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(54) **Title**: STEEL BEAMS AND RELATED METHODS

(57) **Abstract**: A structural beam includes opposed first and second plates, first and second webs extending between the first and second plates and laser-fused welds connecting the first and second webs to the first and second plates. The first and second plates and first and second webs are stainless steel.

STEEL BEAMS AND RELATED METHODS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 61/050,403, filed on May 5, 2008, the contents of which are hereby incorporated by reference in their entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to steel beams, and more particularly, to stainless steel beams used in connection with poured concrete floor and bridge systems.

BACKGROUND OF THE INVENTION

[0003] Referring to Figure 1, a steel beam 410 has a conventional "I" configuration, with first and second plates 412, 414 separated by a single web 416. This ubiquitous beam design has been extremely popular, in part because I-beams are quickly and easily formed with a hot-rolling process. Despite the success of the beam design, improvements are still possible.

[0004] Also, when beams are used in connection with structural applications requiring the pouring of concrete over beams, or portions thereof,

proper securing and reinforcement of the concrete often dictates the attachment of various attachment hardware to the steel. With non-stainless carbon steel varieties, that are easily welded, such attachment hardware is typically added at a worksite based on requirements of the given application.

[0005] Stainless steel varieties, which are generally harder to weld, do not lend themselves to quick and easy attachment of hardware, rendering attachment time consuming and expensive. Accordingly, stainless steel is underutilized in structural applications where concrete pouring requires such attachments.

SUMMARY OF THE INVENTION

[0006] Based on the foregoing, it is an object of the present invention to provide an improved beam design. It is a further object of the present invention to provide a beam design allowing stainless steel beams to be readily used in concrete pouring applications calling for the use of attachment hardware. It is an additional object of the present invention to provide a beam design, and beam assemblies that allow quick and easy forming of a bridge, walkway or like surface.

[0007] These and other objects, aspects and advantages of the present invention will be better appreciated in view of the drawings and following description of preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1 is an end view of a beam;

[0009] Figure 2 is an end view of beam, according to an embodiment of the present invention;

[0010] Figure 3 is a perspective view of a beam, according to another embodiment of the present invention;

[0011] Figure 4 is an end view of a beam, according to a further embodiment of the present invention;

[0012] Figure 5 is an end view of a beam assembly, according to an additional embodiment of the present invention;

[0013] Figure 6 is an end view of a beam assembly, according to another embodiment of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0014] Referring to Figure 2, according to an embodiment of the present invention, a beam 10 includes opposed first and second plates 12, 14 connected by first and second webs 16, 18. The first and second plates 12, 14 and first and second webs 16, 18 are formed of stainless steel. Joints 20 between the plates 12, 14 and webs 16, 18 are laser-fused welds.

[0015] For a beam of a given overall length, width and height, the dual web 16, 18 design affords greater strength and rigidity than a single web having a mass equal to the combined mass of the webs 16, 18. Consequently, a

reduction in the mass of steel required and/or a reduction in the number of additional supporting structures is achievable.

[0016] Referring to Figure 3, according to another embodiment of the present invention, a beam 110 includes opposed first and second plates 112, 114 connected by first and second webs 116, 118. In the beam 110, the first plate 112 is wider than the lower plate 114. Sidewalls 122 extend upwardly from the first plate 112. The first and second plates 112, 114, first and second webs 116, 118 and sidewalls 122 are formed of stainless steel. Joints 120 between first and second plates 112, 114 and first and second webs 116, 118, as well as between the first plate 112 and sidewalls 122, are laser-fused welds.

[0017] Advantageously, the first plate 112 and sidewalls 122 serve as formwork for concrete 124 poured over the beam 110. Connectors 126 are attached to inner surfaces of the sidewalls 122 and facilitate the retention of rebar 128 within the concrete 124 during pouring. Shear studs 130 attached to the first plate 112 provide additional reinforcement to the concrete 124. Post holders 132 are attached to outer surfaces of the sidewalls 122, and are adapted for insertion of railing posts therein. Attachments between the connectors 126, post-holders 132 and sidewalls 122, as well as between the shear studs 130 and first plate 112, are laser-fused welds. The connectors 126, shear studs 130 and post-holders 132 are formed of stainless steel.

[0018] Accordingly, forming a bridge or walkway with the beam 110 is readily accomplished. The beam 110 is completely formed, with connection of plates 112, 114 and webs 116, 118, as well as attachment of connectors 126,

shear studs 130 and post holders 132, completed before the beam 110 is shipped to the desired site. Rebar 128 can be secured to the connectors 126 at the site or also installed earlier. At the site, the beam 110 is simply secured in the desired position, concrete 124 is poured and allowed to cure. Railings are inserted into the post holders 132, if desired.

[0019] From the foregoing, it will be appreciated that a beam 110 according to the present invention allows for quick and easy formation of a walkway or bridge. Advantageously, little or no welding or erection of formwork is required at the desired site.

[0020] Referring to Figure 4, according to a further embodiment of the present invention, a beam 210 includes opposed first and second plates 212, 214 connected by webs 216 and 218. The first plate 212 is wider than the second plate 214. Diagonal webs 240 extend between respective edges of the first and second plates 212 and 214. Diagonal webs 240 supply additional support to the extended edges of the first plate 212. Joints 220 are laser-fused welds. The first and second plates 212, 114, first and second webs 216, 218, sidewalls 222 and diagonal webs 240 are formed of stainless steel.

[0021] As with the beam 110, the beam 210 can also include sidewalls 222 extending upwardly from the edges of the first plate 12, as well as connectors 226, shear studs 230 and post holders 232, to facilitate forming a bridge or walkway on the beam 210.

[0022] Referring to Figure 5, according to an additional embodiment of the present invention, a beam assembly 300 includes a pair of beams 310 extending

approximately in parallel. The beams 310 are formed substantially similarly to the beams 10 and 110, with first and second plates 312, 314 connected by first and second webs 316, 318. The beams can also include diagonal webs 340 like the beam 210.

[0023] Each beam 310 includes one sidewall 322 extending upwardly from its respective first plate 312. The beams 310 are arranged approximately in parallel such that the respective first plates 312 are approximately coplanar and the edges with sidewalls 322 are more distant from each other. A corrugated support 350 is arranged between the sidewalls 322 and extends between the beams 310. Concrete 324 is poured over the corrugated support 350 between the sidewalls 322.

[0024] Advantageously, the beam assembly 300 allows formation of a bridge or walkway having a width appreciably greater than a single beam 310. The beams 310 can also include connectors, shear studs, post holders and the like to facilitate formation of the bridge or walkway.

[0025] Referring to Figure 6, according to another embodiment of the present invention, a beam assembly 400 includes a beam 410 that is connected to one or more additional beams (not shown), for instance, as in the beam assembly 300 (see Figure 5). Plates 460 are connected, preferably by laser-fused welds, to web 418 and diagonal web 440. Plates 460 allow the connection of cross-framing 462 to the beam 410 to add additional lateral stiffness to the beam assembly 400. The cross-framing 462 can be attached to the plates 460 using, for example, bolts, rivets or the like. The cross-framing 462 shown is

generally indicative of cross-framing and does not necessarily limit the invention to a particular cross-framing configuration or manner of attachment.

[0026] The above embodiments are described to illustrate various objects, aspects and advantages of the present invention, and do not necessarily limit the present invention. Instead, those skilled in the art will appreciate that numerous modifications, and adaptations to particular circumstances, fall within the scope of the present invention.

[0027] For example, the present invention is not necessarily limited to the use of stainless steel in forming various components of the beams 10, 110, 210, 310 and 410. However, the use of stainless steel is highly advantageous. For instance, with the use of stainless steel, beams according to the present invention, as well as bridges or walkways formed according to the present invention, are suitable for use in highly corrosive environments. Examples of highly corrosive environments include chemical plants, desalinization plants and wastewater treatment plants. Also, stainless steel bridges or walkways according to the present invention are particularly suitable over roadways and near beaches.

[0028] Additionally, stainless steel is more difficult to weld than non-stainless carbon steel varieties. Accordingly, welded attachment hardware for stainless steel beams, such as connectors, shear studs and the like were not employed in connection with stainless steel beams. The present invention greatly facilitates the use of such connections with stainless steel construction.

[0029] Furthermore, the present invention is not necessarily limited to the connectors, shear studs, post holders or other attachment hardware shown and described, nor is such hardware required for every application. Those skilled in the art will appreciate that use of this and other attachment hardware falls within the scope of the present invention.

[0030] Also, the present invention is not necessarily limited to laser-fusion welding, although this type of welding has been found to greatly facilitate formation of the joints shown herein. Moreover, current hot rolling techniques are not sufficient to form a beam having a double web design.

[0031] The foregoing is not an exhaustive list of modifications or adaptations. Rather, those skilled in the art will appreciate that these and other modifications and adaptations are possible within the scope of the invention as herein shown and described.

What is claimed is:

1. A structural beam comprising:

opposed first and second plates;

first and second webs extending between the first and second plates;

laser-fused welds connecting the first and second webs to the first; and second plates;

wherein the first and second plates and first and second webs are stainless steel.

FIG. 1

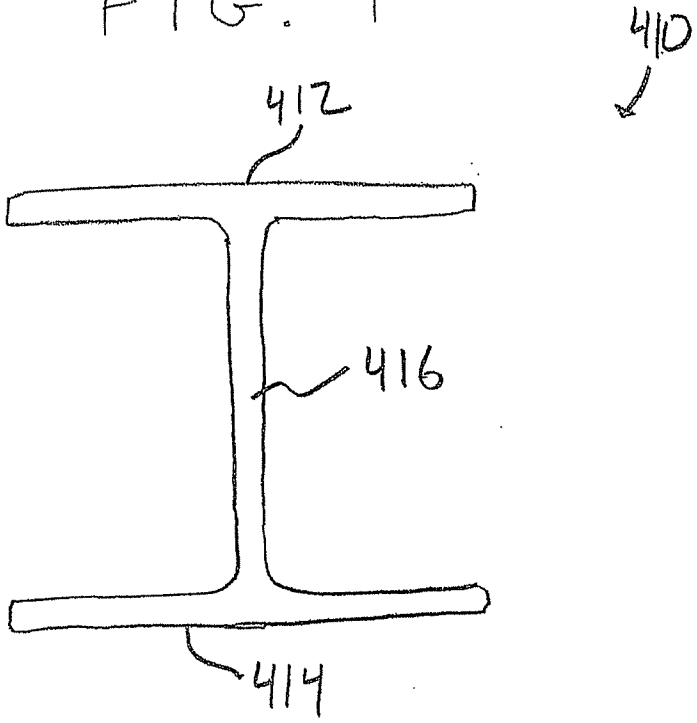


FIG. 2

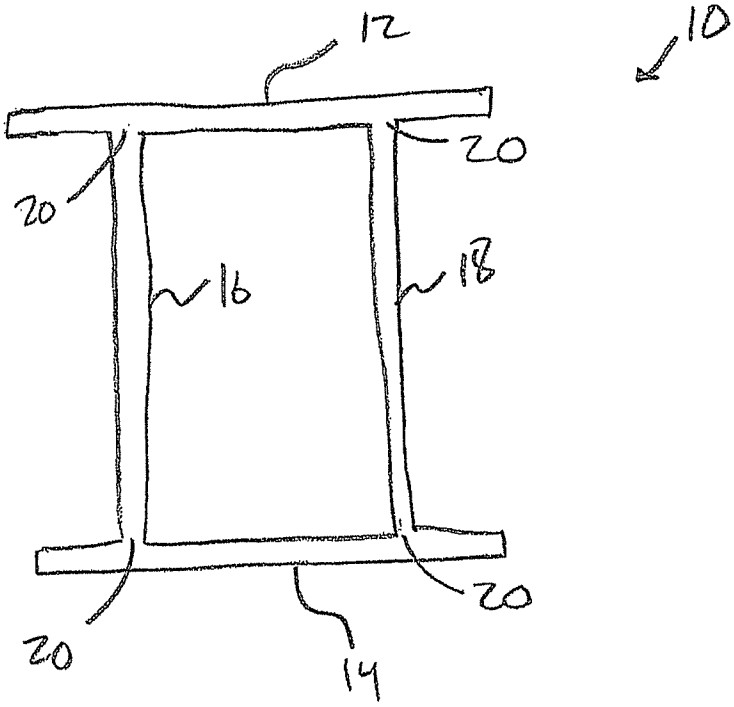


FIG. 3

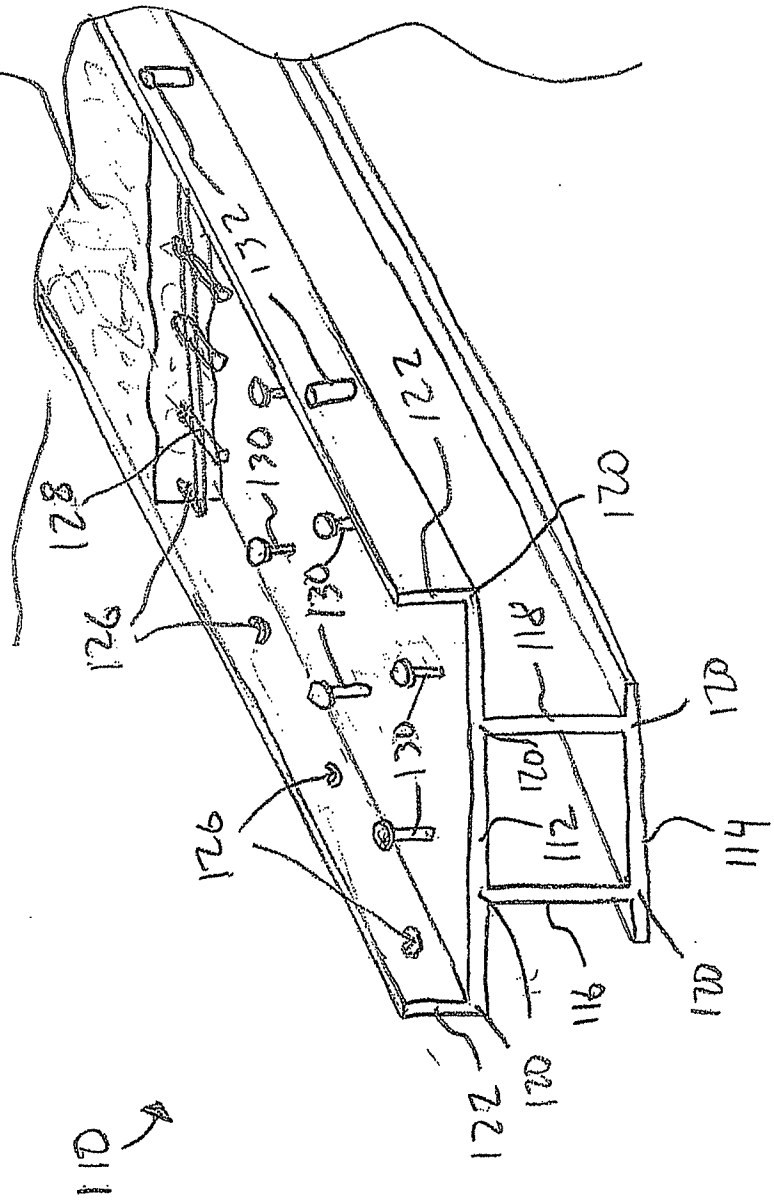


FIG. 4

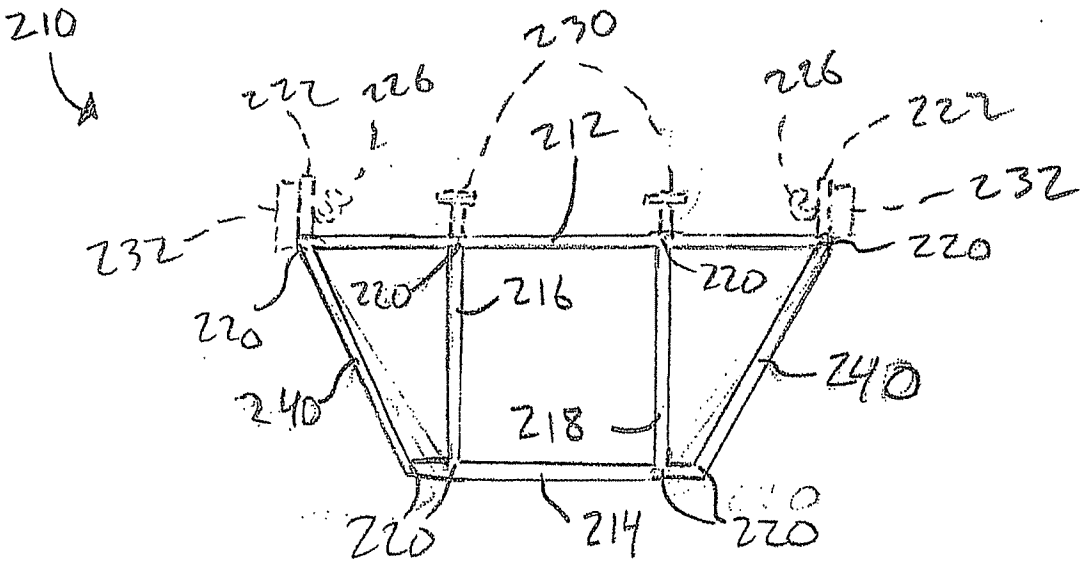

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FIG. 5

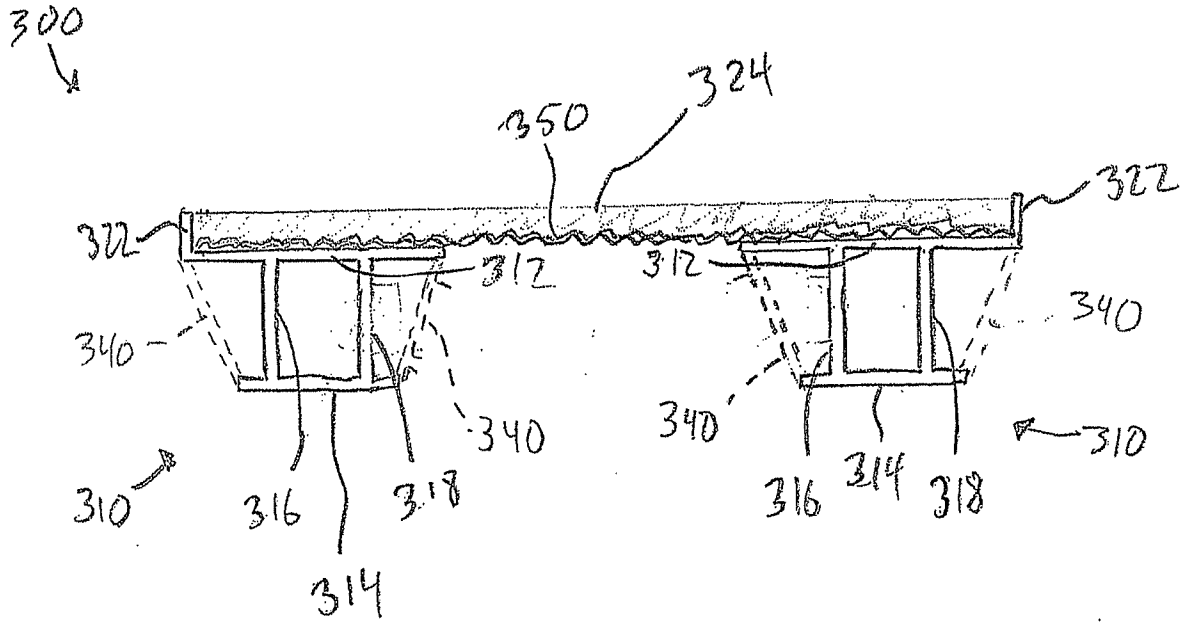

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FIG. 6

