ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book.

"CAN I BECOME AN ELEC-

TRICAL ENGINEER?"
teach Electrical Engineering, Electric Lighting, ic Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail

EARN MORE We teach you what you need to in your own business or another. Engineering, Dratting, Art, Architecture, Mining, Metallurgy, Business, Stenography, Journalism, Bookkeeping, etc.

Wite for free catalogue for sith of the state of t

Write for free catalogue 6, with full particulars. 😰 Special Discounts Now. 🚁

THE CONSOLIDATED SCHOOLS, 156 Fifth Ave., N. Y.

LEARN PROOFREADING. If you poseducation, why not utilize it at a genteel and uncrowded profe ssion paying \$15 to \$35 weekly? Situations always obtainable. We are the original instructors by mail. HOME CORRESPONDENCE SCHOOL, Philadelphia.



New electric roads are being built all the time, requiring strong, intelligent, reliable

Young Men for Motormen.

You might get such a position if you were fitted for it, and once in, there's a chance to rise. Our Correspondence Course in Electrical Engineering teaches you the whole thing, and if you should chance to get a Free Scholarship many do) your only expense would be for instruction papers and postage. We teach also steam and Mechanical Engineering, Mechanical Drawing, Plumbing, Heating, Ventilating.

Write for information and Handbook.

American School or co... Dividend-Paying Mining, Oil and Smelter Stocks, Listed and Unlisted, our Specialty.

DOUGLAS, LACEY & CO.

Bankers & Brokers, Fiscal Agents,

Wells, Oil and Gas Wells drilled by contract to any depth from 50 to 300 feet. We also manufac-ture and furnish everything re-quired to shill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1200 feet. Write us stating exactly what is required and send for illus-trated catalogue. Address INEERING AND SUPPLY CO.

PIERCE WELL ENGINEERING AND SUPPLY CO. 136 LIBERTY STREET, NEW YORK, U. S. A.

IVIDENDS= Risk a postal. Send us your na Risk a postal. Send us your name for prospectus of the Rayo Mining and Developing Co. of California. Every dollar invested in these shares will return you regular, handsome, dividends. MILLIONS of ore values ready to mine; Electric Water-Power Plant in connection. Not he ordinary mining proposition. Shares the ordinary mining proposition. Shares now selling at ground-floor price. Bank ROANOKE INVESTMENT CO. 525 Marquette Building. Chicag

Hutchinson, Goldsmith & Company, Exclusive Eastern Financial Agents, 53 State St., Boston, Mass.







nyone sending a sketch and description may ickly ascertain our opinion free whether an invention is probably patentable. Communica-tions strictly confidential. Handbook on Patents tions strictly confidential. Halmbook of Fatents 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 ayear; four month), \$1. Sold by all newsdealers

MUNN & CO. 361 Broadway, New Yor! Branch Office, 625 F St. Washington, D. C.



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 bis turn.

nis turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same

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 once. Price 10 cents each.

Books referred to promptly supplied on receipt of write.

price.
Minerals sent for examination should be distinctly marked or labeled

(8629) C. H. asks: Will you kindly answer me this question: Ilas the metal selenium the property of offering resistance to a current of electricity when a light is thrown upon it? A. Selenium is not a metal. It is an acid-forming element. Its resistance to the passage of electricity is very great. When a beam of light falls upon a piece of selenium, its electrical resistance is much reduced, but not so that it becomes a good con ductor of electricity.

(8630) O. M. K. asks: Is there a metal or alloy of metals that can be had on the market that will take the place of platinum for sparking points in gas engine cylinders? A. Nothing is known to take the place of platinum for this purpose. Any metal which could be used by reason of its high fusing point is more expensive than platinum.

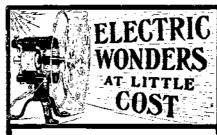
(8631) W. F. G. writes: I have read in past years some discussions on music, and among others found that someone made state ments as to the proper value of each tone or note as they follow in the scale, a, b, c, d, c, f, g, a. It was stated that the half-tones were not half, but varied from it, he giving the proper value of each in this respect. I cannet recall new who it was nor in what paper I read it. Can you help me out and give me information in regard to it? A. The scale in music based on standard pitch, as determined by the Paris Congress of Music, has an a of 435 vibrations per second. In instruments with fixed keys, such as a piano, cornet, etc., the tones have equal intervals, so that each is a half-tone from the next, sharp or flat, throughout. This is called the scale of "equal temperament." The correct scale is formed from a keynote by multiplying the keynote by the following numbers: 1, 9/8, 5/4, 4/3, 3/2, 5/3, 15/8, and 2 for the ectave. This is called the "diatonic scale." It can be played upon a stringed instrument which can be fingered, and thus the strings made of any length desired. Stone, "Elementary Lessons in Sound," will explain this more fully than our space permits.

(8632) B. C. V. asks: Am interested in the manufacture of phonograph records. What light can you give on the composition and process of manufacture of the former process wax records, also the new molded records? A. The composition of phonograph records is regarded by manufacturers as a trade secret. We have ne fermulæ fer them.

(8633) O. M. S. asks: 1. Why is it that a common electric vibrating bell cannot be made to ring if the ground is used to complete the circuit? The batteries are about 300 feet from the bell and they consist of dry cells? A. You ask why an electric bell will not ring if the ground is used for return. We can see no reason why it should not with suitable battery power. All telephone calls on grounded lines are given in this way, and bells are often used for signal calls on short telegraph lines. The trouble does not lie in the ground in your case. 2. Does the ringing of an electric bell depend upon the amperage or voltage of the current? A. The ringing of an electric bell depends upon the strength of the magnets in it. These depend upon the ampere turns of electricity which flow around the iron cores of the coils, and these depend upon the voltage of the current and the resistance of the circuit. So the ringing of an electric bell depends upon the volts, ohms and amperes of the circuit. 3. Why will a current, which has gone through 1/2 mile of iron wire 1/3 inch in diameter, and measures at the terminals, $\frac{1}{2}$ mile from the battery, 1 volt, not ring a common vibrating bell, which can be rung by a cell with a voltage of $\frac{1}{2}$ volt, the cell being connected to the bell by a few feet of copper A. The resistance of the line wire is enough to cut down the current, so that there is not magnetism enough to ring the bell. 4. I want to make an electromagnet to be operated by a low current and will have the great est magnetic power. Will you tell me what kind and size and how much wire to use? A. There is no general answer to the question.

ke iron cores such as you wish and wind th as coarse wire as you can use in the pace at your disposal and produce strength nough for your purpose. No. 16 or 18 wire should be used.





	
Electric Fan Motor with Battery	\$ 5.95
Electric Table Lamp with Battery	3.00
Battery Hanging Lamp	10.00
Telephone, with Battery complete	5.95
Electric Door Bells, all connections	1.00
Electric Carriage Lamp	5.00
Electric Hand Lanterns	2.00
\$8.00 Electrical Medical Batteries	
\$12.00 Belt, with Suspensory	
Telegraph Outfits, complete	
Battery Motors from\$1,00	
\$6.00 Bicycle Electric Lights	
Electric Railway	3.50
Pocket Flash Lights	
Necktie Lights 75c.	
2.00.000	20 0,00

Send for Free Book. Describes and illustrates many of the most useful electric devices, at wonderfully small prices. All practical. The lowest price in the world on everything electrical. Agents can make handsome commissions and many sales. Write for complete information.

OHIO ELECTRIC WORKS, Cleveland, Ohio.

WireCloth, WireLath, Electrically-Welded Wire Fabrics

and Perforated Metal $\frac{\text{of all}}{\text{Kinds}}$

Manufactured by

CLINTON WIRE CLOTH COMPANY, CLINTON, MASS



The Typewriter Exchange



1½ Barclay St.. NEW YORK 124 La Salle St., CHICAGO 38 Bromfield St.. BOSTON 817 Wyandotte St., KANSAS CITY, MO. 209 North 9th St.

ST. LOUIS, MO. 432 Diamond St.. 5 North Calvert St.. BALTIMORE, MD. PITTSBURGH, PA.

536 California St., SAN FRANCISCO, CAL. We will save you from 10 to 50% on Typewriters of all makes. Send for Octobergue.



GOOD INCOMES MADE 25% to 30% Commission.

BEST AND MOST 33C.

BEST AND MOST 33C.

1-lb trade-mark red bags
Coffees, 12c. and 15c.

135c.

The Great American Tea Co. 31 & 33 Vesey St., New York. P. O. Box 289.

Bicycles Below Cost nly we will sacriffee ut less than actual factory New 1902 Models. "Bellise," complete \$8.75 "Gossack," flavanted \$9.75 "Siberian," a fleety \$10.75 "Meudorf," had fisce, \$11.75 to first bigde at any price. Choice of M. a. W. or Record these and hest equipment on all our bicycles. **Xtron.pext. microaltes.**

we SHIP ON APPROVAL C.G. D. teanyone without a cent deposit & allow 10 DAYS FREE TRIAL before purchase is binding. 500 good 2nd-hand wheels \$3 to \$8. Do not buy a bicycle until you have written for our free catalogues with large photographic engravings and full descriptions.

MEAD GYCLE CC. Dept. 59W, Chicago.

"10f all loverations, the alphabet and printing press of me excepted, these inventions which abridge distance have done most for civilization,"—MACAULAY.

MAP OF THE NEW YORK CENTRAL

LINES.

A system of 11,126 miles of railway in the populous territory east of Chicago, St. Louis and Cincimati, furnishing luxurious and rapid transportation facilities for more than one-half of the entire population of the United States.

Details of rates and trains given by any New York Central ticket agent.

A copy of "America's Summer Resorts," will be sent free, postpaid, on receipt of a postage stamp by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York

THE NEW BRISTOL COUNTER



Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000 and repeats automatically. Simple, accurate, durable. Special counters to order. By Send for circular. C. J. ROOT, Bristol, Count. U. S. A.

HARDWARE SPECIALTIES

Contract Manufacturers Difficult Parts or Finished Articles

UNION MFG. & SPECIALTY CO. 506.508 Genesee Street, BUFFALO, N. Y.



The Best" Light

Is a portable 100 candle power light, costing only 2 cts. per week. Makes and burns
its own gas. Brighter than electricity or
acetylene, and cheaper than kerosene. No
Dirt. No Grease. No odor. ever 100 styles.
Lighted instantly with a match. Every
lamp warranted. Agents Wanled Everywhere.

THE "BEST" LIGHT CO. 87 E. 5th Street, CANTON, OHIO.

ELECTRIC KNOWLEDGE Send 10 cents and of these books: "How to Wire Houses for Electric Bells," "Burglar Alarma," "Telephones," "Electric Gas Lighting." Prices and diagrams in each. Books on

GENTEL & MILLER, 1503 Columbia Ave., Philadelphia FREE Catalogue of Architectural, Scientific and Technical Books.
Prospectusfor 1902, for "Architects and Builders' Magazine," monthly \$2 a year.
WM. I. COMSTOCK. Pub., 23 Warren St., New York.

MODELS WINION MODEL WORKS GEARS 193 CLARK CHICAGO.

MATCH Factory Machinery. W. E. WILLIAMS, Mfr., 217 South Chnton St., Chicago, U. S. A.

STREEL TREES WASHINGTON TO THE TOTAL STREET TO REGIONAL MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee Wis.

MODELS & EXPERIMENTAL WORK.

Inventions developed. Special Machinery.

E. V. BAILLARD, Fox Bldg., Franklin Square, New York.



The Franklin Model Shop.

Experimental work for inventors; anything in metal from a single piece to a complete working model. Apparatus for colleges. Exhibition models. Introduction samples of patented articles. Special tools for making metal novelties. Inventions perfected. Drawings and designs worked out from inventors' ideas. Send for circular S.

PARSELL & WEED,

129-131 West31st Street, New York

NOW READY

ITS PRODUCTION, USES AND APPLICATIONS.

By GARDNER D. HISCOX, M. E.

AUTHOR OF "MECHANICAL MOVEMENTS."

LARGE 8VO.

820 PAGES. PRICE, bound in Cloth, \$5.00.

547 ILLUSTRATIONS. Half Morocco, \$6.50.

A complete treatise on the subject of Compressed Air, comprising its physical and operative properties from a vacuum to its liquid form. Its thermodynamics, compression, transmission, expansion, and its uses for power purposes in mining and engineering work; pneumatic motors, shop tools, air blasts for cleaning and painting. The Sand Blast, air lifts, pumping of water, acids and oils; aeration and purification of water supply; railway propulsion, pneumatic tube transmission, refrigeration. The Air Brake, and numerous appliances in which compressed air is a most convenient and economical vehicle for work—with air tables of compression, expansion and physical properties.

A most comprehensive work on the subject of Compress dair

A special illustrated circular of this book will be sent to any address on application. will be sent to any address on application.



MUNN & CO.,

361 Broadway, New York.

Publishers of the Scientific American,

© 1902 SCIENTIFIC AMERICAN, INC.