

Advertisements.

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

The above are charges per square line—about eight words per line. This notice shows the width of the line, and is set in square type. Engravings may be had advertisements at the same rate per square line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

HANGERS AND COUPLINGS

COMPLETE STOCK OF
Double Brace, Self-Oiling, Adjustable Ball and Socket Hangers, Pillow Blocks, Post Hangers, Etc.

Edison Patent Compression Coupling.

EDISON GENERAL ELECTRIC CO.,
SCHENECTADY, N. Y.

Motor of 19th Century
Can be used Any Place, to do Any Work, and by Any One. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. Cost of operation about one cent an hour to each indicated horse power. For circulars, etc., address
Economy, Reliability, Simplicity, Safety.
CHARTER GAS ENGINE CO.,
P. O. Box 148, Sterling, Ill.

CASTINGS OF ALL KINDS
LIGHT GRAY IRON AND BRASS
WE USE HIGH GRADE OF IRON WHICH GIVES A STRONG AND SMOOTH CASTING.
ENTERPRISE FOUNDRY CO. LTD. ALLEGHENY, PA.

KEY SEATERS. Portable and Stationary, with Rack-Cutting Attachment.
VALLEY MACHINE CO.,
1112 Tilden Ave., Saginaw, Mich.
"We are very much pleased with it, and think it the best machine on market for simplicity and effective work."
Davis & Cowgill Iron Works, Omaha."

WOODEN TANKS FOR RAILROADS
LARGE WATER TANKS
MILLS, FACTS, ETC.
W. C. CALDWELL & CO.
No. 217 E. MAIN ST. LOUISVILLE KY.

A PRESENT TO YOUR WIFE
of a warranty deed for 10 Acres of good land in Florida will assure you of a home, no matter what reverses may come to you in business.
Such a deed is given as a bonus with each share of stock, par \$100, but only until first section is built. Write to the ARCADIA, GULF COAST & LAKELAND RR. CO. Boston, Mass., and Arcadia, Fla.

MALLEABLE AND FINE GRAY IRON ALSO STEEL
CASTINGS FROM SPECIAL PATTERNS
THOMAS DEVLIN & CO.
FINE TINNING JAPANING AND FINISHING
LEHIGH AVE. & AMERICAN ST. PHILA.

PROGRESS OF MEDICINE.—BY DR. LAUDER BRUNTON. A masterly analysis of the recent progress of medicine. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 520. Price 10 cents. To be had at this office and from all newsdealers.

Caligraph
LIFE SHORT—WRITE THE WAY
Address: The American Writing Machine Co., Hartford, Conn.; New York Office, 237 Broadway.

PATENT JACKET KETTLES
Plain or Porcelain Lined.
Tested to 100 lb. pressure. Send for Lists.
BARROWS-SAVERY CO.,
E. Front & Reed Streets, Philadelphia, Pa.

COMPLETE STEAM PUMP
10 SIZES FROM \$7 TO \$75
FOR WATER SUPPLY TANKS, FIRE PUMPS & ETC.
VAN DUZEN & TIFT
SOLE MAKERS
CINCINNATI, O.

PATENTS!
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 had forty-five years' experience, and now have unequalled 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 & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business entrusted 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 Patents, etc.
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,
361 Broadway, New York.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

THE BRIDGEPORT WOOD FINISHING CO.
GRANVILLE M. BREINIG PRINCIPAL OFFICE
GENERAL AGENT & SUPERINTENDENT. NEW MILFORD, CONN.
NEW YORK. CHICAGO OFFICE & WAREHOUSE
OFFICE 240 PEARL ST. MANUFACTURERS OF 211 EAST RANDOLPH ST.
WHEELER'S PATENT WOOD FILLER.
BREINIG'S LITHOGEN SILICATE PAINT.
ADAPTED TO ALL CLIMATES ESPECIALLY MARINE EXPOSURES.
PAMPHLET GIVING DIRECTIONS FOR FINISHING HARD WOOD FREE TO ANY ADDRESS.

ASTONISHED!
You wouldn't be if you had seen the "Hartman" Mat. It almost sells itself, and that's why we have made half a million of them. We sell 90 per cent of all the wire mats used in America. Of course they are imitated, but the genuine is "beyond compare."
HARTMAN MFG. CO., works, Beaver Falls, Pa. Branches: 102 Chambers St., New York; 508 State St., Chicago; 51 and 53 S. Forsyth St., Atlanta, Ga. Catalogue and testimonials mailed free. Our Mats have brass tag attached stamped "Hartman."

Motors & Dynamos,
FOR ALL COMMERCIAL USES.
Special Reversible Elevator Motors, Automatic Motors for Church Organs, ELECTRICAL APPLIANCES.
Keystone Electric Co.,
14th and State Sts., Erie, Penn.

HARTFORD STEAM BOILER
HARTFORD
INSPECTION AND INSURANCE CO.
CONN.

BOSTON GEAR WORKS,
33 Hartford St., Boston, Mass.,
HEADQUARTERS FOR GEARS.

THE BACKUS WATER MOTOR
SUPPLIES FROM HYDRANT PRESSURE, the cheapest power known. Invaluable for blowing Church Organs, running Printing Presses, Sewing Machines in Households, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Electric Lights, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engineer, explosion, or delay, no extra insurance, no coal bills. Is noiseless, neat, compact, steady, will work at any pressure of water above 15 lb.; at 40 lb. pressure has 4 horse power, and capacity up to 10 horse power. Prices from \$15 to \$30. Send for circular to THE BACKUS WATER MOTOR CO., Newark, N. J.

FAST AND FUGITIVE DYES. BY Prof. J. J. Hummel. An interesting review of the history of dyeing. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 510 and 511. Price 10 cents each. To be had at this office and from all newsdealers.

FROM ONE OF THE FOREMOST ENGINEERING FIRMS IN THE WORLD.
"After seven years with Thomson-Houston machinery, one hundred motors and about twenty dynamos, we have had the highest satisfaction and no difficulty whatever. In no single case have we had an armature to replace, and the cost of maintenance is practically nothing. You will make no mistake by adopting their system. We adopt them ourselves, because by comparison we have found them best."
Copy of telegram sent in answer to an inquiry regarding reliability and cost of maintenance of Thomson-Houston apparatus. The name of the sender will be gladly furnished on application to the
THOMSON-HOUSTON MOTOR CO., 620 Atlantic Avenue, Boston Mass.

AMERICAN INSTITUTE FAIR.
DAIMLER MOTOR CO.,
MANUFACTURERS OF
GAS ENGINES,
Adapted to STATIONARY, LOCOMOTIVE, AND BOAT PURPOSES.
DAIMLER MOTOR LAUNCHES, 18 to 35 feet, 1 to 10 horse power.
Safe, Speedy, Clean, Reliable, Convenient. No Steam. No Coal. No Ashes.
Office, 111 East Fourteenth Street, New York,
Next door to Steinway Hall.
These Motors are now on exhibition at the American Institute Fair, New York.

CELLULOID ZAPON & CELLULOID LACQUERS
41 BARCLAY ST. NEW YORK.
GUM LACQUERS - BRILLIANT AND DEAD BLACKS - SHELLACS & C.
SOLE LICENSEES OF THE CELLULOID COMPANY.

H.W. JOHNS' ASBESTOS STEAM PACKING
Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, Etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE
H. W. JOHNS MFG. CO., 87 Maiden Lane, N. Y.

SUGARS.—UNITED STATES INTERNAL Revenue Report on the standards and methods for the polarimetric examination of sugars. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 522. Price 10 cents. To be had at this office and from all newsdealers.

LEADING ENGINEERING WORKS of the Past Year. By O. Chanute. A brief description of a few of the leading engineering works of 1890, and an account of some engineering proposals which seem to possess features of novelty. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 514 and 515. Price 10 cents each. To be had at this office and from all newsdealers.

A FREE TICKET TO THE WORLD'S FAIR.
"To go or not to go," that is the question. Well, we will go! But how? Buy a Magic Pocket Bank and you will "get there" without feeling it. Locks and registers deposits! Opens itself when 5¢ in dimes have been deposited. Fits Vest Pocket! Postpaid to any address on receipt of 25¢. Money refunded if not satisfactory. Agents wanted. Write for circulars of Magic Novelties. Mention This Paper.
MAGIC INTRODUCTION CO., 227 Broadway, New York.

NEW KODAKS
"You press the button, we do the rest."
Seven New Styles and Sizes
ALL LOADED WITH Transparent Films.
For sale by all Photo. Stock Dealers.
THE EASTMAN COMPANY,
Send for Catalogue. ROCHESTER, N. Y.

SIEMENS' CABLES.
SUBMARINE, * * * * * TELEGRAPH,
UNDERGROUND, * * * * * TELEPHONE,
INTERIOR, * * * * * ELECTRIC LIGHT.
Manufactured under authority of
SIEMENS & HALSKE by THE EDISON GENERAL ELECTRIC CO.
at their SCHENECTADY WORKS.
Address, Estimates furnished on application.
Cable and Wire Department, Edison General Electric Company,
EDISON BUILDING, Broad St., NEW YORK.

THE GRAVES ELEVATORS.
PASSENGER & FREIGHT
L. S. GRAVES & SON ROCHESTER N. Y. NEW YORK BOSTON ST. LOUIS DETROIT.
THE AMERICAN BELL TELEPHONE CO.
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.

BALL AUTOMATIC MADE ONLY BY CUT OFF ENGINE THE BALL ENGINE CO. ERIE PA.
GEAR CUTTING
Leland, Faulconer & Norton Co., Detroit, Mich.

ESTABLISHED 1846.
The Most Popular Scientific Paper in the World
Only \$3.00 a Year, Including Postage. Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.
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, Canada, or Mexico, on receipt of three dollars by the publishers; six months, \$1.50; three months, \$1.00.
Clubs.—Special rates for several names, and to Post Masters. Write for particulars.
The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

THE Scientific American Supplement
This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. 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, Geography, Archaeology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.
The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated 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 AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for \$7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York,
Publishers SCIENTIFIC AMERICAN.

Building Edition.
THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly, \$2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid Magazine of Architecture, richly adorned with elegant plates in colors, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and all subjects.
A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.
The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. \$2.50 a year. Remit to
MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENRU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York