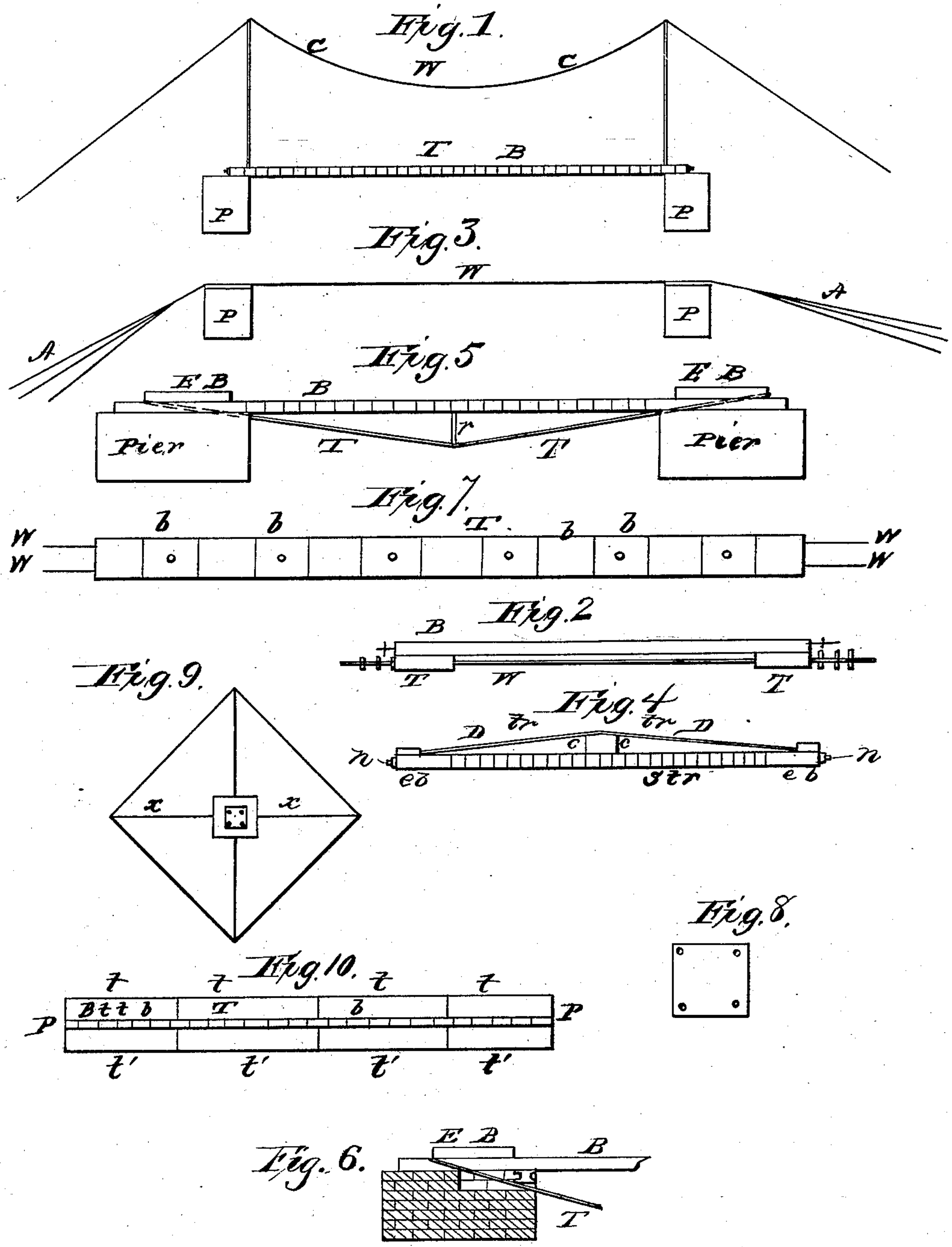
(No Model.)

T. BARLAND.

BRIDGE.

No. 264,220. Patented Sept. 12, 1882.



WITNESSES

Franck L. Ouraud.

George Cornell.

INVENTOR

Thomas Barland.

by L. Deane

ATTORNEY

N. PETERS. Photo-Lithographer. Washington, D. C.

UNITED STATES PATENT OFFICE.

THOMAS BARLAND, OF EAU CLAIRE, WISCONSIN.

BRIDGE.

SPECIFICATION forming part of Letters Patent No. 264,220, dated September 12, 1882.

Application filed October 16, 1880. (No model.)

To all whom it may concern:

Be it known that I, THOMAS BARLAND, a citizen of the United States, and residing at Eau Claire, county of Eau Claire, and State of Wisconsin, have invented a new and useful Improvement in Bridges, of which the following is a specification.

In the accompanying drawings, Figure 1 is a comparative view, showing the old and my new application of wires and cables in bridges. C is the well-known curved-wire suspension-cable; B, the same amount of wire in cross-section, inclosed in my tubes and put in tension against them from pier to pier.

Fig. 2, B is a beam. T T are tubes at the ends of the beams and rigidly secured to it. W is a tensile member, passing through the tubes and put in tension against them at their outer ends, and is in contact with the lower surface of the beam and supporting it.

Fig. 3 illustrates an old and well-known mode of securing cables, particularly in military bridges.

Fig. 4 represents at *s t r* the block tube-stringer; *e b e b*, the end blocks. W is the wire in tension; *t r t r*, the truss above the stringer, composed of struts abutting against each other at the center and thrusting against the end blocks, *e b e b*, and the cable in tension. *c c* are ties uniting the braces to the stringer, so that any deflection of the stringer downward must carry the braces with it, and consequently projecting their ends outward against the tension of the wire must tend to straighten the stringer.

Fig. 5, T T are the tension-truss below, *r* being a short strut. B is the tube-beam; E B, the end blocks, resting on the rear part of the pier and on an iron beam at the front edge of the pier, and over an unbuilt opening in the pier through which, at each end of the beam, the tension-rod T descends under the iron beam toward the middle of the span. E B have notches in them to hold and resist the strain of the tension-truss.

Fig. 6 is a vertical longitudinal section, showing the pier, the iron beam, the unbuilt space, and the tension-rod T passing down through it under the iron beam, as above described.

Fig. 7 is a side view of one of a series of my beams, which are supposed to cross from pier to pier, either close to one another or at certain distances and parallel. The blocks are shown threaded upon two wires in a vertical plane, the principle being the same. It is intended to show that there are holes bored or cast in the blocks, through which transverse bolts cross to bind and brace the beams together.

Fig. 8 represents a cross-section of a beam made by threading the blocks upon four cables or wires, *o o*, above and below, representing the wires, leaving room in the middle for the application of transverse bolts.

Fig. 9 is a cross-section of my invention applied in a skeleton mammoth tubular bridge, in which *x x* represent the roadways.

Fig. 10 is a longitudinal section of the skeleton tube, in which T is my elementary block-tube tension-beam; P P, the upright pieces, made very strong. *t' t t* and *t' t' t* are tension material, with envelopes from P to P, and P P are made so as to have a little play on B *t t b*. These upper and lower surfaces of this skeleton joist resist bending by the whole tensility enveloped, in remarkable contrast with the rigid upper and lower faces of the Victoria bridge.

This invention consists in the combination, with a wire or other tensile rod, cable, or chain, of blocks of solid material, the more solid the better, threaded upon said rod, cable, or chain, the latter being screwed up at the ends to such a degree of tension against the ends of said enveloping-blocks that the combined structure shall form a rigid beam. The said enveloping-blocks may be in the form of tubes, or any other form, provided it presents sufficient transverse sectional area to afford the necessary leverage. The manifest advantages of this beam are these: A very flexible material, such as wire-chains, ropes, &c., may (by being screwed up, as above, against the rigid envelopes) be very easily changed into a very inflexible beam. When vegetable ropes are used it will probably be best to saturate them with tar or an antiseptic and metallizing substance. Also, these materials having a very great tensile power in proportion to their weight, when that great tensile power is applied in a burden-bearing beam as its principal element, as is done by my construction, then my beam exhibits the most important quality that a beam can have—viz., the combination of a maximum of power with a minimum of weight, and its necessary accompaniment a minimum of bulk, consequently a minimum of danger from the violence of tornadoes. Also, owing to the peculiar construction, these powerful beams can be laid parallel to one another from pier to pier throughout the whole width of the roadway, and, being bound and braced together, would have an immense power of resistance, considering the small amount of surface—namely, one or two feet of depth at the edge.

Although tubes may not be properly considered a flexible material, yet as they are lighter than solid rods, and can be made in very short sections, and are capable of being readily coupled together end to end by screw-threading or otherwise, and are consequently separable, they may with propriety be mentioned as possibly advantageous as a substitute for wire, &c.

The anchorage of the cable or the curved wire forms no angle in order to be fastened; but were a cable arranged partly on my plan—that is, put in tension and fastened to ordinary piers—the angle formed between the horizontal cable and the fastening would be a great element of weakness; therefore, as above, the piers would cost more than the anchorage. But this cost is simply avoided by screwing up, as above, the cable in tension against its envelopes. It is true that this wire beam, although, I believe, it would be much less liable to bend when placed in position upon abutments, and consequently to tilt up at the ends, than any other, yet would be liable to this more or less, and to prevent this tilting up I devise three arrangements. Two of these would add very great power by their combination with the above horizontal beam. One of these arrangements is a truss composed of two very long braces, (see Fig. 4,) D being struts or braces meeting in the middle of the span and resisting or pushing against the tensility of the wire by pushing against the outside or pier-end envelope or block-tube, which block would need to be very strongly built in order to bear without compression so great a strain. This arrangement, however, could only be used on the two stringers, because otherwise it would interrupt the roadway. This pushing truss might be supported by the horizontal beam when being built, as it probably would be, in sections; but when built the supports would be removed and it would be connected with the horizontal beam by ties. The vertical load on the beam, tending to deflect it downward, being communicated to the crown of the truss by the ties would also tend to depress it, which in turn would thrust endwise against the ends of the wire beam with tendency to straighten it and counteract deflection. The braces should not be united tightly but so that they would (as it is termed) "play" or accomodate themselves to this movement. The other arrangement to prevent the tilting up and to add very great power is as follows: The horizontal tube-beam rests partly on the rear part of the pier and partly on a strong iron beam at the edge of the pier. (See Fig. 6.) Between that rear part of the pier and the iron beam the pier has an opening unbuilt. Around the part of the tube-beam above that opening a tension member is made fast to the end of the block and descends under the said iron beam toward a point beneath the middle of the horizontal beam. It then presses under a vertical strut, abutting against the tubular beam at its middle part and thence passes and connects similarly with the other end block. When this truss is completed, by tightening the tension member the truss supports the horizontal beam at its middle part, and at the same time, by the pier arrangements just mentioned, it binds down the ends, so that it cannot tilt up. The third arrangement to prevent the tilting up, is to extend the compound tube-beam very far back on a long pier, and secure it to the pier by a system of clamps arranged to admit of the motion resulting from the expansion and contraction of iron beams, and wire after wire and chain after chain, &c., with its envelope may be laid parallel and bound, as above, far back on the pier; and it is my belief that my tube-beam excels all others so much in rigidity that it would not have the effect which wires, chains, &c., alone would have, if thus fastened, of disorganizing the pier by the powerful pulling strain toward the chasm.

It will be observed that I lay especial stress on the utilization of the combined strength of the horizontal wire or chain and the arch element in the enveloping-pieces developed by the rigidity with which these are secured by the nuts at the end upon the wires.

Having thus described my invention, what I consider new, and desire to secure by Letters Patent, is—

1. A beam consisting of a wire or cable, or their equivalent, inclosed in a series of rigid blocks and put in tension within such enveloping-blocks by being screwed up or otherwise strained against the outer faces of the outermost blocks, thereby putting said blocks in compression upon each other, as described.

2. The combination, with the beam constructed as described, of attachments to the end block, adapted to receive the struts above or tension-braces below, substantially as set forth.

3. In a bridge of otherwise ordinary construction and provided with truss or like supports above or below, a stringer formed of tensile material inclosed in enveloping blocks or tubes of considerable transverse area, formed into and acting as a continuous beam by be-

ing rigidly secured in compression against longitudinal resistance of said tensile member, substantially as described.

4. In a bridge, a truss consisting of a series of blocks threaded upon one or more tension wires, rods, or cables in a vertical plane, said blocks being tightly set each against the other, and then held firmly in place by the tension of the wires, substantially as shown and described.

THOS. BARLAND.

In presence of—
GEORGE C. TEALL,
FRED A. TEALL.