

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors. PUBLISHED WEEKLY AT No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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 belonging to Postal Union. 4 00

Remit by postal or express money order, or by bank draft or check. MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

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 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 within Postal Union, eight dollars and fifty cents a year.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, \$2.50 a year. To foreign Postal Union countries, \$3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, \$5.00 a year. To foreign Postal Union countries, \$6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, \$9.00 a year. To foreign Postal Union countries, \$11.00 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of La America is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. \$3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

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, MAY 20, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as 'Age of trees and their rings', 'Aluminum solder', 'Ants, extermination of', 'Arrowroot manufacture', etc., with corresponding page numbers.

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 907.

For the Week Ending May 20, 1893.

Price 10 cents. For sale by all newsdealers.

Detailed table of contents for the supplement, including sections like 'I. ARCHAEOLOGY', 'II. BIOGRAPHY', 'III. BOTANY', etc., with page numbers.

PRICES AT THE WORLD'S COLUMBIAN EXPOSITION.

The specter of extortion is in danger of keeping many people from attending the World's Columbian Exposition, not, however, so much because of its actual presence, as because of the fear of its existence. During the first week or two that the Exposition was open there was without doubt excuse for these fears, but this is a thing of the past now.

Investigations by representatives of the SCIENTIFIC AMERICAN lead to the conclusion that visitors at the Exposition need have no fear of excessive charges if they use judgment and discretion in securing accommodations and making other arrangements. The Exposition management has no jurisdiction whatever over the hotels, and cannot therefore regulate their prices, but fortunately there is no need of such jurisdiction, because of the intervention of the law of supply and demand.

As to the charges at the restaurants in the Exposition grounds, the Exposition management has required that all bills of fare and accompanying prices be submitted to a committee appointed for the purpose, and these prices are regulated in accordance with prices at restaurants of corresponding degree in the center of the city.

The cry of extortion is a false one so far as present conditions and future prospects are concerned, and should not deter one person from visiting the Exposition, which is the greatest industrial achievement in the history of the United States.

ONE HUNDRED AND TWELVE AND ONE HALF MILES PER HOUR.

Sixty years ago, when the steam engine began its competition with the stage coach as a means of passenger transit, its velocity was naturally a matter of wonder and comment. We read in the books of that period of the great speed of fifteen or even twenty miles an hour being attained by the locomotive.

The contrast between the old and the new was vividly brought out in the exhibit prepared by the New York Central Railroad for the World's Columbian Exposition. In our issue of last week we showed the two extremes of railroad engineering in the State of New York.

The engine drawing a regular train of cars on the track of the New York Central road has surpassed the speed of any object propelled by man short of a projectile. The speed of the wind in the most powerful gales has been equaled, and the flight of the swiftest bird through the air has been surpassed.

new speed test was made. Batavia was passed at a speed of sixty miles an hour. This was increased until a mile was run in thirty-five seconds, and soon after a mile was made in thirty-two seconds.

This speed, subjected to analysis, reveals the greatness of the achievement. In every second of its progress the engine covered a distance of 165 feet. This is the velocity which a body falling in a vacuum would acquire in a fall of 425 feet.

There are certain landmarks set for speed achievements by our imaginations. The "even time" of ten seconds for one hundred yards has been surpassed by a running man. The bicyclist it is claimed has surpassed his "even time" of a mile in two minutes, and aided by ball bearings and pneumatic tires the trotting horse drawing a sulky is approaching the same figures.

The achievement means a great deal. The advocates of flying machines speak of a possible speed of sixty or perhaps a hundred miles an hour. Recent experiments with direct-gear electric motors have indicated the possibility of a speed of one hundred and twenty miles an hour.

Geo. Westinghouse, Jr., a recognized authority on the subject, has shown the difficulties in bringing fast trains to a stop and in reducing their speed on emergencies. His communication was reprinted in our issue of October 8, 1892.

THE ELECTRIC RAILWAY TROLLEY.

Another broad patent for a gigantic monopoly has recently been issued by the Patent Office. This is a patent for the invention of the late Chas. J. Van Depoele, who was a well known electrician. The patent was applied for in 1887, but other inventors claimed substantially the same thing at the same time.

The combination of a car, an overhead conductor above the car, an upwardly extending and laterally movable arm carried by the car and having its upper end free, and a contact device carried by the arm at its free end, and making underneath contact with the conductor.

The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm on the car movable on both a vertical and a transverse axis and carrying the contact device.

In an electric railway the combination of a car, a conductor suspended above the line of travel of the car, a rearwardly extending arm pivotally supported on top of the car so as to swing laterally and provided at its outer end with a contact device engaging the under side of the suspended conductor, and a tension spring for maintaining an upward pressure contact with the conductor, substantially as described.

OVER one thousand steamships are traversing the four great ocean routes.