Jan. 4, 1944. J. R. TENCH 2,338,468

CHANNELED GIRDER OR TRUSS

Filed June 19, 1942 2 Sheets-Sheet 1

Fig. 1

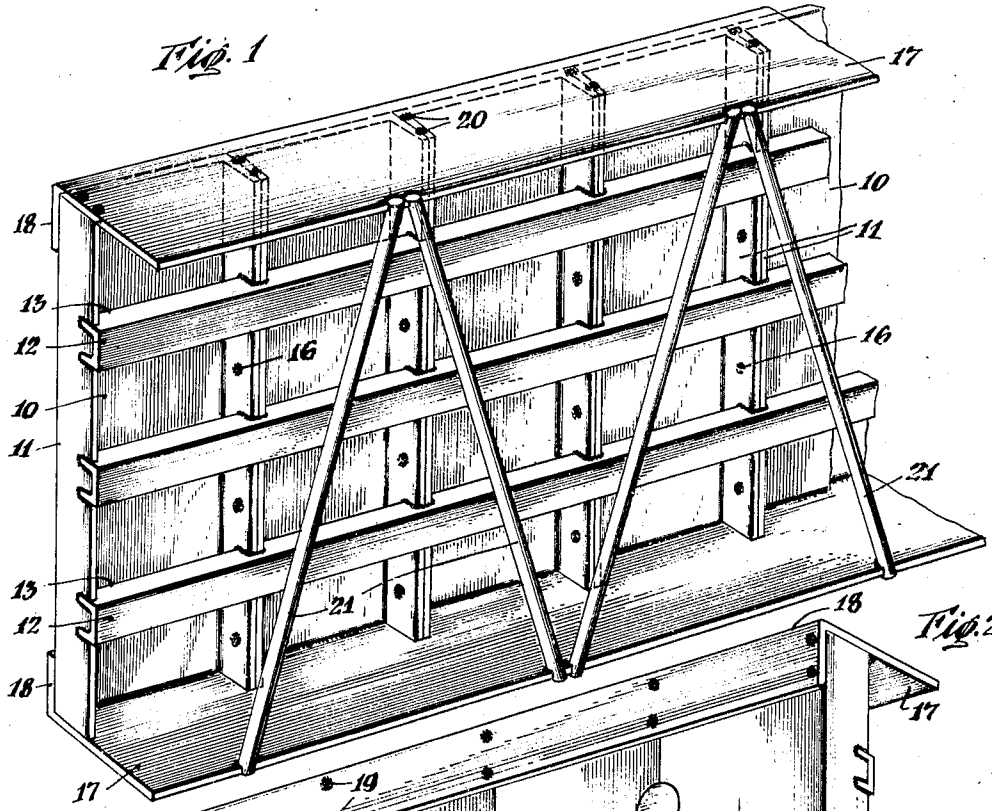
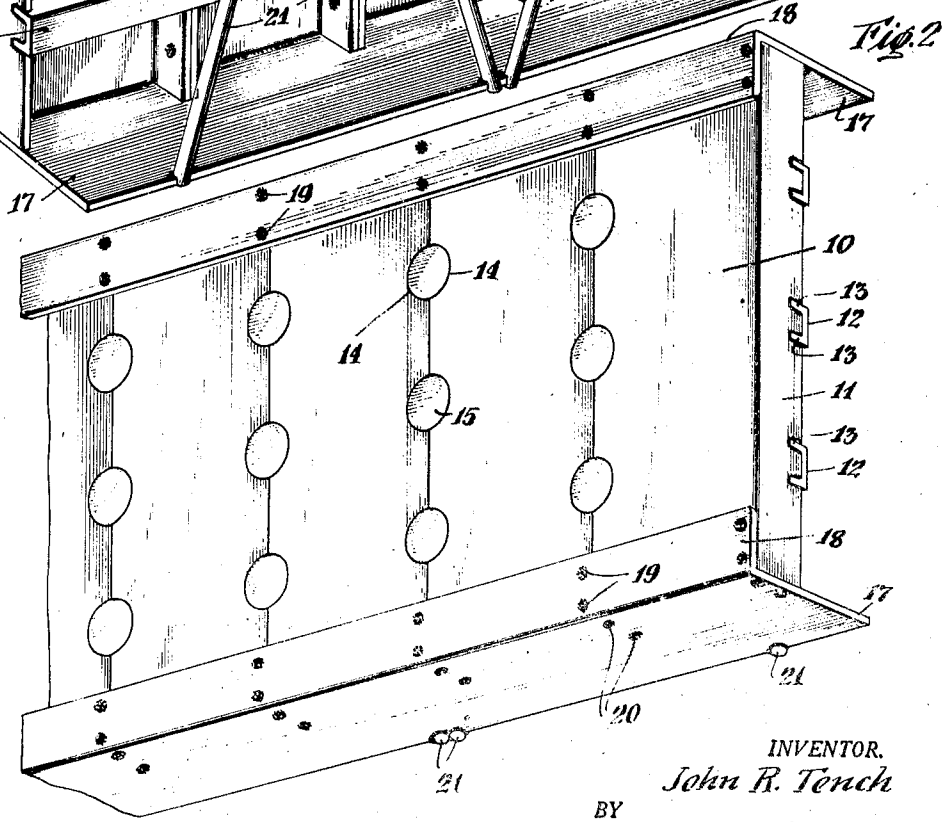


Fig. 2



INVENTOR.
John R. Tench
BY
Townsend & Decker
ATTORNEYS

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Fig. 3

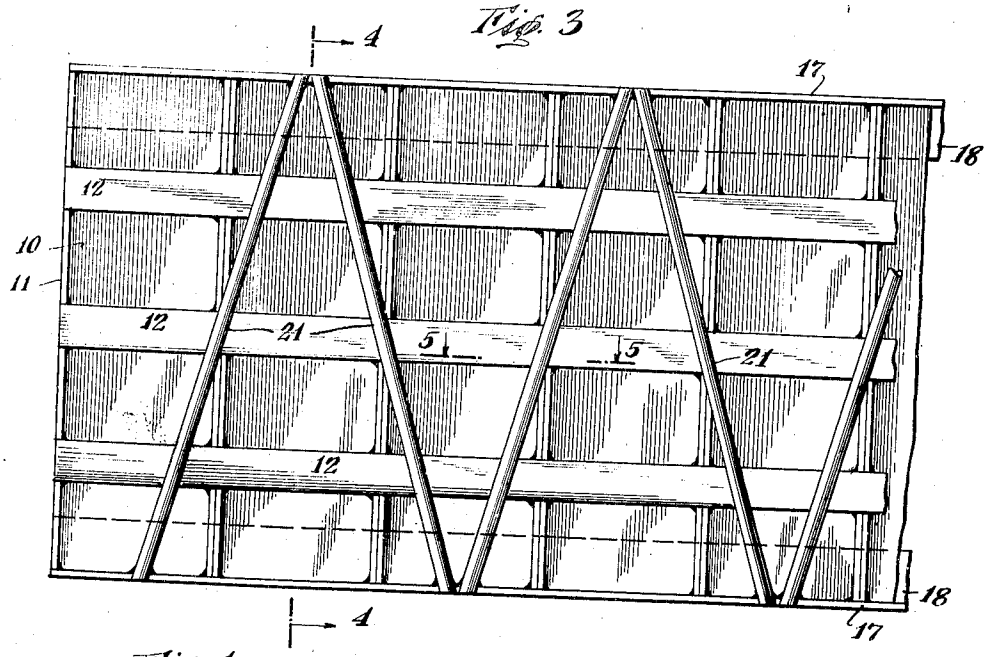


Fig. 4

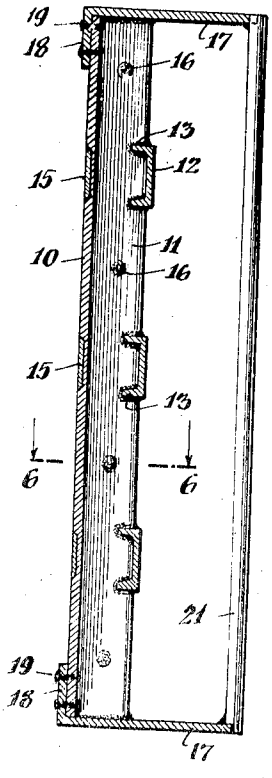


Fig. 5

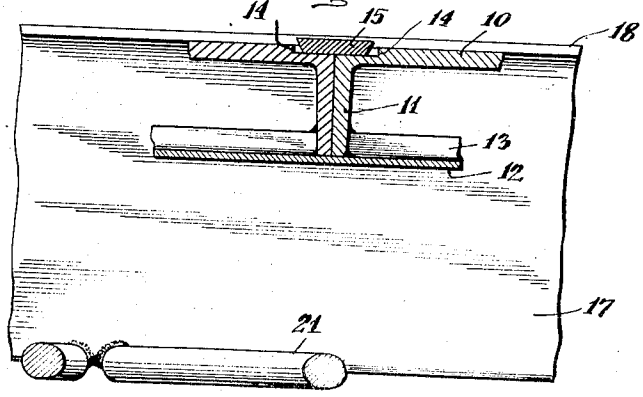
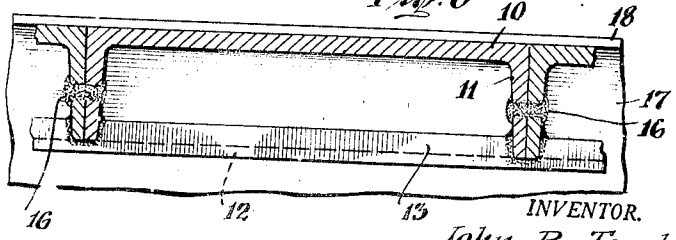


Fig. 6



INVENTOR.
John R. Tench
BY
Townsend & Deckey
ATTORNEYS

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CHANNELED GIRDER OR TRUSS

John R. Tench, Croton on Hudson, N. Y.

Application June 19, 1942, Serial No. 447,641

8 Claims. (Cl. 189—34)

This invention relates to the construction and manner of providing beams, girders, columns, trusses, bridge deckings and analogous structures and particularly those designed and adapted for use in which great strength uniformly distributed throughout its length, rigidity and durability are prerequisites.

The principal object of the invention is the production of a metallic structure of the above character which shall be resistant not only to deforming or bending from forces exerted in the general plane of the structure or concentrated loads applied under compression or impact forces but also resistant to twisting or distortioning by forces exerted in a plane transverse to the general plane of the structure. In other words, the structure of the invention is so designed as to enable it to withstand the destructive effects of both vertical and lateral forces, strains and stresses of whatever nature.

A further object of the invention is the production of a metallic structure having the characteristics recited above and which also shall be constructed preferably of parts or elements of standard size and construction thus permitting the structure to be successfully manufactured with a maximum degree of economy.

Further objects and advantages of the invention will be obvious as the description thereof proceeds, the invention consisting in the details of construction and combinations of parts hereinafter more particularly described and then specified in the appended claims.

In the accompanying drawings illustrating a practical embodiment of the invention:

Fig. 1 is a perspective view looking from the front of the structure of the invention.

Fig. 2 is a rear perspective view thereof.

Fig. 3 is a front elevation of the structure.

Fig. 4 is a vertical cross-section on the line 4—4 of Fig. 3.

Fig. 5 is a fragmentary horizontal section on the line 5—5 of Fig. 3 showing the welding button before it is welded into position, and

Fig. 6 is a fragmentary horizontal cross-section on the line 6—6 of Fig. 4.

The primary supporting element or wall of the structure comprises a plurality of U-shaped channels, preferably conventional rolled channels of standard size and construction, the webs of which are indicated at 10 while the usual flanges or legs thereof, which are integral with the webs, are indicated at 11. These channels are assembled side by side in apposition to each other with a leg or flange of one channel closely engaging a leg or flange of the next succeeding channel and with all of the webs of all of the channels lying in the same plane whereby the wall will be provided with an outer surface substantially smooth and uninterrupted in character. The channels are then rigidly and integrally connected in a manner about to be explained whereby a solid, composite supporting wall of great strength and durability is produced and one which is indestructible and impenetrable for all practical purposes.

The channels comprising the supporting wall or element just described are rigidly connected together to produce an integral structure by spaced, transverse tying members which themselves preferably constitute rolled channels of smaller dimensions than the channels first described. Bars or rods might be employed as alternatives but it is preferred to employ rolled channels because of their inherent strength and rigidity and because they afford a multi-point contact with the edges of the flanges of the first-named channels at their points of intersection. The webs of the said transverse tying channels are indicated at 12 while the free legs or flanges thereof which are integral with the webs are indicated at 13.

The said transverse tying channels are assembled on the channels comprising the supporting wall or element, preferably at equidistantly spaced intervals, with the edges of the flanges of the opposed members engaging each other whereby a four-point engagement is provided at each intersection, as will be manifest. As the edges of the flanges of the opposed channels are of confined or reduced area, an ideal condition is provided for the electric resistance welding process which preferably is practiced in the instant case. Inasmuch as the points of engagement of the opposed members are relatively of small area, the heating electric current is localized thus making a large amount thereof unnecessary and resulting in a considerable saving of expense in the manufacturing operation. Heating electric current is passed through the contacting edges of the flanges of the opposed channels and pressure is simultaneously applied to force the flanges of the tying transverse channels downwardly into and weld them to the opposed flanges of the body channels until the webs of said tying channels preferably engage the upper edges of the flanges of the channels of the supporting wall to produce homogeneous, integral joints between the opposed parts, all as more clearly shown in the

drawings. The four-point contact at each intersection of the opposed members makes for a connection or welded joint therebetween of very great strength, these joints being extremely resistant to any possible tendency of the relative rotation of one member with respect to the other or any possible tendency of one member to become disconnected from the other even though a defective weld may result at any single point of contact between the member.

To prevent any possible spreading of the body channels at their lower meeting edges, that is, the edges which lie immediately adjacent their webs, and to further enhance the strength and rigidity of the entire structure, I provide each body channel, adjacent its lower edge, with a groove 14, preferably of semi-circular configuration, which registers with a correspondingly-shaped groove in the adjacent or next succeeding channel in the series and which forms therewith a circular groove, as illustrated, adapted for the reception of a welding button 15. Said welding button preferably is substantially cone-shaped or tapered and its maximum and upper diameter is such as to enable it to interfit snugly with the circular groove while the diameter of its lower end or the one which bridges the meeting edges of the opposed body channels is somewhat more restricted in size. The said welding buttons 15 have a thickness from top to bottom somewhat greater than that of the circular grooves which receive them to compensate for the loss of metal occasioned by the tapered configuration of the button whereby the grooves will become entirely filled with the metal of the button as the metal fuses when the welding operation proceeds.

The well-known electric resistance welding process preferably is employed for welding the buttons 15 within the grooves described. The buttons are first seated within the grooves, as shown in the drawings, whereby they will bridge or span the meeting edges of the opposed body channels and heating electric current is passed through the buttons and channels while pressure is simultaneously applied to weld the buttons to the channels and within the grooves and thereby securely, rigidly and integrally connect the meeting edges of the body channels together adjacent their webs by integral welds. The tapering of the buttons restricts the area thereof at their points of contact with the body channels which, obviously, localizes the heating electric current and facilitates and expedites the welding operation and effects a saving of the amount of current necessary for its practice. When the welding operation just described is employed, the grooves become entirely filled with the metal of the buttons because of their increased thickness as above referred to. Furthermore, because of the welding of the buttons within the grooves in the manner described, the outer surface of the supporting column or wall of the structure is smooth and uninterrupted in character. For purposes of uniformity of strength and rigidity, it is preferred to stagger the positions of the grooves 14 as respects the positions of the transverse tying channels referred to above.

In some cases, in order to more effectively join or connect the channels constituting the primary supporting element or wall of the structure, it is desirable, as supplementing the tying transverse channels, to weld the flange of one channel to that of the next succeeding channel by electric spot welds indicated at 16. As an alternative, the flanges may be bolted or riveted to each other but welding is preferred as bolting or riveting necessitates a removal of a portion of the metal of the flanges and a consequent weakening of the flanges themselves. Any number of spot welds may be employed as may be found desirable depending on varying circumstances and conditions. Furthermore, by employing electric welds for this purpose, it is possible to utilize channels in which the flanges project from their bases or webs a much less distance than would be required if the fastening were effected by bolts or rivets for the reason that good engineering practice demands the rivet or bolt be set in from the edge of the flange a distance equivalent at least to the diameter of the rivet or bolt whereas when welding is employed, that union may be made very near to, and in fact may embrace, the edge of the flange.

As further necessary elements of the structure of the invention, spaced longitudinals are utilized which embrace, shield and close the ends of the channels constituting the main supporting element or wall and which preferably, and in the embodiment of the invention illustrated, comprise angle members, one leg or flange 17 of which is somewhat elongated and covers and closes the ends of the channels and extends outwardly therefrom, while the other shorter leg or flange 18 of the angle member closely engages the rear side of the supporting wall to which it is secured by spot welds 19. To integrally secure the longer leg or flange 17 to the supporting wall, the flange is welded to the ends of the flanges or legs of the channels comprising said supporting wall by spot welds which are indicated at 20. In both cases the number and location of the electric spot welds employed is entirely discretionary and is dependent entirely on the manner in which the completed structure of the invention is to be utilized. As will be manifest, the longer legs or flanges 17 of the angled longitudinals just described close the ends of the channels of the supporting wall to form open troughs peculiarly adapted for the reception of concrete or for a variety of other purposes which it is unnecessary to catalogue.

To prevent bending or buckling of the free ends of the flanges 17 of the angled longitudinals and to enhance the rigidity and strength of the entire structure, it is preferred to employ struts or braces 21 which are welded, preferably by electric welds, to the free edges of said flanges 17 to securely connect the flanges together. Said struts or braces, by preference, take the form of rods of standard size, easily procurable, and they are diagonally disposed, as shown, with an end of each strut lying adjacent or meeting an end of the adjacent strut and the ends of the struts welded to the edges of the free ends of the flanges 17 of the longitudinals by the electric resistance welding process. The engagement of the edges of the flanges with a circumferential portion of the surface of the rods affords excellent contact points for practicing the process. This pairing and positioning of the struts in the manner explained, in effect, produces tying forked members making the longitudinals particularly resistant to loads applied under compression.

It will be understood that any suitable form of dies, clamps and electrodes or machines or parts thereof may be employed for practicing the electric welding operations described herein and that these form no part of the present invention. It will further be understood that various modifica-

tions may be resorted to without departing from the spirit of the invention as set forth in the appended claims.

The invention claimed is:

1. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therewith, said channels being arranged in apposition to each other with a flange of one channel closely engaging a flange of the next succeeding channel, transversely disposed spaced tying members welded to the free edges of the flanges of said channels, longitudinal members secured to and closing the ends of said channels and extending outwardly beyond the free edges of the flanges of the aforesaid channels and strut members welded to the outwardly extending portions of said longitudinal members and connecting said longitudinal members together.

2. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therewith, said channels being arranged in apposition to each other with a flange of one channel closely engaging a flange of the next succeeding channel, transversely disposed spaced channels each having a web and flanges integral therewith, the flanges of such last-named channels being electrically welded to and within the flanges of said first-named channels with the webs of said last-named channels engaging the edges of the flanges of said first-named channels, longitudinals secured to and closing the ends of said first-named channels to form open troughs and extending outwardly beyond and overhanging said transversely disposed channels and strut members fastened to the overhanging portions of said outwardly extending longitudinals to rigidly connect them together.

3. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therewith, said channels being arranged in apposition to each other in sidewise relation with a flange of one channel closely engaging and integrally united with a flange of the next succeeding channel, oppositely disposed closure members closing the ends of said channels to form open troughs therewith and strut members connecting said closure members together.

4. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therein, said channels being arranged in apposition to each other in sidewise relation with a flange of one channel closely engaging and integrally united with a flange of the next succeeding channel in the series, longitudinals comprising angle members one leg of which engages and is secured to the face of said wall opposed to said flanges while the other leg thereof overhangs and is secured to the ends of said channels to close said ends and provide open troughs with the webs and flanges of said channels and strut members fastened to and rigidly connecting the overhanging flanges of the aforesaid longitudinals.

5. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therewith, said channels being arranged in apposition to each other with a flange of one channel closely engaging a flange of the next succeeding channel in the series, spaced transverse connecting members connecting and integrally united with the flanges of said channels, longitudinals secured to the ends of said channels and overhanging the flanges thereof and the said transverse connecting members and closing said channels at their ends to provide open troughs with the webs and flanges of said channels and paired strut members each pair of which constitutes a fork the ends of which are welded to said longitudinals to rigidly connect them together.

6. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therewith, said channels being arranged in apposition to each other with a flange of one channel closely engaging a flange of the next succeeding channel in the series, spaced transverse tying members welded to the flanges of said channels and having multi-point engagements therewith at their intersections, bridging elements welded to the meeting edges of said channels adjacent their webs, longitudinals secured to the ends of said channels to close the same and to form open troughs with the webs and flanges thereof and strut members rigidly connecting said longitudinals together.

7. A metallic structure including a wall comprising a series of channels each having a web and undeformed flanges integral therewith, said channels being arranged in sidewise relation to each other with a flange of one channel closely engaging the flange of the next succeeding channel to form a series of open double-walled troughs, transversely disposed tying members integral with said channels and welded to and within the free edges of the flanges of said channels by pressure electric resistance welding and longitudinal members comprising angles closely engaging and welded to the ends of the double walls of said troughs and to the outer sides of said webs to assist in holding said channels in close engagement and to close the ends thereof.

8. A metallic structure including a wall comprising a series of channels each having a web and flanges integral therewith provided with free edges, said channels being arranged in apposition to each other in sidewise relation with a flange of one channel closely engaging a flange of the next succeeding channel to form a series of open double-walled troughs, transverse members welded to and within the free edges of the flanges of said channels by pressure electric resistance welding to integrally connect the flanges and transverse members together, preformed connecting elements electrically welded by pressure electric resistance welding to and within the webs and flanges of adjacent channels for integrally uniting the meeting edges of said channels adjacent their webs on the face of said wall opposed to the flanges of said channels, and spaced longitudinals comprising angles closely engaging the ends of said channels and welded to the ends of their webs and to the ends of the double walls of said troughs.

JOHN R. TENCH.