Hammond & Abbott,

Truss Bridge.

No. 102,392. Patented Apr. 26. 1870

Fig 1.

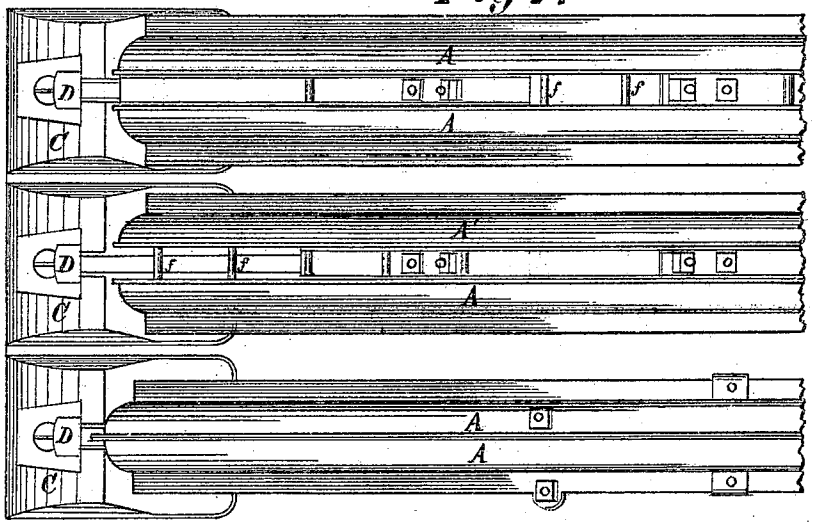

Fig. 4.

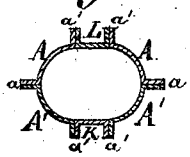

Fig. 5.

Fig. 6.

Fig. 7.

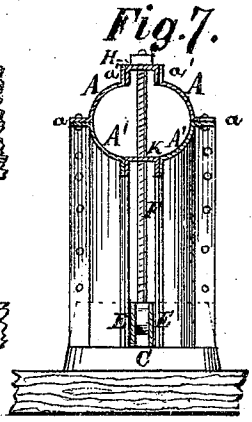

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Fig. 2.

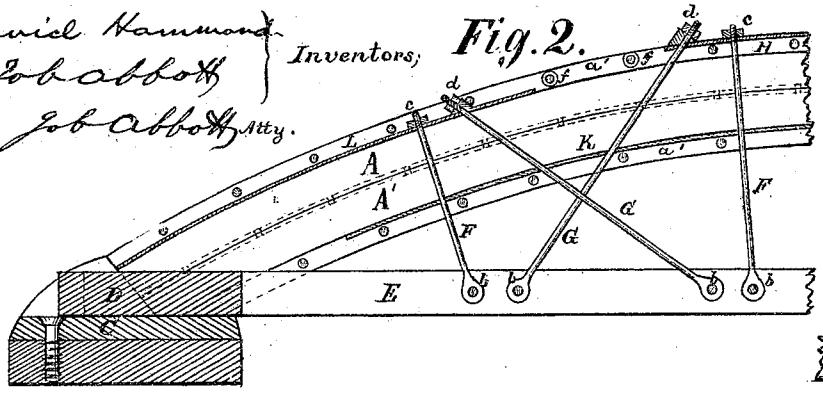
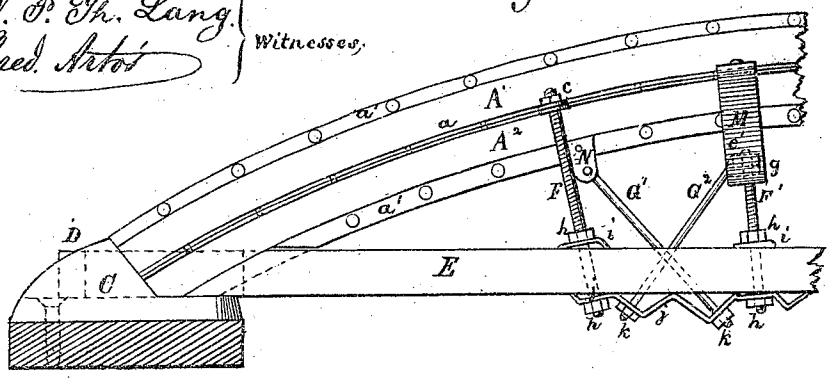
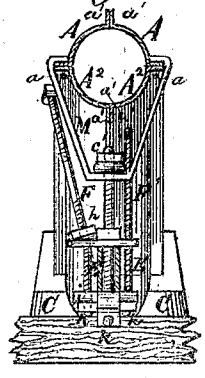


Fig. 3.



J. P. Th. Lang
Fred. Artot
Witnesses.

Fig 8.



United States Patent Office.

DAVID HAMMOND AND JOB ABBOTT, OF CANTON, OHIO.

Letters Patent No. 102,392, *dated April* 26, 1870.

IMPROVEMENT IN TUBULAR ARCH-GIRDERS FOR BRIDGES AND OTHER STRUCTURES.

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

To all whom it may concern:

Be it known that we, DAVID HAMMOND and JOB ABBOTT, both of Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Tubular Arch-Girders; and we do hereby declare that the following is a full, clear, and exact description of that portion of said invention which we have designated as part A, reference being had to the accompanying drawings forming a part of this specification, and to the letters of reference marked thereon, of which drawings—

Figure 1 is a plan showing several modifications of our girder.

Figure 2 is a sectional elevation of the upper girder, shown in fig. 1.

Figure 3 is an elevation of the lower girder, shown in fig. 1.

Figures 4, 5, and 6 are cross-sections of the arches of girders shown in fig. 1.

Figures 7 and 8 are cross-sections of the girders shown in figs. 2 and 3.

The nature of our invention consists in the construction of a girder with an arch composed essentially of two pieces of rolled iron, having a curved or polygonal-shaped web, with flanges on each side, said arch-pieces being curved to the required curve for the arch, and being placed parallel to each other in such a manner as that two flanges (one of each piece) shall be in the same curved horizontal plane, and said two principal arch-pieces being so combined with other arch-pieces as to form a tubular arch of great strength and stiffness, which admits of a very economical distribution and proportion of material to any required case of construction, and forms, when combined with suitable shoes, chords, posts, and braces, a very cheap and strong girder for bridge construction, or other constructions of like character.

To enable others skilled in the art to make and use our invention, we will proceed to describe more fully its application and construction.

The principal arch-pieces A A are of the form shown in fig. 4, being made with the central web A of the circular cross-section shown, (or of a polygonal or other cross-section closely approaching a circular cross-section, if preferred,) and having a flange, *a* or *a'*, on each edge, as shown.

These pieces are curved to conform to the curve of the arch required, and are set up parallel to each other, with the flanges *a a* in the same horizontal straight line, as seen in fig. 4. The character of the other pieces of the arch will depend on the capacity and requirements in any particular case of construction, but the following examples will clearly illustrate this point.

For example, let it be required to construct a girder for a bridge for foot-walk of one hundred feet span and six feet width of track. The arch for such girder need not have a great crushing capacity, as the load to be carried can never be very great, but it must have great lateral capacity to resist a lateral bending of the arch, as the track is too narrow to admit of good lateral bracing without great expense.

Accordingly, the broad plate B is used in combination with the arch-pieces A A, as shown in fig. 5, the flanges *a a* being riveted to said plate, as shown, and the other flanges *a' a'* being brought up to each other and riveted together, as shown in fig. 6, or they may be held apart by thimbles, *f*, which are placed around the rivets which unite the flanges *a' a'*, as shown in fig. 1, when a greater lateral capacity against bending is required, without an increase of cross-section in the arch.

When both an increase of lateral capacity and crushing strength are required, the channel-bars H or L, as shown in fig. 4, may be used between the flanges *a' a'*, where they can be secured either by two rows of rivets, one through each flange *a'* and a flange of the channel-bar, or by a single row of long rivets passing through both flanges *a' a'* and the flanges of the channel-bar, the first being the preferable mode of riveting.

We would here state that by the term "channel-bar" we designate any bar-iron with flanges of suitable width at its edges, whether the web of such bar be plain or curved, or whether the flanges be at right angles to the plane of the web or not, the flanges *a' a'* of the arch-pieces A A being made to conform to the inclination of the flanges of the channel-bar in each case.

In each of the above-described modifications it will be observed that the plate B forms the principal resistant to the lateral bending of the arch, while the arch-pieces A A, either directly in combination with each other and the plate B, or in combination with the thimbles *f* or channel-bars H or L and the plate B, form a tube which is the principal resistant to the crushing strain on the arch; and, further, that by having the pieces A A made with their webs of a curved or polygonal cross-section, the material is placed further away from the axis of the tube forming the arch, and the crushing capacity of such tube is consequently increased without any increase in its cross-section.

It will also be observed that the same capacities of material will be developed, whether the plate B be arranged below the arch-pieces A A, as shown in fig. 5, or whether said arch-pieces be placed below said plate, in which case the cross-section shown in fig. 5 would be simply reversed.

For a second example, let it be required to construct a girder for a railroad bridge of one hundred and fifty feet span and twelve feet width of track.

The arch for such a girder must have a large cross-

section to resist crushing strain, as well as great lateral capacity to resist horizontal deflection, as the track is too narrow in proportion to the span and moving load to give good lateral bracing. Accordingly, we combine two sets of arch-pieces, A A A^1 A^1, as shown in figs. 2, 4, and 7, by riveting together the horizontal flanges *a a a a* and uniting the upper and lower flanges *a' a' a' a'* by rivets and thimbles *f*, or by channel-bars L, H, and K, or by combining these two methods, either by using a channel-bar along the ends and on the upper side of the arch, in combination with pieces of channel-bar riveted in at such points on the upper side as are to serve as points of attachment for the posts of the girder, with thimbles between such pieces and all along between the lower flanges of the arch; or a channel-bar may be used along the whole length of the upper or lower sides, or on both the upper and lower sides, as illustrated in fig. 2, the particular construction required depending very much on the amount of cross-section required in the arch, and also on the amount of lateral stability required, which must be determined on by the engineer in any particular case, and cannot, therefore, be definitely stated here.

For a third example, let it be required to construct a girder for a common road bridge of one hundred and fifty feet span and twenty feet width of track.

The arch for such a girder need have but a moderate amount of crushing cross-section, and the width of track is such that a good lateral bracing can be had; hence, the material in the arch should be so disposed as to give the greatest amount of crushing strength with a proper amount of lateral stiffness.

Accordingly, we combine the two sets of arch-pieces A A A^2 A^2, as shown in figs. 6 and 8, the flanges *a a a a* being united by rivets, as shown, and serving as ribs to give the requisite lateral stability to the arch, while the flanges *a' a' a' a'* are also united by rivets, as shown, thus securing a unity of action between the opposite arch-pieces A A A^2 A^2, the whole forming an arch in which the material is very symmetrically disposed around the axis of the arch, thus giving it great crushing capacity.

The general ideas of the methods used in constructing the arch having been thus fully shown, the manner of completing the girder is readily seen, and differs in but few points from that shown in other arch-girders heretofore constructed.

The ends of the arch rest on cast-iron shoes, C C, in which are formed seats for the heads D D of one or more chords, E E, of flat bar-iron, which unite the ends of the arch.

The posts F F and the tie-rods G G may be formed with eyes at their lower ends, which are secured between the chords E E by bolts *b b*, as shown in figs. 2 and 7, while the upper ends of the said posts and tie-rods are passed through the channel-bars H or L in the arch, and are secured by nuts *c c* and *d d*, as shown.

If it is found desirable not to punch holes in the chords E for the bolts *b*, the posts F' may be attached to said chords by means of jam-nuts *h h*, which bind the clamping-pieces *i* and *j* (through which are passed the posts F') firmly to the chords E E, the tie-rods G^1 and G^2 being, in this case, passed through the lower clamps *j*, and secured by nuts *k k*, as seen in fig. 3.

The ends of the posts' F' may also be attached to the arch by passing them through the flanges *a a*, as shown in fig. 3, or by passing them through the web of the arch-pieces, as shown in fig. 8.

The tie-rods G^1 may also be attached to the arch by means of the plates N, riveted to the lower flanges *a' a'*, and provided with an axial rivet which passes through an eye at the upper end of the tie-rod, as shown in fig. 3.

A convenient mode of attaching both post and tie-rod to the arch is shown in figs. 3 and 8, where M represents a stirrup riveted to the flanges *a a*, and provided with a hole at its bottom, through which is passed the post F'.

The tie-rod G^2 is made with an eye, *g*, at its upper end, which fits over the post F', and both post and tie-rod are secured by the nut *c'*, as shown.

Having thus fully described our invention,

What we claim as new, and desire to secure by Letters Patent, is—

1. The combination of the arch-pieces A A with curved webs A and edge flanges *a a' a a'*, thimbles *f*, or channel-bars H, and broad plate B, the several parts being arranged and united by rivets or their equivalents, substantially as and for the purpose specified.

2. The combination of the arch-pieces A A with curved webs A and edge flanges *a a' a a'*, channel-bar H or L, arch-pieces A^1 A^1, with edge flanges *a a' a a'* and channel-bar K, the several parts being arranged and combined by rivets or their equivalents, substantially as and for the purpose specified.

3. The combination of the arch-pieces A A with curved webs A and edge flanges *a a' a a'*, channel-bar H or L, arch-pieces A^1 A^1 with edge flanges *a a' a a'* and thimbles *f f*, the several parts being arranged and combined by rivets or their equivalents, substantially as and for the purpose described.

4. The combination of the arch, composed of the arch-pieces A A A^1 A^1, with curved or polygonal webs and edge flanges *a a'* and channel-bars H and K, arch-shoes C C, chords E E, posts F F, and tie-rods G G, the several parts being arranged as and for the purpose specified.

As evidence that we claim the foregoing, we have hereunto set our hands in the presence of two witnesses, this 28th day of June, 1869.

DAVID HAMMOND.
JOB ABBOTT.

Witnesses:
J. P. TH. LANG,
FRED. ARTÓS.