during the progress of operations. Finally it was filled with concrete made with Portland cement mortar, 1 cement to 2 sand. A full description of this portion of the work has already appeared in these columns.* The other foundations presented comparatively little difficulty in execution.

The masonry superstructure is of granite, and includes an east and west approach terminating in abutments from which the two great arches spring. The arches meet again at a central pier which acts as abutment for both and which rises between them to the top of the bridge. The total length of the bridge and approaches is 2,380 feet; each approach is 660 feet long, leaving 1,060 feet for the main bridge. The western approach is level; the first portion, 260 feet in length, is in earthwork supported by masonry side walls. The rest is in masonry, including three semicircular arches, each of 60 feet span. The eastern approach starts on a lower grade, and for part of its length rises toward the bridge; 300 feet are in earthwork, as described for the other end. The remaining 360 feet includes three semicircular arches of 60 feet span and one seven-centered arch of 56 feet span. A clear width of 80 feet is afforded over this portion, as well as over the remainder of the structure, 50 feet of which are roadway, while 30 feet are devoted to the two sidewalks. The roadway is paved with asphalt.

The supporting members of the bridge proper consist of two steel arches of 510 feet span each and 90 feet versed sine. Each arch includes six parallel ribs 13 feet deep, divided by radial divisions so as to represent voussoirs. They are braced together horizontally to secure the whole against wind strains, and are connected by trusses at the junction of each voussoir lying in the plane of the radial divisions, so as to act as sway bracing. As each voussoir referred to a horizontal chord gives a projected length of 15 feet, the interval between the sway bracing trusses is a little in excess of this. Each pair of ribs are spaced 14½ feet laterally from center to center. The top and bottom chords are calculated to sustain the bending strains; the web is calculated to resist the shearing strain.

From the extrados of the arches thus formed, lattice columns rise vertically to the floor line. These are also braced laterally by trussing. At intervals of about 15 feet cross beams are placed to support the roadway. Upon these longitudinal beams are placed, the intervals between which are filled by arched buckle plates receiving the roadway.

The pivot system of skewbacks was used, and has already been illustrated in this paper.† As the arched trusses rise and fall under the effects of change of temperature or of load, the hinge joint works to and fro with theoretical exactness. The latter point has been determined by micrometric measurements.

As regards the load which the arches are constructed to carry, it includes 8,000 pounds live load per lineal foot of bridge. This is in addition to the dead weight of the structure, which is about 33,000 pounds per lineal foot. A wind pressure of 1,200 pounds for the same unitary distance is allowed for. A 20 ton road roller can be taken over it without going outside of the very liberal factor of safety provided for in the table of unit strains.

The roadway is 151 feet above the river level. On the approaches it is bordered by a handsome stone parapet, with bronze ornaments. The bridge proper has an iron and bronze rail, designed by Messrs. Delinas & Cordes. Gas lamp posts and combined gas and electric light posts are placed on either side. Over the piers stone refuges with seats are placed.

The bridge, as now situated, can be reached by the cable cars on Tenth Avenue, but the general condition of the roads leading to it on either side leaves much to be desired. It is to be hoped that the beautiful structure will soon be made more accessible, and that its absolute usefulness will not be postponed much longer.

Mr. William Hutton, of this city, was the chief engineer, assisted by Mr. Theodore Cooper.

An Irresistible Bait for Rats.

According to a Washington correspondent to the Cincinnati *Commercial Gazette*, an interesting not to say valuable discovery has been made by Capt. Weedin, in charge of the animals at the Zoo. The building is infested by rats, and how to get rid of them has long been a perplexing question. Traps were used, but nothing would tempt the rodents to enter. In a storeroom drawer was placed a quantity of sunflower seeds, used as food for some of the birds. Into this drawer the rats gnawed their way, a fact which led the Captain to experiment with them for bait in the traps. The result was that the rats can't be kept out. A trap which appears crowded with six or eight rats is found some mornings to hold fifteen. They are turned into the cages containing weasels and minks. The latter will kill a rat absolutely almost before one can see it, so rapid are its movements. The weasels are a trifle slower, but none of the rats escape them.

*See SCIENTIFIC AMERICAN, April 16, 1887.

†See SCIENTIFIC AMERICAN, February 18, 1888, page 101.

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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 698.

For the Week Ending May 18, 1889.

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A REMARKABLE OCEAN VOYAGE.

Five days twenty-three hours seven minutes is now the top record across the Atlantic, the City of Paris making it on her last trip this way—a remarkable trip, not only because it beats by two hours forty-eight minutes the best previous record, to wit, that made by the Etruria last June, but because she is a new ship, and, at least for a small portion of the voyage—crossing the Banks—was slowed down. Thus it is not unreasonable to expect still more of this ship, when her engines shall have become more smooth by attrition and her commander more familiar with her characteristics.

To many the mere fact of record beating will not compare in importance with the fact of using double engines and twin screws on so big a ship. With these and the re-arrangement of bulkheads which they permit, the safety of a ship is believed to be increased. Heretofore a steamer parting her shaft lay helpless on the broad ocean, her sole reliance the coming of another ship to her rescue.

There is another and perhaps it might be called a still more important factor of safety in the twin engine arrangement—it permits the subdivision of that longitudinal section of compartment which heretofore has made the most modern ship vulnerable abaft the mainmast. This contained the engines and the boilers, and the gross weight of sea water it would contain was sufficient to more than counterbalance the ship's buoyancy. With the sister ships City of New York and City of Paris, this compartment is divided into two parts, a separate engine and boilers being placed in each. Should one of these be torn open by collision and flooded, it would not swamp the ship or even destroy her power of locomotion. She would heel over a few degrees in the direction of her hurt, a condition that, to a certain extent, could be rectified by a slight shifting of the upper cargo, if the sea was fairly smooth. In any event, the second engine would go on driving its propeller as though nothing had happened, save for the diminution of speed.

It ought to be added that though the safety of passengers is still further assured by the new type of steamer, vessels that may be in or crossing the steam lanes have additional dangers to fear, not for the greater speed now obtaining, for they have not anything to fear from that during clear weather, but for the desire for quick passages which it induces and the resultant haphazard running in thick weather to insure them.

THE MARINE CONFERENCE.

The marine conference, about to sit at Washington, will devote most if not all its attention to the problem of collisions at sea and how they may be avoided—a problem, be it said, which the ablest navigators have thus far been unable to solve. Many practical suggestions looking to the improvement of the sea rules have come from this side of the water, and the unanimity shown by the maritime powers in joining in an American conference is a not undeserved tribute to Yankee cunning and resource. The masters of the Atlantic liners are most concerned in the result of this conference, and it is interesting, therefore, to note their opinions on the subject. Here are the most noteworthy ones as recently published:

Capt. Kennedy, late master White Star steamer Germanic, favors Barker's American system of signals. [In this, a steamer running in thick weather is expected to indicate by long and short sounds blown on her whistle the course she is holding.] He would restrict the signals to 8; one for each 4 points, N. to N. E.; N.E. to E.; E.S.E.; S.E. to S., and so on. He would, however, advise a separate signal for vessels bound east or west; the first signifying which way the ship is bound, the second the direction her head is pointing.

Capt. Brooks, of the Guion Line's steamer Arizona: "All the codes I have yet seen are too complicated for practical use. Two steamers approaching each other at the rate of 40 knots an hour—combined speed—would not allow their commanders to act if they had to make any such compass signals [referring to the Barker and similar systems]. Nine times out of ten they would be misunderstood. I would strongly recommend the signals in use by the New York ferry boats: one short blast, my helm is to port; two short blasts, my helm is to starboard. Thus, if I hear a steamer's whistle ahead on my port bow, I immediately put my helm a-port and blow one blast. If I hear the whistle on my starboard bow, I put my helm hard a-starboard and blow two blasts."

Capt. Burton, of the White Star steamer Coptic: "I think steamers should be fitted with two separate steam signals. This could be accomplished by having two valves on the same steam pipe." He would blow one whistle for from N. to E., another for from E. to S., etc.—four signals in all.

Capt. Boyer, of the French line's steamer La Champagne: "The rules laid down by the International Convention [the last one] are absolutely insufficient to enable even the most vigilant navigator to escape disaster. Article 12 of the rules says steamers