Scientific

ESTABLISHED 1845.

MUNN & CO.. Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

The Scientific American Supplement

The Scientific American Supplement
(Established 1876)
is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT
is issued weekly. Every number contains 16 octavo pages, uniform in size
with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT,
\$5.00 a year, for the U.S. Canada or Mexico. \$6.00 a year, or £1 4s. 8d.,
to foreign countries belonging to the Postal Union. Single copies 10 cents.
Sold by all newsdealers throughout the country. See prospectus, last page.
("ombined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT
will be sent for one year, to one address in U.S. Canada or Mexico, on
receipt of seem dollars. To foreign countries, eight dellars and fifty cents
a year, or £1 1s. 1d., postage prepaid.

Building Edition of Scientific American. (Established 1885.)

The Building Edition of the Scientific American is a large and spiendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contempiate building this work is invaluable.

Single copies 25 cents. By mail to any part of the United States. Canada or Mexico, \$2.50 a year. To foreign countries, \$5.00 a year, or £0.128. 4d. Combined rate for Building Edition with Scientific American, to one address, \$5.00 a year. To foreign countries, \$5.00 a year, or £1.68. 9d. Combined rate for Building Edition Scientific American and Supplement, \$8.00 a year. To foreign countries, \$5.00 a year, or £2.58. 2d., postage prepaid.

Export Edition of the Scientific American

Export Edition of the Scientific American (Established 1878) with which is incorporated "La America (Tentifica e Industrial," or Spanish edition of the Scientific America, published monthly, uniform in size and typocrapby with the Scientific American. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuda, the West Indies, Mexico, Central and South America, Spain and Spanish hossessions—wherever the Spanish language is spoken. The Scientific American Export Edition has a large guaranteed circulation in all commercial places throughout the world. \$3.00 a year, or £012s.4d., post paid to any part of the world. Single copies, 2 cents.

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

The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO. Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, DECEMBER 5, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

Tride transfer driver driver	and the control of th
Amber, production of 408 Ammonia gas condensation* 408 Ammonia gas condensation* 408 Anchor, Ryan's shore 410 Animals kingdom, census of 411 Animals and steam 411 Armor vs. shot* 412 Birds, the speed of 411 Botany, Roentgen rays in 411 Botany, Roentgen rays in 411 Botany, Roentgen rays in 407 Car. mission. Russian* 409 Corns. cure for (7033) 415 Crater Lake, Oregon* 405 Diseasesspecial, from mechanical devices 407 Fear in animals 411 Granite block, a large 414 Hair, false, facts about 410 Heavens, the, for December 407 Hydraulic engine, Payne's* 410 Lobraries, free, abuse of 411 Locomotive performance, good 406 Lost, the, walking in circles 409	Lunch counter, automatic* Mail transport, new barbor Mecbanical engineers, American Society of Mint building, a new Natural history notes Newspaper office, a night in Poison plants, common Roentgen tube, an improved* Science notes Serotb erapy Sbipbuilding, American Shot vs. armor* Sipbon, a straw and peach pit* Smokeless powders tests. Snake, a twoheaded Street cleaning in Berlin Tree, the fountain Tuberculosis, Dr. Salmon on Vegetation and civilization Water curtains* for high buildings Weather glasses (7039)
	•

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1092

for the Week Ending December 5, 1896.

Price 10 cents. For sale by all newsdealers.

I. AERONAUTICS.—Tests of Exploded Cylinders for Compressed	
Hydrogen GasA valuable investigation into the proper material	
for hydrogen cylinders for containing gas for field ballooning.	1745
II. ANTHROPOLOGYThe British AssociationAnthropology	
Continuation of this important presidential address before the	17/6
British Association III. A RCHÆOLOGY.—Prebistoric European Art.—The result of re-	1740
cent researches into the culture of ancient and prehistoric	
Furna	1744
Europe IV. ASTRONOMY.—Relative Motion of the Stars in the Line of	1111
Sight An authoritative presentation of the present aspect of this	
triumph of modern astronomy, from the pen of Prof. EDWARD C.	
V. BIOGRAPHY.—Sir Benjamin Ward Richardson.—Notes on the	1744
V. BIOGRAPHYSir Benjamin Ward RichardsonNotes on the	
life of the late eminent English physician, with portrait.—1 illus-	
tration VI, CHEMISTRY.—Contributions to a Knowledge of the Rancidiff-	1745
VI, CHEMISTRY.—Contributions to a Knowledge of the Rancidif-	
cation of Fats	1745
VII.: DAIRY FARMING.—The Dairy Show.—Twenty-first annual	1740
exhibition under the British Dairy Farming Association.—Steril-	
ization of milk on a larga scala _2 illustrations	1745
ization of milk on a large scale.—3 illustrations	1130
1 illustration.	1745
1 illustration IX. HISTORY OF SCIENCE.—Phænician Mining.—An interesting	-,
chapter in the history of mining.—Mining and metallurgy in the	
ancient world	1744
Prophecies of Bacilli.—A curious point in the bistory of science.	
-Predictions of the germ theory.	1744
X. MEDICAL AND HYGIENE.—Medico-Mechanical Gymnastics.—	
By Dr. A. LEVERTIN.—Curative symmastics, elaborate apparatus for carrying out the rational application of gymnastics as a	•
health producer.—6 illustrations	1744
The Effects of Snutt on the Human System.—Snuff poisoning.—	
The bad effects of snuff taking shown by cases cited	
XI. METALLURGY.—Historical and Technical Sketch of the Origin	
of the Bessemer Process.—By Sir HENRY BESSEMER.—A paper	•
presented at the New York meeting of the American Society of	
Mechanical Engineers A paper of great historical importance in	ι
view of the recent Bessemer-Weeks controversy18 illustrations.	1745
XII. MISCELLANEOUS.—Preservation of Color in Museum Speci-	
mensA very practical article on the preservation of color in or-	174
ganic specimens by preservative fluids	174
Engineering Notes	

Engineering Notes
Electrical Notes.
Miscellaneous Notes. Mrechancous Autes.
Selected Formulæ.
Selected Formulæ.
Selected Formulæ.
Selected Formulæ.

NaTUAHHSTORY.—Effect of Heat Upon Animals.—An Interesting point in the nature of animals.—Practical considerations of the selection of selection

The application interest of the reduced devices of modell science.

AV. PHOTOGRAPHY.—Hand Camera and Novel Focal Plane Shutter.—A recent portable camera with magazine attachment and novel sbutter.—I illustration.

XVI. PSYCHOLOGY.—The New Psychology.—The International Psychological Congress of 1886.—By Herbert Ernest Cushman.—An important contribution to the new science of modern psychology.—Review of the participants and of the ground to be covered. psychology.—Review of the participants and of the ground to be covered.

'II. SOCIAL SCIENCE. The Relation of the Modern System of Industry to Intellectual Development.—By CARROLL D. WRIGHT.—The development of the operative under the new conditions brought about by the conditions of the modern industrial

Iron Works, of San Francisco, for the construction of of the higher wages. They attributed the difference to opment, or rather rehabilitation of our maritime intergreater efficiency of labor. There is no reason to supago, or the recent successful trials of our three firstclass battleships during the past twelve months.

The action of the Japanese government in intrusting the building of two of the crack ships of its present programme to American builders proves that the uniform excellence of the ships and material which have been turned out of American yards has had its effect. It means that, in the estimation of the youngest and most progressive of the naval powers of the world, our work is fully up to the standard of the oldest and most experienced yards of Europe. Not, how- locomotive No. 1515. The train consisted of thirteen ever, that we needed any such indorsement. Ships cars of more than average weight, as will be seen from like the battleship Indiana, the armored cruiser Brooklyn, and the protected cruisers Minneapolis and Columbia, are as fine vessels of their class as are to be found afloat to-day; but, still there is one circumstance which gives special importance to the action of the Japanese in placing this order with us, and this is that they have but lately emerged from a warin which their victories were won by the type of vessel which they are now having built in American yards. They are, therefore, specially qualified to judge of its value, and would naturally wish to place the order with those firms which are best qualified to carry it out.

The contracts were awarded after mature deliberation, and a thorough consideration of plans submitted by European builders, the Japanese commissioners having first visited the various shipbuilding yards in this and other countries.

The new ships will be 405 feet long, with 45 feet beam, and about 171/2 feet draught, the normal displacement being 4,760 tons. They will have high speed—about 221/2 knots—and will be heavily armed, carrying two 8 inchguns of the semi-rapid fire type, ten 4.7 inch rapid fire guns, twelve 12 pounders, two 6 pounders, and two 2½ pounders. It will be seen that they are enlarged Yoshinos, a type of swift, powerfully armed cruiser, of moderate size, which rendered good service in the operations of the late Chinese war.

There is every reason to expect this successful competition of our home yards with those of the world will open the way for an extended connection with those inch stroke. It has piston valves 121/2 inches in diamecountries whose navies are built abroad. Japan itself! is evidently aiming at naval supremacy in the Pacific, and will undoubtedly call for ships faster than her yards can supply them, and the various South Ameri- the cab floor and just clears the top of the cylinders, can republics are entirely dependent upon foreign ship- being curved down in front of them to the regulation builders for new vessels. Our great shipbuilding concerns on the Atlantic and Pacific coasts are advantageously placed for competition. They are nearer in some feet long. The drivers are, as stated, 7 feet in diamecases by many thousands of miles, and we have, more-ter, and as the boiler is 65 inches in diameter, it is necover, all the advantage which our excellent relations essarily carried very high, the center being 9 feet above with these peoples, especially on the southern conti- the rails. nent, undoubtedly gives us.

The securing of these contracts is another evidence of the wisdom shown by the government in decreeing so that the ships of the new United States navy should weighs 77,000 pounds when loaded with 3,000 gallons be built in American yards and entirely of American of water and 15,000 pounds of coal. material. It required some courage to do this at a 49 time when the cost of building warships was much noticed that 568 tons were hauled for a distance of 90 greater in this country than in Europe, the art miles at the rate of over 40 miles per hour, and we are being yet in its infancy. And yet in no other way informed that the locomotive was working well within could the naval shipbuilding industry have been re- its maximum power. This is as fine a performance in suscitated in this country. The enormous first cost of hauling a heavy train at express speed as has come the necessary plant for the manufacture of armor and within our notice, and it proves that there are cermachinery would have prevented any private corporatain classes of work for which the compound is specially tion from undertaking its erection, unless they were adapted. Recent experience both in this country and sure that a certain amount of orders would be abroad seems to establish the superiority of the simple forthcoming each year. And, although the earlier engine for exceptionally high speeds, and it is signifiships were costly, it was not long before the many im- cant that in the recent racing from London to Scotproved and labor-saving methods which American es- land the latter type did most of the work. At lower tablishments introduced into the manufacture of ships, guns and armor enabled them to make a rapid reduc- to show an economy. tion in the price of their bids for government work. This was shown at the bidding for the last three battleships authorized by Congress, when the prices showed cost of the earlier battleships contracted for a few years before.

Incidentally it should be mentioned in this connecworkmen and the skilled designers which are essential vate, exercise a powerful stimulus upon the general TECHNOLOGY.—The Removal of Iron from Drinking for these Japanese warships. If we cannot at present to cost \$40,000.

A NOTABLE EVENT IN AMERICAN SHIPBUILDING. build the large ocean steamer as cheaply as the English It is not putting the case too strongly to say that no and German firms, there is every reason to hope that event in the history of American shipbuilding has had we soon shall do so. At the last visit of the British greater significance than the recent placing of an order ironmasters to this country they freely admitted that by the Japanese government with the Cramps Ship-manufactured product was turned out more cheaply in building Company, of Philadelphia, and the Union this country than was possible at home, and this in spite two war vessels. It marks a forward step in the devel-improved machinery, skillful administration and ests, as notable in its way as the floating of the first pose that we have reached the limits of progression steel cruisers of our new navy some dozen or more years | along these lines in our shipbuilding industry, and it is reasonable to look for a time, not far distant, when orders for European passenger and sailing ships will be freely placed in American yards.

GOOD LOCOMOTIVE PERFORMANCE WITH HEAVY LOADS,

On the occasion of a recent trip by our representative from Philadelphia to Jersey City over the Pennsylvania Railroad, some exceptionally good running was done by the company's well known compound the accompanying figures, and it was hauled over the division in two hours and twelve minutes, or one minute less than schedule time.

In reply to our inquiry, Mr. Thomas U. Ely, chief of motive power, writes us:

"This locomotive is a compound, and was built in 1892 as an experiment to enable us to get some information in regard to the compounding principle. It was the first locomotive with seven foot driving wheels built in modern practice up to that time. It has done excellent work and seems well adapted to hauling heavy trains at a high speed.

"The train on which your representative rode from Philadelphia to Jersey City on October 4 consisted of thirteen cars, as follows:

	Weight of	Weight with
	Equipment.	Lading.
	Pounds.	Pounds.
Two sleeping cars	190,000	197.500
Three coaches	196,800	216,300
One dining ear	95,000	95,000
Two mail cars	125,600	201,600
One baggage car	55,000	95,000
Four express cars	210,400	330,400
Totals	872,800	1,135,800
Locomotive		145,500
Tender		77,000
Total weight of train		1,358,300

"The steam pressure was 205 pounds."

No. 1515 is a two cylinder compound, with two outside cylinders, 191/2 and 31 inches in diameter, with 28 ter, which are placed in the saddle within the frames. and, therefore, between instead of on top of the cylinders. The hurricane deck is carried at the level of height of an ordinary pilot. The boiler is of the Bel. pane pattern, with a firebox 3 feet 4 inches wide and 9

The truck wheels and those under the tender are unusually large, 42 inch, the tender being of the English type, six wheeled, with a rigid wheelbase. It

Referring again to the table of weights, it will be speeds, and with heavier loads, the compound begins

A New Harbor Mail Transport.

The plan begun last August of having the foreign a reduction of from twenty to thirty per cent over the mails transferred to special tugs while the steamers were detained at quarantine, and transported to the various railway terminals direct without going to the New York office and then to the respective transportation lines, tion that there is no greater stimulus to the creation of has operated so well during the past few months that a merchant marine than is offered by a liberal policy the post office department at Washington will recomof naval shipbuilding. The costly plant, the expert | mend to Congress the building of a special mail transport boat of rapid speed fitted up with sorting bins to the success of naval yards, whether public or pri- and tables similar to the present railway mail cars, which will meet incoming vessels and take the mails off shipbuilding interests of the country. The firm that at quarantine. Then on the way up New York Harbor can build an Indiana or a Massachusetts is well equip- the clerks will quickly distribute and sort the mail matped for the construction of a St. Paul or a St. Louis. ter intended for the different roads. It is calculated There ought to be no reason why we should not com- much time will be saved in this way and a more prompt 17459 pete for Atlantic liners as successfully as we have done delivery of the mails insured. The proposed vessel is