(No Model.) 3 Sheets—Sheet 1.

G. H. PEGRAM.

TRUSS FOR BRIDGES.

No. 314,261. Patented Mar. 24, 1885.

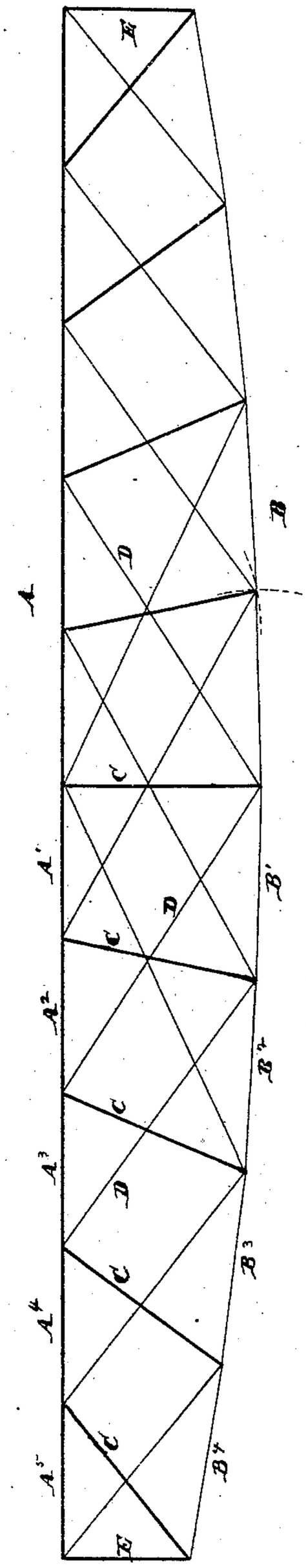

Fig. 1.

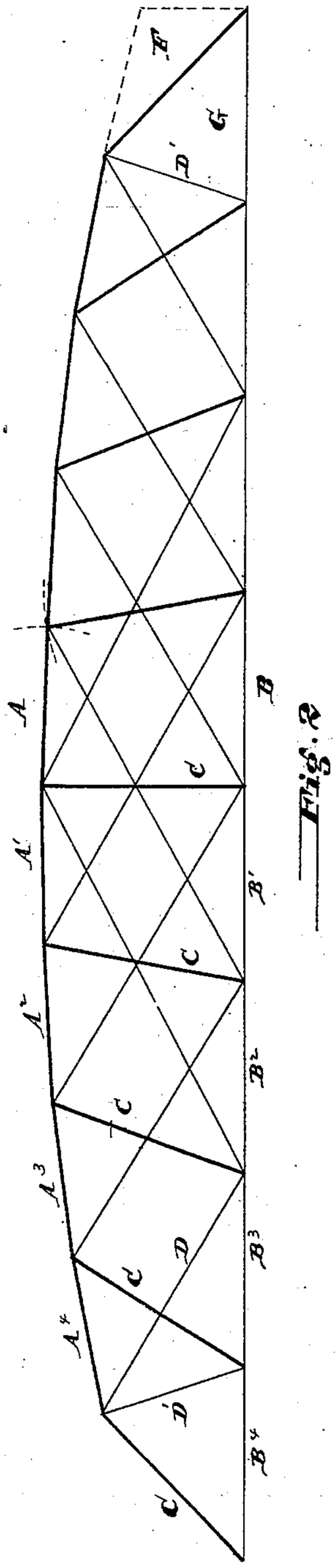

Fig. 2.

Attest
L. J. Minter
William P. McGrade

Inventor
George H. Pegram
By his atty
Thos. H. Hunter

(No Model.) 3 Sheets—Sheet 2.

G. H. PEGRAM.

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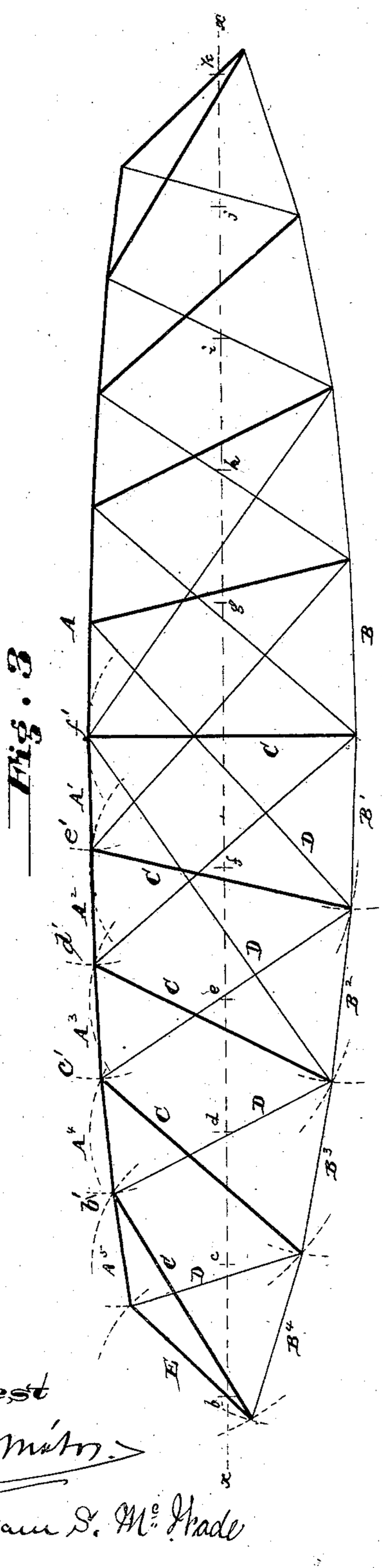

Fig. 3.

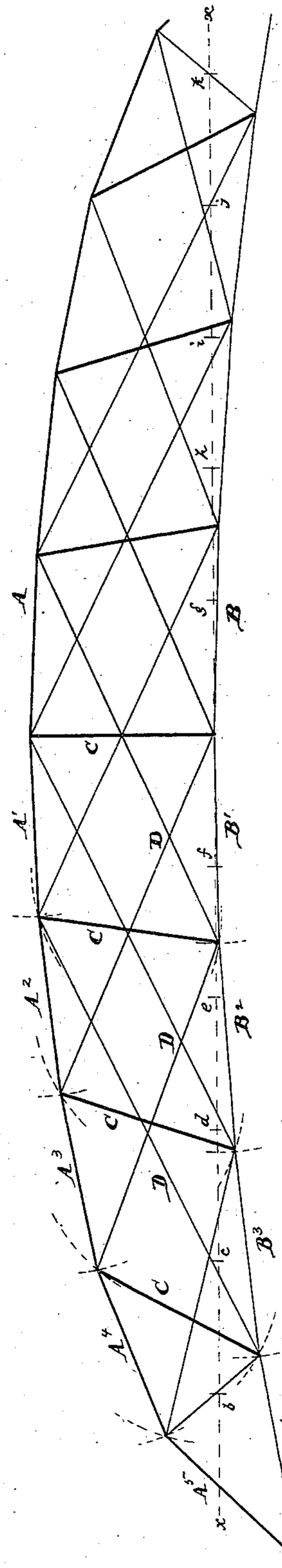

Fig. 4.

Attest
L. J. Mistro
William S. McGrade

Inventor
George H. Pegram
By his Atty.
Thos. Hunt

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

(No Model.) 3 Sheets—Sheet 3.

G. H. PEGRAM.

TRUSS FOR BRIDGES.

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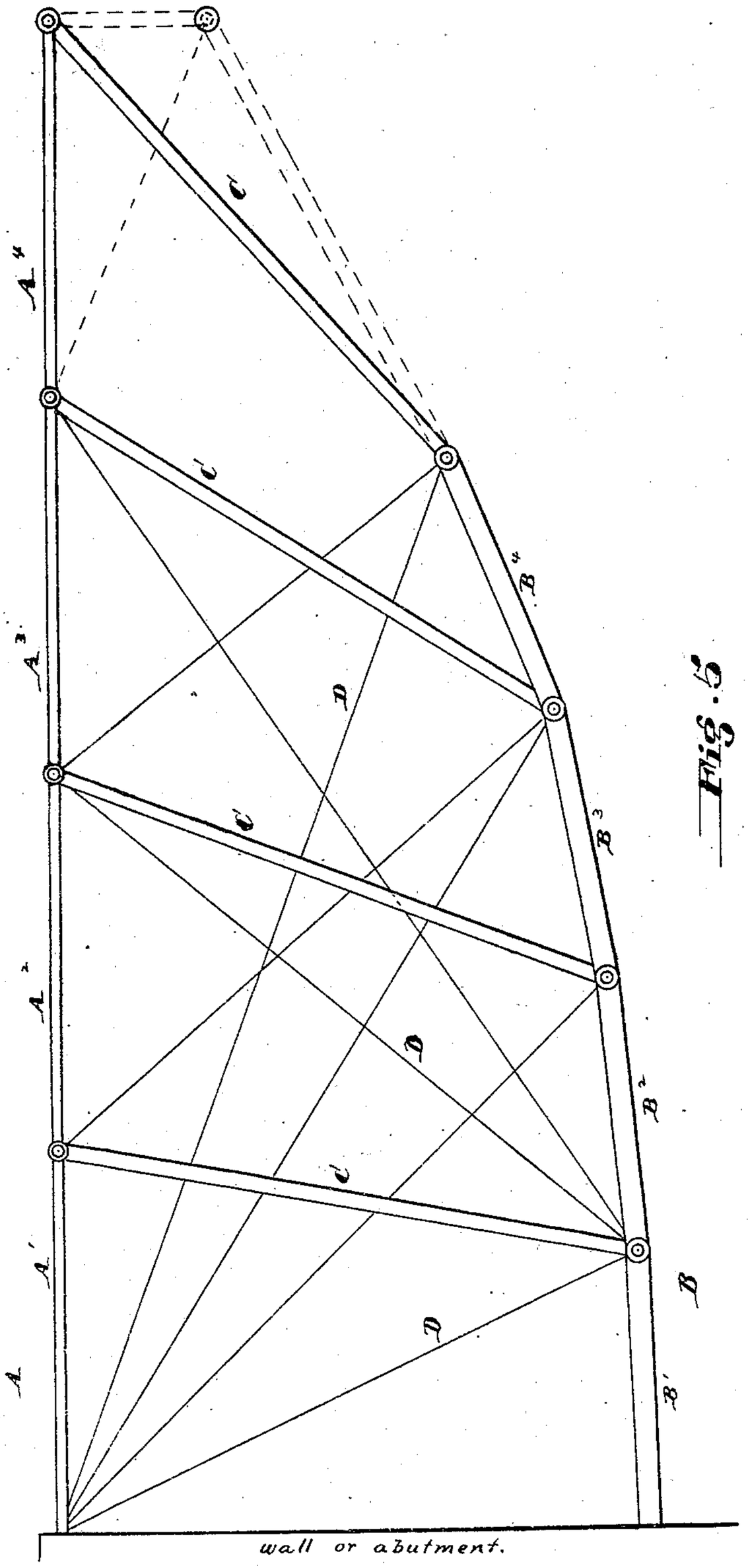

Fig. 5.

Attest
L. J. Mintz
William S. McIlvaine

Inventor
George H. Pegram
by his atty.
[illegible]

UNITED STATES PATENT OFFICE.

GEORGE H. PEGRAM, OF WILMINGTON, DELAWARE.

TRUSS FOR BRIDGES.

SPECIFICATION forming part of Letters Patent No. 314,261, dated March 24, 1885.

Application filed December 21, 1883. (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 an Improvement in Trusses for Bridges, Roofs, &c., of which the following is a specification.

My invention has reference to trusses adapted for use in the construction of bridges, roofs, &c.; and it consists in a form of truss having one or both of its chords curved, the length of panels in the respective chords being unequal, and the posts being inclined and forming the dividing-line of the panels of the upper and lower chords, and in details of construction, all of which is more fully set forth in the following specification and shown in the accompanying drawings, which form part thereof.

The saving in weight by making trusses deeper at the middle than at the ends is easily demonstrated and generally recognized. In existing forms this saving in weight is more than equalled by the increased cost of the shop-work arising from having posts and chord-sections of varying lengths. In the form proposed by me it is possible to have all chord-sections and all post-sections of equal length, respectively, or approximately so. There is also a saving in the number of parts to be made, as the tensile chord requires less panels than in other forms in which the panels are of the same length, or nearly so, in both chords.

Still further advantages arise from the fact that scientific principles are more closely observed than in other forms of trusses, viz:

First. In the compressive chord it is desirable to make the length between supports as small as possible, in order to secure stiffness and admit of a high unit-stress being used. In existing forms this cannot be done without shortening the tensile chord panels, also, which it is desirable to have long. In the form proposed the compressive-chord panels may be made of lengths independent of the tensile chord.

Second. The posts at the middle of the truss having small sections, and consequently low allowable unit-stresses, should be vertical to make them as short as possible, as they are not capable of transmitting the shearing strain horizontally with economy. At the ends of truss, however, the increased diameter of the post allows of a higher unit-stress, provided it (the post) is not proportionally lengthened, thus reducing the ratio between the allowable strain in the ties and that in the posts and making it economy to have the posts assist in transmitting the shearing strain toward the pier. By making the posts of the same lengths, decreasing or slightly increasing in length from the middle or point of maximum chord strains to the ends of the truss and increasing in inclination from said point to the ends, the greatest possible advantage is taken of this principle.

Third. The chords are more uniform in section than parallel chord-trusses, and at the ends have less waste of material, and also through their inclination relieve the web of shearing strain.

Fourth. It is believed that the appearance of the truss is better than that of most forms now in use, the increasing inclination of the posts and curvature of the chord tending to give the eye a better impression of strength and beauty, on the same principle that a suspension-bridge seems more natural than a Whipple truss, to summarize which it is claimed that this truss is lighter, cheaper, and more ornamental than the forms now used.

In the drawings, Figure 1 is a side elevation, and represents one form of truss embodying my invention, and is especially adapted to a deck-bridge. Fig. 2 is a similar view of another form of truss, in which the lower chord is straight. Figs. 3 and 4 are similar views of other forms, in which both the upper and lower chords are curved and are especially adapted for roofs; and Fig. 5 shows an elevation of a cantilever-truss.

A represents the compressive and B the tensile chord. C are the posts, and D the ties. The compressive chord A has its panels A′ A^5 of shorter length than the panels B′ B^4 of the tensile chord B, and the posts C connect the said chords between the juncture of two adjacent panels, and as the panels of one chord are longer than those of the other, the posts will be inclined, converging above or below the truss. Now, in the form shown in Fig. 1 the compressive or top chord is made straight and the lower or tensile chord curved. Given

now the lengths of the panels and of the posts, the curvature of the lower chord is found (beginning at the lower end of the center post, whose height is known) by describing an arc of a circle whose radius is equal to the length of the panels of the lower chord, and intersecting this arc so found by an arc described from the juncture of the panels A′ A² of the upper chord with a radius preferably equal to the length of the center post, as shown in dotted lines, and connecting the said juncture with the point of intersection, and proceeding as before, only now taking the point in the lower chord so found for a center in describing the arc for the length of the next panel in said lower chord. In the construction under consideration it is desirable to make the panels of the upper and lower chords of such a length relatively to their number that the points of termination will be in a vertical line, which points are joined by vertical end posts, E, which are supported upon the abutments in the usual manner. These auxiliary or end posts E may be vertical, as above explained, or may be inclined without regard to the rule laid down for the posts C, one inclination being shown in Fig. 3. While the construction involving the principles set forth will produce in most cases a gradual curve in one of the chords, it is to be understood that the word "curved" as used in this specification and claims includes a form in which either chord may be composed of two straight lines meeting at the center, as if, for instance, the juncture of the lines C and D of Fig. 2 were connected with the top of the center post C by a straight line.

In the form shown in Fig. 2 the process is the same, with the exception that, as now the low or tensile chord is the straight one, the points to be found will be in the upper or compressive chord, and in the case shown the upper chord has two less panels than before, the last or end posts C taking the place of the end posts E of Fig. 1. The end triangular portions (marked G) might be removed and the ties D′ converted into posts or the dotted portions (marked F) added. When the panels of the respective chords are equal, then lines drawn through the points of connection of the respective panels in both chords and extended across the compression-chords will cut a central vertical line through said truss closer and closer to the truss as the panels between which said lines are drawn are removed from said central line.

The curvature of the chord in the above constructions, whether it be the compressive or tensile, is dependent upon the relation between the lengths of the panels of the two chords and posts, and consequently there is a limit to the length of any truss having these lengths given.

In both of the forms referred to, one of the chords has been straight; but in cases where both the compressive and tensile chords are curved, then the construction may be as shown in Figs. 3 and 4. To construct this truss, the length of the panels of the two chords and length of post being given, we proceed as follows: On a center line, *x x*, lay off the distances *b c*, &c., of any convenient lengths. On these points as centers describe circles of the same diameter equal to the length of the posts C, and starting at the point *f′*, with *e′ f′* equal to the length of the panel in the upper or compressive chord as a radius, describe a circle cutting the circle previously drawn with *f* as a center, finding point *f′*. Proceed in the same manner in finding points *d′ c′*, &c., and now, connecting these points, we have the upper chord. The curve of the lower or tensile chord is found in the manner given in finding chord B of Fig. 1, using the curved chord A of Figs. 3 and 4 in place of the straight chord A of that figure. By varying the relative lengths of these panels in the two chords and length of post, various curves may be found for the chords. The curve for either the compression or tensile chord may be found in any other manner, or, if desired, it may be arbitrarily formed, and the other chord constructed therefrom.

If desired, the posts C may be shortened as they approach the ends of the truss, and in place of a single center post two posts bounding a center panel may be used, and the lower chords may have the shortest panels, for in cases where the truss is inverted or hanging or supported upon a pivot or pier in the center or thereabout, the lower becomes the compressive chord, and its panels should be the shorter in carrying out the principle of my invention.

The compressive chord must have the shorter panels, and this rule applies in all cases, for in either of the constructions shown in Figs. 1 and 2 or Fig. 5 the upper chord is the compressive member; but if we invert either of said constructions and use them as pivot-trusses unsupported at their ends, or so arrange them that they are supported at their middle, or using half of one truss as a cantilever, then the lower chord becomes the compressive member, and the strains are transmitted to the central support. In the former case the posts will converge above the trusses and in the latter below the same, and in both cases the posts have an increasing inclination, said inclination increasing from the point of maximum chord-strains to the ends of the truss. From this it is seen that in trusses supported on the ends the posts of least inclination will be at the greatest distance from the supports or abutments, while in trusses supported in the middle or in cantilever spans they will be near or over the support, as shown in Fig. 5.

I do not limit myself to any particular arrangement of tie-rods, as various systems may be used with this construction of upper and lower chords and posts; neither do I confine myself to the use of panels of a uniform length

in each chord, as they may be made of different lengths without altering the principle involved.

It is also evident that the end panels of the lower or upper chord may be of any desired length and independent of the length of the other or intermediate panels to suit the method of support at the abutments. It is, however, necessary to the construction of my improved truss that either one or both chords be curved but not parallel, and in which the respective panels in the upper and lower chords are of different lengths, excepting in the case of the end panels, as stated above.

It is sometimes advisable to construct one portion of a truss on one principle and another portion on another principle; hence my invention comprehends a truss in which any portion of same is constructed under the hereinbefore-described principle.

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

1. A bridge or roof truss or any portion thereof having one or both chords curved but not parallel, in which the panels of the compressive chord are of equal lengths measured on the chord-line, and in which the panels of the tensile chord are of equal lengths and longer than the panels of the compressive chord, and in which lines drawn through the points of connection of the respective panels in both chords and extended across the compression-chord will cut a central vertical line through said truss closer and closer to the truss as the panels between which said lines are drawn are removed from said central line, substantially as and for the purpose specified.

2. A bridge or roof truss or any portion thereof having one or both chords curved but not parallel, in which the panels of the compressive chord are of equal lengths measured on the chord-line, and in which the panels of the tensile chord are of equal lengths, except the end panels of either or both chords, which may be of greater or less length than the intermediate panels, the said intermediate panels of the tensile chord being longer than the intermediate panels of the compressive chord, substantially as and for the purpose specified.

3. A bridge or roof truss or any portion thereof having one or both chords curved but not parallel, in which the panels of the compressive chord are of equal lengths measured on the chord-line, and in which the panels of the tensile chord are of equal lengths and longer than the panels of the top chord, and in which the posts are substantially of equal lengths, substantially as and for the purpose specified.

4. A bridge or roof truss having one or both chords curved but not parallel, in which the panels of the compressive chord are of equal lengths measured on the chord-line, and in which the panels of the tensile chord are of equal lengths and longer than the panels of the compressive chord, and in which the posts are substantially of equal lengths, and increase in inclination from the point of greatest chord-strains to the end or ends of the truss, substantially as and for the purpose specified.

5. A bridge or roof truss or any portion thereof having one or both chords curved but not parallel, in which the respective panels of the top and bottom chords are of different lengths, and the respective points of connection of adjacent panels in said chords being connected by posts of substantially equal length, substantially as and for the purpose specified.

6. A bridge or roof truss or any portion thereof having one or both chords curved but not parallel, in which the respective panels of the top and bottom chords are of different lengths, and the respective points of connection of adjacent panels in said chords being connected by posts which have a gradually-increasing obliquity, in which lines drawn through said posts longitudinally and extended across the compressive chord will cut a vertical line through the center of the truss at points closer and closer to said truss as the posts are removed from said center line, substantially as and for the purpose specified.

7. A bridge or roof truss or any portion thereof provided with posts which incline toward the center line of the truss, and in which lines drawn through said posts in the direction of their length and across the compressive chord cut said center line closer and closer to the truss as said posts are removed from said center line, substantially as and for the purpose specified.

8. A bridge or roof truss having one or both chords curved but not parallel, in which the panels of the compressive chord are of equal lengths measured on the chord-line, and in which the panels of the tensile chord are of equal lengths and longer than the panels of the compressive chord, and in which the posts are inclined, the said inclination increasing in regular order from the point of greatest chord-strain to the end or ends of the truss, substantially as and for the purpose specified.

In testimony of which invention I hereunto set my hand.

GEO. H. PEGRAM.

Witnesses:
R. M. HUNTER,
FRANCIS S. BROWN.