Advertisements.

Inside Page, each insertion - - - 75 cents a line. Back Page, each insertion - - - \$1.00 a line. (About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurer: at, as the letter press. Adver-tisements must be received at publication office as early as Thursday morning to uppear in next issue.

Les A profitable business for a main with a small capital. Also, Lauterns for Home Amusement. 138 page Caralogue fre, MCALLISTER, Mr. Optician. 49 Nassau St., N.



LEATHER BELTING
best and most reliable Belt
est and most reliable Belt
est

TRANSMISSION OF POWER TO A DIS TRANSMISSION OF POWER TO A DIS-t nec.—By Arthur Achard. A paper read before the Institution of Mechanical Engineers. Being a summary of the practical results obtained in the transmission of power to a distance by different modes. I. Transmission of Power by Wire Ropes, and the formula for calcula-tion. II. Transmission by Compressed Air, with formulæ. III. Transmission by Fressure Water, with formulæ. IV. Transmission by Electricity. General results ob-tained by the several methods. This is one of the most valuable, practical, and comprehensive papers on the subjet recently published. Contained in SCIENTER AMERICAN SUPPLEMENT, NOS. 274 and 275. Price 10 cents each. To be had at this office and from all pewsdealers.



Clark's Compressed Paper Skate Rollers. Immensely durable Kasy running. No slipping. No slipping No slipping Hoors. Comparatively Pariseless, Sample Set Lacquered, \$1.26; Nickeded, \$1.36. Pustage & Cts. additional. State size spindle. Also Mfr. Steel Cased Rubber Roll-lers. Protectrade. GEO, P. C. LARK (Box L.). Windsor Locks, Ct.

TOUGHENED GLASS SLEEPERS. C. Wood, C.E. A paper read before the Iron and Steel Institute of Liverpool, in regard to the recent novel application of toughened glass to sleepers and chairs for railways and tramways; describing the method of toughening and moulding the material for such purposes, and giving the results of tests applied to the glassalespers to ascertain their transverse resistance. Historated with Tengravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 2075. Price 10 cents. To behad at this office and from all newsdealers.

H.M.JOHNZ,

Boofing, Building Felt,
Steam Packings, Boiler Coverings,
Fire Proof Paints, Cements, Etc.
Samples and Descriptive Price Lists Free.
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y. 175 Randolph St., Chicago ; 170 N. 4th St., Philadelphia.

AERIAL NAVIGATION. - DESCRIP tion and illustration of a new aeronautic machine, devised by Mr. Fred. W. Brearey, Secretary of the eeronautical Society of Great Britain. Contained in SCINNATIFIC AMERICAN SUPPLEMENT, No. 467. Price 10 cents. To be had at this office and from all newed lers.

DRAWING INSTRUMENTS.

Illustrated catalogue sent on application to Wm. T. COMSTOCK, 6 Astor Place, New York.

SINKING THROUGH QUICKSAND.

—A paper by H. W. Hughes, describing the Poetsch
processor sinking through quicksand by means of artidial freezing Contained in SCIUNTIFIC AMERICAN
SUPPLEMENT, NO. 468. Price II cents. To be tad ta
this office and from all newsdealers.



PERFUMES.—A PAPER BY JACOB Jesson, describing various articles used in perfumery, and the mode of preparing essences therefrom, stating the amount and cost of material required, and giving over thirt; (ormulas for handkerchief extracts, with the cost of lach). Contained in Scientific American Supplement, No. 472. Price 10 cents. To be had at this office and from all newsdealers.

WVM. A. HARRIS,
Providence, R. I. (Park St.) Sixminutes walk West from station.
Original and Only Builder of the
HARRIS-CORLISS ENCINE,
With Harris' Pat. Improvements, from 10 to 1,000 H. P
Send for copy Engineer's and Steam User's
Manual. By J. W. Hill, M.E. Price \$1.25.

AMERICAN MECHANICAL DICTIONARY. American mechanical plutionary.

Descriptive Word Book of Tools, Instruments, Machines, Chemical and Mechanical Processes: Civil, Mechanical, Railway, Hydraulic, and Millitary Engineering; a History of Inventions; General Technological Vocabulary; and Digest of Mechanical Appliances in Science and Industrial and Fine Arts. Illustrated with upward of 7,000 engavings. 48 yEdward H. Knight, A.M., Civil and Mechanical Engineer. In three octavo volumes. The set, cloth, \$24.00; Sheep, \$27.00. For sale by MUNN & Co., 361 Broadway, New Yerk City.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents

In this line of business they have had forty one years' experience, and now have unequaled facilities for the preparation of Patent Drawings, Specifications, and the secution 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.

A pamphlet sent free of charge, on application, con taining full information about Patents and how to procure them; directions concerning Labels, Copyrights Designs, Patents, Appeals, Reissues, Infringements signments, Rejected Cases, Hints on the Sale of Pa-

We also send, free of charge, a Synopsis of Foreign Pa tent 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. 622 and 624 F Street, Pa

cific Building, near 7th Street, Washington, D. C.

RUBBER BELTING, PACKING, HOSE, THE AMERICAN BELL TELEP

RUBBER GOODS,

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.



THE RAILWAY BUILDER. A HANDbook for Estimating the Probable cost of American Railway Construction and Equipment. By William J. Nicolls. Civil Engineer. Illustrated. In one volume, full bound, pocket-book form. Price \$2. This is an invaluable book for railroad men. Address MUNN & CO., 361 Broadway, New York.

Leffel Water Wheels, With Important Improvements. 11,000 IN SUCCESSFUL OPERATION. FINE NEW PAMPALET FOR 1885 Sent free to those interested JAMES LEFFEL & CO., Springfield, Ohio. 110 Liberty St., N. Y. City.

NATURAL GAS.—A PAPER BY C E. Hequembourg, discussing the illuminating power and caloric value of natural gas as compared with that made from coal. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO 471. Price 10 cents. To be had at this office and from all newsdealers.

FOR SALE A four, six, and two half horse power Edgerton Motors. MANLY & COOPER MFG. Co., 2d Street and Elm Avenue, Philadelphia.



ENGINEER'S POCKET BOOK. BY Charles H. Hoswell, Civil, Marine, and Mecnanual Engineer. Civing Tables, Rules, and Formulas pertaining to Mechanics, Mathomatics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Lines, Mortars, Cements, etc. 901 pages, leather, pockel-book form. Price \$4. This valuable work will be sent on receipt of price by MUNN & CO., New York.

THE MANUFACTURE OF CRUCIBLE THE MANUFACTURE OF CRUCHBILE Cast Steel.—A paper r d before the Steel and Iron Institute by Henry Seebohm. A presentation of the facts connected with the oid-fashioned method of covering bar iron into steel and then method in clay pots to form ingots of cast steel. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 464. Price 10 cents. To be had at this office and from all newsdealers.



MODERN PALEONTOLOGY, ITS PREsent Condition and Future Task.—By Prof. Carl Vogt.
An interesting paper, in which the author passes in
review the beings that lived in earlier times, and points
out the proper method of studying them at the present
day, and that, too, in a manner essentially different from
the one usually followed, inasmuch as he tries to prove
the relation between the extinct types and the modern
tepresentatives of the organic world, which he claims
can be proved by generation and descent without calling
in the intervention of a special power of creation existing separate from the organisms. A powerful argument
in favor of the doctrine of evolution. Contained in
SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249 and
250. Price 10 cents each. To be had at this office and
from all newsdealers.



Andrews' Office & Bank Desks
The finest work in the U. S.; kiln
dried lumber. All work guaranteed. The finest work in the U. S.; kiln dried lumber. All work guaranteed. OPERA CHAIRS, School Desks, Globes.

A.H. Andrews & Co. 195 Wabash av. Cal. 13 Bond-st. New Y.

PORTABLE BRIDGES. — DESCRIP-PURTABLE BRIDGES.—DESCRIP-tion of a novel system of portable bridges devised by Mr. Alfred Cottrau, of Naples. Illustrated with 14 en-gravings. Contained in SCIENTIFIC AMBRICAN SUP-PLEMENT, NO. 466. Price iD cents. To be had at this office and from all newsdealers.



BLAKE'S IMPROVED PIPE HANGER IT IS THE CHEAPEST AND BEST HANGER IN THE MARKET.

It saves many expensive Blacksmiths' Jobs. Can be attached to pipe when in position. Expansion always provided for. Cheap because it is simple. Pitch lines of mains easily obtained. No troublesome screws to adjust.

JENKINS BROS., SOLE AGENTS,

71 JOHN ST., NEW YORK. 13 SO. FOURTH ST., PHILA. 79 KILBY ST., BOSTON.



STATIONARY STEAM ENGINES ESPECIALLY
adapted to Electric Lighting Purposes. Treating of the
development of Steam Engines; the principles of Construction and Economy; with descriptions of Moderate
Speed and High Speed Engines. By Robert H. Thurston
A.M., C.E., with many handsomely executed illustrations.
Emo, cloth, \$1.50. Address, MUNN & CO., 361 BroadwayNew York.



CONSTRUCTION OF STABLES. paper by A. W. Wright, describing a model stable just finished for the North Chicago City Rallway. Contained in SCIENTIFIC AMERICAN SUPPLEMENT. NO. 463. Price 10 cents. To be had at this office and from all



POINTERS for Users of Steam Pumps

POINTERS for Users of Steam Pumps.

Van Duzen's Patent Steam Pump

Can P mp Sandy or Impure

Efficient.

Has no moving parts, consequently no wear, no repairs, no trouble. Purchasers assume no risks, as we guarantee every Pump. Abeve comparison with Jet Pumps. Ejectors, etc., made of Iron.

Demand this Fump of your dealer and take no cheap substitute. We make Ten take no cheap substitute. We make Ten Sizes. Prices from \$7 to \$15. Capacities from 100 to 20,000 gailons per bour. State for what purpose wanted and send for Catalogue of "Pumps."

VAN DUZEN & TIPT. Gincianati, 0.

MODEL and Send for Circulars, C.E. Jones & Bro. CINGINNATI, O. (Mention this Paper.)

ASPHALTUM. — A COMPREHENSIVE ASPHALTUM. — A COMPREHENSIVE Report treating of its geological origin, mode of preparation for industrial purposes, and most important applications. Bitumen, Chemical Composition, and Physical Properties. Geographical distribution. Geological Physical Properties. Geographical distribution. Geological Physical Properties. Geographical distribution. Hotelands and applications of Asphaltum. Bituminous mastic. Uses and applications of Crude Asphaltum. Mode of preparation for sidewalks and pavements. Applications of Biuminous Mastic or Cement. Asphalt as a preservative against fires. Illustrated with encavings, showing the probable formation of asphaltum in soft limestone strata; the construction of pavements from crude asphalt at Paris, and the mode of making sidewalks. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 276. Price 10 cents. To be had at this office and from all newsdealers.

PRICTION PULLEYS CLUTCHES and ELEVATORS. PROVIDENCE, R. I.

GLASS PAINTING. BY FRED MILler. A Course of Instruction in the Various Methods of Painting Glass and the Principles of 1) esign. Illustrated, Epot, cloth. London, 1885. Pri e \$2.00. This valuable book sent by mail prepaid by MUNN & Co., New York, on receipt of price.

BIG OFFER. To introduce them, we still sive Awny 1,000 self-Operating Washing Machines. It you want one send us your name, P. O. and express office at once. The National Co., 23 Dey St., N. Y.

BOILER TUBES.—A VERY USEFUL table, giving the draught area and heating surface of the various sized boiler tubes and fuse in use. Contained in SCIENTIFIC AMERICAN SUPPLIMIENT, No. 467. Price il cents. To be had at this office and from all newsdealers.



The Improved Rider COMPRESSION Hot Air Pumping Engine.

Supplies water to city or country residences. Absolutely safe. Still running. Durable. Hen by Hand or Soft Coal or Wood.

DELAMATER IRON WORKS,

Foot of West 13th Street, New York, U. S. A. Down Town Office: 16 CORTLANDT STREET.

PORTLAND CEMENT THE SCIence and Art of the Manufacture of Portland Cement, with observations on some of its constructive applications. By Henry Reid, C.E., author of "A Practical Treatise on Concrete," etc. 8vo, cloth. Price \$7.25. Address MUNN & Co.. 361 Broadway, New York.



THERAPEUTICAL EFFECT OF

Aluminum Bronze, Aluminum Silver, Aluminum Brass, SILICON BRONZE,

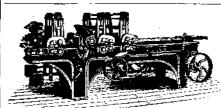
Furnished in Ingots and Castings. Rods and Wire Made to Order. Sheet Aluminum Bronze.

Our Malleable Castings can be made of over 100,000 pounds tensile strength, with extraordinary power to with-stand corrosive influences, and unrivaled beauty of color. Send for parephlet. THE COWLES ELECTRIC SMELTING AND ALUMINUM CO., CLEVELAND, O.

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 therefor.



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

SPECTACLES Engraphics, Thermometers, Pho-Opera Glasses, Microscopes, Telescopes. W. H. WALMSLEY & Col., successors to R. & J. Beck, Philadelphia. Illustrated Price List free to any address.

SANITARY EXAMINATION OF DRINKing Water.—By Prof. E. R. Angell. The odor of water, and how to detect it. Tests and their applications. Nitrates and Nitrites. Lead and iron. Test for lead. Tests for organic matter. A valuable paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT. NO. 462. Price 10 cents. To be had at this office and from all newsdealers.

The Scientific American.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

Published Weekly, \$8.20 a Year; \$1.60 Six Months.

This unrivaled periodical, now in its forty-second year, continues to maintain its high reputation for excellence, and enjoys the largest circulation ever attained by any scientific publication.

Every number contains sixteen large pages, beautifully printed, eleganity flustrated: it presents in popular style a descriptive record of the most novel interesting, and important advances in Science, Arts, and Manufactures. It shows the progress of the World in respect to New Discoveries and Improvements, embracing Machinery, Mechanical Works, Engineering in all branches, Chemistry, Metallurgy, Electricity, Light, Heat, Architecture, Domestic Economy, Agriculture, Natural History, etc. It abounds with fresh and interesting subjects for discussion, thought, or experiment: furnishes hundreds of useful suggestions for business. It promotes Industry, Progress, Thrift, and Intelligence in every

community where it circulates.

The Scientific American should have a place in every Dwelling, Shop, Office, School, or Library. Workmen, Foremen, Engineers, Superintendents, Directors, Presidents, Officials, Merchants, Farmers, Teachers, Lawyers, Physicians, Clergymen, people in every walk

361 Broadway, New York. THE

Scientific American Supplement.

THE SCIENTIFIC AMERICAN SUPPLEMENT is a separate and distinct publication from 'THE SCIENTIFIC AM-ERICAN, but is uniform therewith in size, everynumber containing sixteen large pages. THE SCIENTIFIC AM-ERICAN 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, Geo-Bology, Geology, Mineralogy, Natural History, Georgicaphy, Archaeology, Astronomy, Chemistry, Electricity, Light Hear, Mechanical Engineering, Steam and Bailway Engineering, Mining, Ship Building, Marine Engineering, Photogruphy, Techhnology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information per-taining 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 C nada, \$5.00 a year, or one copy of the SCIENTIFIC AM-ERICAN and one copy of the SUPPLEMENT, both mailed for one year for \$7.00. Address and remit by postal 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, nd all other European States; Japan, Brazii, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted. 34. 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 order or draft to order of

MUNN & CO., 361 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is primed with CHASENEU JOHNSON & CO.'S INK. Tenth and Lonbard Ste. Phila.. and 47 Ro e St., opp. Duane St., N. Y.