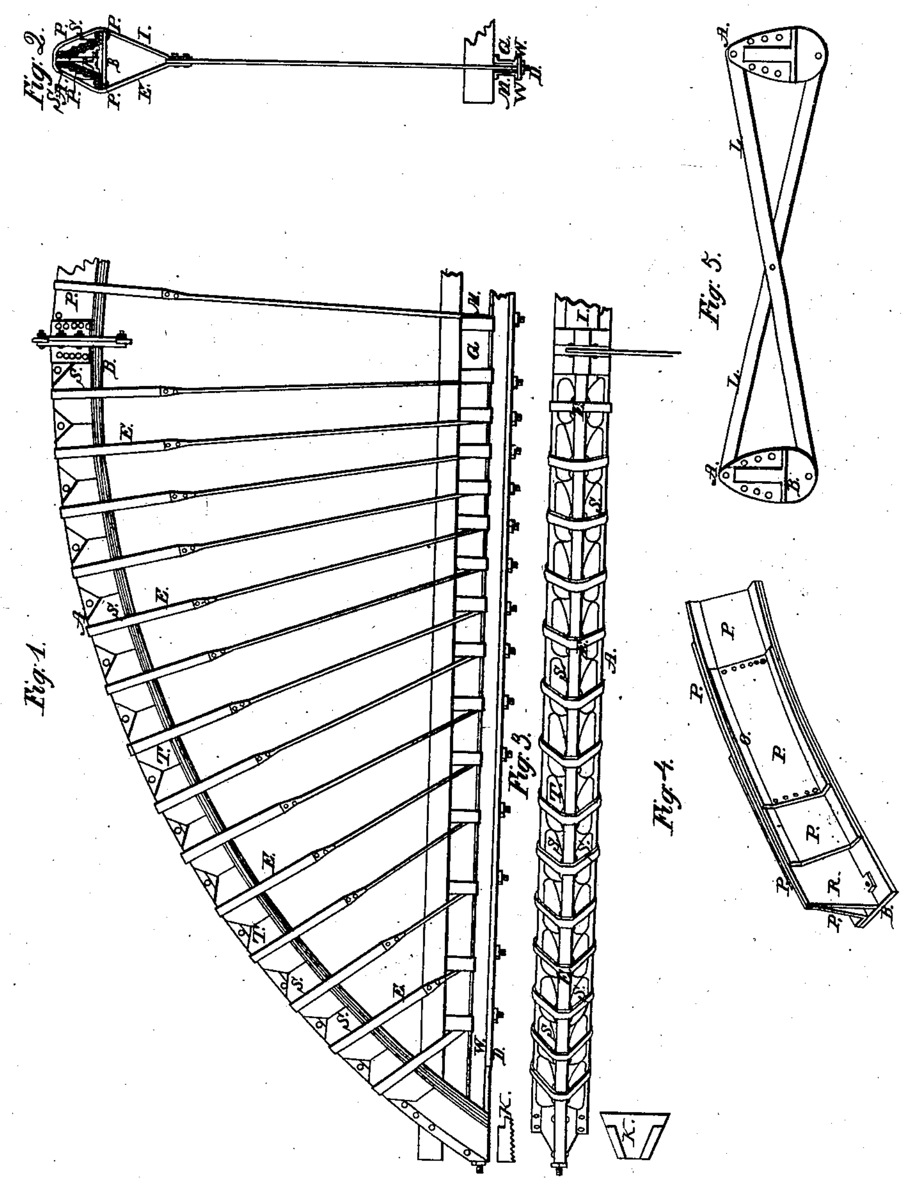
T. W. H. Moseley.

Truss Bridge.

No. 16,572. Patented Feb. 3, 1857.



UNITED STATES PATENT OFFICE.

THOMAS W. H. MOSELEY, OF COVINGTON, KENTUCKY.

BRIDGE.

Specification of Letters Patent No. 16,572, dated February 3, 1857.

To all whom it may concern:

Be it known that I, Thos. W. H. Moseley, of Covington, in the county of Kenton and State of Kentucky, have invented an Improvement in Bridges, and that the following is a full, clear, and exact description of the principle or character which distinguishes it from all other things before known and of the usual manner of making, modifying, and using the same, reference being had to the accompanying drawings, of which—

Figure 1 represents a side elevation of part of one of the arches. Fig. 2 a cross section showing the form transversely of the arches. Fig. 3 is a plan or top view of one half of one of the arches. Fig. 4 a detached view showing the mode of constructing the arches and, Fig. 5 represents the diagonal cross braces which extend from arch to arch.

My invention consists in certain improvements in iron bridges hereinafter described whereby I attain lightness, strength, durability, and economy beyond any iron structure heretofore used for such purposes.

The arches A, A, of my bridge are of a compound character and are built up of wrought plate iron in such manner as to give to the whole arch transversely the form and strength of an arch, and to admit of very long spans without excessive weight, presenting at once the combined features of extraordinary strength and lightness. Hollow arches for such purposes have been essayed before but of such form, application and material as to be objectionable on the grounds of expense, great weight and derangement from expansion and contraction by changes of temperature.

A transverse section of my compound arch as shown in Fig. 2, exhibits an arch in the form of an isosceles triangle the base B of which is the chord of the arch. This form is best adapted to strength, lightness and economy of construction and is in fact the only form with the least weight that can be given to a hollow iron arch for such purpose which is not liable to buckle.

The plates P, P, P, P, Fig. 4 composing the arch are so arranged in its construction as to break joints for the purpose of strength; and for additional strength to the triangular arch, I insert a vertical plate R bolted to the base plate B and secured to plates P, P, P, P, by rivets thus uniting the plates P, R, and B in the most advantageous manner for producing a light and rigid structure, for its own support and the bridge below. Under a strain in any direction which may come upon this compound arch there is less risk of buckling of either of the plates than in other structures for such purpose. In order however to give the utmost strength to the compound arch and preventing all risk of buckling of the plates I insert loose pieces S, S, which I term saddles. These pieces rest upon the plates B, and also bear upon the plates P, P, and also support each other by their edges which come into contact as seen at T. These pieces are not secured to either plate but are inserted loosely and their upper edges receive a part of the pressure of the stirrups E, E, of the suspension rods F F. The chain of saddles on either side of the compound arch thus forms an independent arch and the effect of each individual saddle is to give tension to the plates P, P, where under great pressure in consequence of the pressure of the saddle upon the base plate B and thus prevent the buckling of the plates and with this last increment of strength and support, it is obvious that the arch can give way to extreme pressure only by the actual rupture of the metal of plates P, B, and R. The exterior face of the saddle is formed for lightness and strength, the superfluous metal being removed from those parts subjected to the least strain. The suspension rods are radial or nearly so to the curvature of the arch and therefore all of them inclined to the versed sine of the arch. The flooring of the bridge rests upon the chord M of the arch which is secured to the feet of the arch and supported by the suspension plate D. The suspension rods pass between the two plates G, G, which compose the chord M and the rods are then bolted to the suspension plate D. The suspension plate is not fastened to the chord M and the effect of this in conjunction with the radial suspension rod is, in case of great weight upon any part of the bridge to throw the strain upon the whole span at once.

It will be seen that on no part of the bridge is any weight or pressure under the point of suspension of that part and that every load draws upon the whole arch in consequence of the sliding movement of the suspension plate under the chord M. The chord M is kept in position laterally upon plate D by flanges W, W on this plate. The feet of the arch rest upon corrugated shoes K, K, for the twofold purpose of producing friction upon the abutments and of working their way by gradual abrasion into the material of the abutments and securing a firm hold. The two arches A, A, are held together at top by diagonal braces L L.

What I claim as my improvements is—

1. The compound arch constructed substantially as herein set forth.

2. I claim the saddle pieces in combination with the stirrups and said compound arch.

3. I claim the sliding suspension plate in combination with the chord M and radial suspension rods as set forth.

4. I claim the corrugated shoes K K as set forth.

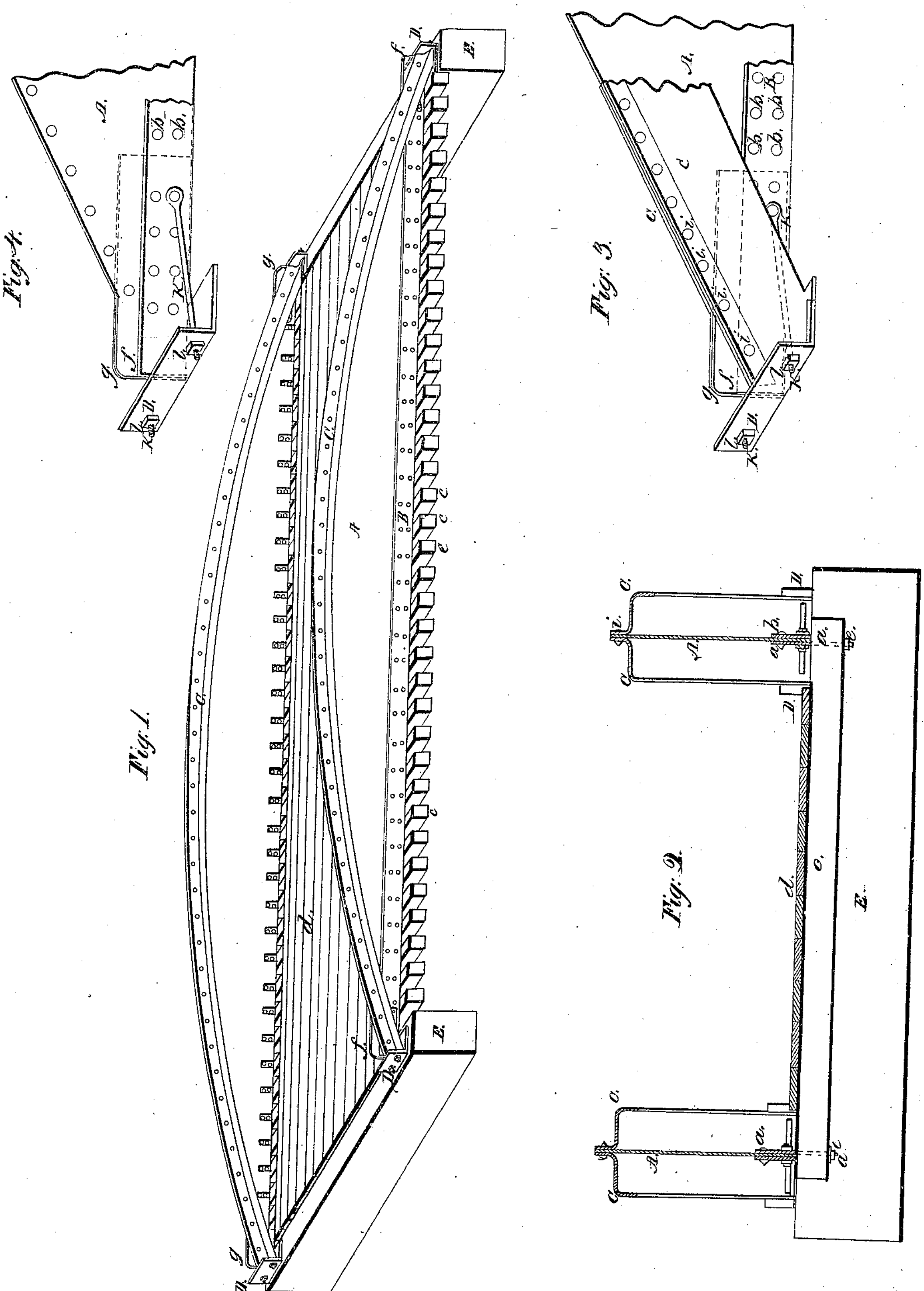
THOMAS W. H. MOSELEY.

Witnesses:
CHAS. G. PAGE,
K. T. CAMPBELL.

T. W. H. Moseley.

Truss Bridge.

No. 59,054. Patented Oct. 23, 1866



Witnesses.
R. H. Eddy
[illegible]

Inventor.
Thos. W. H. Moseley

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

UNITED STATES PATENT OFFICE.

THOMAS W. H. MOSELEY, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. **59,054**, dated October 23, 1866.

To all whom it may concern:

Be it known that I, THOMAS W. H. MOSELEY, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Wrought-Iron Trusses for Bridges; and I do hereby declare the same to be fully described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a perspective view of a bridge-span made with two of my improved trusses. Fig. 2 is a transverse section of it. Fig. 3 is a perspective representation of one end of the truss, with its shoe and the adjusting-rods and nuts applied thereto. Fig. 4 is another end view of the truss, without the flange-plates.

In the drawings, A denotes a girder, to be made of plate-iron, and to have the form of the segment of a circle or an ellipse, or an approximation thereto. A long strip of metal, B, which I term the "chord," is laid along the chord of the said girder, and connected thereto by bolts *b b b* going through the two, and a series of hangers, *a a a*, arranged against the inner face of the girder and projecting below it. In the formation of a bridge these hangers go down through the series of floor-timbers *c c c*, which connect the trusses of the span, and serve to support the flooring-planks *d*, the floor-timbers being held in connection with the hangers by screws and nuts applied to the lower ends of such hangers, they being shown at *e e* in Fig. 2.

To projecting parts *f f*, at the ends of the arched-plate girder A, rectangular strengthening-plates *g g* are riveted, the said plates being placed flatwise against the girder-plate. There is also riveted to each side of the arched girder and along its arc an angle-iron flange, C, shaped in cross-section as represented in Fig. 2, the rivets for holding the flanges to the girder being shown at *i i* in Figs. 2 and 3.

At each toe or end of the truss is a shoe, D, consisting of a sheet of plate-metal bent at a right angle. These shoes rest on the abutments or pieces E E, and each is secured to the truss by two bolts, *k k*, which are connected to the truss, and extend from it in opposite directions, at acute angles with it, and go through the vertical part of the shoe and terminate in screws, on which nuts *l l* are screwed. These bolts, with their screws and nuts, besides serving to secure the shoes to the truss, answer another purpose—viz., as means of adjusting the truss, or springing or drawing it laterally (more or less) in either direction, as circumstances may require.

A truss made of thin plate-iron, and in manner as above described, has been found to possess great strength and stability, and it can be constructed at very little expense in comparison to what is frequently expended for trusses of a like span.

I claim as my invention—

1. The improved truss, as composed of the arched plate A, the chord B, and the flanges C C, or the same and the end strengthening-plates *g g*.

2. The combination of the shoes D D, and their adjusting screw-bolts *k k* and nuts *l l*, with the truss made of the arched plate A, the chord B, and the flanges C C, or the same and the strengthening-plates *g g*, the whole being arranged substantially as described.

THOS. W. H. MOSELEY.

Witnesses:

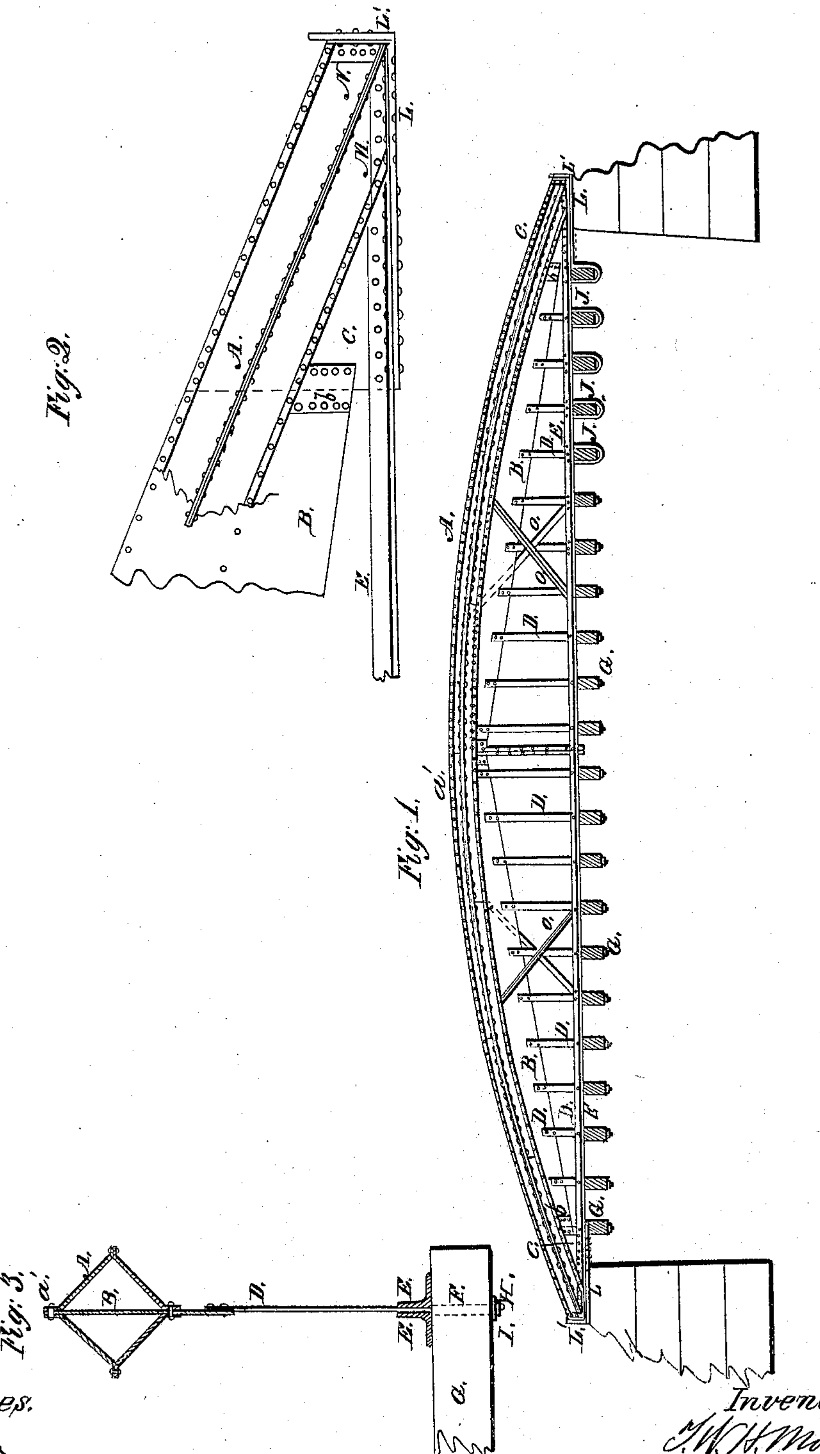
R. H. EDDY,

F. P. HALE, Jr.

T. W. H. Moseley.

Truss Bridge.

No. 103,765. Patented May 31, 1870.



Witnesses.

Jas. L. Ewin
J. Scheitlin

Inventor.

T. W. H. Moseley
By Knight Bros
Attys.

UNITED STATES PATENT OFFICE.

THOMAS W. H. MOSELEY, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN TUBULAR-ARCH BRIDGES.

Specification forming part of Letters Patent No. **103,765**, dated May 31, 1870.

I, THOMAS W. H. MOSELEY, of Boston, in the State of Massachusetts, have invented certain new and useful Improvements in Bridges, which invention is described as follows:

Nature and Objects of the Invention.

The subject of my invention is a tubular-arch bridge. The arch is quadrangular in its transverse section, being constructed of four plates, connected by flanges to each other and to a diaphragm-plate, which is interposed in a vertical plane centrally between the two sides or halves of the arch. The upper edges of these diaphragm-plates are curved, to correspond with the contour of the top of the arch. Their lower edges are straight, or nearly so, and are nearly coincident with the chords of arcs extending from beneath the apex of the arch to its toe at each end. The diaphragm-plates impart great strength, especially to the hips of the arch, by affording a greater depth of girder at those points.

My invention further consists in employing the said diaphragm-plates for the attachment of the upper ends of the suspension-rods, to the lower ends of which the chord-bars and floor-beams are secured.

The third and fourth parts of my invention relate to devices for connecting the arch and its chord-bars, and sustaining the thrust of the one and the tensile strain of the other.

The fifth part of the invention relates to cross or diagonal bracing, employed to impart additional stiffness and strength to the hips of the arch.

Description of the Accompanying Drawing.

Figure 1 is a side elevation of a bridge, illustrating my invention. Fig. 2 is a side elevation of one end of the same on a larger scale. Fig. 3 represents a vertical transverse section of one side thereof.

Like letters of reference refer to corresponding parts in all the views.

General Description.

The main supporting parts of my bridge consist of two or more metallic tubular arches, A, of which one only is here shown. The arch is formed of plates of wrought-iron from one-tenth of an inch to an inch or more in thickness, and from three inches to six feet or more in width, as the length or span of the bridge or the service it is to perform may require. The plates of which the arch is made are sheared in circular arcs of radii to suit the span desired. The longitudinal flanges *a a*, through which the plates are riveted together, are formed on their edges, varying in width as the plates vary—say, from one inch to eight inches or more—and in angle to suit the intended form of the tube in its transverse section. This section is preferably rectangular, as shown in Fig. 3, or diamond-shaped, with the acute angles up and down and the obtuse angles at the sides, so as to bring the major axis in a vertical plane. For a tube of square section the flanges are bent at angles of forty-five degrees, and the angles are correspondingly varied for other forms of sections, so that the planes of the flanges in the finished tubes will bisect the angles formed by the junction of the plates.

The structure thus far described consists of a curved tube of quadrangular section. In application the edge or angle *a′*, having a longitudinal convexity, is placed uppermost, and that which is concave at bottom; and in order to produce an arch of great power and strength, I apply, vertically and longitudinally, between the halves of the arched tube a wrought-iron plate, B, which may be of equal thickness with the side plates of the tube, and is secured between the upper flanges, and also between the lower flanges, by through-rivets.

The plate B thus divides the tube A from angle to angle, forming two prisms or triangles, and producing the strongest form into which iron can be put for such a purpose. This division-plate B, I term a "diaphragm." Its upper edge is curved to conform to the comb or top flanges of the arch-plates; but its lower edge, instead of conforming to the lower concave edge of the arch-plates, is left straight.

The plate B is thus adapted to serve three distinct purposes: First, it forms a chord to half the arch; second, it affords additional depth of girder at the hips or haunches of the arch, thereby imparting greatly-increased strength and stiffness at these points, which, in all arches, are the most frail and flexible parts; third, it is employed for the attachment of the vertical bars, which sustain the chord-bars and the floor-beams of the bridge, and of the diagonal or cross bracing, which is secured to the said plate above and to the main chords below, as hereinafter explained.

Two of the above-described curved tubes A, with their crescent-shaped diaphragms B, are placed together, end to end, as represented in Fig. 1, to form each arch of the bridge.

The vertical suspension-bars D vary in size according to requirement, say from two inches wide and a quarter of an inch thick up to double that size, or more. They are attached, about two feet apart, to the lower part of the diaphragm B, and extend downward between the two chord-bars E E, to which they may be united by through bolts or rivets.

In some cases I weld to each suspension-bar a round rod, F, which is passed through each of the floor-beams G, and is provided at its lower end with a screw-thread to receive a nut, H, which supports a washer, I, upon which the floor-beams rest. In other cases I employ stirrups J, Fig. 1, constructed in U form, of flat bar-iron. The legs of these stirrups inclose the floor-beams, and project upward between the chord-bars E E, to which they are secured by bolts or rivets. The floor-beams rest with a uniform and level bearing on saddles K, which fill the curves of the stirrups.

My mode of making a union of the chords with the arches, at the feet of the latter, is as follows: Each diaphragm-plate B is united at its lower or outer end to a foot-plate, C, which forms a continuation of the diaphragm B, extending between the two sides of the arch to the toe or extremity thereof, and down to the bottom of the arch and the lower edges of the chord-bars. A wrought-iron plate, L, called the "shoe," generally one quarter thicker than the side or diaphragm plate, lies in a horizontal position under the foot of the arch. This shoe is generally made in width equal to one-fourth the vertical height of the arch at its apex, and in length equal to twice or more the greatest diameter of the tube of the arch. Such length is necessary to allow room for rivets, by which it is united to the horizontal stems of the angular chord-bars E, a sufficiency of rivets being used to equal the horizontal stem of the chord-bars E in substance and strength. To the sides of the arches, where they come in contact with the shoe L, are riveted smaller angle-bars, M, the horizontal stems of which are riveted to the shoes, and similar angle-bars, N, connect the upturned end L′ of the shoe to the toe of the arch.

The upright stems of the angle-bars are united to the foot-plate C by like rivets, as shown at *c*, of strength equal to that of the vertical stems of the chord-bars. The diaphragm-plate B is further united to the shoe at its lower end by battens and rivets on each side of the joints, as shown at *b*. All the joints of the diaphragm-plates, both within the arch-tubes and on the outside thereof, are formed by battens and rivets *b*, in similar manner.

To impart additional stiffness to the hips of the arch, I apply, when necessary, diagonal vertical braces O O, of T-iron, crossed, with their straight faces riveted together, their upper ends being riveted to the diaphragm-plates B, and their lower ends secured between the chord-bars E.

Claims.

The following is claimed as new:

1. The arch-tube A, of quadrangular section, constructed of flanged plates, combined with a diaphragm-plate, B, substantially as described.
2. The diaphragm-plates B and suspension-bars D, combined with each other, and with the arch A and chord-bars E, substantially as set forth.
3. The diaphragm-plate B, foot-plate C, and shoe L, when connected and arranged to act as described.
4. The combination and arrangement of the arch A, foot-plate C, shoe L L′, and chord-bars E E, substantially as and for the purposes specified.
5. The diagonal braces O O, constructed and applied substantially as herein stated, in connection with the arch A, plate B, and chord-bars E.

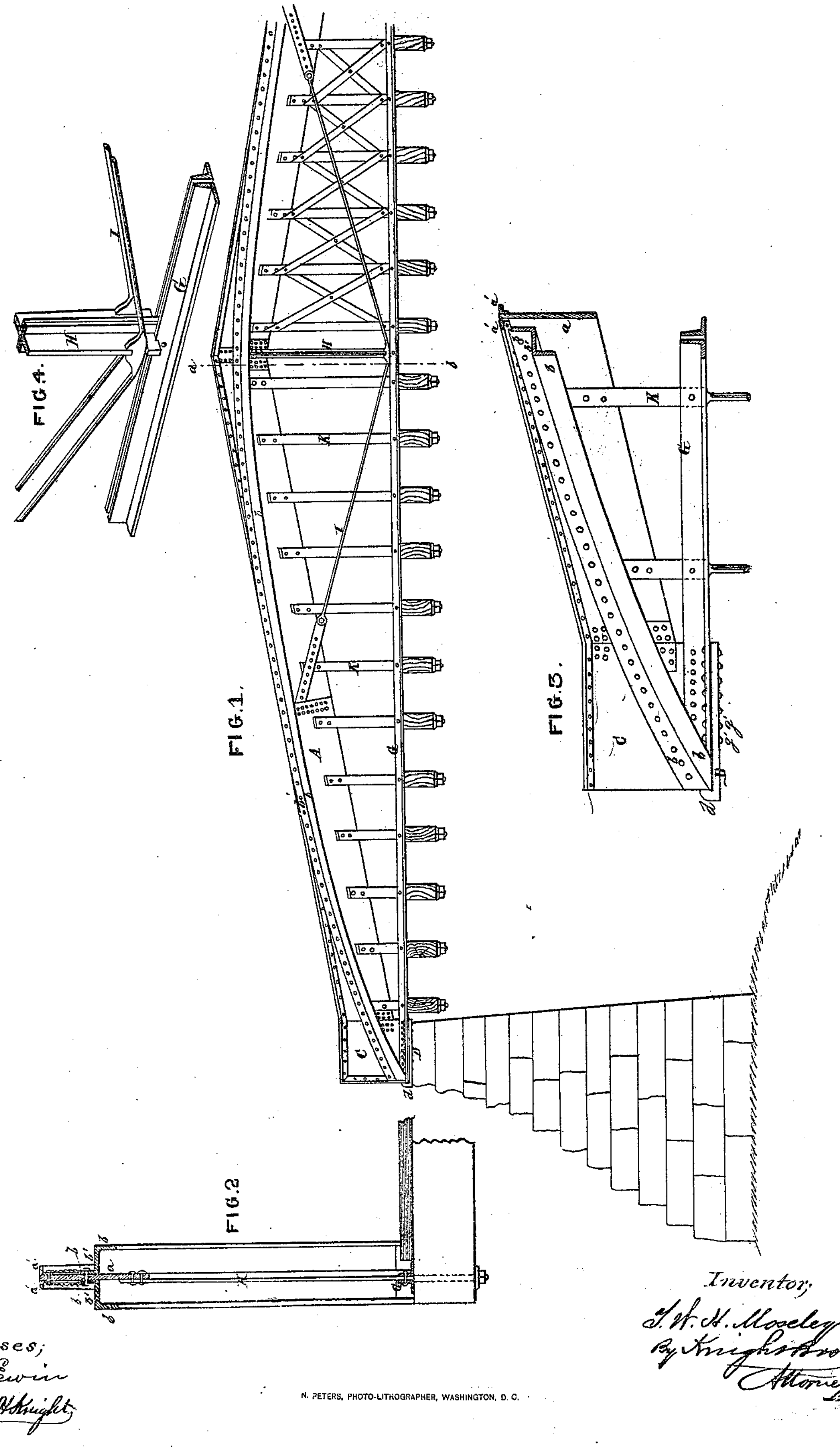
THOS. W. H. MOSELEY.

Witnesses:
WM. H. BRERETON, Jr.,
OCTAVIUS KNIGHT.

T. W. H. Moseley,

Truss Bridge.

No. 106,855. Patented Aug. 30, 1870.



Witnesses;
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UNITED STATES PATENT OFFICE.

THOMAS W. H. MOSELEY, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN BRIDGES.

Specification forming part of Letters Patent No. **106,855**, dated August 30, 1870.

To all whom it may concern:

Be it known that I, THOMAS W. H. MOSELEY, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improved Bridge, of which the following is a specification:

My invention is a combination of the mechanical elements or features which occur singly or in various minor combinations in bridges. These elements, as they may be termed, are the king-post, truss, arch, and girder, the object being to avail the use of all in a structure, to which each shall impart its distinguishing characteristics and valuable quality.

In the accompanying drawing, Figure 1 is a side elevation of a bridge constructed after my plan, and including about three-quarters of the span. Fig. 2 is a sectional view, on an enlarged scale, of the bridge, on the dotted line *a b*, Fig. 1. Fig. 3 is a view, on a scale larger than that of Fig. 1, of one of the ends of the structure, which form the side of a bridge. Fig. 4 is a perspective view of that portion of the structure in the vicinity of the foot of the king-post.

The structure which forms one side of the bridge consists, in the main, of A A, a pair of inclined beams, which meet at the middle of the span, and are stepped against foot-plates C, resting on sole-plate D on the abutments E. (The ends of the bridge are similar, and but one is shown in the principal figure.)

b b′ is an arch, which is secured to the two beams, and springs from the sole-plates D on the respective abutments; G, a girder or chord, which unites the foot-plates C and sole-plates D, and thus sustain the thrust, and acting as a chord to the arch; H, a king-post, which forms the middle vertical member of the truss, connecting the beams at their junction with the girder or chord at its mid-length. I, a tension-rod, connecting the haunches of the arch *b b′* with the foot of the king-post H; K K, &c., suspension-rods from the beams A A, to support the girder or chord and the track-sleepers.

I now proceed to describe the parts more in detail.

The beams A meet at the crown or pitch, and each consists of a fin, *a*, strengthened and stiffened by angle-iron *a′ a′* on its sides at the upper edge, and riveted thereto. These fin-plates rise at an angle varying from six to twenty-two degrees, as may be needed, and are the equivalents of the beams or braces in a king-post bridge, or the principal rafters in a roof-truss. The foot of the fin-plate rests against the foot-plate C, which corresponds in function to a skew-back or thrust-block. The foot-plate rests upon and is secured to a sole-plate of shoe D, which also receives the springing of the arch *b b′* and the end of the girder G, as will be presently described. The iron fin-plate *a* varies in thickness as the span of the arch and the expected burden may require, say, from one-eighth of an inch to one inch or more in thickness, and in width to make a chord to half the arch *b b′*, and to repsent on the back of the latter two tangents, meeting at the haunch.

Unsupported, this fin-plate, even with the stiffening of angle-iron on the upper edge, lacks the lateral rigidity to make it serviceable as a thrust-beam; and this brings me to the description of the arch *b b′*, which is made of upright angle-iron, I-iron, or Z-iron, which is preferably of the form best seen in Figs. 2 and 3.

The plate, as shown, has two flanges, *b b′*, united by a web, *b″*, the flanges being vertical, and the web following the camber of the arch. A pair of such angle-irons is riveted to the fins of the thrust-beams A A, one on each side of the latter. The angle-plates forming the arch vary in thickness and width with the span and expected burden of the bridge, being, say, from one-fourth inch to two inches or more in thickness, and from three inches to two feet or more in width. They are riveted through and through on each side of the fin-plate, as shown in Fig. 2. The shoe-plate D receives the springing of the arch, and has a turned-up toe, *d*, against which the heel of the arch thrusts.

The girder G forms the chord of the arch *b b′*, and also prevents the spreading of the feet of the beams or fin-plates A A. Each girder is made of flat-bar, flat-plate, or angle-iron, and preferably of the latter, as clearly seen in Fig. 3, the shaped irons being laid with their vertical flanges back to back, and riveted together at intervals. At their ends these girders or chords embrace between them the foot-plate C, to which they are securely riveted. The horizontal flanges of these girders or chord-bars are likewise riveted to the sole-plate D, some of the rivets being seen at *g g*, Fig. 3.

I have now described the elements consisting of the inclined beams, the arch, and the girder. The angle-plate arch being added to each side of the fin-plates A, keeps the latter in perfect line, and they then exert their full strength, and each becomes a chord to one-half of the arch, strengthening the latter, especially at its haunches.

H is an iron king-post, preferably formed of two T-bars, *h h*, with their faces together, as seen in Fig. 4. These extend from the beam A above to the girder-plates G beneath, and are made fast to each.

I I are tension-rods, one on each side of the bridge-truss. These are attached at their ends to the ribs of the plates A A, pass obliquely downward to or nearly to the girder G, and take hold of the foot of the king-post, which is then utilized as a strut in the support of the apex of the compound beam and the crown of the arch, the two being practicably coincident as to position. This straining-rod has notch, cut, or gib, to prevent its slipping when the load or burden is thrown on the haunch of the arch.

The suspension-rods K are similar to those in other bridges, and depend from the fin-plate, to support the girders or chords G and the sleepers of the road-bed, as shown at Fig. 2.

Cross or lattice bars may be used between the fin-plates A A and the chord G, in connection with, independent of, or to the exclusion of the suspension-rods K.

What I claim as new is—

The combination, in one bridge-truss, of the following elements: The beams or fin-plates A A, the arch *b b′*, the girder or chord G, king-post H, and tension-rods I I, arranged as described, or in any equivalent manner.

THOS. W. H. MOSELEY.

Witnesses:

JOHN MULFORD,

A. P. HOUGH.