cylinders, and filling in the concrete, of the Kistna Viaduct, and this is illustrated in the figure annexed. This apparatus consists of an annular platform surrounding each cylinder, and suspended from radial arms, which are carried by a set of shear legs. There are eight of these radial arms, one for each segment of the cylinder, and these are temporarily attached to the work as shown. As the work progresses the shear legs are raised by means of the central leg, which is carried on the trestle resting upon the concrete. The materials are raised to the staging by means of a power hoist and tackle; in our engraving, two plates are seen being thus raised. The staging is prevented from oscillating by being made fast to the cylinder after each shift.

The total weight of the ironwork in the superstructure of the Kistna Viaduct is 2500 tons, whilst that in the cylinders is 1200 tons. The viaduct was designed by Mr. George Berkley, C.E., the consulting engineer. The contractors for the girders were Messrs. Pease, Hutchinson, and Co., Messrs. Cochrane being the contractors for the cylinders and the erecting apparatus for the piers.

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THE CINCINNATI SUSPENSION BRIDGE.

Plates LXXXVIII. and LXXXIX.

The suspension bridge completed by the late Mr. J. A. Roebling across the Ohio, at Cincinnati, U.S., in 1867, and illustrated in Plates LXXXVIII. and LXXXIX., has a clear span between the centres of towers of 1057 ft., and was at the time the longest suspension span yet executed. With the exception of the Clifton Bridge at Niagara Falls, it is still the longest span completed, and it is altogether a work of great interest. In describing it we have drawn largely from the excellent reports prepared by Mr. Roebling during its progress.

At the lowest stage of water the Ohio River between Cincinnati and Covington has a width of about 1000 ft. By the charter of the bridge company the position of the towers was fixed at low-water mark, so that the middle span should present an opening of not less than 1000 ft. in the clear. To comply with this Act the distance from centre to centre of towers was fixed at 1057 ft., which leaves a clear space of 1005 ft. between the base of masonry. In the spring of 1832 the river rose 62 ft. 6 in. above low water, and this is the elevation of the approach near Front-street on the Cincinnati side. The centre of this street is only 60 ft. above low water. But such an extreme rise may not occur again in a century. At this stage the width of waterway is over 2000 ft. With one exception, at very high water the entrances may be considered above water at all stages. The approach on the Covington side is 71 ft. above low water, and therefore always dry.

The base of each tower is 82 ft. long in the direction of the river, with a width of 52 ft. This mass is not a solid, but divided in two parts, each having the form of a T, the projecting central part forming a buttress. This feature of buttresses is preserved throughout the whole height, not only on account of appearance, but also for the sake of strength, to save material, and to reduce the weight upon the foundations.

The section of the towers is therefore divided in two parts, 30 ft. apart at the base, and this distance is preserved in two vertical lines to the spring of the arch, 165 ft. above the foundation. From the foundation, however, to the top of the lower cornice, which marks the level of the floor, the two opposite shafts are connected by two massive walls, 10 ft. wide at the bottom, and stepped off to 8 ft. before the floor is reached. A well-hole of 30 ft. by 20 ft. is thus left open in the centre of the masonry. As the river rises and falls, the water in this well-hole is allowed by openings to communicate freely.

To support the great weight of this tower, together with the weight of the superstructure and transient loads, and at the same time to guard against unequal settling, good foundations were absolutely demanded. No definite plan of foundation had been fixed upon; none could be safely adopted before the excavations had been sunk some considerable depth. Whether a solid rock bottom could be reached on either side, was uncertain; therefore the question of piling or solid layers of timber was left open. It is known that the bed of the Ohio River is throughout its extent underlaid with rock, at no great distance below the surface. But the depths