

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 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.



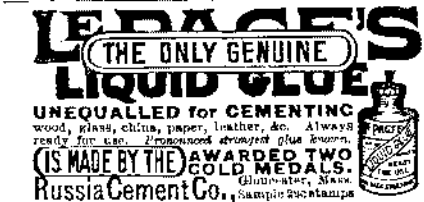
PRICE REDUCED.

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

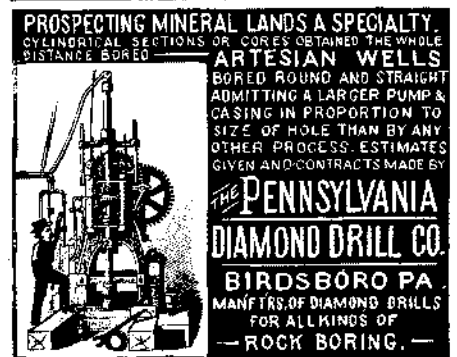
Samples and descriptive Price List free by mail.
H. W. JOHNS MFG CO., 87 MAIDEN LANE, N. Y.

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 comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has just been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address:
MUNN & CO., 361 Broadway, New York.



BIT. Square, Oval, or Round Smooth Holes. For carpenter, cabinet, and pattern work. 1/16 in. 50c, set \$4.00, mailed free. Bridgeport Gun Implement Co., 17 Maiden Lane, N. Y.



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 intrusted 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, Pacific Building, near 7th Street, Washington, D. C.

THE BRIDGEPORT WOOD FINISHING CO.
C. M. BREINIG, AGENT, PRINCIPAL OFFICE AT MANUFACTORY NEW MILFORD, CONN.
NEW YORK BUSINESS OFFICE, 95-93 MAIDEN LANE. MANUFACTURERS OF
WHEELERS PATENT WOOD FILLER.
BREINIG'S LITHOGEN SILICATE PAINT.
LITHOGEN PRIMER, WOOD STAINS
SILEX FLINT AND FELDSPAR.
PAMPHLET GIVING DIRECTIONS FOR FINISHING HARD WOOD FREE TO ANY ADDRESS.

ELECTRIC LEATHER BELTING
BEST and most RELIABLE for swift running.
Chas. A. Schieren & Co.
416 Arch St. Phila.
86 Federal St., Boston.

SHIELDS & BROWN



For BOILERS and STEAM PIPES
Reduces Condensation of Steam.
FOR GAS and WATER PIPES.
Prevents Sweating and Freezing.
The Best Non-Conductor of Heat and Cold in the World
Send for illustrated descriptive Circular, and name of paper.
143 Worth Street, New York.
78 and 80 Lake Street, Chicago.

Hyatt Pure Water Co.

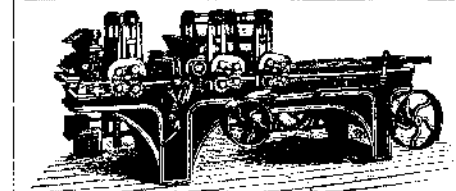
THE HYATT FILTER
NATURE'S PROCESSES
Purifying 150,000,000 Gallons Daily.
Adopted by TWENTY different CITIES and Towns, and a THOUSAND or more MANUFACTURERS, etc., in the United States, Canada, West India, and South America.
HAS NEVER FAILED.
Free from Legal Complications.
Recommended by Engineer Corps, U. S. War Department, and the Highest Authorities on Sanitation and Hydraulic Engineering.
Results Guaranteed.
For Circulars and Estimates Address
HYATT PURE WATER COMPANY,
TRIBECA BUILDING, NEW YORK.

OUR PRIDE. The Pattern Maker. Has two inches marked by eighths on the large blade; oil-tempered, rather hard, made for severe use. The small blade is one to please mechanics. Handy handle, metal ends. Price \$1.00; but for 30 days we will sell it for \$3.00, post-paid. Remit in what is most convenient. Send for our 48-page illustrated list, free; also, "How to Use a Razor." If we sell you one knife, you will buy of us as long as you live. Fact!
MAHER & GROSCH, 40 S Street, Toledo, Ohio.

CLARK'S NOISELESS RUBBER WHEELS
No more Splintered Floors.
Different Styles. Catalogue Free.
Geo. P. Clark,
Box L. Windsor Locks, Ct.

LYON & HEALY
State & Monroe Sts., Chicago.
We mail free, their newly enlarged Catalogue of Hand Instruments, Cutlery and Appliances, 400 Fine Illustrations describing every article required by Bands or Drums Corps, including Repairing Materials, Trappings, etc.
Contains Instructions for Amateurs Bands, Fencing, and Sculls, (Grand Major's Tactics, By-Laws, and a Selected List of Hand Made.)

COPPER TUBES SHEET BRASS BRASS WIRE
Mention this paper.



WITH ERBY, 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.

To Business Men.

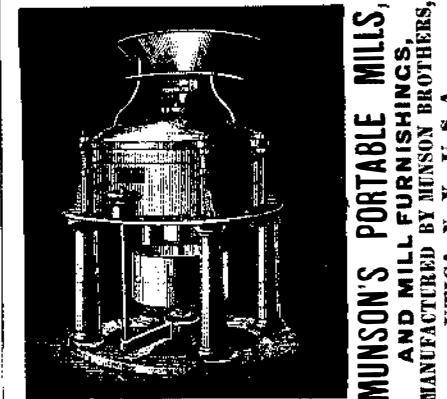
The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the principal States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man 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.

For rates see top of first column of this page, or address
MUNN & CO., Publishers,
361 Broadway, New York.



VOLNEY W. MASON & CO.
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

Barnes' Foot-Power Machinery.
Complete outfits for Actual Workshop Business. Read what 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 veelped 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 Catalogue and Price List Free. W. F. & JOHN BARNES Co. Address 1939 Main St., Rockford, Ill.



MODEL and EXPERIMENTAL WORK
Send for Circulars.
C. E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

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

THE BACKUS WATER MOTOR
SUPPLIES FROM HYDRAULIC PRESSURE the cheapest power known, invaluable for blowing Church Organs, running Printing Presses, Sewing Machines, in Households, Turning Lathes, Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Electric Lights, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engine, explosion, or delay; no extra insurance, no coal bills. Is noiseless, neat, compact, steady, will work at any pressure of water above 15 lb. at 40 lb. pressure 3-horse power, and capacity up to 10-horse power. Prices from \$15 to \$70. Send for circular to THE BACKUS WATER MOTOR CO., Newark, N. J.

BEFORE YOU BUY A BICYCLE
OR GUN send stamp to A. W. GUMP, Dayton, Ohio, for new and second-hand guns, repairing and cleaning. SECOND-HAND BICYCLES, GUNS and REVOLVERS taken in EXCHANGE.

Special Rubber Mould Work. Estimates furnished.
CANFIELD RUBBER CO., Bridgeport, Conn.

STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar, for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids, for Thick, Volatile, Viscous or Foul Liquids, etc. Vacuum Pumps of the highest efficiency. Filter Press Pumps. Air, Gas and Acid Blowers. Air Compressors, Etc.
BUILT BY GUILD & GARRISON, Brooklyn, N. Y.

NOTICE to Users of Steam Pumps.
We have received following letter in regard to one of our No. 5 "L" (810) Steam Jet Pumps elevating 1 1/2 inch pipe of water more than 50 feet high: "LANSE, MICH., Feb. 24, 1888. "VAN DUZEN & TIFF, Cincinnati, O.: "Money could not buy the Jet of us unless another could be had. I would not give your No. 5 "L" for a \$100 pump, equal distance to raise. "N. A. Litchfield, Supt. Mich. Slate Co." We make Ten Sizes of these Pumps. Prices \$7 to \$75. Capacities 100 to 20,000 gallons per hour. State for what purpose wanted and send for Catalogue of "Pumps." VAN DUZEN & TIFF, Cincinnati, O.

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.
71 John Street, N. Y.
105 Milk Street, Boston.
18 So. Fourth St., Phila.
64 Dearborn St., Chicago.

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