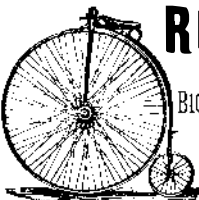


Advertisements.

Inside Page, each insertion - - - 25 cents a line.
Back Page, each insertion - - - \$1.00 a line.
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may be advertised at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



RIDE CYCLES!

VICTORS ARE BEST!
Bicycles, Tricycles, and Safeties.
Send for free illustrated Catalogue.
Overman Wheel Co., Makers,
BOSTON, MASS.

THE COPYING PAD.—HOW TO MAKE and how to use, with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

THE KODAK CAMERA



Makes 100 Instantaneous Pictures by simply pressing a button. Anybody can use it who can wind a watch. No focusing. No tripod. Rapid. Rectilinear. Lens. Photographs moving objects. Can be used indoors.

Division of Labor (operator can finish his own pictures, or send them to the factory to be finished). Morocco covered Camera, in a handsome leather case, loaded for 100 pictures.

For full description of "Kodak" see SCI. AM., Sept. 15, '88. Price, \$25.00. Reloading, \$2.00.
The Eastman Dry Plate & Film Co.
Rochester, N. Y. 115 Oxford St., London.
Send for copy of Kodak Primer with Kodak Photograph.

GRAPHOPHONE AND PHONOGRAPH.—An interesting account of the Edison, Bell, and Tainter apparatus for the mechanical reproduction of speech, with detailed description of the same. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 664. Price 10 cents. To be had at this office and from all newsdealers.



The ECLIPSE
HYDRAULIC
ELEVATOR
Simple, Durable, Economical,
and Absolutely Safe.
Cannot fall or freeze.
Tuerk Hydraulic Power Co.
New York. Chicago.

Scientific Book Catalogue

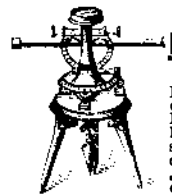
RECENTLY PUBLISHED.
Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.



OIL ENGINES.

For Printers, Steam Yachts, pumping water, sawing wood, making ice-cream, Carpenters, Mechanics, to 8 H. P. Fuel, Kerosene. No dust. Automatic in fuel and water supply. Illustrated Catalogue free. See illustrated notice in Sci. Am. Aug. 4, 1888.
SHIPMAN ENGINE CO.
92 Pearl St., Boston, Mass.

PARIS EXHIBITION OF 1889.—Description of the buildings of the approaching Paris exhibition, and of the grounds which they are to occupy. The Trocadero Park. The Champ de Mars. The Wharves and the Esplanade. Present state of the work. Illustrated with three engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 657. Price 10 cents. To be had at this office and from all newsdealers.



HARMON'S IMPROVED

Leveling Instrument.

With or without Compass.

For Engineers, Contractors, and all others requiring a low priced leveling instrument for grading, measuring heights, squaring, or getting any desired angle. Illustrated circular sent on receipt of stamp.
JOHN W. HARMON, 65 Haverhill Street, Boston, Mass.

ALUMINUM. INFLUENCE OF UPON Cast Iron.—A paper by W. J. Keep, C.E., giving the results of a series of carefully conducted tests to settle the question as to whether aluminum which has been added to iron remains therein after it has been cast. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 662. Price 10 cents. To be had at this office and from all newsdealers.



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. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business entrusted to them is done with special care and promptness, on very reasonable terms.

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, Patent Building, near 7th Street, Washington, D. C.



THE "WELLS' LIGHT"

WALLWORK & WELLS' PATENTS.

Adopted by the British Government at Woolwich Arsenal and Chatham Dockyard, and by the Largest Contractors and Engineers in the World.
CAN EASILY BE CARRIED ABOUT BY TWO MEN.
Requires no Engine! Boiler! or Air Compressors! To Drive it, as others do.
OVER 1000 SOLD IN 6 MONTHS.
200 are in constant use on the extensive workings of the Manchester Ship Canal.
The only Commercially Perfect Lamp of its class in the market.
The Patentees are now starting for the States with a view to granting Licenses for the manufacture and sale of these Lamps, or of forming a Company to work the patents. Communications, which will receive attention on arrival, can be addressed
WALLWORK & WELLS, care David Williams, Esq., 66 Duane St., New York.



THE ORIGINAL UNVULCANIZED PACKING

CALLED THE STANDARD. As it is the Packing by which all others are compared. Accept no packing as JENKINS' PACKING unless stamped with our "Trade Mark."

JENKINS BROS. 21 John Street, N. Y. 105 Milk Street, Boston. 21 North 5th St., Phila. 54 Dearborn St., Chicago.

GOODSELL'S PACKINGS.

RUBBER-BACK FLAX Piston-rod Packing for general work. RUBBER-BACK COTTON Piston-rod Packing for high steam rods. "HECLA" Sheet Packing for permanent joints. REMOVABLE GASKETS for Boilers—always keeps soft. These specialties are the latest improvements in arrangement and materials. Light in weight, no grease, no dented rods, no leaky joints. Results guaranteed. Samples free.
B. W. GOODSSELL, Sole Maker, 137 Lake Street, Chicago, Ill.



SAWS Wanted 50,000 Sawyers and 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.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 632. Price 10 cents. To be had at this office and from all newsdealers.



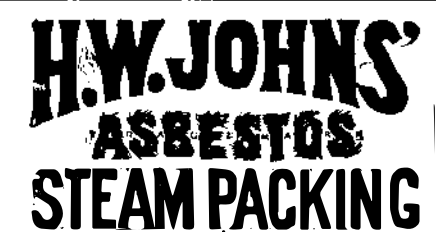
The Dunning Patent Wrought-Iron Boiler

With Self-Feeding Coal Magazine, is the best for Low Pressure Steam or Hot Water Heating.

Made in eleven sizes, suitable to heat the smallest cottage or the largest building. Insures a warm house night and day. Burns Hard or Soft Coal, Wood, Coke, or Gas. Over 14,000 in use. Kerosene up constantly. Also Steam Engines and Boilers of all kinds, and Machinery generally. Manufactured at the New York Central Iron Works, Lock Box 40, Geneva, N. Y., and Watrous Engine Works Co. (Limited), Brantford, Ontario, Canada.
Send for New Illustrated Catalogue.



PULLEYS, HANGERS, FRICTION CLUTCHES. 44 Park Place, N. Y.



Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, Etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE
H. W. JOHNS MFG. CO., 87 Malden Lane, N. Y.

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.



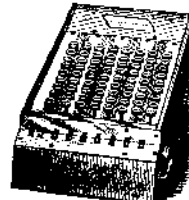
CUTLER DESK. BEST IN THE WORLD.



REGULATORS.
The Mason Steam Regulating Devices are known all over the world as the best of their kind. They are the standard adopted by the American and Southern cotton oil companies. Over 700 of our reducing valves were used by one car-heating firm last year. Send for description to
MASON REGULATOR CO., 22 Central St., Boston, Mass.,
Or JENKINS BROS., Agents, New York, Philadelphia, and Chicago.

SYRACUSE MALLEABLE IRON WORKS

ROYAL MICROSCOPIC SOCIETY.—Annual address by the President Dr. Dollinger, F.R.S., delivered Feb. 8, 1888. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 643. Price 10 cents. To be had at this office and from all newsdealers.



COMPTOMETER

ALL ARITHMETICAL PROBLEMS

Solved rapidly and accurately by using the Comptometer. Saves 40 per cent. of time. Entire relief from mental strain. Adapted to all commercial and scientific computations. Send for circular.

FELT & TARRANT MFG. CO., 52-56 Illinois St. Chicago

WORKING MODELS and Experimental Machinery, metal or wood, made to order by MASON & BAUCH, successors to J. F. Werner, 62 Centre Street, New York.

PATENTS FOR SALE.—Steam Trap, Back Pressure Valve, and Mechanical Boiler Cleaner. Investigate. Address TAYLOR BROS., New Orleans, La.



NICKEL AND ELECTRO-PLATING APPARATUS

MATERIAL HANSON, VAN WINKLE & CO. NEWARK, N. J. 92 LIBERTY ST. N. Y.

KEY SEATING Machines and 20" Drills. W. F. DAVIS, Rochester, N. Y.

THE Scientific American

ESTABLISHED 1846.

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. Complete List of Patents each week.

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.—Special rates for several names, and to Post Masters. Write for particulars.

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 full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. 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 obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated 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. Single copies 10 cents. Address and remit by postal order, express money order, or check.

MUNN & CO., 361 Broadway, N. Y. Publishers 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 a large and splendid Magazine of Architecture, richly adorned with elegant plates in colors, and with other 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, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. \$2.50 a year. Remit to

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

PRINTING INKS.

THE "Scientific American" is printed with CHAS. ENRU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.