago: Frederick J. Drake and Company. 1911. 472 pages with 147 illustrations. Price, $2.00.

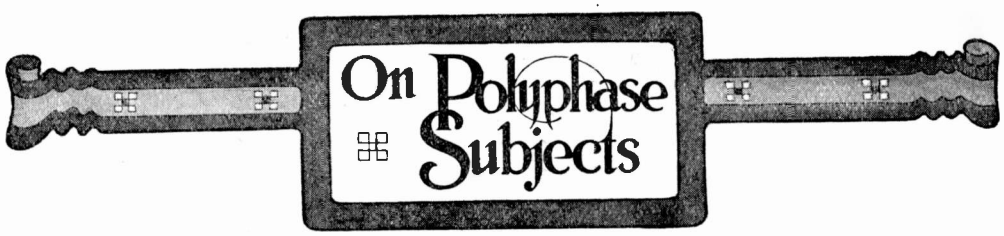
This treatise is the joint work of several air brake experts and contains also material provided by the Air Brake Association. The book aims to enable the student to familiarize himself not only with the older forms of the Westinghouse air brake system but also with the latest improvements. Questions and answers follow each subject.

NEW YORK AIR BRAKE SYSTEM. Chicago: Frederick J. Drake and Company. 1911. 374 pages with 160 illustrations. Price $2.00.

This book is put forth as a plain and practical work on the construction and operation of the New York air brake, treating the subject in detail. The joint authors are men in railroad and allied work. Each subject is followed by a condensed catechism.

THE LAW OF THE AIR. By Harold D. Hazeltine. London: University of London Press (New York: George H. Doran Company). 1911. 152 pages. Price, $1.50.

This work consists of three lectures delivered by the author in December, 1910, at Kings College, University of London, and dealing with the problems of national and international law relating to the air space.



Compulsory Electric Lighting

Just as compulsory education is filling schools with those whose parents are too ignorant to send them voluntarily, and just as sanitary regulations are decreasing the death rates in our larger cities, so the future may bring legal enactments for helping those to the beauty and safety of electric lighting who have not yet learned how to appreciate its advantages. The pioneer in this regard seems to be the little town of Stockfeld, a suburb of the venerable city of Strasburg in Germany, which already has these regulations in Paragraph VI of its Municipal Code:

"1. In every dwelling the kitchen and at least two or three other rooms must be lighted electrically.

"2. The installing of gas lights in dwellings is hereby prohibited."

Evidently the councilmen of Stockfeld want it to be a model of progressiveness.

Line Material Destroyed by Atmospheric Fumes

Special all-copper socket shells and line parts have been required in installing the new street lighting system at Mineral Point, Wis., where the presence of a large zinc smelter produces fumes which rapidly destroy any brass part exposed to the weather. Twenty-five tungsten standard fixtures and 134 single lamps are now being placed for the public lighting, all-copper sockets being specified for all of this work. Porch lamps on houses are similarly affected by the zinc fumes, although the receptacles indoors appear to suffer less severely than those exposed to the outer air.

Dummy Meters

At a recent electrical gathering in Chicago one of the gentlemen present told a story about an experience he had in Boston some years ago while selling meters. One day a typical New England Yankee from a small town came in and said he wanted 25 watt-hour meters. A price of $11.50 each was quoted, but the visitor said that he did not want to pay more than $3 each and that he wanted only the outside case and the dial, the interior mechanism being superfluous. In answer to a further question the caller said that he furnished electric light in his town at a flat rate, but he wanted to put the dummy meters in because of their moral effect in preventing his customers from burning their lamps all night long.

Not a Moment Lost in Long Distance Calls

If you wish to talk by telephone from Chicago to New York, or over any other very long line, and call for a certain person in the distant city, the operator does not call for the party over the telephone. The telephone equipment for such long distance conversation is exceedingly costly and it must be continually loaded with actual conversation. Instead, she telegraphs your order to the distant operator over the telephone line, other people holding regular conversation over it at the same time. When the called party is ready to be connected the distant operator telegraphs that information to the first operator, saying use line No. —. Then the line, which, up to that point has been giving telephone service to others, is thrown open to you.

Walter Kelly, who does the "Virginia Judge" in vaudeville, was walking up the Strand with an English friend, and he remarked on the darkness that enveloped that famous street after nine p. m.

"Why," he said, "Broadway until after midnight is as bright as noonday. There is one sign alone that contains more than 50,000 winking, blazing, electric lights."

"But tell me, old chap," said the Englishman, "doesn't that make it frightfully conspicuous?"

* * *

A fresh young recruit from the woods broke into fast company in the middle of last season and in his very first game was called upon to face Napoleon Lajoie, the great Cleveland slugger.

As the mighty Napoleon advanced to the bat the new man glanced about desperately and his eye fell on Umpire Bill Evans, who has a kind and gentle face.

"Mr. Evans," said the scared young pitcher, "this is my first game in the big league and I don't want to be beaten too badly. Please tell me what sort of a ball I ought to throw to Mr. Lajoie."

"Son," said Evans, "my advice to you is this: Say the Lord's Prayer, put the ball straight over the plate—and fall on your face!"

* * *

In China when the subscriber rings up the exchange, the operator may be expected to ask:

"What number does the honorable son of the Moon and Stars desire?"

"Hohi, two—three."

Silence. Then the exchange resumes.

"Will the honorable person graciously forgive the inadequacy of the insignificant service and permit this humble slave of the wire to inform him that the never-to-be sufficiently-censured line is busy."

* * *

Anxious Old Lady: "I say, my good man, is this boat going up or down?"

Deckhand: "Well, she's a leaky old tub, mum, so I shouldn't wonder if she was going down. But then, again, her b'ilers ain't none too good, so she might go up."

* * *

"Why are you so sore on that eminent millionaire? He has done some good things."

"I was one of them."

Hubert Latham, the Antoinette flyer, was talking at a tea to a pretty California girl.

"Mr. Latham," said the girl, as she took her nineteenth walnut-and-lettuce sandwich, "tell me, does flying require any particular application?"

"Well, no, none in particular," Mr. Latham answered. "Arnica or horse liniment—one's as good as another."

* * *

"You didn't land your job as janitor in the city hall?"

"No."

"Why not?"

"Civil service examination."

"Did that let you out?"

"Yes; the other fellow knew how many moons Jupiter had."

* * *

The professor of internal medicine was quizzing his class. Singling out a somnolent student in the rear of the room, he addressed a question to him. Confused, the student rose, and bent his ear to catch the stage whispers of his friends seated about him.

"Well, you ought to be able to answer," snapped the professor, "with all the aid you are receiving back there!"

"Professor," came the quick reply, "I could, but there's a difference of opinion back here."

* * *

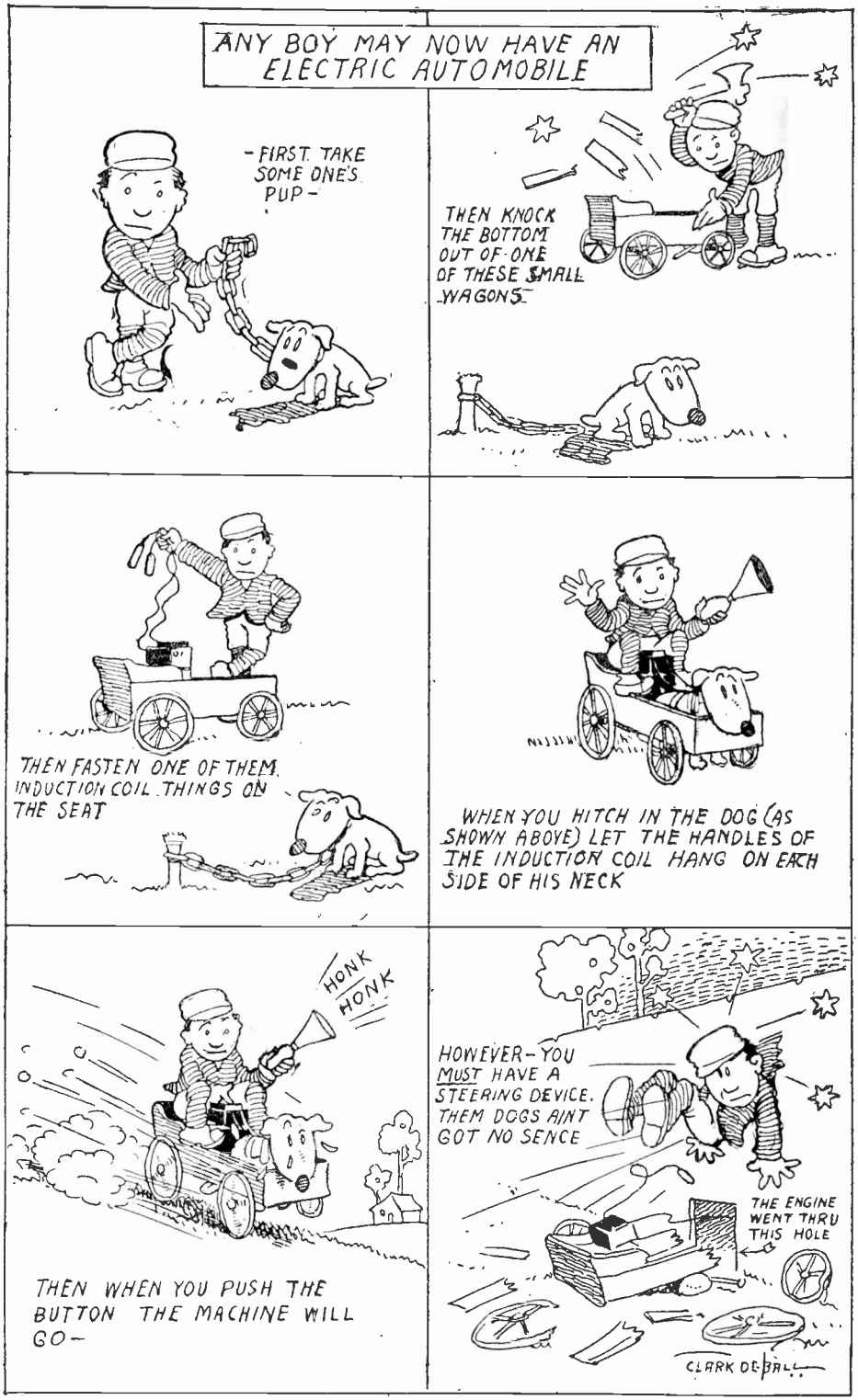
Marshall P. Wilder's little daughter came into the house the other day in great excitement, saying there was a lion in the backyard. Her mother chided her, saying, "You know that isn't true, Grace; now go right upstairs, and say a nice little prayer, and ask God to forgive you for telling such a story." When she came back Marshall asked her if she had done as her mother told her to. The four-year-old answered: "Yes, daddy; I talked to God about it and He said, 'That's all right, little girl. I thought it was a lion myself when I first looked at it.'"

* * *

The rebellious angels had just been cast out of heaven. In the swift downward flight Lucifer overtook Beelzebub.

"What's troubling you, Bub?" he called.

"An old problem," answered the future foul fiend, between somersaults: "Where are we going this fall?"


ANY BOY MAY NOW HAVE AN ELECTRIC AUTOMOBILE
- FIRST TAKE SOME ONE'S PUP -
THEN KNOCK THE BOTTOM OUT OF ONE OF THESE SMALL WAGONS
THEN FASTEN ONE OF THEM INDUCTION COIL THINGS ON THE SEAT
WHEN YOU HITCH IN THE DOG (AS SHOWN ABOVE) LET THE HANDLES OF THE INDUCTION COIL HANG ON EACH SIDE OF HIS NECK
HONK HONK
THEN WHEN YOU PUSH THE BUTTON THE MACHINE WILL GO -
HOWEVER - YOU MUST HAVE A STEERING DEVICE. THEM DOGS AINT GOT NO SENCE
THE ENGINE WENT THRU THIS HOLE
CLARK DE BALL

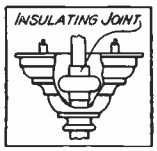
Common Electrical Terms Defined

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

INSTALLATION.—Used to refer to a complete electrical equipment from generator to lights and motors.

INSULATING TAPE.—Cotton or other material saturated with any insulating compound. Used to wrap joints in wires.

INSULATING JOINT.—A coupling of insulating material to place between an electric light fixture and the gas piping or metal work to which the fixture is attached. (See cut.)



Insulating Joint

INSULATOR. — In electricity any non-conducting material such as glass or porcelain. Applied also to the glass or porcelain supports carrying the wires on the crossarms of a pole line.

INTERIOR CONDUIT.—The system of metal piping in a building into which the electric wires are drawn and outlets provided where current is required for light or power.

INTENSITY OF MAGNETIC FIELD.—Having reference to the number of lines of force per unit area.

INTERNAL CHARACTERISTIC.—See Characteristic Internal.

INTERNAL RESISTANCE.—The resistance of a battery or of a dynamo as separate from the resistance of the outside circuit.

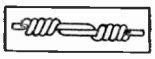
IRONCLAD DYNAMO.—A dynamo in which the metal of the frame encloses the field coils and armature. Motors thus arranged are called enclosed motors.

IRONCLAD MAGNET.—A magnet having its core and coil surrounded by an iron casing. This casing acts as a path for the lines of force from the north to the south poles of the core.

I. W. G.—An abbreviation for Indian wire gauge use in British India.

JABLOCHKOFF CANDLE.—An arc lamp used in France at one time, in which the two carbon rods are placed parallel to each other with a noncombustible insulating material between. A little piece of carbon placed across the top serves to start the arc after which it will burn to the holders. To keep the carbons of the same length the candle must be used on alternating current.

JOINT.—The point at which two wires or cables are joined by twisting or otherwise fastening the wires together. The ordinary twist joint is shown in the cut.


Twist Joint

JOULE.—The unit of electrical energy or work. It is equal to .73734 foot pound.

JUMPER.—A piece of wire conductor used to connect around a break in a circuit.

JUNCTION BOX.—An iron casing or box in a distributing system where mains enter and are tapped for branch circuits or feeders.

K. W.—A contraction for kilowatt.

KATHODE.—The terminal by which an electrolyzing current leaves the solution. In a primary cell the terminal connected to the zinc plate.

KEEPER.—A bar of soft iron placed across the poles of a horseshoe magnet or across the ends of two bar magnets laid side by side with their opposite poles adjacent but not touching. The object of the keeper is to prevent the loss of magnetism, the lines of force traveling from the positive pole to the negative through it.

KEY SOCKET.—A term applied to the ordinary brass shell socket having a key to turn the current on and off as distinguished from the keyless socket.

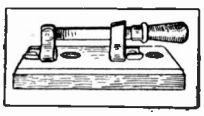
KICKING COIL.—See Choking Coil.

KILOVOLT AMPERES.—The product of kilovolts times amperes. Used to refer to high voltage alternating current systems.

KILOWATT.—One thousand watts. It is equal to 1.34 horsepower.

KILOWATT HOUR.—One thousand watts of energy supplied for one hour.

KNIFE SWITCH.—A switch with a narrow bar of copper on a hinge arranged to close an electric circuit by being thrown edgewise between two spring clips connected to one terminal of the circuit, the hinge being connected to the other terminal. (See cut.)


Knife Switch

LEADS.—Commonly used to refer to conductors connected to a dynamo, motor or other electrical device.

LEAD WIRES.—Applied to the wires which conduct the current into and out of an incandescent lamp. Also used to refer to the wires from the antenna of a wireless station which run into the building to the instruments.

LEYDEN JAR.—A glass jar having tinfoil pasted on its lower part both inside and out. Through a wooden or rubber stopper in the mouth of the jar a rod with a metal chain on the end makes contact with the inner tinfoil coat. The rod carries a brass ball or knob on the top. The two coats are charged with opposite kinds of electricity when in service, and discharged by bringing the two coatings into electrical connection.

The Greatest Florida Book

Ever Written—Yours for the Asking

If you want to know just why thousands upon thousands are flocking to Florida—if you want to know just what has turned the tide of capital and labor to this state—if you want to know ALL about Florida and the great Ocala Palatka Colony, where for 17 cents a day you may own a farm home worth $5,000 a year—write today—now—for this great book, "Ten Acres and Freedom"—the greatest piece of literature written about Florida.

The Evolution of a Ten Acre Colony Farm

These are not pen pictures—but actual every day scenes. The first and second are the same day in Michigan and Florida—March 10th, 1910. The next—a colonist's cozy bungalow.—Eating oranges fresh from the trees—prize potatoes raised by a colonist. Look well into these pictures—certainly here is the charm of the pleasure resort closely bound with the ability to earn an independent living.

This Great Book Tells You Everything You Want to Know About FLORIDA

CHARLES H. SIEG
The Pioneer Florida Small Farm Man

It tells you (and furnishes the proof directly from this great colony) of the enormous profits of a single acre of this land which is startling the whole world. The "fact stories" it gives you about the wonderful climate and rainfall of the limitless opportunities will astonish you—convince you at once that *here is the place for you to make your home.*

This great book tells all about Chas. H. Sieg, the man who is directly responsible for this great Florida land rush. It tells all about his great colony and its hundreds of model little truck and fruit farms—how the people here are becoming wealthy and independent—just as you can do. It gives actual photos of their farms and homes. And, besides, these people tell you *in their own words just how they have succeeded*—the most interesting and inspiring stories you have ever read.

In this great book, you will also learn all about how these new settlers carried away 10 first premiums on their products at the Marion County fair. It explains about the vast amount of money that is being expended in developing and building up this colony—it tells about the new million dollar railroad which runs directly through these colony farms.

Here in the great Ocala Palatka colony, you have the finest of roads—unequaled rail and water transportation—a most delightful climate, schools, churches, daily papers, rural mail routes, local and long distance phones—just an ideal community with the charm of the pleasure resort closely bound with the ability to earn an independent living as long as you live.

A thousand families are here on their colony farms now—five new towns have been established—merchants with well stocked stores are here—everywhere you see cozy bungalows, everywhere you see growing fields.

Learn the truth about Florida—learn of the opportunities here for YOU. Sign, detach and mail coupon at once.

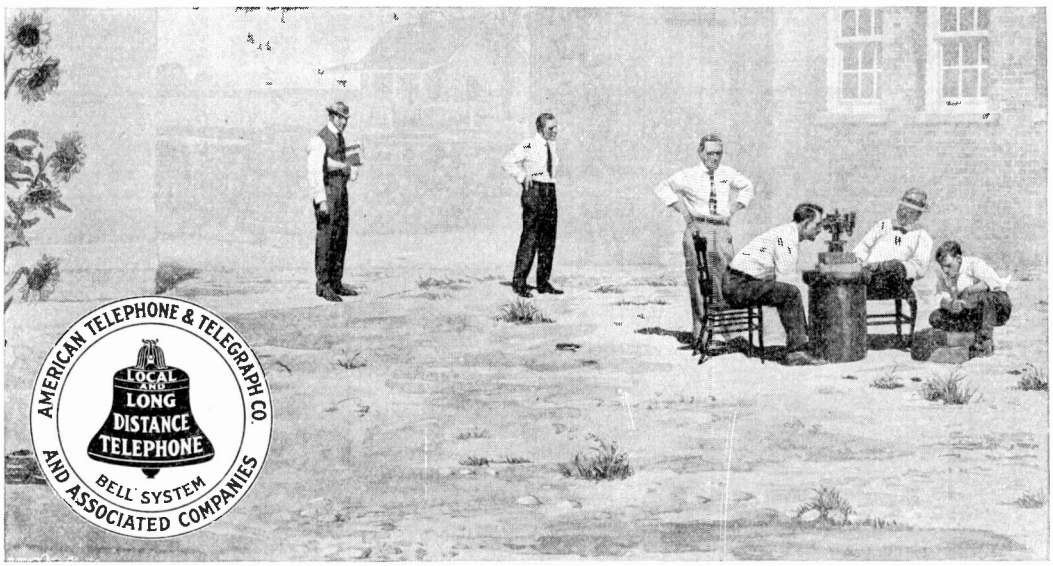
POPULAR ELECTRICITY MAGAZINE FREE FLORIDA BOOK COUPON

New South Farm & Home Company,
685 Duval Hotel Bldg., Jacksonville, Florida.

Please send me your big free book "Ten Acres and Freedom" and proofs, actual photographs and other literature describing your colony farms in the proven districts of Marion and Putnam counties, Florida. I do not bind myself to buy, but will gladly read your free literature.

Name.....

Address.....



From a Photograph Showing the Last Step in Locating the Exact Center of Population of the United States.

"The Center of Population"

A Title that Fits Every Bell Telephone

From the census of 1910 it is found that the center of population is in Bloomington, Indiana, latitude 39 degrees 10 minutes 12 seconds north, and longitude 86 degrees 32 minutes 20 seconds west.

"If all the people in the United States were to be assembled in one place, the center of population would be the point which they could reach with the minimum aggregate travel, assuming that they all traveled in direct lines from their residence to the meeting place."

—*U. S. Census Bulletin.*

This description gives a word picture of every telephone in the Bell system.

Every Bell telephone is the center of the system.

It is the point which can be reached with "the minimum aggregate travel," by all the people living within the range of telephone transmission and having access to Bell telephones.

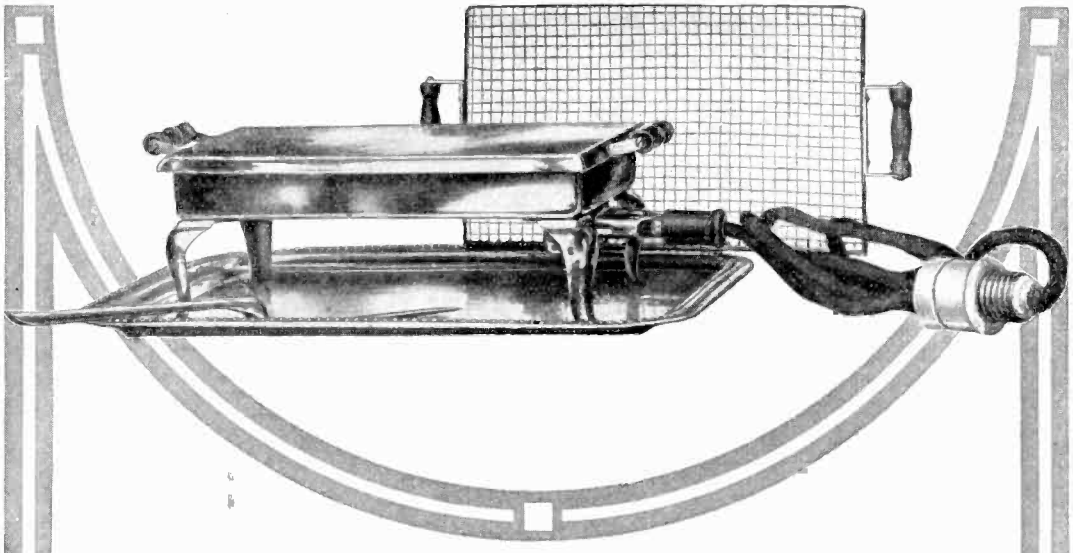
Wherever it may be on the map, each Bell telephone is a center for purposes of intercommunication.

To make each telephone the center of communication for the largest number of people, there must be One System, One Policy and Universal Service for a country of more than ninety million.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

AND ASSOCIATED COMPANIES

One Policy ***One System*** ***Universal Service***



Every Woman is Interested in the Guaranteed Electric Stove Westinghouse Toaster-Stove

THE Westinghouse guarantee means that if anything happens to her Toaster-Stove so that she cannot use it, she can send it back and get a new one. No red tape. No question about it.

The Westinghouse Toaster-Stove is the one electric stove made well enough to back such a guarantee. It makes toast and a dozen other things. Where other heating elements burn out and render electric devices useless, the patented Westinghouse heating element can be relied upon to do its work for years — **getting the most heat out of the electric current you pay for.**

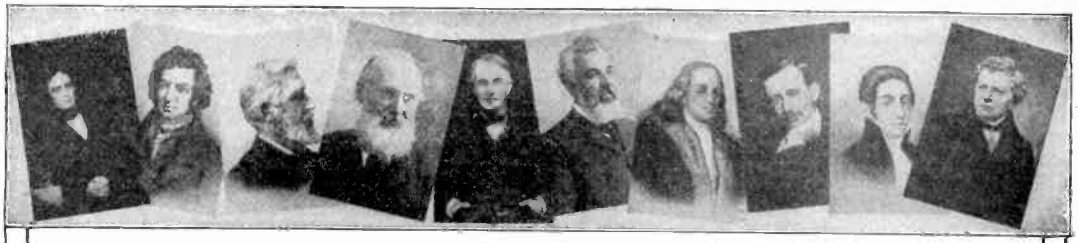
Under no circumstances take a substitute for the Westinghouse Toaster-Stove. Write us if your department store or the nearest electric shop cannot supply you. Tell us where you tried to get it.

We want your name if you have electricity in your home. We want to tell you *all* the good points of the Westinghouse Toaster-Stove, and tell you **how we protect each purchaser.**

Write "Westinghouse Household Dept. F, East Pittsburgh, Pa."

Westinghouse Electric & Manufacturing Company
Pittsburgh

Sales Offices in Forty-Five American Cities — Representatives All Over the World



Ten Beautiful Portraits of Electrical Celebrities

**VOLTA, OHM, LORD KELVIN,
FORADY, FRANKLIN, EDISON,
BELL, AMPERE, GRAY, MARCONI**

These are expensive copper plate engravings on rich enamel stock. Size 8 by 11 inches with plenty of margin for framing.

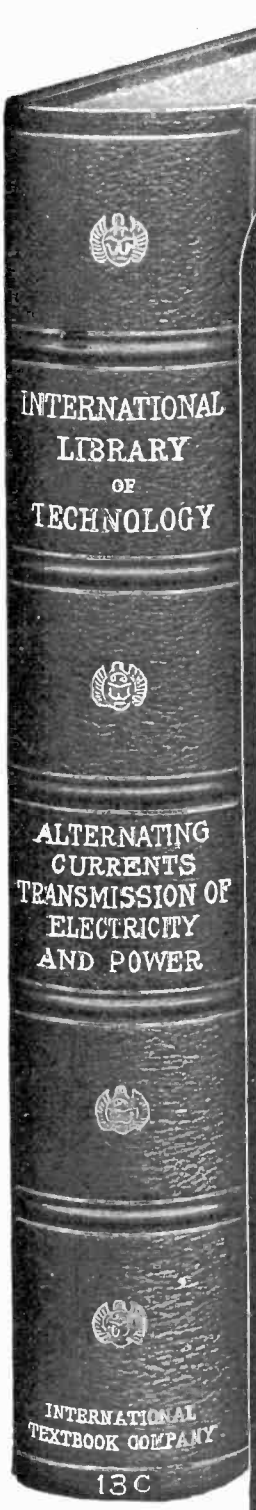
PRICE FIFTY CENTS, PREPAID

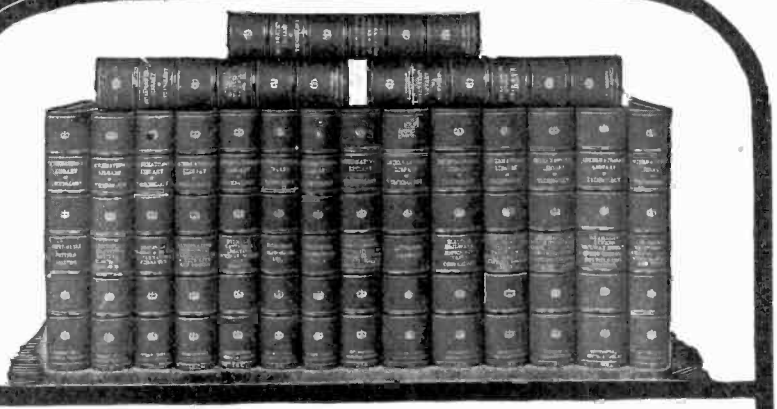
The only portraits of this kind ever published. They are accurate reproductions of the best photographs, oil paintings and engravings extant. Some of these were very difficult to obtain at the present time and no expense was spared to obtain the very best reproductions known to the engraver's art.

THEY WILL LEND TONE TO YOUR LIBRARY, PARLOR, DEN OR OFFICE

The name of the subject with brief biographical sketch under each portrait add to the historical value of the set. They make beautiful pictures framed separately, or they may be trimmed and mounted in groups. Especially suitable for public libraries, electrical and wireless clubs, etc. Mailed flat, well protected and guaranteed to reach you in first-class condition. Your money back if they are not as represented.

POPULAR ELECTRICITY BOOK DEPARTMENT
CHICAGO, ILLINOIS





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.

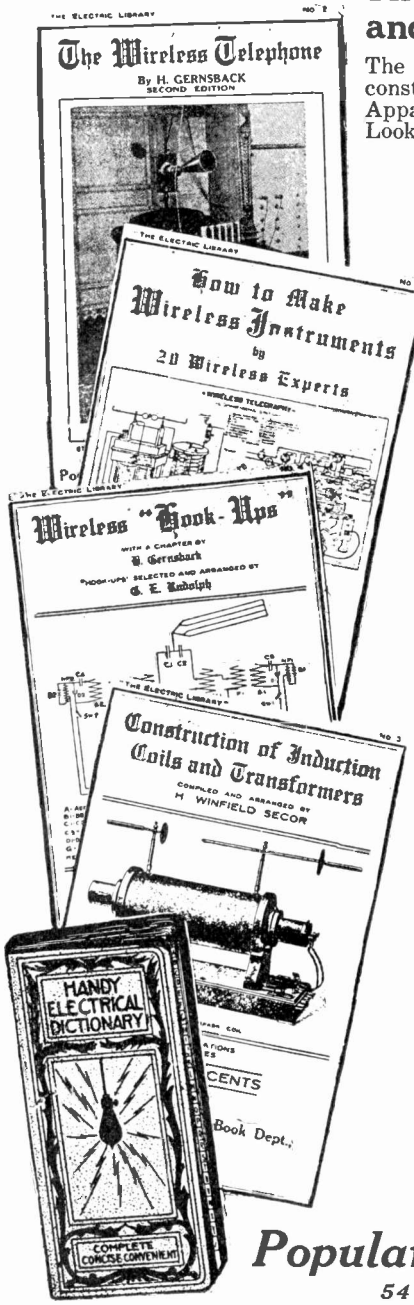
Please send, without further obligation to me, full particulars in regard to your Library of Technology, with special reference to the Electrical Library.

*Name*_____

*St. & No.*_____

*City*_____ *State*_____

All for One Dollar



The Four Best Handbooks on Wireless and a 224-page Electrical Dictionary

The information contained in these books will enable anyone to construct the most approved Wireless Telegraph and Telephone Apparatus and show you how to operate it with the most efficiency. Look over the contents below and send us a Dollar Bill today.

THE WIRELESS TELEPHONE

80 Pages **By H. GERNSBACH** **57 Illustrations**

Written for the student and experimenter and those engaged in research work in Wireless Telephony. Describes all the present systems and inventions, also contains complete directions for constructing a simple wireless Telephone.

HOW TO MAKE WIRELESS INSTRUMENTS

74 Pages **75 Illustrations**

A Treatise by 20 wireless experts for the experimenter and amateur, containing complete directions for making a "Two Mile Wireless Set," also numerous approved Wireless apparatus for both high and low power sets.

CONTENTS OF CHAPTERS

How to Make the Simplest and Most Efficient Wave Detectors—A Silicon Detector—An Electrolytic Detector—A Tantalum Detector—Carborundum Detector—How to Make a Wireless Without an Aerial—How to Make a Bare Point Electrolytic Detector—A Potentiometer—A Tuning Coil—A Loose Coupler—Selective Tuner with Weeding Out Circuit—An Iron Pipe Aerial—How to Suspend and Insulate Aerials—How to Make a Spark Gap Muffler—Transmitting Helix—Simple Antenna Switch—A Complete Two-Mile Wireless Station—A Small Transformer—Coil Vibrator Attachment—A 1000 Ohm Relay—An Electrical Resonance Apparatus—A Talking Condenser—A New Interrupter and Detector Combined, Etc.

WIRELESS HOOK-UPS

96 Pages **By G. E. RUDOLPH** **160 Hook-Ups**

No matter what instruments you have, you will find a perfect hook-up, that works in this book. Directions are also given wherever necessary. It will enable you to get better results from your apparatus and to cover much greater ranges. *If you want to get the most efficiency from your station you need this book.*

CONSTRUCTION OF INDUCTION COILS AND TRANSFORMERS

94 Pages **By H. W. SECOR** **72 Illustrations**

Describes fully the design and construction of various sized Induction Coils and Transformers.

AMONG THE CHAPTERS ARE:

The Induction Coil, Its History, and Theory—Secondary Coils Impregnation—Rating Spark Coils—Increasing Efficiency of Spark Coils—Interrupters—An Efficient Vibrator—An Independent Vibrator—Adjustable Impedance Coil—A Tesla Coil—Air Insulated Tesla Coils—Experimenting with the Tesla Coil—High Tension Transformer—A 250 Watt Closed Core Transformer—How to Build Closed Core Transformers, ½ to 3 K. W. Capacity—How to Find the Capacity of a Condenser. Also practical tables used in constructing Spark Coils and Transformers. Data on Condenser Construction, Iron Core Dimensions, Sparking Distances and Wire Values, Etc.

HANDY ELECTRICAL DICTIONARY

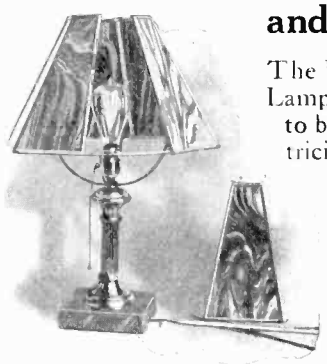
Contains definitions of 4800 words, terms and phrases used in the electrical profession, also various circuits and wiring diagrams. Just fits the vest pocket, where it is always ready to assist you in solving any perplexing problem that may come up.

Popular Electricity Book Department

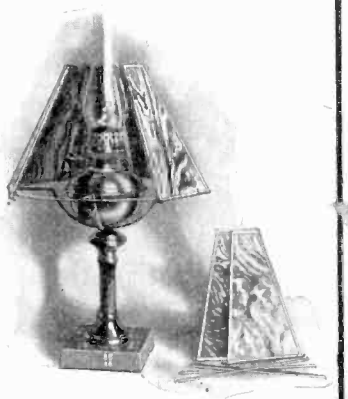
54 West Lake Street *Chicago, Illinois*

Things Electrical for the Home

The United Service Combination Oil and Electric Lamp

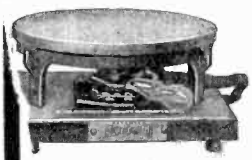


As an Electric Lamp



As an Oil Lamp

The United Service Oil and Electric Lamp meets the demand for a lamp to be used either with oil or electricity as desired, or when one or the other is not available. This lamp can be purchased only at **ELECTRIC SHOP.** It is the result of inventive genius combined with the best lamp designers' skill. Absolutely no trouble to adapt it to oil or electricity. The oil fount is hollowed out at the bottom and fitted with screw plug which may be attached to the electric lamp socket in place of the incandescent bulb. When used as an oil lamp, the cord may be easily disconnected. The fact that the lamp may be taken down and packed in sections makes it particularly desirable for travelers and army and navy officers. The lamp standard is of handsome Colonial design, in a brush brass finish—the shade is of the finest art glass in a variety of beautiful colors. Price, lamp complete with collapsible shade, oil fount, lamp chimney and connecting cord, F. O. B. Chicago, **$15.**



Electric Disc Stove

Electric Disc Stoves are very convenient utensils, applicable to a great variety of cooking purposes. The advantages of disc stove cooking are the absence of soot, dirt and grease always incidental to other forms of cooking. In addition the stove is portable. Made in one or three-heat styles.

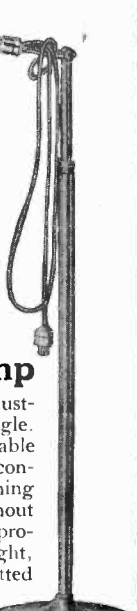
ONE-HEAT STYLE

o. **1700**—3¼ in. in diameter: 100 watts: especially adapted for dentists: with plug . **$5.00**
o. **1701**—4½ in. in diameter: 220 watts: for household use: with plug **$4.00**
1702—6 in. in diameter: 440 watts: with plug **$6.00**
1703—7 in. in diameter: 600 watts: without plug **$7.00**
1704—6 in. in diameter: 735 watts: without plug **$8.50**

THREE-HEAT STYLE

No. **1731**—4½ in. in diameter: minimum watts, 55: maximum watts, 220: with plug . . **$6.00**
No. **1732**—6 in. in diameter: minimum watts, 110: maximum watts, 440: with plug . **$7.50**
No. **1733**—7 in. in diameter: minimum watts, 150: maximum watts, 600: without plug. **$8.50**
No. **1734**—8 in. in diameter: minimum watts, 185: maximum watts, 735: without plug. **$10.00**
No. **1735**—10 in. in diameter: minimum watts, 275: max. watts, 1100: with switch plug, **$13.00**

These stoves require special wiring when not furnished with attachment plug.



The Electric Adjustable Piano Lamp is a handsome, convenient ornament. It can be raised or lowered to any position. It throws the light exactly where it is needed, while the eyes remain in restful shadow. The piano may be placed in the most suitable spot in the room, regardless of the position of the regular lighting fixtures. Finished in ss, or Japanese bronze with green relief; Order No. C.$7.

Electric Floor Lamp

The Electric Floor Lamp is adjustable to any height or at any angle. One can have the best light obtainable for reading, sewing or any other concentrated use of the eyes, assuming the most comfortable position without harmful results. The eyes are protected from the glare of the light, which is thrown where desired. Fitted with lamp and long silk connecting cord. Finished in brush brass or Japanese bronze. **$10.**

ELECTRIC SHOP—CHICAGO

Jackson and Michigan Boulevards

Over 2000 Things Electrical

The Story of a Find

I'm Thorpe—Samuel S. Thorpe—I have farmed and, believe me, I know just what a man needs in the way of soil, climate and moisture to get a good return for the labor he puts into land.

When I talk land and crop possibilities, I know what I'm talking about—there's no guess work—no quoting anybody else, for I've made thoughtful observations in every State in the Union except Arizona and I have had practical farming experience and fruit growing in a number of them.

I have always been looking for something—something that I knew when I found it would help to make those who wanted to better themselves, happy and at the same time add to my contentment as well as my worldly goods.

I Made this Find in Mississippi

Here I found combined the right soil, the right climate, the right moisture, the right markets, the right transportation facilities and the right kind of people who were ready and willing to extend the helping hand of good fellowship providing the right people came along—the right kind of man—the man who was not looking for something for nothing but the man who was ready and willing to work providing he could get a good return for his labor—if you are this man—I want you to write me about the

Lampton Lands of Mississippi

This tract is all on the "BIG LEVEL," a high plateau between two rivers. The elevation is nearly 300 feet above the sea and the land is less than 40 miles from the Gulf of Mexico. On this land you can raise almost anything you can think of and you can have money coming in from crops practically all the year around. I have seen similar lands under similar conditions, but not near as good, rise in value from $20 to $500 per acre in a very short time.

What 3 Crops a Year Mean

Compare the Northern Farmer's lot with the advantages you enjoy here in these God-blest and sun-kissed Lampton Lands. You can raise and get three crops a year, each a bumper, of the Staples, such as corn, wheat, potatoes, both Irish and sweet, as well as sugar-cane, cotton, the smaller fruits, tobacco or oranges. You can raise hogs, those mortgage lifters of the North and dividend payers of Mississippi. You will find a ready market at big prices for all you raise.

While the Northern Farmer is hugging the stove in February, you are picking and marketing strawberries and getting big prices. Now don't think that we are going to put you on the first piece of land we happen to think of. We don't want you for your money alone—we want you to make good because the big men who are back of this project, own and control six big banks. They want men who are going to come down here and prosper so that they may become depositors in these banks. After I have a talk with you and know what your experience has been, then I am going to recommend a location to you. This we will sell you at a price lower than you will ever have the opportunity to get again.

Homeseekers' Excursions Twice a Month or Reduced Fare Any Day.

IF YOU CAN'T COME, WRITE If you are interested in some mighty good reading and some mighty fine photographs, every scene taken from our own lands or vicinity, you want to sit down now and write for a copy of the book that everybody is talking about, "The Turn in the Road." Write me personally and I'll get the book into your hands in short order and it won't cost you anything. Address your letter or postal

S.S. THORPE, Sales Manager, of the LAMPTON REALTY COMPANY
Dept. 3, 1627 First National Bank Building, CHICAGO

WHITE VALLEY GEMS IMPORTED from FRANCE
SEE THEM BEFORE PAYING!

These Gems are chemical white sapphires. Can't be told from diamonds except by an expert. Stand acid and fire diamond tests. So hard they scratch a file, will cut glass. Brilliancy guaranteed 25 years. All mounted in 14K solid gold diamond mountings. Will send you any style ring, pin or stud on approval—all charges prepaid—no money in advance.

Write for Free Illustrated booklet, special prices and ring measure

WHITE VALLEY GEM CO., B742 Saks Bldg., Indianapolis, Ind.

Nulite Gasoline Table Lamp

A complete Light Plant weighing 7 lbs. Portable, absolutely safe. 300 c. p. brilliant light ⅓ cent per hour. Saves 90 per cent of your light bill.

Agents—Write for Special Offer on complete line of gasoline lights and systems. Over 200 different styles. Highest Quality. Lowest Prices. Exclusive territory for capable town, county and traveling salesmen. 72 page illustrated catalog free. Write today.

National Stamping & Electric Works
443 So. Clinton St. Chicago, U. S. A.

WIZARD LIGHT
THE LATEST INVENTION

Lamps are lit with an ordinary match as conveniently as city gas, ¼ the cost. For catalog and agency address

The Nagel-Chase Mfg. Co,
137 West Ohio St Chicago

LOVE In the November issue, we asked all the men who loved their wives to write to us, and judging by the response, loving your wife seems to be quite the thing, in fact, so many men loved their wives that replying to their inquiries kept us so busy we didn't have time to prepare an advertisement for this issue. By the way it's a safe bet that the wives will love the men that did write. Why don't you try it? Just say **"WHIRLPOOL"** to Darche Mfg. Co., 17 N. Jefferson St., Chicago; we will do the rest.

MAKES A PHONOGRAPH SOUND LIFE-LIKE

The Morse Clarifier

is made to fit in tube between reproducer and horn of any make of machine. It renders the sound loud, clear, lifelike and eliminates that unpleasant metallic effect. It fills a longfelt want. Pat. Appl'd For

Can be inserted in a minute and is everlasting.

$1.00 Mailed Prepaid Send dollar bill, 2c stamps or check at our risk.

Guaranteed absolutely satisfactory or money refunded.

State whether for Victor, Victor Victrola, Edison with rubber or metal connection, Columbia disc or cylinder. Information and circular matter free.

MORSE BROTHERS
Manufacturers and Distributers
463 Lumber Exchange, Minneapolis, Minn.

THE DOBSON "X" RAY. The Latest Scientific Wonder. Here is an article boys, that will please you. With it the clothes and flesh turn transparent and the bones can be plainly seen. **Just** think of the fun you can have with it. Sample in strong box with catalogue and agent's prices **10 cents** by mail.

QUINTARD & POLLARD - - - - Norwalk, Conn.

12 Art Panels 50c

Beautiful Duo Tint Reproductions of Famous Paintings—Panel Size 7x10

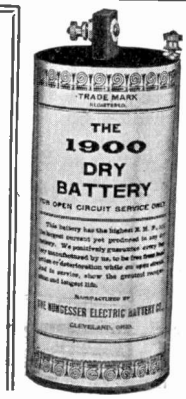
These pictures are real gems—the **most exquisite portrayals of**

"WOMAN BEAUTIFUL"

ever shown in one collection. We send a full set of **12** in handsome Art portfolio, packed flat and safe delivery guaranteed, together with lifelike miniatures of **70** other beautiful and catchy den pictures, for only **50c** coin, money order or U. S. stamps. **Send at once. Money back if not satisfied.** Or send $1.25 for same set hand-colored.

FLORENTINE ART COMPANY
Dept. F.2. 2209 Prairie Ave., Chicago, Ill.

Free Order panels at once and we will include "Free" a beautiful den picture in colors.



The Secret of Your Success

With your experiments depends largely upon a battery which can supply a high electro-motive force as well as long life.

The 1900 Dry Battery

At this point fulfills all these requirements and more, its greatest proof being a trial.

Write Today for Catalogue

The Nungesser Carbon & Battery Co.
CLEVELAND, OHIO
General Sales Office: 627 W. Jackson Blvd., Chicago

The most wonderful and fascinating study of the age. Everybody should have a copy of the new "**Voltamp Electrical Products**" our 112-page Catalog now ready. The most complete and interesting book ever issued. Full of illustrations and descriptions of **Voltamp** Novelties, Motors, Dynamos, Telegraph and "Wireless" Instruments, Spark Coils, Lamps, Flashlights, Transformers, etc. Everything Electrical for the experimenter. The greatest line of **Miniature Electric Railways** ever shown. Catalog with valuable coupon sent only for 6c in stamps or coin. (No postals answered.)

VOLTAMP ELECTRIC MFG. CO., Park Bldg., **Baltimore, Md.**

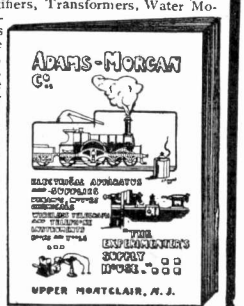
10 AMP.-HOUR STORAGE CELL

PRICE $1.00

A set of these wonderful batteries will almost **double** the transmitting range of your wireless coil. They will also run toy motors, lamps, advertising devices, etc. The most reliable and durable cells made. **No renewals,** simply recharge from direct current supply.

We also manufacture a complete line of Dynamos, Motors, Rectifiers, Transformers, Water Motors, Gasoline Engines, Model Aeroplanes, etc. We sell complete sets of materials for building Loose Couplers, Induction Coils, Motors, Dynamos, Variable Condensers, etc.

We manufacture the largest line of reliable Wireless apparatus, for amateurs, in the world. With every **Wireless Catalogue** we give a complete list of all the Wireless Telegraph Stations, Battleships, Steamships, etc., together with their **CALL LETTERS. Over 1,400 in all.** It is **FREE** for 4 cents in stamps to cover the cost of mailing. Same may be deducted from the first order.



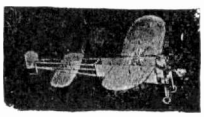
ADAMS-MORGAN CO.
"The Experimenter's Supply House"
Box 72 a Upper Montclair, N. J.

MODERN ELECTRICS

"The Electrical Magazine for Everybody"

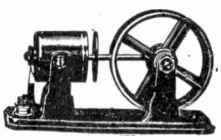
The brightest and most interesting electrical monthly magazine published; nearly five years old, with a new department on "aeronautics" and "with the inventor."

The magazine to read if you want to keep up to date on wireless and progress in electricity. 96 to 128 Pages monthly.



THIS BLERIOT MODEL AEROPLANE, GUARANTEED TO FLY 1000 FEET—FREE with one year's subscription to **MODERN ELECTRICS** for $1.00, (Canada, $1.25), (Foreign, $1.50), add 8 cents for mailing.

Or, if you prefer:



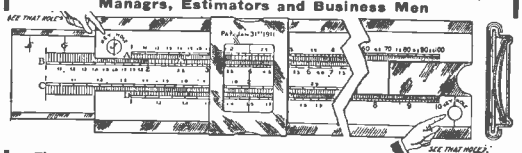
THIS DOUBLE MAGNETIC REVERSIBLE ENGINE WITH SPEED CONTACT LEVER, FREE with one year's subscription to **MODERN ELECTRICS** for $1.00, add 8 cents for mailing. (Canada, $1.25), (Foreign, $1.50). 1000 to 2500 revolutions per minute. Two heavy cast iron fly wheels. Wiring entirely concealed.

SEND TO-DAY and read RALPH 124C 41x in the next number; the most advanced and absorbing story yet written on the future possibilities of electricity;

MODERN ELECTRICS
262 Fulton St., **NEW YORK**
10 cents per copy *(After Apr. 1st., $1.50 per year)* *$1.00 per year*

RICHARDSON SLIDE RULE

Engineers, Electricians, Draftsmen, Superintendents, Managrs, Estimators and Business Men



Electricians are frequently called upon to calculate the size of a motor to run a pump, change gears, and pulley problems, testing recording wattmeters, plotting curves, etc.

The slide rule will do all this mechanically. The Richardson Direct Reading Slide Rule is especially adapted for those who wish to learn the use of this valuable instrument. In addition to being direct reading for 44 electrical and mechanical problems it will multiply, divide, extract the square or cube roots of numbers, calculate interest and percentage, solve proportion, and for making up pay roll accounts the rule has no equal. For a Christmas present there is nothing better. $2.50, including pocket case and instruction book.

GEO. W. RICHARDSON, M. E., E. E.
Late Artificer U. S. Navy **4214 24th Place, Chicago**

Don't Use Batteries To Ring Electric Bells

The Thordarson Junior Bell-Ringing Transformer eliminates battery troubles *forever.* Can't get out of order. Lasts a lifetime when properly installed. Rings bells up to 4 inches in diameter. Fine for buzzers and light signal work.

Thordarson Junior Bell-Ringing Transformer

has a larger output than any other small capacity transformer and the current it consumes does not register on an ordinary wattmeter. For *alternating current* only. Weight 3 lbs. Price..... **$3.00**

Write for full particulars today

THORDARSON ELECTRICAL MFG. CO.
220 South Jefferson Street, Chicago, Ill.

NEARLY half the students of the American School of Correspondence are directed to it by those who have already taken its courses, by those who have put its instruction to the ***hard, practical tests,*** who ***know*** the value of its training, ***because they are holding better positions, drawing bigger salaries, as the direct result.***

Only a short time ago these men were right where you are now. They were discontented and drawing small salaries. They saw men around them holding good positions and ***they*** wanted good positions. They saw men drawing good salaries and ***they*** wanted good salaries. When the American School offered them a way to make themselves ***worth more*** by ***knowing more*** they jumped at the chance.

They made a start—they signed the coupon

and mailed it. In spare moments and without great effort each one acquired ***special knowledge and training*** that made him ***more valuable*** to his employer, that fitted him to step into a better position at the first opportunity.

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. Elect 2-12

....Automobile Operator	....Lawyer
....Draftsman	....Fire Ins. Engineer
....Architect	....Telephone Expert
....Building Contractor	....Moving Picture Op'r
....Structural Engineer	....Bookkeeper
....Civil Engineer	....Stenographer
....Electrical Engineer	....Accountant
....Elec. Light and Power Supt.	....Cost Accountant
....Master Mechanic	....Cert'f'd Public Acc'nt
....Sanitary Engineer	....Auditor
....Steam Engineer	....Business Manager
....Reclamation Engineer	....College Preparatory

NAME .....

ADDRESS .....

OCCUPATION .....

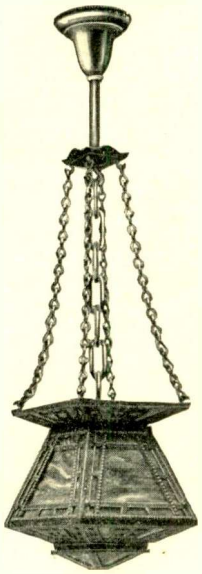
These young men have done nothing that ***you*** can't do. There isn't anything difficult or mysterious about it. It costs you nothing to sign the coupon and we'll send no agents to see you, for we have none. We'll simply send you information as to ***how you can make yourself worth a bigger salary and get it.***

The American School stands back of every student, encouraging him to do his best, and giving instruction equal in quality to that of the largest resident schools. Won't you make the start today? Sign the coupon.

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

Art Glass Electric Fixtures

Some beautiful, artistic designs in Art Glass Fixtures at inexpensive prices are shown below. They make home charming and more attractive; also suitable for public buildings, clubs, cafes and display windows. Made of metal in verde antique finish and fitted with green or amber art glass, these fixtures give the effect of leaded glass at a much lower cost.



No. 1209

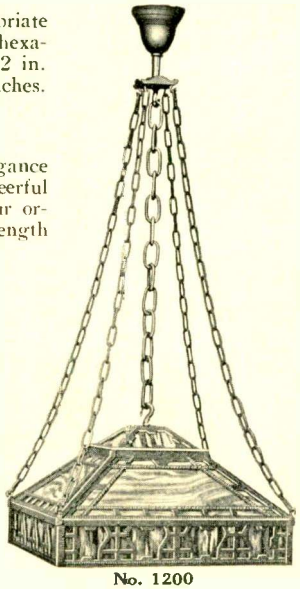
Prices do not include lamps or insulating joints.

No. 1209

This is an attractive, distinctive fixture, appropriate for a hall lamp or for ornamental purposes; hexagonal shade in leaded glass effect. Shade is 12 in. wide by 14 inches high; length of fixture, 36 inches. Wired complete, **Each, $22.85.**

No. 1200

This handsome dining-room shade is full of elegance and exclusiveness. Throws a subdued, cheerful light. Supported by one heavy chain with four ornamental chains. Shade is 19 inches square; length of fixture over all, 36 inches. **Each, $31.40.**

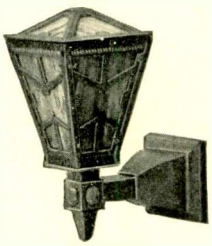


No. 1200

Green glass furnished unless otherwise specified.

No. 1205

Here is an unusual design in a table lamp; has hexagonal pedestal with ornamental feet and 16 inch hexagonal shade, 27 inches high. **Each, $33.60.**



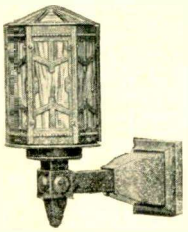
No. 1201

No. 1201

An ornamental wall bracket in inverted style is here shown. Shade is 5½ inches square, has closed top; 4 inches square wall canopy. **Each, $10.50.**

No. 1202

This is another beautiful style in an inverted wall bracket. Has hexagonal shade 5 inches in diameter and 9 in. high, with closed top. **Each, $11.00.**



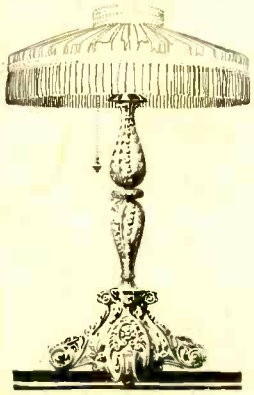
No. 1202

Ask for Pocket Catalogue, No. M1450, of Fixtures and General Supplies
Liberal Discounts to Dealers. All Prices F. O. B. Chicago.

Federal Sign System (Electric)

Home Insurance Building, Chicago

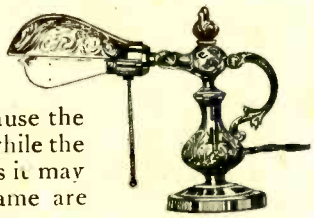
Things Electrical for the Home



Electric Lamps with Silk Shades

Among the prettiest effects in lighting ornaments for the home are Electric Lamps with silk shades. The shades come in various handsome colors to harmonize with any decorative scheme. A subdued cheerful light is given. Standards in old gold and plain or hand-tinted ivory. The price of the silk-shaded lamp illustrated is **$21.** A splendid assortment is shown of other styles, sizes and designs in silk-shaded Electric Lamps up to **$40.**

Electric Couch Bracket



The Federal Electric Couch Bracket is most convenient to use for reading in a reclining position. Saves eyestrain, because the light is concentrated where it is needed, while the eyes are in shadow. Useful also as a piano or desk lamp, as it may be easily adapted to almost any position. The base and frame are of ornamental brass in a handsome design. Price, **$4.50.**

Electric Massage Vibrator

An Electric Massage Vibrator makes possible the finest massage at home. Especially suitable for invalids, as with it the Swedish movement and hand massage may be given more efficiently and more quickly than by the strongest masseuse. The vibrator illustrated is the Shelton-Wayne, for alternating current. Order No. 1102. Price, **$27.**

Electric Dining Room Set

Electric Dining Room Sets are fast becoming popular with women, because their use allows the preparation of foods, without annoyance or bother, right at the dining table. The set consists of a tea kettle, coffee percolator, chafing dish, electric stove and stand, handsomely finished in heavy nickel plate or copper. Ideal for breakfast, afternoon tea, or after-theater suppers. Price of set complete is **$37.**

Separate articles at the following prices:

Stove	$11.50
Chafing Dish	7.00
Percolator	10.00
Tea Kettle	6.00
Stand	2.50

ELECTRIC SHOP—CHICAGO

Jackson and Michigan Boulevards

Over 2000 Things Electrical