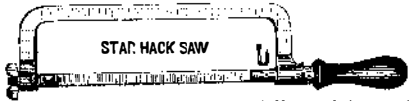


Advertisements.

Inside Page, each insertion . . . 75 cents a line. Back Page, each insertion . . . \$1.00 a line.

(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



Here is something which will not disappoint you. It will cut iron as others saws cut wood. One blade, without filing, will saw off a rod of half-inch iron one hundred times. The blade costs five cents. Files to do the same work would cost ten times as much.

Millers Falls & Co., 74 Chambers St., New York.

THE CATALPAS.—BOTANICAL HISTORY and description of the various species of these favorite trees. Illustrated with three engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 461. Price 10 cents.

JACKET KETTLES, Patent. Plain or Porcelain Lined. Tested to 100 lb. pressure. JAMES C. HAND & CO., 814 and 815 Market St., Philadelphia, Pa.

FOOT OR POWER LATHES FOR WOOD OR METAL. All sizes. Catalogues free. Lathes on trial. SEBASTIAN, MAX & CO., 165 West 2d Street, Cincinnati, O.

ROOTS' NEW IRON BLOWER. POSITIVE BLAST. IRON REVOLVERS, PERFECTLY BALANCED, Has Fewer Parts than any other Blower. P. H. & F. M. ROOTS, Manufacturers, CONNERSVILLE, IND.

MICROSCOPES Telescopes, Spectacles, Barometers, Thermometers, Photographic Outfits for Amateurs, Opera Glasses, &c. W. H. WALKER & CO., successors to E. J. Beck, Philadelphia. Illus. Price List free to any address.

BICYCLES \$35 to \$150. Tricycles, Standard makes, \$7.50. Velocipedes, \$3. Wheels, Bells, Lamps, Bags, Oilers, &c. Second-hand wheels handled. GEO. W. ROUSE & SON, 116 G Street, Peoria, Ill. EASY PAYMENTS.

STATIONARY STEAM ENGINES ESPECIALLY adapted to Electric Lighting Purposes. Treating of the development of Steam Engines; the principles of Construction and Economy; with descriptions of Moderate Speed and High Speed Engines.

PLANING AND MATCHING MACHINES. Special Machines for Car Work, and the latest improved Wood Working Machinery of all kinds.

BURSTED BOILERS DO NOT OCCUR. WHERE PROVIDENT PROPRIETORS KEEP THEIR BOILERS PERFECTLY CLEAN BY USING VAN DUZEN'S MECHANICAL BOILER CLEANER. MANUFACTURED BY E. W. VAN DUZEN, CINCINNATI, O.

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 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.

PATENT RIVETED MONARCH RUBBER BELTING. Best in the World. Specially adapted for PAPER MILLS, SAW MILLS, and THRESHING MACHINES. THE GUTTA PERCHA and RUBBER MFG. CO., New York, Chicago, San Francisco, Toronto.

Aluminum Bronze, Aluminum Silver, Aluminum Brass, AND SILICON BRONZE, FURNISHED IN INGOTS, CASTINGS, RODS, OR WIRE. Our Malleable Castings can be made of over 100,000 pounds tensile strength, with extraordinary power to withstand corrosive influences, and unrivaled beauty of color. Send for pamphlet. THE COWLES ELECTRIC SMELTING AND ALUMINUM CO., CLEVELAND, O.

DISTILLATION UNDER ATMOSPHERIC Pressure.—Description of a simple and perfect arrangement for distillation in laboratories. With four illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 461. Price 10 cents.

THE BEST STEAM PUMP. Van Duzen's Patent Steam Pump. Incomparable in cheapness and efficiency. Needs no care or skill; cannot get out of order; has no moving parts. A superior Fire Pump. Instantaneous and powerful, ever ready. Available, wherever steam pressure can be had, for pumping any kind of liquid (hot, cold, sandy, impure, etc.).

SANITARY EXAMINATION OF DRINKING WATER.—By Prof. E. R. Angell. The odor of water, and how to detect it. Tests and their applications. Nitrates and Nitrites. Lead and iron. Test for lead. Tests for organic matter. A valuable paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 462. Price 10 cents.

THE DESIGNING OF ORDINARY IRON HIGHWAY BRIDGES. Illustrated by Numerous Engravings and 7 Folding Plates. Showing Bridges Actually Constructed, and Giving their Dimensions; also containing 42 Tables. Price, \$1.00. By J. A. L. WADDELL, C.E., B.A.S.C., M.A.E.

ELEVATORS. With best safety devices for Passenger and Freight Service.—MORSE, WILLIAMS & CO., Proprs., Morse Elevator Works, Philadelphia, Pa.

JENKINS STANDARD PACKING. We make the Best Packing that can be made regardless of cost. Users will sustain us by calling for the "JENKINS STANDARD PACKING."

MALLEABLE CASTINGS FROM SPECIAL THOMAS DEVLIN & CO. FINE TUNING, JAPANNING, PATTERNS, FINISHING, MACHINING AND LEHIGH AVE & AMERICAN ST. PHILA.

Wood Working Machinery. Universal Saw Benches, Buzz Planers, Turning Lathes for Pattern, Cabinet, and Wood Working Shops, Single and Double Rotary Bed Surfacers, Stretching Machines, Blind Slat Planers, etc.

REFRESHING RECREATION. With our unrivaled amateur photographic outfits pictures of the highest degree of excellence may be obtained. Call at our store or write for Manual of Instruction.

H.W. JOHNS' ASBESTOS. Roofing, Building Felt, Steam Packings, Boiler Coverings, Fire Proof Paints, Cements, Etc. H. W. JOHNS M'FG CO., 87 MAIDEN LANE, N. Y.

PERFECT NEWSPAPER FILE. The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper.

ENGINEER'S POCKET BOOK. BY Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc.

THE PUSEY & JONES CO. BUILDERS OF ALL DESCRIPTION OF MACHINERY USED BY MANUFACTURERS OF PAPER. Wilmington, Delaware.

ROCK BREAKERS AND ORE CRUSHERS. We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers containing the invention described in Letters Patent, issued to E. H. Blake, June 15th, 1854, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11th, and July 20th, 1880.

W.M. A. HARRIS, Providence, R. I. (Park St.), Six minutes' walk West from station. Original and Only Builder of the HARRIS-CORLISS ENGINE, With Harris Pat. Improvements, from 10 to 1,000 H. P. Send for copy Engineer's and Steam User's Manual. By J. W. Hill, M.E. Price \$1.25.

WATERS for Drinking, Boiler, and M'fg Purposes Analyzed and Reported on by AUSTEN & WILBER Analytical and Consulting Chemists, New Brunswick, N. J. LOCOMOTIVE ENGINE RUNNING AND MANAGEMENT. A Treatise on Locomotive Engines, showing their performance in running different kinds of trains with economy and dispatch; also, directions regarding the care, management, and repairs of Locomotives, and all their connections.

BIBB'S Celebrated Original BALTIMORE FIRE-PLACE HEATERS. To warm upper and lower rooms. The handsomest, most economical Coal Stoves in the World. B. C. BIBB & SON, Foundry, Office and Warehouse, 39 AND 41 LIGHT STREET, Baltimore, Md. MARBLIZED SLATS PATENT. Send for Circular.

SWIMMING.—DESCRIPTION OF THE method of teaching swimming employed in France; with 6 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 462. Price 10 cents.

The Best in the World. We make the Best Packing that can be made regardless of cost. Users will sustain us by calling for the "JENKINS STANDARD PACKING."

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.

Syracuse Malleable Iron Works. For all kinds of STEAM BOILERS. RUE MFG. CO., FILBERT ST., Philadelphia, Pa., U. S. A.

INJECTORS. HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. CONN. For all kinds of STEAM BOILERS. RUE MFG. CO., FILBERT ST., Philadelphia, Pa., U. S. A.

ERICSSON'S NEW CALORIC PUMPING ENGINE, FOR Dwellings & Country Seats. Simplest! Cheapest! Economical! Absolutely Safe! Delamater Iron Works, C. H. Delamater & Co., Proprietors, 16 Cortlandt Street, New York, U. S. A., and 40 Dearborn St., Chicago, Ill.

EVAPORATING FRUIT. Full treatise on improved methods, yields, profits, prices and general statistics of F.R.F. AMERICAN MAN'G CO. P. O. BOX R. WAYNESBORO, PA.

Holland's Double Globe Valves. They combine the brass seat and rubber disks. We guarantee them to weigh more than any others in the market. Samples sent for trial. HOLLAND & THOMPSON, Manufacturers, 217 RIVER ST., TROY, N. Y.

Prof. Chas. F. Chandler, Ph.D., OF THE SCHOOL OF MINES, NEW YORK. Has assumed the Editorship of Anthony's Semi-Monthly Photographic BULLETIN, Which is admitted to be the best Photographic Helper that is published. Announcements or Professionals Who need any advice can obtain it through its Correspondence Column. It will pay you to subscribe for it. Sample Copies Free. Subscription, \$2.00 per Annum. E. & H. T. ANTHONY & CO., PUBLISHERS, 501 Broadway, New York. PHOTOGRAPHIC OUTFITS AND SUPPLIES.

The Scientific American. THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

Published Weekly, \$3.20 a Year; \$1.60 Six Months. This unrivaled periodical, now in its forty-first year, continues to maintain its high reputation for excellence, and enjoys the largest circulation ever attained by any scientific publication. Every number contains sixteen large pages, beautifully printed, elegantly illustrated; it presents in popular style a descriptive record of the most novel, interesting, and important advances in Science, Arts, and Manufactures. It shows the progress of the World in respect to New Discoveries and Improvements, embracing Machinery, Mechanical Works, Engineering in all branches, Chemistry, Metallurgy, Electricity, Light, Heat, Architecture, Domestic Economy, Agriculture, Natural History, etc. It abounds with fresh and interesting subjects for discussion, thought, or experiment; furnishes hundreds of useful suggestions for business. It promotes Industry, Progress, Thrift, and Intelligence in every community where it circulates. The SCIENTIFIC AMERICAN should have a place in every Dwelling, Shop, Office, School, or Library. Workmen, Foremen, Engineers, Superintendents, Directors, Presidents, Officials, Merchants, Farmers, Teachers, Lawyers, Physicians, Clergymen, people in every walk and profession in life, will derive benefit from a regular reading of THE SCIENTIFIC AMERICAN. Terms for the United States and Canada, \$3.20 a year; \$1.60 six months. Specimen copies free. Remit by Postal Order or Check. MUNN & CO., Publishers, 361 Broadway, New York.

THE Scientific American Supplement. THE SCIENTIFIC AMERICAN SUPPLEMENT is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. 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 pertaining to these and allied subjects is given, the whole profusely illustrated with engravings. The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented 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. Address and remit by postal order or check. MUNN & Co., 361 Broadway, N. Y., Publishers SCIENTIFIC AMERICAN. To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, \$4. gold, for SCIENTIFIC AMERICAN, one year; \$9. gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal order or draft to order of MUNN & CO., 361 Broadway, New York.

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