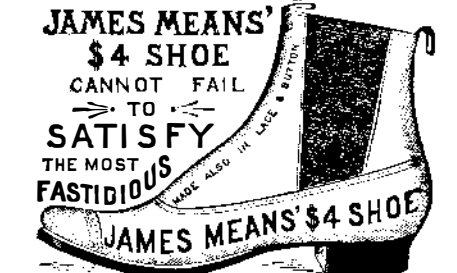


Advertisements.

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

The March of Progress! OUR LATEST IMPROVEMENT!

"Competition is the life of trade," and if you have not seen our improved \$3 shoe, made for the Summer and Fall trade, Engravings may lead you to imagine how lively trade is, or how hard our competitors have to work to keep within sight of us.

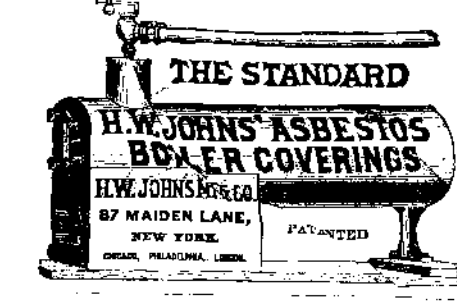


Such has been the recent progress in our branch of industry that we are now able to affirm that the James Means \$4 shoe is in every respect equal to the shoes which only a few years ago were retailed at eight or ten dollars.

OUR ORIGINAL \$3 and \$4 SHOES, and those who imitate our system of business are unable to compete with us in quality of factory products.

THE AMERICAN BELL TELEPHONE CO. 95 MILK ST., BOSTON, MASS.

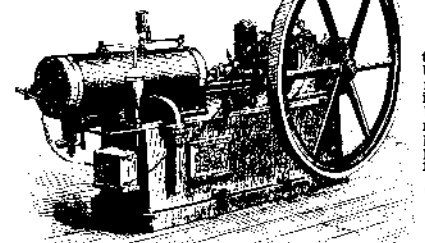
This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.



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.

NEW GAS ENGINE "The Baldwin"

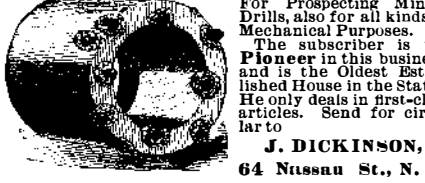


Exhibited at the late American Institute Fair, New York. A four horse-power engine in connection with storage battery, running 24 incandescent electric lights (and without battery, 32 lights), giving a perfect light, with all the steadiness that can be obtained from the high-speed steam engines in common use for electric lighting, and permitting any number of lights to be shut off or turned on without affecting the remaining lights in the slightest degree.

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

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the anti-ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter.

DIAMONDS and CARBON



For Prospecting Mining Drills, also for all kinds of Mechanical Purposes. The subscriber is the Pioneer in this business, and is the Oldest Established House in the States.

J. DICKINSON, 64 Nassau St., N. Y.

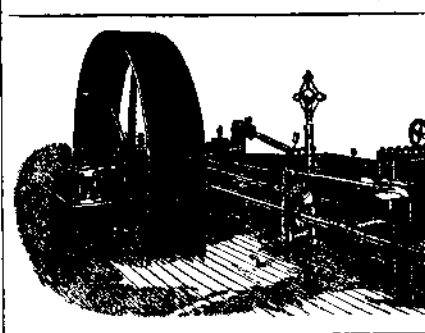
COSTS IN MANUFACTURES.—A Lecture by H. Metcalfe, U. S. A., delivered in the Sibley College course.—An elaboration of a system for the management of factories and employes. A valuable paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 605. Price 10 cents. To be had at this office and from all newsdealers.

PRESERVATION OF MEAT Without Cans—Egg shell method. Apply to DR. SALZER, 413 Park Ave., Baltimore, Md.

ERIE ENGINE WORKS CLEVELAND & HARDWICK, WALNUT STREET, ERIE, PA. STATIONARY, PORTABLE, SEMI-PORTABLE, COMBINE, AGRICULTURAL ENGINES, STATIONARY, PORTABLE, VERTICAL BOILERS.

Steam! Steam!

We build Automatic Engines from 2 to 200 H. P., equal to anything in market. A Large Lot of 2, 3, and 4-H. Engines With or without boilers, low for cash, B. W. PAYNE & SONS, Elmira, N. Y.



THE Improved Greene Engine With its Patented Devices is manufactured Solely by the Providence Steam Engine Co. PROVIDENCE, R. I. H. W. GARDNER, Pres. and Treas. T. W. PHILLIPS, Sec'y.

ART PHOTO-ENGRAVING CO. 53 FRANKLIN ST., N. Y. MACHINE & CATALOGUE WORK.

GOLD MINING MACHINERY.—DESCRIPTION of some new mining plants constructed in England for use in the Transvaal, Austria and Hungary. With 10 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 593. Price 10 cents. To be had at this office and from all newsdealers.

Novelty Hot Air Furnaces. Expose an Immense Heated Surface. Extract all the Heat from the Gases. Furnish Pure Warm Air in Abundance. Fourteen Years of Test. Universally satisfactory. Send for "Our Furnace Book." Abram Cox Stove Co., MANUFACTURERS, Philadelphia and Chicago.

LIGHTNING CONDUCTORS.—DESCRIPTION of a new form of apparatus for testing lightning conductors, and the method of using it. Illustrated with 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 596. Price 10 cents. To be had at this office and from all newsdealers.

WATCHMAKERS

Send for REDUCED PRICE LIST of Whitcomb Lathes, date of July 1, 1888. American Watch Tool Co., Waltham, Mass.

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

PETROLEUM FUEL.—AN ACCOUNT of the Pennsylvania Railroad's experiments with the Urquhart system of burning petroleum on locomotives, and also of the experience of the Great Haritzin Railroad with coal oil as a fuel. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 612. Price 10 cents. To be had at this office and from all newsdealers.

ASBESTOS PIPE COVERINGS Absolutely Fire Proof. CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y. BRANCHES: Phila, 32 S. 2d St. Chicago, 86 E. Lake St. Pittsburg, 37 Lewis Block.

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.

HOW TO MAKE AN INCUBATOR.—Full directions, illustrated with 7 figures. Also directions for operating the apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 612. Price 10 cents. To be had at this office and from all newsdealers.



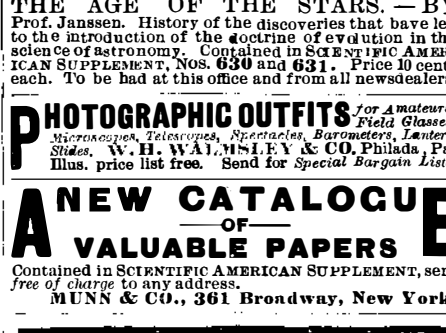
CHEMICAL AND ALLIED INDUSTRIES.—By Watson Smith. An elaborate report upon the objects illustrative of the progress, advance, and present position of the chemical industries shown at the Manchester Royal Jubilee Exhibition. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 627, 628, 629, 630, 631. Price 10 cents each or 50 cents for the series. To be had at this office and from all newsdealers.

MALLEABLE CASTINGS FROM SPECIAL PATTERNS. THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

THE AGE OF THE STARS.—BY Prof. Janssen. History of the discoveries that have led to the introduction of the doctrine of evolution in the science of astronomy. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 630 and 631. Price 10 cents each. To be had at this office and from all newsdealers.

PHOTOGRAPHIC OUTFITS.—For Amateurs, Microscopes, Telescopes, Spectacles, Barometers, Lantern Slides. W. H. WAINSWORTH & CO. Philada., Pa. Illus. price list free. Send for Special Bargain Lists.

A NEW CATALOGUE OF VALUABLE PAPERS Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent free of charge to any address. MUNN & CO., 361 Broadway, New York.



ASTRONOMICAL APPARATUS TELESCOPES, REFRACTORS, REFLECTORS, CLOCKS, CHRONOMETERS, PERMANENT OBJECTIVES, MICROSCOPES, HELIOSCOPES, EYE PIECES AND MICROMETERS. SEND FOR CATALOGUE TO QUEEN & CO 924 CHEST ST. PHILADELPHIA PA.

PIPE COVERINGS Made entirely of ASBESTOS. Absolutely Fire Proof. CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y. BRANCHES: Phila, 32 S. 2d St. Chicago, 86 E. Lake St. Pittsburg, 37 Lewis Block.

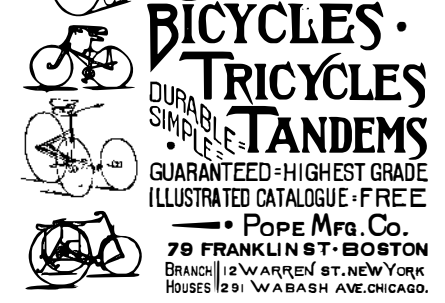
CHALLENGE EVERY GRINDING POLISHING MACHINERY. GIBBEL MFG. CO. 7TH AND GUMBELAND PHILA.

ICE HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. For engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 59. Price 10 cents. To be had at this office and of all newsdealers.

SYRACUSE MALLEABLE IRON WORKS W B BURNS PROPRIETOR

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

AUTOMATIC CUT OFF ENGINES PERFECTLY CONSTRUCTED MANUFACTURED UPON SCIENTIFIC AND PRACTICAL PRINCIPLES BALL ENGINE CO. ERIE PA.



COLUMBIA BICYCLES. TRICYCLES. DURABLE SIMPLE TANDEMS. GUARANTEED—HIGHEST GRADE (ILLUSTRATED CATALOGUE—FREE) POPE MFG. CO. 79 FRANKLIN ST. BOSTON BRANCH 112 WARREN ST. NEW YORK HOUSES 1291 WABASH AVE. CHICAGO.

ESTABLISHED 1846. The Most Popular Scientific Paper in the World. Only \$3.00 a Year, including Postage. Weekly. 32 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.

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