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 checks. 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) is 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, JULY 29, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 917.

For the Week Ending July 29, 1893.

Price 10 cents. For sale by all newsdealers.

THE WORLD'S FAIR INTERNATIONAL ENGINEERING CONGRESS.

The committee in charge of the programme and arrangements for this congress, which opens its sessions on Monday, July 31, has perfected its plans, and there is every promise of the largest gathering of engineers that has ever been held. Headquarters for the engineering fraternity have been established at No. 10 Van Buren Street. These rooms are very commodious and offer every facility for engineers to meet, look after their correspondence, peruse all the leading technical journals of this country and Europe and to enjoy meeting eminent engineers from all parts of the world. In order to facilitate social intercourse, special informal gatherings are held every Monday evening, and these meetings are very popular, from seventy-five to a hundred people usually being in attendance. These headquarters will be kept open for the special entertainment of engineers visiting Chicago during the time of the Exposition. A meeting room for engineers has also been opened in the gallery of the Mining building, in the southwest corner, room number four. In this room the leading scientific papers are on file, and there are almost always a number of engineers present resting from sight-seeing or enjoying the opportunities that the room offers.

The work of this congress comprises seven divisions, as follows: Division A.—Civil Engineering, in charge of the American Society of Civil Engineers. Division B.—Mechanical Engineering, in charge of the American Institute of Mechanical Engineers. Division C.—Mining Engineering, in charge of the American Institute of Mining Engineers. Division D.—Metallurgical Engineering, in charge of the American Institute of Mining Engineers. Division E.—Engineering Education, in charge of a special committee. Division F.—Military Engineering, in charge of Major Clifton Comly. Division G.—Marine and Naval Engineering, in charge of Commodore George W. Melville, Engineer-in-Chief, United States navy.

NAVAL TORPEDOES.

Up to the present time the most practical forms of torpedoes used in connection with vessels of war have been the Whitehead torpedo, worked by compressed air, and the Sims-Edison torpedo, worked by electricity.

The Whitehead torpedo is the one now most extensively adopted, and it was with one of these missiles, delivered from the Chilean war ship Almirante Condell, that the insurgent ironclad war steamer Blanco Encalada was sunk in Caldera Bay on the morning of April 23, 1891.

The Whitehead torpedo, briefly described, consists of a cigar-shaped cylinder of metal carrying in its front end a heavy charge of dynamite, and at the rear two propellers, which are worked by compressed air, with which the main body of the cylinder is charged under a high pressure.

To start the torpedo on its mission of destruction it is placed in a special gun, aimed toward the enemy, and then fired, with a low charge of powder, the propellers having previously been set in motion. The instant the torpedo strikes the water, the revolving propellers take effect and maintain the initial velocity imparted by the gun. The torpedo flies along with a speed reaching thirty miles an hour, and explodes on contact with the intended target. This torpedo is provided with guides or wings and may be made to travel under water, and continues to move until the compressed air is exhausted.

The Sims-Edison torpedo also consists of a cigar-shaped cylinder, provided at its head with an explosive charge, next a reel of small wire cable, an electric motor, and at its rear a propeller is worked by the motor. The electric current is furnished from on board the ship through a wire cable, which reels off as fast as the torpedo advances. The torpedo is steered as well as propelled from on board the ship through the wire cable. The distance of travel of the torpedo is limited to the length of the cable, which may be from one to two miles. Within this range the torpedo may be propelled at the rate of fifteen to twenty miles per hour, may go under water, and its direction of flight can be governed with the utmost ease and accuracy. It has the advantage that its motive power may be indefinitely maintained; whereas the motive power of other torpedoes is soon exhausted. Many successful harbor trials of the electrical torpedo have been made; but we call to mind no example, as yet, of its use in actual warfare.

The Howell torpedo, the invention of Captain Howell, U.S.N., is the simplest device, and might be styled the gyroscopic torpedo. It depends for its motive power upon the momentum of a heavy flywheel. This torpedo is a small cigar-shaped vessel, operated by double propellers, no engine or motor other than a flywheel being required. The torpedo may be started from a gun, similar to the other described weapons. The torpedo may be set to run either on the surface or under the water, and owing to the gyroscopic character of its motive power, it will automatically maintain, with great exactness, the line of travel on which it is set. Prior to discharging the torpedo, its flywheel is set in motion at a high velocity. The flywheel of an 8 foot torpedo is capable of storing up a power of 347,000 foot pounds and driving the torpedo half a mile or more with great speed.

The Cunningham torpedo is a new candidate for warlike honors. It is operated on the same principle as a rocket; its motive power being derived from the burning of pyrotechnic compound, the gases of which issue with force from its rear end, and the reaction drives the torpedo ahead. This device is the invention of Patrick Cunningham, of New Bedford, Mass., who is also the inventor of quite a number of improvements relating to rockets.

The Cunningham torpedo has lately been tried with success by government officers at Newport, R. I. Like the others, it is cigar-shaped, and carries the explosive charge at its head. It is intended to serve either as a submarine torpedo, moving wholly under water, or to travel on the surface of the water, as may be required.

It has no screw or propeller, but has extending from the explosive chamber to the stern eight ribs or spirals, with a twist of one turn in forty-eight feet. These give the torpedo a rotary motion similar to that imparted to a bullet by a rifled gun. All the portion of the torpedo aft of the chamber for the explosive is filled with a rocket composition tightly pressed in. The gases escape forward through a large number of small holes just aft of the explosive chamber, and aft through a smaller number of larger holes in the stern. It is the escape of this gas that forces the torpedo through the water. The torpedo tried was seventeen feet long and fifteen inches in diameter. Electricity exploded the rocket composition. The firing tube was run out, so that the torpedo was four feet below the surface when fired.

The propulsion of boats on the rocket or reaction principle has been several times experimentally tried with success. The last experiment in this line that we recall was that of Buisson and Ciurcu, made on the River Seine, in France, in 1886. In a 25 foot boat the inventors placed a small boiler or receiver, which from time to time they charged with blocks of combustible, the gases from which were conducted into another cylindrical vessel called the reservoir, from which the gases were allowed to escape into the air; the reaction thus produced propelled the boat ahead with great velocity. The office of the reservoir was to hold a reserve of gas under pressure while the main receiver was being newly charged and fired. Many successful experiments were tried, extending over a period of four months. But, finally, one fatal day, from some unexplained cause, too great a gas pressure suddenly took place, and the receiver exploded. Mr. Buisson, and a lad who was steering the boat, both lost their lives.

COLONEL AUCHMUTY, FOUNDER OF THE NEW YORK TRADE SCHOOLS.

Colonel Richard T. Auchmuty died at his summer home in Lenox, Mass., on July 18. He was born in New York in 1831; his great-grandfather was rector of Trinity Church in 1763. Colonel Auchmuty received a college education and afterward studied architecture with Mr. James Renwick and finally became a partner. He served in the civil war, and on his return home devoted himself to charitable work and founded the New York Trade Schools, which he successfully conducted until his death. In 1889, when the schools were incorporated, Colonel Auchmuty and his wife added $160,000 to their previous gifts. J. Pierpont Morgan gave $500,000 at the same time as an endowment fund. At these schools a thorough course of instruction is provided for each of the trades. The branches taught are bricklaying, plastering, plumbing, carpentry, house and sign painting, fresco painting, stone cutting, blacksmith work and tailoring. Low tuition fees are charged and instruction is given either day or evening. The New York Trade Schools are conducted on the principle of teaching thoroughly how work should be done; the scholars actually work at their trades in the school until they become proficient. The system which Colonel Auchmuty inaugurated was a new one and has produced remarkable results. It has attracted much attention both in this country and in Europe, and is regarded by many as the solution of the labor problem. Hundreds of young men trained in these schools have become skilled workmen, and command the highest wages. The trade schools are fully described in our SUPPLEMENT, No. 781.

LIBRARIES IN CHICAGO.

The recent decision of the Supreme Court of the State of Illinois sustaining the will of John Crerar is an incident of much public interest, as it means the establishment of a free public library in the south division of the city of Chicago. Such an institution as this new library gives promise of being will be of inestimable value even to a city as well supplied with libraries as Chicago is, for by the provision of Mr. Crerar's will $2,500,000 was set aside as an endowment for this library. Just where the library will be established is still unsettled, further than that by the re-