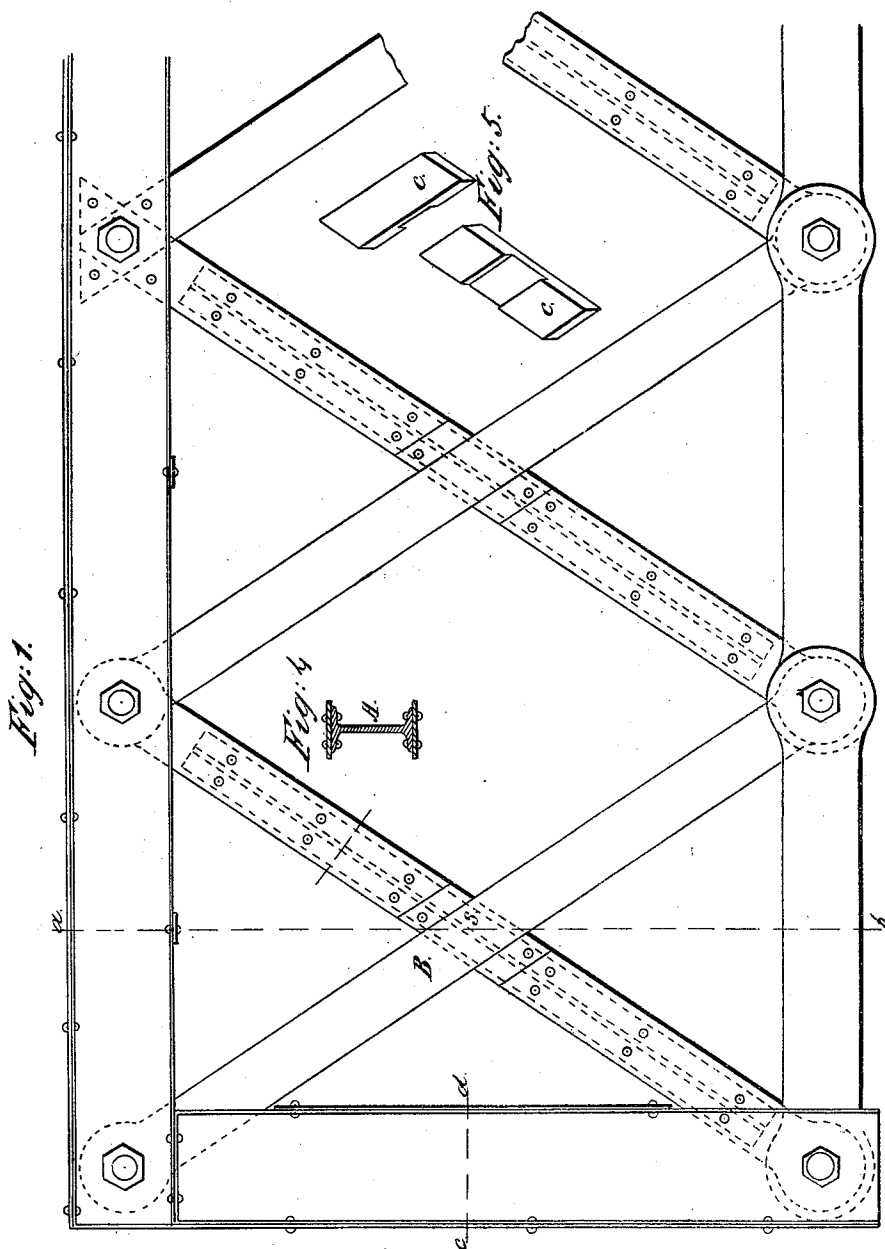


J. H. Linville, Truss Bridge.

No. 84,288.

Patented Nov. 24, 1868.



Witnesses.

Charles H. Crans.

Isaac R. Oakford.

Inventor
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*J. H. Linville,
Truss Bridge.*

No. 84,288.

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Fig. 11.

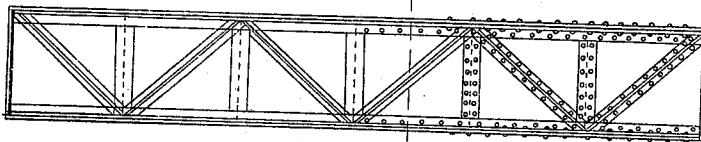


Fig. 10.

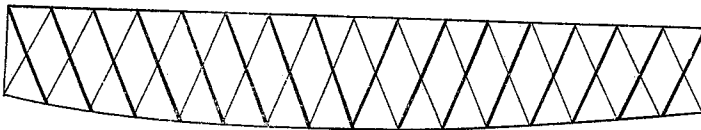


Fig. 9.

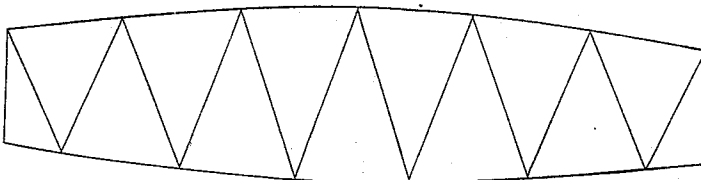


Fig. 8.

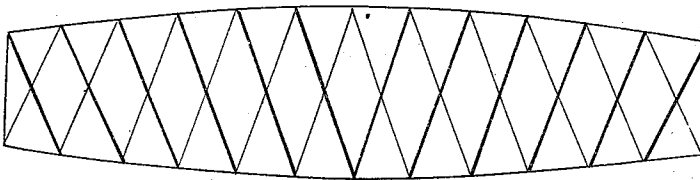


Fig. 7.

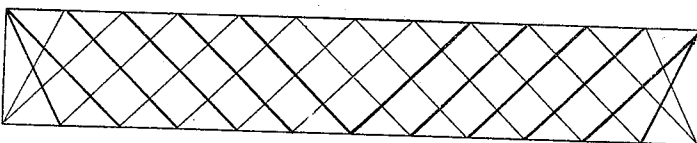


Fig. 6.

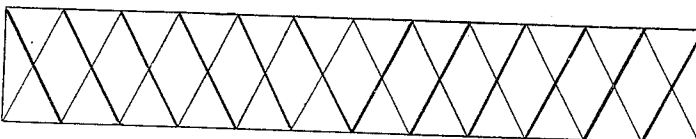


Fig. 12.



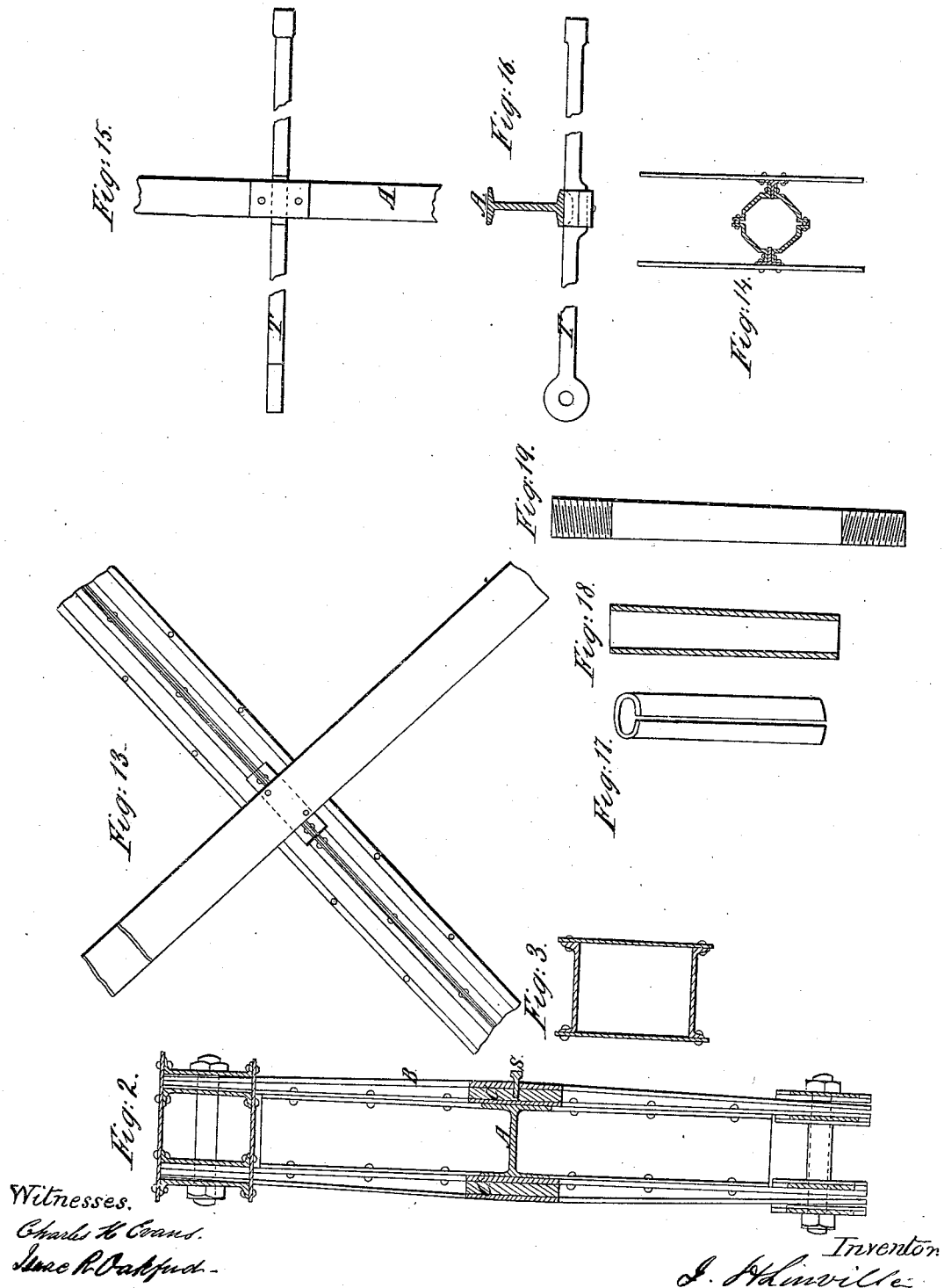
Witnesses
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J. H. Linville, Truss Bridge.

No. 84,288.

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UNITED STATES PATENT OFFICE.

J. H. LINVILLE, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. 84,288, dated November 24, 1863.

To all whom it may concern:

Be it known that I, J. H. LINVILLE, of the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in the Construction of Bridges; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1, Plate 1, is a side elevation of portion of a bridge, showing my improvements when placed in position. Fig. 2, Plate 1, is a vertical section of the same on the line *a b*. Fig. 3, Plate 1, is a sectional view of the standard on the line *c d*. Fig. 4, Plate 1, is a sectional view of a strut. Fig. 5, Plate 1, is a view of plates used at the intersection of the struts and ties. Fig. 6, Plate 2, is a diagonal system of struts and ties with a single intersection. The struts are placed as shown by heavy lines. Fig. 7, Plate 2, is a view showing a series of double intersections. Fig. 8, Plate 2, is a view showing both the upper and lower chords arched or bowed. Fig. 9, Plate 2, is a view showing the struts and ties so they do not cross or intersect at the center of their length. Fig. 10, Plate 2, is a view showing the upper chord bowed or arched and the lower chords straight. Fig. 11, Plate 2, is an elevation of a plate-girder, showing the employment of the struts in a zigzag position. Fig. 12, Plate 2, is a sectional view of same. Fig. 13, Plate 3, is a side view of a strut and tie of another form and construction, with the manner of securing them at the point of intersection. Fig. 14, Plate 3, is a sectional view of same at the point of intersection.

The object of my invention is to construct a bridge of iron or steel so that the dead-weight of the superstructure is lessened and the greatest economy attained, mainly by such disposition of the parts subject to compression as will offer the greatest resistance to this force with a minimum expenditure of material.

To enable those skilled in the art of bridge-construction to make and use my invention, I will now proceed to describe its construction and operation.

If an inclined strut or a vertical post can be intersected at its center, or at two or more in-

termediate points, thereby reducing the length of the intermediate portions, and the struts or posts can at the same time be stayed or stiffened, or held in position laterally, both in the transverse and longitudinal direction of the truss, at as many intermediate points as they are intersected by the ties, (the ties being employed for this additional duty by spreading them apart in a bow shape, where they cross the struts, and at the same time providing a fixed connection between the ties and struts at their several points of intersection,) then it follows that by this disposition of parts I can accomplish the important economical and useful purpose of reducing the posts or struts to a series of short columns or struts, whose resistance to compression and flexure will be increased nearly in the inverse ratio of the squares of the lengths into which the struts are divided.

At the intersection of the ties and struts I form a connection, by knee-pieces, bolts, rivets, clamps, keys, set-screws, or other known devices, by which the ties are tightened, and the ties and struts can be held together at the points of intersection, and all motion at these points prevented.

In Figs. 1, 2, and 4, Plate 1, a strut, *A*, is formed of an I-beam, to which are riveted two flat bars, with enlarged or upset end, to form an economical connection with the chords. *B*, Figs. 1 and 2, are tension diagonals or ties, which may be flat or square, with eyes, or loops, or rivet-holes at the ends, for connecting the same with the chords. *C*, Fig. 5, is the knee-piece or connecting-piece by which the ties *B* are sprung apart or bowed outward from and combined with the struts *A* at their intersection with the ties. *S*, Fig. 2, is a set-screw employed for a similar purpose.

The struts, Figs. 13 and 14, may be formed of upset eye-plates or links, combined with angle-irons or T-irons, or by portions of circular or polygonal or other sections, riveted through flanges, and connected with the ties at the point of intersection by *L*-pieces, or other devices, interposed between the flanges and secured to the same and to the tension-bars, springing the bars apart, by knees, guides, clamps, set-screws, or any equivalent devices, so as to effect the purpose desired, viz., to truss, stiffen, or stay the struts at one or more

intermediate points in their length, by means of the diagonal ties, causing the diagonal ties to act in a twofold capacity, viz., as suspension-ties and as trussing-rods to the struts, without using auxiliary truss-rods for this purpose.

By the interposition of the clamps, knees, combining-pieces, or equivalents, and through their instrumentality springing the tension-bars apart after they have been fixed at the extremities, an initial tensile stress is brought upon the tension-rods, and they are thus made to bear firmly against the connection at the point of intersection with the strut; and by varying the amount of curvature in the ties they will be shortened or lengthened, as may be necessary, to produce a uniform tensile stress on the ties and the requisite camber in the truss of which they form a part.

Since some of the struts and ties, in certain positions of the traveling load, may act respectively either as struts or ties, by these and equivalent methods and devices for trussing the struts or posts their resistance to flexure will be greatly increased.

By this system of mutually-trussed diagonals, or with verticals trussed by diagonals secured and tightened as described, the most economical and effective distribution of material is secured. With the diagonals I combine horizontal upper chords, of wrought-iron, cast-iron, or steel, formed in tubular, cel-

lular, or other sections, as shown in Figs. 6 and 7, Plate 2, or with upper chords bowed or arched, and lower chords straight, as in a bow-strung girder, Fig. 10, or with both upper and lower chords arched or bowed, as in Figs. 8 and 9, or to employ struts in zigzag positions, Figs. 11 and 12, in combination with a plate-girder, instead of vertical struts and stiffeners, in order to make the struts assist in supporting and transmitting the load.

The sizes and proportions of the chords, struts, or posts and ties for any proposed structure embracing these improvements must be determined by the well-known formula for strains in girders, the struts or columns being considered as columns of decreased length when the number of intersections has been increased.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

The construction and arrangement of tension-bars and struts for giving initial tensile stress to the bars and rigidity to the struts, substantially as herein set forth.

In testimony whereof I have hereunto signed my name in presence of two subscribing witnesses.

J. H. LINVILLE.

Witnesses:

CHARLES H. EVANS,
ISAAC R. OAKFORD.