on stone skewbacks projecting from the piers. Each of these timber ribs supported an iron rib immediately above it, the fifth or central iron rib being without direct support.

The fixing of the ironwork commenced by the putting into place of the four outer ribs, which were then braced together in pairs and wedged up. The centering thus relieved of their weight was equal to the duty of supporting the centre rib, which was sustained merely by the cross bracing of the timber ribs. These last were 6.7 ft. deep, and of an I section, the upper and lower flanges being connected by radial struts and by diagonals. The flanges were each formed of two sets of planks, of three planks each, placed one on either side the web, cut to the arc of a circle, and firmly bolted together. Each plank was 94 in. deep, and 34 in. thick. On the centering thus constructed was erected a gantry, carrying the travelling crane used in fixing the ironwork. The whole surface of the extrados of the timber ribs was covered with planking to facilitate the operations of the workmen, and protected with guard rails on either side, to remove as much as possible all chance of accident. (See Figs. 9, 10, and 11, Plate LIV.)

As has been stated, the timber ribs were fixed by means of a platform constructed in advance, and suspended by four chain cables, the links of which were of 1 3/4 in. iron. These cables were supported at the abutments by strong trestles, or A frames, stiffened with iron, and were moored securely by passing through masses of rough masonry built upon the abutments, as shown in Figs. 5, 7, and 8, Plate LIV. Suspension rods depending from the chains supported cross beams, spaced 6 ft. 2 3/4 in., centre to centre, to which was spiked a light platform. The lengths of the rods were so arranged that the platform was exactly parallel to the intrados of the timber ribs, and a small distance below it.

This platform finished, the timber ribs, which had been previously framed together, were lifted into place, piece by piece, and then wedged up so as to relieve the chains of their weight; and the rest of the work was then completed. The chains were then entirely detached from the centering, leaving the latter to support itself, and were only allowed to remain to facilitate its subsequent removal.

The centering and temporary bridge once in place, the construction of the iron arch no longer offered any difficulty. The ironwork was deposited on the abutments, and taken thence by the traveler as wanted. Care was taken to wedge up the cast-iron ribs as soon as they were fixed and braced together, and the centering was then only used as a platform for facilitating the rest of the work. When the bridge approached completion, the centering was taken down piece by piece in the same way that it had been put up, by means of the hanging platform, the suspension rods of which were capable of being secured to the iron ribs. The planking of the platform was then removed, next the suspension rods, and finally the chains.

The distance between the points of support of the chains was 196.80 ft., and the deflection 21.12 ft. The load supported by the chains consisted of their own weight, the weight of the suspension rods, the cross beams and planking of the hanging platform, and as much of the centering as had to be constructed before the ribs could be wedged up, in all 109.71 tons.

With regard to the strain on the chains, supposing the load to be uniformly distributed, which is practically true in this case, the maximum tension is given by the well-known formula,

$$T = \frac{Pd}{2f} \sqrt{\frac{d^2}{f^2} + f^2},$$

in which $T = $ tension, $P = $ weight per foot run, $d = $ semi-span, $f = $ deflection. As $P = .557$ tons, $T$ will be $139.06$ tons, on all cables;

- tension on each cable $= \frac{139.06}{4} = 34.765$ tons.

The sectional area of the links being 5.58 square inches, the strain per square inch is 6.23 tons—a small amount, considering that the proof strain for cables in the French navy is 10.8 tons per square inch.

The span of the ribs was 186.63 ft., and their rise 24.92 ft., which dimensions may be taken for those of the neutral axis without involving any very serious error. The load supported was composed of the weight of all the woodwork, and so much of the ironwork as was in place before the iron ribs were wedged up—together 827.32 tons. Each of the four timber ribs had, therefore, to support a weight of 81.83 tons, which, to allow for irregularity in loading, may be assumed at 90 tons.

If we take the well-known approximate formula for the horizontal thrust,

$$Q = \frac{Pd}{2f'},$$

where $P = $ load on semi-arch, $d = $ semi-span, and $f' = $ rise, we have $Q = 84.25$ tons, and the thrust at the springing, from the formula

$$T = \sqrt{P^2 + Q^2},$$

is 95.6 tons.

The flange of the timber ribs are alone regarded as resisting the thrust; their sectional area being 356 square inches, the pressure per square inch was .27 ton, an amount quite within the limits of safety, as the ribs were well stiffened by bracing, so that the wood used in their construction would probably bear a crushing strain of 2 tons per square inch.

The formula used in the foregoing investigation is but an approximate one, as it takes no account of the