J. ZELLWEGER.

Improvement in Arch-Bridges.

No. 128,349. Patented June 25, 1872.

Fig. 1.

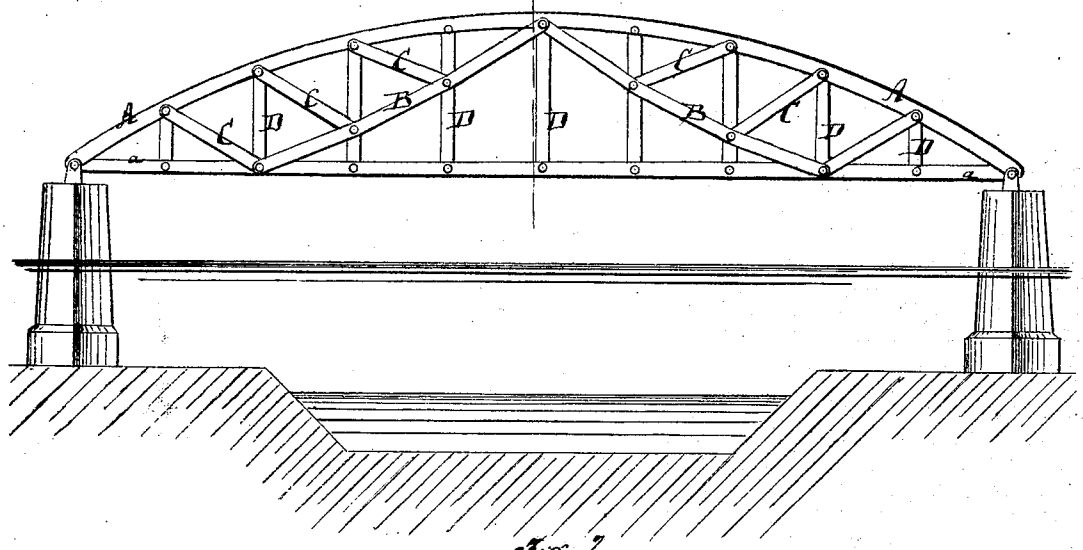


Fig. 3

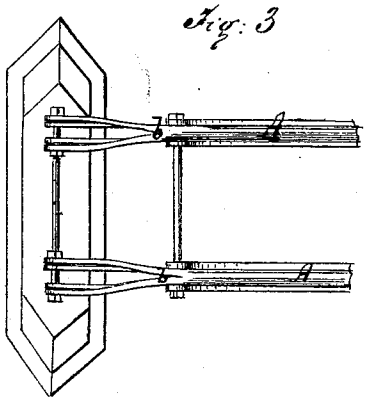


Fig. 2.

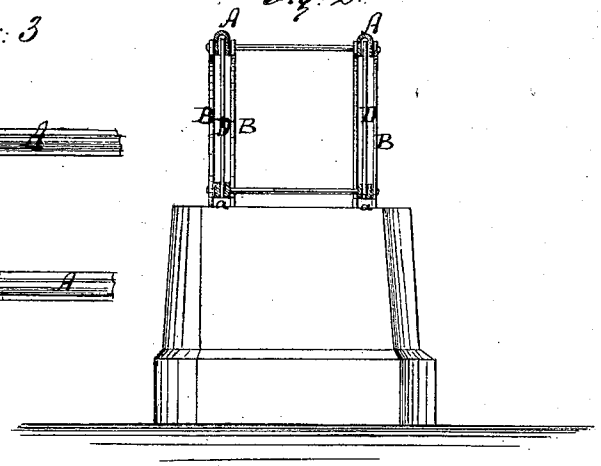
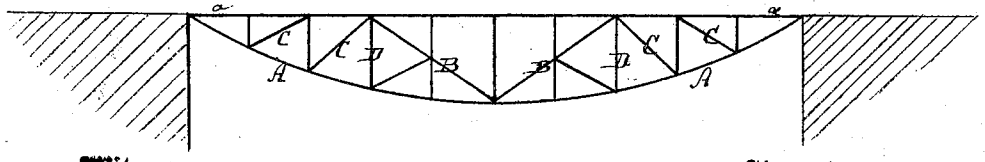


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN ZELLWEGER, OF LOUISVILLE, KENTUCKY.

IMPROVEMENT IN ARCH-BRIDGES.

Specification forming part of Letters Patent No. 128,349, dated June 25, 1872.

Specification describing a new and Improved Arch-Bridge, invented by JOHN ZELLWEGER, of Louisville, in the county of Jefferson and State of Kentucky.

This invention relates to a new manner of stiffening the two halves of the arches in an arch-bridge, and to the proportionate distribution of weight over the same by connecting the middle of the arch to a point in its chord, either at or near the end of the bridge, under no circumstances much more than one-third of the span from the end; by a curved, angular, or straight strut-tie or crown-brace, and by further connecting said strut-tie or crown-brace to the main arch; by a system of other stiff uprights and diagonals, thus making two "arch-trusses," which extend from the middle of the arch to the end of the bridge.

Figure 1 is a side elevation of an arch-bridge embodying my invention. Fig. 2 is a transverse section of the same; Fig. 3, a detail top view of one end; and Fig. 4, a side view of a modification of the same.

Similar letters of reference indicate corresponding parts.

The bridge can either be a through-bridge (Fig. 1) or a deck-bridge (Fig. 4,)—*i. e.*, with a standing or hanging arch. The same geometrical form answers for both and is only reversed in position, but the several parts of the structure have to change their resistance from pressure to tension, and reverse, as the case may be.

The main arch A of the bridge can be a continuous curve or angular piece. The curve can be regular or pointed, like a Gothic arch. The arch may be made of wood, wrought or cast iron, or other material. Its cross-section can show one or more members firmly connected together. Two distinct arches can be made on each side of the bridge to facilitate repairs. B is the crown-brace or strut-tie, straight, angular, or slightly curved. It serves to resist tension and pressure alternately, and has to be constructed accordingly out of wood or iron. Its cross-section can also show one or more members. The pressure or tension in this crown-brace or strut-tie is resisted by a horizontal chain or chord, *a a*, at the lower end. C C are diagonal braces extending from the arch to the strut-tie. They also serve to resist tension and pressure alternately, as do the uprights D D between every two diagonals, as shown. Some of the uprights also serve to maintain the arch in shape. All the uprights in deck-bridges (Fig. 4) are to be made to resist pressure, and those between diagonals have to resist tension also. The diagonals have to resist pressure and tension. The chains *a a* in "through-bridges" have to resist the horizontal strain of the arch and the pressure of the strut-tie or crown-brace with tension, while the chord *a a* in deck-bridges has to resist the horizontal strain of the arch and the tension of the strut-tie or crown-brace with pressure. The planes of the two arches can be inclined. Lateral stiffness of the bridge is attained through the struts and diagonal rods between the two arches and chords.

If the bridge is a "through-bridge," the diagonals C C at the ends might obstruct passage between the arches and have to be left out, when it will become necessary that the end portions of the arches be made double, the two parts diverging toward their base in order to get sufficient stability for the bridge, as indicated in Fig. 3. If the vertical height above the support at the converging point *b* is not sufficient the bridge can be set on pedestals and the suspension or vertical links can be extended downwardly. The combination of the strut-ties or crown-brace and diagonals or the trusses are principally needed when the bridge is unequally loaded and cease to work under a full and uniform load, when the knee-joints are on a parabola. A modification would consist in furnishing an additional bridging for every length of panel. Pin connection appears to be the best for this kind of a bridge. The knee-joints can be castings.

The object of the invention is to reduce the material and cost of an arch-bridge by combining two trusses or girders of equal or uniform strength or stiffness with the natural supporting line of an arch. Instead of making each diagonal in the several panels to resist tension and pressure, two diagonals could be substituted, crossing each other, and each resisting tension only. Instead of making the bottom chord of a through-bridge straight, it can be dropped down near to the level of the road-bed in all those cases where the vertical height between the support of arch and the

upper end of the first vertical brace is not sufficient, thus gaining increased height of arch.

The system of the double-truss arch-bridge as a deck-bridge can be adapted to draw or swing-bridges. The arch may also have a plain panel in the middle, against which the lower ends of the strut-ties abut, thus giving more points of support. The sturt-tie or crown-brace can be fixed laterally by making the uprights laterally stiff between the main arch and its chord.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent—

1. In the bridge herein described, the strut-ties or braces B B, arranged to join at or near the crown of the arch, and thence passing diagonally to join the chord A at points nearly equidistant between the abutments and the center of the bridge, as specified.

2. The combination of the diagonals C C and uprights D D with the strut-ties B B and arch A, as specified.

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