L. W. DENSMORE.

TRUSS-BRIDGE.

No. 188,107. Patented March 6, 1877.

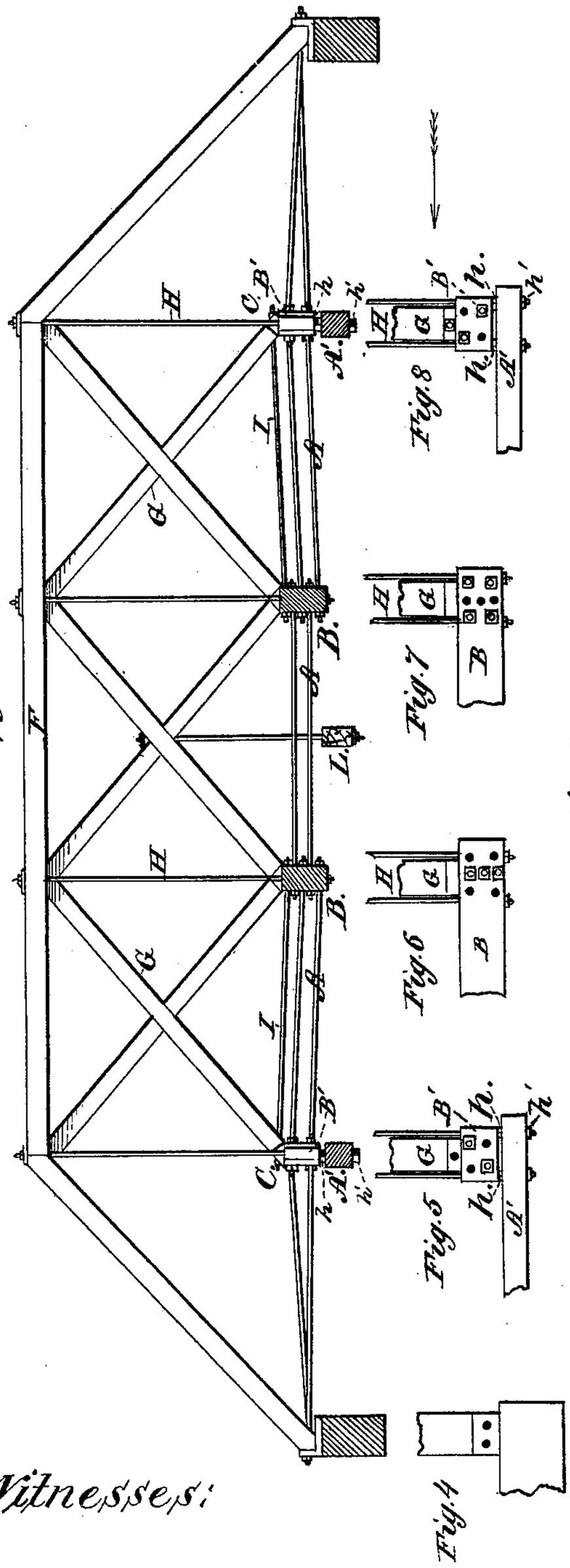
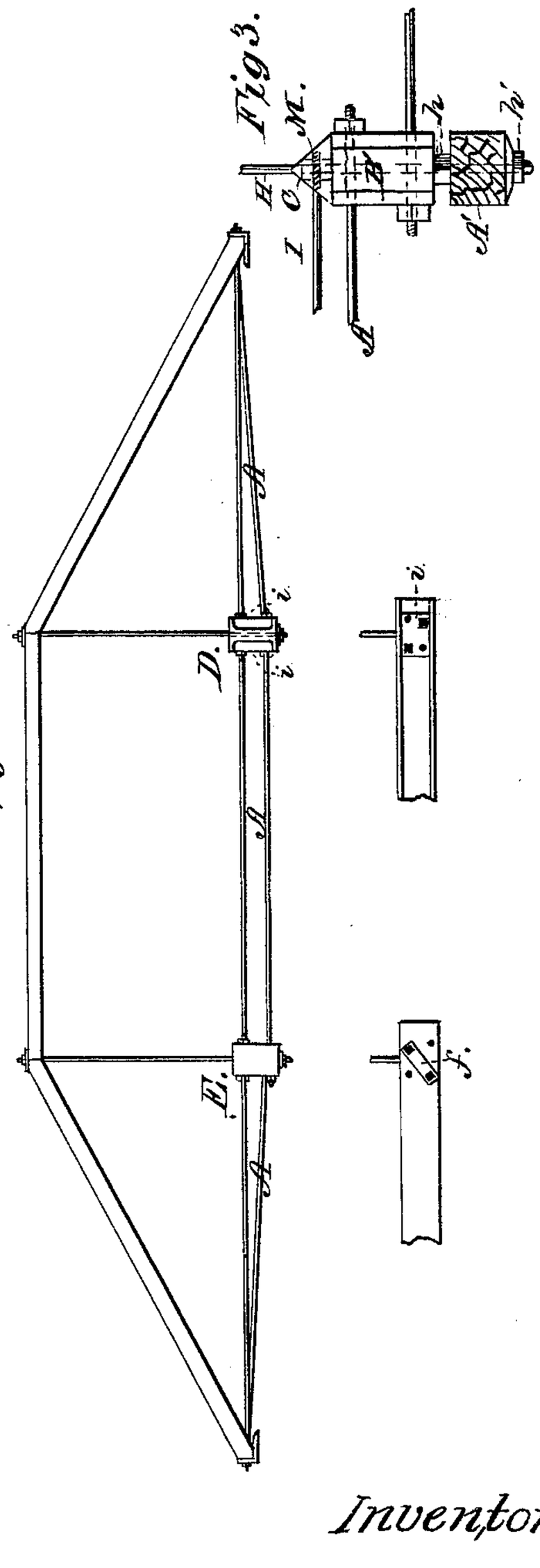


Fig. 1.



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UNITED STATES PATENT OFFICE.

LYMAN W. DENSMORE, OF ST. JOSEPH, MISSOURI.

IMPROVEMENT IN TRUSS-BRIDGES.

Specification forming part of Letters Patent No. **188,107**, dated March 6, 1877; application filed September 16, 1874.

To all whom it may concern:

Be it known that I, LYMAN W. DENSMORE, of St. Joseph, Buchanan county, Missouri, have invented an improved method of constructing and connecting the lower chords of trusses for bridges, roofs, &c., and combining the same with the other members of the truss, of which the following is a specification:

The object of my invention is to apply iron in the form of rods or bars, with nuts and screws at their ends, to the construction of the lower chord of a truss-frame to support heavy loads, with new appliances for connecting them with the other parts of the structure, to resist advantageously the local and general horizontal thrust of the braces or struts forming supporting parts of the same, the whole acting together to form a truss having great strength, with economy in material and construction.

Figure 1 is a longitudinal section of a five-panel truss; Fig. 2, a similar view of a "pony" or "bow-string" truss; Fig. 3, a detail of one of the features of my invention. Figs. 4, 5, 6, 7, 8 are details of the couplings of Fig. 1, beneath which they are respectively placed, looking from the right to the left, the same illustrating an arrangement of the rods of the chord in increasing clusters, so as to preserve the center of tension.

Referring generally to the drawings herewith submitted, I construct my truss with an upper chord or straining-beam, F, in any of the usual forms, with inclined struts G and vertical suspension-rods H, varying the form, size, and position of the same according to length of span and strength required, making the truss in any suitable and convenient number of panels, with iron bars in pairs or clusters of proper length to reach the length of one panel, and through the girders or coupling-blocks, as the case may be, and furnished with nuts and screws to form bearing on their opposite sides, forming the lower chord.

In an "A-truss," so called, there will be two lengths of chord-bars; in the pony or bow-string truss three lengths or panels, coupling on the girders or floor-beams in pairs, as shown in the accompanying drawing, Fig. 2, the tension on the lower chord being sufficiently uniform to practically require no change in weight of metal. If more than three panels, however, are used, the strains on the different members of the truss become cumulative, varying constantly between the ends and center. Thus, if the strain upon the truss be considered one hundred thousand pounds, and there be five panels, as in Fig. 1, there will be twenty thousand pounds to each panel. Now, by dividing the central panel in the middle, there will be ten thousand pounds on each side of the center. Computing the cumulative strain upon each side of the center, the ten thousand pounds, having no direct support, is transmitted to the next outer or second panel, having a local strain of twenty thousand, which makes the cumulative local strain of the panel thirty thousand pounds. This thirty thousand pounds, having no immediate support, is transmitted to the next outer or first panel, which has a local strain of twenty thousand, so that the strain for the chord of this panel is fifty thousand, or its local strain with the additional local strain of thirty thousand of the second panel. The strain upon the second cluster of chord-bars will be, then, fifty thousand plus the local strain of the second panel, (thirty thousand,) making the whole strain upon the second set of chord-bars eighty thousand, and the strain upon the chord of the third or middle panel will be ninety thousand, which is eighty thousand (the strain of the chord of the second panel) plus ten thousand, or one-half the local strain of the middle panel. The strains upon several sets of chord-bars of a five-panel truss, then, are as fifty thousand, eighty thousand, ninety thousand, from the extremities to the center.

To provide for the increasing tension on the lower chord in the panels near the center, I introduce one or more additional rods in the second panel, in a four or five panel truss, as in Fig. 1, and also in the second and third panels in a truss of six or seven panels, and so on to any length of truss with any greater number of panels.

In the accompanying drawing the addition-

al or third chord-bar I in the second panel is connected at its shoreward end to the independent angle-block C, which is cast hollow, like a Howe angle-block, and has in its interior a recess with suitable bearing-faces to receive a nut, M. (Shown in Fig. 3.) At its inward end the same rod passes through the coupling B, thus making a separate and perfect adjustment of the strain produced by the strut carried by the angle-block C. The position of the rods forming each cluster may be varied according to number, so that they may pass each other at the respective couplings, keeping in view the prime condition that the center of tension of each panel shall be coincident with that of the adjoining panels, to prevent twisting and unequal strains at the couplings.

In the drawing herewith shown it will be seen that I adopt two forms of coupling for the chord-bars—one in the body of the girder, which may be of wood or metal, at B B, Fig. 1 of drawing, and one in a separate coupling-block, B′ B′. It will also be seen that the suspension-rods at these points B′ are furnished with two nuts at their lower ends, one of which, *h*, supports the coupling-block, and the other, *h′*, supports the girder A′ below, which is in such case to be of wood, and may, by reason of nut *h*, be removed at any time without disconnecting the truss. The use of either of these forms of coupling and girder connection is equally adapted to my arrangement of chord-bars, which will be the same in either case.

Referring again to the drawings, in the light of the foregoing explanations, it will be seen that Fig. 1 has the couplings B′ B B B′ in order, with girders A′ hung beneath B′, which latter carrying chord-bars in pairs, and also support angle-blocks C C. (Shown enlarged at Fig. 3, to exhibit position of additional rod and nut M.) Couplings B B carry three rods for second panels, and four rods for center panels, all which is more fully seen in the transverse sections underneath, where also are shown the nuts *h*, supporting coupling-blocks, and bottom nuts *h′*, supporting girders. Fig. 2 shows coupling made directly on the girder, which may be of wood, as at E, with diagonal stirrup-plates *f* on opposite sides, or may be of iron, as at D, where two channel-bars are shown, with flush-plates *i i* to stiffen the coupling, the vertical rod passing between the plates, with nut and washer below.

I do not confine myself to the use, in this combination, of either of the above styles of girder, as either may be combined with my arrangement of chord-bars with equal facility, and the length of span and character of strains may make either kind preferable in different cases.

L shows an intermediate girder, with its suspension-rod depending from the intersection of main and counter braces, to be used to subdivide the panels of any span where the bearings on principal girders are too far apart for convenience and safety.

I am aware of the patent to A. Fink, granted April 9, 1867, in which is shown the gradually-increased number of iron bars in the chord, having a link-and-pin connection, together with stay-rods, whose ends pass each other, and are fastened by nuts upon opposite sides of the girders.

I am further aware of the patent to A. J. Post, September 1, 1868, in which a detachable girder is hung to loose hangers swung from the coupling-pins, and also of the patent to F. H. Smith, granted March 10, 1868, showing a chord composed of clusters of iron bars having screw-nuts upon their ends, but provided with special couplings; and I fully disclaim the features of construction therein shown, and confine my invention to the improvements herein described, to wit: first, the extension of the ends of the chord-bars A past each other, and fastening them directly to the couplings (girders or blocks) by nuts, without the expense of providing special forms of couplings shown by Smith, and without the necessity of increasing the size and strength of his special couplings to provide for the increased number of rods in the chord for the central panels; secondly, in connection with a proper distribution of the number and size of the chord-rods A to meet the varying strains in different panels, so varying and adjusting the position of the rods in each panel around a common axis of tension, as shown in Figs. 4, 5, 6, 7, 8, to prevent twisting or breaking strains in the girder or coupling-block; thirdly, the carrying one or more of the tension-rods I in each panel (whose brace or strut G carries a cumulative horizontal thrust) directly through and fastening with the independent angle-block or shoe C bearing such brace, thereby giving the means of a perfect distribution of strains throughout all parts of the truss, and preventing undue or twisting strains upon the couplings at these points; fourthly, the use of the nuts *h h′*, in combination with the suspension-rod H, extended through the coupling-block and girder, whereby the latter may be easily removed and replaced without disconnecting the truss.

I claim—

1. The truss-chord formed of metallic rods A, having their ends extended past each other, combined with, and fastened directly to, the girders or coupling-blocks by means of nuts upon the opposite side of the said couplings from the central parts of the rods, substantially as and for the purpose described.

2. The clusters of chord-rods A, having their ends extended past each other through the couplings, and fastened to their opposite sides, and arranged with increased number or weight of metal toward the center about a

common axis of tension, substantially as and for the purpose described.

3. A bridge having one or more of the tension-rods I in each panel, whose brace or strut carries a cumulative horizontal thrust, combined and connected directly with and fastened to an independent or loose angle-block, C, carrying said strut, substantially as and for the purpose described.

4. The combination, with nuts *h h'*, the coupling-block B', and girder A', of the suspension-rod H, extended through the said coupling-block and girder, and arranged to detachably secure said girders, substantially as and for the purpose described.

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