(No Model.) 3 Sheets—Sheet 1.

G. H. PEGRAM.

TRUSS FOR ROOFS AND BRIDGES.

No. 314,262. Patented Mar. 24, 1885.

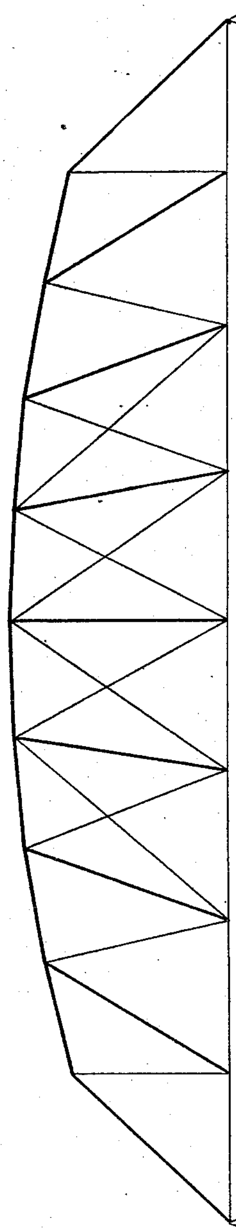

Fig. 1.

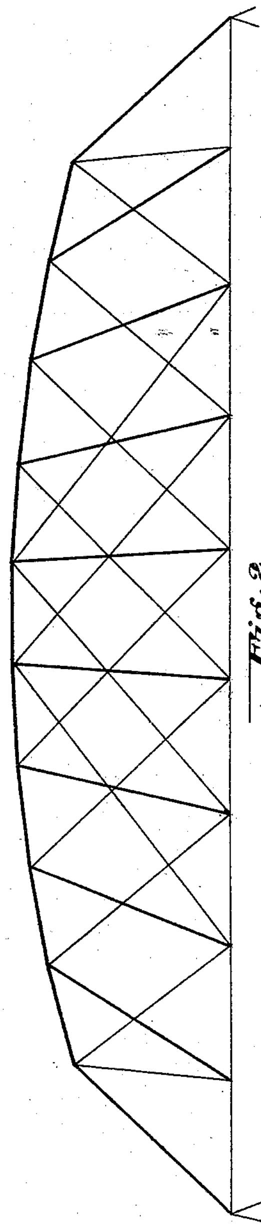

Fig. 2.

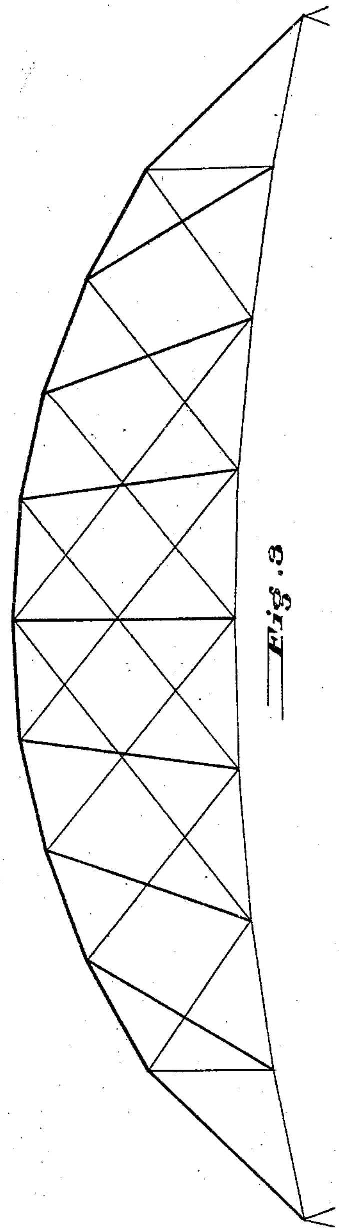

Fig. 3.

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(No Model.)

3 Sheets—Sheet 2.

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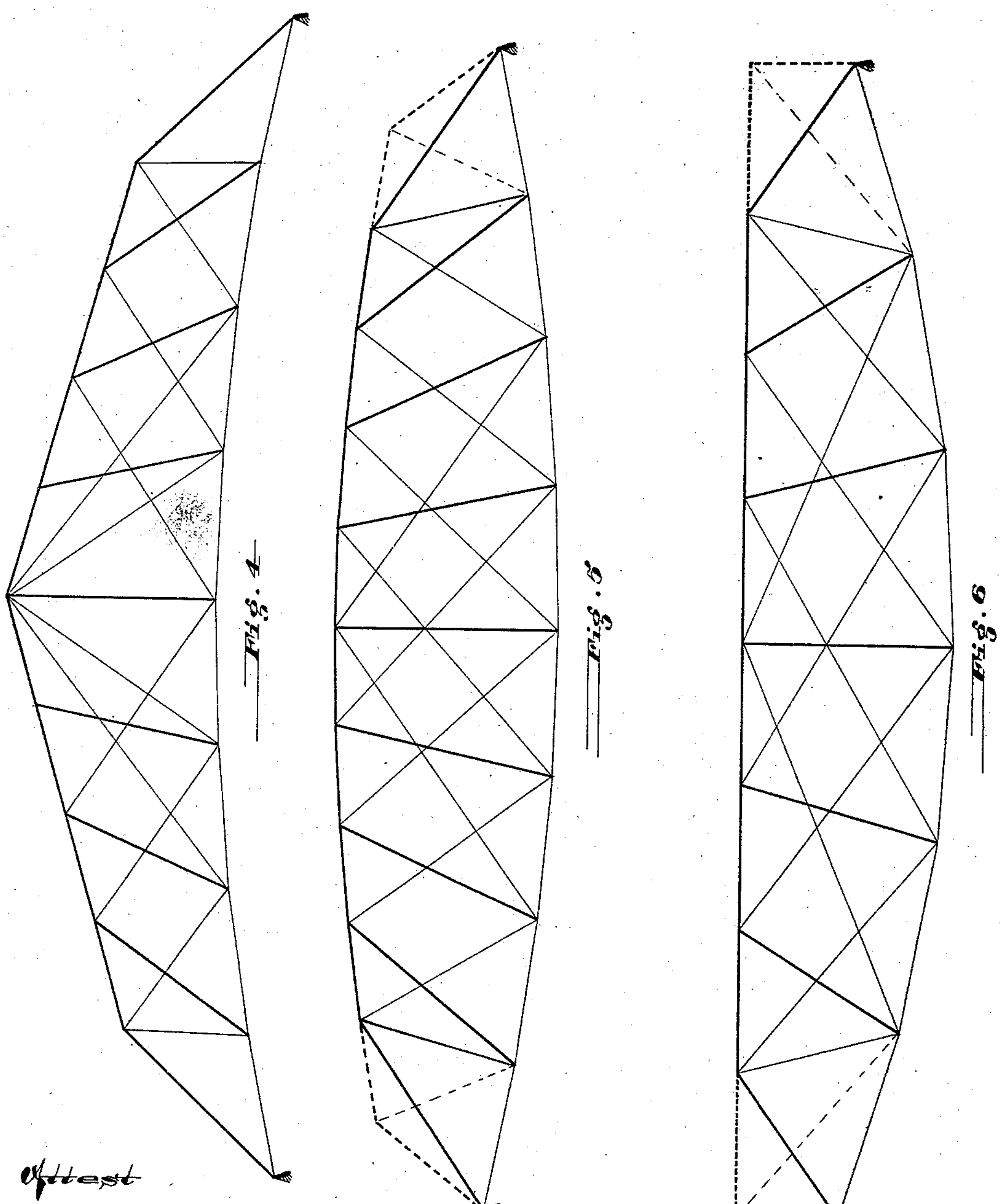

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(No Model.) 3 Sheets—Sheet 3.

G. H. PEGRAM.

TRUSS FOR ROOFS AND BRIDGES.

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Fig. 7

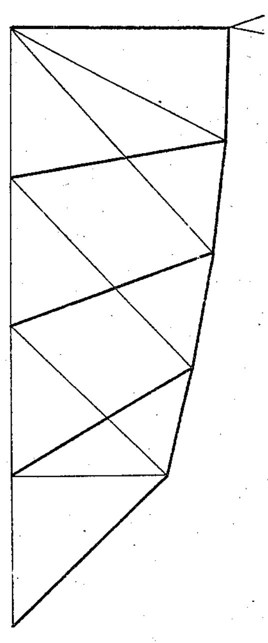
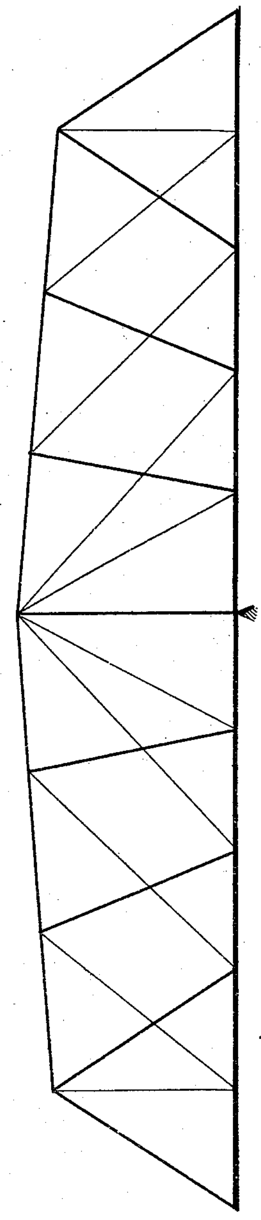


Fig. 8



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UNITED STATES PATENT OFFICE.

GEORGE H. PEGRAM, OF WILMINGTON, DELAWARE.

TRUSS FOR ROOFS AND BRIDGES.

SPECIFICATION forming part of Letters Patent No. 314,262, dated March 24, 1885.

Application filed October 24, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. PEGRAM, of the city of Wilmington, in the county of New Castle and State of Delaware, have invented new and useful Improvements in Trusses for Roofs and Bridges, of which the following is a specification.

My invention has reference to trusses for bridges and roofs; and it consists in certain improvements in their construction, which are fully set forth in the following specification and shown in the accompanying drawings, which form part thereof. It is claimed that trusses formed on the principle herein set forth combine lightness, cheapness, durability, and beauty in a higher degree than in any of the forms now in use. They are lighter, because the members are arranged to carry the loads with the least amount of material. The chords are far apart where there is the largest moment to resist, (as at the middle of a span supported at both ends and over the support in a cantilever,) and approach each other at the point where the moment is small. The truss is thus made deeper at the center than in the parallel chord-bridges and shallower at the ends. The sectional area is therefore made more uniform and the theoretical weight more nearly approximated. Besides this, the chord through its inclination relieves the web members of shearing strains, and thus reduces the weight of these members. These advantages are gained in a degree in the curved-chord trusses of the forms now in use, which are known to be the lightest. The advantages which the proposed forms have over these are that the compression-chord is made of short panels, which give it stiffness, and therefore allow of a high unit-stress, while the tensile-chord sections are made of the greatest practicable length, thus reducing the number of these tensile parts and also the work, as they are eye-bars on which the work would be in a measure independent of the length.

It is possible, and would indeed be the ordinary construction, to make the panels of the compression-chords equal, as well as those of the tensile chord, and this with an advantage rather than a disadvantage to the web members. In the forms of curved-chord bridges now in use the web-bracing consists of vertical posts and inclined tie-rods, or posts and ties forming isosceles triangles, in either of which constructions the assumption of equal sections for one chord makes the sections of the other chord unequal.

The greatest possible advantages are gained in the web members. At the middle of a span the posts are small, and it is necessary to make them as short as possible in order to give them the necessary stiffness. They have a low allowable unit-stress, and are not capable of transmitting the shearing strain horizontally with economy. At the ends of a span the posts are large and have a large allowable unit-stress, and may be made to assist in transmitting the shearing strain toward the piers.

In the forms proposed by me the posts at the middle are vertical, or nearly so, and increase in inclination to the ends of the truss, where they have the maximum inclination. By making the end inclined post about equal in length to the middle post the lengths of all the posts will be nearly the same, through which a great mechanical advantage is gained. This would ordinarily be done, and we could have at pleasure a truss with the sections or panels of both chords equal, respectively, and posts differing but little in length, or one in which the panels of one chord are equal and those of the other chord differing but little in length, and in which the posts are equal; or, again, a form in which the panels of one chord are equal, while the panels of the other chord and the posts, respectively, differ but little in length.

In the two ordinary forms of curved-chord trusses hereinbefore cited, the vertical-post truss has a large variation in the lengths of the posts, and the posts, as they become large and short and have a large allowable unit-stress, are not made to assist the web in transmitting the shearing strain toward the supports. In the triangular braced truss there is also a great variation of length, and the posts, or more properly tie-struts, near the middle of the span, are very long and slender, and are further subjected to reverse strains. This latter objection it is proposed to overcome by the use of the tie-rods, as in the Pratt and Whipple trusses.

A glance at the figures shows that the forms have more beauty than those in present use.

Referring to the drawings, the compression-chord and posts are shown in heavy lines, while the tensile members are in light lines. The eight figures have been properly proportioned for practical cases. Other forms might be devised; but those shown are deemed to be the most important. In all figures the chords are made of straight lines and circular curves, (a curved chord being understood to be one in which the panel-points are in a curve, but which panel-points may be connected by straight lines, according to the general interpretation,) and the center post is made equal in length to the end inclined post.

Figure 1 represents a thorough bridge-truss, in which the bottom chord is divided into equal panels and the top chord is divided into equal panels of shorter length. The tie-rods are arranged as in the Pratt truss. Fig. 2 is similar to Fig. 1, excepting that the chords are divided into nine in place of eight panels, thus making a center panel in place of a center post, and illustrating the way the posts may be "nearly vertical." The tie-rods are arranged as in the Whipple truss. Fig. 3 is a truss with both chords curved upward. The lower chord is divided into eight equal panels, and arcs described from these panel-points as centers, using the middle post length as a radius and cutting the top chord, make sections there of slightly different lengths. Fig. 4 is a truss in which the bottom chord is curved and the top chord a broken line, both chords being divided into equal panels, respectively, and would be well adapted to roofs. Fig. 5 is a truss with both chords curved outward, formed in the manner described when speaking of Fig. 3. The dotted portion might be added to facilitate the connection of the roadway with the abutments in deck-bridges. Fig. 6 is a truss for a deck-bridge, formed in the same general way as the others. The dotted portions might be advantageously added in some cases. Fig. 7 represents a cantilever. Fig. 8 is a pivot-span with broken-line top chord.

Any of the figures for simple spans—viz., Figs. 1, 2, 3, 4, 5, and 6—if inverted and supported at the center, would represent a pair of cantilevers or a pivot-span.

It has been stated and can be easily proven that the forms shown are lighter than the truss forms now in use. An inspection of the figures will show that they are cheaper in the shops through the small differences in length of the parts of one kind, and by making the tensile members long and reducing the number of these parts. Other points of economy come in with the facility with which changes may be made in the form to suit special cases without extra cost. Thus Fig. 3 represents a bridge where height under the bridge is gained in the middle, as in a highway-bridge over a canal. Fig. 4 would serve for a roof with straight outsides and a vaulted ceiling below.

With railway-bridges on a grade the posts are required to be plumb, thus destroying the symmetry of an ordinary Pratt or Whipple truss; but in the trusses proposed the various inclinations of the posts would render it unnecessary to make any changes for grades. As regards durability, it is believed that a bridge with curved chords will more readily adjust itself to inequalities of expansion caused by changes of temperature. The avoidance of reverse strains in the members is conducive to the "life" of the material, and ability to adjust tension members, and keeping all parts in tight working-contact avoids the play and consequent wear which is common to all bridges having members subjected to reverse strains—*i. e.*, alternating tension and compression.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A bridge or roof truss having one or both chords curved or broken-lined but not parallel, said chords being the greatest distance apart at the point of greatest moment, (being at the middle of a span supported at both ends and over the support in a cantilever,) and further being connected by posts which are vertical or nearly vertical at the point of greatest moment and increase in inclination toward the ends of the truss, the posts forming with the top and bottom chords quadrilateral panels, in each of which the section of the tensile chord is longer than the corresponding section of the compressive chord, substantially as and for the purpose specified.

2. A bridge or roof truss having one or both chords curved or broken-lined but not parallel, said chords being the greatest distance apart at the point of greatest moment, (being at the middle of a span supported at both ends and over the support in a cantilever,) and further being connected by posts which are vertical or nearly vertical at the point of greatest moment and increase in inclination toward the ends of the truss, the posts forming with the top and bottom chords quadrilateral panels, in each of which the section of the tensile chord is longer than the corresponding section of the compressive chord, the intersections of said chords and posts being connected by tie-rods and counter tie-rods, arranged substantially as in the Pratt and Whipple trusses, or in such a way that the web members cannot be subjected to reverse strains by different positions of the loads, substantially as set forth.

In testimony of which invention I have hereunto set my hand.

GEO. H. PEGRAM.

Witnesses:
R. M. HUNTER,
ANDREW ZANE, Jr.