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(54) Floor structure for portable unit

(57) A floor structure in or for a portable building unit, the floor structure comprising a floor frame comprising a pair of side beams interconnected together by transversely extending joists, a floor panel supported on the floor frame, an underdrawing and insulation material disposed between the floor panel and the underdrawing, characterised in that the underdrawing comprises a sheet spaced from the floor panel with the joists disposed between the floor panel and the underdrawing sheet and thermally insulating material disposed between the floor panel and the underdrawing sheet.

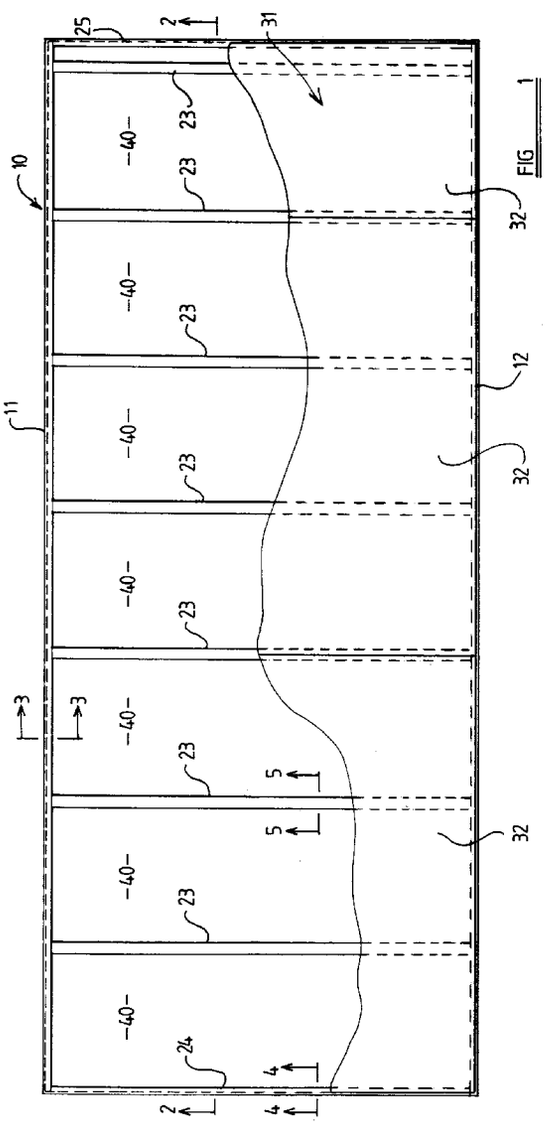

FIG 1

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Description

This invention relates to a floor structure in or for a portable building unit.

EP-B-0,058,354, EP-B-0,105,406 and GB-B-2,084,213 and each disclose an example of a portable building unit which is factory assembled for delivery to a prepared site in assembled condition.

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

The building units of the above mentioned examples have a floor structure which comprises a floor frame comprising a pair of side beams connected together by transversely extending joists and a floor panel supported on the floor frame with an underdrawing of bitumen impregnated fibreboard thermal insulation laid between and supported by the joists with mineral fibre insulation laid between the joists between the floor panel and the underdrawing.

However, such an underdrawing is susceptible to puncturing, for example during transport or handling and this can lead to, for example, a loss of thermal insulation efficiency and infestation by insects.

An object of the present invention is to provide a new and improved floor structure in or for a portable building unit.

According to one aspect of the present invention we provide a floor structure in or for a portable building unit, the floor structure comprising a floor frame comprising a pair of side beams interconnected together by transversely extending joists, a floor panel supported on the floor frame, an underdrawing and insulation material disposed between the floor panel and the underdrawing, characterised in that the underdrawing comprises a sheet spaced from the floor panel with the joists disposed between the floor panel and the underdrawing sheet and thermally insulating material disposed between the floor panel and the underdrawing sheet.

The thermal insulating material may be sandwiched between and bonded to the floor panel and the underdrawing sheet.

The thermal insulating material may comprise a rigid foam expanded plastics material such as a closed cell polymer insulating material, for example, polyurethane.

The floor panel and the underdrawing sheet may engage top and bottom surfaces respectively of the joists.

The underdrawing sheet may be profiled comprising a plurality of spaced parallel recesses in which are received a portion of the joists.

The underdrawing sheet may comprise a metal sheet of, for example, zinc aluminium alloy but, depending on desired service conditions and performance, may be made of other sheet material such as galvanised or colour coated steel, or may be made of sheet material such as aluminium or of a synthetic plastics material such as glass reinforced plastics material.

Since the bottom part of the floor panel is subjected to tension forces in use, it is important that the bottom part of the floor panel can accommodate tension loads. This is achieved, despite the profiled nature of the underdrawing sheet, by the bonding of the underdrawing sheet to the floor panel with the rigid foam expanded plastics material.

Because the floor panel and the underdrawing sheet are made of gas impermeable, or at least substantially gas impermeable, material any gas which permeates outwardly from the expanded plastics material is trapped by the floor panel, underdrawing sheet and the side beams and joists and so is retained within the floor structure, thereby contributing to the thermally insulating properties of the floor panel.

Moreover, during manufacture of the floor structure, by injecting a fluid precursor of the rigid expanded plastics material into a chamber or chambers provided between the side beams, transverse joists, floor panel and underdrawing sheet, gas which is evolved during the injection process is trapped within the chamber because of the impermeable nature of the floor panel and underdrawing sheet and of the beams and joists.

Depending upon the size of the floor structure, the floor panel may comprise a plurality of floor panel elements disposed in side by side relationship.

Similarly, alternatively or in addition, the underdrawing may comprise a plurality of underdrawing sheets.

Where a plurality of underdrawing sheets are provided adjacent edge portions of adjacent sheets may be disposed in overlapping relationship, and in particular in the region of the above mentioned recesses.

Each recess may be of generally trapezoidal configuration comprising a pair of limbs which extend downwardly away from the floor panel and inwardly towards each other and a web part extending between the lower ends of the limbs parallel to the floor panel.

One edge of a one underdrawing sheet of a pair of adjacent underdrawing sheets may be provided with a first downwardly and inwardly inclined limb, a web part at the lower end of the first limb and a second limb which extends upwardly and outwardly away from the web whilst the adjacent edge of the other sheet of the pair is provided with a first, downwardly and inwardly inclined limb, a web part at the lower end of the first limb and a second limb which extends upwardly and outwardly away from the web part, the first limb, web part and the second limb of the other sheet being arranged to be disposed in overlapping relationship with portions of the limbs and web of the one sheet.

A joist may be engaged with an inwardly directed surface of the web part of the one sheet and a fastening may extend through a portion of the joist and of the two web parts to secure said elements together.

Each end underdrawing sheet may be provided with a flange adapted to engage opposite end joists of the floor structure.

Suitable sealing means may be provided between edge parts of each underdrawing sheet where the un-

derdrawing sheet engages end joists and/or the side beams.

The sealing means may comprising a foam plastics tape material.

A thermal break may be provided between the upper surface of the joists and/or side beams and the undersurface of the floor panels.

Examples of the invention will now be described with reference to the accompanying drawings wherein:

FIGURE 1 is a plan view of a floor structure embodying the invention but with the floor panel shown broken away.

FIGURE 2 is a section on the line 2-2 of Figure 1,

FIGURE 3 is a section on the line 3-3 of Figure 1,

FIGURE 4 is a section on the line 4-4 of Figure 1,

FIGURE 5 is a section on the line 5-5 of Figure 1,

FIGURE 6 is a side elevation, with parts omitted, of a first end underdrawing sheet of the floor structure of Figure 1,

FIGURE 7 is a side elevation, with parts omitted, of an intermediate underdrawing sheet of the floor structure of Figure 1,

FIGURE 8 is a side elevation of a second end underdrawing sheet of the floor structure of Figure 1,

FIGURE 9 is a diagrammatic plan view of the floor structure shown in Figure 1, and

FIGURE 10 is a fragmentary longitudinal section of the floor structure of Figure 9, drawn to an enlarged scale and with parts omitted.

Referring to the drawings, a floor structure for use in a portable building unit of, for example, the kind described in any one of EP-B-0,058,354, EP-B-0,105,406, GB-B-2,084,213 and EP-B-0,039,592 or in any other suitable portable building unit is shown at 10 and comprises two parallel longitudinally extending floor side beams 11, 12 disposed to extend along the longitudinal sides of the floor structure. The floor side beams 11, 12 are identical and are made as rolled sections in steel, preferably cold rolled, and are of essentially channel configuration having a web 13, comprising a main part 13a and an upper inclined part 13b which allows an outwardly opening door set to be fitted with a threshold flush with the surface of the floor deck. The side beams 11 and 12 also have top and bottom limbs 14, 15 which extend perpendicular to the web part 13a.

Fastened by rivets to the side beams 11, 12 are a plurality of intermediate cross-beams or joists 23 which extend transversely of the floor structure and are located at spaced positions longitudinally of the side beams 11, 12 at positions intermediate their ends. In addition, end cross-beams or joists 24, 25 are provided to extend between opposite ends of the side beams 11, 12.

The end joists comprise a web 26 comprising a main part 26a and an upper inclined part 26b corresponding to the inclined part 13b and provided for the same purpose. The end joists also have top and bottom limbs 27, 28 with a downwardly depending lip 29 at the free end of the upper limb 27. The length of the web 26 is such that the limb 27 lies in the same plane as the upper limb 14 of the side beams 11, 12 whilst the lower limb 28 is in face to face contact with the upper surface of the lower limb 15 of the side joists 11 and 12.

The intermediate joists 23 are of essentially the same configuration as the end joists 24, 25 and hence the same reference numerals are used but with the addition of a prime sign. The intermediate joists 23 differ only in that the web 26' is planar and the upper and lower limbs 27', 28' are wider than the corresponding limbs 27, 28 of the end joists and they are made of somewhat thicker section. The joists 23, 25 are provided with cut-outs 30 to accommodate the limb 14 of the side beams 11, 12. The limbs 27' of the intermediate floor joists are joggled downwardly at their opposite ends, as shown at 27'a to receive the upper limb 14 of the side beams 11, 12, the flange 14 of the side beams 11, 12 and to enable a screw fixing, not shown, to be applied, thereby securing the limb 14 to the limb 27' of the side beams 11, 12.

In the present example the intermediate joists 23 are 800mm apart and the end joist 24 is at substantially the same spacing from the adjacent intermediate joist 23, whilst the joist 25 is spaced from the adjacent intermediate joists of about 105mm.

Supported from the joists 23, 24 and 25 and the upper limbs 14 of the side beams 11, 12 is a floor deck 31 made of, in the present example, three floor panels 32 made of flooring grade with particle board with a fully bonded vinyl covering. However, if desired, other material may be used.

The nature of the floor deck, which in the present example is 18mm thick and moisture resistant and gas impermeable, provides the floor structure with a solid feel which is aided by the floor covering of vinyl.

The floor structure is provided with an underdrawing which, in the present example comprises a plurality of underdrawing sheets comprising a first end underdrawing sheet 35 as shown in Figure 6, six intermediate underdrawing sheets 36 as shown in Figure 7, and one opposite end underdrawing sheet 37 as shown in Figure 8.

The underdrawing sheets in the present example are made of a zinc aluminium alloy but, if desired, may be made of any other suitable material such as galvanised or colour coated mild steel, or a synthetic plastics material such as glass reinforced plastic.

The underdrawing sheets have co-operating end formations which provide generally trapezoidal shaped

recesses 38. Each recess 38 comprises a pair of downwardly and inwardly inclined limbs 39 with a web 40 extending between their lower ends parallel to the floor deck 31.

The first end underdrawing sheet 35 shown in Figure 6 has a main planar part 35a which, in use, lies parallel to and spaced from the floor deck 31 at a position intermediate the top and bottom ends of the joists 23, 24, 25 and, at one end thereof has a downwardly depending end flange 35b. At the other end there is an end formation F_1 which is adapted to co-operate with an end formation F_2 or F_3 of an adjacent intermediate panel 36.

The end formation F_1 of the underdrawing sheet 35 comprises a first limb part 35c, a web part 35d and a second limb part 35e of shorter extent than the limb part 35c.

Each intermediate underdrawing sheet 36 has a main planar part 36a which lies in the same plane as the part 35a and, at one end, an end formation F_2 having a first limb part 36b, a web part 36c and a second limb part 36d and at the other end an end formation F_3, having a first limb part 36e, a web part 36f and a second limb part 36g. The formations F_2 and F_3 are similarly configured and the sheet thickness is such that a formation F_2 or F_3 of one sheet can nest in a formation F_3 or F_2 respectively of an adjacent sheet, as hereinafter to be described in more detail.

The other end underdrawing sheet 37 likewise has a main planar part 37a which lies in the same plane as planar parts 35a and 36a and an end downwardly depending flange 37b. At its other end it has an end formation F_4 comprising a first limb part 37c, a web part 37d and a second limb part 37e. The web part 37d of this sheet is somewhat wider than the web parts 36c and 36f of the other sheets. In the present example the web parts 36c and 36f are 70mm long, whilst the web parts 35d and 37d are 80mm long.

The underdrawing sheets 35, 36, 37 are assembled together as described hereinbefore and as shown in Figures 2, 5, 9 and 10. Initially, the central sheet marked 1 in Figure 9 is positioned. The remaining sheets 2a, 2b and 3a, 3b are then positioned working outwards towards each end and finally the end sheets 4 and 5 are positioned.

Sheet 1 and the sheets 2a, 2b and 3a, 3b are underdrawing sheets 36 with the sheets 2a and 2b being orientated as shown in Figure 7, whilst the sheet 1 and the sheets 3a and 3b are orientated at 180° to the orientation shown in Figure 7. It will be noted that at the junction of the left-hand side of sheet 1 with the sheet 2 the formations F_3 of the respective sheets are nested, whereas at the junction between the two sheets 2a and 2b formation F_2 is nested within formation F_3 whilst at the junction between sheet 4 and the left-hand end of sheet 2b region F_2 is nested with the region F_1. Similarly, at the junction between sheet 1 and sheet 3a region F_2 is nested with region F_3, whilst at the junction between sheet 3a and sheet 3b formation F_2 is nested within formation F_3, and at the junction between sheet 3b and sheet 5 formation F_2 is nested within formation F_4.

To ensure that end flange 35b of the first end underdrawing sheet 35 shown in Figure 6 and shown at 4 in Figure 9 and end flange 37b of other end underdrawing sheet 37, shown in Figure 8 and at 5 in Figure 9, are in contact with the internal faces of the two end joists 24 and 25, and web part 37d of other end underdrawing sheet 37 is made wider than the web parts 36c, 36f of the intermediate sheets 36, (in the present example 10mm wider) to accommodate any tolerance in spacing of the components. If desired the web part 35d of first end underdrawing sheet 35 may, alternatively or in addition, be made wider than the web parts 36c, 36f.

Received in the recesses thus formed are the bottom limbs 28' of the intermediate joists 23 and a fastening, such as a rivet 38, extends through apertures provided in the overlapping web parts and in the limb 28' to secure the sheets and limb together.

The downturned flanges 35b, 37b abut the webs of the end joists 24, 25 respectively whilst the edges of the sheets which are adjacent the side beams 11, 12 abut the webs 13 thereof with a foam tape 39 or other suitable sealing material being provided to provide a gas tight seal therebetween.

The floor deck panels 32, which are secured to the upper limbs of the joists and side beams by suitable self tapping screws, together with the underdrawing sheets 35 - 37 and the end beams and joists, provide a plurality of chambers 40 each of which is filled with rigid foam expanded plastics material such as polyurethane foam in conventional manner and preferably using the method and apparatus described in a co-pending application, reference no. A8155GB. The foam material, shown in the drawings diagrammatically at 41, is bonded to the above described components and thus provides a composite structural sandwich floor structure which is capable of accommodating tension forces in the lower part of the panel.

If desired, a suitable thermal break such as wood or other thermally insulating material may be provided between the upper surface of joist and/or the side beams and the underside of the floor deck panels 32.

The provision of the above described underdrawing sheets ensures that thermal efficiency is maintained and minimises risk of puncturing during transport and handling and because the non-permeable nature of the components of the floor structure which define the chambers 40 any loss of the gas from the cells of the foam plastics material is minimised. In the present example the cells contain carbon dioxide which has relatively good thermal insulation properties and therefore even if carbon dioxide permeates from the foam plastics material it is retained within the floor structure because of the impermeable nature of the components defining the chambers.

The composite structure described hereinbefore permits the spacing of the joists to be increased compared with that provided previously for joints of the same

size. In the present example the joists are spaced 800mm apart whilst hitherto the spacing had typically been 400mm. If desired the spacing and size of the joists may be varied from that described hereinbefore as appropriate for the load conditions encountered in service.

In the present example the foam plastics material has a thickness of approximately 50mm but if desired it may be of a different thickness either greater or smaller and the underdrawing sheets being profiled accordingly. If desired the underdrawing sheets may be planar in which case the foam plastics material would have a thickness corresponding to the depth of the joists.

In order to prevent the foam plastics material preventing access to rivet nuts 43, attached to the beams 11, 12 and end joists 24, 25 for securing wall panels and other components to the building structure, wood particle board packers 42 are provided as shown in Figures 3 and 4.

In addition a foam tape is positioned between the main parts 35a and 37a of the end underdrawing sheet and the particle board packers 42.

The end joists 24, 25 and the side beams 11 and 12 are connected together at the four corners of the floor using a connecting angle 9 to which the webs of the joists and side beams are riveted. The end underdrawing sheets 35 and 37 are provided with recesses at the corners having the flanges 35b and 37b to accommodate the angle 9.

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 floor structure in or for a portable building unit, the floor structure comprising a floor frame comprising a pair of side beams interconnected together by transversely extending joists, a floor panel supported on the floor frame, an underdrawing and insulation material disposed between the floor panel and the underdrawing, characterised in that the underdrawing comprises a sheet spaced from the floor panel with the joists disposed between the floor panel and the underdrawing sheet and thermally insulating material disposed between the floor panel and the underdrawing sheet.

2. A floor structure according to claim 1 wherein the thermal insulating material is sandwiched between and bonded to the floor panel and the underdrawing sheet.

3. A floor structure according to claim 1 or claim 2 wherein the thermal insulating material comprises a rigid foam expanded plastics material such as a closed cell polymer insulating material, for example, polyurethane.

4. A floor structure according to any one of the preceding claims wherein the floor panel and the underdrawing sheet engage top and bottom surfaces respectively of the joists.

5. A floor structure according to any one of the preceding claims wherein the underdrawing sheet is profiled comprising a plurality of spaced parallel recesses in which are received a portion of the joists.

6. A floor structure according to any one of the preceding claims wherein the underdrawing sheet comprises a metal sheet or a sheet of a synthetic plastics material.

7. A floor structure according to any one of the preceding claims wherein the floor panel and the underdrawing sheet are made of gas impermeable, or at least substantially gas impermeable, material.

8. A floor structure according to any one of the preceding claims wherein the floor panel comprises a plurality of floor panel elements disposed in side by side relationship.

9. A floor structure according to any one of the preceding claims wherein the underdrawing comprises a plurality of underdrawing sheets.

10. A floor structure according to claim 9 wherein adjacent edge portions of adjacent sheets are disposed in overlapping relationship.

11. A floor structure according to claim 5 or any one of claims 6 to 10 when dependent on claim 5 wherein each recess is of generally trapezoidal configuration comprising a pair of limbs which extend downwardly away from the floor panel and inwardly towards each other and a web part extending between the lower ends of the limbs parallel to the floor panel.

12. A floor structure according to claim 10 or claim 11 wherein one edge of a one underdrawing sheet of a pair of adjacent underdrawing sheets is provided with a first downwardly and inwardly inclined limb, a web part at the lower end of the first limb and a second limb which extends upwardly and outwardly away from the web whilst the adjacent edge of the other sheet of the pair is provided with a first, downwardly and inwardly inclined limb, a web part at the lower end of the first limb and a second limb which extends upwardly and outwardly away from the web

part, the first limb, web part and the second limb of the other sheet being arranged to be disposed in overlapping relationship with portions of the limbs and web of the one sheet.

13. A floor structure according to claim 11 or claim 12 when dependent on claim 11 wherein a joist is engaged with an inwardly directed surface of the web part of the one sheet and a fastening extends through a portion of the joist and of the two web parts to secure said elements together.

14. A floor structure according to any one of the preceding claims wherein each end underdrawing sheet is provided with a flange adapted to engage opposite end joists of the floor structure.

15. A floor structure according to any one of the preceding claims wherein sealing means is provided between edge parts of each underdrawing sheet where the underdrawing sheet engages end joists and/or the side beams.

16. A floor structure according to claim 15 wherein the sealing means comprises a foam plastics tape material.

17. A floor structure according to any one of the preceding claims wherein a thermal break is provided between the upper surface of the joists and/or side beams and the undersurface of the floor panels.

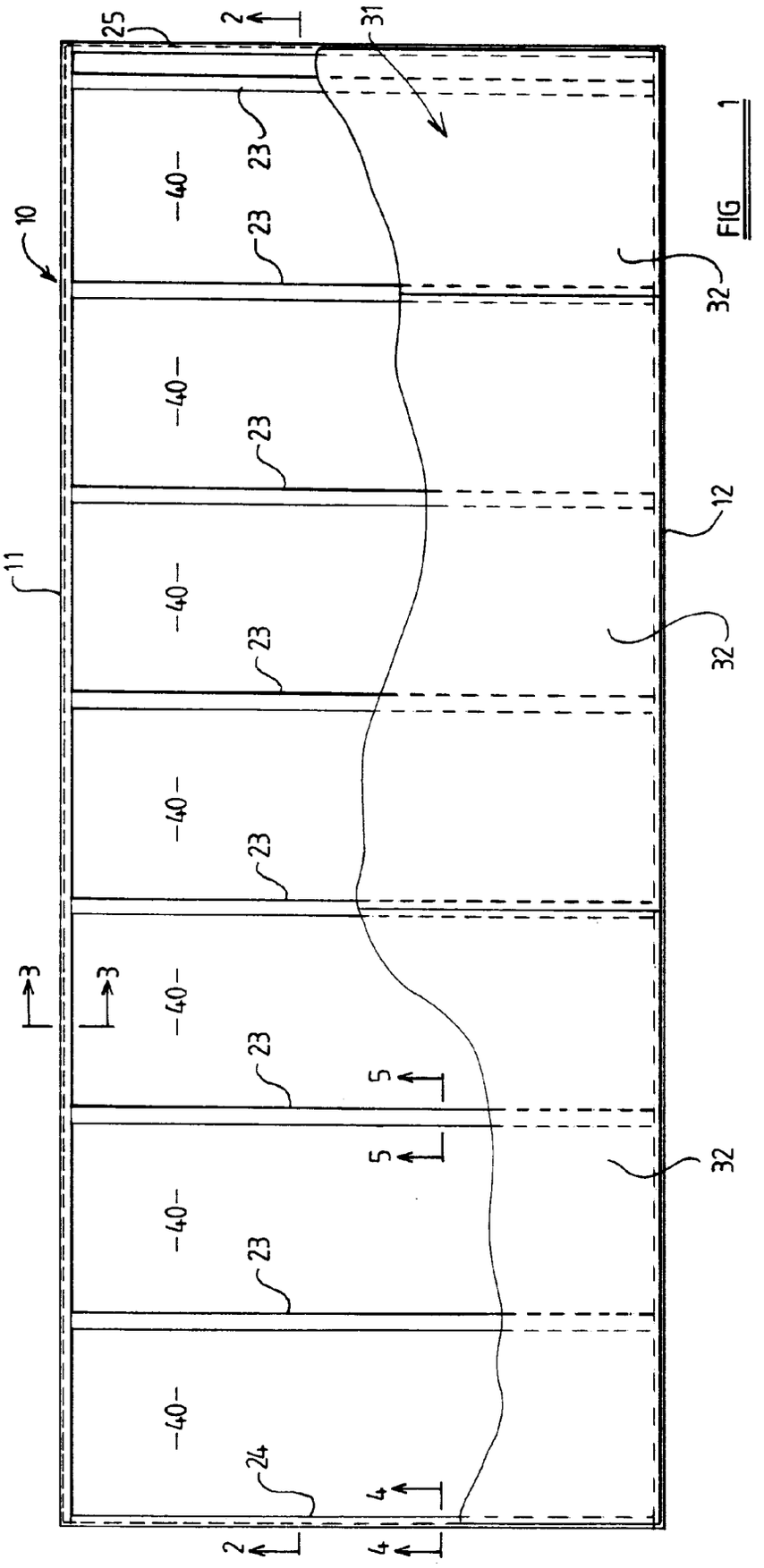


FIG 1

FIG 2

FIG 3

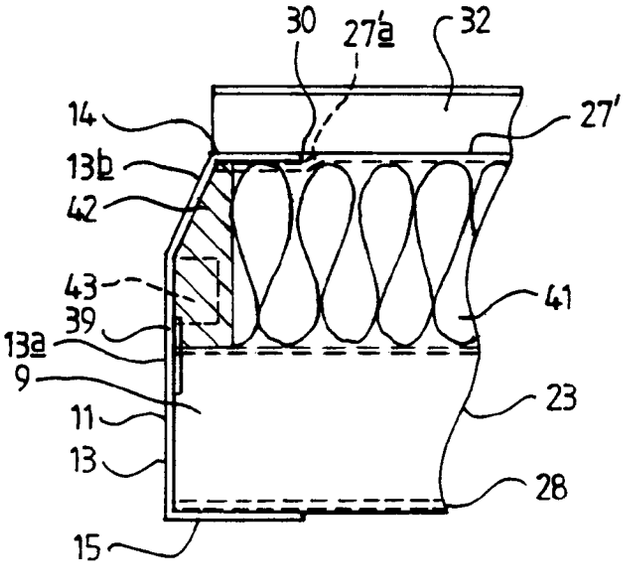


FIG 4

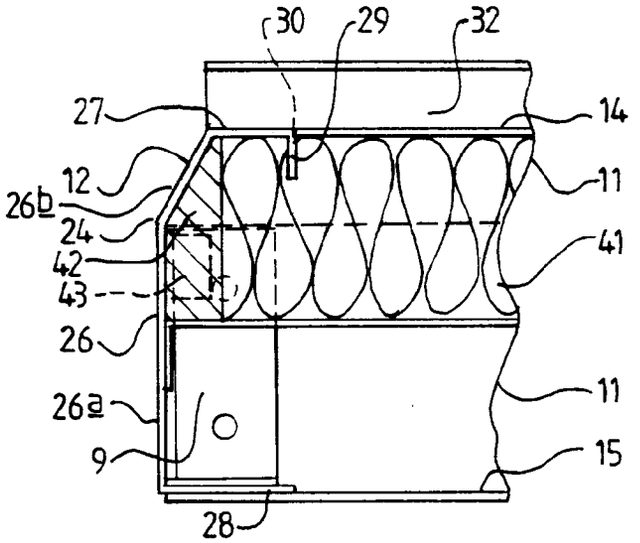
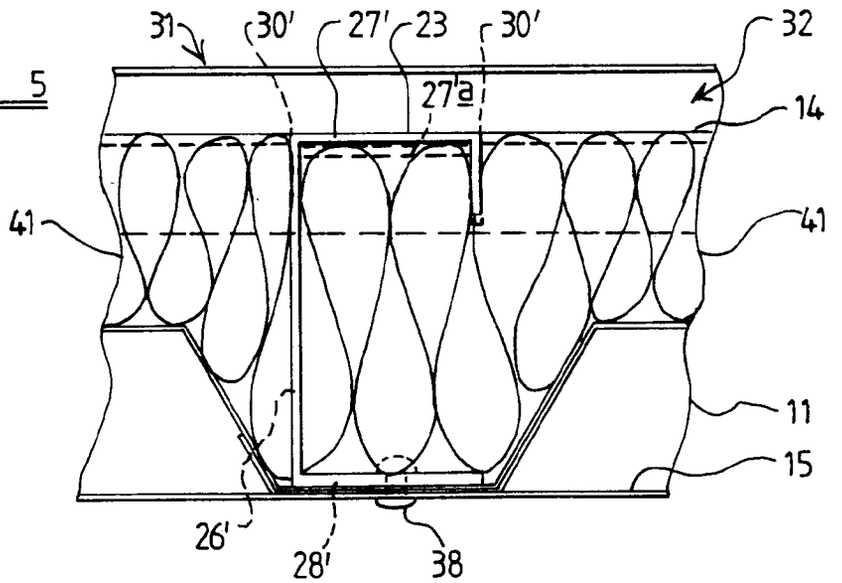


FIG 5



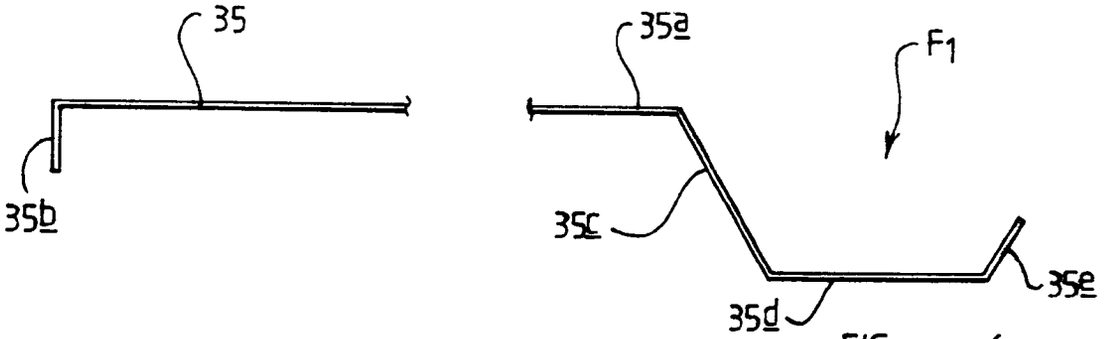


FIG 6

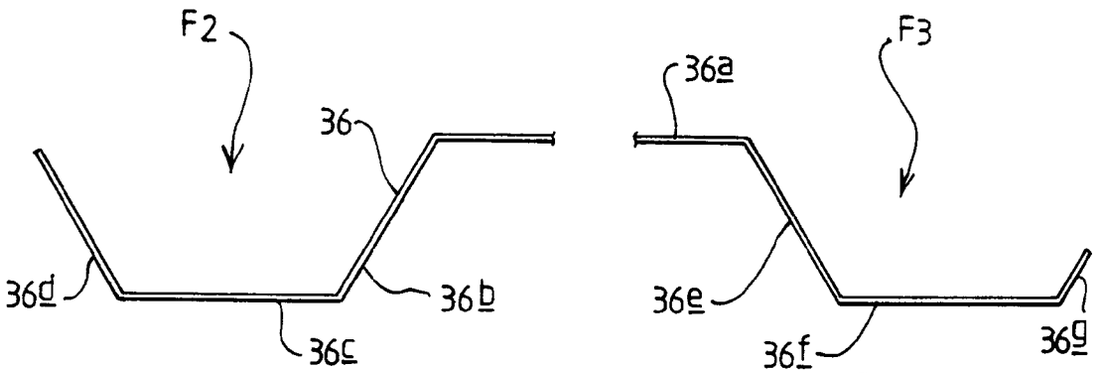


FIG 7

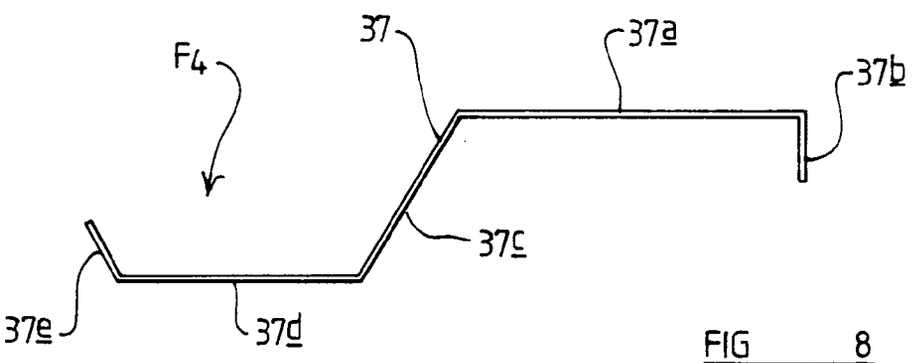


FIG 8

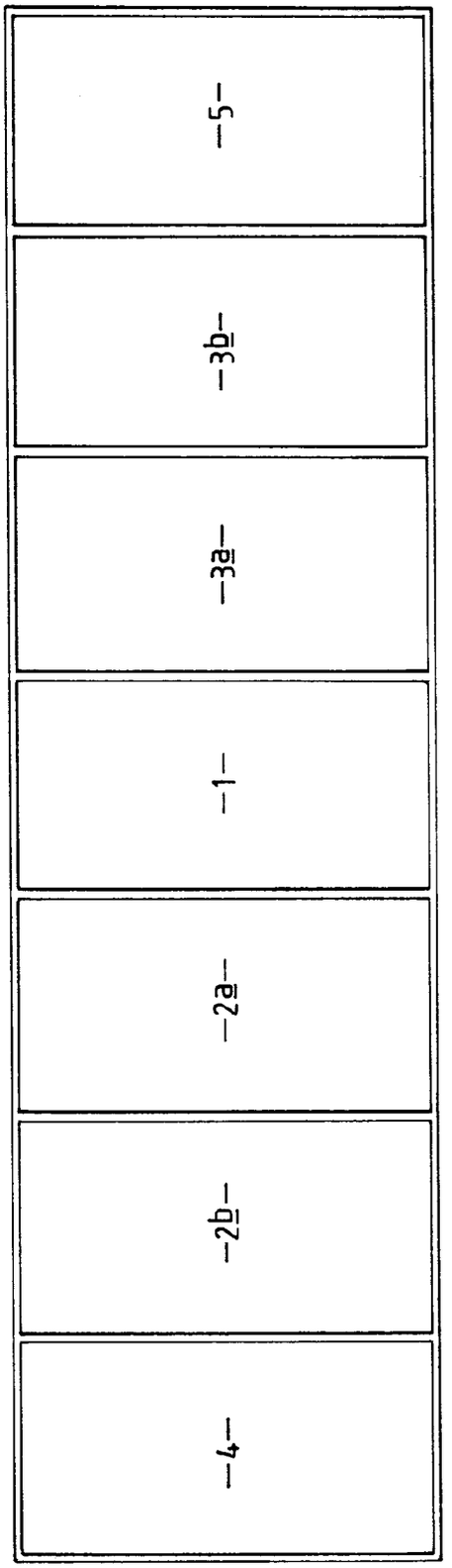


FIG 9

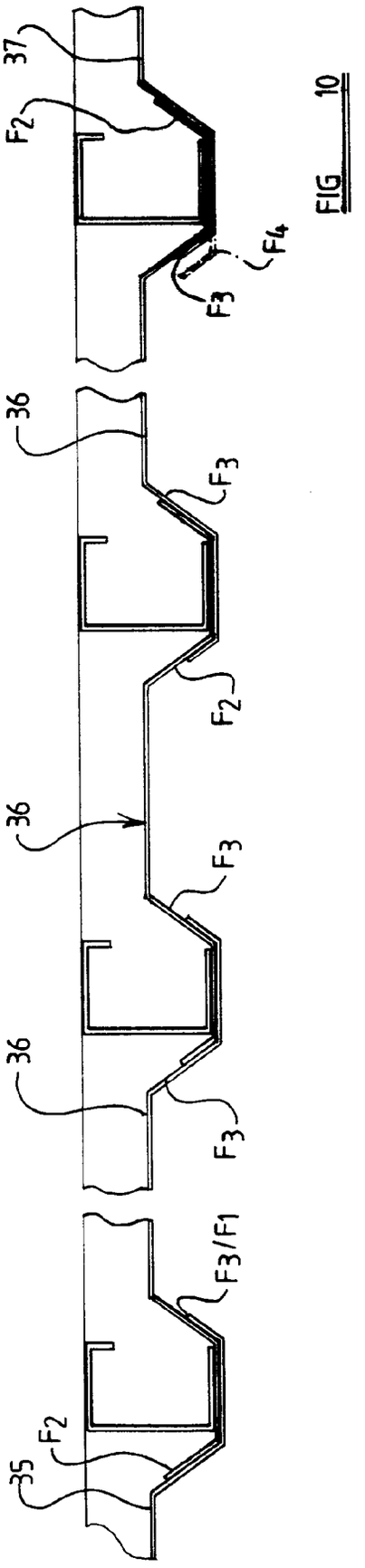


FIG 10