2 Sheets--Sheet 1.

T. C. BOUTET.

Improvement in Bridges.

No. 114,401. Patented May 2, 1871.

Fig. 1.

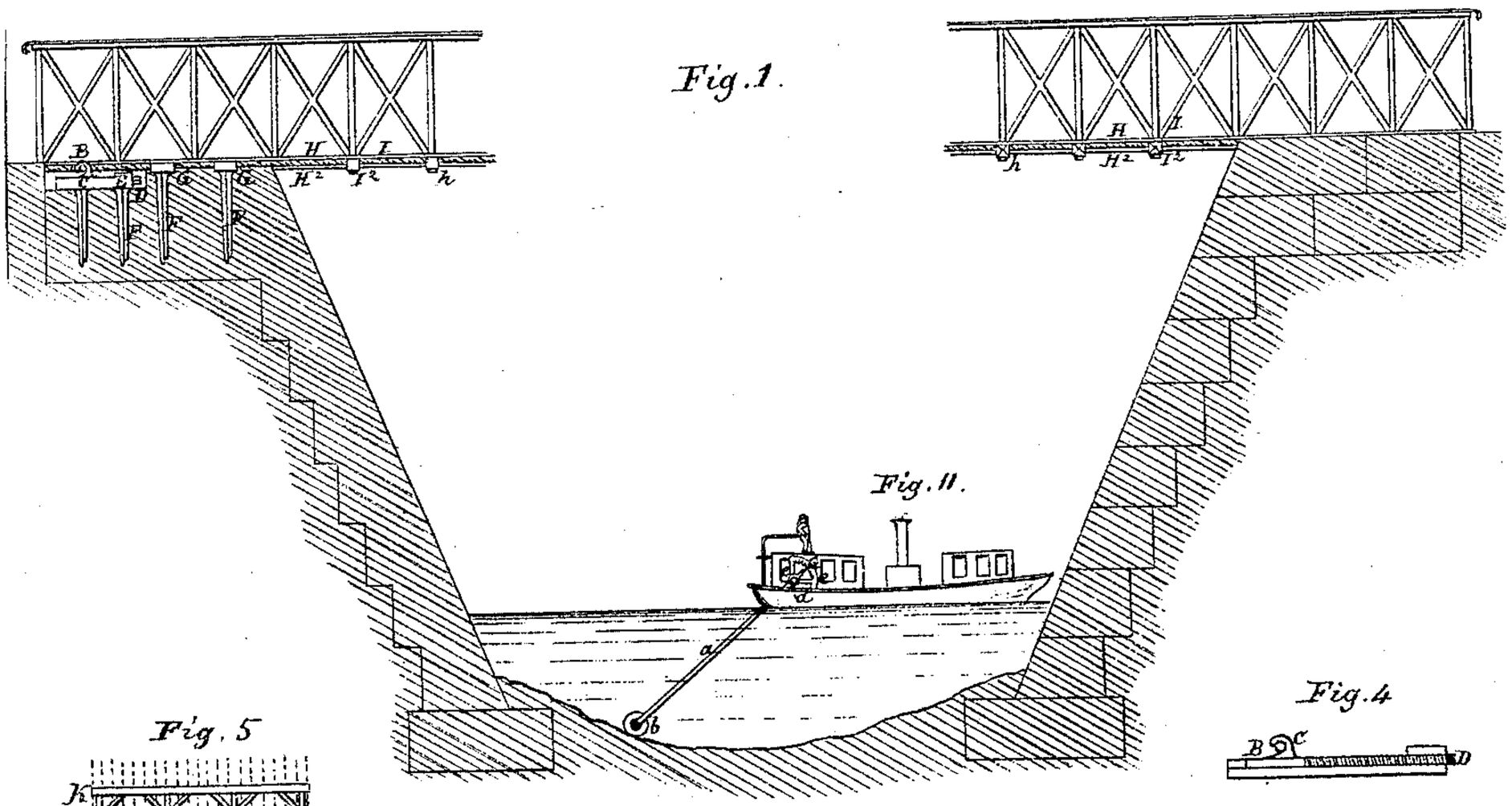


Fig. 11.

Fig. 5

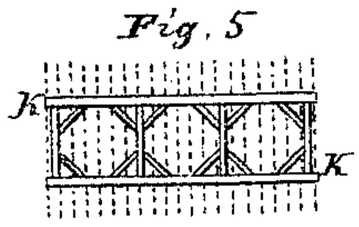


Fig. 4

Fig. 4 bis

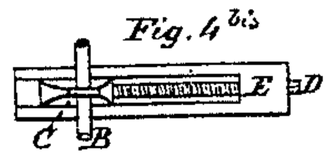


Fig. 5 bis

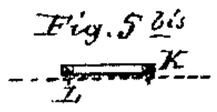


Fig. 5 ter

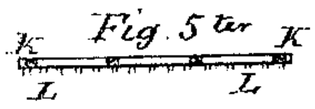


Fig. 6

Fig. 6 bis

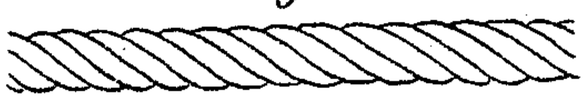


Fig. 8.

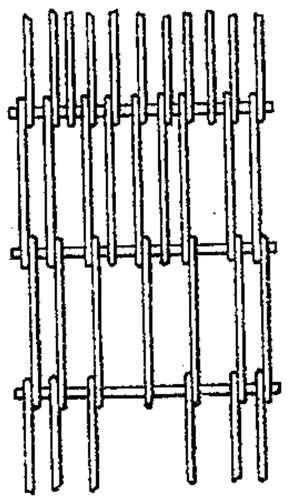


Fig 8 bis

Fig. 2.

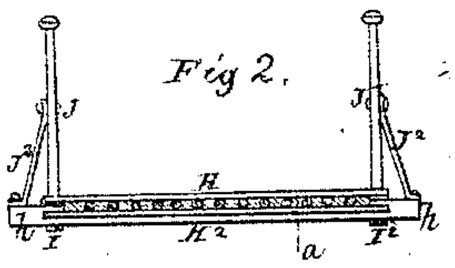
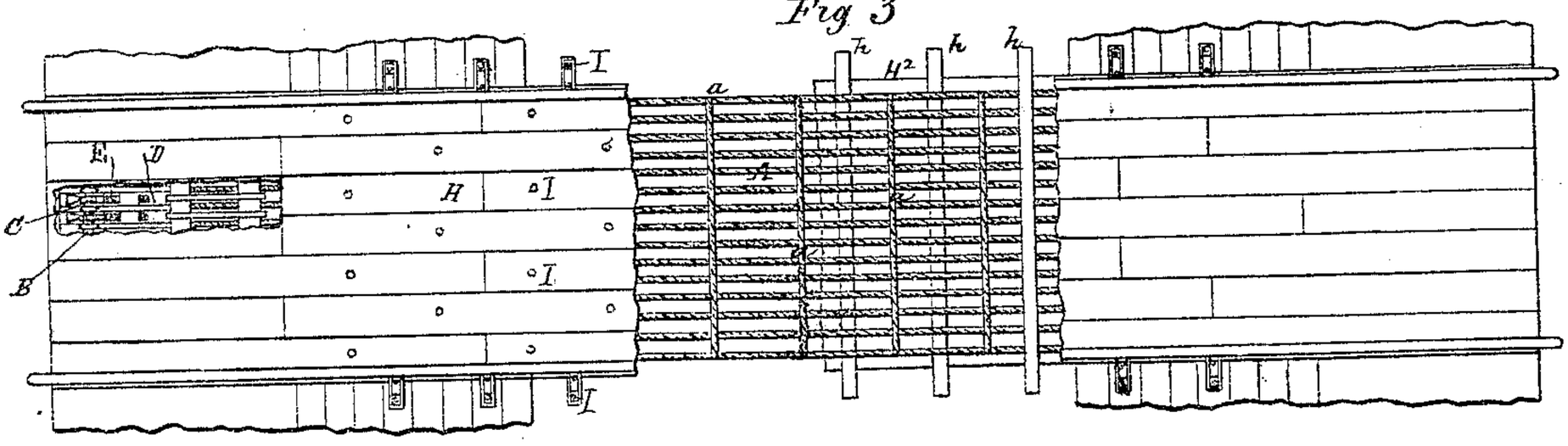


Fig. 3



Witnesses.

Inventor.

Thomas Charles Boutet

by his atty A Pollok

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T. C. BOUTET.

Improvement in Bridges.

No. 114,401. Patented May 2, 1871.

Fig. 10.

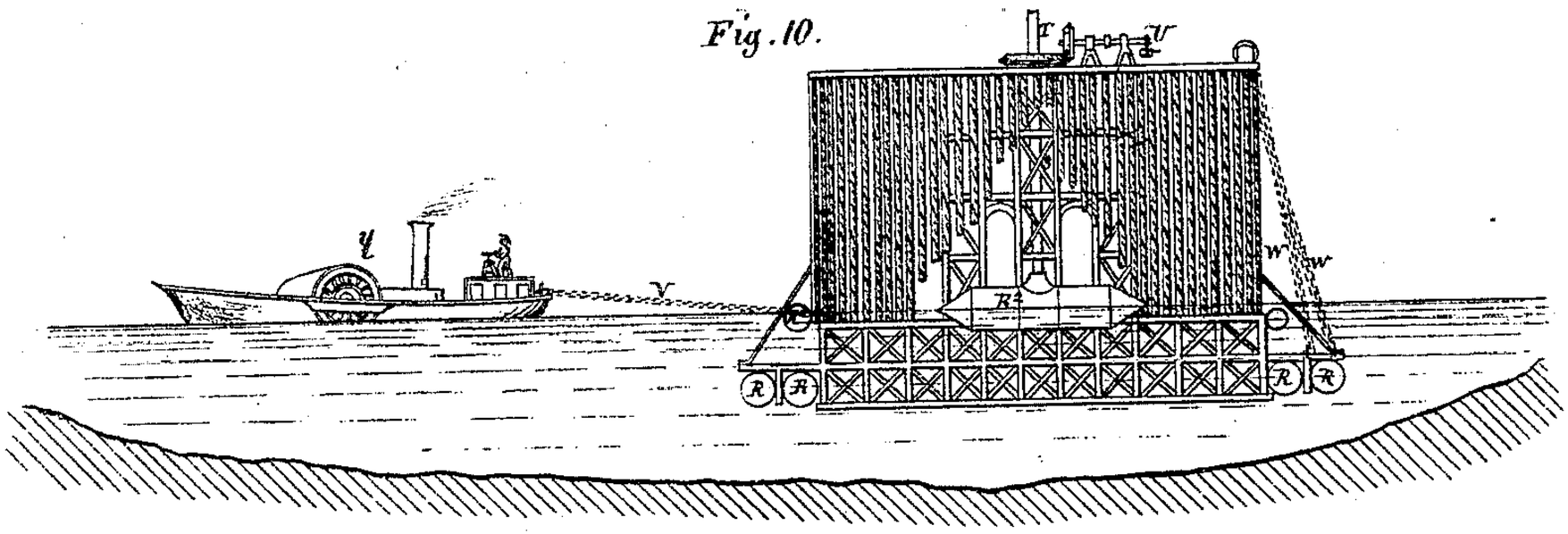


Fig. 7.

Fig 7 bis

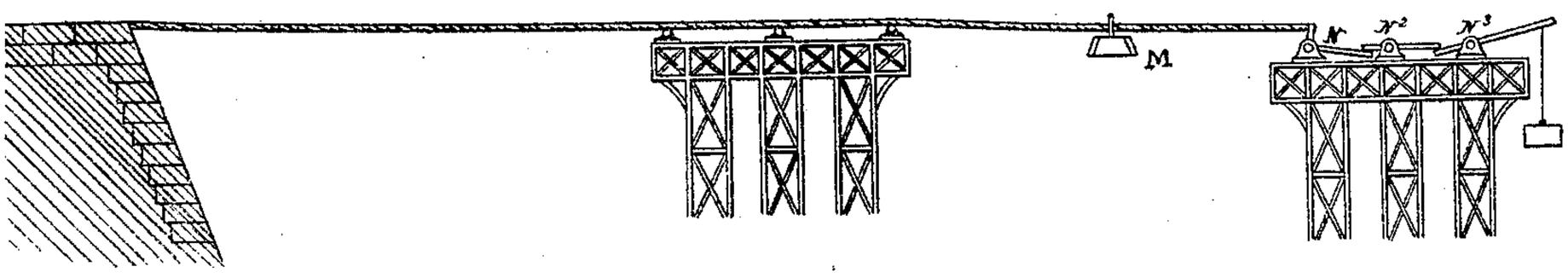
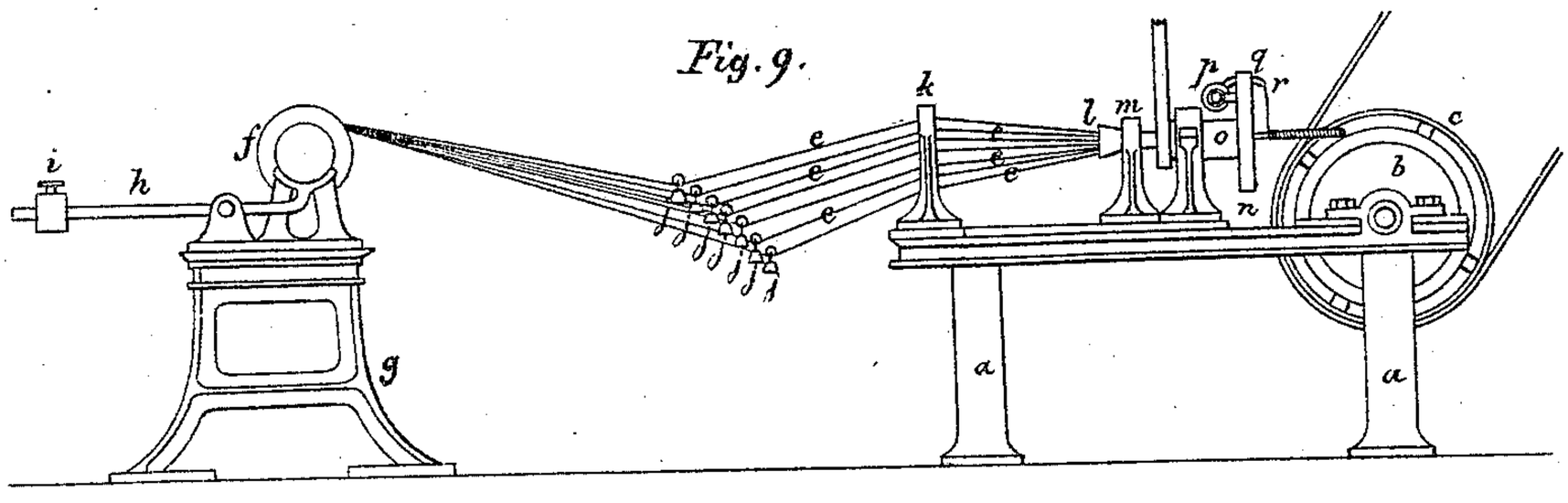


Fig. 9.



Witnesses.

H. Bailey

Inventor.

Thomas Charles Boutet

by his atty A. Pollock

United States Patent Office.

THOMAS CHARLES BOUTET, OF PARIS, FRANCE.

Letters Patent No. 114,401, dated May 2, 1871.

IMPROVEMENT IN BRIDGES.

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

To whom it may concern:

Be it known that I, THOMAS CHARLES BOUTET, of Paris, in the Empire of France, have invented certain new and useful Improvements in the Construction of Metallic Bridges, of which the following is a specification.

The bridge system in which my invention is embodied is composed—

First, of a metallic tress formed of cables made of iron or steel fixed to abutments, and stretched parallel with one another by means of rollers, screws, or counter-weights, and bound and held at the proper distance apart by means of ties placed in the plane of the tress, but perpendicularly to the cables and at equal distances apart. These ties are formed of smaller cables, which cross and are interlaced with the larger cables, and are bound together by means of an annealed iron wire wrapped around these small cables, which are thus pressed and bound together in such manner that the large cables are firmly held between them, and that the whole forms a tress or "plait," all of the parts of which are solidly united and of equal strength.

Second, of two wooden floorings, fixed the one above and the other beneath the tress, which is pressed and held between the two by bolts which pass through the two floorings and the tress. These bolts are held in position by nuts on their ends. The result of this arrangement is that the cables, being held and bound to the wooden flooring throughout their whole length, cannot expand or contract, and consequently experience no injurious strain or alteration.

Third, of wooden or metal stringers and cross-pieces intended to stiffen the structure, and to complete the compression or binding of the tress between the two floorings.

Fourth, of wooden or metal balustrades or side rails, fastened to the structure at their base by means of pins or bolts, which, traversing the floorings, the tress, and the stringers, are drawn down tightly by means of heavy nuts. These balustrades form parapets, and at the same time assure the vertical rigidity.

Abutments.

The abutments are constructed in the ordinary way. They can be either masonry or wood-work. Cast-iron anchor-plates, to which are fixed the cables of the tress, are let vertically into the abutments.

Piers.

The piers are of cast or wrought metal, and are divided into two parts. The first, constituting the base or pedestal of the pier, is built to the height of several meters. This pedestal is sustained on the water by buoys which serve to float it, and is towed by a steam-vessel to the spot which it is to occupy, and is there sunk by means of a large buoy placed in the center of the pier, and which permits the pier to descend upon the bed of the stream without shock. The said buoy is actuated by a long vertical screw, by means of which the buoy is raised or lowered. When it is raised, the weight of the pedestal becomes greater than its volume of water, and it therefore gradually descends. If, on the contrary, the buoy is lowered, the whole system becomes specifically lighter than the water and rises again to the surface.

The movement of the pedestal can be regulated at pleasure. When the pedestal is sunk it can be fixed in place by any suitable means.

The second part and main portion is then mounted upon the pedestal. All the parts which compose this portion of the structure having previously been prepared, it is only necessary to bolt them together and to the pedestal in order to complete the construction of the pier.

The nature of my invention and the manner in which the same is or may be carried into effect will be readily understood by reference to the accompanying drawing.

Figure 1 represents an elevation of the bridge and a vertical section of the abutment.

A is the horizontal tress formed of cables stretched from one abutment to the other, the number and diameter of which are proportionate to the weight of the bridge and to the load which it is to sustain.

These cables terminate at each end in rings fitting on an iron bar, B, which is placed in hooks C, mounted on cast-iron plates D, which are embedded in the masonry.

Heavy screws E are arranged to push back the hooks in a groove made in the plates D, in case it should be necessary to tighten the tress.

F are other cast-iron anchor-plates, which serve to make fast the cables by means of caps G, which are pressed down over the cables by means of screws. The cables where they pass under the cap are surrounded by leather washers, which prevent friction between the cables and the metallic anchor-plates.

H is the lower wooden flooring.

h, the stringers.

I, the bolts.

I^2, the nuts which bind together the whole system.

J are cast or wrought-iron balustrades, the feet of which traverse the floorings and the tress, and are held under the stringers by the nuts I^2.

Figure 2 is a transverse vertical section of the bridge, showing the longitudinal cables bound together by the transverse ties *a*.

A is the tress, which is held between the two floorings H and H^2.

h are the wooden cross-ties.

I, the bolts.

I^2, the nuts.

J, the balustrades.

J^2, the braces for upholding the balustrades.

Figure 3 is a plan of the bridge and abutments. The part of the bridge broken away over the abutment upon the left of the figure represents the devices for holding the cables. In the center of the bridge the upper flooring is broken away in order to expose to view the tress and its attachments. (The cross-pieces represented as placed above the tress should be placed beneath it.)

A is a tress formed of longitudinal cables bound and held together by cross-cables *a;*

B are the end bars upon which the ends of the cables are fixed;

C are the hooks which hold the bars;

D are cast-metal plates which hold the hooks; and

E are the screws which serve to push back the hooks in their grooves in order to tighten the tress.

G are the caps which bind the cables upon the plates F, fig. 1, by means of screws.

H is the upper flooring.

H^2, the under flooring.

h, the cross-pieces.

I, the bolts.

Figures 4 and 4 *bis* are detailed views of the anchor or holding-hooks.

B is the bar which supports the cables.

C, the hooks which sustain the bar.

D, the screw for causing the hooks to move forward or backward. For this purpose the screw may be operated in any suitable manner.

Figures 5, 5 *bis*, and 5 *ter*, represent a device for keeping the cable in proper position during the formation of the tress.

This device is composed of a rectangular wooden or iron frame K, provided with teeth L, which is placed crosswise on the cables in such manner that each cable will be held between two of the teeth. The cables being thus maintained at the proper distance apart, the cross cables or ties can readily be applied and attached without deranging the positions of the tress.

Grooved pulleys or rollers placed under the frame and running on the cable will facilitate its movement, so that the frame may be easily pushed forward as the work progresses.

Figure 6 represents a portion of the cable of the tress, which is formed of a suitable number of galvanized iron or steel wires, which are first stretched by means of counter-weights and then bound together by an exterior annealed wire, which is wound spirally around the bundle of wire, as shown in the drawing.

These cables thus made are superior to others—

First, because the wires or strands are not strained by torsion, and consequently retain their maximum of resistance.

Second, because they possess greater rigidity.

Third, because they are less liable to stretch under a load.

Figure 6 *bis* represents a portion of the cable formed of strands in the ordinary manner.

Cables of this kind may also be used to form the tress; but as the strands are strained by torsion these cables possess less rigidity and power of resistance than the cables above mentioned.

Figure 7 represents the mode of stretching the cables.

The cable being fixed at its two ends, if it is placed on grooved pulleys mounted on a support (or upon one of the piers for bridges of great span) located midway between its two ends, the two parts of the cable will be of equal weight and will be curved alike; but if a weight, M, is placed in the center of one of the parts, it will force that part to bend more and will tighten up the other part. The cable can thus be stretched almost horizontally without any undue strain upon the metal.

This simple method can be equally well applied to stretching the tress, and will be readily understood without further explanation.

Figure 7 *bis* represents another method of stretching the cables and the tress.

It may sometimes be impossible, either from want of space or for other reasons, to stretch the tress in the manner above indicated. It might be possible to remedy this by making use of a roller mounted on the pier, but the resistance of the tress would produce a traction which, acting upon the top of the pier, would overturn it. All these difficulties may be avoided by means of the apparatus shown in the figure.

It is composed of a series of levers, the first of which is an angle or bell-crank lever whose longer arm is acted on by the short arm of the lever N^2; the longer arm of the latter acts in an opposite direction on the lever N^3, and so on upon other levers if a greater number is necessary.

On the long arm of the last lever is mounted a counter-weight which is held by a pressure-screw, and has a power proportionate to the weight of the tress. By this arrangement the tress acts no longer by traction on the pier, but by compression on the axis or point of support of the levers, and the latter act by compression on the vertical axis of the pier, which, consequently, is not liable to be overturned.

Figures 8 and 8 *bis* are plan and side elevations of an improved form of tress.

It is well understood that the weight of the strands has much to do with the absolute resistance of the cable, which, if it were suspended over too great a span, would break under its own weight, the rupture taking place near the abutments.

This difficulty is obviated by arranging the tress in such manner that the number of cables shall diminish gradually from the abutments toward the center of the span, where only a sufficient number is left to support the flooring and the moving load.

Figure 8 represents a plan view of this arrangement. The first panel of the tress is formed of eleven cables, the second of nine, the third of seven, and so on.

The cables here shown terminate at each extremity in a ring, and bars of iron or steel pass through these rings and bind the cables together.

A tress thus made is much stronger at the ends near the abutments, where the weight acts with more force, than at the center, and the tress will thus, if well proportioned, present an equal resistance at every point.

The same result may be obtained by forming the tress of an equal number of cables throughout its whole length, and by diminishing gradually the diameter of the cables as they approach the center of the span. This latter arrangement is preferable, as it gives a better support for the flooring.

Having now described my invention,

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

1. The construction of bridges in the manner herein shown and described.

2. The combination of the metallic tress formed of longitudinal cable and transverse ties, as described, the upper and lower wooden floorings between which said tress is held, the stiffening-stringers and cross-pieces, and the balustrades or side rails, said parts being united together to form a bridge-span supported upon proper abutments, substantially as shown and described.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

TH. CH. BOUTET.

Witnesses:

M. BAILEY,

A. POLLOK.