No. 623,904. Patented Apr. 25, 1899.

H. V. HINCKLEY.

CONSTRUCTION OF METAL-CONCRETE ARCH BRIDGES.

(No Model.) (Application filed Mar. 11, 1898.)

Fig. 1.

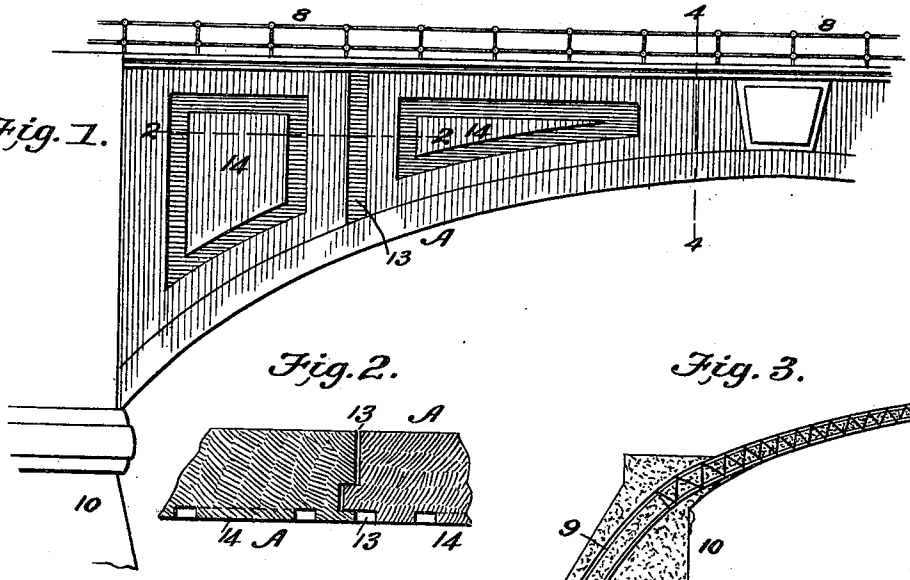


Fig. 2.

Fig. 3.

Fig. 4.

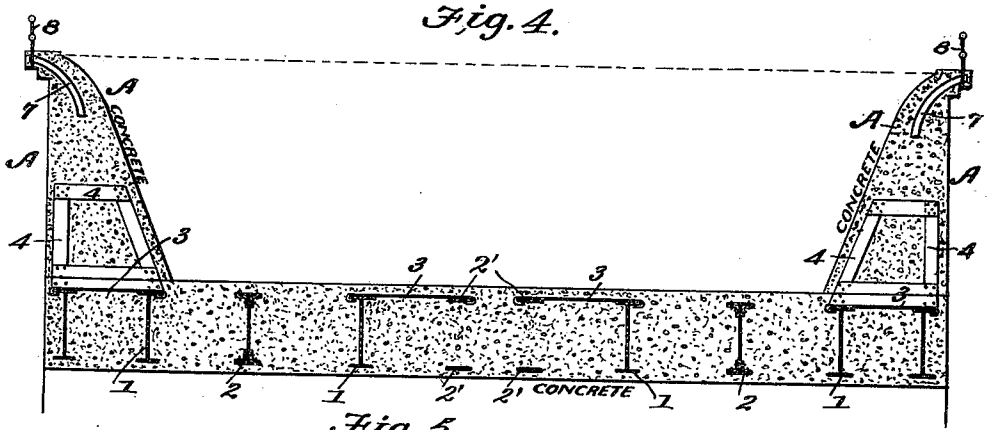


Fig. 5

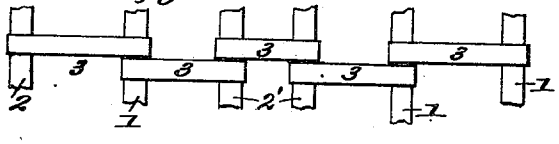
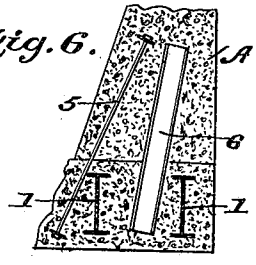


Fig. 6.



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CONSTRUCTION OF METAL-CONCRETE-ARCH BRIDGES.

SPECIFICATION forming part of Letters Patent No. 623,904, dated April 25, 1899.

Application filed March 11, 1898. Serial No. 673,493. (No model.)

To all whom it may concern:

Be it known that I, HOWARD V. HINCKLEY, a citizen of the United States, residing at Topeka, in the county of Shawnee and State of Kansas, have invented new and useful Improvements in the Construction of Metal-Concrete-Arch Bridges, of which the following is a specification.

It is the object of my invention to improve the construction of that class of bridges, and arches for other purposes, which are constructed of concrete, with an interior skeleton metal frame.

My invention is embodied in the construction and arrangement and combination of parts hereinafter described, and shown in the accompanying drawings, in which—

Figure 1 is a side view of a concrete arch embodying my invention. Fig. 2 is a horizontal section of a spandrel on line 2 2 of Fig. 1. Fig. 3 is a vertical section of a portion of the arch and abutment, illustrating one feature of my invention. Fig. 4 is a transverse vertical section of the arch with spandrels. Fig. 5 is a plan view illustrating the arrangement of ties with the metal ribs or beams. Fig. 6 illustrates a modification of the means for stiffening the spandrels.

Heretofore in the construction of metal-concrete arches I beams 1, built beams 2, or bars 2′, arranged longitudinally in pairs, have been used as an embedded arch-skeleton in a concrete arch. It is often impossible to build the concrete of the entire arch in a day or as continuous work. It is customary to build arches, therefore, in longitudinal sections, the vertical dividing-plane between the sections being midway any two beams. A weakness or lack of homogeneity in the arch is liable to develop along this vertical plane, resulting in a crack, which on account of the weight of the spandrels on the outer sections tends to open along the extrados. To overcome this tendency, I use metal clamps 3, so made as to fit over and part way under the upper bar of each pair or over and part way under the upper flange of each beam or rib—that is to say, each clamp consists of a flat bar having inturned flanges at each end. There is no rivet-work or bolt-work connected with the use of these clamps, and the spacing may be such as occasion requires. The side edges of these clamps upon each beam or bar will usually touch each other, so that the several clamps 3 will form practically a straight line across the arch at right angles to the face of the spandrels A. They may, however, be placed apart instead of together. Once in place, the concrete built around them holds them to their work as firmly as if they were riveted to the bars or beams, and the latter are prevented from spreading in the slightest.

It is customary for spandrel-walls A (like retaining-walls) to be so constructed that their weight suffices to counteract the outward thrust or pressure of the empounded earth, which in practice fills the space between them. By putting part of this thrust upon a metal bar or frame embedded in the concrete a saving can be effected in the cost of the spandrel-wall. This may be accomplished in several ways—*i. e.*, by different, but equivalent means, namely, by a triangular or quadrangular frame 4, erected upon and riveted, bolted, or clamped to one or two of the beams of the arch or simply built into the concrete of the arch and standing either parallel with or at right angles with face of spandrel, by an anchor bar or rod 5, by a channel or I beam 6, or by both the latter taken together, as shown in Fig. 6. The form of construction will vary with varying dimensions of arch and wall.

Posts of parapet-railing are usually simply embedded at their feet in the upper or parapet course. In case of any weakness between the upper course and the spandrel proper, on which such course rests, such weakness extends to the railing and is a source of danger to people overhanging it. I overcome this by building into the concrete a curved metal channel-bar 7 or other form of rolled-metal beam or bar in the spandrel A for holding the metal or concrete posts of the railing 8. As shown in Fig. 4, the railing-posts are inserted and secured in the bar 7. The precise form and the details of the connection between the railing-post and its metal support will, however, vary to suit the design of the railing and the general shape of the parapet, cornice, and spandrel.

It has been customary in building steel-concrete arches to allow the steel ribs, bars, or I-beams to extend along the upper face of

the abutment to a point above or back of the front face of the abutment and there to stop. Circumstances are readily conceived in which the thrust of the arch would tend to tip the abutment, causing it to rotate about a horizontal line upon its rear face. The result of such tendency would naturally be a crack. I overcome this tendency by taking advantage of the tensile strength of the metal ribs or bars 9, extended down the rear face of the abutment 10 to the point 12. The section of the abutment and the location of the point 12 must be computed for every individual case. In practice it will only be necessary to extend the upper one of the bars 2′ or the upper plate of the I-beams 1 and 2 down the rear face of the abutment.

It has been customary in the construction of concrete and metal-concrete arch bridges to build the spandrel-walls with expansion-joints at each end and only at each end—that is to say, with joints between the spandrels proper, A, and the vertical upper portions of the piers. I have found that concrete spandrels built without expansion-joints between their ends and the keystone or crown of the arch almost invariably crack at a point between the end and center and crack usually on a line which is nearly vertical. I overcome this result and practical objection by putting in an expansion-joint, (an artificial crack 13)—two of them, if necessary. In order to avoid the objection to appearance of a vertical line on the face of the spandrel A, I build two or more panels 14 on each side of the keystone. Between each two panels appear two vertical lines, one of which is an expansion-joint and the other of which is not. When the arch-ring is finished in imitation of stone voussoirs, the panels 14 may be partially or wholly radial instead of vertical. The panels may be either sunken or raised, but will generally be sunken and built with raised forms of wood, plaster, and cloth.

What I claim is—

1. In a concrete arch, the combination with a series of parallel metal I-beams extending through said arch longitudinally, of the series of bars or clamps 3, having integral hooked ends that clasp the longitudinal flanges of said beams, and are likewise embedded in the concrete whereby the clamps tie the I-beams together so that the latter are held immovable laterally, as shown and described.

2. In a metal-and-concrete arch, the combination with the concrete arch having metal beams extending longitudinally therein, and concrete spandrel-walls erected on said arch, of metal anchorage-frames which are rigidly secured to said beams and extend up into spandrel-walls and support the same as shown and described.

3. A bridge, having a concrete spandrel-wall a metal bar extending down into such wall, and the metallic parapet-railing rigidly secured to said bar, as shown and described, whereby the latter strengthens the wall and supports the railings, as specified.

4. In a concrete or metal-concrete spandrel-wall of a concrete or metal-concrete arch bridge the combination of two or more panels with one or more vertical panels, one side of one or each vertical panel being an expansion-joint; the panels and joints being constructed for the purposes specified.

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