THE NEW EAST RIVER BRIDGE.

Work upon the new East River Bridge is so far advanced that the completion of the piers for the steel towers is within measurable distance and the masonry of the anchorages inshore is assuming definite shape. On the New York side the piers are completed and capped ready for the steelwork, and the anchorage is well under way. On the Brooklyn side one of the piers is completed (this pier is shown in the illustration), while the foundations of the other pier have been carried down to bed rock and the masonry is being built up to its finished level. The first few courses of masonry in the anchorage have been laid and the anchorage plates and girder platforms have been built in place.

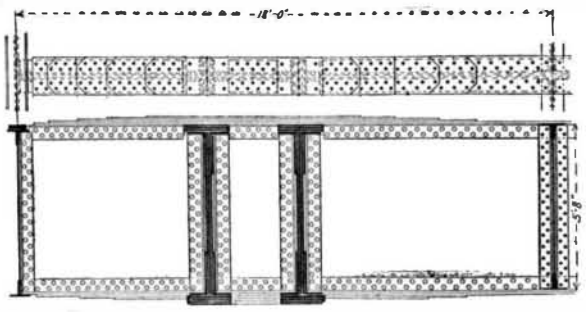
The new bridge will be the largest, the strongest, and the most handsome of the large suspension bridges of the world. Its entire length between terminals will be 7,200 feet, the length of the main span, center to center of towers, will be 1,600 feet, and the extreme width of the floor, from railing to railing of the outside sidewalks, will be 118 feet. The next largest suspension bridge is the famous structure a mile and a half down the East River, which is 1,595½ feet between towers and 3,455 feet long between the anchorages. It is in the great width of the floor and number of railway tracks carried that the new bridge exceeds the older structure. The present bridge is only 80 feet wide as against 118 feet, and carries only four tracks as against six. The new bridge, moreover, having the advantage of later improvements in the materials and methods of bridge building, will be a much stiffer and, relatively to the loads it will carry, a much stronger structure.

The foundations of the towers are timber and concrete caissons sunk in every case to bedrock. Above these are solid masonry piers, two for each tower, which are carried up to 23 feet above high water. Upon each pier, one at each corner, will be laid four massive pedestal blocks of dressed granite to form the footings for the four legs of the towers. The towers consist of four corner posts or legs strongly braced together, the two groups of four on each pier being connected by massive transverse lattice trusses and diagonal ties. The tops of the towers will be 335 feet above the river and 442 feet above the lowest foundation. The center span will be carried upon four 18-inch steel wire cables which will extend inshore 590 feet, where they will be anchored to masonry anchorages. The inshore portion of the cables will not, as in the Brooklyn Bridge, carry the shore spans, but the latter will be supported by the tower, the anchorages, and an intermediate pier. The arrangement is shown very clearly in our front page engraving.

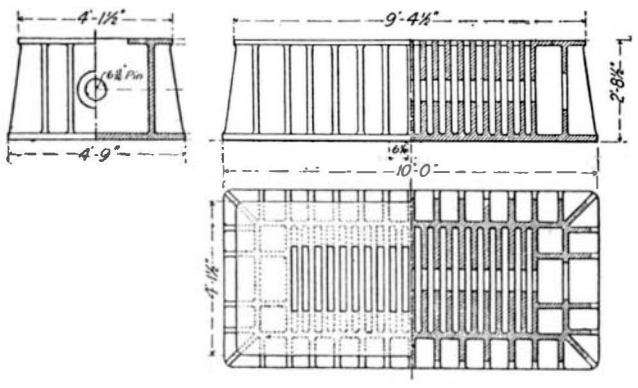
A further point of difference from the Brooklyn Bridge will be the method of stiffening the floor against deformation. In the Brooklyn Bridge this is accomplished by six shallow trusses assisted by a series of stiffening cables running from the panel points of the trusses to the tops of the towers—an unsatisfactory and unscientific arrangement, as the recent buckling of the trusses has proved. In the new bridge stiffness is imparted by two continuous lattice trusses 40 feet in depth and of great solidity. At each panel point of the trusses a deep plate-girder floorbeam, reaching clear across the floor, will be riveted to the trusses. The stiffening trusses will be 67 feet apart, and to support the floorbeams at the center, vertical ties will be carried up from two points on the floorbeams to connect with light transverse trusses which will connect the stiffening trusses overhead.

The new bridge will not have any terminal stations, the purpose being to provide a broad, continuous thoroughfare over which trains, vehicles, and pedestrians may pass without any interruption, the bridge thus forming a part of the street system of Greater New York.

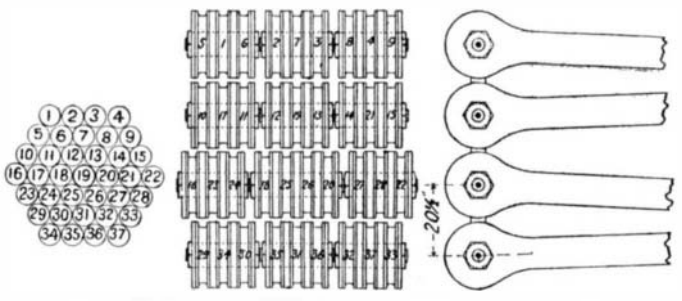
The construction of the piers of the Brooklyn towers is similar to that of the New York piers, which was described in an illustrated article in our issue of August 7, 1897. The only difference is in the depth of the foundations, which in the case of the second of the two piers were carried down to 107 feet below high water. The caissons are, consequently, deeper than those on the New York side, and it was not necessary to introduce the heavy steel stiffening girders which are a feature in the first-named caissons. The last caisson to be sunk passed through 50 feet of water, 20 feet of sand, gravel, and bowlders, 30 feet of hard clay and hardpan, and 12 feet of rock. The rock excavation was rendered necessary by the steep slope of the rock. The rock was stepped out and the lower side of the slope was concreted up to meet the lower edge of the caisson, the whole of the working chamber being ultimately filled with concrete and grouted up with liquid cement.



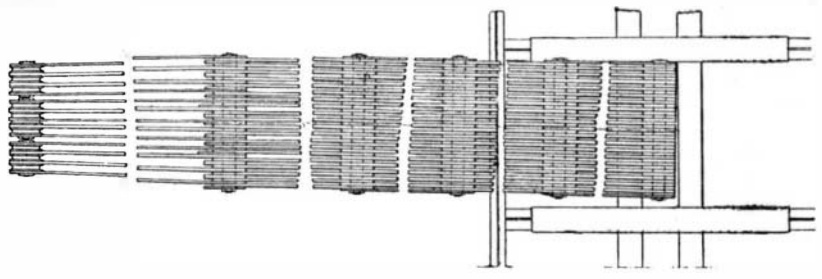
6.—DETAIL OF ANCHORAGE GIRDERS FOR INSIDE CABLES.



7.—ANCHORAGE PLATE—WEIGHT, 11¾ TONS.



8.—METHOD OF ATTACHING CABLE STRANDS TO ANCHOR CHAINS.



9.—PLAN SHOWING ARRANGEMENT OF LOWER ANCHOR CHAIN BARS FOR ALL CABLES.

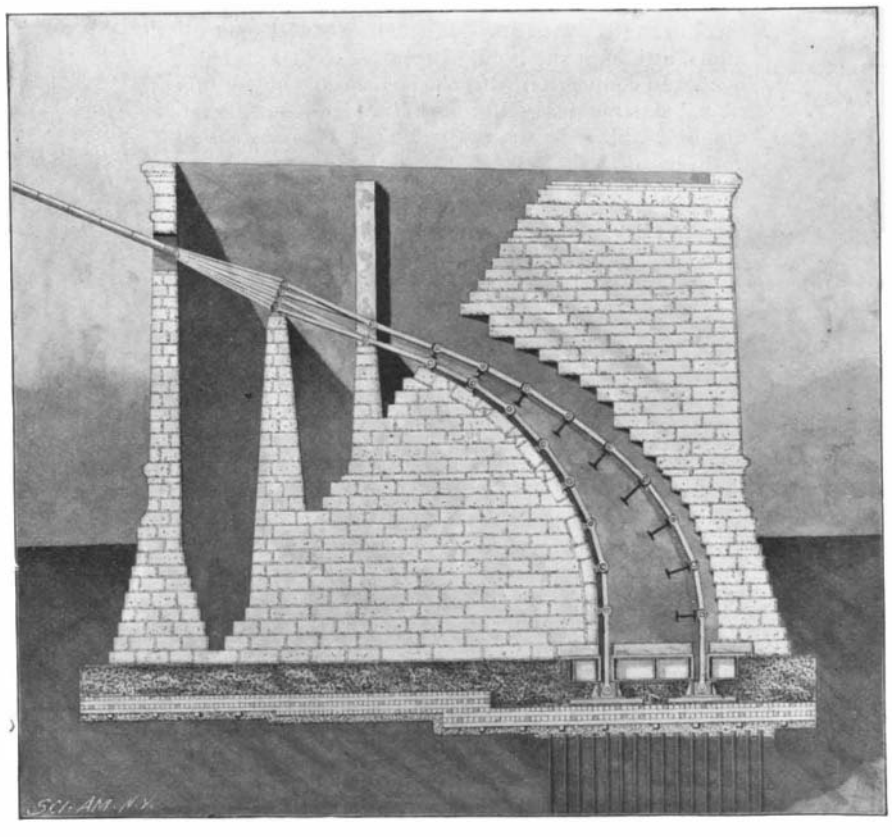
The sinking of this caisson, which was carried out under Mr. James Tabor, was a very rapid and successful piece of work, especially in view of the great depth to which the caisson was carried. The sinking and concreting was done in three months and six days of actual work. The caisson measures 63 feet by 79 feet and contains 74,700 cubic feet of timber and 98 tons of iron, chiefly in the form of drift bolts. Its weight, without the concrete, is 1,965 tons. Above the roof of the working chamber are 6,000 yards of concrete. Above the caisson was a cofferdam 50 feet deep, which contained 29,000 cubic feet of timber and 32 tons of iron. The sinking was accomplished by a gang of men, who worked in shifts of eight hours each, down to a depth of 55 feet. Below this the shifts were shortened, being six hours long down to 70 feet, four hours down to 80 feet, two hours down to 90 feet, one and a half hours down to 107 feet. The shifts were latterly divided into two, each of which was only forty-five minutes long. The pay of the men who carry on this arduous work is increased in proportion to the depth, varying from $2.50 for the eight-hour shift up to $3.75 for the short shifts at the lowest level. One of our illustrations shows an air-lock hoist of the kind used for taking out the excavated material. Another hoist for the men carried a cage 5½ feet in diameter, which has brought up as many as eighteen men at a time. The air pressure at the 107-foot level was 46 pounds per square inch, yet there was very little sickness, and only one case was serious.

The piers are built of limestone masonry up to the low water level, above which they consist of granite facing with a limestone backing. The piers are finished with two heavy coping courses of simple but handsome design, and one pedestal course, consisting of four selected granite blocks measuring 8 feet by 8 feet by 3 feet in thickness.

The anchorages for resisting the pull of the cables will be extremely massive and imposing structures. They will measure 182 feet in width, 158 feet in depth, and 120 feet from the foundation to the coping. Forty feet of the mass will be below the street level, above which it will rise some 80 feet. The excavation at the Brooklyn anchorage was first concreted to a depth of from 18 inches to 3 feet (see view, Fig. 10). Above this was built a platform of four layers of timbers strongly bolted together, while over the platform was laid a great mass of concrete from 6 to 10 feet in thickness, reaching up to high water level. Above this the masonry commences. It is laid in 3-foot courses, and the blocks, as can be seen from the engravings, are several tons in weight. Altogether there will be in one anchorage 44,597 cubic yards of masonry, and the total weight, including concrete platforms, etc., will be 125,000 tons.

The total pull of the four cables will be 20,250 tons. The anchorage could only move by being rotated about its toe, or by sliding bodily forward. To resist rotation the masonry is massed at the rear (see illustration, Fig. 10), the forward half being of hollow construction. Sliding is resisted by the mass of earth 40 feet deep at the toe and by the frictional resistance between the great mass and the earth upon which it rests. The latter is increased by stepping the bottom of the foundation.

The pull of the cables is transmitted to the foundation by eight sets of anchor chains, two to each cable. The strands are separated as they enter the masonry and passed around large spools carried at the ends of the anchor chains. The distribution of the strands is shown in the accompanying cut. The chains are made up of steel eye bars 2 inches thick by 9 inches deep. They are carried through curved tunnels in the masonry down to massive anchorage platforms located at the base of the masonry, where it rests on the concrete. The platform are made of deep and very heavy intersecting girders of steel. There is a single platform for each outside cable and a larger double platform for the two inside cables. The outside platforms are 24 feet by 36 feet and weigh 100 tons each, and the inside platform is 36 by 50 feet and weighs 225 tons. The chains pass down through the platforms and are pinned into massive cast anchor plates of the form shown in Fig. 7. These are strongly ribbed to enable them to stand the great pressure to which they are subject. The object of the platforms is to distribute the upward pull of the chains throughout the mass of the masonry. To further distribute the pull of the chains, they are divided into two sets, one above

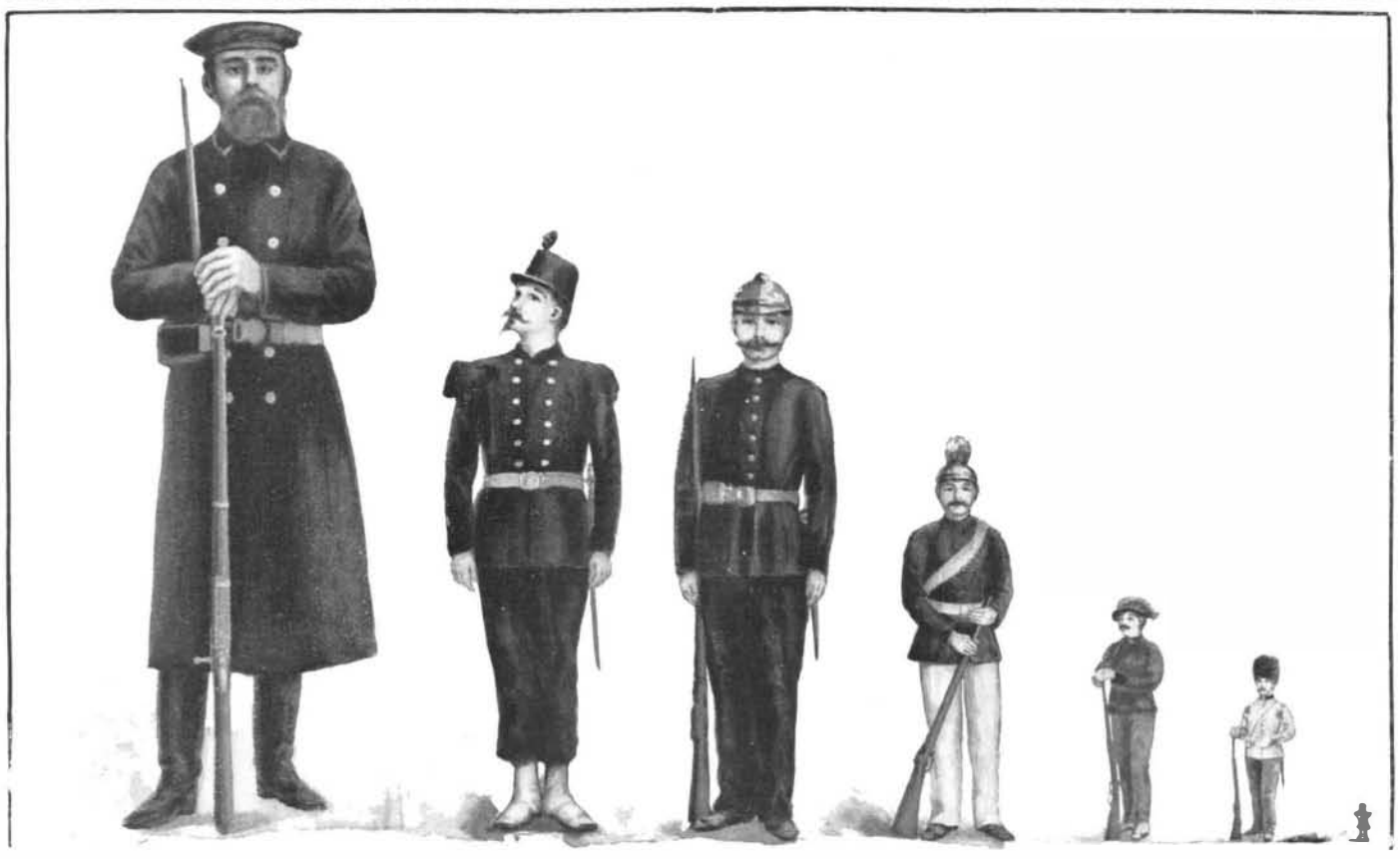


10.—LONGITUDINAL SECTION THROUGH BROOKLYN ANCHORAGE OF THE EAST RIVER BRIDGE.

the other. At each link the chains rest upon the masonry, either directly by means of pedestals or by means of short transverse girders, which transmit the pressure to the side walls of the tunnels in which the chains are laid.

Our illustration, Fig. 2, shows the four anchor plates in the central pit before the anchorage girder platform has been built over them. In Fig. 3 is shown a side platform completed, with deck beams in place ready for the masonry.

We are indebted to the chief engineer, Mr. L. L. Buck, for the plans from which the present article is prepared.



RELATIVE SIZES OF THE WORLD'S STANDING ARMIES GRAPHICALLY REPRESENTED.

THE ARMED FORCES OF THE WORLD.

The plan of the Czar to disarm the standing-armies of Europe, admirable and humane though it be, is, perhaps, too indefinite in character to enable us to form any judgment as to its chances of success, or as to its ultimate results, should it prove successful. Universal peace may be a chimera, a mere dream, but one thing at least is certain—the imperial autocrat's manifesto to the Powers calling for a general convocation for the disarmament of European troops has concentrated the attention of the world on the enormous masses of men supported by the European governments. Time and time again it has been said that all Europe is but a vast camp, that every man is compelled to spend part of his life in a barracks. The evil, instead of decreasing, has become more menacing with each succeeding year. For in the endeavor of a nation to bring its armies to as high a state of efficiency as that of some rival power, it is compelled to augment the number of its troops each year by a constantly increasing ratio. In the struggle for martial supremacy some nations have naturally surpassed others. It would be a most difficult task to ascertain exactly what army is the strongest; for the efficiency of a force depends not upon numerical strength alone, but upon the discipline of the men constituting that force, upon the manner in which these men are armed, upon the term of service, and upon many other factors. It is, therefore, evident that no statistics, however accurate, can exactly indicate how much greater the efficiency of one army is when compared with another. So far as mere numbers are concerned, it would not be difficult to ascertain which army is the largest, and this we have endeavored to do in the present article.

IN GERMANY, 17 CIVILIANS ARE DEFENDED BY A SINGLE SOLDIER.

According to the best information at hand, the peace-armies maintained by the principal nations exclusive of native colonial troops may be tabulated thus:

TABLE I.—ARMIES ON A PEACE-FOOTING.

Russia	860,000	Italy	231,355
France	615,413	Great Britain	168,569
German Empire	585,440	United States	25,000
Austria-Hungary	385,697		

IN FRANCE, ONE SOLDIER GUARDS 15 CIVILIANS.

A RUSSIAN SOLDIER DEFENDS 37 CIVILIANS.

IN ENGLAND, ONE SOLDIER DEFENDS 72 CIVILIANS.

IN THE UNITED STATES, ONE SOLDIER DEFENDS 445 CIVILIANS.

SCIENTIFIC AMERICAN

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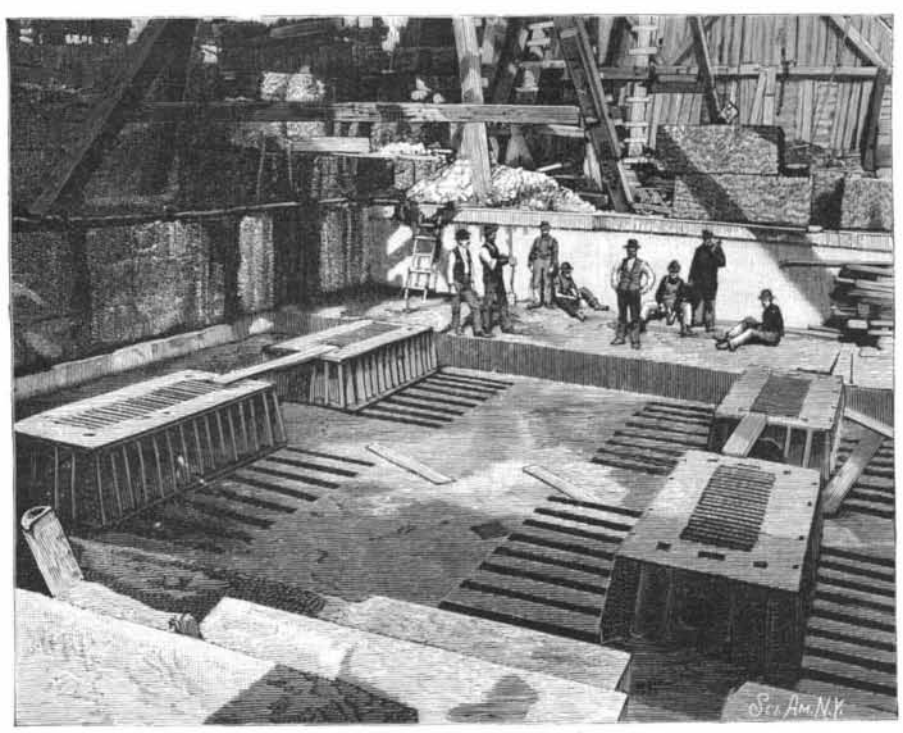
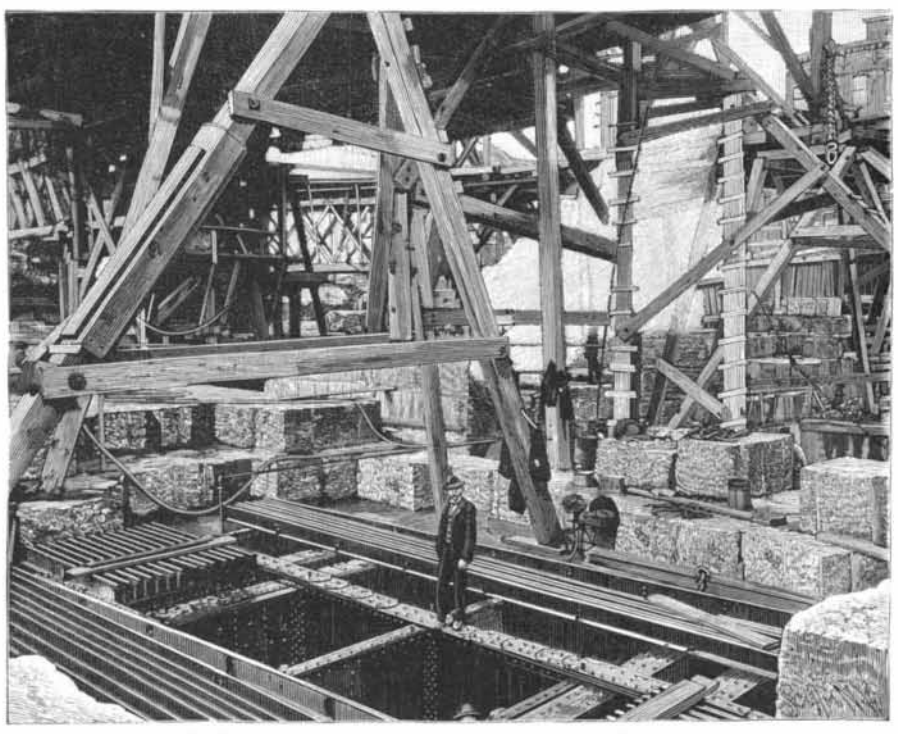
The New East River Bridge.

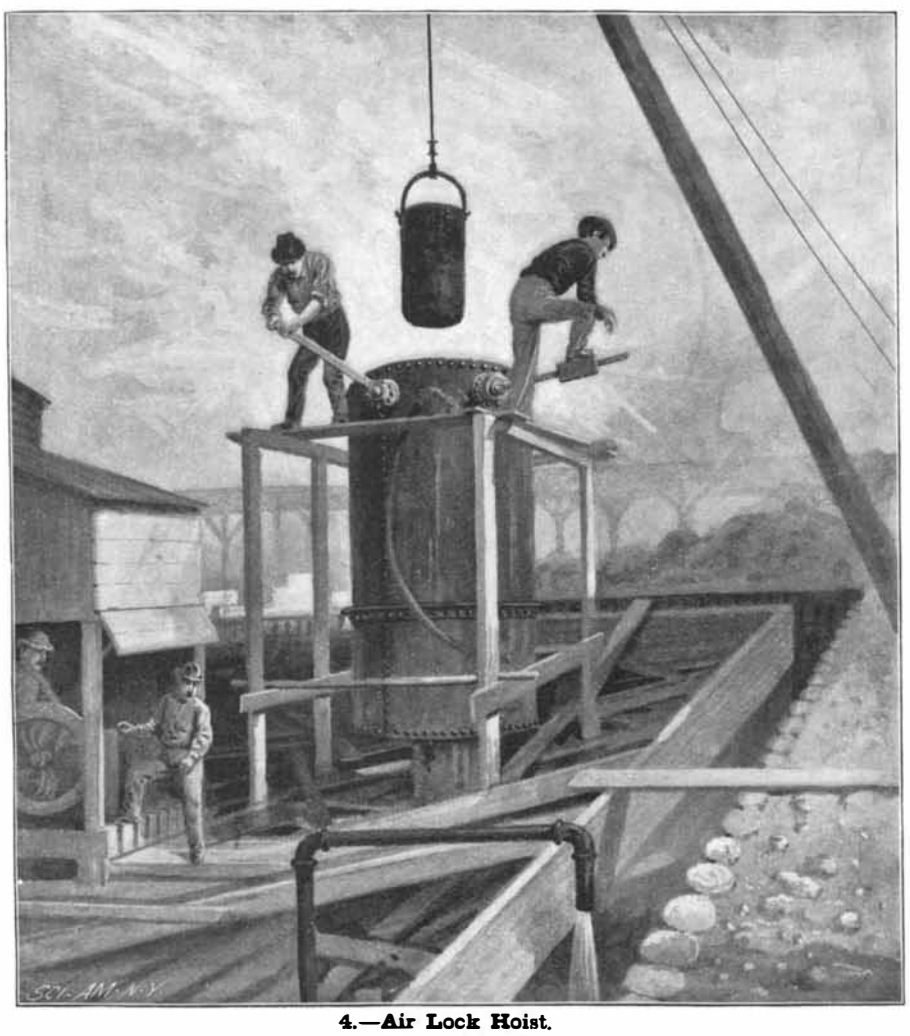
Length between terminals, 7,200 feet; length of main span, 1,600 feet; extreme width of bridge, 118 feet; height of floor above high water, 135 feet; height of cables at top of towers above high water, 332 feet.



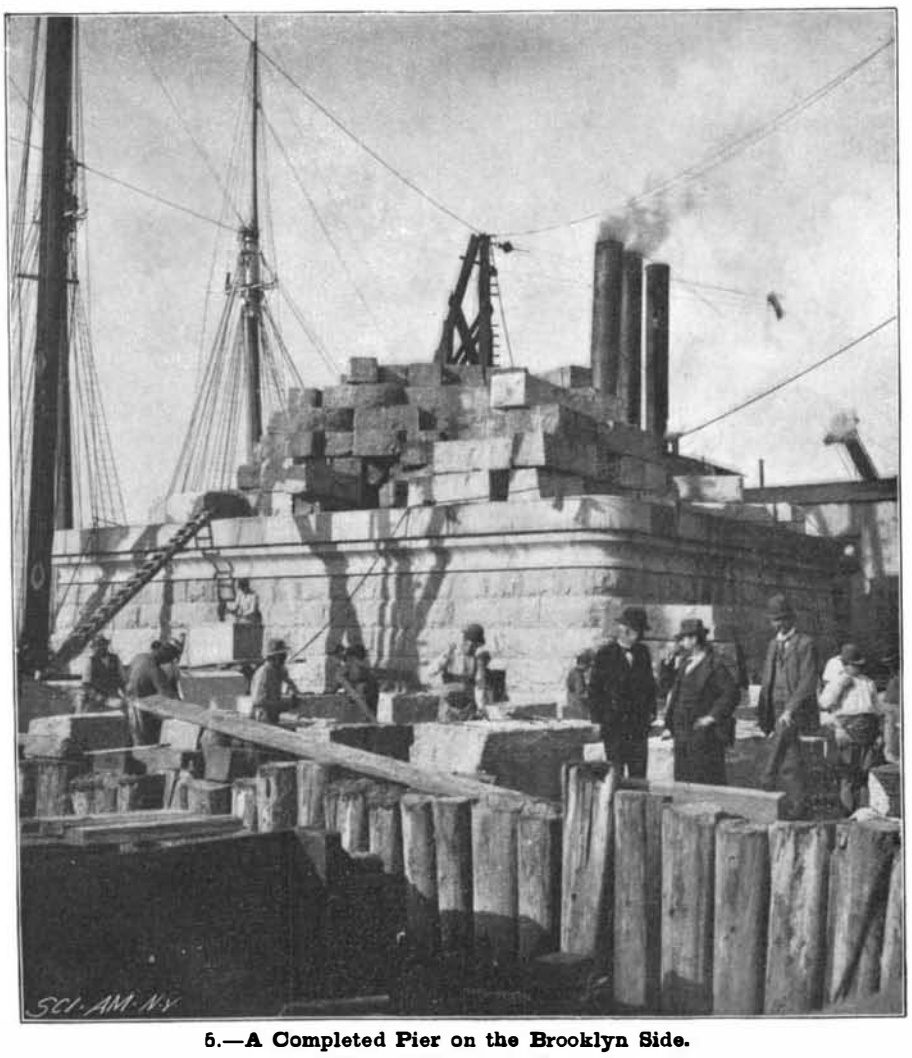
2.—Anchor Plates for Inside Cables, Before the Girders are in Place.



3.—Anchor Platform for Side Cable, with Flooring of Steel Deck Beams to Receive Masonry.



4.—Air Lock Hoist.



5.—A Completed Pier on the Brooklyn Side.

CONSTRUCTION OF THE NEW EAST RIVER BRIDGE.—[See page 10.]