No. 725,695. PATENTED APR. 21, 1903.

H. FRIEND.

ROAD BRIDGE.

APPLICATION FILED FEB. 3, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

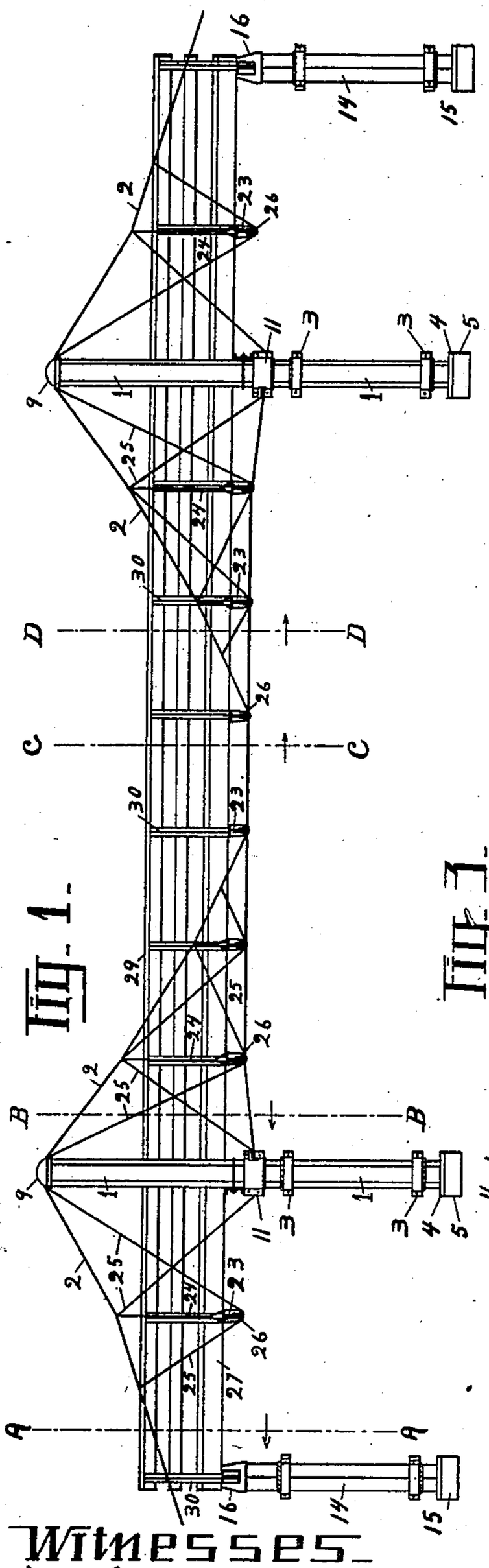


Fig. 5.

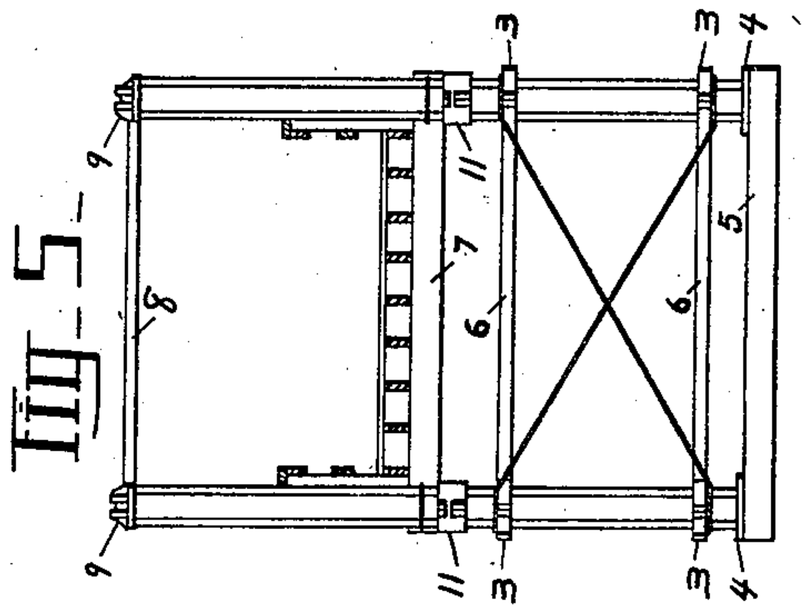


Fig. 3.

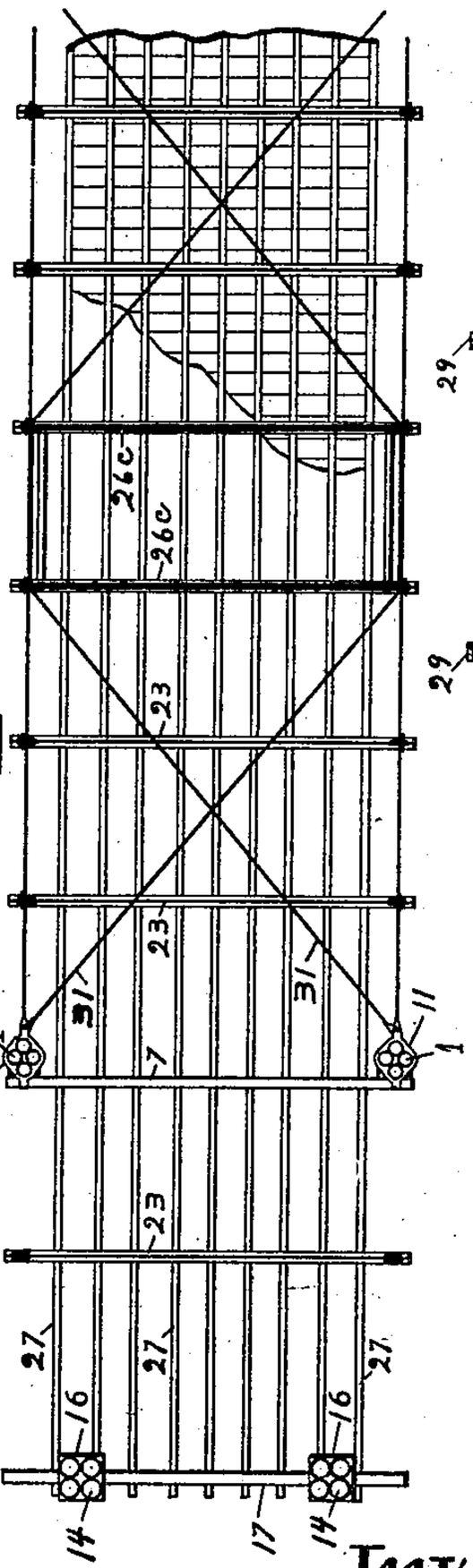


Fig. 4.

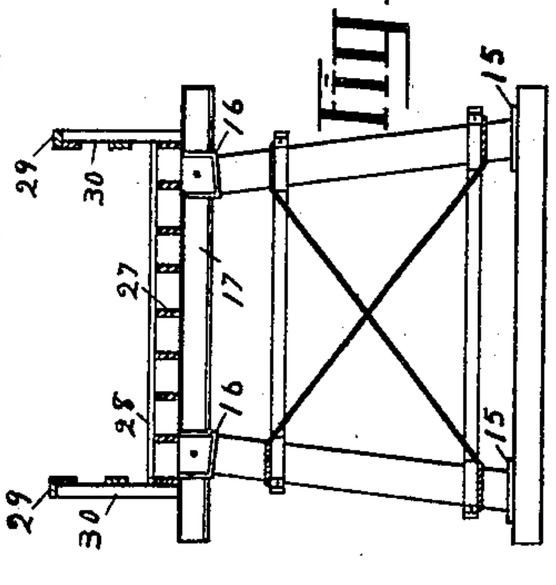
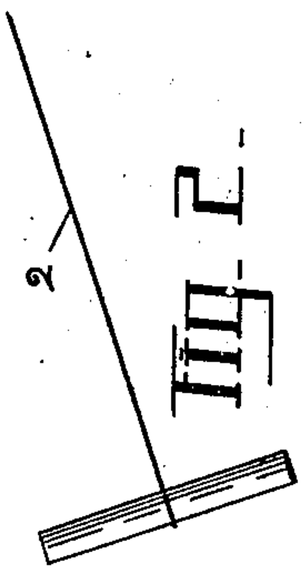


Fig. 2.



Witnesses.

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NO MODEL. 3 SHEETS—SHEET 2.

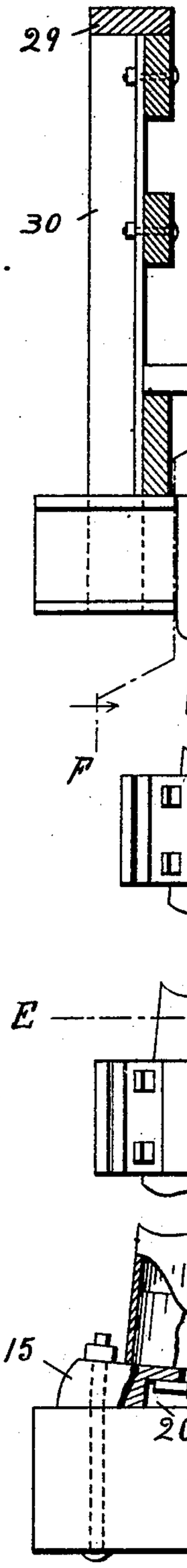

Fig. 9.

Fig. 8.

Fig. 7.

Fig. 6.

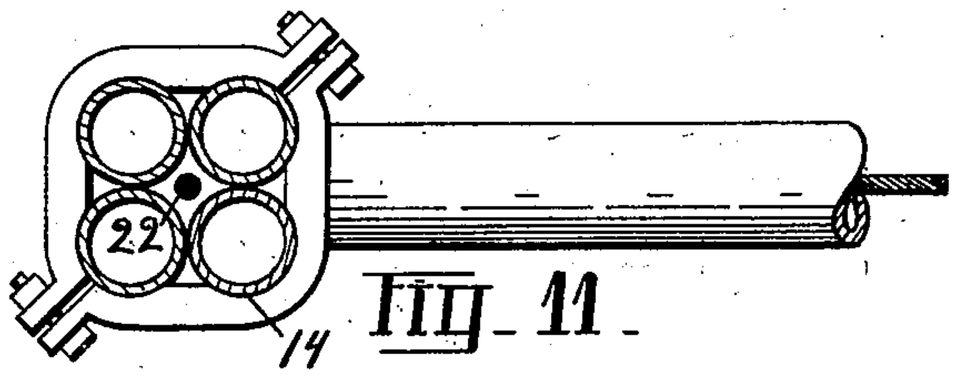

Fig. 12.

Fig. 11.

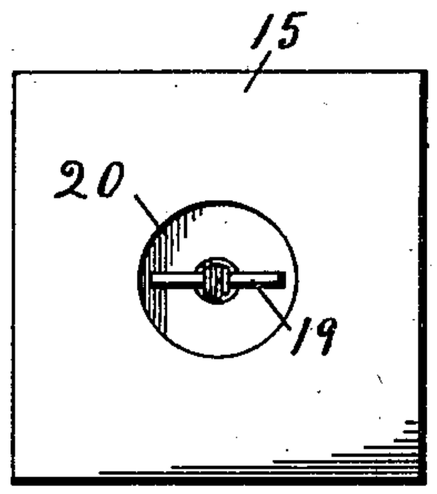

Fig. 10.

Witnesses.

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ROAD BRIDGE.

APPLICATION FILED FEB. 3, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

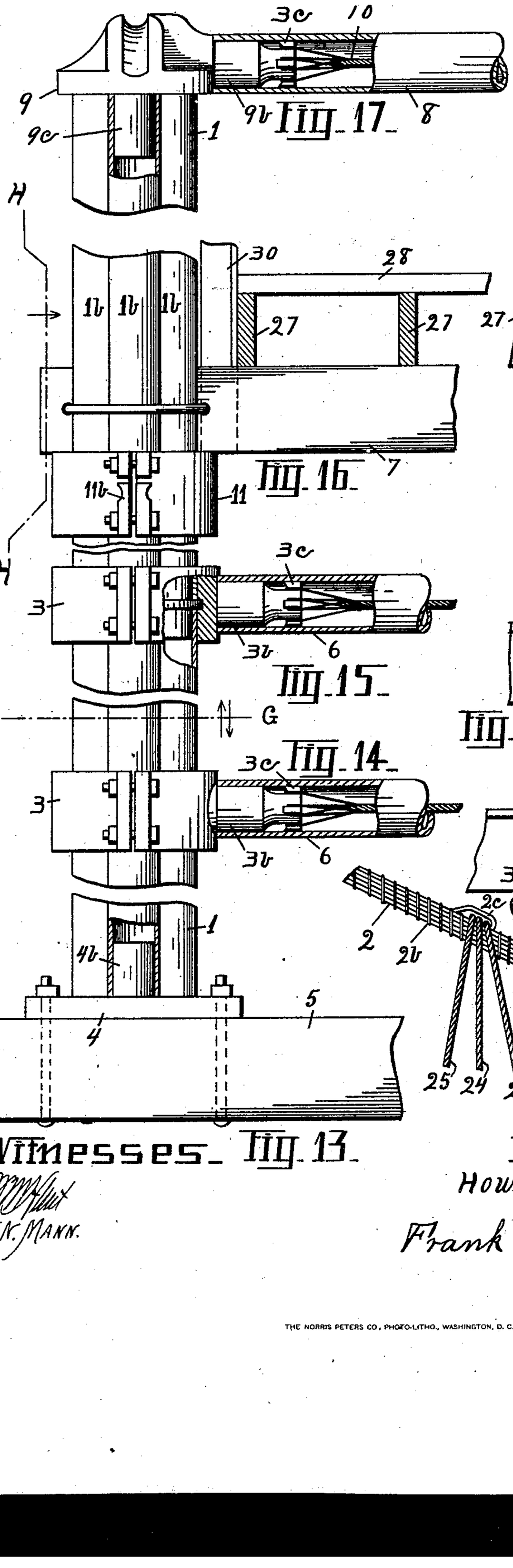

Fig. 17.

Fig. 16.

Fig. 15.

Fig. 14.

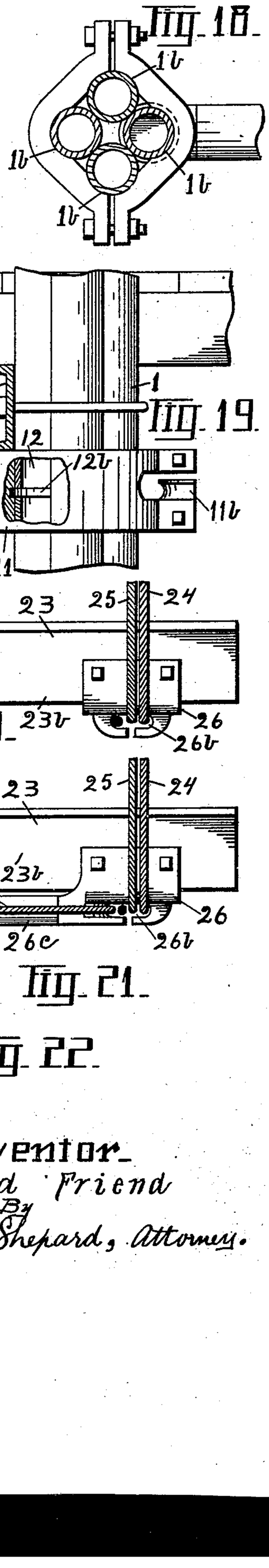

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 22.

Fig. 13.

Witnesses.

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UNITED STATES PATENT OFFICE.

HOWARD FRIEND, OF LEXINGTON, OKLAHOMA TERRITORY.

ROAD-BRIDGE.

SPECIFICATION forming part of Letters Patent No. 725,695, dated April 21, 1903.

Application filed February 3, 1902. Serial No. 92,485. (No model.)

To all whom it may concern:

Be it known that I, HOWARD FRIEND, a citizen of the United States, residing at Lexington, in the county of Oklahoma and Territory of Oklahoma, have invented a new and useful Bridge, of which the following is a specification, reference being had to the drawings hereunto annexed.

This invention relates to the class of bridges in which the roadway or floor portion is suspended from main cables at either side thereof, said cables being passed over and supported by columns at the ends of the span.

The object of the invention is to produce a bridge of this class which shall be cheap and simple, yet light and strong.

In carrying out the objects of the invention I employ, as far as possible, staple classes of material—such as bar-iron, wire, and metal tubing, together with a few parts of cast metal—and construct all parts so that no screw-thread cutting and but little machine-work other than common bolts is required in making them. The landward spans, not uncommon, are employed in addition to the main span, and an intermediate portion or portions of said spans are suspended from the main cable in the same manner as the main span.

Referring to the drawings, in all of which like characters of reference designate like parts, Figure 1 is a side elevation of the bridge. Fig. 2 shows the anchorage for the ends of the main cable. Fig. 3 is an under side view of the bridge. Fig. 4 is a transverse section of Fig. 1, taken on the line A A. Fig. 5 is a transverse section taken on the line B B, Fig. 1, Figs. 1 to 5, inclusive, being on the same scale. Figs. 6, 7, 8, and 9 are enlarged views, partly in section, of portions of Fig. 4 from bottom to top thereof. Fig. 10 is an under side view of the base of one of the landward-span columns. Fig. 11 is a horizontal section through Fig. 7 on the line E E. Fig. 12 is a vertical section taken on the line F F, Fig. 9. Figs. 13, 14, 15, 16, and 17 are views, partly in section, of Fig. 5 from bottom to top thereof. Fig. 18 is a horizontal section taken on the line G G, Fig. 14. Fig. 19 is a view of Fig. 16 on the line H H. Figs. 20, 21, and 22 will be referred to later, Figs. 6 to 22, inclusive, being on the same scale.

The columns 1, supporting the main cable 2, are each composed of four hollow metal tubes 1^b, bound together by belts 3, and are provided with foot-plates 4, resting upon and bolted to a sill 5 and having projecting cores 4^b, fitting within the separate tubes of the column. The two columns at each end of the bridge are connected together by the sill 5, by the two tubular cross-rods 6, by a channel-iron cross-beam 7, and by a tubular cross-rod 8 at their upper ends. The cross-rods 6 are fitted tightly over projecting cores 3^b on the belts 3, and the cross-rod 8 fits tightly over a like core 9^b on the cable-saddle 9, said saddle having cores 9^c, fitting within the separate tubes of the column. Each of the cores 3^b and 9^b has laterally-projecting spurs 3^c, and strands of wire extend inside the cross-rods and loop around said spurs, connecting the cores in one end of the rods with the cores in the other end, said strands of wire being twisted together into a taut cable 10 by revolving one of the cores relative to the other. The cross-beam 7 is supported at each of its ends by a two-part belt 11, inside of which one of the tubes is cut in two, and a double core 12, having an intermediate flange 12^b, fits into the contiguous ends of said tube, as shown in Fig. 19. The flange 12^b of this core 12 lies within a groove therefor in the belt, and thus supports the same. When the tubes composing the columns are of such length as to require splicing, the splice is made within one of the belts 3 in the same manner as in the belt 11, care being taken that only one of said tubes is so spliced in a single belt. To prevent lateral swinging of each end pair of columns, strands of wire loop around each column just below the lower belts 3, pass across and up to the upper belts of the opposite columns, loop around said columns just above said belts, and are twisted into a taut cable 13, as shown only in Fig. 5. The outer ends of the landward spans are supported by columns 14, which, together with their supporting-sills, foot-plates, belts, cross-rods, and brace-cables, are constructed in the same manner as the columns 1 and are inclined inwardly at their tops, as shown in Fig. 4. The foot-

plates 15 and the caps 16, which are provided for these columns, have each projecting cores fitting into the separate tubes of said columns, and said caps have upwardly-projecting flanges 16^b, between which an I-shaped cross-beam 17 lies and is secured by the bolts 18. Said cap 16 and foot-plate 15 are secured in place by strands of wire which loop around a pin 19, lying within a flat-bottomed circular recess 20 in the lower face of the foot-plate, pass through said plate and up between the four tubes of the column, through the cap 16, and around a pin 21, lying within a recess in said cap under the cross-beam 17. These strands of wire are then twisted into a taut cable 22 by turning the pin 19 around in its recess, and said cap and plate are drawn tightly against the ends of the columns. At intervals throughout the length of the main and the landward spans T-shaped cross-beams 23 for supporting the floor-joist are suspended from the main cable 2 at even height with the cross-beams 7 and 17 aforesaid. At the center of the main span the main cable 2 passes under two of the cross-beams 23, but at all other points wire cables 24 are employed to suspend said cross-beams from said cable. Diagonal brace-cables 25 are also used, attaching the cross-beams 23 to two other points each on the main cable, thus more evenly distributing the load or weight of the floor portion over the structure.

The main cable 2 is composed of a number of strands of wire, not twisted together, but wrapped and bound together into a compact body by a strand of wire 2^b, as shown in Fig. 22. The cables 24 and 25 are composed of a number of strands of wire, which pass over the main cable 2 and under the ends of the cross-beams 23 and are twisted into a taut cable from their central points. One or more of the strands 2^c in the upper part of the main cable 2 after passing under the cables 24 and 25 are drawn back tightly over the said cables and extended inside the wrapping-strand 2^b entirely back to the anchorage of the cable. The ends of the cross-beams 23 are provided with saddle-blocks 26, having recesses or seats 26^b, through which the cables pass, said blocks straddling the stem portions 23^b of the said beams and bolted thereto, as shown in Fig. 20. The saddle-blocks of the two center cross-beams of the bridge differ from the others in that they are braced from each other by tubular rods 27, which fit tightly over projecting cores on said saddle-blocks and are designed to prevent said blocks moving toward each other from the action of a brace-cable to be referred to later.

The floor-joists 28 rest upon the cross-beams 7, 17, and 23 and support the floor 29.

A rail 30 of suitable height is provided at each side of the bridge and is bolted to iron posts 31 of T-shaped cross-section, which are secured to the ends of the cross-beams by bolts passing through the web or stem portions of said beams, the upper flanges of said cross-beams being cut away to admit said posts.

To prevent lateral swinging of the main span, cables 32 are looped over upwardly-projecting grooved studs 11^b, formed in the projecting separable ends of the belts 11, pass diagonally across under the cross-beams to the opposite side of the bridge, through the saddles of the two center cross-beams 23, thence diagonally across back to the belt 11 at the opposite end of the span, where it loops over a like stud 11. These cables 32, like other cables used, are formed of single strands of wire twisted into a taut cable after being put in place.

The foregoing being a full, clear, and exact description of my invention, what I claim, and wish to secure by Letters Patent, is—

1. In a device of the class described, columns comprising a plurality of tubes bound together, cross-beams secured to said columns and supporting portions of the floor, said cross-beams resting upon belts encircling the columns, one of the tubes of the columns being spliced within each of the said belts by a double core, said core having a projecting flange extending beyond the edges of the tube and lying within a groove therefor in the belt to support said belt, substantially as described.

2. In a bridge of the class described, columns comprising a plurality of tubes bound together, a cable-saddle mounted upon each of the columns and supporting the main cables, said saddle having projecting cores fitting within the separate tubes of the columns, a belt encircling each column and supporting the floor portion at said columns, one of the tubes of the columns being spliced within each of the belts by a double core fitting within the contiguous ends of the tube, said tube having a projecting flange extending beyond the edges of the tube and lying within a groove therefor in the belt to support said belt, substantially as described.

3. In a bridge of the class described, columns comprising a plurality of tubes grouped together and adapted to support the main cables, main cables supported by said columns and composed of a number of strands of wire, cables suspending the floor portion from said main cables, said suspending-cables looping around said main cable, one or more of the upper strands of the main cable being drawn back up over the suspending-cables and extended back along said main cable to the main-cable anchorage to prevent the suspending-cables from slipping downward, substantially as described.

4. In a bridge of the class described, columns comprising a plurality of tubes grouped together, said columns supporting the main cables, said cables being composed of a number of strands of wire wrapped and bound together by a strand or strands of wire, wire cables suspending the floor portion from said main cables, said suspending-cables being

composed of a number of strands of wire passing over the said main cable and formed into a cable by twisting them together, one or more of the upper strands of the main cables being turned and drawn back tightly over the said suspending-cables and extended inside the wrapping-strand entirely to the main-cable anchorage, substantially as described.

5. In a bridge of the class described, columns comprising a plurality of tubes grouped together, said columns supporting the main cables, cross-beams connecting the columns at each end of the bridge together, said cross-beams resting upon belts encircling the columns, one of the tubes of each column being spliced within its belt by a double core fitting into the contiguous ends of said tube, said core having an intermediate projecting flange extending beyond the edges of the tube and lying within a groove therefor in the belt, a floor or roadway portion resting upon the cross-beams of the columns and having intermediate cross-beams suspended from the main cables, substantially as described.

6. In a bridge of the class described, columns comprising a plurality of tubes grouped together, a main cable supported upon the tops of said columns at each side of the bridge, said cables being anchored at their ends, cross-beams connecting the columns at each end of the span, said cross-beams supporting the ends of the floor portion and resting upon a belt encircling each column, one of the tubes of each column being spliced within its belt by a double core fitting within the contiguous ends of said tube, said core having an intermediate projecting flange extending beyond the edges of the tube and lying within a groove therefor in the belt, intermediate cross-beams supporting the floor portion, the main cable deflecting down and passing under one or more of the said cross-beams to support same, the remaining cross-beams being supported from the main cables by strands of wire which loop around the ends of said cross-beams and around the main cable, said main cable being composed of a plurality of strands of wire wrapped and bound together by a strand of wire, one or more of the upper strands of said cable being turned back over the cables supporting the cross-beams and extended inside the wrapping-strand back to the main-cable anchorage, substantially as described.

In testimony whereof I have signed this specification, in the presence of two subscribing witnesses, this 30th day of January, 1902.

HOWARD FRIEND.

Witnesses:
FRANK N. MANN,
W. M. HUNT.