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(54) **Connector**

(57) The present invention relates to a connector for use in fastening a first component having a slot at an end surface thereof to a second component. The connector comprises at least one fastening flange for affixing, in use, the connector to the second member, and an attachment web arranged substantially perpendicular to the at least one fastening flange for affixing, in use, the connector to the first member. The at least one fastening flange comprises at least two slots each for receiving, in use, the shank of a fastener. The at least two slots permit, in use, rotation or twisting of the connector about its fastening flange to effect installation of the connector such

that the shanks of at least two fasteners move from a first connector insertion position where the shank of each of the at least two fasteners passes through a slot and is out of the plane of the attachment web to a second connector located position where the shank of each of the at least two fasteners passes through a slot and is in the plane of the attachment web.

The present invention also relates to a connector assembly comprising the connector and two or more mechanical fasteners, and to a connection between a first component and a second component formed using the connector.

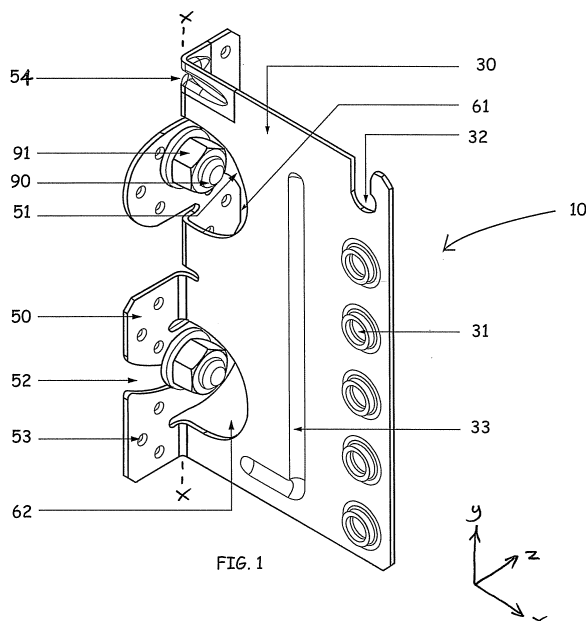


FIG. 1

Description

[0001] The present invention relates to a connector, preferably of thin sheet metal, and in particular to a connector for the concealed joining of a first component such as a beam or a post to a second component made of wood or another material. The present invention also relates to a connection formed using the connector, and to a method forming a connection using the connector.

[0002] The connector according to the present invention has particular utility as a concealed beam attachment or a post foot, and comprises a planar attachment web provided with through holes which is to be received in a slot, generally in the end surface of the first, typically wooden, component to be attached. The planar attachment web is also provided with, or is capable of having formed in it, one or more apertures dimensioned to receive the head of fasteners protruding from the second element. The connector is first fastened to the second component, and then fastened to or configured to hold the first component with fasteners such as dowels or the like which, in use, extend through the through holes of the connector. The connector further comprises one or more fastening flanges which, in use, are generally bent 90 degrees out of the plane of the attachment web and configured integrally with the attachment web. The fastening flange or flanges comprise one or more slots dimensioned to receive the shank of the one or more fasteners protruding from the second component, so as to permit rotation or twist of the connector from a first connector insertion position where the shank of each fastener protruding from the second component passes through a slot and is out of the plane of the attachment web to a second connector located position where the shank of each fastener protruding from the second component passes through a slot and is in of the plane of the attachment web.

[0003] In timber construction, for example, a concealed joint is understood to be a joint in which the first timber component (or "joining element") is at least substantially surrounded by other timber components. In a completely concealed joint, in which even the receiving slot is not visible externally, the slot is configured not as a continuous slot but as a "blind slot" in order to weaken the first timber component as little as possible and to prevent the slot from being visible after assembly. Available for this purpose are "keyway cutters". Alternatively, continuous slots are cut, generally with a circular saw, into the end surface of a beam.

[0004] Connectors known in the art are generally no more than 1 mm less than the slot width in which they are to be received in order to prevent the attachment web from "wobbling" in the slot. Accordingly, the sheet thickness of such connectors has previously been up to at least 6 mm. This gives rise to a requirement for an unnecessary use of raw material, and it is also known that thicker sheets are more difficult and complex to work. It is therefore desirable to reduce significantly the material

thickness of the type of connectors under discussion here, and embody them, for example, with a sheet thickness of only up to 3 mm. However, in turn, this limits the load capacity of known connectors and can complicate the assembly and number of parts required to achieve the connection.

[0005] For example, DE 9001067 discloses a connector formed from a thin sheet approximately 3 mm thick, and provides its attachment web with formed embossment knobs or beads whose height is substantially equal to the slot width of the first timber component being attached. Although the risk of wobbling in a slot at least twice as wide can be reduced with a fitting of this kind, nevertheless with such thin sheet metal the number of through holes, and the number of fasteners to be installed in them, must be correspondingly large, since otherwise the permissible hole face pressure in the through holes will be exceeded. Also, the load capacity is limited as the fasteners in the second component cannot be aligned in the plane of the attachment web.

[0006] In US 5896721, the fasteners in the second component can be aligned in the plane of the attachment web, but to achieve this requires a significant number of parts. This makes the connector cumbersome and requires manual dexterity and accuracy for an installation to achieve its design load capacity. However, incorrect installation of one or more of the parts can result in significant reduction of load capacity.

[0007] The present invention addresses these known limitations of prior art connectors.

[0008] The present invention is a one-piece connector, made in particular of thin sheet metal, in which the disadvantageous effects described above do not occur even under extreme stresses that lie within the allowable range. In addition, the present invention provides a joining element which is suitable not only as a fitting for concealed attachment of a beam, but also as a post foot.

[0009] In a first aspect, the present invention provides a connector as set forth in claim 1.

[0010] Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a connector according to a first preferred embodiment of the present invention;

Figures 2a to 2c are schematic views of an installation sequence to achieve a connection using the connector of Figure 1;

Figure 3 is a schematic plan view from above of the connector of Figure 1 used to achieve a first connection configuration between a joist and a header beam;

Figures 4a to 4e are schematic views of the means of connection between the connector of Figure 1 and the first component of Figure 3;

Figure 5 is a schematic plan view from above of the connector of Figure 1 used to achieve a second con-

nection configuration between a joist and a header beam;

Figure 6a and 6b illustrate schematically the different load transmission pathways in a connector according to the present invention and a prior art connector; Figure 7 is a schematic side elevation view of a connector according to a second preferred embodiment of the present invention in its flat form configuration before its fastening flange is folded and bent out of the plane of the attachment web;

Figures 7a to 7f are schematic views of an installation sequence to achieve a connection using the connector of Figure 7; and

Figure 8 is a schematic side elevation view of a connector according to a third preferred embodiment of the present invention in its raw flat form configuration before its fastening flange is folded and bent out of the plane of the attachment.

[0011] Referring first to Figure 1, there is shown a schematic perspective view of a connector 10 according to a first preferred embodiment of the present invention. The connector 10 is a single cut sheet element for concealed joining of a first component 60, such as a timber beam or a post, to a second component 80, which may be for example a timber beam or joist extending perpendicularly therefrom (see Figure 3). Alternatively, the connector 10 may, for example, be a foundation (affixed to the floor or other substructure) on which a post is to be supported (not shown).

[0012] Connector 10 has an attachment web 30, provided with through holes 31, and a locating slot 32, which in the depiction of Figure 1 has been folded about a bend line x-x so as to form a fastening flange 50 arranged substantially perpendicular thereto. An embossment 33 is provided to add strength and to help take up the space of the slot in order to prevent the attachment web 30 from "wobbling" in the slot. The fastening flange 50 comprises two slots 51, 52 each dimensioned to receive the shank of respective bolts 90 protruding from the second component (not shown), so as to permit rotation or twist of the connector 10 from a first connector insertion position where the shank of each bolt 90 protruding from the second component passes through the slot 51, 52 and is out of the plane x-y of the attachment web 30, to a second connector located position where the shank of each bolt 90 protruding from the second component passes through a slot 51, 52 and is in of the plane x-y of the attachment web 30, as shown. The attachment web 30 is also provided with, or is capable of having formed in it, two apertures 61, 62 dimensioned to receive the nuts 91 used with bolts 90. Fastening flange 50 is provided with optional through holes 53 for fasteners (e.g. nails), and a strengthening embossment 54 is provided which traverses the bend line x-x between attachment web 30 and fastening flange 50.

[0013] The embossments 33 and 54 provided on attachment web 30 are features known in the art from DIN

6932. One bead of embossment 33 runs parallel to fold or bending line x-x, and a further bead parallel to an edge.

[0014] Figures 2a to 2c are schematic views of an installation sequence to achieve a connection using the connector of Figure 1. Two bolts 90 are arranged in line in a substantially vertical spaced relationship so as to protrude from the second component (not shown). A nut 91 is provided on each bolt 90 and serves to provide a head behind which the sheet material of the connector 10 can be received. Connector 10 is offered up to a surface of the second component in a slanted from vertical orientation, as illustrated in Figure 2a, and inserted between the bolts 90 as illustrated in Figure 2b. When the connector 10 is rotated or twisted as indicated by the arrows, the bolts 90 enter the respective slots 51, 52 of the fastening flange 50. Once in a vertical orientation, as illustrated in Figure 2c, the fastening flange 50 is retained behind respective nuts 91 which are then tightened. Optional fasteners (e.g. nails) may then be employed using through holes 53. Next, with reference to Figures 3 and 4a to 4e, attachment web 30 is inserted into a slot 82, generally on the end surface, of the first component 80 to be attached (depicted in certain Figures only for clarity), and fastened or held therein with fastening means such as dowels 95 or the like, which when installed extend through locating slot 32 and through holes 31.

[0015] All through holes 31 of attachment web 30 are crimped over at their edges. In Figure 4e, the crimped sections of through holes 31 are denoted by the depth L which is shown proportionately to the thickness of material used for the connector 10.

Figure 5 is a schematic plan view from above of the connector of Figure 1 used to achieve a second connection configuration between a joist and a header beam, and in particular depicts a fully concealed connection.

Figure 6a and 6b illustrate schematically the different load transmission pathways in a connector according to the present invention (Figure 6a) and a prior art connector (Figure 6b).

[0016] Referring next to Figure 7, there is shown a schematic side elevation view of a connector 110 according to a second preferred embodiment of the present invention in its flat form configuration before its fastening flange 150 is folded and bent out of the plane of the attachment web 130. The connector 110 is again a single cut sheet element for concealed joining of a first component 60, such as a timber beam or a post, to a second component 80, which may be for example a timber beam or joist extending perpendicularly therefrom (see Figures 7e and 7f). Alternatively, the connector 110 may, for example, be a foundation (affixed to the floor or other substructure) on which a post is to be supported (not shown).

[0017] Connector 110 has an attachment web 130, provided with through holes 131, and a locating slot 132.

The attachment web 130 will be folded about a bend line x-x so as to form a fastening flange 150 arranged substantially perpendicular thereto. An embossment 133 is provided to add strength and to help take up the space of the slot in order to prevent the attachment web 130 from "wobbling" in the slot. The fastening flange 150 comprises two enclosed slots 151, 152 each dimensioned to receive the shank of respective bolts 190 protruding from the second component (not shown), so as to permit rotation or twist of the connector 110 from a first connector insertion position where the shank of each bolt 190 protruding from the second component passes through the enclosed slot 151, 152 and is out of the plane x-y of the attachment web 130, to a second connector located position where the shank of each bolt 190 protruding from the second component passes through the enclosed slot 151, 152 and is in of the plane x-y of the attachment web 130. The attachment web 130 is also provided with, or is capable of having formed in it, two apertures 161, 162 dimensioned to receive the nuts 191 used with bolts 190. Fastening flange 150 is provided with optional through holes 153 for fasteners (e.g. nails), and a strengthening embossment (not shown) may be provided which traverses the bend line x-x between attachment web 130 and fastening flange 150 (see Figure 7d).

[0018] Figures 7a to 7f are schematic views of an installation sequence to achieve a connection using the connector of Figure 7. Two bolts 190 are arranged in line in a substantially vertical spaced relationship so as to protrude from the second component (not shown). A nut 191 is provided for each bolt 190 and later serves to provide a head behind which the sheet material of the connector 110 can be received. Connector 110 is offered up to a surface of the second component in a slanted from vertical orientation, as illustrated in Figure 7a, and inserted over the bolts 190 as illustrated in Figure 7a. Nuts 191 are then affixed to each bolt 190 to prevent withdrawal of the connector 110. When the connector 110 is rotated or twisted as indicated by the arrows in Figure 7c, the bolts 190 enter the respective vertically extending portions of enclosed slots 151, 152 of the fastening flange 150. Once in a vertical orientation, as illustrated in Figure 7c, the fastening flange 150 is retained behind respective nuts 191 which are then tightened. Optional fasteners (e.g. nails) may then be employed using through holes 153. Next, with reference to Figures 7e and 7f, attachment web 130 is inserted into a slot 182, generally on the end surface, of the first component 180 to be attached (depicted partially in Figure 7e for clarity), and fastened or held therein with fastening means such as dowels 195 or the like, which when installed extend through locating slot 132 and through holes 131.

[0019] Referring next to Figure 8, there is shown a schematic side elevation view of a connector 210 according to a third preferred embodiment of the present invention in its raw flat form configuration before its fastening flange 250 is folded and bent out of the plane of the attachment web 230. The connector 210 is again a single

cut sheet element for concealed joining of a first component 60, such as a timber beam or a post, to a second component 80, which may be for example a timber beam or joist extending perpendicularly therefrom. Alternatively, the connector 210 may, for example, be a foundation (affixed to the floor or other substructure) on which a post is to be supported (not shown).

[0020] Connector 210 has an attachment web 230, provided with through holes 231, and a locating slot 232. The attachment web 230 will be folded about a bend line x-x so as to form a fastening flange 250 arranged substantially perpendicular thereto. An embossment 233 is provided to add strength and to help take up the space of the slot in order to prevent the attachment web 230 from "wobbling" in the slot. The fastening flange 250 comprises one enclosed slot 251 and one open slot, 252 each dimensioned to receive the shank of a fastener. In particular, a bolt 290 is received in enclosed slot 251, and a nail or other suitable fastener 295 is received in open slot 252, both fasteners protruding from the second component (not shown), so as to permit rotation or twist of the connector 210 from a first connector insertion position where the shank of bolt 290 and fastener 295 protruding from the second component pass through the slots 251, 252 and out of the plane x-y of the attachment web 230, to a second connector located position where the shank of bolt 290 and fastener 295 protruding from the second component pass through the slots 251, 252 and in the plane x-y of the attachment web 230. The attachment web 230 is also provided with, or is capable of having formed in it, an aperture 261 dimensioned to receive the nut 291 used with bolt 290. Fastening flange 250 is provided with optional through holes 253 for fasteners (e.g. nails), and a strengthening embossment (not shown) may be provided which traverses the bend line x-x between attachment web 230 and fastening flange 250.

[0021] The installation sequence is similar to that described above to achieve a connection using the connector of Figure 7. A bolt 290 and a fastener 295 are arranged in line in a substantially vertical spaced relationship so as to protrude from the second component (not shown). A nut 291 is provided for bolt 290 and later serves to provide a head behind which the sheet material of the connector 210 can be received. Connector 210 is offered up to a surface of the second component in a slanted from vertical orientation and inserted over the bolt 290 and fastener 295. A nut 291 is then affixed to bolt 290 to prevent withdrawal of the connector 210. Connector 210 is then rotated or twisted about fastener 295 and bolt 290 enters the vertically extending portion of enclosed slot 251 of the fastening flange 250. Once in a vertical orientation, the fastening flange 250 is retained behind respective nut 291 and head of fastener 295 which are then tightened or inserted further as appropriate. Optional fasteners (e.g. nails) may then be employed using through holes 253. Next, attachment web 230 is inserted into a slot 282, generally on the end surface, of the first component to be attached, and fastened or held therein with

fastening means such as dowels 295 or the like, which when installed extend through locating slot 232 and through holes 231.

[0022] As is already apparent from the foregoing, the connector 10, 110, 210 according to the present invention can be used not only as a perforated sheet-metal fitting for concealed beam attachment, but also as a post foot.

[0023] Whilst it is envisaged that connectors according to the present invention will be metallic and used in timber construction, the present invention is not limited as such. Connectors according to the present invention may be made from any suitable material and by any suitable manufacturing process, and may be formed from multiple parts or as a single part. Furthermore, the connectors according to the present invention may be used in any suitable connection application, e.g. concrete, brick, block, composites etc. and affixed using any suitable fasteners.

[0024] Whilst reference herein is made to the terms vertical, horizontal, above, below, x-x plane, x-y plane, etc., this does not infer any strict position, but simply the relative position or orientation of features or other things with reference to a connector, e.g. as shown in Figure 1.

[0025] Each feature disclosed in this specification (including the accompanying claims and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features. In addition, all of the features disclosed in this specification (including the accompanying claims and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. Accordingly, while many different embodiments of the present invention have been described above, any one or more or all of the features described, illustrated and/or claimed in the appended claims may be used in isolation or in various combinations in any embodiment. For the avoidance of doubt, any one or more of the features of any embodiment may be combined and/or used separately in a different embodiment with any other feature or features from any of the embodiments.

[0026] Whilst preferred embodiments of the present invention have been described above and illustrated in the drawings, these are by way of example only and non-limiting. It will be appreciated by those skilled in the art that many alternatives are possible within the ambit of the invention. As such, the true scope of the invention is that as set out in the appended claims.

Claims

1. A connector for use in fastening a first component having a slot at an end surface thereof to a second component, the connector comprising:

at least one fastening flange for affixing, in use, the connector to the second member;
 an attachment web arranged substantially perpendicular to the at least one fastening flange for affixing, in use, the connector to the first member;
 the at least one fastening flange comprising at least two slots each for receiving, in use, the shank of a fastener;
 the at least two slots permitting, in use, rotation or twisting of the connector about its fastening flange to effect installation of the connector such that the shanks of at least two fasteners move from a first connector insertion position where the shank of each of the at least two fasteners passes through a slot and is out of the plane of the attachment web to a second connector located position where the shank of each of the at least two fasteners passes through a slot and is in the plane of the attachment web.

2. A connector according to claim 1 wherein the at least two slots are open slots.
3. A connector according to claim 1 wherein the at least two slots are closed slots.
4. A connector according to claim 1 wherein at least one of the at least two slots is a closed slot and at least one of the at least two slots is an open slot.
5. A connector according to any one of claims 1 to 4 wherein the connector is formed of a substantially plate like element or substantially plate like elements.
6. A connector according to any one of the preceding claims wherein the connector is affixed to the first and/or second components by mechanical fasteners.
7. A connector according to any one of the preceding claims wherein the connector is formed from sheet metal.
8. A connector assembly comprising the connector of any one of claims 1 to 7 and two or more mechanical fasteners.
9. A connector assembly according to claim 8 wherein the two or more mechanical fasteners comprise at least one bolt.
10. A connection between a first component and a second component formed using the connector according to one of the preceding claims.
11. A connection between a first timber component and

a second component formed using the connector according to one of claims 1 to 9.

12. A connector substantially as hereinbefore described with reference to or as shown in the accompanying drawings. 5
13. A connector assembly substantially as hereinbefore described with reference to or as shown in the accompanying drawings. 10
14. A connection substantially as hereinbefore described with reference to or as shown in the accompanying drawings. 15
15. A method of forming a connection between a first component and a second component substantially as hereinbefore described with reference to or as shown in the accompanying drawings. 20

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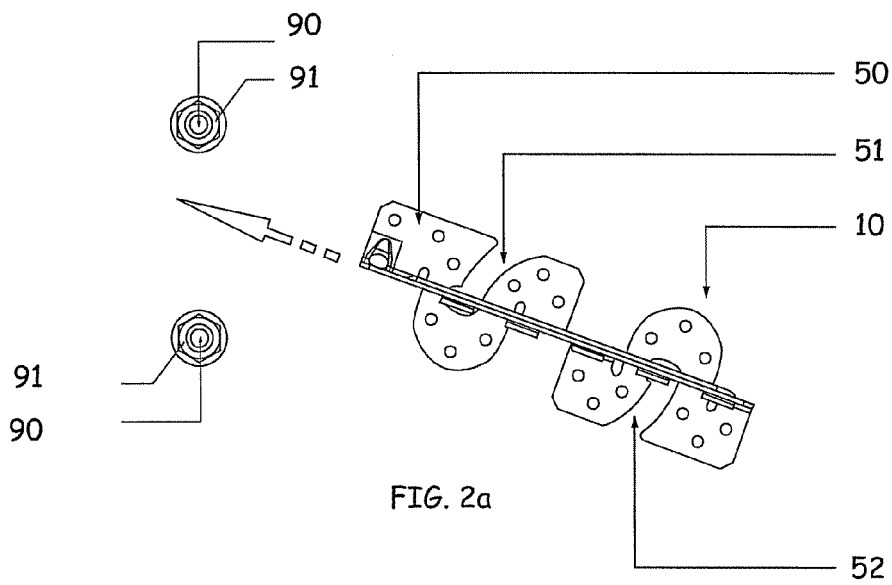
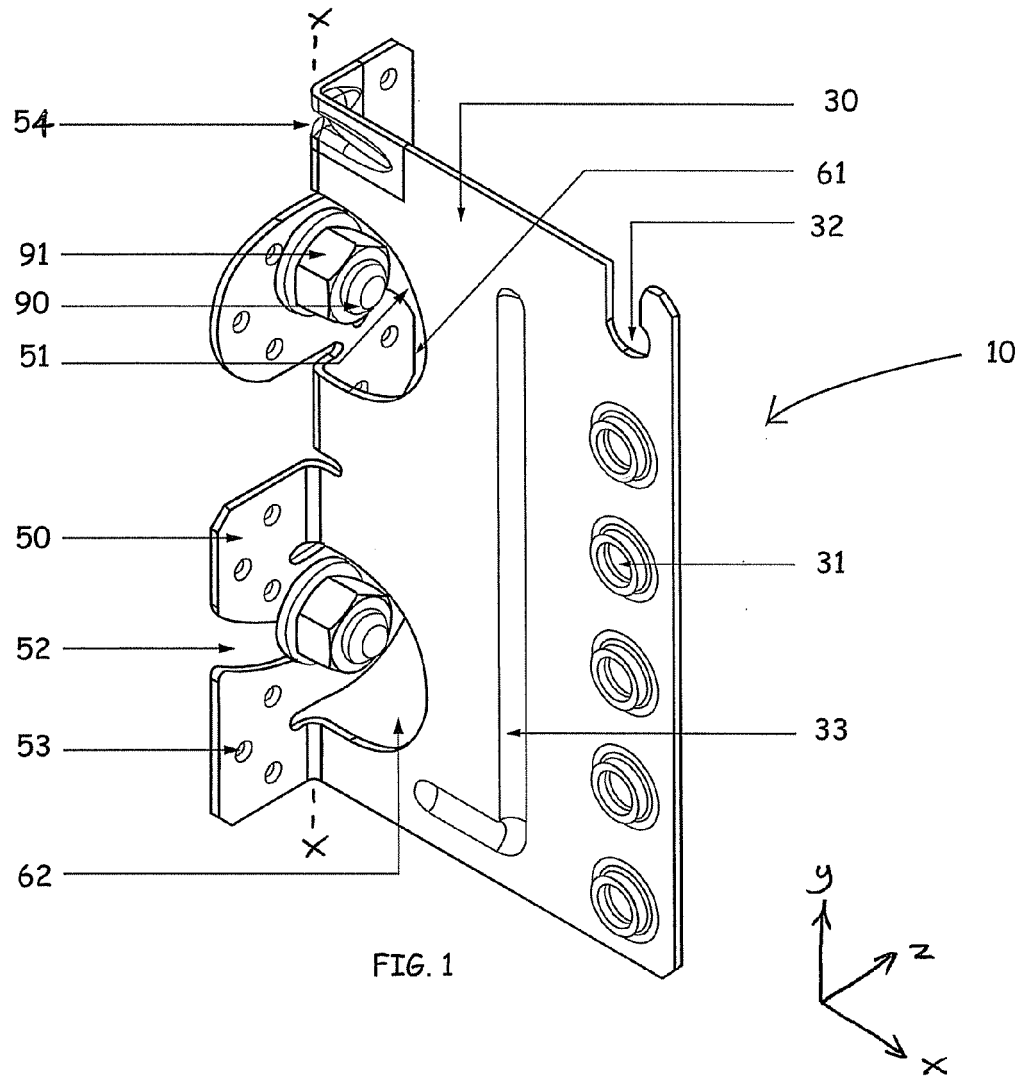
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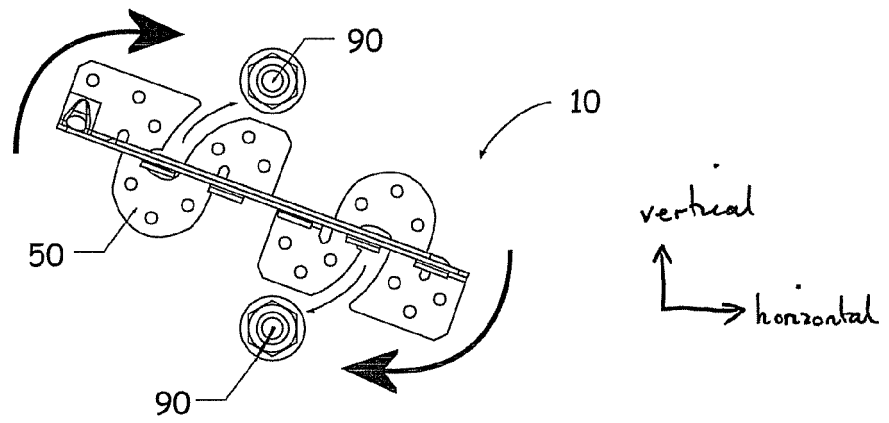


FIG. 2b

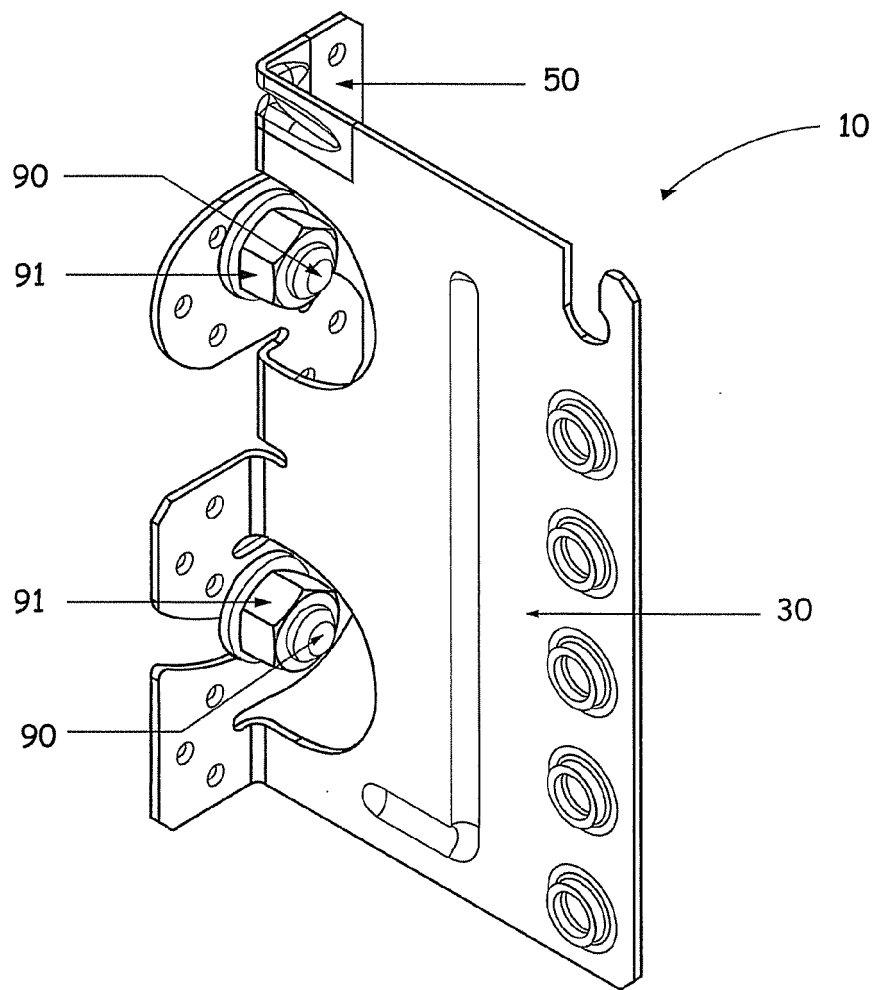
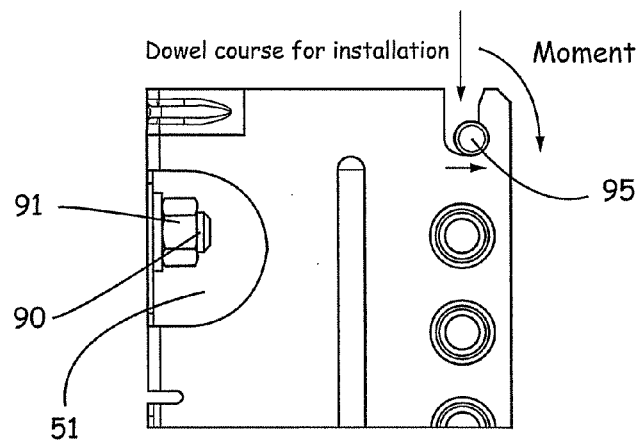
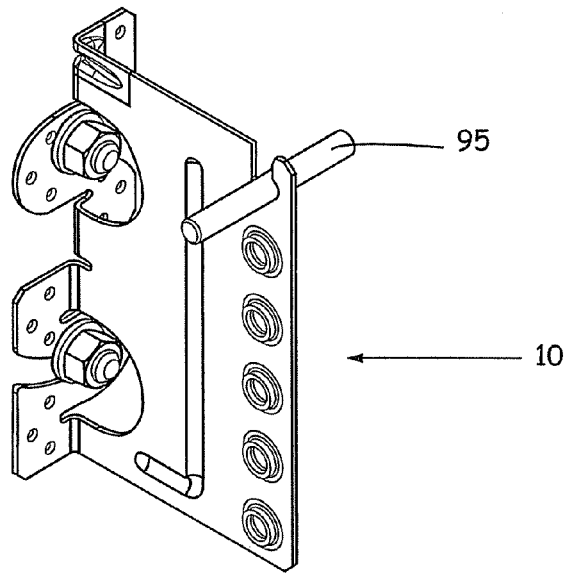
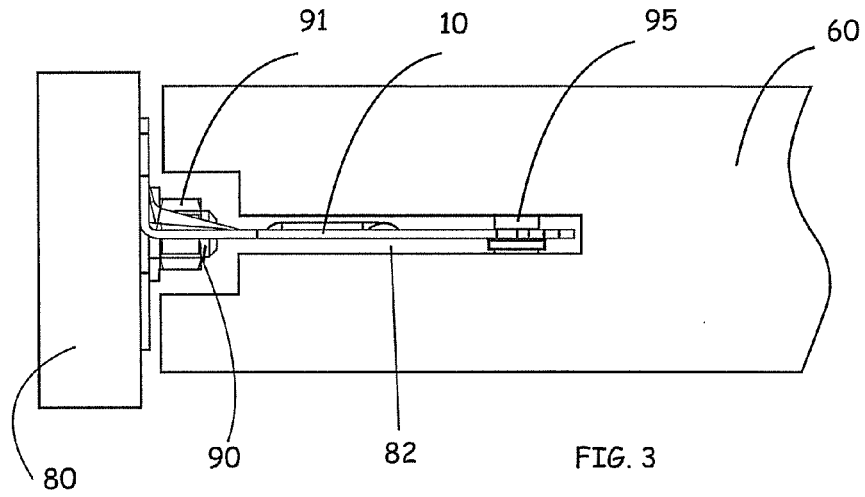


FIG. 2c



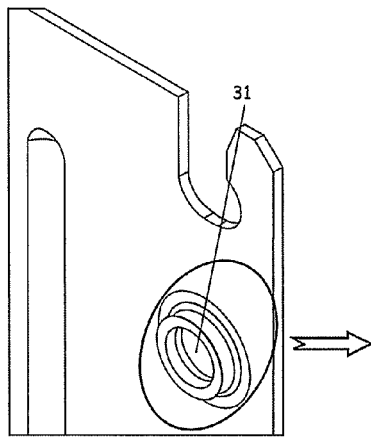


FIG. 4c

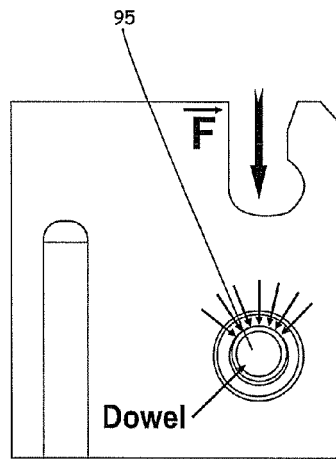


FIG. 4d

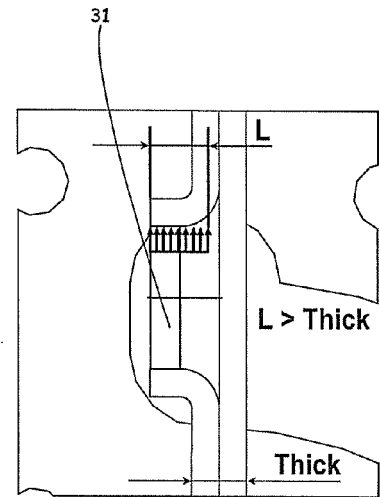


FIG. 4e

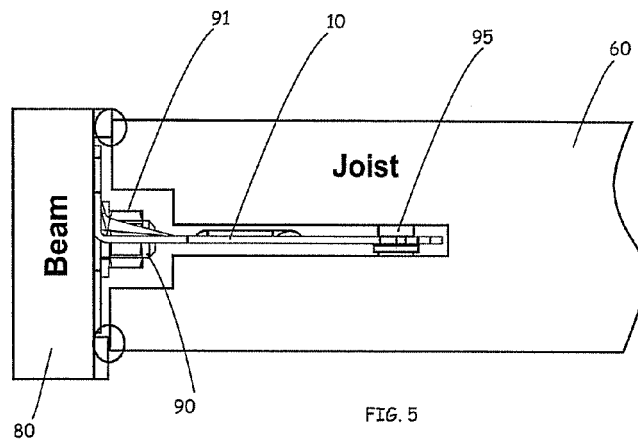


FIG. 5

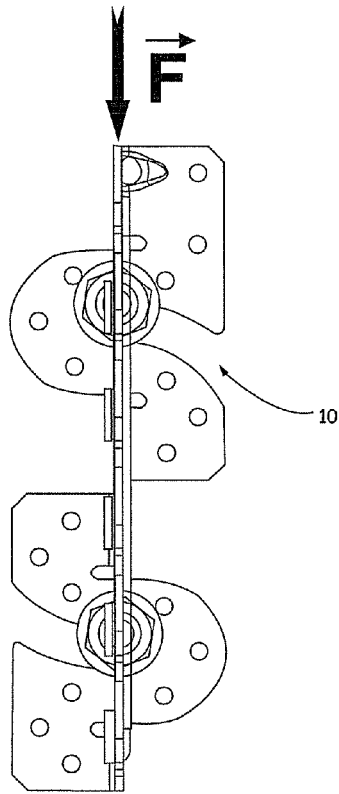


FIG. 6a

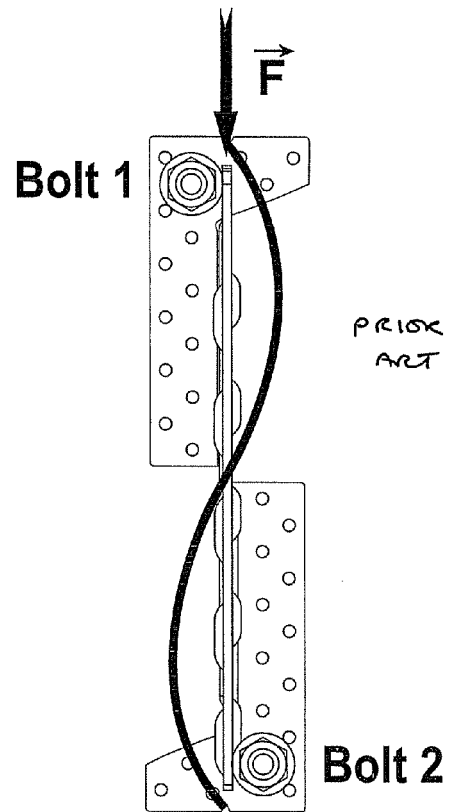


FIG. 6b

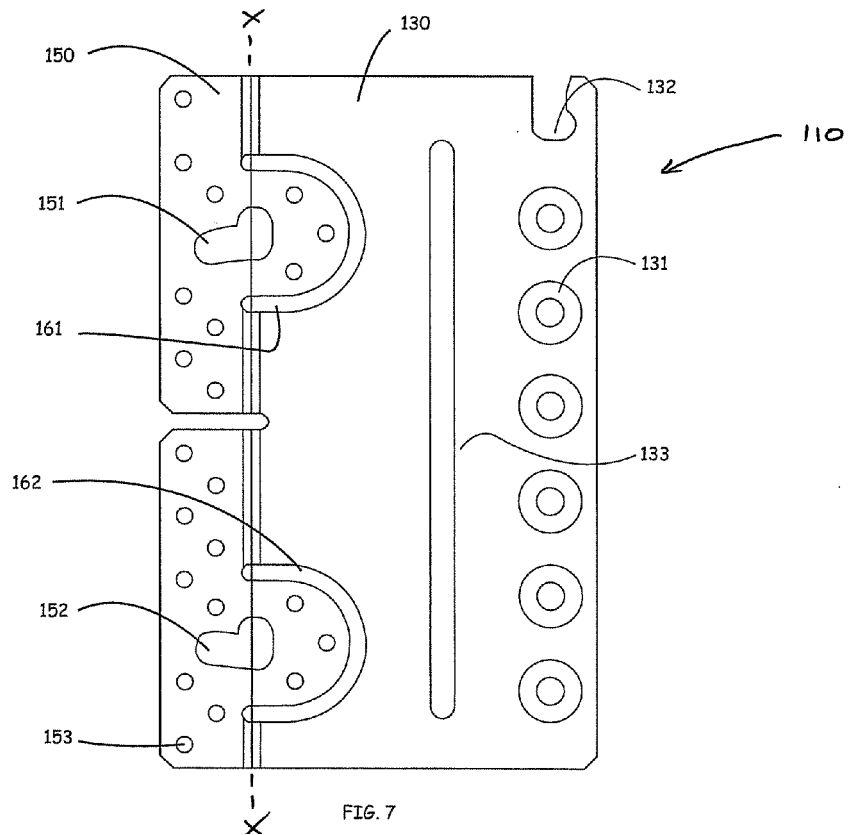


FIG. 7

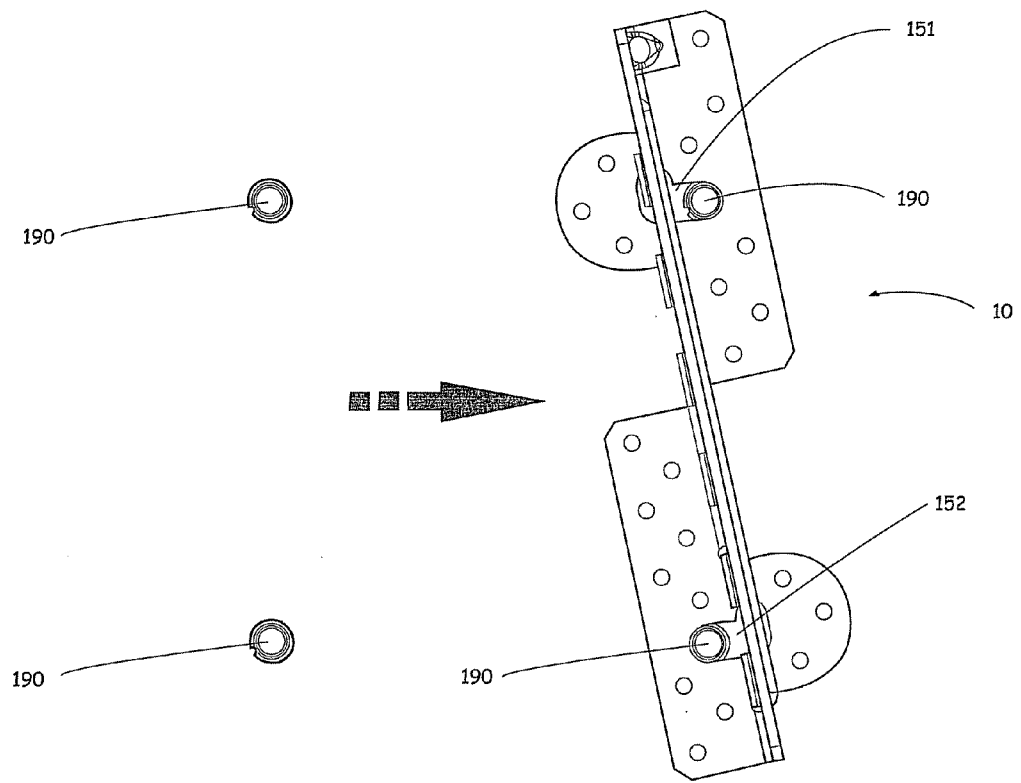
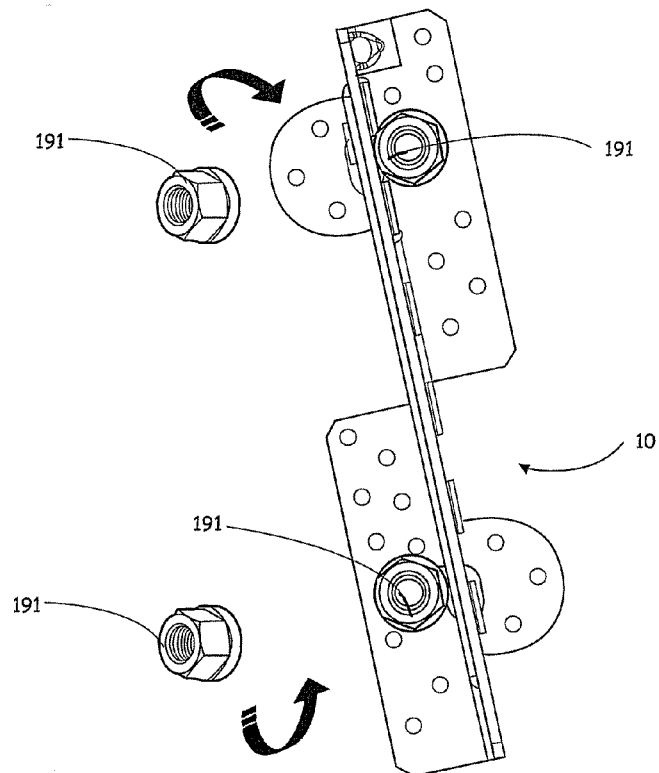


FIG. 7a



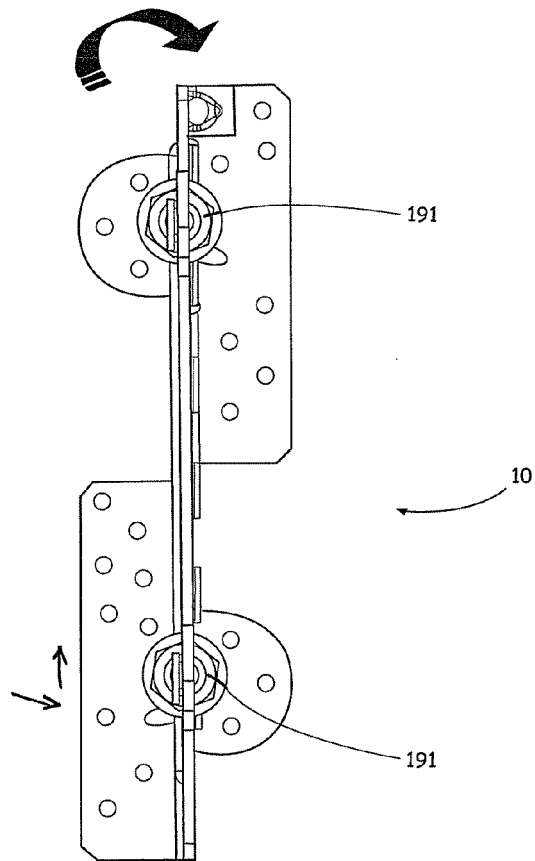


FIG. 7c

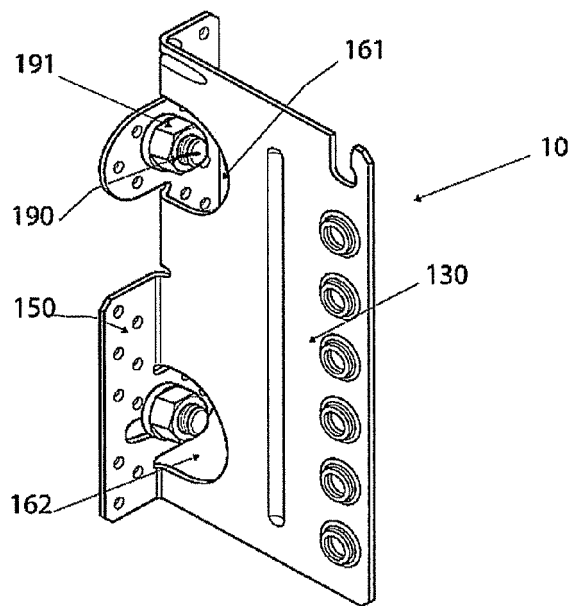


FIG. 7d

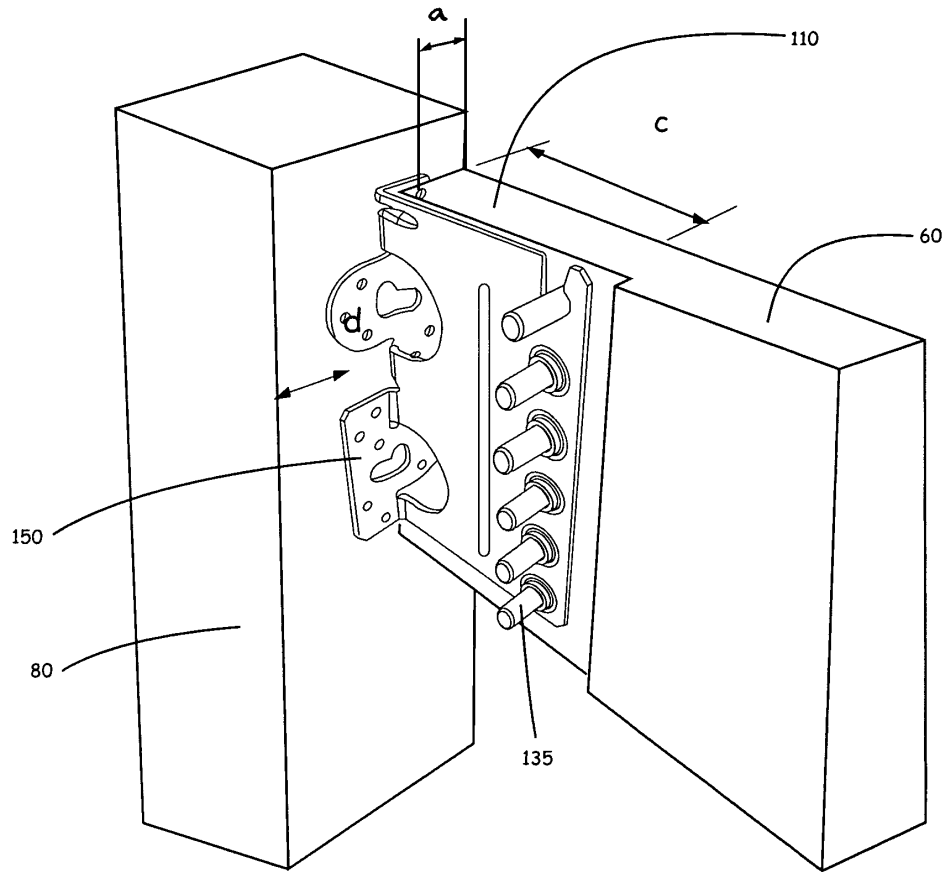


FIG. 7e

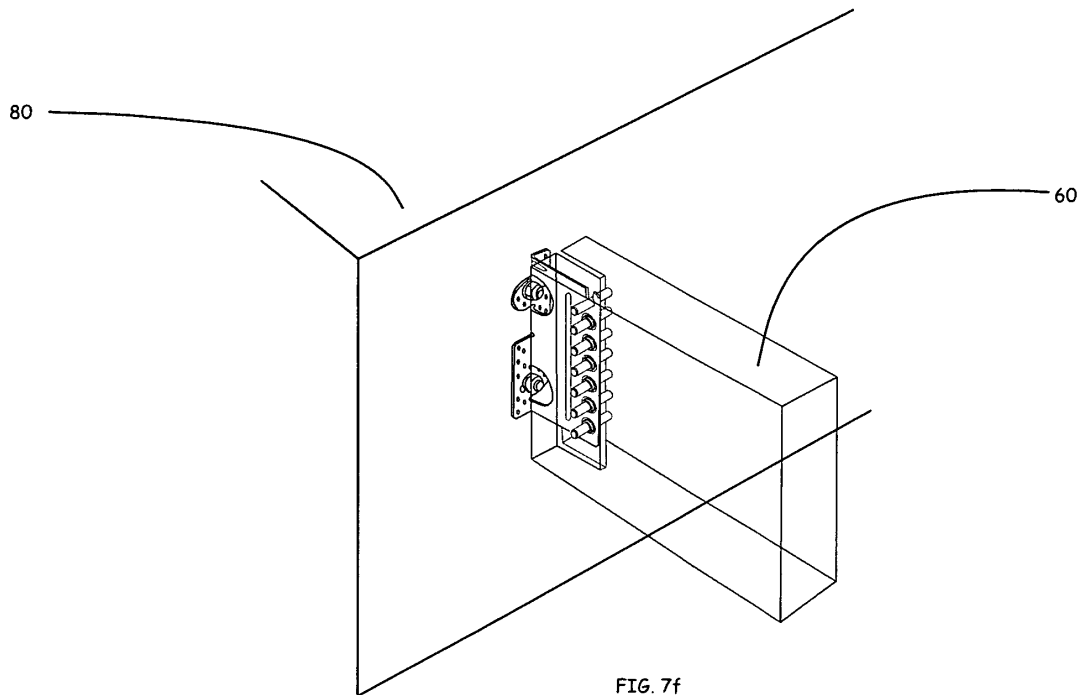


FIG. 7f

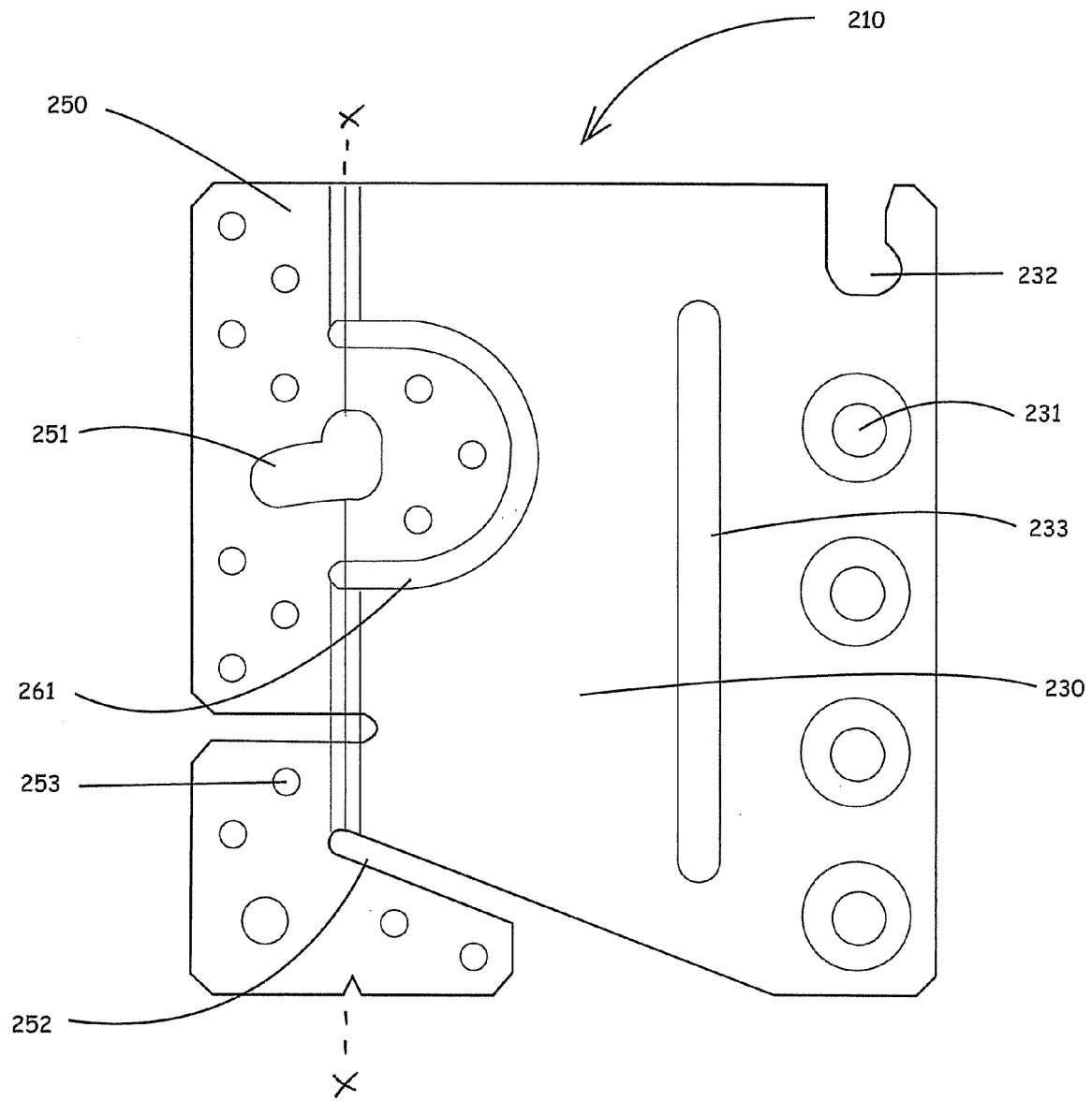


FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 5896721 A [0006]