2 Sheets, Sheet 1.

A. McD. Campbell,

Suspension Bridge.

No. 110,546. Patented Dec. 27, 1870.

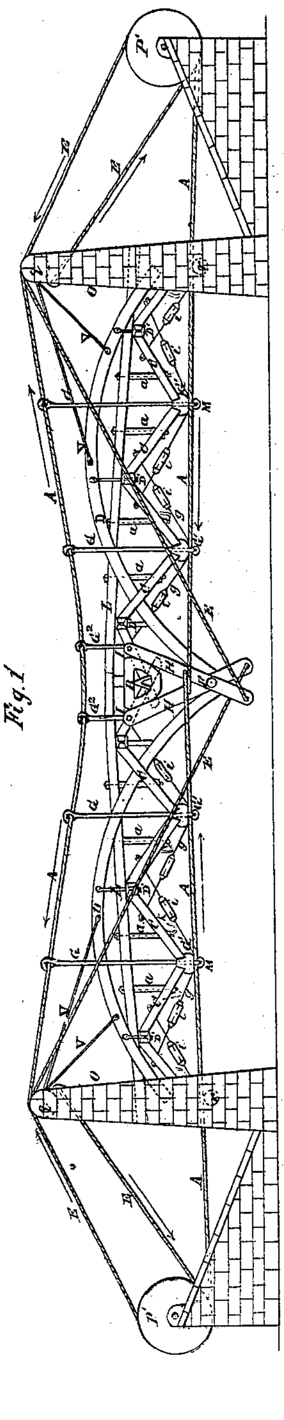

Fig. 1

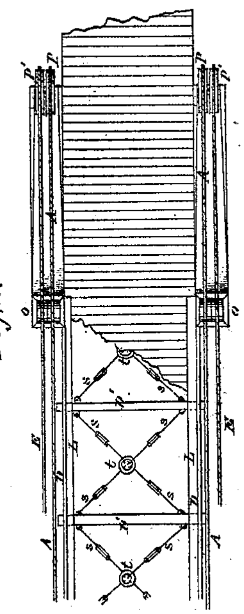

Fig. 2.

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William H. Dodd

Henry C. Post

Inventor:

Alex. McDonald Campbell

2 Sheets. Sheet 2.

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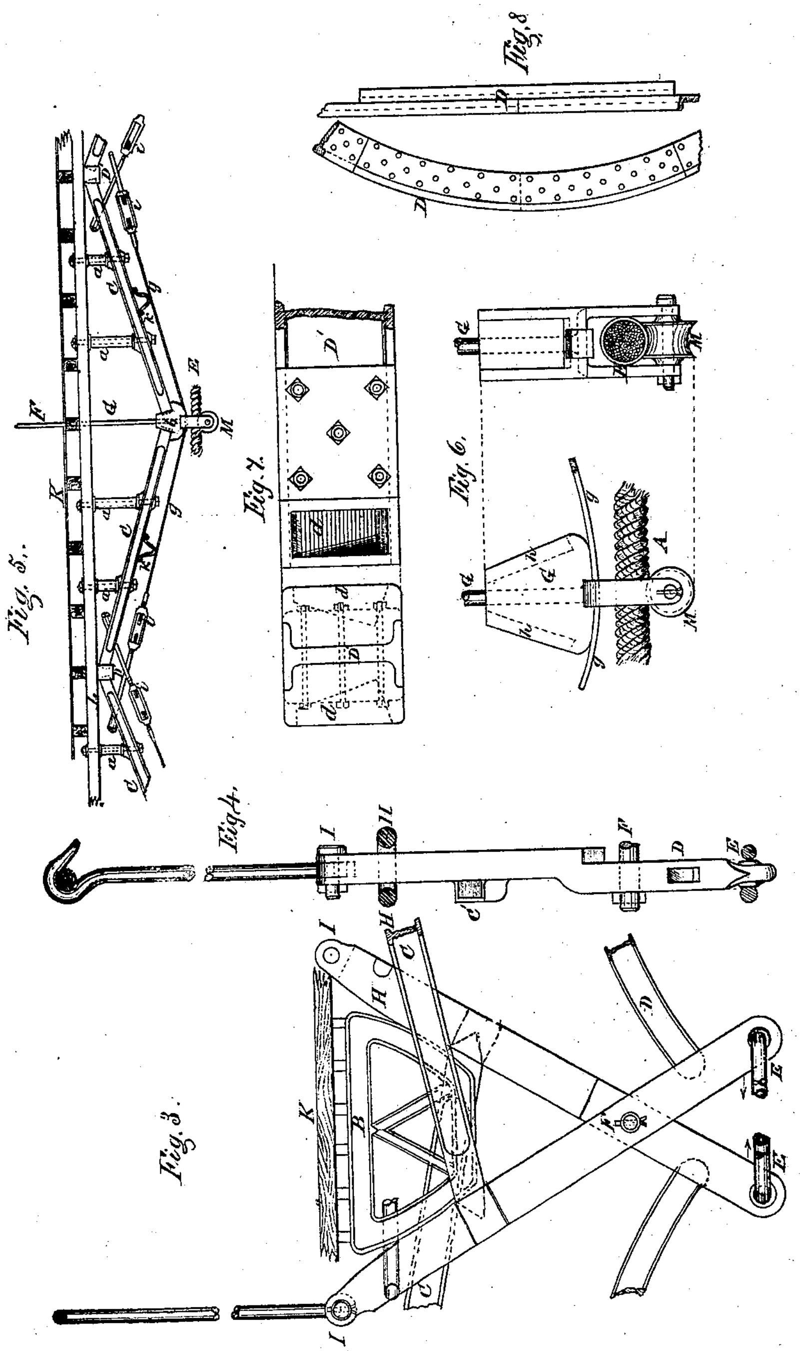

Witnessess

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ALEXANDER McDONALD CAMPBELL, OF NEWARK, NEW JERSEY, ASSIGNOR TO HIMSELF, CHARLES M. BOLEN, AND FREDERICK K. DAY.

Letters Patent No. 110,546, dated December 27, 1870.

IMPROVEMENT IN BRIDGES.

The Schedule referred to in these Letters Patent and making part of the same.

I, ALEXANDER McDONALD CAMPBELL, of the city of Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Suspension-Bridges, which I denominate the self-bracing compensating suspension-bridge, of which the following is a specification.

My invention has for its object the adaptation of the principle of self-bracing and compensation to suspension-bridges, thereby enabling them to be constructed of greater length of span, and obviate deflection and vibration to the greatest possible extent; and

It consists in the continuation of the main cable around cylinders at either abutment, and their anchorage in compensating-levers, which are actuated by the moving weight upon the roadway; in the means by which such weight is made to act upon said levers; in the arrangement of a series of skew-backs to equalize and distribute the moving weight; in the combination, with the compensating-levers, of bracing cables extending therefrom over the top of the towers, around the cylinders, and returning to and anchored in the towers; in the employment of cylinders and in the base of the towers to overcome the friction on the cables; and in the combination and arrangement of the several parts mentioned, and the construction of their details, as will hereinafter appear.

In the drawing—

Figure 1 is a side elevation of my improved bridge, and

Figure 2 a plan view of a portion of the same, showing the tower and butment walls, and a portion of the space of the bridge, having the roadway removed to show the lateral bracing.

Figure 3 is an enlarged side view of the central wedge-bearing and compensating-levers.

Figure 4, a side view of one of the latter.

Figure 5, an enlarged fragmentary side view of the roadway and string-piece, and stanchions supporting the latter upon the skew-backs with the hanger-block and brace-straps of the latter;

Figure 6, enlarged side and transverse views of said hanger-block, and a portion of the main cable, and one of the friction-pulleys on which it is supported;

Figure 7, enlarged end and side views of the truss-girder and skew-back connection; and

Figure 8, side and top view of a portion of the girder-arch.

The main cables A A are continued from the top of the towers O O around drums or cylinders P P, which have their axis firmly secured in the heavy mason-work of the abutments, and thence back to the center of the span, where their ends are anchored to the compensating × levers H H, at a point above their axis or pivot F, thereby making the tensile strength of the cable fully available.

The pivot F is so placed that the long arms of the levers are uppermost, and are suspended by the hangers G^2 G^2 from the main cable, having swivel-joint connections at I I.

A wedge-shaped bearing, B, is interposed between these long arms, on which rest the string-pieces L and roadway. The effect of a moving weight over the roadway at this point, sufficient to depress it in any degree, acts to the same extent on the wedge-piece B, expanding the long arms of the × levers, thereby drawing the two ends of the cables A, in opposite directions, (they having lapped each other before fastening,) as indicated by the arrows.

This movement tightens and raises the sag of the cables between the towers, and consequently elevates the crown of the roadway. It is in consequence of this movement of the cables that the cylinders P P are employed to prevent friction, they consisting of drums of such diameter that the largest size of cable required will readily bend around them.

This movement of the cables (which, however, is practically so slight as to be almost imperceptible) is a leading feature of my principle of compensation, the action described being the beginning of that which operates through the entire structure. Thus, the stringers are supported at suitable intervals on transverse truss-girders D′ D′, which rest on skew-backs C C C, the feet of which are set in recess of the hanger-blocks G^1 G^1, which are suspended by the rod G, to the main cable.

Those skew-backs which meet in the center have their ends crossed and anchored in the compensating-levers H H, so that the skew-backs adjust themselves to the expansion of the levers and tightening of the main cable, which raises the crown of the roadway at every point, the strain being equally distributed, or nearly so, through all parts of the span, and no deflection can occur from a weight not exceeding the absolute strength of the material to bear.

At intermediate points between the truss-girders the string-pieces are supported from the skew-backs by stanchions *a a*, and the hanger-blocks G are likewise supported by the brace-straps *g g*, having their ends in each alternate series of skew-backs with turnbuckles *i i* for tightening, and saddles *k k* for intermediate support.

The hanger-blocks have sockets *h h*, (fig. 6,) on either side, for receiving the feet of the skew-backs, and pendent from each hanger is a friction-pulley, M, for supporting the continuation of the main cable A.

Each span is provided with a pair of girder-arches, D D, which spring from the towers, and anchor in the × levers H H at points below their axis, so that their thrust is met by the action produced by the general strain on those levers, which strain has the effect of tightening them up.

For long spans I employ what I term the tower-brace cables E E, which extend from the lower extremities or short arms of the × levers H H over the caps of the towers, and are continued around the cylinders P′ P′, and thence return to the towers, where they are anchored at or near the top, as seen in fig. 1.

In will be seen that by this arrangement the strain which is exerted on the cables E E by the weight of the bridge, the tendency of which is to draw the towers toward each other, is counteracted by the same force acting in the opposite direction through each cable, as indicated by the arrows.

Friction-drums are provided on the lower caps, as shown by dotted lines at *q q*, fig. 1, for both the main and brace-cables, and similar ones in the body of the tower at *r r*, which support and prevent friction to the continuation of the cables at these bearings.

Separate cylinders, P P and P′ P′, are employed for each cable.

The girder-arches are formed of segments of iron, rolled with a web on one side, the pieces being bolted or riveted with their flat sides together, and joints broken, as shown in fig. 8, making a light but strong girder.

Lateral rigidity is obtained by a system of bracing shown in fig. 2, in which four radial braces, *s s*, are connected with a central head, *t*, and their opposite ends with eyes to the truss-girders D′ D′, and provided with turn-buckles for tightening.

It will be noticed that the auxiliary braces V V balance the tensile strain of cables E E.

This system of construction combines the several advantages of the suspension, truss, and girder principles, and unites them in such a manner as to insure the utmost stability with lightness, and enables spans of great length to be constructed, the length being limited only by the strength of the material employed.

I claim as my invention—

1. The continuation of the main cables A A around sustaining points P P of the abutment, and their anchorage on the bridge, substantially as set forth.

2. In combination with the continuous return-cables A A and E E, the cylinders P P and P′ P′, for obviating friction, substantially as set forth.

3. The compensating-levers H H, in combination with the return-cables A A and hangers G^1 G^1, as set forth.

4. The wedge-bearing B, in combination with the compensating-levers H H, as set forth.

5. In combination with the levers H H, the skewbacks C C C, the adjoining ones connected therewith for equalizing the weight upon all parts of the roadway, as set forth.

6. The combination of the girder-arches D D with the compensating-levers H H, as set forth.

7. The friction-pulleys M, in combination with the hangers G and G^2 and the cables A A, as set forth.

8. The tower-brace cables E E, in combination with the cylinders P′ P′, arranged and anchored, substantially as described.

9. The combination of the return-cables A A, compensating-levers H H, girders D D, and skewbacks C C C, with or without the tower-brace cables E E, substantially as set forth.

ALEXR. McDONALD CAMPBELL.

Witnesses:
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