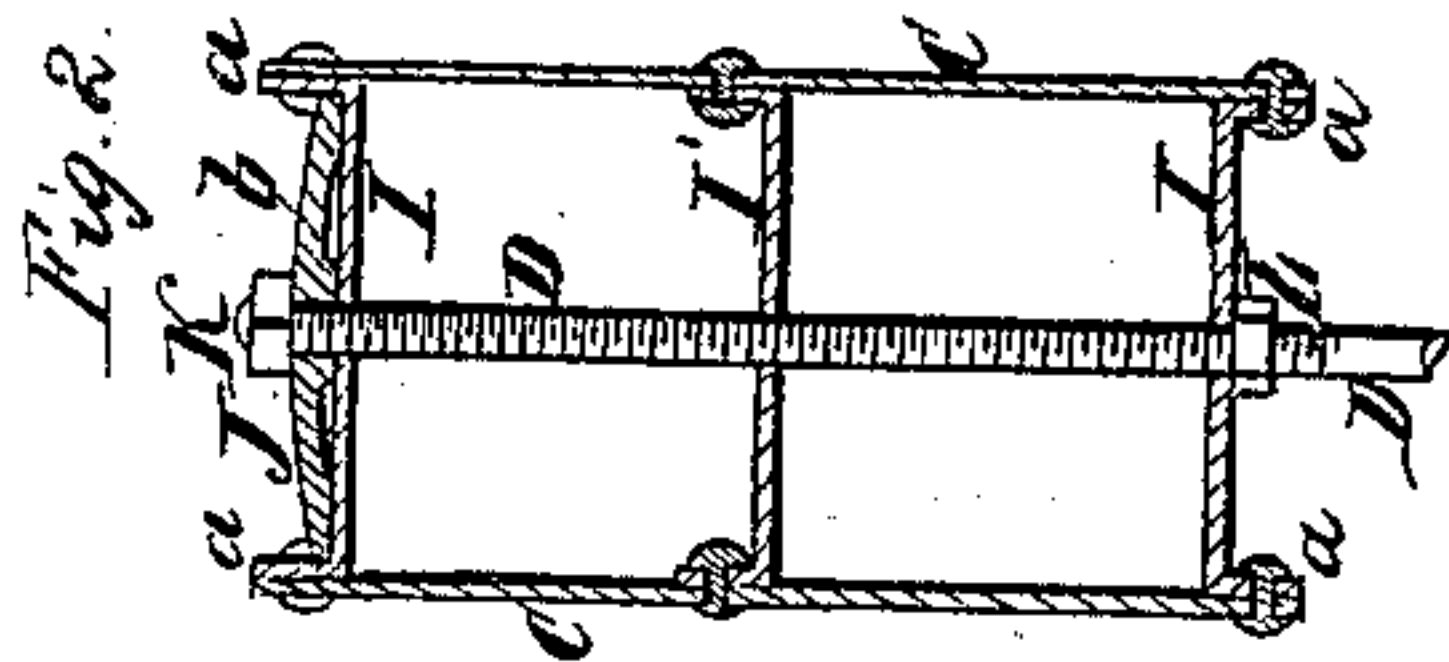
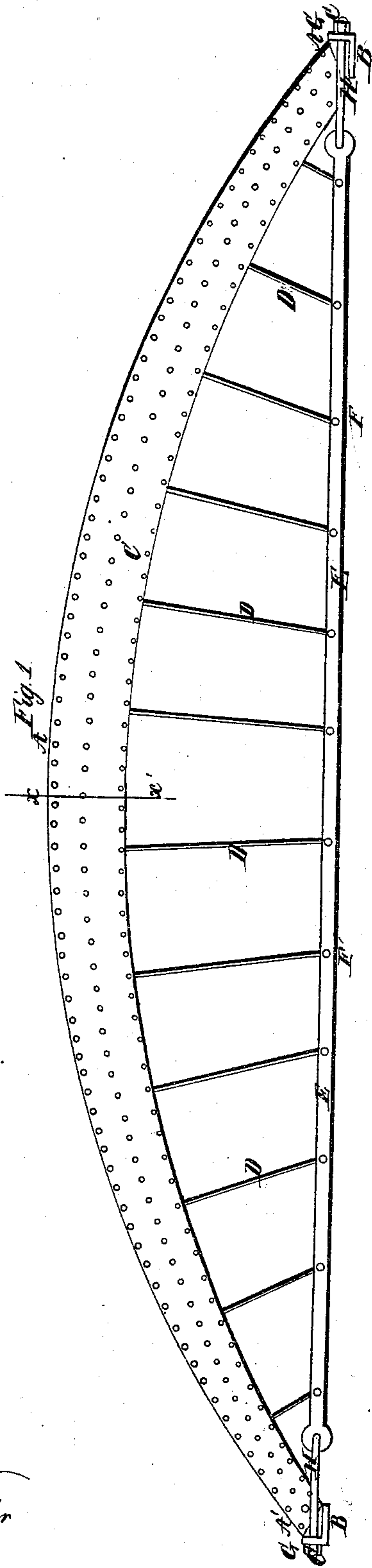


Frees & King. Truss Bridge.

No 2,380.
33,384.

Patented Oct. 1, 1861.



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UNITED STATES PATENT OFFICE.

ZENUS KING, OF MILAN, AND PETER M. FREES, OF CINCINNATI, OHIO.

IMPROVEMENT IN TRUSSED BEAMS FOR BRIDGES, &c.

Specification forming part of Letters Patent No. 33,384, dated October 1, 1861.

To all whom it may concern:

Be it known that we, ZENUS KING, of Milan, in the county of Erie and State of Ohio, and PETER M. FREES, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and useful Improvement in Iron Bridges; and we do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings and the letters of reference marked thereon, making part of this specification.

Our invention relates to that class of bridges which have tubular iron arches, and in which the roadway is supported by a tie-beam attached to each end or foot of the arch, and connected to the arch by radial rods passing at various points from one to the other.

Our invention consists in the construction of these arches, which we make with a gradually-increasing sectional area from each foot toward the center or crown of the arch, so as to make the arch proportionately more resistant to deflection at all the points where an increase of deflection would naturally take place, and, vice versa, diminishing the sectional area of the arch, as the deflection would naturally decrease from the ends receiving more directly (from their contiguity) the vertical support of the abutments, when a weight of any kind passed over the bridge, thus making each section equally strong in proportion to the deflection which it has to resist, and thereby insuring an extremely stable structure. This increase in the sectional area of the arch is generally confined to its vertical dimensions and does not ordinarily include its width or lateral measurement. All structures of this kind are really stronger and more capable of enduring the wear and tear or resisting any accident to which they are liable when they are equally rigid and equally flexible at all points in proportion to the amount of resistance which each point has to exert to the work or weight which tends to injure or destroy it, and this desideratum is fully attained by this method of constructing bridges.

The object of our invention is to make a bridge of the same strength with less metal than is now employed by distributing the metal in proportion to the strain it has to

bear, and thus lightening the bridge, or to make a much stronger bridge by employing the same amount of metal now employed. These are of course great advantages.

In the drawings, Figure 1 is a side elevation of the whole bridge, and Fig. 2 is a cross-section taken through the line $x x'$ in Fig. 1.

The same letters of reference indicate similar parts in each.

A is the arch, extending from pier to pier and resting on each pier in a suitable and proper bearing, as at B. This arch is constructed of two side and parallel plates C, which are connected together by an upper and lower plate I, running the whole length of the arch and having their edges turned at right angles in order to allow of their being riveted to the side plates, and so forming a hollow arched girder. Between these two plates I a stay-plate I' is placed and riveted to the side plates C to give rigidity and strength to the structure. These angles and rivets are seen at a , Fig. 2. As will be seen in Fig. 1, the arch gradually increases in sectional area vertically from the point A'—one foot of the arch—to the point x —the center or crown of the arch—and gradually diminishes in sectional area vertically from the point x to the other foot of the arch A''. Each foot of the arch rests in a suitable step G, to which the tie-beam E is also secured by stirrups H, whose ends are threaded and pass through holes in the back of the step on each side of the arch, where they are secured by nuts c . This tie-beam is constructed of two parallel plates or bars connected by eyes, or in any other suitable way.

Connected to the tie-beam by pins F are one series of radial rods D, which pass upward to the arch above them, where they are secured in the following way: In the upper and lower plates I, which connect the side plates horizontally, and in the central stay plate a hole or aperture is cut large enough to admit of the radial rod D passing through it, and on the upper end of the radial rod a screw-thread is cut. Fitting in the recess formed by the top plate I and its junction with C by means of the portion turned up at right angles to it, to be riveted to C, is a cast-iron washer or plate J, whose under side is channeled by grooves b to admit of any rain passing through

over the top of the arch to the ground which would otherwise lodge on the top and tend to rust the bridge, and thus cause premature decay. Through this passes also the end of the radial rod D and on it the nut K, which secures the rod in its place, rests. By having the nut rest on this plate the strain of the radial rod is distributed equally over all parts of the arch which naturally belong to it. A nut L is also screwed around the rod D up to the lower horizontal plate I to prevent any vibration of the rod, and thereby prevents the rod wearing out the holes through which it passes, and thus becoming loose.

We have described our improvement as applied to tubular arches having a rectilinear cross-section. It is, however, equally appli-

cable to tubular wrought-iron arches made in other forms.

Having thus described our improvement in the construction of tubular metallic bridges, what we claim as new, and desire to secure by Letters Patent, is—

The peculiar formation or configuration of the arch A, the same being made to increase gradually in its vertical and lateral dimensions from the ends A' A'' of the arch to its center or crown, in the manner as described, for the purposes set forth.

Z. KING.

P. M. FREES.

Witnesses:

WM. CLOUGH,

CHARLES L. FISHER.