

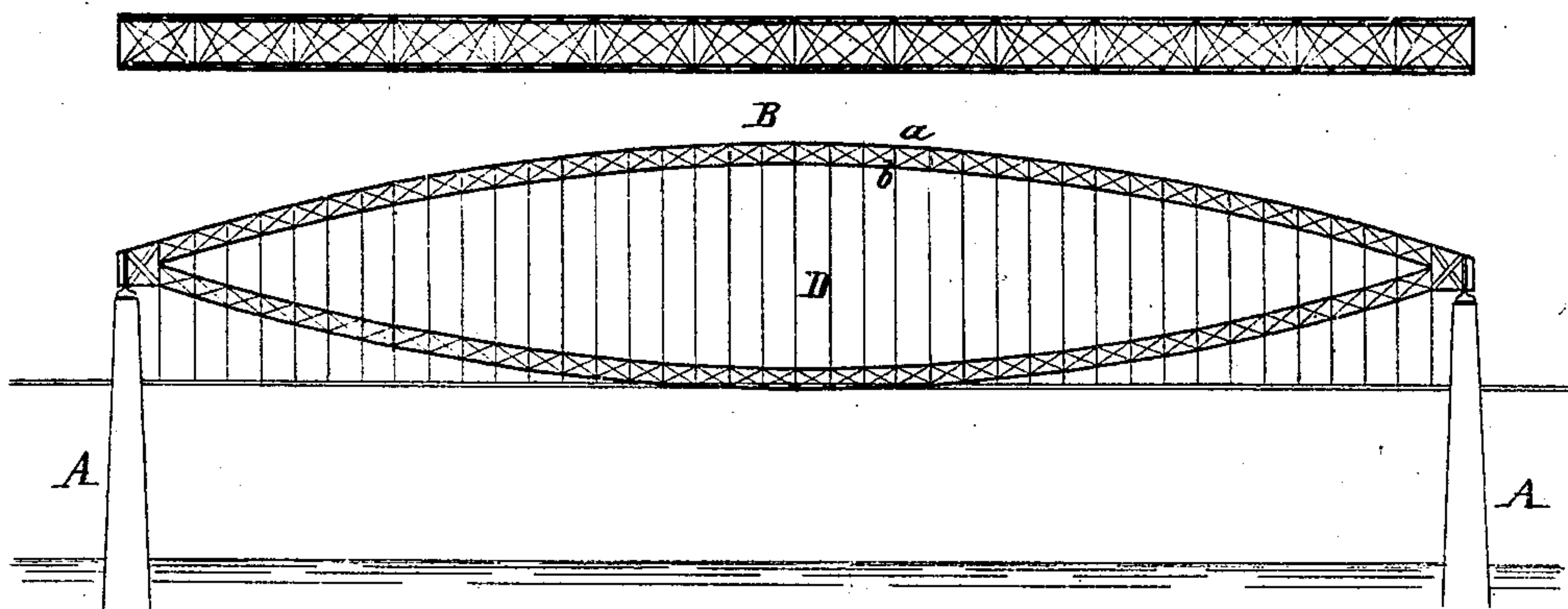
G. E. HARDING.

Improvement in Bridges.

No. 132,398.

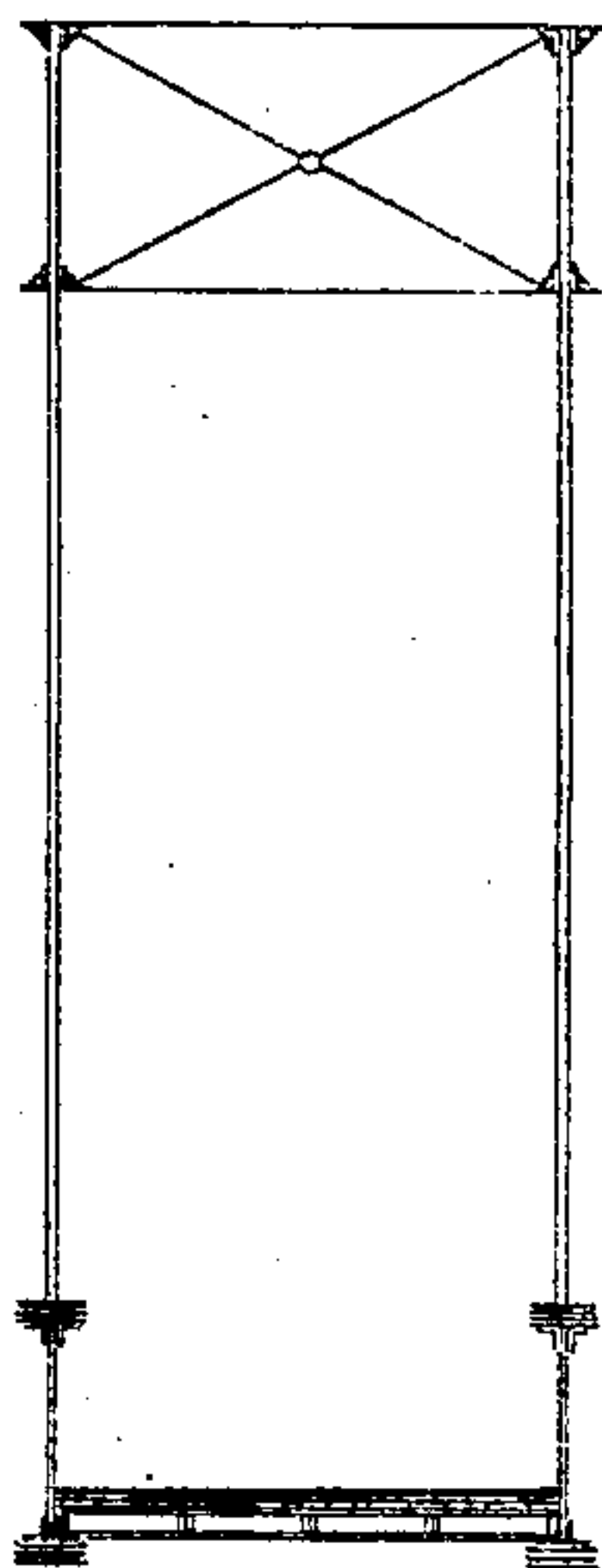
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Fig. 1.



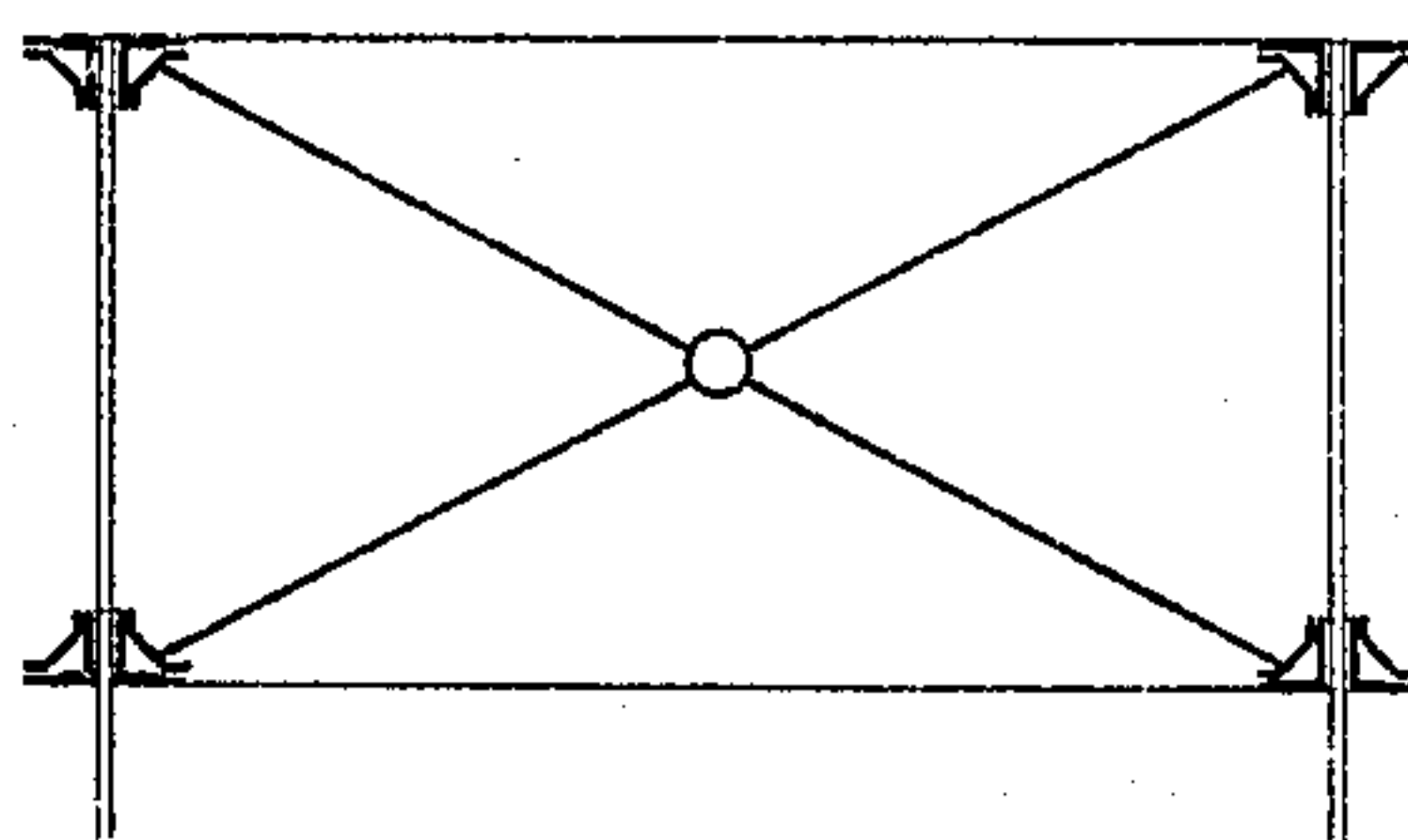
ELEVATION AND PLAN

Fig.



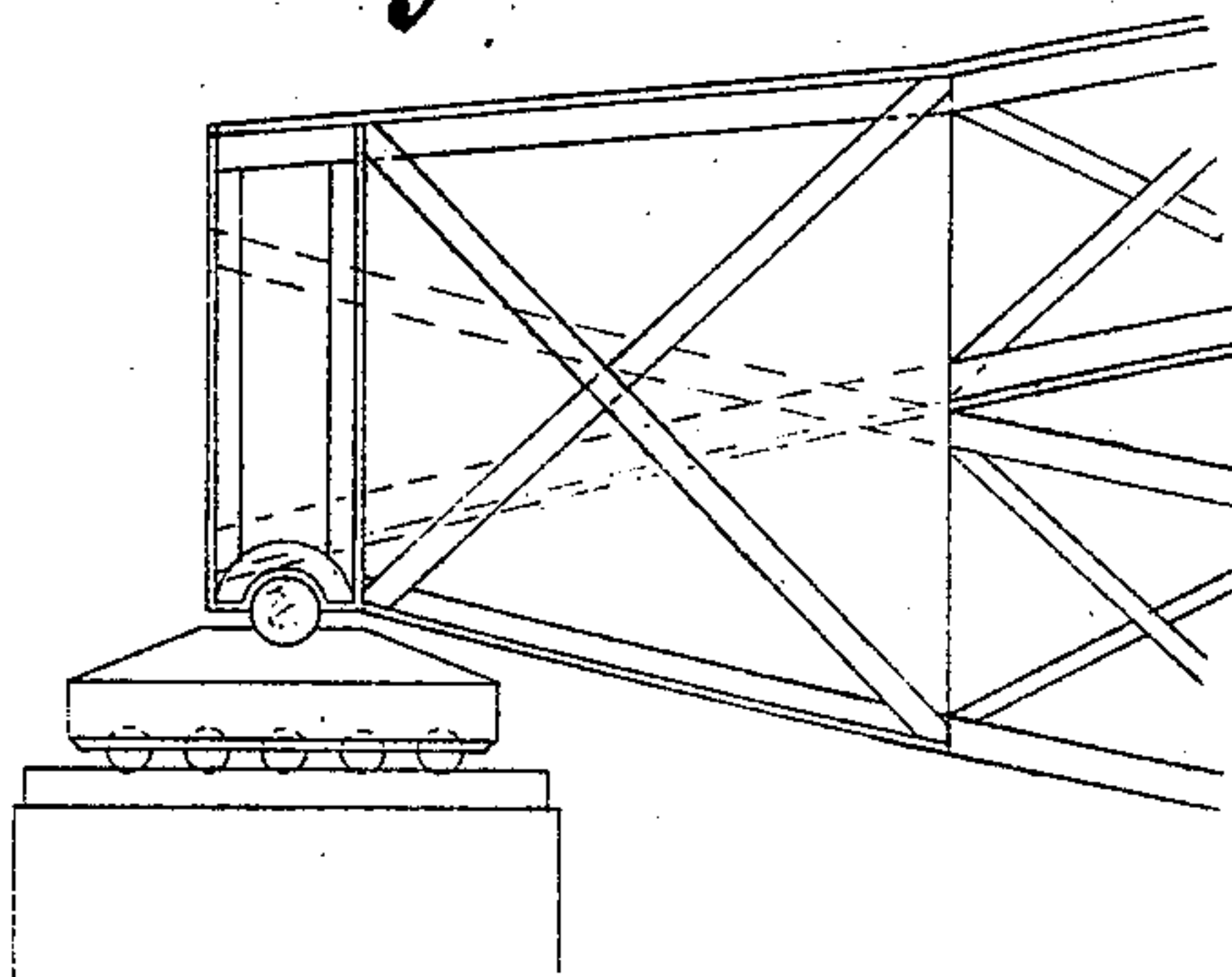
SECTION

Fig. 3.



UPPER CHORD

Fig. 5.



SUPPORT OF TRUSS

Fig. 4.



LOWER CHORD

WITNESSES

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GEORGE E. HARDING, OF NEW YORK, N. Y.

IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. 132,398, dated October 22, 1872.

To all whom it may concern:

Be it known that I, GEORGE E. HARDING, civil engineer, of New York, in the county of New York and State of New York, have invented a Long-Span Parabolic Truss for Bridges, Viaducts, and analogous purposes, of which the following is a specification:

The invention consists in a stiff upper chord of metal or wood, preferably arranged in the form of a double-ribbed arch, braced and counterbraced in suitable panels, and rigidly connected at each end with a double lower catenary chord, also braced and counterbraced with vertical tension-rods connecting the upper and lower chords.

Figure 1 is a plan and side elevation; Fig. 2, a transverse section of truss; Figs. 3 and 4, detail views in section of upper and lower chords; and Fig. 5, a side elevation of expansible end of truss arranged on trunnions and saddle-block.

A A represent the piers upon which one span of the bridge rests; B, the upper arch-chord; and C, the lower catenary chord. Each chord is divided into panels suitably braced and counterbraced by rods *a b*. D represents a series of vertical parallel tension-rods that connect the upper and lower chords, thereby equalizing the strains between the upper and lower chords. The chord B is preferably composed of tubes, circular or angular, or of channeled section, so as to give the maximum stiffness in proportion to weight of material. The lower chord C is preferably composed of plates, chain-riveted together so as to allow it to assume the form of a parabola or a catenary curve. The object aimed at in employing preferably double upper and double lower chords, braced and counterbraced as described, is to secure sufficient stiffness in the chords themselves to provide against any alteration of form, and thus secure the necessary strength without the use of intermediate diagonals or vertical struts. The chords B C are rigidly connected at their

ends, one end being made fast to a pier while the other has play to allow for the expansion and contraction due to change of temperature. This rigid connection of ends renders their counteraction more perfect and increases the strength of the structure. In order to afford this play one end rests upon a trunnion, E, attached to a saddle-block, F, which has itself a limited movement on rollers placed thereunder. The employment of the trunnion E, intervening between the truss ends and saddle-block or supports, equalizes any slight variation that may arise from unequal extension and contraction of the chords, tending to vary the original horizontal planes of the truss. The roadway may be above, below, or between the trusses.

By this method of construction struts between the upper and lower chords of each truss are entirely dispensed with, whereby I obtain longer spans than have hitherto been deemed practicable for trusses, with unusual lightness, stiffness, and strength in proportion to weight and cost of material. By this mode of forming the truss the thrust of the arch or upper member is counterbalanced by the tension of the lower member, and, there being no horizontal thrust or pull, piers of extreme lightness may be used. Each span of bridge consists of two or more parallel trusses suitably braced each to the other to provide against lateral forces, and also to equalize the strain.

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

A truss for long-span bridges, consisting of stiff braced and counterbraced parabolic chord B and lower catenary chord C, rigidly joined together at the ends, and connected by vertical parallel tension-rods D, as and for the purpose described.

GEO. ED. HARDING.

CHAS. A. PETTIT,
SOLON C. KEMON.