(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 500 322 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **92301323.9**

(51) Int. Cl.[5] : **E04B 1/343**

(22) Date of filing : **18.02.92**

(30) Priority : **20.02.91 GB 9103576**

(43) Date of publication of application :
26.08.92 Bulletin 92/35

(84) Designated Contracting States :
DE ES FR GB

(71) Applicant : **PORTAKABIN LIMITED**
New Lane
Huntington York Y03 9PT (GB)

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

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

(54) Portable building modules.

(57) A portable building module comprising a floor structure (16), a roof structure (15) and at least one first wall (11) structure in the form of a knocked down pack wherein the floor structure (16) is provided with a first connecting means (24), the roof structure (15) is provided with a second connecting (48) means and the or each first wall (11) structure is provided with a third (65) and fourth (66) connecting means, the roof structure (15) being supported above the floor structure (16) in the pack by releasable inter-engagement of the first (24) and second (48) connecting means and the third (61) and fourth (66) connecting means being inter-engageable with the first (24) and second (48) connecting means respectively when the pack is erected whereby the roof structure (15) may be supported above the floor structure (16) with the or each first wall structure erected therebetween.

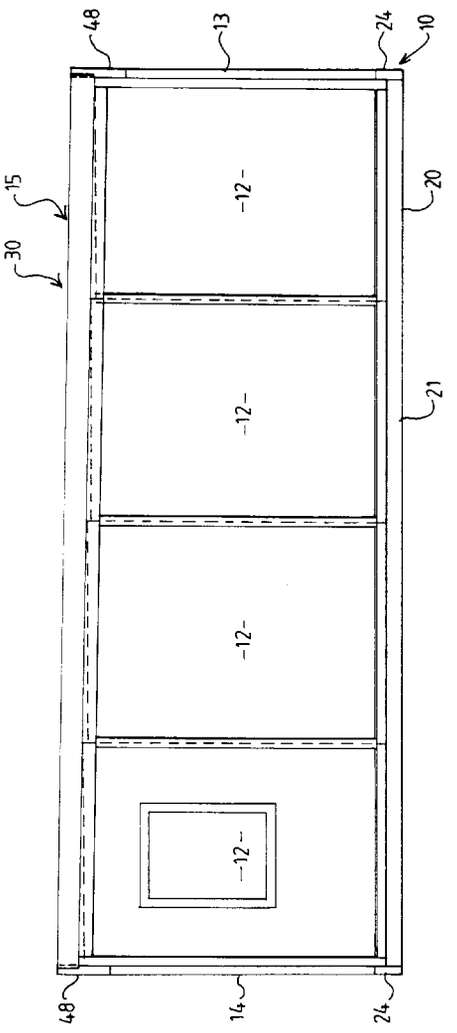


FIG 1

EP 0 500 322 A1

This invention relates to portable building modules of a kind which are intended to be transported in compact packs ready for erection when delivered to a suitable site. The building modules may then be linked to form larger multistorey buildings.

An object of the present invention is to provide a new and improved portable building module of the above kind.

According to one aspect of the present invention we provide a portable building module comprising a floor structure, a roof structure and at least one first wall structure in the form of a knocked down pack wherein the floor structure is provided with a first connecting means, the roof structure is provided with a second connecting means and the or each first wall structure is provided with a third and fourth connecting means, the roof structure being supported above the floor structure in the pack by releasable inter-engagement of the first and second connecting means and the third and fourth connecting means being inter-engageable with the first and second connecting means respectively when the pack is erected whereby the roof structure may be supported above the floor structure with the or each first wall structure erected therebetween.

The connecting means may comprise spigot and/or socket members.

The first connecting means may comprise a spigot member and the second connecting means a socket member adapted releasably to receive the spigot member of the first connecting means.

In this case, the third connecting means may comprise a socket member and the fourth connecting means a spigot member to inter-engage respectively with the first and second connecting means.

Alternatively, the first connecting means may comprise a socket member and the second connecting means a spigot member.

In this case the third connecting means may comprise a spigot member and the fourth connecting means a socket member to inter-engage respectively with the first and second connecting means.

Alternatively, the first connecting means and the second connecting means may each comprise a spigot member or a socket member and there being a separate intermediate member in the knocked down pack providing at least one of a socket or spigot respectively to inter-connect said members. In this case the third and fourth connecting means may each comprise a socket member or a spigot member respectively or, alternatively, may each comprise a spigot member or a socket member respectively with an additional socket member or spigot member provided for each connection.

The pack preferably comprises two first wall structures each provided with third and fourth connecting means to engage with respective first and second connecting means of the roof and floor structure.

The or each first wall structure is preferably rotatably inter-connected to the roof structure so that an upper end of the or each first wall structure is lifted when the roof structure is lifted, whilst the opposite end of the or each first wall structure is permitted to move to a position generally vertically below< the upper end of the respective wall structure.

The rotatable connection is preferably provided by means of a flexible member inter-connected between the roof structure and the or each first wall structure.

Releasable fasteners may be provided to interconnect the first and second connecting means when the pack is knocked down and the first and third and second and fourth connecting means when the building is erected.

At least one second wall structure, to be orthogonally disposed to the or each first wall structure, may also be incorporated in the pack, disposed between the floor and the roof structures.

The or each first wall structure may comprise a pair of corner columns provided at their lower and upper ends with the third and fourth connecting means respectively and the corner columns being inter-connected by a wall panel.

The wall panel may comprise an insulated structural sandwich having inner and outer sheets with an insulating infill therebetween. The skins may comprise a suitable plastic coated steel outer sheet and a gypsum board or, if desired, a suitably coated steel inner sheet.

The roof structure may comprise a pair of spaced parallel roof beams inter-connected by a roof panel.

The roof panel may be fastened to the underside of the roof beams and preferably without any spacer. Where it is desired that the roof panel in the building is to be inclined the second connecting means at one end is made of a different height to the second connecting means at the other end so that the roof panel is appropriately inclined when the pack is erected.

The roof beams may be inter-connected solely by one or more roof panels, the or each roof panel comprising an insulated structural sandwich having inner and outer skins and with an insulating infill therebetween and at least one transverse reinforcing member disposed between said skins and intermediate the ends of the panel.

The outer skin may comprise a profiled sheet having a plurality of corrugations which extend parallel to the roof beams and there being at least one reinforcing member extending transversely of the panel and comprising a steel section disposed between the inner and outer skins and intermediate the ends of the panel, the or each reinforcing member being connected, at opposite ends thereof, to an associated roof beam by means of a fastener engaged with the transverse reinforcing member and with an associated roof

beam.

The or each panel may comprise a pair of spaced parallel side members and the or each reinforcing member may extend transversely between and be connected to the side members.

The inner skin may comprise a steel sheet, the infilling may comprise a foam plastics material, the inner and outer skins and infilling may be bonded together.

The or each transverse reinforcing member may comprise a channel section with the web of the channel extending generally perpendicular to and between the inner and outer skins and one limb of the channel extending generally parallel to and adjacent the outer skin and being of greater length than the other limb, which is disposed closer to the inner skin and generally parallel thereto.

One limb may project lengthwise of the reinforcing member beyond the web and overlie a portion of the side member at each end of the reinforcing member.

Where the pack is to provide a ground or intermediate storey of a multi-storey building, the roof panel is horizontal and the roof structure is provided not only with at least one second connecting means but also with at least one first connecting means to receive third connecting means of at least one wall structure of a storey next above.

Where the pack is to provide a single storey building, or the top storey of a multi-storey building, the roof panel is arranged to slope so as to discharge rain water.

According to a second aspect of the invention we provide a method of erecting a portable building module comprising the steps of transporting a knocked down pack according to any one of Claims 1 - 29 to site, then disengaging the first and second connecting means and then engaging the third and fourth connecting means with the first and second connecting means respectively to support the roof structure above the floor structure with the or each first wall structure erected therebetween.

According to a third aspect of the invention we provide a portable building module when erected from a pack according to the first aspect of the invention or by a method according to the second aspect of the invention.

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

FIGURE 1 is a side elevation of a module erected from pack embodying the invention;

FIGURE 2 is an end elevation of the module of Figure 1 in the direction of the arrow A;

FIGURE 3 is a perspective view of a pack embodying the invention and including the components of the module of Figures 1 and 2.

FIGURE 4 is a fragmentary perspective view of part of a roof structure of the module of Figures 1 and 2 and which is incorporated in the pack of Figure 3.

FIGURE 5 is a front elevation of an end wall structure of the module of Figures 1 and 2 and which is incorporated in the pack of Figure 3;

FIGURE 6 is a horizontal section through the end wall of Figure 5;

FIGURE 7 is a fragmentary side elevation of the pack of Figure 3;

FIGURE 8 is a fragmentary side elevation showing a bottom corner of a module erected from the pack of Figure 3, but with the side wall structures omitted for clarity, and

FIGURE 9 is a fragmentary side elevation showing a top corner of a module erected from the pack of Figure 3 but with the side wall structures omitted for clarity.

Referring to Figures 1 and 2 of the drawings there is shown a building module 10 assembled from a knocked down pack which is shown in Figure 3, which includes all the essential components necessary to provide the module.

The module 10 comprises two side walls 11 each made up from four units 12, and two end walls 13, 14, the wall 13 being of lesser height than the wall 14 to provide for an inclined roof 15. The module also includes a load bearing floor 16. The side and end walls of the module may be provided as desired with windows and/or doors or the like.

The floor 16 is provided by a floor structure 20 having a peripheral frame comprising a pair of spaced parallel side frame members 21 inter-connected by end frame members 22, the frame members being made of rolled steel sections. The frame members 21, 22 carry a load bearing platform 23 and are provided with transversely extending reinforcing joints and insulating material in conventional manner. Adjacent each corner the frame is provided with a tubular socket 24. Spigot members 25, see Figure 7, are received within the sockets 24 and bolted thereto by bolts 26 so that an upper end part 27 of each spigot member 25 provides a first connecting means.

The roof 15 is provided by a roof structure 30 which, as best shown in Figure 4, comprises two spaced apart horizontal roof beams 31 of channel shape in cross-section and having a vertically disposed web 32 and laterally inwardly directed horizontal flanges 33.

A roof panel 34 extends between and is secured to the roof beams 32 by attachment directly to the lower flanges 33 thereof. The roof panel 34 comprises an inner skin 35 of plastic coated steel, an outer skin 36 also of plastic coated steel, a timber perimeter framework 37 and the space between them being filled with a foam plastics material 38 which, in the present example, is polyurethane foam.

The inner skin 35 comprises a plurality of planar

plastic coated steel sheets 35a, for example seven. In the present example, the plastic coating is 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 sheet are crimped together as shown at 39 in Figure 4.

The outer skin 36 comprises a plurality of profiled plastic coated steel sheets 36a, for example 3, the plastic coating in the present example providing a white plastisol coating.

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

The roof panel is manufactured by assembling the sheets 35a of the lower skin in crimped relationship in a jig, positioning roof blocks and the peripheral frame 37 on top of the sheets of the lower skin and positioning dividers 40 adjacent the crimped together seams 39. Each divider 40 comprises a base part 40a of plywood and an upper part 40b of expanded polyurethane foam material, the upper surface of which has a configuration corresponding to the configuration of the profile of the sheets 36a of the upper skin 36. These dividers 40 serve to divide the roof panel into sections which are filled, after assembly of the sheets 36a of the upper skin 36 on top of the previously described components through injection grooves provided on the upper surface of one longitudinally extending member of the frame 37.

Also assembled in the jig adjacent each divider 40 is a transversely extending reinforcing member 41 made of steel and of asymmetric channel configuration comprising a web 42 disposed vertically so as to extend normal to the general plane of the inner and outer skins 35, 36, a lower limb 43 of relatively short extent and an upper limb 44 of relatively longer extent, in the present example approximately twice as long as the limb 43. The limbs 43, 44 are disposed so as to extend perpendicular to the web part 42.

If desired, the reinforcing member 41 may be disposed at different positions and a different number of reinforcing members may be provided as described above. Each reinforcing member may be of different shape and/or different material than described above.

At each end, the limb 44 projects longitudinally outwardly of the web part 42 and the lower limb 43 so as to overlie the longitudinally extending members of the frame 37 to be received in a rebate 45 formed therein so that the upper surface of the limb 44 is flush with the upper surface of the longitudinally extending frame member. The lower limb 43 is spaced above the skin 35 so that when foam insulating material, in the present example polyurethane foam, is injected into the sections the insulating material enters the space between the under surface of the limb 43 and the upwardly facing surface of the skin 35, so as to avoid cold bridging between the inner and outer skins for the transverse reinforcing members 51.

The roof panel is connected to the beams 16 by a plurality of bolts 47 which pass through apertures formed in the lower skin 35, longitudinally extending frame members 37, projecting part of the upper limb 44 and the flange 33 of the roof beams 31.

The frames 31 are thus structurally inter-connected solely by the roof panel 40 and it has been found that this provides sufficient strength.

Tubular socket members of rectangular cross-section 48 are bolted to the roof beams 31 at opposite ends thereof and provide second connecting members.

As best shown in Figures 5 and 6 each end wall 13 is provided by a first, or end, wall structure 50 comprising a wall panel 51 in the form of a structural sandwich having an outer plastic coated steel sheet 52 and an inner sheet 53 which in the present example is a gypsum sheet but which may alternatively comprise a suitably coated steel sheet. Sandwiched between and bonded to the inner and outer skins is a foam infilling of further insulating material 54. The panel 51 has a peripheral timber frame 55 and a rectangular section tubular column 56 is secured to the vertical frame members 55 by suitable self tapping screws 57 and a suitable sealant 58 is provided to prevent ingress of water.

At its lower end 61 each column 56 is provided with four openings 59 on the side thereof facing the panel 51, the panel being cut away in way of the openings 59. The openings 59 are spaced similarly to threaded bores 60 provided in the spigot members 27. This lower portion 61 of each column provides a third connecting means.

At its upper end each column 56 is provided with four further apertures 62 in which are received bolts to secure a spigot member 63 therein. Each spigot member 63 is provided with threaded bores 64 spaced similarly to openings 65 provided in the second connecting members 48. The upwardly projecting part 66 of the spigot members 63 provides a fourth connecting means.

The side walls 11 are made up of four sub-units 12 each of which is provided by a second, or side, wall structure 50a, of similar construction to the first, or end, wall structures 50 described hereinbefore but without the columns 56 and with suitable weather proofing strips being provided between the adjacent units 12.

The above described components are assembled together in a knock down pack as illustrated in Figures 3 and 7, from which it will be seen that the floor structure 20 provides a base part of a frame of the pack and the roof structure 30 is connected to and supported

above the floor structure by virtue of the spigot part 27 comprising the first connecting means being received within the tubular socket providing the second connecting means 48. The end wall structures 30 are disposed in the pack between the floor and roof structures with an angle bracket 70 being fastened by bolts 71 to the spigot 27 and to the spigot 63 providing the fourth connecting means. Also disposed in the pack between the floor and roof structures are the units 12 of the side walls.

Up to four such packs can be stacked for transport and up to eight such packs for storage. In Figure 7 a first pack is indicated at P_1 and a second stacked panel at P_2.

A locating stub L aids assembly of one pack on another.

When such a pack has been delivered to site, it is simply necessary to remove the angle bracket 70 and release the other bolt 72 securing the spigot 27 to the socket 48. The roof structure 30 is then lifted using a suitable crane by means of a four member span attached to lifting brackets 73 attached to the tubular members 48. Each pair of lifting brackets 73 at the same end of the roof structure 30 are inter-connected by a removable cross-brace 74.

As the roof structure 30 is lifted the upper end of the end wall structures 50 having the spigot 63 are lifted with it by virtue of a flexible connection 74 whilst the lower end of the end wall structure is moved so that the end wall structure adopts a generally vertical orientation with the upper end of the spigot 63 beneath the socket 48 and so that the socket 61 at the lower end of the wall structure 50 can be manipulated onto the spigot 27, as shown in Figure 8, whilst the spigot 63 is manipulated into the socket 48, as shown in Figure 9. Appropriate bolts are then driven into the sockets to secure the connection.

Where the pack is to provide a ground floor module, or an intermediate module of a multi-storey building, the roof structure is provided with tubular members similar to the members 48 but ones which project above the top surface of the floor structure and spigot members are fastened therein so as to constitute a first connecting means for inter-engagement with third connecting means of the wall structures of the next unit thereabove.

Where the module is a ground floor or intermediate storey the roof panel may be horizontal and may be constituted as described above or may, for economy, comprise a flat, composite panel with a temporary weather proofing membrane.

Where the module is a single storey or top storey of a multi-storey building, the roof beams may slope with the roof panel being fastened directly to them to shed rain water.

If desired, the final building may comprise a plurality of modules described as hereinbefore disposed side by side and in this case side wall panels for one or both sides of the building are provided as appropriate.

The features disclosed in the foregoing description, or the following claims, or 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 module comprising a floor structure, a roof structure and at least one first wall structure in the form of a knocked down pack wherein the floor structure is provided with a first connecting means, the roof structure is provided with a second connecting means and the or each first wall structure is provided with a third and fourth connecting means, the roof structure being supported above the floor structure in the pack by releasable inter-engagement of the first and second connecting means and the third and fourth connecting means being inter-engageable with the first and second connecting means respectively when the pack is erected whereby the roof structure may be supported above the floor structure with the or each first wall structure erected therebetween.

2. A module according to Claim 1 wherein the connecting means comprises spigot and/or socket members.

3. A module according to Claim 1 wherein the first connecting means comprises a spigot member or a socket member and the second connecting means a socket or a spigot member adapted releasably to receive the spigot or the socket member respectively of the first connecting means and the third connecting means comprises a socket member or a spigot member and the fourth connecting means a spigot member or a socket member to inter-engage respectively with the first and second connecting means.

4. A module according to Claim 1 wherein the first connecting means and the second connecting means each comprise a spigot member or a socket member and there being a separate intermediate member in the knocked down pack providing at least one socket or spigot respectively to inter-connect said members and wherein the third and fourth connecting means each comprise a socket member or a spigot member respectively

or wherein the third and fourth connecting means each comprise a spigot member or a socket member respectively with an additional socket member or spigot member provided for each connection.

5. A module according to any one of the preceding claims wherein the or each first wall structure is rotatably inter-connected to the roof structure so that an upper end of the or each first wall structure is lifted when the roof structure is lifted, whilst the opposite end of the or each first wall structure is permitted to move to a position generally vertically below the upper end of the respective wall structure.

6. A module according to Claim 5 wherein the rotatable connection is provided by means of a flexible member inter-connected between the roof structure and the or each first wall structure.

7. A module according to any one of the preceding claims wherein releasable fasteners are provided to inter-connect the first and second connecting means when the pack is knocked down and the first and third and second and fourth connecting means when the building module is erected.

8. A module according to any one of the preceding claims wherein at least one second wall structure, to be orthogonally disposed to the or each first wall structure, is incorporated in the pack, disposed between the floor and the roof structures.

9. A module according to any one of the preceding claims wherein the or each first wall structure comprises a pair of corner columns provided at their lower and upper ends with the third and fourth connecting means respectively and the corner columns being inter-connected by a wall panel.

10. A module according to Claim 9 wherein the wall panel comprises an insulated structural sandwich having inner and outer sheets with an insulating infill therebetween.

11. A module according to any one of the preceding claims wherein the roof structure comprises a pair of spaced parallel roof beams inter-connected by a roof panel.

12. A module according to any one of Claim 11 wherein the roof beams are inter-connected solely by one or more roof panels, the or each roof panel comprising an insulated structural sandwich having inner and outer skins and with an insulating infill therebetween and at least one transverse reinforcing member disposed between said skins and intermediate the ends of the panel.

13. A method of erecting a portable building module comprising the steps of transporting a knocked down pack according to any one of Claims 1 - 12 to site, then disengaging the first and second connecting means and then engaging the third and fourth connecting means with the first and second connecting means respectively to support the roof structure above the floor structure with the or each first wall structure erected therebetween.

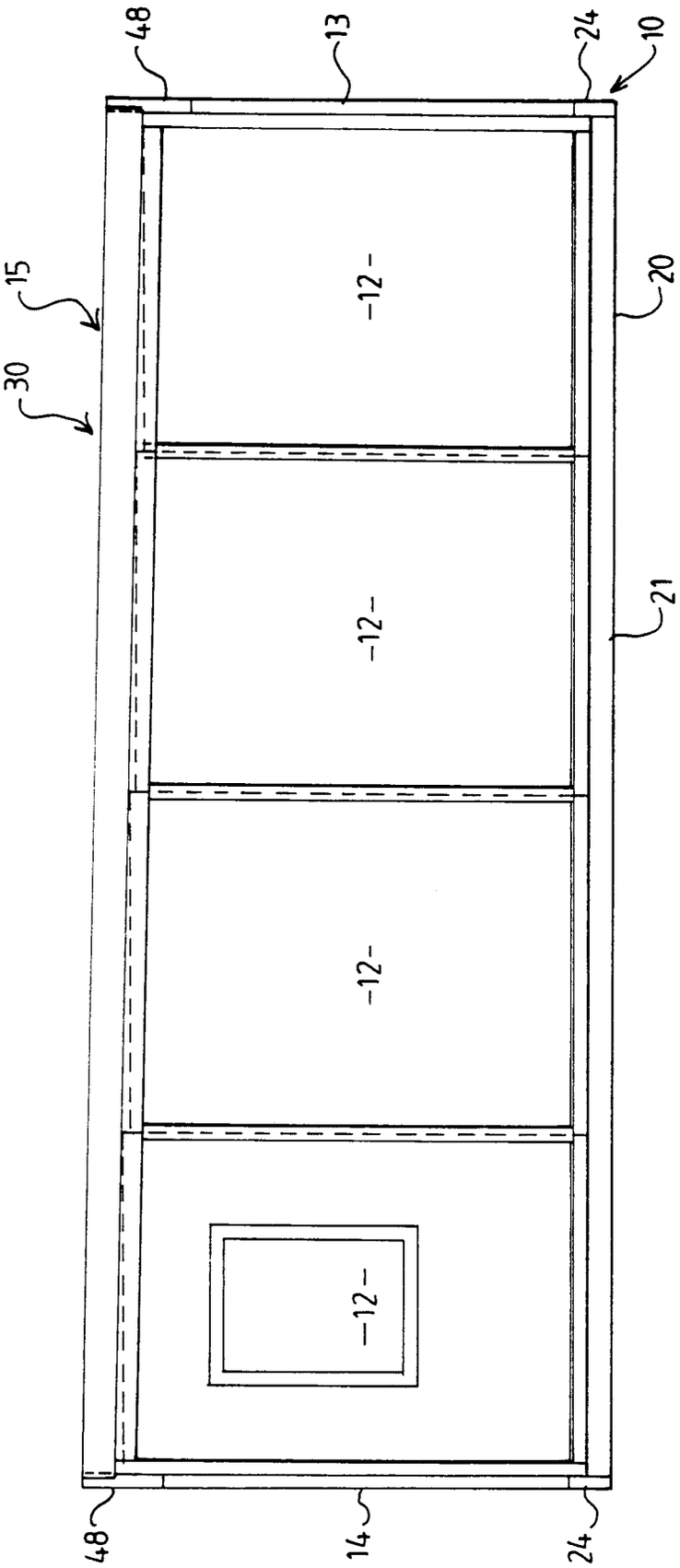


FIG 1

FIG 2

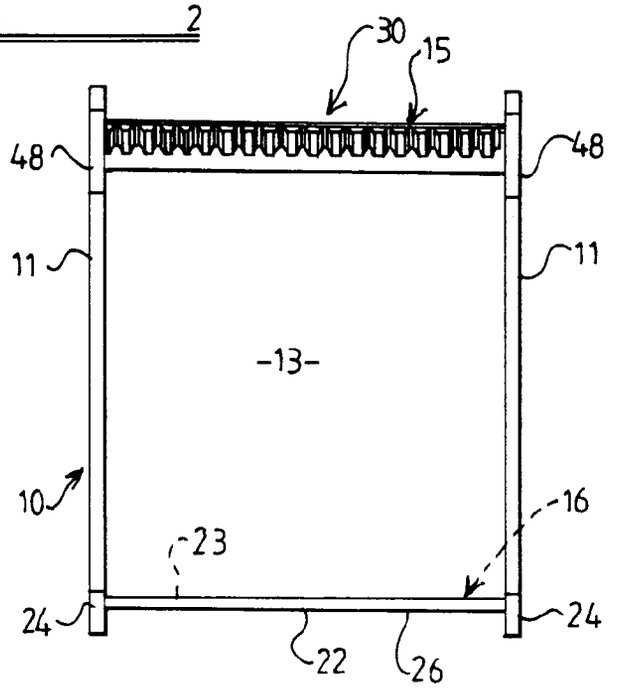
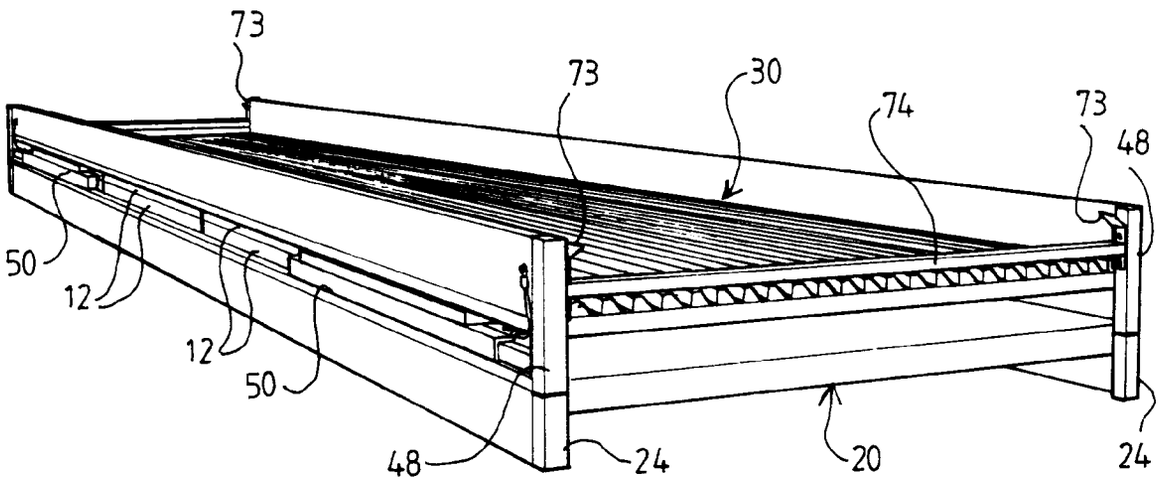

30
15
48
48
11
11
-13-
10
16
23
24
24
22
26

FIG 3


73
73
30
74
73
48
50
12
12
50
48
24
20
24

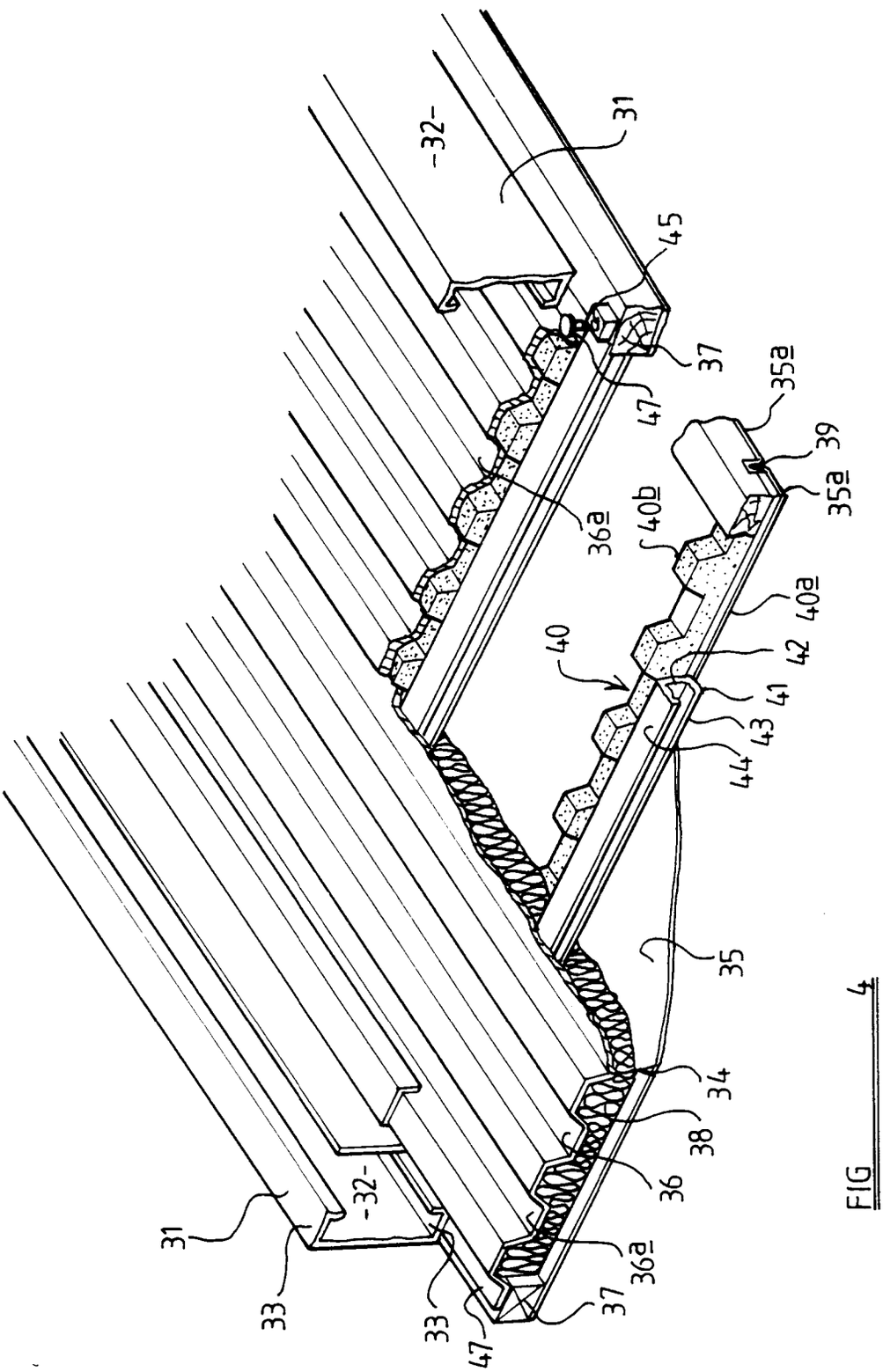

31
-32-
45
37
47
35a
39
35a
40b
36a
40a
42
40
41
43
44
35
34
38
36
36a
37
33
33
47
31
-32-

FIG 4

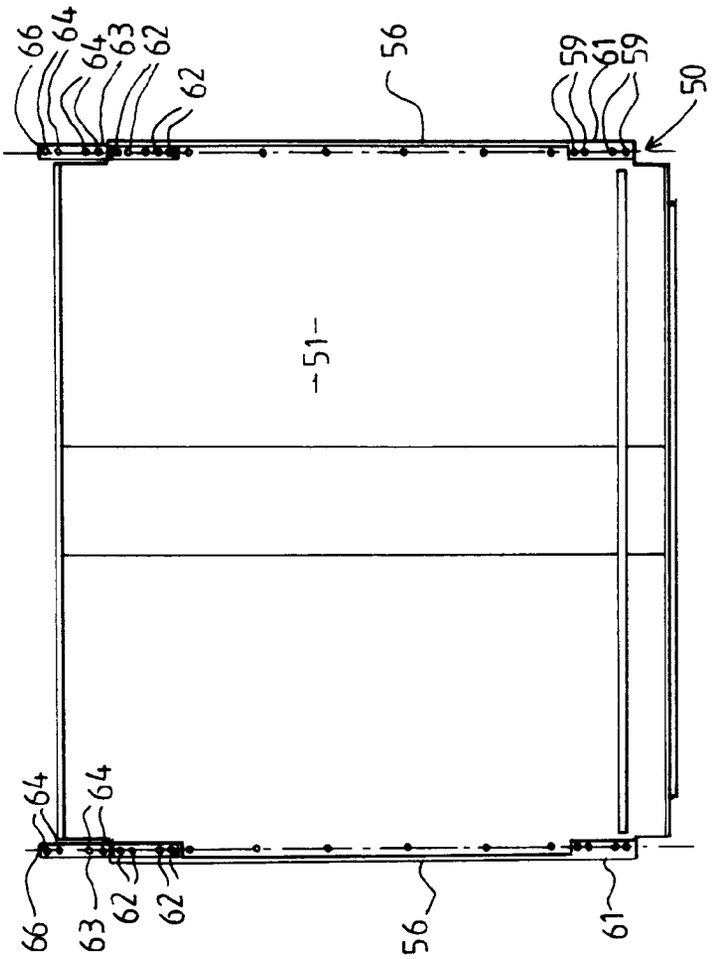

66
64
64
63
62
62
56
59
61
59
50
51
64
64
66
63
62
62
56
61

FIG 5

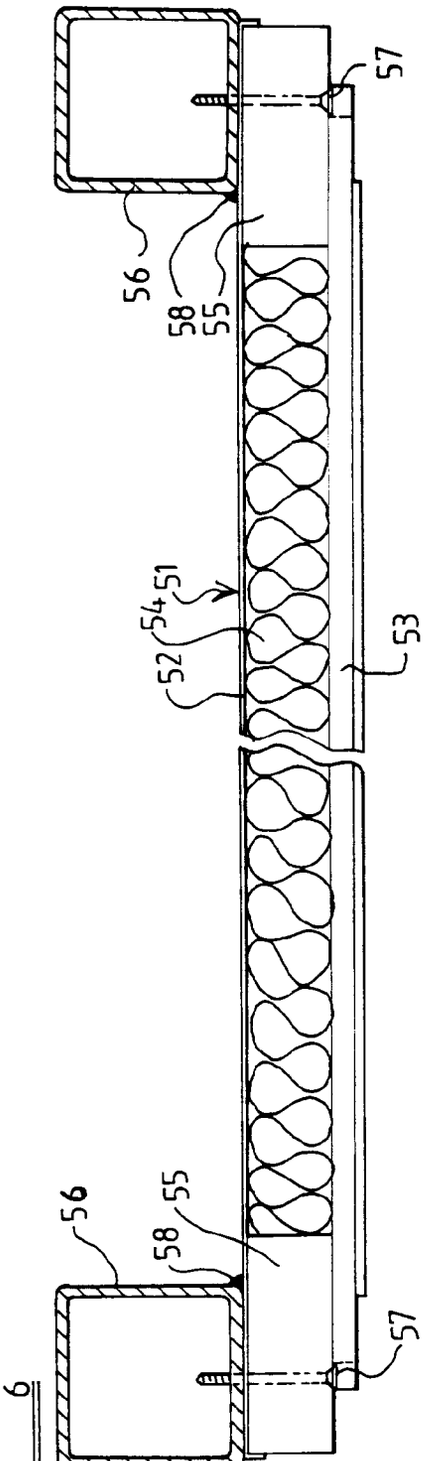
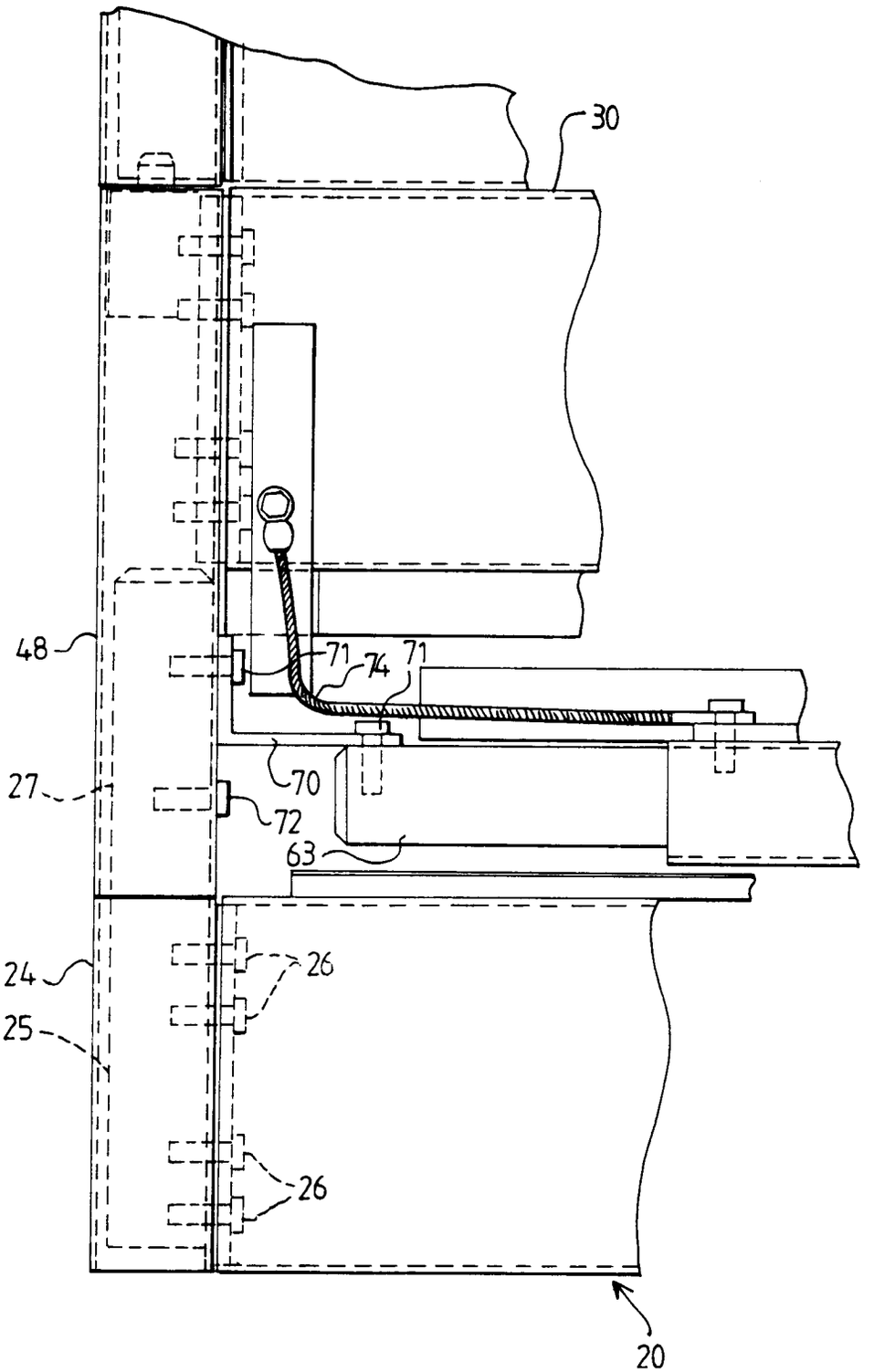

57
56
58
55
51
54
52
53
56
58
55
57

FIG 6

FIG 7



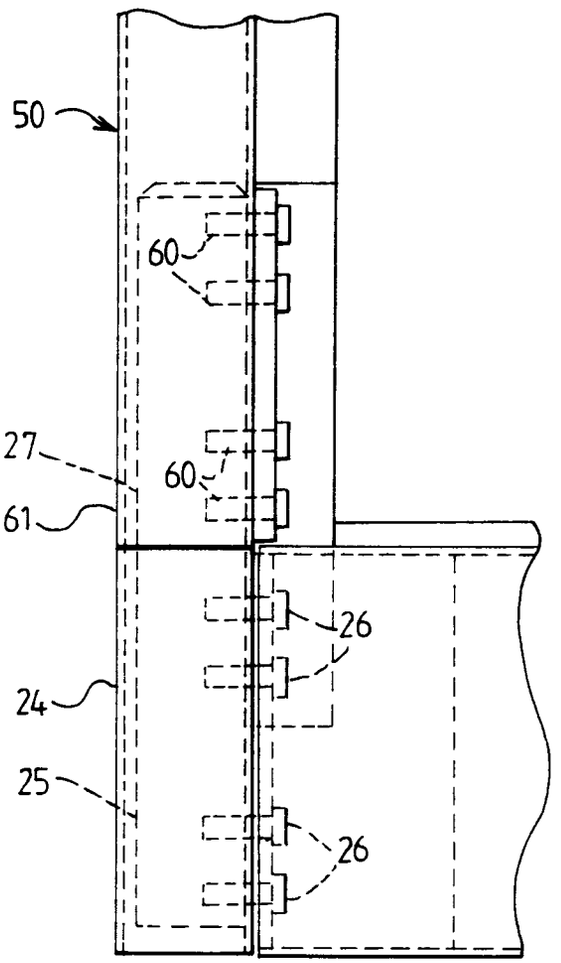


FIG 8

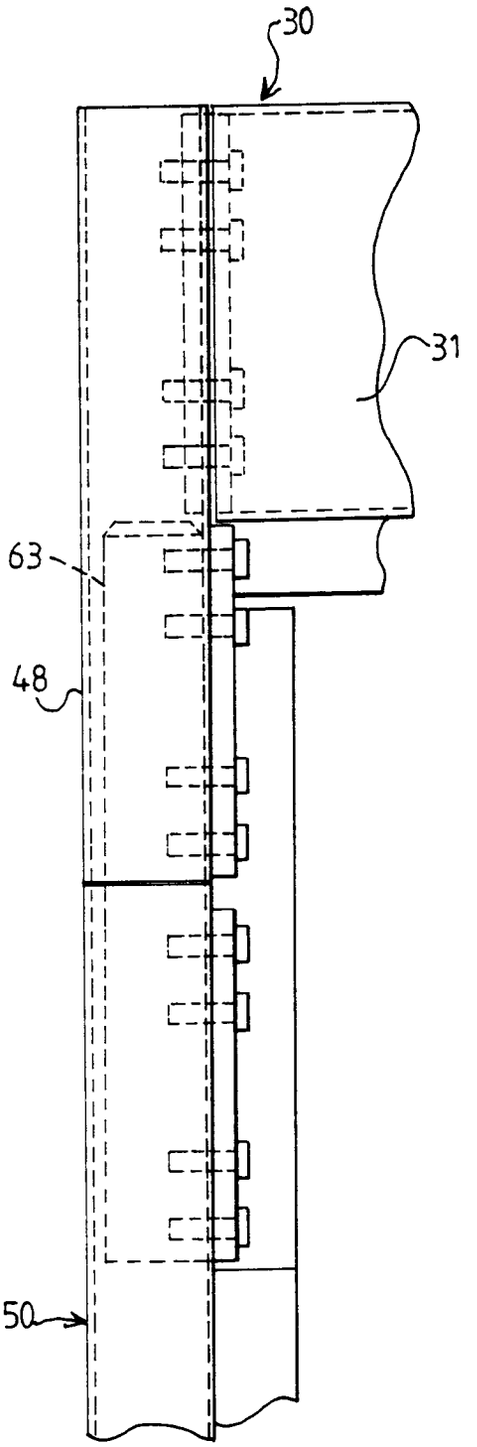


FIG 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 1323

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	US-A-3 023 463 (BIGELOW) * column 1, line 72 - column 4, line 2; figures 1-5 *	1,7,8,10	E04B1/343
A	GB-A-2 160 239 (CLIVE-SMITH) * page 1, line 86 - page 2, line 114 * * page 3, line 81 - line 93; figures 1-5,9 *	1-4	
A	GB-A-1 565 499 (PORTAKABIN LTD) * page 2, line 82 - page 3, line 28; figures 1-4 *	1,5,6	
A	EP-A-0 310 926 (PORTAKABIN LTD) * column 2, line 37 - line 44; figure 7 *	11,12	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 MAY 1992	BARBAS A.

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

EPO FORM 1503 03.82 (P0401)