The Study of

Is fascinating to all those who engage in it. All students are naturally enthusiastic on the sub-ject, and eagerly read whatever literature cou-

they have an up-to-date Library and Book of Reference on all scientific subjects. It is a week-

ly publication devoted to the interests of scien-

tists, engineers, mechanics, electricians, manu-

facturers, inventors, chemists, students, etc. and

contains educational information even for those who are far advanced in the various sciences. No other publication in the world gives so much

authentic information for all classes. It is the world's standard authority on all matters per-

taining to science. \$3.00 yearly, \$1.50 half yearly, \$1.00 for four months. LF Send Check, Draft, Postal Order, or Express Money Order to

HAWKINS' NEW CATECHISM OF ELECTRICITY

A PRACTICAL TREATISE

for Engineers, Electricians, Wiremen and Amateurs, 560 pages 300 illustrations, bound in leather, pocketbook form gold titles and edges. Strictly: "Up-to-Date." Postpaid, 22.00. THEO. AUDEL & Co... 63 Fifth Avenue, New York,

Western Agency Wanted

A reliable Chicago of oncern, located in the machinery
district, and selling Hydraulic Cider Presses, has facilities for handling another line lof goods in connection,
as cider press season is short.

EF Correspondence for
Western Agency solicited. Reliable references.

DAVIS JOHNSON CO., 41 W. Randolph St., Chicago

GAS ** GASOLINE ENGINES

ROTARY PUMPS AND ENGINES:

cerning it that they can secure. In the

Scientific American

MUNN & CO., Publishers,

361 Broadway, New York City.

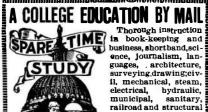
SURVEYING AND MAPPING

Railroad, 31 COURSES & Hydraulio Municipal, 31 COURSES & Bridge Engineering; Sheet Metal Pattern Cutting; Mechanical and Architectural Drawing; Book-Keeping; Shorthand; English Branches. All who GUARANTEED SUCCESS.

Fees Moderate, Advance er lastailments. Circular Free; State subject you wish to study, International Correspondence Schools, Box 94:



METHODS AND INSTRUMENTS USED METHODS AND INSTANCE AND LANGUAGE IN ASTRONOMY.—An illustrated description of the telescopes in the Lick and Paris Observatories 6 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT 1120. Price 10 cents for sale by Munn & Co. and all newsdealers. Send for new 1897 catalogue.

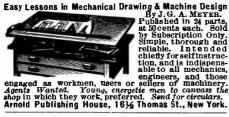


il, mechanical, steam electrical, bydraulic, municipal, sanitary, railroad and structural engineering. Expert in-structors. Fifth year. Fees moderate.

Illustrated catalog free State subject in which interested.

NATIONAL CORRESPONDENCE INSTITUTE, (Inc.) 66 Second National Bank Building, Washington, B. C.

\$15 course in mech. drawing at Rockton Corresp School of Mech. Engineer's, Little Falls, N. Y. B. 703, will make you a proficient draughtsman



SO SIMPLE A CHILD CAN USE THEM SUNART

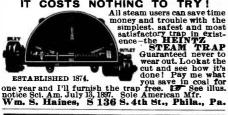


MAGAZINE CAMERA. Folding Cameras. All sizes, ranging in price from \$5 to \$100. Sunart Junior, 3% x 3% picture, \$5. EF Send 2 cent stamp for Illustrated Catalogue.

SUNART PHOTO CO. 5 AQUEDUCT STREET, ROCHESTER, N. Y.

ELECTRO MOTOR, SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electro motor 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 atheory any machine requiring not over one man power. With II figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

IT COSTS NOTHING TO TRY!





Electric & Coy & Making

DYNAMO BUILDING and ELECTRIC MOTOR CONSTRUCTION.

By Prof. T. O'CONOR SLOANE.

140 Pages, Very Fully Ilustrated, Price \$1.00.



THIS work treats of the making at home of electrical toys, electrical apparatus, motors, dynamos and instruments in general, and is designed to bring within the reach of young and old the manufacture of genuine and useful electrical appliances. The work is especially designed for amateurs and young folks. Thousands of our young people are daily experimenting, and busily engaged in making electrical toys and apparatus of various kinds. The present work is just what is wanted to give the much needed information in a plain, practical manner, with illustrations to make easy the carrying out of the work.

We can also furnish Prof. Sloane's works on electricity

We can also furnish Prof. Sloane's works on electricity as follows:

Arithmetic of Electricity, 138 pages.....\$1.00 Electric Toy Making, 140 pages 1.00 How to Become a Successful Electrician, 189 pages..... 1.00

Standard Electrical Dictionary, 682

The above five volumes, comprising a COMPLETE ELECTRICAL LIBRARY, sold at the special reduced price of \$5.00 put up in a neat folding box. You save \$2.00 by ordering the set complete.

Five volumes 1,300 pages, over 450 illustrations.

Send for special circular containing full table of contents of the above books.

TUNN & CO., 361 Broadway, New York. ers. Valuable information and illus, hooklet on re Prof. And Broadway, 8. A. 127, Masonic Temple, Chic



IMPROVED WASHBURNE'S PATENT
CUFF HOLDER
AND DRAWERS SUPPORTER.
A Cuff Holder that bolds
the cuff just whereyou want
it. No button holes needed.
No tearing of shirt or cuff.
Drawers supporters that
are easily adjusted or taken
off. Hold tight, burt nothing, and save annoyance.
Sample of either of the
above, by mail, for 10 cents.

Et llus. catalogue free.
American Ring Co.. Box P. Waterbury, Conn.

BALL BEARING AXLES AND RUBber Tires.—A paper read before the Carriage Builders' National Convention, Philadelphia, October, 1894, showing the advantage to be derived from the use of ball bearings and pneumatic tires in road vehicles. Contained in Scientific American Supplement, No. 992. Price 10 cents. To be had at this office and from all newsdealers.



Mitraleuse Gas Bursers. Invented Aug. '97 (on new principle—'Man-tels' superceded) indestructible, economic, bandsome, \$1.50. I self consumers express prepaid, till local agent appointed. A. G. MOREY LaGrange, III.

BOYS I "FUN WITH ELECTRICITY" is just what you want. Every boy should have it. Ilius. Book, 5x7k, in., structive experiments. No acids, no danker Complete, postpaid, 65c. Ilius. circulars of games and amusements free. Thos. S. St. John, 407 West 51st St., New York.

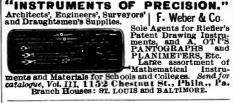


TYPEWRITERS HALF PRICE

We will sell you any typewriter made for one half regular price, anny forone quarter. Every machine guaranteed in perfect order. TYPEWRITERS SOLE, RENTEN, EX. CHANGED. Sent anywhere with privilege of examination. Send for Ill-

National Typewriter Exchange, Chicago.

"INSTRUMENTS OF PRECISION."



\$10 TEN DOLLARS \$10

COMPLETE TELEPHONE OUTFIT Comprising 2 Instruments, 4 Cells of Battery, 100 feet of Inside Wire, Tacks, Tape, Insulators, etc. It is made for service and gives perfect satisfaction. Send for Catalogue. Double Pole Watch Case Receiver. 45c. U. S. TELE-PHONE MFG. CO., 125 Franklin St., Boston, Mass.

HALF A CENTURY OF CYCLES.—AN HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A band and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.



A faultless batching machine for 38 eggs. Price, \$6.00. Heat and moisture regulation and ventilation absolutely perfect. A book about the Wooden Hen, and one about the

EXCELSIOR INCUBATOR

will be sent free to any one naming this paper.

GEO. H. STAHL, Quincy, Ill.



EVOLUTION OF THE AMERICAN LO-EVULUTION OF THE AMERICAN LO-comotive.—By Herbert T. Walker. A valuable series by a member of the National Railway Museum Commit-tee. The locomotive from 1825 to date is described and illustrated by careful drawings, great attention being given to historical accuracy. 21 illustrations. SCIEN-TIFIC AMERICAN SUPPLEMENTS 1112, 1113, 1114. Price 10 cents each. For sale by Munn & Co. and all newsdealers.



B 4 U BY INCUBATORS

Get our 128 p. catalogue. Beautifully illustrated; full of pointers on poultry culture and explainon positry culture and eaplaining the art of hatching eggs by machinery. Mailed for 6 cents in stamps; worth a dollar bill.

DES MOINES INCUBATOR CO., Box 75 DES MOINES, IA.

IMPROVED VAPOR AND TURKISH BATHS AT HOME.

This is the only practical Vapor Bath Cabinet made. Don't condition of the condition of the

Prices from \$3.50 to \$12.50. Salary and Liberal Commission to No. 1 Agents. 48 page book "Health and Beauty," sent free.

THE ROBINSON THERMAL BATH CO. 912 L. Summit St., Toledo, O.

HYPNOTISM Easy mail course for investigators Exhibitors. Lecturers, and Heal-

MODELS AND PARTS. Gears, Dies, etc. Catalogue Free. J. C. SEY L. 181 Madison Street, CHICAGO,

SPECTACLES { F. E. BAILEY sells spex cheap. Write for new optical catalogue. 271 Wabash Ave., Chicago.

DEVELOP Your Own Films. Booklet free on developing and testing of under and over exposures. Yonkers Photo Specialty Co., Yonkers, N.Y.

MACHINES, Corliss Engines, Brewers and Bottlers' Machinery. THE VILTER MFG. CO., 839 Clinton Street, Milwaukee, Wis

ELECTRICAL Blcycle, and Photo. Novelties low prices, 100 page cat. FREE L. E. S. CO., 82 Cortlandt St., N. X.

Experimental & Model Work

THE BLACKWALL TUNNEL UNDER the Thames.—A concisedescription of this engineering work, with illustrations showing the methods of construction employed including the great hydraulic shield. 13 illustrations SCIENTIFIC AMERICAN SUPPLEMENT 1122. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for new catalogue.



WOODEN TANKS.

For Railroads, Mills and Manufactories. Builders of Steel Towers and Tanks. La. Red Cypress Wood Tanks a specialty. W. E. CALDWELL CO., 217 E. Main Street, Louisville. Ky.



Anyone sending a sketch and description may quickly ascertain our opinion free whether an item of the strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents. Patents taken through Munn & Co. receive special notice, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, \$3 a year; four months, \$1. Sold by all newsdealers. MUNN & CO.361 Broadway, New York

Branch Office, 625 F St., Washington, D. C.

Their Origin and Development.—An important series of papers giving a bistorical resume of the rotary pump and engine from 1688 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in SUPPLEMENTS 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co. and all newsdealers. Beginning of New Volume

MAGAZINE



Beautifully illustrated. Eight pages in color.

The Wooing of Malkatoon

A Narrative Poem by LEW. WALLACE





George William Curtis at Concord

Ву George Willis Cooke

The Queen's Jubilee

The most picturesque feature of English life during the present century.

By RICHARD HARDING DAVIS

Superbly illustrated by R. CATON WOODVILLE.

A BIRD'S EGG. By ERNEST INGERSOLL.

Illustrated by facsimiles in color of the eggs of eighty-seven American birds. 35 cents a copy. \$4 00 a year.

Harper & Brothers. New York and London