

Grasp this Opportunity to Rise

For ten years we have been training ambitious men and women to be specialists—to fill positions and to earn salaries beyond the reach of ordinary workers that lack this special training. We can do this for you if you will write for information, mentioning the subject that interests you.

I. C. S. Textbooks make it easy for busy people to

LEARN BY MAIL.

Courses in Mechanical, Steam, Electrical, Telephone, Telegraph, Civil, and Mining Engineering; Shop and Foundry Practice; Mechanical Drawing; Architecture; Plumbing; Chemistry; Ornamental Design; Bookkeeping; Stenography; Teaching English Branches; German; Spanish; French; International Correspondence Schools, Box 942 Scranton, Pa.

Technical Writer Wanted.

Plan with clear, concise style, experienced in treating practical scientific subjects. State age, experience and salary expected.

Address Box 210, Scranton, Pa.

ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book. "CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute endorsed by Thos. A. Edison and others.

ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 W. 34th St., New York.

YOUR PAY

can be increased more quickly by us than by any one else if you will study in some of our spare time. We'll help you learn what you need and give you the best books free to study from, while giving you a chance to

EARN MORE WHILE LEARNING

Courses in Electrical, Mechanical, Steam and Civil Engineering, Drafting, Art, Architecture, Mining, Metallurgy, Business, Stenography, Journalism, Bookkeeping, etc. Write for free catalogue & with full particulars. THE CONSOLIDATED SCHOOLS, 156 Fifth Ave., N. Y.

ELECTRIC AUTOMOBILE. — DIRECTIONS, with many illustrations, for making a complete machine from two bicycles are given in SUPPLEMENT No. 1195. The motor and battery are also treated in detail. Price 10 cents. For sale by Munn & Co. and all newsdealers.

Only \$5.00 Capacity 999,999,999 THE LOCKE ADDER Performs all computations that any higher priced machine will do. Most simple, practical, durable and convenient device for Adding, Subtracting, Multiplying and Dividing. Saves mental strain and

QUICKLY PAYS FOR ITSELF Adds nine columns simultaneously. Endorsed by bookkeepers and employers wherever used. Price \$5.00 prepaid. Send for free illustrated booklet. AGENTS WANTED. C. E. LOCKE MFG. CO., 26 Walnut St., Kessett, Iowa.

We want to send you a circular of the Rich Handy Drawing Outfit It is a time saver for the Draughtsman, and an aid to the learner. Circulars free. J. & G. RICH, 125 N. 6th St., Philadelphia, Pa., U.S.A.

JUST \$1 buys best bell outfit built. Easy to put up and an up-to-date convenience. We sell Bells, 32c; dry batteries, 15c; push buttons, 7c; insulated wire, 30c. lb.; lamps, 35c. Write for price list. LIBERTY ELECTRICAL SUPPLY CO. 136 Liberty St., New York

50 YEARS' EXPERIENCE PATENTS TRADE MARKS DESIGNS COPYRIGHTS & C. Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communication strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents. Patents taken through Munn & Co. receive special notice, without charge, in the Scientific American. A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, \$3 a year; four months, \$1. Sold by all newsdealers. MUNN & Co. 361 Broadway, New York Branch Office, 625 F St. Washington, D. C.

"Korn-Krisp," for a food preparation, Korn-Krisp Co. 9,104
"Mellin's Lacto-Glycose," for milk food, Mellin's Food Company of North America 9,107
"Palacelite Oil," for oils, Great Western Oil Co. 9,103
"West Baden Sprudel Mineral Water," for mineral water, West Baden Springs Water Co. 9,109

PRINTS.

"Alexander," for a medicine, W. W. Alexander & Co. 498
"Dorothy Quincy," for a medicine, Dr. Miles Medical Co. 497
"Katrina Knickerbocker," for a medicine, Dr. Miles Medical Co. 496
"The Ransom & Randolph Co. for artificial teeth, Ransom and Randolph Co. 495

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication. References to former articles or answers should give date of paper and page or number of question. Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn. Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same. Special Written Information on matters of personal rather than general interest cannot be expected without remuneration. Scientific American Supplements referred to may be had at the office. Price 10 cents each. Books referred to promptly supplied on receipt of price. Minerals sent for examination should be distinctly marked or labeled.

(8599) P. A. B. asks: 1. I have built an electric furnace as described in SUPPLEMENT No. 1182, and use 52 volts, but cannot get the triple arc to light. None of the carbons will light when brought into contact, unless all the carbons on the same side are connected, and then only one pair of them will light. Can you explain this? A. Forty-five to 50 volts are required to produce an arc between carbons. When you place three carbons in series in the electrical furnace, the 52 volts at your disposal cannot push the current across the three air gaps in the carbons. Put the three arcs in multiple with some external resistance. 2. Can you recommend an elementary book on the electric furnace and any SUPPLEMENTS besides the above? A. We can send you thirteen papers at 10 cents each upon the electrical furnace in addition to the one you have. We do not know any book upon this special subject.

(8600) G. M. D. asks: What should be the dimensions, size and amount of wire for a 12-inch coil, 15-inch coil and 18-inch coil? Is there any definite relation existing whereby the above information may be determined from a known coil? A. The dimensions of induction coils are the result of experience rather than of calculation. The properties of the magnetic circuit and the effects of induction are well known, and can be applied to an induction for giving sparks; but almost every builder works from designs which have been wrought out by experiment and are known to give good results. The sizes and windings of certain large coils are given in Hare's "Large Induction Coils," price \$2.50 by mail.

(8601) A. B. writes: I am desirous of studying the science of electricity from the very beginning. Please suggest what would be best, and the price. A. We should advise that you buy Jackson's "Elementary Electricity," price \$1.40 by mail, and Swoope's "Practical Electricity," price \$2 by mail, with which to make a beginning of the study of electricity. After these are mastered there are many special works on separate subjects for study.

(8602) D. C. asks: Can you inform me what the solution is in which incandescent gas mantles are washed or dipped to render them incandescent? A. Oxides of the rare earths are used for coating the mantles of incandescent gas burners.

(8603) J. O. H. asks: In the building of motors or dynamos, is it a rule to use coarser wire on fields than armature, and why? A. The size of wire in field and armature is a matter of calculation, and may give either a coarser or finer wire on armature than on field.

(8604) P. S. S. asks: What solution is used in plating, for instance silver, or nickel, when batteries are used for circuit? A. For nickel the double sulphate of nickel and ammonium is commonly employed, and for silver the cyanide of silver is almost universally used. Full instructions are to be found in Langbein's "Electro-Deposition of Metals," price \$4 by mail.

PERFORATED METALS

OF EVERY DESCRIPTION AND FOR ALL USES.
THE HARRINGTON & KING PERFORATING CO.
225 N. UNION ST. CHICAGO, ILL. U.S.A.

Queen Transits and Levels

High Grade Instruments with the Latest Improvements. 160 page Engineering Catalogue or 240 page Mathematical Catalogue on application.

ENGINEERS' AND DRAFTSMEN'S SUPPLIES. QUEEN & CO., Optical and Scientific Instrument Works, 59 Fifth Ave., New York. 1010 Chestnut St., Phila.

Bench Levels.

Adjustable, with ground and graduated vials, accurate and very sensitive. Outer tube may be turned so as to protect glass when not in use. See our free 112-page catalogue for prices. THE L. S. STARBETT CO., Box 18, Athol, Mass., U.S.A.

HOW TO MAKE AN ELECTRICAL Furnace for Amateur Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by an amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer.

GAS and GASOLINE ENGINES.

Using Natural Gas, Coal Gas, Producer Gas, and Gasoline direct from the tank. 1 to 40 H. P., actual. The Springfield Gas Engine Co., 21 W. Washington St. Springfield, O.

HOPPE'S SEPARATORS

give dry steam. HOPPE'S OIL ELIMINATORS remove all oil and grease from exhaust steam. Write for new catalogue of these and our Feed-Water Heater and Purifier. HOPPE'S MFG. CO., 25 Larch Street, Springfield, Ohio.

EDISON WIZARD FOUNTAIN PEN and a Box of WIZARD INK ONLY 50 CTS.

These A. Edison, Jr., has invented a fountain pen that is as superior to the ordinary pen as the electric light is superior to the candle. Made on correct scientific principle, with special machinery we are enabled to sell these pens at 50 cts. each, and will present each purchaser a box of Mr. Edison's famous WIZARD INK TABLETS, which by dissolving in water make ONE PINT of the best writing fluid ever produced. Non-corrosive and chemicals cannot eradicate it. This remarkably low price is made to induce everybody to try our ink, knowing where once used no other can take its place. Agents wanted everywhere. Address THE THOS. A. EDISON, JR. CHEMICAL CO., Dept. L, 51 Stone St., New York.

PROPOSALS.

The Imperial Ottoman Government wishes to buy 20,000 TONS STEEL RAILS. 2,400 " FISH PLATES. 480 " SPIKES. 160 " BOLTS AND NUTS. Send for full particulars to CHEKIB BEY, Imperial Turkish Legation, 1218 New Hampshire Ave., N. W., WASHINGTON, D. C.

Patents Protected

Against Infringers. Dealers in and Manufacturers of PATENTED ARTICLES. Owners and Users of COPYRIGHTS AND TRADE-MARKS PROTECTED against dangerous litigation at a nominal cost. Booklet on application. PATENT TITLE & GUARANTEE CO., CAPITAL \$500,000.00. Tel. 4232 Cortlandt. 150 Broadway, New York.

LEARN TELEGRAPHY

THE OMNIGRAPH teaches you perfectly in the shortest time at a small cost of \$4. TRANSMITTER, Key and Sounder, Complete. An Expert Operator with you all the time. Circular Free. THE OMNIGRAPH MFG. CO., Dept. 39 Cortlandt St., New York.

REAL ESTATE WANTED

If you want to Sell your Real Estate or Business no matter where it is, send me full particulars and lowest cash price. My office is headquarters for quick sales to cash buyers. FRANK P. CLEVELAND, "The Real Estate Expert" 1501 Adams Express Bldg., CHICAGO, ILL.

SYNCHRONOGRAPH.—A NEW METHOD of rapidly transmitting intelligence by the alternating current. A full description of the interesting apparatus of Crehore and Squier. 13 illustrations. SCIENTIFIC AMERICAN SUPPLEMENTS 1114 and 1115. Price 10 cents each. For sale by Munn & Co. and all newsdealers. Send for new catalogue.

I Pay The Freight \$25

Will ship C. O. D. to any station in the United States for \$25 The "WILLARD STEEL RANGE" Has 6-8-in. lids, oven 17x12x21, 15 gallon reservoir, large warming closet, duplex grate, burns wood or coal, weighs 400 lbs., lined throughout with asbestos. GUARANTEED TO BE AS REPRESENTED. Write for free descriptive circulars and testimonials from parties in your section who are using one. WM. G. WILLARD, Dept. 14, 619 N. 4th St., St. Louis, Mo. AGENTS WANTED TO SELL FOR CASH OR ON CREDIT.

GASOLINE AUTOMOBILES.—VALUABLE illustrated articles on the above subject containing many details of the motors and vehicles, are contained in SUPPLEMENT Nos. 1099, 1270, 1275 and 1311. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

Prevention of Accidents

is not always possible, but you can insure against loss of income while disabled by taking out An Accident Policy in The Travelers of Hartford, the oldest Accident Insurance Company in America and the largest in the world. These policies guarantee a weekly income while disabled and large amounts for loss of legs, arms, hands, feet or eyes. If death ensues, a stated sum is paid. \$2,000,000 have been distributed among 376,000 policy holders or their families for injurious death. A Life Policy in the Travelers Insurance Company provides safe insurance at a lower guaranteed net cost than mutual companies. Mutual companies charge for insurance and give such a share in the profits as the company may see fit. The Travelers charges for insurance only. Therefore the net cost of a policy in The Travelers is guaranteed and known beforehand, and the difference in cost is in your pocket first to last. Agents in every town, or write for interesting literature. The Travelers Insurance Company Hartford, Conn. (Founded 1863)

ROTARY PUMPS AND ENGINES. Their Original Development.—An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in SUPPLEMENTS 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

EDISON WIZARD FOUNTAIN PEN and a Box of WIZARD INK ONLY 50 CTS.

These A. Edison, Jr., has invented a fountain pen that is as superior to the ordinary pen as the electric light is superior to the candle. Made on correct scientific principle, with special machinery we are enabled to sell these pens at 50 cts. each, and will present each purchaser a box of Mr. Edison's famous WIZARD INK TABLETS, which by dissolving in water make ONE PINT of the best writing fluid ever produced. Non-corrosive and chemicals cannot eradicate it. This remarkably low price is made to induce everybody to try our ink, knowing where once used no other can take its place. Agents wanted everywhere. Address THE THOS. A. EDISON, JR. CHEMICAL CO., Dept. L, 51 Stone St., New York.

SEALED PROPOSALS WILL BE RECEIVED AT the Office of the Lighthouse Engineer, Tompkinsville, N. Y., until 1 o'clock P. M., May 9, 1902, and then opened, for furnishing miscellaneous articles for the Lighthouse establishment for the fiscal year to end June 30, 1903. Information and specifications may be had upon application. MAJ. W. T. ROSELL, U. S. A., Engineer Third Lighthouse District.

MATCH Factory Machinery. W. E. WILLIAMS, Mfr., 217 South Clinton St., Chicago, U. S. A. Experimental & Model Work. Ctr. & advice free. Wm. Garbam & Son, 45-51 Rose St., N. Y.

NOVELTIES & PATENTED ARTICLES Manufactured by Contract. Punching Dies, Special Machinery. E. Konigsloew & Bro., 181 Seneca St. Cleveland, O. Best Drying Machines and Coffee Hullers. Established 1878. S. E. WORRELL, Hannibal, Mo.

VOLNEY W. MASON & CO., Friction Pulleys, Clutches & Elevators PROVIDENCE, R. I.

HORNS FOR TALKING MACHINES Crane Bros., Mfrs. Westfield, Mass.

Magical Apparatus. Grand Book Catalogue. Over 700 engravings, 25c. Parlor Tricks Catalogue, free. MARTINKA & CO., Mfrs., 438 Sixth Ave., New York.

MODEL MACHINE & Experimental WORK. PATTERN SHOP. GEO. KIRKEGAARD, Mechanical and Electrical Engineer, formerly with Thos. A. Edison, 514 Pearl Street, corner of Centre, New York City.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE WILFERT MFG. CO., 839 Clinton Street, Milwaukee Wis.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery. E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

For Sale.—Patent No. 692,128, detachable shoe heel for U. S. Patented Jan. 23, 1902. V. A. FABRICKI, Box 161, La Salle, Ill.

MODELS & CHICAGO MODEL WORKS 79 E. MADISON ST. CHICAGO, ILL. ESTABLISHED 1867