

F. H. SMITH.
Bridges.

No. 128,449.

Patented June 25, 1872.

Fig. 1.

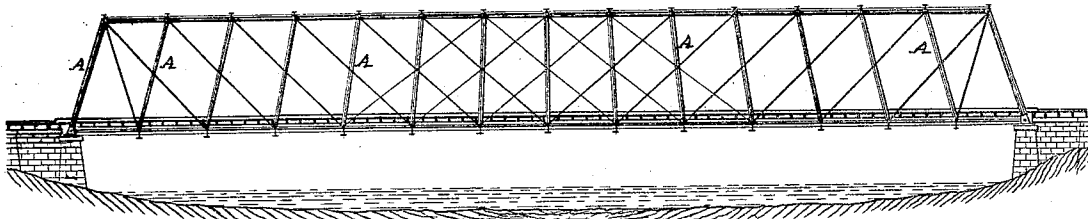


Fig. 2.

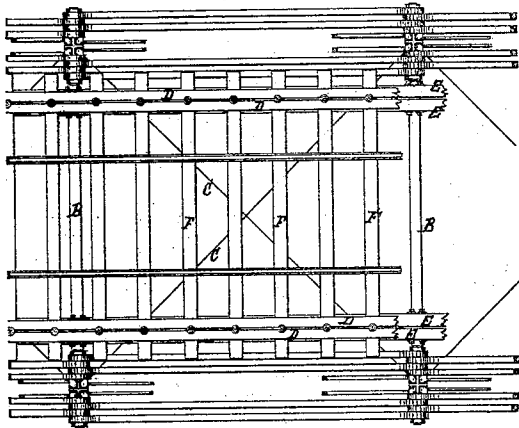


Fig. 3.

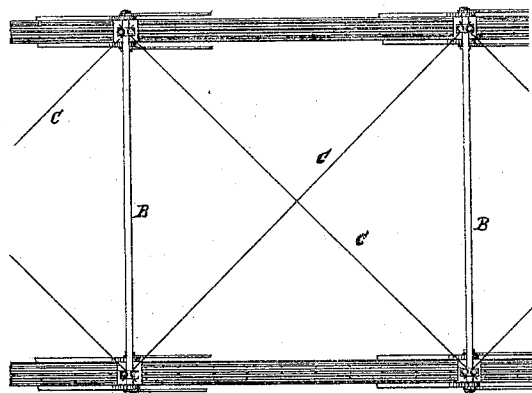
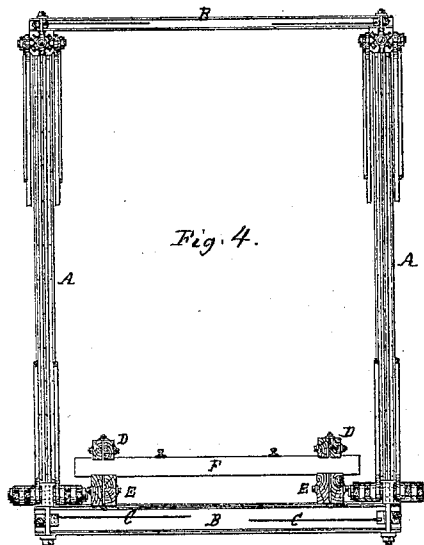


Fig. 4.



Scale of Elevation.
0 10 20 30 40 50 60 70 80 90 100

Scale of Plan & Section.
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

WITNESSES

S. M. Pool
C. B. Nottingham.

INVENTOR

Frederick H. Smith
by atty A. Pollok

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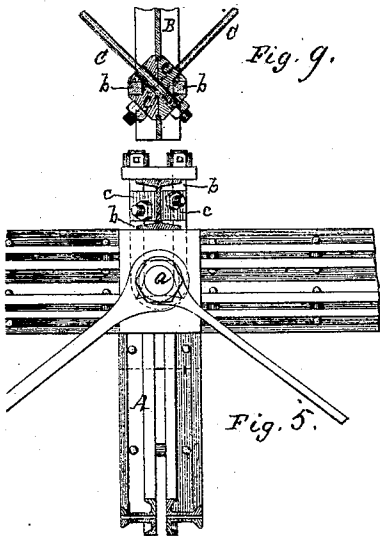


Fig. 9.

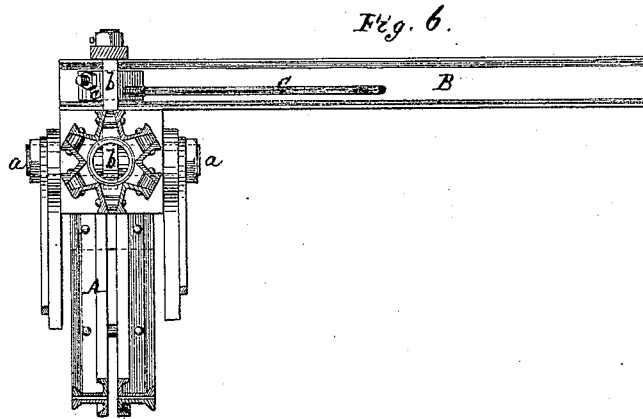


Fig. 6.

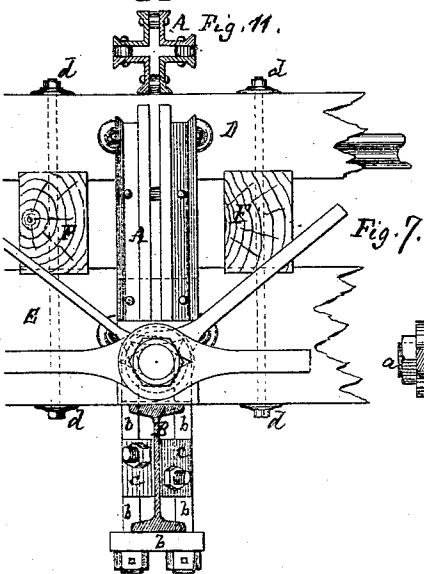


Fig. 7.

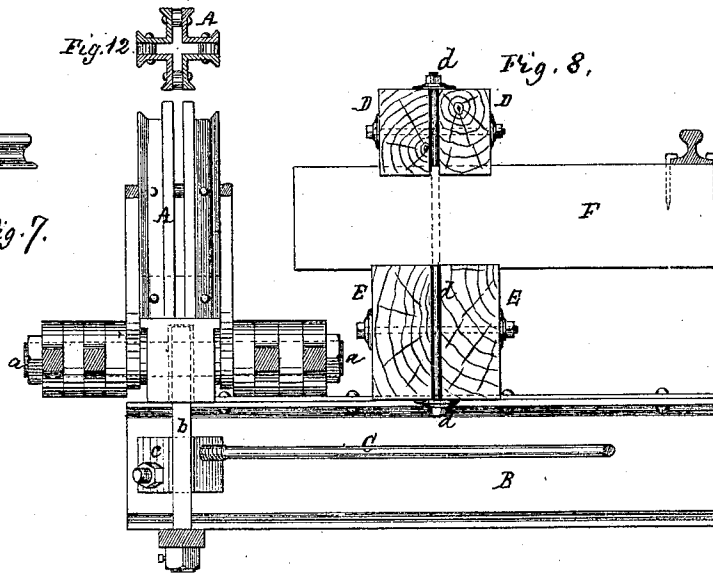


Fig. 8.

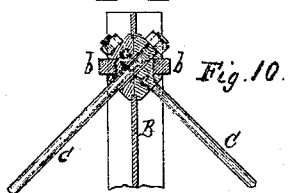
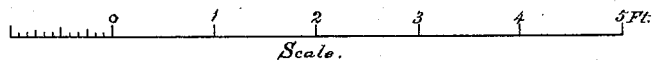


Fig. 10.



WITNESSES

J. M. Pool
C. B. Nottingham

INVENTOR

Fredrick H. Smith
by Atty. Hollok.

UNITED STATES PATENT OFFICE.

FREDERICK H. SMITH, OF BALTIMORE, MARYLAND.

IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. 128,449, dated June 25, 1872.

To whom it may concern:

Be it known that I, FREDERICK H. SMITH, of the city and county of Baltimore and State of Maryland, have invented certain new and useful Improvements in the Construction of Bridges of which the following is a specification:

My invention relates, first, to the arrangement of the posts or compression-members of the vertical system of truss-frames for bridges; secondly, to the combination of the bracing-rods and struts of the lateral system with twin bevel-washers, as hereinafter described; and, thirdly, to the construction of the floor of the truss.

In the accompanying drawing, Figure 1 is a side elevation of a bridge made in accordance with my invention. Fig. 2 is a top view on an enlarged scale of a portion of the lower chords and lateral system and the floor. Fig. 3 is a like view of a portion of the upper chords and lateral system. Fig. 4 is a transverse vertical section of the truss. Fig. 5 is a side elevation, and Fig. 6 is an end elevation, on a still more enlarged scale, of a portion of the top chord, representing the mode of combining the struts and lateral rods of the lateral bracing system through twin bevel-washers. Figs. 7 and 8 are like views of a portion of the bottom chord, representing the connections of the lower lateral bracing system and the construction of the floor. Figs. 9 and 10 are horizontal sections through the web and the washers of the upper and lower struts of the lateral bracing system. Figs. 11 and 12 are transverse sections of the vertical posts or compression-members of the truss.

On all systems of truss-frames for bridges in which both top and bottom chords are used, connected vertically and laterally by bracing systems composed of struts and ties, it is known, first, that the horizontal strains of compression and tension in the chords are greatest in the middle of the span, and diminish in intensity toward the ends; second, that the vertical and diagonal strains of compression and tension in the vertical bracing system are greatest at the ends of the span, and diminish in intensity toward the middle; third, that the strength per square inch of sectional area of compression-members increases in a certain proportion to the increase of diameter as compared to the

length between supports; fourth, that compression-members in vertical bracing systems should have as much inclination within the theoretically economical angle of forty-five degrees as is compatible with a sufficient ratio of diameter to length to insure them against flexure or dangerous vibration; fifth, in all bridges of ordinary lengths of span it is necessary to waste material in those compression-members which carry the minimum strains, because the member must in any event be of a certain proportionate diameter to resist flexure and vibration, whereas the minimum strains are generally so small at these points that they do not utilize a tithe of the sectional area of members made large enough to resist flexure and vibration.

In the bridge I propose the compression-members A of the vertical system are vertical at the center of the span, and inclined at the ends, as shown in Fig. 1, the intermediate posts varying in inclination more or less as they are nearer to the ends or the center, the center lines of the posts being radial, and converging to a common central point above the span-center, by which design I gain the following advantages: First, in all other bridges within my knowledge the panels of the top chord are equal in length to those of the bottom chord; but in my design, while retaining the same economical length of panel for bottom chord as in other plans, I reduce the length of panel in the top chord, thereby materially increasing the ratio of diameter to length and consequent capacity per square inch of sectional area, and also lessen the amount of waste material in end panels subject to minimum strains. Second, in the vertical bracing system the strains are smallest in the middle of the span; and at this point my posts are vertical and shortest, thus again keeping down to a minimum all waste on account of light strains, while by successively increasing length, inclination, and sectional area of the posts toward the ends of the span as the strains increase I am enabled to utilize the material to the best advantage. My bridge is thus a medium between those forms of truss in which the posts all incline at the same angle and those in which the posts are all vertical—the first form being economical at the ends and wasteful at the middle, the second form being economical in

the middle and wasteful at the ends—while my design is eclectic and utilizes the economical features of both the ordinary plans, and forms a distinct system in itself.

I do not confine myself to any particular inclination for the posts, as this will necessarily vary with conditions of span or depth of truss, or the number of intersections of systems, or the materials of members.

The lateral systems are composed of cross-struts B and diagonal ties C, the struts in both chords being similar in form of section, but different in area of section, as the area will depend upon whether the floor is on the top or bottom chord of the bridge, as the struts in the floor-chord will have to do duty as floor-beams as well as struts. These struts are bolted to the chord-pins *a* by one or more yokes or bolts, which cut into the flanges of the struts, and thus prevent any motion, as seen particularly in Figs. 5 and 7.

The lateral diagonal tie-rods C pass through twin bevel-washers *c* let into the web of the struts, and are tightened by screw-nuts on their ends, as seen in Figs. 9 and 10. These twin bevel-washers may be either inside or outside of the yokes *b*, which attach the struts to the chord-pins; but I prefer to place them between the arms of the yokes, as shown, as by this plan the rods cross each other immediately under or over the center lines of the chords, and also obtain a bearing for the washers against the yokes, a channel being left in the washers, in which the yokes rest, as indicated in section in Figs. 9 and 10.

The floor is composed of four sets of stringers, D D E E—two sets, E, below and two sets, D, above the cross-ties F—with long vertical bolts *d* passing through from top to bottom of stringers and cross-ties, thus combining the strength of both upper and lower stringers into one mass. The stringers are placed so far apart as not to be touched by any part of engine or train except in case of accident, in which case the upper stringers also act as guard-rails.

Having described my invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. A bridge-truss in which the posts or compression-members of the vertical system are radial from a central point above the span-center, as shown and described.

2. The combination of lateral bracing-rods and struts through twin bevel-washers, as shown and described.

3. A floor for a bridge-truss composed of upper and lower sets of stringers bolted to each other through cross-ties, as shown and described.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

FRED. H. SMITH.

Witnesses:

G. E. SANGSTON,

THOS. M. BEADENKOPF.