

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 had 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.

COMPLETE LISTS OF MANUFACTURERS

Of ANY ARTICLE or in ANY TRADE furnished at reasonable rates by the Armstrong & Knauer Pub. Co., Ltd., 822 & 824 Broadway, New York, Publishers of "THE MANUFACTURERS OF THE UNITED STATES," for 1887, arranged by ARTICLES and TRADES. Giving the Manufacturers of over 20,000 Articles and 89 Separate Trades.

PRICE \$15.00. (This book will be found invaluable to all Patentees.)

Patent Key Fastener. Impossible to turn or remove the key from the outside. The only SURE way of preventing lock picking. Send for descriptive circular. Price 35c. complete. Agents wanted everywhere. Send for terms. Sample for 25c. postal note. LINCOLN, HOLLAND & CO., Sole Manufacturers, No. 8 WASHINGTON SQUARE, Worcester, Mass.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatin pad, and also the unlinen ink by which the copies are made; how to apply the written letter to this 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 newswriters in all parts of the country.

USEFUL BOOKS.

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has just been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address, MUNN & CO., 361 Broadway, New York.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN. Includes an illustration of a steam boiler.

\$10.00 to \$50.00 per night. A light and profitable business. Magic Lanterns and Views of popular subjects. Catalogue on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. L. MANASSE, 85 Madison Street, Chicago, Ill.

Illustration of a steam engine or boiler machinery.

WITHERBY, RUGG & RICHARDSON Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

COPPER TUBES SHEET BRASS BRASS WIRE. MENTION THIS PAPER.

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-one 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. 623 and 624 F Street, Patent Building, near 7th Street, Washington, D. C.

RUBBER ROOFING. UNEQUALED For House, Barn, and all out-buildings. Anybody can put it on. PRICE LOW. Write for Sample and Book. 143 Duane St., New York City. INDIANA PAINT & ROOFING CO.

JENKINS BROS. VALVES.

THE ENDORSEMENT OF FIRST-CLASS ENGINEERS AND MECHANICS THROUGHOUT THE COUNTRY has fully demonstrated these valves to possess the following advantages over all other valves now in use: 1. A perfectly tight valve under any and all pressures of steam, oils, or gases. 2. Sand or grit of any kind will not injure the seat. 3. You do not have to take them off to repair them. 4. They can be repaired by any mechanic in a few minutes. 5. The elasticity of the Disc allows it to adapt itself to an imperfect surface. In Valves having ground or metal seats, should sand or grit get upon the seat, it is impossible to make them tight, except by regrinding, which is expensive if done by hand, and if done by machine soon wears out the valve, and in most cases they have to be disconnected from the pipes, often costing more than a new valve. The Jenkins Discs used in these valves are manufactured under our 1880 patent, and will stand any pressure of steam, oils, or acids. JENKINS BROS., 71 John St., N. Y.; 106 Milk St., Boston; 13 So. Fourth St., Phila.; 54 Dearborn St., Chicago.

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

DO NOT BUY a Drill Chuck until you have seen the "Hartford." It is the strongest, best, and is now made in three sizes as follows: PRICE: No. 0, holding from 0 to 1/4 inch \$6.00; No. 1, " " 0 to 3/8 " 7.00; No. 2, " " 0 to 1/2 " 8.00. Send for catalogue of chucks of every size and description to The Cushman Chuck Co., Hartford, Conn.

SAWS Wanted 50,000 Sawyers and SAW Saws full address for a copy of Emerson's "Book of Sawing." We are first to introduce NATURAL GAS for heating and tempering SAWS with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.

WIRE ROPE. Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheel and Rope for conveying power long distances. Send for circular.

SHAFTING DEPARTMENT Couplings, Hangers, Shafting, Pulleys. EDISON MACHINE WORKS. SEND FOR CATALOGUE. Salesroom 19 DEY STREET New York.

RUBBER BELTING, PACKING, HOSE, AND ALL OTHER KINDS OF RUBBER GOODS, FOR MECHANICAL and MANUFACTURING PURPOSES. The Largest and Most Extensive Manufacturers in America. THE GUTTA PERCHA AND RUBBER MFG. CO. New York, Chicago, San Francisco, Toronto.

DROP FORGINGS. FINISHED TOOLS. BILLINGS & SPENCER Co.

PATENT RIGHTS FOR SALE. APPARATUS FOR BUILDING CONCRETE BUILDINGS AND WALLS. County Rights, \$50. State Rights, \$500. See descriptive notice in Sci. AMERICAN, May 22, 1887. Send for circulars. Ransome, 408 Montgomery St., S. F. Cal.

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.

HARRISON CONVEYOR! For Handling Grain, Coal, Sand, Clay, Tar, Bark, Clinders, Ores, Seeds, &c. BORDEN, SELLECK & CO., Sole Manufacturers, Chicago, Ill.

Shafting and Gearing, Textile Machinery, ELEVATORS, ETC. THOS. WOOD & CO. 22d and Wood Sts., Philadelphia, Pa.

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.

STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. Vacuum Pumps of the highest efficiency. Filter Press Pumps, Air, Gas and Acid Blowers. Air Compressors. Etc. BUILT BY GUILD & GARRISON, Brooklyn, N. Y.

MAGIC LANTERNS AND STEREOPYICONS, all prices. Views illustrating every subject for PUBLIC EXHIBITIONS, etc. A profitable business for a man with small capital. Also Lenses for Home Amusement. 162 page Catalogue free. MALLISTER, Optician, 49 Nassau St., N. Y.

A PRACTICAL SUCCESS. VAN DUZEN'S PAT. LOOSE PULLEY OILER. Thousands in satisfactory everyday use. Entire reliability and constancy demonstrated in a two years' test by (would be) Eastern skeptics. Economy shown by reasonable prices and perfect performance. Send for our "Catalogue No. 55." VAN DUZEN & TRIFT, Cincinnati, O.

PRICE REDUCED. ASBESTOS ROOFING. FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC. Samples and descriptive Price List free by mail. H. W. JOHNS MFG CO., 87 MAIDEN LANE, N. Y.

Telegraph and Electrical SUPPLIES. Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue O. E. JONES & BHO, Cincinnati, O. It is important to us that you mention this paper.

CHARTER'S GAS ENGINE. The safest, most reliable and economical Motor in existence. Independent of Gas Works and Machines. 2 to 25 H. P. So it can be used anywhere. Makes Its Own Gas AT COST OF ABOUT 65 cents per M Feet. A saving of 25 to 85 per cent guaranteed over all other Gas Engines. Chicago Agent: H. H. LATHAM, 42 Dearborn Street, New York House: 12 Cortlandt Street. Williams & Orton Mfg. Co. P. O. Box 148. STERLING, ILL.

GEO. W. MARBLE, Sole Manufacturer of THE ACME WRENCH. The best made, all steel, and warranted, 5 sizes. 28 to 32 South Canal Street, Chicago, U. S. A.

FOR SHEDS OR OUTBUILDINGS we are now manufacturing a most excellent roof for \$2.00 PER 100 SQUARE FEET, Including nails, caps, and paint for entire roof. We also have first quality sheathing for lining inside. \$1.50 PER ROLL OF 300 SQ. FT. Keeps building cooler in Summer, warmer in Winter. TRY IT! INDIANAPOLIS, IND. INDIANA PAINT & ROOFING CO.

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 therefore.

BARREL MACHINERY. E. & R. HOLMES, BUFFALO, N. Y.

PROSPERUS OF THE Scientific American FOR 1887.

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. All Classes of Readers find in the SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It promotes knowledge and progress in every community where it circulates.

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.—One extra copy of the SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.00 each; additional copies at same proportionate rate.

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.

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. 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, Aethnology, 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, express money 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 or express money order, or draft to order of MUNN & CO., 361 Broadway, New York.

PRINTING INKS. THE "Scientific American" is printed with CHAS. T. BENEJOHN & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Roe St., opp. Duane St., N. Y.