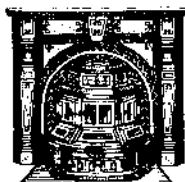


Advertisements.

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



Bibb's Celebrated Original BALTIMORE FIRE-PLACE HEATERS.

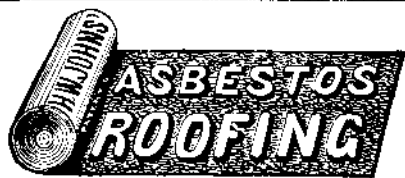
MICROSCOPES Telescopes, Spectacles, Barometers, Thermometers, Photographic Optics for Amateurs, Opera Glasses, etc.

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.

AERIAL NAVIGATION.—DESCRIPTION and illustration of a new aeronautic machine, devised by Mr. Fred. W. Brearey, Secretary of the Aeronautical Society of Great Britain.



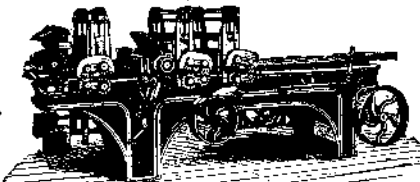
FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail. H. W. JOHNS MFG CO., 87 MAIDEN LANE, N. Y.

LIGHTNING RODS.—DESCRIPTION OF the arrangement adopted by Mr. Melsen for protecting the Brussels Hotel de Ville against lightning.

INTERNATIONAL INSTITUTE FOR Liquefied Carbonic Gas. O. BIUNLER, 357 Broadway, New York.

VENTILATION.—GREAT IMPORTANCE of ventilation. The vitiation of air that is constantly going on in inhabited places.



WITHERBY, RUGG & RICHARDSON, Manufacturers of Patent Wood Working Machinery of every description.

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

PATENTS.

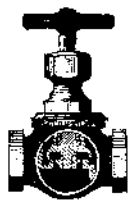
MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

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.

We also send, free of charge, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

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



A FAIR OFFER.

If you will put a JENKINS BROS. VALVE on the worst place you can find, where you cannot keep other Valves tight, and if it is not perfectly tight or does not hold Steam, Oils, Acids, or other fluids longer than any other Valve, you may return it, and your money will be refunded.

To avoid imposition, see that valves are stamped "Jenkins Bros."

JENKINS BROS.,

71 John St., New York. 13 So. Fourth St., Phila. 79 Kilby St., Boston.

\$10.00 to \$50.00 per night. A light and profitable business. Magic Lanterns and Views of all popular subjects. Catalogues on application.

L. MANASSE, 88 Madison Street, Chicago, Ill.

WIRE ROPE

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

EVOLUTION; THE LATEST ADVANCES of the Doctrine of Evolution. By E. C. Cope and W. H. Ballou.—Present status of the theory. Mr. Darwin's views. Beginnings of structures and origin of them, adaptation of means to ends. Every day phenomena. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 527. Price 10 cents. To be had at this office and from all newsdealers.

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.

REMOVAL OF SEWAGE.—BY W. H. White, C.E.—The five methods in use in Europe, and their relative values. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 527. Price 10 cent. To be had at this office and from all newsdealers.

EPPS'S COCOA

GRATEFUL—COMFORTING.

ELECTRIC TRAMWAYS.—DESCRIPTION of the electric tramway recently constructed at Blackpool, England, from plans by Mr. Holroyd Smith. With full page of illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 528. Price 10 cents. To be had at this office and from all newsdealers.

ASBESTOS PIPE COVERINGS

Made entirely of ASBESTOS. Absolutely Fire Proof. BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES. CHALMERS-SPENCE CO., FOOT B. 8TH ST., N. Y.

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. BIRDSBORO PA. MANUFACTURERS OF DIAMOND DRILLS FOR ALL KINDS OF ROCK BORING.

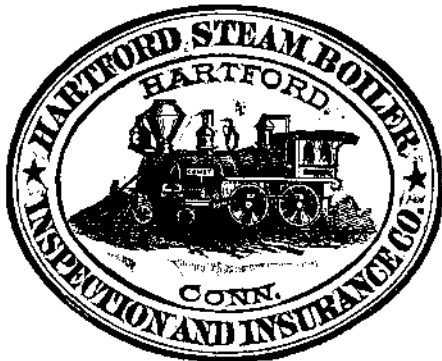
ON SEWAGE DISPOSAL.—BY PROF. H. HUBBARD. Sewage disposal on land. Sewage disposal by chemical treatment. Sewage disposal by discharge into river or sea. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 467. Price 10 cents. To be had at this office and from all newsdealers.

BARREL, KEG, Hoghead, AND STAVE MACHINERY. Over 50 varieties manufactured by Truss Hoop Driving. E. & B. Holmes, BUFFALO, N. Y.

LUBRICATING OILS.—A PAPER BY C. J. H. Woodbury, giving the results of the examination of a single lubricant under a wide range of investigation concerning its friction. Illustrated with 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 473. Price 10 cents. To be had at this office and from all newsdealers.

ENGINES AND BOILERS of all sizes. Write for Circular and tell us what you want. R. W. PAYNE & SON, 104 Kinatra, N. Y. New York Office: 107 Liberty Street. Eastern Agents, HILL, CLARKE & CO., Boston, Mass. Our patented Vertical Boiler will not prime. No danger of burning flues.

HOISTING ENGINES LIDGERWOOD MANUFACTURING CO., 96 LIBERTY STREET, NEW YORK.



CONCRETE AS A BUILDING MATERIAL. A paper by Thomas Potter, calling attention to some of the less generally known, but most vital, points in connection with the production of good concrete for building purposes. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 487. Price 10 cents. To be had at this office and from all newsdealers.

COPPER TUBES, SHEET BRASS, BRASS WIRE. Mention this paper.

FIRE DAMP IN COAL MINES.—DESCRIPTION of apparatus invented by H. G. Carleton for indicating the presence of fire damp, with 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 528. Price 10 cents. To be had at this office and from all newsdealers.

DROP FORGINGS FINISHED TOOLS. BILLINGS & SPENCER CO., HARTFORD, CONN.

BOSTON SEWAGE WORKS.—A FULL description of the system, accompanied with a map showing the general arrangement, and discharge into the harbor, and with 26 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 524. Price 10 cents. To be had at this office and from all newsdealers.

A New steam yacht for sale. Length, 48 feet; 11 1/2 feet beam; licensed for 50 passengers. Address Wm. STEIN, Blue Island, Ill.

PIPE COVERINGS

Machinery and Education.—A lecture by Dr. R. W. Raymond, pointing out some interesting analogies between the evolution illustrated in the growth of natural forms in the visible world and the development and adaptation of the human mind and thought, as modified by environment and education. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 525. Price 10 cents. To be had at this office and from all newsdealers.

FILM PHOTOGRAPHY. Negatives made by means of the Roll-Holder. Circulars free. The EASTMAN DRY PLATE & FILM CO., 137 State Street, Rochester, N. Y.

Van Duzen's Pat. Loose Pulley Oiler HAS Highest Indorsements, Enviable Reputation, Scientific Pedigree. A two years' test by conservative manufacturers of national reputation has shown it to be the only perfect Lubricator for Loose Pulleys in use. Prices very reasonable. Send for our "Catalogue Number 55." VAN DUZEN & TIFT, Cincinnati, O.

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

School of Engineering, OHIO STATE UNIVERSITY, COLUMBUS. Civil, Mechanical and Mining Engineering. Full courses and ample equipment. The year will open September 16. Entrance Examinations September 14 and 15. Announcement sent on application. W. H. SCOTT, President.

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

and Boilers for every possible duty. New catalogue ready.

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.

DRAWING INSTRUMENTS. Illustrated catalogue sent on application to Wm. T. COMSTOCK, 6 Astor Place, New York.

NINTH AND ARCH MUSEUM, PHILADELPHIA, PA.,

Will open its fourth season about September 13th next. C. A. Bradenburgh & Co., Proprietors. Wanted for exhibition, all kinds of Mechanical Novelties, Industrial Art Exhibits, ingenious contrivances, inventions, patents, automata, scientific discoveries, working figures and models, expert exhibitions of handwork and machinery, and, in fact, everything of interest. Upward of 50,000 people in attendance weekly. Address as above.

Reflecting Telescopes, Equatorial Mountings, etc. Reasonable prices. Gardam & Sons, 96 John St., N. Y.

PROSPECTUS OF THE Scientific American

FOR 1886. The Most Popular Scientific Paper in the World. Only \$3.00 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.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

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 by the publishers; six months, \$1.50; three months, \$1.00.

Clubs.—One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.00 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.