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(54) Title: FLOOR ASSEMBLY FOR MODULAR BUILDING UNITS

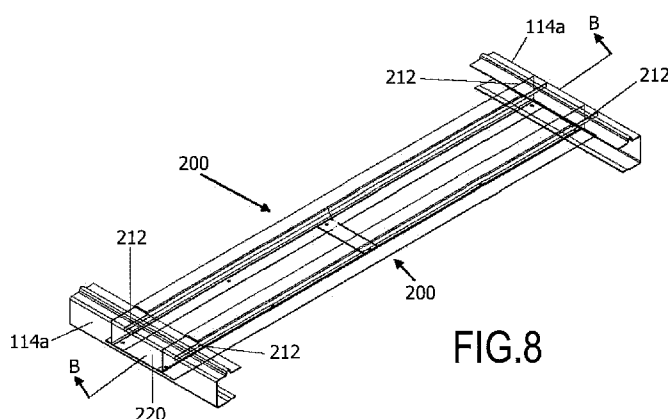


FIG. 8

(57) Abstract: Disclosed is a floor assembly for a modular building unit that avoids the need to turn the floor assembly frame over for installation of a floor subsheet, and that likewise provides a modular floor subsheet that may be fitted to the modular building unit without welding, rivets, screws, or other tooling. A floor assembly frame includes side rails that form the exterior, bottom perimeter of the modular building unit, and joists that extend between parallel side rails of the floor assembly frame. The joists are configured at their base on one side with a slot configured to receive one end of a section of a floor subsheet. An opposite end of the floor subsheet is then positioned overtop the joist element that forms the top portion of the slot on an adjacent joist, which opposite end may then be held in place with a pin, clip, or other fastener requiring minimal effort to install. Such assembly allows all components of the floor to be installed from above, thus avoiding the need to invert the frame of the floor assembly during installation. Likewise, the modular nature of the assembly allows installation to be carried out by fewer personnel than required in traditional installations.



FLOOR ASSEMBLY FOR MODULAR BUILDING UNITS

CROSS REFERENCE TO RELATED APPLICATION

This application is based upon and claims benefit of copending U.S. Provisional Patent
5 Application Serial No. 62/026,287 entitled "Floor Subsheet For Modular Building Units," filed
with the U.S. Patent and Trademark Office on July 18, 2014 by the inventor herein, the
specification of which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

This invention relates generally to modular building construction, and more particularly
10 to a floor assembly for use in a modular building unit.

BACKGROUND OF THE PRIOR ART

Modular buildings typically comprise a skeletal metal (e.g., steel) frame that supports a
number of elements allowing easy transportation, construction, and customization of the building
unit. Those elements typically include a solid roof and floor and wall panels that are inserted
15 into the frame. In order to provide access into the building unit, a door is typically provided on
at least one of the walls of the building unit. The floor assembly typically comprises an elongate
sheet that must be attached to the structural frame by first turning the floor assembly upside-
down, installing flooring sheet on the bottom of the frame, and then turning the floor assembly
right-side-up so that the flooring sheet is facing the ground. This is a time consuming and labor
20 intensive process, typically requiring multiple personnel to manipulate the sizable floor
assembly.

Thus, there remains a need in the art for a modular building unit construction having a
floor assembly that would offer a modular assembly allowing easier assembly than prior known
floor assemblies, that could be installed without a team of installation personnel, and particularly

that can be installed without requiring that the floor assembly frame be inverted during setup of the modular building unit.

DESCRIPTION OF THE INVENTION

Disclosed is a floor assembly for a modular building unit that avoids the need to turn the floor assembly frame over for installation of a floor subsheet, and that likewise provides a modular floor subsheet that may be fitted to the modular building unit without welding, rivets, screws, or other tooling. A floor assembly frame includes side rails that form the exterior, bottom perimeter of the modular building unit, and joists that extent between parallel side rails of the floor assembly frame. The joists are configured at their base on one side with a slot configured to receive one end of a section of a floor subsheet. An opposite end of the floor subsheet is then positioned overtop the joist element that forms the top portion of the slot on an adjacent joist, which opposite end may then be held in place with a pin, clip, or other fastener requiring minimal effort to install. Such assembly allows all components of the floor to be installed from above, thus avoiding the need to invert the frame of the floor assembly during installation. Likewise, the modular nature of the assembly allows installation to be carried out by fewer personnel than required in traditional installations.

In accordance with certain aspects of an embodiment of the invention, a floor assembly for a modular building unit is disclosed, comprising: bottom rails forming a perimeter of the floor assembly; and a plurality of floor joists extending between two of the bottom rails, each floor joist further comprising a bottom generally horizontal wall, a horizontal slot wall above the bottom wall extending over a portion of the bottom wall and forming a slot between the slot wall and the bottom wall, a vertical wall extending upward from the slot wall, and a top horizontal floor support wall extending outward from the vertical wall; and a plurality of sub-floor sheets

positioned between adjacent floor joists, wherein a first edge of a first sub-floor sheet is positioned within the slot, and wherein a second edge of the sub-floor sheet is positioned on a top surface of the slot wall.

In accordance with further aspects of an embodiment of the invention, a modular building unit is disclosed, comprising: a rigid, fixed modular building unit frame having a plurality of corner support posts, a bottom rail extending between adjacent pairs of corner support posts and forming a perimeter of a floor assembly, a top rail extending between adjacent pairs of corner support posts, and a plurality of wall panels extending between the corner support posts, the top rails, and the bottom rails; and a plurality of floor joists extending between two of the bottom rails, each floor joist further comprising a bottom generally horizontal wall, a horizontal slot wall above the bottom wall extending over a portion of the bottom wall and forming a slot between the slot wall and the bottom wall, a vertical wall extending upward from the slot wall, and a top horizontal floor support wall extending outward from the vertical wall; and a plurality of sub-floor sheets positioned between adjacent floor joists, wherein a first edge of a first sub-floor sheet is positioned within the slot, and wherein a second edge of the sub-floor sheet is positioned on a top surface of the slot wall.

BRIEF DESCRIPTION OF THE DRAWINGS

The numerous advantages of the present invention may be better understood by those skilled in the art by reference to the accompanying drawings in which:

FIG. 1 is a perspective view of a modular building unit in accordance with certain aspects of an embodiment of the invention.

FIG. 2 is a perspective view of a skeletal frame of the modular building unit of Figure 1.

FIG. 3 is a top view of the floor assembly of the modular building unit of Figure 1.

FIG. 4 is a perspective view of a first end of a floor joist for use with the floor assembly of FIG. 3.

FIG. 5 is a cross-sectional view of the floor joist of FIG. 4.

FIG. 6 is a cross-sectional view of floor assembly 130 along section line A-A of FIG. 3.

5 FIG. 7 is a close-up, cross-sectional view the floor assembly of FIG. 6.

FIG. 8 is a perspective view of a section of the floor assembly showing two floor joists positioned within bottom long rails of the frame of FIG. 2.

FIG. 9 is a cross-sectional view of the section of the floor assembly along section lines B-B of FIG. 8.

10 FIG. 10 is a side view of an interior of a bottom long rail for use with the frame of FIG. 2.

FIG. 11 is a cross-sectional view of two bottom long rails at an end region.

FIG. 12 is a cross-sectional view of a bottom long rail along section line C-C of FIG. 10.

FIG. 13 is a perspective view of a floor joist attaching to a bottom long rail in a reinforced end region of the bottom long rail.

15 **BEST MODE(S) FOR CARRYING OUT THE INVENTION**

The following description is of a particular embodiment of the invention, set out to enable one to practice an implementation of the invention, and is not intended to limit the preferred embodiment, but to serve as a particular example thereof. Those skilled in the art should appreciate that they may readily use the conception and specific embodiments disclosed
20 as a basis for modifying or designing other methods and systems for carrying out the same purposes of the present invention. Those skilled in the art should also realize that such equivalent assemblies do not depart from the spirit and scope of the invention in its broadest form.

Figure 1 provides a perspective view of a modular building unit 100 in accordance with certain aspects of an embodiment of the invention. Modular building unit 100 includes a skeletal frame formed by corner support posts 112, bottom rails 114, and top rails 116, wall panels 118, windows 120, and doors 120. This skeletal frame provides the key structural integrity for the modular building unit. As shown in Figure 1, wall panels 118 are positioned between corner support posts 112, bottom rails 114, and top rails 116, which wall panels 118 form the wall structures spanning each side of the modular building unit.

Figure 2 is a perspective view of a skeletal frame of modular building unit 100, including a floor assembly 130 bordered by bottom rails 114, and more particularly by bottom long rails 114a and bottom short rails 114b. As shown in Figure 2 and in the top view of floor assembly 130 of Figure 3, floor assembly 130 includes floor joists 200 extending between bottom long rails 114a in a direction generally parallel to one another and to bottom short rails 114b. Additionally, forklift pockets 140 are preferably provided that open to the outside of bottom short rails 114a to allow insertion of the arms of a forklift to maneuver modular building unit 100.

Floor joists 200 provide the primary support for floor boards 150 (Figure 7). As shown in the perspective view of a section of a floor joist 200 of Figure 4, and in the cross-sectional view of the floor joist 200 of Figure 5, each floor joist 200 has a bottom, generally horizontal wall 202 having a first free end and a second end terminating in an upward u-bend 203. U-bend 203 transitions into an upper slot wall 204, such that a slot is formed between the underside of slot wall 204 and the top side of horizontal wall 202. A vertical wall 206 extends upward from slot wall 204, and a top, horizontal floor support wall 208 extends outward from the top edge of vertical wall 206 to provide a support surface for the floor boards 150 of the modular building

unit 100. A flange wall 210 may be provided extending downward from the free end of horizontal floor support wall 208.

The slot formed between bottom, horizontal wall 202 and slot wall 204 is configured to receive an end of a sub-floor sheet 220, as shown in the cross-sectional views of floor assembly 130 of Figures 6 and 7. Floor joists 200 are positioned with the slots defined by slot wall 204 and bottom wall 202 opening to the right for joists on the left portion of floor assembly 130, and opening to the left for joists on the right portion of the floor assembly 130, with two joists facing one another at the center of the floor assembly 130. Of course, the two facing joists may be placed at a location other than in the center of floor assembly 130, as it is simply desirable to ensure that support surfaces are provided across the entire length of the floor assembly 130 for supporting separate sub-floor sheets 220.

With particular reference to Figure 6, sub-floor sheets 220 at the ends of floor assembly 130 are supported out their outer ends by the bottom portion of bottom short rails 114b, and are supported by facing floor joists 200a adjacent each forklift pocket 140.

With this configuration, and with particular reference to the close-up view of Figure 7, each pair of floor joists 200 has a sub-floor sheet 220 positioned between them. A first end of the sheet 220 is positioned in the slot of a first floor joist 200 in the pair, and the second end sits on the slot wall 204 of the second floor joist 200 in the pair. The second end of the sheet 220 may then be held in place with, by way of non-limiting example, a clip 205, a pin, or any other fastener that may be installed without tools, so as to maximize the ease of installation.

Alternatively, in those instances in which a more permanent installation is desired, sub-floor sheet 220 may be tack welded at various spots along the length of both bottom wall 202 and slot

wall 204 of adjacent floor joists 200. In any case, the floor assembly may be installed without the need to invert the floor assembly 130 during the installation process.

Figure 8 provides a perspective view of two floor joists 200 positioned within bottom long rails 114a of modular building 100, and Figure 9 provides a cross-sectional view of the floor assembly 130 along section line B-B of Figure 8. Each joist 200 extends between and generally perpendicular to bottom long rails 114a. Bottom long rails 114a each have a bottom face 170 having an upwardly bent portion 171 at a distal end which positions the bottom wall 202 of floor joists 200, and thus the bottom surface of sub-floor sheets 220, above the surface on which modular building unit 100 is positioned. Bottom long rails 114a also have an exterior vertical wall 172 that extends upward from bottom face 170 and forms the exterior bottom perimeter of modular building unit 100, and a top wall 173 extending inward from the top portion of vertical wall 172. Top wall 173 is provided an upwardly directed ridge that is configured to releasably engage a notch on the bottom surface of a wall panel, as described in co-pending and co-owned U.S. Patent Application No. 62/026,256, titled "Interlocking Wall Panels for Modular Building Units," the specification of which is incorporated herein by reference in its entirety.

In order to mate with bottom long rails 114a, floor joists 200 are provided a notch 212 at each end that removes a portion of top horizontal support wall 208 and flange wall 210. Thus, the top surface of top wall 208 of floor joists 200 aligns with the top surface of top wall 173 of bottom long rails 114a, while the end portions of each floor joist 200 extend into the body of bottom long rails 114a and abut the interior of vertical wall 172. Within bottom long rails 114a, the bottom surface of bottom wall 202 of floor joists 200 is supported by upwardly bent portion 171 of bottom long rails 114a, and the top surface of notch 212 sits directly below top wall 173

of bottom long rails 114a. Floor joists 200 may be tack welded in place to bottom long rails 114a to provide a permanent connection between the two in a manner well known to those of ordinary skill in the art.

As shown in Figures 10 through 13, bottom long rail 114a may be provided structural reinforcement in the form of rigid reinforcement plates to add structural rigidity to the frame of the modular building unit, particularly at end regions 115 adjacent to the corners of the frame and to the forklift pockets 140. More particularly, bottom long rails 114a may receive an upper horizontal reinforcement plate 160 and a lower horizontal reinforcement plate 162 in end regions 115 and along forklift pockets 140. Bottom long rails 114a may further receive a vertical reinforcement plate 164 in end regions 115 to provide further structural support. In these regions of added structural support, and with particular reference to Figure 13, floor joists 200 may be shortened at their side edges but cutting an end from notch surface 212, vertical wall 206, and bottom wall 202 of floor joist 200 so as to allow the floor joists in such reinforced regions to come in direct contact with those reinforcement members. Floor joists 200 may then be rigidly attached to the reinforcements, such as by tack welding, to provide a rigid, structurally integrated support frame.

The foregoing configuration results in a modular building construction that avoids the need to turn the floor assembly frame over for installation of a floor subsheet,, and that likewise provides a modular floor subsheet that may be fitted to the modular building unit without welding, rivets, screws, or other tooling. Such assembly allows all components of the floor to be installed from above, thus avoiding the need to invert the frame of the floor assembly during installation. Likewise, the modular nature of the assembly allows installation to be carried out by fewer personnel than required in traditional installations.

Having now fully set forth the preferred embodiments and certain modifications of the concept underlying the present invention, various other embodiments as well as certain variations and modifications of the embodiments herein shown and described will obviously occur to those skilled in the art upon becoming familiar with said underlying concept. It should
5 be understood, therefore, that the invention may be practiced otherwise than as specifically set forth herein.

CLAIMS

1. A floor assembly for a modular building unit, comprising:

bottom rails forming a perimeter of said floor assembly; and

a plurality of floor joists extending between two of said bottom rails, each said floor joist further comprising a bottom generally horizontal wall, a horizontal slot wall above said bottom wall extending over a portion of said bottom wall and forming a slot between said slot wall and said bottom wall, a vertical wall extending upward from said slot wall, and a top horizontal floor support wall extending outward from said vertical wall; and

a plurality of sub-floor sheets positioned between adjacent floor joists, wherein a first edge of a first sub-floor sheet is positioned within said slot, and wherein a second edge of said sub-floor sheet is positioned on a top surface of said slot wall.

2. The floor assembly of claim 1, further comprising a plurality of forklift pockets extending through said floor assembly parallel to said plurality of floor joists.

3. The floor assembly of claim 1, further comprising floor boards positioned on top of said top wall of said floor joists.

4. The floor assembly of claim 1, further comprising a removable fastener extending through said vertical wall of said floor joist above said second edge of said sub-floor sheet and positioned to block upward movement of said second edge of said sub-floor sheet.

5. The floor assembly of claim 1, wherein a plurality of said floor joists extending into a body of said bottom rails.

6. The floor assembly of claim 5, wherein said bottom rails further comprise a rail bottom wall having a base portion and an upwardly bent portion, a rail vertical wall extending

upward from said base portion, and a top horizontal wall extending inward from a top end of said vertical wall.

7. The floor assembly of claim 6, wherein a bottom surface of said bottom wall of said floor joists is supported by said upwardly bent portion of said rail bottom wall.

5 8. The floor assembly of claim 6, wherein said top wall of said floor joists is notched in a region of said floor joist that extends into said body of said bottom rails.

9. The floor assembly of claim 6, wherein said floor joists are welded to said bottom rails.

10 10. The floor assembly of claim 1, said bottom rails further comprising reinforcement plates extending along only a portion of an interior of said bottom rails in an end region of said bottom rails adjacent corners of said floor assembly.

11. A modular building unit, comprising:

15 a rigid, fixed modular building unit frame having a plurality of corner support posts, a bottom rail extending between adjacent pairs of corner support posts and forming a perimeter of a floor assembly, a top rail extending between adjacent pairs of corner support posts, and a plurality of wall panels extending between said corner support posts, said top rails, and said bottom rails; and

20 a plurality of floor joists extending between two of said bottom rails, each said floor joist further comprising a bottom generally horizontal wall, a horizontal slot wall above said bottom wall extending over a portion of said bottom wall and forming a slot between said slot wall and said bottom wall, a vertical wall extending upward from said slot wall, and a top horizontal floor support wall extending outward from said vertical wall; and

a plurality of sub-floor sheets positioned between adjacent floor joists, wherein a first edge of a first sub-floor sheet is positioned within said slot, and wherein a second edge of said sub-floor sheet is positioned on a top surface of said slot wall.

12. The modular building unit of claim 11, further comprising a plurality of forklift
5 pockets extending through said floor assembly parallel to said plurality of floor joists.

13. The modular building unit of claim 11, further comprising floor boards positioned on top of said top wall of said floor joists.

14. The modular building unit of claim 11, further comprising a removable fastener extending through said vertical wall of said floor joist above said second edge of said sub-floor
10 sheet and positioned to block upward movement of said second edge of said sub-floor sheet.

15. The modular building unit of claim 11, wherein a plurality of said floor joists extending into a body of said bottom rails.

16. The modular building unit of claim 15, wherein said bottom rails further comprise a rail bottom wall having a base portion and an upwardly bent portion, a rail vertical wall
15 extending upward from said base portion, and a top horizontal wall extending inward from a top end of said vertical wall.

17. The modular building unit of claim 16, wherein a bottom surface of said bottom wall of said floor joists is supported by said upwardly bent portion of said rail bottom wall.

18. The modular building unit of claim 16, wherein said top wall of said floor joists is
20 notched in a region of said floor joist that extends into said body of said bottom rails.

19. The modular building unit of claim 16, wherein said floor joists are welded to said bottom rails.

20. The modular building unit of claim 11, said bottom rails further comprising reinforcement plates extending along only a portion of an interior of said bottom rails in an end region of said bottom rails adjacent corners of said floor assembly.

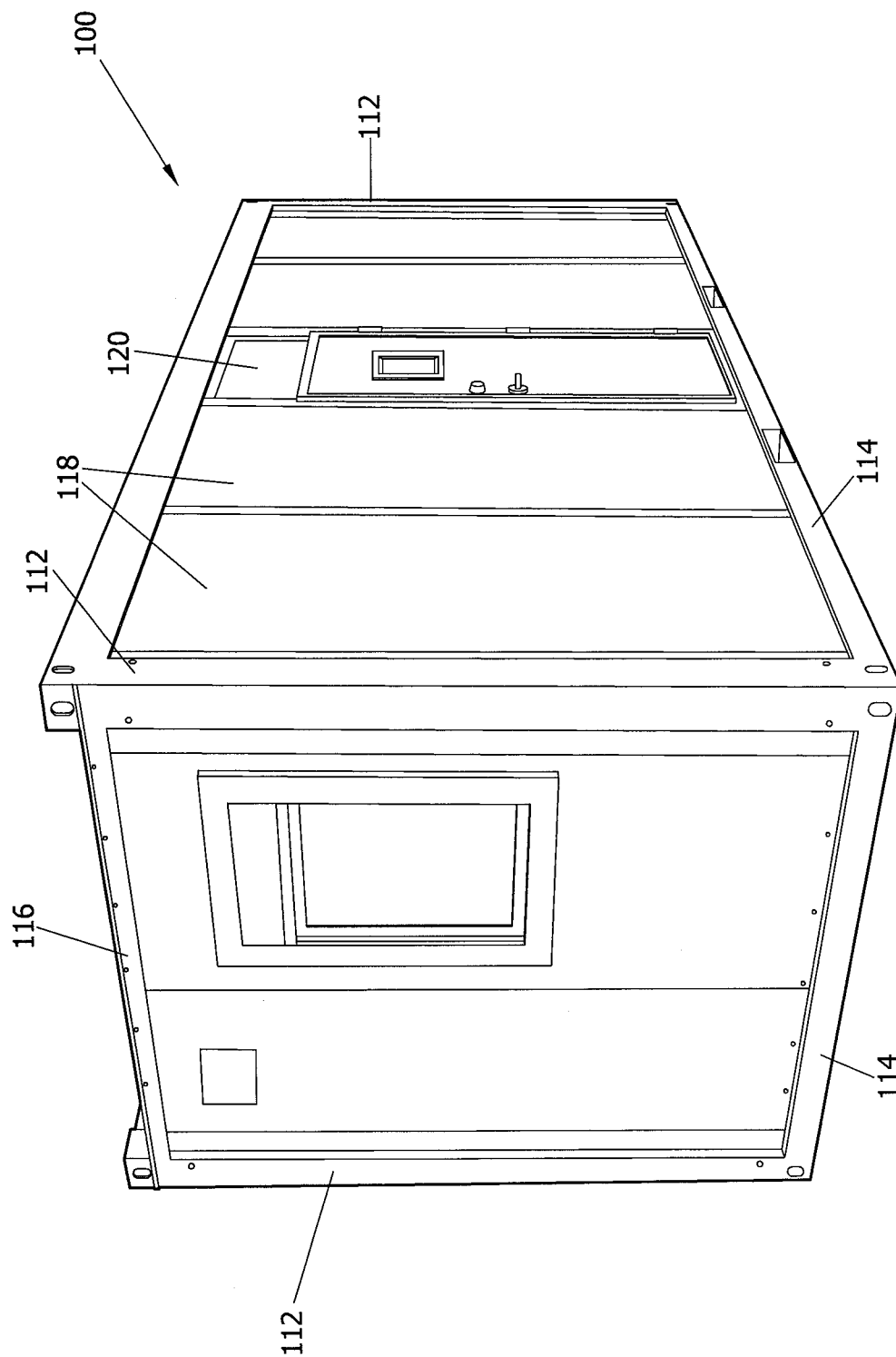


FIG. 1

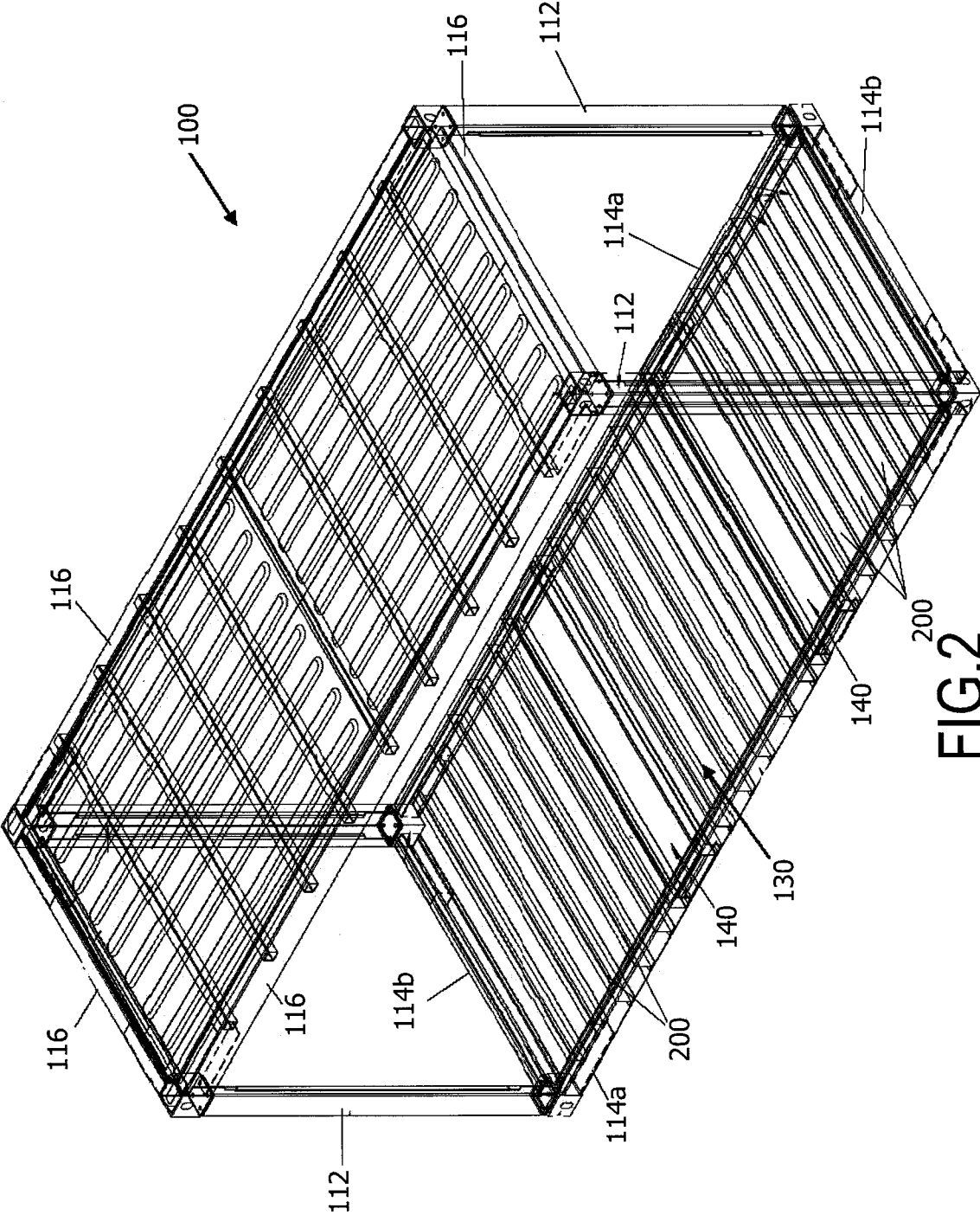


FIG. 2

3/8

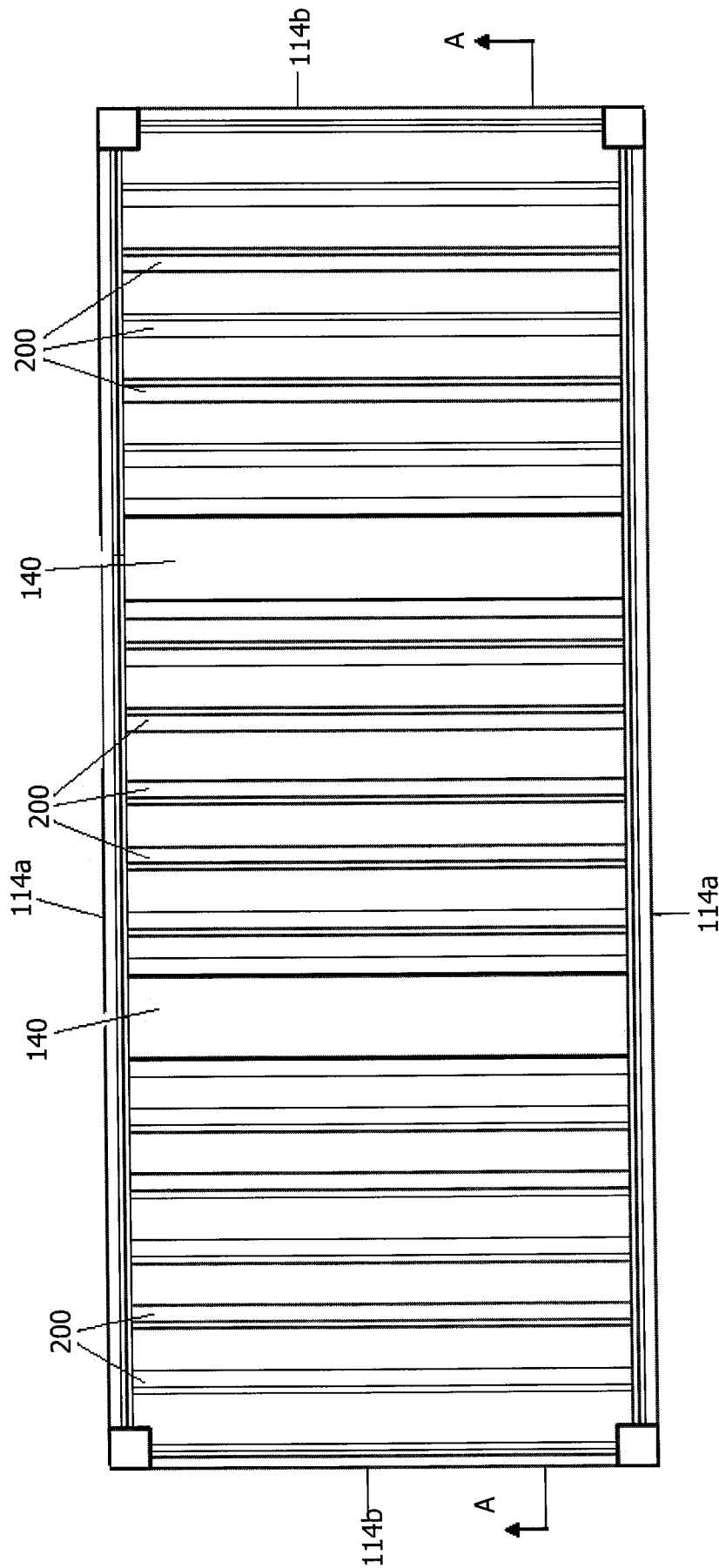


FIG.3

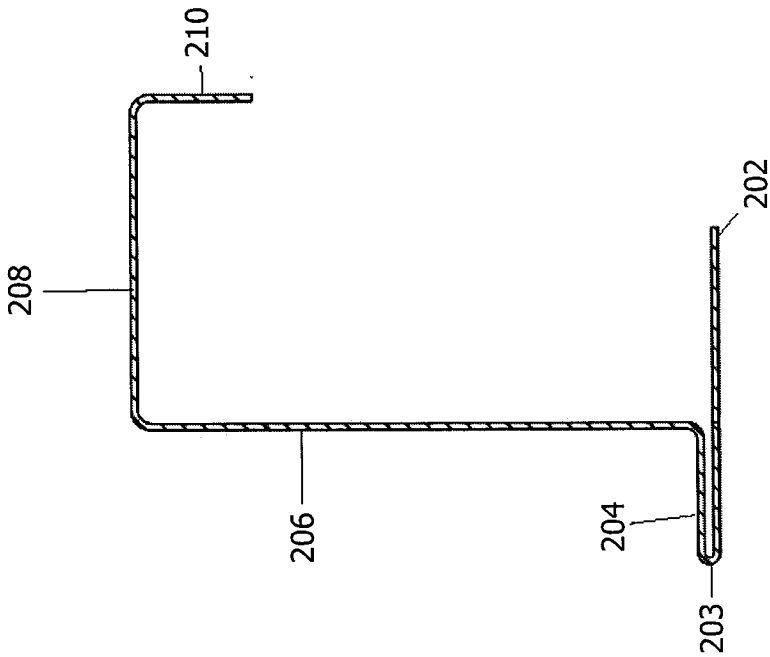


FIG.5

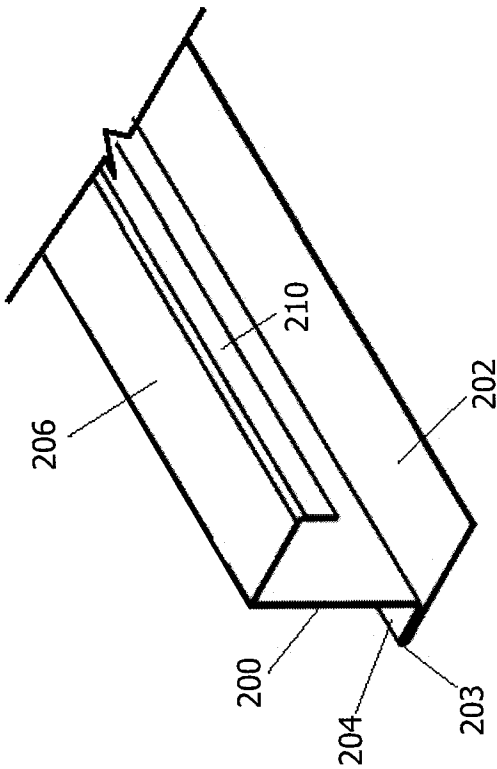


FIG.4

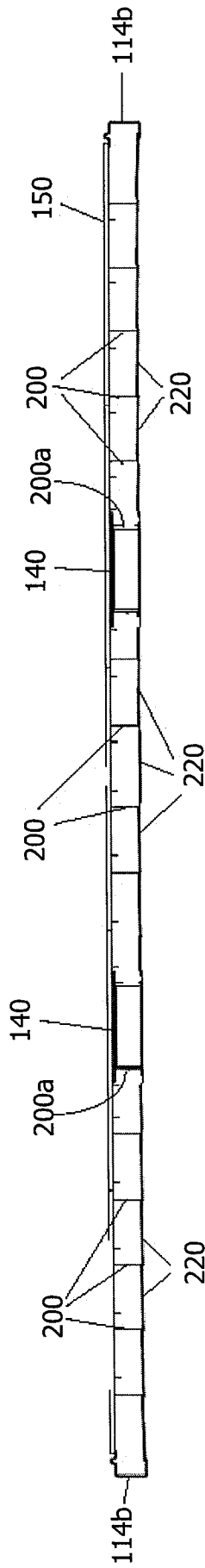


FIG. 6

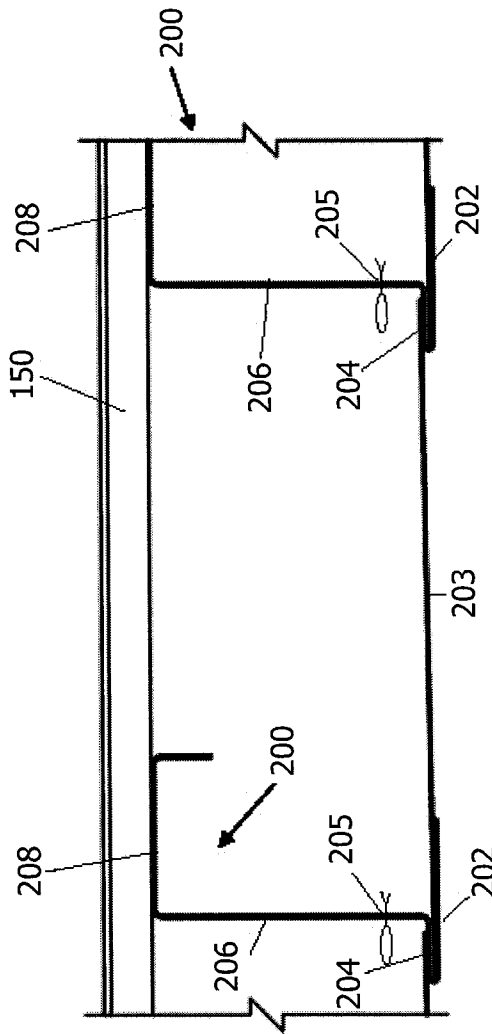
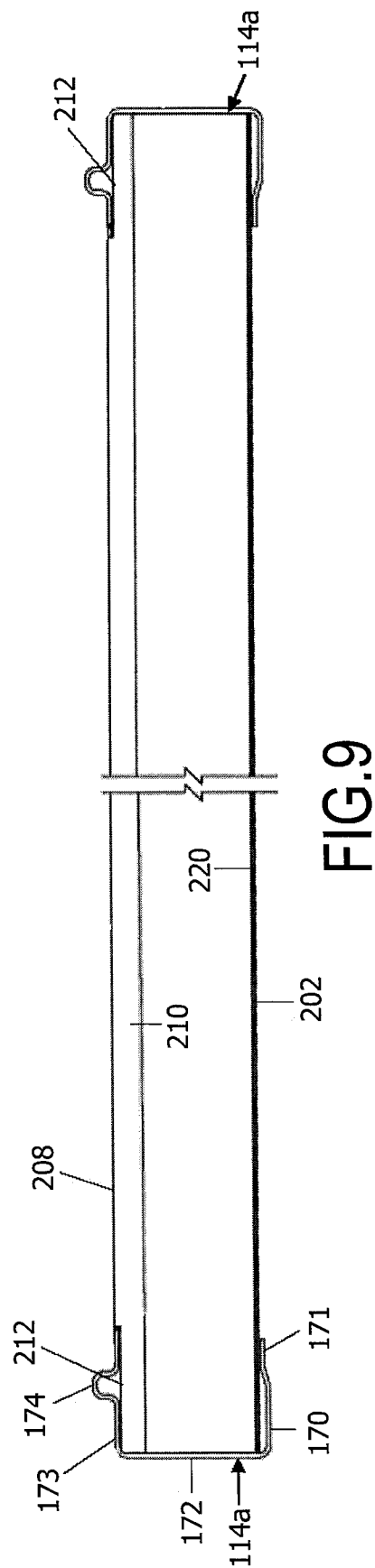
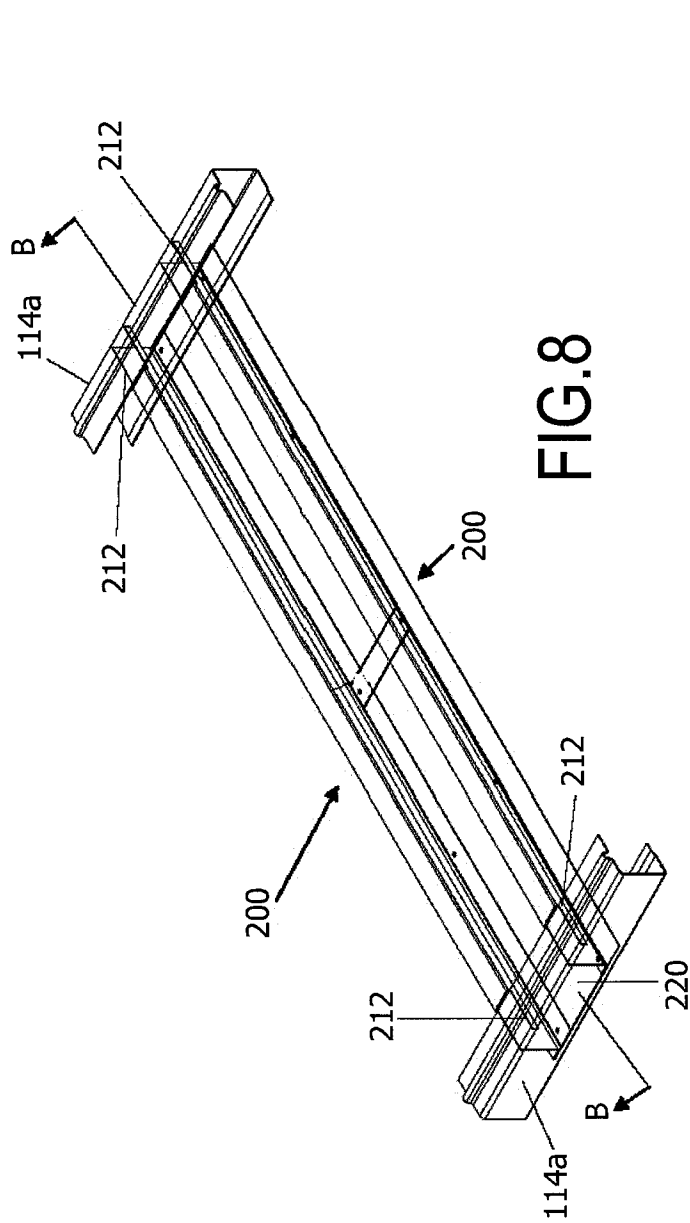


FIG. 7



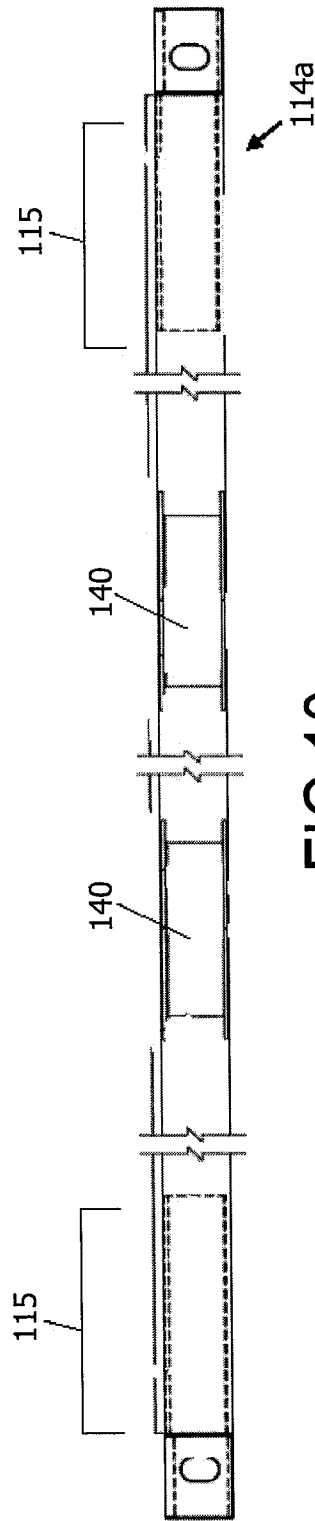


FIG. 10

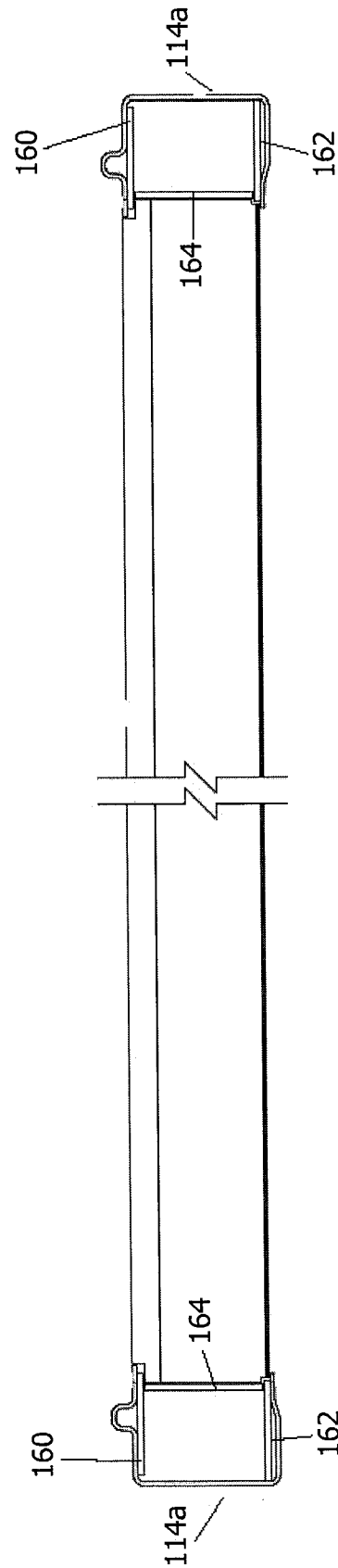


FIG. 11

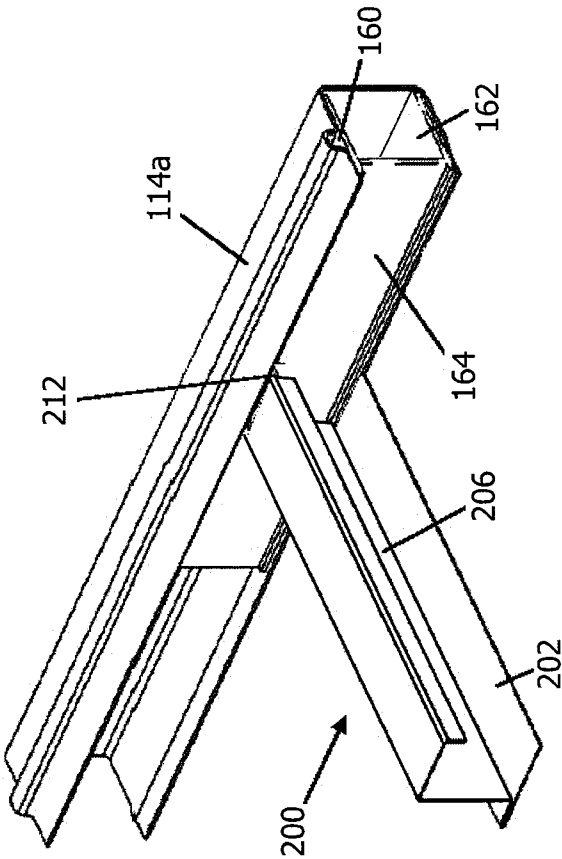


FIG.13

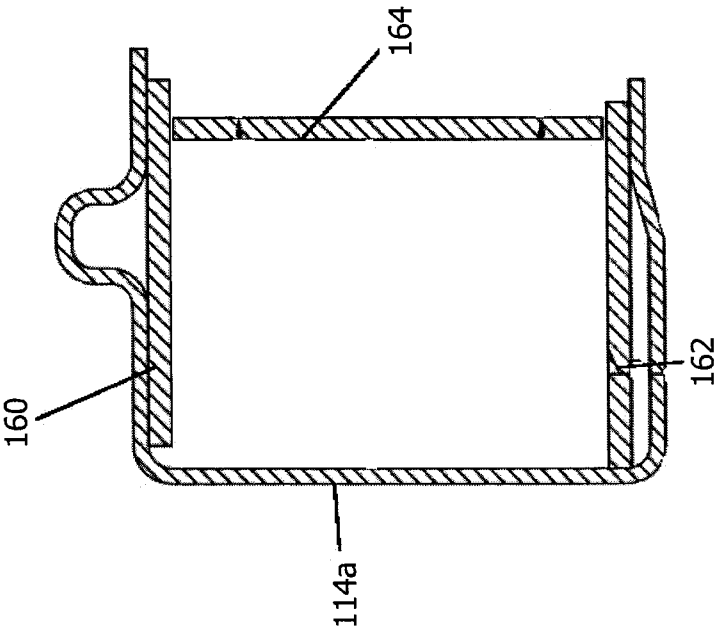


FIG.12

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066480

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04C3/07 E04B5/10 E04H1/12 E04B9/24 E04B9/06
E04B1/348

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04C E04B E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013/159772 A (INNOVAC GMBH) 31 October 2013 (2013-10-31) abstract; figures 1-3 -----	1-20
A	GB 2 062 060 A (ANGLIA JAY PURLIN CO.) 20 May 1981 (1981-05-20) abstract; figures 1-4,8 -----	1-20
A	US 6 327 828 B1 (CARROLL) 11 December 2001 (2001-12-11) abstract; figures 1,2 -----	1-20
A	US 2005/257494 A1 (BRANDES) 24 November 2005 (2005-11-24) figures 1,5,16 -----	1
A	CA 2 455 071 A1 (BEST JOIST INC.) 24 May 2005 (2005-05-24) figures 24,26 -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

4 December 2015

Date of mailing of the international search report

14/12/2015

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Authorized officer

Righetti, Roberto

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013159772 A	31-10-2013	DE 102012103719 A1	31-10-2013
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