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(54) Improvements in or relating to panels

(57) Panels (1,1a) for roofing or cladding comprise a box-like section suitable for containing insulating material and first and second cooperating formations which cooperate to interlock adjacent panels in use. A resilient sealing material (11) is disposed at the side of the panel such that, on interlocking, the sides of adjacent panels are urged together to compress the resilient sealing material. Advantageously, the panels include an outwardly extending lip (8a) along one side edge and a lip receiving portion (12) along an opposite side edge on one or both of which the resilient sealing material may be disposed.

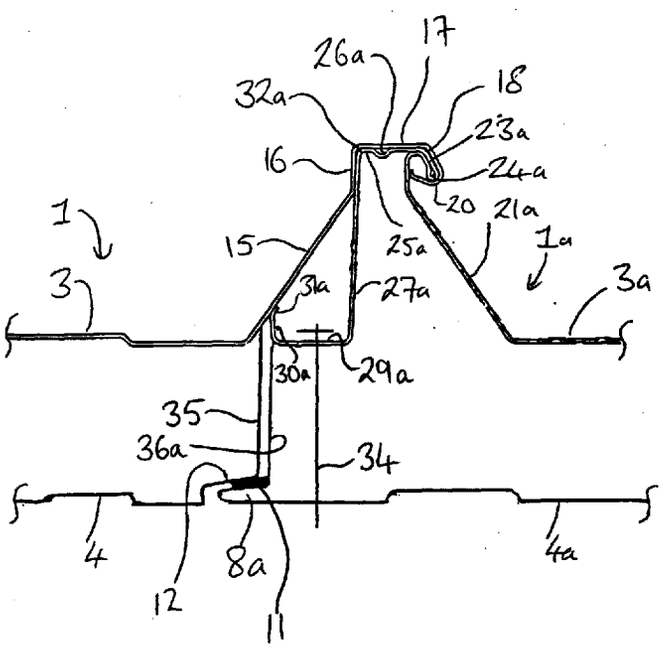

Fig 3b

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Description

[0001] The present invention relates to panels, sheeting and cladding members, and in particular to interlocking panels for roofing and cladding of buildings.

[0002] Panels for cladding and roofing are well known and in general comprise a sheet of material, which may include strengthening ribs, which is attached to a roof supporting structure by suitable fastening means such as nails, bolts screws or clips. Adjacent panels may be joined together to form a single structure and formations may be provided at the edges of the panel to achieve this, such as by seaming the panels together. It is also known to provide interlocking panels wherein first and second interlocking formations are formed along opposed edges of the panel. The first interlocking formation of one panel is constructed to cooperate with the second interlocking formation of an adjacent panel to join the panels together. It is desirable that the fastening means are concealed in order to protect them from the atmosphere and to avoid corrosion.

[0003] So called composite panels are also known in which the panel includes a box-like section formed from first and second sheet members which form the respective outer surfaces of the panel and an insulating layer located between the first and second sheet members. The conventional method of securing composite panels to a supporting structure has been to drill through the sheet and leave the fixing exposed or to fit a continuous metal cap over the particular area where the fixings are located, in order to conceal them. Although the metal cap may protect the fixings from the environment, an additional on-site operation is required in fitting the cap and the cap has a tendency to fall off over time. The improved appearance of the panel achieved by concealing the fastening means and the protection of the fixings from the weather depend on the integrity of attachment of the metal cap and this is not reliable.

[0004] A particular problem with composite panels is that relatively warm moist air from inside the building (of which the panels form the roof) is able to enter the gap between adjacent panels. The outer areas of the panels are colder which causes the moisture in the air to condense onto the panels and thus to drip back into the building. Although it has been suggested to provide vapour seals between adjacent panels, these have not been sufficiently effective.

[0005] Accordingly, the present invention seeks to provide an interlocking composite panel, in particular for roofing or cladding, having one or more of the following advantages, that is, providing excellent weather-proofing, allowing concealed fixing to the supporting structure, requiring the minimum of on-site operations during installation of the panel and providing an effective vapour seal to prevent moisture penetration between adjacent panels.

[0006] According to a first aspect of the present invention there is provided a panel comprising a box-like section having first and second opposed major faces and first and second opposed minor faces connecting said opposed major faces, and

first and second cooperating formations defined along opposed marginal portions of the first major face, the first cooperating formation of a first panel being adapted to engage the second cooperating formation of an adjacent second panel to interlock the panels, and

a resilient sealing material disposed along a length of said box section adjacent a corner formed between the second major face and a minor face,

whereby on engagement of the first cooperating formation of a first panel with the second cooperating formation of an adjacent second panel the sealing material is placed in compression to form a seal between said panels.

[0007] A particular advantage of the panel of the present invention is that the sealing material can be applied to the panel in the factory and so an additional on site operation is avoided. Furthermore, because the sealing material is resilient and is placed in compression, a greatly improved seal is achieved.

[0008] In a preferred embodiment of the invention, an insulating material is contained in the box-like section of the panel. In this embodiment, the exposed side edges of the insulating material may form the said first and second opposed minor faces of the panel.

[0009] In a preferred form of the invention, the resilient sealing material is disposed directly on one or both of said minor faces.

[0010] In another preferred form of the invention, the panel further comprises an outwardly extending lip formed along a first marginal portion of the second major face and a lip receiving portion extending along a second marginal portion of said second major face opposed to said outwardly extending lip and wherein said resilient sealing material is disposed along said outwardly extending lip and/or along said lip receiving portion.

[0011] Preferably, the outwardly extending lip projects in a direction substantially parallel to the second major face of the box-like section. Preferably a face of the outwardly extending lip is contiguous with said second major face and the sealing material is disposed along a face of said lip opposite said contiguous face. Preferably the sealing material is a flexible cellular foam such as EPDM. Other suitable sealing materials include polyethylene foams.

[0012] In a further variation of this form of the invention, the lip receiving portion comprises a rebate defined along the edge of said second major face. Desirably the rebate is so sized as to allow the outwardly extending lip to lie in the rebate such that in use the second major faces of adjacent panels lie flush to one another.

[0013] Preferably the panels of the invention are made from metal sheet such as aluminium or steel sheet. Other suitable materials include plastics materials and laminates.

[0014] In a particularly preferred embodiment of the invention, the first and second cooperating formations of adjacent panels, when interlocked, define a closed void including a securing surface which surface operatively may cooperate with fastening means to retain the panel in its position of use.

[0015] In a another preferred embodiment of the invention, the first and second cooperating means on interlocking act to latch adjacent panels together such that after such latching one panel can be rotated about the cooperating formation of the other panel through at least 25° to unlatch the sheet and further rotation is required before the formations can be separated. This construction provides advantageous strength characteristics and improved interlocking.

[0016] In this embodiment of the panel, the first cooperating formation comprises a hook member wherein the hook portion is directed away from said box-like section and the second cooperating formation comprises a hook-receiving member and a valley portion extending along the marginal edge. The hook receiving portion of the hook receiving member is directed towards the box-section and away form the valley portion. The hook member of a first panel can hook over the hook receiving member of an adjacent second panel and cover its valley. In this way, fastening means by which the panel is attached to a supporting structure can be concealed in the valley portion which is covered by the hook member.

[0017] According to a second aspect of the invention there is provided a roofing structure comprising a plurality of panels of the first aspect of the invention.

[0018] In a preferred form of this second aspect of the invention, the first and second cooperating formations of adjacent panels, when interlocked such that the panels form a roof surface, define a closed void including a securing surface and the roof structure is secured to a support structure by fastening means each having a head portion which engages respective said securing surfaces and an engagement portion which engages said support structure thereby to retain the panels in position, and wherein each said head portion is disposed within said closed void.

[0019] For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example only, to the following drawings, in which:

Figures 1a and 1b are transverse section through panels according to the invention,

Figure 2 is a section showing, on a larger scale, the inter-connection between two adjacent panels. For reasons of clarity, the box-like section has been omitted, except for the first major face,

Figures 3a and 3b are transverse sections through the adjoining portions of a pair of panels according to two embodiments of the invention.

Figures 4 and 5 are schematic cross-sectional views (not to scale) of examples of prior art fastening techniques for conventional panels, and

Figures 6 and 7 are schematic cross-sectional views (not to scale) of examples of prior art fastening techniques for composite panels.

[0020] Referring now to Figure 4, the panels 41, 41a include complementary hook-like formations 45, 45a and 46, 46a which are adapted to engage around clips 47. The clip 47 includes an enlarged head portion 48 about which formations 45a, 46 (in the embodiment illustrated) are seamed. Each clip has a short length of, say, 5cm and several clips are provided along the length of each panel 41, 41a. The clips 47 are attached to the supporting structure 49 by suitable fastening means, illustrated schematically at 40, such as nails, bolts and screws.

[0021] Figure 5 illustrates a similar clip 57, having an enlarged head 58, onto which a panel 51 is secured by a "snap" fit. The clip 57 is attached to the supporting structure 59 by suitable fastening means 50. Again, each clip 57 has a relatively short length of say 5cm.

[0022] The clip of Figure 4 may be adapted for use with composite panels and may notionally be adapted to accommodate a vapour seal by making the clip 47 continuous along the length of the panel. Two vapour seals would then be required, one each between respective side faces of the upright portion of the clip and the side faces of adjacent panels. It is believed that such a solution would be prohibitively expensive in use and is not likely to provide an adequate vapour seal. It is not considered possible to adapt the clip of Figure 5 to provide a vapour seal with a composite panel.

[0023] In Figure 6 there is shown a fastening technique for composite panels in which a vapour seal is provided. Each panel 61, 61a includes a formation 62 which is adapted to overlap an adjacent panel. A vapour seal 63 is provided between the adjacent panels. The panels 61, 61a are secured to the supporting structure 69 directly by fastening means such as screws, nails or bolts illustrated at 60. The fastening means remain exposed to the atmosphere and are commonly subject to corrosion. Also, the vapour seal achieved by this technique is often inadequate.

[0024] Figure 7 illustrates a further prior art technique for attaching composite panels in which the panels 71, 71a lie adjacent one another but do not overlap. The panels 71, 71a are secured to the supporting structure 79 directly by means of fastenings 70 which may suitably be screws, nails or bolts. The fastening means 70 are covered by a metal cap 72 and a vapour seal 73 is provided between adjacent panels. The metal cap 72 is

liable to become dislodged over time, exposing the fastening means 70 to the atmosphere so that they may corrode, and the vapour seal 73 is, again, often inadequate.

[0025] Referring now to Figures 1 to 3, the panel 1 comprises a box-like section 2 having first and second opposed major faces 3, 4 and first and second opposed minor faces 35, 36. The panel may be made from any suitable material, although steel and aluminium are preferred. The depth "T" of the box-section may be selected as desired in accordance with the desired use of the panel. Similarly, the width of the panel may be selected as desired.

[0026] First and second cooperating formations 5, 6 depend from the first major face 3 at opposed marginal portions thereof, that is, towards opposite side edges of the box-like section. The space formed between the first and second opposed major faces 3, 4 may be filled with an insulating material 7, preferably during production at the factory. The opposed minor faces 35, 36 may be defined by the side edges of the insulating material 7.

[0027] In the embodiment of Figures 1b and 3b an outwardly extending lip 8 is formed along a marginal portion of the second major face 4 of the box-like section 2. The lip 8 includes a face 9 which is contiguous with the second major face 4 and an opposite face 10 on which a layer of resilient sealing material 11 is formed. At a marginal portion of the second major face 4 opposite the lip 8, a lip receiving portion 12 is formed. The lip receiving portion 12 will generally have a width of between 10mm and 40mm and is in the form of a rebate along the edge of the second major face 4. The lip receiving portion 12 is so sized to accommodate the lip 8 such that the face 9 of the lip 8 of a first panel may, in use, be substantially flush with surfaces 4b of the second major face 4. In a variation of the invention, the resilient sealing material may alternatively or additionally be disposed along the lip receiving portion. Ribs 13 may be formed in the first and second major surfaces 3, 4 for additional strength and rigidity.

[0028] In the embodiment shown in Figures 1a and 3a, the lip and lip receiving portion are absent. The resilient sealing material 11 is disposed between the minor faces 35, 36 and may, during production, be attached to either or both of said faces. It will be appreciated that the resilient sealing material may be disposed at any point along the minor faces 35, 36, but is preferably located near to the second major face 4.

[0029] The first cooperating formation 5 includes a hook formation 14. The hook formation 14 includes a sloping part 15 a wall 16 which is approximately at right angles to the first major face 3, a flat 17 and downwardly and inwardly projecting parts 18, 19 which together constitute a hook having a curved part 20. In the embodiment illustrated, the outer edge of the part 19 is curved to be approximately parallel to the wall 16 and to allow run out of the material on roll forming.

[0030] The second cooperating formation 6 comprises a sloping part 21, the upper end 22 of which is approximately at right angles to the first major face 3 and is then folded at a part 23 which together with wall 22 defines a hook receiving formation. The lower end of the folded part 23 is formed as a hollow bead 24 and the rolled material of the panel is then formed as a platform 25 with a recess 26 and a side wall 27 approximately at right angles to the first major face 3. A valley 28 is formed integrally with the first cooperating formation 6. The floor 29 of the valley 28 is approximately parallel to the first major face 3 and continues to form an upwardly turned part 30 and an edge return 31. The edge return 31 is at the same angle with respect to the first major face 3 as the sloping part 15. The edge return 31 allows run out of the edge of the sheet on roll forming.

[0031] Figures 2 and 3 illustrate the interlocking of the first and second cooperating formations. In Figures 2 and 3 the same reference numerals have been used except that for the "adjoining" panel, the suffix "a" has been added to each reference numeral.

[0032] In the illustrated embodiment, the panel 1a is already mounted on a suitable supporting structure, such as suitably spaced apart purlins (not shown) and secured thereto by suitable means. The panel 1 is then held with the first and second major faces (3,4) approximately vertical and the hook formation 14 of the first cooperating formation 5 engaged around the bead 24a. The panel 1 is then pivoted to the position indicated as "R" in Figure 2 and attached to the supporting structure. As can be seen from Figure 2, the sloping part 15 engages the edge return 31a, and the wall 16, the flat 17, the part 18 and the curved part 20 respectively embrace the upper part of the sidewall 27a, the platform 25a, the part 23a and the bead 24a. Sealing material may optionally be disposed in the recess 26a. The dimensions of the respective formations 5, 6 are such that the upper part of the formation 5 is a latching fit over the upper part of formation 6a.

[0033] As can be seen from Figures 2 and 3, when the panel 1 is rotated from the position indicated as "E" through positions indicated as "D" to "A" and finally to the rest position shown as "R", the sloping part 15 and the wall 16 ride over the platform 25a until the lower portion of the wall 16 passes the shoulder 32a between wall 27a and platform 25a. At this point, the wall 16 and the flat 17 can "snap" into position against the upper part of wall 27 and platform 25a respectively. In the embodiment of Figure 3a, during the rotation of the panel 1, the minor face 35 is urged towards the minor face 36a of the adjacent panel, by virtue of the above described interlocking action. Thus, the sealing material 11 is compressed between the adjacent minor faces 35, 36a, thereby forming an effective seal. In the embodiment of Figure 3b, during the rotation of the panel 1 the lip 8a moves into the recess 12 and the face 12b of the recess is urged, by virtue of the above described interlocking action, against the lip 8a. Thus, the sealing material 11 is compressed between the lip 8a and the recess 12,

thereby forming an effective seal.

[0034] As may best be seen from Figures 3a and 3b, the formations 5, 6 form an enclosed void or space, defined by sloping part 15, side wall 27a, valley floor 29a upwardly turned part 30a and edge return 31a. This space is not open to the atmosphere and accordingly is protected from the effects of the weather. In preferred embodiments of the invention, the panels 1 are secured to the supporting structure by fastening means 34 which act on valley floor 29 which serves as a securing surface. In this way, the fastening means are not exposed to the environment and are protected from the corrosion causing effects of the weather. Also, concealment of the fastening means is aesthetically more pleasing. The fastening means 34 (which are illustrated schematically in Figures 3a and 3b) may be any suitable fastening means, although self tapping or self drilling and tapping screws are preferred.

Claims

1. A panel comprising a box-like section having first and second opposed major faces and first and second opposed minor faces connecting said opposed major faces,

   first and second cooperating formations defined along opposed marginal portions of the first major face, the first cooperating formation of a first panel being adapted to engage the second cooperating formation of an adjacent second panel to interlock the panels, and

   a resilient sealing material disposed along a length of said box section adjacent a corner formed between the second major face and a minor face,

   whereby on engagement of the first cooperating formation of a first panel with the second cooperating formation of an adjacent second panel the sealing material is placed in compression to form a seal between said panels.

2. A panel as claimed in claim 1 wherein the resilient sealing material is disposed directly on one or both of said minor faces.

3. A panel as claimed in claim 1 further comprising an outwardly extending lip formed along a first marginal portion of the second major face and a lip receiving portion extending along a second marginal portion of said second major face opposed to said outwardly extending lip and wherein said resilient sealing material is disposed along said outwardly extending lip and/or along said lip receiving portion.

4. A panel as claimed in claim 3 wherein the outwardly extending lip projects in a direction substantially parallel to the second major face of the box-like section.

5. A panel as claimed in claim 4 wherein a face of the outwardly extending lip is contiguous with the second major face.

6. A panel as claimed in any of claims 3 to 5 wherein the lip receiving portion comprises a rebate along an edge of the second major face.

7. A panel as claimed in claim 6 wherein the rebate is so sized as to allow the second major faces of adjacent panels to lie flush when the outwardly extending lip of a first panel lies in the rebate of a second adjacent panel.

8. A panel as claimed in any preceding claim wherein an insulating material is contained in the box-like section.

9. A roof structure comprising panels according to any preceding claim.

10. A panel as claimed in any of claims 1 to 8 wherein the first and second cooperating formations of adjacent panels, when interlocked, define a closed void including a securing surface which surface operatively may cooperate with fastening means to retain the panel in its position of use.

11. A roof structure comprising a plurality of panels, according to claim 10 interlocked to form a roof surface and fastening means each having a head portion which engages respective said securing surfaces and an engagement portion which engages a roof supporting structure thereby to retain the panels in position, and wherein each said head portion is disposed within said closed void.

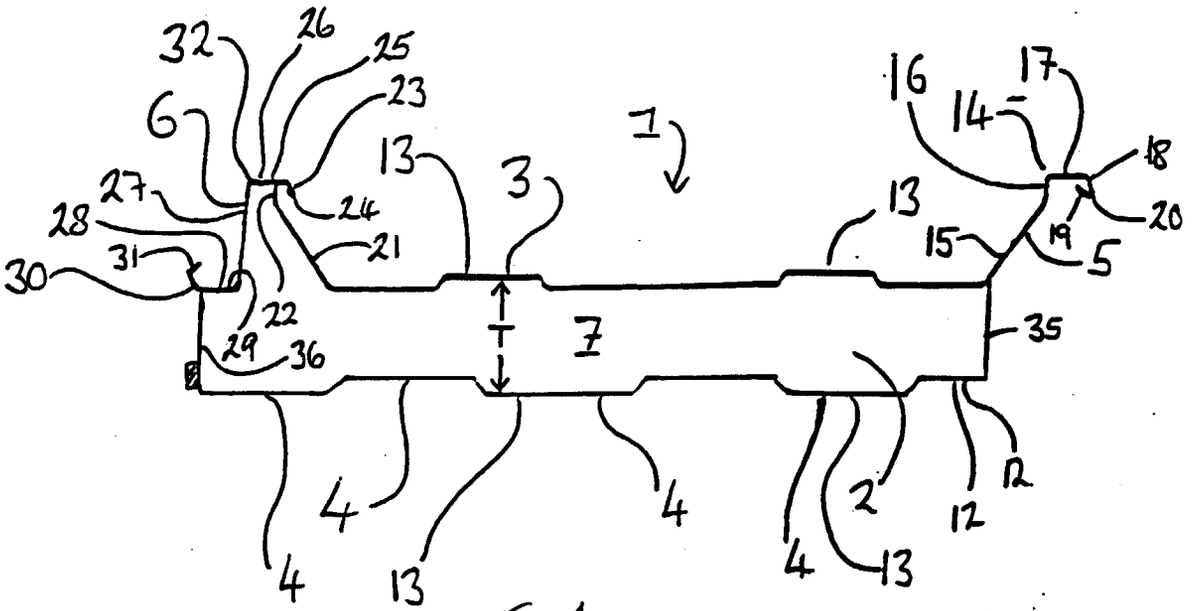
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Fig 1a

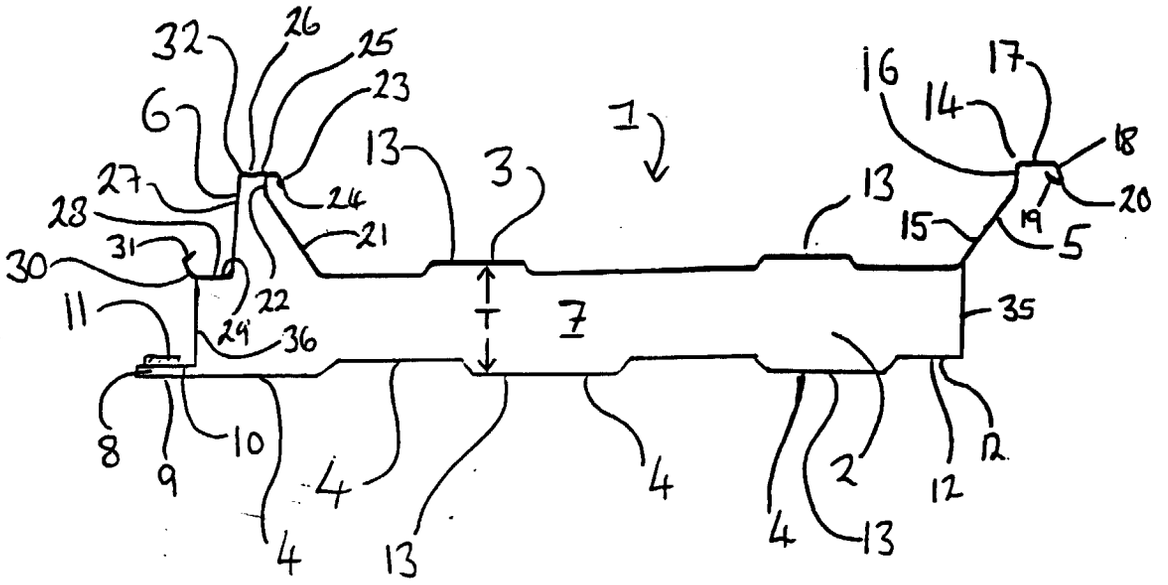
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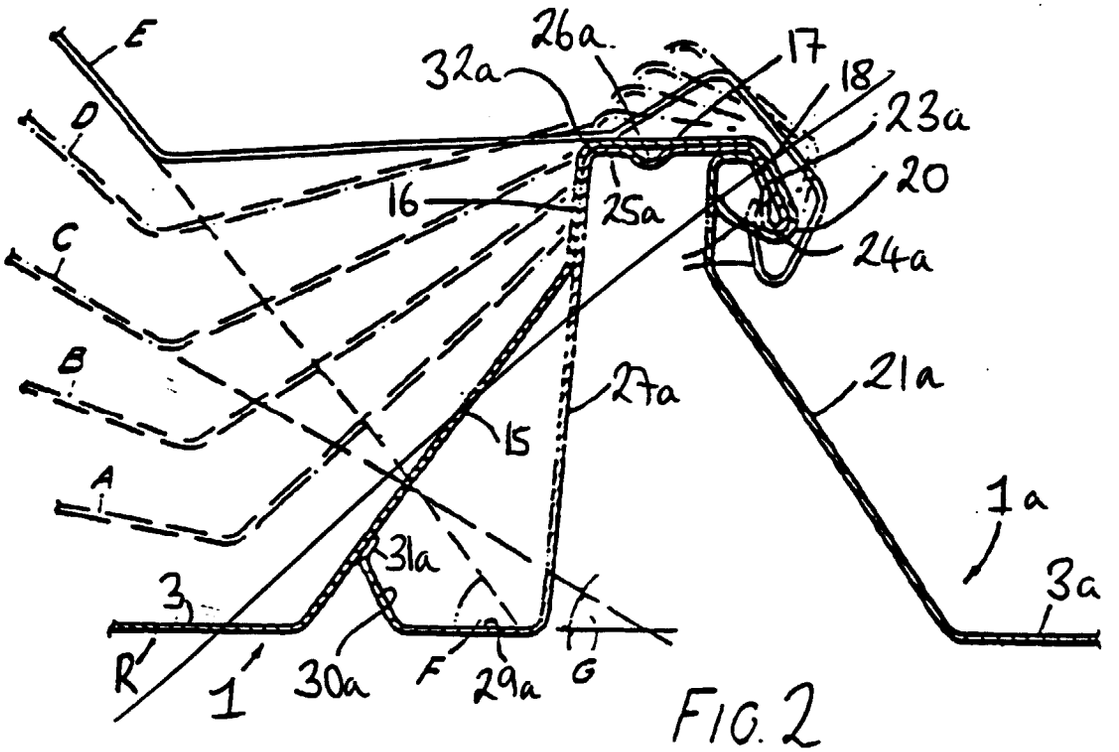
Fig 1b


E
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C
B
A
3
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1'
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26a
17
18
23a
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F
29a
G

FIG. 2

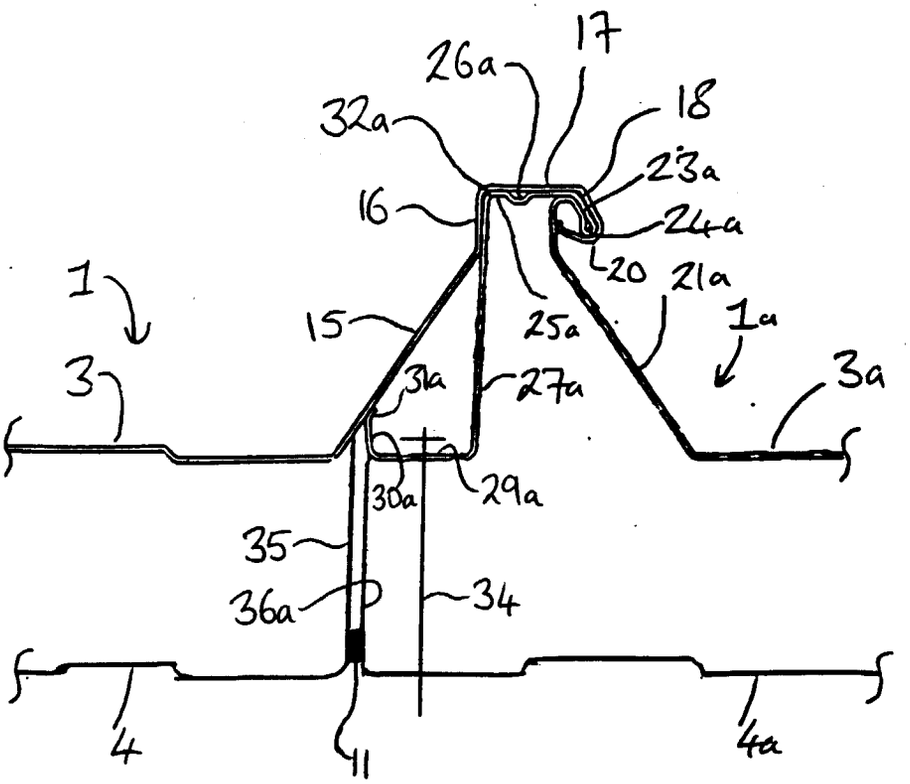
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Fig 3a

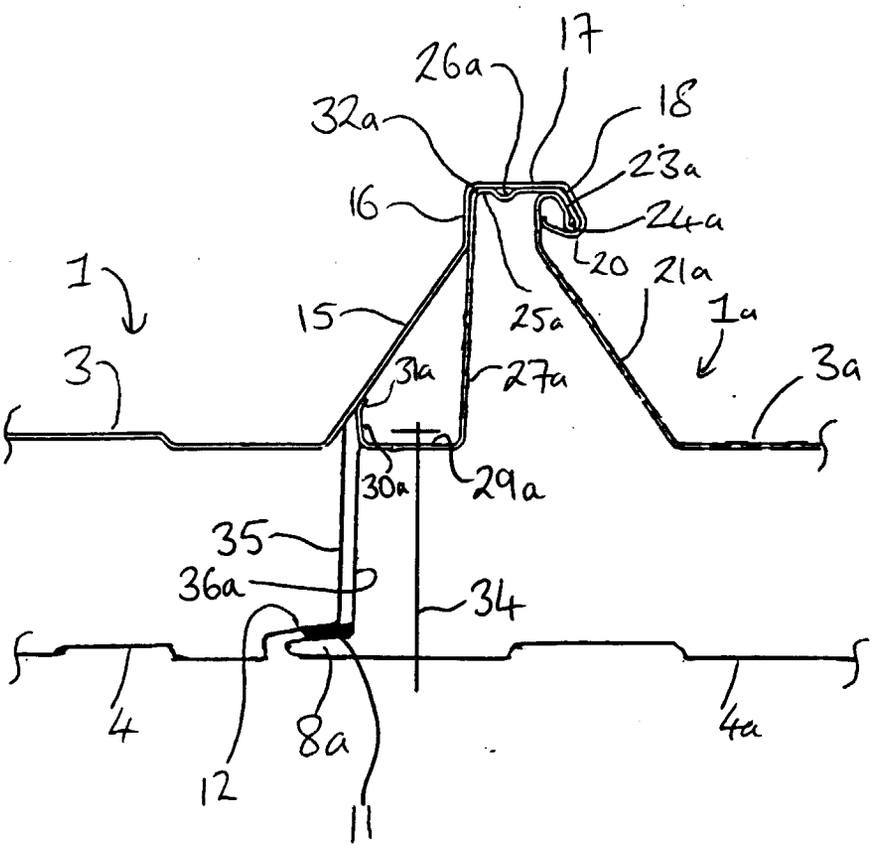
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Fig 3b

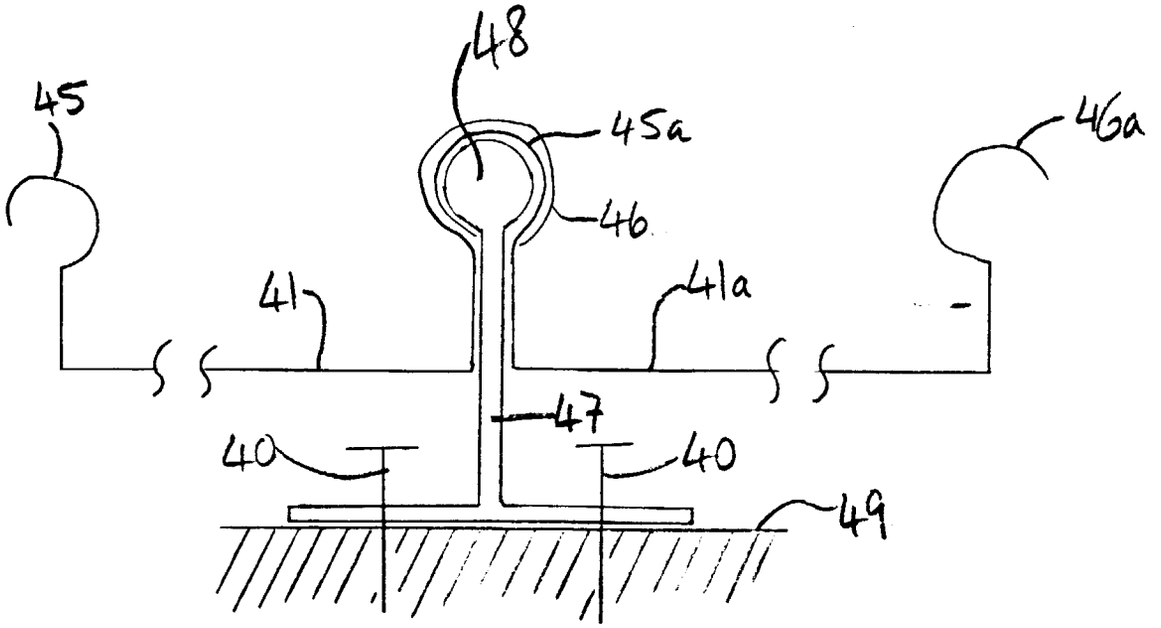

Figure 4

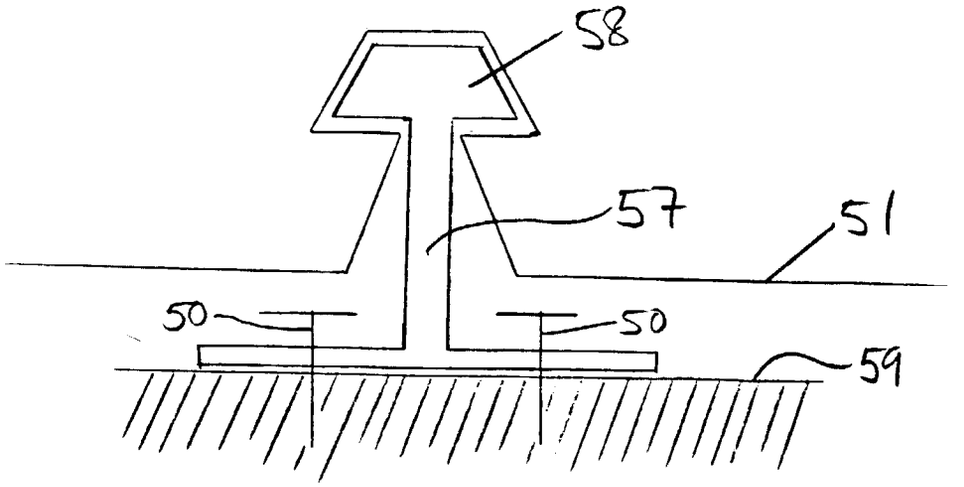

Figure 5

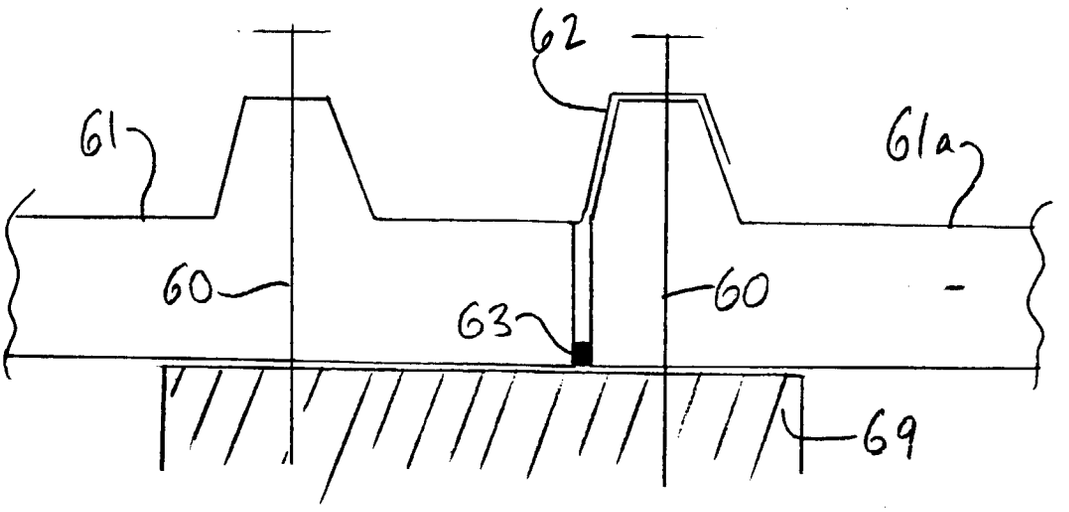

Figure 6

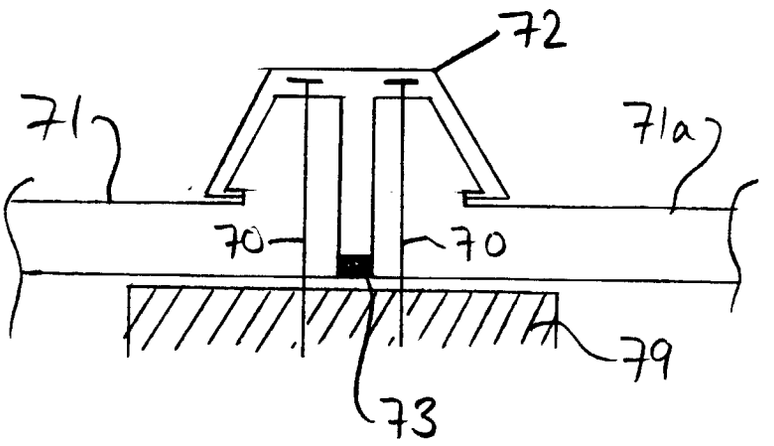

Figure 7.