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Publication number: **0 546 540 A1**

EUROPEAN PATENT APPLICATION

Application number: **92121060.5**

Int. Cl.⁵: **E04B 1/348**

Date of filing: **10.12.92**

Priority: **13.12.91 GB 9126460**

Applicant: **PORTAKABIN LIMITED**
New Lane
Huntington York YO3 9PT(GB)

Date of publication of application:
16.06.93 Bulletin 93/24

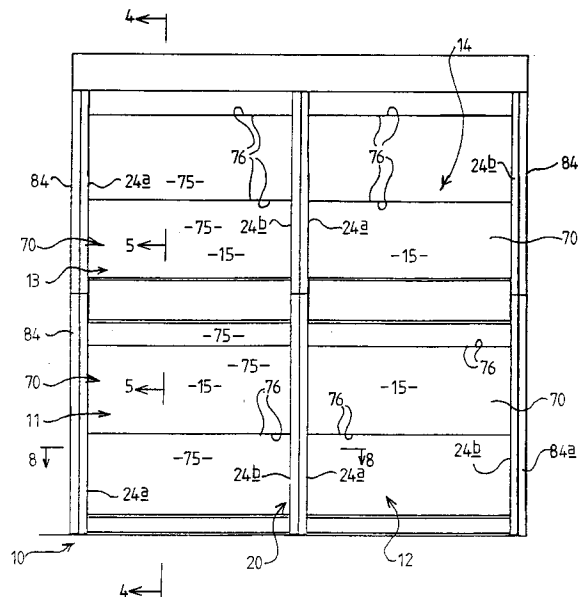
Inventor: **Tinkler, David**
48 Main Street
Stamford Bridge, York YO4 1AB(GB)
Inventor: **Body, Glyn Thomas**
4 Hollytree Cottage, Main Street
Linton-on-Ooze, York YO6 2AX(GB)

Designated Contracting States:
BE DE FR GB NL

Representative: **Leach, John Nigel et al**
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
W-8000 München 40 (DE)

Portable building unit.

An assembly (10) of portable building units (11,12,13,14) each comprising a roof structure and a wall structure, the wall structure comprises at least one wall panel structure having an outer skin comprising at least one sheet which provides an external surface of the wall structure, longer sides of the sheet being disposed to extend laterally and shorter sides of the sheet being upstanding wherein a building unit (13,14) is stacked on top of another building unit (11,12) and an intermediate panel structure is provided between the bottom lateral edge of at least one of the side and end walls of the upper unit and the top lateral edge of at least one of the side and end walls of the lower unit.



EP 0 546 540 A1

This invention relates to a portable building unit, hereinafter referred to as being of the kind specified, comprising a roof structure and a wall structure. The unit may comprise a structural metal frame to which the roof and wall structures are attached.

EP-0,058,354B and GB-2,084,213B disclose examples of such a unit which are fully factory assembled for delivery to prepared sites in an assembled condition complete with at least the roof structure.

EP-0,039,592B discloses such a unit which is intended to be transported in a pack for erection when delivered to a suitable site.

The invention also relates to a modular building assembly, hereinafter referred to as being of the kind specified, comprising a first building unit of the kind specified stacked on top of a second building unit of the kind specified to provide a building assembly having at least two storeys.

An object of the invention is to provide a new and improved building unit of the kind specified and another object of the invention is to provide a new and improved building assembly of the kind specified.

According to one aspect of the invention we provide a building unit of the kind specified wherein the wall structure comprises at least one wall panel structure having an outer skin comprising at least one sheet which provides an external surface of the wall structure, longer sides of the sheet being disposed to extend laterally and shorter sides of the sheet being upstanding.

The sheets may be of quadrilateral shape and may be of parallelogram shape or rectangular.

Preferably, the longer sides of the sheet extend horizontally or substantially horizontally and the shorter sides of the sheet external vertically or substantially vertically.

Said at least one panel structure may comprise an insulated sandwich panel having inner and outer skins with insulating infilling therebetween to which the skins may be bonded.

The outer skin may be made of metal, such as steel, which may be coated with plastics material or otherwise provided with a weatherproof finish.

The inner skin may be of plasterboard, plastisol or of metal, such as steel, which may be coated with a plastics material.

The insulating infilling may comprise a foam plastics material.

The outer skin of said panel structure may comprise a plurality of rectangular metal sheets, each of which has opposed laterally disposed edges, the lateral edges of adjacent sheets being joined together.

Said edges may be joined together continuously or at least at a plurality of positions along the

lengths of said edges.

Said lateral edges of adjacent sheets may be provided with intumed flanges which are secured together continuously or at least at a plurality of positions along the lengths thereof.

The or each flange may be continuous in which case the outer sheets are joined together continuously along their lengths, or discontinuous, in which case the outer sheets are joined together at a plurality of positions spaced along their length.

One of said flanges may be of generally channel shape, having a pair of limbs interconnected by a base and the other flange being received between said limbs.

The channel may have a restricted width mouth to provide a frictional engagement with the other flange.

The panel structure may include an internal framework which may comprise a plurality of lateral members extending therebetween and positioned at or adjacent the joints between the sheets of the outer skin.

The panel structure may also comprise a pair of spaced upright edge members.

The lateral members may be disposed adjacent one side of the joint so that the joint is embedded in the insulating infilling.

The inner skin may comprise a plurality of rectangular sheets each of which have opposed laterally disposed edges, lateral edges of adjacent sheets being juxtaposed with the inner sheets in overlapping relationship with said lateral members of the framework.

The building unit may comprise a structural metal frame to which are secured the roof structure and said at least one wall panel structure.

The building unit may also be provided with a floor structure which may be secured to the metal frame.

The structural metal frame may comprise uprights.

The structural metal frame may comprise a pair of lateral upstanding, preferably generally vertical, sub-frames, each of said sub-frames including an upper member and a lower member, the upper and lower members of each sub-frame being interconnected by uprights.

The lower members of the sub-frames may be rigidly interconnected in spaced apart parallel relation by frame cross-members which extend between the lower members.

A floor panel may extend between and be supported by the lower members of the sub-frames.

The upper members of the sub-frames may be interconnected solely by one or more roof panels, each of which extends between and is secured below the upper members of such sub-frames so

that the upper members are wholly external of the habitable volume of the unit.

Said at least one roof panel may comprise an external skin of sheet metal, an internal skin and an infilling therebetween, the external skin comprising a plurality of profiled metal sheets, the sheets being disposed in side by side relationship with edge corrugations of the profile in overlapping and sealing relationship and preferably each sheet extends as a one-piece sheet over the full length of the roof structure from one end of the roof beam to the opposite end thereof.

Preferably the sheets are bonded to the infilling and the infilling is bonded to the internal skin.

Alternatively, the structural metal frame may comprise rectangular floor sub-frame comprising a pair of spaced parallel floor beams connected together by transversely extending floor joists, a rectangular roof sub-frame comprising a pair of spaced parallel roof beams interconnected by a plurality of transversely extending roof joists, at least some of the transverse joists being connected to the roof beams intermediate the ends of the roof beams, and a plurality of upstanding, preferably generally vertical, columns extending between and interconnecting the floor and roof sub-frames.

At least one floor panel may be supported on the floor joists.

At least one roof panel may be supported on the roof joists.

At least of one of said shorter upstanding sides of at least one of said rectangular sheet may be disposed behind a surface, of an upright element, which face inwardly of the building unit, so that said upright element is disposed external to the habitable volume of the unit.

Both of said shorter upstanding sides of each of said rectangular sheets may be disposed behind surfaces, of upright elements, which face inwardly of the building unit.

Said upstanding frame members of the panel structure may be fastened to said upright elements, for example by screw threaded fasteners.

The building unit may be rectangular in plan, having a pair of, shorter, end walls and a pair of, longer, side walls.

An end wall may comprise a panel structure wherein the sheets extend across the full width of the end wall with the upstanding edges of the panel structure disposed behind a surface, of an upright element, which faces inwardly of the building unit, so that said upright element is disposed external to the habitable volume of the unit.

Preferably the end wall comprises a single panel structure.

The upright elements at the ends of the end wall may be square in cross section.

A side wall may comprise a plurality of panel structures, wherein the sheets extend across the full width of the respective panel structure and the upstanding edges of adjacent sheets are disposed behind a surface of an intermediate upright element, which faces inwardly of the building unit, so that said upright element is disposed external to the habitable volume of the unit.

The intermediate upright elements may be rectangular in cross-section with the longer sides extending parallel to the length of the side wall.

The upstanding edges of the panel structures at the ends of the side wall may be disposed adjacent a surface of an upright element, which faces inwardly of the building unit along the length of the side wall so that said upright element is disposed external to the habitable volume of the unit.

The upright elements adjacent which the upstanding edges of the panel structures at the end of the side wall are disposed and may comprise a further upright element disposed adjacent an upright of the structural frame of the building unit at the ends of the end wall.

The upright elements, intermediate upright elements and/or further upright elements may comprise an upright of the structural frame of the building unit which is disposed external to the volume of the building unit.

The wall structure is provided with an opening which is disposed so that at least one of its upper edge and its lower edge is disposed below or above respectively an upper longer side or a lower longer side of said at least one sheet.

At least one wall of the unit, adjacent its bottom edge, may be provided with a rebate to receive an edge portion of a skirt panel structure.

Said at least one wall may be provided with said rebate by having a reduced thickness portion provided in the wall structure itself and an upper edge portion of the skirt panel structure overlaps a lower edge portion of the outer sheet of the wall panel structure of said wall, said outer sheet being configured to provide a surface of said rebate.

The skirt panel may be of sandwich construction comprising inner and outer metal sheets and may have an infilling of timber or mineral composite board.

The outer surface of the skirt pad structure may lie in, or substantially in, the same plane as the outer skin of said at least one wall.

According to a second aspect of the invention we provide an assembly of building units according to the first aspect of the invention wherein the units are connected together in side by side or end to end or side to end relationship.

According to a third aspect of the invention we provide an assembly of building units according to

the first aspect of the invention or the second aspect of the invention wherein a building unit is stacked on top of another building unit.

Preferably an intermediate panel structure is provided between the bottom lateral edge of at least one of the side and end wall of the upper unit and the top lateral edge of at least one of the side and end wall of the lower unit.

The skirt panel may be of sandwich construction comprising inner and outer metal sheets with an infilling of timber or mineral composite board.

The outer surface of the skirt panel structure may lie in or substantially in the same plane as the outer skins of said at least one wall.

The lower edge of the panel structure of the lower unit may be provided with a reduced thickness portion to provide a rebate similar to the rebate of the upper unit and there being a skirt panel to provide a trim at the bottom of the unit.

The upper unit of said assembly may be provided with a roof panel.

The roof panel may comprise an external skin of sheet metal, an internal skin and an infilling therebetween, the external skin comprising a plurality of profiled metal sheets, the sheets being disposed in side by side relationship with edge corrugations of the profile in overlapping and sealing relationship and preferably each sheet extends as a one-piece sheet over the full length of the roof structure from one end of the roof beam to the opposite end thereof.

The lower or an intermediate unit, where provided, of said assembly may be provided with a ceiling panel.

The ceiling panel may comprise a sandwich construction having an upper skin of plywood and a lower skin of steel with suitable insulating material therebetween and with a peripheral timber frame disposed between the inner and outer skins.

The invention will now be described by way of example with reference to the accompanying drawings, wherein:

FIGURE 1 is an end elevation of a building assembly embodying the invention,

FIGURE 2 is a side elevation of the building assembly of Figure 1,

FIGURE 3 is a section, to an enlarged scale, on the line 3-3 of Figure 2,

FIGURE 4 is a section, to an enlarged scale, on the line 4-4 of Figure 1,

FIGURE 5 is a section, to an enlarged scale, on the line 5-5 of Figure 1,

FIGURE 6 is a section, to an enlarged scale, on the line 6-6 of Figure 2,

FIGURE 7 is a section, to an enlarged scale, on the line 7-7 of Figure 5,

FIGURE 8 is a section, to an enlarged scale, on the line 8-8 of Figure 1,

FIGURE 9 is a section, to an enlarged scale, on the line 9-9 of Figure 2,

FIGURE 10 is a front elevation, partly broken away, from a panel structure of the building assembly of Figure 1,

FIGURE 11 is a section, to an enlarged scale, on the line 11-11 of Figure 10,

FIGURE 12 is a fragmentary section, to an enlarged scale, through an alternative joint between lateral edges of the outer sheet of a wall panel structure for use in the building assembly of Figure 1, and

FIGURE 13 is a section, to an enlarged scale, on the line 13-13 of Figure 2.

Referring to the drawings, there is shown in Figures 1 and 2 a building assembly 10 comprising four building units 11 - 14. Each building unit is rectangular in plan view having a short end wall 15 and a long side wall 16.

The units 11 and 12 are disposed in side by side relationship with two of their longer sides adjacent. The building units 13, 14 are likewise disposed in side by side relationship but with the unit 13 stacked on top of the unit 11 and the unit 14 stacked on top of the unit 12.

If desired more than two units may be provided in each storey and in each storey the units can be disposed in side by side relationship and/or end to end and/or end to side relationship to provide any desired combination.

Alternatively, or in addition, the building assembly may comprise more than two storeys by stacking three units, one on top of the other.

Each building module 11 - 14 in accordance with the invention comprises a structural steel frame 20 as shown in Figures 3 and 4, preferably constructed from steel beams. Each frame 20 comprises two upstanding sub-frames 21a, 21b, which lie in a vertical plane, each comprising respective horizontal roof beams 22a, 22b and lower horizontal floor beams 23a, 23b interconnected at their ends by uprights 24a, 24b. The two vertical sub-frames 21a, 21b are connected together by a plurality of floor joists 25, of which two, end, joists extend between the floor beams 23a, 23b at positions adjacent but spaced from the uprights 24a, 24b and intermediate floor joists 25 are extended as shown in Figures 3 and 4.

The roof and floor beams 22a, 22b, 23a, 23b are each of channel shape in cross-section and each includes a vertically disposed web 26, the roof and floor beams 22a, 22b, 23a, 23b having laterally inwardly directed horizontal lower flanges 27 and upper flanges 28. The flanges 27, 28 all have inwardly directed lips at their free ends.

The uprights 24a, 24b are of rolled hollow section or alternatively of channel section.

To enable the beams 22a, 22b, 23a, 23b and uprights 24a, 24b to be connected rigidly together, and beams 22a, 22b, 23a, 23b are butted directly against the uprights 24a, 24b and secured thereto by means of an angle bracket 29 bolted or welded to the web 26 and side wall 31 of the uprights 24a, 24b, which is reinforced by an apertured plate 32 to which nuts 33 are welded (Figure 7).

The floor joists 25 are of channel shape in cross-section and each comprises a vertical web 34 with horizontally directed flanges 35 and 36, the upper flange 35 of the intermediate joists having a downwardly directed lip at its free edge and both flanges of the end joists having inturned lips.

It will thus be seen that each sub-frame 21a, 21b affords a rectangular aperture defined by the beams and uprights 22a, 23a, 24a, and 22b, 23b, 24b, respectively which may be closed by end and side wall panels as hereinafter described.

Lifting eyes may be removably secured to the tops of the uprights 24a, 24b by bolts which engage nuts provided at the top of the uprights.

The units illustrated in Figures 3 and 4 include a floor structure 41 comprising an upper sheet of wood particle board 42 which rests at its lateral margins on the upper flanges 28 of the lower beams 23a, 23b and is supported on the floor joists 25.

A foil faced film or blanket 45 underdraws the floor joists 25 and is secured to the bottom flange of each joist by pneumatically driven nails and galvanised washers, or self drilling screws or other suitable fasteners.

To enable the whole structure to be supported on a lorry affording a bed narrower than the overall width of the building module, longitudinal wooden bars 47 are secured in position beneath the joists 25 inwardly of the ends of the module.

Each unit has a "roof" structure, which extends between and is secured to the roof beams 22a, 22b therebelow by attachment to the lower flanges 27 thereof. The roof structure of each top storey unit 13,14 has a roof panel 50, and each bottom unit 11, 12 (and intermediate unit, if present) a ceiling panel 50a.

The roof panel 50 comprises an inner skin 51 of plastic coated steel, an outer skin 52 also of plastic coated steel, a timber perimeter framework, part of which is shown at T, with the space between them being filled by an insulating infilling comprising a foamed plastic material 53, which in the present example is polyurethane foam.

The inner skin 51 comprises a plurality of planar plastic coated steel sheets, e.g. seven. In the present example, the plastic coating is that commonly known as a "low gloss Dolomite architectural polyester". The seven sheets are disposed side-by-side longitudinally of the roof panel

and each sheet extends across the whole of the transverse extent of the roof panel. The adjacent edges of the sheets are crimped together.

The outer skin 52 comprises a plurality of profiled plastic-coated steel sheets, e.g. three, the plastic coating in the present example providing a white plastisol coating.

Each sheet, preferably, extends throughout the longitudinal extent of the roof panel and the sheets are disposed in side-by-side relation across the transverse extent of the roof panel with adjacent side portions in overlapping relationship so that the adjacent end two corrugations particularly overlap.

A transversely extending reinforcing member 57 made of steel and of asymmetric channel configuration comprising a web 58 disposed vertically so as to extend normal to the general plane of the inner and outer skins 51, 52; a lower limb of relatively short extent and an upper limb of relatively longer extent, in the present example approximately twice as long. The limbs are disposed so as to extend perpendicular to the web 58.

The reinforcing member 51 is disposed at all desired positions and a desired number of reinforcing members may be provided. Each reinforcing member may be of different shape and/or different material than described above.

At each end, the upper limb projects longitudinally outwardly of the web part 58 and lower limb so as to overlie the longitudinally extending members of the frame T to be received in a rebate formed therein, so that the upper surface of the upper limb is flush with the upper surface of the longitudinally extending frame member. The lower limb is spaced above the skin 51 so that foam insulating material, in the present example polyurethane foam, enters the space between the under-surface of the lower limb and the upwardly facing surface of the skin, so as to avoid cold bridging between the inner and outer skins through the transverse reinforcing members 57.

The sheets of the upper skin 52 stop short of the longitudinally extending members of the frame T and one limb of a steel trim strip 56 is arranged in overlapping relationship with the edge of the sheets 52 adjacent the associated frame member T with a sealant therebetween, whilst another limb of the strip 56 is fastened to the roof beam.

The roof panels 50 are positioned below the lower flanges 27 of the roof beams with spacers 59 therebetween. The spacers 59 increase in height from one end of the roof panel to the other so that the roof panel is inclined downwardly as the spacers 59 increase in height relative to the roof beams so that water is discharged from the lower end of the roof panel. The angle of inclination may lie in the range of 1 in 120 to 1 in 60 depending upon the application of the building.

The connection between the roof panel and the beam 16 comprises a plurality of bolts 60 which pass through apertures formed in the lower skin 51, longitudinally extending frame members T, projecting part of the upper limb and the flange 27 of the roof beams 22a and 22b.

Thus, whilst the vertical sub-frames 22a and 22b of the rigid frame 20 are connected at the bottom by the joists 25, no frame parts interconnect the sub-frames 21a and 21b at the top, the sub-frames being structurally interconnected solely by the roof panel 50.

It has been found, surprisingly, that the roof panel 50 described above provides sufficient strength to hold the sub-frames 11a and 11b rigidly apart at their upper ends and thus serve a similar function as would metal frame cross-members. This is particularly due to the reinforcing members 57.

The ceiling panel 50a extends between and is secured to the roof beams 22a and 22b therebelow by attachment to the lower flanges 27 thereof.

The ceiling panel 50a comprises an inner skin 51a of steel, an outer skin 52a of plywood, a timber perimeter framework, part of which is shown at Ta, with the space between them being filled by a foamed plastics material 53a, which in the present example is polyurethane foam. The timber framework Ta is bolted to the flanges 27 by bolts 60a.

Secured to the frames 20 are end wall panel structures 70 and side wall panel structures 80 although side wall panel structures are omitted from adjacent sub-frames 21a, 21b to provide an obstruction free interior for each storey. The adjacent sub-frames 21a, 21b of adjacent units 11, 12 and 13, 14 respectively are directly bolted together by bolts 61. In addition the mating flanges 22a, 23a and 22b, 23b of stacked units 11, 13, and 12, 14 respectively are also bolted together by bolts 62, a desired plurality of bolts 62 being provided longitudinally of the beams.

If desired, further units may be bolted together in either end to end or side by side, or side to end relationship with appropriate end wall panel structures and/or side wall panel structures being omitted as desired to enable units to be linked together to provide a building construction of desired configuration.

The end wall panel structures 70 are secured to the inwardly facing surface 31 of uprights 24a 24b so that the panel structures 70 are received entirely within the metal frame 20. Cut-outs are provided at the bottom for the panels to accommodate the floor beams 23a

As shown in Figures 8 to 12, the end wall panel structures 70 comprise an outer skin 71 of plastics coated steel and an inner skin 72 of plasterboard secured to a framework 73 of timber members 73a

to c and with foamed plastics insulation material or infilling 74 therebetween.

The outer skin comprises a plurality, in the present example, three, rectangular metal sheets 75, each of which has opposed edges 76 disposed to extend laterally in a horizontal direction, a horizontal edge of adjacent sheets being joined together along the length of said edges. The uppermost sheet is of the smallest height, the middle sheet the greatest height and the lowermost sheet the least height. This configuration is adopted so that the joint between the lowermost and middle sheet is at or below the bottom of any window or other opening with which the building unit may be provided. Similarly, the joint between the uppermost sheet and the middle sheet is at or above the level of the top of any such opening. This avoids the need to cross the or each of the above mentioned joints with a window or other opening. Of course, if desired, an opening may cross one or more of the joints, for example, in the case of a door, although, it is preferred to cross as few joints as possible.

As best shown in Figures 11 and 12 the horizontal edges of adjacent sheets are provided with inturned flanges 77, 78, the flange 77 providing a clip of generally channel shape having a pair of limbs 77a, interconnected by a base 77b and the channel having a restricted mouth 79 so as to exert frictional restraint on the other flange 78. If desired the sheets may be interconnected only at spaced positions along their edges 76 and by other means than that described and illustrated in Figure 11 and 12. In Figure 11, the clip is shown provided on an upper sheet 75 whilst Figure 12 shows an alternative and preferred configuration where the clip is provided on the lower sheet. Otherwise the joint is the same in both Figures.

As best shown in Figures 10 and 11, the internal framework 73 comprises a pair of spaced upright edge members 73a and a pair of lateral edge members 73b at the top and bottom of each panel structure and a pair of intermediate lateral members 73c extending between and positioned at or adjacent the joints of the outer skin. The intermediate horizontal members 73c are disposed adjacent one side of the joints so that the joint is embedded in the plastics infilling material 74.

The inner skin 72 comprises a plurality of rectangular sheets each of which have opposed horizontally disposed edges, horizontal edges of adjacent sheets being juxtaposed with the inner sheets in overlapping relationship with the intermediate horizontal members 73c of the framework.

The shorter edges 76a of the rectangular sheets 75 are upstanding in a vertical direction and disposed behind upright elements provided by the uprights 24a, 24b adjacent the surfaces 31 and so

are protected from the elements.

The side wall panel structures 80 are of similar construction to the end wall panel structures 70 and the vertical edges 81 of their rectangular sheets 75 are disposed behind an inwardly facing surface 82 of intermediate upright elements 83. The intermediate upright elements 83 may be provided for aesthetic reasons, for example, to reflect the appearance of the shorter end wall of the building assembly and/or they may contribute to the overall structural strength of the frame and so comprise an upright of the structural frame, depending upon the size of the building and the way in which the intermediate upright elements 83 are attached to the building unit. In the present example, as shown in Figure 11, they are attached to the roof beams 22a, 22b and to the floor beams 23a, 23b by brackets 83a, 83b which are bolted respectively to a roof beam and a floor beam.

Each bracket comprises a square section tubular part 83c which is welded to an associated intermediate element 83 and to a mounting plate 83d which is bolted by bolts 83e to the web 26 of the associated roof beam or floor beam.

The vertical edges 81 of the outer edges of the wall are disposed behind an additional upright element 84 provided at the corner of the assembly and which provides a balanced aesthetic appearance so that the column pattern at the corners matches that at the junction between adjacent units where two uprights 24a, 24b are disposed side by side. A sealing strip 85 is disposed between the transversely facing surface 86 of the corner upright element 84 and the vertical edge 81 of the panel structure to provide a protective seal with suitable sealing material therebetween. The panel structures 70, 80 are fastened to the respective uprights by means of self-tapping screws driven from the interior of the panel structures and trimmed by suitable trim strips 88. Suitable sealant 89 is provided between the vertical edges of adjacent panels. In addition the timber frame at the vertical edges of the panels 80 at the corner of the building is screwed to the mating timber frame at the vertical edge of the panel 70. The additional upright elements 84 may be wholly aesthetic or may contribute to the overall structural strength of the frame and so comprise an upright of the structural frame, depending upon the size of the building and the way in which they are attached to the building unit. In the present example, as shown in Figure 6, the corner uprights 84 are fastened to the webs 26 of the roof and floor beams 23a, 22a by means of angle brackets 91 welded to the uprights 84 and bolted to the webs 26 by bolts 92.

An intermediate panel 100 is disposed between the adjacent upper and lower edges of the end wall panel structures 70 of two stacked units (see Fig-

ure 5). Panel structure 100 comprises a metal outer skin 101 and an inner skin 102 of steel with an infilling 103 of timber or mineral composite board therebetween. The external surface 104 of the intermediate panel 100 lies in the same plane as the external surface 105 of the panel structure 70. If desired, however, the surfaces 104 and 105 may lie in slightly different but adjacent planes.

In order to permit of the surface 104 lying in the same plane as the surfaces 105 each panel structure 70 of the upper and lower unit is provided with a rebate 110, 111 respectively. The rebate 110 is provided by forming the lower timber horizontal frame member with a reduced thickness lower edge portion into which the outer sheet 75 is bent to provide a surface of the rebate 110. The rebate 111 is provided by a vertically extending limb 112 of an angle bracket 113 which is fastened by a screw 114 to the upper timber frame member 73 of the lowermost panel 70 and also to the peripheral frame member Ta of the ceiling structure 50a. Again the outer metal sheet 75 is bent to lie against the limb 112 to provide a surface of the rebate 111.

The intermediate panel 100 has reduced thickness upper and lower edge portions 115 through which screws 116 are passed to secure the intermediate panel to the timber frame member 73 and the limb 112 respectively.

Referring now to Figure 6, a similar intermediate panel 100 is provided between the upper and lower horizontal edges of the panel structures 80 on the side walls 16 of the units. The intermediate panels are as described with reference to Figure 5 and a rebate is formed in the lowermost horizontal frame member 73 of the upper panel structure 80, also as described with reference to Figure 5. The lower rebate 111 is provided by a vertical limb 117 of a channel section bracket 118 which is fixed by a screw 119 to the uppermost horizontal frame member 80 and which has a vertically extending limb 120 parallel to and spaced from the limb 117 which is fastened by a screw 121 to the timber frame member Ta of the ceiling 50a. A water deflector member 122 is provided between the web 26 and the upper edge of the limb 117.

The intermediate panel 100 corresponds in length to the associated wall panel structures 70, 80.

Referring now to Figures 3 and 4, it will be seen that the lowermost frame members 73 of the panels 80 of the lowermost units are similarly provided with a rebate 110 as are the lowermost frame members 73 of the panel members 70 of the lowermost units. Skirt members 123 of similar construction at their upper ends to the intermediate panels are secured in the rebates 110 by screws similar to the screws 116 and trim the base of the

lowermost module.

A fascia panel 124 extends along the side wall 16 to trim the top of the uppermost unit and is carried on the corner upright elements 84 and its immediate upright elements 83. A similar fascia panel 125 extends along the width of the end wall 15 to trim the uppermost units and are carried on the uprights 24a, 24b.

A gutter 126 and drain pipe 127 are positioned at the lower end of the roof panel.

Although not shown, the end and side wall panels, where provided, may be equipped with all necessary doors and windows, and the windows may be single or double glazed as required.

All required internal fittings, including partition walls, carpeting or other floor covering, and appropriate mains services such as gas, electricity, water supply and sanitation may be provided so that the complete unit may be delivered to a prepared site, ready for use, subject only to securing adjacent units together where necessary and applying internal trim strips as necessary at the joints between adjacent units, and if required external trims.

When two or more units are connected together in end to end configuration, the higher ends may be adjacent with suitable guttering being provided at the lower ends.

If desired, a plurality of roof panels may be provided secured to and below the roof beams instead of a single roof panel.

If desired, the structural frame may be of other configurations than that described hereinbefore. For example, it may comprise a rectangular floor sub-frame comprising a pair of spaced parallel floor beams connected together by transversely extending floor joists, a rectangular roof sub-frame comprising a pair of spaced parallel roof beams interconnected by a plurality of transversely extending roof joists, at least some of the transverse joists being connected to the roof beams intermediate the ends of the roof beams, and a plurality of upstanding, preferably generally vertical, columns extending between and interconnecting the floor and roof sub-frames. At least one floor panel may be supported on the floor joists. At least one roof panel may be supported on the roof joists.

Although an assembly of four building units have been described above, a single building unit may be provided, or an assembly of any suitable combination of building units may be provided. Where a single building unit is provided a single storey assembly of building units, the or each unit may be provided with skirt members 123 and fascia panels 124 as described herein before.

Although in the above example the units, their wall, roof and floor structures, and wall panel structures are all rectangular with the edges of the wall panel structure lying in vertical and horizontal

planes, if desired the above described structures may be of other than rectangular shape. For example, the wall structures of a building unit may be inclined upwardly and inwardly or outwardly and the shorter upstanding walls may lie in a vertical plane but be inclined to the vertical; alternatively, or in addition, a wall panel structure may be of parallelogram shape with the longer side extending laterally but in a plane inclined to the horizontal whilst the shorter side may be upstanding in a vertical or near vertical direction. If desired the wall panel outer sheets may be of any other shape so long as the longer sides extend laterally, i.e. in a direction inclined to the vertical, and the shorter sides are upstanding, i.e. inclined to the horizontal.

The features disclosed in the foregoing description, or in the following claims, or in the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A portable building unit comprising a roof structure and a wall structure characterised in that the wall structure comprises at least one wall panel structure having an outer skin comprising at least one sheet which provides an external surface of the wall structure, longer sides of the sheet being disposed to extend laterally and shorter sides of the sheet being upstanding.
2. A unit according to Claim 1 wherein said at least one panel structure comprises an insulated sandwich panel having inner and outer skins with insulating infilling therebetween to which the skins may be bonded.
3. A unit according to Claim 2 wherein the outer skin is made of metal and/or the inner skin is made of plasterboard, plastisol or metal, and/or the insulating infilling comprises a foam plastics material.
4. A unit according to any one of the preceding claims wherein the outer skin of said panel structure comprises a plurality of rectangular metal sheets, each of which has opposed laterally disposed edges, the lateral edges of adjacent sheets being joined together.

5. A unit according to Claim 4 wherein said lateral edges of adjacent sheets are provided with inturned flanges which are secured together continuously or at a plurality of positions along the lengths thereof. 5
6. A unit according to Claim 5 wherein the or each flange is continuous, in which case the outer sheets are joined together continuously along their lengths, or discontinuous, in which case the outer sheets are joined together at a plurality of positions spaced along their length and wherein one of said flanges is of generally channel shape, having a pair of limbs interconnected by a base and the other flange being received between said limbs. 10 15
7. A unit according to any one of the preceding claims wherein the panel structure includes an internal framework comprising a plurality of lateral members extending therebetween and positioned at or adjacent the joints between the sheets of the outer skin. 20
8. A unit according to Claim 7 wherein said at least one panel structure comprises an insulated sandwich panel having inner and outer skins with insulating infilling therebetween to which the skins may be bonded and the inner skin comprises a plurality of rectangular sheets each of which have opposed laterally disposed edges, lateral edges of adjacent sheets being juxtaposed with the inner sheets in overlapping relationship with said lateral members of the framework. 25 30 35
9. A unit according to any one of the preceding claims wherein the building unit comprises a structural metal frame to which are secured the roof structure and said at least one wall panel structure. 40
10. A unit according to Claim 9 wherein the structural metal frame comprises a pair of lateral upstanding sub-frames, each of said sub-frames including an upper member and a lower member, the upper and lower members of each sub-frame being interconnected by up-rights. 45
11. A unit according to Claim 10 wherein the upper members of the sub-frames are interconnected solely by one or more roof panels, each of which extends between and is secured below the upper members of such sub-frames so that the upper members are wholly external of the habitable volume of the unit. 50 55
12. A unit according to Claim 11 wherein said at least one roof panel comprises an external skin of sheet metal, an internal skin and an infilling therebetween, the external skin comprising a plurality of profiled metal sheets, the sheets being disposed in side by side relationship with edge corrugations of the profile in overlapping and sealing relationship and preferably each sheet extends as a one-piece sheet over the full length of the roof structure from one end of the roof beam to the opposite end thereof.
13. A unit according to any one of the preceding claims wherein at least one of said shorter upstanding sides of at least one of said rectangular sheets is disposed behind a surface, of an upright element, which faces inwardly of the building unit, so that said upright element is disposed external to the habitable volume of the unit.
14. A unit according to any one of the preceding claims wherein the building unit is rectangular in plan, having a pair of, shorter, end walls and a pair of, longer, side walls and wherein an end wall comprises a panel structure wherein the sheets extend across the full width of the end wall with the upstanding edges of the panel structure disposed behind a surface, of an upright element, which faces inwardly of the building unit so that said upright element is disposed external to the habitable volume of the unit.
15. A unit according to any one of the preceding claims wherein the building unit is rectangular in plan, having a pair of, shorter, end walls and a pair of, longer, side walls and wherein a side wall comprises a plurality of panel structures, wherein the sheets extend across the full width of the respective panel structure and the upstanding edges of adjacent sheets are disposed behind a surface, of an intermediate upright element, which faces inwardly of the building unit so that said upright element is disposed external to the habitable volume of the unit.
16. A unit according to Claim 15 wherein the upstanding edges of the panel structures at the ends of the side wall are disposed adjacent a surface, of an upright element, which faces inwardly of the building unit along the length of the side wall, so that said upright element is disposed external to the habitable volume of the unit.

17. A unit according to Claim 16 wherein the upright elements adjacent which the upstanding edges of the panel structures at the ends of the side wall are disposed comprise a further upright element disposed adjacent uprights of a structural frame of the building unit at the ends of the end wall. 5
18. A unit according to any one of Claims 13 to 17 wherein the upright elements comprise an upright of a structural frame of the building unit disposed external to the habitable volume of the unit. 10
19. A unit according to any one of the preceding claims wherein the wall structure is provided with an opening which is disposed so that at least one of its upper edge and its lower edge is disposed below or above respectively an upper longer side or a lower longer side of said at least one sheet. 15 20
20. A unit according to any one of the preceding claims wherein at least one wall structure of the unit, adjacent its bottom edge, is provided with a rebate to receive an edge portion of a skirt panel structure. 25
21. A unit according to Claim 20 wherein said at least one wall is provided with said rebate by having a reduced thickness portion provided in the wall structure itself and an upper edge portion of the skirt panel structure overlaps a lower edge portion of the outer sheet of the wall panel structure of said wall, said outer sheet being configured to provide a surface of said rebate. 30 35
22. An assembly of building units according to any one of Claims 1 to 21 wherein a building unit is stacked on top of another building unit and an intermediate panel structure is provided between the bottom lateral edge of at least one of the side and end walls of the upper unit and the top lateral edge of at least one of the side and end walls of the lower unit. 40 45
23. An assembly according to Claim 22 wherein the intermediate panel is of sandwich construction comprising inner and outer metal sheets with an infilling of timber or mineral composite board. 50
24. An assembly according to Claim 22 or Claim 23 wherein the outer surface of the intermediate panel structure lies in or substantially in the same plane as the outer skins of said at least one of the side and end walls between which the intermediate panel structure is disposed. 55
25. An assembly according to any one of Claims 22 to 24 wherein said at least one wall of the upper unit adjacent its bottom edge is provided with a rebate to receive an edge portion of the intermediate panel structure.
26. An assembly according to Claim 25 wherein said at least one wall of the upper unit is provided with said rebate by having a reduced thickness portion provided in the wall structure itself and in this case the upper edge portion of the intermediate panel structure preferably overlaps a lower edge portion of the outer sheet of the wall panel structure of said wall, said outer sheet being configured to provide a surface of said rebate.
27. An assembly according to Claim 26 wherein said wall of the lower unit is provided with a rebate by virtue of an upstanding flange provided by a member fastened to the top edge of the respective wall panel structure, said flange being spaced inwardly from the plane of the outer skin and the outer skin being configured so as to provide a surface of said rebate and so that the lower edge portion of the intermediate panel structure overlaps the portion of the sheet lying in the rebate.
28. An assembly according to any one of Claims 22 to 26 wherein the upper unit of said assembly is provided with a roof panel which comprises an external skin of sheet metal, an internal skin and an infilling therebetween, the external skin comprising a plurality of profiled metal sheets, the sheets being disposed in side by side relationship with edge corrugations of the profile in overlapping and sealing relationship and preferably each sheet extends as a one-piece sheet over the full length of the roof structure from one end of the roof beam to the opposite end thereof.
29. An assembly according to any one of Claims 22 to 28 wherein the lower, or an intermediate unit where provided, of said assembly is provided with a ceiling panel and wherein the ceiling panel comprises a sandwich construction having an upper skin of plywood and a lower skin of steel with an insulating material therebetween and with a peripheral timber frame disposed between the inner and outer skins.

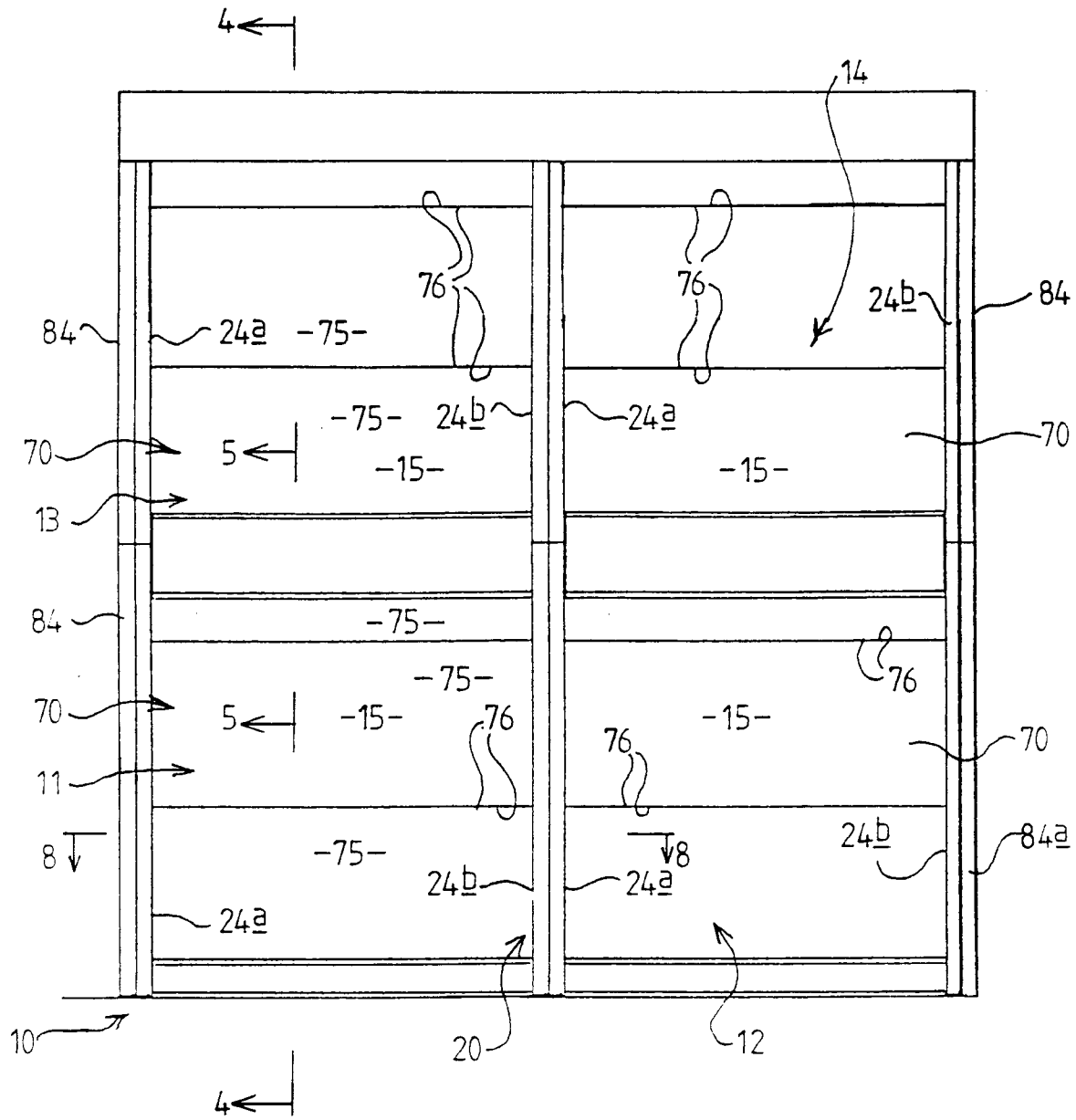
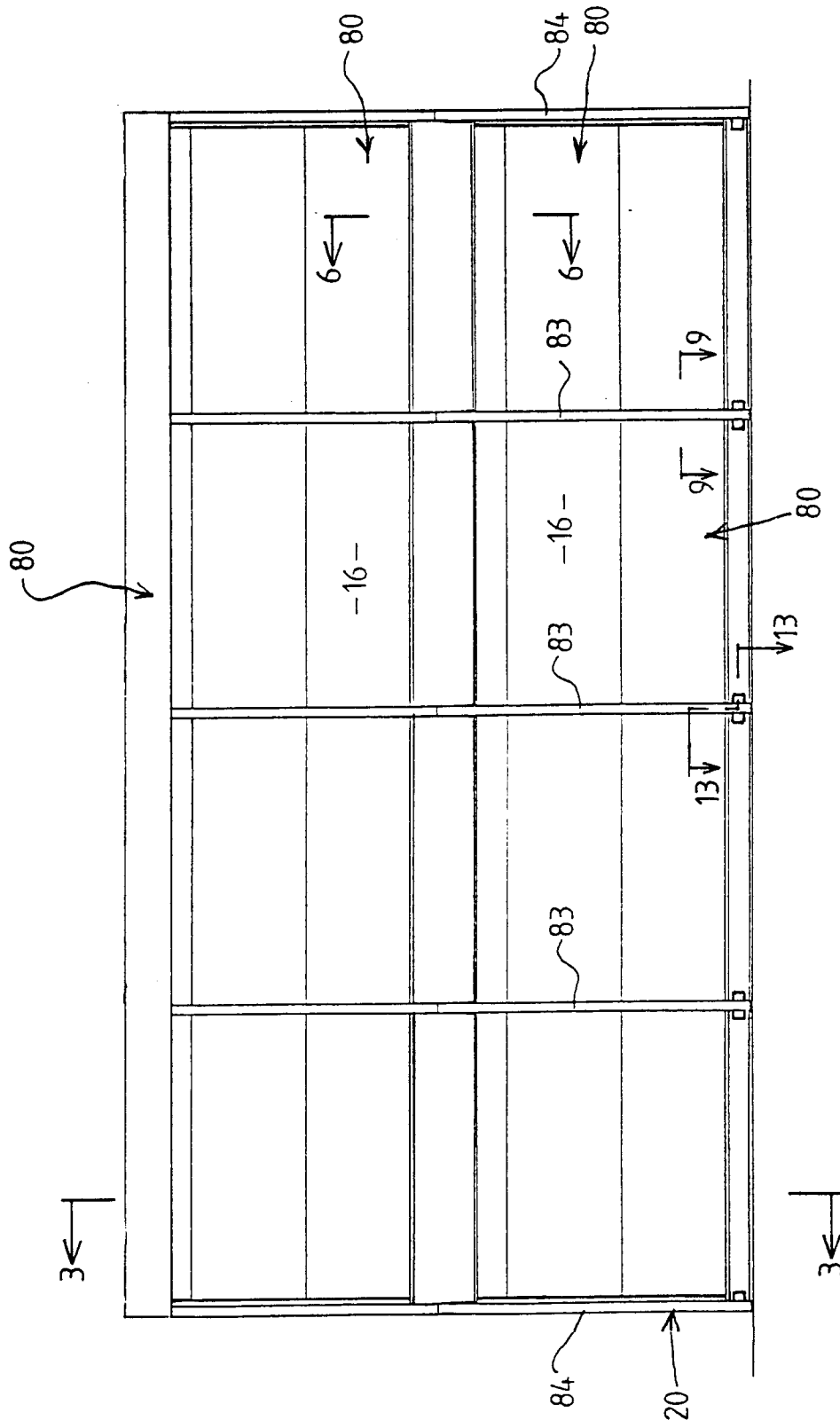


FIG 1

FIG 2



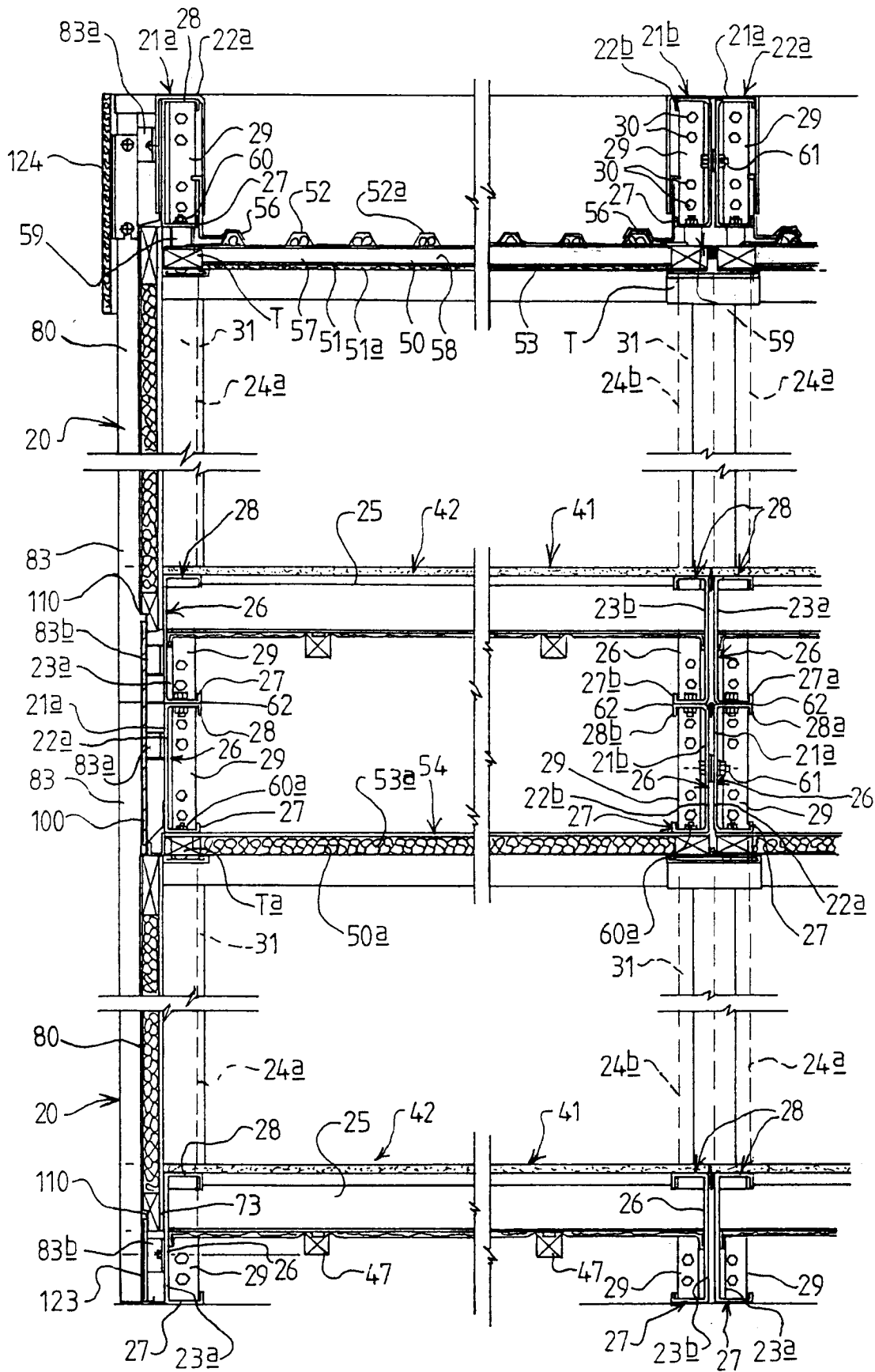


FIG 3

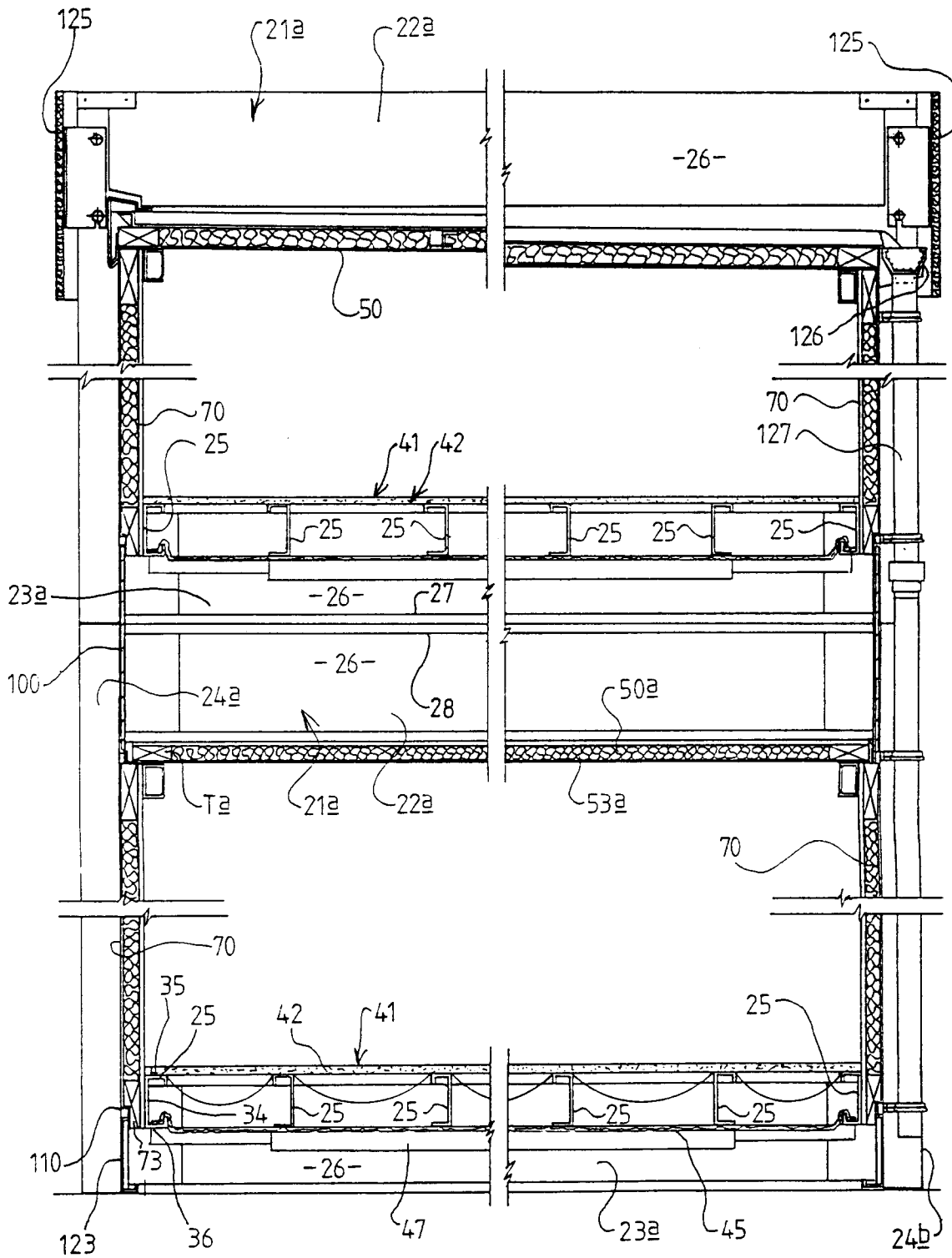


FIG 4

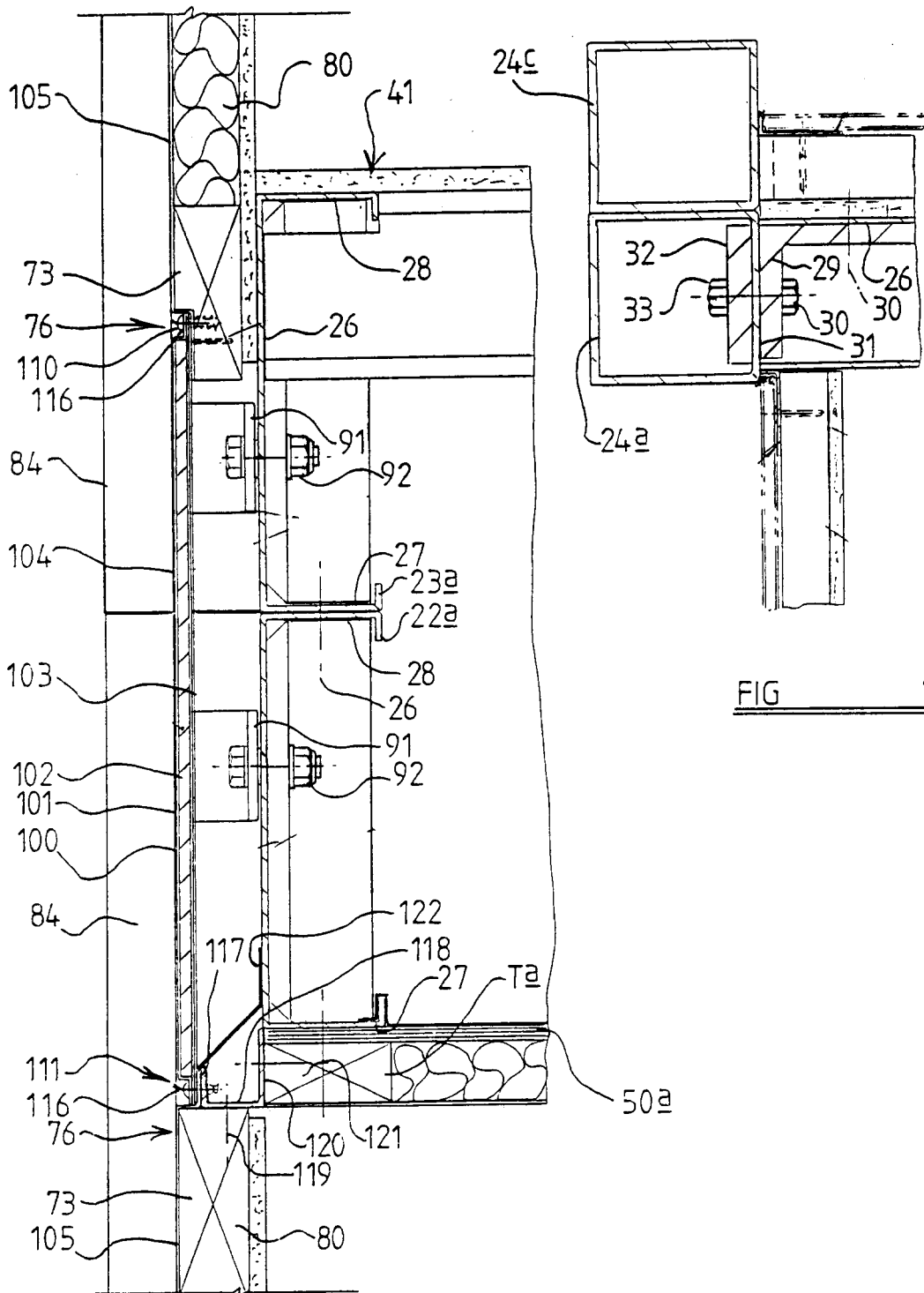


FIG 6

FIG 7

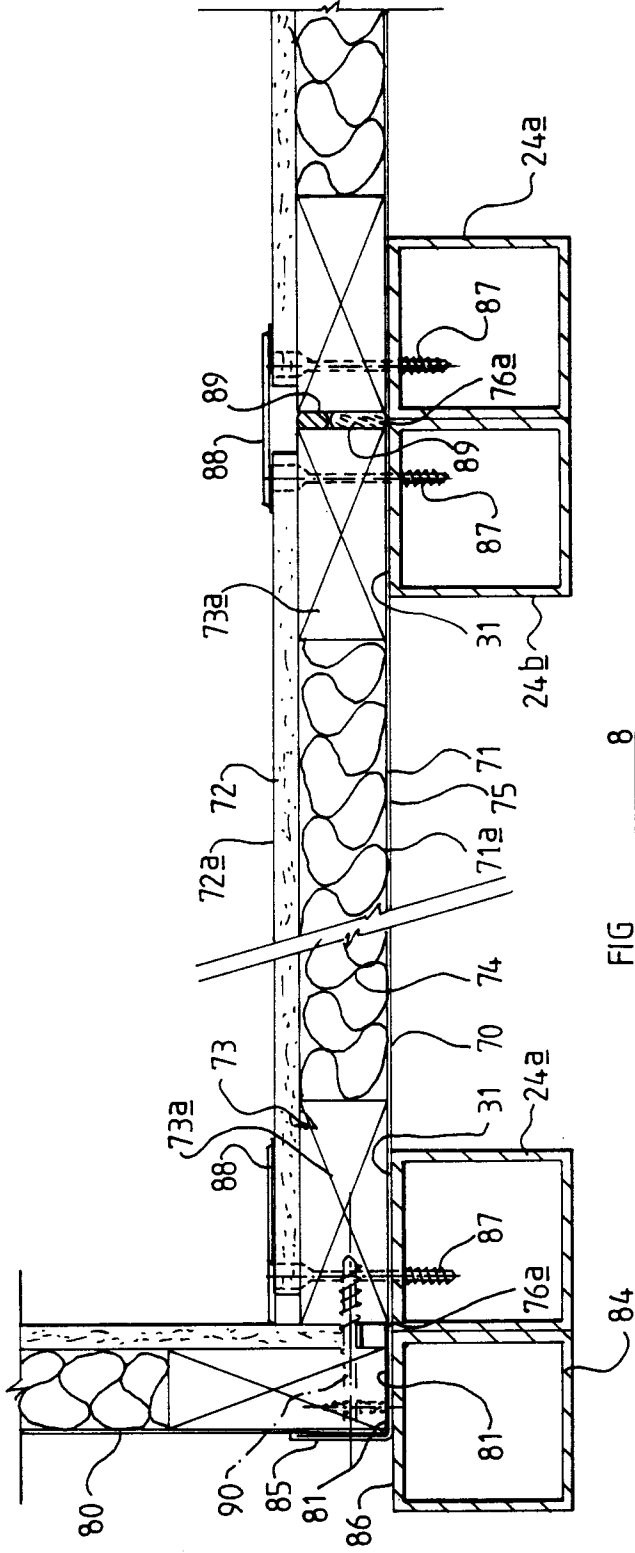


FIG 8

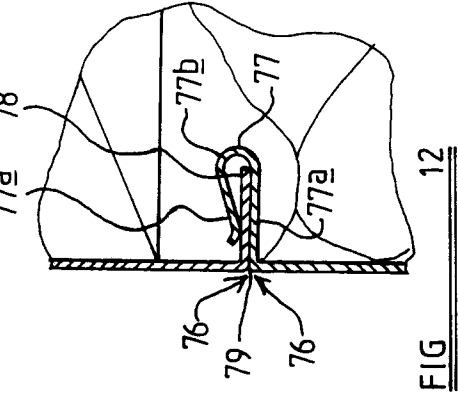


FIG 12

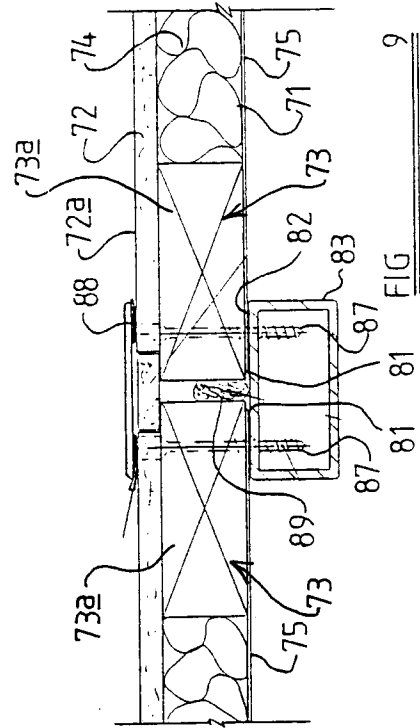


FIG 9

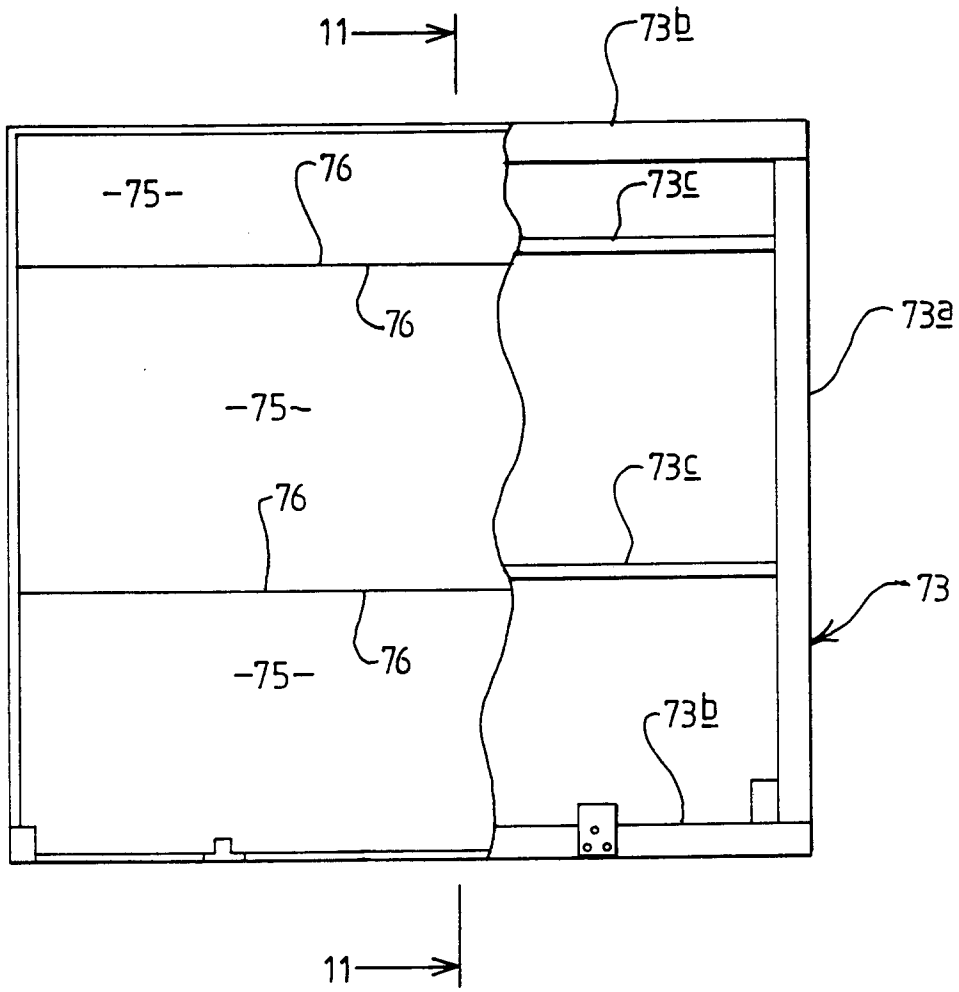


FIG 10

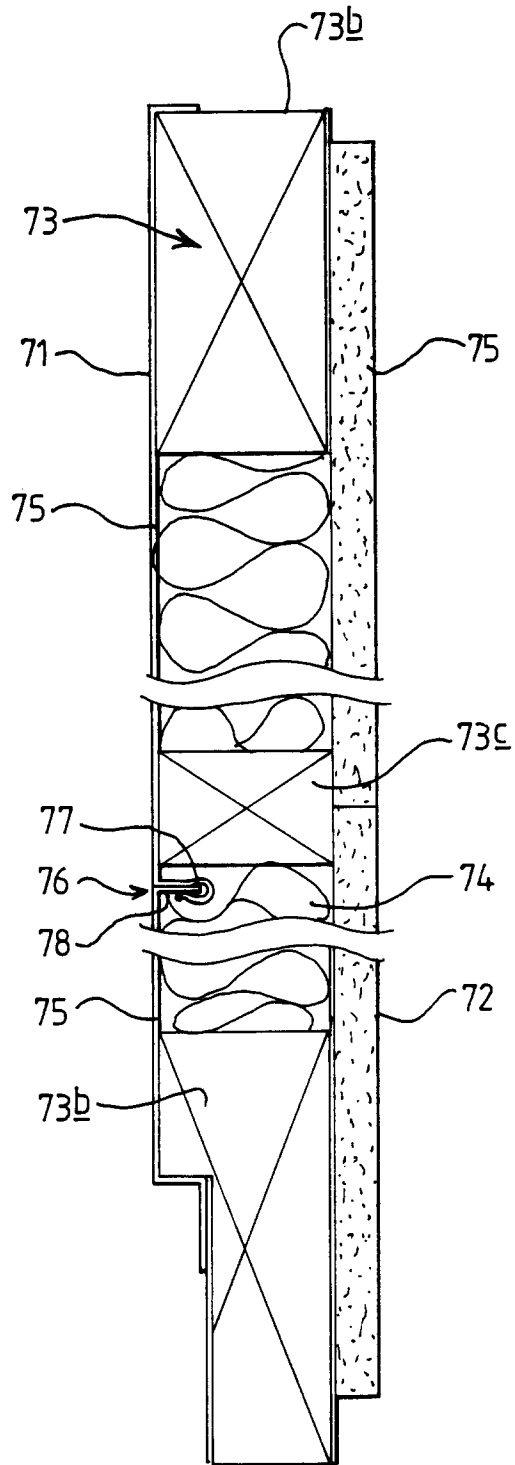


FIG 11

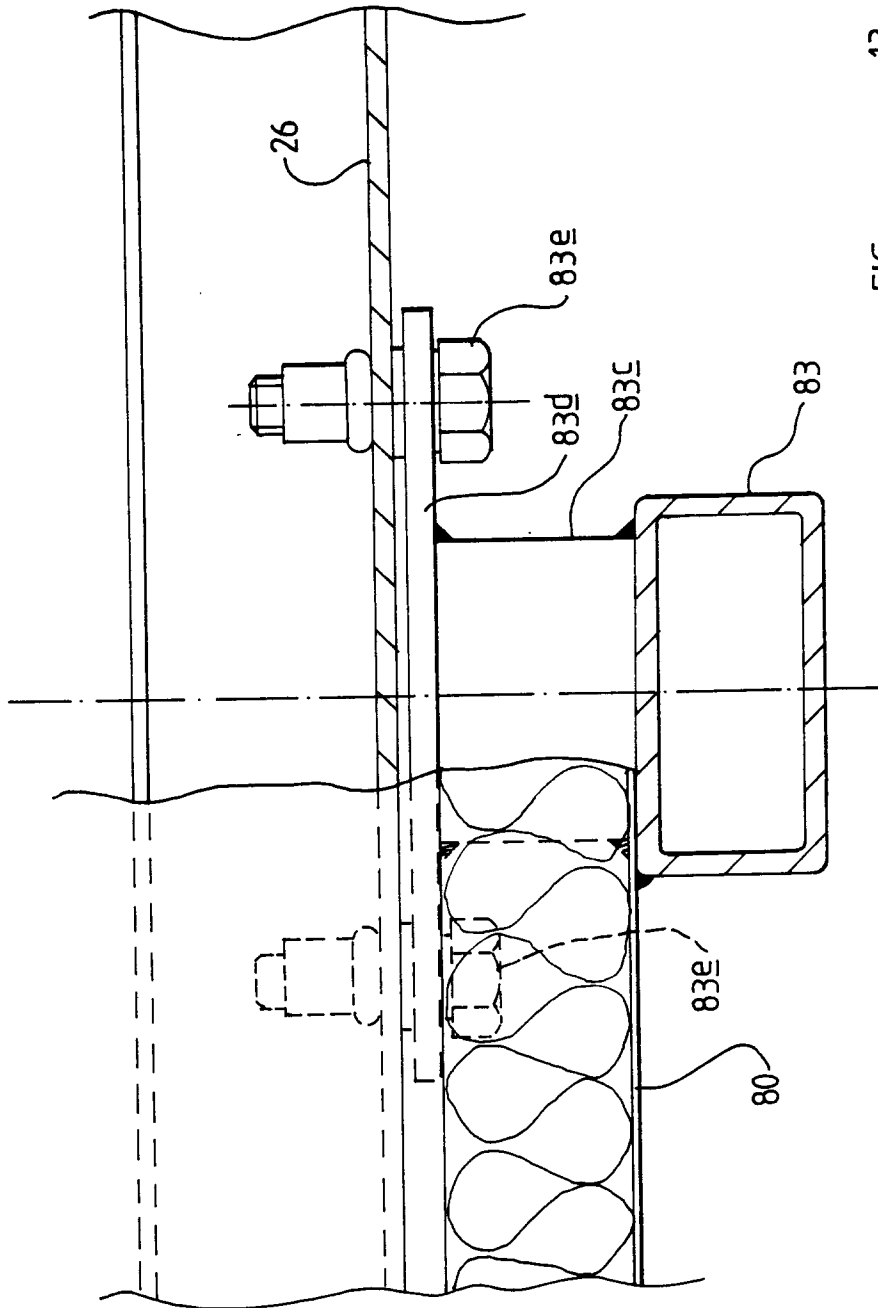


FIG 13



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,X	EP-A-0 058 354 (PORTAKABIN LTD)	1-3, 7-11,13, 14	E04B1/348
D,Y	* page 1, line 1 - page 3, line 34 *	4,5,12, 19,22,24	
D,A	* page 4, line 27 - line 34 * * page 5, line 13 - page 6, line 4 * * page 6, line 27 - page 8, line 32; figures *	18,28,29	
Y A	--- GB-A-2 173 229 (PORTAKABIN LTD) * page 1, line 96 - page 2, line 29 * * page 2, line 86 - page 3, line 130 * * page 3, line 44 - line 90 * * page 3, line 122 - page 4, line 40; figures *	4,5,12 1-3,6,9, 22,28,29	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
Y A	--- EP-A-0 034 185 (FIELD) * page 1, line 1 - page 2, line 20; figure 8 *	19 15	
Y A	--- DE-A-1 434 704 (C. VAN DER LELY N.V.) * page 1, line 1 - line 13 * * page 3, line 14 - line 21 * * page 5, line 33 - page 6, line 6 * * page 21, line 12 - page 22, line 2 * * page 26, line 11 - page 27, line 18 * * page 28, line 14 - page 29, line 31 * * page 35, line 2 - page 36, line 16; figures 1,6,9,18,20,25 *	22,24 1,15,18, 19,27	
A	--- GB-A-1 520 272 (PORTAKABIN LTD) * page 1, line 45 - page 2, line 4 * * page 2, line 19 - line 32 * * page 2, line 46 - line 85 * * page 2, line 108 - page 3, line 81; figures *	1-8	E04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 FEBRUARY 1993	Examiner HENKES R.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-2 538 017 (VEB METALLEICHTBAUKOMBINAT) * page 1, line 3 - line 7 * * page 7, line 17 - line 20; figure 3 * ---	20	
A	DE-A-2 336 482 (H. BRUNOTTE KG) * page 1, line 1 - line 17 * * page 14, line 27 - page 16, line 8; figure 13 * -----	24	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
Place of search THE HAGUE		Date of completion of the search 26 FEBRUARY 1993	Examiner HENKES R.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			