

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....\$3.00
 One copy, six months, for the U. S., Canada or Mexico..... 1.50
 One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00
 Remit by postal or express money order, or by bank draft or check.
 MUNN & CO., 361 Broadway, corner Franklin Street, New York.

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. 6d., to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.
 Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of seven dollars. To foreign countries, eight dollars and fifty cents a year, or £1 14s. 11d., postage prepaid.

Building Edition of Scientific American.

(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly 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 contemplate 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, \$3.00 a year, or £0 12s. 4d. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, \$5.00 a year. To foreign countries, \$6.50 a year, or £1 6s. 9d. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN, and SUPPLEMENT, \$8.00 a year. To foreign countries, \$11.00 a year, or £2 5s. 2d., postage prepaid.

Export Edition of the Scientific American

(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 100 pages, profusely illustrated. It is the finest scientific industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—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 £0 12s. 4d., postage prepaid to any part of the world. Single copies, 25 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 25, 1897.

Contents.

(Illustrated articles are marked with an asterisk.)

Aluminum balloon, the Berlin*.....	405
Archaeological news.....	406
Arctic ship "Winward" presented to Lieut. Peary.....	403
Armor plate question, the.....	402
Beet sugar in Nebraska.....	407
Bicycle frame, a cushion*.....	404
Bicycle records, wonderful.....	402
Books, new.....	410
Buildings, dustless.....	403
Caisson dry dock gate, a large*.....	408
Cements, caoutchouc and gutta percha.....	404
Copyright injustice.....	403
Dry dock, Brooklyn, repairing*.....	408
Economy in details.....	412
Electric seismoscope, an.....	406
Electric traction, high speed.....	402
Elevators abroad.....	406
Engineering landmark to go.....	402
Feather evil, the.....	405
Flour, compressed.....	407
Grain elevator, the largest in the world*.....	401
Guns, heavy, "knock-down".....	408
Human speed and endurance.....	402
Inventions recently patented.....	410
Kansas, a year of plenty in.....	403
Lasso, the.....	403
Navy yard, Brooklyn, dock repairs*.....	408
Notes and queries.....	411
Ordnance, heavy, new method of manufacturing*.....	408
Patents granted, weekly record.....	411
Peary, Lieut., receives a ship.....	403
Science notes.....	406
Sleep, inducing.....	405
Steel grain bins enormous*.....	401
Stovepipe, boiler, Griswold & Chase*.....	404
Submarine boat, Fulton's.....	404
Wrench, Avery's*.....	404
Yacht service, a transatlantic.....	404

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1147.

For the Week Ending December 25, 1897.

Price 10 cents. For sale by all newsdealers.

I. AERONAUTICS.—A New Steam-propelled Aeroplane.....	18338
II. BOTANY AND HORTICULTURE.—The Tomato Grafted upon the Potato.—1 illustration.....	18336
The Weeping Spruce.—1 illustration.....	18337
III. CIVIL ENGINEERING.—Enlargement of the Port of Marseilles.—Full details of an important engineering work which includes the construction of an entire new basin.—3 illustrations.....	18331
IV. CYCLING.—Alfred Kocher and His Pace Makers.—1 illustration.....	18335
V. HOROLOGY.—Repeating Bells in Clocks.—2 illustrations.....	18329
VI. MECHANICAL ENGINEERING.—The Comparative Advantages and Disadvantages of Steam, Compressed Air and Electricity for Power Purposes in Coal Working, with Special Reference to Coal Cutting and Haulage.—The Iron and Coal Trades Review Prize Essay.....	18331
VII. MEDICINE.—New System for Locating Bullets.—Use of Roentgen photography to accurately determine the position of foreign objects in the head.—3 illustrations.....	18328
VIII. MISCELLANEOUS.—Things American.—By MARCUS BENJAMIN.—An entertaining account of Prof. Benjamin's travels and the souvenirs which are obtainable.....	18335
Electrical Notes.....	18333
Miscellaneous Notes.....	18333
Selected Formulae.....	18333
IX. PHOTOGRAPHY.—Marine Photography.....	18337
X. PHYSICS.—New System of Locating Bullets.—3 illustrations.....	18328
XI. SOCIOLOGY.—The Musee Social and its Work in Switzerland.....	18334
XII. STEAM ENGINEERING.—Testing a Boiler to Destruction.....	18329
XIII. TEXTILES.—Philadelphia Textile School.—A description of an important textile school equipped with the latest form of textile machinery.—3 illustrations.....	18333
Pineapple Fiber.....	18332
XIV. TRAVEL AND EXPLORATION.—Scenes around Phnom-Penh, the Capital of Cambodia.—1 illustration.....	18334

FAMOUS ENGINEERING LANDMARK TO BE REMOVED.

The laying of the new 48 inch water mains on Fifth Avenue, New York, has reached a point where it is possible to dispense with the distributing reservoir at Forty-second Street, and this famous engineering work will now be torn down to make way for the noble pile which is to form the home of the New York Public Library. The reservoir was built over half a century ago to provide a terminal for the Croton Aqueduct, in common with which it forms the most monumental engineering work of the first half of the century in America. The cost of this water supply was more than \$12,000,000, and the enterprise with which the city of only a quarter of a million souls faced so great a financial burden was only equaled by the skill and good taste with which the engineers of that day, Jervis, Allen and Davis, carried out the engineering and architectural features of the work.

The reservoir, which crowns the summit of Murray Hill, stood well out in the country at the date of its erection. Fault has been found with its architectural design; though it has always seemed to us that the simple and massive Egyptian style in which it is built is singularly adapted to express the purpose of the inclosing walls of the structure. The reservoir covers four acres and is built entirely above ground. The walls are carried up high enough to give a maximum depth of 36 feet of water and a total capacity of 24,000,000 gallons. The walls are double, with a space between them, varying from 9 feet 9 inches to 14 feet in width, and they are tied together at intervals with cross walls. The outer wall, 4 feet thick throughout, has a batter of 1 in 6. The inner wall varies from 6 to 4 feet in thickness and is vertical. A puddled embankment is laid against the inside of the inner wall and the bottom is covered with 2 feet of puddled earth, above which is 12 inches of concrete.

The work was carried out with that conscientious care which marks the whole of the Croton water scheme, and testifies to the skill of the engineers and the thoroughness of the contractors of an earlier day.

THE POSSIBILITIES OF HIGH SPEED ELECTRIC TRACTION.

In view of the many impossible schemes for air-line electric roads with speeds of from 100 to 200 miles an hour which from time to time find their way into the press, it is a relief to find the subject taken up and discussed in a scientific way by professional men who have no other object than to place the actual possibilities and limitations of high speed electric travel before the reader. In a recent series of articles in the Engineering Magazine the authors discuss the engineering and financial features of an electric road between New York and Philadelphia which would carry passengers between the two cities in thirty-six minutes, or at the rate of one hundred and fifty miles per hour. It is the opinion of the authors that the scheme would present no civil or electrical engineering difficulties which could not be overcome. The cost, however, as figured out, would be \$190,000,000. The estimate is made on the basis of a road on the third rail system, with trains running at three-minute intervals. Three-phase 10,000 volt current would be used for transmission lines, and 1,000 volt direct current on feeders. Each station would have an economical capacity of 30,000 horse power and each substation a capacity of 20,000 horse power. The travel, estimated on the basis of several existing elevated and suburban roads, is put down at 187,040 passengers both ways per day. This is more than four times the traffic of all the existing roads between these cities. It is considered, however, that the reduced time and the low fare, assumed at twenty cents, would greatly increase the travel. It is evident that, in the opinion of the authors, Messrs. C. H. Davis and F. S. Williamson, the difficulties would be rather of a financial than electrical nature, and their study of the question of high speed travel shows once more that the limits to engineering performance are set by financial rather than technical considerations.

PROBABLE SOLUTION OF THE ARMOR PLATE QUESTION.

There is some prospect of a settlement of the armor plate controversy between the government and the firms engaged in armor plate manufacture, by the latter offering to supply a much superior plate at the price fixed upon by the Secretary of the Navy. It is well understood in naval circles that the great Krupp factory is turning out nickel plates treated with its new gas process which have shown better ballistic results than the nickel-steel Harvey plates which have won such world-wide celebrity. It now appears that the Carnegie and Bethlehem Companies have acquired the rights to the Krupp process in this country, and two experimental plates are being made which will shortly be tested at the naval proving station at Indian Head. The Krupp plates have shown all the hardness of the Harvey plates, with a remarkable toughness which renders it practically impossible to break them. Extreme toughness and extreme hardness seemed to be incompatible in the same plate, until Harvey combined the two by the use of nickel and face hardening. The

hardness, however, is always present in greater degree than the toughness in Harvey plates. The new Krupp process seems to render the plate absolutely proof against fracture.

If the two experimental plates show all the good qualities expected of them, the obvious course for the government would be to fix a fair price and close a contract for the supply of the much needed armor for the new battleships.

A YEAR OF PLENTY IN KANSAS.

It is a commonplace truth that the source of the prosperity of this country lies in the soil—that good crops mean good times; but it is only when we have before us such astonishing figures as are furnished this year by the Kansas State Board of Agriculture that we appreciate the supreme importance of agriculture. Omitting the odd thousands, we find that the yield of winter wheat in that State is fifty million bushels, worth thirty-four million dollars, or 160 per cent more than last year. The corn crop totals one hundred and fifty-two million bushels, and the yield of oats is twenty-three million bushels, the two together bringing in thirty-two million dollars. The total value of winter and spring wheat, corn and oats is sixty-six million dollars.

This is the record of a year of plenty. Compare it with the crops of the previous year, when the combined winter and spring wheat, corn and oats brought only fifteen million dollars to the farmers.

The table of the yields and values of the crops and products of all kinds, including, in addition to the cereals already mentioned, potatoes, flax, sorghum, dairy products, etc., is one hundred and thirty-six million dollars. The total value of crops and live stock is two hundred and thirty million dollars, and the total net increase of all agricultural products is over forty million dollars. In the presence of such figures one is prepared to believe there may be more truth than jest in the statement that Kansas will "forward a car load of canceled mortgages" to the forthcoming exposition at Omaha as a token of her returning prosperity.

ECONOMY IN DETAILS.

There is a good story told in a Philadelphia paper of a French officer of engineers who, during a visit to one of the large machine shops in that city, regarded with comparative indifference the massive tools and "show" features of the establishment but paid close attention to a little tool-sharpening machine—a type of those numerous ingenious labor-saving appliances with which an American shop abounds. At the close of his inspection he stated that he had visited all the most notable engineering undertakings and establishments in America, and that he should report to his government that the biggest things in America are the little things. He was struck with the fact that in some establishments which he had visited the profits were mainly realized in the saving of materials and labor by close attention to details which in Europe are unconsidered trifles, and as an instance of this he quoted the little grindstone which he had noticed in the shops.

The criticism of the French engineer went direct to the mark, for while we have engineering works as great as any in the world, it is in our genius for invention of labor-saving appliances that we lead the world, and herein, too, lies the secret of the extraordinary reductions which we have been able to make in the cost of manufacture.

With the ever-growing magnitude of industrial operations and the increasing keenness of competition, the race will be won by the people who have a genius for economy in details, who are untiring in their efforts to save time and labor in the most insignificant trifles of shop and factory management. The rapidity with which the new inventions of one country are patented and bought up in other countries has an equalizing effect which prevents any one nation from enjoying a monopoly of the fruits of its ingenuity, at least in the more important and costly inventions; but as long as the American mechanic continues to devise more rapid and less laborious ways of doing even the most insignificant work, it will continue as easy for us to undersell the European producer as it is puzzling to him to understand how we can do it.

THE LIMITS OF HUMAN SPEED AND ENDURANCE.

The many forms of use and abuse to which the bicycle has been put have served to demonstrate that man is capable of feats of speed and endurance the mere suggestion of which would have been deemed absurd and impossible a generation ago. While it has long been known that the human frame was capable of exertion far beyond the powers of the brute creation, it was reserved for the bicycle to show just what the measure of its endurance was. While we consider that six day races, such as have lately been concluded in New York, are to be condemned on obvious grounds of humanity and common sense, it is undeniable that they possess an interest as showing the amazing feats of strength and endurance of which a well trained athlete is capable.

The past year has been fruitful in record-breaking