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### (54) A MODULAR BUILDING UNIT

(57) A modular building unit has a base frame for supporting a floor panel and a roof frame for supporting a roof panel. The roof frame includes elongate roof members extending between the corners of the unit, and each

defines a channel extending therealong such that elongate roof members form a gutter extending at least partially around the roof frame.

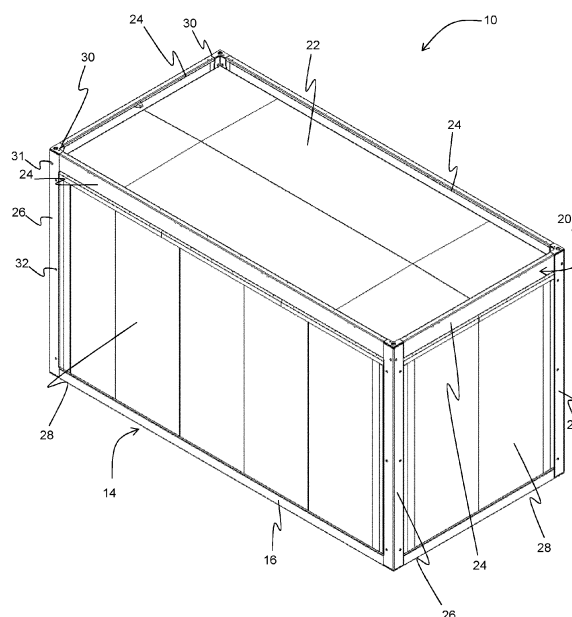


FIG. 1

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## Description

### FIELD

**[0001]** The present teachings relate to a modular building unit.

### BACKGROUND

**[0002]** Modular buildings are prefabricated buildings that are formed from one or more modular units. These modular building units are manufactured in a factory away from the building site, and then transported to the building site so as to be assembled into a modular building. The modular building units are constructed so as to be capable being attached side-by-side, end-to-end, or stacked, which enables modular buildings to be produced having a variety of shapes and styles using a single repeatable modular building unit.

**[0003]** After the modular building units have been assembled, e.g. using a crane, the modular building units are connected together. It is then necessary to seal the joints between adjacent modular building units, for example to prevent draughts and the ingress of rain water into the modular building, and to increase the thermal insulation of the modular building by reducing heat escaping between the adjacent modular units.

**[0004]** The modular building units are designed to have sufficient strength/rigidity to comply with the local laws of the country in which the modular building is to be constructed. However, existing modular building units may not be suitable to be used in the construction of buildings as they may not comply with local wind, heat, and snow load requirements.

**[0005]** The present teachings seek to overcome or at least mitigate one or more problems associated with the prior art.

### SUMMARY

**[0006]** A first aspect of the teachings provides a modular building unit comprising: a floor assembly comprising a substantially rectangular base frame for supporting a floor panel thereon; a roof assembly comprising a roof frame for supporting a roof panel thereon; and a plurality of corner assemblies each comprising an upright column extending between the base frame and the roof frame, wherein the roof frame is formed from a plurality of elongate roof members extending between adjacent corner assemblies, wherein each elongate roof member comprises an inner wall and an outer wall connected by a base to define a channel extending along the elongate roof member, and wherein the plurality of roof members are arranged such that the plurality of channels form a gutter extending at least partially around the roof frame.

**[0007]** Each of the roof frame members are provided as a substantially U-shaped beam so as to form a channel therealong. Through this arrangement, the roof frame of

the modular building unit is able to both support a roof panel and also to provide drainage to drain rain water away from the roof assembly without any additional components being mounted to the roof frame/modular building unit. This helps to provide a more compact roof assembly and so to provide a more compact modular building unit.

**[0008]** The base frame may be substantially rectangular.

**[0009]** The roof frame may be substantially rectangular.

**[0010]** The gutter may extend around an entirety of the roof frame.

**[0011]** This helps to improve the ability of the roof frame to drain rain water away from the roof assembly.

**[0012]** Each of the plurality of corner assemblies may be interposed between adjacent roof frame members and may define a flow path therethrough for connecting the channels of adjacent roof frame members.

**[0013]** This helps to improve the ability of the roof frame to drain rain water away from the roof assembly.

**[0014]** One or more of the corner assemblies may comprise a drainage conduit for draining water received in the gutter.

**[0015]** Providing a drainage conduit, i.e. a drain pipe, that is positioned within, or contained within, an upright column of the modular building unit further improves the ability of the modular building unit to drain rain water away from the roof assembly without any additional components being mounted to the modular building unit.

**[0016]** The modular building unit may comprise a drainage outlet at or near a downstream end of the drainage conduit for discharging water received in the gutter out of the modular building unit.

**[0017]** The drainage outlet may be provided on the floor assembly, e.g. on a base frame member.

**[0018]** Providing a drainage outlet enables the collected rain water to be discharged from the modular building unit in a controlled way. The outlet may enable the collected rainwater to be discharged outside of the modular building unit, for example into a tank for storage, or into a further modular building unit or below the modular building unit.

**[0019]** Providing a drainage outlet in the base assembly enables the water to flow down to the bottom of the modular building unit, which allows the water to be drained into a unit below, if the modular building unit is stacked on top of another unit.

**[0020]** The modular building unit may comprise an overflow outlet for discharging built up water from the gutter.

**[0021]** The overflow outlet may be positioned at or near an upstream end of the drainage conduit, e.g. in a column of a corner assembly or a roof frame member.

**[0022]** The overflow outlet enables rainwater to be discharged out of the modular building unit in the event that the drainage outlet and/or drainage conduit become blocked.

**[0023]** The inner wall of each roof beam member may be configured to sealingly engage a roof panel, in use.

**[0024]** This helps to reduce the ingress of water into the modular building unit, which is particularly advantageous as it helps to prevent/minimise any of the collected rainwater from entering the modular building unit.

**[0025]** The modular building unit may comprise a compressible seal positioned at a distal end of the inner wall for sealingly engaging a roof panel, in use.

**[0026]** The use of a compressible seal to sealingly engage the roof panels further helps to reduce the ingress of water into the modular building unit.

**[0027]** The compressible seal may comprise an air cavity arranged to be interposed between the distal end of the inner wall and a roof panel, in use.

**[0028]** The compressible seal may comprise a serrated or undulating surface arranged to engage a roof panel, in use.

**[0029]** The provision of an air cavity within the seal between the roof frame and the roof panel helps to increase the compressibility of the seal, which in turn helps to improve the seal formed between the roof frame and the roof panel.

**[0030]** Providing a seal surface that is rough/uneven/non-planar has been found to improve the seal formed between the roof frame and the roof panel.

**[0031]** The compressible seal may comprise a deformable material, for example a rubber such as ethylene propylene diene monomer (EPDM).

**[0032]** Each roof frame member may comprise a stiffening configuration.

**[0033]** The provision of a stiffening configuration on the roof members has been found to provide increased stiffness and rigidity to the roof frame, which helps to reducing local buckling effects in the roof frame. This, in turn, improves the overall structural performance of the modular building unit.

**[0034]** The stiffening configuration may comprise a stiffening wall extending away from, e.g. perpendicularly away from, a distal end of the outer wall.

**[0035]** The stiffening configuration may comprise a return arm extending away from, e.g. perpendicularly away from, a distal end of the stiffening wall.

**[0036]** The stiffening configuration may comprise an end return extending away from, e.g. perpendicularly away from, a distal end of the return arm.

**[0037]** The provision of a stiffening configuration on the roof members has been found to provide increased stiffness and rigidity to the roof frame, which helps to reducing local buckling effects in the roof frame. This, in turn, improves the overall structural performance of the modular building unit.

**[0038]** Each of the plurality of roof frame members may comprise an inward projection for supporting a roof panel thereon, in use.

**[0039]** The modular building unit may comprise a roof panel supported on the roof frame.

**[0040]** The roof panel may comprise an upper surface

defining an outer edge that is tapered or stepped along an entirety of a perimeter thereof.

**[0041]** Providing a tapered upper edge increases the space between the roof beam member and the roof panel, so as to provide a larger opening into the guttering of the modular building unit.

**[0042]** The roof panel may comprise a lower surface defining a stepped perimeter region, said stepped perimeter region comprising a first inner surface supported on the roof frame and a second outer surface configured to form a seal against the roof frame.

**[0043]** This arrangement provides a separate part of the roof panel that is to be supported on the roof frame, this enables a compressible seal to be used to seal against the roof panel, which has been found to improve sealing of the modular building unit.

**[0044]** The roof panel may comprise a pitched upper surface.

**[0045]** An entirety of the upper surface of the roof panel may be pitched, optionally wherein the pitch is in the range 1° to 2°.

**[0046]** This arrangement has been found to improve the drainage of rain water away from the modular building unit.

**[0047]** The roof panel may comprise a downward projection configured and arranged to act as an inner stop for a wall panel, in use.

**[0048]** This has been found to facilitate the fitting of wall panels to the modular building unit without requiring additional components to be added to the modular building unit.

**[0049]** Each of the plurality of roof frame members may comprise a downward projection configured and arranged to act as an outer stop for a wall panel, in use.

**[0050]** This has been found to facilitate the fitting of wall panels to the modular building unit without requiring additional components to be added to the modular building unit.

**[0051]** The base frame may be formed from a plurality of base frame members, e.g. in the form of box-section beams.

**[0052]** Each of the plurality of base frame members may comprise first and second upward projections defining a lower wall channel for receiving a part of a wall panel therein. The use of box-section beams for the base frame has been found to provide increased stiffness and rigidity to the base frame, which helps to reducing local buckling effects in the base frame. This, in turn, improves the overall structural performance of the modular building unit.

**[0053]** This has been found to facilitate the fitting of wall panels to the modular building unit without requiring additional components to be added to the modular building unit.

**[0054]** Each of the plurality of base frame members may comprise an inward projection for supporting a floor panel thereon.

**[0055]** The modular building unit may comprise a wall

panel mounted to the modular building unit. The modular building unit may be configured such that an upper extent of the wall panel is spaced apart from the base of the roof frame.

**[0056]** Providing a wall panel that is positioned within the upper wall channel but that is spaced apart from the roof frame has been found to increase the insulation properties of the modular building unit. Moreover, the spacing also provides a cavity into which an insulation material may be placed.

**[0057]** According to a second aspect, there is provided a modular building assembly comprising: a first modular building unit according to the first aspect; a second modular building unit positioned adjacent to the first modular building unit; and a roof cover extending over adjacent roof members of the first and second modular building units for providing a seal therebetween, wherein the roof cover comprises a fastening arrangement for securing the roof cover to the first and second modular building units, and wherein the fastening arrangement is located within an interior space defined by the first and second modular building units.

**[0058]** This arrangement helps to improve the sealing of adjacent units, which, in turn, helps to prevent/minimise the ingress of water into a modular building assembly.

**[0059]** Moreover, providing a fastening assembly that is operable from within the modular building assembly enables the roof cover to be attached without requiring an operator to work at height on the roof.

**[0060]** According to a third aspect, there is provided a compressible seal for a modular building unit of the type having a roof frame for supporting a roof panel thereon, the roof frame formed from a plurality of elongate roof members each comprising opposing inner and outer walls connected by a base to define a channel therealong, the compressible seal comprising: a body defining a recess for receiving and engaging a part of an inner wall of a roof frame member therein; and a sealing surface for sealingly engaging a surface of a roof panel, in use.

**[0061]** The body may comprise an air cavity therein that is arranged to be interposed between an inner wall of a roof frame member and a roof panel, in use.

**[0062]** The sealing surface may comprise a serrated or undulating surface arranged to engage a roof panel, in use.

**[0063]** The compressible seal may comprise a deformable material, for example a rubber such as ethylene propylene diene monomer (EPDM).

**[0064]** According to a fourth aspect, there is provided a modular building unit comprising: a floor assembly comprising a base frame for supporting a floor panel thereon; a roof assembly comprising a roof frame for supporting a roof panel thereon; and a plurality of corner assemblies each comprising an upright column extending between the base frame and the roof frame; and a compressible

seal according to the third aspect, wherein the roof frame is formed from a plurality of elongate roof members, each comprising an upright wall, and wherein the upright wall of the roof frame member extends into the recess of the compressible seal.

**[0065]** Each roof frame member may comprise a stiffening configuration.

**[0066]** The provision of a stiffening configuration on the roof members has been found to provide increased stiffness and rigidity to the roof frame, which helps to reducing local buckling effects in the roof frame. This, in turn, improves the overall structural performance of the modular building unit.

**[0067]** The stiffening configuration may comprise a stiffening wall extending away from, e.g. perpendicularly away from, a distal end of the outer wall.

**[0068]** The stiffening configuration may comprise a return arm extending away from, e.g. perpendicularly away from, a distal end of the stiffening wall.

**[0069]** The stiffening configuration may comprise an end return extending away from, e.g. perpendicularly away from, a distal end of the return arm.

**[0070]** The provision of a stiffening configuration on the roof members has been found to provide increased stiffness and rigidity to the roof frame, which helps to reducing local buckling effects in the roof frame. This, in turn, improves the overall structural performance of the modular building unit.

**[0071]** Each of the plurality of roof frame members may comprise an inward projection for supporting a roof panel thereon, in use.

**[0072]** The modular building unit may comprise a roof panel supported on the roof frame.

**[0073]** The roof panel may comprise an upper surface defining an outer edge that is tapered or stepped along an entirety of a perimeter thereof.

**[0074]** Providing a tapered upper edge increases the space between the roof beam member and the roof panel, so as to provide a larger opening into the guttering of the modular building unit.

**[0075]** The roof panel may comprise a lower surface defining a stepped perimeter region, said stepped perimeter region comprising a first inner surface supported on the roof frame and a second outer surface configured to form a seal against the roof frame.

**[0076]** This arrangement provides a separate part of the roof panel that is to be supported on the roof frame, this enables a compressible seal to be used to seal against the roof panel, which has been found to improve sealing of the modular building unit.

**[0077]** The roof panel may comprise a pitched upper surface.

**[0078]** An entirety of the upper surface of the roof panel may be pitched, optionally wherein the pitch is in the range 1° to 2°.

**[0079]** This arrangement has been found to improve the drainage of rain water away from the modular building unit.

**[0080]** The roof panel may comprise a downward projection configured and arranged to act as an inner stop for a wall panel, in use.

**[0081]** This has been found to facilitate the fitting of wall panels to the modular building unit without requiring additional components to be added to the modular building unit.

**[0082]** Each of the plurality of roof frame members may comprise a downward projection configured and arranged to act as an outer stop for a wall panel, in use.

**[0083]** This has been found to facilitate the fitting of wall panels to the modular building unit without requiring additional components to be added to the modular building unit.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0084]** Embodiments will now be described with reference to the accompanying drawings, in which:

Figure 1 is an isometric view of a modular building unit;

Figure 2 is a cross-sectional view of a part of a roof assembly of the modular building unit of Figure 1;

Figure 3 is a schematic cross-section of a seal of the modular building unit of Figure 1;

Figure 4 is a cross-sectional view of a part of a floor assembly of the modular building unit of Figure 1; and

Figure 5 is a cross-sectional view of a part of a modular building assembly.

#### DETAILED DESCRIPTION OF EMBODIMENT(S)

**[0085]** Referring firstly to Figure 1, a modular building unit is illustrated and indicated generally at 10.

**[0086]** The modular building unit 10 has a floor assembly including a base frame 14. The floor assembly also includes a floor panel (not shown) supported on the base frame 14. The floor panel may be mounted to the base frame 14 via a floor panel mounting arrangement. It will be appreciated that the floor panel mounting arrangement may be in the form of a plurality of fasteners and/or an adhesive, or may be any other suitable mounting arrangement capable of securing the floor panel to the base frame 14.

**[0087]** The modular building unit 10 has a roof assembly including a roof frame 20. The roof assembly includes a roof panel 22 supported on the roof frame 20. The roof panel 22 may be mounted to the roof frame 20 via a roof panel mounting arrangement. It will be appreciated that the roof panel mounting arrangement may be in the form of a plurality of fasteners and/or an adhesive, or may be any other suitable mounting arrangement capable of securing the roof panel 22 to the roof frame 20.

**[0088]** The modular building unit 10 is substantially rectangular in shape, and includes a corner assembly at each corner thereof. Each corner assembly includes an upright column or corner column 26. The corner assemblies extend between the floor assembly and the roof assembly 14. Put another way, the four upright columns 26 extend between the base frame 14 and the roof frame 20. The corner columns 26 are provided with apertures 32 for receiving fasteners (not shown) therethrough to enable the modular building unit 10 to be attached to a further modular building unit.

**[0089]** Each corner assembly includes a corner module mounted to the upper and lower end of the upright column 26. The upper and lower corner modules provide a mounting surface to mount the roof frame members 24 and base frame members 16 to the corner assemblies. The roof assembly of the modular building unit 10 is provided with four corner modules 30. The upper corner modules 30 are configured to connect the roof frame 20 to the corner columns 26. The upper corner modules 30 are provided with an opening 34 on an upper surface thereof that is configured to engage a lifting apparatus (not shown) for lifting the modular building unit 10 into place.

**[0090]** The modular building unit 10 is provided with four side walls 28 substantially enclosing the modular building unit 10. In alternative arrangements, one or more of the side walls 28 may be omitted, for example to enable two or more modular building units 10 to be assembled together to form a modular building assembly.

**[0091]** The base frame 14 is formed from four elongate base frame members 16 arranged so as to form a substantially rectangular base frame 14. It will be appreciated that in alternative arrangements, the shape of the base frame 14 (and the number of base frame members 16) may vary to suit the application.

**[0092]** The roof frame 20 is formed from four elongate roof frame members 24 arranged so as to form a substantially rectangular roof frame 20. It will be appreciated that in alternative arrangements, the shape of the roof frame 20 (and so the number of roof frame members 24) may vary to suit the application.

**[0093]** Referring now to Figure 2, a roof frame member 24 is illustrated.

**[0094]** Each of the elongate roof members 24 are provided in the form of substantially U-shaped beams. Put another way, each elongate roof member 24 includes opposing inner 34 and outer 36 walls connected by a base 38 to define a channel 40. The four elongate roof members 24 are arranged end-to-end such that the channels 40 form a gutter extending at least partially around the roof frame 20. Although not illustrated, it will be appreciated that the corner modules 30 include a flow path therethrough for connecting the channels 40 of the connecting roof frame members 24.

**[0095]** As is illustrated, the outer wall 36 extends upwards from the base 38 by a greater distance than the inner wall 34. This arrangement enables the outer wall

36 to act a stop for rain water flowing from the roof panel 22 and into the gutter. The outer wall 36 extends past an upper edge of the roof panel 22.

**[0096]** An outer edge 23 (i.e. the perimeter) of the roof panel 22 is tapered/chamfered. This chamfered outer edge 23 extends substantially around entirety of the roof panel 22. The tapered upper edge 23 increases the opening into the gutter (by increasing the space between an upper surface of the roof panel 22 and the roof beam member 24), which improves visibility and access into the gutter.

**[0097]** The arrangement of the outer edge 23 of the roof panel 22 and the outer wall 36 of the roof members 24 has been found to facilitate the collection of rain water into the guttering. It will, however, be appreciated that in some arrangements both the tapered outer edge 23 and the increase height of the outer wall 36 may not be provided, and the modular building unit 10 may include only one of these features.

**[0098]** In the illustrated arrangement, the gutter (i.e. the channels 40) extends around an entirety of the perimeter of the roof panel 22, such that rain water falling onto the roof panel 22 will flow into the gutter. Through this arrangement, the roof frame 20 enables rain water received in any of the channels 40 to be collected without having to attach an additional separate guttering system to the module building unit.

**[0099]** The modular building unit 10 includes a drainage conduit (not shown). The drainage conduit will be positioned within a corner assembly extending along the length of the upright column 26. It will be understood that the rain water is able to flow around the gutter until it reaches an inlet of the drainage conduit in one of the corner columns 26, and will flow down/along said drainage conduit. Although not illustrated, the modular building unit 10 includes a drainage outlet at or near a downstream end of the drainage conduit for discharging water received in the gutter to outside of the modular building unit. It will be appreciated that the drainage outlet may be provided on the floor assembly or in one of the corner columns 26. The outlet may enable the collected rainwater to be discharged outside of the modular building unit, for example into a tank for storage, or into a further modular building unit adjacent or below the modular building unit. In the illustrated arrangement, the modular building unit 10 includes two drainage conduits positioned at opposing corners (i.e. positioned in opposing corner assemblies) of the modular building unit 10. In alternative arrangements, the modular building unit 10 may include any suitable number of drainage conduits such as one, three or four drainage conduits.

**[0100]** The modular building unit also includes an overflow outlet 31. In the illustrated arrangement, the overflow outlet 31 is provided as an aperture in the upright column 26. In alternative arrangements, the overflow outlet may be provided in the corner module 30 or the roof frame 20. In the arrangement shown, each corner column 26 includes an overflow outlet 31 positioned between adja-

cent roof beam members 24. In alternative arrangements, the modular building unit 10 may only include an overflow outlet 31 on one, two or three corner columns 26. In some arrangements, an overflow outlet 31 may be provided at or near an upstream end of the drainage conduit. The overflow outlet enables rainwater to be discharged out of the modular building unit in the event that the drainage outlet and/or drainage conduit become blocked.

**[0101]** In order to reduce/prevent the ingress of water into the modular building unit 10, the roof frame 20 is configured to sealingly engage the roof panel 22. In the illustrated arrangement, each of the roof frame members 24 are configured to sealingly engage the roof panel 22. The seal between the roof panel 22 and the roof frame 20 extends around an entirety of the perimeter of the roof frame 20. Put another way, the seal between the roof panel 22 and the roof frame 20 extends around an entirety of the gutter around the modular building unit 10.

**[0102]** In order to form a seal between the roof panel 22 and the roof frame 20, the modular building includes a compressible seal 42. Adjacent compressible seals 42 may be sealed together so as to form a continuous seal around the roof frame 20. In the embodiment, the compressible seal 42 is formed from a deformable material. One such deformable material that may be used is rubber, such as ethylene propylene diene monomer (EPDM), but it will be appreciated that any suitable compressible/deformable material may be used in alternative arrangements.

**[0103]** The compressible seal 42 is provided on the roof frame 20 and extends around substantially all of the perimeter of the roof frame 20. Put another way, a compressible seal 42 is provided on each of the roof frame members 24 extending substantially along an entirety of the elongate length of each roof frame member 24. This arrangement effectively seals the internal space of the modular building unit 10. The compressible seal 42 is positioned at a distal end of the inner wall 34 for sealingly engaging the roof panel 22. This arrangement effectively seals the internal space of the modular building unit 10 from the gutter.

**[0104]** Each of the roof frame members 24 includes a stiffening configuration to increase the stiffness and rigidity of the roof frame member 24 (and so the roof frame 20). This increased strength of the roof frame members 24 helps to reducing local buckling effects, which in turn, improves the overall structural performance of the modular building unit 10.

**[0105]** In the illustrated arrangement, the stiffening configuration includes a stiffening wall 44 extending away from a distal end of the outer wall 36. In the arrangement shown, the stiffening wall 44 extends perpendicularly away from the distal end of the outer wall 36. Put another way, in the arrangement shown, the stiffening wall 44 extends away from the outer wall 36 in a direction towards the inner wall 34, e.g. so as to be substantially parallel with the base 38.

**[0106]** The stiffening configuration also includes a return arm 46 extending away from a distal end of the stiffening wall 44. In the arrangement shown, the return arm 46 extends perpendicularly away from a distal end of the stiffening wall 44. Put another way, in the arrangement shown, the return arm 46 extends away from the stiffening wall 44 in a direction towards the base 38, e.g. so as to be substantially parallel with the outer wall 36.

**[0107]** The stiffening configuration also includes an end return 48 extending away from a distal end of the return arm 46. In the arrangement shown, the end return 48 extends perpendicularly away from a distal end of the return arm 46. Put another way, in the arrangement shown, the end return 48 extends away from the return arm 46 in a direction towards the outer wall 36, e.g. so as to be substantially parallel with the base 38 and stiffening wall 44.

**[0108]** The stiffening configuration of the present arrangement has been found to provide increased stiffness and rigidity to the roof frame, and so to the overall modular building unit 10. However, it will be appreciated that in some arrangements the stiffening configuration may only include the stiffening wall 44, or may only include the stiffening wall 44 and return arm 46.

**[0109]** Each of the roof frame members 24 (i.e. the roof frame 20) is configured and arranged to support the roof panel 22. In the illustrated arrangement, each roof frame member 24 includes an inward projection 50 for supporting the roof panel 22. The inward projection 50 is provided as an inwardly projecting plate extending from the roof frame member 24. In the illustrated arrangement, the inward projection 50 is attached, e.g. welded, onto the base 38 of the roof frame member 24.

**[0110]** The roof panel 22 defines a stepped outer region of the lower surface thereof. The roof panel 22 includes a first, or upper, step 52 that defines a first surface 52 arranged to form a seal against the roof frame 20. The first surface 52 of the roof panel 22 is arranged to abut against the compressible seal 42 so as to form a seal against the roof frame 20.

**[0111]** The roof panel 22 includes a second step 54 defining a second surface arranged to be supported on the roof frame 20. The second surface 54 is arranged below and inward relative to the first surface 52. The second surface 54 is arranged to abut against the inward projection 50 of the roof frame so as to be seated thereon. This arrangement of the roof panel 22 enables the seal to be spaced apart from the load bearing part of the roof panel 22 (i.e. the part of the roof panel 22 that is seated on and supported by the roof frame 20).

**[0112]** Although not illustrated, the upper surface of the roof panel 22 is pitched in order to facilitate drainage of rain water from the roof panel 22 into the gutter. In the illustrated arrangement, the roof panel pitch is in the range of 1° to 2°, but it will be appreciated that any suitable pitch angle may be used. The roof panel may have a double pitched upper surface, or may have at least four contiguous and converging angled planes.

**[0113]** The roof panel 22 includes a downward projection 56 configured and arranged to act as an inner stop for the wall panels 28. Each of the roof frame members 24 is provided with a downward projection 58 configured and arranged to act as an outer stop for the wall panels 28. Put another way, the downward projections 56, 58 are arranged so as to define an upper channel for receiving an upper part of a wall panel 28 therein. This arrangement has been found to facilitate the fitting of wall panels 28 to the modular building unit 10 without requiring additional components to be fitted to the modular building unit 10.

**[0114]** As is illustrated, when a wall panel 28 is mounted to the modular building unit 10 (i.e. when the wall panel 28 is received in the upper and lower channels), an upper extent of the wall panel 28 is spaced apart from the base 30 of the roof frame member 24. This arrangement provides a cavity that provides insulation between the wall panels 28 and the roof frame 20. It will be appreciated that in some arrangements, the cavity may be filled with an insulation material to further insulate the modular building unit 10.

**[0115]** Referring now to Figure 3, the compressible seal 42 is illustrated in more detail.

**[0116]** The compressible seal 42 has a body 60 defining a recess 62 for receiving a part of the inner wall 34 therein. The recess 62 of the compressible seal 42 and the inner wall 34 are configured (i.e. dimensioned) so as to form a close-fit therebetween, which enables the compressible seal 42 to engage the inner wall 34 of the roof frame 20. The compressible seal 42 includes first and second opposing seal arms 64 forming the recess 62 therebetween. The first and second arms 64 are arranged to extend along the sides of the inner wall 34 so as to engage the inner wall 34 therebetween.

**[0117]** The compressible seal 42 includes a sealing surface 66 arranged to abut against a surface of the roof panel 22 to form a seal against said roof panel 22. In the illustrated arrangement, the seal surface 66 is serrated. Providing a seal surface 66 that is rough/uneven/non-planar has been found to improve the seal formed between the roof frame 20 and the roof panel 22. It will be appreciated that, in alternative arrangements, the seal surface 66 may not be serrated and instead may define an undulating surface or may be any suitable non-planar configuration.

**[0118]** The body 60 contains an air cavity 68 therein. The air cavity 68 is arranged to be interposed between the inner wall 34 of a roof frame member 24 and a roof panel 22. The air cavity 68 increases the compressibility of the seal 42. When the roof panel 22 is seated on and supported by the roof frame 20, the roof panel 22 compresses the seal 42, which helps to improve the seal formed between the roof frame 20 and the roof panel 22.

**[0119]** Referring now to Figure 4, a base frame member 16 is illustrated.

**[0120]** Each of the base frame members 16 is provided in the form of an elongate box-section beams. This has

been found to increase the rigidity and structural strength of the base frame 14, and so of the modular building unit 10 as a whole.

**[0121]** The base frame members 16 each include first and second upwards projections 70, 72. The first and second upward projections 70, 72 extend in a direction towards the roof frame 20. The first upward projection 70 is configured and arranged to act as an inner stop for the wall panels 28. The second upward projection 72 is configured and arranged to act as an outer stop for the wall panels 28. Put another way, the first and second upward projections 70, 72 are arranged so as to define a lower channel for receiving a lower part of a wall panel 28 therein. This arrangement has been found to facilitate the fitting of wall panels 28 to the modular building unit 10 without requiring additional components to be fitted to the modular building unit 10.

**[0122]** The base frame 14 (i.e. the base frame members 16) are configured to support a floor panel thereon. In the illustrated arrangement, each of the base frame members 16 has an inward projection 74 for supporting a floor panel 76 thereon. The inward projection 74 may be provided in the form of a substantially L-shaped member or a plate that is attached, e.g. welded, to the base frame members 16.

**[0123]** The inward projection 74 may be configured to form a seal against the floor panel 76. This arrangement helps to prevent moisture and vapours from entering into the modular building unit 10 from below. The inward projection 74 may include a seal (not shown) on an upper surface thereof for engaging the floor panel 76. The seal may be formed from a deformable material. The deformable material of the seal may be a rubber, such a neoprene.

**[0124]** Referring now to Figure 5, a modular building assembly is illustrated and is indicated generally at 100.

**[0125]** The modular building assembly 100 includes first and second modular building units 10 arranged adjacent to each other (i.e. side-by-side). It will be appreciated that the first and second modular building units 10 may both be modular building units as described with reference to Figures 1 to 4.

**[0126]** As is illustrated, a roof frame member 24 of each of the modular building units 10 are positioned adjacent to each other.

**[0127]** The modular building assembly 100 includes a roof cover 102 extending over the adjacent roof members 24. This arrangement provides a seal between the two modular building units 10.

**[0128]** The roof cover 102 is provided in the form of a cover plate 104 having first and second cover arms 106 arranged to extend around the adjacent roof members 24.

**[0129]** The roof cover also includes a fastening arrangement 108 for securing the roof cover 102 to the modular building assembly 100.

**[0130]** The fastening arrangement 108 includes a cover bracket 118. The fastening arrangement 108 includes

a connecting rod 110 connected to the cover bracket 118 via a fastener 112. The provision of the cover bracket 118 enables the upper surface of the cover plate 104 to be free of apertures which helps to prevent the ingress of water into the modular building unit 10.

**[0131]** In the illustrated arrangement, the cover bracket 118 is separate from the cover plate 104 and is connected to said cover plate 104. The cover bracket includes opposing outwardly projecting flanges 20 that are received in corresponding openings (not shown) in the cover plate 104 so as to connect the cover bracket 118 to the cover plate 104.

**[0132]** In alternative arrangements, the cover bracket 118 may be integrally formed with the cover plate 104. In further alternative arrangements, the cover bracket 118 may be omitted. In such arrangements, the connecting rod 110 may be connected to the cover plate 104 via welding, an adhesive, or via any other suitable means not requiring an aperture in the upper surface of the cover plate 104.

**[0133]** A first end of the connecting rod 110 extends through an aperture in the cover plate 104 and is secured thereto via the fastener 112. A second end of the connecting rod 110 is secured to the roof frame 20. In the arrangement shown, the second end of the connecting rod 110 extends through an aperture in a mounting plate 114. The connecting rod 110 is secured to the mounting plate 114 via a fastener 116. The mounting plate 114 is arranged so as to abut against the roof frame 20 (i.e. against the roof frame members 24). This arrangement helps to improve the sealing of adjacent units, which, in turn, helps to prevent/minimise the ingress of water into a modular building assembly.

**[0134]** In the arrangement shown, the fastening arrangement 108 is located within, and accessible from, an interior space defined by the modular building assembly 100 (i.e. by the first and second modular building units 10). Providing a fastening assembly that is operable from within the modular building assembly enables the roof cover to be attached without requiring an operator to work at height on the roof.

**[0135]** Although the teachings have been described above with reference to one or more preferred embodiments, it will be appreciated that various changes or modifications may be made without departing from the scope as defined in the appended claims.

## Claims

1. A modular building unit comprising:

a floor assembly comprising a base frame for supporting a floor panel thereon;  
a roof assembly comprising a roof frame for supporting a roof panel thereon; and  
a plurality of corner assemblies each comprising an upright column extending between the base

- frame and the roof frame,  
 wherein the roof frame is formed from a plurality  
 of elongate roof members extending between  
 adjacent corner assemblies,  
 wherein each elongate roof member comprises  
 an inner wall and an outer wall connected by a  
 base to define a channel extending along the  
 elongate roof member, and  
 wherein the plurality of roof members are ar-  
 ranged such that the plurality of channels form  
 a gutter extending at least partially around the  
 roof frame.
2. A modular building unit according to claim 1, wherein  
 the gutter substantially extends around an entirety  
 of the roof frame.
  3. A modular building unit according to claim 1 or claim  
 2, wherein each of the plurality of corner assemblies  
 are interposed between adjacent roof frame mem-  
 bers and define a flow path therethrough for con-  
 necting the channels of adjacent roof frame mem-  
 bers.
  4. A modular building unit according to any preceding  
 claim, comprising an overflow outlet for discharging  
 built up water from the gutter, optionally wherein the  
 overflow outlet is positioned at or near an upstream  
 end of the drainage conduit, e.g. in a column of a  
 corner assembly or a roof frame member.
  5. A modular building unit according to any preceding  
 claim, wherein the inner wall of each roof beam mem-  
 ber comprises a compressible seal positioned at a  
 distal end thereof configured and arranged to seal-  
 ingly engage a roof panel, in use.
  6. A modular building unit according to claim 5, wherein  
 the compressible seal comprises an air cavity ar-  
 ranged to be interposed between the distal end of  
 the inner wall and a roof panel, in use, and/or com-  
 prises a serrated or undulating surface arranged to  
 engage a roof panel, in use.
  7. A modular building unit according to any preceding  
 claim, wherein each roof frame member comprises  
 a stiffening configuration comprising a stiffening wall  
 extending away from, e.g. perpendicularly away  
 from, a distal end of the outer wall, optionally wherein  
 the stiffening configuration comprises a return arm  
 extending away from, e.g. perpendicularly away  
 from, a distal end of the stiffening wall, optionally  
 wherein the stiffening configuration comprises an  
 end return extending away from, e.g. perpendicularly  
 away from, a distal end of the return arm.
  8. A modular building unit according to any preceding  
 claim, comprising a roof panel supported on the roof  
 frame, wherein the roof panel comprises an upper  
 surface defining an outer edge that is tapered or  
 chamfered substantially along an entirety of a perim-  
 eter thereof.
  9. A modular building unit according to any preceding  
 claim, comprising a roof panel supported on the roof  
 frame, wherein the roof panel comprises a lower sur-  
 face defining a stepped perimeter region, said  
 stepped perimeter region comprising a first inner sur-  
 face supported on the roof frame and a second outer  
 surface configured to form a seal against the roof  
 frame.
  10. A modular building unit according to any preceding  
 claim, comprising a roof panel supported on the roof  
 frame, wherein the roof panel comprises a pitched  
 upper surface, optionally wherein an entirety of the  
 upper surface of the roof panel is pitched, optionally  
 wherein the pitch is in the range 1° to 2°.
  11. A modular building unit according to any preceding  
 claim, comprising a roof panel supported on the roof  
 frame, wherein the roof panel comprises a downward  
 projection configured and arranged to act as an inner  
 stop for a wall panel, in use.
  12. A modular building unit according to claim 11, where-  
 in each of the plurality of roof frame members com-  
 prise a downward projection configured and ar-  
 ranged to act as an outer stop for a wall panel, in use.
  13. A modular building unit according to any preceding  
 claim, wherein the base frame is formed from a plu-  
 rality of base frame members, e.g. in the form of box-  
 section beams, optionally wherein each of the plu-  
 rality of base frame members comprises first and  
 second upward projections defining a lower wall  
 channel for receiving a part of a wall panel therein.
  14. A modular building unit according to any preceding  
 claim, comprising a wall panel mounted to the mod-  
 ular building unit, wherein the modular building unit  
 is configured such that an upper extent of the wall  
 panel is spaced apart from the base of the roof frame.
  15. A modular building assembly comprising:
    - a first modular building unit according to any pre-  
 ceding claim;
    - a second modular building unit according to any  
 preceding claim, the second modular building  
 unit positioned adjacent to the first modular  
 building unit; and
    - a roof cover extending over adjacent roof mem-  
 bers of the first and second modular building  
 units for providing a seal therebetween,  
 wherein the roof cover comprises a fastening

arrangement for securing the roof cover to the first and second modular building units, and wherein the fastening arrangement is located within an interior space defined by the first and second modular building units.

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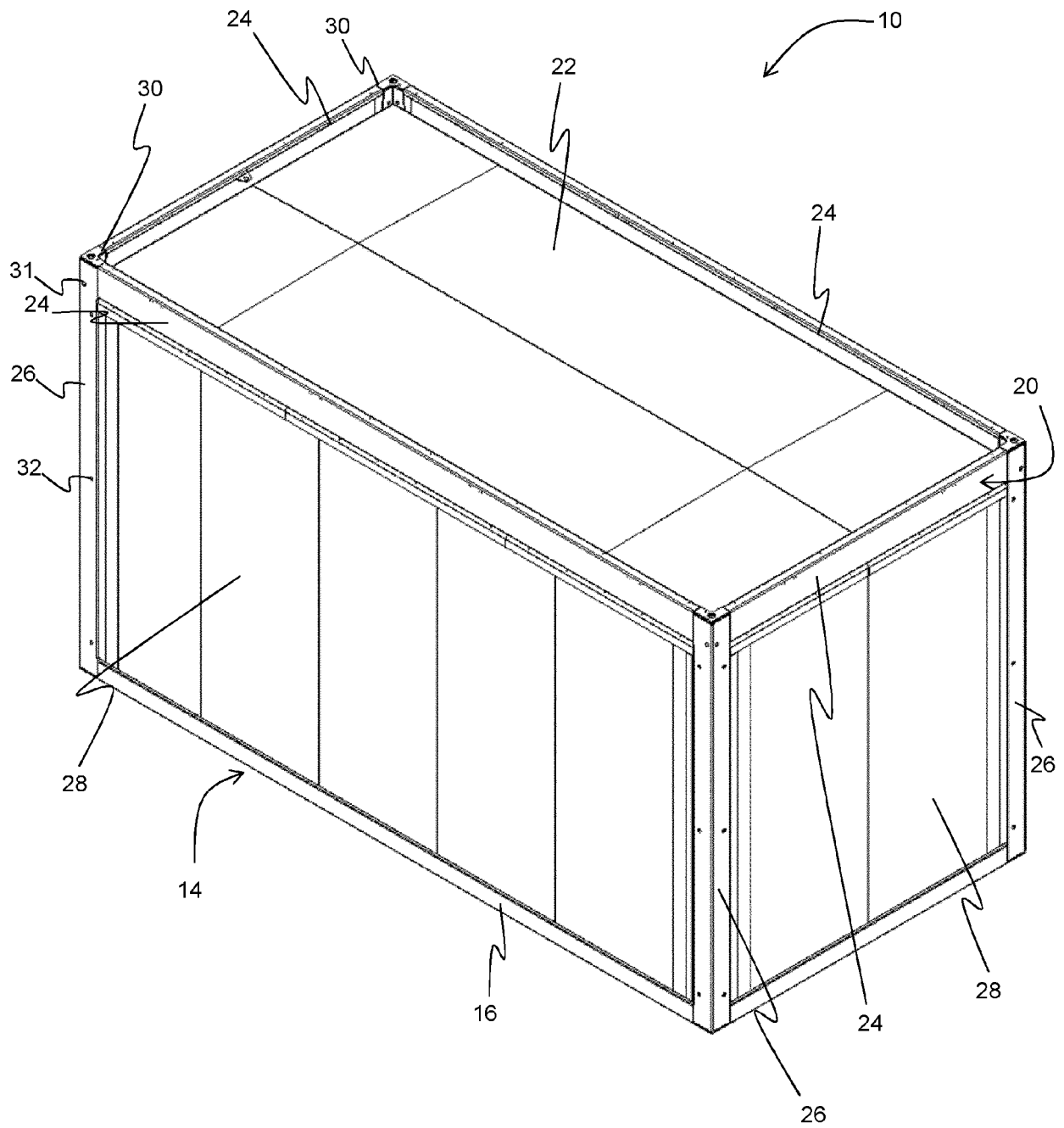


FIG. 1

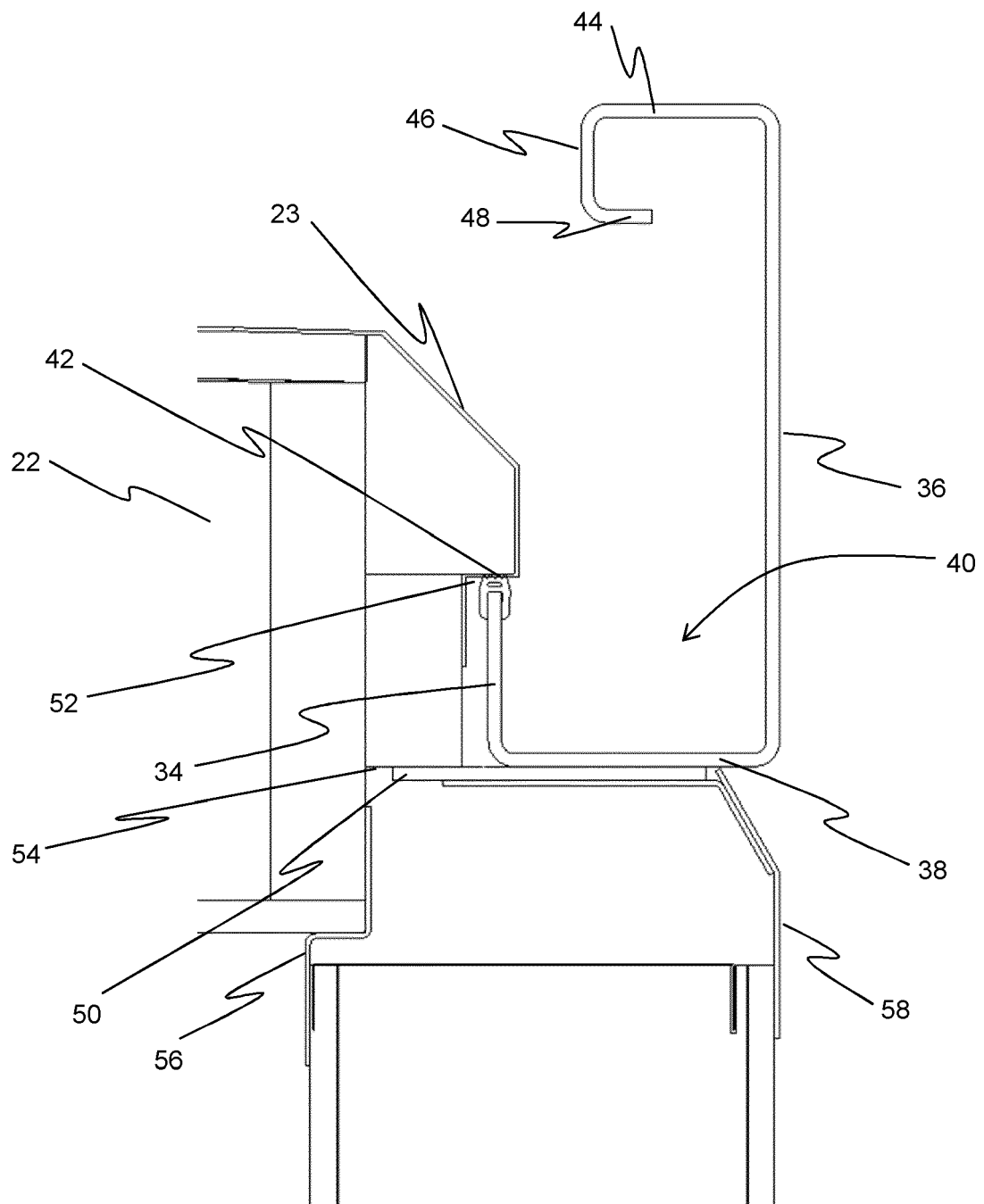


FIG. 2

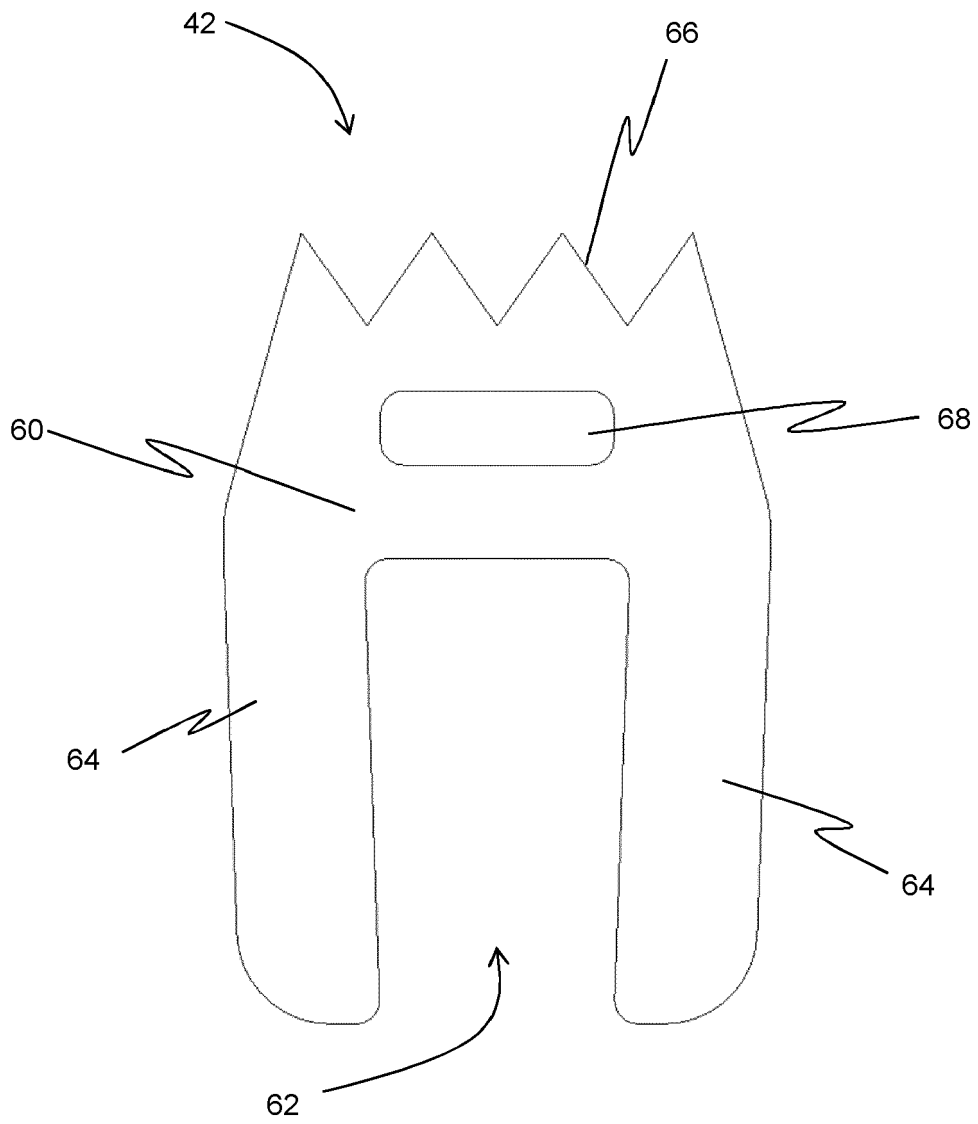


FIG. 3

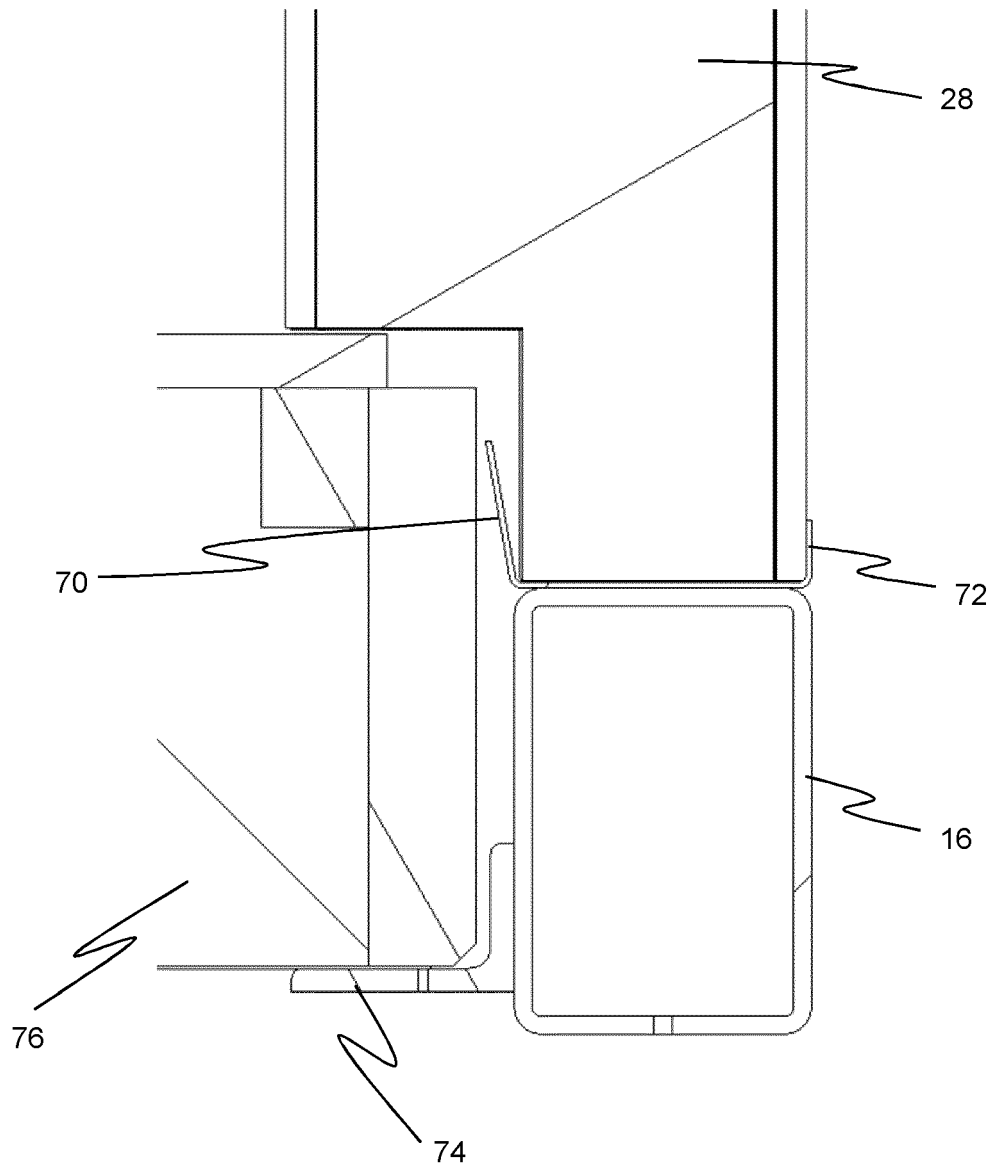


FIG. 4

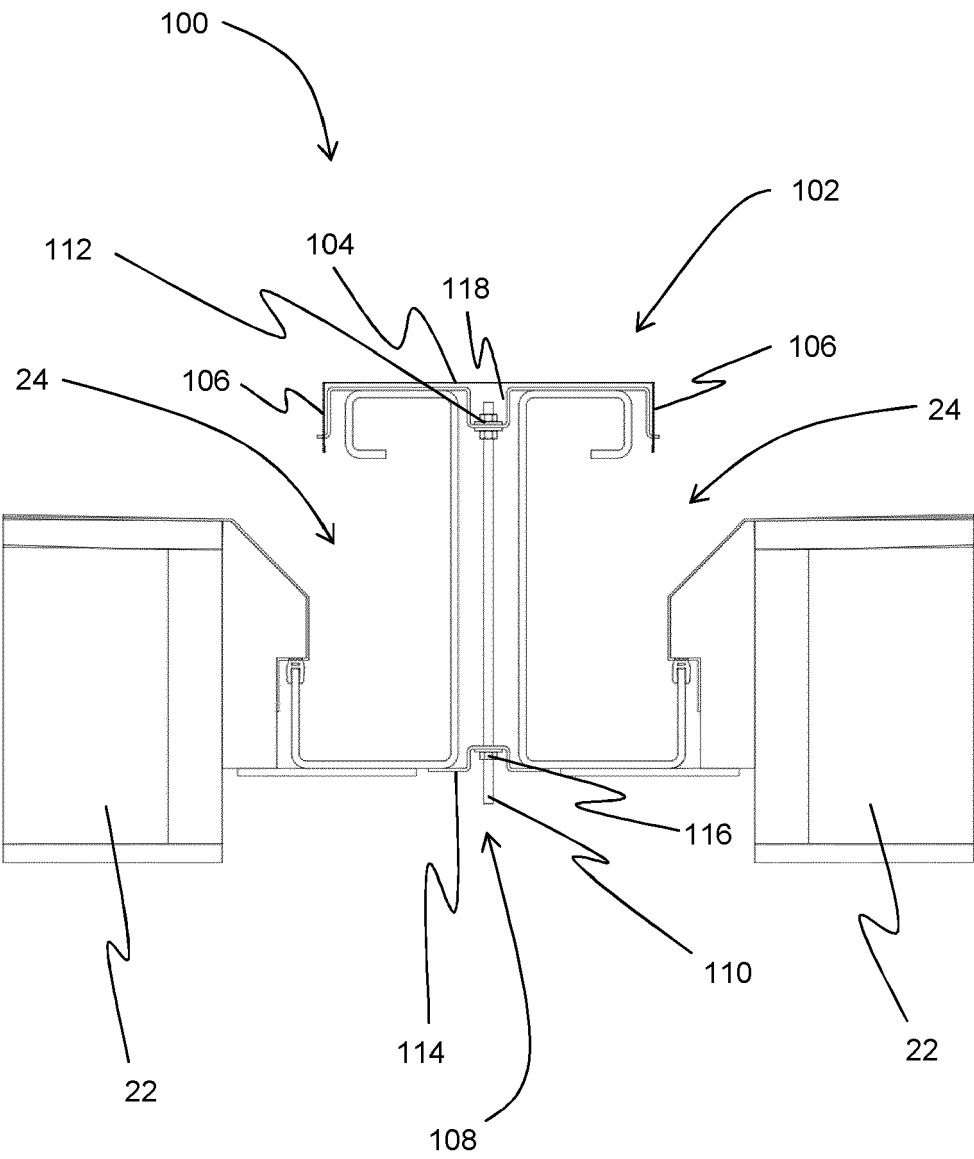


FIG. 5



## EUROPEAN SEARCH REPORT

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                       |                                                                                                                                                                                                                                                                              |                                         |
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| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                         | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC) |
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| X                                                                                                                                                                                                                                                      | EP 0 465 935 A1 (JODAG MOBILSYSTEME GMBH [DE]) 15 January 1992 (1992-01-15)<br>* column 2, line 8 - column 8, line 35;<br>figures 1-6 *               | 1-12                                                                                                                                                                                                                                                                         |                                         |
| A                                                                                                                                                                                                                                                      | DE 203 11 789 U1 (ALHO SYSTEMBAU GMBH [DE]) 2 October 2003 (2003-10-02)<br>* page 7, line 24 - page 8, line 13;<br>figure 3 *                         | 1-15                                                                                                                                                                                                                                                                         |                                         |
| X                                                                                                                                                                                                                                                      | WO 2013/159772 A1 (INNOVAC GMBH BERLIN [DE]) 31 October 2013 (2013-10-31)<br>* page 1, line 8 - page 23, line 5;<br>figures 1-13 *                    | 1-4,7,8,13,14                                                                                                                                                                                                                                                                | TECHNICAL FIELDS SEARCHED (IPC)         |
| A                                                                                                                                                                                                                                                      |                                                                                                                                                       | 5,6,9-12,15                                                                                                                                                                                                                                                                  | E04B                                    |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                       |                                                                                                                                                                                                                                                                              |                                         |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                                                    |                                                                                                                                                       | Date of completion of the search<br><b>8 November 2021</b>                                                                                                                                                                                                                   | Examiner<br><b>Dieterle, Sibille</b>    |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                       | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                         |

EPO FORM 1503 03.82 (P04C01)

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ON EUROPEAN PATENT APPLICATION NO.**

EP 21 17 9840

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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08-11-2021

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