#### 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 office as early as Friday morning to appear in next issue.



# **Berryman Patent** Feed Water Heater,

#### Purifier,

For High or Low Pressure Engines. Delivers Feed Water at 210° Far. Prevents formation of Scale. Removes old Scale. The only Heater applicable to Condensing Engines. Over 3,500 in use in United States and England. Send for circular.

#### I. B. DAVIS, Hartford, Ct., Sole Proprietor and Manufacturer.

ICROSCOPES At Reduced Prices.
Opera Glasses, Spectacles, Teluscopes, Thermometers. Send for
Illustrated Catalogue. R. & J. BECK,
921 Chestnut St., Philadelphia.

STRANGER PAUSE! TA copy of the Weekly Union Advertiser, Wayland, N.Y., size 30x42; an excellent journal, established 1873, can be obtained by addressing a postal card as above. can be obtained by addressing a posta It will please you.

Mention this paper in writing us.



# VEST POCKET

By Far the Smallest and Most Perfect POCKET ARM in the World. Secured by U. S. and Foreign Letters Patent.

By far the most rapid repeating arm ever manufactured. Is a positive safeguard against accident, so frequent with other FIRE ARMS. Adapted to the usual size cartridge, and can be carried in the vest pocket with perfect convenience. Sold by the trade generally. Unusual inducements to responsible agents in all sections. Send for circulars.

#### All Right Fire Arms Co., Lawrence, Mass.

A LCOTT LATHES, for Broom, Rake and Hoe Handles. S. C. HILLS, 78 Chambers St. N. Y.



#### COPYRIGHTS, TRADE MARKS, ETC.

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 and over THIRTY TEARS' EXTERNIENCE, and now have unequaled facilities for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreig Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate

terms.
We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents .- 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. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about one HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English Patent is \$75; German, \$100; French, \$100; Belgian, \$100; Canadian, \$50.

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 office \$1.

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 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, contain: 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

#### MUNN & CO.,

Publishers SCIENTIFIC AMERICAN.

37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and Ith Streets,
Washington, D. C.

#### Harrison's System of Grinding!

Illustrated Catalogue Now Ready.

NEW STANDARD FLOURING MILLS. NEW STANDARD FLOURING MILLS.
Old Theories, Ho zontal Grinders, Slow Runners,
Fully Exploded. Fine Flour, High Speed, and Economical Milling Fully Established.
A NEW Copy For All.
Millers and Editors please address
EDWARD HARRISON,
No. 135 Howard Ave. New Haven, Conn.

#### CUARDIOLA'S

COFFEE & SUGAR MACHINERY Coffee, Malt, Corn, Cocoa, and Grain-Brying Machine. Coffee-Hulling and Polishing Machines. Coffee-Washing Machine. Helix Sugar Evaporator.

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

#### ESTABLISHED 1844.

JOSEPH C. TODD,

(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging
Machinery, Steam Engines, Bollers, etc. Also Agent for
the celebrated and improved Rawson & Rittinge. Holsting 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.

"Indispensable to the Library, Cicrayman, Lawyer, Physician, Editor, Teacher, Student, and all of any calling in tife who desire knowl-

#### ENCYCLOPÆDIA BRITANNICA Ninth Edition. - American Reprint.

This great work is beyond comparison superior in its elaborate and exhaustive character to all similar works. The contributors are the most distinguished and original tinkers and writers of the present and of the past.

This issue is the Ninth revision in a space of over one hundred years since its inception, and this reprint, a copy in every particular of the British Edition now in course of publication, is the best and cheapest work ever offered to the American people.

The articles are written in a most attractive style, and the quantity of matter in each volume is one-third greater per volume than in any other Cyclopædia sold at the same rates.

The work contains thousands of Engravings on Steel and Wood, and is printedfrom entirely new type made expressly for it.

It will be comprised in twenty-one Imperial octavo volumes, six of which are now ready, and the succeeding volumes will be issued at the rate of three a year.

Price per vol., extra cloth binding.........\$5.00.

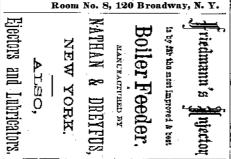
Price per vol., extra cloth binding.......\$5.00. In half Turkey Morocco, extra...........\$7.80.

Sold only by subscription.
A neat Pamphlet, giving specimens of pages, cuts, full-page illustrations, list of contributors, etc., will be mailed gratis to applicants.

J. M. STODDART & CO., Publishers, 723 Chestnut Street, Philadelphia.

H. H. KEY, Publisher,

Room No. 8, 120 Broadway, N. Y.



## PATENT ROLL

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 intrish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, TY Street, 2d and 3d Avenues Pittsburgh, Pa. 190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.

FINITER, DANA & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.

PUNCHING Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

FOOT LATHES | Fret Saws! Send 6c. for 90 pp. E. Brown, Lowell, Mass.

PATENT SCROLL AND BAND SAW MACHINES A speciality. CORDESMAN, EGAN & CO., Cincinnati, O.



#### Niagara \_\_\_\_ Steam Pump Works. ESTABLISHED 1826.

CHARLES B. HARDICK,

o. 23 Adams Street, BROOKLYN, N. Y.

DOGARDUS' PATENT UNIVERSAL ECCENTRIC MELIS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Coconnut, Fluxsod, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc., and Without Son, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.



#### P.BLAISDELL & CO.,

Worcester, Mass.,

Manufacturers of the Blaisdell Patent Upright Drills and other first-class Machinists' Tools.

#### HARTFORD

#### STEAM BOILER

Inspection & Insurance COMPANY.

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



Pyrometers, For showing heat of Ovens, Hot Blast Pi es, Holler Flues, Super-Ireated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

25 Fashionable Cards, no two alike, with name, 10c. postpaid. Geo. I. REED & Co., Nassau, N. Y.

### ENCINEERS WANTED

Il towns in Eastern, extreme Western and Southern ies as agents to sell the best two piston rod packings le, 'Liberal terms given good men. FOREST CITY FACKING CO., Cleveland, Ohio.

ROCK DRILLING MACHINES AIR COMPRESSORS

MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS

# Mill Stones and Corn Mills.

We make Bur Millstones, Portable Mills Smut Machines, Pacters, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue. J. T. NOYE & SON, Buffalo, N. Y.

to any press. Larger sizes for large work. Do your own printing and advertising and save money. Excellent spare hour amusement for old or young. Or it can be made money making business anywhere. Send a stamps for large catalogue to KELSEY & CO., Manufacturers, Meriden, Coun.

DANBURY DRILL CHUCKS.

Perfected and Price reduced.

Manuf'd by the HULL & BELDEN CO., Danbury, Ct.





for making small sam Engines I 1-2 in. bore, 3 in. stroke, price, 34; bore, 4 in. stroke, price, 30, same style as cut, oot Lathes only 15 Dollars. Gear Wheels and Models, All kinds of Small Tools and Materials lustrated Catalogue Free. OODNOW & WIGHTMAN,23 Cornhill, Boston, Mass

KNOW

A new Medical Treatise, "THE
SCIENCE OF LIFE, OR SELF-PRESERVATION," a book for everybody.

THYSELF Price \$1, sent by mail. Fifty
ortginal prescriptions, either one
price of the book. Gold Medal awarded the author. T e
Boston Herald says: "The Science of Life is, beyond
all comparison, the most extraordinary work on Physiology
ever published."
An Illustrated
Pamphiet sent PAREER, No. 4
Bulfinch Street, Boston, Mass.



SHEPARD'S CELEBRATED \$50 Screw Cutting Foot Lathe. Foot and Power Lathes, Drill Presses, Fot and Power Lathes, Drill Presses, Scroll, Circular and Band Saws, Saw Attachments, Chucks, Mandrills, Twist Drills, Dogs, Calpers, etc. Send for catalogue of outdits for amateurs or artisans.

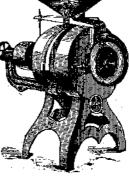
H. L. SHEPARD & CO., 88, 90 & 92 Elm St., Ciucinnati, Ohio.

Lightest, Strongest, and Best

# MILL

Tins; also, agramme Frant Frances and Tappo outlings. Send for catalogue. Address. Taper-Siceve Pulley Works, Erie, Pa.

#### Phillips' Vertical Burr Mills.



adapted to all kinds of grinding, with Scroll Ventilator and Discharge. Approved Self-Oiling Bridge Tree Box. Our clean-ingattachment of Fan and Screen makes it Mill ever constructed. We use forged Cast Steel Shafts, and guarantee our Mills superior to anything in the market. Address C. C. PHILLIPS,

4048 Girard Ave., West Phila.

Calculating Machines. G. B. Grant, Beverly St., Boston. THE TANITE CO. STROUDSBURG, PA. EMERY WHEELS AND GRINDERS. GEO. PLACE, 121 hambers St., New York Agent.

# Steel Castings,

PRICE 18T TO CHESTER STEEL CASTING COMPAN' EVELINA STREET, PHILADELPHIA, PA.

TORPEDO VESSELS. By Mr. DONALD SON. A valuable paper, lately read before the United Service Institute. Being a full exposition of the Torpado-boat system, from the earliest efforts to the present time. Giving dimensions and performances of the several sizes built by Thornycroft Bros. for the various governments, highly interesting trials of these boats, and experiences in war, and a description of the torpedoes used. 1 illustration. Contained in Scientific American Supplement No. 79. Price 10 cents. To be had at this office and of all newsdealers.

# H. W. JOHNS' PATENT.

Liquid Paints—all shades, finest in the world.
Fire Proof Paint, for Wood work &c.
Roof Paint, for Tin Roofs, Iron Work, &c.
Roofing, with white Fire Proof Coating,
Roof Con ting, for restoring and preserving old roofs.
Cements, for Retorts, Furnaces, Loaky Roofs, &c.
Steam Pipe and Roifer Coverings,
Steam Pucking, Asbestos Boards, Fire Proof
Coatings, Sheathings and Roofing Felts, &c.
These articles are ready for use, and can be easily applied by any one. Send for Samples, Pamphlets, Price
Lists, &c.

#### H. W. JOHNS MANUFACTURING COMPANY,

87 Maiden Lane, New York.

PHILADELPHIA BRANCH, 406 Arch St.
DOWNIE, TRAINER & CO., Boston.
S. W. HEMPSTED & CO., Columbus, Ohio.
M. M. BUCK & CO., St. Louis.
C. A. PARKER & CO., New Orleans.
THOMPSON & UPSON, San Francisco.

FOUNDRY AND MACHINE SHOP FOR Sale or Rent. We offer at a bargain, our old works, consisting of three substantial brick buildings sheds, ample water power and facilities for conducting an iron or wood working business. Coal, iron, hard and soft humber close at band. Three rethroads. or wood working business.

On, 1002, Address lumber close at hand. Three railroads. Address SOUTH BEND IRON WORKS, South Bend, Ind.

PERFECT

### NEWSPAPER FILE

he 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. \_Keverse Motion Paneling, Va-riety Moulding & Dovetailing riety Moulding & Doverailing Machine, Cuts Panels of any design or style of mould in the solid wood with neatness an d diapatch.

I sa first-class Shaper, Edge, & Scroll Moulder, Does general Dovetailing with thick or

thin stuffs. Simple, Burable and
Efficient. If Send for Pamp let
and Sample of work. Improved
Solid Steel Cutters for all kinds of
Variety Moulders made to order, and warranted by the B. C. MACHINERY CO.,

Battle Creek, Mich. 25 Snowflake Assorted Cards, with name 10c. Outfit 10c. SEAVY BROS., Northford, Ct.

1872, 1874, 1875, SCIENCE RECORD.

A few copies of these splendid books are offered at the following very low prices.

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, ECECTRICITY, LIGHT, HEAT, SOUND, TECHNOLOGY, THE USEFUL ARTS, ROTANY, AND HORITOUL TURE.

ROTANY AND HOISTIGHTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MFIDICA, THERAPEUTICS, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY 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. Address MUNN & CO., PUBLISHERS,



### BRADFORD MILL CO.

37 Park Row, New York city.

MANUFACTURERS OF French Buhr Millstones, Prench Buhr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, desiers in Bolting Cloths and
General Mill Furnishing.
Office & Factory, 168 W. 2d8t,
CINCINNATI, O.
J.R.Stewart, Pres. W.R.Duniap, Sec.

CFPRICE-LISTS SENT ON APPLICATION.

#### MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS. Send for new illustrated catalogue.

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

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