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(71) Applicant: **Talfab Holdings Limited**
Worcester WR3 8ZJ (GB)

(72) Inventor: **Taylor, Peter**
Shropshire, Bridgnorth WV15 6EP (GB)

(74) Representative: **Harrison Goddard Foote**
Belgrave Hall
Belgrave Street
Leeds LS2 8DD (GB)

(54) Composite panels

(57) A composite panel for forming roofing or wall structures comprises first and second sheet members and a layer of insulating material formed therebetween. The first (outer) sheet member includes engagement formations which co-operate to join the panels together. A clip for securing the panels to an underlying structure comprises a head portion which engages with one of the engagement formations, a post part and a foot. The length of the post part is selected so that the foot lies between the planes of the sheet members. The foot is secured to a supporting structure by fastening means such as a self-tapping screw.

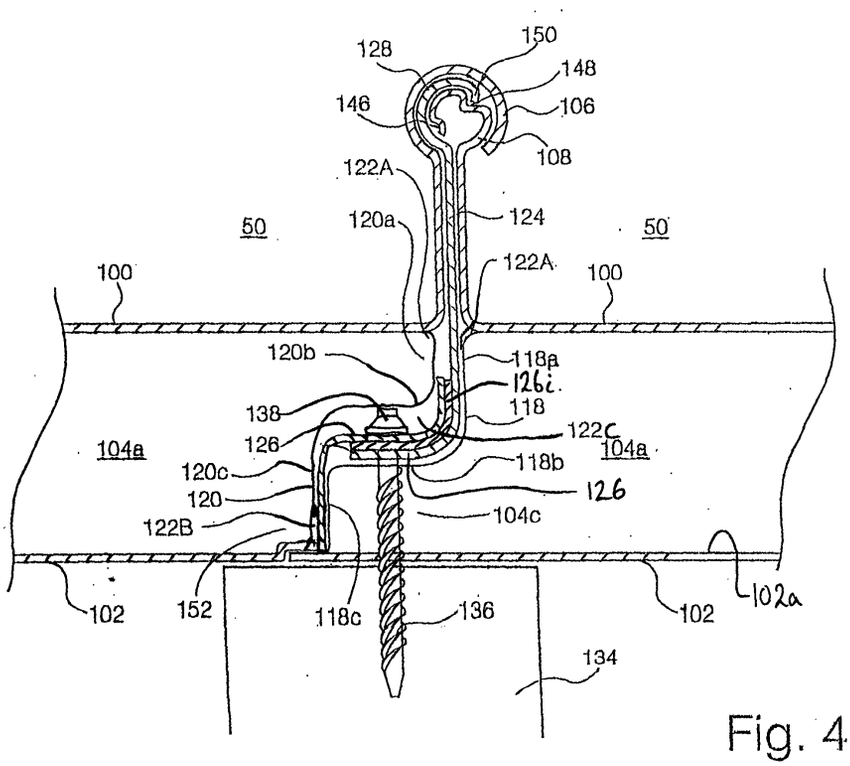

Fig. 4a

EP 1 279 777 A1

Description

[0001] The present invention relates to roofing panels and panels for wall cladding or construction made from a metallic substrate, in particular steel or aluminium. Panels of this sort may be used to construct the roof or walls of a new building or to replace the roof or walls of an existing building.

[0002] Conventional panels are made from a longitudinal web of metallic material which may include corrugations for increased strength. The panels are mounted, by means of fastenings such as brackets, on an underlying supporting structure of a building. Adjacent panels are joined together at their edges to provide a weatherproof structure. Various means of joining panels are known in the art, and one commonly used method is known as a "standing seam" or "zipped-up" system. An example of such a system is shown in Figure 1, which is a lateral cross-section through a roofing structure. In Figure 1A, brackets or halters 16 are fixed to suitable supporting locations on the underlying structure 20. A liner sheet 21 is placed over the underlying structure 20, and the halters 16 are attached to the underlying structure 20 through the liner sheet 21, by means of suitable fixing means 22, such as self tapping screws. Panels 11, 11a of sheet material which form the outer surface of the roof are mounted on the halters 16. The halters 16 include an enlarged head portion 18. A first panel 11 has a hook-like formation 12 which is "snapped" into position over the enlarged head portion 18 of the halter 16. The second panel 11a has a hook-like formation 12a which is substantially identical to formation 12, and a second hook-like formation 14a. The panel 11a is mounted by "snapping" the formation 14a over both the halter head portion 18 and the hook-like formation 12 of the panel 11. The panels 11, 11a are then secured to the halter 16 by means of an electrically driven "zipping tool" which passes along the seam (formed by the halter and formations 12 and 14a) tightening the curl of the formation 14a so that it grips the formation 12 and the halter 16 thus locking the three components and forming a tight seal. This sort of product is widely used and accepted for long-life span metal roofing.

[0003] More recently, composite panels have been developed which, as manufactured, include a layer of insulation in the void between the panels forming the exterior of the building (e.g. panels 11, 11a) and the internal liner sheet (21). The insulation may be a polyisocyanurate or polyurethane foam. However, the applicants are not aware of any commercially marketed composite panel which successfully employs a standing seam type joint between adjacent panels. A particular problem in considering such a system arises because of the need for brackets (halters) to pass from the exterior roofing panel through the entire composite panel in order to attach them to the underlying supporting structure. The presence of the halters makes it extremely difficult to maintain the integrity of the insulation.

[0004] One prior art method of providing insulating material is illustrated in Figure 1B. It can be seen that this is not a true composite panel. Each layer of the structure must be applied sequentially to the building structure. Thus, liner 21 and vapour barrier 26 are applied first. The halters 16 are then fixed in position and the insulating material 24 is laid in position around the halters. The insulating material is commonly in the form of foam blocks or strips, or a felt or fibrous material. Finally, the outer roofing panels 11, 11a are applied as indicated above. It will be appreciated that roofs constructed in this way can provide a satisfactory finished product, but a large amount of assembly is required on site which is time consuming and which can be difficult, for example in adverse weather conditions.

[0005] Some proposed constructions of interlocking composite panels are described in GB 2 345 705. One example of the panels described in that application is shown in Figures 2A and 2B. Figure 2A shows a section through a composite panel and Figure 2B shows the interlocking of two such composite panels. In Figure 2A, the composite panel 61 has an outer panel member 62 in the form of a web of metallic material such as steel or aluminium which in use will form the outer surface of the roof or wall. A second panel 64 provides the inner surface of the panel 61 and an insulating material such as a foam insulating material 66 is disposed between the panel members 62, 64. Panel member 62 is so shaped as to include an upstanding formation 72 in the form of a post 84 and an enlarged head portion 86. At the other lateral side of the panel member 62 is another upstanding formation 74 in the form of a post 92 and a hook-like formation 90.

[0006] In Figure 2B, two panels 61 and 61a are illustrated. The panels are identical and the same reference numbers are used for like components of the panels, except that the suffix "a" has been added to each reference numeral for the left-hand panel, as illustrated. The panel 61 is secured to the underlying structure 110 by fastening means 112 in the form of a self-tapping screw. The panel member includes a flat surface 96 at its margin which is engaged by the head 114 of the fastening means 112. The panels 61, 61a are secured together by snapping hook-like formation 90a over enlarged head portion 86 and tightening the seam in a similar way to that described above in relation to Figure 1A. The panel 61 is provided with a bead of sealing material 78 to form a vapour seal between the interior and exterior of the building. Panel 61a also includes a portion 100c which serves to cover the fastener head 114 to protect it from damage and deterioration caused by exposure to adverse weather conditions.

[0007] The panel shown in Figures 2A and 2B does have some disadvantages. Firstly, roofing panels and the like are often subjected to changing external temperatures. Depending on the geographic location of the building, the external temperature may vary from a minimum of about -10°C to about 45°C, while the internal

temperature of the building remains essentially constant. This means that the panel must accommodate differential thermal expansion and contraction of the inner and outer layers 64, 62. Usually the outer layer 62 moves to a greater extent than the inner layer 64. In the composite panel shown in Figures 2A and 2B, expansion of the outer layer 62 causes rotation of the fastening means 112 about the point at which it enters this underlying structure 110. The thermal expansion and contraction causes considerable movement of the fastener over time, which can lead to the failure of the fastener and elongation of the hole through the inner layer 64, so affecting the moisture barrier properties of inner layer 64.

[0008] In the prior art shown in Figures 2A and 2B, and in other examples of prior art composite panels, the thermal expansion and contraction can cause delamination of the outer layer and the insulating layer. Depending on the nature of the panel joints and the fixing means, this can be an immediate problem leading (by, for example, action of the wind) to the complete separation of the outer layer. In the case of the prior art shown in Figures 2A and 2B, the problem of delamination becomes significant when the thermal expansion and contraction has already caused elongation of the hole for the fastener. Thus, if the outer layer becomes delaminated, there is a danger that the outer layer might be pulled over the fastenings, so that the integrity of its attachment is compromised.

[0009] Additionally, the design of Figures 2A and 2B may be subject to the phenomenon known as "cold bridging" in which the joint 86, 90 between the panels and the fastening means 112 provides a thermally conductive link between the outer layer 62 and the underlying structure 110 of the building which supports the panel. This results in cold "tracking" from the exterior to the interior of the building and causing condensation on the supporting structure (e.g. purlins) 110.

[0010] US 4 177 615 describes a composite panel and fixing clip where adjacent panels are joined by a "standing seam" type joint. An upper portion of the fixing clip is incorporated into the standing seam joint. The fixing clip is in two parts. An upper part includes the abovementioned upper portion and a lower plate portion which rests on a part of the insulating material and, at its edge, on a lip formed by deformation of the lower sheet member of the composite panel. A lower part of the clip includes a plate portion which rests in use on the plate portion of the upper part of the clip and a flange which depends downwardly from the plate portion and penetrates the insulating material to contact the lower sheet member of the panel.

[0011] The design of US 4 177 615 does not provide a complete solution. It is disadvantageous for the clip to penetrate the insulating material as this makes accurate positioning of the clip more difficult and is damaging to the integrity of the insulating material. Also, this design does not overcome the problem of compression of the insulating material by over-tightening of the fixing screw (which acts on the plate portions). In this respect, the fact that the plate portion of the lower part of the clip rests on the lip formed from the lower sheet member is insufficient. A further problem is that the clip does not resist compression of the insulating material caused by foot traffic (which occurs when the panels are being fitted or during maintenance). The plate portion of the upper part of the clip lies below the plate portion of the lower part of the clip and (other than the lip of the lower sheet member, which is not sufficient) there is nothing to present downward movement of the upper part of the clip resulting from the weight of a person standing on the outer surface of the panels. Compression of the insulating material in these ways can result in a loosening of the fixings so that the strength and integrity of the roof structure formed from the composite panels is compromised.

[0012] Accordingly the present invention seeks to provide an improved composite panel of the standing seam type which attempts to overcome some of the disadvantages of the above described prior art.

[0013] According to a first aspect of the present invention, there is provided a clip for securing composite panels comprising inner and outer sheet members and a body of insulating material disposed therebetween to a supporting structure, the clip comprising:

(i) a head portion which engages in use with engagement formations of adjacent composite panels, by means of which formations the composite panels are secured together;
(ii) a fastening web oriented in use substantially parallel to the outer surface of the panel;
(iii) a first upstanding wall portion extending between the head portion and the fastening web; and
(iv) a second wall portion depending from and extending downwardly from the fastening web and having a leading edge which rests in use against the inner surface of the inner sheet member of the composite panel.

[0014] In a preferred first embodiment the first and second wall portions depend from opposite sides of the fastening web.

[0015] In a second preferred embodiment the head portion comprises a hook-like formation which engages corresponding hook-like formations of the adjacent composite panels, the hook-like formation having a leading edge spaced apart from the first upstanding wall portion at a side thereof opposite to the fastening web.

[0016] In a especially preferred third embodiment, the clip comprises first and second fixedly engaged clip parts, the first clip part comprising the head portion, the first upstanding wall portion and a first fastening web portion, the second clip part comprising the second wall portion and a second fastening web portions, said fastening web portions lying one above the other and together forming the fastening web.

[0017] In a preferred construction a layer of thermally insulating material is disposed between the respective first and second fastening web portions.

[0018] In a variation of the third embodiment of the invention, preferably oppositely directed first and second slots are provided in a lower part of the first upstanding wall portion and the second clip part further comprises a third upstanding wall portion disposed adjacent the first upstanding wall portion and including oppositely laterally directed tongues which are deformed into engagement with the respective slots of the first upstanding wall portion, thereby to secure the first and second clip parts together.

[0019] According to a second aspect of the invention, there is provided a composite panel assembly comprising:

(i) a composite panel comprising:

(a) first and second sheet members forming respective major external surfaces of the composite panel.
(b) an insulating material disposed between the first and second sheet members;
(c) first and second minor faces defined substantially by side surfaces of the insulating material and extending respectively between the first and second sheet members, each said minor face having a stepped profile consisting of a first surface portion extending from the first sheet member, a second surface portion extending from the second sheet member and laterally displaced with respect to the first surface portion, and, a third generally planar surface portion joining the first and second surface portions;
(d) a first engagement formation formed adjacent to and substantially parallel to a first marginal portion of the first sheet member;
(e) a second engagement formation formed adjacent to and substantially parallel to a second marginal portion of the first sheet member and comprising an upstanding wall portion depending from the first sheet member, and a head portion; and

(ii) at least one clip according to the first aspect of the invention associated with said second engagement formation and disposed in use such that said first upstanding wall portion is adjacent a first surface portion of the panel, said fastening web rests on a third surface portion of the panel and said second wall portion is adjacent a second surface portion of the panel.

[0020] In a first preferred embodiment of this second aspect of the invention the head portion of the clip comprises a hook-like structure defining a hollow interior and a head portion of the second engagement formation is inserted in use into said hollow interior. Most preferably the head portion of the clip is resiliently deformed to a relatively expanded configuration as it engages the head portion of the second engagement formation and returns substantially to its initial configuration when the head portion of the second engagement formation is fully inserted therein.

[0021] In a second preferred embodiment of this aspect of the invention the first engagement formation comprises a head portion comprising a hook-like structure defining a hollow interior and the engaged head portions of the second engagement formation and the clip of an adjacent panel are inserted in use into the hollow interior of said head portion of the first engagement formation. Desirably the head portion of the first engagement formation is operatively deformable into engagement with the head portions of the second engagement formation and clip of said adjacent panel.

[0022] In a preferred construction according to this aspect of the invention a layer of sealing material is formed along the length of the first and/or second minor faces.

[0023] According to a third aspect of the present invention there is provided a roofing structure comprising:

(1) first and second composite panels joined at their marginal edges, each said panel comprising:

(a) first and second sheet members forming respective major external surfaces of the panel;
(b) an insulating material disposed between the first and second sheet members;
(c) first and second minor faces defined substantially by side surfaces of the insulating material and extending between the first and second sheet members at respective sides of the panel;
(d) first and second engagement formations formed adjacent to and substantially parallel to side marginal portions of the first sheet member, the first engagement formation of the first panel co-operating with the second engagement formation of the second panel to join the panels together;

(2) at least one clip according to the first aspect of the invention, and
(3) fastening means for securing the clip to a supporting structure,
wherein:

(i) the first and second minor faces of each panel each have a stepped profile consisting of a first surface portion extending from the first sheet member, a second surface portion extending from the second sheet member and laterally displaced with respect to the first surface portion, and, a third generally planar surface

portion joining the first and second surface portions and formed substantially parallel to the first sheet member;

(ii) the first, second and third surface portions of the first composite panel lie in spaced apart relation to the respective first, second and third surface portions of the second composite panel thereby to define a void between each pair of confronting surface positions;

(iii) the head portion of the clip is engaged with the co-operating first and second engagement formations of the joined panels, the first upstanding wall portion is disposed in the void between the confronting first surface portions, the second wall portion is disposed in the void between the second surface portions and the fastening web is disposed in the void between the third surface portions, resting on the lower said third surface portion; and

(iv) the fastening means includes a head portion which engages the fastening web, and a shank portion which passes through the fastening web and the insulating material and into the supporting structure.

[0024] In a preferred first embodiment of this third aspect of the invention the confronting first surface portions are spaced apart by a first distance and the confronting third surface portions are spaced apart by a second distance, which second distance is greater than said first distance.

[0025] Preferably in accordance with this third aspect of the invention one or both of the minor faces includes a layer of sealing material along its length.

[0026] For a better understanding of the invention and to show how the same may be carried into effect reference is made, by way of example only, to the following drawings, in which:

Figure 1A is a cross-section through a prior art roofing structure;

Figure 1B is a partially cut away perspective view of a roofing structure illustrating the application of insulating material according to the prior art;

Figure 2A is a cross-section through a prior art composite panel;

Figure 2B is a cross-section illustrating the manner in which the composite panels of Figure 2A are joined and secured to an underlying structure;

Figure 3 is a schematic cross-section of a composite panel employed in the present invention;

Figure 4A is a schematic cross-section through parts of two panels of Figure 3, joined together;

Figure 4B is similar to Figure 4A showing a variation in the means by which the two panels may be joined;

Figure 5A is a perspective view of a clip used in Figure 4A; and

Figure 5B is a perspective view of a clip used in Figure 4B.

[0027] Referring now to Figures 3 to 5, the composite panel 50 employed in the invention has an outer sheet member 100 and an inner sheet member 102. Sheet members 100, 102 may include ridges or other corrugations (not shown) for improved strength. The sheet members 100 and 102 are made from a suitable metallic material such as steel or aluminium. Non-metallic materials may also be used to form sheet numbers 100, 102 provided that they have sufficient strength, rigidity and durability. Outer surfaces 101, 103 of the sheet members 100, 102 form the respective major external surfaces of the composite panel 50.

[0028] Between sheet members 100 and 102 a body of insulating material 104 is provided. The insulating material is preferably an insulating foam such as a polyurethane or a polyisocyanurate foam which is injected into the void between sheet members 100, 102 during manufacture, to substantially fill the void. The insulating material may itself be adherent, or may be adhered, to the inner surfaces of the sheet members 100, 102.

[0029] At the respective marginal edges of the composite panel 50, first and second engagement formations 106, 108 are provided which extend substantially along the length of the composite panel 50. In the embodiment illustrated, these engagement formations 106, 108 are formed integrally with the outer sheet member 100 and comprise respective upstanding wall portions 110, 112 and head portions 114, 116. The head portions 114, 116 are illustrated to have a hook-like shape, but other constructions can be used, provided that the respective engagement formations 110, 112 co-operate to join adjacent panels together.

[0030] The composite panel 50 has minor faces 118, 120 extending between the sheet members 100, 102 and preferably defined mainly or predominantly by the side surfaces of the insulating material 104. The respective first and second minor faces each comprise a first surface portion 118a, 120a extending from the first sheet member and a second surface portion 118c, 120c extending from the second sheet member. These surface portions are preferably generally planar and preferably extend generally perpendicularly with respect to the first sheet member or the second sheet member respectively. The second surface portions 118c, 120c are laterally displaced with respect to the first surface portions 118a, 120a and the respective first and second surface portions (118a, 118c), (120a, 120c) are joined by a third surface portion 118b, 120b. The third surface portions

118b, 120b are also generally planar and extend substantially parallel with respect to the first sheet member. Thus, the insulating material 104 includes a main body portion 104a and portions 104b and 104c extending beyond the main body portion 104a. As may best be seen from Figures 4A and 4B, the portion 104b of the insulating material lies in use above the portion 104c and the respective first surface portions 118a, 120a of adjacent panels are in spaced apart relationship, as are the respective second surface portions 118c, 120c and the respective third surface portions 118b, 120b. In this way, a void 122 is defined between the adjacent panels comprising a part 122A between the first surface portions 118a, 120a, a part 122B between the second surface portions 118c, 120c and a part 122C between the third surface portions 118b, 120b. The void 122 provides a space in which the fastening clip 132 according to the invention may be disposed.

[0031] Referring especially to Figures 5A and 5B, the clip 132 according to the invention comprises an upstanding wall portion 124, a fastening web 126, a head portion 128 and a second wall portion 125 extending downwardly from the fastening web 126. The fastening web 126 extends substantially perpendicularly to the upstanding wall portion 124 and includes means such as hole 130 by which the clip 132 may be secured to the underlying supporting structure 134 of the building. (The underlying supporting structure 134 is shown schematically in Figures 4A and 4B). The head portion 128 of the clip 132 is shown in the illustrated embodiments as having a hook-like construction, but other structures are possible provided that the clip 132 may co-operate with the second engagement formation 108 to retain the composite panel on the supporting structure 134.

[0032] In Figures 4A and 4B, adjacent panels 50 are shown which panels 50 are secured together by the respective engagement formations 106, 108 and clip 132, and which are secured to the underlying supporting structure 134 by means of the clip 132 and a fastening means 136 which is preferably a self-tapping screw. As shown in Figures 4A and 4B the clip 132 is disposed between minor faces 118, 120 of the adjacent panels 50, so that the fastening web 126 lies in the void 122C defined between minor surface portions 118b, 120b. Fastening web 126 lies in use on surface 118b which forms the upper boundary (as illustrated) of portion 104c of the insulating material. The fastening means 136 which secures the clip 132 to the supporting structure 134 includes a head portion 138 which engages the fastening web 126 of the clip to retain the clip 132 in its position of use. The surface portion 120b which forms the lower boundary (as illustrated) of the portion 104b of the insulating material lies above head portion 138 of the fastening means 136. In this way, the head portion 138 (and the fastening web 126 of the clip 132) are disposed in the void 122C and thus are substantially surrounded by the insulating material. The exposure of the head portion 138 of the fastening means 136 and of the fastening web 126 of the clip 132 to changes in temperature and to adverse weather conditions is thus much reduced. The upstanding wall portion 124 of the clip 132 extends substantially vertically as illustrated and lies in use between wall portions 110, 112 of first and second engagement formations 106, 108. The upstanding wall portion 124 and wall portions 110, 112 are preferably substantially parallel.

[0033] The panels 50 with the minor faces 118, 120 are desirably constructed so that the gap or voids 122, 122A, 122B, 122C between the confronting minor faces is made as small as possible, in order to maximise the insulating properties of the finished structure. Further, in order to fill any gap or void 122, 122A, 122B, 122C a compressible foam material (such as compressible foam strips) may be inserted into the gap or voids 122, 122A, 122B, 122C. The compressible foam may thus lie on respective sides of the upstanding wall portion 124 and the downwardly extending wall portion 125 of the clip 132, between the clip 132 and the minor faces 118a, 120a and 118b, 120b respectively. A compressible foam may similarly be provided between minor face portions 118c, 120c. By filling any gap or void 122, 122A, 122B, 122C the compressible foam prevents the formation of condensation in the gap or void 122, 122A, 122B, 122C.

[0034] The head portion 128 of the clip 132 is engaged with the head portion 116 of the second engagement formation, and the head portion 114 of the first engagement portion engages the combination of the head portions 128 and 116 of the clip and second engagement portions 132, 108 respectively. In this way, the clip 132 by co-operating with the fastening means 136 retains the composite panel 50 on the supporting structure 134 and the adjacent panels 50, 50 are joined together.

[0035] In the embodiment illustrated in Figure 4B, a clip 132 according to Figure 5B is used. The head portions 128 and 116 of the clip 132 and the second engagement formation 108 are so constructed that the head portion 128 of the clip is disposed in use within the head portion 116 of the second engagement formation 108. The respective head portions 128 and 116 are so sized and shaped that in its use position as illustrated in Figure 4B, the head portion 128 of the clip 132 cannot be removed from the head portion 116 of the second engagement formation 108. The method by which the clip 132 of Figure 5B is located in the second engagement formation 108 is as follows. Initially the clip 132 is inverted so that lower edge 152 of wall portion 125 is uppermost and so that the leading edge 140 of the head portion is inserted into the space defined between the leading edge 142 of the head portion 116 of second engagement formation 108 and the shoulder 144 where the head portion 116 meets the wall portion 112. The clip 132 may then be rotated in a counter-clockwise direction until the clip 132 reaches its use position.

[0036] The embodiment illustrated in Figure 4A employs a clip 132 according to Figure 5A and is the preferred arrangement. The embodiment Figure 4A varies

in that the head portion 116 of the second engagement formation 108 is innermost and the head portion 128 of the clip thus surrounds the head portion 116 of the second engagement formation 128. As in the embodiment illustrated in Figure 4B, the head portion 114 of the first engagement formation engages the combination of the head portions 116, 128 of the second engagement formation and the clip 132. The head portion 116 of the second engagement formation 108 may, in the embodiment illustrated in Figure 4A, be provided with grooves 146, 148 which serve to add strength to the head portion 116. The groove 148 can also provide a latching action to assist in retaining the head portion 128 of the clip 132 in position, in combination with a lip 150 formed at the leading edge of the head portion 128. The latching action is provided by the resilient deformation of the head portion 128, as it passes over the head portion 116, into its somewhat expanded configuration, until the lip 150 is resiliently urged into groove 148, and the head portion 128 regains substantially its initial condition.

[0037] As indicated above, the clip 132 comprises a head portion 128, and upstanding wall portion 124, a fastening web 126 and a downwardly extending wall portion 125. The wall portions 124,125 most preferably extend from opposite respective sides of the fastening web 126. Preferably, as illustrated in Figure 5A, the leading edge 150 of the head portion 128 is disposed on the opposite side of upstanding wall portion 124 with respect to the fastening web 126.

[0038] In the most preferred construction, the clip 132 is formed from two clip parts 131,133. These parts are a first (upper) part 131 and a second (lower) part 133. The upper clip part 131 comprises the head portion 128, the upstanding wall portion 124 and a lower fastening web portion 126a. The lower clip part 133 comprises the downwardly extending wall part 125 and an upper fastening web portion 126b. The fastening web portions 126b, 126a lie in use one above the other. The clip parts 131, 133 are secured together so that they are capable of substantially no relative movement. In the embodiment illustrated in Figure 5a, the upper clip part 131 is provided with a pair of oppositely directed slots 121. The lower clip part 133 is provided with a pair of tongues 123 at its upper leading edge which are deformed into engagement with the slots 121 thereby to secure the clip parts 131, 133 together. Although this construction for securing the clip parts 131, 133 together is preferred, other techniques may be used. For example the clip parts may be adhered or riveted together. No securing means are shown in Figure 5b and any suitable means, such as that illustrated in Figure 5a, may be used.

[0039] The clip 132 is so sized with respect to the composite panel with which it is used that, when the head portion 132 is engaged with the second engagement formation 108, the lower leading edge 152 of the downwardly extending wall portion 125 rests against the inner surface 102a of the lower sheet member. In this way, it is essentially impossible to cause compression of the insulating material 104 by over-tightening of the fastening means 136 and similarly, compression of the insulating material by foot traffic over the first sheet member 100 is avoided.

[0040] In a particularly preferred embodiment, a layer of a thermally insulating material 126i is provided between the clip parts 131, 133. This prevents the transmission of heat from the interior of a building to the exterior by means of the clip (the so-called "cold bridging" effect).

[0041] In use, a first composite panel 50 is first placed at the appropriate location on supporting structure(s) 134. One or more clips 132 are then engaged with the second engagement formation 108. Given that each clip 132 has a relatively short length of, say, 2 to 20 cm and preferably about 5 cm and that a panel (and its respective engagement formations) extends often to a length of several metres, a number of clips are usually required at spacings of about 0.5 to 2m. Each clip 132 is engaged with the second engagement formation 108 at an appropriate location in relation the supporting structure(s) (e. g. purlins) 134 and, with the fastening web 126 of the clip 132 lying adjacent surface 118b, a fastening means 136 is inserted through foot portion 126 of the clip 132, through portion 104c of the insulating material 104, through inner sheet member 102 and into the supporting structure 134, thereby to secure the clip 132 (and hence the panel 50) to the supporting structure 134. A particular advantage of the clip 132 of the invention and of the panel assemblies and roofing structures of the invention is that the clip 132 lies entirely in the void 122 defined between adjacent panels. Thus, it is not necessary for the clip to penetrate the insulating material 104 and so the integrity of the insulating material is preserved.

[0042] If desired, in order to further reduce the transmission of heat from the interior of the building to the exterior (i.e. to reduce further the cold bridging effect) an insulating washer such as of rubber or the like may be disposed between the head portion 138 of the fastening means 136 and the fastening web 126 of the clip 132. In comparison with the panels of Figures 2A and 2B, the cold bridging effect is inherently reduced in the panels of the present invention, since the clips 132 are discontinuous along the length of the panel 50, whereas the surface 96 is continuous along the length of the prior art panel and this provides for greater heat transmission.

[0043] When all the required clips 132 have been secured in position by fastening means 136, the second panel 50 (the left hand panel in Figures 4A and 4B) is placed in position so that the head portion 114 of its first engagement formation 106 engages the combined head portions 116 and 128 of the second engagement formation 108 and clip 132. The combined head portions are then non-resiliently deformed into their final, closed and sealed configuration by means of the "zipping tool" known from the prior art. An advantage of the present invention is that zipping tools already in use (or such tools with only minor modification) can be used to make

the final sealed joint between the panels. The second panel 50 is then secured using clips 132 and fastening means 136 in the same manner as for the first panel 50. A third and subsequent panels, as desired, may be added until the structure is finished.

Claims

1. A clip for securing composite panels comprising inner and outer sheet members and a body of insulating material disposed therebetween to a supporting structure, the clip comprising:

(i) a head portion which engages in use with engagement formations of adjacent composite panels, by means of which formations the composite panels are secured together;
(ii) a fastening web oriented in use substantially parallel to the outer surface of the panel;
(iii) a first upstanding wall portion extending between the head portion and the fastening web; and
(iv) a second wall portion depending from and extending downwardly from the fastening web and having a leading edge which rests in use against the inner surface of the inner sheet member of the composite panel.

2. A clip as claimed in claim 1 wherein the first and second wall portions depend from opposite sides of the fastening web.

3. A clip as claimed in claim 2 wherein the head portion comprises a hook-like formation which engages corresponding hook-like formations of the adjacent composite panels, the hook-like formation having a leading edge spaced apart from the first upstanding wall portion at a side thereof opposite to the fastening web.

4. A clip as claimed in any preceding claim comprising first and second fixedly engaged clip parts, the first clip part comprising the head portion, the first upstanding wall portion and a first fastening web portion, the second clip part comprising the second wall portion and a second fastening web portion, said fastening web portions lying one above the other and together forming the fastening web.

5. A clip as claimed in claim 4 wherein a layer of thermally insulating material is disposed between the respective first and second fastening web portions.

6. A clip as claimed in claim 4 or 5 wherein oppositely directed first and second slots are provided in a lower part of the first upstanding wall portion and the second clip part further comprises a third upstanding wall portion disposed adjacent the first upstanding wall portion and including oppositely laterally directed tongues which are deformed into engagement with the respective slots of the first upstanding wall portion, thereby to secure the first and second clip parts together.

7. A composite panel assembly comprising:

(i) a composite panel comprising:

(a) first and second sheet members forming respective major external surfaces of the composite panel.
(b) an insulating material disposed between the first and second sheet members;
(c) first and second minor faces defined substantially by side surfaces of the insulating material and extending respectively between the first and second sheet members, each said minor face having a stepped profile consisting of a first surface portion extending from the first sheet member, a second surface portion extending from the second sheet member and laterally displaced with respect to the first surface portion, and, a third generally planar surface portion joining the first and second surface portions;
(d) a first engagement formation formed adjacent to and substantially parallel to a first marginal portion of the first sheet member;
(e) a second engagement formation formed adjacent to and substantially parallel to a second marginal portion of the first sheet member and comprising an upstanding wall portion depending from the first sheet member, and a head portion; and

(ii) at least one clip as claimed in any of claims 1 to 6 associated with said second engagement formation and disposed in use such that said first upstanding wall portion is adjacent a first surface portion of the panel, said fastening web rest on a third surface portion of the panel and said second wall portion is adjacent a second surface portion of the panel.

8. A composite panel assembly as claimed in claim 7 wherein the head portion of the clip comprises a hook-like structure defining a hollow interior and a head portion of the second engagement formation is inserted in use into said hollow interior.

9. A composite panel assembly as claimed in claim 8 wherein the head portion of the clip is resiliently deformed to a relatively expanded configuration as it

engages the head portion of the second engagement formation and returns substantially to its initial configuration when the head portion of the second engagement formation is fully inserted therein.

10. A composite panel assembly as claimed in any of claims 7 to 9 wherein the first engagement formation comprises a head portion comprising a hook-like structure defining a hollow interior and the engaged head portions of the second engagement formation and the clip of an adjacent second panel are inserted in use into the hollow interior of said head portion of the first engagement formation.

11. A composite panel assembly as claimed in claim 10 wherein the head portion of the first engagement formation is operatively deformable into engagement with the head portions of the second engagement formation and clip of said adjacent second panel.

12. A composite panel as claimed in any of claims 7 to 11 wherein a bead of sealing material is formed along the length of the first and/or second minor faces.

13. A roofing structure comprising:

(1) first and second composite panels joined at their marginal edges, each said panel comprising:

(a) first and second sheet members forming respective major external surfaces of the panel;
(b) an insulating material disposed between the first and second sheet members;
(c) first and second minor faces defined substantially by side surfaces of the insulating material and extending between the first and second sheet members at respective sides of the panel;
(d) first and second engagement formations formed adjacent to and substantially parallel to side marginal portions of the first sheet member, the first engagement formation of the first panel co-operating with the second engagement formation of the second panel to join the panels together;

(2) at least one clip as claimed in any of claims 1 to 6; and
(3) fastening means for securing the clip to a supporting structure,
wherein:

(i) the first and second minor faces of each panel each have a stepped profile consisting of a first surface portion extending from the first sheet member, a second surface portion extending from the second sheet member and laterally displaced with respect to the first surface portion, and, a third generally planar surface portion joining the first and second surface portions and formed substantially parallel to the first sheet member;
(ii) the first, second and third surface portions of the first composite panel lie in spaced apart relation to the respective first, second and third surface portions of the second composite panel thereby to define a void between each pair of confronting surface positions;
(iii) the head portion of the clip is engaged with the co-operating first and second engagement formations of the joined panels, the first upstanding wall portion is disposed in the void between the confronting first surface portions, the second wall portion is disposed in the void between the second surface portions and the fastening web is disposed in the void between the third surface portions, resting on the lower said third surface portion; and
(iv) the fastening means includes a head portion which engages the fastening web, and a shank portion which passes through the fastening web and the insulating material and into the supporting structure.

14. A roofing structure as claimed in claim 15 wherein the confronting first surface portions are spaced apart by a first distance and the confronting third surface portions are spaced apart by a second distance, which second distance is greater than said first distance.

15. A roofing structure as claimed in claim 13 or 14 wherein one or both of the minor faces includes a bead of sealing material along its length.

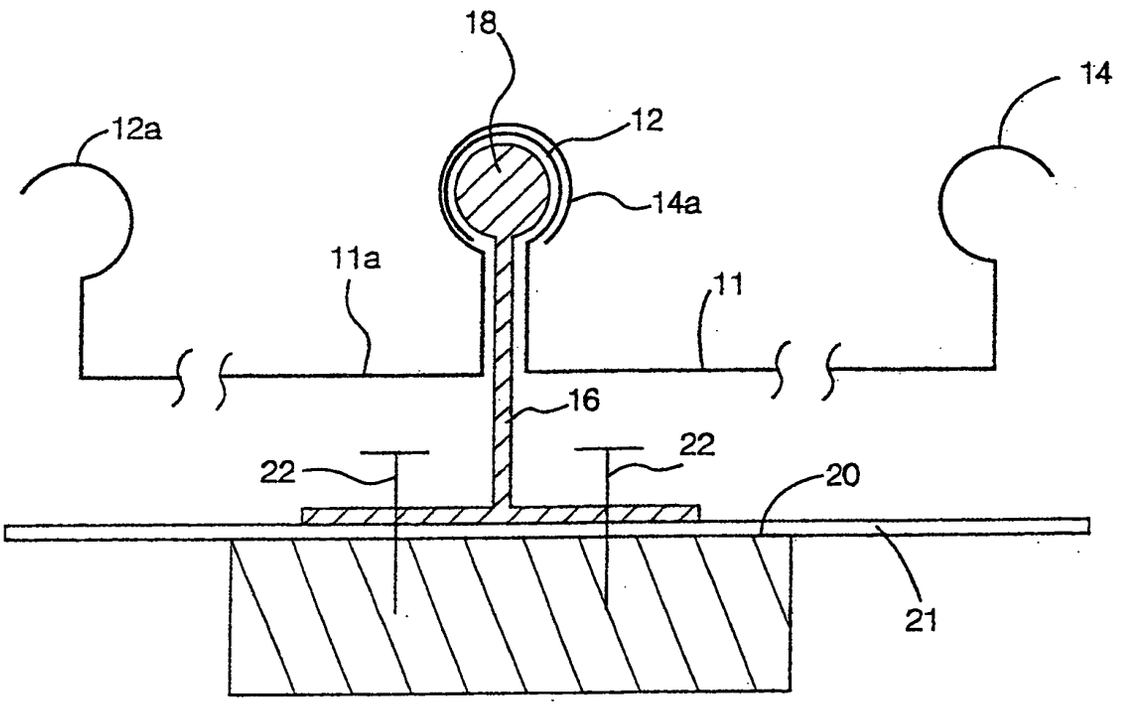

Fig. 1A

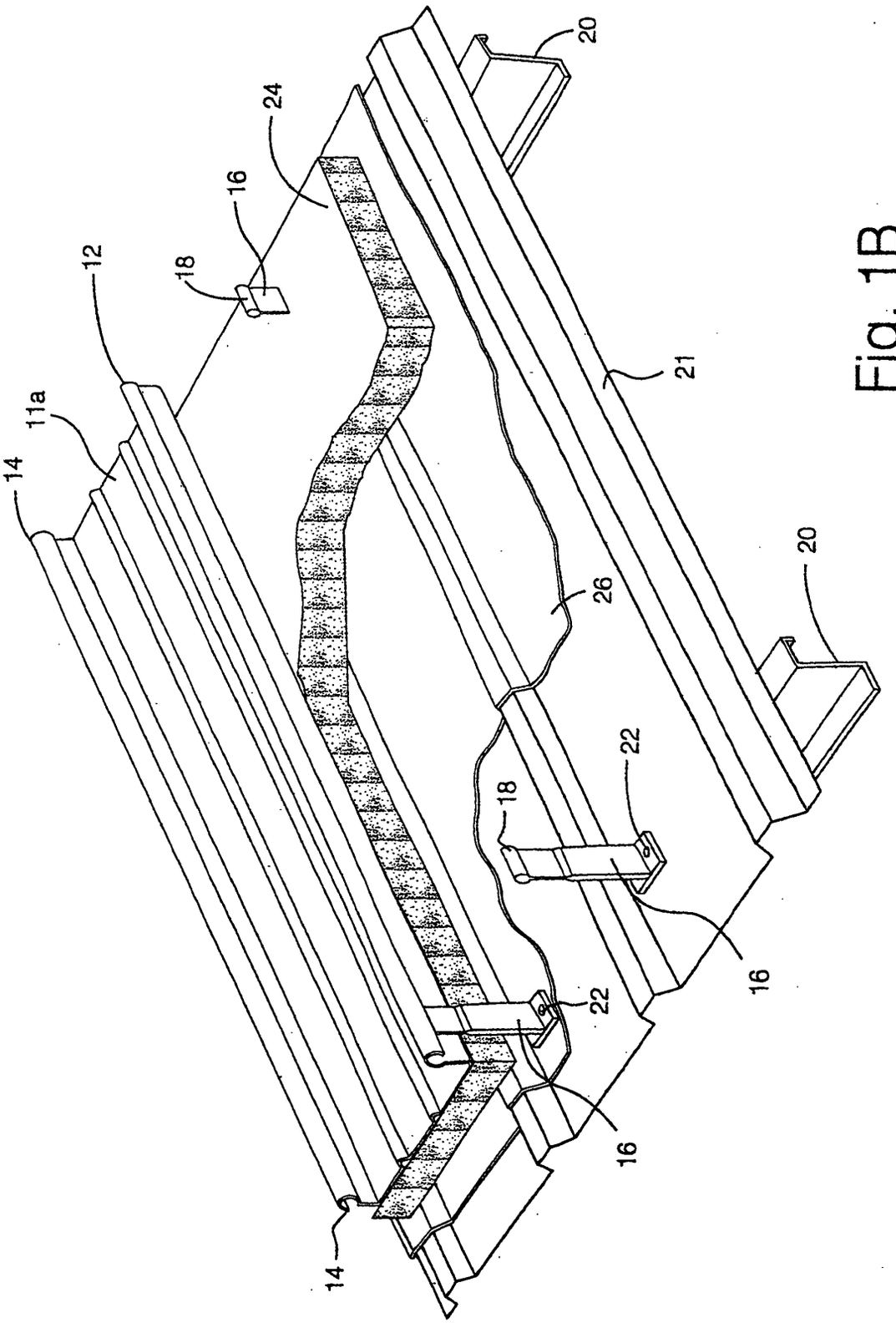

Fig. 1B

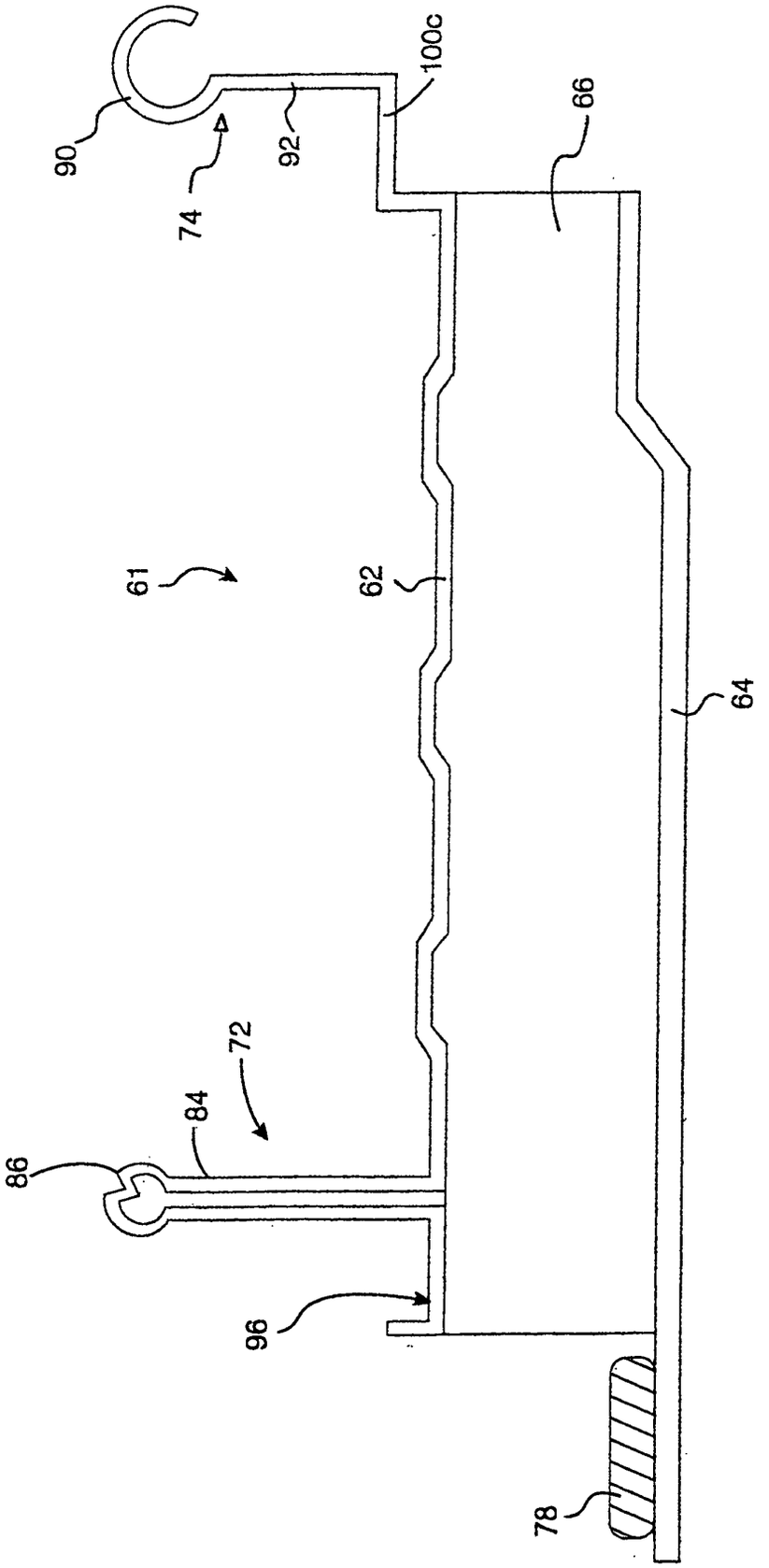

Fig. 2A

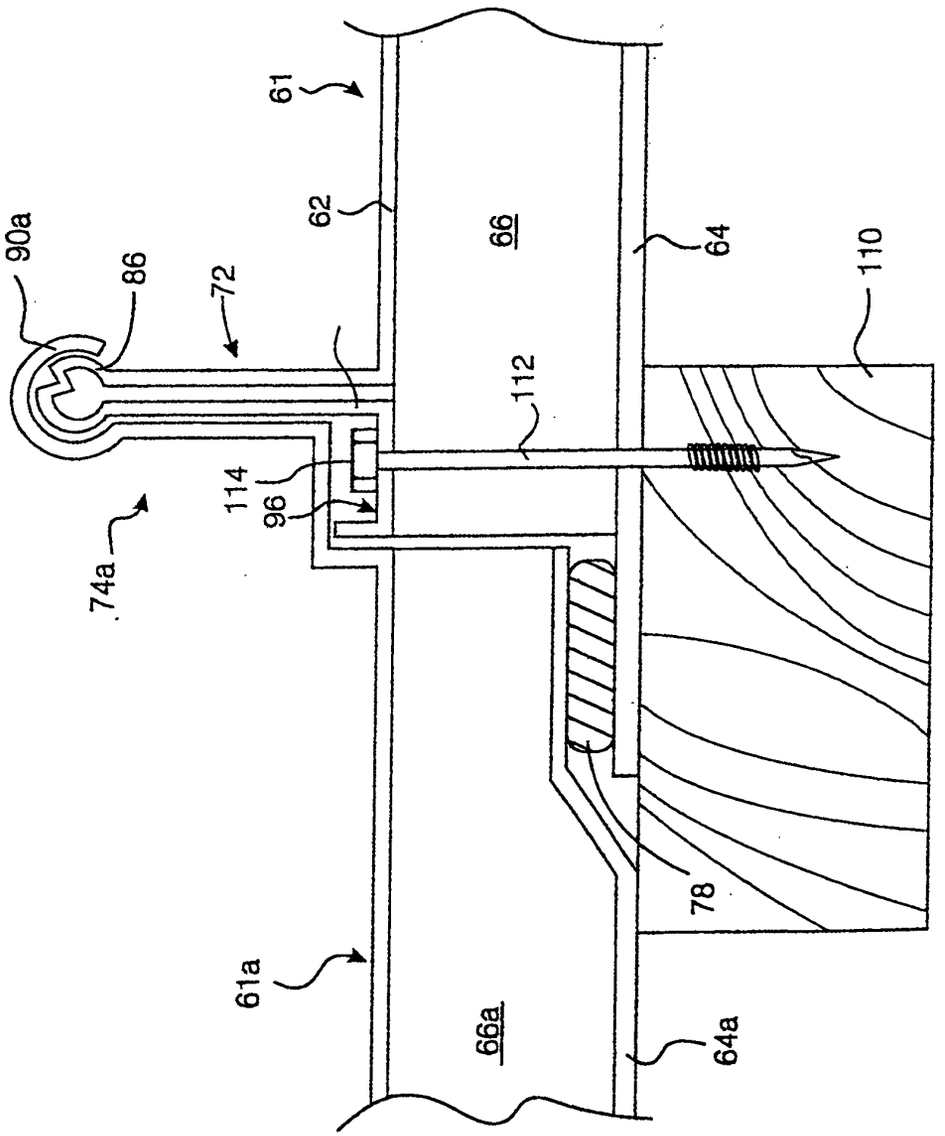

Fig. 2B

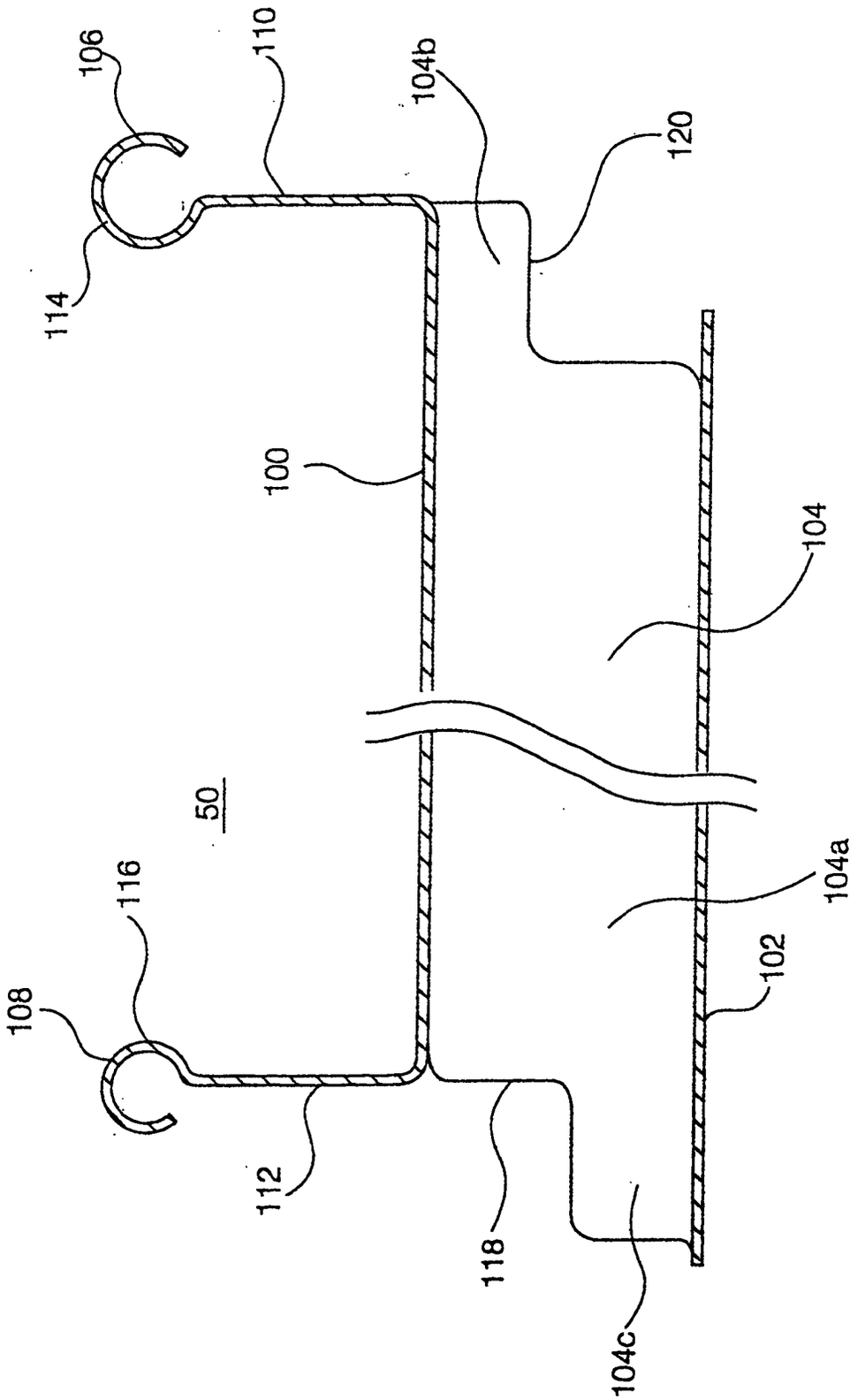

Fig. 3

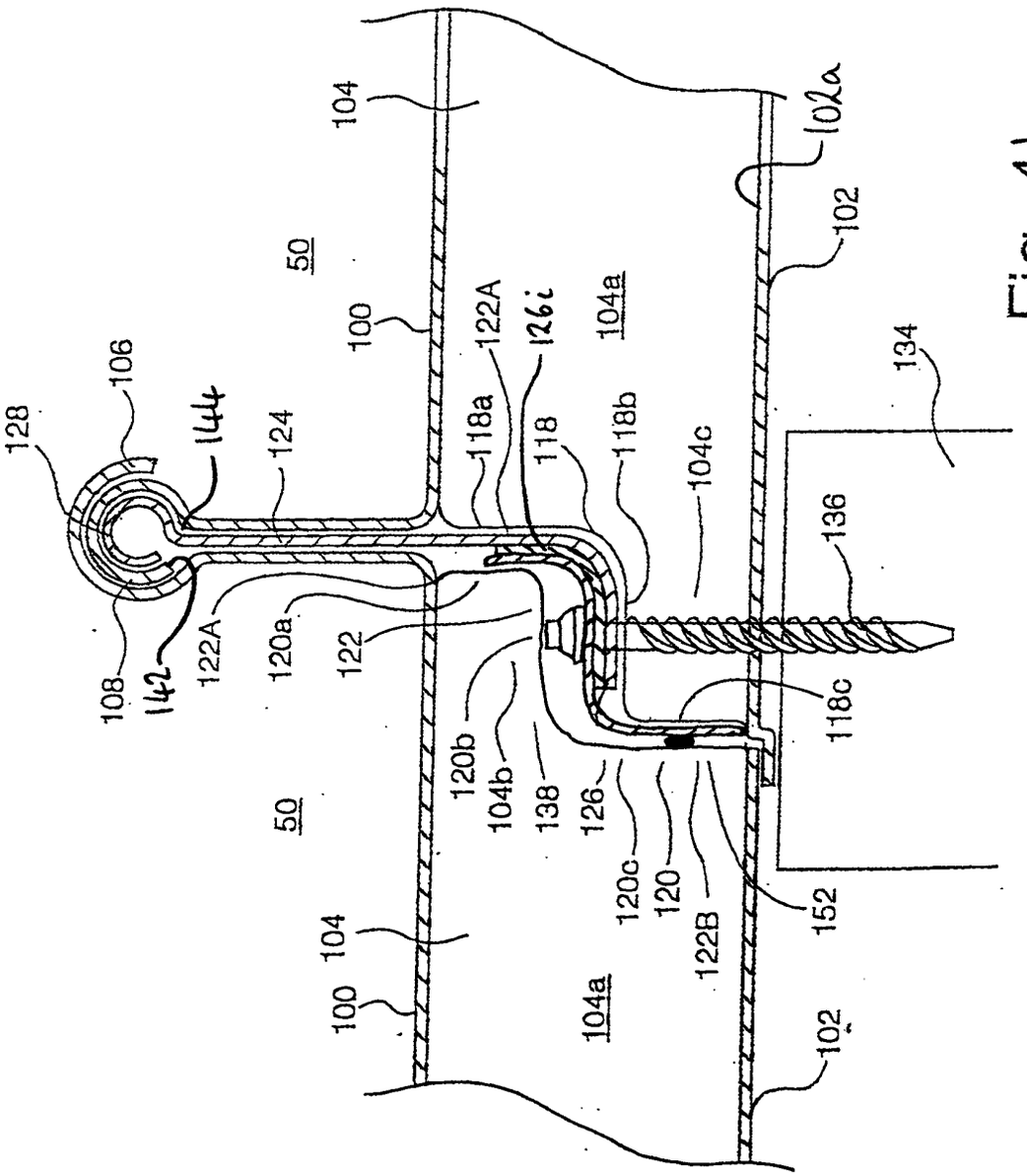
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Fig. 4b

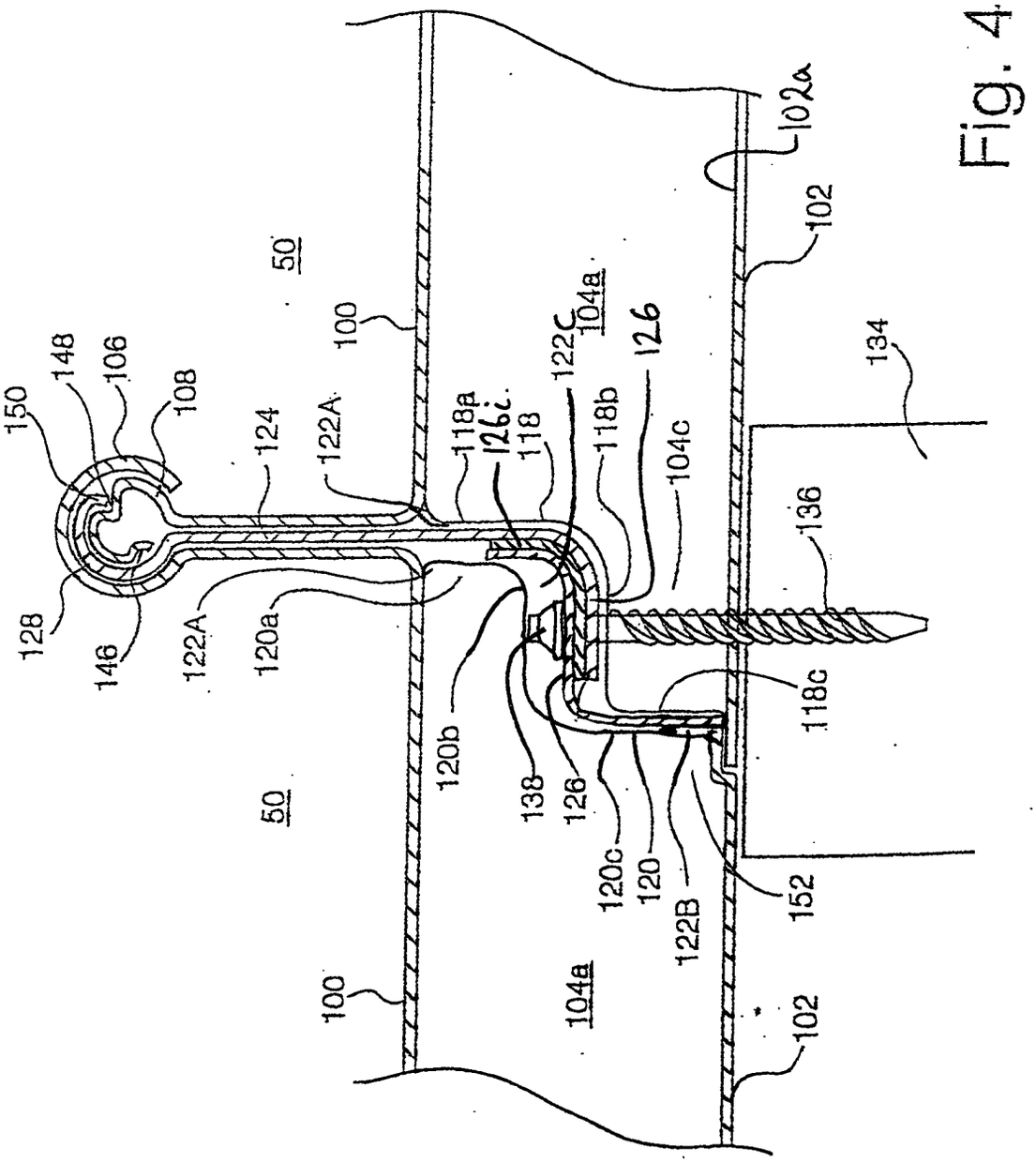
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Fig. 4a

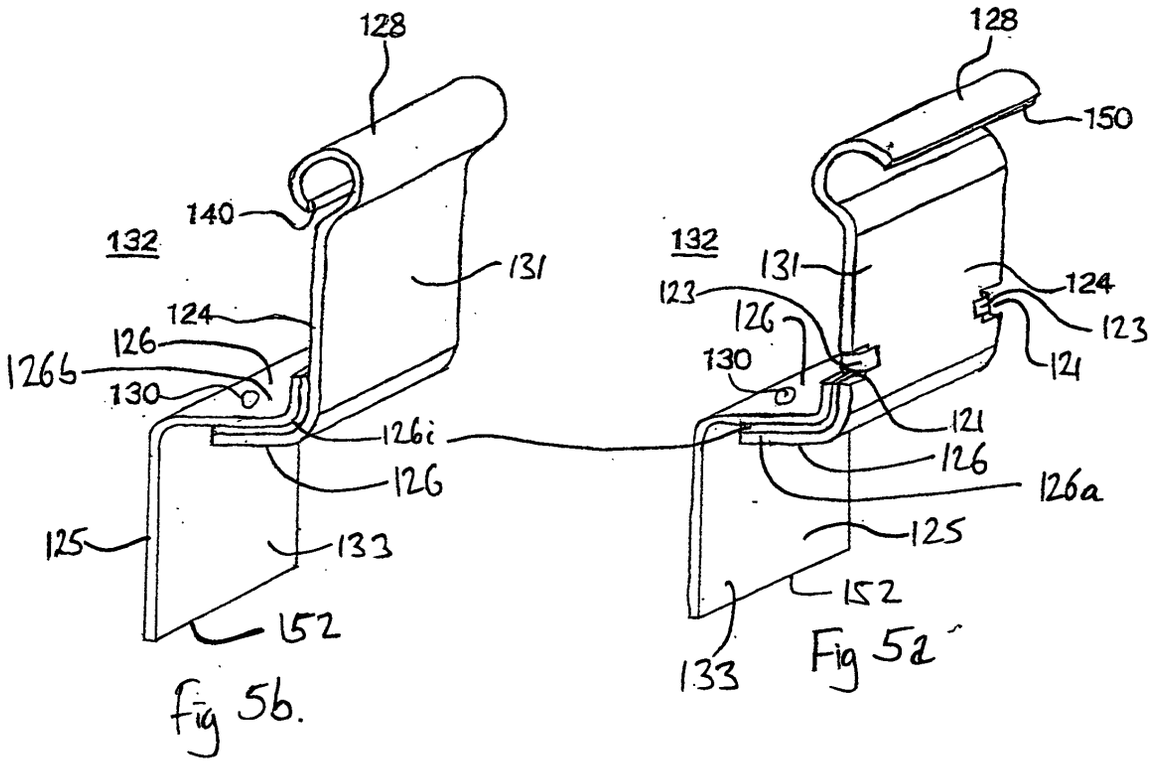
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Fig 5b.

Fig 5a

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 25 5227

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A	* column 12, line 61 - column 13, line 19; figures 14,15 *	7,8,10,12,13,15	
X	US 4 184 301 A (ANDERSON JOHN W ET AL) 22 January 1980 (1980-01-22) * figures 5,6 *	1-3	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 October 2002	Demeester, J

CATEGORY OF CITED DOCUMENTS

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