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 anyfore gncountry belongingto Postal Union. 4 00

Remit by postal or express money order, or by bank draft or checs.
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 8, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 914.

For the Week Ending July 8, 1893.

Price 10 cents. For sale by all newsdealers.

THE CENTRALIZATION OF MOTIVE POWER.

For a number of years the distribution of power over a large area from one or more producing centers or stations has been a problem of engrossing interest to engineers. Before the advent of modern electricity—for such a name may be considered the due of this greatly developed industry—all sorts of methods were proposed for the distribution of power. Many of such methods have been utilized. Thus in pipe conduit systems compressed air, rarefied air at a very slight excess over atmospheric pressure, and water under high pressure have all been utilized as the bases of more or less successful and extensive operations. As a purely mechanical method the transmission by wire cable has proved reasonably effective. A light cable running at high velocity has proved itself suited for transmitting very high horse power for great distances.

Electricity has now been found capable of doing this class of work with good efficiency. The alternating current, working under high pressure, needs but a small wire to carry a large horse power. The high speed cable transmission alluded to above is comparable to it in this respect.

The transmission of power over considerable distances is so far proved that a new movement in the engineering world in the direction of centralization of power is discernible. Doubtless this movement will, in the next few years, be fraught with most important results. In this country, especially, it has taken root. Thousands of horses are now employed drawing street cars through the streets of our cities. This means a division of power into very low units, without any centralization whatever. Within the last few years the great street railroads have felt the impulse, and in our large cities, by the use of the cable and slot or by the electric trolley line, have centralized their power and have substituted each a single unit of thousands of horse power magnitude for the many one or two horse power units formerly assigned to each car.

In the suburbs of the same cities the electric road has been greatly developed. The motor machinery for a car carrying thirty to fifty passengers is of inconsiderable weight, giving a high efficiency from the point of view of ratio of weight moved to load carried. The generation of power at a central station is far cheaper than where small generating plants—the boilers—are distributed in locomotives all along a railroad line. These advantages are such as to have made the electric road a serious rival to steam roads. It is easy to believe that the day will come when the locomotive engine will be relegated to an altogether secondary place in the economies of mankind

Electric power is now furnished by the city companies. This has made possible the installation of small factories, so that in the best buildings in our best streets workshops are established with machinery driven by electric motors. But most of the great factories still run in the old way. At Niagara Falls the project of providing power for factories of the largest size will soon be accomplished. An industrial city will be erected about the nucleus of the power works, electric railroads will be run from them, the lighting of neighboring cities will be provided for, and Buffalo will possibly be the recipient of many thousands of horse power from the same place.

Transmission of power by electricity is now an accomplished fact. The production of power economically in central stations is the problem to be solved. Such a locality as Niagara Falls contains in itself the solution. But Niagara is unique. Natural gas seems to be on the decline. The old time coal fire and steam boiler are still in the ascendency. In the SUPPLEMENT of the present week an interesting paper contains the suggestion of establishing steam plants in coal mines. Coal as such is of exceedingly slight value. When extracted from the veins and lying on the floor of the mine, it represents but little. But after coal has been hoisted or drawn out of the mine, has been screened and placed in cars, and after these cars have carried it perhaps two or three hundred miles to the seaboard; after it has been transferred to vessels and has been towed hundreds of miles further to the wharves of some city, and has been hoisted out of the vessels' holds, then its value is enhanced.

By establishing an electric plant in the heart of a coal mine, the fuel account would be almost nothing, and a rival of Niagara Falls might be established. From some coal mine in the heart of Pennsylvania, power might be distributed over a great area, including cities and railroads on all sides. The culm heap would disappear, ashes would be stored in the empty chambers, and future geologists would have these ashes to deal with as examples of igneous changes, while fossil men and boilers would interest the archæologist of the fuelless days yet to come.

A CONCRETE BRIDGE.—A bridge of concrete is being constructed over the Pennypack Creek at Pine Road, Fox Chase, Pa. The outside surfaces will be pebble dashed and outlined in imitation of pointed stone work, so that when completed it will present the appearance of a handsome cut-stone structure.

Discovery in Solar Physics.

Professor J. M. Schaeberle, of the Lick Observatory, arrived in New York on June 24 from South America, where he had gone to observe the solar eclipse of April 16.

He set up his instruments near Merciditas, Chile. The big telescope was erected a month before the eventful day. Preliminary observations were then carefully conducted. The plates used with the large telescope were 18 by 22 inches. He had also a Clark equatorial with a 6 inch lens, a 6 inch Dallmeyer lens with a 3 foot focus, and two small cameras. On the day of the eclipse he made about fifty negatives of the corona. With the large telescope he made eight negatives, and they are larger than any that have ever been taken by any one of an eclipse. The big plates of the corona show the full length of the plates, and the details are brought out with great precision. The photographs taken with the smaller instruments are also valuable. He is confident that the theory he had before making the observations is sustained beyond a doubt. His theory may be thus stated:

The corona, which appears during every total eclipse, is caused by the fact that the sun was covered with immense volcanoes, which continually belched forth great masses of molten material, which the sun drew back to it with a speed which could not be realized. The mechanical actions seem to be shown plainly on the large photographs. Until the professor himself publishes in full the account of his observations it will be premature to discuss the influence which his discovery will have upon solar physics.

A Paper to Prevent Forged Documents.

It is very desirable that dishonest persons be prevented from duplicating certificates of stock, bonds, drafts, and such valuable documents: and many devices have been employed for this purpose. A new process has just been introduced in making a paper which will at least be difficult to imitate successfully. Ink is applied to a lithographic stone, and another similar stone is placed on its face and rubbed together until the ink is so distributed that a variegated design is produced. When the ink is dry, the design is transferred to paper after the usual manner in lithographic printing. Of course any color may be selected for the ink. It is manifest, also, that the design thus cheaply produced can be varied indefinitely until a pleasing or effective one is obtained. A counterfeit is detected at once when compared with a sample of the genuine paper.

Experiments with Rattlesnakes.

In the pathological laboratory of Johns Hopkins Hospital it was necessary recently to determine the exact action of the poison of the rattlesnake. The creatures were kept in a wire-covered box. When one was required for experimental purposes, it was caught round the neck by a noose at the end of a stick. A deep glass vessel was then presented to the enraged animal, and it instantly struck its cage with its fangs. The poison, which was caught in the bottom of the vessel, was free from all foreign admixture. Minute quantities injected beneath the skin of rabbits produced marked lesions. For some reason or other the snakes refused food, and in order to keep them alive an egg mixture had to be forced down their throat by means of a stout glass tube.

A New Use for the Tricycle.

A company has been formed in Milan for supplying the city with tricycles. At a trifling cost a person may hire one of these machines, to be had at certain defined places, and take a drive either for business or pleasure. Each tricycle has a driver, so that the hirer has nothing to do with either its propulsion or direction. The fare may depend upon the distance to be traversed or the time to be occupied by the journey. As to speed, it is believed the tricycle can go about twice as fast as the ordinary cab horse; that is to say, if the payment is to be for a definite distance. But if the tricycle has been engaged by the hour, the speed, as a rule, is not remarkable. This system of local transit is on a par with the Japanese hand cart method or "rickshaw." The Jap vehicle is, doubtless, preferable to the tricycle.

Scientific Excursions.

The tenth geological expedition to the West has just gone out from Priceton College, under Professor Scott. The first of these useful enterprises set out, under Professor Brackett, in 1877, the second in 1878 under Professor J. B. McMaster, and all of the others under the present leader. In time it is hoped that a complete representation of American fresh water tertiary fossils may be obtained from the promising fields discovered in Colorado, Wyoming, Utah, Dakota, Oregon, and Montana. Hitherto the finds have been most encouraging. Immense numbers of extinct vertebrate specimens have been collected. Among the very important fossils may be mentioned the bones of a mesonyn, the only complete skeleton of the kind yet found, and the legs and pelvis of a three-toed horse.