S. H. Long.

Truss Bridge.

No. 1,397. Patented Nov. 7, 1839.

Fig: 1.

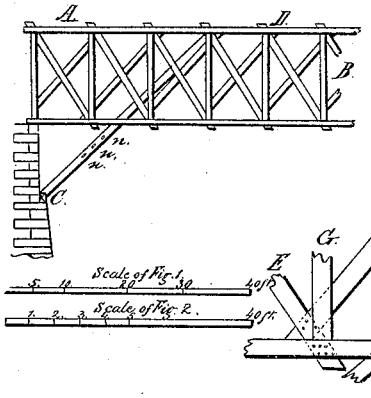

Fig: 2.

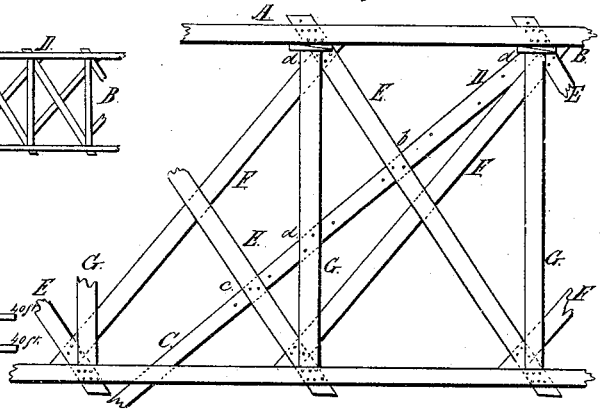

Fig: 3.

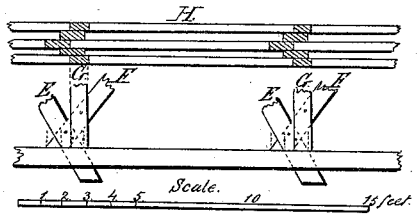

Fig: 4.

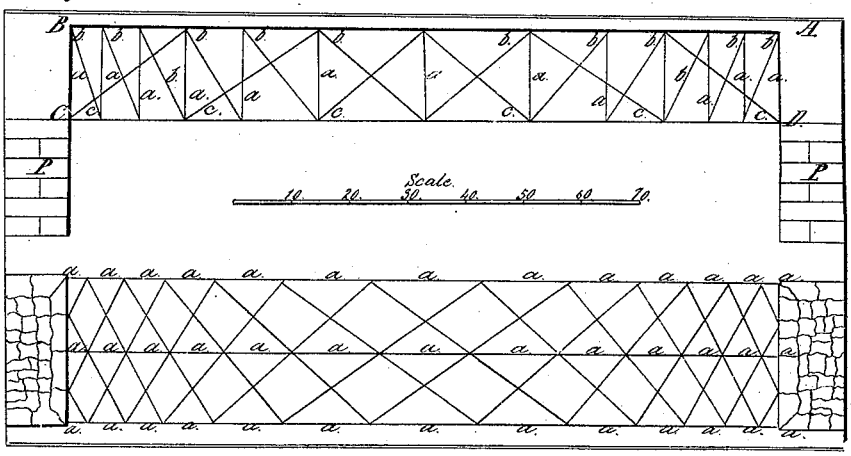

Fig: 5.

E. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

STEPHEN H. LONG, OF THE UNITED STATES ARMY.

WOODEN-FRAMED SUSPENSION-BRIDGE.

Specification of Letters Patent No. 1,397, dated November 7, 1839.

To all whom it may concern:

Be it known that I, STEPHEN H. LONG, of the United States Army, have invented a new and useful Method of Constructing Wooden or Frame Bridges, which I shall describe under the name and designation of the "Suspension Bridge," and of which the following is a true and adequate description.

The suspension bridge is composed of two or more truss frames, together with arch braces, lateral braces, flooring, &c., and is distinguished from other bridges heretofore invented and now in use by reason of the following actions in the posts, main braces and counter braces of its truss frames: to wit, the posts act by thrust instead of tension, and the main and counter braces by tension instead of thrust, as in other bridges. Of course, the relative positions occupied by the main and counter braces in the suspension bridge are completely the reverse of those occupied by them in common bridges; and the modes of attachment between the several parts of the truss frame, are materially different from those of other truss frames, as will be hereinafter explained. In all other respects, the suspension bridge is similar to the bridges, and parts of bridges, heretofore patented by myself.

The truss frames consist of the same nominal parts, respectively, of about the same dimensions, according to circumstances, as those described, and in part claimed as new in my specification of a patent for a wooden, or frame, bridge, for which I make application for Letters Patent simultaneously with this for a brace bridge, excepting that the posts may be narrower and shorter, and the main braces about two feet longer, than those applicable in conformity to the specification just referred to; said braces passing through, and protruding five or six inches beyond, the strings both above and below. The length of the posts of the suspension bridge is such as to occupy the distance in the clear between the upper and lower strings or rather somewhat short of this distance, in order to admit a wedge, or a set of counter wedges, between one end of the post and the contiguous string. The posts are all flush, or in the same plane with the outer string-pieces of each truss frame.

The main braces occupy spaces between the central and outer string-pieces, extending several inches above the upper, and an equal distance below the lower, string, and are suspended by treenails passing through them and the string-pieces at the head of the first set of posts, and attached in a similar manner to the lower string-pieces, at the foot of the second set of posts. This mode of suspension and attachment is carried on through the half bridge-span, beginning at the abutment, or pier, and ending at the center of the span. At the center of the span, the main braces are halved or locked together and treenailed, as before, between the string-pieces. The spaces for the main braces between the central and side string-pieces of the upper string, at the center of the span, being unoccupied, may receive timbers of the same transverse dimensions as the main braces, which may also be treenailed to the string and thus afford substantial attachments for the heads of the posts and counter braces that meet at that point.

The counter braces are treenailed at their heads and feet between the main braces excepting at the center of the bridge span where they are attached in the manner already explained, and at the abutment, or piers, where they are accommodated with similar attachments in connection with the lower strings.

Arch braces may be applied in a manner to act as suspension braces, by erecting a gallows at each pier and abutment, of sufficient height and strength for this purpose; but the most appropriate mode of applying these parts is that adopted in connection with the plan heretofore recognized in my patents.

In further explanation of the suspension bridge, reference is respectfully made to the accompanying drawings, which will illustrate more clearly the manner of constructing the suspension bridge, and the arrangement of its parts.

Should it be regarded as an object of importance to give to the main braces of the suspension bridge an equable action in all the panels of a bridge, the following rules should be observed, and the object in view will be, approximately, accomplished. Let the extent of the bridge span between the abutment, or pier, supports be 120 feet, and the height of the truss frame, or rather the distance from center to center of the strings, be fifteen feet. Now, commencing at either extremity of the span, the first panel should

have a distance measured on the strings from center to center of the posts, equal to $5\frac{1}{4}$ feet; the second panel, a distance of $6\frac{1}{4}$ feet; the third, equal to $7\frac{3}{4}$ feet, the fourth, $9\frac{3}{4}$ feet; the fifth, 13 feet; and the sixth, 18 feet, making the aggregate extent of the half span equal to 60 feet. By this arrangement all the main braces respectively will be subjected to an action nearly equable, and their greatest possible efficiency may be rendered available. The diagrams hereinafter referred to will serve to illustrate this arrangement and guide the builder. This method of adjustment, by means of which a uniformity of action may be given to all the main braces of a truss frame, respectively, is also claimed as new and original; not only with respect to the construction of wooden bridges, but also with respect to bridges composed of iron, or partly of iron and partly of wood, which may be constructed of similar parts nominally, though these parts may all differ in shape, dimensions, and manner of attachment to each other, all of which may be varied according to circumstances.

In the accompanying drawings, Figure 1, A, B, C, D, exhibits a side view of a portion of a truss frame of my suspension bridge, attached to its abutment; and Fig. 2, shows a similar side view of a part of the truss frame, on an enlarged scale, for the purpose of exhibiting its construction the more clearly.

C, D, is the arch brace, which bears upon the abutment as shown at C, Fig. 1. *n*, *n*, *n*, *n*, in the same figure, represent gibs and keys which pass through, and firmly connect the respective thicknesses of timber of which the arch brace consists, below the lower string-piece. The space between two thicknesses of timber of which the arch brace consists is filled in with what may be denominated a splicing piece, the whole being confined together by bolts, gibs and keys, or treenails.

G, G, are the posts which extend vertically, and have their ends bearing against the lower and upper string-pieces, against which they abut. At *d*, *d*, between the upper ends of these posts and the upper string-pieces, there are counter wedges, which when driven in, necessarily cause the posts to act upon the string-pieces by direct thrust, which causes the main and counter braces to act by tension instead of thrust.

The string-pieces consist each of three thicknesses of stuff, as shown in the top view H, Fig. 3, and the main suspensor braces E, E, Fig. 2, occupy the spaces between the central and outer string-pieces, as above stated, and extend several inches above the upper, and below the lower, string-pieces the five thicknesses composing the braces and string-pieces being secured together by treenails passing through them. The first of these braces extends from the head of the first set, to the foot of the second set of posts, and so on to the center of the bridge, where their direction is reversed. The counter extensor braces, are shown at F, F, Fig. 2. These consist, each, of a single piece of stuff which passes, obliquely, between the two which constitute the main braces, abutting against the middle timber of the string-pieces, and confined at each of their ends between the main braces and posts, by means of treenails, or other analogous devices.

Fig. 3, exhibits a horizontal and vertical section of a portion of one of the strings, and shows the manner of connecting the posts, main, and counter, braces, with the strings. The shades in the upper part H, of this figure, indicate sections of the posts, main and counter braces, at the upper edge of the lower string, and, by inversion, at the lower edge of the upper string. E, F, and G, designate the same parts as in Fig. 2.

In Fig. 4, A, B, C, D, is a vertical diagram intended to exhibit the relative dimensions of the panels of a truss frame for my suspension bridge, so graduated as that the stress or action upon the main suspensor braces may be respectively equal in every part of the frame. *a*, *a*, are the posts; *b*, *b*, the main suspensor braces, and *c*, *c*, the counter suspensor braces. P, P, are the abutments, or piers, of the bridge.

Fig. 5, shows the manner of applying the lateral braces, in order to afford a corresponding action laterally, between the string-pieces *a*, *a a*, *a;* it will be seen from an inspection of the figures, that the extent of the panels as measured on the strings, increase as measured from the extremities toward the center of the span of the bridge.

The straining, or trussing, of the truss frames is effected by driving the counter wedges, above mentioned, which are situated, as shown in the drawing, between the upper end of each post, and the upper string-piece, but which may, if preferred, be situated between the lower ends of said posts, and the lower string pieces. This operation is calculated to elevate the upper string, at the points where the main braces are attached to it; and of course to increase the tension of the main braces of the adjacent panel. Every increment of tension thus produced is counteracted by a corresponding degree of antagonal tension in the counter braces. Hence the main and counter braces act by tension instead of thrust, and the posts by thrust instead of tension.

Having thus fully described the manner in which I construct my suspension bridge, I do hereby declare that what I claim as new therein, and desire to secure by Letters Patent is—

The manner in which I have combined the

posts, the main braces, and the counter braces, as herein set forth, so that by wedging up the posts between the upper and lower string-pieces, by wedges or counter wedges, the thrust of the posts shall cause the main and counter braces to operate by tension, and thereby to sustain the bridge; the main braces, the counter braces, and the posts being connected with each other, and with the string-pieces, in the manner described.

I will here remark that although I have mentioned the strings of my bridge as each composed of three pieces, this number may be increased, if desired, the number of pieces of timber in the respective braces, &c., being made to correspond therewith.

STEPHEN H. LONG.

Witnseses:
H. L. CURRIER,
T. STOCKTON.