Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO. Industrial Publishers, Booksellers, and Importers, 810 Walnut St., Philadelphia. Pa., U. S. A.

Our newand Revised Catalogue of Practical and Scientific Books, 36 pages, 5vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

Send a postal card to

the publishers for

NEW ILLUSTRATED SCIENTIFIC CATALOGUE mailed free to any address.

J. B. LIPPINCOTT COMPANY, 715-717 Market Street, Philadel phia.

<u>ARCHITECTURAL</u>

Useful, Beautiful, and Cheap.

To any person about to erect a dwelling house or stable, either in the country or city, or any builder wishing to examine the latest and best plans for a church, school house, club house, or any other public building of high or low cost, should procure a complete set of the ARCHITECTS' AND BUILDERS' EDITION of the SCIENTIFIC AMERICAN.

The information these volumes contain renders the work almost indispensable to the architect and builder, and to persons about to build for themselves they will and to person about the time they work suggestive and most useful. They contain colored plates of the elevation, plan, and detail drawlngs of almost every class of building, with specification and approximate cost.

Nine bound volumes are now ready and may be obtained, by mail, direct from the publishers or from any newsdealer. Price, \$2.00 a volume. Statched in paper covers. Subscription price, per annum, \$2.50. Address

MUNN & CO., Publishers, 361 Broadway, New York.

&POLISHING MATERIALS UCKER & LEVET CHEMICAL CONEW YORKUSA



NICKEL ANODES, NICKEL SALTS COMPOSITION BUFFING WHEELS, ELECTRO & NICKEL PLATING OUTFITS.

LOCOMOTIVES WITH WORKING LOUOMOTIVES WITH Petroleum Fuel.—By Thomas Urquhart. An interesting account of the recent results of the author's experience in the use of petroleum refuse as fuel on an unprecedented scale upon the Grazi & Tsaritsin Rallway, Southeast Russia. With 52 illustrations. Contained in Scientific American Supplement. Nos. 769 and 7701. Price ten cents each. To be had at this office and from all newsdealers,



Barnes' Foot-Power Machinery
Complete outtis for Actual Worksnon
Business. A customer some Complete outfits for Actual Worksnop Business. A customer says: "Considering its capacity and the accuracy of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day, and at night feel as little tired as if I had been walking around."

Descriptive Price List Free.

W. F. & JOHN BARNES CO.,
1929 RUBY ST., Rockford, Ill.

NEW YORK TRADE SCHOOLS.-DE scription of the New York Trade Schools which were established inney years ago for the purpose of giving instructions to young men in certain trades, and to enable young men aiready in such trades to improve themselves. With 10 illustrations. Contained in Sourvierte American Suppliement. No. 781. Price 10 cents. To be had at this office and from all newsdealers.



PATENTS!

MESSES. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to training 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 unequaled facilities for the preparation of Patent Drawins, 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 intrusted to them is done with special care and promptness, on very reasonable terms.

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 Patents, and 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. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

DEAF NESS & HEAD NOISES CURED by Feck's Invisible Tubular Ear Cuchions. Whappers only by F. HECOX, 833 Bway, N.T. white for book of proofs FREE



ELECTRO MOTOR, SIMPLE, HOW TO ELECTRO MUTOR. SIMPLE, HOW ID make. By G. M. Hopkins.—Description of a small electromotor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in Scientific Amelican Supplement. No. 641. Price 10 cents. To be had at

SUPPLEMENT. No. 641. Price 10 of this office and from all newsdealers.

The most Successful Lubricator for Loose Pulleys in use.
VAN DUZEN'S PATENT LOOSE PULLEY OILE

Highly recommended by those who have used them for the past four years. Prices very reasonable. Every user of machin-ery should have our "Catalogue No. 56," sout free. Mention this paper. YAN DUZEN & TIFT, Cheinnati, Ohio.

FOR RENT

In the best Natural Gas City in Indiana, Buildings with Heat, Light, and Power. Equipped with Automatic Sprinklers, Steam Heat, and Electric Light, suitable for light or heavy manufacturing. Address,

JAS. BOYCE, MUNCIE, IND.

THE EACLE THE EASIEST RUNNING BICYCLE IN THE WORLD. Speed, Comfort and Safety.

AGENTS WANTED. Large Illustrated Catalogue sent Free to any Address. THE EAGLE BICYCLE MFG. CO., STAMFORD.

ARTIFICIAL INCUBATION.-A DEscription of the French process of raising chickens. With 7 figures. Contained in Scientific American Supplement, No. 778. Price 10 cents. To be had at this office and from all newsdealers.



Barrel, Keg, Hogshead STAVE MACHINERY. Over 50 varieties manu factured by

Truss Hoop Driving. E. & B. Holmes, BUFFALO, N. Y. AISO A FULL LINE OF WOOD WORKING MACHINERY

ANTED. Selling Agents for Electrical Novelties. Battery Motors surprise electrical experts. Stampfor catalygue, \$10 per day made. BUSH CO., 24 Park Place, New York.

CUTLER

ELECTRIC POWER TRANSMISSION in Mining Operations—By H. C. Spaulding. A brief presentation of some of the work already done toward the application of electrical apparatus to mining processes, with some bractical suggestions and statements from those who have had personal experience in the operations of such apparatus. With 2 illustrations. Contained in Scientific American Supplement, No. 783. Price 10 cents. To be had at this office and from all newsdealers.



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 different subjects, has recently 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

MUNN & CO., 361 Broadway, New York,

THE LONDON ELECTRIC UNDERround Railway. Description of the plan followed methods of work, and use of the hydraulic shield. With 6 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 771. Price 10 cents. To be had at this office and from all newsdealers.



BLUE PRINT Paper, Superior Quality, Photographic Supplies. Send for catalogue.
T. H. McCOLLIN & CO., 1039 Arch Street, Philadelphia.
The Smith Premier Typewriter Co., Syracuse, N. Y., U. S.

ICE-HOUSE AND REFRIGERATOR.
Directions and Dimensions for construction, with one
illustration of cold house for preserving fruit from
season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT NO. 116.
Price 10 cents. To be had at this office and of all newsdealers.

PHOTOGRAPHY! Our Latest Novelties for the Amateur are

Our Latest Novelties for the Amateur are
KNACK CAMERAS,
MASCOT CAMERAS,
TRIAD CAMERAS,
Waterbury Detective Cameras,
Irving View Cameras, and
Magazine Cameras for Films.

THE SCOVILL & ADAMS CO., 423 Broome Street, New York



For Catalogue "S," addres CHANDLER & TAYLOR CO., INDIANAPOLIS, IND

CHUCK AND MICROMETER STOP for Amateurs.—By C. D. Parkhurst. Description of a simple and easily constructed chuck for use with a dividing machine, and the micrometer stop that is used to regulate the depth of the cut in the graduation of circles, etc. With 9 figures. Contained in "CIENTIFIC AMERICAN SUPPLEMENT, NO. 772. Price 10 cents. To be had at this office and from all news dealers.



Specialties in Machinery of all kinds wanted to place in the English, German, and French markets. Good English, German, and French Patents Bought. Our Representative will leave for England about May 15th.

Address LARMACO, BOSTON, MASS.

DEVELOPMENT OF AMERICAN Blast Furnaces, with special reference to large Yields.— By James Gayley. A description of some of the princi-pal blast furnaces in the United States, showing the changes in design and practice by means of which ex-traordinarily large yields have been obtained in the last decade. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 776. Price 10 cents. To be had at this office and from all newsdealers.

BEST IN THE WORLD. A CUTLER & SON, BUFFALO, N.Y., U.S.A. RANKS THE HIGHEST

NATIONAL STEEL TUBE CLEANER



Office, 59 Liberty St., New York. **CASOLINE** and **GAS ENGINES**

Our new Engines are hustlers. A 6 x 7 inch Engine, now running 100 feet of shafting. Boring Mills, Planers, Lathes, Drill Presses and Milling Machines for 20 Machinists, on 6 gal. Gasoline per day, costing only 60 cts. Write for information. Mention this paper.

Van Duzen Gas & Gasoline Engine Co. CINCINNATI, OHIO.

GAS ENGINES. - A VALUABLE paper by E. Delamare-Deboutteville, touching upon the history of gas motors in general, and describing in detail the "Simplex" engine invented by the author and Mr Malandin. With 25 figures. Contained in SCIENTIFIC cents each. To be had at this office and from all newsdessiers.

useful books by different authors, on more than fifty A Machine Shop and Laboratory Where inventors may be helped out of their mechanical troubles. Will send a primer that is itself a help.

THE JONES BROTHERS ELECTRIC CO. CIN'TI, O.

Improvement the order of the age.



Important Improvements.
All the Essential Features greatly perfected.

The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIKYTIFIC AMERICAN SUPPLEMENT, NO. 632. Price 10 cents. To be had at this office and from all newsdealers.

© 1891 SCIENTIFIC AMERICAN, INC



PROPOSALS.

PROPOSALS FOR MAIL-BAG CORD-FASTENERS AND FOR IRON AND STEEL, &c., FOR POST OFFICE DE-PARTMENT.

POST OFFICE DEPARTMENT, WASHINGTON, D. C., February 28, 1841.—Sealed proposals will be received at this Department until noon. on Wednesday, the sixth day of May, 1841, for furnishing, according to contract, Mail-bag Cerd-fasteners, Iron, Steel, Brass, Oils, and Waste. All proposals must be in accordance with the specifications, which can be obtained from the Second Assistant Postmaster General, Mail Equipment Division. JOHN WANAMAKER, Postmaster General.

BERMUDA.

NOTICE TO ENGINEERS, CONTRACTORS, Etc.

Sealed tenders for deepening the channels leading nto Hamilton Harbor, Bermuda, will be received at the Office of the Colonial Secretary, Hamilton, Bermuda, up o 12 o clock noon of

TUESDAY, THE 14TH OF JULY, 1891. TUESDAY, THE 14TH OF JULY, 1891.
Tenders to be sent in in duplicate, and to be marked on the covers, "Tender for Channel Improvements."
Complete plans of the work may be seen, and specifications, conditions of contract, forms of tender, and printed information regarding the work may be obtained at the office of the Crown Agents for the Colonies, Downing Street, London; at the office of Her Britannic of the Colonial Surveyor, Hamilton, Bermuda.
The Government of Bermuda will not be bound to accept the lowest or any other tender.

W. CARDY HALLETT, Calenial Surveyor.

W. CARDY HALLETT, Colonial Surveyor.

Experimental Science



Geo. M. Hopkins, Geo. M. Hopkins,
In teresting Experiments in Every Branch of Physics. Descriptions of Simple and Efficient Apparatus, much of which may be Made at Home. Among Subjects treated are Electricity in all its Branches, Magnetism, Heat, Light, Photography, Micrescopy, Optical Hlusions, Mechanics, etc. A world of Valuable Information. A Source of Rational Amusement. A superbwork for Young and Old.

Illustrated Circular and Table of Contents sent free.

740 PAGES. 630 ILLUSTRATIONS.

740 PAGES. \$30 ILLUSTRATIONS.
PRICE, by mail, postpaid, - - - \$4.00.
MUNN & CO., Publishers,
Office of The SCENTIFIC AMERICAN,
361 Broadway, New York.

STEAM ENGINE. HOW TO MANAGE. SIEAM ENGINE. HOW 10 MANAYE.

By J. C. S — A very practical paper on the subject. How
to fire with wood and coal, how to manage the water
supply, how to clean the engine, how to clean the supply
pipe. how to gauge the pump, etc. With 12 illustrations.
Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No.
747. Price 10 cents. To be had at this office and
from all newsdealers.

INCOMBUSTIBLE MACHINERY

ING MATERIAL. Much cheaper and better Cotton Waste. Consumers and dealers should for particulars to BORDEN & REMINGTON, Fall River, Mass., U.S.A.

STEEL TYPE FOR TYPEWRITERS Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc. Work Model and Experimental Work Small Machinery, Novelties, etc., manufactured by special contract. New York StencilWks., 100 Nassau St., N.Y

ECONOMICAL APPARATUS.—BY W. H. Ince, Ph.D. Descriptions of apparatus which can be easily made by any one who possesses a certain amount of ingenuity and mechanical skill—blow pipes, Eunsen burners, steam apparatus, chemical apparatus. With 20 figure. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 72-01. Price 10 cents. To be had at this office and from all newsdealers.



SMOKELESS EXPLOSIVES.—A LECture by Sir Frederick Abel, F.R.S., treating of the production of explosives for rapid firing guns, and giving an account of the work of inventors in this line of research. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. 745. Price ID cents. To be had at this office and from all newsdealers.

THE SMITH PREMIER TYPEWRITER PATENT FOR SALE. SELF-HEATING SAD IRON.

Agents look here! 158 dozen sold in one County If you want a rapid seller with big profits, write to H. S. PEASE, 171 Elm Street, Cincinnati, Ohio.

WILL SELL United States, British, French, Austria-Hungarian, and Belgian patents on a valuable invention for \$1,000. Address Box 243, North Collins, New York.

The Scientific American PUBLICATIONS FOR 1891.

The prices of the different publications in the United States, Canada, and Mexico are as follows: RATES BY MAIL.

The Scientific American (weekly one year The Scientific American (weekly), one
The Scientific American Supplement (weekly), one
5.00

The Scientific American, Spanish Edition (monthly) one year. The Scientific American, Architects and Builders
Edition (monthly), one year. 2.50

COMBINED RATES. The Scientific American and Supplement, . \$7.00 The Scientific American and Architects and Builders Edition, 5.00

The Scientific American, Supplement, and Architects and Builders Edition. Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal rexpress money order, or draft to order of MUNN & CO., 361 Broadway, New York.