

Advertisements.

Inside Page, each insertion ... 25 cents a line. Back Page, each insertion ... \$1.00 a line.

New Gas Engine "The Baldwin"

Exhibited at the late American Institute Fair, New York. A four-horse-power engine in connection with storage battery, running 81 incandescent electric lights...

Otis Brothers & Co., Elevators and Hoisting Machinery, 38 PARK ROW, NEW YORK.



THE MODERN ICE YACHT. - BY Geo. W. Polk. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts...

THE CHEAPEST AND BEST! PHOTO ENGRAVING CO. 67 PARK PLACE, NEW YORK. ENGRAVING FOR ALL ILLUSTRATIVE AND ADVERTISING PURPOSES.

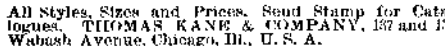
COMPARATIVE VALUE OF STEAM and hot water for transmitting heat and power. - An elaborate discussion of the subject, by Charles E. Emory. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 613.

STEAM YACHTS AND PLEASURE BOATS.



Hulls, 19 to 40 ft. Strongest and best obtainable models. Stationary and Marine Engines and Boilers. Petroleum Fuel. Simple, Safe, Compact, Durable, Cheap.

Row and Sail Boats. Paddling and Sailing Canoes. All Styles, Sizes and Prices. Send Stamp for Catalogues. THOMAS KANE & COMPANY, 137 and 139 Wabash Avenue, Chicago, Ill., U. S. A.



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

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 the line of business they have had forty-one years' experience, and now have unexcelled 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.

THE BRIDGEPORT WOOD FINISHING CO. G. M. BREINIG, AGENT, PRINCIPAL OFFICE AT NEW BRIDGEPORT, NEW MILFORD, CONN. WHEELERS PATENT WOOD FILLER. BREINIG'S LITHOGEN SILICATE PAINT. LITHOGEN PRIMER, WOOD STAINS, SILEX FLINT AND FELDSPAR.

PETROLEUM FUEL.-AN ACCOUNT of the Pennsylvania Railroad's experiments with the Orquhart system of burning petroleum on locomotives, and also of the experience of the Great Britain Railroad with coal oil as a fuel.

COPPER TUBES SHEET BRASS BRASS WIRE. MENTION THIS PAPER.

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

IF YOU USE VALVES CALL FOR AND INSIST ON HAVING JENKINS BROS. 71 John St., New York. 105 Milk St., Boston. 13 S. Fourth St., Phila. 54 Dearborn St., Chicago.

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

THE BACKUS WATER MOTOR. Is the cheapest power known for driving all kinds of light machinery.

THE BACKUS MOTOR. Is the cheapest power known for driving all kinds of light machinery. Thousands in use the world over.

THE BACKUS EXHAUSTER. A wonderful Air Motor. Invaluable for ventilating factories and public buildings.

AMERICAN Leather Link Belt Co. A new article in Belting which is made of small Leather Links joined together with steel bolts.

FOR SALE.-Road Cart Patent, by State or Shop right. Address C. L. NESMITH, Washington, Illinois.

TIGHT & SLACK BARREL MACHINERY. A SPECIALTY OF JOHN GREENWOOD & CO. ROCHESTER, N. Y.

PATENT RIGHTS FOR SALE. APPARATUS FOR BUILDING CONCRETE BUILDINGS AND WALLS. County Rights, \$50. State Rights, \$500. See descriptive notice in SCIENTIFIC AMERICAN, May 22, 1888.

PHOTO-ENGRAVING PROCESSES.-The "Washout" process. The swelled gelatine process. Full details of each. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 612. Price 10 cents. To be had at this office and from all newsdealers.

THE CURTIS RETURN STEAM TRAP. For returning steam condensed under pressure automatically into the boiler, whether taken from above or below the boiler lever, without loss or waste. Manufactured by THE CURTIS REGULATOR CO., BOSTON, MASS. Send for Circular No. 19.

SHIELDS & BROWN CO. Manufacturers of Sectional Insulated Air Coverings. FOR Steam, Gas and Water Pipes, Drums, Heaters, etc. The Best Non-Conductor of Heat & Cold in the World.

MALLEABLE THOMAS DEVLIN & CO. AND FINE GRAY IRON AND STEEL CASTINGS FROM SPECIAL PATTERNS. LENOX AVE. & AMERICAN ST. N. Y.

Hyatt Pure Water Co. 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 Indies and South America. HAS NEVER FAILED. Free from Legal Complications.

HYATT PURE WATER COMPANY, TRIBUNE BUILDING, NEW YORK.

ICE-HOUSE AND COLD ROOM.-BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

COLUMBIA BICYCLES. TRICYCLES. TANDEM. GUARANTEED-HIGHEST GRADE ILLUSTRATED CATALOGUE-FREE. POPE MFG. CO. 79 FRANKLIN ST. BOSTON. BRANCH 12 WARREN ST. NEW YORK. HOUSE 1291 WABASH AVE. CHICAGO.

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. L. SHEPARD, AGENT, 134 East 2d Street, Cincinnati, Ohio.

MODERN SMOKING PIPES. H.G. SCHRAMM CAMDEN, N. J.

SYRACUSE WATER MOTOR. With Automatic Governor shutting off all surplus water. The amount of power developed by these motors is only limited by the amount of pressure available and quantity of water used. We guarantee something which is safer than a high rated horse power, and that is, that these motors will perform the work satisfactorily which they are sold for. Are adapted for all kinds of light machinery, electric light dynamos, dairy work, elevators, church organs. Moulded by TURK WATER METER CO., SYRACUSE, N. Y.

Shafting and Gearing, Textile Machinery, THOS. WOOD & CO. 224 and Wood Sts., Philadelphia, Pa. ELEVATORS, ETC.

RUBBER BELTING, PACKING, HOSE. Oldest and Largest Manufacturers in the United States. VULCANIZED RUBBER FABRICS For Mechanical Purposes. Air Brake Hose A SPECIALTY. RUBBER MATS, RUBBER MATTING, AND STAIR TREADS. NEW YORK BELTING & PACKING CO., 15 PARK ROW, N. Y. JOHN H. CHEEVER, Treas., Branches: 167 Lake St., Chicago; 308 Chestnut St., Phila.; 52 Summer St., Boston; J. D. CHEEVER, Dep'y Treas., Post & Co., Cincinnati, O. Pickhuben 5 Hamburg (Freihafengebiet), Germany.

We are prepared to furnish the finest quality of THROUGH PUNCHES and DIES FOR METAL WORK, for the manufacture of which we have unequalled facilities. Henry Dinston & Sons, Incorporated, Jobbing Department, Front & Laurel Sts., Phila., Pa.

SYRACUSE MALLEABLE IRON WORKS. W. B. BURNS, PROPRIETOR.

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.

BUFFALO FORGE CO. MAKE BEST LINE FORGES BLOWERS EXHAUSTERS HAND & POWER DRILLS BUFFALO, 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, Archeology, 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 as 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.

Builders 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. T. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.