

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.

PENBERTHY IMPROVED AUTOMATIC INJECTOR. Why 20,000 have been sold in two years. Because they cost less than others and do equal work. Lift 3 feet and work from head as well. Re-start themselves and require no watching. Will lift through hot pipes, work from 25 to 150 lbs. pressure. Parts removable without disconnecting, also interchangeable. Send for pamphlet. Penberthy Injector Co., Detroit, Mich.

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.

Wheeling is Better than Walking. Victor Bicycles Are Better than Any Others. Catalogue Free. Overman Wheel Co., Makers, BOSTON, MASS.

INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 86, Cleveland, O.

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 handsome sole 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.

THE ARMSTRONG MFG. CO. BRIDGEPORT, CONN. WATER, GAS AND STEAM FITTERS' TOOLS.

Stocks and Dies for Pipe, Bolts, and Brass Pipe, Wrenches, Pipe Vises, Pipe Cutters, etc. Catalogues sent free on application.

Shepard's New \$60 Screw-Cutting Foot Lathe. Foot and Power Lathes, Drill Presses, Scroll Saw, etc. Address H. A. SHEPARD, 134 East 52d Street, Cincinnati, Ohio.

THE EIFFEL TOWER.—AN EXCELLENT engraving of the Eiffel one thousand-foot-high tower, which was opened to the public a few days ago, and which is to form a part of the French Exposition attractions, may be found, with description, in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 554. To be had from newsdealers or at this office. Price 10 cents.

KEEP COOL! CLARK'S Light-Running Ventilating FANS. Adapted for Ventilating and Drying of every description. Catalogue free. GEO. P. CLARK, Box 1, Windsor Locks, Conn.

GRAPHOPHONE AND PHONOGRAPH.—An interesting account of the Edison, Bell, and Taintor apparatus for the mechanical reproduction of speech, with detailed description of the same. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 669. Price 10 cents. To be had at this office and from all newsdealers.

MALLEABLE AND FINE GRAY IRON ALSO STEEL. CASTINGS FROM SPECIAL PATTERNS. THOMAS DEVLIN & CO. FINE TUNING, JAPANNING AND FINISHING. 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-two 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, Pacific Building, near 7th Street, Washington, D. C.

ASBESTOS PIPE COVERINGS Made entirely of ASBESTOS. Absolutely Fire Proof. BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES. CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y. BRANCHES: Phila, 24 Strawberry St. Chicago, 86 E. Lake St. Pittsburg, 414 Lewis Block.

JENKINS BROS. 71 John Street, New York. 105 Milk Street, Boston. 21 North 5th Street, Phila. 54 Dearborn Street, Chicago.

THE ONLY PRACTICAL Low-Priced Typewriter First-Class, Rapid, Durable, Business WORLD TYPEWRITER, 44 characters, \$10; 77 characters, \$15. Catalogue free. Typewriter Dept., POPE MFG. CO., Boston, New York, Chicago.

COPPER TUBES SHEET BRASS BRASS WIRE

POP SAFETY VALVE WATER RELIEF VALVE IMPROVED STEAM GAGE STEAM ENGINE INDICATOR Single Bell Chime Whistle, and all instruments used in connection with Steam, Air and Water. Sole Agents for Clark's Lamp Fire Hose. NEW YORK. LONDON. GOSBY STEAM GAGE & VALVE CO., 95 Oliver St., Boston, Mass.

The CUSHMAN Patent 3 Pinion Geared Scroll Chucks with their latest improvements are unexcelled. Made in all sizes from 2 1/2 inch to 12 inch diameter, and are sold by the trade all over the world. Manufactured by The Cushman Chuck Co., Hartford, Conn.

WORKING MODELS and Experimental Machinery, metal or wood, made to order by MASON & RACON, successors to J. F. Werner, 82 Centre Street, New York.

CARY & MOEN CO. STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. NEW YORK CITY. 224 W 29 ST.

H. W. JOHNS' Asbestos PATENTED Roofing FIRE-PROOF. This is the perfected form of Portable Roofing manufactured by us for the past thirty years; is adapted for use on steep or flat roofs, can be easily applied by unskilled workmen, and costs only about half as much as tin. Samples and descriptive price list free by mail. H. W. Johns Mfg. Co., 87 Maiden Lane, N. Y. CHICAGO. PHILADELPHIA. LONDON. SOLE MANUFACTURERS OF H. W. Johns' Liquid Paints, Asbestos Fire-Proof Paints, Sheathings, Building Felts, Asbestos Steam Packings, Boiler Coverings, etc. VULCABESTON Moulded Piston-rod Packing Rings, Gaskets, etc.

OTTO GAS ENGINES. Over 25,000 Sold. Horizontal Otto Gas Engines. Vertical Otto Gas Engines. Twin Cylinder Otto Gas Engines. Combined Otto Gas Engines and Pumps. Combined Otto Gas Engines and Dynamoes. OTTO GAS ENGINE WORKS, CHICAGO, PHILADELPHIA. New York Agency, 15 Vesey Street

PULLEYS. Cheapest, Lightest, and Best. Made by Hardwood Split P. Co., Menasha, Wis. VAN DUZEN GAS ENGINE NO BOILER. NO COAL. NO ENGINEER. No Extra WATER RENT or INSURANCE. INSTANTLY STARTED. DURABLE, RELIABLE, SAFE and ECONOMICAL. Send for description and prices. Van Duzen Gas Engine Co., 63 E. 2nd St., CINCINNATI, O.

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. A. CUTLER & SON, BUFFALO, N. Y., U. S. A.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. CONN.

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.

SECTIONAL INSULATED AIR COVERINGS FOR PIPES, BOILERS, DRUMS, AND ALL STEAM HOT & COLD SURFACES. ASBESTOS, CEMENT, PACKING, SHEATHING, ETC. SHIELDS & BROWN CO., 143 WEST ST., NEW YORK.

BARBLESS HOOKS. All sizes, No. 1 to 10. Made of music wire. No spitting out. No trouble landing any bite. 7 samples, 25c. No. 5, 30c. per doz., postpaid. Best English Spring Steel Bass Hooks, 10c. a doz. SPOON HOOKS for pike or bass, 15c.; rubber minnows, 50c.; trout flies, 50c. doz. best; 75 ft. braided linen line, 25c. postpaid. Chinese grass line, 30 ft., 25c. 75 ft. reel, 35c. postpaid. Free list of Cutlery and Fishing Tackle. MAHER & GROSS, 40 S. St., Toledo, Ohio.

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.

JUST OUT! ALUMINUM-STEEL HACK SAW. Frame and 1 doz. blades. \$2. Blades per doz., 8-inch, \$1. by mail upon receipt of price. Hard but not brittle. CRESCENT MFG. CO., CLEVELAND, O. New catalogue of Engineers' Specialties.

COMPLETE STEAM PUMP ONLY SEVEN DOLLARS DEMAND THIS PUMP OF YOUR DEALER OR WRITE TO US FOR PRICES VAN DUZEN'S PATENT VAN DUZEN & TIFT. SOLE MAKERS CINCINNATI, O.

HOME-MADE INCUBATOR.—PRACTICAL directions for the manufacture of an effective incubator that has been carefully tested and found to perform all that may be reasonably expected; with directions for operating. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 630. Price 10 cents. To be had at this office and from all newsdealers.

ANNOUNCEMENT! Improved methods and special tools make it possible for us to manufacture Elevators, to be operated from line of shafting, at a largely reduced cost. Purchasers desiring a safe and reliable Elevator, which has stood the test of 37 years' use, should apply to us for an estimate. Our Elevator machinery is made of the very best materials, and by skilled workmen. Also manufacturers of Hydraulic Passenger and Freight Elevators. OTIS BROTHERS & CO., 38 Park Row, New York.

Caligraph. LIFESHORT-WRITE WAY. Address: The American Writing Machine Co., Hartford, Conn.; New York Office, 237 Broadway.

TIMBER AND SOME OF ITS DISEASES.—An elaborate and a very valuable series of papers showing the various causes of the decay of timber and how in many cases it can be prevented. Illustrated with 39 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 637, 638, 640, 643, 644, 648, 656, 661, 664, 665. Price 10 cents each, or \$1 for the entire series. To be had at this office and from all newsdealers.

SYRACUSE MALLEABLE IRON WORKS W B BURNS PROP

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 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.

Novelty HOT AIR Furnaces Expose an Immense Heated Surface. Extract all the Heat from the Gases. Furnish Pure Warm Air in abundance. Fifteen Years of Test. Universally Satisfactory. Send for "Our Furnace Book." Abram Cox Stove Co., MANUFACTURERS, Philadelphia and New York.

KEY SEATING Machines and 20" Drills. W. P. 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. L. BENEJOHNSON & CO.'S INK, Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.