

Advertisements.

Inside Page, each insertion --- 75 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 head advertisements 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.

THE KODAK CAMERA



Makes 100 instantaneous pictures by simply pressing a button. Nobody 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 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.

FOR
JENKINS BROS. VALVES
71 JOHN ST., NEW YORK.
21 North 5th ST. PHILA.
105 MILK ST. BOSTON.
54 DEARBORN ST. CHICAGO.

THE MODERN ICE YACHT.—BY Geo. W. Foltz. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 624. Price 10 cents. To be had at this office and of all newsdealers.

STEEL BALLS.

For Anti-Friction Bearings, of Best Cast Steel. Hardened, Ground, and Burnished, from 3-16 in. to 2 in. diameter. In quality and density, and in uniformity of temper, and in accuracy and nicety of finish warranted unequalled.

Simond's Rolling-Machine Co., Fitchburg, Mass.

VELOCITY OF ICE BOATS. A COLLECTION of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 214. Price 10 cents. To be had at this office and of all newsdealers.

Barnes' Foot-Power Machinery
Complete outfits for a small workshop. A customer says: "Considering its capacity and the accuracy of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day, and at night feel as little tired as if I had been walking around." Descriptive Price List Free.
W. F. & JOHN BARNES CO.,
1899 RUBY ST., ROCKFORD, ILL.

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 of all newsdealers.

ERIE ENGINE WORKS MANUFACTURERS OF STEAM ENGINES, BOILERS, AND ALL KINDS OF MECHANICAL WORK.

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.

MALLEABLE THOMAS DEVLIN & CO. CASTINGS FROM SPECIAL PATTERNS. LEHIGH AVE. & AMERICAN ST. PHILA.

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, Reimbursements, and Reports on Infringements of Patents. All business entrusted to them is done with special care and promptness, on very reasonable terms.

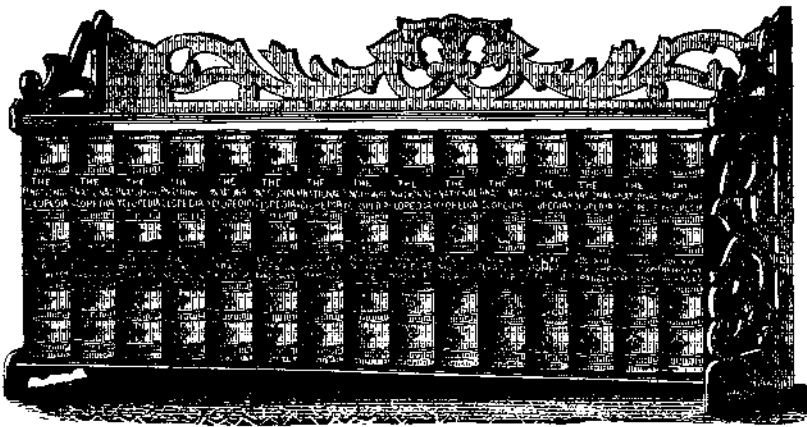
A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Issues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

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.

THE INTERNATIONAL CYCLOPEDIA



IT IS THE UNIVERSAL EDUCATOR.
WHAT A CYCLOPEDIA MEANS TO ITS POSSESSOR:

All Knowledge Held Up as in a Mirror.
The Lives of Illustrations Men Presented as Examples.
Help in Every Kind of Study.
The Great Sciences Explained.
The Great Religions Defined.
All History Crystallized.
Every Man His Own Lawyer, and Every Family Its Own Physician.
Every Question Answered, and Every Problem Solved.

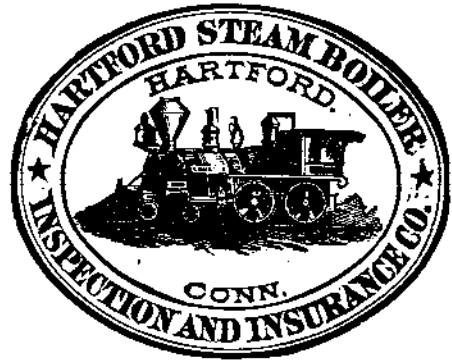
AGENTS WANTED. The Money Made in Selling Knowledge is The Best Money in the World.

DODD, MEAD & COMPANY, Publishers, 753 & 755 Broadway, NEW YORK.

COPPER TUBES
SHEET BRASS BRASS WIRE

HYATT FILTERS.

The Franklin Institute of Philadelphia has awarded The Scott Legacy Premium Medal to this Company for the adaptability of their system to the Purification of Water Supplies of Cities.
LONG BRANCH, NEW JERSEY,
NEWPORT, RHODE ISLAND,
ATLANTA, GEORGIA,
and over 20 cities and towns have adopted this system, which is the only successful legitimate one. We have suits against the National, Jewell, and other Companies who infringe our patents.
HYATT PURE WATER COMPANY,
18 Cortlandt Street, New York City.



PHOTOGRAPHIC OUTFITS for Amateurs.
Microscopes, Telescopes, Spectacles, Barometers, Slides, W. H. WALKER & CO. Philada, Pa.
Plus. price list free. Send for Special Bargain List.

THE BRIDGEPORT WOOD FINISHING CO.
NEW MILFORD, CONN.
WHEELERS PATENT WOOD FILLER.
BREINIGS LITHOGEN SILICATE PAINT
LITHOGEN PRIMER. WOOD STAINS
SILEX FLINT AND FELDSPAR.
PAMPHLET GIVING DIRECTIONS FOR FINISHING HARD WOOD FREE TO ANY ADDRESS.

STANDARD TOOL CO.
ATHOL, MASS.
MANUFACTURERS OF
The Celebrated Chapin Try and Center Square, Standard Steel Rules, Steel Caliper Rules, Universal Bevels, Caliper Gauges, Improved Surface Gauges, Bevel Protractors, Depth Gauges, Screw Pitch and Center Gauges, Hardened Steel Squares, Graduated Steel Squares, Spring Callers, Pliers, Straight Edges, etc., etc.
WRITE FOR ILLUSTRATED CATALOGUE AND PRICE LIST OF FULL LINE.

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.

DELAFIELD'S PAT. SAW CLAMP
With saw for cutting metals. Saves all the broken hack-saw blades. In use over two years in all parts of the country. The new clamps have the edges bevelled that hold the saw. By mail, with one blade, 50 cents. Extra blades 8¢. "Star" 7¢ each. 70 cents per dozen, by mail. Blades 8" x 1", "Stubbs," 35 cents each, by mail. Discount to dealers.
NOROTON MFG. WORKS, Noroton, Conn.

THE STANDARD
H.M. JOHNS ASBESTOS
BOILER COVERINGS
H.M. JOHNS MFG. CO.
62 WALDEN LANE,
NEW YORK
PATENTED
INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 88, Cleveland, O.

PEDERSEN'S PATENT BIT-BRACES
With Ratchet and without. In every style and grade of finish. Nickel-plated and polished. Cherry, black walnut, cocobola, and lignum vitae heads and handles.
An Indispensable Tool to every Practical Carpenter and Builder
Ask for them at the nearest hardware store; if not in stock, send to
AMERICAN BIT-BRACE CO.
122, 124 & 126 Washington St., Buffalo, N. Y.

The Boomer & Boschert Presses
Leather Press. Oil Press. Lard Press. Baling Press. Cider Press.
We make a great variety of Presses, both screw and knuckle joint, with movement of platens from one inch to six feet or more, to work by hand or power, and at any speed required.
BOOMER & BOSCHERT PRESS CO.,
198 WATER STREET,
SYRACUSE, N. Y., U. S. A.
SEND FOR CATALOGUE.

SYRACUSE MALLEABLE IRON WORKS

NATURAL GAS INDUSTRY AT PITTSBURGH, Pa.—A brief history of the Chartiers Valley Gas Company. With 5 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 627. Price 10 cents. To be had at this office and from all newsdealers.

Shepard's New \$60 Screw-Cutting Foot Lathe
Foot and Power Lathes, Drill Presses, Scroll Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Lathes on trial. Lathes on payment. Send for catalogue of Outfits for Amateurs or Artisans. Address H. J. SHEPARD, AGENT,
134 East 2d Street,
Cincinnati, Ohio.

PETROLEUM BOAT. DESCRIPTION of a petroleum motor devised by Mr. Lenoir for the propulsion of small boats. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 637. Price 10 cents. To be had at this office and from all newsdealers.

ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 5 to 300 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send agents for illustrated catalogue. Pierce Artisan and Oil Well Supply Co., 89 Beaver Street, New York.

PATENT JACKET KETTLES,
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
RAND, BURR & CO.,
614 and 616 Market St., Philadelphia, Pa.

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. TENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.