ENGINEERING WORKS, PRESENT AND FUTURE, IN THE CITY OF NEW YORK.

The city of New York, the metropolis of the United States, is every year increasing in importance as the terminal of the great commercial arteries of the country. Her great growth in population and the development of her suburbs has been but one step in her progress; for she not only has to give homes to her population proper. she has also to act as a great receiving and distributing center. From the entire area of the United States the products of farm, orchard and plantation are poured into her lap. These she distributes to the old world. America now is the granary of the world, as Sicily was once the granary of Rome.

From the eastern hemisphere vast cargoes of imports of every description are unloaded at her quays. These have in turn to be sent north, south and west, over thousands of miles of railroads and internal water routes to every State in the Union.

Our engravings are designed to illustrate the great engineering works existing and projected in and about the city. A population of nearly three millions clusters about Manhattan Island. In New York proper there are nearly two millions to be provided for. Our maps shows the city proper in its relation to the surrounding territory. On the map the bridges and tunnels across the Hudson River, the Harlem River and the East River are shown. The enlargement of the Harlem River so as to form a great ship canal at the back of Manhattan Island is also indicated. Crossing the Harlem River and running through the city to Central Park, the course of the two Croton aqueducts can be traced. The ferry lines plying across the two rivers, the Hudson and East Rivers, are also to be noted. In the East River, Hell Gate, once famous as the scene of many accidents to shipping, has now been cleared of so many rocks as to be a safe waterway for all craft.

The water supply has been one of the great problems to be dealt with. The columns of this paper have described in detail the improvements in the water supply. The various dams and the new aqueduct are familiar to our readers. To present a summary of the work in prospect, we give a small map of the Croton watershed. The black portions extend to the outlines of the future reservoir capacity of the city. This will be given by the new Cornell dam. In the midst of the black a shaded area is shown. This is the present Croton Lake. Its area, it will be seen, is but a small proportion of that of the new reservoir. The drainage area of the surrounding watershed is shown in part shaded. This is the portion tributary to the present upper reservoirs. The additional area utilized by the Cornell site dam is shown in white. It will be seen at a glance how vastly increased is the reservoir capacity soon to be called on for the metropolitan supply. The present Croton Lake has a capacity of two thousand millions of gallons; the capacity of the new lake is put at fifteen times this figure. The watershed will be 332 square miles.

The new dam itself is shown in elevation with its spillway. Its size is forcibly brought out by the view of the sections of the Sodom dam, now in operation, and of the proposed Cornell site dam. The great structure is to be 229 feet in height from foundation to crest. The foundation is to extend 70 feet below the river bed. The crest is to be 1,736 feet long. For the water from the spillway a new channel is to be made in the rock, to replace the old river bed. For fuller details the SCIENTIFIC AMERICAN of June 20, 1891, may be consulted.

The next illustration is a bird's eye view of the railroad system of the city, and the bridges and tunnels to be tributary thereto. Reference numbers have been introduced to facilitate the understanding of the cut. The bridges may first be considered. Far in the distance is seen the East River bridge (marked Fig. 1), by whose graceful suspension span Brooklyn and New York have so long been united. A cable road carries passengers from terminal to terminal, and at each end connections with the elevated road systems of both cities are provided.

Some miles to the north of this is the locality for the proposed New York and Long Island bridge, marked Fig. 2. This is situated on a line starting between Sixty-seventh and Sixty-eighth Streets and running across Blackwell's Island to Long Island. It is to be a trussed suspension bridge, and is to carry trains from the Long Island Railroad, with its many divisions, into New York. Running up Sixty-seventh Street, the approach bends to the north and connects with the tracks running from the Grand Central depot. Fig. 3 shows the Hunter's Point or eastern terminal of its Long Island approach.

Fig. 4 shows the present Grand Central station. This is the terminus of the New York Central, the Harlem and the New Haven roads. The tunnel and cutting through which the four tracks run to the Harlem River is shown also.

The Hudson River is the next point of interest. Two bridges are proposed for it.

Fig. 5 shows the terminus of the great North River bridge, which is to be the greatest bridge of the world. It will connect the two States of New Jersey and New York. This has already been elaborately illustrated by us. (See SCIENTIFIC AMERICAN, May 23, 1891.) It is to be of steel, with an extreme length of nearly 7,000 feet. The central span alone, from center to center of piers, is to be 3,100 feet long—about twice the span of the East River bridge. It is to be situated about in line with Twenty-third Street. It is designed to accommodate ultimately fourteen railroad tracks, some for through service, others for rapid transit trains. It is to have connections with the different lines from the West, and is expected to do much local business, incident to the development of the territory north of its New Jersey terminal.

Fig. 6 is the New York and New Jersey bridge. In our SUPPLEMENT, No. 877, some of the details of this great enterprise were given. This bridge is designed primarily for through traffic and passenger business. It is to be of cantilever type. It is believed that four tracks will be enough to accommodate the traffic. It is to cross the Hudson River in line with Seventy-first Street. The New York approach includes two lines. The southern approach runs to a union station at Forty-second Street and Broadway. This station is shown in Fig. 7. It is proposed to cover two city blocks, giving a plan area of nearly four acres. The buildings were designed by Messrs. Creighton Withers and Ernest R. Tilton, of New York, according to a general plan of arrangement submitted to them by Mr. T. C. Clarke, chief engineer of the company. The northern approach is carried in a curve, running under the southern approach, and under the main approach as shown, and thence following the Hudson River shore to the mainland. Here connections for the Eastern States may be made. The object of thus curving the line of the approach is to avoid Riverside Park.

Fig. 8 shows the present terminus of the West Shore Railroad. In the near future this road, now run by the New York Central, is to be a more important factor in the development of the city than it has hitherto been. It opens up the beautiful region back of the Palisades, and to it the western slopes of the great trap rock ridge are tributary.

There are also tunnels proposed, and one in process of construction, for crossing the rivers. The East River tunnel is shown at Figs. 9, 9. It is to start well back from the Long Island shore and crossing the East River at Forty-second Street goes under the city, following the line of Forty-second Street, at a depth varying from 95 to 118 feet, connecting with the Grand Central depot. In the future it is proposed to continue it across the city and perhaps under the Hudson River. At the Grand Central station, and at other points if required, stations with elevators will be located. The total length is about 17,000 feet. Mr. O. W. Barnes, of this city, is the engineer. In our SUPPLEMENT, No. 755, a description, with illustrations, of the work was given.

Fig. 10, 10 shows the line of the Hudson River tunnel, now partly completed. This is to extend between New York and Hoboken. It crosses the Hudson River nearly in a line with Leroy Street. It is to have its main New York entrance probably at Fourteenth Street, near Sixth Avenue, although much of this part has not been definitely decided on. This tunnel has been very fully described in several issues both of the SCIENTIFIC AMERICAN and SUPPLEMENT.

On the right hand of this view and far in the distance the New Jersey approaches and connections with the roads to the West and South can be seen.

This view presents a wonderful summary of the present and future of New York. It should be filled in in the reader's imagination with elevated roads, surface cable roads and other means of internal transit.

As an example of the last line of work we present a view of the One Hundred and Fifty-fifth St. viaduct and Seventh Avenue bridge. This viaduct runs from the high ridge of ground to the west of Ninth Avenue to the southern terminal of the new Seventh Avenue bridge. This viaduct has already been illustrated in our columns (see SCIENTIFIC AMERICAN, June 21. 1890). It will form a most striking addition to the metropolitan features. Its connection with the bridge is seen in the distance.

Space will not permit a fuller description of the matters thus briefly treated. The story is well told by the illustrations.

PROFESSOR WILLIAM R. BROOKS, director of the Smith Observatory, Geneva, N. Y., has just been awarded from the Lick Observatory the prize medal of the Astronomical Society of the Pacific, for his discovery of the new comet on August 28, 1892. Two years ago he also won the first medal ever awarded by the above society.

The Brooks comet, for which this latest prize has been bestowed, is in the eastern morning sky. It has grown much brighter since discovery, and will continue to increase in brilliancy until its perihelion passage, at the close of the present year.

Correspondence.

What Keeps the Bicycle Upright?

To the Editor of the Scientific American:

In your issue of date October 29 appears an article by Mr. J. H. McDiannon upon "What Keeps the Bicycle Upright?" While his explanation is ingenious, and doubtless applicable to the rolling hoop, it is, however, unsatisfactory in the matter of bicycling.

At a slow speed the centrifugal force is too slight to have any perceptible effect. Nor can the most dextrous rider maintain an upright position unless in motion, except by a writhing sort of motion of the body. Note this: the track of a bicycle is never absolutely straight, and were the handle bars to exercise no control over the guiding or front wheel, no amount of centrifugal force at the highest speed could maintain an upright position.

At a slow speed the unskilled rider is seen to sway first to one side then to the other, and is taught to turn his wheel toward the side to which he leans. The wheel then becomes upright, and he directs it straight forward until this is again repeated. Increased speed and skill diminish these maneuvers until they become invisible to the eye, but a minute examination of the track in the dust after even the most skilled cyclist reveals them. It is simply a series of rapid applications of a common mechanical law, *i. e.*, the lever. The wheel and rider inclined to fall are the "weight," the momentum is the "power," and the friction of wheel and point of contact with the earth the "fulcrum." Of course dextrous balancing plays a part too. Momentum acts in a straight line, and when the wheel is turned at an angle to this line the rider, being the principal weight, is carried forward and would pass over the upright position and fall upon the opposite side; but, as before said, he directs the wheel straight forward so soon as the upright is attained.

ROBERT A. HATCHER.

New Orleans, October 31, 1892.

Spider Web from the Clouds.

A subscriber living in Gainesville, Fla., sends us for identification a white thread-like substance which he states fell to the earth in large quantities during a rain on September 20. A sample of the material had already been forwarded by another person to the Smithsonian Institution and was thence sent to Dr. George Marx, of the Department of Agriculture, who makes the following report:

"The sample of a white substance which fell in large quantities in Gainesville, Fla., has been handed me by the botanist of this department for examination.

"This very interesting material is without doubt a product of the spinning glands of a spider, or rather thousands of spiders. The chemical reagencies prove it is not a vegetable matter, but animal, and the fact that strands can be dissolved almost infinitely into minute threads, and further, the great length of the strands, hundreds of yards, causes the inference that only a spider could manufacture it.

"The species of this spider is unknown to me, but it is not improbable that it might be a Nephila, a very large orb weaver, which abounds in the southern part of the United States and the West Indies.

"The young spiders of many genera avail themselves of their spinning products to migrate from their birthplace by floating through the air to localities at a great distance. Should rain moisten these weavings, the spider web becomes too heavy to float in the air, and sticking together in great masses, falls from above.

"A similar occurrence was reported to me from Vallicita, Calaveras County, California, November 16, 1891. It has occurred there for the last four years in October and November."

This is the first time this phenomenon has occurred in the South. The web is perfectly white and appears to be a mixture of silk and cotton, but mostly silk.

The Island of Jamaica.

The island of Jamaica was discovered by Columbus upon his second voyage of discovery in 1494. A landing was effected at a place known on the old maps and still known as Oracabassa. Without regard to many changes since then in the occupany of the island, Oracabassa is known to all steamship men as a great banana port.

In 1889 the entire growth of bananas, amounting to two million eight hundred and seventy-nine thousand five hundred and sixty bunches, went to the United States. Of rum manufactured, one million two hundred and sixteen thousand and twelve gallons were shipped to England and thirty-seven thousand four hundred and forty-two gallons to the United States. A railway in Jamaica runs between groves of mangoes, cactus hedges and banana walks, and along streams over which great cocoanut trees lean and pineapple bushes grow, then climbing hills looking upon the beautiful valley below. One wants to be there to realize the beauty of the scenery.—*Confectioners' Journal.*