(No Model.) 3 Sheets—Sheet 1.

G. W. & F. P. STEDMAN.

SUSPENSION BRIDGE.

No. 441,598. Patented Nov. 25, 1890.

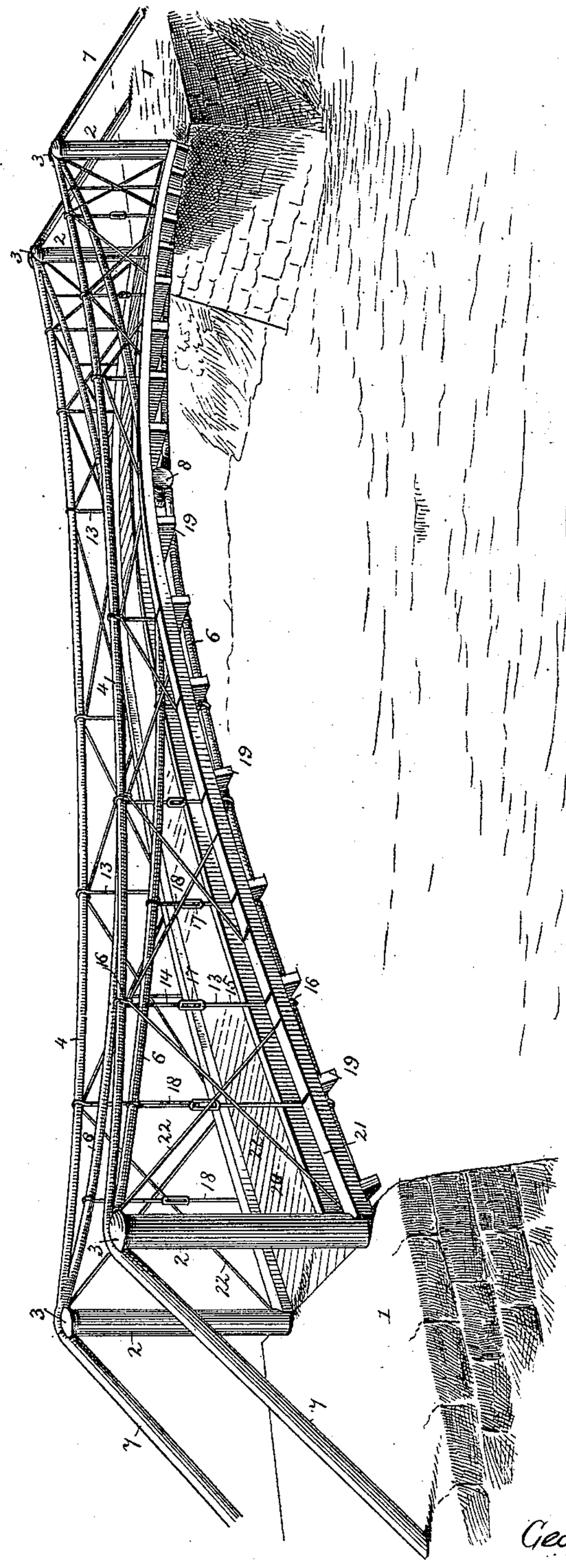

Fig. 1.

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SUSPENSION BRIDGE.

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Fig. 2.

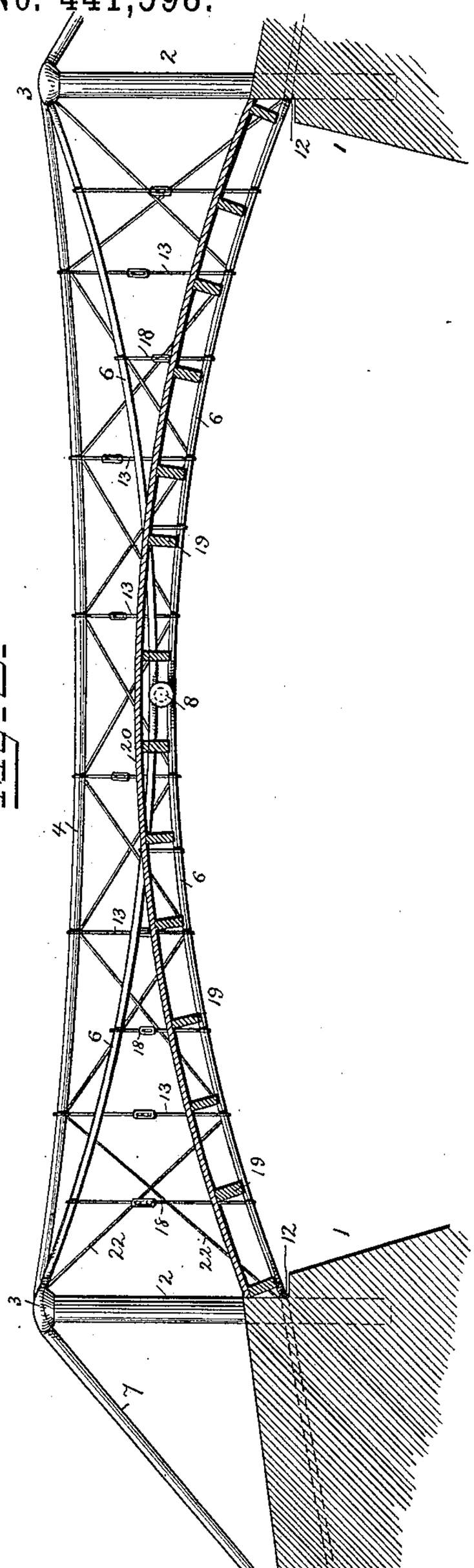
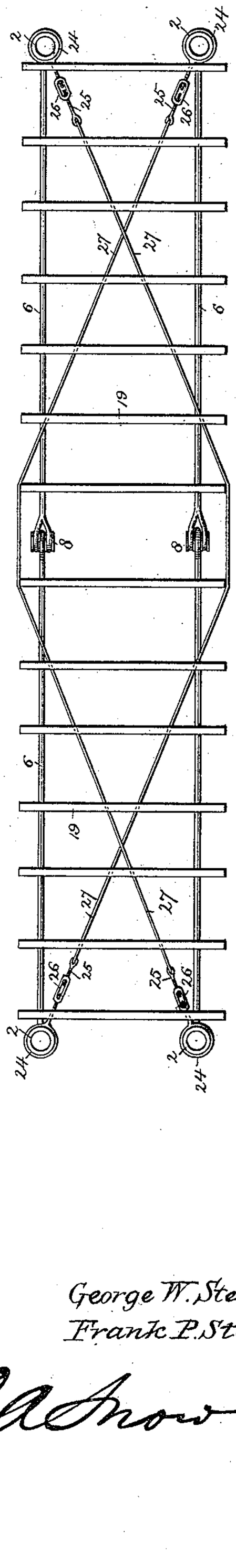


Fig. 7.



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(No Model.) 3 Sheets—Sheet 3.

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SUSPENSION BRIDGE.

No. 441,598. Patented Nov. 25, 1890.

Fig. 3.

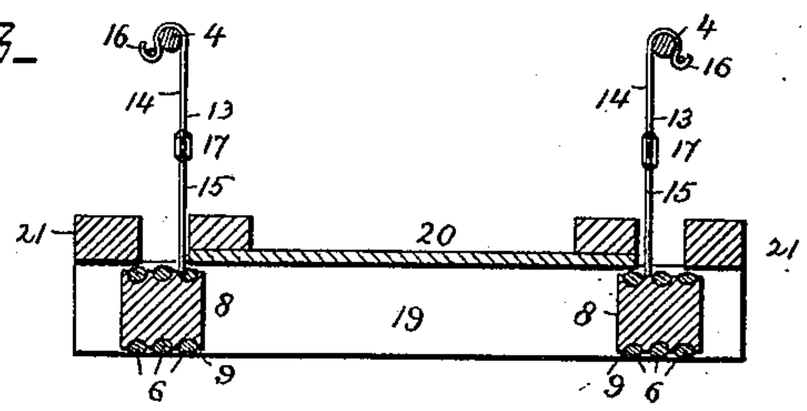


Fig. 4.

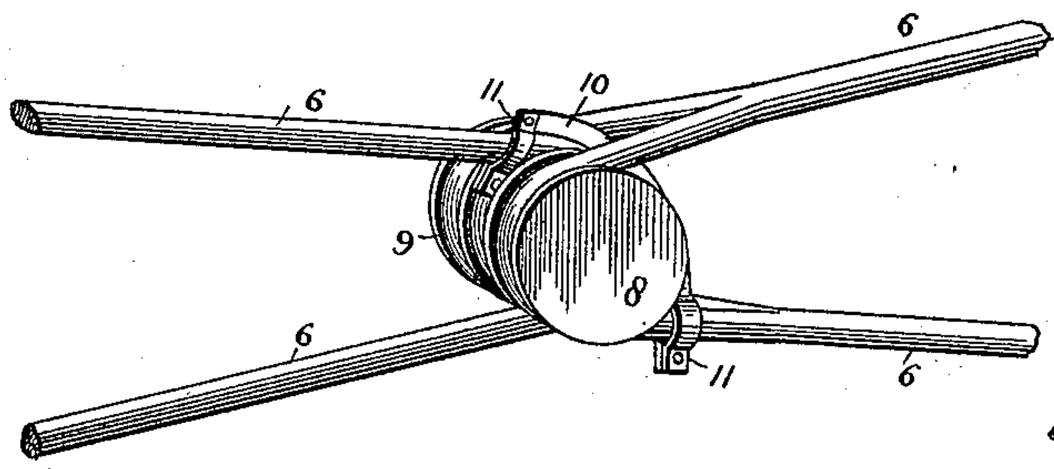


Fig. 5.

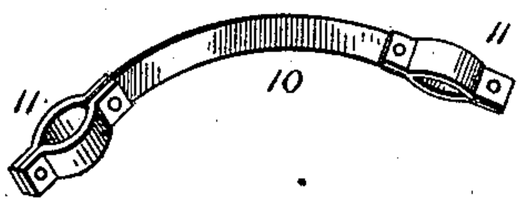


Fig. 6.

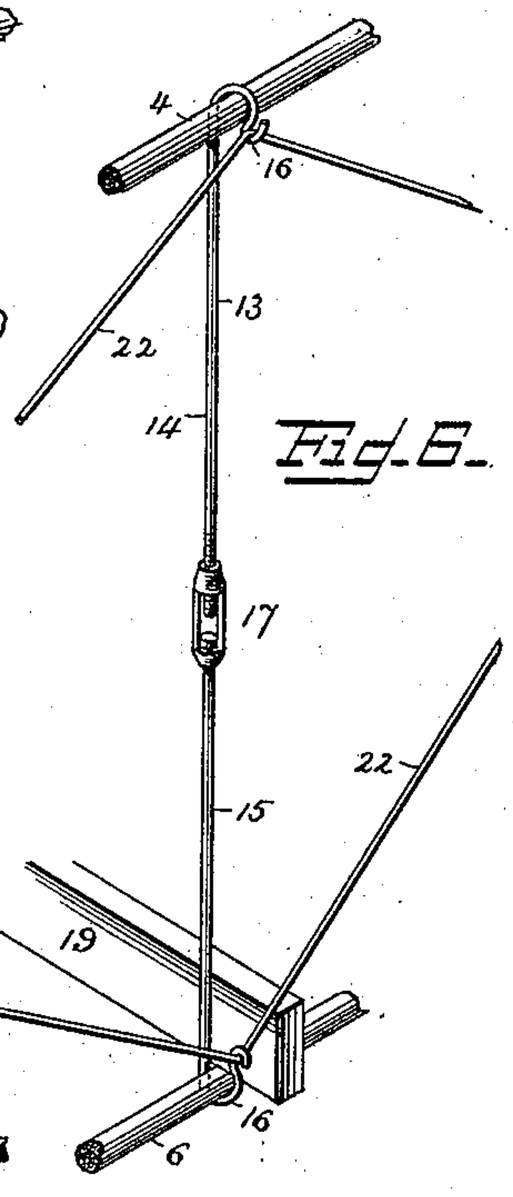
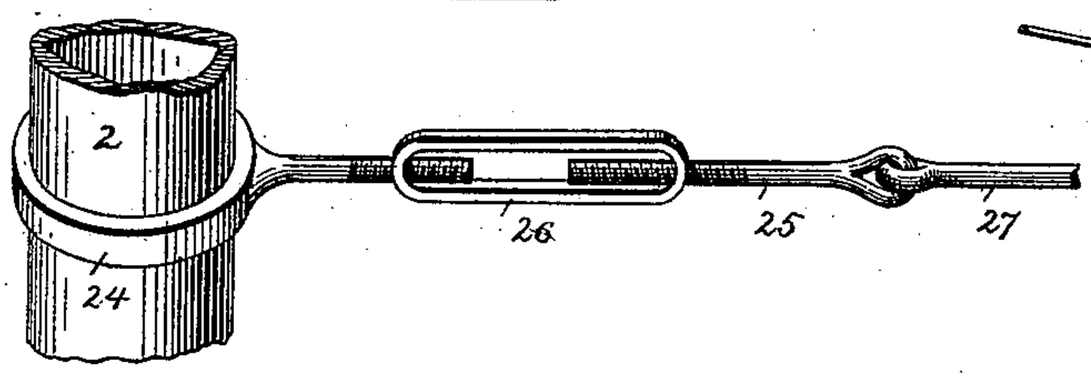


Fig. 8.



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UNITED STATES PATENT OFFICE.

GEORGE W. STEDMAN AND FRANK P. STEDMAN, OF SAN FRANCISCO, CALIFORNIA.

SUSPENSION-BRIDGE.

SPECIFICATION forming part of Letters Patent No. 441,598, dated November 25, 1890.

Application filed July 24, 1890. Serial No. 359,803. (No model.)

To all whom it may concern:

Be it known that we, GEORGE W. STEDMAN and FRANK P. STEDMAN, citizens of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a new and useful Suspension-Bridge, of which the following is a specification.

This invention has relation to improvements in suspension-bridges; and the objects in view are to provide a bridge of the above class which shall be light, rigid, cheaply and easily constructed, strong, and durable.

Other objects and advantages of the invention will hereinafter appear, and the novel features thereof will be particularly pointed out in the claims.

Referring to the drawings, Figure 1 is a perspective of a bridge constructed in accordance with our invention. Fig. 2 is a longitudinal vertical section. Fig. 3 is a transverse section through the center of the bridge. Fig. 4 is a detail in perspective of one of the saddle-shafts, the cables wound thereon. Fig. 5 is a detail in perspective of one of the cable-clamps for passing around the saddle-shaft. Fig. 6 is a detail in perspective of one of the suspension or truss rods, illustrating its connection with the suspension and supporting cables. Fig. 7 is a plan of the bridge, the roadway removed. Fig. 8 is a perspective in detail of a portion of one of the posts or pillars and the diagonal brace, together with its connection.

Like numerals of reference indicate like parts in all the figures of the drawings.

1 designates the opposite abutments located upon the opposite banks of a stream and at the points to be spanned by the bridge. These abutments may be of any desired construction or form of masonry, as will be apparent. At the front edges of the two abutments are located pairs of vertical posts or pillars 2, the bases of which are secured deep within the masonry of the abutments, in order to insure their rigidity. Each of the posts or pillars is surmounted by a saddle 3, provided with a longitudinal groove or recess, the grooves or recesses being disposed lengthwise the bridge and those at one side in alignment with those at the opposite side of the span.

4 designates the opposite main suspension-cables, which are passed over the saddles and rest within the grooves or recesses thereof at the sides of the bridge and have their extremities anchored to anchoring-posts 5, located in rear of the posts or pillars 2 and within or in rear of the masonry of the abutments 1.

6 designates the auxiliary cables, of which there are four. One of the ends of each of the cables is connected to the anchoring-post 5 adjacent thereto, and said cable is then continued and passed over the saddle 3 adjacent to the post, and between the anchoring-posts 5 and the saddles 3 the cables 4 and secondary or auxiliary cables 6 are combined either by interweaving or wrapping, as shown at 7. Beyond the saddles the secondary cables tend toward the center of the bridge, and each is passed over the opposite side of a cylindrical saddle-shaft 8, one of which is located at each side of the bridge and at the center thereof. These saddle-shafts are each provided with three circumferential grooves 9, one secondary cable taking in the central groove and the opposite companion secondary cable being divided and having a portion taking in each of the outer circumferential grooves, as shown, whereby the draft of the two cables is distributed throughout the entire length of the shaft and the same remains transversely disposed, as will be apparent.

10 designates a strap terminating at its upper ends in clamps 11. This strap is passed partially around the central groove of each of the saddle-shafts 8, and the clamps 11 serve to connect the two auxiliary or secondary cables. After passing around the saddle-shafts each of said cables is doubled upon itself or given a rearward course and passed through openings 12 in the posts or pillars 2, over whose saddle said cable passes, and is then connected to the anchoring-posts 5. By this disposition of the secondary cables it will be observed that one branch of said cables—namely, the lower branch—constitutes

the floor-supporting cables of the bridge, while the upper branch constitutes the secondary suspension-cables.

The main suspension-cables are connected to the lower branches of the secondary cables, or what I term the "floor-supporting cables," by means of vertical truss-rods 13. These truss-rods are formed in sections, and consist of an upper section 14 and a lower section 15, terminating in hooks 16 at their free ends, and having their adjacent ends adjustably connected by a swivel or turn-buckle 17. In a similar manner are the secondary suspension and the floor-supporting cables connected—namely, by truss-rods 18, terminating at their outer ends in the hooks 16 and having their adjacent ends adjustably connected by a turn-buckle 17. These truss-rods 18 alternate with the truss-rods 13, as shown, and the tension of the rods is such as to draw upwardly the floor-supporting cables, so that the span formed thereby is curved, as shown.

Upon the floor-supporting cables are laid the transverse joists 19, upon which is mounted the roadway 20. The roadway terminates within the space bounded by the cables, while the joists project beyond the cables and have their ends connected by means of strips or beams 21.

22 designates diagonal trusses, which connect with the main suspension-cables and the floor-supporting cables adjacent to their connection with the posts or pillars 2, there being two of such diagonal trusses, and passing from the suspension-cable to the floor-supporting cable, over and under the hooks 16 of the rods 13, and vice versa, until they reach the opposite pair of pillars 2, at which they terminate.

Around each of the posts or pillars 2 is passed an eye or clasp 24, to which eye or clasp are connected eyebolts 25 by means of turn-buckles 26, whereby the eyebolt and the clasp are connected in an adjustable manner.

27 designates a pair of diagonally-disposed braces, which braces extend from the eyebolts around the opposite end of the central joists, and from thence diagonally to the opposite eyebolt, as shown.

Having described our invention, we claim—

1. In a bridge of the class described, the combination, with opposite pairs of posts or pillars 2, of a main suspension-cable 4, connected to the upper ends of the posts or pillars, and opposite pairs of secondary cables, the upper ends of which are connected to the upper ends of the posts or pillars and their lower ends connected to the lower ends of said posts or pillars and between their ends connected to each other, substantially as specified.

2. In a suspension-bridge, the combination, with opposite abutments 1 and opposite pairs of posts or pillars 2, provided at their upper ends with saddles, of main suspension-cables 4, passing over the saddles at each side of the bridge and anchored in rear of said posts or pillars, secondary cables 6, connected at their ends to the said anchors and having their upper terminals passing over said saddles and their lower terminals through openings in the posts or pillars, and saddle-shafts around which the adjacent inner ends of the secondary cables are passed, substantially as specified.

3. In a suspension-bridge, the combination, with opposite abutments 1 and opposite pairs of posts or pillars 2, provided at their upper ends with saddles, of main suspension-cables 4, passing over the saddles at the sides of the bridge and anchored in rear of the posts, secondary cables 6, connected at their ends to the said anchors and having their upper terminals passing over the saddles and their lower terminals through openings in the posts or pillars and connected to said anchors, opposite saddle-shafts connecting the adjacent inner ends of each pair of secondary cables, and a series of truss-rods connected alternately to the main suspension-cable and upper branches of the secondary cables and at their lower ends to the floor-supporting cable, substantially as specified.

4. In a suspension-bridge, the combination, with opposite abutments 1 and opposite pairs of pillars 2 rising therefrom, of anchors located in rear of each pillar, saddles having grooves mounted on tops of the pillars, opposite main suspension-cables 4, passing over the saddles and connected at their ends to the anchors, and opposite pairs of secondary cables 6, bent upon themselves to form upper and lower branches, one branch of each cable passing over a saddle and connected to an anchor and combining with the suspension-cable between the saddle and anchor and the opposite branch passing rearwardly and through openings formed in the post and connected to the anchor, substantially as specified.

5. In a suspension-bridge, the combination, with opposite abutments and opposite vertical posts having grooved saddles, of main suspension-cables 4, passed over the saddles and anchored in rear thereof, opposite pairs of secondary cables 6, bent upon themselves and having their upper branches forming secondary suspension-cables passing over the saddles, their lower branches combining to form a continuous floor-supporting cable passed through the posts and connected to the anchors, and opposite saddle-shafts provided with three circumferential grooves, one cable passing around the central groove and opposite cable divided and passing around the outer grooves, substantially as specified.

6. In a suspension-bridge, the combination, with the opposite abutments and opposite pairs of vertical posts provided at their upper ends with saddles, of main suspension-cables passing over the saddles and anchored in rear thereof, opposite pairs of secondary cables folded upon themselves and connected at their inner ends, and having one of their

terminals passing over the saddle and connected to the anchor at the rear of the posts and the other terminal passing through the posts and connected to the anchors, the vertical truss-rods terminating in hooks and alternately connected at their upper ends to the suspension-cable and the upper terminal of the secondary cable and at their lower ends to the lower terminals of said secondary cable, which form floor-supports, and the opposite diagonal truss-wires, each pair connected to the upper and lower ends of the posts and diagonally disposed and alternately connected with the upper or main suspension-cable and the lower floor-supporting cable and to the opposite post, and the opposite diagonal transverse braces passing around the central joists of the roadway and connected to the diagonally-opposite posts, substantially as specified.

7. In a suspension-bridge, the combination, with the opposite pairs of posts having saddles, of the main suspension-cables passing over said saddles and anchored in rear thereof, secondary cables bent upon themselves to form opposite terminals, saddle-shafts connecting said cables at their bent portions, the upper terminals of said secondary cables passing over the saddles and anchored in rear thereof and the lower terminals passing through the posts and anchored in rear thereof and forming a floor-support, a series of adjustable truss-rods, the upper ends of which are alternately connected to the main suspension-cables and the upper terminals of the secondary cables and at their lower ends to the floor-supporting cable, opposite pairs of diagonal trusses alternately connecting the suspension-cables with the floor-supporting cable or lower terminal of the secondary cable, a series of transverse joists crossing the floor-supporting cables and extending beyond the same, a roadway mounted upon said joists, and opposite transverse diagonal braces passing around the ends of the central joists, thence diagonally disposed, a clasp mounted upon each of the posts, a turn-buckle connected to the end of the clasps, an eyebolt connected to the turn-buckle, and the ends of the braces connected to the eyebolts, substantially as specified.

8. In a bridge of the class described, the combination, with opposite pairs of posts or pillars 2, of main suspension-cables 4, connected to the upper ends of the posts or pillars and anchored at their ends in the foundation or abutments of the bridge, and opposite pairs of secondary cables, each pair formed of a single strand doubled or bent back from the center of the bridge, and the upper ends of which cables are connected to the upper ends of the posts or pillars and their lower ends connected to the lower ends of said posts or pillars and between their ends connected to each other by means of the saddle-shafts 8, which are fitted in the doubled portion of the secondary cables, substantially as specified.

9. In a bridge of the class described, the combination, with opposite pairs of posts or pillars 2, of main suspension-cables 4, connected to the upper ends of the posts or pillars and anchored at their ends in the foundation or abutments of the bridge, and opposite pairs of secondary cables, each pair formed of a single strand doubled or bent back from the center of the bridge, and the upper ends of which cables are connected to the upper ends of the posts or pillars and their lower ends connected to the lower ends of said posts or pillars, and between their ends connected to each other by means of the saddle-shafts 8, which are fitted in the doubled portion of the secondary cables, and a series of truss-rods having their lower ends connected to the lower branch of the secondary cable and their upper ends to the main and upper branch of the secondary cable alternately, substantially as specified.

10. In a suspension-bridge, the combination, with the abutments and opposite pairs of pillars 2 rising therefrom, of anchors located in rear of each pillar, saddles having grooves mounted on the tops of the pillars, opposite main suspension-cables 4, passing over the saddles and connected at their ends to the anchors, and opposite pairs of secondary cables 6, bent upon themselves to form upper and lower branches, one branch of each cable passing over a saddle and connected to an anchor and combining with the suspension-cable between the saddle and anchor, and the opposite branch passing rearwardly and through openings formed in the post and connected to the anchor, and the saddle-shafts 8, fitted in the secondary cables at the point where they are bent or doubled and serving to connect the secondary cable on one end of the bridge with secondary cable at the other end, substantially as specified.

11. In a suspension-bridge, the combination, with the opposite abutments and opposite pairs of vertical posts provided at their upper ends with saddles, of main suspension-cables passing over the saddles and anchored in rear thereof, opposite pairs of secondary cables folded upon themselves and connected at their inner ends and having one of their terminals passing over the saddle and connected to the anchor at the rear of the posts, and the other terminal passing through the posts and connected to the anchors, the vertical truss-rods terminating in hooks and alternately connected at their upper ends to the suspension-cable and the upper terminal of the secondary cable and at their lower ends to the lower terminals of said secondary cable, and the opposite diagonal truss-wires, each pair connected to the upper and lower ends of the posts and diagonally disposed and alternately connected with the upper or main suspension-cable and the lower or floor-sup-

porting cable and to the opposite post, substantially as specified.

12. In a suspension-bridge, the posts or pillars 2, the suspension-cables 4, supported by the posts, the floor-supporting cables, the suspension-rods connecting the suspension-cables with the floor-supporting cables, and the transverse joists 19, crossing the floor-supporting cables, in combination with the opposite diagonal braces 27, connected at their ends to the posts or pillars, crossing each other and having their intermediate portions passing around the ends of the central joists, as set forth.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in presence of two witnesses.

GEORGE W. STEDMAN.
FRANK P. STEDMAN.

Witnesses:
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JAS. B. IVORY.