Nov. 16, 1943. C. WALTERS 2,334,521

BRIDGE

Filed June 25, 1942 2 Sheets-Sheet 1

FIG. 1.

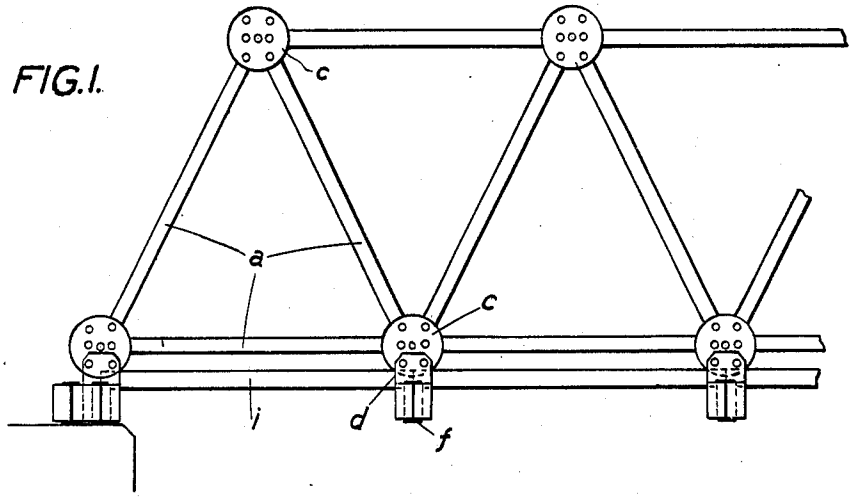


FIG. 2.

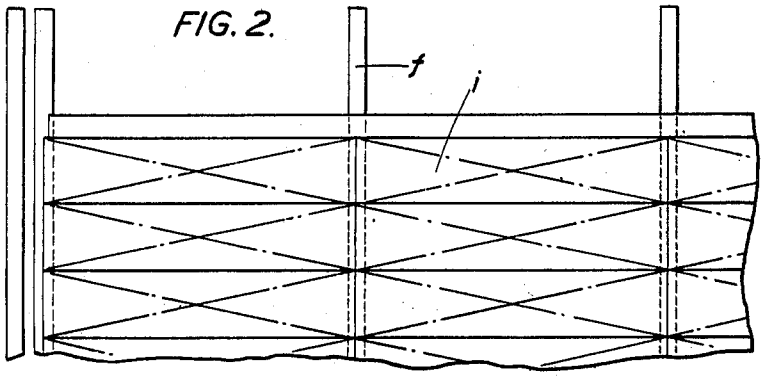


FIG. 3.

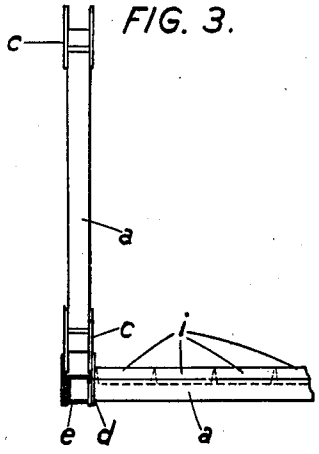
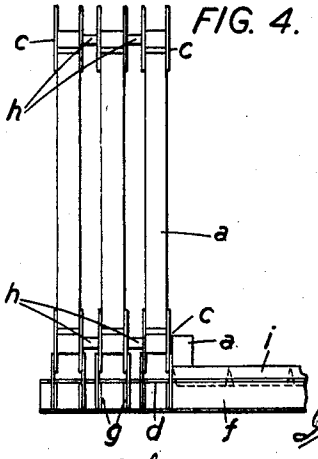


FIG. 4.



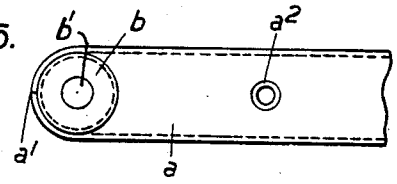
Inventor,
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BRIDGE

Filed June 25, 1942 2 Sheets-Sheet 2

FIG. 5.



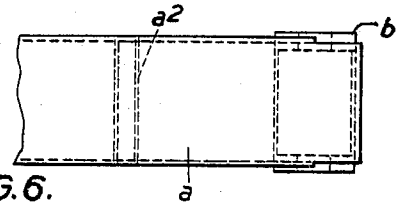


FIG. 6.

FIG. 7.

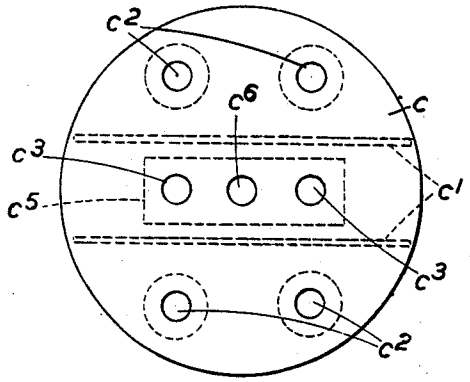


FIG. 8.

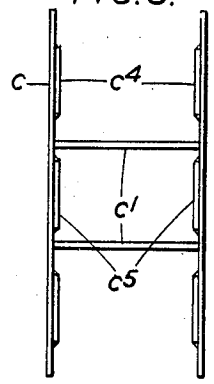


FIG. 9.

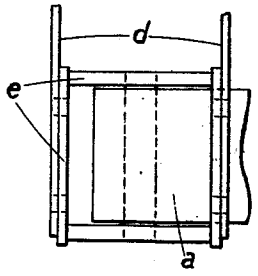


FIG. 10.

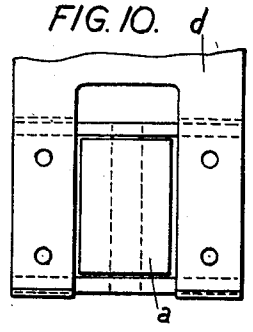


FIG. 11.

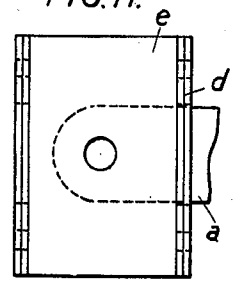


FIG. 12.

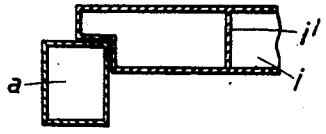


FIG. 13.

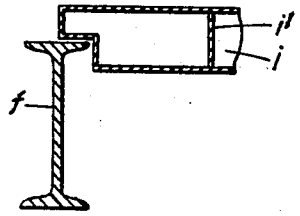
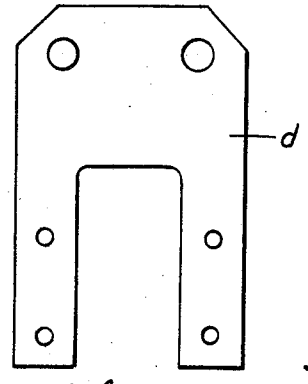


FIG. 14.



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UNITED STATES PATENT OFFICE

2,334,521

BRIDGE

Christopher Walters, Swanwick, England, assignor to The Butterley Company Limited, Butterley, England

Application June 25, 1942, Serial No. 448,448
In Great Britain February 21, 1941

11 Claims. (Cl. 14—13)

This invention relates to the construction of bridges.

The object of the invention is to provide a system or method of construction applicable to bridges of all types from light footbridges to heavy bridges of large spans which will require only a small number of different standard parts.

A further object of the invention is to provide forms of bridge which will be simple and speedy in erection.

A further object of the invention is to provide a bridge constructed of standard parts which will be inexpensive in production.

A further object of the invention is to provide a system of construction employing standard parts which can be easily stored in readiness for use.

A further object of the invention is to provide a system of construction in which the same standard parts can be used for light or heavy bridges of varying spans.

The invention consists in using box-section or equivalent standard girders to form chord and diagonal units arranged in triangles constituting the sides of the bridge, the girders being attached at their intersections to connecting members such as drums or bobbins, from some of which also the floor of the bridge is carried.

Referring to the drawings which form a part of this specification:

Figure 1 is a side elevation of a part of a bridge.

Figure 2 is a plan thereof.

Figure 3 is a part transverse section of a light footbridge.

Figure 4 is a similar view to Figure 3 but showing the heavier construction illustrated in Figure 1.

Figures 5 and 6 are respectively a part side elevation and part plan of one of the box section girders used in the construction.

Figures 7 and 8 are elevations of one of the drums or bobbins to which the box section girders are attached.

Figures 9 and 10 are elevations and Figure 11 a plan showing details of the construction of Figure 3, where the transverse girders are connected to the main side girders.

Figures 12 and 13 are part longitudinal sections showing how the floor plates are supported on the transverse girders in light and heavier constructions.

Figure 14 is an elevation of a suspension plate by means of which the transverse girders are carried.

Figures 5 to 14 are drawn to enlarge scales.

The sides of a bridge, Figures 1, 2, 3 and 4, are constructed of box section mild steel girders a shown in detail in Figures 5 and 6. A cylindrical drum, boss or bar b, having a central hole b^1, is welded in position at each end of each girder, the sides of the girder being cut out to receive it and the top and bottom of the girder hammered down and welded round the member b finishing at the extreme end a^1 with a butt weld. The girders a are of standard length and section, and may be internally reinforced for example by tubular members a^2: they are assembled in triangular formation as shown in Figure 1 by being secured to bobbins or drums c. As shown in detail in Figures 6 and 7 these consist of circular or other suitably shaped side plates c, connected by two transverse plates c^1 parallel to each other welded or otherwise secured between the side plates. Six holes c^2, c^3 are formed in the side plates, which are spaced at equal angles radially: the two holes c^3 which are intended, when the bobbin is in use, to lie on the horizontal diameter of each side plate, may be formed nearer to the centre of the side plate than the other four holes c^2. These holes receive bolts or pins which pass through the members b in the ends of the girders a. A seventh central hole c^6 in the bobbins or drums will be hereinafter referred to. The side plates of the bobbins are strengthened where the various holes occur by welding thereto, preferably on their inner faces, four bosses c^4, one round each of the upper and lower holes, and a rectangular or other plate c^5 having holes therein corresponding with the holes c^3, c^6. Along the bottoms of the sides of the bridge, floor girder suspension plates d are attached to the bobbins c. These are of inverted U-shape, as shown in Figure 14, drilled for connection to the members c and also having holes in their leg portions for the cross girder connections. For footbridges as shown in Figures 3, 9, 10 and 11, the standard box section girders a are used as cross girders and are attached to the suspension plates d through the medium of box-like cradles e adapted to receive the girders a. For roadway and heavier types of bridge, as shown in Figures 1, 2 and 4, rolled steel joists f are substituted, wing plates g being welded to the webs of the joists for connecting to the suspension plates. To provide for very heavy loading, as shown in Figure 4, one or two additional box section side structures may be provided alongside the original ones at each side of the bridge, connected together by tie bars and distance pieces h through the cen-

tral holes c^6 of the drums or bobbins *c*, and therefore the floor joists *f* are desirably provided with three sets of wing plates *g* at each end as shown in Figure 4, to receive the suspension plates *d* from the three side structures when these are necessary. The ends of the floor joists are drilled for gangway attachments. Heavy bridges or bridges of large spans may have their side structures built up in a double tier, the construction being carrier out by means of the standard drum connections at the intersections of the box section girders. Overhead bracings may be provided. The connecting pins are desirably of one standard pattern throughout, a turned pin with nut and split cotter being suitable. At the sides of wide bridges the box section girders *a*, Figure 4, may be utilised as curbs or fenders, secured to the sides of the bridge by cleats passed through the tubes a^2 in the members *a*. The floor plates *i* are of the same length as the intersections of the girders *a* and of chequered type, having ends and sides flanged downwardly, with stiffeners i^1, Figures 12 and 13, welded on, and they are preferably arranged longitudinally with the span of the bridge. Their ends are stepped for bedding on to the cross-girders *a*, *f*, as shown in Figures 12 and 13, and they fit closely up to the sides of the bridge.

The construction can be adapted to "deck" type spans by simply suspending the cross girders from the top chords of the sides instead of from the bottom chords as in the "through" type hereinbefore contemplated.

In the foregoing description it has been assumed that the box section girder members are of integral construction throughout their length, but this is not necessarily the case; it might be found convenient to make the end parts of the girders separately, and secure them to the main part by any suitable method such as welding. It has also been assumed that the girders are of a rectangular box-section throughout their length, as shown in the drawings; this also is not necessarily the case, since so long as the end parts of the girders are suitable for use as hereinbefore described the shape of the intermediate portion of their length is immaterial.

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

1. In a bridge the combination comprising a plurality of standard girder members assembled in triangular formations, and a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured between said pair of plates, said plates being spaced apart a distance substantially equal to width of a girder member, said spacing members extending transversely in parallel relation between said plates and being spaced apart a distance substantially equal to the thickness of a girder member, said girder members being secured separately between their respective pair of plates.

2. In a bridge the combination comprising a plurality of standard hollow tubular girder members, each of said girder members having a hole adjacent each end thereof, said holes having their axes parallel to one another, said girder members being assembled in triangular formations, a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured in parallel relation between said plates, said plates and said spacing members being spaced apart a distance substantially equal to the width and thickness respectively of a girder member and receiving the end of a girder member between them, each of said plates having holes therein which are spaced at substantially equal angles radially about the centre of the plate, the holes in the two plates being in register, and means passing through the registering holes in the plates and through the holes in the ends of the girder members for securing said girder members to said bobbins.

3. In a bridge the combination comprising a plurality of standard hollow tubular girder members, each of said girder members having a hole adjacent each end thereof, said holes having their axes parallel to one another, said girder members being assembled in triangular formations, a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured in parallel relation between said plates, said plates and said spacing members being spaced apart a distance substantially equal to the width and thickness respectively of a girder member and receiving the end of a girder member between them, each of said plates having holes therein which are spaced at substantially equal angles radially about the centre of the plate, the holes in the two plates being in register, two of said holes in each plate, when said bobbin is in position, being located on a horizontal diameter of their corresponding plate and being nearer to the centre of the side plate than the other holes, and means passing through the registering holes in the plates and through the holes in the ends of the girder members for securing said girder members to said bobbins.

4. In a bridge the combination comprising a plurality of standard hollow tubular girder members, each of said girder members having a hole adjacent each end thereof, said holes having their axes parallel to one another, said girder members being assembled in triangular formations, a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured in parallel relation between said plates, said plates and said spacing members being spaced apart a distance substantially equal to the width and thickness respectively of a girder member and receiving the end of a girder member between them, each of said plates having holes therein which are spaced at substantially equal angles radially about the centre of the plate, the holes in the two plates being in register, each of said plates also having a central hole therein, and means passing through the registering holes in the plates and through the holes in the ends of the girder members for securing said girder members to said bobbins.

5. In a bridge the combination comprising a plurality of standard hollow tubular girder members, each of said girder members having a hole adjacent each end thereof, said holes having their axes parallel to one another, said girder members being assembled in triangular formations, a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured in parallel relation between said plates,

said plates and said spacing members being spaced apart a distance substantially equal to the width and thickness respectively of a girder member and receiving the end of a girder member between them, each of said plates having holes therein which are spaced at substantially equal angles radially about the centre of the plate, the holes in the two plates being in register, two of said holes in each plate, when said bobbin is in position, being located on a horizontal diameter of their corresponding plate and being nearer to the centre of the said plate than the other holes, each of said plates also having a central hole therein, a pair of reinforcing plates, each having holes therein corresponding with the holes on the horizontal diameter and the central hole, said reinforcing plates being secured to said plates, and a plurality of apertured bosses secured one over each of the remaining holes in said plates, said reinforcing plates and bosses being secured to adjacent faces of said plates, and means passing through the registering holes in the plates and through the holes in the ends of the girder members for securing said girder members to said bobbins.

6. In a bridge the combination comprising a plurality of standard girder members assembled in triangular formations of chord and diagonal units, and a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured between said pair of plates, said plates being spaced apart a distance substantially equal to the width of a girder member, said spacing members extending transversely in parallel relation between said plates and being spaced apart a distance substantially equal to the thickness of a girder member, said girder members being secured separately between their respective pair of plates, a plurality of pairs of inverted U-shaped members secured in pairs to some of said bobbin members, a plurality of cradle members secured one between each pair of inverted U-shaped members, and further standard girder members engaging said cradle members and extending transversely across the bridge to act as floor girders.

7. In a bridge the combination comprising a plurality of standard girder members assembled in triangular formations, and a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured between said pair of plates, said plates being spaced apart a distance substantially equal to the width of a girder member, said spacing members extending transversely in parallel relation between said plates and being spaced apart a distance substantially equal to the thickness of a girder member, said girder members being secured separately between their respective pair of plates, a plurality of pairs of inverted U-shaped suspension members secured in pairs to some of said bobbin members, and a plurality of section floor girders arranged transversely across the bridge and carried at opposite ends in pairs of inverted U-shaped members at opposite sides of the bridge.

8. In a bridge the combination comprising a plurality of standard girder members assembled in triangular formations, and a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured between said pair of plates, said plates being spaced apart a distance substantially equal to the width of a girder member, said spacing members extending transversely in parallel relation between said plates and being spaced apart a distance substantially equal to the thickness of a girder member, said girder members being secured separately between their respective pair of plates, a plurality of pairs of inverted U-shaped suspension members secured in pairs to some of said bobbin members, and a plurality of section floor girders arranged transversely across the bridge and carried at opposite ends in pairs of inverted U-shaped members at opposite sides of the bridge, and wing members secured to said floor girders and said suspension plates.

9. In a bridge the combination comprising a plurality of standard hollow tubular girder members, each of said girder members having cutaway side portions adjacent each end thereof, said cutaway portions having their axes parallel to one another, said girder members being assembled in triangular formations, each of said girders being of box-section, a drum located in said cutaway portions, the top and bottom walls of said girder member adjacent the cutaway portions being bent around said drums, a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured in parallel relation between said plates, said plates and said spacing members being spaced apart a distance substantially equal to the width and thickness respectively of a girder member and receiving the end of a girder member between them, each of said plates having holes therein which are spaced at substantially equal angles radially about the centre of the plate, the holes in the two plates being in register, and means passing through the registering holes in the plates and through the drum for securing said girder members to said bobbins.

10. In a bridge the combination comprising a plurality of standard girder members assembled in triangular formations, and a plurality of bobbin members located one at each of the junction points of said girder members, each of said bobbin members consisting of a pair of plates, and a pair of spacing members secured between said pair of plates, said plates being spaced apart a distance substantially equal to the width and thickness respectively of a girder member, said spacing members extending transversely in parallel relation between said plates and being spaced apart a distance substantially equal to the thickness of a girder member, said girder members being secured separately between their respective pair of plates, said girders being of box-section, each end of said girders having a cutaway portion in its side walls, a drum located in said cutaway portions, and top and bottom members extending from each end of said girder members adjacent the cutaway portions, said top and bottom members having their ends bent towards one another around the corresponding drum.

11. A bridge comprising two sides, each side consisting of a plurality of standard box-section girders arranged in triangular formation of chord and diagonal units, each girder including two sides and top and bottom walls, said sides and top and bottom walls being separated from one another adjacent opposite ends of each

girder, said sides having cutaway portions adjacent their ends, a drum being located between each pair of sides in the cutaway portions thereof, the ends of the top and bottom walls being bent around the corresponding drum, a plurality of bobbins located one at each junction point of said girders, each of said bobbin members comprising two circular side plates, and two parallel horizontally located spacing plates secured between said side plates, the spacing between said side plates and said spacing plates being substantially equal to the width and thickness respectively of a girder, the inclined girders being engaged between the side plates, while the horizontally arranged girders fit into the space enclosed by the side plates and the spacing plates, said side plates each having seven registering holes therein, one hole being located centrally of each plate, while the remaining holes are spaced at substantially equal angles radially, securing means passed through the radially spaced holes, the holes in the sides and through the drums, inverted U-shaped suspension plates secured to some of the bobbins, each of said suspension plates having a hole therein, securing means engaging with the holes in the suspension members and bobbins, and a floor structure supported by said suspension plates.

CHRISTOPHER WALTERS.