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**A modular building frame panel**

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## ABSTRACT

A modular building frame panel having: a pair of opposing upright, box shaped primary support members defining the extremities of the panel; services apertures formed in the edge, front and rear walls of the box shaped support members to form services paths for routing of services through the panel; access apertures are formed in the primary support members to facilitate attachment of panels via connection bolts, and lintel systems; a secondary support member located equidistantly between the opposing primary support members, having a front wall, side walls, rear flange and return lip; services apertures are formed in the front and side walls of each secondary support member to form services paths extending to the apertures of the primary support members for routing of services through the panel; a top tie member is fixed to and extends between the top of each primary support member and across the secondary support member, with link member mounting apertures and locating aperture points and truss mounting apertures and locating points; a bottom tie is fixed to and extends between the bottom of each primary support; a link member to attach the panel to another panel at a variety of points and directions along top tie member of each panel; and a truss mount to attach to the panel at a variety of points along top tie member of each panel.

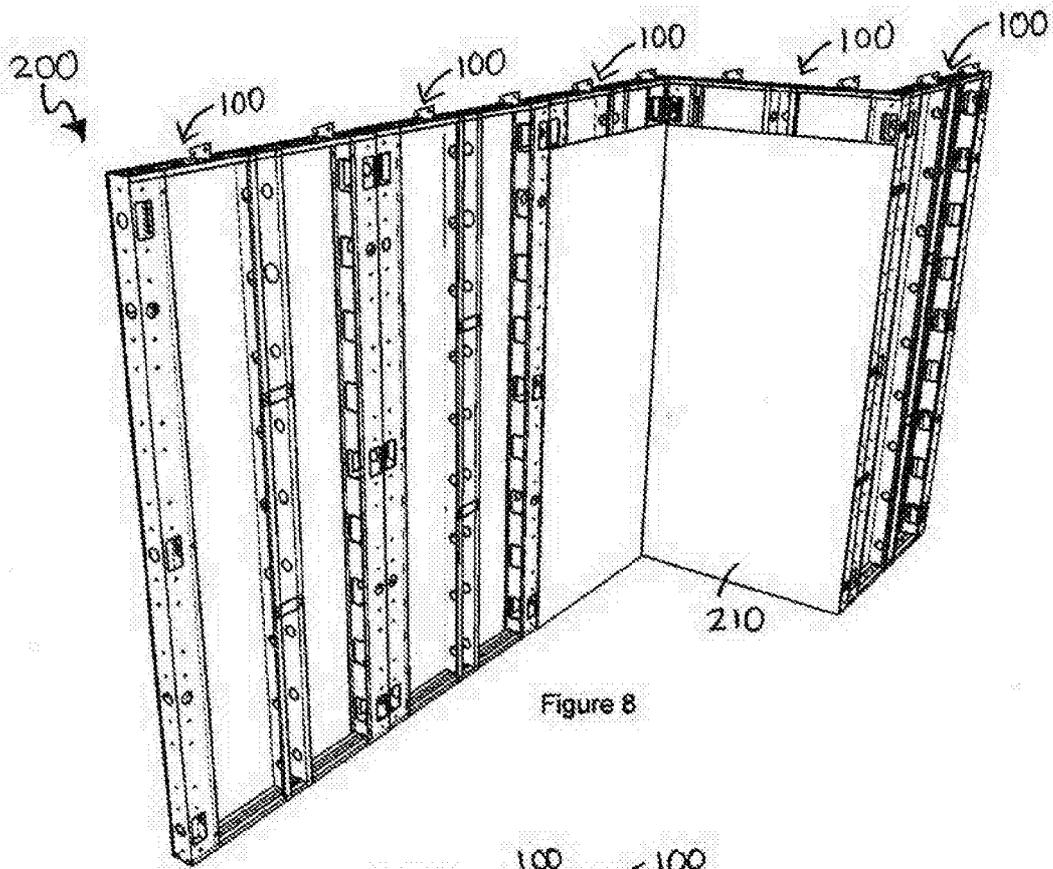


Figure 8

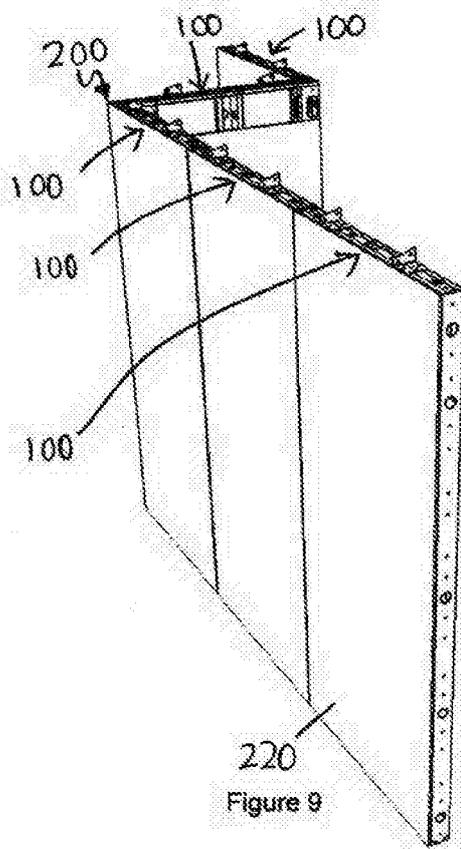


Figure 9

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**STANDARD SPECIFICATION FOR THE INVENTION ENTITLED:**

A modular building frame panel

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This invention is best described in the following statement:

## A MODULAR BUILDING FRAME PANEL

### Technical Field

The present invention relates to the field of building products, and particularly relates to a modular building panel frame.

### Background of the Invention

Building structures having walls formed of a frame and cladding have traditionally been fully constructed in situ with frames typically being formed from timber stud, or metal elements which are either cut to size and constructed in situ or alternatively pre-cut to size and then constructed in situ.

Various forms of prefabricated modular building frames have previously been proposed, formed of various materials and configurations. Various known forms of modular building frame panels, however, suffer from various disadvantages, typically relating either to efficiency of manufacture or of construction onsite and non reusability, labour intensive handling, transport inefficiencies, limited life span, or structural integrity.

### Object of the Invention

It is the object of the present invention to substantially overcome or at least ameliorate one or more of the above disadvantages.

### Summary of the Invention

A modular panel in a finite range of sizes that can be attached to each other at multiple points and directions, to produce a structural building frame. The panels are lightweight steel and are easily manipulated and assembled, incorporate truss mountings and services architecture, and are designed for mass production with minimal tooling requirements.

In a first aspect, the present invention provides a modular structural building frame panel system comprising:

a pair of opposing upright primary support members each extending between a top end and a bottom end of said primary support member, each said primary support member having an end wall, a front wall and a rear wall, and a primary 'C' shaped structural insert, said end walls of said primary support members defining opposing end faces of said panel, said front walls of said primary support members defining front face of said panel and said rear walls of said primary support members defining a rear face of said panel;

a top tie member fixed to and extending between a top end of each said primary support members, the member being folded or corrugated shape; and

a services aperture formed in said end wall, and front and rear walls, and primary structural insert of each said primary support member, a services path extending between said service apertures in said walls for routing of services through said panel.

In a preferred form, for each said primary support member, said front wall and said rear wall have a width greater than that of said end wall.

Typically, a link mounting surface is formed by top tie member, located above said primary support member, above said secondary support member and at two points located equidistantly from said top tie member, each said link mounting surface being adapted to mount a link member for fixing said panel, in use, to an adjacent said panel.

In a preferred form, typically, each said link mounting surface is formed between said end wall, said secondary support member and two additional points along said link mounting surface of the respective said primary support member and an adjacent end of said top tie member.

Typically, each said link mounting surface is provided with a link mounting aperture, rivet nut insert and four link locating apertures for fixing the link member to said panel.

Typically, each said link mounting aperture is located equidistantly from said end wall, said front wall and said rear wall of the respective said primary support member.

Typically, each said link locating aperture is located equidistantly, longitudinally and transverse along said link mounting surface from said link mounting aperture.

Typically, said top tie member is in the form of a metal plate top plate

In a preferred form, each said top tie member is provided with one or more truss mounting apertures each for fixing a roof truss mount to said panel.

In a preferred form, each said truss mounting aperture has a rivet nut attached.

In one form, said panel further comprises a bottom tie member, that is folded or corrugated, fixed to and extending between said bottom end of each of said primary support members.

Typically, said bottom tie member is in the form of a corrugated or folded bottom plate.

In a preferred form, said bottom tie member is provided with one or more longitudinally extending slots, or holes, each for receipt of a fastener for securing said bottom tie member to an underlying structure.

In one form, said panel further comprises an upright secondary support member located between said primary support members and extending between and secured to said top and bottom tie members, said secondary support member having a services aperture extending through and forming part of said services path.

In a preferred form, each of said primary support members is in the form of two connected C-channel sections, forming a box section, and two opposing flanges forming said front, rear and inner walls of said primary support member.

In a preferred form, said front wall and said rear wall of each said primary support member is provided with a services aperture extending through. Typically, said service apertures of said front, rear and end walls of each said primary support member are each located at a common height above

said bottom end of the respective said primary support member and a common distance from an intersection between said end face and the respective said front or rear face of said primary support member.

In a preferred form, said top tie member is provided with a services apertures 143 extending there through. Typically, said bottom tie member is provided with a services aperture extending there through and generally aligned with said services aperture in said top tie member, in the centre of said bottom tie member.

In a preferred form, said services aperture in said top tie member is located directly above said primary support member, directly above said secondary support member, said secondary member being in the form of a channel section with said services aperture of said top tie member communicating with a recess of said channel section of said secondary support member and equidistant between said services apertures directly above said primary support member and said secondary support member.

In a preferred form, said front wall, said rear wall and said inner wall of each said primary support member is provided with an access aperture extending through. Typically, said access apertures of said front, rear and inner walls of each said primary support member are each located at a common height above said bottom end of the respective said primary support member and a common distance from an intersection between said end face and the respective said front or rear face or inner wall of said primary support member.

In a preferred form, said end wall of each said primary support member is provided with a fixing aperture for fixing said panel, in use, to an adjacent said panel extending coplanar to said panel, said fixing apertures in said end walls being aligned.

In a preferred form, said front wall and said rear wall of each said primary support member is each provided with a fixing aperture for fixing said panel, in use, to an adjacent said panel extending perpendicular to said panel, and can be used as lintel mounting points. Typically, said fixing apertures of said front, rear and end walls of each said primary support member are each located at a common height above said bottom end of the respective said primary support member at a common distance from an intersection between said end wall and the respective said front or rear wall of said primary support member.

In an alternate form, said panel further comprises a door frame located between and fixed to said primary support members. In a preferred form, said door frame comprises a pair of opposing door jambs fixed to said primary support members and a door header fixed to and extending between said door jambs.

In a second aspect, the present invention provides a building structure comprising a plurality of said panels arranged end-to-end with adjacent primary support members of each adjacent pair of said panels abutting and being mutually fixed by way of a link member fixed to and extending between adjacent said link mounting surfaces of said adjacent panels.

### Brief Description of the Drawings

A preferred embodiment of the present invention will now be described, by way of an example only, with reference to the accompanying drawings wherein:

Figure 1 is a perspective view of a modular building frame panel;

Figure 2 is a front elevation view of the panel of Figure 1;

Figure 3 is a rear elevation view of the panel of Figure 1;

Figure 4 is a left end elevation view of the panel of Figure 1;

Figure 5 is a top plan view of the panel of Figure 1;

Figure 6 is a top plan view depicting the cross-section of a primary support member of the panel of Figure 1;

Figure 7 is a top plan view depicting the cross-section of the secondary support member of the panel of Figure 1;

Figure 8 is a front perspective view of a partially constructed building wall utilizing the panel of Figure 1;

Figure 9 is a rear perspective view of the building wall of Figure 8;

Figure 10 is a front perspective view of a partially constructed building wall utilizing the panel of Figure 1 in a perpendicular manner;

Figure 11 is an enlarged fragmentary view of the building wall of Figure 8, particularly depicting a link member and roof truss mount;

Figure 12 is a perspective view of a partially completed building wall incorporating a door frame;

Figure 13 is a fragmentary perspective view of the wall of Figure 12 depicting engagement of the door frame and a primary support member; and

Figure 14 is a perspective view of a partially completed building wall incorporating a lintel.

### Detailed Description of the Preferred Embodiments

Referring firstly to Figures 1 to 5 of the accompanying drawings, a modular structural building frame panel 100 comprises a pair of opposing upright primary support members 110, an upright secondary support member 150, a bottom tie member 130 and a top tie member 140. In the present embodiment, each of the members forming the panel 100 is formed of sheet steel material that would typically be galvanised for corrosion protection, although any suitable structural building material may be utilised as desired. Sheet steel material is particularly desired for its strength and fire resistant properties. The thickness of the sheet steel material may be adjusted as desired to provide the required strength for a particular application, particularly utilizing thicker sheet thicknesses for multi-storey applications. In the arrangement depicted, the panel 100 has a height of approximately 2700 mm, a width of approximately 1200 mm and a thickness of approximately 100 mm. Other panels may be 1000mm, 900mm and 600mm wide, to fulfill necessary building alignments.

The primary support members 110 are here identical and extend between a top end 111 and a bottom each 112 of the primary support member 110. Each primary support member 110 has an end wall 113, a front wall 114, a rear wall 115 and an inner wall 124. The end walls 113 of the primary support members 110 define opposing end faces of the panel 100. The front walls 114 of the primary support members 110 define a front face of the panel 100 to which a cladding element may be fixed. The rear walls 115 of the primary support members 110 define a rear face of the panel 100, to which an opposing cladding element may be fixed. The inner walls 124 of the primary support member 110 define the inner face of the primary support member 110. Any desired form of cladding element may be fixed to the front and rear faces of the panel 100 including, for example, plasterboard, fibrous cement board, timber sheet, plastic or metal panels which would typically be selected for suitability to either form internal or external wall surface of a building formed using the panels 100.

Referring specifically to Figure 6, each primary support member 110 is in the general form of a C-shaped channel comprising a web forming the end wall 113 and opposing flanges forming the front and rear walls 114, 115 of the primary support member 110. A primary support "C" shaped section 123 is attached by the clinching method to the inner surfaces of the front wall 114 at the clinching point 170 and the rear wall 115 at clinching point 171 of the primary member 110 forming a box shaped form and an inner wall 124, parallel with end wall 113, with extensions along the front wall 114 and the rear wall 115, which creates exceptional strength in vertical loads and torsion.

The front and rear walls 114, 115 will typically have a width greater than a width of the end wall 113. This ensures that, when two panels 100 are arranged to form a corner, with the end wall 113 of a primary support member 110 of one panel 100 abutting either the front or rear wall 114, 115 of an adjacent panel 100, the respective front or rear wall 114, 115 will overlap the abutting end wall 113, thereby providing an exposed surface for fixing of a cladding element. In the preferred embodiment depicted each end wall 113 has a width of approximately 100 mm and the front and rear walls 114, 115 have a width of approximately 140 mm. The 'C' shaped channel defining each primary support member 110 will typically be roll formed or folded.

The bottom tie member 130 is fixed to and extends between the bottom end 112 of each of the primary support members 110. Typically, the bottom tie member 130 is in the form of a folded or corrugated plate, and is attached, typically by the clinching method at clinching point 174, to the bottom end of 112 of each of the primary support member 110. Here the bottom member 130 extends to adjacent the end wall 113 of each primary support member 110.

The top tie member 140 is fixed to and extends between the top end 111 of each of the primary support members 110. Typically, the top tie member 140 is in the form of a folded or corrugated plate and is attached, typically by the clinching method at clinching point 172, to the top end 111 of each of the primary support members 110.

The top tie member 140 extends across the full width of the panel 100. Typically, the top tie member 140 extends between the end walls 113 of the primary support members 110, across the approximately square exposed portion of the top end 111 of each primary support member 110.

Each top tie member 140 is adapted to mount a link member 20, as depicted in Figure 11, fixing the panel 100, in use, to an adjacent panel 100, as will be discussed further below.

An optional top load plate 180, Figure 1, for additional downward load strength, as may be required for two storey applications, can be affixed to the top tie member 140. The top load plate 180 is in the form of steel plate. Typically, the top load plate 180 is provided with link mounting apertures 180, link mounting locating apertures 182, roof truss mounting apertures 183, roof truss mounting locating apertures 184 and services apertures 185, corresponding with top tie member 140.

Referring specifically to Figure 7, the secondary support member 150 is here in the form of a channel section, particularly a top-hat channel section having a web defining a front wall 151, a pair of opposing flanges forming side walls 152 and a rear secondary flange 153 projecting from the rear end of each side wall 152, and two secondary support member return lips 157. The top-hat channel section defining the secondary support member 150 will typically be roll formed, or folded. The secondary support 150 is compression strengthened by a compression tie 156 at two points equidistant along the length of the secondary support member 150. The secondary support member compression tie 156 is in the form of a steel plate spanning the width of the secondary support member 150 from one secondary support rear flange 153 to the second rear flange support 153. The front wall 151 lies in the same plane as the front walls 110 of the primary support members 110 to, in part, define the front face of the panel 100. The rear secondary flanges 153 lie in the same plane as the rear walls 115 of the primary support members 110 so as to, in part, define the rear face of the panel. The secondary member return lip 157 is parallel to the secondary support member side walls 152. The secondary support member 150 is typically clinched at clinching point 175 to the bottom tie member 130 and top tie member 140 at clinching point 173.

An alternative, narrower form of the panel 100 is also envisaged, omitting the secondary support member 150. Such a narrower panel may conveniently have a narrower width of the order of 600 mm, 900 mm or 1000 mm, limiting the range to standard sizes which may be added to as demand requires.

The spaces defined between the central secondary support member 150 (or the single space between primary support members 110 for narrow panels as discussed above) may be filled with insulation as desired prior to the fixing of cladding elements to both the front and rear faces of the panel 100.

The various members forming the panel 100 are provided with various forms of apertures for fixing the panel 100, for fixing various other elements to the panel 100 and for the passage of services, such as electrical, communication and plumbing services through the width of each panel and between adjacent panels.

The bottom tie member 130 is provided with eight holes, equidistant, 131 for the receipt of fasteners to fix the panel to an underlying structure, such as a floor slab. In the configuration depicted, the bottom tie member 130 is provided with eight holes 131 in total, four each being equidistant between the secondary support member 150 and the primary support members 110 on each side.

The primary mode of fixing adjacent panels 100 to each other is by way of a link member 20, as particularly depicted in Figure 11. The link member 20 is particularly in the form of a steel plate, with a link member aperture 21 for allowing fixing, and link member locating pins 22 to locate the link member 20 and the panels 100. The link member 20 is provided with two corresponding link member apertures 21 and eight link member locating pins 22 for fixing the link member to the top tie member 140. Link member apertures correspond with top tie member link apertures 142 while link member locating pins 22 correspond with top tie member locating apertures 144 and 145.

As a result, the link member 20 may be arranged collinear with a top tie member 140 for fixing two adjacent panels in a coplanar manner for form a linear wall, as per the three left end panels 100 of the wall depicted in Figures 8 and 9, the link member 20, or, alternatively, arranged to the top tie member 140 to enable adjacent panels to be arranged perpendicular to each other so as to form right-angle corners as shown between the three right end panels 100 of the wall depicted in Figures 8 and 9.

An alternative, link member 20 is also envisaged, which may allow for multiple connections. Such multiple connection link member 20 may be in the form of a three or four way link member to allow multiple building frame panels 100 to be connected from a central point.

The secondary fixation between adjacent panels is provided by way of fixing apertures 119 provided in the end wall 113 of each primary support member 100. In particular, there are multiple such fixing apertures 119 provided in the end wall 113 of each primary support member 110, with a fixing aperture 119 in each end wall being aligned with a corresponding fixing apertures 119 in the end wall 113 of the opposing primary support member 110 such that the fixing apertures 119 will align when two panels are located adjacent one another and extending in a coplanar manner.

To provide secondary fixation for arrangements where adjacent panels 100 are arranged perpendicular to each other to form a corner, further multiple fixing apertures 120 is formed in each of the front and rear walls 114, 115 of each of the primary support members 110.

A subsequent manner of fixation for arrangements where panels 100 are arranged perpendicular to form a "T" shaped form, secondary support member fixing apertures 158 in the secondary support member front wall 151 such that fixing apertures 185 will align two panels located in a perpendicular arrangement forming a "T" shape arrangement.

The fixing apertures 119, 120 are also located at a common distance from the intersection between the end wall 113 and the front wall 114 (in the case of the fixing apertures 120 in the front wall 114) or the rear wall 115 (in the case of the fixing apertures 120 in the rear wall 115). This provides that, when two adjacent panels 100 are located extending perpendicularly and with the front face or rear face of one panel 100 located in the same plane as the end wall 113 of the adjacent primary support member 110 of the adjacent panel 100, the fixing apertures 119, 120 will align. A fastener may then be extended through the aligned fixing apertures (whether the adjacent panels are arranged in a coplanar or perpendicular manner) to provide the desired secondary fixation between adjacent panels 100. Additional fixing apertures 120 may be provided in the front and rear walls 114,

115 of each primary support member 110 at the common height to the upper fixing apertures 119 of the end walls 113 of the primary support members 110.

The top tie member 140 is provided with one or more truss mounting apertures 142, and here particularly three truss mounting apertures 142, for fixing a roof truss mount 30 to the top surface of the top tie member 140, as particularly depicted in Figure 11. The roof truss mounts 30, each in the form of an angle bracket, are used for fixing roof trusses to the top of the panel 100. In the arrangement depicted, the truss mounting apertures 142 are via rivet nut, thereby enabling fixing of the roof truss mounts 30 to the panel 100 even after the fixing of cladding elements to the panel 100, resulting in there being no access from the underside of the tie member 140.

Each primary support member 110 is provided with services apertures 121 extending through primary support end wall 113 and corresponding with services apertures 122 extending through primary support front wall 114 and primary support rear wall 115. The secondary support member 150 is also provided with services apertures 154, extending through each of the side walls 152 of the secondary support member 150 and services apertures 155, extending through the front wall 151.

Each primary support member 110 is provided with access apertures 127 extending through front wall 114, access aperture 129 extending through rear wall 115 and access aperture 128 extending through inner wall 124.

The access apertures 127, 129 in the primary support member 110 are located at common heights of the primary support member 110, so as to define linear paths for access and services extending through the panel. The access apertures 127, 129 are located at common heights to service apertures 121 of primary support member 110 and 154 of secondary support member 150, so as to define linear service and access paths.

The services apertures 121, 122, 154, 155 and access apertures 127, 129 in the primary and secondary support members 110, 150 are located at corresponding, common heights of the primary support member 110, so as to define linear services paths extending through the width of the panel 110 for routing of services, such as electrical, communication and plumbing services through each panel 100. Multiple service and access paths are located from upper end 111 of each primary support member and equidistantly towards the bottom end of 112 along the end wall 113, the front wall 114 and the rear wall 115 of each primary support member 110. Multiple access paths are located from the upper end 111 of each primary support member and equidistantly towards the bottom end of 112 along the inner wall 124 of the primary support member.

The services apertures 121 in the end wall 113 of each primary support member 110 are aligned such that, when two panels 100 are abutted and fixed to each other in a coplanar manner, the services apertures 121 of adjacent panels will align so as to form a continuous services path through the two, or more, panels 100. If desired, a cable tray or conduit may be arranged to extend along either services path as desired.

To provide for the continuity of services paths between adjacent panels arranged in a mutually perpendicular manner, further services apertures 122 and access apertures 127, 129 are

provided in the front and rear walls 112, 115 of each of the primary support members 110. Services apertures 122 and access apertures 127, 129 are again provided, at a common height to the services apertures 121 formed in the end walls 113 of each of the primary support members 110. The services apertures 121, 122 and access apertures 127, 129 are also located at a common distance from the intersection between the end wall 113 and the front wall 114 (in the case of the services apertures 122 and access apertures 127 in the front wall 114) or the rear wall 115 (in the case of the services apertures 122 and access apertures 129 in the rear wall of 115). This provides that, when two adjacent panels 100 are located extending perpendicularly and with the front face or rear face of one panel 100 located in the same plane as the end wall 113 of the adjacent primary support member 110 of the adjacent panel 100, the services apertures 121, 122 will align so as again to provide continuous services paths between the adjacent panels 100.

The services apertures 122 and access apertures 127 in the front wall 114 of each primary support member 110 also provide for direct communication of services extending through any cladding element applied to the front face of the panel over the services aperture 122 to communicate with the services path. Similarly, additional services apertures 155 are located in the front wall 151 of the secondary support member 150, again at a common height to the other corresponding services apertures 154, 121, 122 and access apertures 127, 129.

Further services apertures 143 provided in the top tie member 140 to allow the routing of services into an overlying roof space. In the arrangement depicted, one of the service apertures 143 is located in the centre of the top tie member 140, directly above the secondary support member 150 and communicating with a recess of the channel section defined by the secondary support member 150. A corresponding service aperture is located in the center of the bottom tie member and generally aligned with services aperture 143 located in the confines of the secondary support member 150. Further services apertures 143 are located in the top tie member, two on either side above the primary support member 110 and a further service aperture 143 located equidistantly between the primary support member 110 and secondary support member 150 on each side.

Referring specifically to Figures 8 to 10, a building structure 200, comprising a plurality of walls, may be formed using several of the panels 100 described above.

Each of the panels 100 forming the building structure 200 is arranged on a support surface, such as a floor slab, and abutted end-to-end. Each pair of adjacent panels 100 used to form a linear length of wall is arranged to extend in a coplanar manner with end walls 113 of adjacent primary support members 110 of the adjacent panels 100 aligned and abutting. For each pair of adjacent panels used to form a corner, the end wall 113 of a primary support member 110 of one panel 100 is arranged to abut either the front wall 114 or rear wall 115 of the adjacent primary support member 110 of the adjacent panel 100, with either the front face or rear face (as the case may be) of one panel 100 arranged to be coplanar with the adjacent end wall 114 of the adjacent primary support member 110 of the adjacent panel 100.

Each panel 100 is secured to the underlying support surface by way of fasteners extending through holes 131 in the bottom tie member 130.

Alternatively, referring specifically to Figure 10, a building structure 201, comprising a plurality of walls, using two of the panels described above. Each of the panels 100 formed in building structure 201 is arranged on a support surface, such as a floor slab, and abutted in a perpendicular fashion. Each panel 100 is arranged in a "T" shaped manner with end wall 113 abutted to secondary support member 150.

Roof truss mounts 30 are secured to the top of the panels 100 as required by aligning locating apertures in each roof truss mount 30 with a truss mount aperture 142 provided in each top tie member 140 and securing with a threaded fastener allowing a building formed to attain the highest available wind rating. Alignment of truss mount apertures 142 through locating apertures 144 located in the top tie member 140.

Insulation may be used to fill the cavities between the primary and secondary support members 110, 150 in each panel 100. Services may also be routed through the various services apertures 121, 122, 132, 143, 154, 155 and access apertures 127, 128, 129, as necessary. Sheet cladding elements 210, 220 are then applied and fixed to the front and rear faces of each panel 100 to provide a complete, clad wall. Construction of walls of building structures utilizing the panels 100 can thus be seen to be relatively rapid and simple.

Alternatively, building frame panel 100 may include the application of exterior cladding and insulation to further enhance the modular design of the product.

Referring next to Figures 12 and 13, a modified form of modular building frame panel 100' may be provided incorporating a doorway or window opening. In the modified panel 100' depicted in Figures 11 and 12, a pair of opposing primary support members 100 and 140 are provided in the same form as that described above in relation to the standard panel 100. The modified panel 100' has a shortened secondary support member 150' that is fixed to and extends downwardly from the top tie member 140.

A doorway is defined by a door frame 160. The door frame 160 comprises a pair of opposing upright door jambs 161 and a horizontal door header 162 extending between and welded to the top end of each of the door jambs 161. Typically, the upright door jambs 161, with the exception of the door jamb locator 166, is folded from sheet metal and the horizontal door header 162, is folded from sheet steel. The door jamb locator is a box steel section. As depicted in Figure 13, each door jamb 161 is formed of a door jamb "C" shaped channel section making up the door jamb soffit 163 and the door jamb stop 169 that is fixed to a relatively flat second section making up the door jamb rabbet 168. The door jamb rabbet 168 is at right angles, opposite to door jamb soffit, to the door jamb front backbend 165 and rear wall door jamb rear backbend 164 that are arranged to extend partway across the front and rear walls 114, 115 of a primary support member 100, leaving a gap therebetween, the door jamb throat. A return flange from the door jamb backbend 164, 165 creating the door jamb backbend return 167. The door jamb backbend return 167 extends from the door jamb front backbend

165 towards the primary support front wall 114 and the door jamb rear backbend 164 towards the primary support rear wall 115, leaving a narrower gap sized to receive the thickness of a typical cladding element 210, 220 such that, in use, the edge of the cladding element 210, 220 is hidden behind the doorjamb 161. Immediately between the door jamb soffit 163, and butting up to the door jamb stops 169, is a door jamb locator 166, which is welded onto the primary support structural insert face 124.

The door frame 160 may thus be assembled into the modified panel 100' by locating the door frame using the door jamb locator 166 and then sliding the door frame 160 upwards relative to the primary support members 110 until the bottom end of the secondary support member 150' engages the door header 162, which would typically have a form identical to the first channel type section 163 of the door jamb 161.

The secondary support member 150' will typically be welded to the door header 162 so as to secure the door frame 160 in position. The door jambs 161 may also be further fixed to the primary support members 110, typically either by welding to the bottom plates, as described below.

As will be noted, the modified panel 100' does not have a bottom tie member 130 extending between the primary support members 110. In place of the bottom tie member, bottom plates may be welded to the bottom end 112 of each of the primary support members 110, and fasteners extending through an aperture provided in such plate to secure the panel 100' to an underlying support surface.

Further modified forms of panel may also be provided incorporating windows utilizing a similar structure to the modified panel 100', with a window frame of generally similar configuration to the door frame 160, with the addition of a window frame sill element defining the bottom of the window opening and incorporating a further secondary support member 150' between such a sill member and a bottom tie member 130 extending between the bottom ends 112 of the primary support members 110.

Referring next to Figure 14, a modified form of modular building frame panel 100' may be provided as a lintel for spanning openings, such as windows and doorways. Typically, the modified panel 100' is a narrowed and possibly shortened building modular panel 100 rotated from a vertical position into a horizontal arrangement which may be of an increased thickness to achieve necessary load tolerances. Depicted in Figure 14, a building panel 100 and modified building panel 100' abutted end-to-end with a further building panel 100 abutted end-to-end with the modified building panel 100'. The modified lintel panel 100' is attached via fixings utilizing the primary support fixing apertures 119, 121.

The claims defining the invention are as follows:

1. A modular structural building frame panel system comprising;

a pair of opposing upright, box shaped primary support members each extending between a top end and a bottom end of said primary support member, each said primary support member having an end wall, a front wall, a rear wall, and inner wall said end walls of said primary support members defining opposing end faces of said panel, said front walls of said primary support members defining a front face of said panel and said rear walls of said primary support members defining a rear face of said panel;

services apertures formed in said end wall, front wall and rear walls of each said primary support member, a services path extending between said service apertures in said end walls, front wall and rear walls for routing of services through said panel;

access apertures formed in said end wall, front wall, rear wall and inner wall, to facilitate attachment of panels via connection bolts, and lintel systems;

a secondary support member located equidistantly between aforementioned pair of opposing primary support members, having a front wall, side walls, rear flange and return lip, said front wall of secondary support member defining the front face of said panel and rear wall of said secondary support member defining the rear face of said panel;

services apertures formed in said front wall and side walls of each said secondary support member, a services path extending between said service apertures to primary support end walls, end wall, front wall, rear walls, and inner wall for routing of services through said panel;

a top tie member fixed to and extending between a top end of each of said primary support member and across said secondary support member, with link member mounting apertures and locating aperture points and truss mounting apertures and locating points;

a bottom tie fixed to and extending between a bottom end of each said primary support;

a link member to attach said panel to another said panel at a variety of points and directions along top tie member of each of said panel; and

a truss mount to attach to said panel at a variety of points along top tie member of each said panel.

2. A structural, modular and finite range of lightweight steel panels according to claim 1 that can be attached to each other at multiple points and directions, with services architecture, to produce a building structure, designed for mass production with minimal tooling requirements;

3. The structural modular building panel system includes modified panels according to claim 1 to produce door frame panels, window panels and lintels;

4. The structural modular building panels according to claim 1 are re-usable at the end of the buildings lifecycle, as well recyclable;

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5. The panels are a medium for pre-insulation, external cladding and internal cladding additions;
6. A building structure comprising a plurality of panels according to claim 1 arranged end-to-end with adjacent primary support members of each adjacent pair of said panels abutting or in a perpendicular fashion and being mutually fixed by way of a link member fixed to and extending between adjacent and perpendicular said link mounting surfaces of said adjacent and perpendicular panels.

**Dated 29 January 2013**  
**Gregory Charles McInnes**

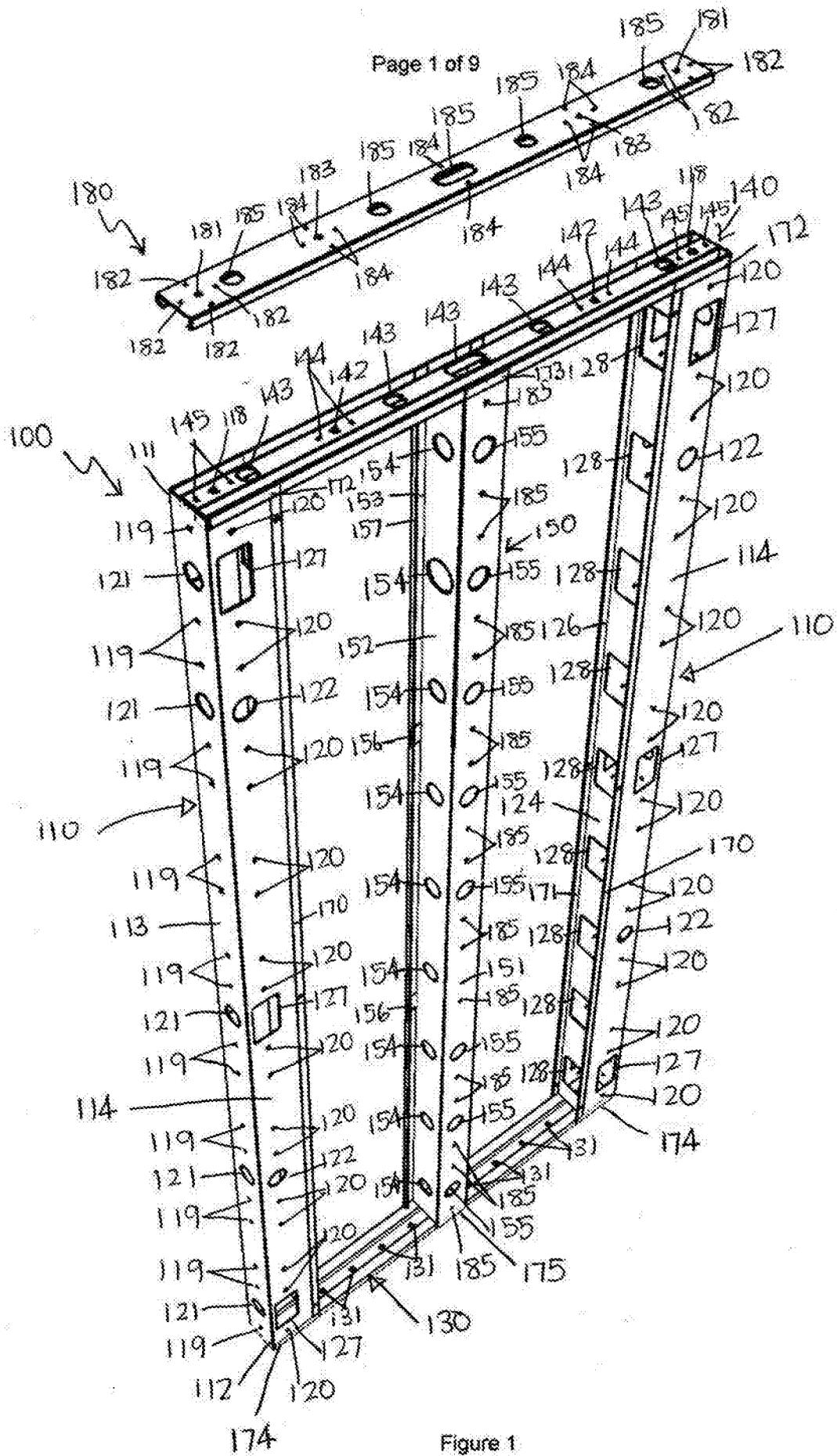


Figure 1

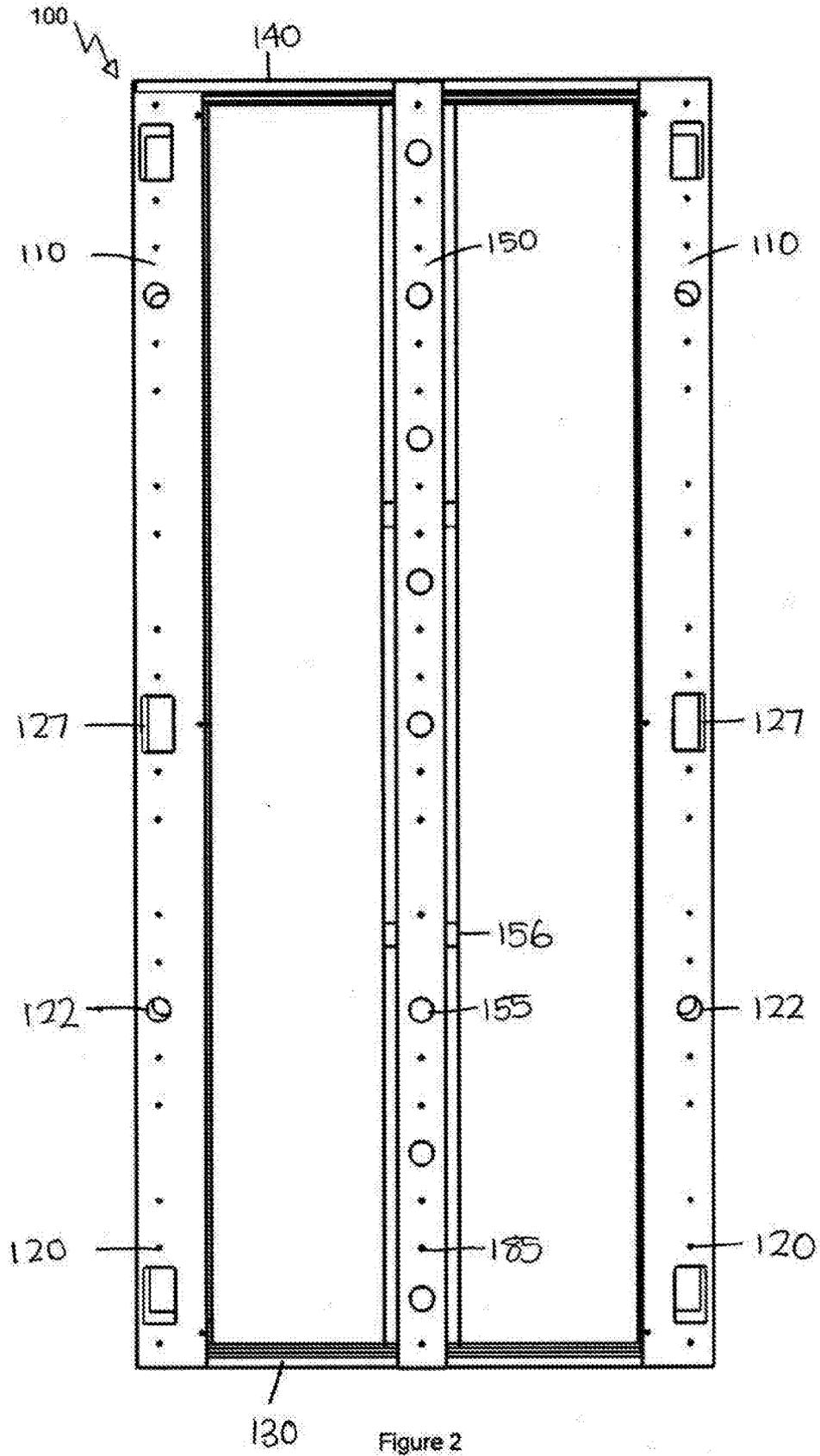


Figure 2

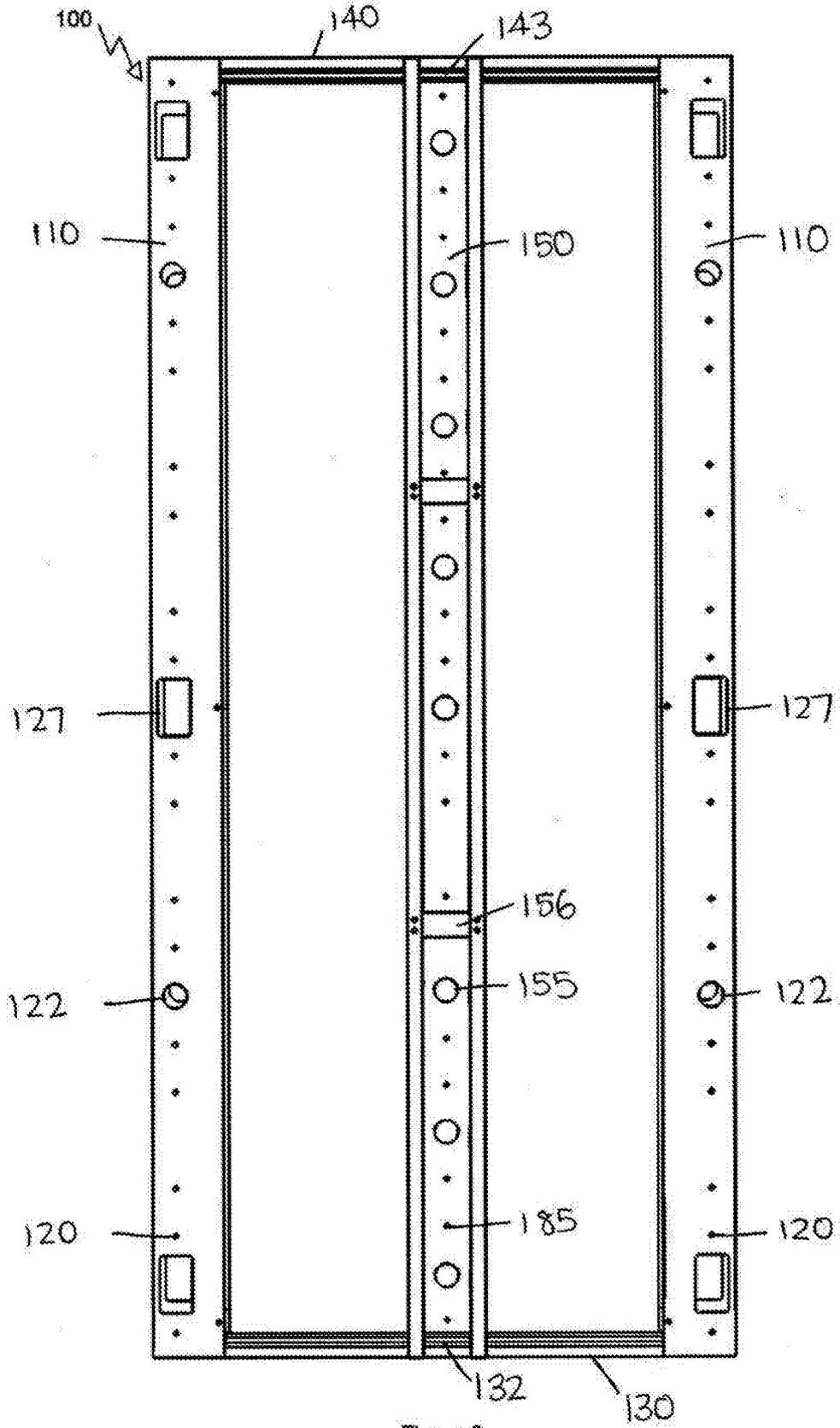


Figure 3

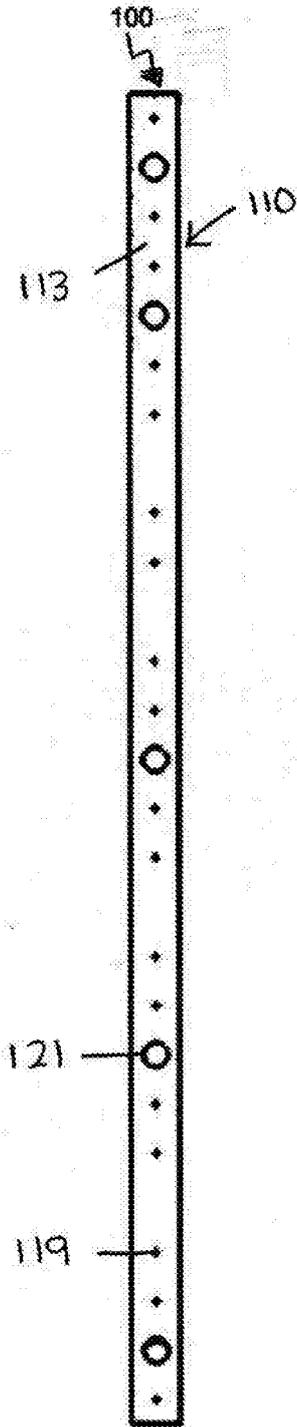


Figure 4

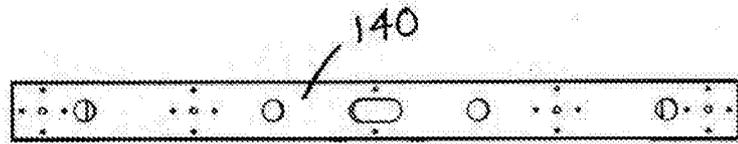


Figure 5

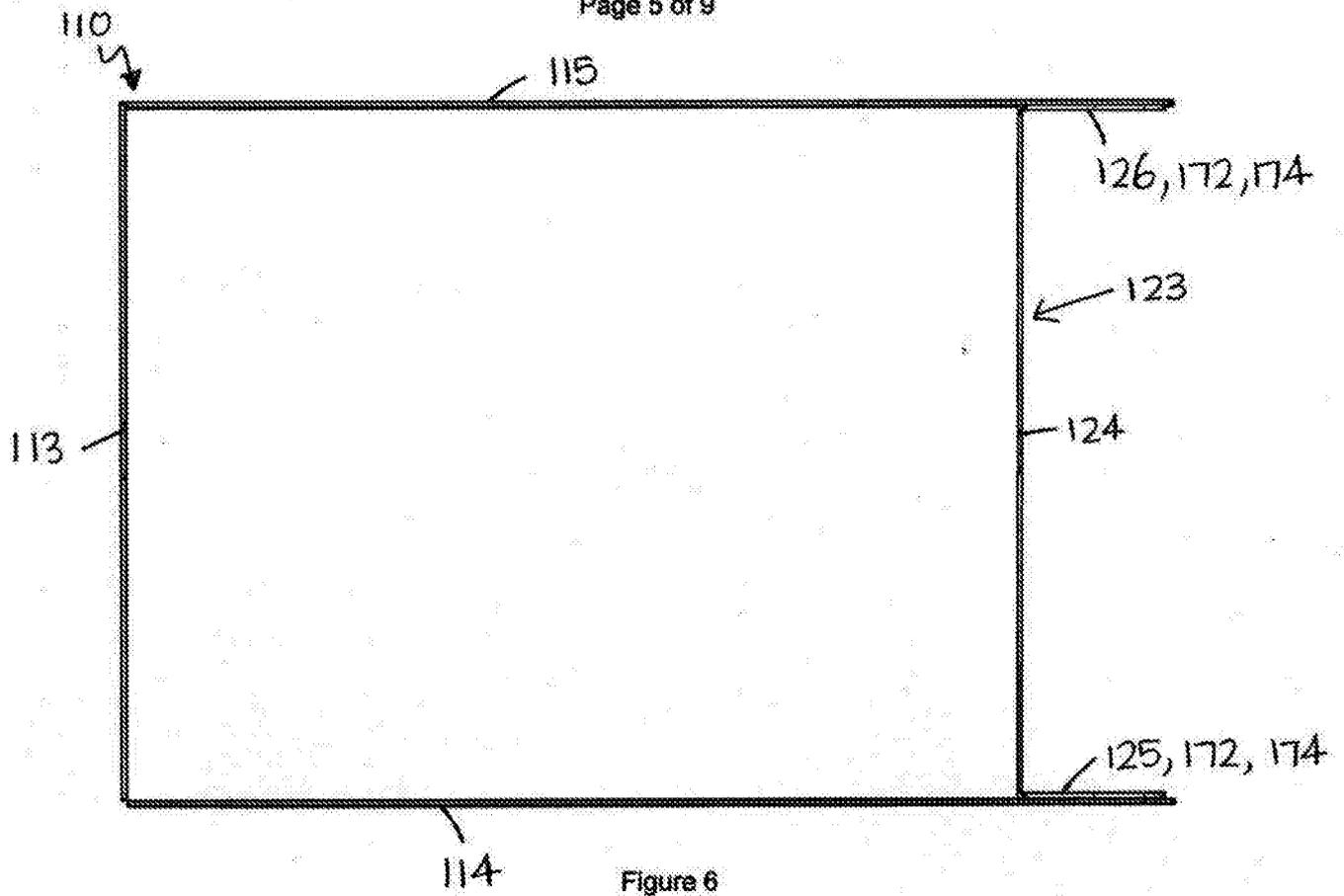


Figure 6

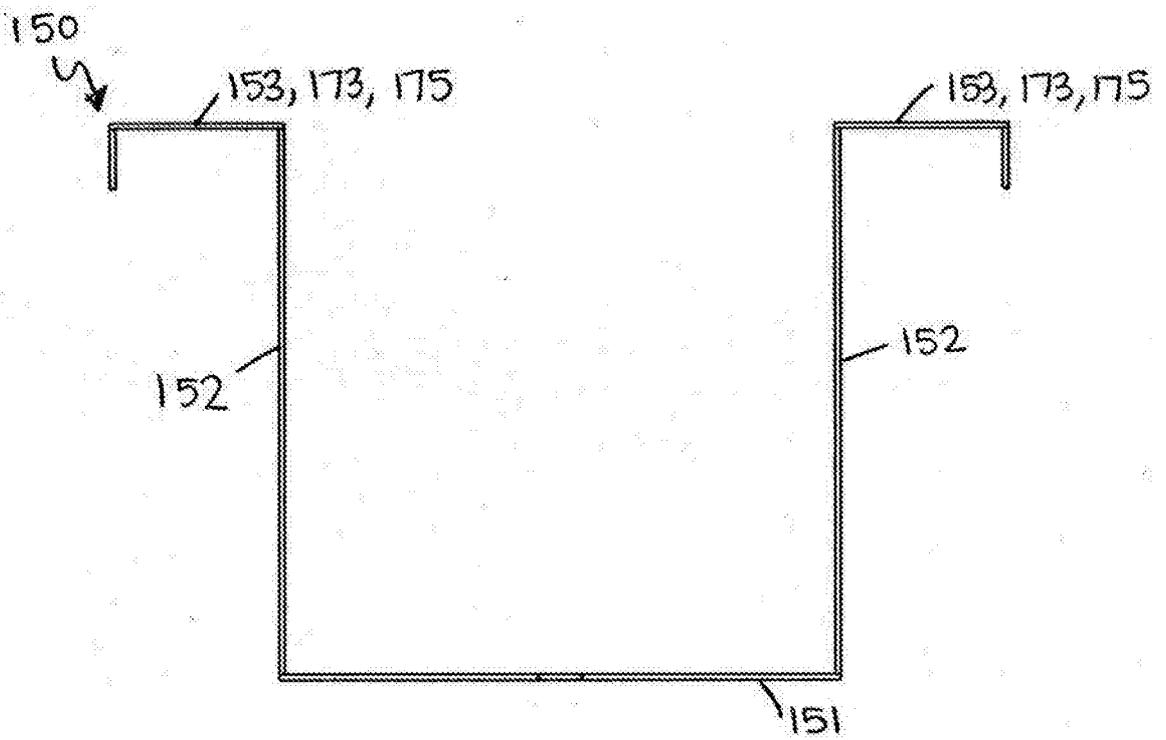


Figure 7

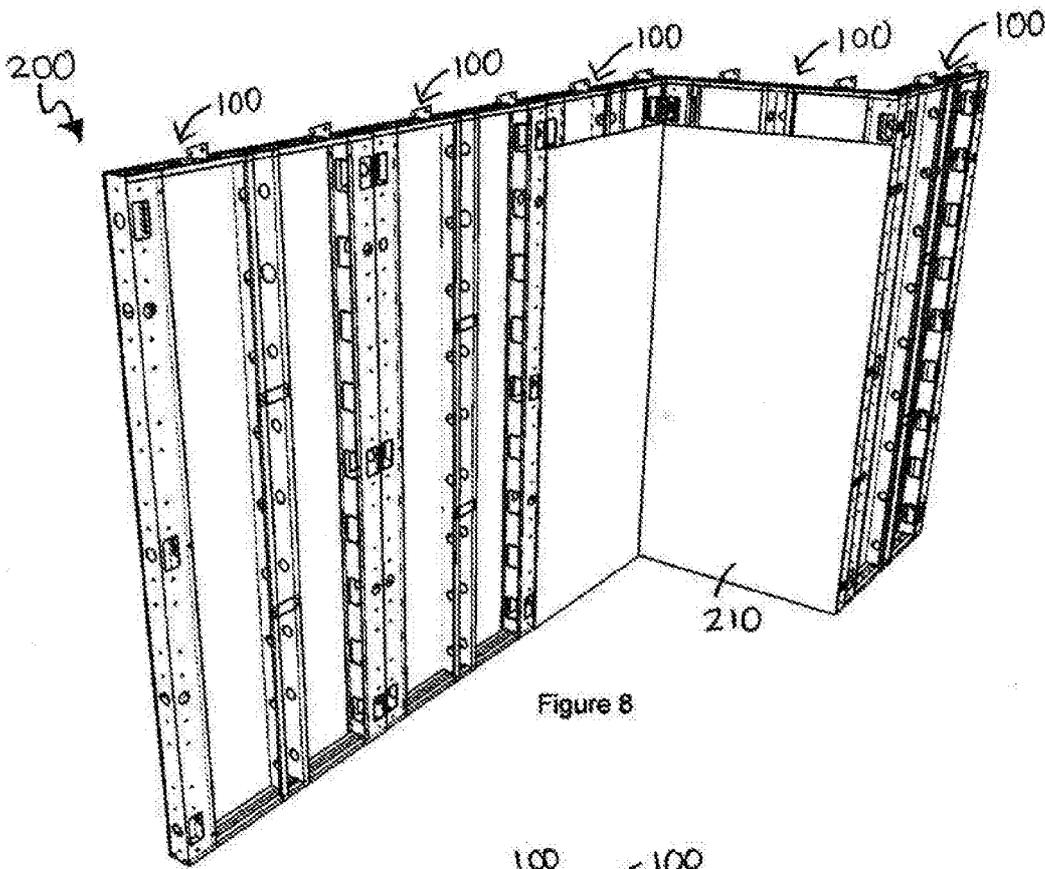


Figure 8

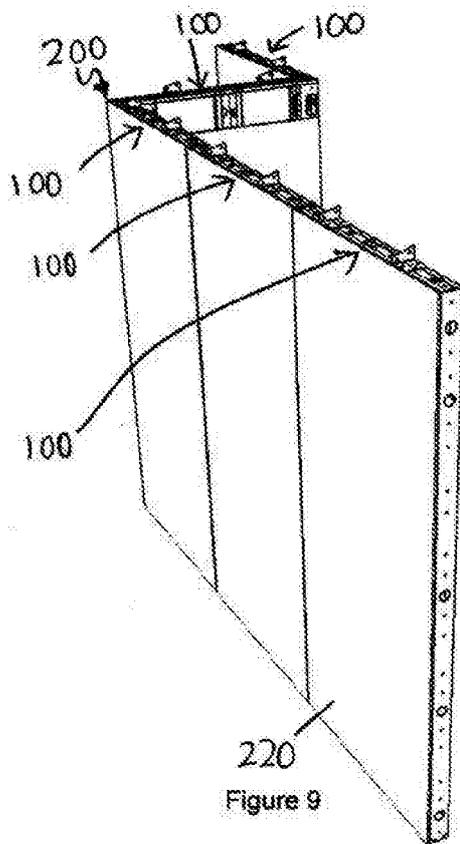


Figure 9



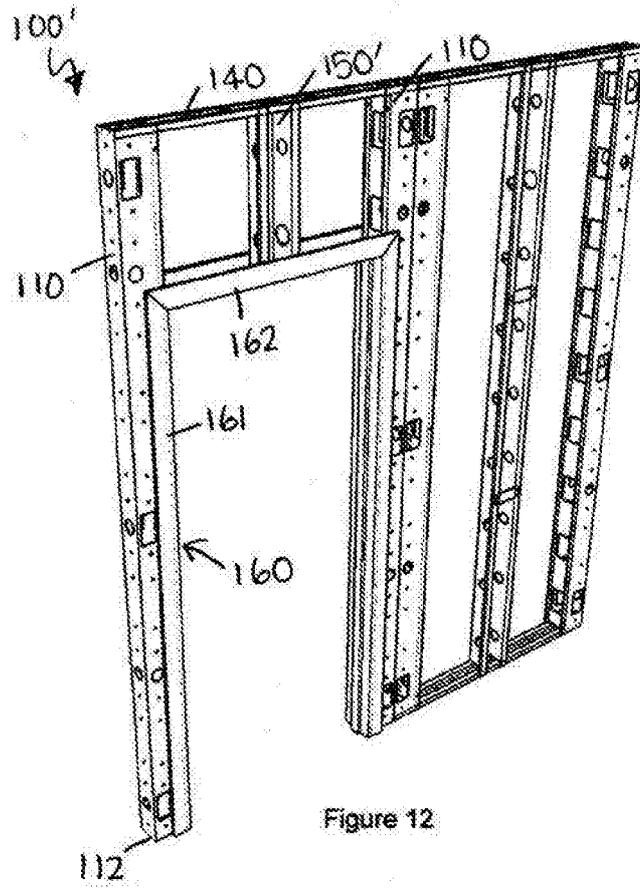


Figure 12

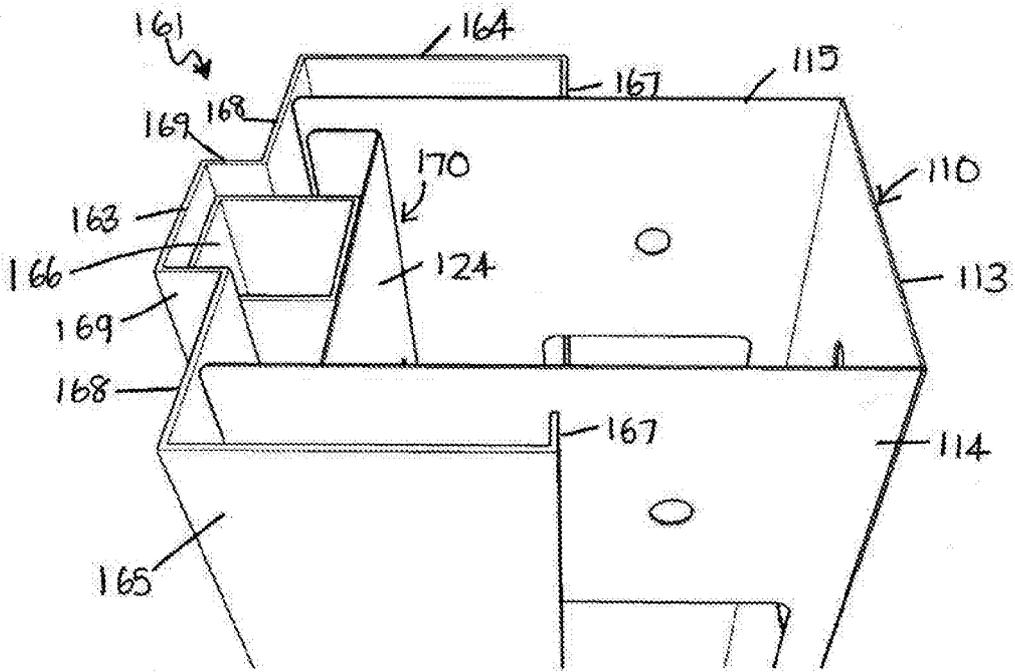


Figure 13

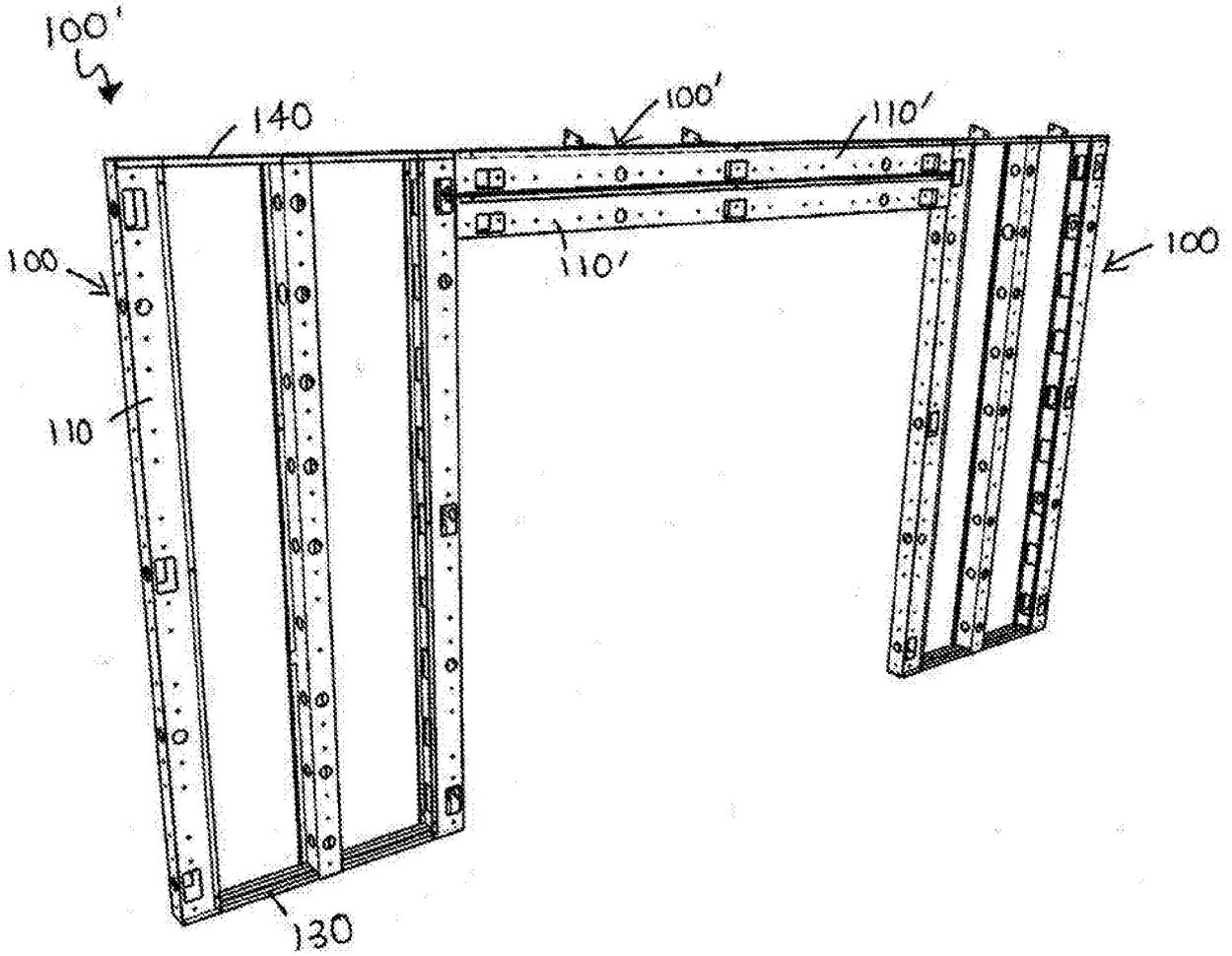


Figure 14