shape of the ribs, a condition which evidently influences their reaction at the supports; the line of pressure also is assumed to coincide with the neutral axis of the rib, which is never really the case.

The cast-iron arch has a span of 188.27 ft., and a rise of 26.24 ft.; it is supported by two abutment piers in masonry, and has a width between parapets of 33.12 ft., divided into two footpaths of 6.56 ft. and a roadway of 20 ft. There are five ribs, braced by spandrels, and twenty-five sets of cross braces. The ribs have an uniform depth of 4.92 ft., and are each divided into fifteen segments bolted together, the faces of the joints being planed to secure a firm and even bearing. They are of an I section, having an area of 84.72 square inches, and about against iron skewbacks, 4.92 ft. x 2.29 ft.

The appearance of the spandrel fillings, railing, and cornice, is shown by Fig. 3, Plate LIV. The roadway is formed of arched plates of cast iron resting on the spandrels, and covered with road metal. The footways are formed of plates of iron, bearing on one side on the cornice and the other on the spandril, and are without the usual covering of asphalt or flagging.

The arch was tested with the most satisfactory results. With a test load of 108 lb. per square foot over the whole surface of the platform, the maximum deflection at the crown was not more than 4 in. Advantage was taken of the facility with which cast iron lends itself to ornamentation to make the features of this bridge accord with the Oriental style of architecture of the principal buildings in Algeria. An escutcheon containing the monogram of the Emperor is placed at the crown of the arch. (See Fig. 12.)

The weight of cast iron in the superstructure is 414 tons, or 78.85 lb. per square foot; which, with 106.5 lb. per square foot for the roadway, and 105 lb. per square foot for the test load, gives a strain on the ribs of 22 tons per square inch at the crown, and about 3 tons per square inch at the springing. The maximum strain allowed by the specification was 3.2 tons per square inch.

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THE MORLAIX VIADUCT.

PLATE LIV.

THE viaduct which forms the subject of Plate LIV, carries the Rennes and Brest Railway over the valley in which is situated the town of Morlaix. The viaduct crosses many of the streets of the town, and spans the quays of the harbour, the rails being 186 ft. 2 in. above the quay level. The maximum height of the viaduct from its foundations to the level of the rails is 204 ft., and its length is 758 ft. The work is constructed in two stories, the upper consisting of fourteen and the lower of eleven semicircular arches. The upper series of arches are each of 50 ft. 10 in. span, and their breadth on the crown is 28 ft., this breadth being rather less than that of the piers at the top, as shown in the enlarged section, Fig. 3. The thickness of the piers at the springing of the upper series of arches is, except in three cases, 14 ft. In three of the piers, however, the thickness of the springing of the upper arches has been made 16 ft. 5 in. The two extreme arches of the upper series are scarcely clear of the side slopes of the valley; they spring from abutments 18 ft. in thickness. The arches are coated with asphalt, this being arranged, as shown in the transverse section, so that the flow of the water takes place towards the centre line of the bridge, and towards the centre of each arch. The maximum height of the ballast—that over the centre of each arch—is 4 ft. 1 in.; and the minimum height—that over the centre of each pier—is 3 ft. 7 in.

The lower series of arches are each of 44 ft. 2 in. span, and are 32 ft. 9 in. broad on the face. They carry a paved roadway, as shown in the section, the piers being pierced at the level of the roadway by openings 7 ft. 7 in. in width, so that there is a passage right through from one side of the valley to the other. In the direction of the line of the viaduct the piers have a batter of 1 in 22 from their bases to the level of the roadway just mentioned, and from this level to their summits the batter is 1 in 40. The batter in a direction transverse to the line of the bridge is 1 in 100 from the base to the first stage, and 1 in 122 from thence to the top.

All the piers are founded on a hard blue schist, which