of the cylinder length; that is, a picture or cut which occupies the whole length of the cylinder, 8 inches, will be transmitted in 8 minutes time. In the reproduction of a very fine-meshed picture, the stylus of the transmitting machine and the pen of the receiving machine will rule 80 lines per inch. Coarser pictures are transmitted at the rate of 40 lines per inch, or in 4 minutes. The space occupied by a cut in a newspaper could be filled by an equivalent number of words telegraphed by an ordinary operator at a speed of 25 or 30 words per minute. Hence, the time required in transmitting a picture by means of the electrograph is exactly the same as that consumed in telegraphing a verbal message. About 40 minutes are required to prepare the zinc plate for transmission and about 30 minutes to prepare the picture reproduced by the receiving machine for newspaper printing. On a 1,500-mile circuit 80 minutes suffice to prepare a zinc enlargement, transmit the picture, and reduce the picture reproduced for the press. Of this time not more than 10 minutes are consumed in transmission. Machines with cylinders thirty inches in length, having two carriages, are now in the course of construction and are to be used in duplex transmission, one picture being sent simultaneously each way over a single wire. A machine thus receives and sends a picture at the same instant. With two instruments at each end of the line, a quadruplex transmission is possible, four pictures being sent over the wire simultaneously. Thus the average time of transmitting a picture is reduced to two minutes' wire service. That these speeds can be practically attained has been proven time and time again by severe tests made over the Western Union, American Telephone and Telegraph Company, and the Associated Press wires.

FLOOR SYSTEM OF THE NEW EAST RIVER BRIDGE.

In comparing the greatest bridges of the world—and it seems as though we can only arrive at a correct idea of the proportions of one of these great structures by expressing it in terms of some other one—it is impossible to say of any particular bridge that it is, in the total, the greatest of its kind. One bridge may have the longest single span, and another the greatest number of extremely long spans; to another may belong the distinction of having the greatest carrying capacity, while a fourth may be distinguished by the magnitude of certain parts, such as the foundations, which are entirely hidden from view. In respect of the length of its main span, the present Brooklyn Suspension Bridge is practically the equal of the new East River Bridge, the new structure having a span of 1,600 feet between towers and the older bridge being five or six feet less. In over-all measurement, indeed, the Brooklyn Bridge greatly exceeds the new structure, the distance from anchorage to anchorage being 3,455 feet 6 inches, whereas the distance between anchorages of the East River Bridge is about 675 feet less than this. Although the total length of the steel structure of a bridge is what we might call the most spectacular feature of its measurement, the true test of the capacity of these modern, long-span bridges is the width of the floor system, or its capacity for traffic. Judged on this basis, the new East River Bridge is considerably the largest structure of its kind in the world.

With a view to giving the reader an adequate impression of the carrying power of the new bridge, our artist has prepared the cross-sectional view which is found on the front page of this issue. The section is supposed to be taken at a point about a third way across the main span, starting from the Brooklyn tower. As the parts of the bridge at the point of section are shown to exact scale, the drawing not merely affords an admirable perspective view of the finished structure, as it will appear to a passenger in crossing the bridge, but it shows with great detail the exact proportion of the various members, the method in which they are assembled, and the functions which they severally perform. For purposes of comparison it may be mentioned that the extreme breadth of the suspended structure of the Brooklyn Bridge is 85 feet; whereas the extreme width of the floor of the new East River Bridge will be 118 feet. The total width of the latter is about evenly divided into five separate roadways. Of these, the center roadway, which is devoted to the elevated cars, contains two tracks, one for east-bound and the other for west-bound traffic. On each side of the elevated tracks are two street-railway car tracks, while beyond these, on the extreme outside of the bridge, are two carriage roadways. Above the street railway tracks are two platforms, each divided at about its center by an iron railing. Of the four roadways thus formed those on the outside are devoted to bicycle traffic, while the inside roadways are given up to foot passengers.

The great load of the suspended roadway is carried by four steel wire cables, in each of which there are 10.397 wires, 0.165 inch in diameter. The wire has a breaking strength of 100 tons to the square inch. The floor system is suspended from these cables by steel wire ropes, 1¾ inches in diameter, which are carried up and over steel saddles clamped upon the main cables. Each suspending cable is continuous; that is to say, it is carried over the cable saddle and below a bottom suspension saddle, the two ends being coupled in a sleeve. Two heavy inverted steel U-bolts depend from each bottom suspension saddle and are bolted beneath the covering plate of the bottom cords of the trusses.

If the floor system of a suspension bridge were at all times equally loaded from end to end, there would be no danger of a deformation of the cables, and the floor would maintain a true surface. But since the traffic is liable to be concentrated or "bunched" at one or more positions on the bridge, it is necessary to stiffen the floor system to resist the vertical distortion which would otherwise result. This stiffening is afforded by two massive stiffening-trusses, each 40 feet in depth, which extend entirely across the bridge from anchorage to anchorage. These trusses are located immediately on the outside of the street railway tracks, and lie in a vertical plane between them and the carriageways. The bottom chord of the truss is of the same depth as the floor system into which it is built, and with which it is firmly incorporated. The floor proper of the bridge consists of a series of transverse plate-steel girders, 5 feet in depth, which extend entirely across the floor from side to side. These girders are placed 20 feet apart and the gaps between them are bridged longitudinally by lines of plate-steel stringers, of about half the depth of the floor beams. There are twenty of these lines of stringers counted across the width of the bridge, and they extend entirely throughout the structure from end to end. The load of the roadways is carried by the overhanging, cantilever-like, ends of the floor beams, and the middle portion of the floor beams between the stiffening trusses is supported at two intermediate points from a series of overhead trusses, which are built in between opposite panel-points of the top chords, at every 20 feet of the length of the bridge. The advantage of this method of construction is that it saves weight, and also enables the floor beams to be made many feet shallower than they would have to be were they not thus supported.

The stiffening trusses are constructed on the riveted system in preference to the eyebar system, which was at one time so greatly in vogue as to be considered the typical American construction. As a matter of fact, in the whole of this bridge, there is not, as far as we know, a single eyebar used, except at the anchorages, where eyebar chains extend through the masonry to take hold of the anchorage platforms. The web members of the stiffening trusses are arranged on the triple-intersection plan and they consist, as do also the members of the lateral system, of heavy angles placed back to back and latticed together. The bicycle and foot-passenger platforms are carried upon plate steel floor beams which are supported at their outer ends by the web members of the stiffening trusses and at their inner ends are riveted to the vertical ties connecting the overhead trusses with the floor beams.

In a suspended structure of this great span, presenting such a large total area to the pressure of the wind. it becomes necessary to make special provision to resist wind stresses. As far as the floor system is concerned, this provision consists of a heavy horizontal system of trussing between the top chords of the stiffening trusses, while in the plane of the floor of the bridge sufficient resistance to lateral distortion is afforded by the manner in which the longitudinal stringers are riveted intercostally between the floor-beams; the tensional stresses, due to a wind blowing transversely across the bridge being resisted in the leeward half of the floor by the stringers and the bottom chord of the stiffening truss, and the compressive stresses being similarly resisted by the stringers and bottom chord of the windward half of the floor system. The wind stresses are also resisted by the "cradling" or inclining together of the cables.

The upper view of the East River Bridge on our front page was taken from a position slightly to the rear and to the side of the Brooklyn anchorage. The cables, which are shown stretched in position, are those which have been strung for the purpose of carrying the temporary platform, from which the four main cables will be constructed. The latter will be assembled and the wrappings and clamps put on at an elevation slightly higher than that at which they will be finally suspended. When they are completed the temporary platform cables will be removed, and the main cables will be lowered to their permanent position. The next step will be to hang the suspending cables upon the main cable saddles, and then to the lower end of these will be gradually attached and built together the heavy framework of intersecting floorbeams and stringers. Upon the foundation thus prepared will be erected the great 40-foot stiffening trusses, with their intermediate trusses for carrying the railway tracks and the passenger platforms.

Engineering Notes.

A large seven-story building in Chicago has just been raised without cracking a pane of glass or marring a wall. The building was raised 21½ feet with the aid of a steel sub-structure and 1,500 jacks. The work was completed in twenty-one days.

Consul General Guenther, of Frankfort, reports that on the 20th of March official tests of so-called fireproof stairs for apartment houses were made at the yards of one of the fire-department stations in Frankfort, where intense fires had been started for the purpose. The stairs covered with plastering showed the longest resistance and could still be used after being subjected to the fire for twenty-five minutes. Of stairs coated with fireproof paints, no tangible results could be stated, as the stairs experimented with were of great variety as to material and strength; but they were still serviceable after five or ten minutes under fire. Of the wooden stairs without fireproof paints, those of oak withstood the fire the longest.

On March 1 a mail train, consisting of engine, mail car, baggage car, and sleeping car, was run over the Savannah, Florida & Western Railroad from Fleming, 24 miles south of Savannah, to Jacksonville, Fla., 149 miles, in 130 minutes, or at the rate of 68.8 miles an hour. This time includes one stop, and there were two other places where speed had to be slackened. It is stated, says The Railroad Gazette, that the time taken in covering five miles between the sixty-ninth and the seventy-fourth milestones was 2 minutes 30 seconds, a speed of 120 miles an hour. The engine was a ten-wheeler, burning bituminous coal. It weighs 65 tons, of which 48 tons is on the drivers. The cylinders are 19 inches by 28 inches, and the driving wheels are 73 inches in diameter. The boiler is the extended wagon-top type, with 300 flues 2 inches diameter and 14 feet long.

An expedition of a private character dispatched from Norway last summer to Spitzbergen to exploit the coalfields there, has returned to Throndhjem with good results. In Advent Bay large coalfields were discovered and seized, and some 500 hectoliters brought home as a sample. The coals, which are said to resemble anthracite, are reported by experts to be of good quality. A company is in course of formation in Throndhjem in order to work these coalfields. In addition, a cargo of coals has been brought from the well-known deposit at Cape Boheman, and they have been tried on the state railways and otherwise. The drawback to these coals is, however, that they leave a very large quantity of porous slag in the furnaces, and are quite unsuitable for locomotives. The slag, or deposit, of scoria would also prevent the use of the coals for domestic and factory purposes.

A machine for extinguishing fires in ships' holds recently introduced into Great Britain depends for its action on the generation of sulphurous acid gas, which is forced into the chamber in which the conflagration has occurred, and which, by replacing the air, so vitiates the atmosphere that combustion cannot continue. The machine consists of a generating chamber, into which air is forced by a fan, and in which a store of sulphur is placed. This can be simply ignited by throwing upon it a piece of burning waste. The gas thus generated is forced into the chamber, and after a while extinguishes the flames. Attached to the apparatus is also a condenser, by means of which, the fire once extinguished, the gas is passed through and through the chamber as it cools, until the materials which have been burning are reduced to such a temperature that they do not burst into flame when the air is at length introduced. This is brought about by a gradual process.

A series of interesting experiments on the explosive effects of the modern infantry bullet have been carried out in Germany by C. Cranz and K. R. Koch, says Nature, London. They used a new Mauser rifle of 6 millimeter (½ inch) bore, having a muzzle velocity 100 meters (328 feet) greater than model 88. To imitate the effect upon large bloodvessels, while at the same time obtaining simple physical conditions, the experimenters constructed short, hollow tin cylinders filled with water, and closed at one end with a sheet of rubber and at the other with a sheet of parchment paper. Electrodes were mounted before or behind the cylinders, or inside them, and the discharge spark produced by the bullet was utilized to obtain a photograph of its silhouette at various points of its path. Among the important facts thus elicited it appears that the body struck is not displaced by the entry of the bullet. On leaving the body, the bullet carries away with it a small part of the hind surface, having a small round perforation through which the bullet passed. The explosion does not take place until the bullet has left the body. After discussing the evaporation, hydraulic pressure, rotation, and sound-wave theories of the explosion, and discarding them all, the authors conclude that the apparent explosion is due to the transfer of kinetic energy to the portions hit at later stages, which are thus torn away from those first encountered.

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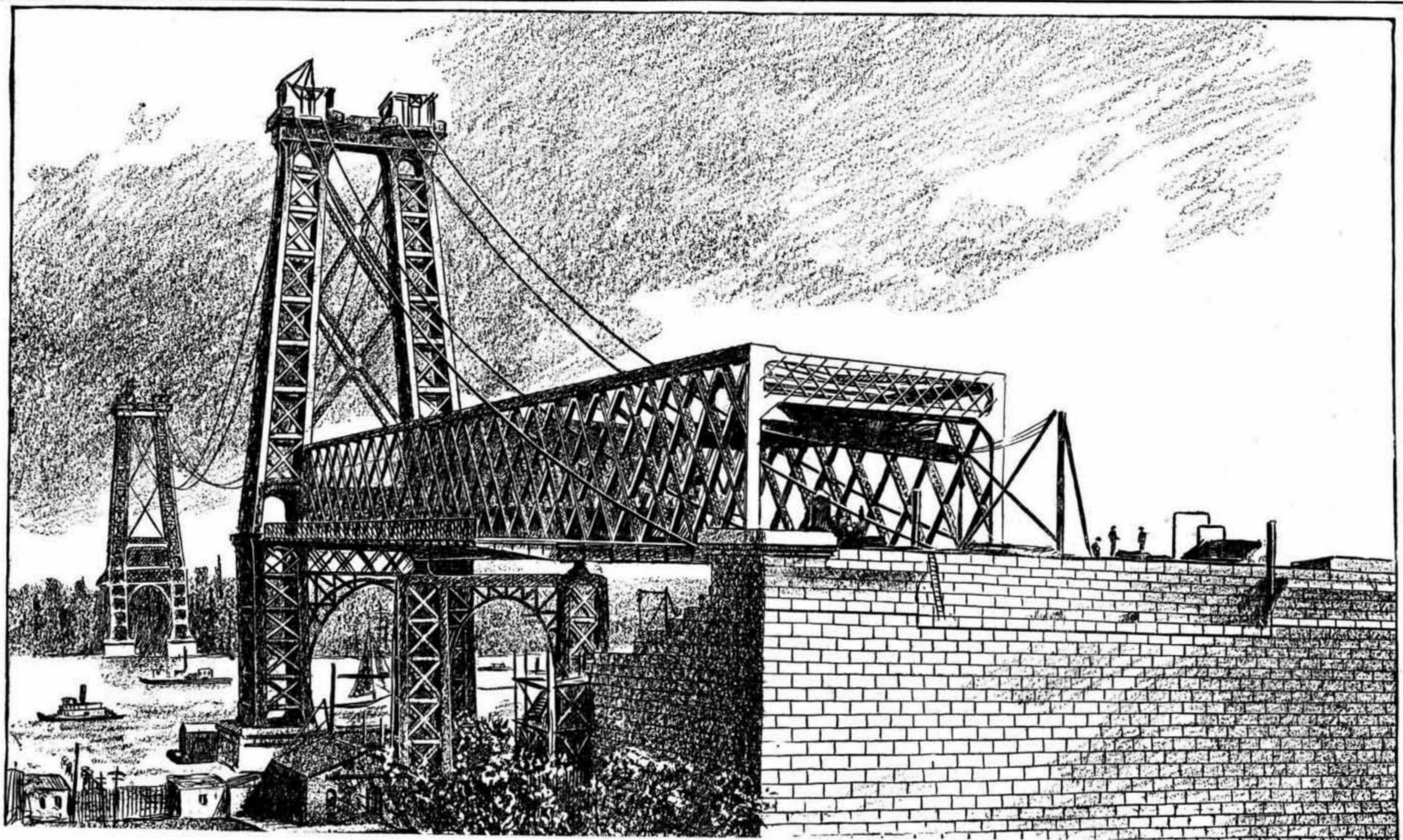
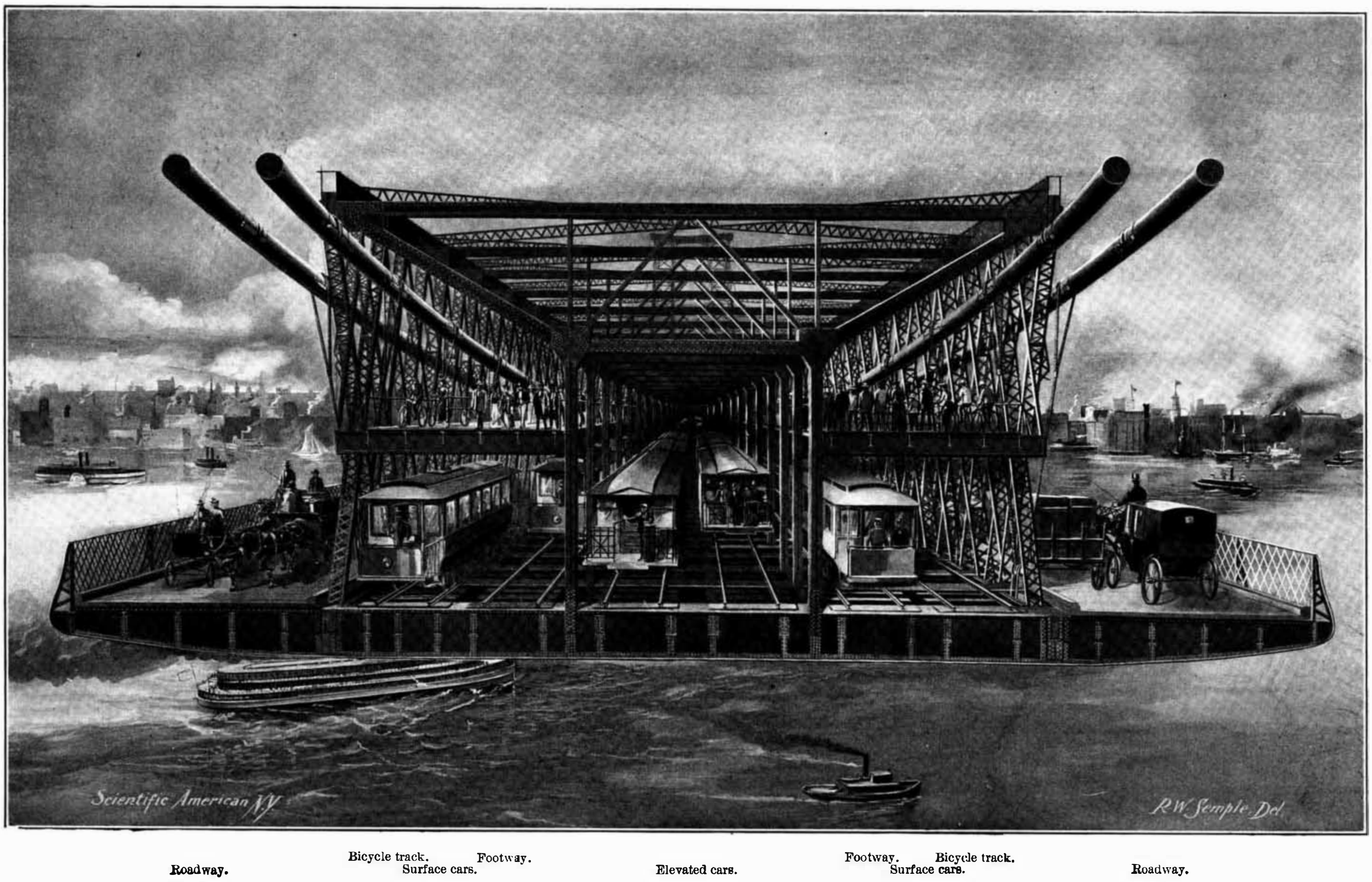


View of East River Bridge from Brooklyn, Showing Temporary Footway Cables.



Roadway. Bicycle track. Surface cars. Footway. Elevated cars. Footway. Bicycle track. Surface cars. Roadway.

Extreme Breadth, 118 Feet. Depth of Trusses, 40 Feet. Length of Main Span, 1,600 Feet.

THE FLOOR-SYSTEM OF THE NEW EAST RIVER BRIDGE.—[See page 374.]