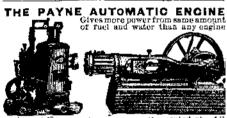
### Sodvertisements.

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 measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



AUSTRALIA. Bona fide American Manufacturers wishing to be represented in these colonies please comunicate with Messrs. Imray & Co., Australian Agents, 23a Basinghall St., London, E. C., and at Sydney and



cent more power than rated at. Ald. All sizes and styles, 2 to 256 horse

engines warranteu.
power. Send for prices and catalogue A4.
B. W. PAYNE & SONS.
P. O. Box 1207.
Or our General Sales Office, 83 Liberty St. & 149 B'way, N.Y.

# ASBESTOS

Our improved elastic Asbestos Piston Rod Packing is made from the best quality of pure Asbestos fiber, and is the most perfect, compact, and durable Packing ever produced for locomotive, marine, and other engines.

Asbestos Wick Packing,
Asbestos Mill Board and Sheathing,
Asbestos Gaskets and Rings,
Asbestos and Rubber Tape and Cloth.

Asbestos Boiler Coverings. Our Asbestos Cement Felting is the most effective and durable Non-conducting covering for Steam Pipes, Boil-ers, Stills, and other Steam-Heated Surfaces. Asbestos Hot Blast Cement Felting, Asbestos Air Chamber Covering, Asbestos Locomotive Langing. Asbestos and Hair Woven Felt.

### ASBESTOS ROOFING.

Asbestos Building Felt. Asbestos Cloths, Cord, Twine, Yarn, and Sewing Twine, Asbestos Gasket and Retort Cements, etc.

LIQUID PAINTS, AND PURE COLORS. DESCRIPTIVE PRICE LIST AND SAMPLES FREE.

### H. W. JOHNS M'F'C CO.,

Sole Manufacturers,
87 Maiden Lane, New York.
175 Randolph St., Chicago. 170 N. 4th St., Philadelphia.
Billiter House. London.

MESSRS. MUNN & CO.. in connection with the pub lication of the Scientific American, continue to exfor Inventors.

In this line of business they have had forty years' experience, 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 Foreign Countries. Messrs. Munn & ('o. 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, 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 Pa-

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.

MUNN & CO., Solicitors of Patents,
Sol Broadway, New York.
BRANCH OFFICE.—Corner of F and 7th Streets,
Washington, D. C.

# KINS PACKING \* TRADE MARK %

SAWS Wanted 50,000 Sawyers and SAW S full address for a copy of Emerson's Law Book A of SAWS. We are first to introduce NATURE AL GAS for heating and tempering Saws with wonderful effect upon inproving their quality and toughness, enabling us to reduce we prices. Address. ices. Address EMERSON, SMITH & CO. (Ind.), Beaver Falls, Pa. S

For Users of Steam Pumps.

Van Duzen's Patent Steam Pump (No Packing or Oil, Is Requires (No Care or Attendance, ab e. Can pump any kind of liquid; ever pump any kind of order, fully fested; liquidreds in duly use; every pump guaranteed; not like cheap Pumps made of Iron; all sizes to 8 inch discharge; prices from \$7 opward; enpactics from 100 to 20,000 gallons per hour. State for what purpose wanted and send for Catalogue of "Pumps."

VAN DUZEN & TIFT, Cincinuati, U.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents wanted. T. NEW, 32 John Street, New York.

MACHINES FOR PRODUCING COLD MACHINES FOR PRODUCING COLD
Air.—A paper read by Mr.T. B. Lightfoot, before the
Institution of Mechanical Engineers, London, giving a
brief description of each of the machines hitherto devised for producing cold air; and including the theory,
construction, and practical working of a greatly improved form of apparatus for the same purpose. Illustrated with an engraving giving perspective view of one
of these machines as constructed for marine purposes,
and intended to supply 5,000 cubic feet of cold air per
hour. Contained in Scientific American Supple.
MENT, No. 274. Price 10 cents. To be had at this
office and from all newsdealers.

### KORTING UNIVERSAL



INJECTOR FOR BOILER FEEDING.

Operated by one handle.

WILL LIFT HOT WATER.

POSITIVE ACTION GUARANTEFO LINDER

ALL COMMITTIONS.

NO ADJUSTMENT FOR VARYING STEAM PRESSURE.

### The Best in the World.

We make the Best Packing that can be made regardless of cost. Users will sustain us by calling for the "JEN-KINS STANDARD PACKING."

Our "Trade Mark" is stamped on every sheet. None genuine unless so stamped. Send for Price List " B."

JENKINS BROS., 71 John Street, N. Y. 79 Kilby Street, Boston

The "MONITOR." | Best Boiler Feeder in the world. A NEW LIFTING AND NON-LIFTING INJECTOR. 

Also Patent EJECTORS

Water Elevators. For Conveying Water and Liquid. Patent Ollers, Lu-

NATHAN MANUFACTURING COMPANY, Sænd forcatalogue. 92 & 94 Liberty St., New York.

### SPEAKING TELEPHONES.

THE AMERICAN BELL TELEPHONE COMPANY, W. H. FORBES, W. R. DRIVER, THEO. N. VAIL, President. Treasurer. Gen. Manager.

President. Treasurer. Gen. Manager.

Alexander Grabam Bell's patent of March 7, 1876, owned by this company, covers every form of apparatus, including Microphones or Carbon Telephones, in which the voice of the speaker causes electric undutations corresponding to the words spoken, and which articuations produce similar articulate sounds at the receiver. The Commissioner of Patents and the U.S. Circuit Court have decided this to be the true meaning of his claim; the validity of the patent has been sustained in the Circuit on final hearing in a contested case, and many injunctions and final decrees bave been obtained on them. This company also owns and controls all the other telephonic inventions of Bell. Edison, Berliner, Gray, Blake. Phelps, Watson. and others.

Descriptive catalogues forwarded on application. Telephones for l'rivate line, Club, and Social systems can be procured directly or through the authorized agents of the company.

All telephones obtained except from this company, or its authorized licensees, are infringements, and the makers sellers, and users will be proceeded agents.

its authorized licensees are infringements, and the makers sellers, and users will be proceeded against Information furnished upon application. Address all communications to the

AMEILICAN BELL TELEPHONE COMPANY, 95 Milk Street. Boston, Mass.



will lift water 25 feet. Send for Descriptive circular.

OFFICES AND WAREROOMS:

Philada, 12th & Thompson Sts. Roston, 61 Oliver St. Augusta, Gas, 1028 Fenwick St. San Francisco, Cal., 2 California Street.

New York, 109 Liberty Street. Street. Street. Street. Street. Chicago, Ill., 204 Lake St. Chicago, Ill., 204 Lake St. Street. Chicago, Ill., 204 Lake St. Street. Chicago, Ill., 205 Lake St. Street. Chicago, Ill., 206 Lake St. Street. Chicago, Ill., 207 La

BUILDERS OF ALL DESCRIPTION OF

# PUSEY & JONES CO. MACHINERY USED BY MANUFACTURERS OF PAPER.

SECTION STEAM PROPERTY OF THE SECTION OF THE SECTIO CONN. THE

HIGH RAILWAY SPEEDS.—BY W. Barnet Le Van. Description of trial trip of the "new departure" locomotive No. 5,000 imade by Burnham, Parry & Co., from Philadelphia to Jersey City and return. Account of speed made between stations going and consing. Steaming capacity of the new locomotive's boiler. Water consumed. Hest speed made. SI miles per hour. Table of speeds in miles per hour of the fast times in Europe and America. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 240. Price III cents. To be had at this office and from all newsdealers.



### EVERY USER OF MACHINERY SHOULD LEARN

How to Use Loose Pulleys. Useful information on this subject is given in our "Catalogue No. Ki." Sent free to any address. VAN DUZEN & TIFT, Cincinnati, O.

APPARATUS FOR ELECTRICAL MEAS APPARATUS FOR EDECTRICAL MEAS are ments. Illustrations and description of the various interesting apparatus for measuring electricity that were shown at the Munich Exhibition, including Wiedemann's bifliar galyanometer; wiedemann's galyanometer for strong currents; Zonger's differential photometer, for Beetz's solenoid; apparatus for demonstrating the principle of the Graume machine; Van Rysselberghe's thermometergraph; Von Beetz's chronograph; and Harlacher's apparatus for studying deep currents. I ustrated with seventeem engravings. Contained in Scientific American Supplement, No. 421. Price Deents. To be had at this office and from all newsleaders.

### PIPE COVERING.



Fireproof Non-conducting Coverings for Steam Pipes, Bollers, and all hot surfaces. Made in sections three feet long. Easy to apply. Asbestos Waterials—Fiber, Millboard Packing, and Cement.

CHALMERS-SPENCE CO. 419-421 Eighth St., New York.

WATERPROOFING PAPER AND VEGE. table Tissues.—A valuable paper by C.R. A. Wright. F.R.S., discussing the use of cupro-ammonium solutions as an application to paper and vegetable tissues in order to render the latter water-proof, rot-proof, and practically proof against the attack of insects. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 444. Price 10 cents. To be had at this office and from all newsdealers.

A SHOE THAL WILL NOT PINCH.—
By Benjamin Lee, M.D. A study of the hygiene of the feet, pointing out bow a shoe should be made in order to conform to the true shape of the foot. Illustrated with 8 diagrama. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 444. Price 10 cents. To be had at this office and from all newsdealers.





SWEEPSTAKES PLANER, MATCHER. SWEDD STARFOLD TEARING. BILLY CHIEF and Monther, The best Machine for the price ever marke. Top head, driven with two betts, four genred freed Rolls, front rolls weighted. Planing 20 in, wide, 6 in, thick weight 2,500 lb., \$350.00; 24 in, wide, 6 in, thick weight 2,500 lb., \$350.00; 24 in, wide, 6 in, thick, weight 3,001 lb., \$40.00, including shound routding head. Sash, Door, and Blind Machinery a specialty. Write for special prices. Rowley & Hermance, Williamsport, Pa.

## FIRE BOICK THEANDCLAY RETORTS ALL SHAPES. BORGNER & O'BRIEN ABOVE RACE, PHILADELPHIA.



ROOKWALTER EXCINE. Compact. Substantial Economical, and easily managed: guaranteed to work well and give full power claimed. Engine and Boiler complete including Governor. Pump, etc., at the low price of

ernor. Pump, etc., at the lor-price of 3 HORSE POWER. \$240 00 456 ... ... .280 00 655 ... ... .440 00 557 Put on cars at Springfield, O. JAMES LEFFEL & CO. Springfield. Ohio, or 110 Liberty St., New York.

### THE HARDEN STAR HAND GRENADE



205 Wabash Ave., Chicago. 10 Oliver St., Boston, or 84 West Broadway, New York.



### STEAM ENGINES.

Horizontal and Vertical.
Huffer's Automatic Vacuum
Pump. Powder, Slate, and
Fint Mill Machinery, Turbine Water Wheels.

YORK M'F'G. CO., York, Pa., U. S. A.

HOW TO PREPARE LANTERN SLIDES. -Formula for an unwashed collodio-bromide emulsion with free bromide, with full directions for use in making ates for lantern slides. Contained in SCIEXTIFIC AMIGNICAN SCIEXTIFIC AMIGNICAN SCIPLEMBENT. No. 444. Price 10 cents. To be had at this office and from all newsdealers.



### BARREL, KEG, Hogshead,

AND

Stave Machinery. Over 50 varieties manu-

E. & B. HOLMES, BUFFALO, N. Y.

Fan and Stave Jointer. RELATIONS OF THE SOIL TO HEALTH. By Geo. H. Rohe, M.B. The soil. Ground air. Ground water. Diseases spread by soil impurities. Diseases of animals due to impurities of soil. I reventive remedy-drainage. Contained in SCIENTIFIC AMERICAN SHUPLEMENT, NO. 444. Price il cents. To be had at this office and from all newsdealers.

WM. A. HARRIS, Providence, R. I. (Park St.), Significates walk West in Original and Only Builder of the t fromstation HARRIS-CORLISS ENGINE 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.

### 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-first year. continues to maintain its high reputation for excellence, and enjoys the largest circulation ever attained by any

scientific publication. Every number contains sixteen arge pages, beautifully printed, elegantly illustrated; it presents in popu ar 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, Archi-tecture, 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, Forenien, Engineers. Superintendents, Directors, Presidents, Officials, Merchants, Farmers, Teachers, Lawyers, Physicians, Clergymen, people in every walk and profession in life, will derive benefit from a regular reading of THE SCIENTIFIC AMERICAN. Terms for the United States and Canada, \$3.20 a year;

\$1.60 six months. Specimen copies free. Remit by

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, every number containing sixteen large pages. The Scientific American 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-graphy, Archæology, Astronomy, Chemistry, Electricity, Light Heat, Mechanical Engineering, Steam and Rail-Light Heat, Mechanical Engineering, Steam and Rail-way Engineering, Mining, Ship Building, Marine En-gineering, Photography, Techhnology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horti-culture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining 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 Canada, \$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 Poreign 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, and all other European States; Japan Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, \$4. 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 printed with CHAS, ENEU JOHNSON & CO.'S INK. Tenth and Lom-bard Sts. Phila., and 47 Rose St., opp. Duane St., N. Y