John Bright No. 1 Iron Bridge
Spanning Poplar Creek at Havenport Road (TR 263)
Carroll vicinity
Fairfield County
Ohio

HAER No. OH-44

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

Historic American Engineering Record
National Park Service
U. S. Department of the Interior
P. O. Box 37127
Washington, D. C. 20013-7127

HISTORIC AMERICAN BUILDING RECORD

John Bright No. 1 Iron Bridge

HAER No. OH-44

Location: Havenport Road (Township Route 263) over Poplar Creek 3 miles northeast of Carroll Liberty Township, Fairfield County, Ohio

UTM Coordinates: 17/356720/4909940

Date of Construction: 1884-5

Present Owner: County of Fairfield (Board of Commissioners)
County Courthouse
Main Street
Lancaster, Ohio

Present Use: Vehicular traffic

Significance: The John Bright No. 1 Iron Bridge was built by the Hocking Valley Bridge Works (HVBW) of Lancaster, Ohio, probably in 1884-5. It is one of a relatively small number of surviving bridges to have been built by this local firm. The suspension truss design is very unusual, and is only known to have been used in a few bridges in Ohio by three bridge builders. There are some similarities in this bridge to several patented designs, but it most closely resembles Archibald McGuffie's 1861 patent for "Improvement in Construction of Bridges." The bridge is very similar in design to the nearby John Bright No. 2 Covered Bridge (see HAER No. OH-45). The bridge was listed on the National Register of Historic Places in 1978.

Report prepared by: Frances A. Jones
Project Historian
Ohio Historic Bridge Recording Project
Summer 1986

A contract for the building of this bridge has not been found, but it has been suggested that a number of references in the Commissioners' Journals for dates in 1884 and 1885, all referring to the Smith Mill Bridge in Liberty Township, are for this iron bridge. There was a Smith Mill by Poplar Creek, hence the name Smith Mill Bridge. Augustus Borneman was paid $1000 for the Smith Mill Bridge in June 1884, and in July he was paid a further $400. In January 1885 he received $520 making a total of $1920 - a high price for 1885.[1]

As with the John Bright No. 2 Covered Bridge, which pre-dates No. 1 by about three years, there was, according to the Commissioners Journals a covered combination truss bridge on this site, prior to the building of the metal bridge. That bridge stood from 1876 to 1884. As with the predecessor to the covered bridge no reason is given for the need to replace it, but perhaps it is relevant that 1884 was a year in which flooding was a problem in that area.

Structurally the bridge is almost exactly the same as the John Bright No. 2 Covered Bridge, but it is constructed entirely in iron. However, the iron bridge has no secondary strengthening as in the wooden arch of the covered bridge, and is virtually unchanged. The vertical end posts bear ornamental urns, and there is a plaque on the nothern portal

stating that the bridge was built by the Hocking Valley Bridge Works, which was owned by Augustus Borneman.

Some of the structural differences between this and the covered bridge are due to the fact that a different material was used. In this structure the vertical posts are six inch channels joined together by diagonal lacing. The end posts also are made of channels, linked this time by a plate. The upper chord is constructed in the same way, and the suspension chain hangs down between the vertical posts, although it is made of flat eye-bars instead of the square rods used at the covered bridge. The plates are riveted to the channels in the end posts and upper chord, but otherwise pins were used for all structural connections in this bridge, as they were on the covered bridge. There is horizontal diagonal bracing between panels in the plane of the upper chord, and of the deck, but tension rings are not used here as they are on John Bright No. 2. Instead, two diagonals simply cross each other but each one is itself made up of two rods. These have threads on their inner ends and are linked by a sleeve nut. This bridge has an overall length of 90 feet and the deck is 15 feet wide.

It has been suggested that the design of the John Bright Bridges, considered unusual, was derived from an 1875 bridge patent by William Black (US patent No. 166,960 dated 24 August 1875, see data page 11). Black was incidently a former partner of HBVW's owner, Augustus Borneman (see below).[2] His patent is similar in appearance to the John Bright

Bridges, although other patents, more closely resembling the John Bright Bridges exist. It has inclined (not vertical) end posts, and a suspension chain of eye bars, called a catenarian tension-arc by Black. The posts and upper chord are again built-up of iron channels and plates. Posts are set between the upper chord and the arc to, according to the patent, "communicate the strain at right angles,or nearly so, to the tension-arc . . . at the point of contact therewith." Black claims various elements of the design as being his invention. These connection details, and the method of suspending the deck, are different to those used by Borneman. He emphasizes the use of a specially designed cap to join the ends of the upper chords to the posts, and also to protect that joint. This is not used on the Bright bridges. In the John Bright Iron Bridge the upper chord sits over the end post (it also projects beyond it, but the projection is merely decorative, not structural). The bottom chord is connected to the end post by a pin connection and is composed of eye-bars. That connection is covered by two separate cast iron plates: one is attached to the under side of the upper chord projection, while the other is a plaque bearing the name of the Hocking Valley Bridge Works, and blocks off the end of the upper chord. The ornamental urn is set on a third cast iron plate.

However, two similar truss patents have been noted which more closely resemble the John Bright Bridges.[3] One is W. O. Douglas' "Improvement in Truss-Bridges" (US patent No. 202,526 dated 16 April 1878, see data page 14). It is a lenticular truss, with the design making use of two

chords, one in compression and one in tension joined together at the extremities. The chords can be hipped or parabolic, but in all cases the two are bound together by vertical posts and diagonals. Deck Beams, which support the roadway, run laterally from panel point to panel point, and is supported by vertical hangers suspended from the bottom chord. The design is visually not dissimilar to that of the Bright bridges, although the upper chord is a curved member. The other patent is Archibald McGuffie's "Improvement in Construction of Bridges" (US patent No. 33,954 dated December 1861). McGuffie's design is almost identical to the John Bright bridges. A suspension chain consisting of lengths of double eye-bars with the ends welded together by joint blocks. The joint blocks (the points where braces, suspension rods supporting the deck, and vertical posts all meet on the line of the suspension chain) consist of large pins inserted through the links. This chain is suspended from the upper chord. The ends of the chain are stirrups with screw threads at the ends, which pass through the upper chord and are held there by nuts. The upper chord is of "a sectional tubular cast-iron". Diagonal braces run from the upper chord to the joint blocks, the connection with the chord being at the next panel point along from the one where the brace starts.

It is explained in McGuffie's patent that:

> By combining the chord posts and braces with the catenary series of links in the manner above described to truss the links in the true catenary line, the tendency of any one part of

> the girder to sink more than another is prevented, for if a load (it is stated) rests at one point, the weight of the whole truss is tending to operate against it and counteract the tendency to depression at that point.[4]

THE HOCKING VALLEY BRIDGE WORKS, Augustus Borneman and Benjamin Dum

The Hocking Valley Bridge Works was started by Augustus Borneman, a Prussian immigrant. He is listed as being 35 years old in the 1880 census for Fairfield County.[5] In July 1876 he is mentioned in the Fairfield County Commissioners Journals as being a partner in the firm of Black and Borneman (or Black Borneman & Co.).[6] Within two years of this entry Borneman was working on his own. Little is known of his partner, William Black, who seems to have been the son of an Irish immigrant who emigrated to America in 1790.[7] Black died in 1887, and although he did patent at least one bridge design used after their partnership by Borneman (see p 3), his name seems to have been quickly eclipsed by that of his partner.

The firm of Augustus Borneman and Sons began building bridges in about 1880, and the Hocking Valley Bridge Works (HVBW) began operating in 1881.[8] An entry dated 27 June 1884 appears for the company in the Fairfield County Individual Partnership and Traders Records, necessitated by "An Act Requiring Individual and Partnership Traders to Record their Names" which was passed on 10 April 1884, several years after the establishemnt of the Bridge Works. It is stated in the records that "Augustus Borneman" was "carrying on a Manufacturing Business" know as the Hocking Valley Bridge

Works. The only owner or partner listed is Borneman himself. The Works had no connection with the Hocking Valley Manufacturing Company which was operating in the same area of Lancaster during the same period.

Borneman died on 23 March 1889, and his widow, Mary, sold the HVBW to Benjamin Dum. Dum was born in Amanda Township, Fairfield County on 16 March 1845. He went to school in the township and in Lancaster, and taught school for eight years before farming full-time. In 1877 he became deputy auditor for the County Commissioners of Fairfield County, becoming auditor in 1885. Four years later he took over Hocking Valley Bridge Works, which, by 1901 was said to be manufacturing bridges as well as architectural and prison iron work.

The Bridge Works was located on a piece of land known as Lot 300 (or Old Lot 103) in Lancaster on the corner of High and Canal Streets. Borneman had bought Lot 300 on 1 November 1882 from William B. Pearce and his wife for $800.[9] Seven years later Dum paid Borneman's widow $3000 for the site, which presumably included buildings and equipment.[10] On 2 January 1907 Dum declared to be bankruptcy in the District Court of the United States for the Southern District in Ohio. His real estate was to be sold at auction on May 27 of the same year. It was necessary for the real estate to be advertised in the local paper (the Lancaster Gazette) prior to the auction. In both the deed book in which the notice of bankruptcy is recorded,[11] and in the newspaper,[12] the contents of the HVBW are listed. The Gazette's list is as follows:

> Twenty horse power Bessemer gas engine; "18" lathe by 72", with tapper attachment and one set lathe dogs; one power hack saw; one grindstone, complete; one double wheel emery grinder, complete; one blower; one bolt and nut cutter, taps and dies; one punch and sheers; one power drill press; shafting and pulleys; belting and two anvils; blacksmith tools; erection tools; five cranes; one angle former. Appraised at $1,952.00. Also material for iron structural work, consisting principally of "I" beams, channels, angles, plates, bars and rods, platform scales, office desk, drafting table, copying press, scrap iron and many other minor articles used in and about the manufacture of bridges and other iron structural work. All being in and constituting a part of the personal property used in the said The Hocking Valley Bridge Works.

John Jos. and Wm. H. Dum (sons?) bid $3714 for the site, and it was sold to them for that price. John Jos. and William H. Dum sold the site only four years later, however, to Moris Mogilewsky and J. Werlinsky for the sum of $1250.[13] No list of contents is given in the 1911 sale, and as the price had dropped considerably it would appear that the Bridge Works was no longer operational, or that it was at least failing badly. The Sanborn Insurance Maps for Lancaster for the late nineteenth/early twentieth century show that the company expanded only slightly during its life.[14] It acquired one or two additional workshops in the grounds between 1884 and 1899, and on the 1904 map the main building appears to have been extended. It must always have been a small company, however (it was never listed in the directory Iron and Steel Works of the US for example), and it states on the 1904 map that it had only seven employees. It last appears in 1910, which would suggest that John Jos. and Wm. H. Dum did continue to run the Bridge Works, although the map information could perhaps have been out-of-date. The site is marked as being a junk yard on later maps.

NOTES

1 Interview with Miriam Wood (Secretary, Southern Ohio Covered Bridge Association) Columbus, Ohio, 17 June 1986.

2 Ibid.

3 William Chamberlain as reported by Robert M. Vogel, Editor's Note to "The John Bright Bridges," by Miriam Wood, Society for Industrial Archaeology Newsletter vol. 8 no. 1 & 2 (January & March 1979): 8.

4 Engineering News (14 July 1883): 326.

5 Lancaster (4th Ward), Fairfield County, Ohio, Census (1880): B p. 30 line 35.

6 Interview, Miriam Wood, 17 June 1986.

7 S. J. Clarke, A Biographical Record of Fairfield County, Ohio (New York 1902), p. 53.

8 A. A. Graham, History of Fairfield and Perry Counties (Chicago: W. H. Beers and Co., 1983).

9 Fairfield County, Ohio, Deed Book (1 November 1882) vol. 50, pp. 422-3.

10 Fairfield County, Deed Book vol. 64, p. 407.

11 Fairfield County, Deed Book vol 110, p. 121.

12 Lancaster Gazette vol. 82 no. 20, Thursday, 16 May 1907, sec. 2, p. 8, col. 3.

13 Fairfield County, Deed Book vol. 121, p. 356.

14 Sanborn Fire Insurance Map (Sanborn Map & Publishing Company Ltd, New York).

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UNITED STATES PATENT OFFICE.

WILLIAM M. BLACK, OF LANCASTER, OHIO.

IMPROVEMENT IN TRUSS-BRIDGES.

Specification forming part of Letters Patent No. **166,960**, dated August 24, 1875; application filed July 17, 1875.

To all whom it may concern:

Be it known that I, WILLIAM M. BLACK, of Lancaster, in the county of Fairfield and State of Ohio, have invented certain new and useful Improvements in Bridges; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification.

The object of the invention is to so construct a truss-bridge that the strain resulting from a burden on the roadway may be communicated to the main tensile member of the truss at right angles at the point of contact therewith, and simultaneously at different points, whereby the strain may be distributed proportionately throughout said member.

This object is effected by the peculiar construction and arrangement of a truss, composed of an upper chord and a catenarian tension-arc, together with radial compression-posts and diagonal tension-bars, in combination with a suspended lower chord, to which is attached the roadway.

The invention also consists in the peculiar construction of the catenarian tension-arc and of a cap used to join the truss with the inclined end main posts, and also in the manner of suspending the lower chord.

In the accompanying drawing, Figure I is a side elevation of the bridge. Fig. II is a plan view of the catenarian tension-arc. Fig. III is a plan view of the lower chord. Fig. IV is a transverse section view of the upper chord on the line *x x*. Fig. V is a view of the cap detached.

The chord A is made of iron or steel, in the form of plate and channel-bar, or in any other suitable form. C is a catenarian tension-arc, or the arc of a circle, cutting the points K, and, at its greatest deflection from the chord A, cutting a point from three-fourths to seven-tenths of the distance from the center of the chord A to the center of the chord E. The tension-arc C is composed of sections or sets of eye-bars of suitable equal lengths, connected by bolts and hitch-plates D, hereinafter more fully described, and is joined to the chord A by bolts, or in any suitable manner. This tension-arc is the main tensile member of the bridge, and the bridge is so constructed that its other parts follow this member freely without the usual resulting strain from contraction and expansion. The posts L are made of iron or steel, in the form of plate and channel-bar, or in any other suitable form, with an eye at each end, being joined to the chord A by bolts, and to the tension-arc C by bolts and the hitch-plates D. These posts may be placed at right angles to the tension-arc C at the point of contact therewith, whereby they are radial from the center of the circle, of which the tension-arc is a part; or they may be so placed that the points of contact of any post (except the central one) with the tension-arc C and the chord A are equidistant from the nearest point K; or they may be so placed that their points of contact with the chord A divide said chord into equal sections, the posts in all cases retaining the same position on the arc C. Any of these arrangements of the posts L has the effect to communicate the strain at right angles, or nearly so, to the tension-arc C at the point of contact therewith, whereby the strain is distributed equally between the members connected by the hitch-plates D. Ordinary tension-bars H extend from the junction of the posts L with the tension-arc C, diagonally to the junction of the next corresponding post L with the chord A, or to the junction of the second corresponding post L with the chord A at pleasure. These tension-bars are joined to the arc C by a single bolt passing through the hitch-plate D, sets of eye-bars *p* in the arc C, and the bars H, and to the chord A by a single bolt passing through the chord A, the posts L, and the bars H. The inclined end main posts B are made of steel or iron, in the form of plate and channel-bar, or in any suitable form, and may be joined to the chord A in any convenient manner; but it is the purpose to join them by means of the cap J, hereinafter more fully described. These posts are rounded at the lower end, and are set in cast-iron shoes, one or both of the shoes being placed on ordinary friction-rollers.

The chord E is made of sections or sets of eye-bars of suitable equal length, the several

sections being united by bolts and hitch-plates F. The chord E is joined to the posts B by bolts, or in any suitable manner. The roadway is attached to the chord E by any convenient method. The chord E is suspended to the tension-arc C by means of the bars G, two sets of bars being attached to the same point or hitch-plate F by bolts. The two sets of bars G, which are joined to any point or plate F, are made to diverge, so that the opposite angles, formed by these sets of bars and the chord E, are equal, or practically so. The one set of these bars is joined to the first right-hand hitch-plate D in the tension-arc C, and the other to the first left-hand one, a single bolt passing through the hitch-plate D, the post L, and the bars G.

If desirable, the lengths of the several sections of the chord E may be so governed and varied as to make the opposite angles, formed by the sets of suspension-bars G and the chord E, always precisely equal. By this manner of suspending the chord E the strain of a burden at any point or plate F on the chord E is divided and communicated to the tension-arc C at two separate points instead of one, as in the case of vertical suspension-bars. The plan of suspending the roadway obviates the necessity of heavy posts extending the entire distance from the upper chord to the lower chord.

The cap d, as shown in Fig. V, is made of cast iron in a single piece, and is intended not only to unite the chord A and the main posts B, but also to protect the joint from the weather. The lower part of this device, as shown in Fig. V, and the accompanying transverse section view, is made with a stud or nose to project into the end of the hollow post B, and a recess fitted to receive the end of said post, thus firmly uniting the cap and the post. The middle part of the device is solid. The upper part has a cavity fitted to receive the rounded end of the cord A, forming therewith a knuckle-joint. A single bolt passes through the cap d, the chord A, the arc C, and the bars H, thus securing the several parts.

The hitch-plates D are made of wrought-iron or steel, and are semicircular in form, the bolt-holes therein being arranged in the circumference of a circle conforming with the shape of the plate. The posts L and the bars G only are connected with the hitch-plates D by the lower bolt. By this arrangement the plate D has a tendency to equalize the strain upon the members of the bridge secured by the other bolts, the plate turning upon the lower bolt, to accommodate itself to the inequality of strain. Greater strength is also obtained by having the strain on any of the joints in the arc C divided between three bolts, instead of being carried by a single one. An additional advantage is secured by the fact that the strain on any of these bolts is in but two directions, whereas with a single bolt there would be strain in at least four directions.

In order to better understand the symmetrical relations of the parts of this bridge, it must be noticed that the chord E is always composed of an odd number of sections, and exceeds the chord A in length by the length (or average length, if the sections in the chord E differ) of one of these sections. There is also always one less section in the arc C than in the chord E. The inclination of the end main posts B is, therefore, governed by the varying difference in length of the chord A and the chord E, and the number of sections in the chord E regulates the relations of the remainder of the bridge.

I claim as my invention—

1. In combination with a catenarian tension-arc, an upper chord, radial compression-posts, and diagonal tension-bars, substantially as shown, and for the purpose specified.

2. The catenarian tension-arc C, composed of sections or sets of eye-bars, united by the hitch-plates D, substantially as shown, and for the purpose specified.

3. In combination with a catenarian tension-arc and end main posts, a lower chord, suspended by sets of diverging bars, substantially as shown, and for the purpose specified.

4. The cap d, substantially as shown, and for the purpose specified.

In testimony that I claim the foregoing as my own invention I affix my signature in presence of two witnesses.

WM. M. BLACK.

Witnesses:
GEORGE W. BROCK,
WM. MITCHELL.

W. M. BLACK.

Truss-Bridge.

No. 166,960. Patented Aug. 24, 1875.

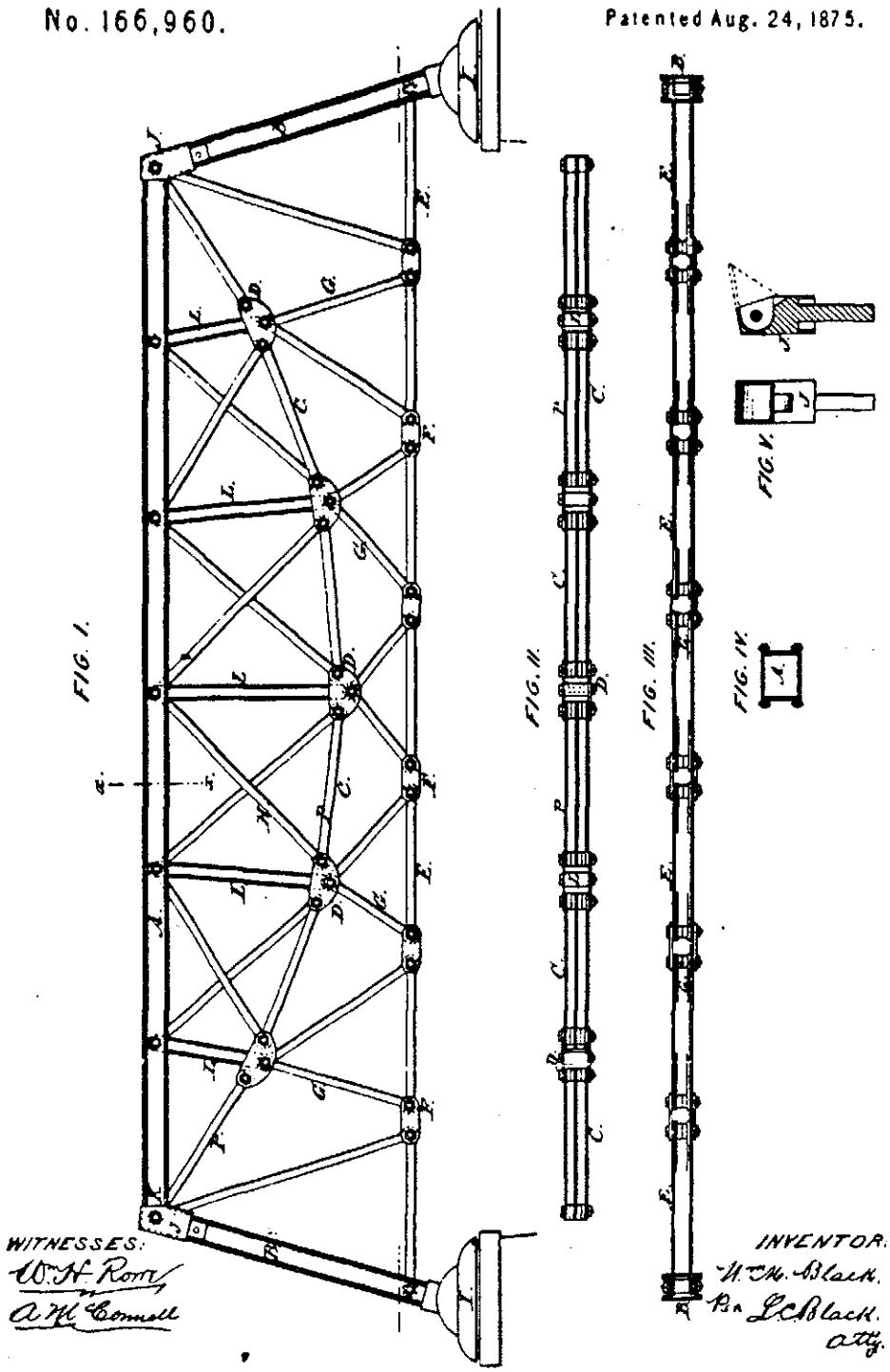

FIG. I.

FIG. II.

FIG. III.

FIG. IV.

FIG. V.

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UNITED STATES PATENT OFFICE.

ARCHIBALD McGUFFIE, OF ROCHESTER, NEW YORK.

IMPROVEMENT IN CONSTRUCTION OF BRIDGES.

Specification forming part of Letters Patent No. 33,954, dated December 17, 1861.

To all whom it may concern:

Be it known that I, ARCHIBALD McGUFFIE, of Rochester, in the county of Monroe and State of New York, have invented a new and useful Improvement in the Construction of Bridges; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 is a side sectional view of my invention, taken in the line *x x*, Fig. 2; Fig. 2, a transverse vertical section of the same, taken in the line *y y*, Fig. 1; Fig. 3, a detached and enlarged longitudinal section of one of the joints pertaining to the same; Fig. 4, a detached view of a portion of the bracing pertaining to the same; Fig. 5, a transverse section of Fig. 3, taken in the line *z z*.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to an improvement in that class of bridges in which the suspension and arch bridges are combined.

To enable those skilled in the art to fully understand and construct my invention, I will proceed to describe it.

A A represent the two abutments of the bridges, and B B are two arches, the ends of which rest on the abutments A A, one at each side. The arches B B are formed in sections, each section *a* being a straight metal tube, the ends of which are fitted on joints *b*, which are simple angular metal heads provided with tenons *c* and shoulders *d*, the ends of the tubes *a* fitting on the tenons *c* and abutting against the shoulders *d*, as shown clearly in Fig. 3. The shoulders *d* have a miter or beveled position, so that when the sections are connected together they form arches, as shown clearly in Fig. 1.

The joints *b*, by which the sections *a* are connected together, form the medium for connecting the suspension-rods to the arches, and also for connecting lateral stays thereto. The joints *b* have each a rod *e* passing through them transversely, and to the ends of the rods *e* the upper ends of forked suspension-rods C are attached. The lower ends of the rods C pass through the ends of sleepers D, which support the flooring of the bridge or the rails E laid thereon, provided the structure be used as a railroad-bridge. The lower ends of the rods C are secured to bars F, on which the ends of the sleepers D rest, and said bars F are braced or retained in proper position by means of rods G, which pass around the bars F at each end like links, the end rods G being secured in the abutments A A, as shown at *f* in Fig. 1.

The bars F and joints *b* are braced by diagonal or cross-rods *g*, as shown in Fig. 1.

H represents rods which are forked and have their lower ends connected to the rods *c*, which pass through the joints *b*. The rods H form supports for longitudinal and horizontal bars I I, which are connected by cross-bars *h* and diagonal rods *i*. The bars I I *h* and rods *i* form a framing A', to prevent any lateral movement of the arches B B.

When the bridge is designed for railroad purposes, the transverse sleepers D may be of cast or wrought iron, and the longitudinal sleepers J may be of the same material, the latter being grooved longitudinally to receive the rails E, which should rest on wooden strips *j*, or other material, in order to allow the rails to yield or give to a certain extent. For railroad-bridges it would be preferable to have all the materials of metal, in order to guard against fire.

By forming or constructing the arches B as shown and described—to wit, of tubular sections *a*, fitted on joints *b*—the sections and joints may be readily and snugly adjusted together, so as to form tight and firm connections, as the ends of the tubes *a* may be turned to form perfect joints.

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

1. The combination of the angular tenoned heads *b* with the tubular arch-sections *a*, in the manner herein shown and described.

2. The arrangement, with the heads *b* and sections *a*, of the rods *e*, forked rods C, sleepers D, bars F, rods G *g* H, and bars I, as herein shown and described.

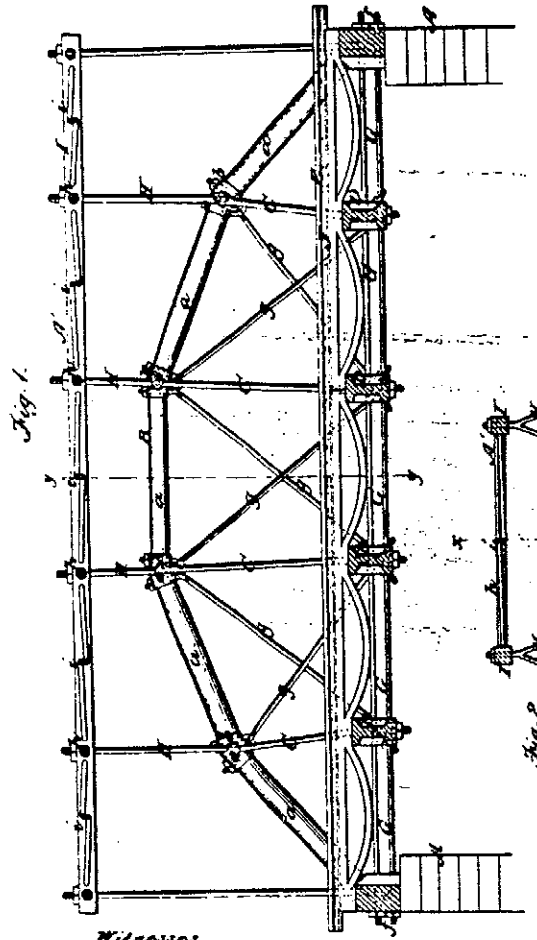
ARCHIBALD McGUFFIE.

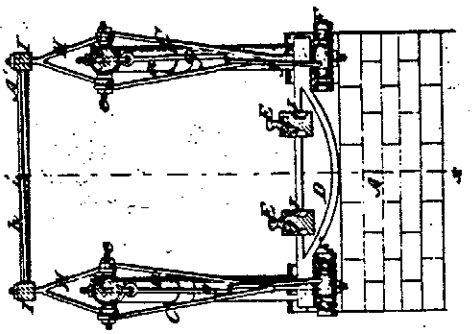
Witnesses:
H. McGUFFIE,
JNO. H. HILL.

A. Mc. Guffie.
Truss Bridge

No. 24,950
33,954.

Patented Dec. 17, 1861.





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