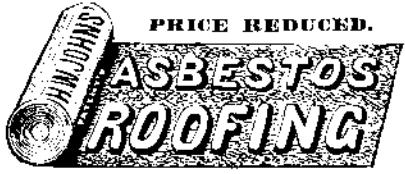


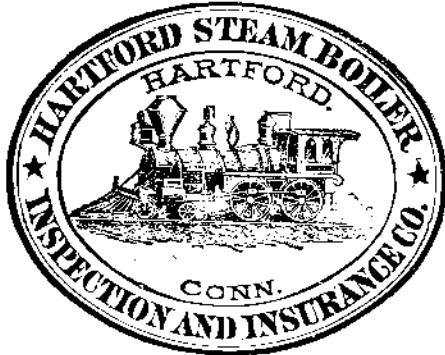
Advertisements.

Inside Page, each insertion... Back Page each insertion... The above are charges per agate line...



PRICE REDUCED. ASBESTOS ROOFING. FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

THE GREAT AQUEDUCT OF NEW YORK CITY.—Lengthy and very complete account of the great aqueduct now being built by the City of New York...



THE ECLIPSE OF ALGOL, WITH THE LATEST DETERMINATIONS OF ITS DISTANCE AND DIMENSIONS.—By Royal B. Hill. An interesting account of recent studies of the variations in intensity of the star Algol...

Barnes' Pat. Foot Hand Power Machinery, \$18. Contractors and Builders, Cabinet-Makers and Jobbers in Wood or Metal...

SINKING MINE SHAFTS.—Description of Mr. Pötsch's method of sinking mine shafts in watery earth by means of freezing. With 2 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 537. Price 10 cents.

POINTERS for Users of Steam Pumps. Van Duzen's Patent Steam Pump. Hot or Cold. Can Pump Sandy or Impure Water or Liquids. Efficient. Has no moving parts...

THE SIEGE OF ALEXANDRIA BY JULIUS CAESAR.—By Rear Admiral Serre, of the French Navy.—The situation of ancient Alexandria, as compared with modern Alexandria. Caesar's account of the siege of the city. Deductions to be drawn from the account. Illustrated with one engraving and two maps. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 506. Price 10 cents.

Chandler & Farquhar, 177 Washington St., BOSTON. Agents for Fay's "Yankee" CALIPERS AND Barnes' Foot Power Machinery, AND DEALERS IN Machinists' Supplies of Every Kind.

ORNAMENTAL DESIGN, PRINCIPLES AND PRACTICE.—By Lewis F. Day. The second of a series of lectures on this subject, discussing the lines upon which ornament can be distributed. With 5 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 589. Price 10 cents.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors. In this line of business they have had forty-one years' experience...

JENKINS BROS. VALVES.

THE ENDORSEMENT OF FIRST-CLASS ENGINEERS AND MECHANICS THROUGHOUT THE COUNTRY has fully demonstrated these valves to possess the following advantages over all other valves now in use. 1. A perfectly tight valve under any and all pressures of steam, oils, or gases. 2. Sand or grit of any kind will not injure the seat. 3. You do not have to take them off to repair them. 4. They can be repaired by any mechanic in a few minutes. 5. The elasticity of the Disc allows it to adapt itself to an imperfect surface.



Ajax Anti-Acid Metal. We guarantee 100 per cent longer service than ordinary composition metal and our prices are reasonable. HARRISON BROTHERS & CO., MANUFACTURERS OF WHITE LEAD, COLORS AND CHEMICALS. PHILADELPHIA, April 21st, 1887.

ALKALOIDS AND OTHER CRYSTALLINE BODIES.—Identification of by the Microscope. By A. Percy Smith, F.C.S. With 50 figures of microcrystals. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 543. Price 10 cents.

Ainsworth's Patent Improved BELT CLAMP. This clamp is light and strong; a pair will last a lifetime; are made of the best cast steel. No tool or wrench is needed, as it is complete in itself. Can be used on any size belt, from one inch to size of clamp. E. Ainsworth, Mfr., 825 Washington St., Wilmington, Del.

COMPRESSED AIR FOR TRAMWAYS.—A paper by Norman Selge, discussing the comparative merits of compressed air under high and low pressures, as a motive power for street cars. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 553. Price 10 cents.

AGENTS WANTED (Samples FREE) for Dr. Scott's beautiful Electric Corsets, Brushes, Belts, Etc. No risk, quick sales. Territory given, satisfaction guaranteed. DR. SCOTT, 843 Broadway, N. Y.

EXAMINATION QUESTIONS IN GENERAL construction. Copy of the last examination papers given to candidates who are desirous of employment in the constructive departments of the municipality of New York. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 561. Price 10 cents.

HARRISON CONVEYOR! For Handling Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c. BORDEN, SELLECK & CO., Sole Manufacturers, Chicago, Ill.

TEST RECORDING APPARATUS.—Description by J. H. Wicksteed, of a new testing machine, with autographic recording apparatus, and an explanation of its mode of operation. With 4 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 538. Price 10 cents.

USEFUL BOOKS.

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost.

A SYNOPSIS OF ALL THE KNOWN Anesthetics, with their physical and physiological properties, and anesthetic value. By B. W. Richardson, M.D. Contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 515 and 516. Price 10 cents each.

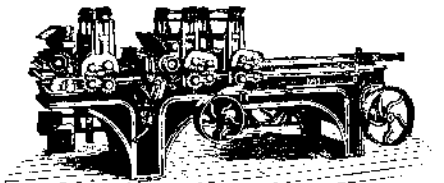
SAWS Wanted 50,000 Sawyers and SAW S Lumbermen to send us their full address for a copy of Emerson's Book of SAWS. We are first to introduce NATURAL GAS for heating and tempering saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.

HISTORY OF THE ELECTRICAL ART in the U. S. Patent Office.—By C. J. Kintner. An interesting history of the growth of electrical science in this country, and notices of some of the more important models in possession of the Patent Office. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 544. Price 10 cents.

WATERBURY MALLEABLE IRON COMPANY, WATERBURY, CONN. MALLEABLE AND GRAY IRON CASTINGS. FITTINGS for STEAM, GAS & WATER.

HOW TO GRAFT.—A VALUABLE PAPER, giving complete directions for making various kinds of grafts in fruit trees.—Cleft grafting, slip grafting, bear's mouth grafting, wired grafting, side grafting, whip grafting, saddle grafting, tongue grafting, split grafting, crown grafting. Grafting-wax. Waxed cloth. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 540. Price 10 cents.

SHAFTING DEPARTMENT Couplings, Hangers, Shafting, Pulleys. EDISON MACHINE WORKS. Salesroom 19 DEY STREET New York.



WITHERBY, RUGG & RICHARDSON, Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

COLORS, COMMON AND POISONOUS.—A table showing the composition of some of the pigments in common use, with a classification of the latter based upon poisonous properties. Contained in the SCIENTIFIC AMERICAN SUPPLEMENT No. 546. Price 10 cents.

THE TEST OF THE ROADS FOR TEN YEARS. By the majority of American riders of first-class machines, proves the COLUMBIA BICYCLE & TRICYCLES SUPERIOR TO ALL OTHERS. Illustrated catalogue sent free. POPE MFG. CO., Boston, New York, Chicago, Hartford.

CONCRETE.—BY JOHN SLATER, B.A.—A paper on the means to be adopted in order to render buildings stable, and on the use of concrete as a building material. Value of concrete. Materials of which concrete is composed. Concrete buildings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 539. Price 10 cents.

STEAM ENGINES. Horizontal and Vertical. Dredging Machinery, Flour, Powder, Sift and Flint Mill Machinery, Turbine Water Wheels. York Mfg Co., York, Pa. U. S. A.

AIR, PURIFICATION OF.—BY D. Prince, M.D. An experimental study in relation to the removal from the air of the dust or particulate material, supposed to produce yellow fever, small-pox, and other infectious disease. Illustration. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 549. Price 10 cents.

AN IMPROVED ARMY FILTER.—Description of a very effective portable filter devised by Mr. Maignen for army use, but likewise adapted for the use of wine and spirit merchants and brewers, and for laboratory purposes. Illustrated with 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 436. Price 10 cents.

To Business Men.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man who wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

WIRE ROPE. Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheels and Rope for conveying power long distances. Send for circular.

WIRE ROPE. Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheels and Rope for conveying power long distances. Send for circular.

CHLORINATION OF GOLD ORES.—A paper by G. W. Small, E.M., detailing the method of chlorinating gold adopted by the Plymouth Consolidated Gold Mining Co. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 545. Price 10 cents.

CHARTER'S GAS ENGINE.

The safest, most reliable and economical Motor in existence. Independent of Gas Works and Machines. 2 to 25 H.P. So it can be used anywhere. Makes its Own Gas AT COST OF ABOUT 65 cents per M Feet. A Saving of 25 to 85 per cent guaranteed over all other Gas Engines. Chicago Agent: H. H. LATHAM, 42 Dearborn Street, New York House: 12 Cortlandt Street. Williams & Orton Mfg. Co. P. O. Box 148. STERLING, ILL.

THE AMERICAN BELL TELEPHONE CO. 95 MILK ST. BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

Water Wheels New and Second Hand Address FLENNIKEN TURBINE CO., Dubuque, Iowa.

Scientific American Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. \$2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid Magazine of Architecture, richly adorned with elegant plates in colors, and with fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Costs, Bills of Estimate, and Sheets of Details.

Architects, Builders, and Owners will find this work valuable in furnishing fresh and useful suggestions. All who contemplate building or improving homes or erecting structures of any kind, have before them in this work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

Many other subjects, including Sewerage, Piping, Lighting, Warming, Ventilating, Decorating, Laying Out of Grounds, etc., are illustrated. An extensive Compendium of Manufacturers' Announcements is also given, in which the most reliable and approved Building Materials, Goods, Machines, Tools, and Appliances are described and illustrated, with addresses of the makers, etc.

The fullness, richness, cheapness, and convenience of this work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., Publishers, 361 Broadway, New York.

Building Plans and Specifications.

In connection with the publication of the BUILDING EDITION of the SCIENTIFIC AMERICAN, Messrs. Munn & Co. furnish Plans and Specifications for Buildings of every kind, including Public Buildings, Churches, Schools, Stores, Dwellings, Carriage Houses, Barns, etc. In this work they are assisted by able and experienced architects.

Those who contemplate building, or who wish to alter, improve, extend, or add to existing buildings, whether wings, porches, bay windows, or attic rooms, are invited to communicate with the undersigned. Our work extends to all parts of the country. Estimates, plans, and drawings promptly prepared. Terms moderate. Address MUNN & CO., 361 Broadway, New York.

PRINTING INKS. THE "Scientific American" is printed with CHAS. T. NEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.