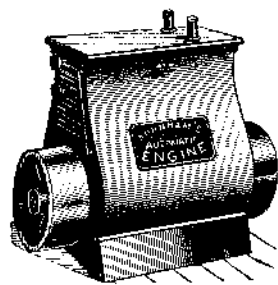


Advertisements.

Inside Page, each insertion - - - 75 cents a line. Back Page, each insertion - - - \$1.00 a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



BURNHAM SELF-OILING Automatic Steam ENGINE Patented Feb. 23, 1886.

Catalogue sent free by Burnham Engine Co., YORK, PA.



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.

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

THE CONVERSION OF HEAT INTO USEFUL WORK.—A series of interesting lectures by Wm. Anderson, M. Inst. C.E., presenting the modern views connected with the conversion of heat into useful work.

H.W. JOHNS' ASBESTOS

Roofing, Building Felt, Steam Packings, Boiler Coverings, Fire Proof Paints, Cements, Etc. Samples and Descriptive Price Lists Free.

DOUBLE BOATS.—TWENTY-ONE illustrations of patented double boats, the general construction and plan of which are so clearly shown as to need no detailed description.



BARREL, KEG, Hogshead, AND STAVE MACHINERY. Over 50 varieties manufactured by E. & B. HOLMES, BUFFALO, N. Y.

WM. A. HARRIS, Providence, R. I. (Park St.) Six minutes' walk West from station. Original and Only Builder of the HARRIS-CORLISS ENGINE.

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, and now have unequalled facilities for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

MUNN & CO., Solicitors of Patents, 361 Broadway, New York. BRANCH OFFICES.—No. 622 and 624 F Street, Patent Building, near 7th Street, Washington, D. C.

HALF A MILLION GARDENS SEEDS Peter Henderson & Co. PLANTS. Our Seed Warehouses, the largest in New York, are fitted up with every appliance for the prompt and careful filling of orders.

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.

SEBASTIAN, MAY & CO'S Improved Screw Cutting LATHES Foot & Power \$60. Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. Lathes on trial. Catalogues mailed on application 165 W. 2d St., Cincinnati, O.

VENTILATION.—GREAT IMPORTANCE of ventilation. The vitiation of air that is constantly going on in inhabited places, exhaustion of oxygen by gas, candles and lamps. Ventilation by natural and artificial means. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 525. Price 10 cents. To be had at this office and from all newsdealers.

THE HERCULES This superior lacing has an established reputation, and a rapidly growing trade both in this country and abroad. It is giving the best of satisfaction wherever it is tried. Made only by the Page Belting Co., Manufacturers of superior leather belting, Concord, N. H., also New York, Boston, Chicago, St. Louis, Cincinnati, and Kansas City. Send for new Catalogue.

THE IMPROVED Rider Hot Air Pumping Engine For City or Country Residences, Burns Coal, Wood, or Gas. Safe, Simple, Durable. 3,000 in use. Send for Illustrated Catalogue "A." SAYER & CO., 37 Dey St., New York.

GAS ENGINES. Best in principle, workmanship, and materials. An unequalled small Motor adapted to all uses. When the motor is not at work, the expense of running it ceases. Simple, Safe, Economical, Durable. No extra insurance. Four sizes: 1 H. P., 1/2 H. P., 1 man power, and Dental Engine. These Engines are especially suited for Gasoline Gas for country use. Send for Illustrated Catalogue.

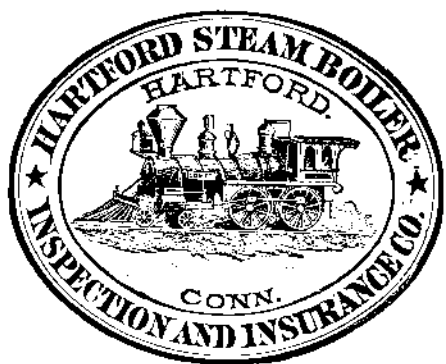
INTERNATIONAL INSTITUTE FOR Liquefied Carbonic Gas. O. BRUNEL, 857 Broadway, New York.

STEWART'S READY ROOFING For ROOFS OF ALL DESCRIPTIONS, steep or flat, can be applied by ordinary workmen having no previous experience. Send for Samples and Illustrated Pamphlet. Address W. H. STEWART, 74 Cortlandt Street, New York. IRON-FIBRE PAINT, for Roofs and Factory and Farm Buildings.

EPPS'S GRATEFUL-COMFORTING COCOA IT PAYS To sell our Rubber Stamps. Free Catalogue to agents. FOLJAMBE & Co., Cleveland, O.

PROSPECTING MINERAL LANDS A SPECIALTY. CYLINDRICAL SECTIONS OR CORES OBTAINED THE WHOLE DISTANCE BORED. ARTESIAN WELLS BORED ROUND AND STRAIGHT ADMITTING A LARGER PUMP & CASING IN PROPORTION TO SIZE OF HOLE THAN BY ANY OTHER PROCESS. ESTIMATES GIVEN AND CONTRACTS MADE BY THE PENNSYLVANIA DIAMOND DRILL CO. BOX 423 POTTSVILLE PA. MANUFACTURERS OF DIAMOND DRILLS FOR ALL KINDS OF ROCK BORING.

BLAKE'S IMPROVED PIPE HANGER. IT IS THE CHEAPEST AND BEST HANGER IN THE MARKET. It saves many expensive Blacksmiths' Jobs. Can be attached to pipe when in position. Expansion always provided for. Cheap because it is simple. Pitch lines of mains easily obtained. No troublesome screws to adjust. JENKINS BROS., SOLE AGENTS, 71 JOHN ST., NEW YORK. 13 SO. FOURTH ST., PHILA. 79 KILBY ST., BOSTON



LIGHTNING RODS.—DESCRIPTION OF the arrangement adopted by Mr. Melsens for protecting the Brussels Hotel de Ville against lightning. With 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 525. Price 10 cents. To be had at this office and from all newsdealers.

NICKEL PLATING & POLISHING MATERIALS. ZUCKER & LEVETT CHEMICAL CO NEW YORK U.S.A. NICKEL & ELECTRO PLATING OUTFITS.

ECONOMIC MOTOR CO., Office and Salesrooms, 9 CORTLANDT ST., NEW YORK.

MUNSON'S PORTABLE MILLS, AND MILL FURNISHINGS, MANUFACTURED BY MUNSON BROTHERS, Utica, N. Y., U. S. A.

COMMON SENSE CHAIRS, SETTEES, AND ROCKERS. Strong, durable, and comfortable. No light, trashy stuff, but good, honest, home comforts. Special discount to clergymen. Send stamp for catalogue to F. A. SINCLAIR, Mottville, Onondaga Co., New York.

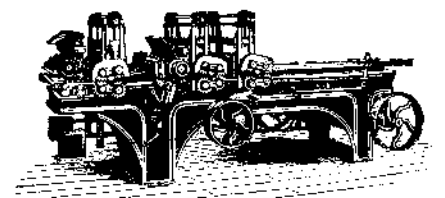
STEAM ENGINES. Horizontal and Vertical. Dredging Machinery, Flour Powder, Slate and Flint Mill Machinery, Turbine Water Wheels. York Mfg Co., York, Pa., U. S. A.

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.

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.



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.

PROSPECTUS OF THE Scientific American FOR 1886.

The Most Popular Scientific Paper in the World. Only \$3.20 a Year, including Postage. Weekly 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, \$1.60; three months, \$1.00.

Clubs.—One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to MUNN & CO., 361 Broadway New York.

THE Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archaeology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, \$5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for \$7.00. Address and remit by postal order, express money order, or check.

MUNN & Co., 361 Broadway, N. Y., Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, \$4, gold, for SCIENTIFIC AMERICAN, one year; \$9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of MUNN & CO., 361 Broadway, New York.

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