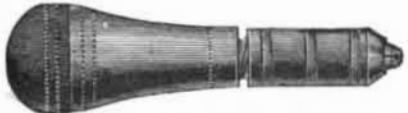


Advertisements.

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

No. 4 TOOL HANDLE



This handle is six inches long, and incloses ten large working size tools, of best quality, viz.: Two each Brad Awis, Screw Drivers and Chisels, one each Gouge, Scratch Awl, Reamer, and Gimlet.

MILLERS FALLS CO., 93 Hende St., New York.



VICTORS MAKE THE PACE HIGHEST GRADE CATALOGUE FREE

OVERMAN WHEEL CO., MAKERS, CHICOPEE FALLS, MASS.

WOODEN TANKS FOR RAILROADS, MILLS, FARMS, ETC. COMPLETE STOCK OF CYPRESS LUMBER.

JENKINS STANDARD PACKING! JENKINS BROS., 71 John St., N. Y.; 105 Milk St., Boston; 21 North 5th St., Phila.; 54 Dearborn St., Chicago

KEUFFEL & ESSER CO. NEW YORK. Levels, Transits, Surveyors' Compasses, Pocket and Prismatic Compasses, Hand Levels, Angle Mirrors, Planimeters, Pantographs, Engineers' Slide Rules, Leveling Rods, Poles, Chains, etc.

MACHINE TOOLS Engine Lathes, Planers, Shapers, Turbine Lathes, etc. Send for Catalogue. The Hendey Machine Co., Torrington, Conn.

GRAND PRIZE-PARIS EXPOSITION, 1889

THIN PANEL STOCK

In Whitewood, Walnut, etc. Manufactured by the original "Système Bartlett," received the Highest Award and only "Grand Prize" given to this industry.

HENRY T. BARTLETT, CABINET WOODS, MAHOGANY and VENEERS, SAW MILLS, 200 Lewis Street, New York.

BABCOCK & WILCOX CO. WATER TUBE BOILERS. 30 CORTLANDT ST. N.Y. 107 HOPE ST. GLASGOW, SCOTLAND.

VALVES

are operated by a Wheel, but the Handy has a Lever, and is more compact, simpler, cheaper, and consequently better.

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.

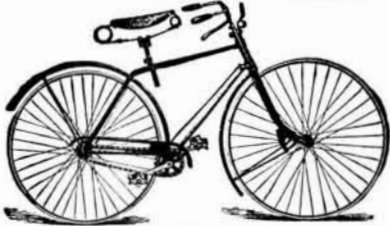
MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS. THOMAS DEVLIN & CO. LEHIGH AVE & AMERICAN ST. PHILA.

PACKING, BELTING, HOSE, MATS, MATTING, ETC.



Established 1855. The Largest Manufacturers of Mechanical Rubber Goods in the World. THE GUTTA PERCHA AND RUBBER MFG. CO. Para Building, 35 Warren St., New York.

COLUMBIAS HIGHEST GRADE ONLY CATALOGUE FREE



POPE MFG. CO., 77 Franklin Street, BOSTON. Branch Houses: 12 Warren St., NEW YORK, 291 Wabash Ave., CHICAGO, Factory, HARTFORD, CONN.

COMBINATION MILL FOR CRUSHING & GRINDING Bones, Shells, Minerals, etc. FERTILIZER MIXING MACHINES. Complete Outfits Furnished. C. H. Dempwolf & Co. YORK, PA.

ARMSTRONG MAN'G. CO. Our ADJUSTABLE STOCKS and DIES are universally acknowledged to be the BEST! We also make all our Tools on the same principle of the BEST MATERIAL and WORKMANSHIP, and always with a view of time and labor saving in their use.

\$85 Lovell Diamond Safety \$85 Diamond Frame, Steel Drop Forgings, Steel Tubing, Adjustable Ball Bearings to all Running Parts, including Pedals, Suspension Saddle, Finest material money can buy. Finished in enamel and nickel.

PORTER AUTOMATIC ENGINE (CENTER CRANK) ECONOMY PERFECT REGULATION OF SPEED ABSENCE OF ALL PARTS REQUIRING FREQUENT ATTENTION

PORTER MFG. CO. LIMITED BUILDERS OF AUTOMATIC AND PLAIN SLIDE VALVE ENGINES ALSO CONSTRUCTORS OF TANKS STAND PIPE BOILERS AND STONE CRUSHERS SPECIFICATIONS SOLICITED ESTIMATES GIVEN

The Motor of 19th Century Can be used Any Place, to do Any Work, and by Any One. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. Cost of operation about one cent an hour to each indicated horse power.

IMPROVED INCUBATOR EXCELSIOR Simple, Perfect and Self-Regulating. Hundreds in successful operation. Guaranteed to hatch a larger percentage of fertile eggs at less cost than any other hatcher. Send 6c. for Illus. Catalogue. Circulars free. CEO. H. STAHL, QUINCY, ILL.

Burnham's New Improved Standard Turbine Vertical or Horizontal. Yields a greater percentage of water used, either with full or part gate drawn, and is the simplest constructed and best finished wheel in the market.

ESTABLISHED HALF A CENTURY. MARVIN'S FIRE & BURGLAR SAFES HAVE MANY PATENTED IMPROVEMENTS NOT FOUND IN OTHER MAKES THAT WILL WELL REPAY AN INVESTIGATION BY THOSE WHO DESIRE TO SECURE THE BEST SAFE MARVIN SAFE CO. NEW YORK, PHILADELPHIA, LONDON, ENGLAND.

NEW KODAKS "You press the button, we do the rest." Seven New Styles and Sizes ALL LOADED WITH Transparent Films. For sale by all Photo. Stock Dealers. THE EASTMAN COMPANY, ROCHESTER, N. Y. Send for Catalogue.

WORKING MODELS and Experimental Machinery, metal or wood, made to order by MASON & RAUCH, successors to J. F. Werner, 47 & 49 Centre Street, New York.

THE STANDARD H.W. JOHN'S ASBESTOS BOILER COVERINGS H.W. JOHN'S MFG. CO. 87 MAIDEN LANE, NEW YORK. PATENTED CHICAGO, PHILADELPHIA, LONDON.

NATIONAL FILTER PRICE \$95.00. BRIGHT SPARKLING WATER GUARANTEED NATIONAL WATER PURIFYING CO., Address for Pamphlet. 145 Broadway or 86 Liberty St., New York.

CUTLER DESK BEST IN THE WORLD. A. CUTLER & SON, BUFFALO, N. Y., U. S. A.

SYRACUSE MALLEABLE IRON WORKS W. B. BURNS PROP.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents.

Otis Electric Elevator - ALSO - Manufacturers of the Standard Hydraulic Passenger and Freight, Steam and Belt ELEVATORS, Otis Brother & Co., 38 Park Row, New York

GRAVES ELEVATORS. PASSENGER & FREIGHT. L. S. GRAVES & SON ROCHESTER N. Y. NEW YORK, BOSTON, ST. LOUIS, DETROIT.

LITTLE HERCULES DRILL CHUCK Has eccentric rotating, self-gripping jaws, which hold strongest when working hardest. The larger the drill, the more powerful the leverage. All working parts of best steel, hardened. The most powerful, accurate, and durable chuck in the market. ONEIDA MFG. CO., ONEIDA, N. Y., U. S. A.

NEW MAIL New Grade, \$100. CUSHION TIRES and TANGENT SPOKES. Handsomest and Best Diamond Safety. Send for Catalogue. MANUFACTURERS, WM. READ & SONS, 107 Washington St., Boston, Mass.

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.

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.

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. & NEU JOHNSON & CO'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York