Advertisements.

Back Page - - - - - - \$1.00 a line. Inside Page - - - - - 75 cents a line. Engravings may head advertisements at the same rate ver line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning o appear in next issue

CELEBRATED FOOT LATHES



Foot Power, Back-geared Screw Lathes, Small Hand and Power Plan-ers for Metal, Small Gear Cutters, Silde-rests, Ball Machine for Lathes, Foot Scroll Saws, light and heavy, Foot Circular Saws. Send for Illustrated Catalogues. N. H. BALDWIN Laconia, N. H.

Old

Point

Common-Sense Rockers and Chairs.



F.A. SINCLAIR, Mottville, N. Y.



Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty St., New York Wheels and Rope for conveying power long distances. Send for Circular.

OMPRESSED AIR MOTIVE POWER.—For particulars of the most recent practice, send 20 cents for SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1 and 2, containing 5 engravings of the "Compressed Air" Locomotives now in use in St. Gothard Tunned Works, with dimensions. etc.



[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for Soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in

They employ as their assistants a corps of the most ex perienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the government fees, and watch each case step by step whilepending before the examiner. This is done through their branch office, corner F and 7th streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and re-issues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERI-CAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patentsobtained in Canada, England, France, Belgium Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are ranted, at prices greatly reduced from former rates. which states the cost, time granted, and the requirements or each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this of-

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and scate name of patentee, title of invention,

and date of patent.

A pamphlet containing full directions for obtaining
United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 page and many engravings and tables important to every patentee and mechanic, and is a useful handbook of refer ence for everybody. Price 25 cents, mailed free.

Address MUNN & CO.,

Publishers SCIENTIFIC AMERICA , 37 Park Row, N. Y.
BRANCH COFFICE-Corner F and 7th Streets. Washngton, D. C

ROCK-DRILLING MACHINE S AIR COMPRESSORS

Manufactured by
BURLEIGH ROCK DRILL CO.,
Send for Pamphlet.
Fitchburg. Mass





REYNOLDS & CO.,
145 EAST ST., NEW HAVEN, CT.,
ANUFACTURE

Iron and Steel Set Screws, Round, Square, and Hexagon Head; Machine and Cap Screws; Plano, Knob, and Lock Screws; Machine, Bridge, and Roof Botts, Bott Ends, Blanks, Nuts, Washers, etc., of every description. Scnd for Friec List.

MILL STONE DIAMOND DRESSING MA-CHINES. Simple, effective, and durable. Also, diamond-pointed toofs for trueing Emery Wheels, Grind-stones, Chilled Iron, and Paper Calender Rolls, and other mechanical purposes. Also, Diamond Tools, Saws, and Drill s made to order. J. DICKINSON, 64 Nassau St., N.Y.

THE NEW FIFTY DOLLAR BACK GEAR, SCREW-CUTTING FOOT LATHE. Send for Circular to POST & CO., Cincinnati, Ohio.

Lawrence Scientific School, HARVARD UNIVERSITY.

THIS School provides a four years' course in HIS School provides a four years' course in neer, or Mining Engineer; and four years' courses in Chemistry, in Natural History, and in Mathematics, Physics, and Astronomy, each of which leads to the degree of S. B. A large portion of the instruction is the same as that given to undergraduates in the College. The University is amply provided with laboratories, apparatus and collections. Students of the Scientific School can occupy rooms in College Buildings and board at Memorial Hall. Examinations for admission will be held September 28 and 29, beginning at 8 A.M. For information, address JAMES W. HARRIS, Secretary.



The Standard-Best Stock-Finest Finish-

MANUFACTURED ONLY BY D. ARTHUR BROWN & CO. Fisherville, N.H.



Asbestos Roofing, with the improved White Asbestos Fire Proof Coating, for steep or flat Roofs in all climates. Asbestos Roof Coating, for old Leaky Roofs. Asbestos Cement, for repairing Leaks on Roofs. Asbestos Roof Paint, for Tin Roofs, Ironwork, &c. Asbestos Paints-all colors-for structural purposes. Asbestos Paints-all colors-for structural purposes. Asbestos Steam Pipe and Boiler Coverings. Asbestos Steam Pipe and Boiler Coverings. Asbestos Steam Packing, flat and round, all sizes. Sheathing Felts, Vermin-Froof Lining, &c. These articles are ready for use, and can be easily applied by any one. Send for Pamphiets, Price Lists, &c. H. W. JOHNS 87 Maiden Lane, N. Y., Patentee and Manufacturer. Established 1858.



NON-COMBUSTIBLE STEAM BOILER & PIPE WITH "AIR SPACE" IMPROVEMENT.

es 10 to 20 per cent. CHALMERS SPENCE CO., Foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.



THREE THINGS IN ONE

VENTILATION of a Fire Place; RADIATION of a Stove: CIRCULATION of a Furnace

Pure Air and an Even Temperature throughout a Room, 'THE CENTENNIAL,'' Annex Main Building.

THE OPEN STOVE VENTILA-TING COMPANY, 107 Fulton St., New York.

BEAMS & GIRDERS

'HE UNION IRON MILLS, Pittsburgh, Pa.
The attention of Engineers and Architects is called The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided. We are prepared to furnish all sizes at terms as favorable as can be actually a support of the provided of the standard and the standard obtained elsewhere. For descriptive lithograph, address Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

Todd & Rafferty Machine Co.

MANUFACTURERS OF
The celebrated Greene Variable Cut-Off Engine, Lowe's
Patent Tubular and Flue Boilers, Plain Silde Valve Stationary, Hoisting, and Portable Engines. Boilers of all
kinds. Steam Pumps, Mill Gearing, Shafting, &c., Silk,
Tow Oakum, Bagging, Rope, Flax, and Hemp Machinery,
Agents for the New Haven Manufacturing Co.'s Machinerist's Tools, for Judson's Governors and Stop Valves,
Startevant Blowers, and Differential Pulley-Blocks,
WAREROOMS, 88 LIBERTY STREET, NEW YORK.
WORKS, PATERSON, NEW JERSEY.

PERFECT NEWSPAPER FILE.

The Koch Patent File, for preserving newspapers, magazines, and pampblets, has been recently improved and price reduced. Subscribers to the SOLENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.

Address

MUNN & CO., Publishers Scientific American.

As a rule, it pays best to advertise what one has to sell or wishes to purchase, in papers having the largest circulation among the class of persons likely to be interested in the article. Parties having Manufacturing Establishments to sell orlease, or who wish Estimates made for Constructing Bridges, Dams, Iron Buildings, Furnaces, Heating Apparatus, Steam Engines, Bollers, Wood and Iron Working Machinery, Agricultural Implements, or Contracts for Engineering Works of all kinds, will find that it pays to advertise in the SCIENTIFIC AMERI-CAN.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be over-estimated. It goes into all the machine and workshops in the country, and is taken at the principal libraries and reading rooms in the United States and Europe.

The SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT have a larger circulation than all other papers of their kind in the world com-bined; and at no period since the commencement of the publication of these papers has the weekly circulation been as large as at the present time. The actual issue of the SCIENTIFIC AMERICAN is

47,500 per week, and of the SCIENTIFIC AMERICAN SUPPLEMENT, 15,000, making the combined circulation, 62,500 every week.

If anything is wanted in the mechanical line, advertise for it in the SCIENTIFIC AMERICAN.

If one has a patent or machinery to sell, advertise in the SCIENTIFIC AMERICAN.

If any one is exhibiting at the Centennial, it will nav

them to advertise where they may be found.

For rates, see the first column of the last page of this

The Supplement.

Next to the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT has the largest circulation of any paper of its class published. The SUP PLEMENT's a distinct publication from the SCIEN-TIFIC AMERICAN, and has a large circulation other than among the subscribers of the regular edition. Terms for advertising are very low, as follows:

Back Page, tinted cover....35c. a line | EACH Inside page25c. a line | INSERTION. Discount for large space, and to quarterly advertisers. Address the publishers.

> Munn & Co., 37 Park Row, New York

Brayton Keady Motor. It has no boiler, is safe, economical, started by any one in one minute, occupies small space, and gives an unsurpassed steady, reliable power. Address

Penna. Ready Motor Co., 132 N. 3d St., Philadelphia, Pa.

Working Models

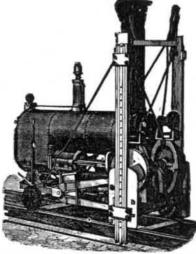
And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Center St., N. Y. Lathes, Planers, Shapers, Drills, Gear & Bolt Cutters, &c. E. GOULD, Newark, N.J.

HANDASYDE'S COMPOSITION

For the Removal and Prevention of Incrustation in Steam Boilers. Used by the principal Railroads, Coal Mines, and General Manufacturers in Great Britain and Ireland. Satisfaction guaranteed. The best and cheapest in the market. Send for circulars and testimonials.

G. C. CAMPBELL, AGENT,
24 Broadway, New York.

Channeling Stone Quarrying Machine,



WARDWELL PATENT,

FOR CUTTING STONE INTO VARIOUS SIZES AND DIMENSIONS IN ALL KINDS OF

STEAM STONE CUTTER CO., RUTLAND, VT.
SOLE PROPRIETORS AND MANUFACTURERS. Three Machines at Philadelphia Exhibition, Annexe No. 2. Machinery Hall.

ROGERS' TANNATE OF SODA BOILER SCALE PREVENTIVE.

JOS. G. ROGERS & CO., Madison, Ind.

Send for book on Boiler Incrustation.

Portland and Keene's Cement. From the best London Manufacturers. For sale by JAMES BRAND, 85 Beckman St., New York. A Practical Treatise on Cement furnished for 25 cents.



Niagara **SteamPumpWorks** ESTABLISHED 1826.

CHARLES B. HARDICK, 23 Adams Str BROOKLYN, N. Y.

The Tanite Co.,

STROUDSBURG, PA. EMERY WHEELS&GRINDERS GEO. PLACE, Gen'l. Agent for N. Y. city and State.

Machinists' Tools.

New and Improved Patterns.

Send for nev illustrated catalogue.

Lathes, Planers, Drills, &c.

NEW HAVEN MANUFACTURING CO.

New Haven, Cond.

M. SELIG JUNIOR, & CO.,
Importers of American Machinery, Tools, Agriculturs.
Implements, Wholesale and Export Hardware and Machinery Merchants. Est'd 1866.
LONDON, ENGLAND, and BERLIN, GERMANY.

PORTLAND CEMENT

ROMAN & KEENE'S. for Walks, Cisterns. Founda-tions, Stables, Cellars, Bridges, Reservoirs. Breweries. etc Remit 10 cents for Practical Treatise on Cements. S. L. MERCHANT & Co., 76South St. New York.

PUNCHING
AND
AND
DROP PRESSES. MIDDLETOWN, CONN.

DOGARDUS' PATENT UNIVERSALECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oli Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Saits, Roots, Spices, Coffee, Coccanut, Flaxseed, Asbestos, Mics, Spices, Company, Compan

DAMPER REGULATORS **BEST** GAGE COCKS, MURRILL & KEIZER, 44 Holliday St., Balt.

HARTFORD

STEAM BOILER

Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't. J. B. PIERCE, Sec'y.

NOYE'S Mill Furnishing Works
are the largest in the United States. They make Burr
Millstones, Portable Mills, Smut Machines Packers, Mill
Picks, Water Wheels, Pulleys and Gearing, specially
adapted to flour mills. Send for Catalogue.

J. T. NOYE & SON, Buffalo, N. Y.



SCIENTIFIC AMERICAN, FOR 1876.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTY-FIRST YEAR.

VOLUME XXXV.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the first day of July, 1876, a new volume commenced. It will continue to be the aim of the publishers to render the con tents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIEN-TIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publica-

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room. Each volume contains hundreds of Notes, Receipts, and Suggestions and Advice, by Practical Writers, for Working Men and Employers, in all the various arts.

PAID BY US. One copy Scientific American, one year .. \$3 20 One copy Scientific American, six months. 1,60 One copy Scientific American, threemonths 1,00 One copy Scientific American and one copy

SUBSCRIPTION

TERMS OF

Scientific American Supplement, both for one year, post-paid...... 7.00

The Scientific American Supplement. A weekly paper, uniform in size with the SCIENTIFIC AMERICAN, but a distinct publication. It contains working drawings of engineering works, and elaborate treatises on every branch of Science and Mechanics, by eminent writers, at home and abroad. An illustrated cover protects the handsomely printed sheets. Price, \$5.00 per annum Single copies 10 cents.

Remit by postal order, draft, or express. Address all letters and make all Post Office orders and drafts payable to

MUNN & CO., 37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York