(No Model.)

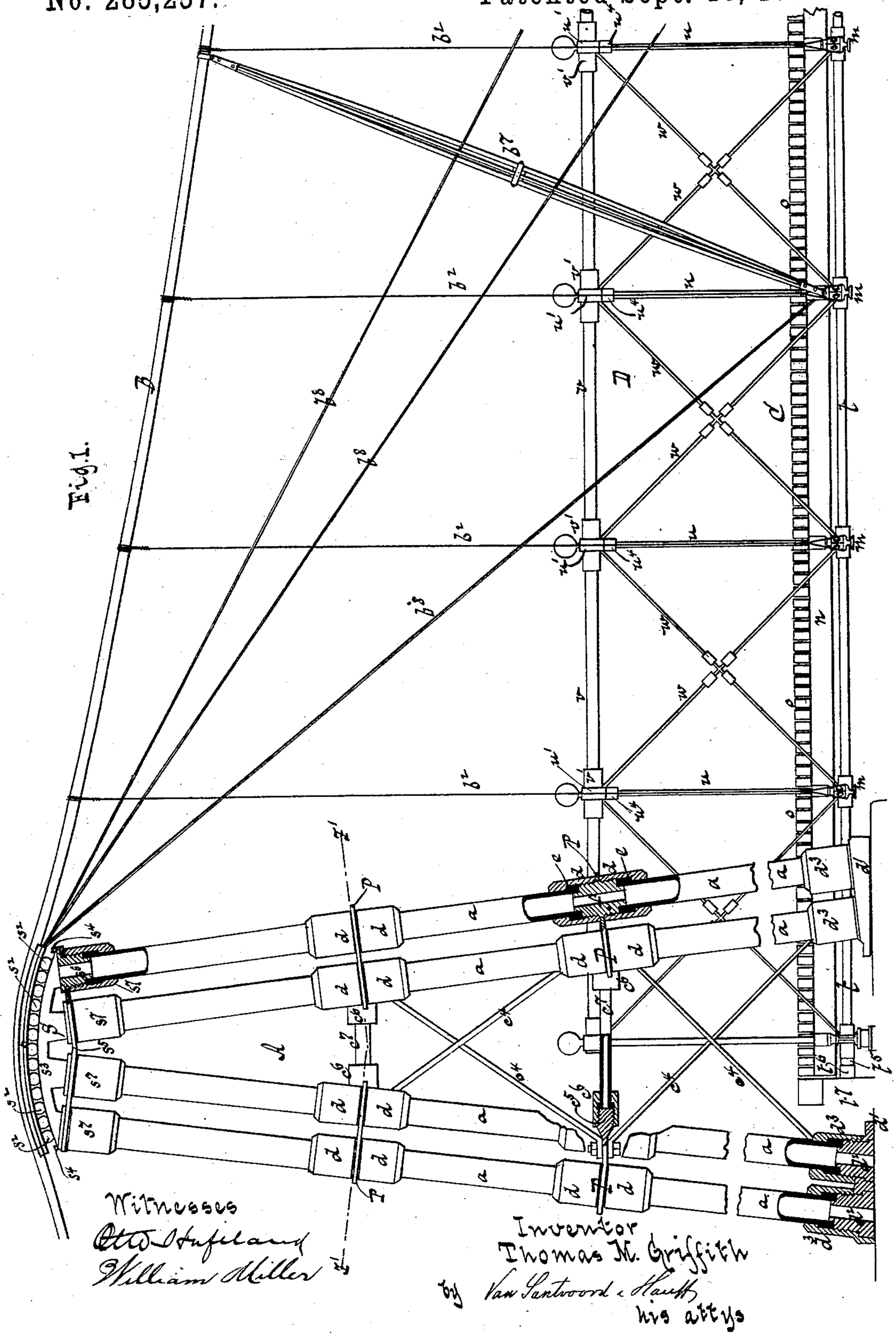
4 Sheets—Sheet 1.

T. M. GRIFFITH.

SUSPENSION BRIDGE.

No. 285,257. Patented Sept. 18, 1883.

Fig. 1.



Witnesses
Otto Hufeland
William Miller

Inventor
Thomas M. Griffith
by Van Santvoord & Hauff
his attys

(No Model.)

4 Sheets—Sheet 2.

T. M. GRIFFITH.

SUSPENSION BRIDGE.

No. 285,257.

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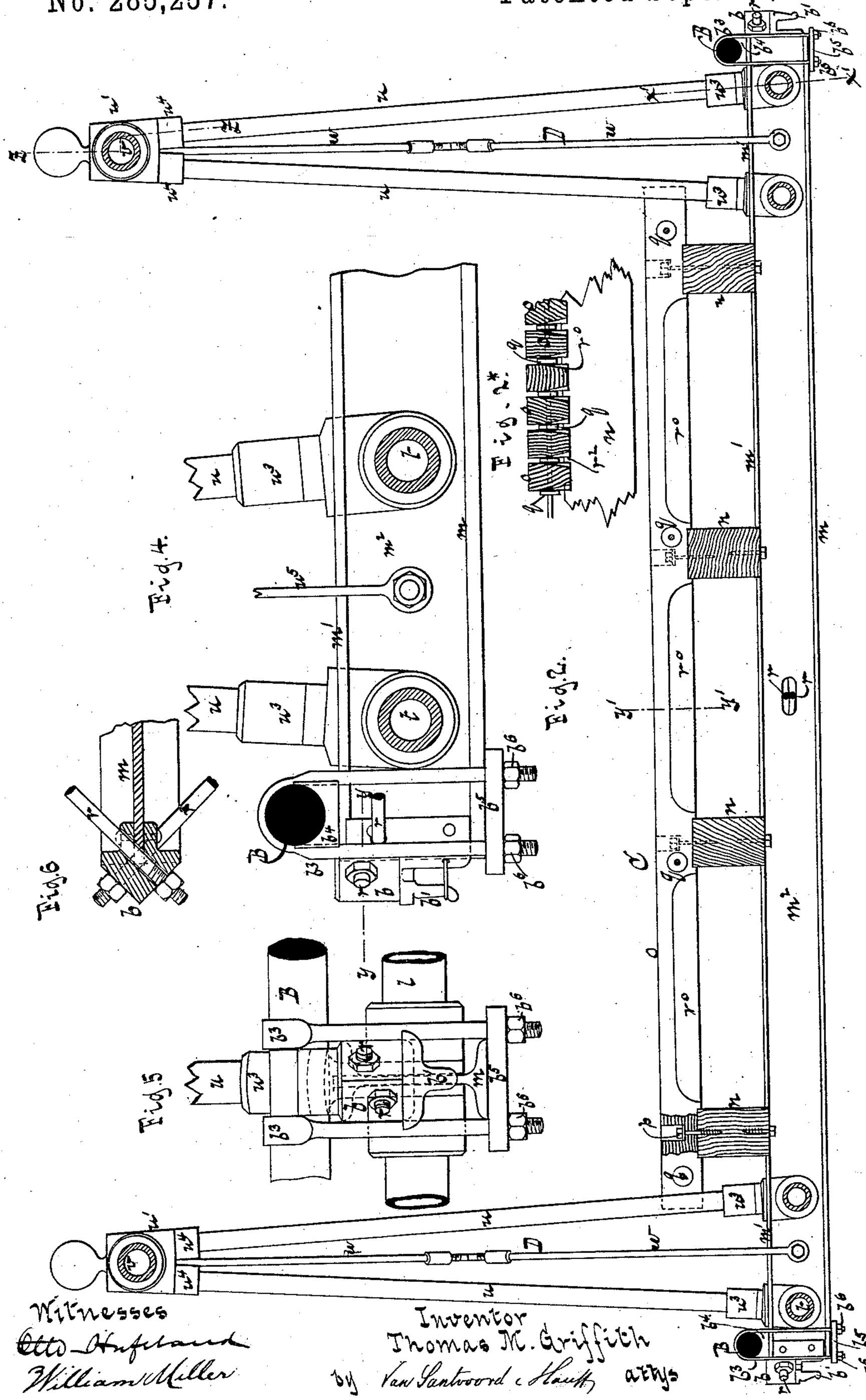

Witnesses
Otto Hupfeld
William Miller

Inventor
Thomas M. Griffith
by Van Santvoord & Hauff attys

(No Model.)

4 Sheets—Sheet 3.

T. M. GRIFFITH.

SUSPENSION BRIDGE.

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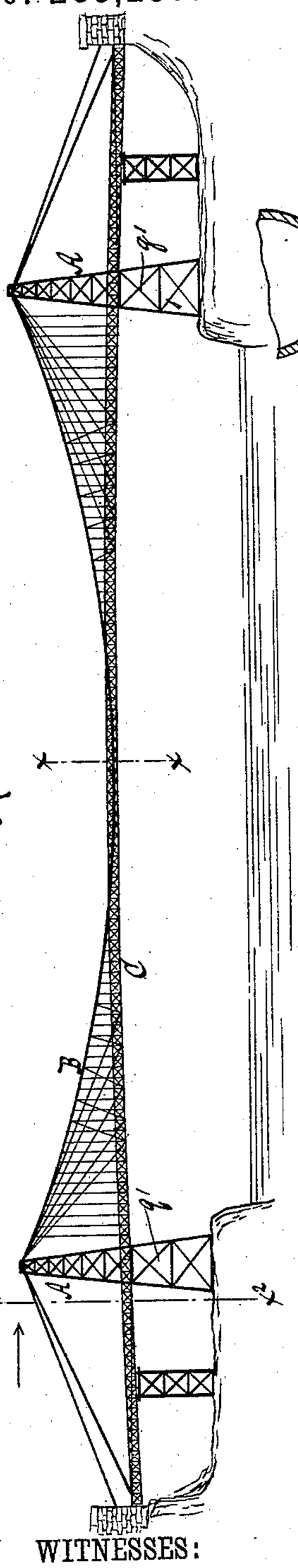

Fig. 9.

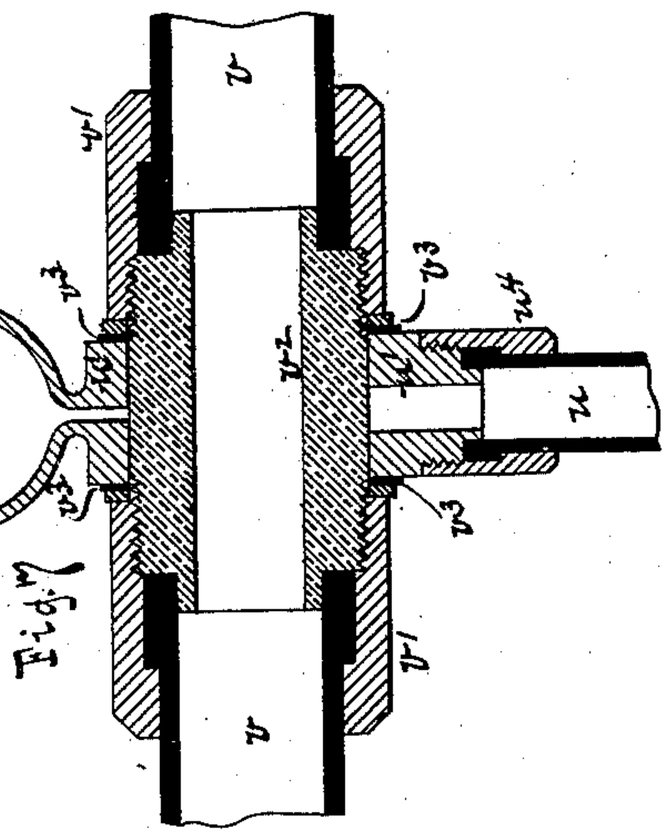

Fig. 7.

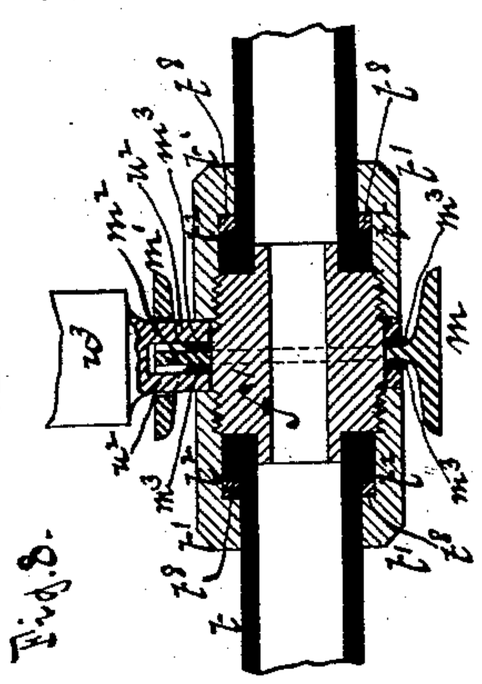

Fig. 8.

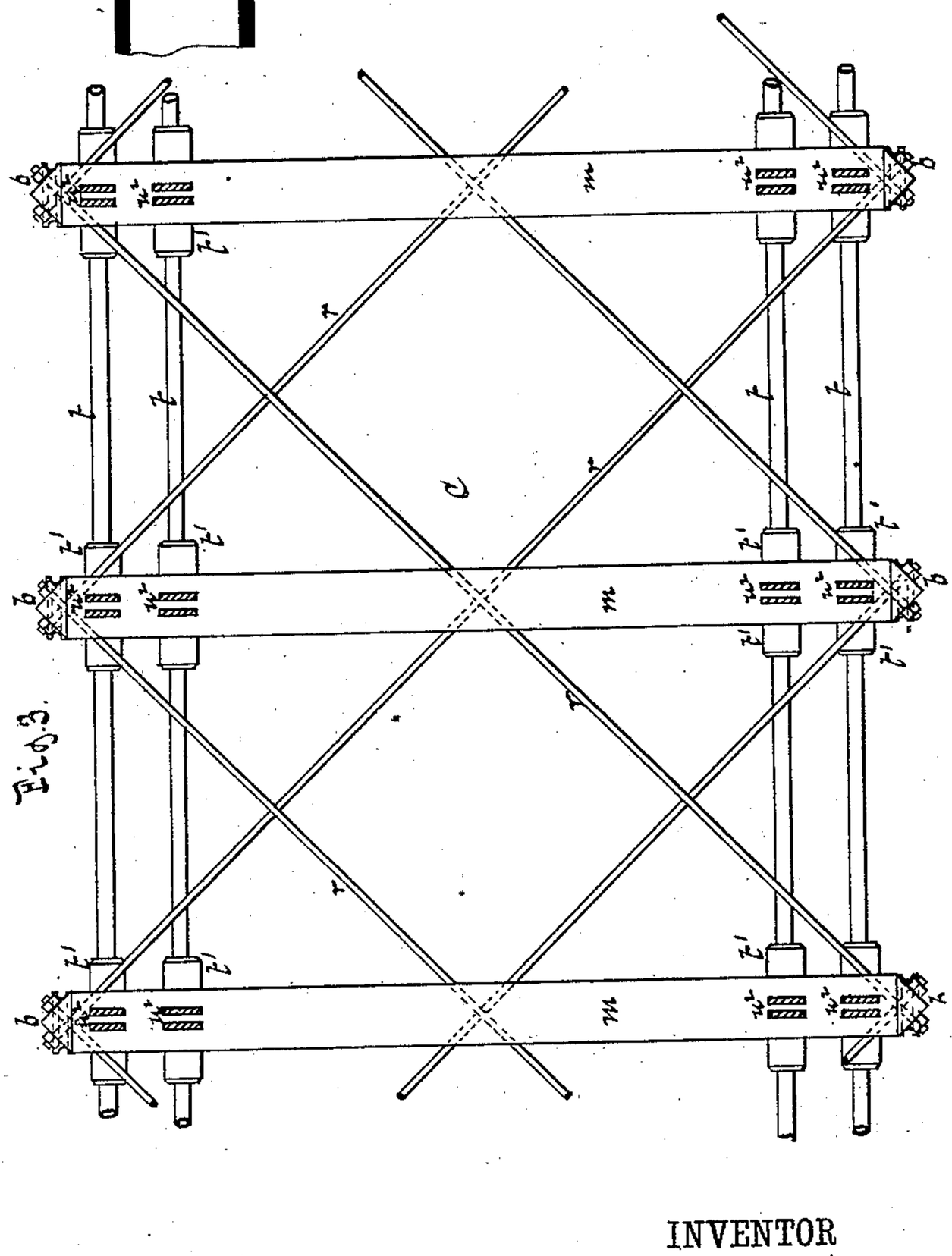

Fig. 3.

WITNESSES:

Otto Sufland

William Miller

INVENTOR

Thomas M. Griffith

BY Van Santvoord & Hauff

ATTORNEYS

(No Model.)

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SUSPENSION BRIDGE.

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Fig. 10.

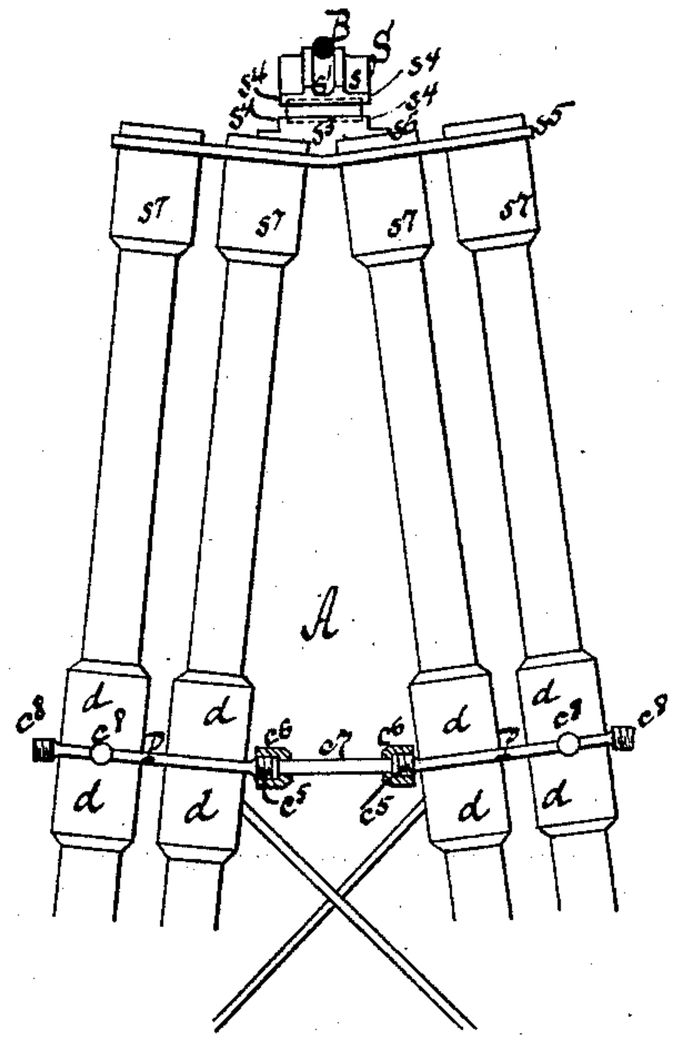


Fig. 11.

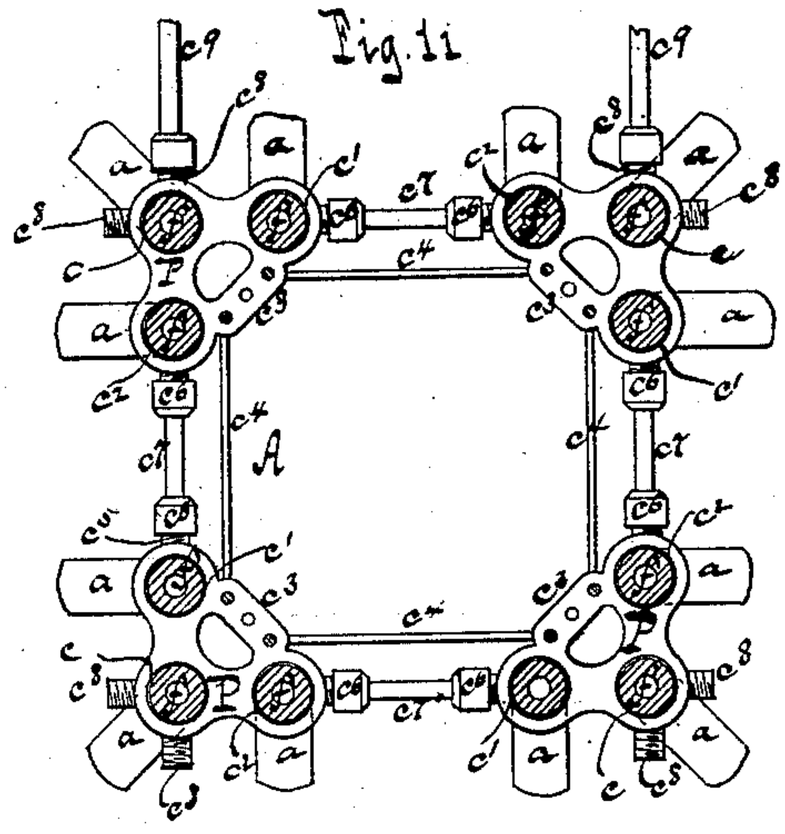
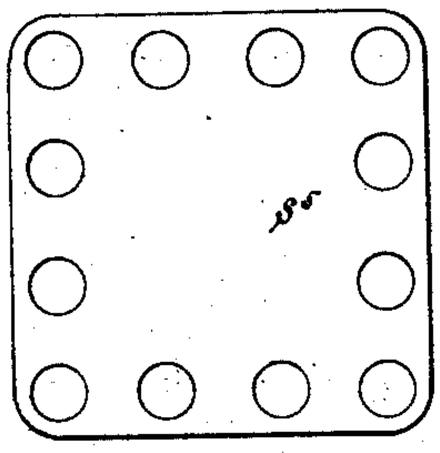


Fig. 12.



WITNESSES:

Otto Hufeland

William Miller

INVENTOR

Thomas M. Griffith

BY Van Santvoord & Hauff

ATTORNEYS

UNITED STATES PATENT OFFICE.

THOMAS M. GRIFFITH, OF ARLINGTON, NEW JERSEY.

SUSPENSION-BRIDGE.

SPECIFICATION forming part of Letters Patent No. 285,257, dated September 18, 1883.

Application filed August 2, 1882. (No model.)

To all whom it may concern:

Be it known that I, THOMAS M. GRIFFITH, a citizen of the United States, residing at Arlington, in the county of Hudson and State of New Jersey, have invented new and useful Improvements in Suspension-Bridges, of which the following is a specification.

This invention relates to a suspension-bridge which is composed entirely of pieces of moderate length and weight, which can easily be carried by men or pack-mules, and which when once delivered at the site of the proposed structure can be easily and cheaply put together, so as to form a complete, strong, and elegant bridge.

The pecularities and improvements in the construction of my bridge are pointed out in the following specification.

In the accompanying drawings, Figure 1 represents a sectional side view of a portion of of my bridge, including one of the towers. Fig. 2 is a transverse section on a larger scale than the previous figure, the line *x x*, Fig. 9, indicating the plane of section. Fig. 2* is a longitudinal section in the plane *y' y'*, Fig. 2. Fig. 3 is a plan of the platform supporting the roadway. Fig. 4 is an elevation of a portion of one of the beam-girders, with its attachment, on a larger scale than the previous figures. Fig. 5 is an end view of the same. Fig. 6 is a horizontal section in the plane *y y*, Fig. 4. Fig. 7 is a vertical section in the plane *z z*, Fig. 2. Fig. 8 is a similar section in the plane *x x'*, Fig. 2. Fig. 9 is an elevation of the bridge when completed. Fig. 10 is a partial front view of one of the towers. Fig. 11 is a horizontal section of one of the towers in the plane *z' z'*, Fig. 1. Fig. 12 is a plane of the supporting-plate of the saddle.

Similar letters indicate corresponding parts.

In the drawings, the letters A A, Figs. 1, 9, and 10, designate the towers which support the cables B B. Each of these towers is constructed of twelve posts, *a*, arranged in groups of three or more posts, each of which are connected to each other by ring-plates P, (best seen in Fig. 11,) while the several groups of posts are connected with each other by traverses and cross-braces, as hereinafter more fully explained. The posts *a* are constructed of wrought-iron or steel pipes, cut in such lengths that they can be easily handled, and all the pieces of pipe are as much as practicable of the same length and diameter, so that they can be readily packed and transported and that they can be used indiscriminately, requiring no marking and no particular attention in erecting the towers. Each of the pieces of pipe is provided with two couplings, *d*, one at each end, and these couplings bear against shoulders *e*, formed at the end of each piece of iron pipe, (one shoulder on each piece being formed after the couplings have been slipped on.) Between the adjoining ends of two pieces of iron pipe are placed plugs *f*, the ends of which fit the bores of the pipes, and which are provided on their outer surfaces with the screw-threads to engage with the internal screw-threads of the couplings *d*. Each of the plates P is composed of three rings, *c* *c'* c^2, Fig. 11, to admit the plugs *f* of the corresponding posts, Fig. 1, and when the couplings *d* are screwed up tight they retain the plate P firmly in position. The rings *c'* c^2 are connected by flanges c^3, to which are secured the cross-braces c^4, and on the peripheries of said rings *c'* c^2 are formed screw-nipples c^5, to engage with couplings c^6, attached to the ends of the traverses c^7. By these traverse, and the cross-braces c^4 the four groups of posts constituting each tower are firmly connected. The rings *c* of the plates P are provided each with two screw-nipples, c^8, some of which serve for the connection of traverses c^9, extending from one tower to the other. The ring-plates P are all of uniform size and shape, so that they can be interchanged, and require no marking.

On the top of each tower is placed a saddle, S, for the support of the cables. A side view of the saddle is shown in Fig. 1, an end view in Fig. 10, and a plan of its supporting-plate in Fig. 12. The saddle consists of a head, *s*, with a segmental groove, *s'*, for the reception of the cable B. The head *s* is concave, (see Fig. 1,) and it rests upon rollers s^2, which are placed upon the convex bed s^3, both the head and the bed being provided with flanges s^4 to retain the rollers in position. The bed s^3 is placed upon the supporting-plate s^5, which is placed on the top of the posts *a*, composing the tower, and fastened thereto by screw-nipples s^6

and couplings s^7. The screw-nipples s^6 are provided with heads, and they pass loosely through holes in the supporting-plate, their bottom ends being made to fit into the posts *a*. By drawing the couplings s^7 up tight the supporting-plate is firmly secured in its position. The bottom ends of the posts *a* are connected to foot-plates d' by means of screw-nipples d^2 and couplings d^3, Fig. 1. Each group of three posts is provided with its own foot-plate.

The platform or roadway C is formed of light iron or steel girder-beams *m*, Figs. 5, 2, and 3, of such a length as may be necessary for the width of the bridge required. Upon these girder-beams are laid longitudinal stringers *n* of wood to receive the flooring. This flooring consists of transverse beams *o* of wood, the length of which is equal to the width of the platform or roadway required. These transverse beams are secured to the longitudinal stringers *n* by screws *p*, Fig. 2, and between them are placed washers *q*, Figs. 2 and 2*, which serve to keep the same at a certain distance apart, so that the air can pass freely through between them, and the danger that the platform is lifted up by wind is materially lessened, if not altogether obviated. In order to still further facilitate the passage of wind through between the transverse beams *o*, their lower edges are chamfered off, as shown at r^0, Figs. 2 and 2*.

The girder-beams *m* are connected by cross-braces *r*, (best seen in Fig. 3,) the ends of which extend through roof-shaped heads *d*, formed at the ends of said beams. (See Figs. 2, 3, 4, and 6.) By referring to Fig. 3 it will be seen that the cross-braces extending from the ends of each beam pass through and cross each other in the web of the next succeeding beam, Fig. 2, and are secured to the second beam beyond. The inclined faces of the heads *s* form bearing-surfaces for the nuts, which serve to fasten the cross-braces in position. Said girder-beams are further connected by two pairs of longitudinal bars *t t*, and the required stiffness of the platform is insured by trusses D, which also form a railing on each side of the platform, so as to afford entire security to men and animals. Said railings or trusses are constructed of posts *u*, longitudinal bars *v*, and cross-braces *w*, as hereinafter explained. The longitudinal bars *t t* are made of sections of wrought-iron or steel pipes, which are fastened together by screw-couplings t' and plugs f', Fig. 8. These plugs are fitted into holes in the prongs u^2 of the posts *u* and in the webs m^2 of the girder-beams *m*, and their ends fit the sections in the tubular bars *t*, which are to be connected. The couplings t' are made to bear on shoulders t^2, formed near the ends of each section. When these couplings are screwed up tight, the sections *t t*, Fig. 8, are firmly united. Between the prongs u^2 and the web m^2 are placed packing-pieces m^3 of india-rubber or other suitable material, so as to provide for expansion and contraction. The joints between the sections of the longitudinal bars *t t* are also rendered elastic by the interposition of packing-pieces t^8 between the coupling t' and shoulders t^2. In the same manner the joints of the posts *a*, which constitute the towers, and those of the posts *u* and bar *v*, which form part of the railings, are rendered elastic.

The posts *u* are tubular, and they are arranged in pairs at each side of the structure, such posts being inclined toward each other, their upper ends being adjacent to each other and suitably secured in couplings u^4, secured to the heads u', carried by the longitudinal bars *v*. The lower ends of the posts are secured to the prongs u^2 by means of couplings u^3, carried by the longitudinal bars *t*, all as clearly shown in Figs. 2 and 7. The longitudinal bars *v* are made of sections of wrought-iron or steel pipes, which are united to each other and to the heads u' by couplings v' and plugs v^2, said plugs being fitted into the heads u', as shown in Fig. 7. Between the couplings v' and the heads u' are placed packing-pieces of india-rubber or other suitable material to provide for expansion and contraction. The cross-braces *w* extend from the heads u' to the girder-beams *m*, and they are provided with turn-buckles to adjust their tension. On the ends of the longitudinal bars *t*, Fig. 1, are secured cushions t^5, of india-rubber or other suitable material, in such a position that they are directly opposite to projection t^6, formed on the mason-work or wall t^7 opposite the shore ends of the platform. Whenever a heavy vehicle passes upon the platform or roadway of the bridge, said platform swings in the direction of its length, and if the cushions t^5 are not interposed the wall t^7 is exposed to severe and injurious blows. By means of the cushions t^5 these blows are avoided, and at the same time the platform is free to expand and to contract.

The girder-beams *m* are provided at their roof-shaped heads *b* with hooks b', Figs. 2 and 4, which serve to engage with the suspension wires or ropes b^2, the upper ends of which are firmly connected to the cables B. In the middle of the bridge the cables B are secured to the girder-beams *m* by means of clips b^3, which contain concave boxes b^4 for the cables to rest in. (See Figs. 4 and 5.) These clips are applied in pairs, as shown in Fig. 5, and each pair is secured to the girder-beam *m* by a cross-bar, b^5, and nuts b^6, which serve to draw the cross-bar up tight against the lower surface of the girder-beam. The connection between the platform and the cables is further insured by rigid braces b^7, Fig. 1, and by additional ropes b^8, which latter extend from the towers to the platform. Each of the rigid braces b^7 is secured at its bottom end to one of the girder-beams *m* by a bracket, or in any other suitable manner, and at its upper end to the cable by a clip or other device suitable for the purpose, and it extends in an oblique direction between

two of the suspension-wires b^2. By these rigid braces the steadiness and firmness of the bridge is materially increased.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in the construction of towers and other parts, of a series of pipe-sections, shoulders formed at the ends of each section, two screw-couplings fitted on each section, and a screw-plug placed between the adjoining ends of the successive pipe-sections, substantially as and for the purpose set forth.

2. The combination, in the construction of towers and other parts, of a series of pipe-sections, shoulders formed at the end of each section, two screw-couplings fitted on each section, a screw-plug placed between the adjoining ends of the successive sections, and elastic packing-pieces placed between the shoulders on the pipe-sections and the screw-couplings, substantially as and for the purpose shown and described.

3. The combination, with the posts a a and with the screw-couplings d, which serve to unite the pipe-sections composing said posts, of ring-plates P, for retaining the posts in the proper relation toward each other, substantially as shown and described.

4. The ring-plate P, provided with openings for the reception of the posts, the flange c^3, formed on said openings, and the screw-nipples c^5 c^8, substantially as and for the purpose shown and described.

5. The combination, in the construction of a tower, of four groups of posts, a, a series of ring-plates, P, one for each group of posts, cross-braces c^4, secured to the flanges of the ring-plates, and traverses c^7, secured to the nipples of the ring-plates, substantially as and for the purpose set forth.

6. The combination, with the posts a, of the foot-plates d', the screw-nipples d^2, fitted into said foot-plates, and the screw-couplings d^3, fitted on the lower ends of the posts a, substantially as and for the purpose described.

7. The combination, with the posts a and with the cable-supporting saddle S, of a plate, s^5, screw-nipples s^6, fitted into this plate, and screw-couplings s^7, fitted to the upper ends of the posts, substantially as and for the purpose set forth.

8. The combination, in the construction of the platform C, of the girder-beams m, the stringers n, the transverse beams o, and the washers or distance-pieces q, interposed between said transverse beams, substantially as and for the purpose set forth.

9. The combination, in the construction of the platform C, of the girder-beams m, the stringers n, the transverse beams o, having their lower edges chamfered off, and the distance-pieces q, substantially as and for the purpose shown and described.

10. The combination, in the construction of the platform C, of the girder-beams m, the cross-braces r, the pipe-sections composing the longitudinal bars t t, the plugs f', fitted into the webs of the girder-beams, and the screw-couplings t', substantially as and for the purpose set forth.

11. The combination, in the construction of the platform C, of the girder-beams m, the cross-braces r, the pipe-sections composing the longitudinal bars t t, the plugs f', fitted into the webs of the girder-beams, the screw-couplings t', and the elastic packing-pieces t^8, substantially as and for the purpose described.

12. The combination, in the construction of the platform C, of the girder-beams m, the cross-braces r, the pipe-sections composing the longitudinal bars t t, the trusses or railings D, the prongs u^2, and the couplings u^3 for uniting the posts u of the railings with the girder-beams m, substantially as set forth.

13. The combination, in the construction of the platform C, of the girder-beams m, the cross-braces r, the pipe-sections composing the longitudinal bars t t, the plugs f', and screw-couplings t', the prongs u^2, connected to the girder-beams by the plugs f' and couplings t', the posts u, connected to the prongs u^2 by screw-couplings u^3, the heads u', connected to the posts u by couplings u^4, the plugs v^2, fitted into the heads u', and the pipe-sections v, connected to the plugs v^2 by couplings v', substantially as and for the purpose set forth.

14. The combination, with the platform C, of elastic cushions t^5, interposed between the shore ends of the platform and the masonwork opposite to said shore ends, substantially as and for the purpose set forth.

15. The combination, with the cables B, the suspension-wires b^2, the platform C, and girder-beams m, of roof-shaped heads b, which are rigidly attached to the girder-beams and provided with hooks b', substantially as and for the purpose described.

16. The combination, with the cable B, the suspension-wires b^2, and the platform C, of rigid braces b^7, inserted between and connected to the cables and to the girder-beams m, substantially as and for the purpose set forth.

17. The combination, with the girder-beams m and the cable B, of clips b^3, boxes b^4, cross-bars b^5, and nuts b^6, to form a firm connection between the platform and the cable, substantially as described.

In testimony whereof I have hereunto set my hand and seal in the presence of two subscribing witnesses.

THOMAS M. GRIFFITH. [L. S.]

Witnesses:
HORACE W. GRIFFITH,
W. HAUFF.