W. M. BLACK.

Truss-Bridge.

No. 166,960. Patented Aug. 24, 1875.

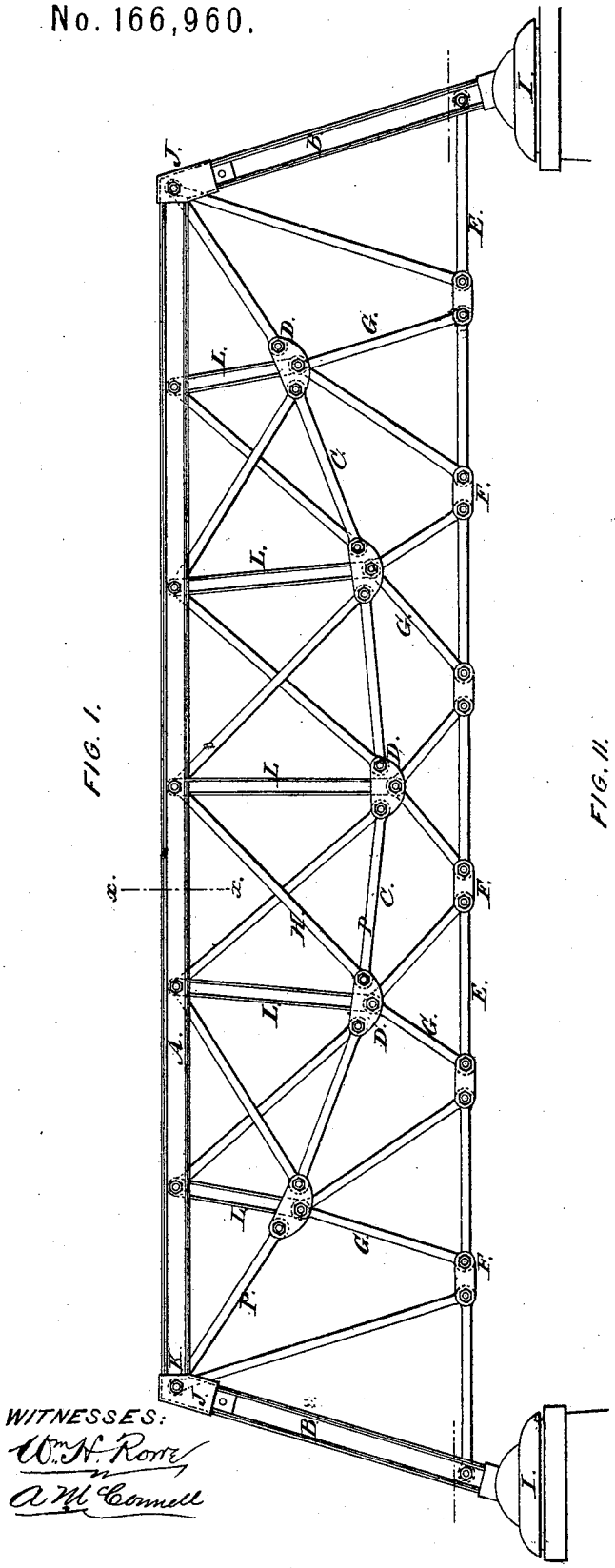

FIG. I.

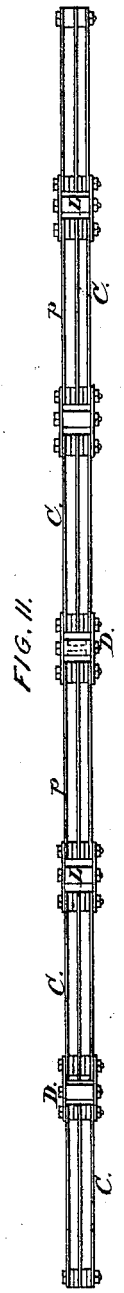

FIG. II.

FIG. III.

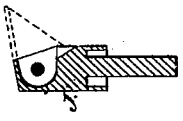

FIG. V.

FIG. IV.

WITNESSES:

Wm. H. Rote

A. M. Connell

INVENTOR:

Wm. M. Black,

Per L. C. Black.

Atty.

UNITED STATES PATENT OFFICE.

WILLIAM M. BLACK, OF LANCASTER, OHIO.

IMPROVEMENT IN TRUSS-BRIDGES.

Specification forming part of Letters Patent No. **166,960**, dated August 24, 1875; application filed July 17, 1875.

To all whom it may concern:

Be it known that I, WILLIAM M. BLACK, of Lancaster, in the county of Fairfield and State of Ohio, have invented certain new and useful Improvements in Bridges; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification.

The object of the invention is to so construct a truss-bridge that the strain resulting from a burden on the roadway may be communicated to the main tensile member of the truss at right angles at the point of contact therewith, and simultaneously at different points, whereby the strain may be distributed proportionately throughout said member.

This object is effected by the peculiar construction and arrangement of a truss, composed of an upper chord and a catenarian tension-arc, together with radial compression-posts and diagonal tension-bars, in combination with a suspended lower chord, to which is attached the roadway.

The invention also consists in the peculiar construction of the catenarian tension-arc and of a cap used to join the truss with the inclined end main posts, and also in the manner of suspending the lower chord.

In the accompanying drawing, Figure I is a side elevation of the bridge. Fig. II is a plan view of the catenarian tension-arc. Fig. III is a plan view of the lower chord. Fig. IV is a transverse section view of the upper chord on the line *x x*. Fig. V is a view of the cap detached.

The chord A is made of iron or steel, in the form of plate and channel-bar, or in any other suitable form. C is a catenarian tension-arc, or the arc of a circle, cutting the points K, and, at its greatest deflection from the chord A, cutting a point from three-fourths to seven-tenths of the distance from the center of the chord A to the center of the chord E. The tension-arc C is composed of sections or sets of eye-bars of suitable equal lengths, connected by bolts and hitch-plates D, hereinafter more fully described, and is joined to the chord A by bolts, or in any suitable manner. This tension-arc is the main tensile member of the bridge, and the bridge is so constructed that its other parts follow this member freely without the usual resulting strain from contraction and expansion. The posts L are made of iron or steel, in the form of plate and channel-bar, or in any other suitable form, with an eye at each end, being joined to the chord A by bolts, and to the tension-arc C by bolts and the hitch-plates D. These posts may be placed at right angles to the tension-arc C at the point of contact therewith, whereby they are radial from the center of the circle, of which the tension-arc is a part; or they may be so placed that the points of contact of any post (except the central one) with the tension-arc C and the chord A are equidistant from the nearest point K; or they may be so placed that their points of contact with the chord A divide said chord into equal sections, the posts in all cases retaining the same position on the arc C. Any of these arrangements of the posts L has the effect to communicate the strain at right angles, or nearly so, to the tension-arc C at the point of contact therewith, whereby the strain is distributed equally between the members connected by the hitch-plates D. Ordinary tension-bars H extend from the junction of the posts L with the tension-arc C, diagonally to the junction of the next corresponding post L with the chord A, or to the junction of the second corresponding post L with the chord A at pleasure. These tension-bars are joined to the arc C by a single bolt passing through the hitch-plate D, sets of eye-bars *p* in the arc C, and the bars H, and to the chord A by a single bolt passing through the chord A, the posts L, and the bars H. The inclined end main posts B are made of steel or iron, in the form of plate and channel-bar, or in any suitable form, and may be joined to the chord A in any convenient manner; but it is the purpose to join them by means of the cap J, hereinafter more fully described. These posts are rounded at the lower end, and are set in cast-iron shoes, one or both of the shoes being placed on ordinary friction-rollers.

The chord E is made of sections or sets of eye-bars of suitable equal length, the several

sections being united by bolts and hitch-plates F. The chord E is joined to the posts B by bolts, or in any suitable manner. The roadway is attached to the chord E by any convenient method. The chord E is suspended to the tension-arc C by means of the bars G, two sets of bars being attached to the same point or hitch-plate F by bolts. The two sets of bars G, which are joined to any point or plate F, are made to diverge, so that the opposite angles, formed by these sets of bars and the chord E, are equal, or practically so. The one set of these bars is joined to the first right-hand hitch-plate D in the tension-arc C, and the other to the first left-hand one, a single bolt passing through the hitch-plate D, the post L, and the bars G.

If desirable, the lengths of the several sections of the chord E may be so governed and varied as to make the opposite angles, formed by the sets of suspension-bars G and the chord E, always precisely equal. By this manner of suspending the chord E the strain of a burden at any point or plate F on the chord E is divided and communicated to the tension-arc C at two separate points instead of one, as in the case of vertical suspension-bars. The plan of suspending the roadway obviates the necessity of heavy posts extending the entire distance from the upper chord to the lower chord.

The cap J, as shown in Fig. V, is made of cast-iron in a single piece, and is intended not only to unite the chord A and the main posts B, but also to protect the joint from the weather. The lower part of this device, as shown in Fig. V, and the accompanying transverse section view, is made with a stud or nose to project into the end of the hollow post B, and a recess fitted to receive the end of said post, thus firmly uniting the cap and the post. The middle part of the device is solid. The upper part has a cavity fitted to receive the rounded end of the cord A, forming therewith a knuckle-joint. A single bolt passes through the cap J, the chord A, the arc C, and the bars H, thus securing the several parts.

The hitch-plates D are made of wrought-iron or steel, and are semicircular in form, the bolt-holes therein being arranged in the circumference of a circle conforming with the shape of the plate. The posts L and the bars G only are connected with the hitch-plates D by the lower bolt. By this arrangement the plate D has a tendency to equalize the strain upon the members of the bridge secured by the other bolts, the plate turning upon the lower bolt, to accommodate itself to the inequality of strain. Greater strength is also obtained by having the strain on any of the joints in the arc C divided between three bolts, instead of being carried by a single one.

An additional advantage is secured by the fact that the strain on any of these bolts is in but two directions, whereas with a single bolt there would be strain in at least four directions.

In order to better understand the symmetrical relations of the parts of this bridge, it must be noticed that the chord E is always composed of an odd number of sections, and exceeds the chord A in length by the length (or average length, if the sections in the chord E differ) of one of these sections. There is also always one less section in the arc C than in the chord E. The inclination of the end main posts B is, therefore, governed by the varying difference in length of the chord A and the chord E, and the number of sections in the chord E regulates the relations of the remainder of the bridge.

I claim as my invention—

1. In combination with a catenarian tension-arc, an upper chord, radial compression-posts, and diagonal tension-bars, substantially as shown, and for the purpose specified.

2. The catenarian tension-arc C, composed of sections or sets of eye-bars, united by the hitch-plates D, substantially as shown, and for the purpose specified.

3. In combination with a catenarian tension-arc and end main posts, a lower chord, suspended by sets of diverging bars, substantially as shown, and for the purpose specified.

4. The cap J, substantially as shown, and for the purpose specified.

In testimony that I claim the foregoing as my own invention I affix my signature in presence of two witnesses.

WM. M. BLACK.

Witnesses:

GEORGE W. BROCK,

WM. MITCHELL.