SINKING THE CAISSONS FOR EAST RIVER BRIDGE NO. 3.

The new East River Bridge No. 3, which will span the river between the present Brooklyn Bridge and the new East River Bridge No. 2, which is nearing completion, crosses from the foot of Washington Street, Brooklyn, to the foot of Pike's Slip, Manhattan. It will have a total length between anchorages of 3,165 feet, and a span from center to center of towers of 1,465 feet. The floor will be carried by four steel cables, and like the new East River Bridge referred to, its towers will be built of steel. As originally planned, the floor of the bridge was to have a total width of 120 feet, or 2 feet more than the floor of the new East River Bridge, and provision will be made for a large number of trolley tracks, as well as for two lines to connect with the elevated railroad system. The plans which are under consideration by the Bridge Commissioner contemplate track connections with both the Brooklyn Bridge and the new East River Bridge, and a circulating system of traffic, by which cars can cross by one bridge and return by some other, thereby avoiding the congestion which would occur if the railroads terminated at the bridge entrances, a congestion which is painfully evident every night and morning at the Manhattan end of the Brooklyn Bridge.

In the present article we describe the important work of sinking the caissons which form the foundations of the towers for the new bridge. The caissons for the new East River Bridge No. 2 were four in number, there being two beneath each tower. This arrangement was necessitated by the rather steep slope of the underlying rock at the site of the towers of that bridge on each side of the river; but fortunately the preliminary borings for Bridge No. 3 showed that the surface of the underlying rock was fairly level, and hence it was decided to construct a single huge caisson to form the foundation under each tower.

Our front page illustration shows the process of sinking the Brooklyn caisson, which is located immediately at the foot of Washington Street. The structure measures 78 feet in the direction of the axis of the bridge by 144 feet transversely to the axis. The caisson proper is 55 feet 6 inches in depth, and above this is a temporary cofferdam 44 feet in height, which is built up to prevent the water from flowing into the work during sinking. It will thus be seen that the total depth of this huge box, when it is finally sunk to bedrock, will be just 6 inches short of 100 feet. The walls of the caisson are built up of two layers of 12 x 12-inch timber, the outer one laid horizontally and the inner vertically, while on the outside of this is a double layer of 2-inch planking, the inner laid diagonally, and the outer vertically, as shown in our engraving. The planking is calked to make it perfectly watertight. The bottom edge of the caisson is shod with a half-inch steel plate to protect it from injury as it is forced downward through the silt and sand. Six feet from the bottom edge there is built over the whole caisson a solid roof of timber 2 feet 9 inches in thickness. The space beneath this watertight roof is known as the working chamber, and here are employed the "groundhogs," as the men who are engaged in the work of excavating are called. This working chamber is divided into three longitudinal sections, from which to the surface of the cofferdam there extend nine plate-steel material shafts and one elevator shaft, both material and elevator shafts being furnished with air locks. There are also fourteen 4-inch wrought-iron pipes which extend, like the shafts, from the roof of the working chamber to the surface. At the bottom of each of these pipes is a flexible hose similar to the section hose of a fire engine. At the top of the pipes there are bends which pass over the edge of the cofferdam and discharge into the river. Under the old system of building caissons, it was customary to build the roof of solid timber to a thickness of some 10 or 12 feet; but in the present case the roof is made of the same thickness as the side walls, namely, 2 feet 9 inches, and the necessary strength is secured by building a cofferdam of 12 x 12-inch timbers, which for the first 25 feet above the roof are laid on 12-inch centers vertically and for the next 15 feet of the height are laid on 2-foot centers vertically, the lateral distance between centers being 6 feet. This mass of cribwork is stiffened vertically and laterally by a perfect forest of diagonal trussing, the great depth of this trussed cribwork serving to give a very powerful bridge effect in supporting the load upon the roof of the working chamber.

The caisson, which was built in the Harlem district, was towed down the East River to its site, and sunk to the river bed by loading it with concrete. The material for the concrete is brought by barges to each side of the pier at the foot of which the caisson is being sunk, and a couple of powerful derricks on the pier lift the sand, broken stone and cement, and empty it into a large concrete mixer on the pier. From the mixer the concrete is run through the bottom of a hopper into buckets, which are then picked up by other derricks and dumped into the caisson. The concrete falls among the cribwork and is rammed tight, filling all the interstices from the roof upward.

Under ordinary circumstances, in sinking a caisson the bulk of the material would be shoveled from the bottom of the river that is covered by the working chamber into buckets and then hauled up through the shafts and airlocks, and finally dumped into barges and carried away. But in the present case the material of the river bottom has been found to be such an almost pure sand, that the bucket shafts have been used but very little, and it has been found possible to blow out the materials by the force of the compressed air, which is forced into the working caisson for the use of the workmen. The method of blowing out the sand is as follows: The bottom of each of the 4-inch permanent pipes, which we spoke of above as being fixed in the caisson, has a length of hose which reaches from the roof of the working chamber to the bottom of the excavation. A 4-inch water pipe, which also passes through the caisson, supplies water at 100 pounds pressure to six jets. One of these jets is directed at the sand around each blowpipe, and loosens it so thoroughly that the air pressure in the caisson is sufficient to blow it up through the pipe and out over the edge of the caisson. Thus far practically the whole of the excavation has been done by this method, but very few bowlders and rocks being encountered. The cutting edge of the caisson reached the bed of the river at 20 feet below mean high water. Here it passed through 4 feet of mud, and then entered a deep bed of fine sand which the borings show to extend through a depth of 66 feet. Below this is about 4 feet of coarse gravel, and then is found the solid underlying rock on which the caisson will finally rest, the rock being found at 94 feet below mean high water, or 74 feet below the bed of the river. Considering the huge size of the caisson, the largest ever constructed, the speed of sinking has been remarkable. The work commenced on March 26, and at the present writing the caisson is about two-thirds down. The probability is that by the middle of June it will rest upon the rock bottom.

From what we have already said, it will be understood that the longer side of the caisson lies up and down stream, parallel to the shore. Our front page illustration is drawn looking downstream toward the Brooklyn Bridge, the easterly towers of which are visible in the distance. The side of the caisson is broken away in the drawing in two places for the purpose of showing the elevator shaft and the cage descending with workmen. The construction of the roof, walls and bulkheads of the caisson is also clearly shown, and in the working chamber a workman is seen directing a blowpipe hose against the loose material on the bed of the river. When the caisson has reached solid rock, the whole interior of the working chamber will be filled with tightly-rammed concrete up to the very roof, thus providing a solid concrete and timber mass from the rock level to the top of the caisson, which will be 37 feet below mean high water. The surface will be carefully leveled off, and upon it will be built a solid masonry pier, whose base will be 67 feet by 134½ feet, and whose coping will be 23 feet above mean high water, the total height of the masonry pier being 60 feet. We are indebted to Mr. F. M. Sylvester, the Resident Engineer in charge of the work, for courtesies extended in the preparation of this article.

The Current Supplement.

A large picture of what is perhaps the largest crane in the world constitutes the frontispiece of the current SUPPLEMENT, No. 1378. A full description of the crane is also published. A subject which should be of rare interest to engineers is the purification of feed-water. The article in which this matter is treated is very fully illustrated and very exhaustive. Dr. H. F. Keller discourses entertainingly on the gases of the atmosphere; and Dr. Stephen D. Peet tells something of ethnic styles in Central American architecture, illustrating his text by good pictures. Messrs. Swinburne and Cooper's paper on the "Development of Electric Railways," which has attracted such widespread attention among electrical engineers, is published in the current SUPPLEMENT. The recent Nice automobile races are described, and some of the vehicles that took part are illustrated. An article of timely interest is that on the unveiling of the Rochambeau statue, which is accompanied by a picture of the statue itself.

Iron Ore in Porto Rico.

Dr. David T. Day, Chief of the Division of Mineral Resources of the Geological Survey, returns from a trip to Porto Rico with accounts of the iron resources of the island. His superficial inspection rendered it difficult for him to ascertain how productive the ore beds might prove to be. But it seems certain that there is enough to warrant the growth of a fair-sized industry. Gold is not found in sufficient quantities to warrant a repetition of the Klondike excitement. At present about four hundred families are engaged in gold-mining. The product of their labor is carried to the stores, where it is weighed and given in exchange for food, clothing and cattle.

Automobile News.

In the recent speed trials organized by the Automobile Club over a kilometer course at Gunton Park the highest average speed for four runs was attained by a 50-horse power Napier carriage, which covered the distance at the rate of 44 miles per hour. A 24 horse power Mors car gave an average speed of 41 miles per hour. The road surface was heavy, and two runs were down hill and two up hill.

Emperor William is doing his best to promote the alcohol industry. He has induced the North German Lloyd and Hamburg-American lines to adopt, experimentally, spirit motors on their small harbor craft. It is said that the Krupps are about to order an eight horse power spirit motor for their station at Meppen. The Alcohol Association will supply the spirit for these experiments gratis. What the outcome of these experiments will be is hard to say. That alcohol ought to prove an admirable fuel is evident enough from the recent trials made in Paris and Berlin, but up to the present time no satisfactory alcohol motor has been invented. There is here a chance for inventors.

One of the latest men of prominence to testify to the usefulness of the automobile to a business man in the time saved going to and from his business is Mr. H. C. Frick, the well-known steel magnate of Pittsburg. Mr. Frick uses a powerful machine to cover the fourteen miles from his home to his office twice daily, and the time consumed in the journey is but twenty-one minutes. The millionaire is reported to have said the time saved him by the new means of locomotion amounts to at least half a million dollars yearly. At the present rate of improvement, it will not be long before the automobile will compete with the railroad over much greater distances, and the life of the cinder begrimed commuter will be freshened by a rapid ride to business through the clear morning air from his country seat twenty-five to fifty miles away. Good roads are all that are needed to cause such prophecies to be realized.

An ingenious sparking plug, called the "Seer," has been devised, in which the usual porcelain core has been replaced by a glass thimble. The metal portion of the plug is of the standard pattern, and the glass can be adapted to existing plugs. As a means of viewing the spark while the plug is in place it has obvious advantages, for it is not always certain that a plug needs attention when one unscrews it to see. If the plug is so dirty that the spark cannot be seen through the glass, there is certainly occasion for cleaning, but the advantage of being able to view it from outside is emphasized by the fact that an external spark when the plug is dislodged does not occur under the same conditions as in actual use. The heat and the pressure are disturbing factors, and it is therefore a decided convenience to see that the plug is doing its work correctly. Tough glass, which is less fragile than porcelain, is used, and experiments have shown that the glass is less likely to get dirty than porcelain, probably owing to its higher degree of polish.

The automobile with which Messrs. Lehmess and Cudell have started from London to make a tour around the world, is of the Panhard & Levassor make, with a Centaur motor of 20 horse power, four-cylinder type, with four speeds and rear movement. To avoid breakdowns caused by the igniting apparatus they took three kinds with them: a gasoline burner, an auto-sparker and a third igniter fed by accumulators which they will charge from dynamos. The four wheels have equal diameters and the front wheels may be placed in the rear, being provided with bosses for attaching the chain-wheel. The reservoirs contain 150 gallons of petrol, 25 gallons of water and the same of oil. The weight of the six passengers and baggage is 6,600 pounds. The automobile carries also Mr. G. S. Harvey and Baron de Breyne, besides a mechanic and a cook. The party started from London on the 1st of May. They are to remain in Paris about ten days and will then start on their tour around the world. The route has been carefully studied. They will pass by Brussels and reach Berlin by way of Cologne and Magdeburg. Upon reaching Russian territory they will pass by Posen, Grodno and Wilna to St. Petersburg, which Dr. Lehmess counts upon reaching about the end of May. Then come Moscow, Nijni-Novgorod and finally Ischelbinsk in the Ural region. They will pass through Asia by way of Siberia, through Omsk and Irkoutsk, and traverse China by Urga, Kalgan and Pekin, thence embarking at Shanghai. They will have one stage in Japan, from Nagasaki to Tokio. After stopping at Honolulu they will embark for San Francisco and undertake the tour of America, passing by Mexico, New Orleans, St. Louis, Chicago and New York, after making a point as far as Canada. From New York they will sail for Southampton. The party expects to reach London in eight months, if all goes well. At Paris Mr. Cudell found one of his friends, Mr. O. Heymann, who is to accompany the party with a 12 horse power Ader machine and serve as scout along the road.

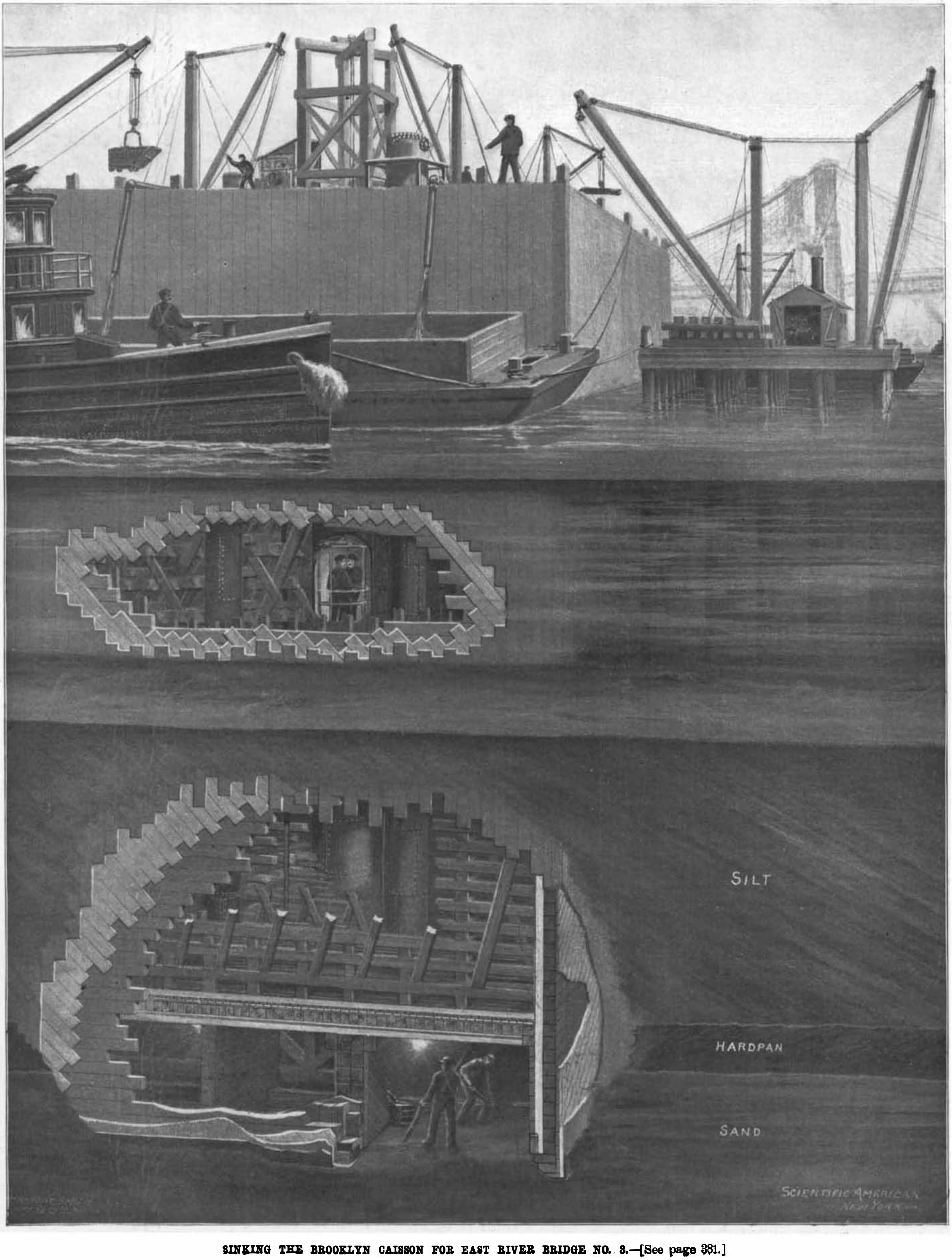
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1902, by Munn & Co.]

Vol. LXXXVI.—No. 22.
ESTABLISHED 1845.

NEW YORK, MAY 31, 1902.

$3.00 A YEAR.
8 CENTS A COPY



SINKING THE BROOKLYN CAISSON FOR EAST RIVER BRIDGE NO. 3.—[See page 381.]