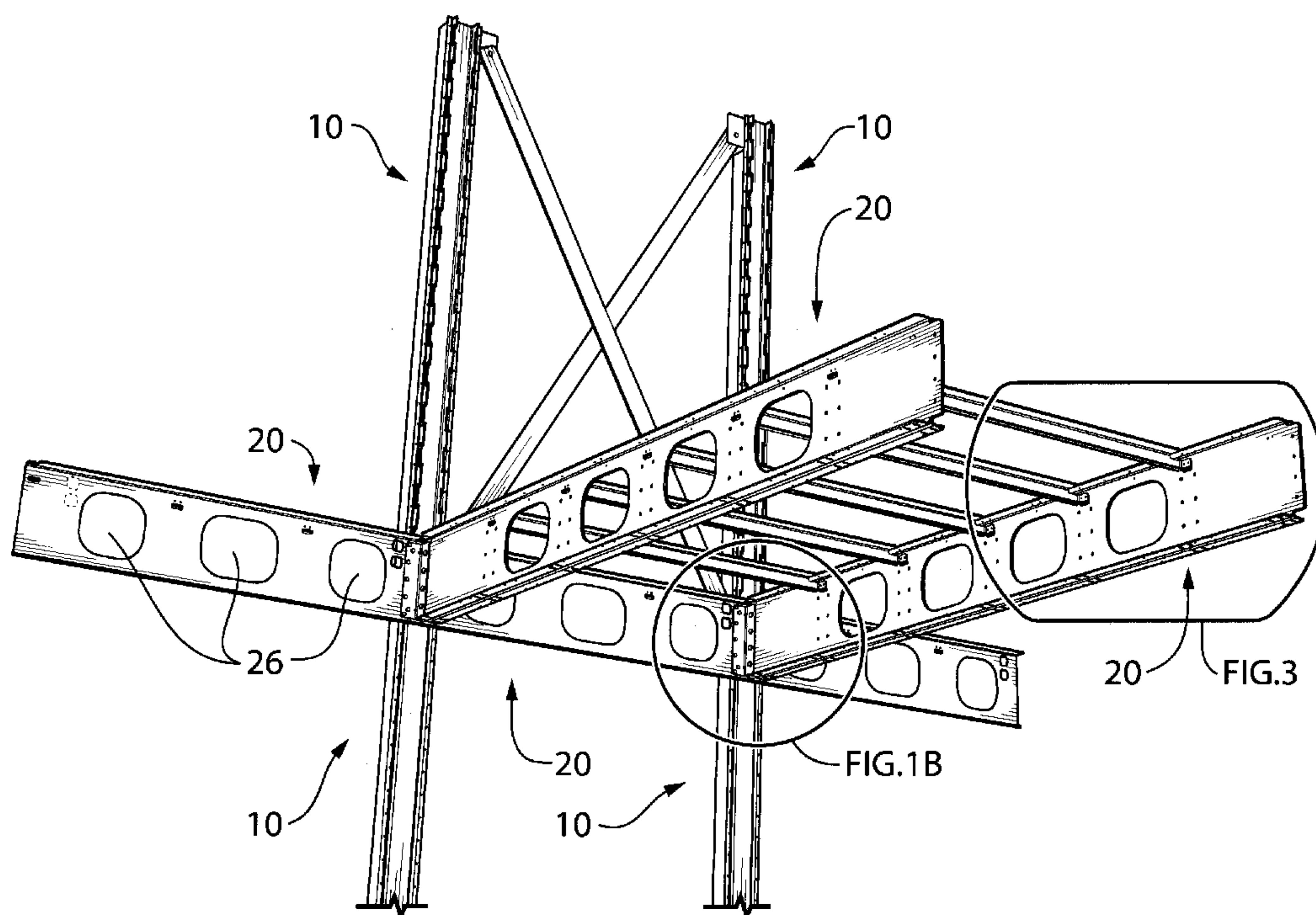




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(72) Inventeurs/Inventors:
BOVET, MARC A., CA;
TREMBLAY, MICHELLE, CA
(73) Propriétaire/Owner:
9344-8462 QUEBEC INC., CA
(74) Agent: BENOIT & COTE INC.

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(54) Title: EVOLVING BUILDING STRUCTURES IMPROVEMENTS



(57) **Abrégé/Abstract:**

There is provided building structures that are demountable from a first configuration to be reassemblable to the first configuration or another configuration. The building structures include systems and kits for the structure, post anchors, kits for floor structure, method for assembling floor structures, wall and ceiling support systems, electrical junction box supports, and kits for frame assembly.

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(71) Applicant (for all designated States except US):

3088-7418 QUÉBEC INC. MAD MAB CORP.
 [CA/CA]; 108, avenue Lazard, Ville Mont-Royal, Québec
 H3R 1N7 (CA).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **BOVET, Marc A.**
 [CA/CA]; 2812 Joseph-A-Bombardier, Laval, Québec
 H7P 6E2 (CA). **TREMBLAY, Michelle** [CA/CA]; 108
 avenue Lazard, Ville Mont-Royal, Québec H3R 1N7
 (CA).

(74) Agent: **BENOÎT & CÔTÉ, ASSOCIÉS INC.**; 1001 De
 Maisonneuve Blvd West, Suite 210, Montréal, Québec
 H3A 3C8 (CA).

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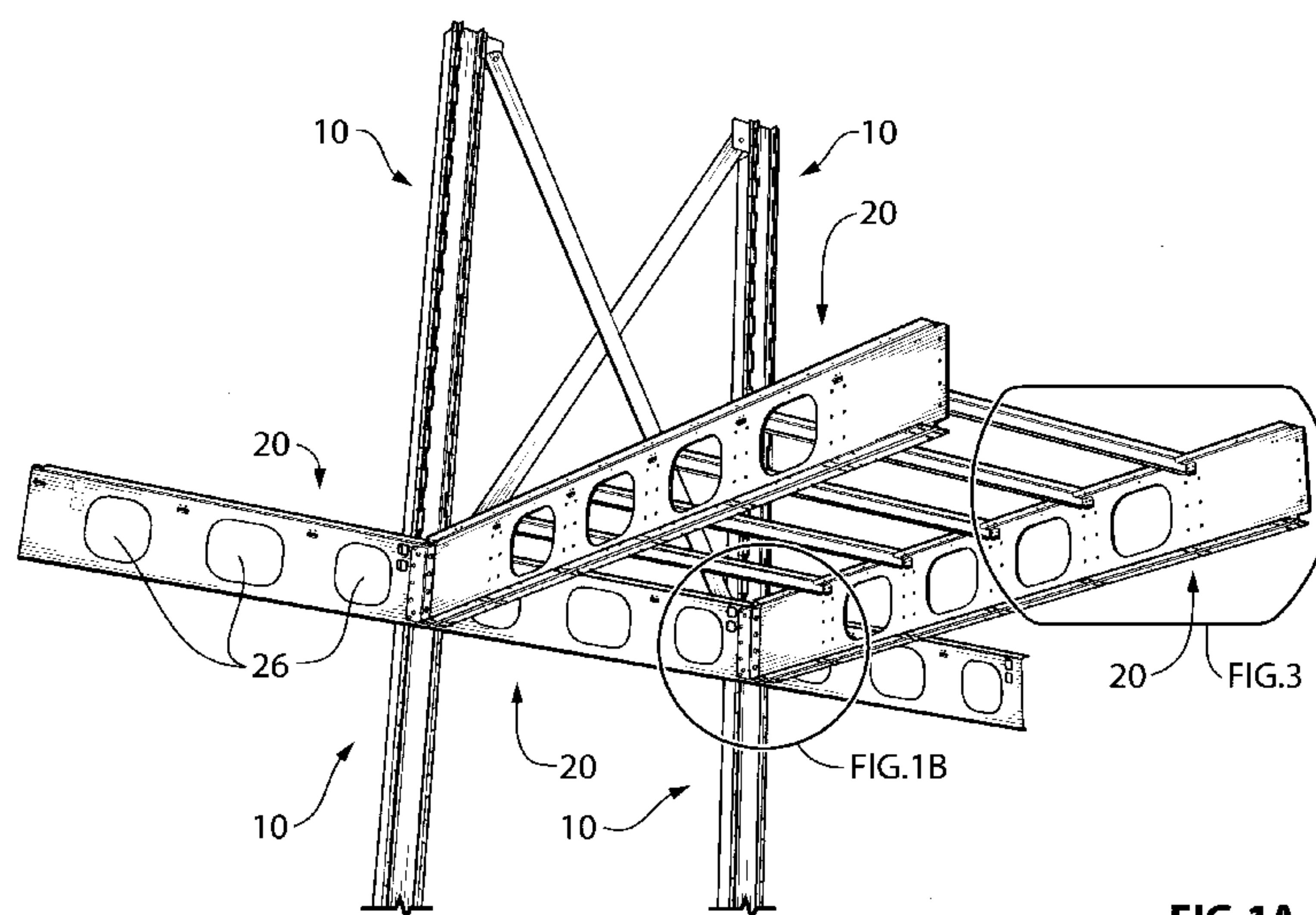


FIG. 1A

(57) Abstract: There is provided building structures that are demountable from a first configuration to be reassemblable to the first configuration or another configuration. The building structures include systems and kits for the structure, post anchors, kits for floor structure, method for assembling floor structures, wall and ceiling support systems, electrical junction box supports, and kits for frame assembly.

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Title: Evolving building structures improvements

BACKGROUND

(a) Field

[0001] The subject matter disclosed generally relates to the field of construction work, and more specifically to evolving building structures.

(b) Related Prior Art

[0002] There are many types of building structures kits. These building structures usually take the form of a kit including components that may be assembled together at a construction site. However, such kits typically have only a limited number of parts and therefore only serve to assemble buildings according to a few simple blueprints. Furthermore, many currently existing kits have only limited structural rigidity so that the buildings that are assembled using these kits are typically relatively simple buildings, such as sheds.

[0003] In cases where a kit is used to assemble a building, the builders have to resort to use traditional measurements techniques to assemble the kit components, with all associated risks of errors, and delays because of the measurement procedures.

[0004] Moreover, in cases where a kit is used to assemble a building, these kits must be complemented with additional parts to fully finish the building. Therefore, advantages brought by a kit are mitigated by the fact that some traditional construction techniques typically have to be used. These construction techniques often require cutting pieces of wood and of other materials on a construction site. Therefore, there is a need to take measurements, with all associated risks of errors, and to cut a piece of material, which often leads to unusable relatively small remaining pieces of material that are thrown away. These traditional construction techniques are therefore relatively time consuming and generate relatively large quantities of wastes.

[0005] Also, in current modular buildings assembled using a kit, the building is generally assembled, and there is no possibility to demount the

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structure and reassemble the structure into the original configuration, or in another configuration since some elements of the original kit had to be destroyed during the disassembly process.

[0006] Furthermore, in currently existing buildings, whether assembled using a kit or using traditional construction techniques, there are typically many thermal bridges between an interior of the building and an exterior of the building. These thermal bridges occur because insulation is typically inserted between an internal wall and an external wall of the building. These internal and external walls are typically attached to studs. Therefore, no insulation is provided at the location where these studs are found and heat may then be transferred between inside and outside the building through these studs. The thermal bridges typically cause relatively large heat losses during winter and heat admission into the building during summer.

[0007] Therefore, there exists a need in the industry to provide new and improved building structures.

SUMMARY

[0008] An object of the present invention is therefore to provide improved evolving building structures.

[0009] The term "evolving" is intended to mean that the building structures of the present invention are constructed from assembly of prefabricated pieces that are demountable and reassemblable. The evolving building structures of the present invention can be easily modified to suit the needs of a family through its evolution or for new owners. Windows, doors and inside walls among others can be moved around in the building structure. In the extreme scenario, the entire evolving building structure can be demounted, moved and reassembled elsewhere in a different or same configuration. The evolving structures of the present invention may be preassembled from such prefabricated pieces in order to construct modules that may be used in the construction of an evolving building structure.

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[0010] In a first embodiment there is disclosed a measurement free system for building a demountable and reassemblable building structure comprising:

[0011] assembling into a building structure of a first configuration a plurality of prefabricated building components comprising a plurality of posts and joists, having a plurality of regularly spaced apart attachment receiving elements with a plurality of removable attachments engaged into the regularly spaced apart attachment receiving elements, the attachments demountably joining the plurality of posts and joists,

[0012] wherein regular positioning of the regularly spaced apart attachment receiving elements provides for a measurement free assembly and wherein the building structure is partly or completely demountable and reassemblable in the first configuration or a different configuration.

[0013] The joist may comprise at least one elongated joist sections, to be connected together to form the joist beam.

[0014] The joist may further comprise at least one securing member to join the at least two elongated joist sections together to form the joist.

[0015] The posts and joists may each further comprise at least one aperture to receive plumbing wiring, heating, ventilation, air conditioning (HVAC) ducting, and/or central vacuum ducting.

[0016] In a further embodiment there is disclosed a kit for building a demountable and reassemblable building structure, the kit comprising:

[0017] an exterior wall panel defining an interior and an exterior of the structure comprising a first exterior wall panel attachment and a second exterior wall panel attachment;

[0018] at least two substantially elongated posts, each of the post comprising at least one attachment receiving element for receiving a respective one of the first and second exterior wall panel attachment so that when the first and second wall panel attachments are received by the

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attachment receiving elements, the wall panel is spaced from the at least two posts defining a space between the panel and each of the posts; and

[0019] an insulation adapted to be engaged between each of the posts, adjacent the wall panel,

[0020] wherein the space substantially reduces a thermal bridge effect between the interior and the exterior of the structure and wherein the building structure is adapted to be partly or completely demounted and reassembled in a first configuration or a different configuration.

[0021] The insulation may be chosen from an insulation panel, an insulation fiber, an insulation foam, a sprayed insulation foam, mineral wool, cellulose or combinations thereof

[0022] The insulation panel may further comprise a lip projecting over each of the post.

[0023] The first and second wall panel attachment may each further comprise a securing element to secure the insulating panel in place.

[0024] The securing element may be at least one tongue.

[0025] In a further embodiment there is disclosed a demountable exterior wall panel attachment comprising:

[0026] a first demountable attachment member, to be received in a compatible attachment receiving element;

[0027] a second demountable attachment member, to receive a compatible exterior wall panel; and

[0028] a spacer, connecting the first and second attachment member.

[0029] The spacer may further comprise a securing element.

[0030] The securing element may be at least one tongue.

[0031] In a further embodiment there is disclosed a post anchor adjustable along the three dimensional axes comprising:

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[0032] a base member to be embedded into a building foundation and having a mounting member thereon, the mounting member being adjustable along a first axis; and

[0033] a retaining member having

[0034] a seat, mountable on the mounting member and being adjustable along a second axis, and

[0035] a crown, to receive a post and being adjustable along a third axis,

[0036] wherein the post anchor is adjustable along the three dimensional axes to correctly align the post anchor to the foundation and level a post to be attached thereto.

[0037] The mounting member may comprise a first adjustment member, the first adjustment member allowing adjustment of the seat along the first axis.

[0038] The mounting member may comprise at least one threaded rod.

[0039] The mounting member may consist of two threaded rods.

[0040] The mounting member may comprise a mounting joint.

[0041] The mounting joint may be a dovetail joint.

[0042] The first adjustment member may comprise a threaded nut inserted on the threaded rod.

[0043] The seat may comprise a second adjustment member, the second adjustment member allowing adjustment of the seat along the second axis.

[0044] The second adjustment member may comprise at least one aperture.

[0045] The second adjustment member may comprise two apertures.

[0046] The at least one aperture may be at least one of a substantially circular, oval, elliptical, and rectangular apertures.

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[0047] The second adjustment member may be adapted to receive a securing member.

[0048] The crown may comprise a third adjustment member, the third adjustment member allowing adjustment of the crown along the third axis.

[0049] The third adjustment member may comprise at least one aperture.

[0050] The at least one aperture may be at least one of a substantially circular, oval, elliptical, and rectangular aperture.

[0051] The third adjustment member may be to receive at least one securing member, the at least one securing member securing the crown to the seat.

[0052] The at least one securing member may be a threaded bolt and a threaded nut.

[0053] The crown may comprise a post receiving member.

[0054] The post receiving member may comprise a fastener receiving element.

[0055] The post receiving member may comprise a bracket.

[0056] The post anchor may be anchored to the building foundation by being embedded, by mechanical anchoring and/or by adhesive anchoring into said foundation.

[0057] In a further embodiment there is disclosed a kit for a demountable floor anchor system comprising:

[0058] at least two joists, each of the joist comprising at least one bridge element located at a predetermined position along the joist; and

[0059] at least one secondary joist comprising at each end a lug to be received in the bridge element,

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[0060] wherein when the secondary joist is inserted into each of at least two joists, the secondary joist is substantially perpendicular to the at least two joists, and forms a planar surface to receive a flooring surface, and

[0061] wherein the demountable floor anchor system can be partly or completely demounted and reassembled in a first configuration or a different configuration.

[0062] The joist may comprise two or more bridge elements.

[0063] The two or more bridge elements may be spaced apart at fixed regular interval.

[0064] The lug may further comprise a fastener receiving element.

[0065] The joist may comprise at least one fastener receiving element.

[0066] The joist may comprise a plurality of fastener receiving elements.

[0067] The secondary joist may comprise at least one fastener receiving element.

[0068] The secondary joist may comprise a plurality of fastener receiving elements.

[0069] The fastener receiving elements may be spaced apart at fixed regular intervals.

[0070] The joist may comprise at least two joist sections to be connected together to form the joist.

[0071] The joist may further comprise at least one securing member, to join the at least two joist sections together to form the joist.

[0072] The beam may further comprise at least one aperture to receive plumbing, wiring, heating, ventilation, air conditioning (HVAC) ducting, and/or central vacuum ducting.

[0073] In a further embodiment there is disclosed a method of assembling a demountable and reassemblable floor structure comprising:

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[0074] a) assembling a plurality of prefabricated floor components comprising a plurality of joists, and a plurality of secondary joists as described above into a demountable floor structure by placing the plurality of joists parallel to each other, and inserting the lug provided at each end of the secondary joist into each facing bridge element,

[0075] wherein the joists and the secondary joists are substantially perpendicular to each other and form a planar surface to receive a flooring surface and wherein the floor structure is partly or completely demountable and reassemblable in the first configuration or a different configuration.

[0076] The method may further comprise a step b) after step a) :

[0077] b) fastening the plurality of secondary joists to the plurality of joists.

[0078] The method may further comprise a step c) after step b):

[0079] c) overlaying a flooring surface on the demountable floor structure.

[0080] In a further embodiment there is disclosed a method of assembling a demountable floor comprising:

[0081] a) forming a planar surface to receive a plurality of flooring tiles by assembling prefabricated floor components comprising a plurality of joists, and a plurality of secondary joists as described above, and a plurality of flooring tiles; into a demountable floor structure by placing the plurality of joists parallel to each other, and inserting the lug provided at each end of the secondary joist into each facing bridge element, and

[0082] b) overlaying the plurality of flooring tiles over the demountable floor structure,

[0083] wherein the joists and the secondary joists are substantially perpendicular to each other and form a planar surface to receive a plurality of flooring tiles and wherein the floor structure can be partly or completely

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demounted and reassembled in a first configuration or a different configuration.

[0084] The method may further comprise a step i) after step b):

[0085] i) fastening the plurality of secondary joists to the plurality of joists prior to or after overlaying of the flooring tiles.

[0086] In a further embodiment there is disclosed a demountable furring strip support comprising:

[0087] a demountable furring strip gripping member comprising

[0088] at least one of

[0089] a spacer, and

[0090] a first and second hook member connected at opposite ends of the spacer; and

[0091] a demountable attachment member, to be received in a compatible attachment receiving element and connected to the demountable furring strip gripping member.

[0092] The furring strip support may be integral.

[0093] In a further embodiment there is disclosed a kit for a demountable and reassemblable wall support system comprising:

[0094] at least one furring strip; and

[0095] at least two furring strip supports as defined above.

[0096] In a further embodiment there is disclosed a kit for a demountable and reassemblable wall comprising:

[0097] a wall panel defining an interior and an exterior,

[0098] at least one furring strip,

[0099] at least two furring strip support as defined above; and

[00100] at least two substantially elongated posts, each of the posts comprising at least one attachment receiving element for receiving a furring

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strip support so that when the at least one furring strip is received by the at least two furring strip support, the wall panel is spaced from the at least two substantially elongated posts defining a space between the panel and each of the substantially elongated posts; and

[00101] wherein the space substantially reduces a thermal bridge effect between the interior and the exterior demountable wall and wherein the wall can be partly or completely demounted and reassembled in a first configuration or a different configuration.

[00102] The kit may further comprise an insulation element adapted to be engaged between each of the post, adjacent the wall panel.

[00103] The insulation element may be at least one of an insulation panel, an insulation fiber, and an insulation foam.

[00104] The furring strip may be made of a sound dampening material.

[00105] In a further embodiment there is disclosed a demountable furring strip support comprising:

[00106] at least one elongated planar member comprising

[00107] at least one furring strip gripping member having a first and second hook member to secure a furring strip; and

[00108] a plurality of regularly spaced apart attachment receiving elements to receive compatible attachments.

[00109] The demountable furring strip support may comprise two elongated planar member connected by a spacer member.

[00110] The demountable furring strip support may be U-shaped.

[00111] The furring strip support may be integral.

[00112] In a further embodiment there is disclosed a kit for a demountable and reassemblable wall support system comprising:

[00113] at least one furring strip; and

[00114] at least two furring strip supports described above.

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[00115] In a further embodiment there is disclosed kit for a demountable and reassemblable wall comprising:

[00116] a wall panel defining an interior and an exterior,

[00117] at least one furring strip,

[00118] at least two furring strip support described above; and

[00119] at least two substantially elongated posts, each of the posts comprising at least one attachment receiving element for receiving a demountable furring strip support so that when the at least one furring strip is received by the at least two furring strip support, the wall panel is spaced from the at least two substantially elongated posts defining a space between the panel and each of the substantially elongated posts; and

[00120] wherein the space substantially reduces a thermal bridge effect between the interior and the exterior demountable wall and wherein the wall can be partly or completely demounted and reassembled in a first configuration or a different configuration.

[00121] The kit may further comprise an insulation element adapted to be engaged between each of the post, adjacent to the wall panel.

[00122] The insulation element may be at least one of an insulation panel, an insulation fiber, and an insulation foam.

[00123] The furring strip may be made of a sound dampening material.

[00124] In a further embodiment there is disclosed a demountable electrical junction box support comprising:

[00125] a demountable furring strip gripping member comprising at least one of

[00126] a spacer, and

[00127] a first and second hook member connected at opposite ends of the spacer; and

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[00128] a housing, connected to the demountable furring strip gripping member, the housing comprising an aperture to receive at least one electrical junction box.

[00129] The demountable electrical junction box support may be integral.

[00130] The demountable electrical junction box support may further comprise at least one electrical box therein.

[00131] In a further embodiment there is disclosed a kit for a demountable and reassemblable frame comprising:

[00132] a frame assembly having an interior and an exterior surface comprising

[00133] at least two frame assembly attachments facing the interior surface to secure the frame assembly to a respective first and second substantially parallel post,

[00134] the post having a plurality of regularly spaced apart attachment receiving elements to receive the frame assembly attachments;

[00135] a first and second furring strip receiving bar comprising

[00136] at least one furring strip gripping member to receive at least one furring strip;

[00137] the furring strip receiving bar adapted to be secured substantially perpendicular to the first and second substantially parallel posts to form a border around the frame assembly.

[00138] The furring strip gripping member may comprise a first and second hook member to secure a furring strip.

[00139] The furring strip receiving bar may be adapted to receive two furring strips.

[00140] The frame assembly may be a window assembly or a door assembly.

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[00141] Features and advantages of the subject matter hereof will become more apparent in light of the following detailed description of selected embodiments, as illustrated in the accompanying figures. As will be realized, the subject matter disclosed and claimed is capable of modifications in various respects, all without departing from the scope of the claims. Accordingly, the drawings and the description are to be regarded as illustrative in nature, and not as restrictive and the full scope of the subject matter is set forth in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[00142] Fig. 1A illustrates a view of a building structure according to one embodiment of the present invention.

[00143] Fig. 1B illustrates a view of a building structure according to one embodiment of the present invention.

[00144] Fig. 2A illustrates perspective back view of a substantially elongated post according to one embodiment of the present invention.

[00145] Fig. 2B illustrates perspective frontal views of a substantially elongated post according to one embodiment of the present invention.

[00146] Fig. 3A illustrates perspective view of a joist or beam according to one embodiment of the present invention.

[00147] Fig. 3B illustrates perspective view of a joist or beam according to one embodiment of the present invention.

[00148] Fig. 3C illustrates perspective view of a joist or beam according to one embodiment of the present invention.

[00149] Fig. 4 illustrates a side view of a substantially elongated post according to one embodiment of the present invention.

[00150] Fig. 5 illustrates a perspective view of a joist or beam according to one embodiment of the present invention.

[00151] Fig. 6A illustrates side perspective views of a wall structure according to one embodiment of the present invention.

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[00152] Fig. 6B illustrates side perspective views of a wall structure according to one embodiment of the present invention.

[00153] Fig. 6C illustrates side perspective views of a wall structure according to one embodiment of the present invention.

[00154] Fig. 7 illustrates a side view of a demountable wall panel attachment according to one embodiment of the present invention.

[00155] Fig. 8A illustrates a perspective view of a post anchor according to one embodiment of the present invention.

[00156] Fig. 8B illustrates a perspective view of a post anchor according to one embodiment of the present invention.

[00157] Fig. 8C illustrates a perspective view of a post anchor according to one embodiment of the present invention.

[00158] Fig. 9A illustrates a demountable floor anchor system according to an embodiment of the present invention.

[00159] Fig. 9B illustrates a demountable floor anchor system according to an embodiment of the present invention.

[00160] Fig. 10 illustrates a demountable floor anchor system according to an embodiment of the present invention.

[00161] Fig. 11A illustrates a demountable floor anchor system according to an embodiment of the present invention.

[00162] Fig. 11B illustrates a demountable floor anchor system according to an embodiment of the present invention.

[00163] Fig. 12A illustrates a side view of a wall panel support system according to an embodiment of the present invention.

[00164] Fig. 12B illustrates a side view of a wall panel support system according to an embodiment of the present invention.

[00165] Fig. 13A illustrates a perspective view of an electrical junction box support according to an embodiment of the present invention.

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[00166] Fig. 13B illustrates a perspective view of an electrical junction box support according to an embodiment of the present invention.

[00167] Fig. 13C illustrates a top view of a electrical junction box support according to an embodiment of the present invention.

[00168] Fig. 13D illustrates a perspective view of an electrical junction box support according to an embodiment of the present invention.

[00169] Fig. 13E illustrates a front view of an electrical junction box support according to an embodiment of the present invention.

[00170] Fig. 13F illustrates a front perspective view of an electrical junction box support according to an embodiment of the present invention.

[00171] Fig. 13G illustrates a back perspective view of an electrical junction box support according to an embodiment of the present invention.

[00172] Fig. 13H illustrates a front perspective view of an electrical junction box support according to an embodiment of the present invention.

[00173] Fig. 13I illustrates a front perspective view of an electrical junction box support according to an embodiment of the present invention.

[00174] Fig. 13J illustrates a front perspective view of an electrical junction box support according to an embodiment of the present invention.

[00175] Fig. 14A illustrates a front view of a frame structure according to an embodiment of the present invention.

[00176] Fig. 14B illustrates a front view of a frame structure according to an embodiment of the present invention.

[00177] Fig. 14C illustrates a section view of a frame structure according to an embodiment of the present invention.

[00178] Fig. 15A illustrated a side perspective view of a ceiling furring strip receiving elements according an embodiment of the present invention.

[00179] Fig. 15B illustrated a side perspective view of a ceiling furring strip receiving elements according an embodiment of the present invention.

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[00180] Fig. 15C illustrated a flat pattern view of a ceiling furring strip receiving elements according an embodiment of the present invention.

[00181] Fig. 15D illustrated a side view of a ceiling furring strip receiving elements according an embodiment of the present invention.

[00182] Fig. 16A illustrated a perspective view of a frame assembly according an embodiment of the present invention.

[00183] Fig. 16B illustrated a perspective view of a frame assembly according an embodiment of the present invention.

[00184] Fig. 16C illustrated a perspective view of a frame assembly according an embodiment of the present invention.

[00185] Fig. 16D illustrated a perspective view of a frame assembly according an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00186] In embodiments there are disclosed a measurement free system for building a demountable and reassemblable building structure by assembling into a building structure of a first configuration a plurality of prefabricated building components that have a plurality of regularly spaced apart attachment receiving elements with a plurality of removable attachments engaged into the regularly spaced apart attachment receiving elements, and the attachments are demountably joining the plurality of prefabricated building components. The regular positioning of the regularly spaced apart attachment receiving elements provides for a measurement free assembly and the building structure is partly or completely demountable and reassemblable in the first configuration or a different configuration.

[00187] The various components of the kits are dimensioned so that they are readily attachable to the other components to which they are to be attached. Therefore, there is no need to cut parts, or measure parts to assemble the building structure using the kits according to the invention. However, it is within the scope of the invention to have kits similar to the kit

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described in this document in which some of the components need to be cut before being used.

[00188] The reader skilled in the art will readily appreciate that while kits for building a complete building structure is described in the present specification, it is within the scope of the invention to use only some of the kits to assemble part of alternative houses or other buildings. Furthermore, the kits are also usable to assemble other building structures such as, for example, sheds, barns and larger buildings, or portions thereof.

[00189] Although a specific building structure including all the above-mentioned components is described in the present document, the reader skilled in the art will readily appreciate that it is also within the scope of the invention to have kits that include only some of the components so that less complex houses may be built. Similarly, it is also within the scope of the invention to have kits that include other components that are not mentioned hereinabove.

[00190] Now referring to Figs. 1, 2 and 3. There is disclosed a measurement free system for building a demountable and reassemblable building structure by assembling into a building structure of a first configuration a plurality of prefabricated posts, and joists, such as posts **10** and joists **20**.

[00191] As shown in Figs. 1A and B. The posts **10** and joists **20** have a plurality of regularly spaced apart attachment receiving elements, such as elements **12**, **14**, on the posts of Fig. 2 and elements **22** and **24**, on the joists shown in Fig. 3A. A plurality of removable attachments, such as combinations of bolts, rods and compatibles nuts as may be appreciated by the person skilled in the art, are engaged into the regularly spaced apart attachment receiving elements **12**, **14**, **22** and **24** and the attachments are demountably joining the plurality of posts **10** and joists **20**. The regular positioning of the regularly spaced apart attachment receiving elements **12**, **14**, **22** and **24** provides for measurement free assembly and the building structure is partly or

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completely demountable and reassemblable in the first configuration or a different configuration.

[00192] The posts **10** and joists **20** may comprise a number of apertures **18** (see Fig. 4) and **26** (see Fig. 1) that may receive plumbing and/or wiring such as electrical wiring, optical fiber cables, or any desired cabling that may be required to be used in the structure. The apertures may also be used to received heating, ventilating, and air conditioning (HVAC) ducting, ducting for central vacuum cleaners, or any other elements that may be required to be inserted in the structure.

[00193] Now referring to Fig. 3B and C. The building structure of the present invention includes joists **20** that are formed of at least one elongated joist section **20A** and/or **20B**. The elongated joist sections **20A/20B** are joined at their ends by securing members **28**, which may connect the elongated joist sections by insertion of fasteners in attachment receiving elements present on both structures. The use of joists **20** that are assembled from shorter elongated sections is particularly advantageous as it allows the manufacture of sections that can be handled by one or a few workers without the need for heavy lifting equipment. This is quite advantageous when assembling a housing structure in a wooded area, as trees do not need to be cut to make way for the machinery normally required for assembly of long joists. Furthermore, transportation of the section of joist does not require long and heavy machinery as the sections will fit nicely inside regular truck load.

[00194] Now referring to Fig. 6. The building structure of the present invention also includes a kit for building a demountable and reassemblable wall panel structure **30** which has a wall panel **32** defining an interior and an exterior of the structure. To connect the wall panel **32** to the posts **10**, attachments such as wall panel attachments **40** are used. Each of the substantially elongated posts **10** has a number of attachment receiving elements **14** to receive the wall panel attachment **40**. When the wall panel attachments **40** are received by the attachment receiving elements **14**, the wall panel **32** is spaced from the posts **10**, such that a space is defined

between the wall panel **32** and each of the posts **10**. The space between the wall panel **32** and the posts **10** substantially reduces any thermal bridge effect that may occur between the interior and the exterior of the structure. The wall structure **30** may be partly or completely demounted and reassembled in a first configuration or a different configuration.

[00195] To further insulate the wall structure **30**, an insulation panel **36** may be inserted between wall panel **32** and the posts **10**. Other types of isolation are also contemplated, for example, mineral wool, sprayed insulation foam such as polyurethane, cellulose or any other types of insulation material. The insulation panel **36** may be frictionally engaged between each of the posts **10**, adjacent the wall panel **32**. The insulation panel **36** may comprise a lip **36l** that is projecting over each of the post **10**, further reducing any thermal bridging effect and thereby improving insulation. To prevent movement of the insulation panel **36**, the wall panel attachments **40** may be provided with a securing element. The securing element may be any suitable fastener, for example a wedge or a short elongated piece that is inserted through an aperture present in one embodiment of the of wall panel attachments **40**. The securing element may be built integral the wall panel attachments **40**, for example as a section of the wall panel attachment **40** which is folded over and above the surface of the insulating panel **36** facing the wall panel **32**, thereby preventing the insulating panel **36** from being pushed toward the wall panel **32**. As shown in Fig. 6, the securing element may be a tongue that may be folded over the insulating panel **36** from the wall panel attachment **40**.

[00196] Now referring to Fig. 7, the demountable wall panel attachment **40** of the present invention comprises a first demountable attachment member **42** which may be received in a compatible attachment receiving element such as attachment receiving element **14** in posts **10**. It also comprises a second demountable attachment member **44** which may receive a compatible wall panel **32**; and a spacer **46** connects the attachment member **42** and **44** together. The demountable wall panel attachment **40** may comprise a securing element, such as tongue shown in Fig. 7.

[00197] Now referring to Fig. 8. The building structure of the present invention is suitable for being built on a foundation, such as a concrete foundation. To anchor the posts **10**, a post anchor may be used. A post anchor **50** of the present invention comprises a base member **52** which may be anchored into a building foundation **F**. The anchoring of the base member **52** may be done by embedding the base member **52** into the foundation when it is first poured. The anchoring may also be an adhesive anchor. Adhesive anchors are for example resin anchors comprising steel studs, bolts and anchorages which are bonded into a substrate, usually masonry and concrete, using a resin based adhesive system. Ideally suited for high load applications, in virtually all cases the resulting bond is stronger than the base material itself and as the system is based on chemical adhesion, no load stress is imparted to the base material as with expansion type anchors and are therefore ideal for close to edge fixing, reduced center and group anchoring and use in concrete of unknown quality or low compressive strength. The anchoring may also be a mechanical anchoring, where a mechanical anchor is inserted (e.g. into a drilled hole) into the foundation by conventional means.

[00198] The base member **52** comprises a mounting member thereon. For example, the mounting member may be a rod or the likes, with a suitable mounting joint (e.g. a dovetail joint), or threads. A retaining member is disposed over the base member **52**, and comprises a seat **62**, which is mountable on the mounting member, and a crown **64** which may receive a post **10**, and is adjustable along a third axis.

[00199] The mounting member of the anchor **50** comprises a first adjustment member in order to be adjustable along a first axis. For example, a number of threaded rods **54** are disposed on base member **52**, and when seat **62** is mounted on the mounting member comprised of the threaded rods **54**, the position of the seat **62** on the mounting member may be adjusted by using a suitable assembly of threaded nuts on the threaded rods **54**.

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[00200] The seat **62** comprises a second adjustment member which allows adjustment of the seat **62** along a second axis. For example, the seat **62** may comprise one or more apertures **66** that may receive a mounting member (e.g. threaded rods **54**). The aperture **66** is suitably shaped as substantially circular, oval, elliptical, or rectangular, so as to accommodate the shape of the preferred mounting member chosen. The second adjustment member may receive the mounting member therein, while leaving a space around the mounting member, such that the seat **62** may be moved back and forth in a desired direction along the second axis to adjust the position of the seat **62** as may be required to align the post anchor **50** with the other post anchors **50** of the entire building structure.

[00201] The crown **64** of the post anchor **50** also comprises a third adjustment member allowing adjustment of the crown along a third axis. For example, the crown **64** may comprise one or more aperture **68** that may receive a securing member (e.g. threaded bolt **70**, secured by a nut). The aperture **68** is suitably shaped as substantially circular, oval, elliptical, or rectangular, so as to accommodate the shape of the preferred securing member chosen. The third adjustment member may receive the securing member therein, while leaving a space around the securing member such that the crown **64** may be moved back and forth in a desired direction along the third axis to adjust the position of the crown **64** as may be required to align the post anchor **50** with the other post anchors **50** of the whole entire building structure. The three adjustment members therefore allow for the adjustment of the post anchor **50** along the three dimensional axes, thereby levelling the post **10** attached thereto.

[00202] To connect posts **10** on the post anchor **50**, the crown **64** comprises a post receiving member **80**. The post receiving member has one or more fastener receiving elements **82** that will align with the regularly spaced apart attachment receiving elements **12** of posts **10** so that a suitable attachment may be inserted therein to secure the post **10** on the crown **64** of the post anchor **50**. As exemplified in Fig. 8, the post receiving element

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comprises a U-shaped bracket, but any suitably shaped bracket may be used as a post-receiving member.

[00203] Now referring to Fig. 9A and B. The building structure of the present invention also includes a demountable floor anchor system. The floor anchor system has joists **20** comprising one or more bridge elements **92** located at a predetermined position along the joists **20**. The bridge elements **92** may also be spaced apart at fixed regular interval. The joists **20** may comprise at least two joist sections (**20A/20B**) to be connected together to form the joist **20**. The joist sections may be joined together at their ends by securing members **28**, which may connect the elongated joist sections by insertion of fasteners in attachment receiving elements present on both structures. The use of joists **20** that are assembled from shorter elongated sections is particularly advantageous as it allows the manufacture of sections that can be handled by one or a few workers without the need for heavy lifting equipment. This is quite advantageous when assembling a housing structure in a wooded area, as trees do not need to be cut to make way for the machinery normally required for assembly of long beams. Furthermore, transportation of the section of joist does not require long and heavy machinery as the sections will fit nicely inside regular truck load. Furthermore, this allows for the joining of multifunctional joist sections that may comprise, for example apertures to receive plumbing, wiring, heating, ventilation, air conditioning (HVAC) ducting, and/or central vacuum ducting.

[00204] The floor anchor system has also secondary joists **100** comprising at each of their end a lug **102** that may be received in the bridge elements **92**. The secondary joists **100** are inserted into the joists **20**, substantially perpendicular to the joists, forming a planar surface that may receive a flooring surface, for example flooring tile T shown in Fig. 10, or other suitable flooring panels. The floor anchor system of the present invention may be partly or completely demounted and reassembled in a first configuration or a different configuration. This is useful in situations where a flooring surface is necessary to complete a phase of construction on a given floor or level of a

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building structure, and upon completion of the phase of construction, the flooring may be completely or partly demounted to create, for example, an entry point for further building materials or machinery inside the structure.

[00205] To further strengthen the floor anchor system, the joists **20** and the secondary joists **100** may be joined reversibly together. In one embodiment, the lug **102** present on the secondary joists **100** comprises a fastener receiving element **104** that aligns with a fastener receiving element **94** present on the joist **20**. Suitable fasteners may be inserted therein to reversibly join the secondary joists **100** to the joists **20** (see Fig. 9). In another embodiment, the secondary joist **100** comprises at each end one or more fastener receiving element **106** that align with a fastener receiving element **96** present on the joist **20**. Suitable fasteners may be inserted therein to reversibly join the secondary joists **100** to the joists **20** (see Figs. 5 and 11).

[00206] To further strengthen the flooring surface disposed on the floor anchor system of the present invention, the joists **20** and the secondary joists **100** include one or more fastener receiving elements **98** or **108**, that may be disposed at predetermined positions, and/or be spaced apart at fixed regular intervals.

[00207] In use, the demountable and reassemblable floor structure is built by assembling a plurality of prefabricated floor components including a plurality of joists **20**, and a plurality of secondary joists **100**. The plurality of joists **20** are placed parallel to each other, and the lugs **102** of the secondary joists **100** are inserted into each facing bridge elements **92**. After assembly, the joists **20** and the secondary joists **100** are substantially perpendicular to each other and form a planar surface that may receive a flooring surface (e.g. floor tiles **T**). The floor structure is partly or completely demountable and reassemblable in the first configuration or a different configuration by pulling the lugs **102** off the secondary joists **100**.

[00208] The floor structure may be solidified by fastening the plurality of secondary joists **100** to the plurality of joists **20**, and a usable floor may be built by overlaying a flooring surface on the demountable floor structure.

Fastening of the plurality of secondary joists **100** to the plurality of joists **20** may be done before or after the flooring surface has been disposed over the planar surface.

[00209] Now referring to Fig. 15A-D. After completion of the flooring, ceiling panels may be installed. This may be achieved by disposing perpendicular to the joists **20** a plurality of ceiling furring strip receiving elements **110**. The ceiling furring strip receiving elements **110** are inserted in receiving elements **112** which are disposed on the joists **20**, preferably at regular intervals. The ceiling furring strip receiving elements **110** may be fastened by regular means, or the end portion inserted into the receiving elements **112** may be bent in order to secure them in the receiving elements **112**. Furring strips **130** may then be inserted into the furring strip gripping members **116** which are disposed along the length of the ceiling furring strip receiving elements **110** and have opposed hook members **118** which are separated by a length of the ceiling furring strip receiving elements **110**. Ceiling panels may be attached to the furring strips **130** to constitute a ceiling. The ceiling panels may be any type of wall panel, for example a wood, a dry wall panel, etc.

[00210] In embodiment, there is also disclosed a kit for a demountable and reassemblable wall. This kit contains a demountable furring strip support **120** (see Fig. 12A) having a demountable furring strip gripping member **122** which comprises one or more spacer, and hook members **126** connected at opposite ends of the spacer. The demountable furring strip support **120** also has a demountable attachment member **128** that is connected to the demountable furring strip gripping member **122**. The demountable attachment member **128** may be received in a compatible attachment receiving element, such as elements **14** of posts **10**. The demountable furring strip support **120** may be manufacture as a single, integral piece of material. The material of the furring strip support **120** may be a sound dampening material to provide the assembled walls with an additional level of sound proofing if required. . The

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wall panel may be any type of wall panel, for example a wood, a dry wall panel, etc.

[00211] The kit may also comprise another embodiment of a demountable furring strip support **210**, which comprises an elongated planar member **212** that includes at least one furring strip gripping member **214** having first and second hooks **214**. A plurality of furring strip gripping member may be disposed on the edge of the elongated planar member so as to accommodate several furring strips **130**. Furthermore, the elongated planar member comprises a plurality of regularly spaced apart attachment receiving elements that may receive compatible attachments therein so as to affix the furring strip support **210** to a post **10**. The demountable furring strip support **210** may comprise two elongated planar member held substantially parallel to each other by a spacer member. For example, the demountable furring strip support **210** may be a U-shaped integral structure.

[00212] In use, the demountable and reassemblable wall support system comprises furring strips **130** and two or more furring strip supports **120** or **210**. The furring strip **130** is inserted into and supported by the furring strip support **120** or **210**, and the assembly may be mounted on substantially elongated posts **10**. Also, kits for a demountable and reassemblable wall comprise one or more wall panels **140** that define interior and an exterior, one or more furring strips **130**, and two or more furring strip support **120** or **210**. The wall panel **140** may be any type of wall panel, for example a wood, a dry wall panel, etc. In use, the furring strips **130** are received by the furring strips supports **120** or **210**, and they are mounted into the attachment receiving elements (e.g. elements **14**) of two or more substantially elongated posts **10**. The wall panels **140** may be fixed to the furring strips **130** prior to or after the furring strips **130** and furring strips supports **120** or **210** have been combined. Once assembled and mounted on the substantially elongated posts **10**, the wall panel **140** is spaced from the substantially elongated posts **10** in such a manner that a space is defined between the wall panel **140** and each of the substantially elongated posts **10**. The space therein defined substantially

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reduces thermal bridge effects between the interior and the exterior demountable wall system. To complement the insulation of the wall, an insulation element may be added, engaged between each of the substantially elongated posts **10**, adjacent to the wall panel **140**. The insulation element may be an insulation panel, an insulation fiber, or insulation foam, sprayed insulation foam (e.g. polyurethane foam), mineral wool, cellulose or any other types of insulation material or combinations thereof.

[00213] Now referring to Fig. 13A-J, the present invention also includes a demountable electrical junction box support **160** that comprises a demountable furring strip gripping member **162** which has one or more spacer **164**, and hook member **166** connected to the spacer **166**. According to one embodiment, the demountable furring strip gripping member **162** may comprise two hook members **166** connected at opposite ends of the spacer **164** (Fig. 13A-J). A housing **168** is connected to the demountable furring strip gripping member **162**. The housing **168** contains an aperture that may receive at least one electrical junction box B (Figs. 13A and B). According to another embodiment, the housing **168** may contain an aperture capable of receiving two or more electrical junction box B or one large, two slotted electrical box B is shown in Figs. 13D-F, H and J. The demountable electrical junction box support **160** may be built integrally from a single piece of material, and it may also be prepared with an electrical box B already comprised therein. According to one embodiment, the demountable furring strip gripping member **162** may be connected to the spacer **164** at a right angle or at an angle different than a right angle. Preferably, the demountable furring strip gripping member **162** may be connected to the spacer **164** at an obtuse angle (Fig. 13C), for example from about 100° to about 120°, or from about 100° to about 110°, and preferably 110°.

[00214] In use, an electrical box B is preferably inserted into the demountable electrical junction box support **160** prior to its positioning on a furring strip **130**. The electrical box B may also be inserted after the demountable electrical junction box support **160** is positioned on the furring

strip 130. The electrical box B may be fixed to the demountable electrical junction box support **160** through any suitable fixation elements premade in the housing **168** and/or spacer **164**. According to one embodiment, the fixation element may be holes premade to receiving conventional fasteners such as screws, but other commonly used means known in the art are also contemplated. For example, complementary clips and grooves, or friction engagement means would be suitable. The demountable electrical junction box support **160** is mounted on the furring strip **130** by the pressure of a hand so that the rims of the furring strip **130** are inserted in the hook member **166**. The demountable electrical junction box support **160** allows positioning of the electrical box B at any position on the furring strip **130**, irrespective of the position of vertical beams.

[00215] Now referring to Fig. 14A-C. The present invention also includes a kit for a demountable and reassemblable frame **1400** comprising a frame assembly **1410** such as a window assembly or a door assembly, having an interior and an exterior surface. The interior of the frame assembly has at least two frame assembly attachments **1430** facing the interior surface. The frame assembly attachments **1430** may secure the frame assembly **1400** to a respective first and second substantially parallel post **10**. The posts **10** have a plurality of regularly spaced apart attachment receiving elements that may receive the frame assembly attachments **1430**, by insertion, for example, of a fastener **1431**. Alternatively, the frame assembly attachments **1430** may be configured to directly insert and secure into the attachment receiving elements. The frame **1400** also comprises a first and second furring strip receiving bar **1420** which comprises at least one furring strip gripping member that may receive at least one furring strip **130**. The furring strip receiving bar **1420** may be secured substantially perpendicular to each of the substantially parallel posts to form a border around the frame assembly **1400**. The furring strip gripping member comprises first and second hook members, opposed and facing each other so as to secure a furring strip therein. The furring strip receiving bar **1420** may receive two or more furring strips **130**.

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[00216] The demountable and reassemblable frame **1400** is particularly advantageous to easily install windows in a building structure according to the present invention. Windows are commonly installed from the exterior of the building, where they are inserted in the space prepared for such purpose. This does not pose particular problems for windows that are installed at ground level, but for windows that are installed above ground level, workers must lift the windows frames to the appropriate height, using lifting equipment and/or scaffolding. This type of work always comprises a degree of risk to the workers that may fall off the equipment or scaffolding. With the frame of the present invention, the window frames are preferably simply brought inside the building structure, and workers only need to slide them in the aperture define by the posts **10** and the furring strip receiving bar **1420**, and secure them as required. All the work may be performed inside the structure, where the risk of falling a great distance to the ground is practically inexistent. The window frames **1400** may also be installed from the exterior of the building structure if desired.

[00217] Now referring to Fig. 16A-D. The present invention also includes a kit for a demountable and reassemblable frame assembly **200** defining an aperture **210**, and comprising vertical frame elements **220** and horizontal frame elements **230**, and at least two frame assembly attachments **250**. The frame **200** may be used to frame window assembly **215** or a door assembly, having an interior and an exterior surface. The frame assembly attachments **250** may secure the frame assembly **200** to a respective first and second substantially parallel post **10**. The posts **10** have a plurality of regularly spaced apart attachment receiving elements that may receive the frame assembly attachments **250**, by insertion, for example, of a fastener. Alternatively, the frame assembly attachments **250** may be configured to directly insert and secure into the attachment receiving elements. According to some embodiments, the frame assembly attachments **250** may connect to regularly spaced apart attachment receiving elements on the surface of the posts **10** which is parallel and adjacent to the vertical frame elements **220**

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(such as in Fig. 16C-D). According to another embodiment, the frame assembly attachments **250** may be shaped and/or positioned to connect to regularly spaced apart attachment receiving elements on the surface of the posts **10** which is perpendicular to the vertical frame elements **220**. The vertical and horizontal frame elements **220** and **230** may be manufactured as unitary elements, or they may be manufactured as several element such as first and second vertical frame elements **221** and **222**, and first and second horizontal frame elements **231** and **232**, which may also be fastened to the posts **10** by insertion of fasteners into regularly spaced apart attachment receiving elements. The frame assembly **200** may be assembled prior to insertion of the window assembly **215**, such that insulation material may also be added prior to the insertion of the window assembly. This is convenient in cases where the window assembly is made from a material that may be deformed by the pressure caused by the expansion of sprayed insulation material, for example, PVC made window assemblies. The window frames **200** may also be installed from the exterior of the building structure if desired.

[00218] The embodiments and examples presented herein are illustrative of the general nature of the subject matter claimed and are not limiting. It will be understood by those skilled in the art how these embodiments can be readily modified and/or adapted for various applications and in various ways without departing from the spirit and scope of the subject matter disclosed claimed. The claims hereof are to be understood to include without limitation all alternative embodiments and equivalents of the subject matter hereof. Phrases, words and terms employed herein are illustrative and are not limiting. Where permissible by law, all references cited herein are incorporated by reference in their entirety. It will be appreciated that any aspects of the different embodiments disclosed herein may be combined in a range of possible alternative embodiments, and alternative combinations of features, all of which varied combinations of features are to be understood to form a part of the subject matter claimed.

CLAIMS

1. A measurement free system for building a demountable and reassemblable building structure comprising:

- a plurality of prefabricated building components comprising a plurality of posts and joists, each having a plurality of regularly spaced apart attachment receiving elements;

- a plurality of removable attachments for engaging into the regularly spaced apart attachment receiving elements for demountably joining the plurality of posts and joists,

wherein the regularly spaced apart attachment receiving elements allow for assembling measurement free building structures which are demountable and re-assemblable in different configurations; and a demountable ceiling anchor system comprising:

- at least two joists, each of said joists comprising receiving elements located at a predetermined position along the joist for receiving a ceiling furring strip receiving element;
- at least one ceiling furring strip receiving element comprising a gripping member and adapted to receive at least one furring strip within the gripping member; said at least one ceiling furring strip receiving element having a first end for attaching to a first receiving element of a first joist and a second end for attaching for attaching to a second receiving element of a second joist, and being disposed perpendicular to the first joist and the second joist;
- at least one furring strip to be inserted into the gripping member of the ceiling furring strip receiving element; wherein when two or more furring strips are inserted in said ceiling furring strip receiving element they form a planar surface to receive a ceiling surface.

2. The system as defined in claim 1, wherein each joist comprises an upper surface for receiving a floor and a lower surface for receiving the ceiling surface,

and wherein the receiving elements adapted to receive the ceiling furring strip receiving element are provided in the lower surface of the joists.

3. The system as defined in claim 1, wherein the joist comprises at least two elongated joist sections, to be connected together to form the joist and at least one securing member to join the at least two elongated joist sections together to form the joist.

4. The system as defined in claim 3, wherein the posts and the joists each further comprises at least one aperture to receive plumbing wiring, heating, ventilation, air conditioning (HVAC) ducting, and/or central vacuum ducting.

5. The system of any one of claims 1 to 4, comprising:

an exterior wall panel defining an interior and an exterior of the structure comprising a first exterior wall panel attachment and a second exterior wall panel attachment;

at least two substantially elongated posts, each of the posts comprising at least one attachment receiving element for receiving a respective one of the first and second exterior wall panel attachment so that when the first and second wall panel attachments are received by the attachment receiving elements, the wall panel is spaced from the at least two posts defining a space between the panel and each of the posts; and

an insulation adapted to be engaged between each of the posts, adjacent the wall panel,

wherein the space substantially reduces a thermal bridge effect between the interior and the exterior of the structure and wherein the building structure is adapted to be partly or completely demounted and reassembled in a first configuration or a different configuration.

6. The measurement free system for building a demountable and reassemblable building structure of any one of claims 1 to 5, further comprising a demountable exterior wall panel attachment comprising:

- a first demountable attachment member, to be received in a compatible attachment receiving element;

- a second demountable attachment member, to receive a compatible exterior wall panel; and
- a spacer, connecting the first and second attachment member.

7. The measurement free system for building a demountable and reassemblable building structure of any one of claims 1 to 6, further comprising a post anchor adjustable along the three dimensional axes comprising:

a base member to be anchored into a building foundation and having a mounting member thereon, the mounting member being adjustable along a first axis; and

a retaining member having

a seat, mountable on the mounting member and being adjustable along a second axis, and

a crown, to receive one of the posts and being adjustable along a third axis,

wherein the post anchor is adjustable along the three dimensional axes to correctly align the post anchor to the foundation and level the one of the posts attached thereto.

8. The system for building a demountable and reassemblable building structure of claim 5, further comprising a kit for a demountable floor anchor system comprising:

at least two joists, each of the joist comprising at least one bridge element located at a predetermined position along the joist; and

at least one secondary joist comprising at each end a lug to be received in the bridge element,

wherein when the secondary joist is inserted into each of the at least two joists, the secondary joist is substantially perpendicular to the at least two joists, and forms a planar surface to receive a flooring surface, and

wherein the demountable floor anchor system can be partly or completely demounted and reassembled in a first configuration or a different configuration.

9. The system for building a demountable and reassemblable building structure of claim 5, further comprising a demountable floor structure comprising a plurality of secondary joists, wherein the joists and the secondary joists are substantially perpendicular to each other and form a planar surface to receive a flooring surface.

10. The measurement free system for building a demountable and reassemblable building structure of any one of claims 1 to 9, further comprising a demountable furring strip support comprising:

- a demountable furring strip gripping member comprising
at least one of
 - a spacer, and
 - a first and second hook member connected at opposite ends of the spacer; and
- a demountable attachment member, to be received in a compatible attachment receiving element and connected to the demountable furring strip gripping member.

11. The measurement free system for building a demountable and reassemblable building structure of any one of claims 1 to 9, further comprising a demountable furring strip support comprising:

- at least one elongated planar member comprising
 - at least one furring strip gripping member having a first and second hook member to secure a furring strip; and
 - a plurality of regularly spaced apart attachment receiving elements to receive compatible attachments.

12. The measurement free system for building a demountable and reassemblable building structure of any one of claims 1 to 11, further comprising a demountable electrical junction box support comprising:

- a demountable furring strip gripping member comprising at least one of

a spacer, and

a hook member connected to the spacer; and

- a housing, connected to the demountable furring strip gripping member, the housing comprising an aperture to receive at least one electrical junction box.

13. The system for building a demountable and reassemblable building structure of claim 5, further comprising a kit for a demountable and reassemblable frame comprising:

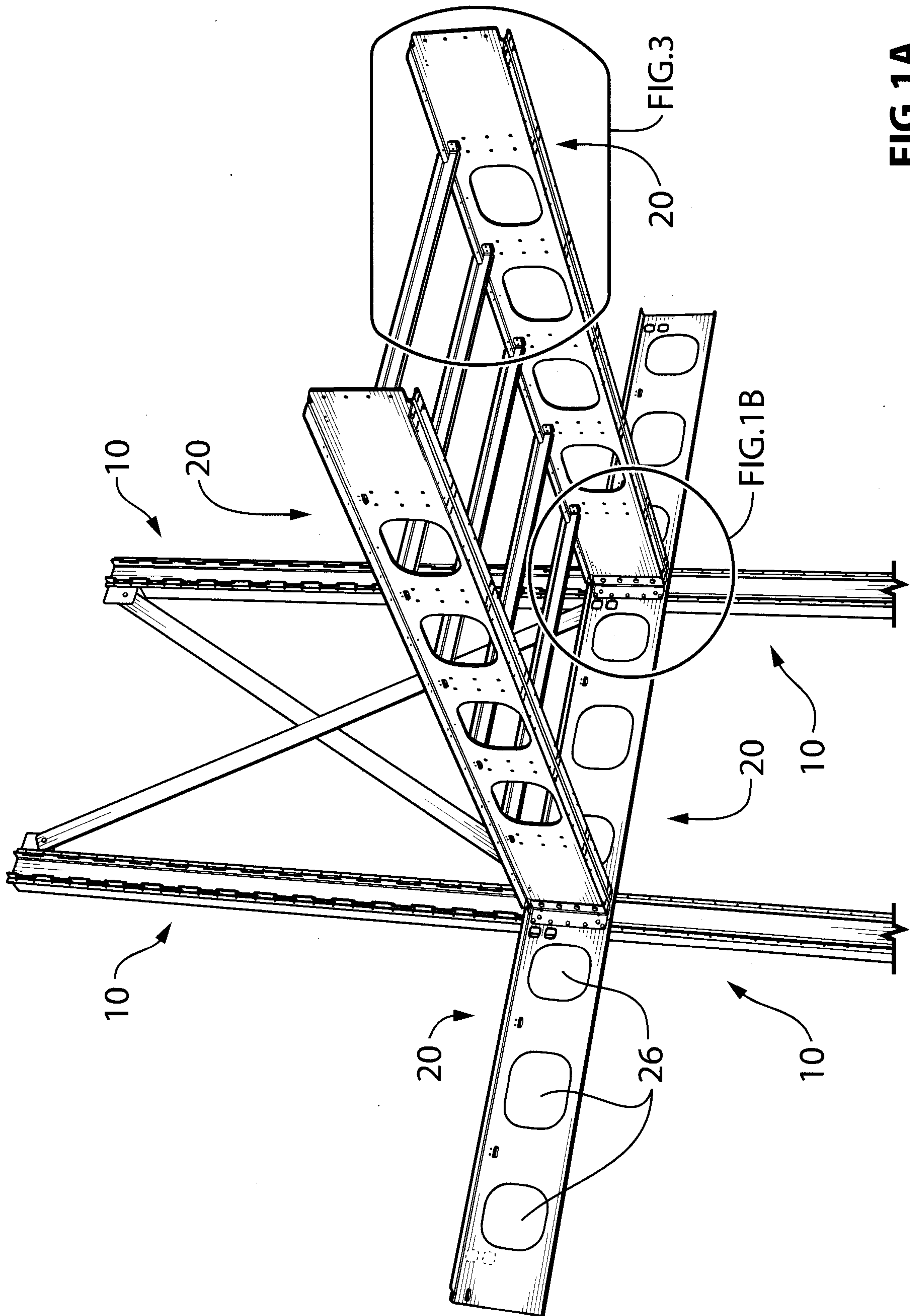
- a frame assembly having an interior and an exterior surface comprising
 - at least two frame assembly attachments facing the interior surface to secure the frame assembly to a respective first and second substantially parallel post,
 - the post having a plurality of regularly spaced apart attachment receiving elements to receive the frame assembly attachments;
- a first and second furring strip receiving bar comprising
 - at least one furring strip gripping member to receive at least one furring strip;
 - the furring strip receiving bar adapted to be secured substantially perpendicular to the first and second substantially parallel posts to form a border around the frame assembly.

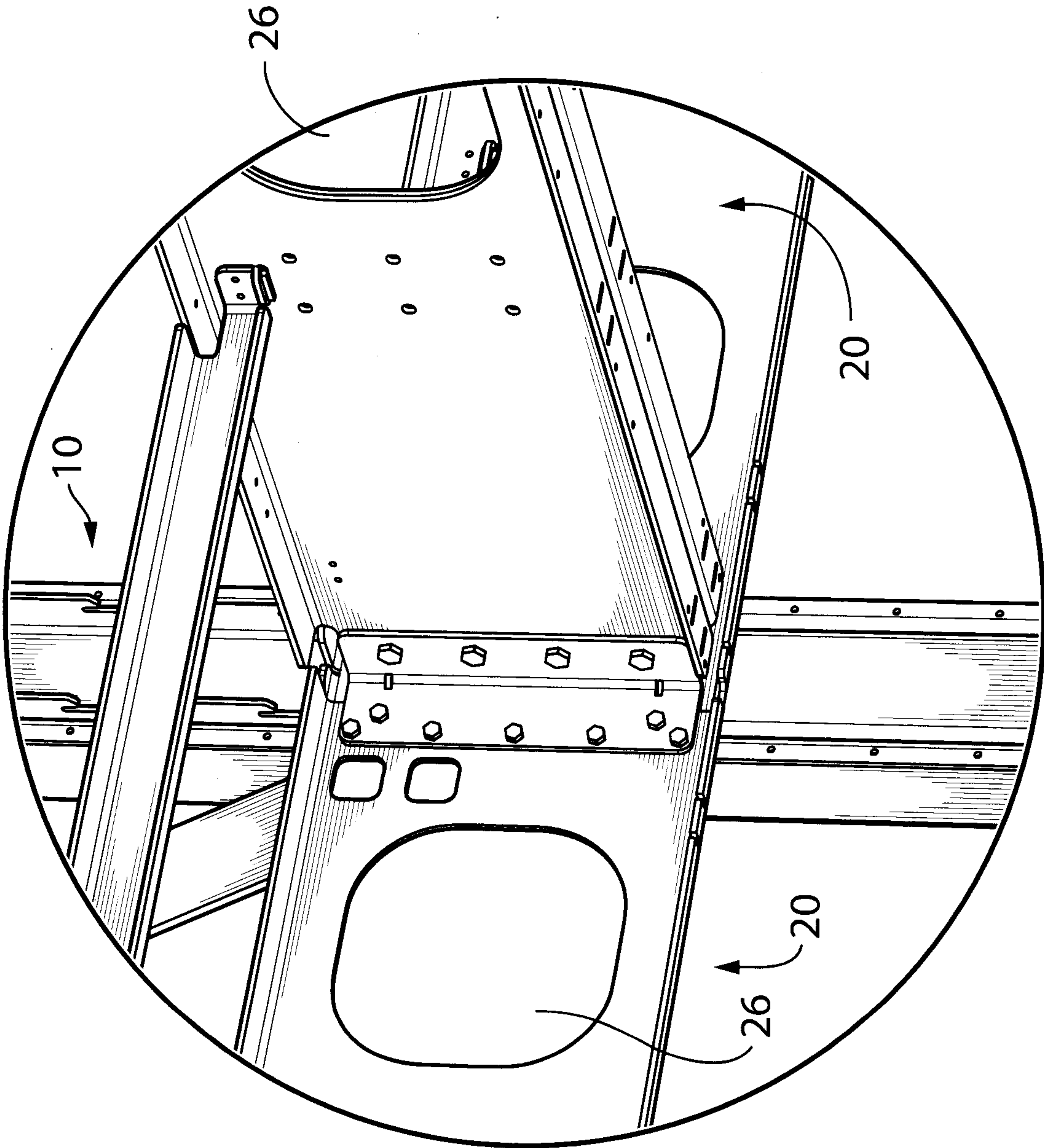
14. The system for building a demountable and reassemblable building structure of claim 5, further comprising a kit for a demountable and reassemblable frame comprising:

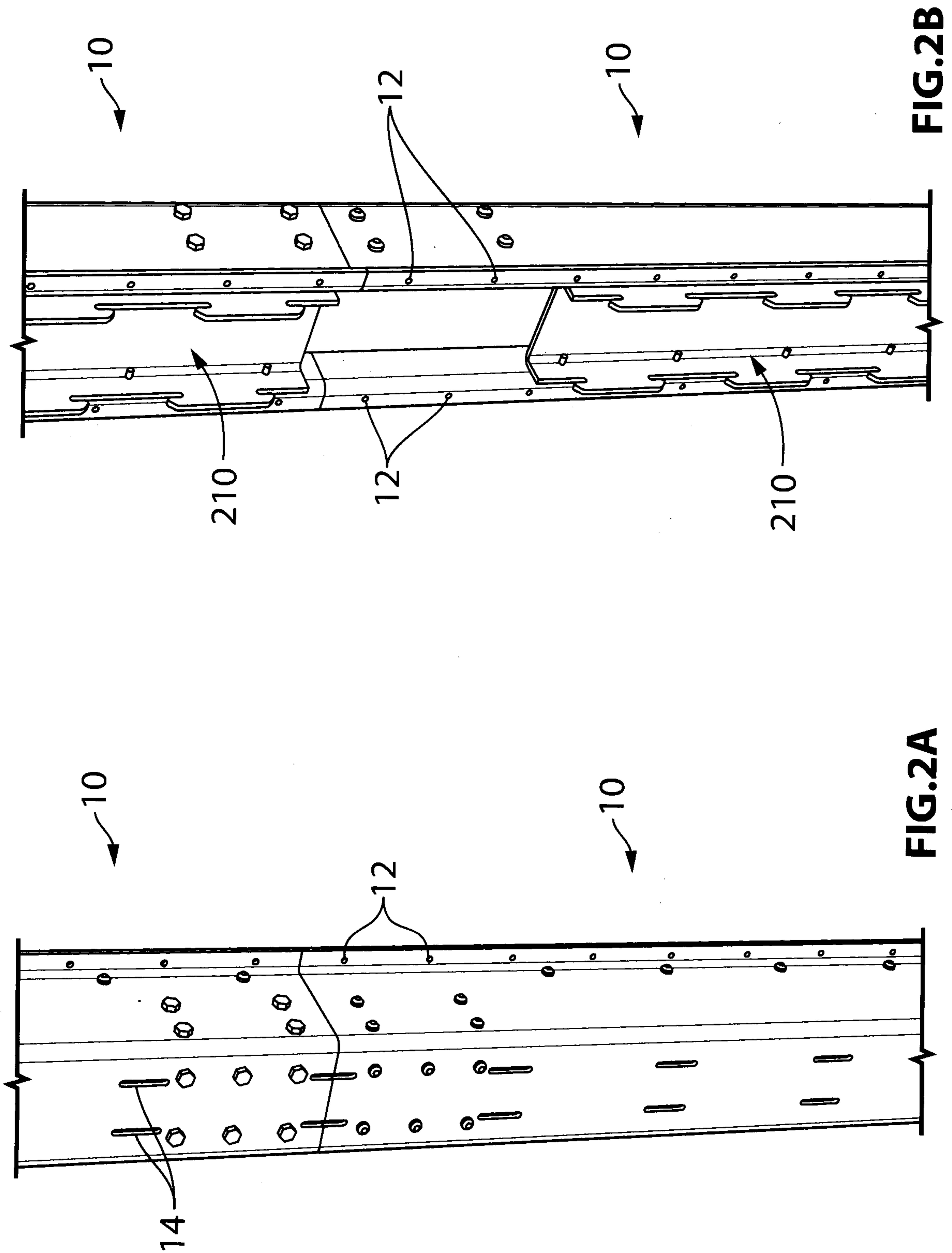
- a frame assembly having
 - at least two horizontal frame elements, substantially parallel to one another,
 - at least two vertical elements substantially parallel to one another, defining an aperture, and
- at least two frame assembly attachments to secure the frame assembly to a respective first and second substantially parallel post

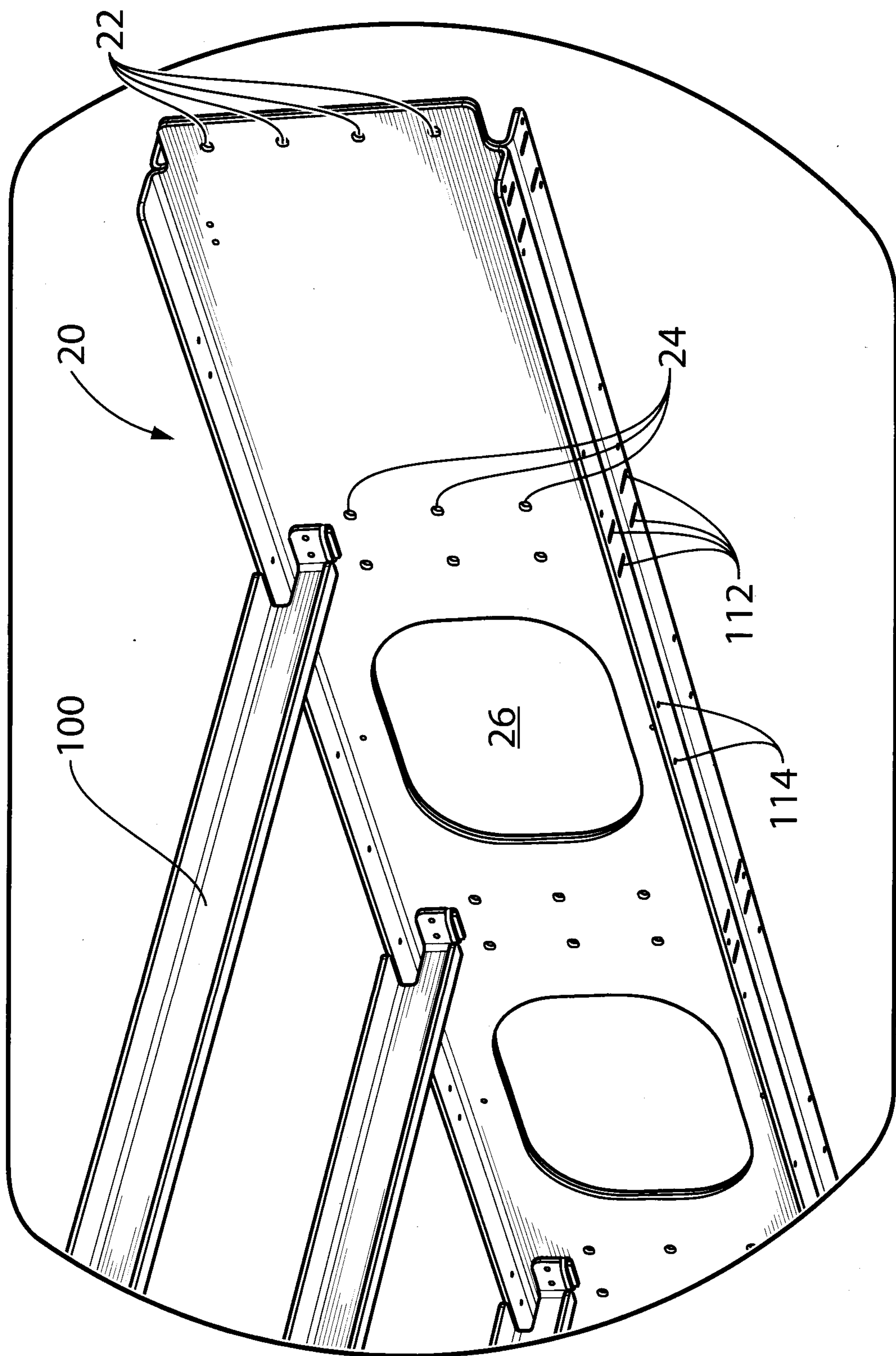
wherein the post having a plurality of regularly spaced apart attachment receiving elements to receive the frame assembly attachments.

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**FIG. 1B**



**FIG. 3A**

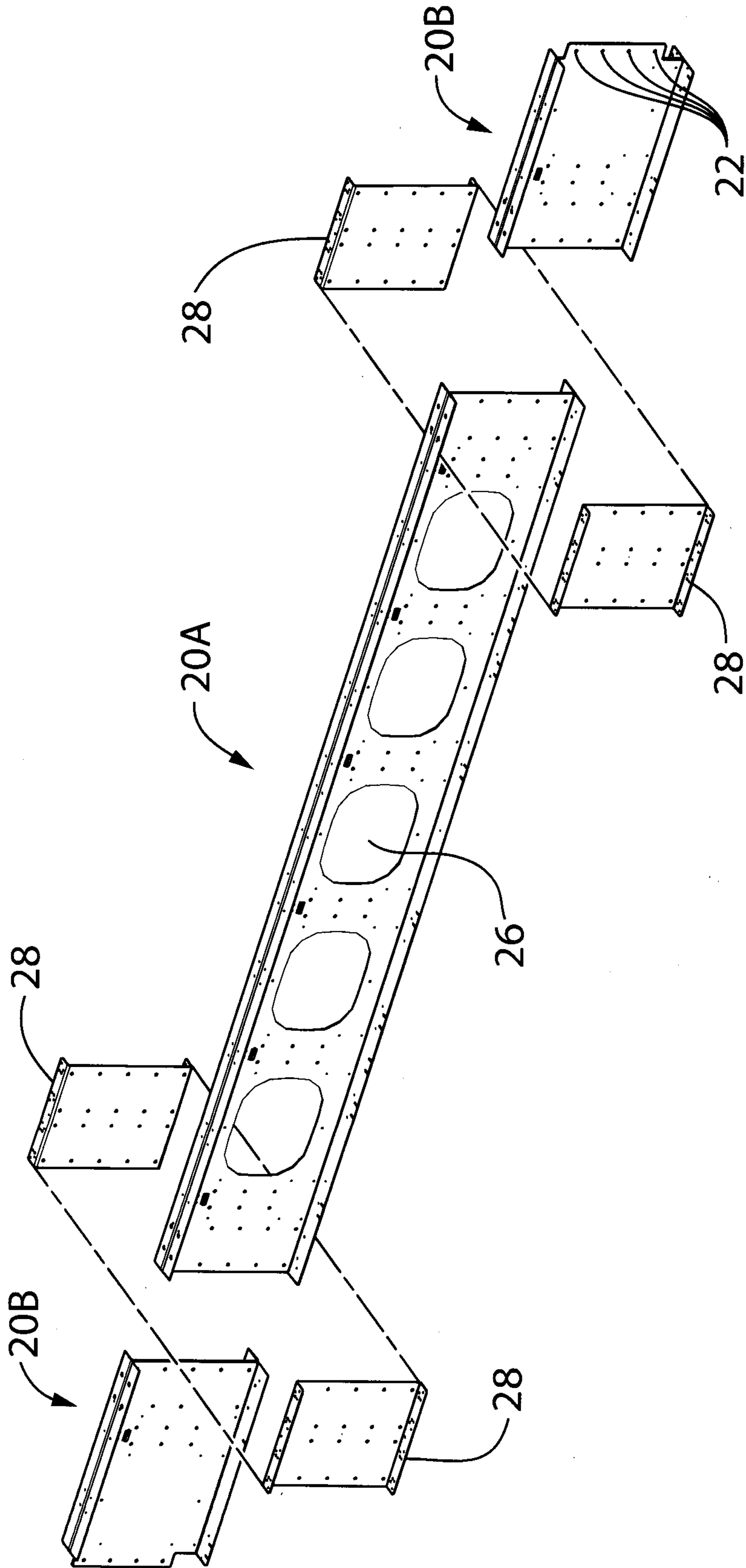
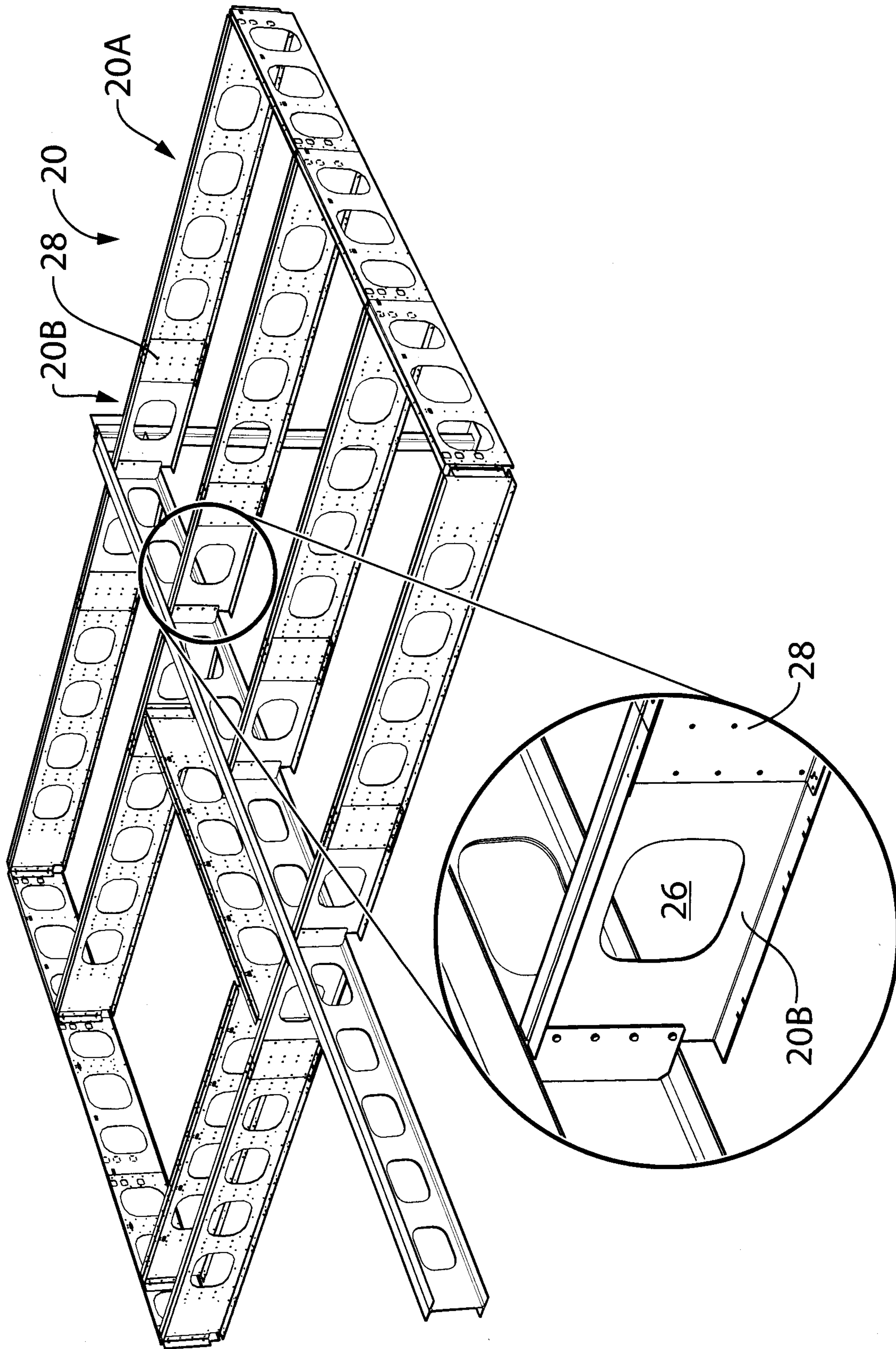


FIG.3B

**FIG. 3C**

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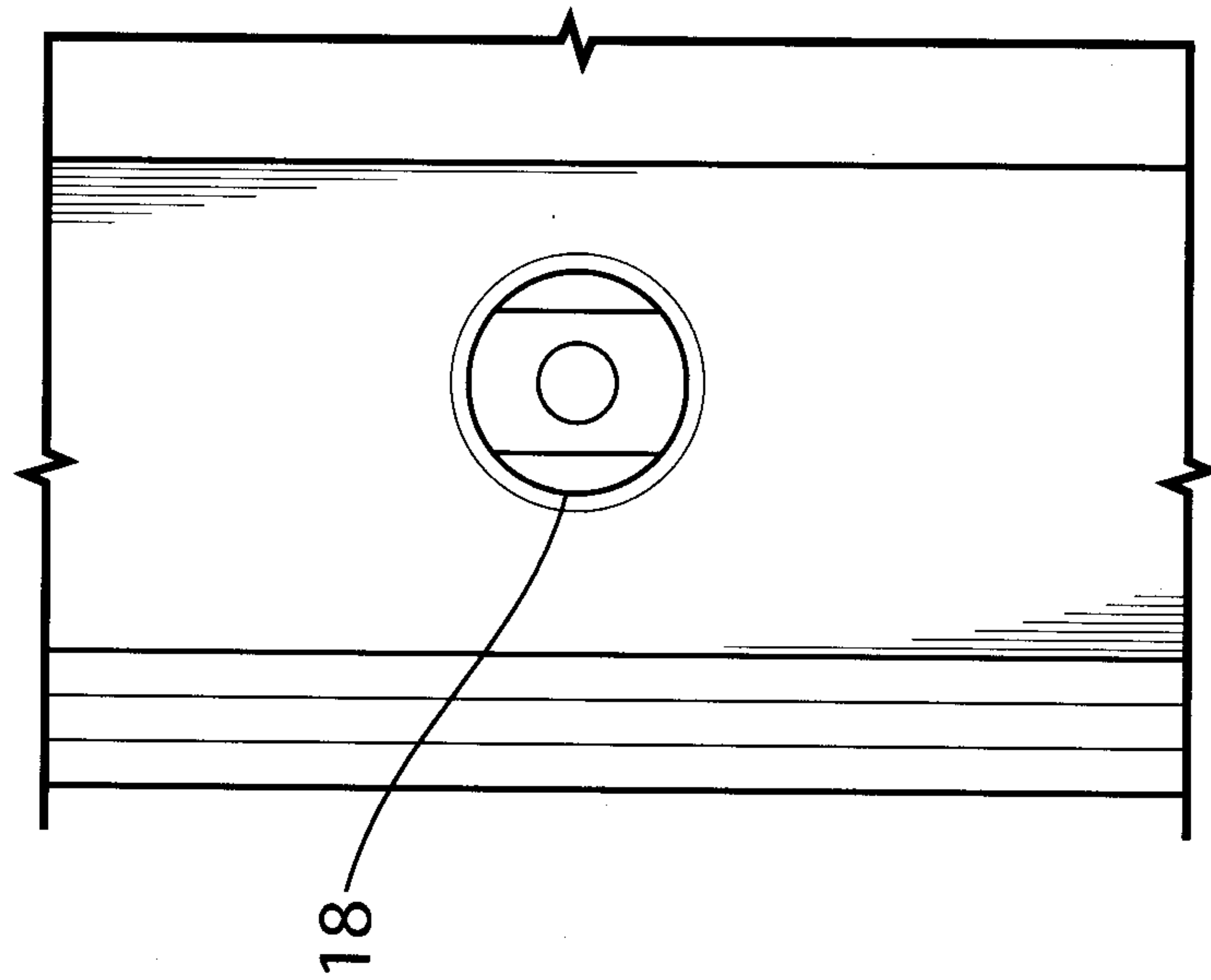


FIG. 4

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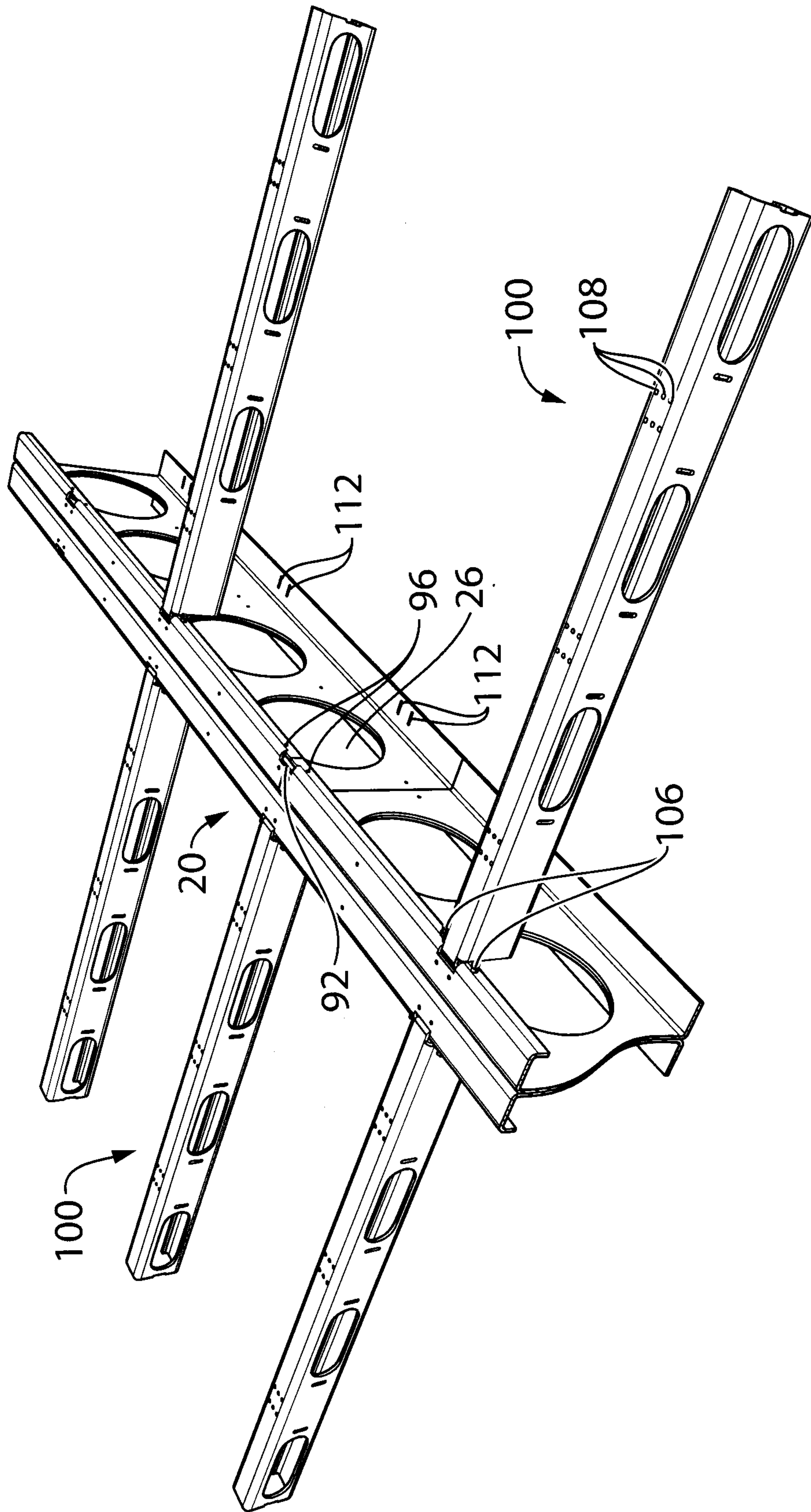
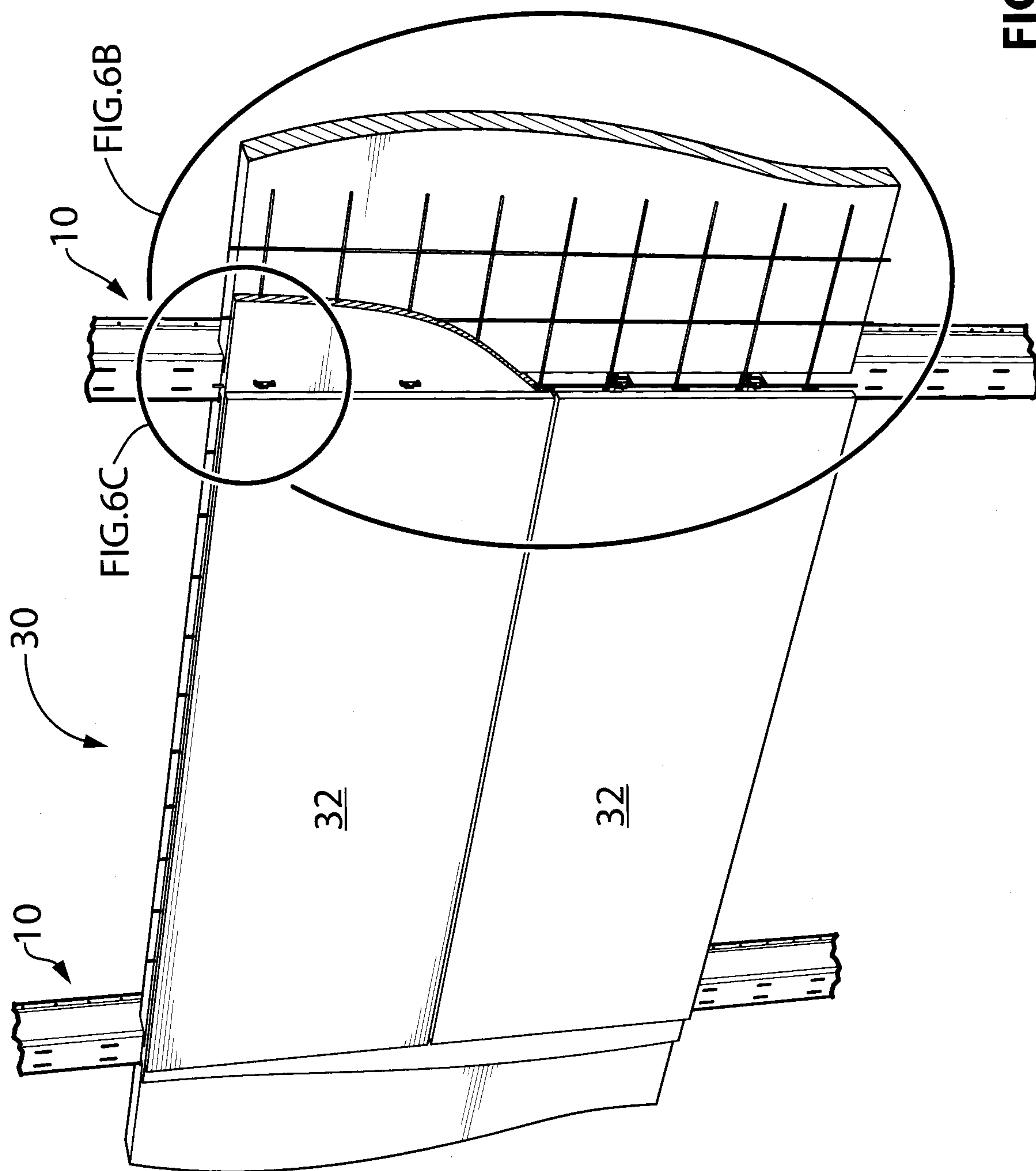


FIG. 5

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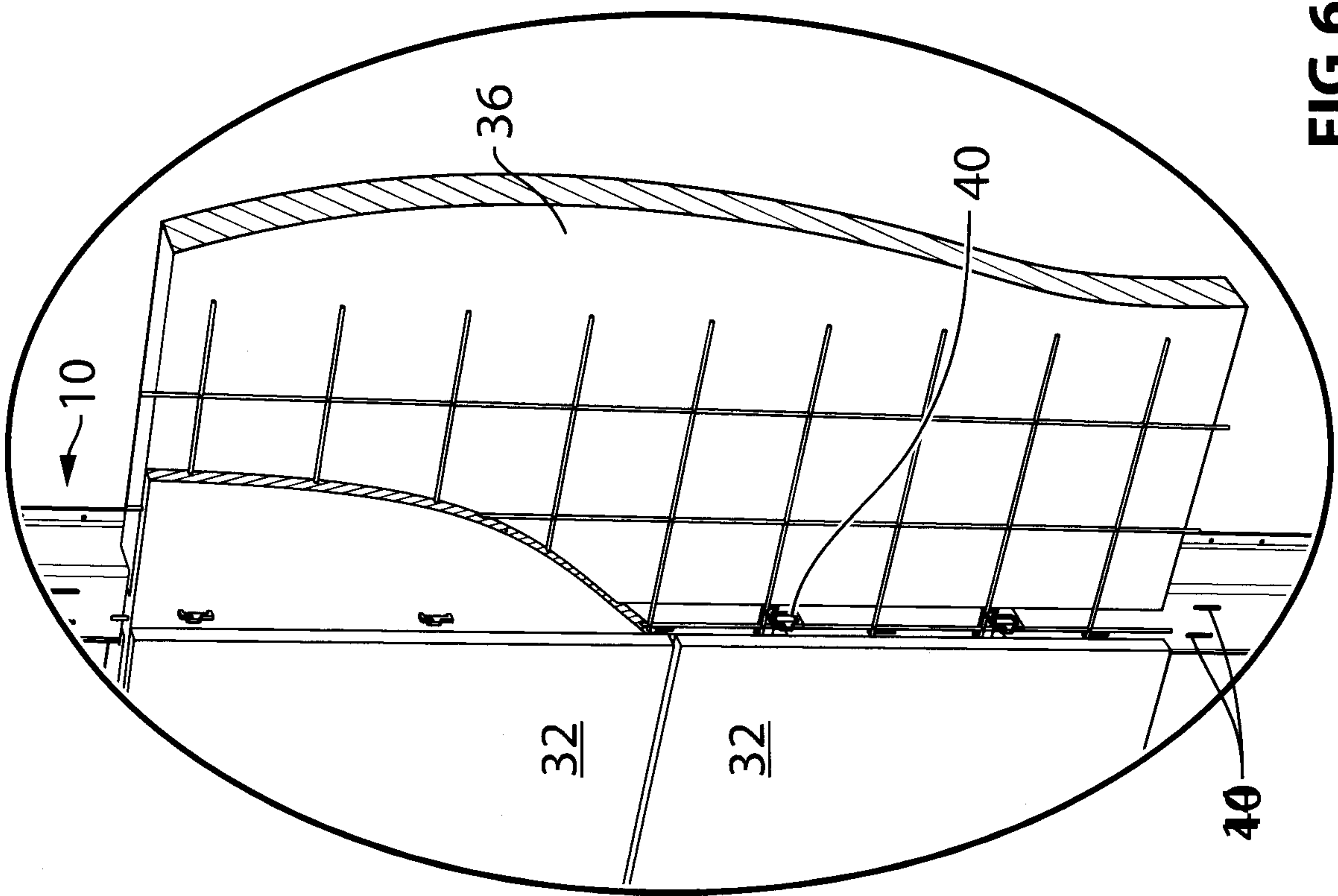


FIG. 6B

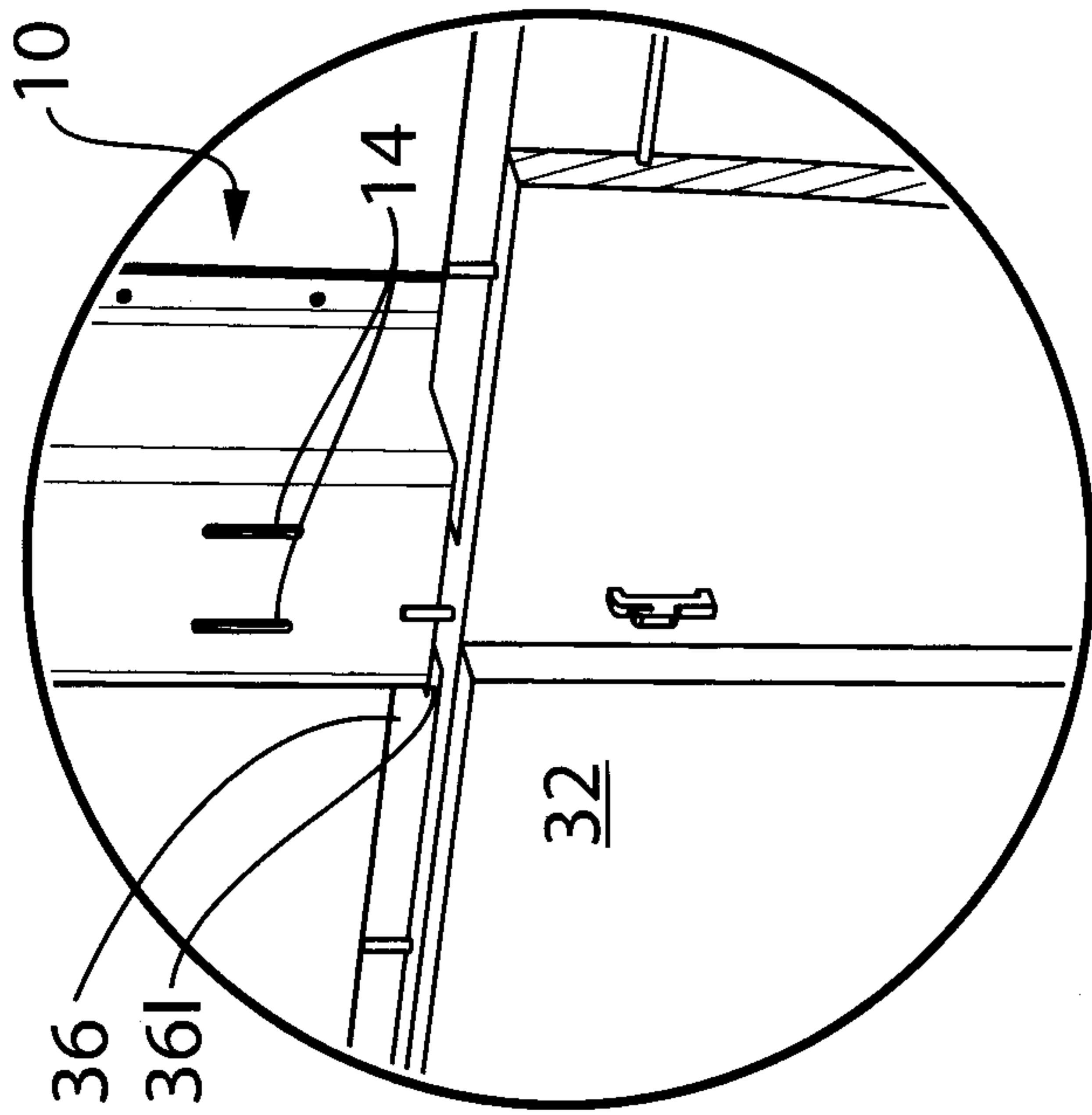
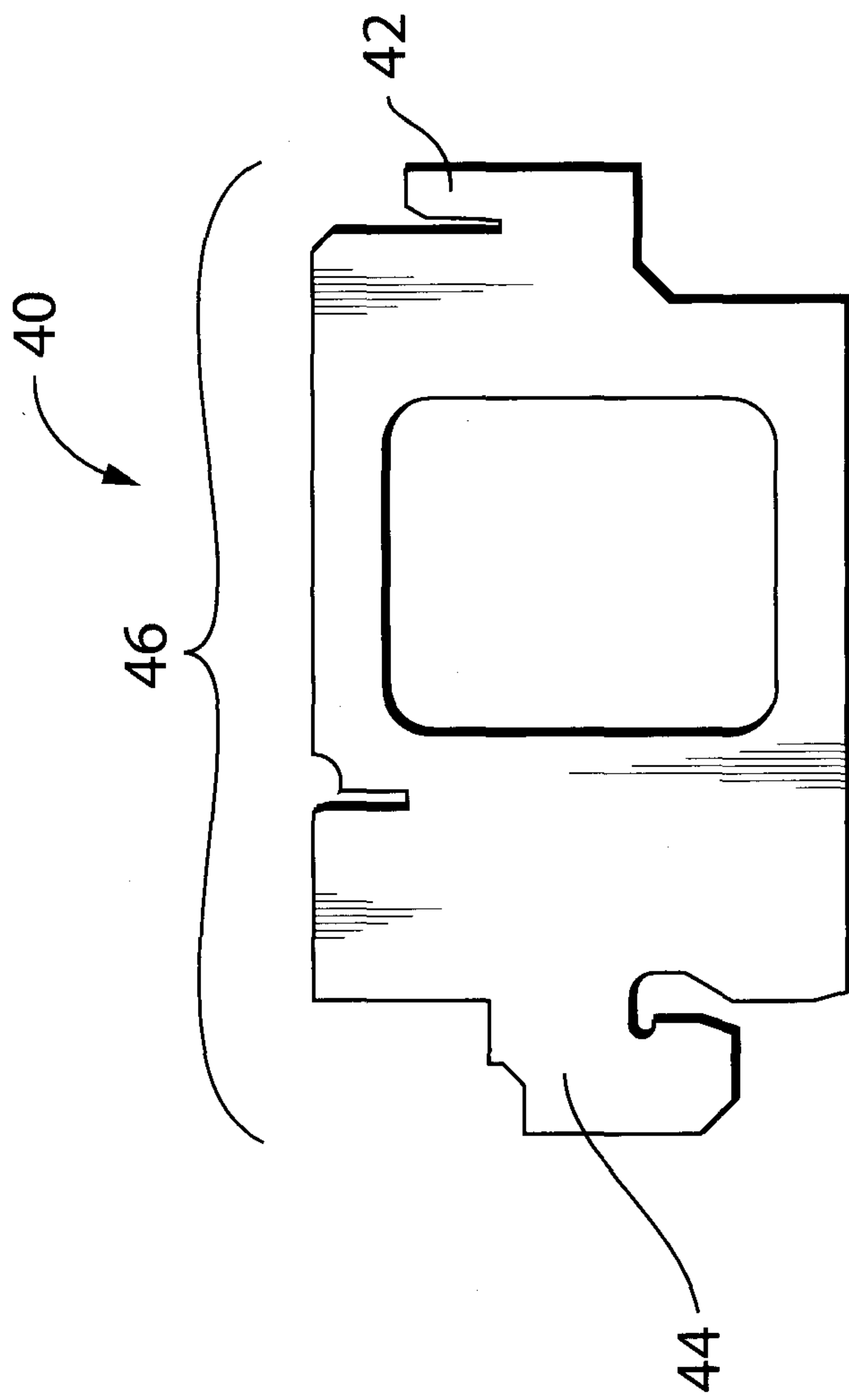
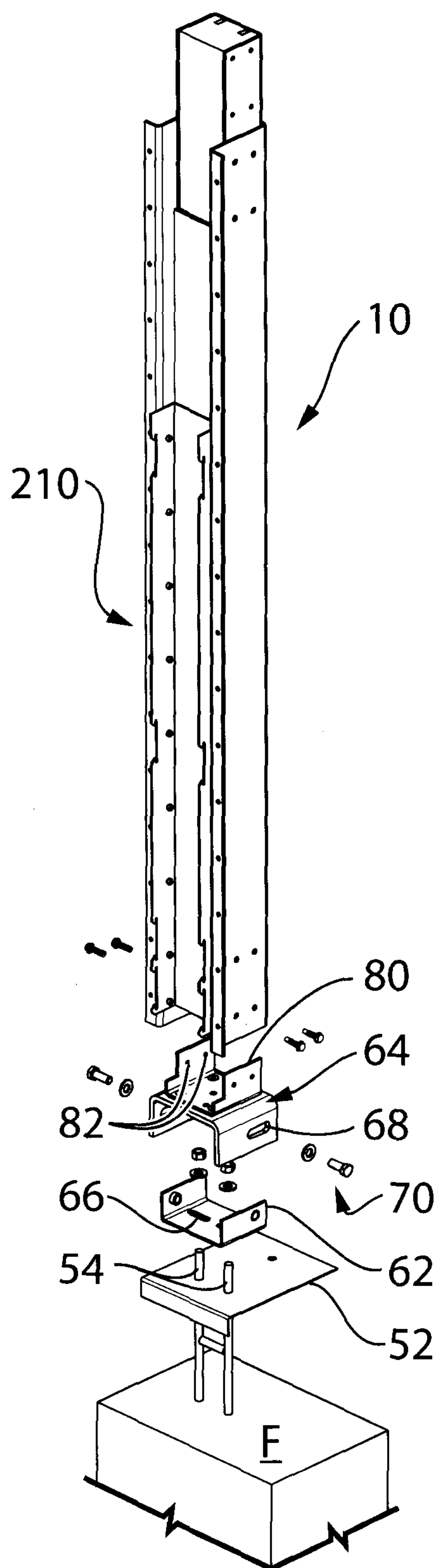
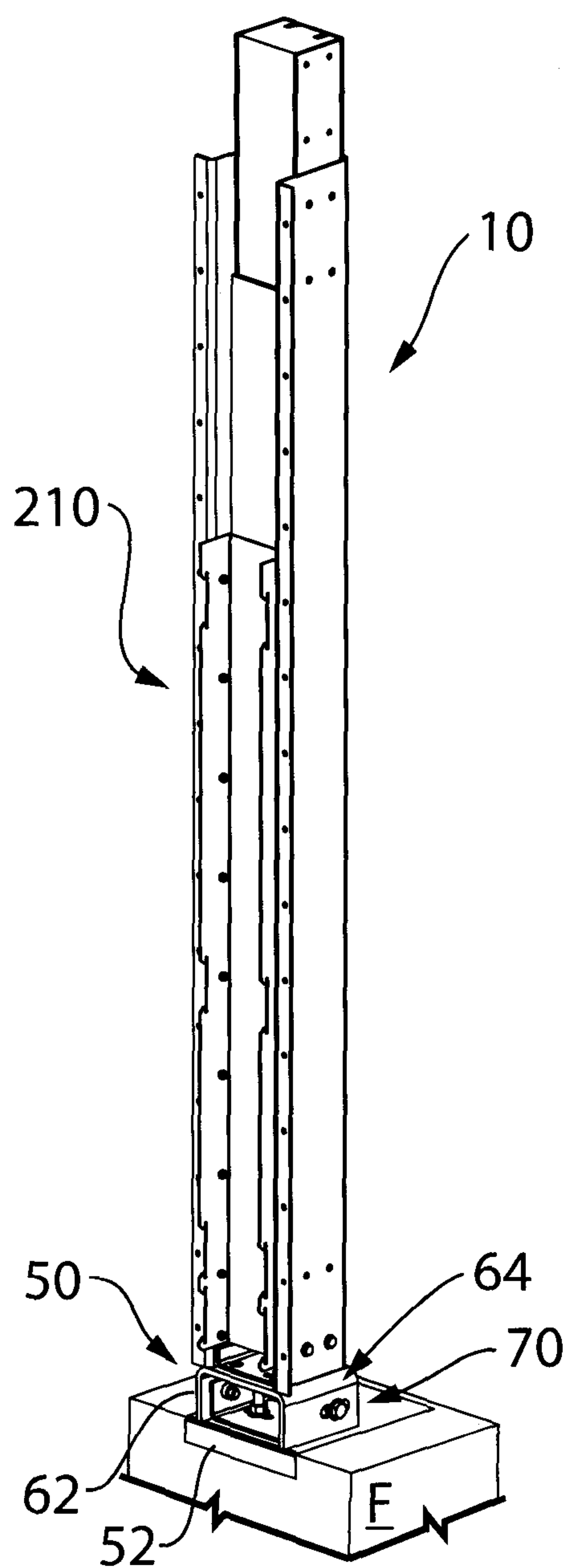


FIG. 6C

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**FIG. 7**

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**FIG.8A****FIG.8B**

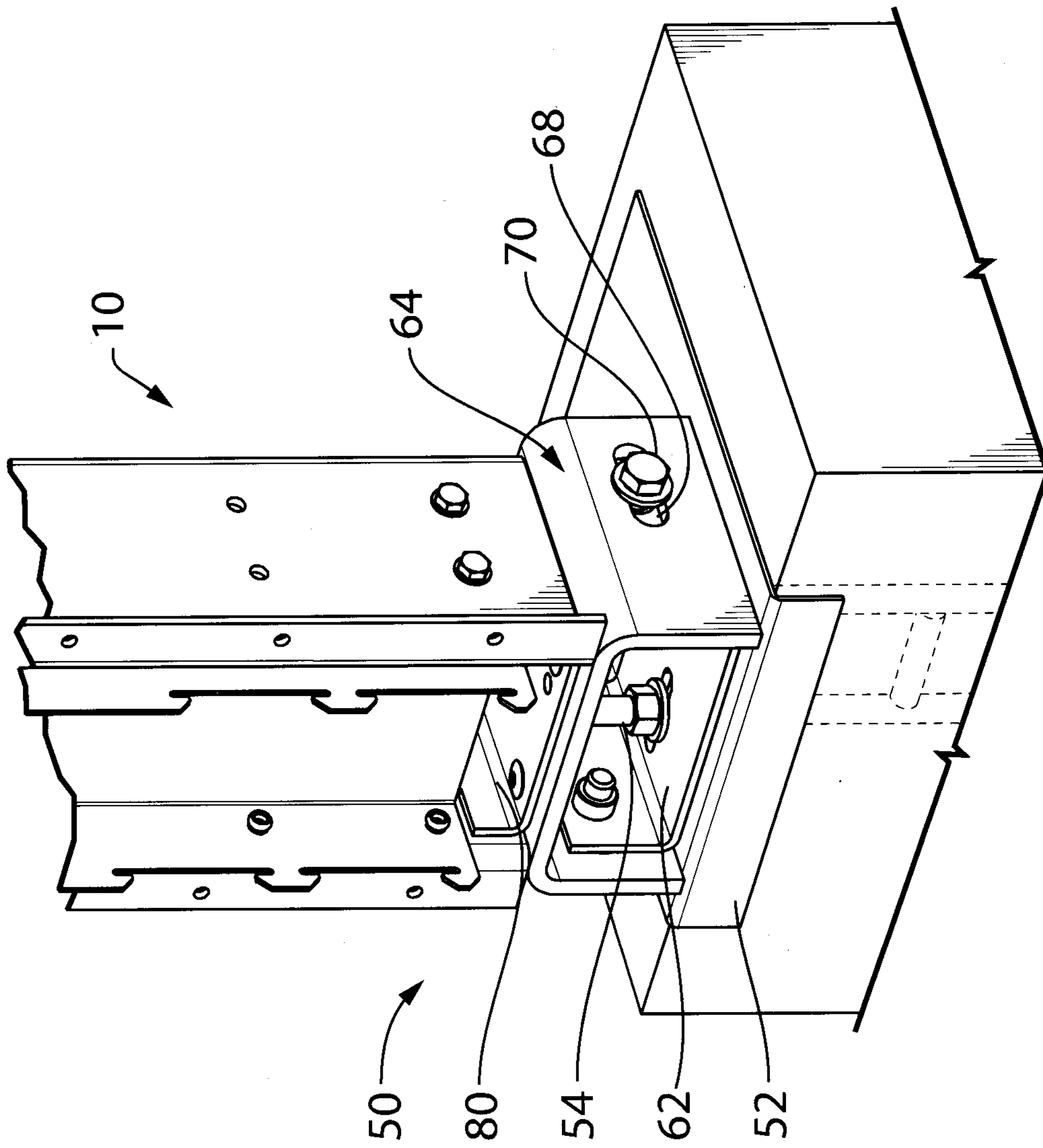
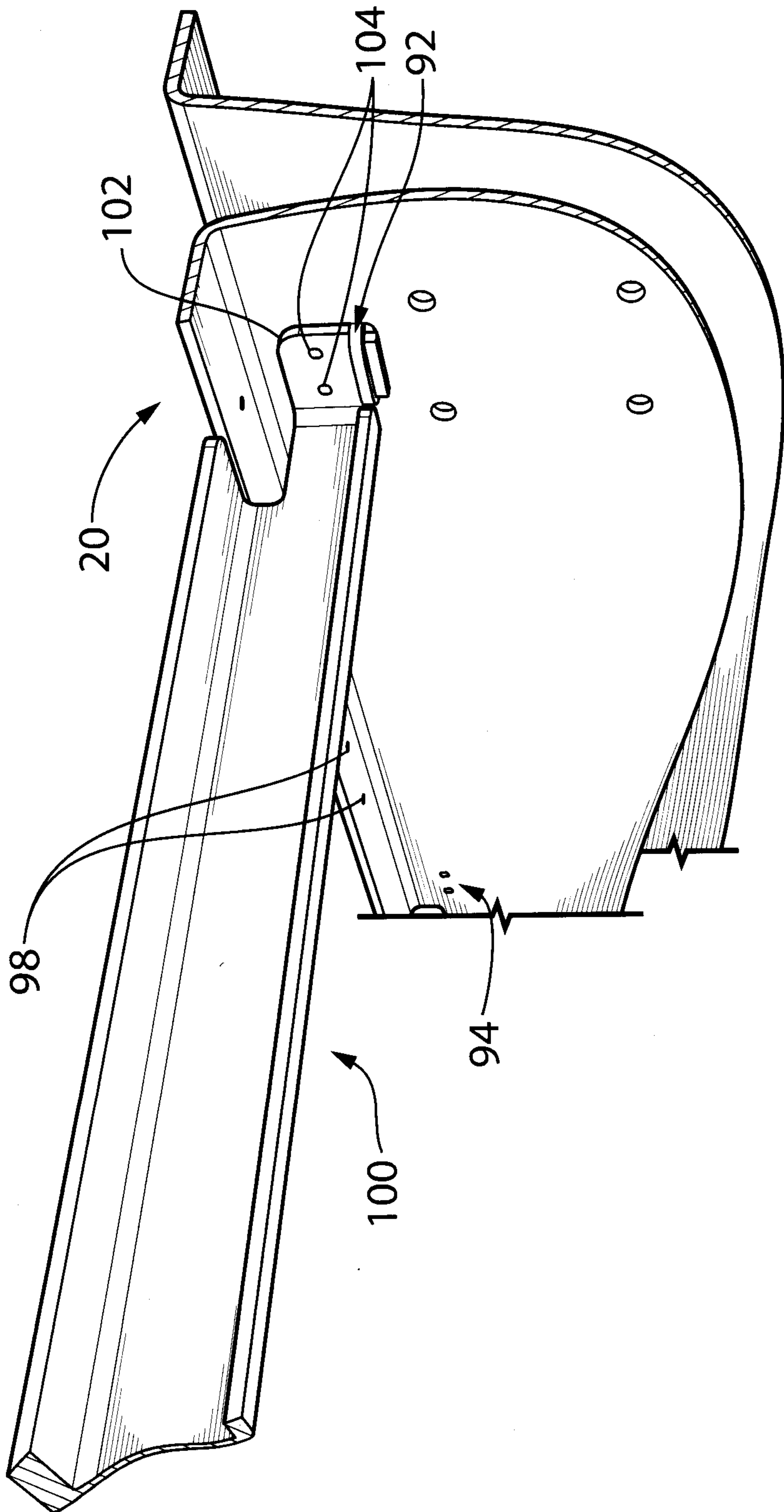
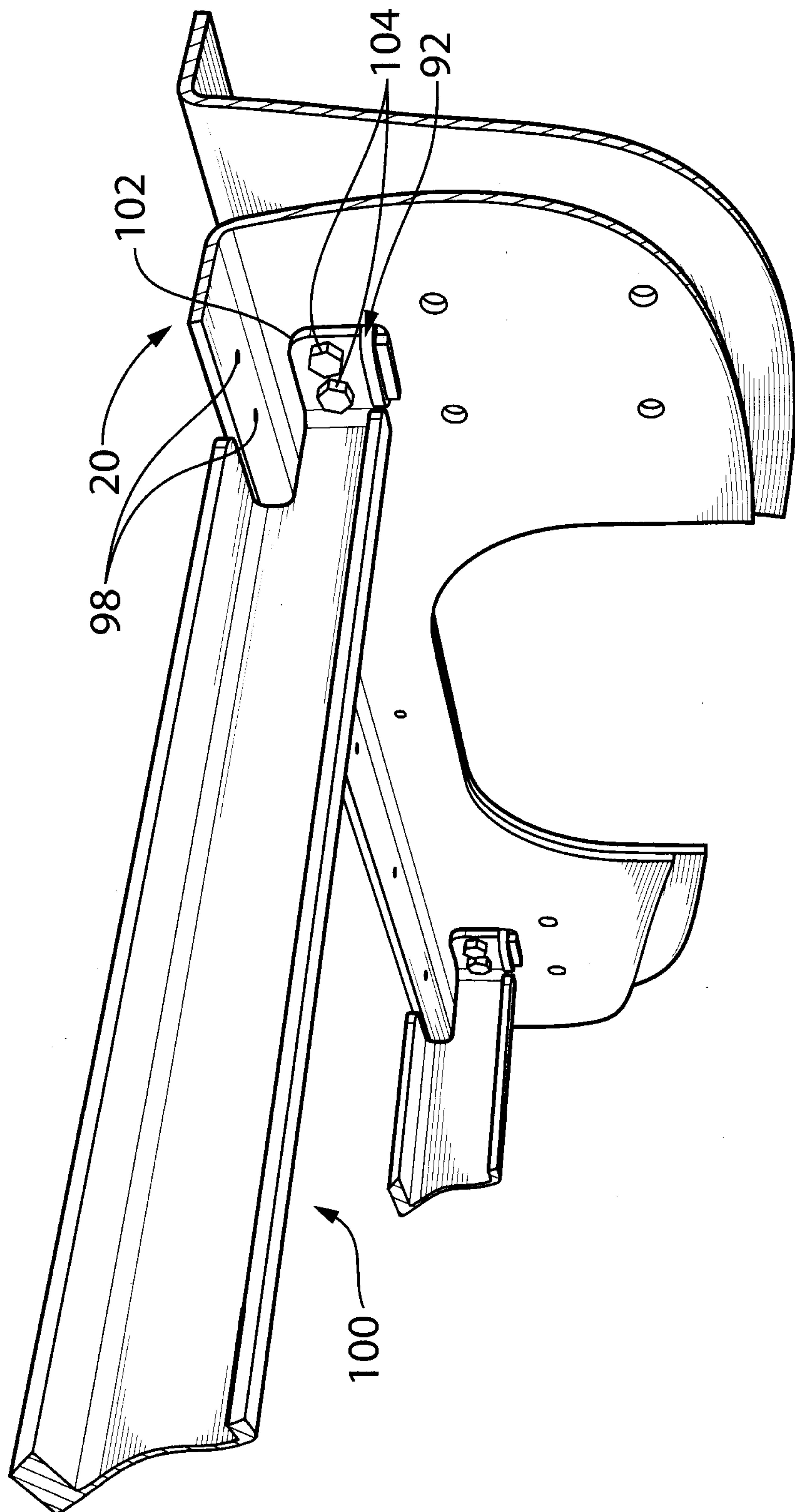
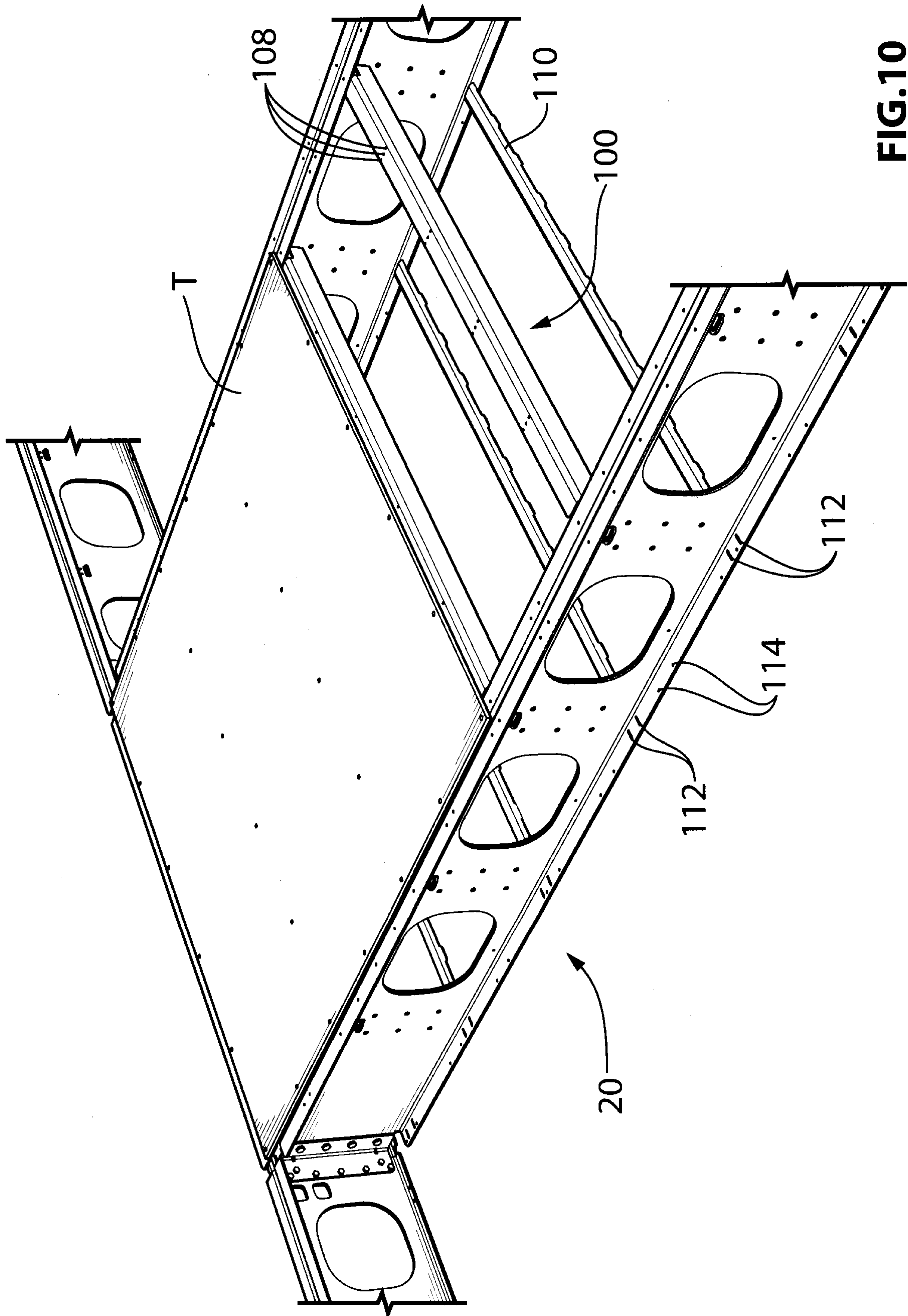


FIG. 8C

**FIG.9A**

**FIG. 9B**

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**FIG. 10**

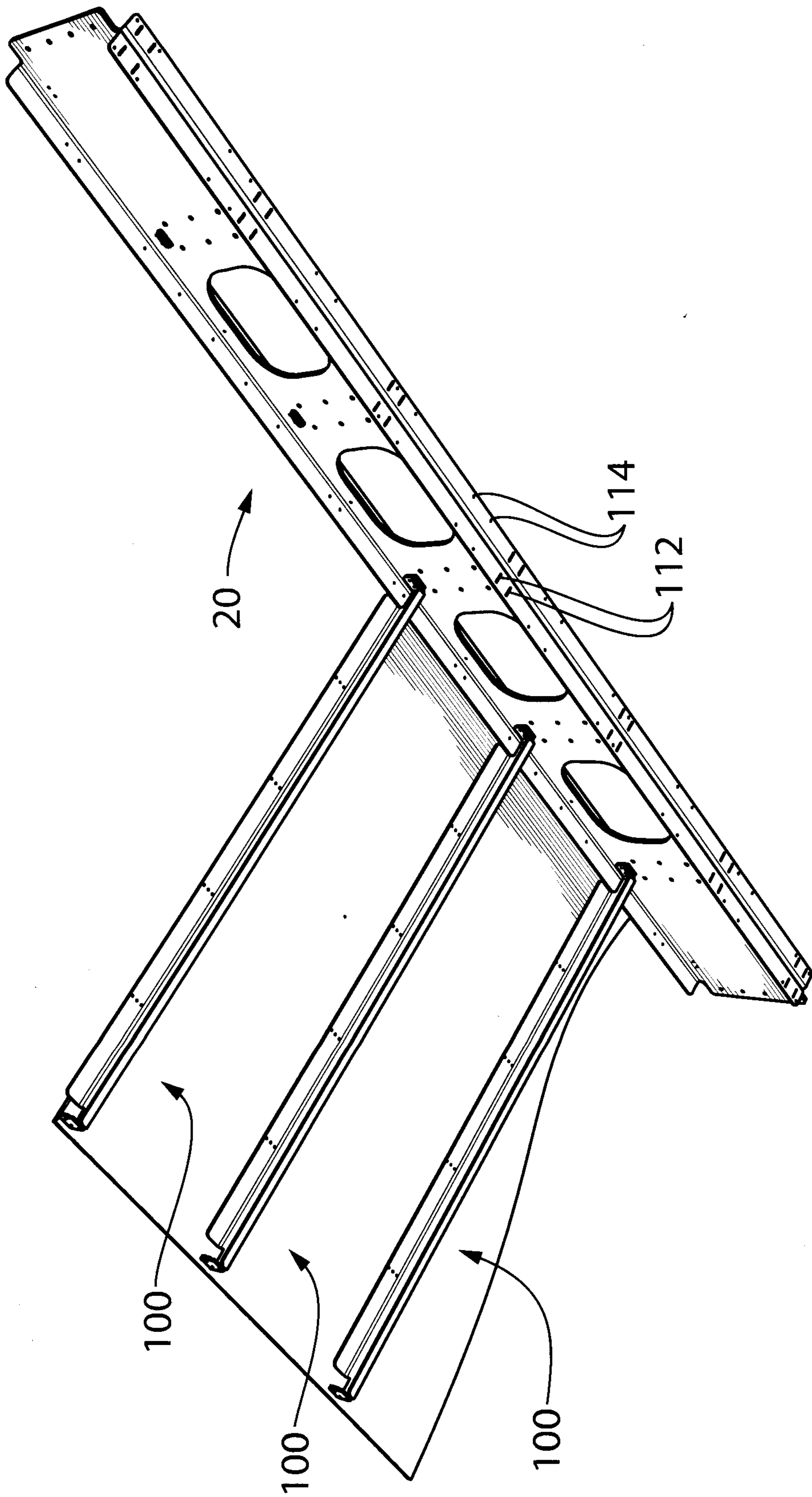
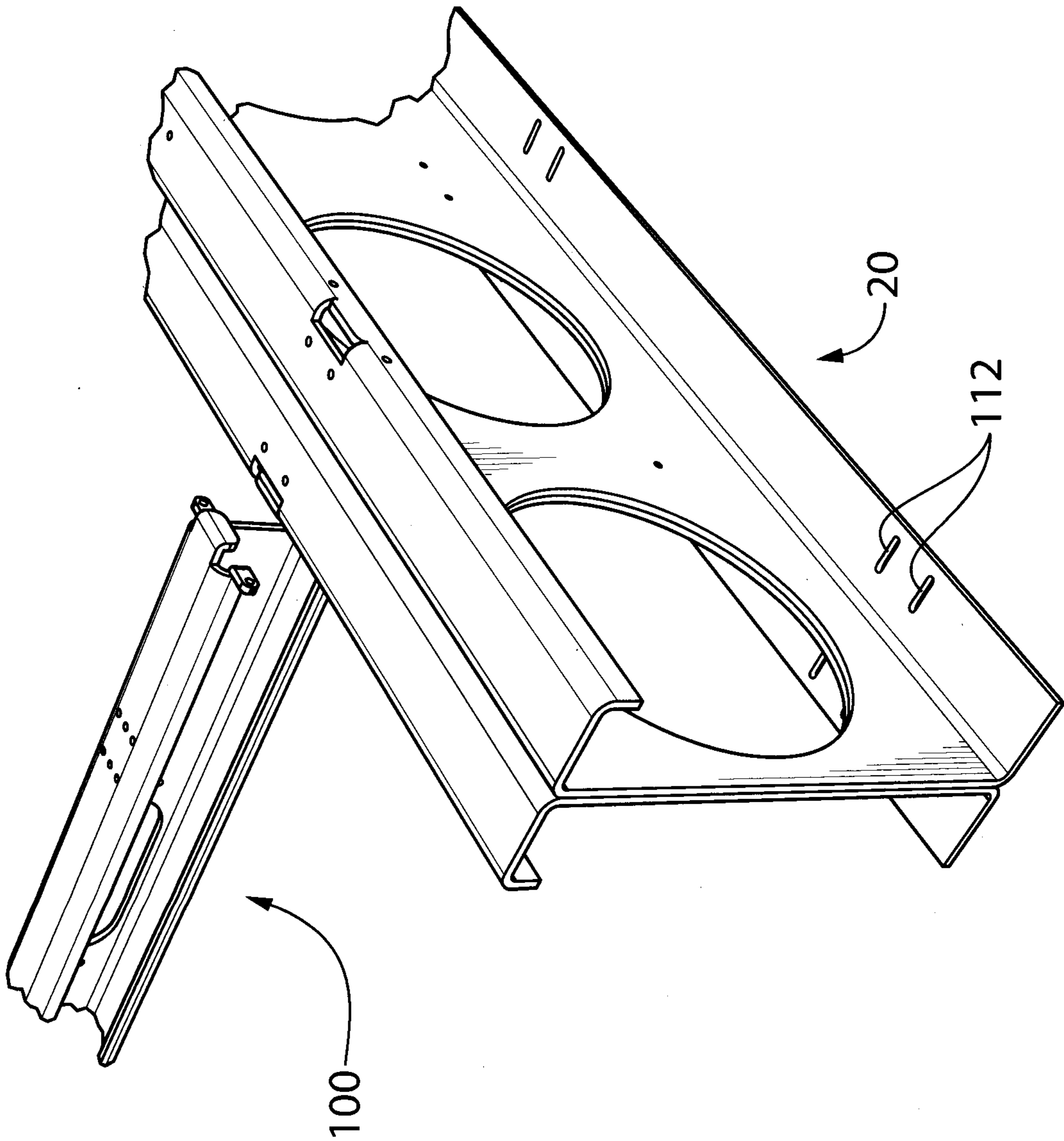
**FIG. 11A**

FIG.11B



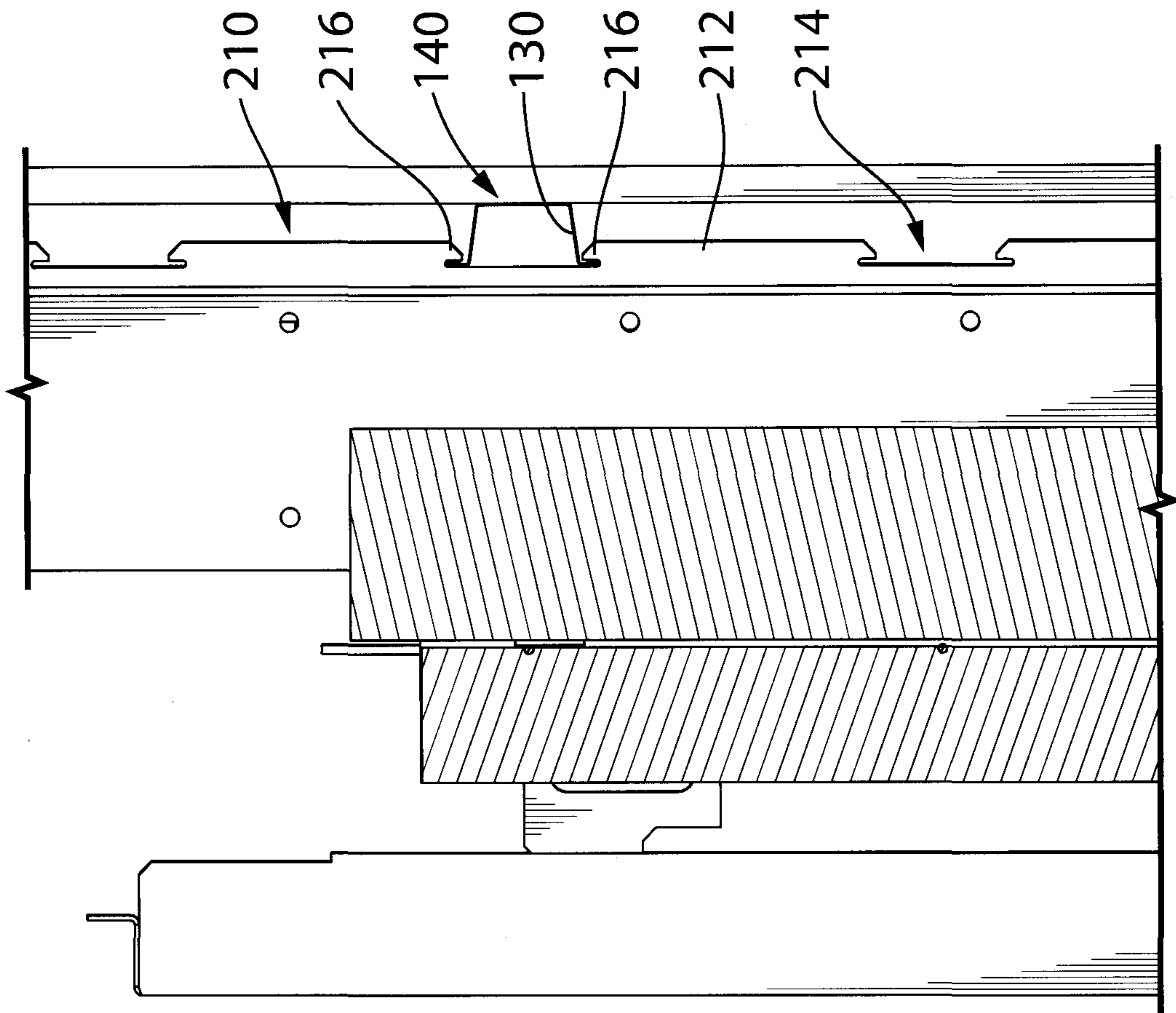


FIG. 12A

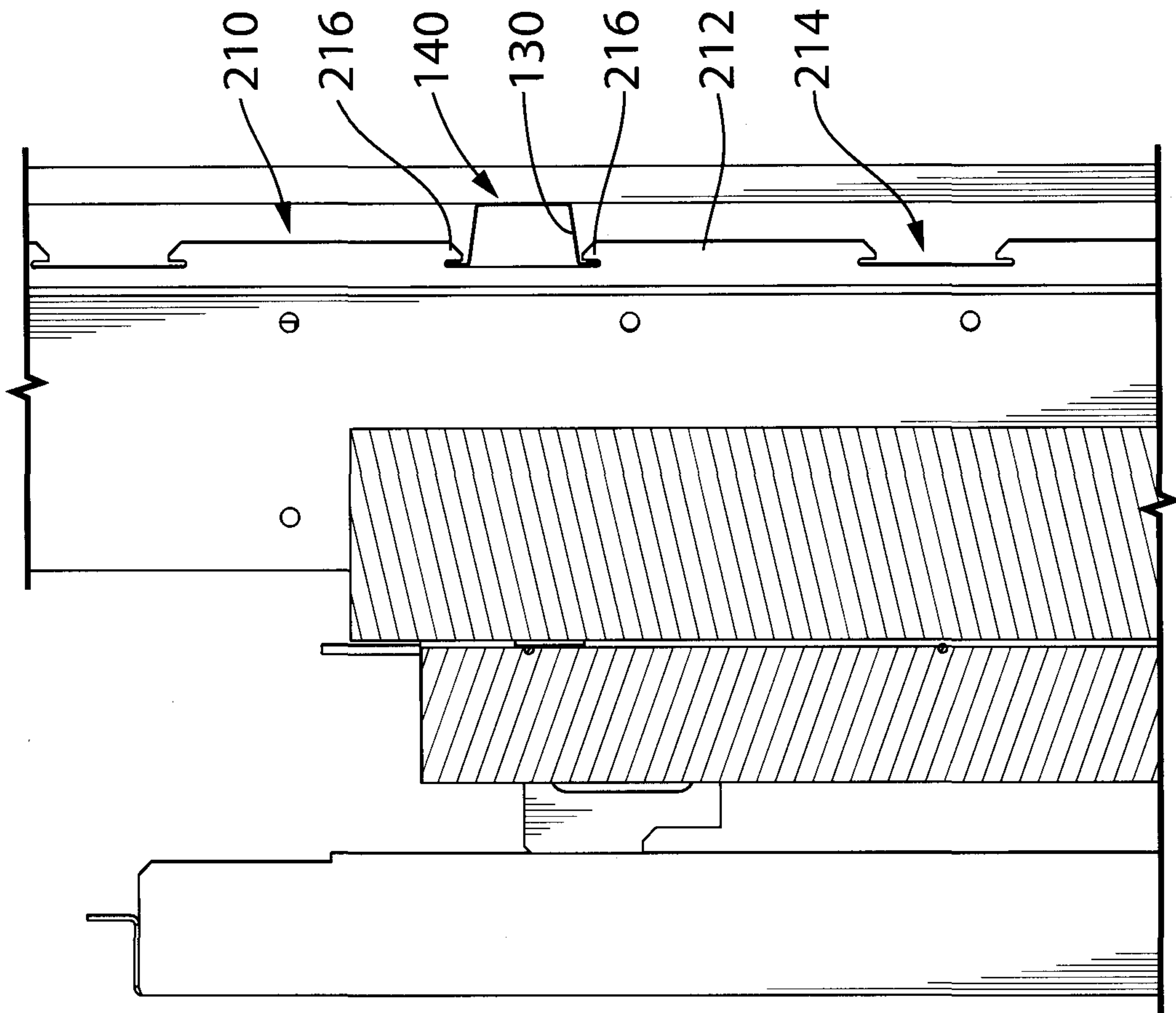


FIG. 12B

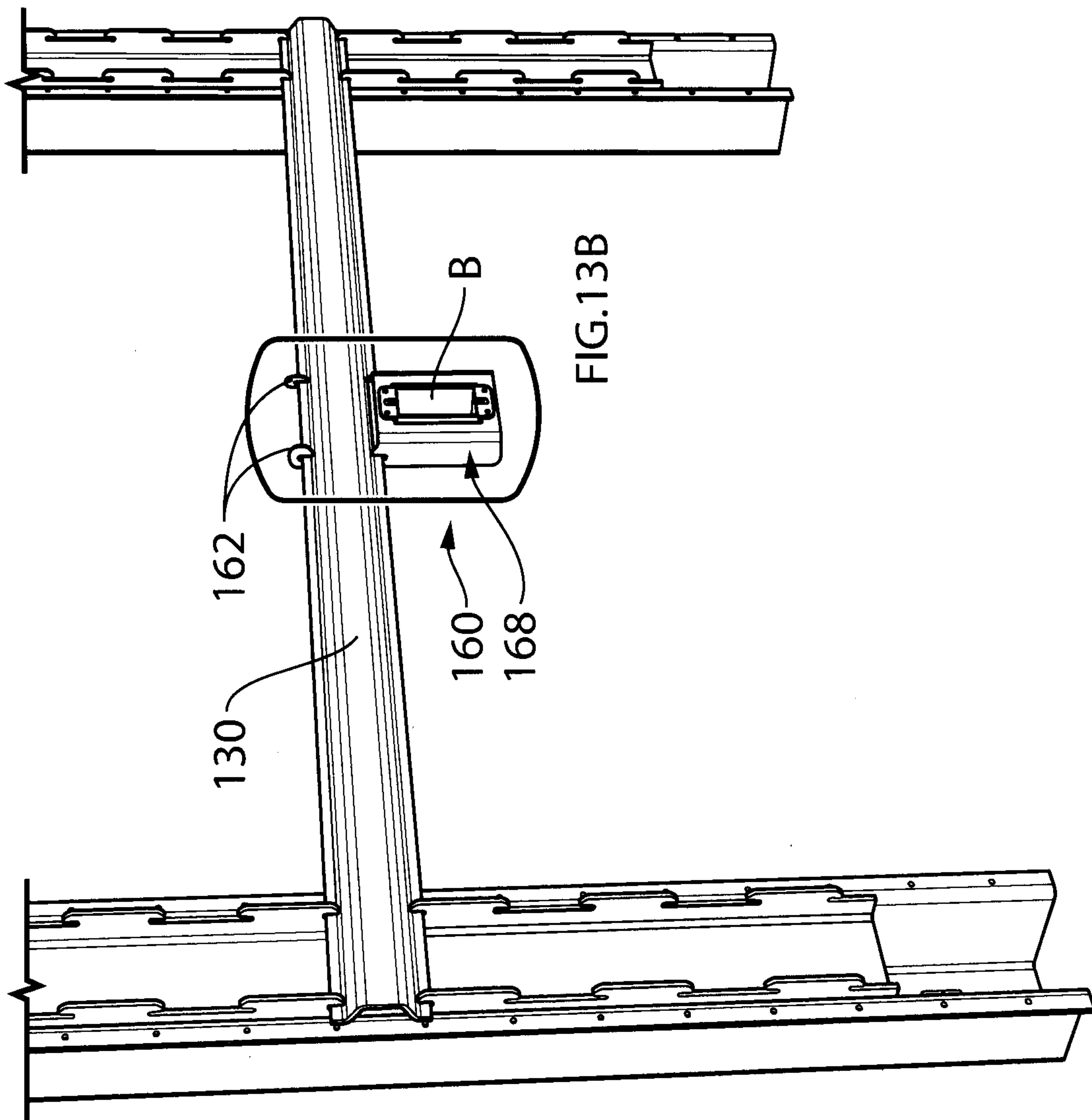


FIG. 13B

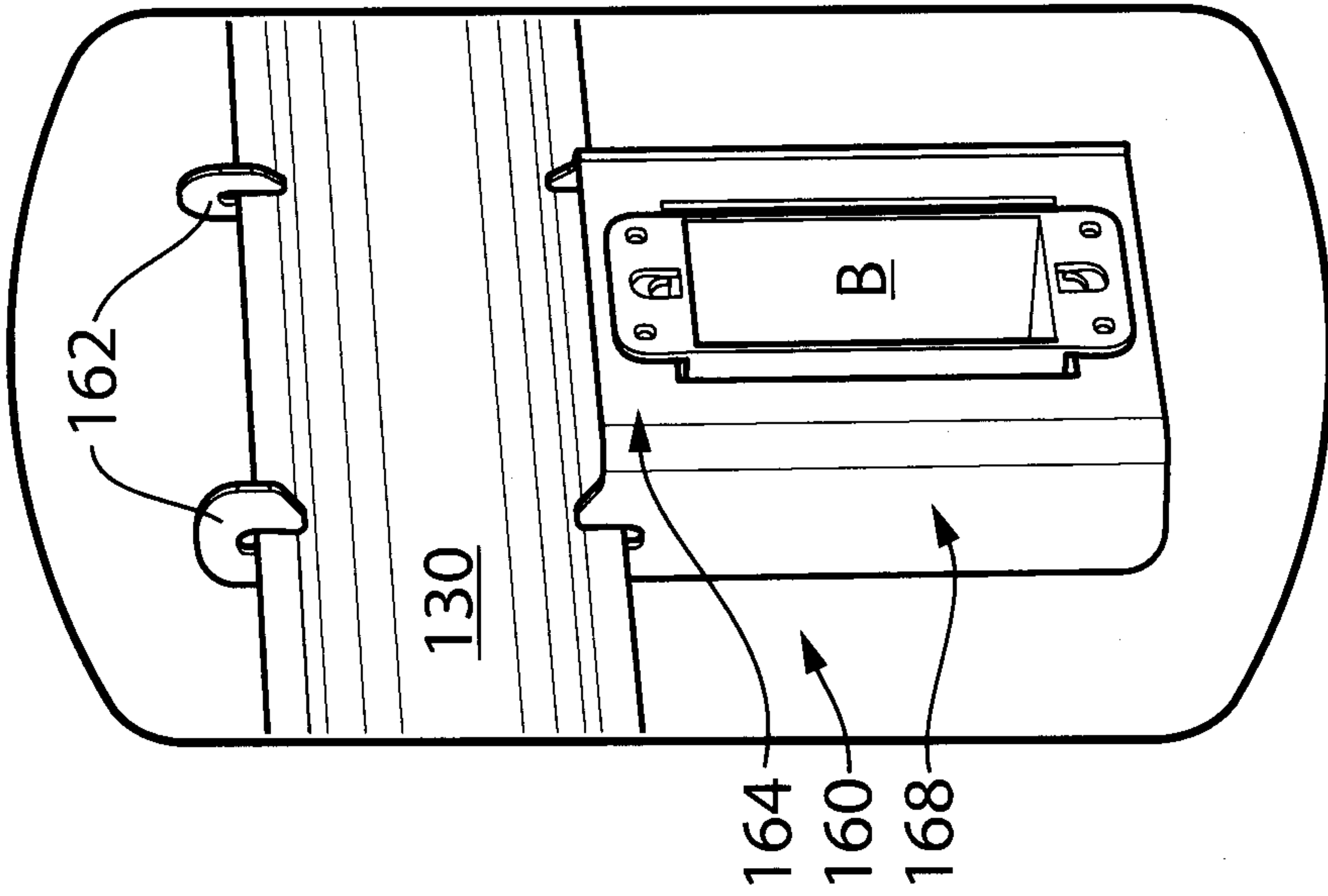


FIG. 13A

FIG. 13B

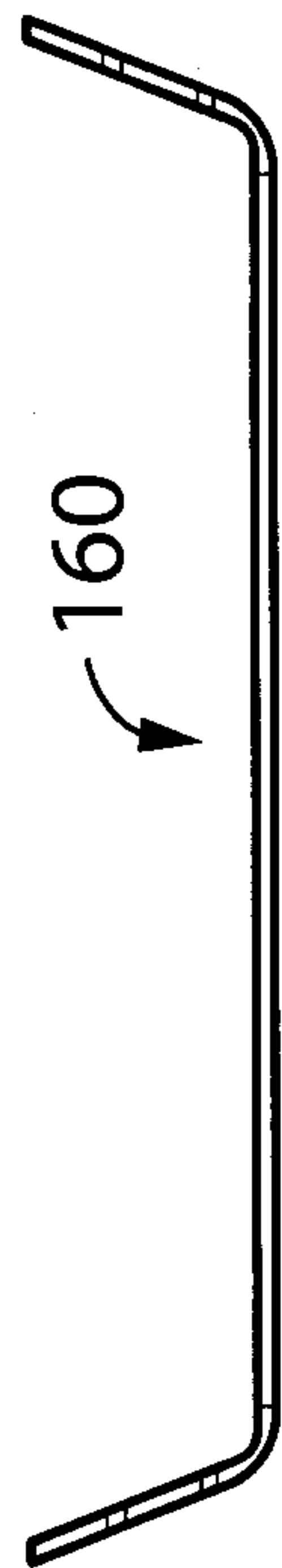


FIG. 13C

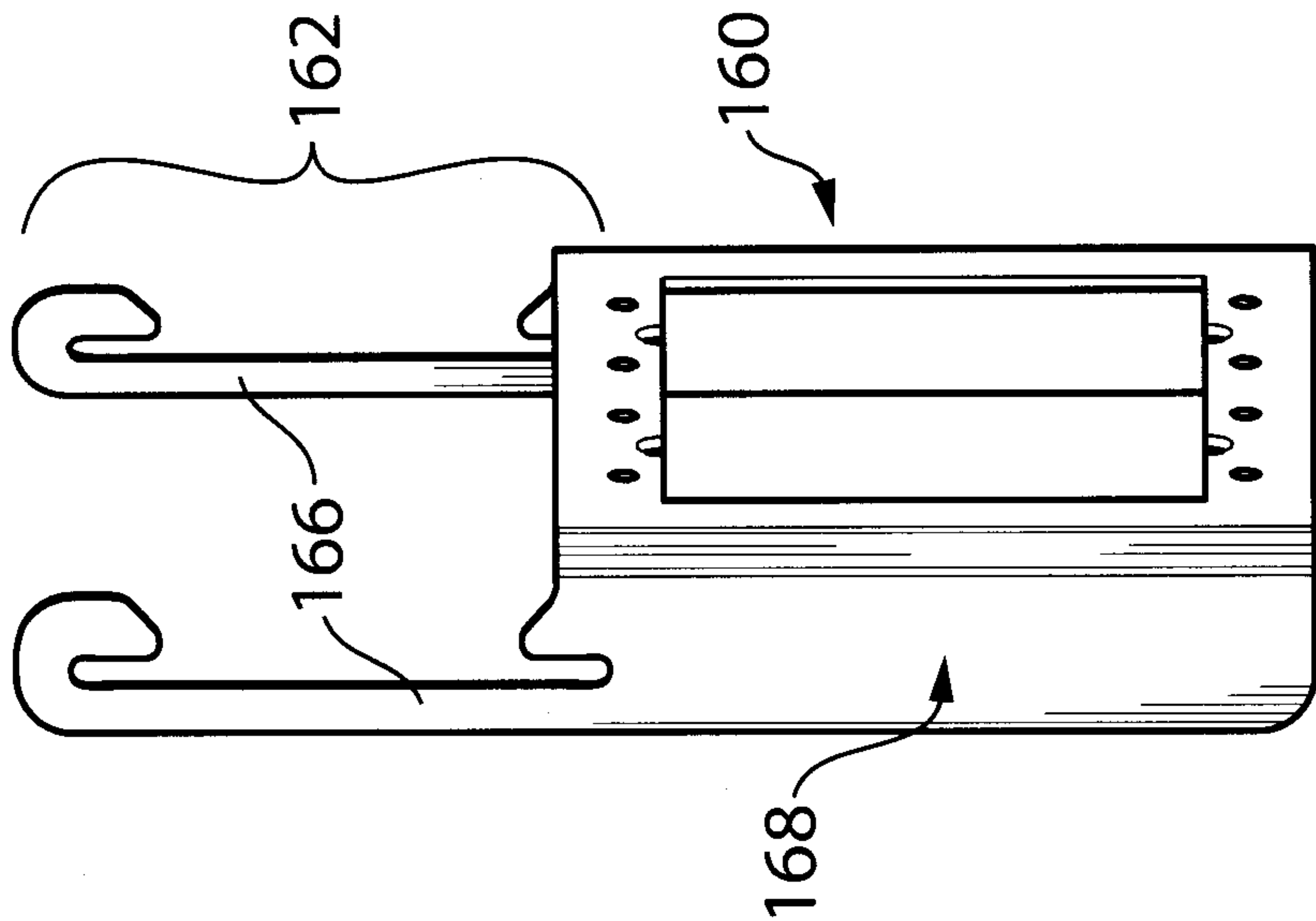


FIG. 13D

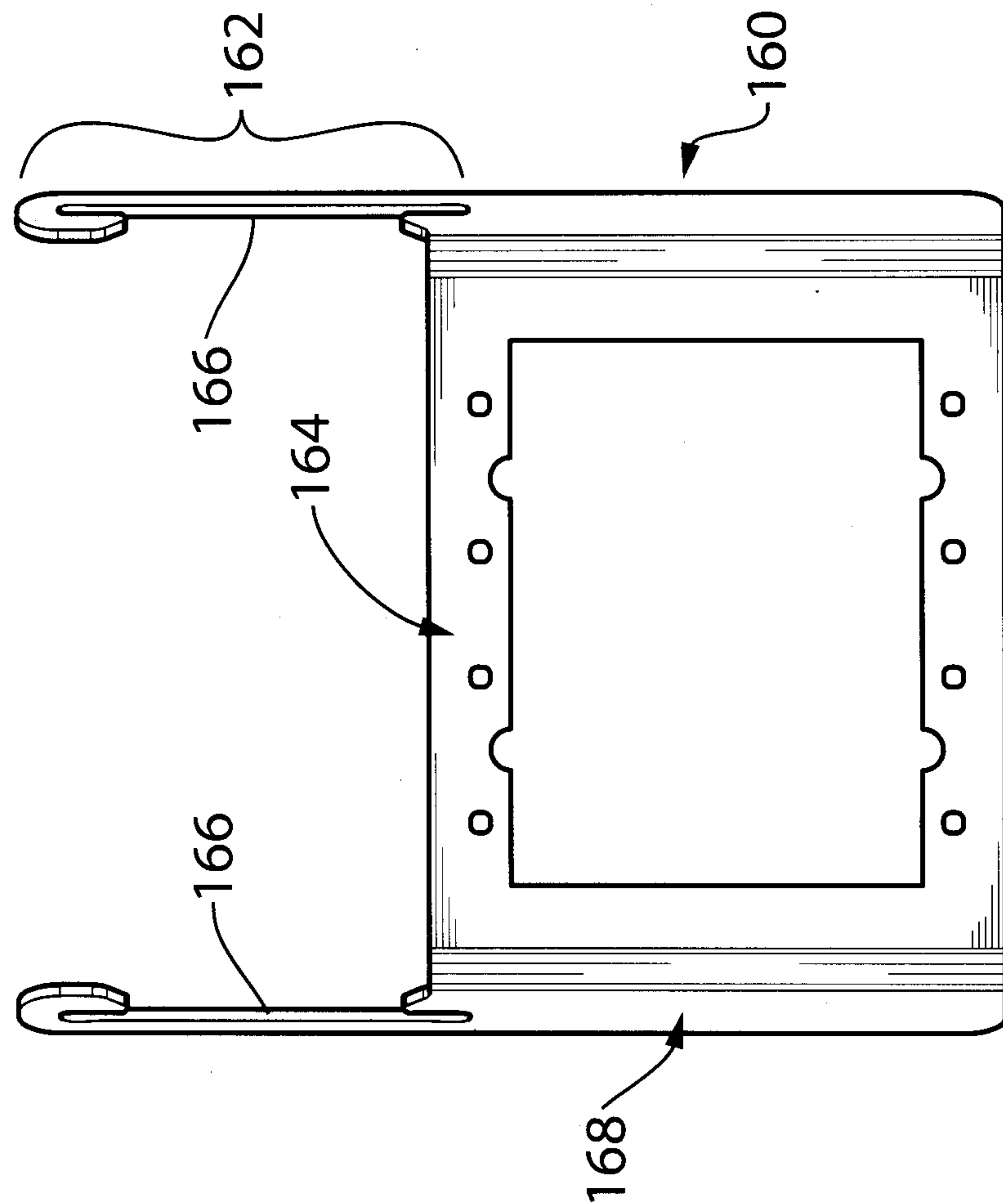
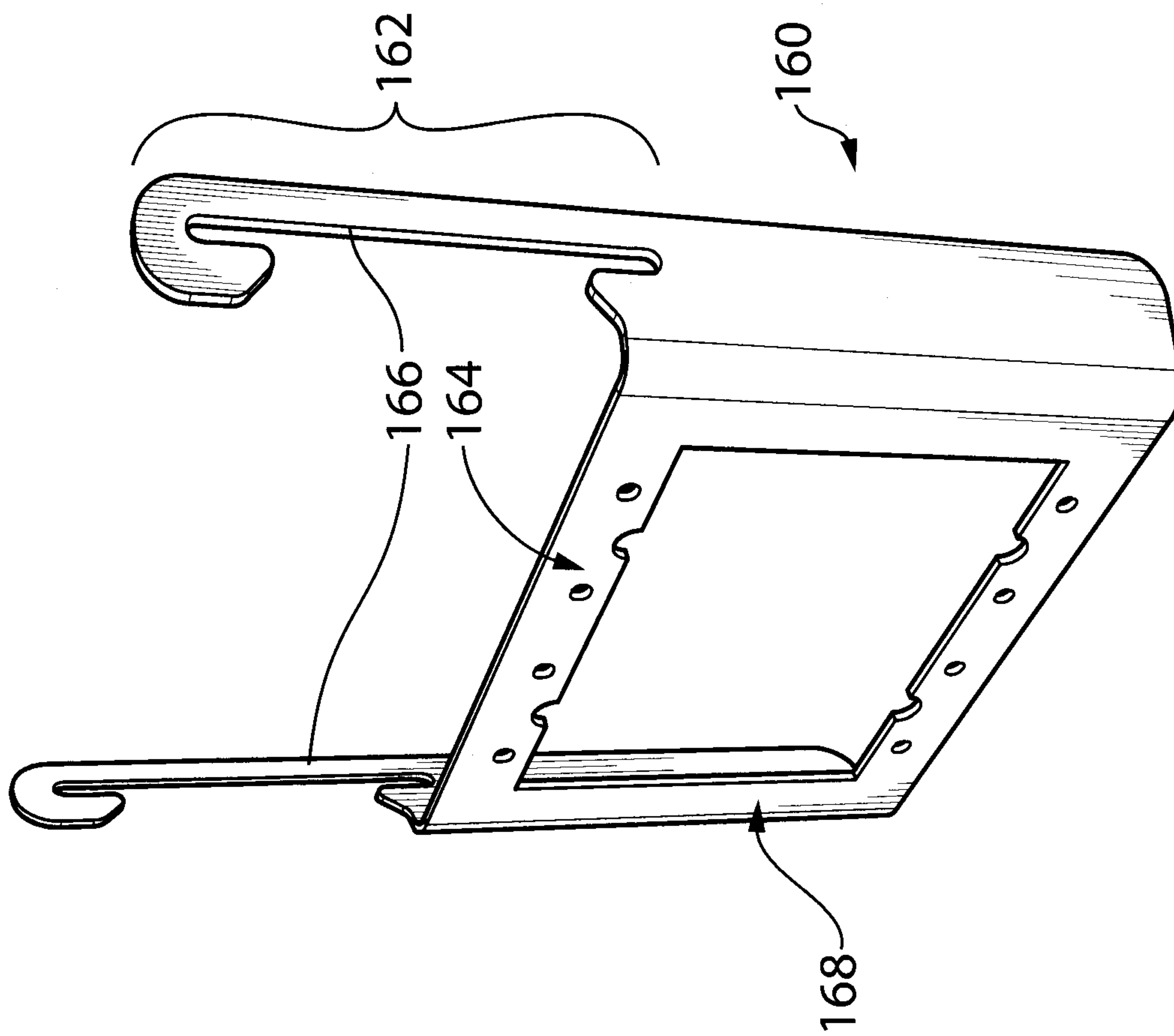


FIG. 13E

**FIG.13F**

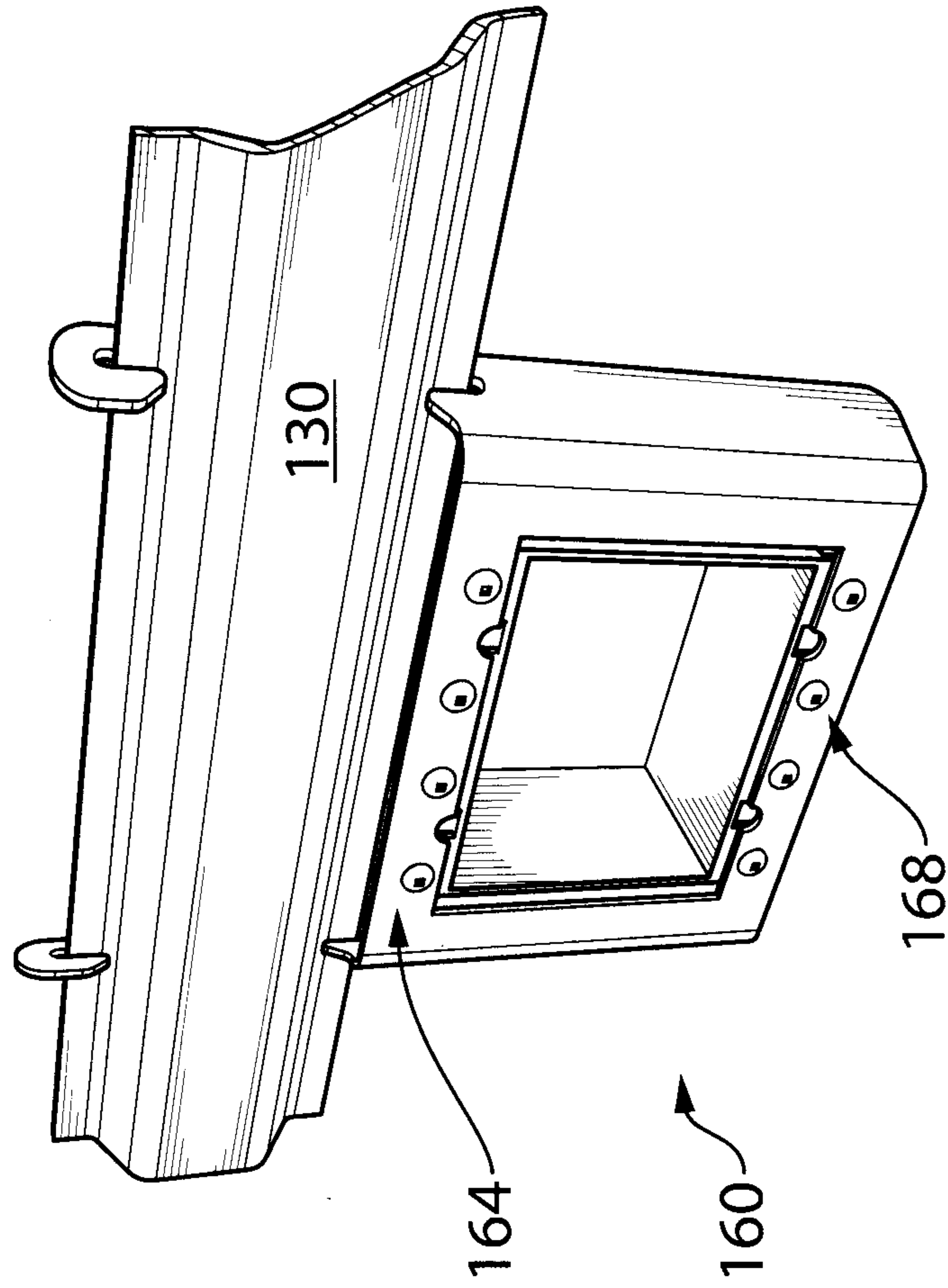


FIG. 13H

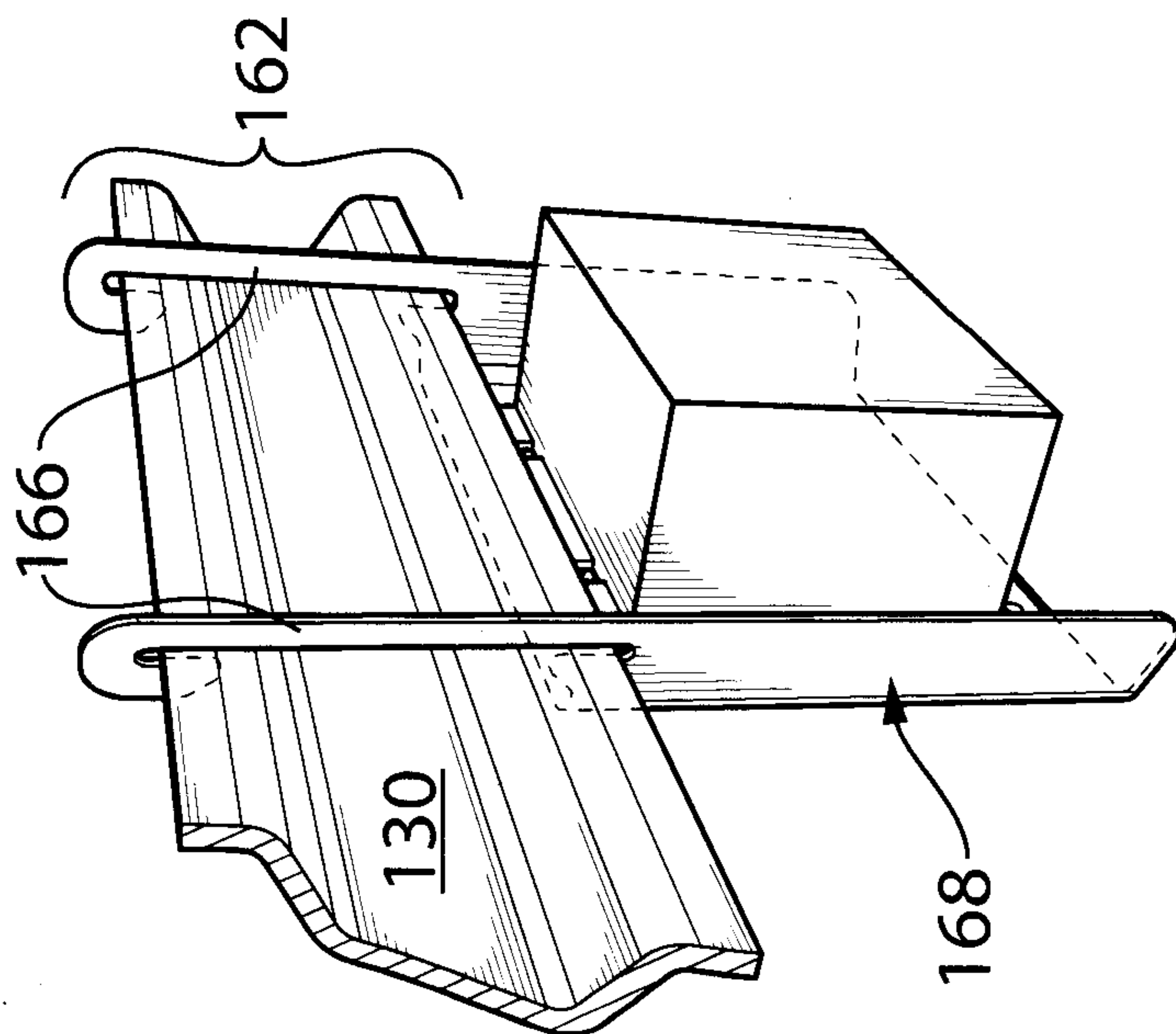
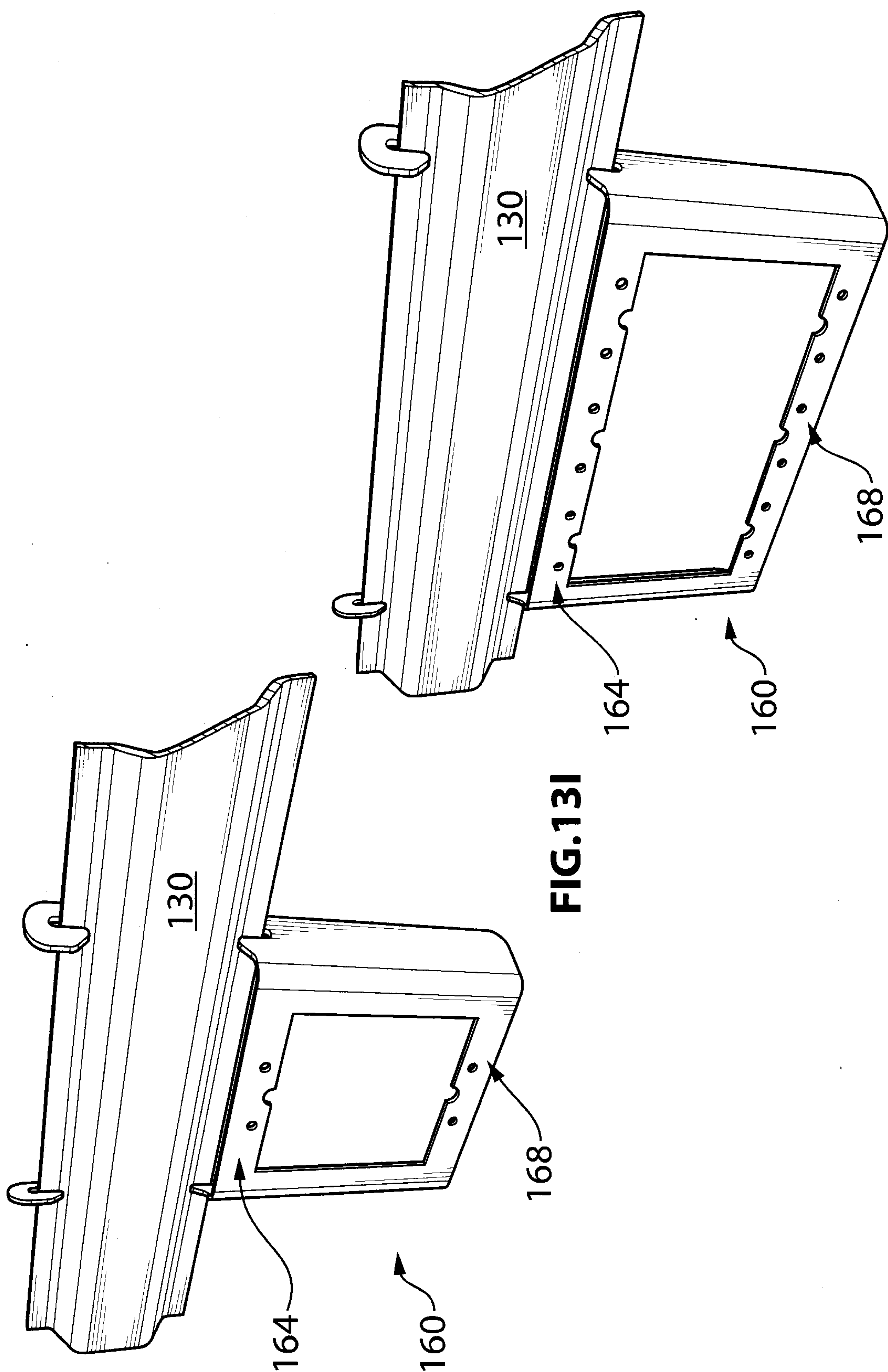
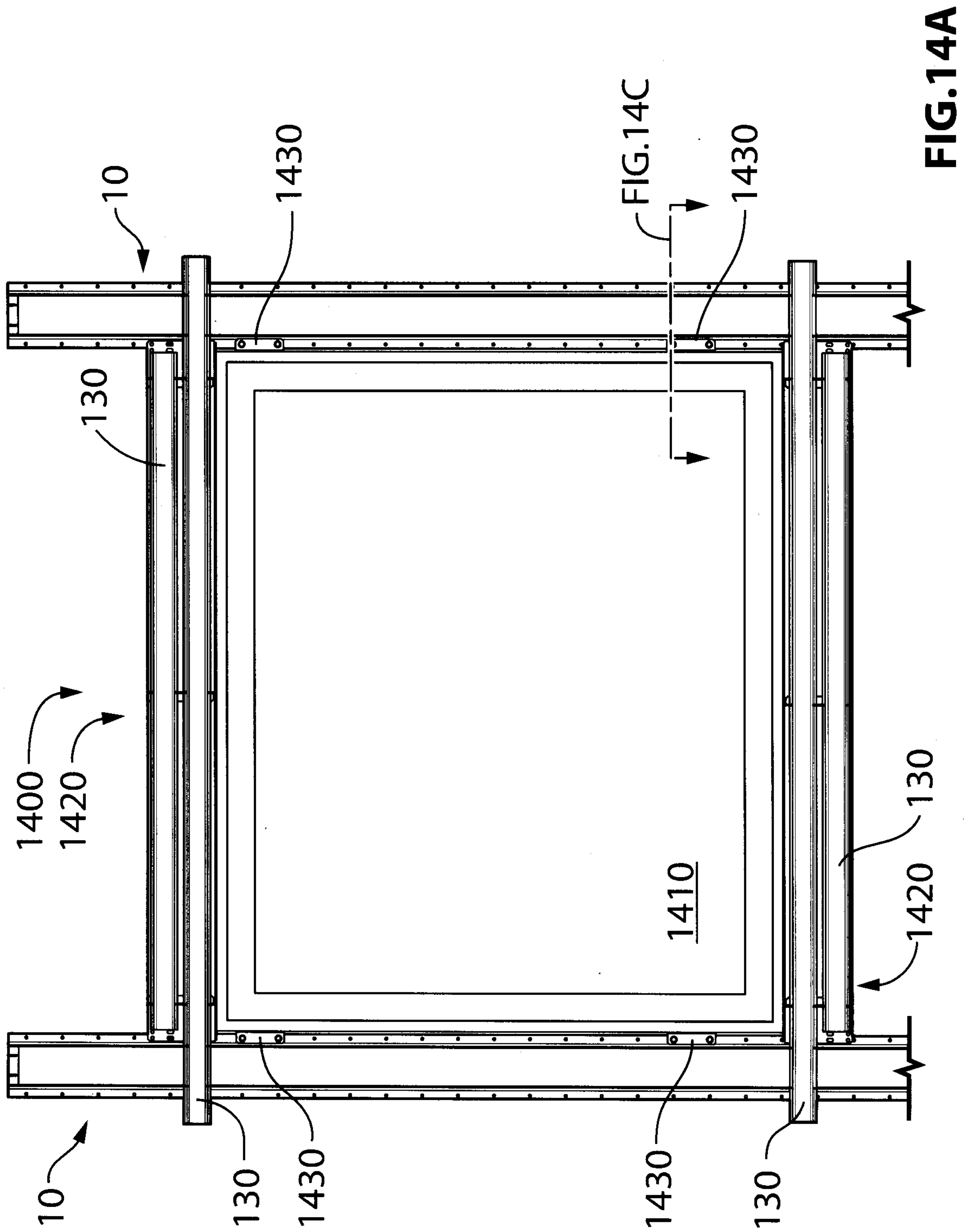


FIG. 13G

**FIG. 13I****FIG. 13J**



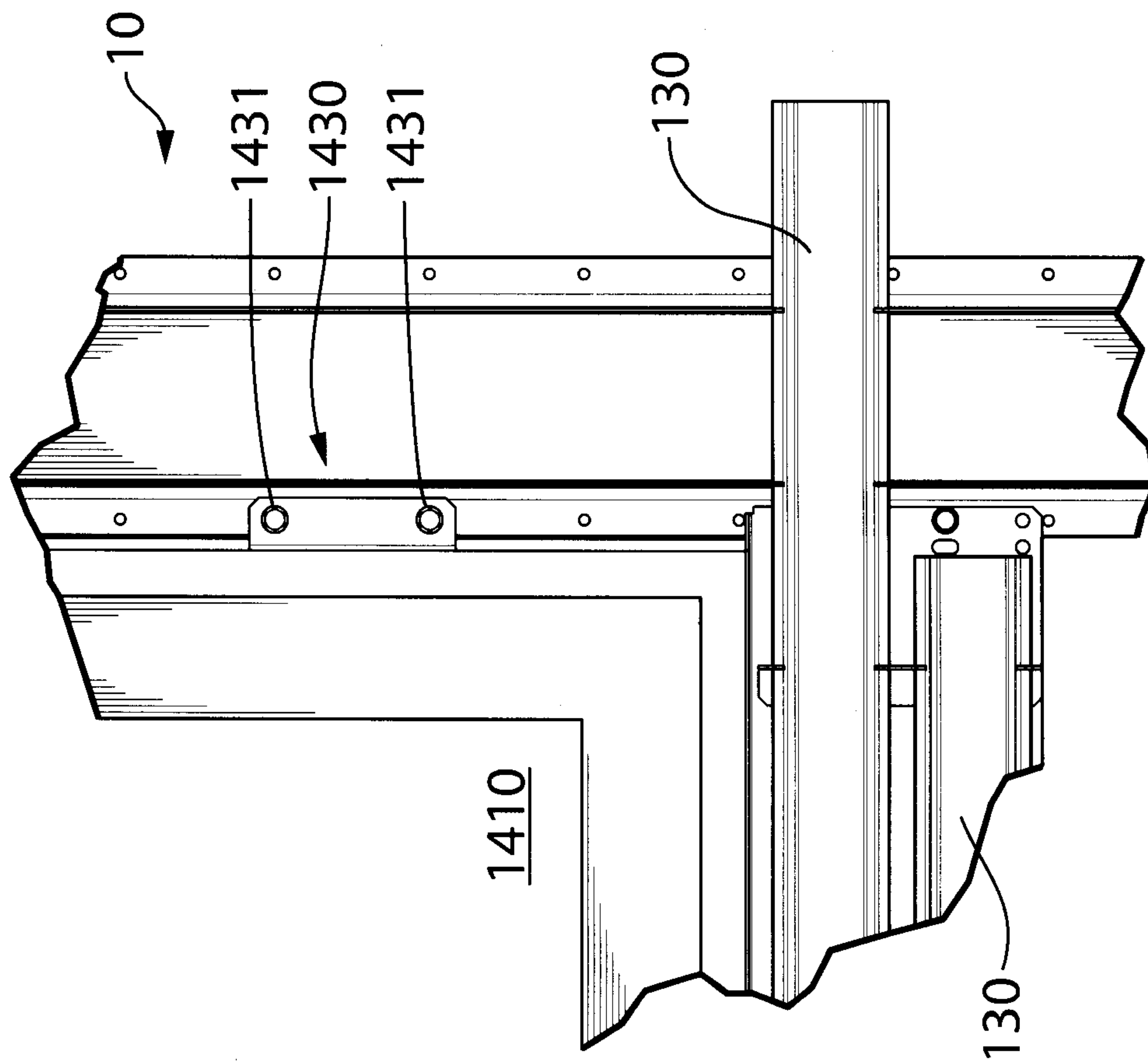
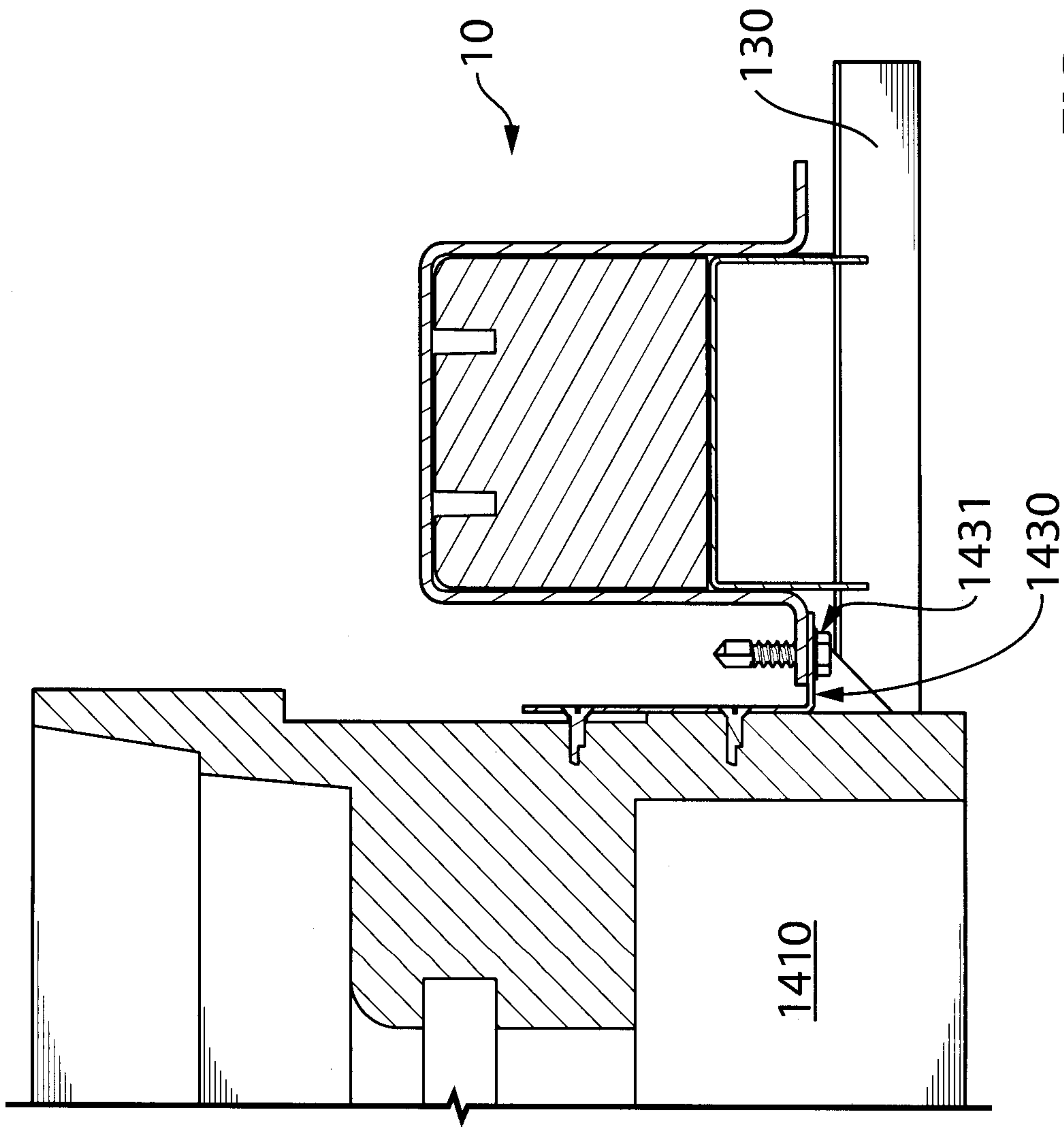
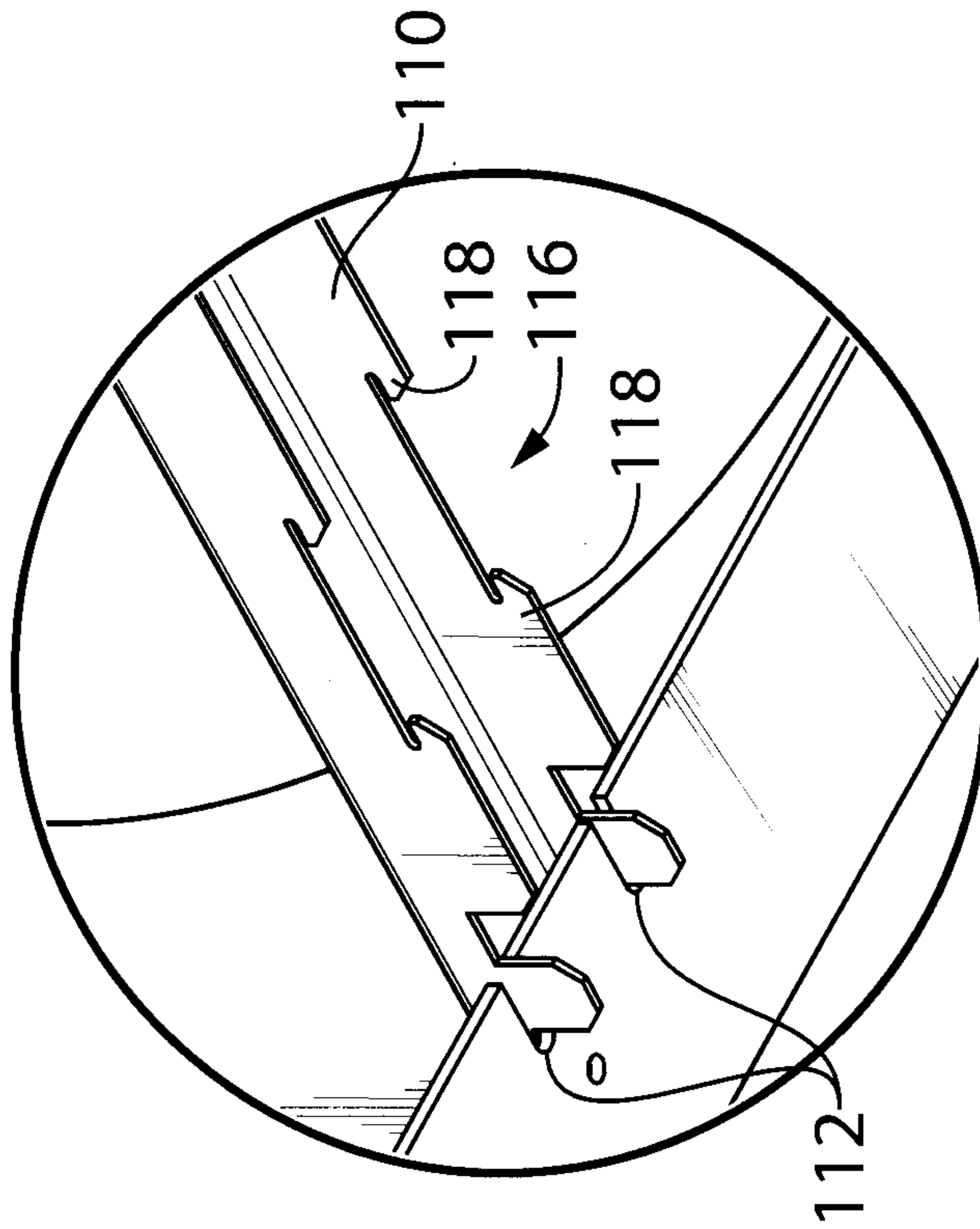
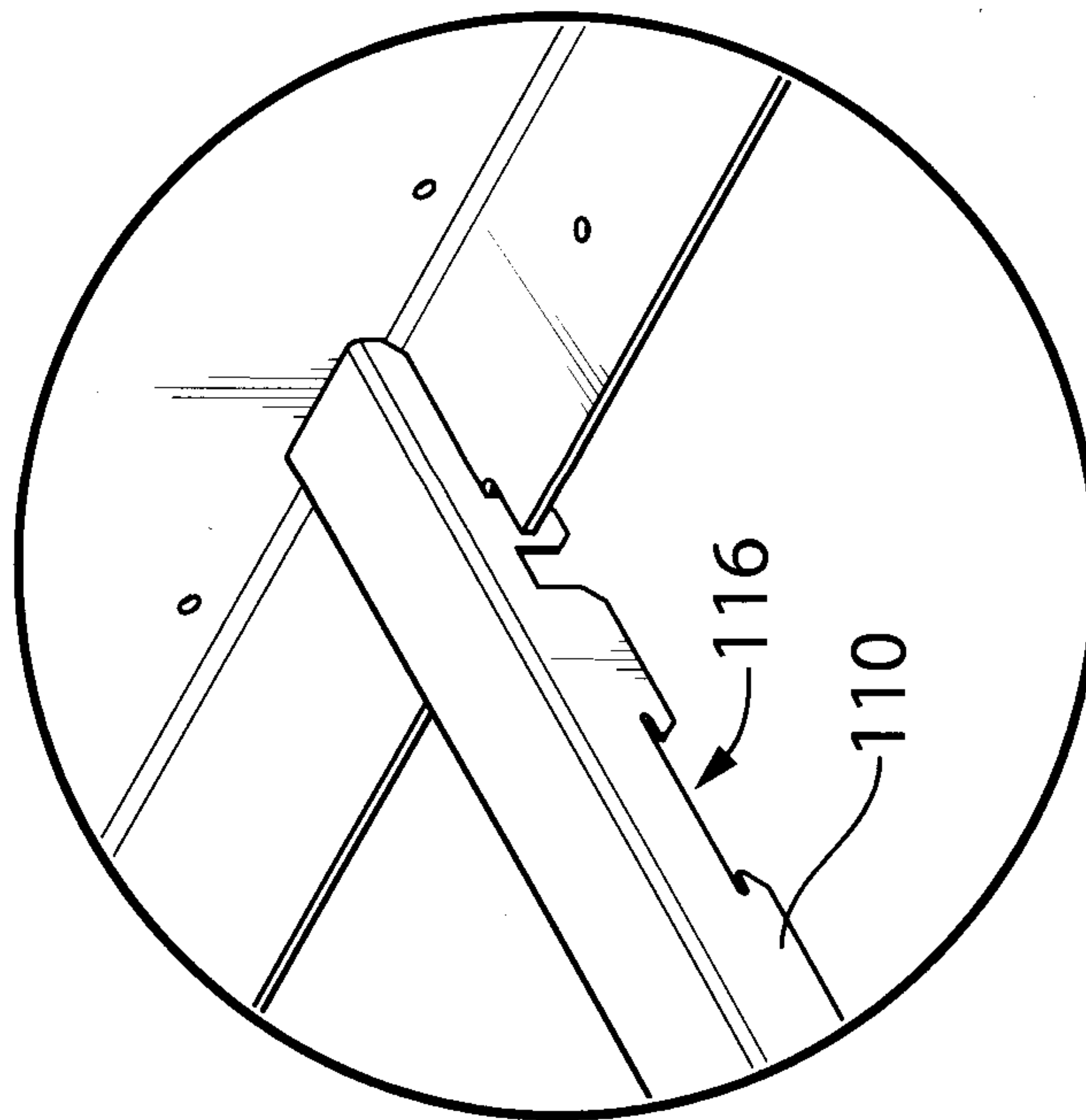


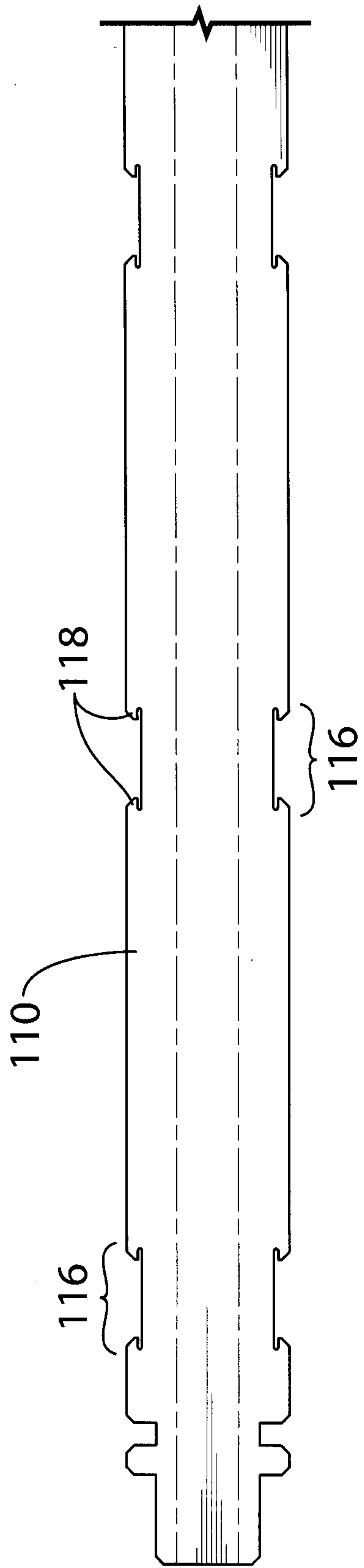
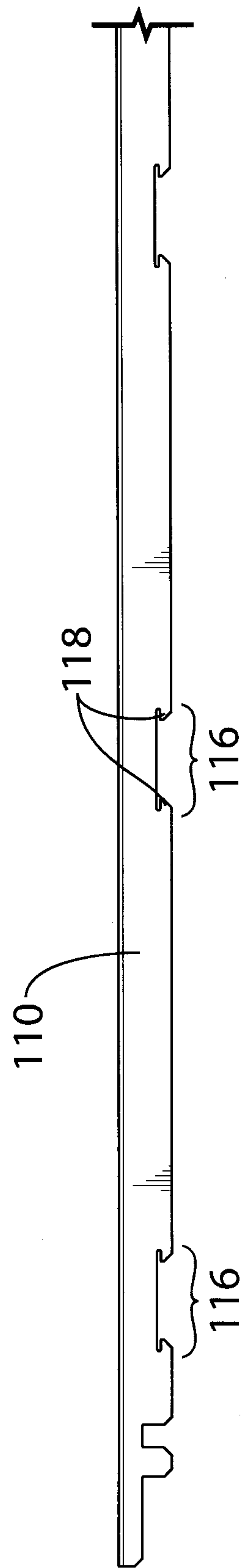
FIG. 14B

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**FIG. 14C**

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**FIG. 15B****FIG. 15A**

**FIG. 15C****FIG. 15D**

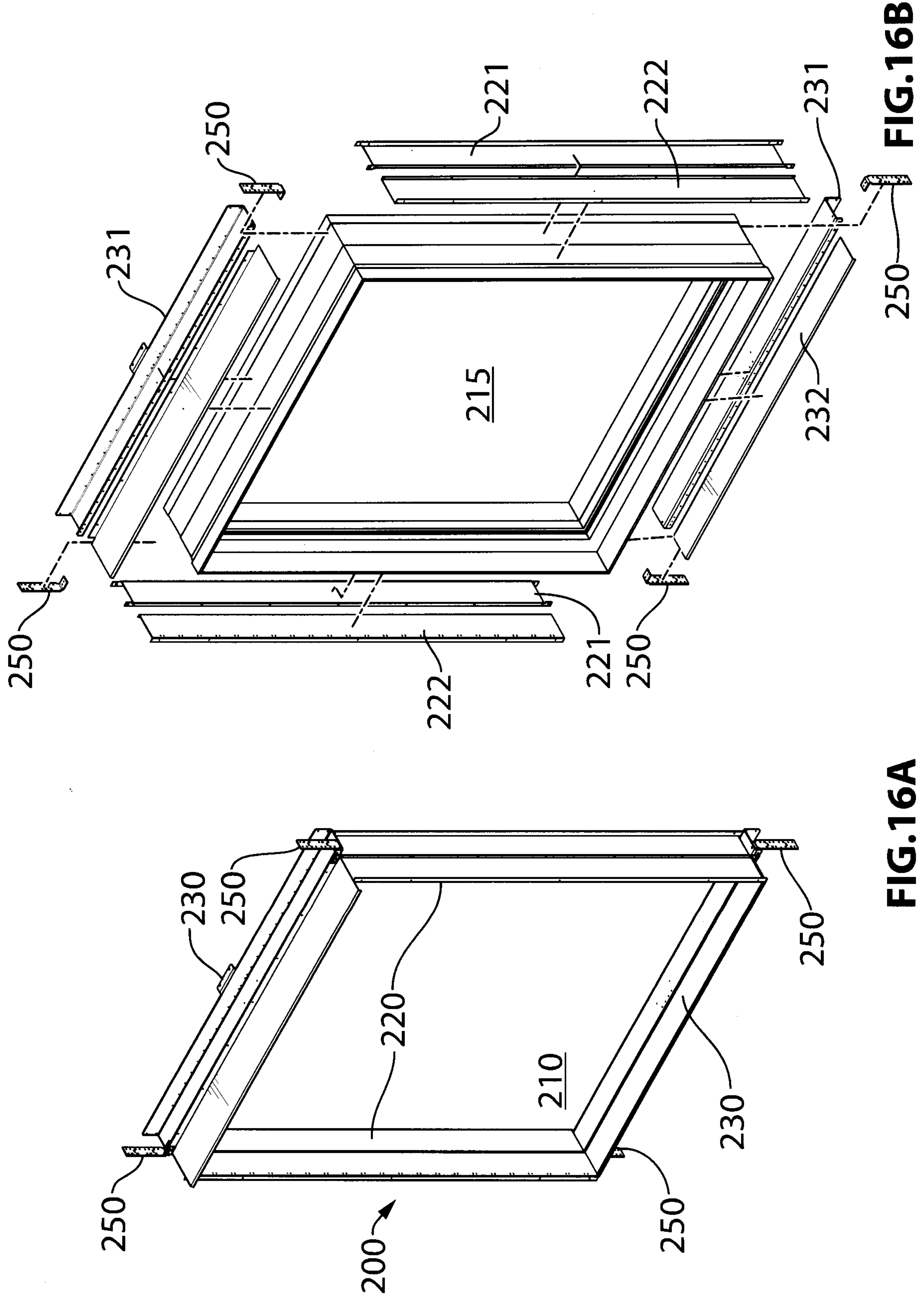


FIG. 16A

FIG. 16B

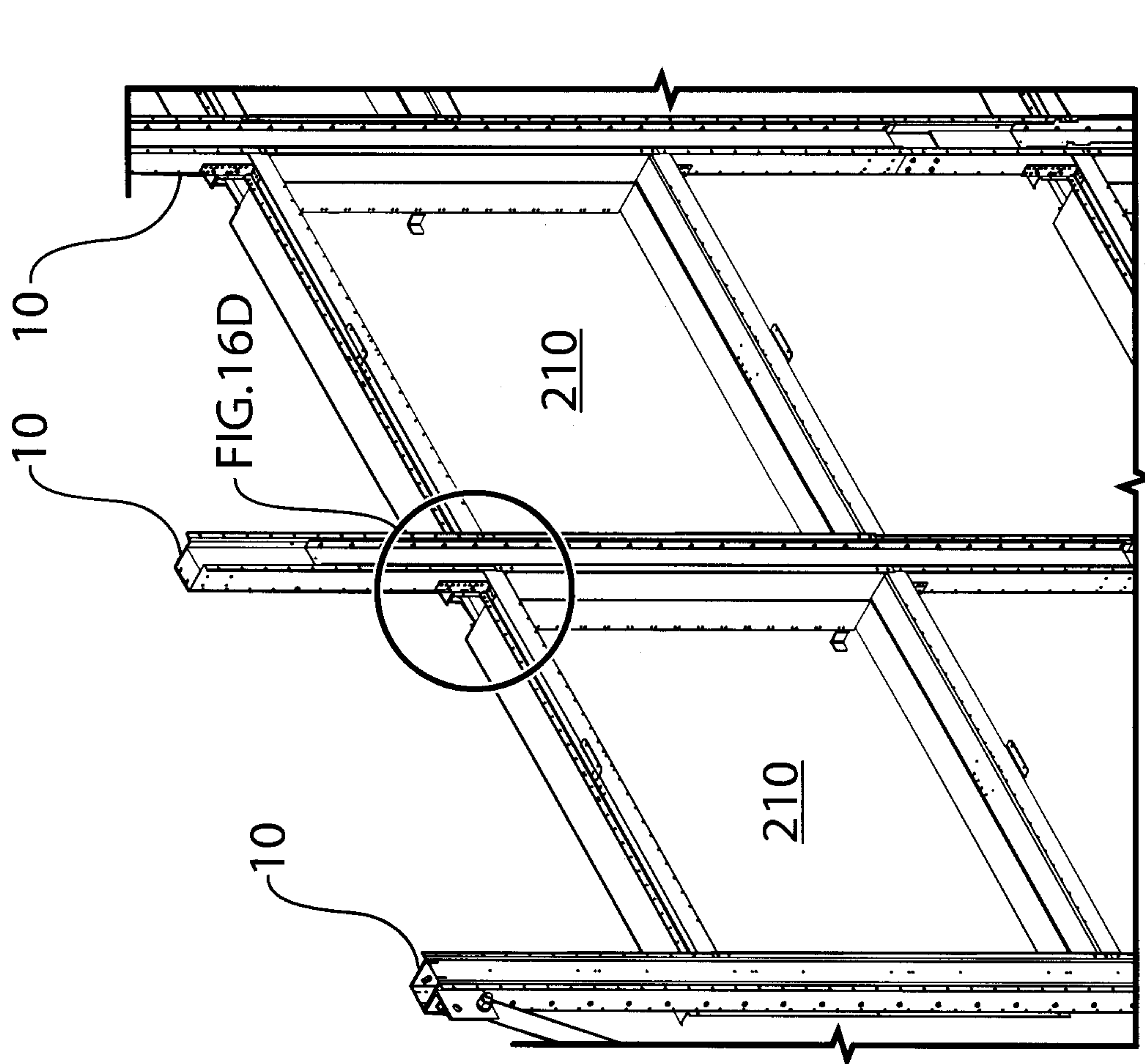


FIG. 16C

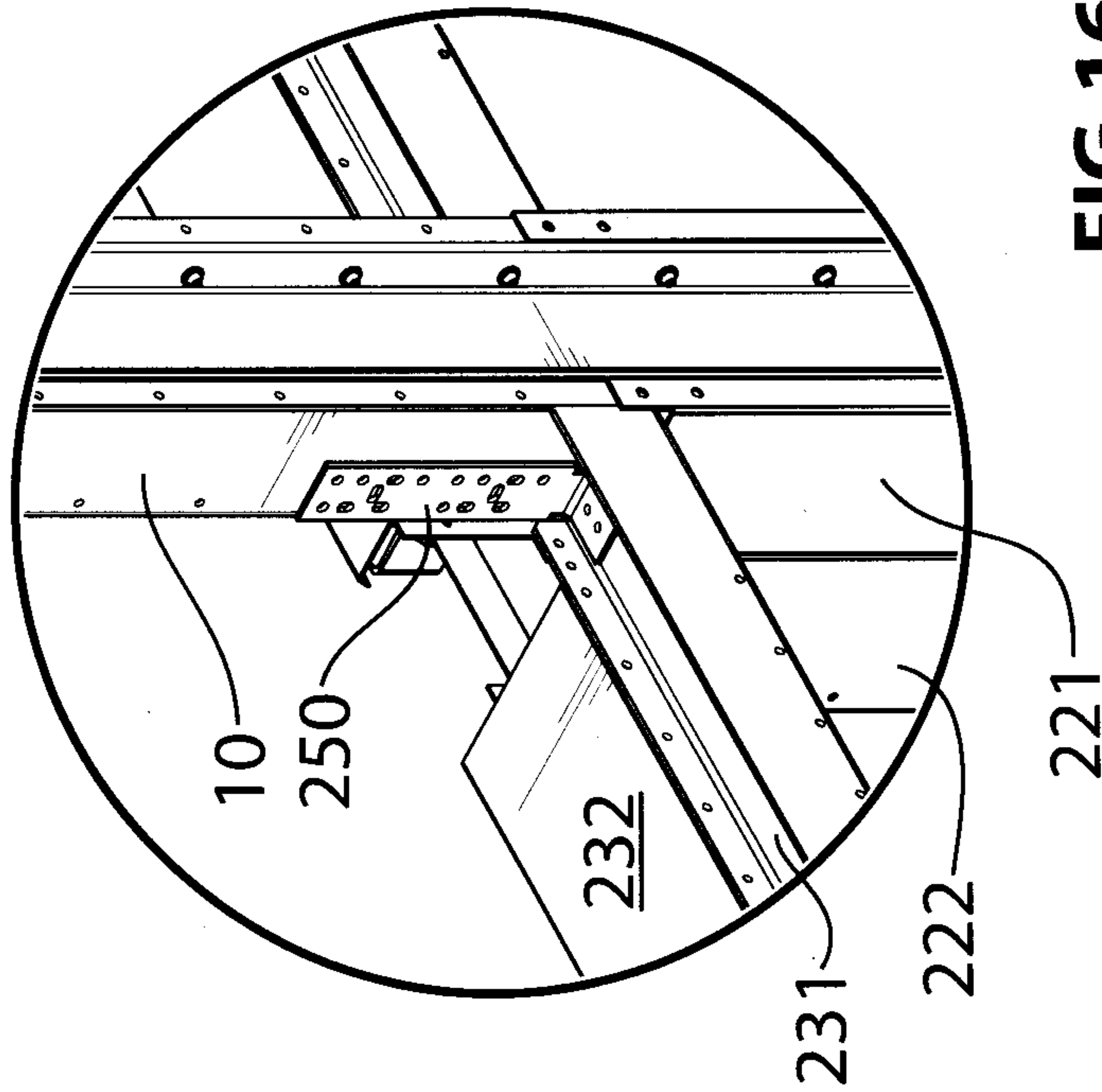


FIG. 16D

