Advertisements.

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

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

CUARDIOLA'S COFFEE & SUGAR MACHINERY

Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine. Coffee-Hulling and Polishing Machines. Coffee-Washing Machine. Helix Sugar Evaporator.

Messrs. C. ADOLPHE LOW & CC., 42 Cedar Street, Messrs. MUNOZ & ESPRIELIA, 52 Pint Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.



Best Tempered Cast Steel. Retail Price, 9 Cents per lb. WARRANTED. F Send for Circular. Fisher & Norris, Trenton, N. J.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS. Send for new illustrated catalogue.

Lathes, Planers. Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

Mill Stones and Corn Mills.

We 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.

Tube Cleaners for cleaning Boiler Tubes. THE NA-

WOODWORTH SURFACE PLANERS, \$125. Planers and Matchers, \$350. S. C. HILLS, 78 Chambers Street. New York.

Local and Traveling Agents Wanted in every State and Territory in the Union, to sell Mechanical Goods. Liberal commission offered. Prompt replies desired, and full details. Address "MORGAN," Box 2574, N. Y.

DAMPER REGULATORS **BEST** GAUGE COCKS.
MURRILL & KEIZER, 44 HOLLIDAY ST., BALTIMORE.



[ESTABLISHED 1846.]

Mann & 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 draughtsmen, that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed them selves 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, while pendingbeforethe examiner. This is done through their branch office, corner F and 7th Sts., Washington. They also prepare and file caveats, procure design patents, trade marks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to inter-ferences, 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 for-

A special notice is made in the SCIENTIFIC AMER-ICAN 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.

Patents obtained in Canada, England, France, Belgium Germany, Russia. Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for vamphlet vertaining specially to foreign patents, which states the cost, time granted, and the re-

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 1638 will be furnished for \$1.

When ordering copies, please to remit for the same as

above, and state 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 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed tree.

Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN,

37 Park Row, N. Y.

BRANCH OFFICE-Corner of F and 7th Streets, Washington, D. C.

THE TANITE CO.,

Just out. 10,000 copies new edition EMERSON'S Illustrated Hand Book. 75 engravings, and 100 pages of valuable information about SAWS and SAW MILLS, free, on application. From your full address on postal card to EMERSON, SMITH & CO., Beaver Fails, Pa.

ESTABLISHED 1844.

JOSEPH C. TODD,

(Formerly of Todd & Rafferty), Engineer and Machinester. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Bollers, etc. Also Agent for the celebrated and improved Rawson & Rittinger Hoisting Engine, I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address.

J. C. TODD,

10 Barclay St., New York, or Paterson, N. J.

FOR SALE—A 25-HORSE POWER HARRISON Boiler, nearly new, by JAMES BINNS, Iron Founder, 27 Walworth St., Brooklyn, N. Y.

NON-COMBUSTIBLE STEAM BOILER AND PIPE COVERING

WITH "A IR SPACE" IMPROVEMENT.
Saves 10to 20 per cent. CHALMERS SPENCE .,
Foot E 9th St. N. Y.: 1202 N. 24 St., St. Louis, Mo.



Niagara Steam Pump Works

ESTABLISHED 1826. CHARLES B. HARDICK, . 23 Adams Street BROOKLYN, N. Y.

HARTFORD

STEAM BOILER

Inspection & Insurance COMPANY.

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



Wright's Pat, Ducaca Plungers are the best. VALLEY MACHINE Co. Easthampton, Mass.

FORGINGS and SPECIAL MACHINERY, THE HULL & BELDEN CO., Danbury, Conn. **DROP**

Machines



Send for Illustrated Circular,

Weissport.

Incombustible Mineral Wool

The best and cheapest insulator of heat or cold. Send for circulars, 26\(\frac{1}{2}\) Broadway, New York.

ALEXANDER D. ELBERS,
P. O. Box 4461.

Agent for the Patentee.



GUILD & GARRISON, 34 to 44 First St., Williamsburgh, N. Y., Manufacturers of STEAM PUMPS

for all purposes.

Also Vacuum Pumps
Vacuum Paus, and
Air Compressors.

MEN OF PROGRESS.

Persons desiring to secure a copy of this magnificent Engraving can do so at the following greatly reduced rates:

Among the personent Inventors:

nent Inventors:

§ F R MORSE ELectric Telegraph.

CVRUS H MCCORMICK Reaper.

THOS BLANCHARD Lathe for Irregular Forms.

WILLIAM T. G. MORTON Chlereform.

SAMUEL COLT Revolving Fire-Arms.

CHARLES GOODYBAR Revolving Fire-Arms.

FREDBRICK E. SICKELS Steam Cut-Off.

HENRY BURDEN Horse Shoe Machine.

JOHN ERICSSON First Monitor.

JAMES BOGARDUS Tron-Rolling Machinery.

PETFER COOPER Iron-Rolling Machinery.

JOSEPH BAXTON Machines.

ISAIAH JENNINGS Friction Matches.

ISAIAH JENNINGS Friction Matches.

RICHARLD M HOE Fast Printing Presses. RICHARD M. HOE. Fast Printing Presses

MUNN & CO., 37 Park Row New York city.

Pyrometers, For showing heat of evens. Het Blast Pipes, Boiler Flues, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, New York.

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 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.

MUNN & CO., Publishers SCIENTIFIC AMERICAN.

A. S. CAMERON'S PATENT

"SPECIAL" Steam Pump Is the Standard of Excellence at home and abroad.

REDUCED PRICE LIST.

Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
9	\$ 50	3)% in.	Zin.	4
2	100	5	316	ĕ
.4	200	2	31/2	10
6	325	10	5	10
8	425 480	1ŏ	ğ	13
1 9	550	14	18%	13
12	850	18	12"	18

Illustrated Catalogue sent free, on application to the Inventor and Sole Manufacturer in the United States,

A. S. CAMERON,

Works, Foot of East 23d St. NEW YORK CITY.



\$3 PRINTING PRESS! to any press. Larger sizes for large work.
Do your own printing and absorbing and
save money. Excellent spare hour amusement for old or young. Or it can be made
money making business anywhere. Send
3c. stamps for large catalogue to
KELSEY & CO., Manufacturers,
Meriden, Conn.

1872, 1873, 1874, 1875, 1876, SCIENCE RECORD.

A few copies of these splendid books, copiously illustrated, are offered at the following very low prices. Persons desiring a condensed history of the most interesting Facts and Discoveries in the Arts, Sciences, and Inventions, for the years from 1872 to 1876, will find them recorded in the five volumes of the SCIENCE RECORD, now offered at half the original price.

Every Department of Science is treated in these volumes, and the important discoveries of the several years are not only faithfully described, but many of the subjects are illustrated with finely executed engravings, prepared expressly for these Annuals.

Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:

CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND,
TECHNOLOGY, THE USEFUL ARTS,
BOTANY AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MEDICA, THERAPEUTICS, HY LENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOGRAPHY,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,

METEOROLOGY, TERRESTRIAL PHYSICS, GEOGRAPHY, GEOLARPHY, GEOLARPHY, GEOLARPHY, AND MINERALOGY, ASTRONOMY, BIOGRAPHY AND NECROLOGY. Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of \$1.25 each, or \$5 for the set of five volumes.

They were published and heretofore sold at \$2.50 each, or \$10 for the set.

State, in remitting for a single volume, which year, from 1872 to 1876, is desired, remembering that the date of the volume covers the events and discoveries of the previous year. Sent by mailon receipt of price. Address MUNN & CO., Publishers. MUNN & CO., PUBLISHERS, 37 Park Row, New York city.

PATENT

The fact that this shafting has 75 per cent, greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2s and 3rd Avenues, Pittsburgh, Pa. 1908, Canal Street, Chicago, Ill., and Milwaukie, Wis.

Stocks of this shafting in store and for sale by FULLER, DANA, & FITZ, Bosten, Mass. GEO, PLACE & CO. 121 Chambers St., N. Y.

Working Models

And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Center St., N. Y.

EAGLE FOOT LATHES, Improvement in style. Reduction in prices April 2th. Small Engine Lathes, Slidle Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outlits for Amateurs or Artisans.

WM. L. CHASE & CO. 95 & 97 Liberty St., New York,

DOGARDUS PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crueibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMPS BOGAR-DUS, corner of White and Elm Sts., New York

DUC'S IMPROVED PATENT ELEVATOR BUCKET, FOR BREWERS, FLOUR MILLS, GRAIN ELEVA-TORS, SUGAR REFINERS, &c.



TO ROOFERS AND BUILDERS.

Irish Flax and Hemp Roofing Felt

With Composition Cement Coating.

In use for more than thirty years. For steep or flat roofs. Fire-proof, durable, and economical. Send for circular and price list to E. H. MARTIN & CO., 70 Maiden Lanc, and 9 Liberty St. N. Y. P. O. Box 4784.

STROUDSBURG, PA. EMERY WHEELS AND CRINDERS. GEO. PLACE, 121 Chambers St., New York Agent.

ROCK DRILLING MACHINES

AIR COMPRESSORS,

MANUFACTURED BY BURLEIGHROCK DRILL CO.
SEND FOR PAMPHLET FITCHBURG MASS. SEND FOR PAMPHLET.

BUY YOUR BOILER AND PIPE

COVERING

direct from the Manufacturers.

ASBESTOS FELTING CO., Front St., near Gouverneur, N. Y.

The HOADLEY
PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR
AND BALANCED VALVE.
THE BEST MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J.C.HOADLEY CO. LAWRENCE. MASS.
STATE WHERE YOU SAW THIS.

Patented x868-1874.

BOLT CUTTERS.

Dies open and close and Bolt
sthrown out automatically.

One pattern, holds finished bolts on centres and threads them with greater accuracy and uniformity and ten times as fast as a chaser in a Lathe. Highest award of American Institute, 1869 & 1874.

Wood & Light Machine Co., Worcester, Mass-make all kinds of Iron Working Machinery-Also, Shafting, Pulleys, &C.

LeCOUNT'S PATENT Machinists' Tools.

TO INVENTORS AND MANUFACTURERS

FOLLOWS & BATE, Manchester, England, Hardware and Machinery Merchants, are prepared to buy American Goods for Cash, and to act as Sole Wholesale Agents.

5 Outfit free. Salary guaranteed. Write at once to EMPIRE NOVELTY CO., 369 Broadway, New York.



SCIENTIFIC AMERICAN For 1877,

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTY-SECOND YEAR.

VOLUME XXXVI.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the sixth day of January, 1877, a new volume was commenced. It will continue to be the aim of the publishers to render the contents 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 Scientific American. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

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 and twenty cents by the publishers.

One extra copy of the Scientific American will be supplied gratis for every club of five subscribers at \$3.20 each; or six copies for \$16.50 without extra copy.

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.

One copy of the Scientific American and one copy of the Scientific American Supplement will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven Dollars by the publishers. The safest way to remit is by Postal-Order, Draft, or

Express. Money carefully placed inside of envelopes, securely scaled, and carefully addressed, seldom goes astray; but it is at the sender's risk. Address all letters and make all orders, drafts, etc., 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.