(No Model.) 2 Sheets—Sheet 1.

R. GRAY.

BRIDGE.

No. 489,946. Patented Jan. 17, 1893.

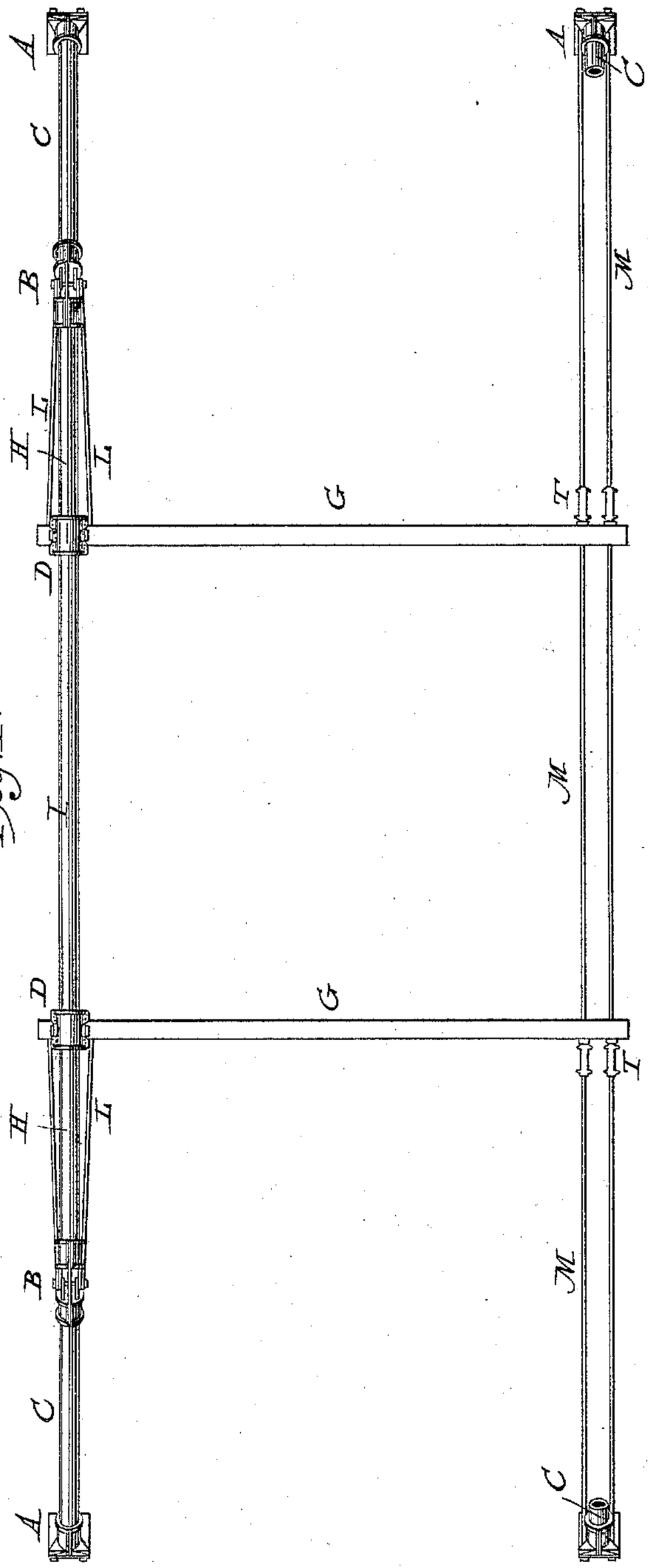

Fig. 1.

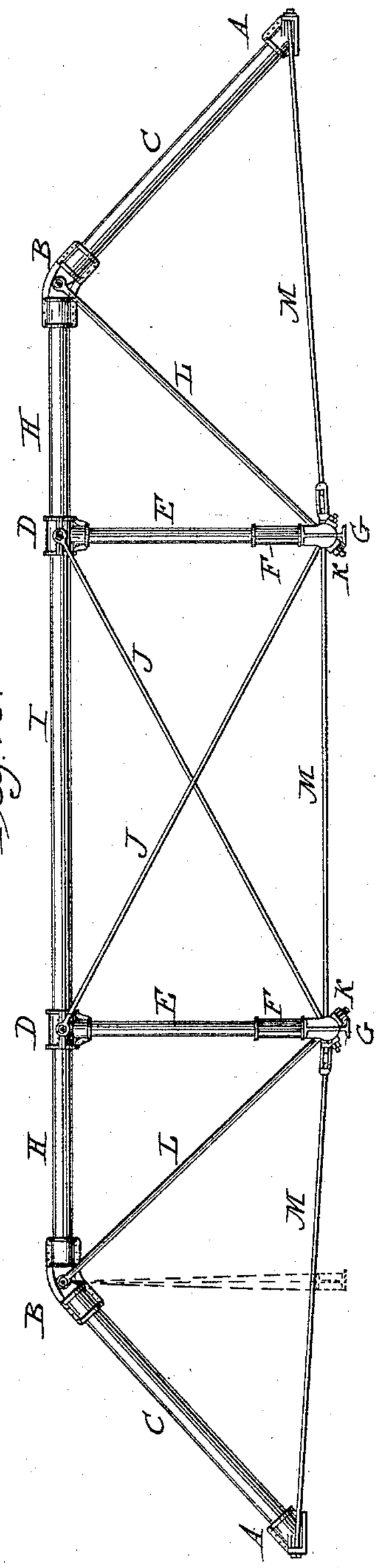

Fig. 2.

Witnesses
Sidney P. Hollingsworth
James F. Duhamel.

Richard Gray.
Inventor,
by his attorneys
Dodger Sons.

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R. GRAY.

BRIDGE.

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Fig. 3

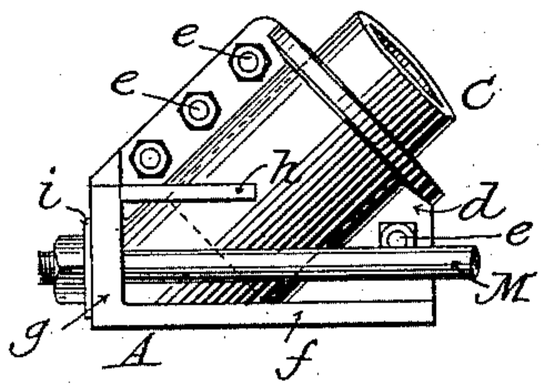


Fig. 5.

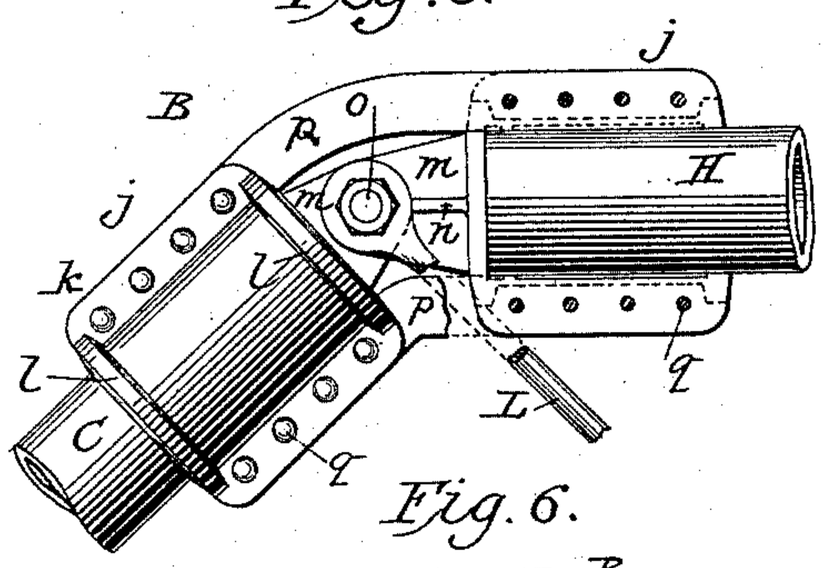


Fig. 7.

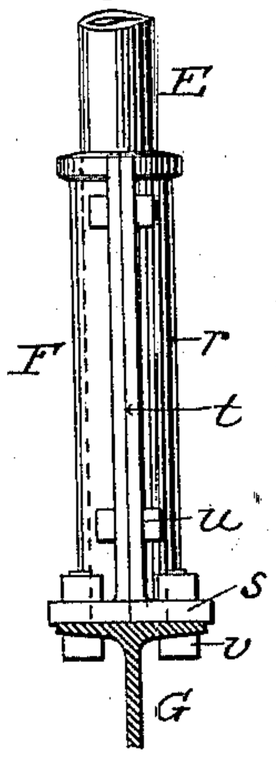


Fig. 4.

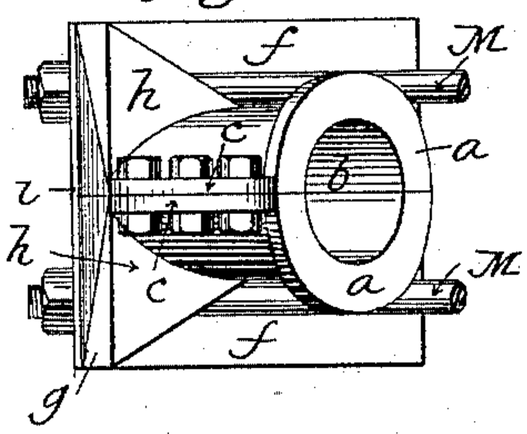


Fig. 6.

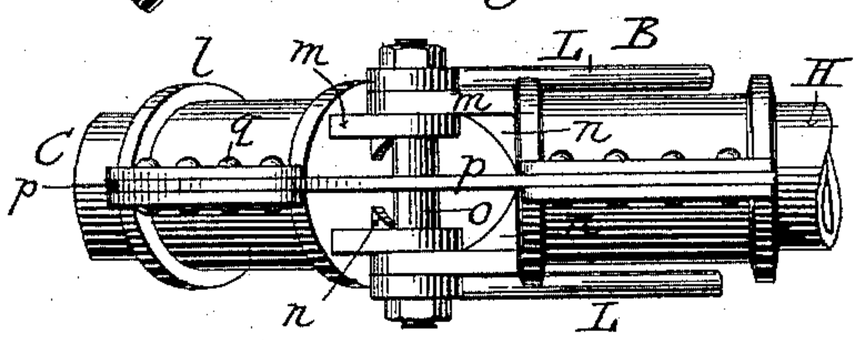


Fig. 10.

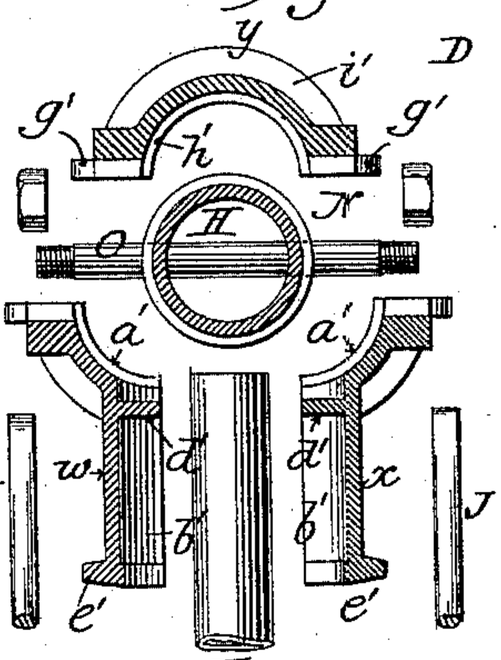


Fig. 8.

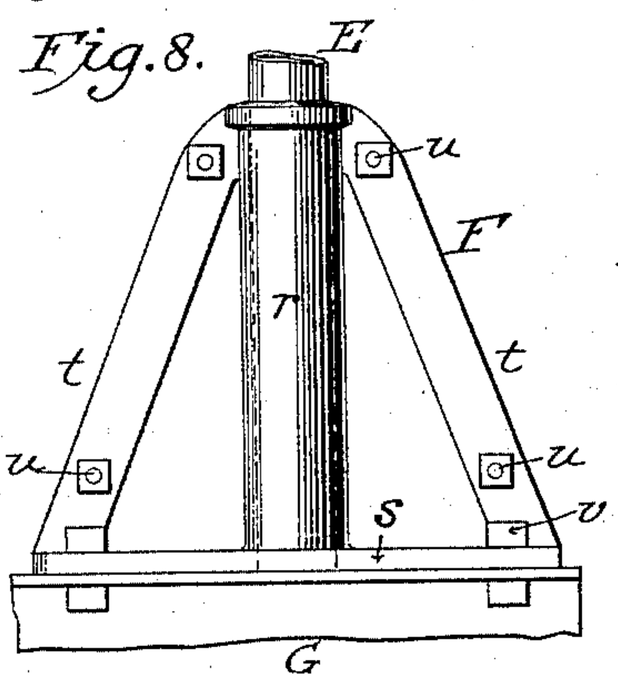


Fig. 9.

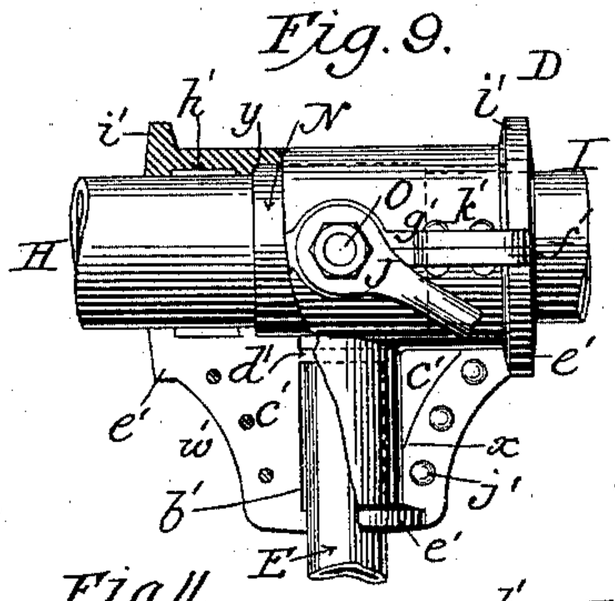


Fig. 11.

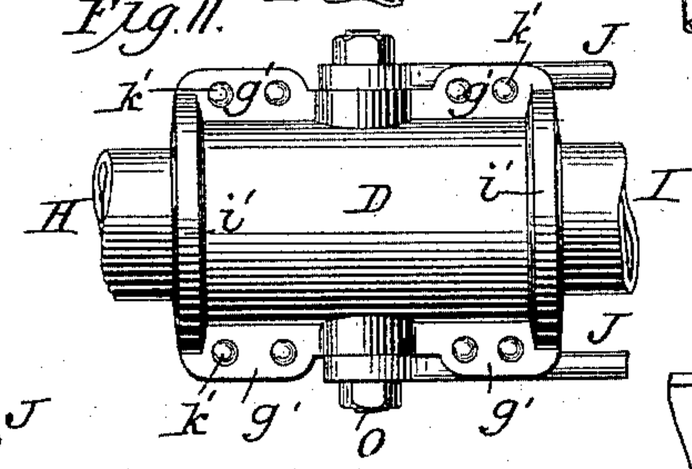


Fig. 12.

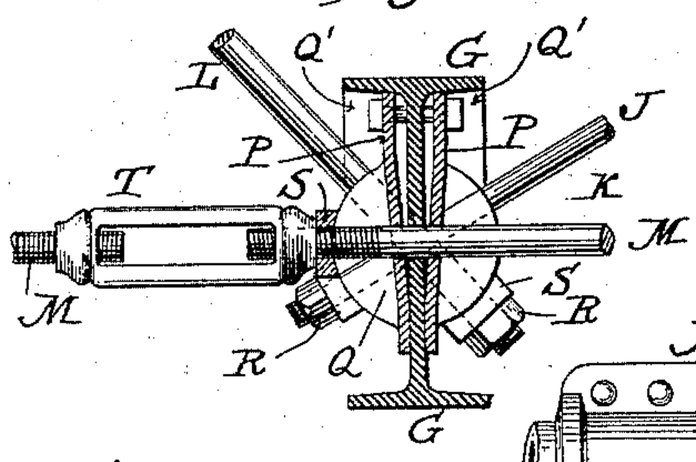


Fig. 13.

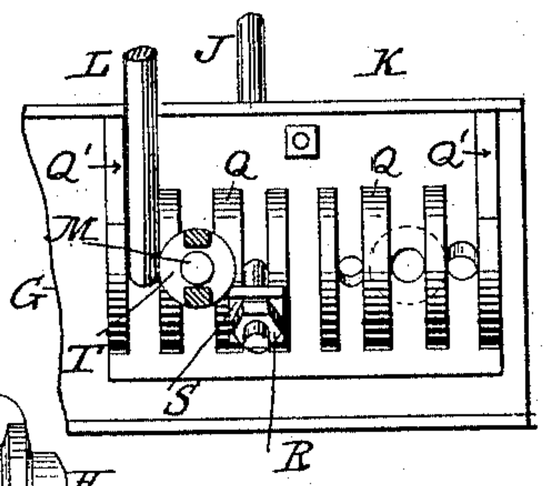
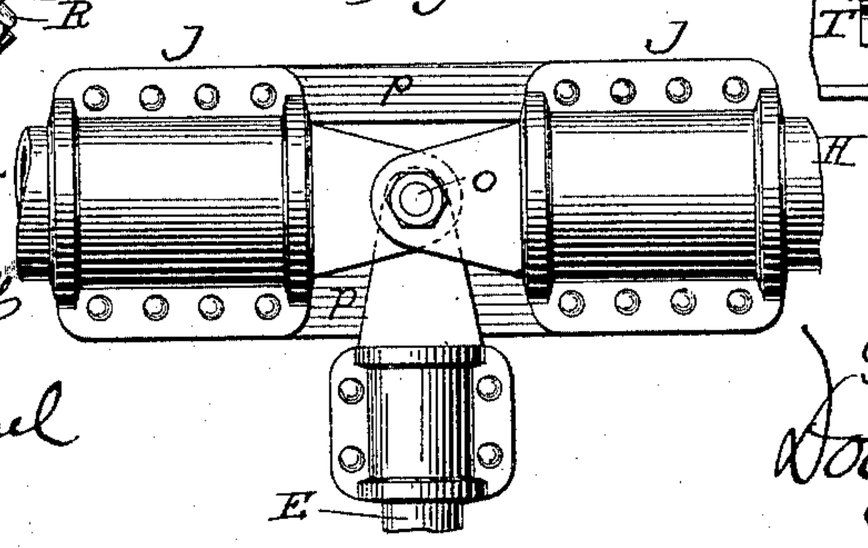


Fig. 14.



Witnesses,
Sidney P. Hollingsworth
James F. Duhamel

Richard Gray,
Inventor,
by his attorneys,
Dodger Sons.

UNITED STATES PATENT OFFICE.

RICHARD GRAY, OF BLOOMINGTON, ILLINOIS.

BRIDGE.

SPECIFICATION forming part of Letters Patent No. 489,946, dated January 17, 1893.

Application filed July 12, 1892. Serial No. 439,794. (No model.)

To all whom it may concern:

Be it known that I, RICHARD GRAY, a citizen of the United States, residing at Bloomington, in the county of McLean and State of Illinois, have invented certain new and useful Improvements in Bridges, of which the following is a specification.

My invention relates to bridges, and consists in a novel construction of the same, as hereinafter set forth and claimed.

In the drawings,—Figure 1 is a top plan view, with parts removed, of my improved bridge; Fig. 2, a side view; Figs. 3 and 4, side and plan views of one of the shoes; Figs. 5 and 6, side and plan views of the hip-joint; Figs. 7 and 8, edge and side views of the socket connecting the posts with the floor beams; Figs. 9, 10 and 11, views illustrating the construction of the upper panel joint and post connection; Figs. 12 and 13, respectively, sectional and face views of the lower panel joint; and Fig. 14, a view illustrating a slight modification of the construction shown in Figs. 5 and 6.

A indicates the shoes, B the hip joints, and C the batter posts secured at opposite ends to the parts A and B.

D indicates the upper panel joint and post-connection, and E the upright post seated at its upper end in the part D and at its lower end in the post-connection F, the latter being secured to the upper side of the floor beam G. These upper connections D also receive the sections H and I of the upper chord, and the pins or bolts carried by these parts D serve to hold the upper ends of the diagonal brace rods J, the lower ends of which pass through the beams G where they are secured to the lower panel joint K. This lower panel joint K also receives the lower ends of the diagonal hip braces L, and the lower chords M, as shown in Fig. 2. These braces L, as shown in Fig. 1, diverge or are spread apart at their lower ends, so as to brace the hip joint and assist in maintaining the upper chord in true vertical position.

The parts A, B, D, F, K, may be made of cast iron, cast steel, or made of drop forgings, while the compression members C, E, H and I will advisably be made of wrought iron pipe.

The hollow cylindrical is acknowledged to be the most economical form possible, in a compression member, and hence by its use a truss of given strength can be made with less weight of material than with any other form.

The difficulty heretofore encountered in making simple, cheap and efficient joints or attachments, has led to the general adoption of other forms or sections,—non-circular,— less economical from every standpoint. The present invention is therefore directed more particularly to a novel construction and arrangement of these joints or attachments which will now be described in detail.

The shoes A, Figs. 3 and 4, are each made in two parts *a*, so combined as to form a tubular socket *b* for the lower end of post C. These parts *a* each have a flange *c* along the back or upper edge, and a flange *d* along the front edge, to receive the bolts *e* by means of which the two parts are fastened securely together and to the batter post. They also have a broad base or footing *f*, and an upright flange *g* on the rear edge,—the said flanges *g* being connected with the tubular body by means of the webs or braces *h*. The flanges *g* are perforated to receive the ends of the lower chord bars M, which latter also pass through a plate *i* applied to the rear face of the flanges as shown. When the bars M are in place and have the plate applied thereto, they tend to prevent the parts *a a* from separating.

The hip-joint B,—Figs. 5 and 6,—comprises two castings or forgings, each made up of two socket pieces *j* having flanges *k* along their upper and lower meeting edges, and closed at adjacent ends,—the inner faces of the sockets being formed with ribs near their inner and outer ends to support and receive upper chord sections H and I. These semi-cylindrical socket pieces *j* are also provided at opposite ends with circumferential flanges *l;* and at their adjacent edges each with a pair of arms *m*,—those of one socket piece fitting within those of the other, as clearly shown in Fig. 6. Webs or flanges *n* connect the arms with the body portion of the respective socket pieces.

Arms *m m* are perforated to receive a pin or bolt *o* upon which are hung the diagonal hip braces L, as shown in Figs. 1, 2, 5 and 6. Besides being connected by the pins *o*, the

two castings or forgings forming the joint B, are connected by the curved bars or plates *p* which are embraced between the flanges *k* and secured thereto by bolts or rivets *q*. The office of the curved bars or plates *p* is to stiffen the joint, whereby the compressive strength of the pipes is increased by converting what would otherwise be a pin bearing into a square bearing.

It is obvious that verticals can be attached to the hip pins *o*,—as shown by dotted lines in Fig. 2,—and any number of posts used, thereby providing for an indefinite increase in the number of panels.

The lower post connection F,—Figs. 7 and 8,—comprises two plates, each having a semi-cylindrical upright socket *r*, lateral foot *s*, and upright flanges *t*, the latter being thickened along their outer edges. Bolts *u* pass through the flanges to unite the two parts of the connection and clamp the lower end of the post, E, (which latter rests upon the top of beam G,) while bolts *v* pass through the feet or lateral flanges *s*, and fasten the device to said beam. This connection with the beam constitutes an effective and cheap lateral brace for the truss without encroaching upon the roadway or materially increasing the length of the floor beam.

The upper panel joint and post connection D, Figs. 9, 10 and 11, is made up of three main parts *w*, *x* and *y*, two of which, *w* and *x*, are alike while the third one *y* forms a cap for the others. The plates, castings, or forgings, *w* and *x*, each have a curved seat *a'* for the upper chord pipes H and I, which latter are threaded and united by means of a coupling N. These two parts *w* and *x* are also provided with a semi-cylindrical seat or socket *b'* for the upper end of the post E,—the vertical and horizontal portions of each part *w* and *x* being connected by the integral flanges or webs *c'* as shown in Fig. 9. Projecting from the sockets *b'*, is a flange or ledge *d'* to rest upon the upper end of the post E, while around the lower edge of socket *b'* and the outer edge of socket or seat *a'*, is a circumferential flange *e'* which is designed to give increased strength and stiffness or rigidity. Along the upper edge of each part *w* and *x*, is a laterally projecting flange *f'* upon which rests a corresponding flange *g'* formed along the lower edge on each side of the cap *y*. This cap *y* has a seat *h'* for the upper chord sections, and has also at each end a strengthening rib or flange *i'* corresponding to the circumferential flanges *e'* on the parts *w* and *x*. Bolts or rivets *j'* pass through the flanges *c'*, while bolts or rivets *k'* pass through the flanges *f' g'*, thereby firmly uniting all three parts *w*, *x* and *y* of the connection D. A pin or bolt O passes through the center of the device D from side to side, and through the inclosed chord section; and also affords means for attachment of the diagonal braces J. In case a greater number of panels and consequently a larger number of counter braces be employed, the length of the pin or bolt O will have to be correspondingly increased to receive these additional braces.

The lower panel joint connection K,—Figs. 12 and 13,—comprises two plates P P bolted to opposise sides of the beam G. Each of these plates, as well as the web of beam G,—is perforated to receive the various rods or braces which center at this point, and is provided on each side of these openings with outwardly projecting flanges or lugs Q. The outer faces of these lugs or projections Q are curved on the arc of a circle struck from the point within the beam where the rods or braces pass through. Each of the rods is provided with a nut R, and a block or washer S having a face curved to conform to the curvature of the lugs Q. The end lugs Q' extend upward and rest against the underside of the top flange of beam G. The lower chord bars or rods M (one end of which is carried by the shoe A) are here provided with a turnbuckle T which connects the sections of such chord on that side of the beam toward the nearest abutment.

It is obvious that the length of the plates P may be varied and the number of circular flanges increased to receive any number of rods meeting at this point. It will also be seen that the rods or braces may be passed through the beam and plates, and attached at most any desired angle; and that all the lines of stress pass through the same horizontal line whereby (as in the ordinary pin construction) cross strains are avoided. But while this connection retains the advantages of the pin-construction, it is superior to the latter in that there is no bending strain; that it constitutes a cheap and safe support for the floor beam without the use of hangers or other devices; that it permits of adjustability of all the tension members in a cheap, easy and simple manner; and finally, in that it is, on the whole, cheaper and requires less accurate workmanship in its manufacture.

It is obvious that the rods or bars M may be provided with heads instead of nuts where they are secured to the shoes A, the turnbuckle T affording the means for connecting the sections of rod and giving the required adjustability.

Passing the lower chord bars M through the lower panel joints without attachment thereto, where there is a difference in the strains of the lower chord bars, is a feature of importance. By placing the turnbuckle or an equivalent device in the lower chord bars as shown, it performs several distinct functions,—first, the longitudinal adjustment of the lower chord; second, a means for varying the section of the lower chord bars to correspond with the strains, and third, to receive and support the difference of horizontal stress in the adjacent panels.

In Fig. 14 I have illustrated a modification of the structure shown in Figs. 5 and 6, whereby it is adapted to act as an upper panel joint. The differences consist first in making the

bars or plates *p* straight; and second in mounting upon the pin or bolt *o*, a third socket piece for the upright post similar to but smaller than the other socket pieces.

Having thus described my invention, what I claim is:—

1. The two-part shoe A having a socket for the batter post, and the rear flange *g*, to receive the chord bars, and the plate *i* extending across the rear face of flange *g*.

2. The herein described two-part shoe A comprising the socket *b*, flanges *c d*, bolts *e* passing through the flanges, the footing *f*, the rear flange *g* and webs *h*, and the plate *i*.

3. The hip-joint B comprising two sockets connected by the bars *p*.

4. The hip-joint B comprising two flanged sockets, and the bars *p* embraced between and secured to the flanges.

5. The hip-joint B comprising two sockets having arms *m*, and a bolt *o* connecting the arms.

6. The hip-joint B comprising two flanged sockets having arms *m*, bolts *o* connecting the arms, and plates *p* bolted to the flanges.

7. The panel joint D comprising the parts *w*, *x*, and *y*, having curved seats to form the horizontal and vertical sockets, and bolts uniting the parts.

8. In combination with parts *w* and *x* each having curved seats *a' b'*, the cap plate *y* having curved seat *h'*; bolts *j'* connecting the parts *w* and *x*; and bolts *k'* uniting the cap to the parts *w* and *x*.

9. In combination with the chord sections H and I united by a coupling N, the panel joint D provided with a shouldered seat therefor, and with a seat for the upright post.

10. In combination with the perforated beam G, perforated plates applied thereto and provided with curved lugs Q substantially as and for the purpose described.

11. In combination with perforated beam G, plates P applied thereto and provided with curved lugs Q, the braces passing through the beam and plates, and provided with nuts and curved washers.

12. In a bridge, the combination with the beam G, of the lower chord passing therethrough, the braces passing through the beam in the same horizontal axis or plane as the chord, and means for securing the parts.

13. In a bridge, the combination with the perforated beam, of the plates applied thereto, and lugs Q curved on the arc of a circle struck from a point within the beam.

14. In a bridge truss, the combination with the upper and lower chords, and transverse beam G, of the posts E and C, the post connection F secured to the upper side of the beam, and the panel joint K.

In witness whereof I hereunto set my hand in the presence of two witnesses.

RICHARD GRAY.

Witnesses:
GEO. R. FRISBIE,
WM. ORENDORFF.