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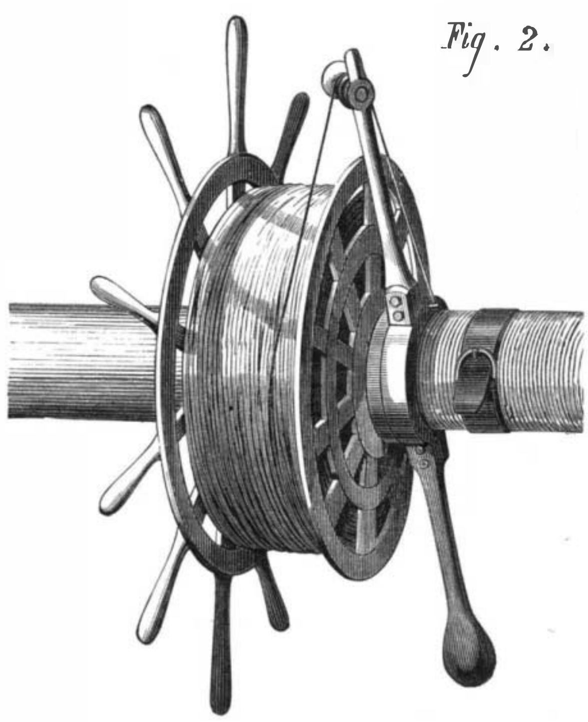
PROGRESS AND PROSPECTS OF THE EAST RIVER BRIDGE.

In following the progress of the East River bridge we have now reached the final stage in the construction of the great supporting cables. The reader will remember that the superstructure of the bridge is to be sustained by four such cables, each composed of 6,300 No. 8 steel wires, lying parallel with each other, making a grand non-twisted rope of steel 16 inches in diameter and 3,500 feet long.

The process of combining the seven interior strands forming the core of each cable was described and illustrated in the SCIENTIFIC AMERICAN for May 18. The accompanying engravings show the method of assembling the twelve exterior strands about the central seven, in the course of which the entire cable is completed and securely wrapped with wire. This is but the repetition on a larger scale of the process of binding the six intermediate strands about the central strand, as already described—with the final process of closely winding the completed cable with wire.

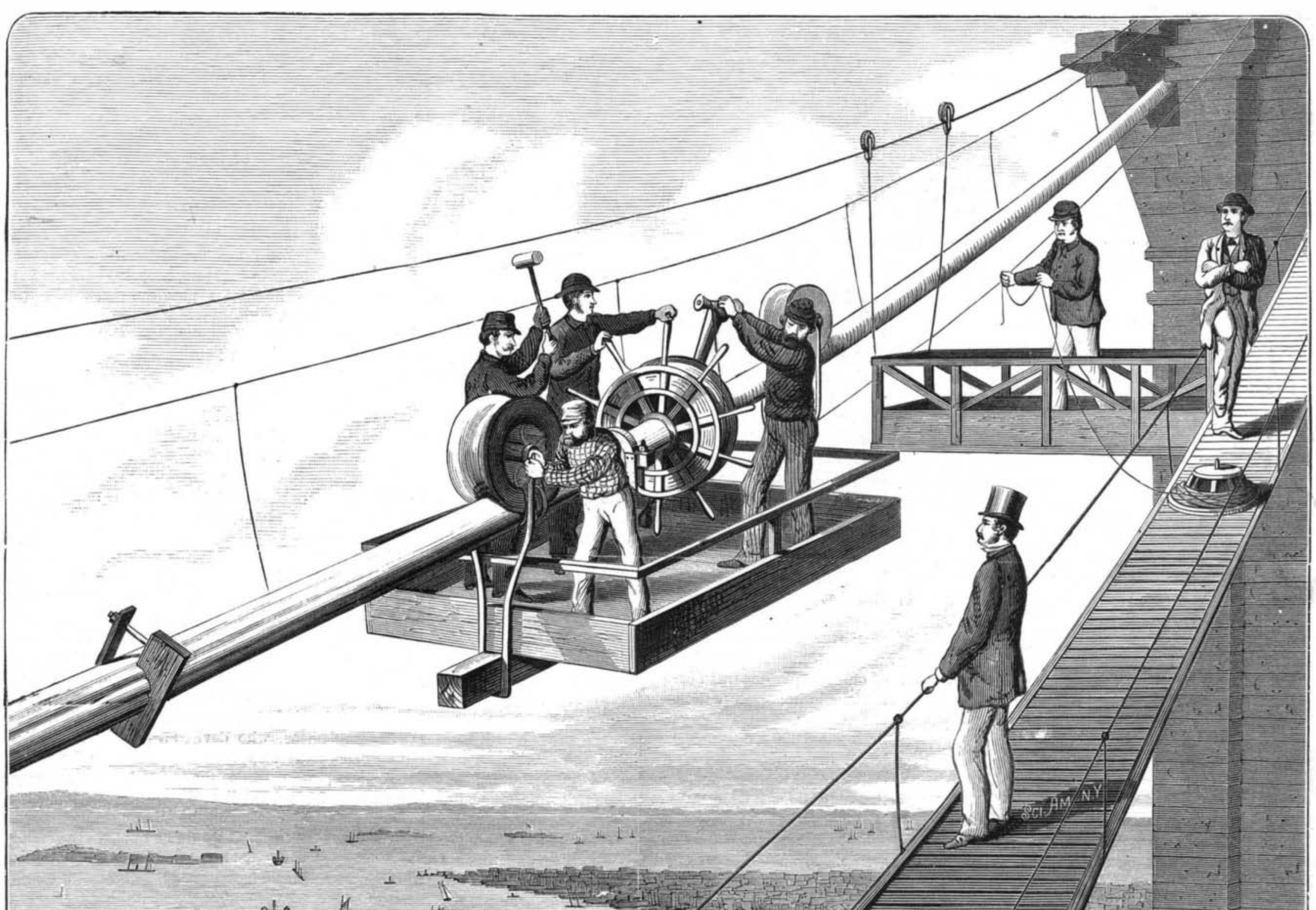
All the strands having been brought together around the core, the lashings of each, and of the central core as well, are removed, and the partially liberated wires are collectively brought into cylindrical form by means of powerful clamps as the winding proceeds. In this operation four men are employed, as shown in Fig. 1. The first manipulates the winding lever; the second attends to the tension of the wire, which he controls by means of the spokes of the drum, while the other two apply the white lead with which the cable is saturated, and with heavy wooden mallets beat the wires together. The winding apparatus consists of a carriage for the workmen, a drum carrying the wire to be wound upon the cable, and a winding lever which turns upon the sleeve of the drum, but independently. The wire is wound upon the drum from a portable reel on the foot bridge, as shown in the upper right corner of the cut.

Fig. 2.



In the process of wrapping the cable the winding wire is carried over one end of the lever (see Fig. 2), thence through a groove in the collar of the apparatus to the cable. The entire apparatus is pushed forward by the pressure of the wire against the collar, the average daily advance being about 10 feet. To hasten the winding, sixteen sets of apparatus are employed, four on each cable. In every instance the winding is begun at the towers, two gangs working shoreward from the towers on each cable, and two from the towers outward to the middle of the river. As a guard against unwinding in case the wire should break, a stout strap is buckled about the cable as close as may be to the winding apparatus.

These operations, though simple in themselves, acquire a special interest from the circumstance that they are carried on at such a gigantic scale and at such an enormous elevation above the river. The length of the river span is 1,595 feet 6 inches; the clear height of the bridge at the center of the span is to be 135 feet above high water; and the total height of the towers 277 feet. The entire length of the bridge is 5,989 feet; its width 85 feet. Its construction was begun in January, 1870.—[*Continued on next page.*]



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VOL. XXXIX., No. 19. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, NOVEMBER 9, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 149,

For the Week ending November 9, 1878.

Price 10 cents. For sale by all newsdealers.

Depth of Nevada Gold and Silver Mines.

The Sierra Nevada mine is at a depth of 2,200 feet; Ophir, 108 feet on stope below 2,100 feet; Consolidated Virginia and California are 2,050 each; Gould & Curry, 1,900; Savage, 2,300; Hale & Norcross, 2,300; Chollar Potosi, 1,850; Imperial, 2,400; Consolidated, 2,400; Bullion, 2,200; Yellow Jacket, 2,400; Crown Point, 2,360; Belcher, 2,360; Julia, 2,100; North Consolidated, 1,425. Levels in North Consolidated are 1,100 and 1,425 feet from the surface.

THE EAST RIVER BRIDGE.

[Continued from first page.]

At the outset the estimated cost of the bridge, exclusive of the land, was $7,000,000. When at the death of his father, Colonel Roebling, the present engineer in chief, Mr. W. A. Roebling, took charge of the work in 1872, he raised the estimate of cost to from $8,000,000 to $9,500,000. In 1875 the directors asked and obtained an appropriation raising the expected outlay to $13,500,000. Even this vast sum is now found to be insufficient; and the probability is that the amount needed will not be less than the estimate made by the SCIENTIFIC AMERICAN, some five years ago, namely, $20,000,000, a sum nearly double what would be needed—as was shown in this paper February 3, 1877—to provide at least fourteen tunnels crossing under the East River at as many principal streets.

Already the limit fixed by the Legislature has been passed, and yet the work is far from completion As a natural consequence the undertaking has aroused the strenuous opposition of influential parties, who insist that no more of the city's money should be expended on account of the bridge until the courts decide that it must be paid. Prominent in this connection is the New York Council of Reform, whose president, Mr. William H. Webb, the eminent ship builder, has lately given an elaborate statement of the grounds on which their opposition to the bridge has been based. A summary of his argument will be given below. How far the charges against the bridge—on the score of its injury to commerce, its incapacity to meet the needs of the two great cities which it is to unite, and its inability to withstand the force of storms such as that which has just made such havoc along our coast and in neighboring cities—how far these charges are true, how far exaggerations of fact, we shall not now attempt to discuss. We give them as an essential element in the history of the great bridge.

Under the head of injury to commerce, Mr. Webb asserts that two thirds of the 19,534 sea-going vessels that came into this harbor in 1876 had to pass the towers of this bridge, some of them several times, in the process of loading, unloading, and repairing; and that the masts of a large majority of these vessels were found to be too high to pass under the flooring of the bridge under all conditions of weather and the crowded occupation of the river.

The cost and delay of taking down and replacing the top masts, and the frequency of the collisions of ship masts with the cables of the bridge, are said to be so great that it has already become the practice to insert in the charters of vessels coming to this port the conditions that they shall not pass this bridge, or, if compelled to do so, shall receive extra allowance. Since the commerce of this city is its life, and has a State and national importance, no such injury to it can be tolerated.

In view of the circumstance that the United States Government, in the interests of the whole country, is spending many millions in removing the natural obstructions to commerce at Hell Gate (the eastern entrance to New York harbor, on the same channel the bridge is to open), the Council insist that it is not to be supposed that it will neutralize these improvements by imposing a still greater obstruction in the same river by this bridge, especially when such obstructions are expressly prohibited by the laws of this State; and that with so strong a presumption that the bridge will be judiciously condemned, it is a criminal waste to spend any more of the public money upon it, at least until a final decision of this question has been rendered.

Under the head of excessive cost it is urged that, since the act of the Legislature authorized only the construction of such "a bridge as should render the travel of the people of this district certain and safe at all times, and whose cost should not exceed $8,000,000 when completed and open to the public, with all its debts and liabilities paid;" and since the Engineer's estimates show that the bridge cannot be completed for less than double the sum allowed, any further work upon the bridge is unauthorized and illegal, and the further issue of city bonds on account of the bridge should be stayed until some competent judicial authority shall decide that they must be issued.

Touching the incapacity of the bridge to facilitate either passenger or business traffic across the East River, Mr. Webb claims that the bridge will sustain per hour the weight of only 250 passengers in cars and 10,000 moving on foot at the usual rate; while at the busy periods of the day, morning and evening, Fulton Ferry alone carries 20,000 an hour. Seeing that 190,000 passengers are daily carried both ways by all the ferries between New York and Brooklyn, it is claimed that the bridge will not begin to meet the demands that may be made upon it, in case the ferries are suspended by ice or otherwise.

Still more serious is the charge that the bridge will not be secure. Mr. Webb says: "This is wholly an experimental bridge. It is the highest and longest in the world, and probably the only one entirely unsupported by any form of stays. The history of suspension bridges in this country and in Europe shows their most dangerous exposure to be that to storms, producing oscillations and ruptures. Five of the largest suspension bridges in this country, and several in Europe, have been destroyed within a few years after their erection in this manner, although all of them were substantially stayed. The Engineer-in-Chief of this bridge, in his report of March last, asserts: 'During the severe northeast gale of January 31 last it would have been extremely dangerous to have sent trains across on narrow gauge.' This storm, which was not at all exceptional for its violence, Mr. Roebling estimates at 21 pounds per square foot pressure, which is 1-6th greater than the sustaining power of the bridge, and expresses the opinion in this report that a train of cars on either a 4-foot 8-inch track, or 6-foot track, would be upset by a wind pressure 17 per cent less than this, and asks: 'Who can guarantee that the wind will never blow with stronger force?' He instances a recorded case of the velocity of the wind during the last year at 186 miles an hour, or about 170 pounds pressure per square foot. If, then, railroad cars, with their low iron wheels and heavy structure, are liable to be overturned by frequent storms, what must be the liability of top-carriages and business vehicles, with their high wheels, lighter structure, and narrower gauge? What is the liability of foot passengers? What of the bridge itself, with its 130,000 square feet of flooring, and the 17 per cent storm resistance of its trusses? If an eddy of air were to strike the bridge from beneath with greater force than its own weight it would be lifted, to crash back again with its destructive momentum of thousands of tons."

Another source of peril lies in the circumstance that while the bridge will provide space for 5,000 passengers in the car-division and twice as many more on foot, it will bear the weight of only 2,400 at one time, and these equally distributed.

"How are these conditions to be secured in a public bridge 'at all times' when there are at least six hours each day during which, if the ferries are stopped, there will be a pressure for freight and passengers at least ten times greater than the bridge can sustain?"

Again, Mr. Webb urges, the weight and working of the endless rope for propelling the cars is likely to prove a fatal strain upon the bridge. "The iron cable, more than two and one-fourth miles in length, must be of sufficient strength to overcome the friction of the wheels upon which it rests, to carry its own weight, and the car attached to it, at a speed of 15 miles an hour up and down a grade of 100 feet, revolving around drums 6,000 feet apart, and frequently stopping and starting. As this cable is held by drums at each terminus of the bridge, 100 feet lower than it is at the center, when the horizontal power is applied to revolve the cable, it must bear down the center with a crushing perpendicular force."

The feasibility of the method of moving the cars is doubted, Mr. Webb says, by all the best engineers the Council have consulted, while the Engineer-in-Chief of the bridge has condemned the only other method, the use of locomotives, for the reason that the structure has neither been designed nor built to bear such heavy concentrated loads.

In view of these strongly put if not inherently strong objections, Mr. Webb insists that it would be foolish, if not wicked, to spend more money on "a bridge that is not called for, cannot be made to answer the purposes for which it was professedly built, very seriously damages a large part of the commerce of this harbor, taxes the financial ability of these two cities to their utmost, and cannot fail either to be taken down by the mandate of the courts or demolished by the winds."

PROFESSOR MORTON ON THE ELECTRIC LIGHT.

In a lecture before a meeting of the American Gas Light Association, at Stevens Institute, Hoboken, October 17, Professor Morton reviewed the progress made in producing light by electricity, and discussed at some length the question of competition between electricity and gas. In tracing the history of the electric light he said that it is, as applied to practical purposes, essentially a phenomenon of magneto-electricity, or the mechanical production of electricity, because electricity produced by the battery is only used as a matter of scientific interest. In this sense the possibilities of the usefulness of the electric light originated with Faraday's discovery of magneto-electricity in 1831, as everybody knows. This was followed within a year or two by the invention and construction of magneto-electric machines by Saxton, Clark, and others, and these were developed in size and power by Holmes, and by the various inventors whose work is embodied in the machine known as that of the Alliance Company, in Paris, a machine capable of producing a very brilliant electric light, but very bulky and very expensive, requiring immense power to drive it. Its use was consequently limited to the Falmouth lighthouse, in England, and to some French lighthouses and works of construction like the Cherbourg docks.

The first decided improvement upon this machine was made by Siemens, who devised a peculiar form of armature. The next step forward was made by Mr. Wild, of England, who made the remarkable discovery that if a current from a small magneto-electrical machine was made to pass around the coils of a large magnet, the attractive power of that magnet would be immensely greater than the force of the magnets in a small machine. Thus by working a small machine, passing the currents through electro-magnets of a large one, and then taking from the armature of the large machine the current to be used, he obtained great electric power in a small compass. Almost at the same time Wheatstone and Siemens made similar improvements, and a machine, between them and Ladd, of London, received another development by having this curious combination introduced. A single set of electro-magnets were employed, with an armature between the poles wound with two coils, one coil being so connected as to pass the current through the electro-magnet itself, and the other supplying a current for exterior use. In this way the machine, as it were, excited itself, and then yielded a powerful current for exterior work.