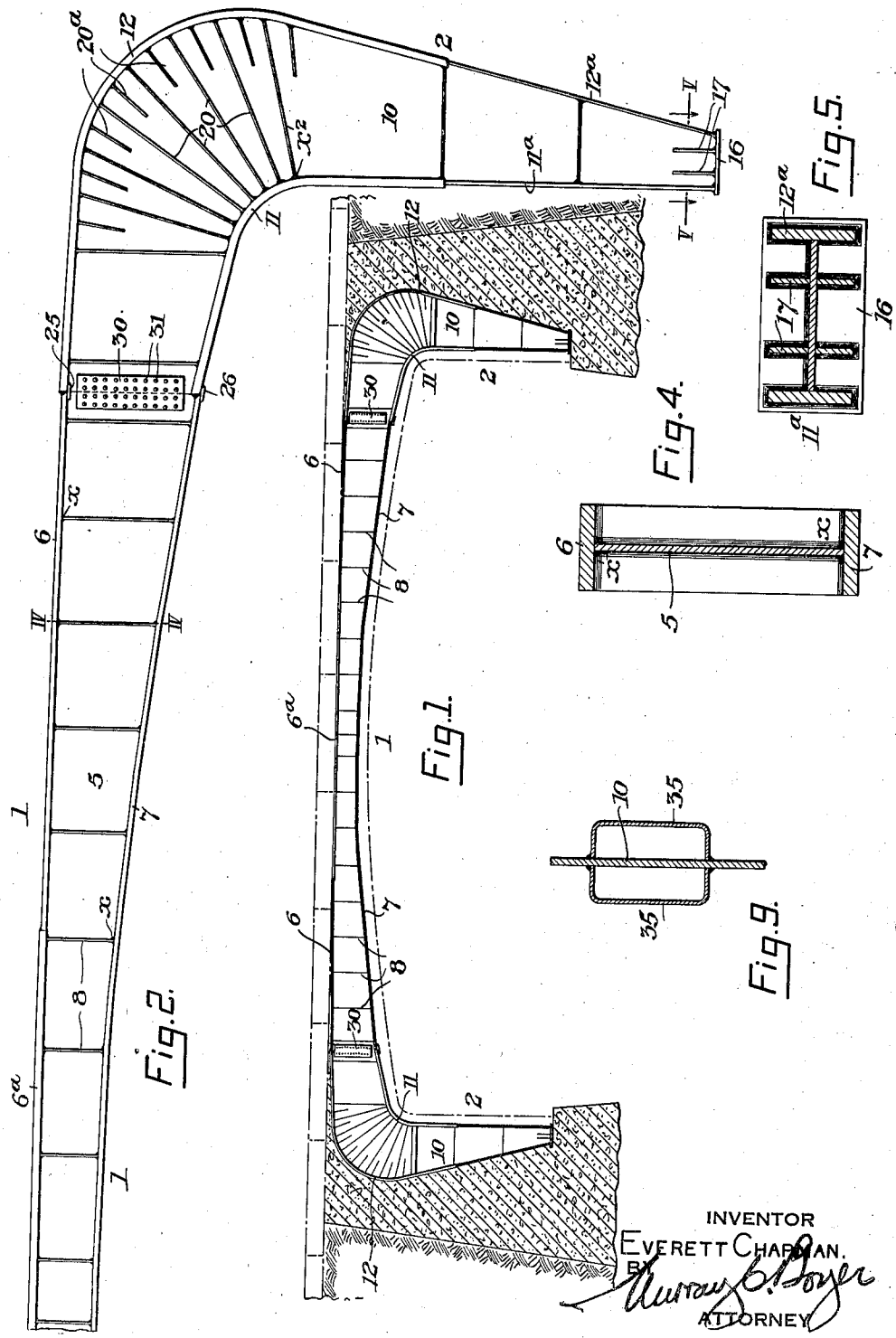
Jan. 4, 1938. E. CHAPMAN 2,104,022

BRIDGE CONSTRUCTION

Original Filed Dec. 14, 1933 3 Sheets-Sheet 1



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BRIDGE CONSTRUCTION

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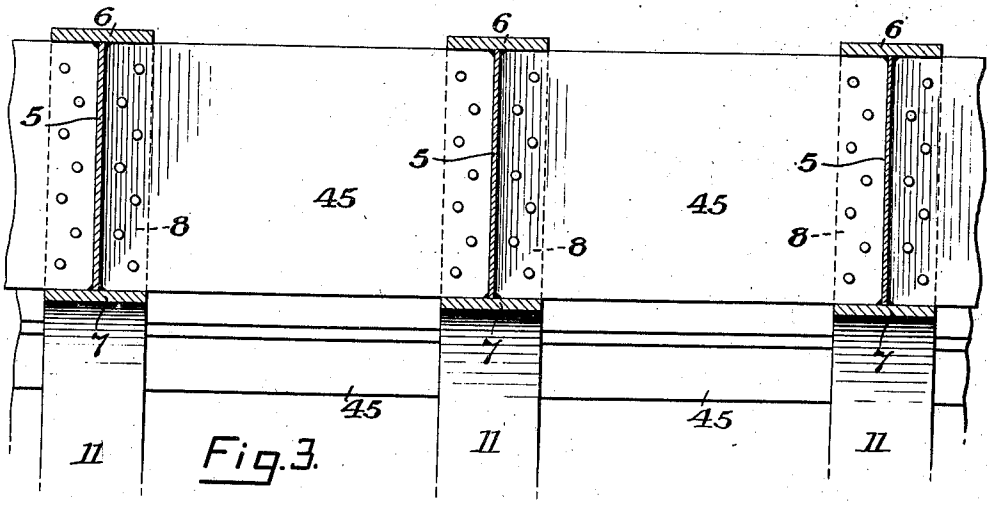


Fig. 3.

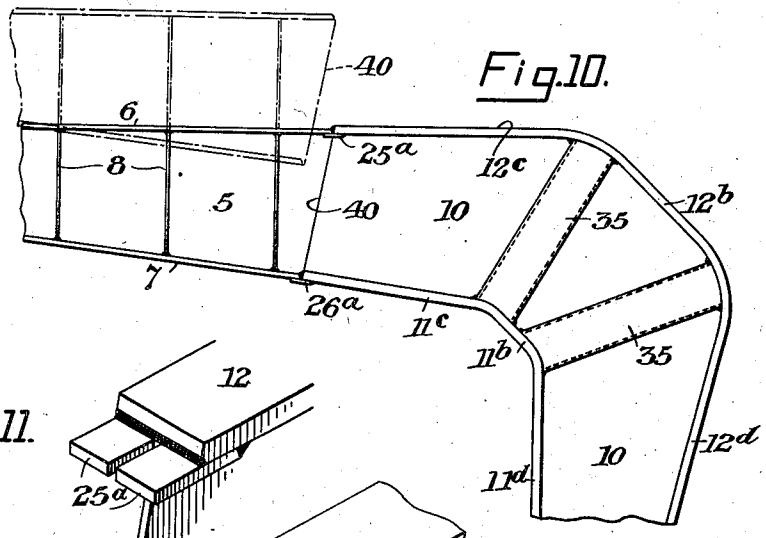


Fig. 10.

Fig. 11.

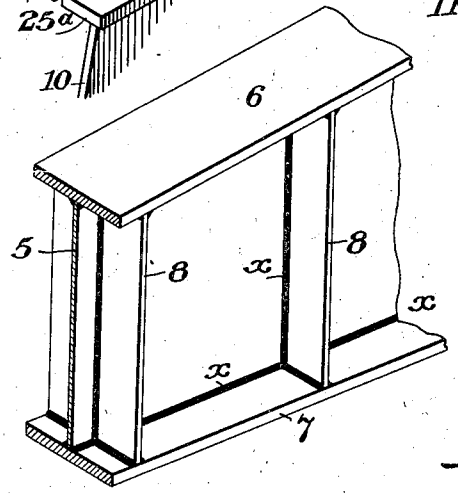


Fig. 6.

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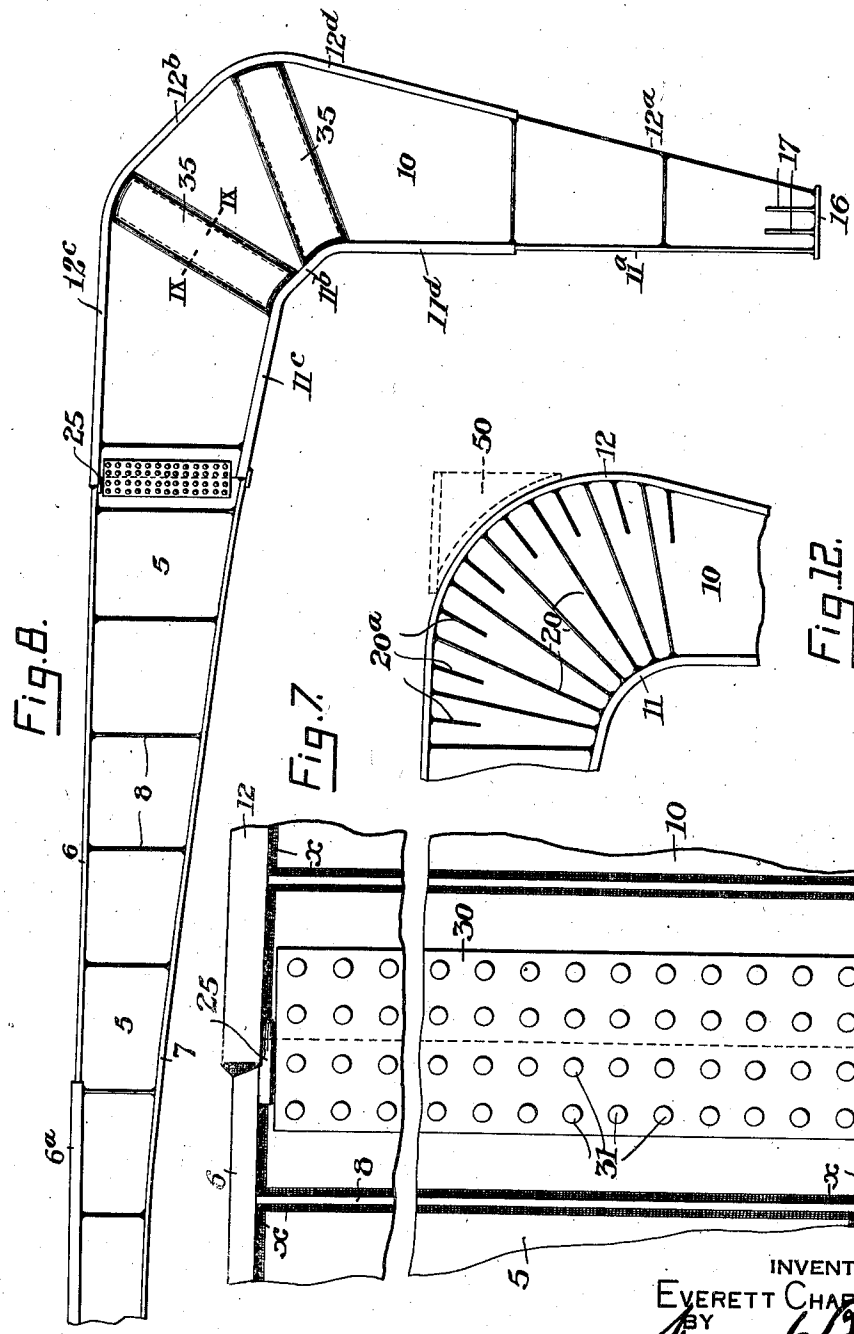


Fig. 8.

Fig. 12.

Fig. 7.

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UNITED STATES PATENT OFFICE

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BRIDGE CONSTRUCTION

Everett Chapman, Coatesville, Pa.

Application December 14, 1933, Serial No. 702,386
Renewed September 8, 1936

13 Claims. (Cl. 14—24)

My invention relates to bridge structures, more particularly those intended for highway use; my present construction involving a metal supporting frame made up of suitably connected unit sections and serving as a continuous truss upon which flooring may be placed, concrete or the like, whereby a suitable roadbed serving as the continuation of a highway, street, or the like, may be provided.

The structure forming the subject of my invention may also be employed in railroad construction with or without a fill of concrete or other material serving as the permanent way and upon which the rails and cross ties may be laid.

My improved construction comprises a series of inherently stable members; each of said members including a relatively light central section made up of a metal plate and other sections which are welded together, with haunches also made of metal plates and other sections welded together. The central section is permanently connected at its ends to said haunches and the whole structure is developed to sustain the required load without, substantially, unequal distribution of stress or substantial vertical deflection of the road bed or other portions of the bridge sections; in other words, a continuously acting structure made up of welded elements.

A further object of my invention is to provide continuous members made up of plate sections and the like, which sections may be of different weights, welded together into unitary elements. Initially each unit of my improved bridge structure comprises two haunch members and an intermediate connecting section welded and/or riveted at its ends to such haunch members.

The bridge structure proper is made up of a plurality of the composite frame sections of the character hereinafter described; such composite frame sections being tied together or stayed by cross members which may be welded, riveted, or otherwise secured to vertical or other members of the composite frame sections in any proper or suitable manner well known to those skilled in the art.

These and other features of my invention are more fully described hereinafter; reference being made to the accompanying drawings in which:

Figure 1 is a view in elevation of one form of bridge unit structure within the scope of my invention.

Fig. 2 is an enlarged view of a part of the structure shown in Fig. 1.

Fig. 3 is a cross sectional view illustrating an assembly of unit bridging elements in a typical bridge structure.

Figs. 4 and 5 are cross sectional views on the lines IV—IV, and V—V, Fig. 2.

Fig. 6 is a fragmentary perspective view illustrating a detail of my invention.

Fig. 7 is a fragmentary view on a larger scale illustrating a detail of the structure shown in Figs. 1 and 2.

Fig. 8 is a view similar to Fig. 2, illustrating a modified haunch construction within the scope of my invention.

Fig. 9 is a cross sectional view on the line IX—IX, Fig. 8.

Fig. 10 is a fragmentary view similar to Figs. 2 and 7, showing a further modification within the scope of my invention.

Fig. 11 is a fragmentary perspective view illustrating a detail of the structure shown in Fig. 10.

Fig. 12 is a fragmentary view illustrating another detail within the scope of my invention.

The object of my invention is to provide a built-up structural unit for bridge construction having a central portion or section providing a substantially flat top, with haunches continuous with the central section or that part of the structure forming such substantially flat top; the whole constructed of plate, sections welded together and developed to take the load stresses without appreciable deformation.

A plurality of such built-up structural units to form a bridge of the desired width, properly tied together, may be embedded in concrete, or in masonry of any description, and such structure may receive a road bed made up of concrete slabs, or a reinforced concrete road surface may be laid upon the same. In lieu of any form of concrete road or floor surface, any other type of floor surface that will function for the desired purpose may be employed; my invention not having to do with the road structure, per se. My improved bridge structure or frame may be covered with masonry of any character, and such masonry may include spandrels of any usual type.

In the drawings, 1 represents the central section of the improved built-up bridge unit embodying my invention, and 2 the buit-up haunch sections at the ends of the central section.

The central section preferably comprises a vertically disposed web 5 cut from a metal plate of suitable thickness, and upper and lower chord members 6 and 7, respectively, of plate metal, to which the vertically disposed plate or web 5 is welded, as indicated at x; said plate 5 being pref-

erably centrally disposed. In addition, vertical stiffening ribs 8 in the form of plate sections laterally disposed with respect thereto are welded to the web 5 and to the flanges of the upper and lower chords 6 and 7. While registering position of these stiffening ribs is preferred, they may be in staggered relation; such arrangement depending somewhat upon the size of the section and the weight of the metal composing the same.

The haunch members 2 are made up of centrally disposed webs in the form of plate elements 10, which may be of the shape indicated in Figs. 1 and 2, or of the shape shown in Figs. 8 and 10. The intrados and extrados portions of the haunches, indicated at 11 and 12, respectively, are in the form of heavy plate sections which may be bent to the contour illustrated and welded at x' to said web members 10; the latter being centrally disposed with respect to the lateral dimensions of the sections forming the intrados and extrados. These plate members or sections 11 and 12 forming the intrados and extrados may be continued in planes tangent to curves of the shoulder portions of such haunches to meet the upper and lower chords of the central section; the extrados being brought to a substanially flat condition in alignment with the upper chord of the central section, while the intrados is continued in such curved and/or angular relation as to bring it into the desired tangential relation to the lower chord of such central section.

The plate or web members 10 taper to foot elements which may include base plates 16, and the flange portions 11^a and 12^a welded to said webs 10 and forming continuations of the intrados and extrados sections 11 and 12. The flange portions 11^a and 12^a may be of lighter metal than the intrados and extrados sections 11 and 12, and they are arranged in converging relation with respect to the web 10; being correspondingly inclined to meet the footing which is relatively short longitudinally of the bridge elements and to which such sections 11^a and 12^a and the lower ends of said webs 10 are welded. Additionally, stiffening buttress ribs 17 may be welded to the foot members and said webs.

In order that the haunches may be strengthened to withstand any flange instability produced by the load on the bridge elements, I provide a plurality of stiffening ribs 20 which extend across the same at the shoulder portions; such ribs being welded at x^2 to such web and to the intrados and extrados plate sections, with short buttress ribs or knees 20^a disposed between said ribs 20.

In the construction of my improved bridge element, I propose to build the central section and the haunch sections as separate pieces in the shop, and to transport the same to the point of erection. In assembling these elements in the field the haunches are set up in their properly aligned position with respect to the gap to be spanned, and the central section is then brought into proper aligned relation therewith; the ends of the web 5 of such central section preferably abutting the ends of the webs 10 of the haunches. To facilitate such assembly, I provide the haunches with small shelf brackets 25 and 26, welded to the under surface of the intrados and extrados sections at the ends of the same, which shelves may be in offset relation vertically so that the central section may drop in place and be supported by such shelf brackets before it is connected with the haunch members. The final connection may be a combined riveted and welded joint.

In the final connection of these parts, the respective webs of the central section 1 and the haunches 2 are held together by tie plates 30, disposed on opposite sides of said webs at their meeting point and secured in place by rivets 31, cold or hot driven, as may be desired. In practice, the central section is mounted in proper position with respect to the haunch members; the webs of both of which have been punched with holes to register with the holes of the tie plates, and a suitable number of temperary bolts are applied to the tie plates 30 to hold the members together while the upper and lower chords of the central section are being welded to the members constituting the intrados and extrados of the haunch members; such welded joints being clearly indicated in Fig. 7. After this welding operation, the temporary bolts may be removed and, if necessary, the holes may be reamed to alignment and the tie plates 30 finally riveted in place; thus completing the bridge element.

It will be understood, therefore, that if the extrados portions of the haunch members are supported in suitable footings and held against any tendency to spring outwardly, no load applied upon the central section within the limit of the structure will appreciably deflect the same. Hence, I have produced a rigid bridge element of superior character and capable of sustaining any load within the limits of the particular construction and in which the elements of the structure are fabricated by welding. Any cross section of the bridge element is so proportioned as to give a reasonable working stress when considered in conjunction with the bending moments, shears, and thrusts, which exist at the section when the whole element is considered to be working as a rigid entity.

It will be noted that the upper chord 6 of the central section is made of plates of different thicknesses; the middle portion 6^a, subject to compression stresses, being thicker than the parts which join such central section to the extrados sections of the respective haunches. In like manner, the shoulder portions of the extrados sections of the respective haunches are much heavier than the plates 11^a and 12^a forming the flange elements continuous therewith, and which extend to the footing of such haunches.

In the form of structure illustrated in Fig. 8, the intrados and extrados sections of the haunches have been given a different contour with a view of economizing in the amount of metal required. The geometrical haunch is cheaper than the curvilinear haunch by reason of the elimination of the necessary radial stiffeners which must be applied to the curvilinear haunch to stabilize the flange members. In this geometrical form, the shoulder portions of the haunches are formed in planes, 11^b and 12^b, and these plane portions merge with other plane portions of the haunches 11^c and 11^d, and 12^c and 12^d, on arcs of suitable radius. In lieu of the stiffening ribs 20, shown in Figs. 1 and 2, I may provide the web 10^a with channel or rib reinforcements 35 which support the extrados at the changes in direction joining the planes which represent changes in contour. The channel or rib reinforcements are preferably disposed on opposite sides of the web in registering relation as indicated, and they are welded to the webs and to the intrados and extrados sections with full section welds. In other respects the form of structure illustrated in Fig. 8 is identical with that shown in Figs. 1 and 2, et seq.

In some instances, it may be desirable to arrange the parts of the bridge units, comprising the central section and the haunches, with a wedge fit and such arrangement is shown in Fig. 10; the ends of the web **5** (one of which is shown) being cut diagonally, as indicated at **40**, with the end of the web **10** complementarily cut so that the central section, in effect forms a keystone. The intrados and extrados members are provided with shelf brackets **25a** and **26a**, welded thereto; the latter being clearly shown in Fig. 11, upon which the ends of the upper and lower chords **6** and **7** may rest during assembly and while these sections are being secured by the tie plates **30**. When finally assembled in completed condition, the chord members are welded to these shelf brackets. By reason of the angularity of the web engagement, the upper shelf brackets **25a** are set back with respect to the lower shelf brackets **26a** so that the central section may drop into place without interference.

It will be understood, of course, that a plurality of the bridge elements in proper spaced relation will be employed in a bridge structure and that such elements will be properly tied by cross members welded, riveted, and/or otherwise secured between their respective webs; Fig. 3 showing a plurality of bridge elements connected by cross members **45**, riveted to the vertical members **8** of the central section.

My improved bridge element may be employed with any form of concrete road construction or the like, with or without the employment of expansion joints. Additionally, I may employ other forms of road elements, and if desired, the shoulders of the haunches may be provided with step brackets, such as indicated by dotted lines at **50**, in Fig. 12, in order that a continuous support may be provided for plate elements or other forms of road surfacing to form the desired roadway.

Various modifications may be made in the above-described embodiment of my invention without departing from the spirit and scope thereof as set forth in the following claims.

I claim:

1. A bridge element comprising a continuous member consisting of a central section and haunches connected thereto in spaced relation and constituting an inherently stable structure; each of said elements comprising a central web in continuous alignment and continuous flange members to which the central webs of said central section and haunches are welded; the central webs of said haunches including substantially horizontal portions aligned with the central web of the central section, and the flange members of said central section forming the upper and lower chords of the central section and being continuous with the flanges forming the intrados and extrados of said haunches, respectively.

2. A bridge element comprising a continuous member consisting of a central section and haunches connected thereto in spaced relation and constituting an inherently stable structure; each of said elements comprising a central web in continuous alignment and continuous flange members to which the central webs of said central section and haunches are welded; the central webs of said haunches including substantially horizontal portions aligned with the central web of the central section, and the flange members of said central section forming the upper and lower chords of the central section and being continuous with the flanges forming the intrados and extrados of said haunches, respectively, and vertical ribs welded to said central web and the flange portions of the central section.

3. A structure such as set forth in claim 1, in which the web of the central section is cut diagonally at its ends to fit complementarily shaped central webs of the respective haunches, aligned with the central web of the central section.

4. A structure such as set forth in claim 1, in which the haunches have integral shoulder portions which extend longitudinally beyond the footings.

5. A structure such as set forth in claim 1, in which the haunches have integral shoulder portions which extend longitudinally beyond the footings; said shoulder portions having curved flanges forming the intrados and extrados thereof, with radially disposed reinforcing elements carried by the webs of said haunches between said flanges.

6. A structure such as set forth in claim 1, in which the haunches have shoulder portions in diagonal planes, with radial reinforcing channel members carried by the webs of said haunches between the intrados and extrados flanges and disposed between the latter at their points of change in direction.

7. A structure such as set forth in claim 1, in which the central section is welded to said haunches; and temporary supporting means secured to the flanges of said haunches for positioning said central section before welding.

8. A structure such as set forth in claim 1, in which the central section is welded to said haunches, temporary supporting means secured to the flanges of said haunches for positioning said central section before welding, and tie plates for the meeting ends of said sections supplementing the welded connection; said tie plates being secured together through the respective central webs of said sections.

9. A bridge structure comprising a plurality of continuous members, each consisting of a central section and haunches connected thereto in spaced relation and constituting an inherently stable element and each of said elements comprising a central web in continuous alignment and continuous flange members to which the central webs of said central section and haunches are welded; the central webs of said haunches including substantially horizontal portions aligned with the central web of the central section, and the flange members of said central section forming the upper and lower chords of the central section and being continuous with the flanges forming the intrados and extrados of said haunches, respectively, and cross members between the webs of said central section for tying the continuous bridge members together.

10. A bridge element consisting of a continuous member comprising a central arched section with a substantially flat upper chord, haunches in spaced relation with respect to said central section and forming a continuation of the arched contour thereof, and connections between said central section and said haunches; the whole constituting an inherently stable structure and each of said elements comprising a central web in continuous alignment and continuous flange members to which the central webs of said central section and haunches are welded; the central webs of said haunches including substantially horizontal portions aligned with the central web of the central section, and the flange members of said central section forming the upper and lower chords of the central section and being continu-

ous with the flanges forming the extrados and intrados of said haunches, respectively.

11. A structure as set forth in claim 10, with ribs, some of which are vertically disposed, arranged at right angles with respect to said central webs and the flange portions of the several sections and welded thereto.

12. A structure as set forth in claim 10, with vertical ribs arranged at right angles with respect to said web and the flange portions of the central section and welded thereto.

13. A bridge structure comprising a plurality of continuous members, each consisting of a continuous member comprising a central arched section with a substantially flat upper chord, haunches disposed in spaced relation with respect to said central section and forming a continuation of the arched contour thereof, connections between said central section and said haunches; the whole constituting an inherently stable structure and each of said elements comprising a central web in continuous alignment and continuous flange members to which the central webs of said central section and haunches are welded; the central webs of said haunches including substantially horizontal portions aligned with the central web of the central section, and the flange members of said central section forming the upper and lower chords of the central section and being continuous with the flanges forming the extrados and intrados of said haunches, respectively, and cross members between the webs of said central sections for tying the plurality of bridge members together.

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