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(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 side edges of the panel formed by the insulating material have a stepped configuration to define a void between adjacent panels into which a clip may be disposed. The first (outer) sheet member includes engage-

ment formations which co-operate to join the panels together. The 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.

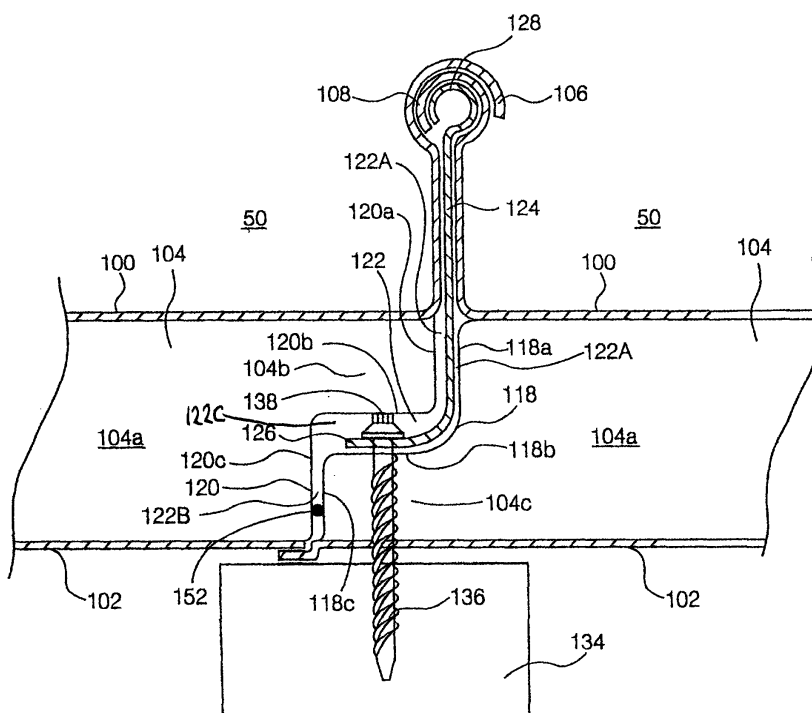


Fig. 4a

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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 weather-proof 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 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] 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.

[0011] According to a first aspect of the present 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 member, each said mi-

nor 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 associated with the second engagement formation and comprising a generally planar fastening portion which co-operates in use with a fastening means to retain the panel in its portion of use, a head portion which is operatively engaged with the head portion of the second engagement formation, and, an upstanding wall portion which extends between the said fastening portion and the head portion of the clip, said wall portion having a length greater than the length of the upstanding wall portion of the second engagement formation, such that, with the clip located in use between respective surface portions of said composite panel and an adjacent second composite panel said fastening portion is located between the respective third surface portions of adjacent panels; and wherein

the first engagement formation comprises an upstanding wall portion depending from the first sheet member, and a head portion, such that the head portion of the first engagement formation of said adjacent second composite panel cooperates in use with the head portion of the second engagement formation and the clip to join the panels together.

[0012] Most preferably, the first surface portions are generally planar and extend generally perpendicularly with respect to the first sheet member. Similarly, the second surface portions are also preferably generally planar and extend generally perpendicularly with respect to the second sheet member.

[0013] In one preferred arrangement the head portion of the second engagement formation comprises a hook-like structure defining a hollow interior and the head portion of the clip is inserted in use into said hollow interior. In a preferred form of this arrangement the head portion of the clip is insertable into said hollow interior with the clip in a first orientation and the clip is rotatable about

its head portion to a use position in which the enlarged head portion of the clip cannot be removed from the hollow interior.

[0014] In an alternative, particularly preferred arrangement the head portion of the clip comprises a hook-like structure defining a hollow interior and the head portion of the second engagement formation is inserted in use into said hollow interior. Preferably in this preferred arrangement 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.

[0015] In one preferred embodiment of this aspect of the invention the head portion of the first engagement formation comprises a hook-like structure defining a hollow interior and the engaged head portions of the second engagement formation and clip of an adjacent panel are inserted in use into the hollow interior of said head portion of the first engagement formation. The head portion of the first engagement formation is desirably operatively deformable into engagement with the head portions of the second engagement formation and the clip of said adjacent panel.

[0016] In another preferred variation according to this first aspect of the invention a bead of sealing material is formed along the length of the first and/or second minor faces.

[0017] According to a second aspect of the invention, there is provided a composite 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 the 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 a first composite panel being adapted to co-operate with a second engagement formation of an adjacent second composite panel to join the panels together;

wherein the first and second minor faces 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 respective first and second surface portions and formed substantially parallel to the first sheet member, whereby, when a first composite panel is joined to a second composite panel by means of said first and second

engagement formations, the first, second and third surface portions of the first composite panel lie in confronting spaced apart relation to the respective first, second and third surface portions of the adjacent second composite panel, thereby to define a void between each pair of confronting surface portions.

[0018] In accordance with this second aspect of the invention, it is preferred that, when a first composite panel is joined to a second composite panel by means of said first and second engagement formations 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.

[0019] In this second aspect of the invention it is also preferred that the first surface portions are generally planar and extend generally perpendicularly with respect to the first sheet member, and further that the second surface portions are generally planar and extend generally perpendicularly with respect to the second sheet member.

[0020] According to a third aspect of the present invention, there is provided a roofing structure comprising 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,

wherein 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, whereby 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 portions.

[0021] Preferably in 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 sec-

ond distance is greater than said first distance.

[0022] It is also preferred in this third aspect of the invention that the first surface portions are generally planar and extend generally perpendicularly with respect to the first sheet member and also that the second surface portions are generally planar and extend generally perpendicularly with respect to the second sheet member.

[0023] In another preferred variation of this aspect of the invention each of the first and second engagement formations comprises an upstanding wall portion and a head portion, the head portions co-operating in use to join the panels together, and wherein the respective first and second upstanding wall portions of the first and second panels are spaced apart by a distance not greater than or substantially equal to said first distance.

[0024] The roofing structure of the above variation most preferably further comprises a fastening clip, said clip comprising a head portion which co-operates with the head portions of the first and second panels, a wall portion disposed between the upstanding wall portions of the first and second engagement formations and a generally planar fastening portion disposed generally parallel to said third surface portions.

[0025] Preferably the roofing structure of this aspect of the invention further comprises a fastening means having a head portion acting on an upper surface of said planar fastening portion and a shank portion when penetrates said insulating material and is securable in a underlying supporting structure.

[0026] Preferably, in the roofing structure of this aspect of the invention the head portion of the above-mentioned fastening clip comprises a hook-like portion having a leading edge spaced apart from said wall portion, said hook-like portion substantially defining a hollow interior and wherein said leading edge is disposed at the opposite side of the clip with respect to the wall portion as said generally planar fastening portion. Most preferably, the head portion of the second engagement formation is inserted into the hollow interior of the head portion of the clip.

[0027] Desirably in this third aspect of the invention, one or both of the minor faces includes a bead of sealing material along its length.

[0028] Preferably in the roofing structure of this aspect of the invention the first engagement formation is mechanically deformed from a relatively expanded configuration to a relatively contracted configuration in order to engage the engaged second engagement formation and clip.

[0029] Desirably a washer of thermally insulating material is disposed between the head portion of the fastening means and the foot portion of the clip.

[0030] 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 according to 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,

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

Figure 6 shows schematically how the clip of Figure 5A is located in an engagement formation of a composite panel according to the invention.

[0031] Referring now to Figures 3 to 6, the composite panel 50 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.

[0032] 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 inserted 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.

[0033] 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 em-

bodiment 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 and such a construction is much preferred, but other constructions can be used, provided that the respective engagement formations 110, 112 co-operate to join adjacent panels together.

[0034] The composite panel 50 has minor faces 118, 120 extending between the sheet members 100, 102 and substantially defined by side surfaces of the insulating material 104. The minor faces 118, 120 in the illustrated embodiment respectively comprise a first surface portion 118a, 120a extending generally perpendicularly from the first sheet member 100 and a second surface portion 118c, 120c extending generally perpendicularly from the second sheet member 102. Each respective minor face further comprises a third surface portion 118b, 120b extending substantially parallel to the first sheet member 100 and joining the first and second surface portions (118a, 118c) (120a, 120c). The respective first and second surface portions (118a, 118c), (120a, 120c) are spaced laterally apart by a distance equal to the width of the respective third surface portions 118b, 120b. 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 respective first, second and third surface portions of adjacent panels are spaced apart so that a void 122 is formed therebetween. The void 122 comprises a region 122A defined between the confronting first surface portions 118a, 120a, a region 122B defined between the confronting second surface portions, 118c, 120c and a region 122C defined between the confronting third surface portions 118b, 120b. Preferably the width of the void between the respective confronting surface portions is greater in region 122C than in region 122A.

[0035] Referring especially to Figures 5A and 5B, the clip 132 employed in conjunction with the invention comprises an upstanding wall portion 124, a generally planar fastening portion 126 and a head portion 128. The generally planar fastening portion 126 extends substantially perpendicularly to the 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 and such a construction is much preferred, 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.

[0036] 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 generally planar fastening portion 126 lies in the void 122C defined between minor faces 118b, 120b. Said fastening portion 126 lies in use on third surface portion 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 said fastening portion 126 of the clip to retain the clip 132 in its position of use. The third 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 said fastening portion 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 portion 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 post portion 124 and wall portions 110, 112 are preferably substantially parallel.

[0037] 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 remaining when the clip is present a compressible foam material (such as compressible foam strips) may be inserted into the gap or voids 122, 122A, 122B, 122C. The compressible foam will thus lie on respective sides of the post portion 124 of the clip 132, between the clip 132 and the first surface portions 118a, 120a. A compressible foam may similarly be provided between minor face portions 118c, 120c. By filling up any remaining gap or void 122, 122A, 122B, 122C the compressible foam prevents the formation of condensation in the gap or void 122, 122A, 122B, 122C.

[0038] 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.

[0039] In the preferred embodiment illustrated in Figure 4B a clip 132 according to Figure 5B is employed so that the head portion 116 of the second engagement for-

mation 108 is innermost and the head portion 128 of the clip thus surrounds the head portion 116 of the second engagement formation 128. 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 4B, 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. In accordance with the preferred form of the clip illustrated in Figure 4, the head portion comprises a hook-like structure of which the lip 150 forms a leading edge, so that the head portion defines a hollow interior. In this preferred form, the leading edge 150, which is spaced apart from the wall portion 124, is so disposed that the leading edge 150 and the fastening portion 126 are on opposite sides of the wall portion 124. This construction is advantageous in resisting uplift of the roofing structure comprising the panels, or parts thereof, due to wind over the outer surface of the panels.

[0040] In the embodiment illustrated in Figure 4A, a clip 132 according to Figure 5A 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 4A, 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 5A is located in the second engagement formation 108 is illustrated in Figure 6. The initial position of the clip 132 is shown in dotted lines and it can be seen that initially the clip 132 is inverted so that the leading edge 140 of the head portion is inserted into the space 142 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 (as illustrated by arrow A in Figure 6) until the clip 132 reaches its use position (indicated in solid lines).

[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 respec-

tive 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 portion 126 of the clip 132 lying adjacent surface 118b, a fastening means 136 is inserted through fastening 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. 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 portion 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.

[0042] 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 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 insu-

lating 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 associated with the second engagement formation and comprising a generally planar fastening portion which co-operates in use with a fastening means to retain the panel in its position of use, a head portion which is operatively engaged with the head portion of the second engagement formation, and, an upstanding wall portion which extends between the said fastening portion and the head portion of the clip, said wall portion having a length greater than the length of the upstanding wall portion of the second engagement formation such that, with the clip located in use between respective surface portions of said composite panel and an adjacent composite panel said fastening portion is located between the respective third surface portions of adjacent panels; and wherein

the first engagement formation comprises an upstanding wall portion depending from the first sheet member, and a head portion, such that the head portion of the first engagement formation of said adjacent composite panel co-operates in use with the head portion of the second engagement formation and the clip to join the panels together.

2. A composite panel assembly as claimed in claim 1 wherein the first surface portions are generally planar and extend generally perpendicularly with respect to the first sheet member.

3. A composite panel assembly as claimed in claim 1

or claim 2 wherein the second surface portions are generally planar and extend generally perpendicularly with respect to the second sheet member.

4. A composite panel assembly as claimed in any of claims 1 to 3 wherein the head portion of the second engagement formation comprises a hook-like structure defining a hollow interior and the head portion of the clip is inserted in use into said hollow interior.

5. A composite panel assembly as claimed in claim 4 wherein the head portion of the clip is insertable into said hollow interior with the clip in a first orientation and the clip is rotatable about its head portion to a use position in which the enlarged head portion of the clip cannot be removed from the hollow interior.

6. A composite panel assembly as claimed in any of claims 1 to 3 wherein the head portion of the clip comprises a hook-like structure defining a hollow interior and the head portion of the second engagement formation is inserted in use into said hollow interior.

7. A composite panel assembly as claimed in claim 6 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 position of the second engagement formation is fully inserted therein.

8. A composite panel assembly as claimed in any of claims 1 to 7 wherein the head portion of the first engagement formation comprises a hook-like structure defining a hollow interior and the engaged head portions of the second engagement formation and clip of an adjacent panel are inserted in use into the hollow interior of said head portion of the first engagement formation.

9. A composite panel assembly as claimed in any of claims 1 to 8 wherein the head portion of the first engagement formation is operatively deformable into engagement with the head portions of the second engagement formation and the clip of said adjacent panel.

10. A composite panel assembly as claimed in any preceding claim wherein a bead of sealing material is formed along the length of the first and/or second minor faces.

11. A composite 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 the 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 a first composite panel being adapted to co-operate with a second engagement formation of an adjacent second composite panel to join the panels together;

wherein the first and second minor faces 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 respective first and second surface portions and formed substantially parallel to the first sheet member, whereby, when a first composite panel is joined to a second composite panel by means of said first and second engagement formations, the first, second and third surface portions of the first composite panel lie in confronting spaced apart relation to the respective first, second and third surface portions of the adjacent second composite panel, thereby to define a void between each pair of confronting surface portions.

12. A composite panel as claimed in claim 11 wherein, when a first composite panel is joined to a second composite panel by means of said first and second engagement formations 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.

13. A composite panel as claimed in claim 11 or 12 wherein the first surface portions are generally planar and extend generally perpendicularly with respect to the first sheet member.

14. A composite panel as claimed in claim 11, 12 or 13 wherein the second surface portions are generally planar and extend generally perpendicularly with respect to the second sheet member.

15. A roofing structure comprising 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,

wherein 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, whereby 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 portions.

16. 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.

17. A roofing structure as claimed in claim 15 or claim 16 wherein the first surface portions are generally planar and extend generally perpendicularly with respect to the first sheet member.

18. A roofing structure as claimed in any of claims 15 to 17 wherein the second surface portions are generally planar and extend generally perpendicularly with respect to the second sheet member.

19. A roofing structure as claimed in any of claims 15 to 18 wherein each of the first and second engagement formations comprises an upstanding wall portion and a head portion, the head portions co-operating in use to join the panels together, and wherein the respective first and second upstanding wall portions of the first and second panels are spaced apart by a distance not greater than or substantially equal to said first distance.

20. A roofing structure as claimed in claim 19 further

comprising a fastening clip, said clip comprising a head portion which co-operates with the head portions of the first and second panels, a wall portion disposed between the upstanding wall portions of the first and second engagement formations and a generally planar fastening portion disposed generally parallel to said third surface portions. 5

21. A roofing structure as claimed in claim 20 further comprising a fastening means having a head portion acting on an upper surface of said planar fastening portion and a shank portion when penetrates said insulating material and is securable in a underlying supporting structure. 10

22. A roofing structure as claimed in claim 20 or 21 wherein the head portion of the fastening clip comprises a hook-like portion having a leading edge spaced apart from said wall portion, said hook-like portion substantially defining a hollow interior and wherein said leading edge is disposed at the opposite side of the clip with respect to the wall portion as said generally planar fastening portion. 15 20

23. A roofing structure as claimed in claim 22 wherein the head portion of the second engagement formation is inserted into the hollow interior of the head portion of the clip. 25

24. A roofing structure as claimed in any of claims 15 to 23 wherein one or both of the minor faces includes a bead of sealing material along its length. 30

25. A roofing structure as claimed in any of claims 15 to 24 wherein the first engagement formation is mechanically deformed from a relatively expanded configuration to a relatively contracted configuration in order to engage the engaged second engagement formation and clip. 35

26. A structure as claimed in any of claims 15 to 25 further comprising a washer of thermally insulating material disposed between the head portion of the fastening means and the foot portion of the clip. 40 45

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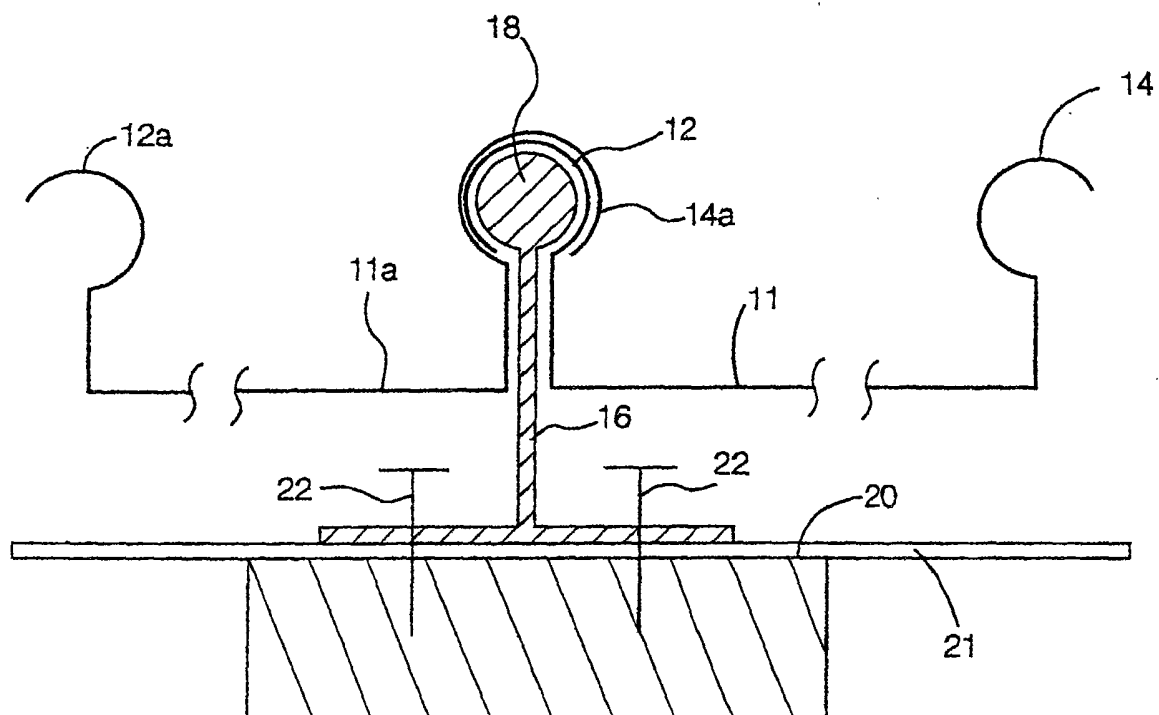


Fig. 1A

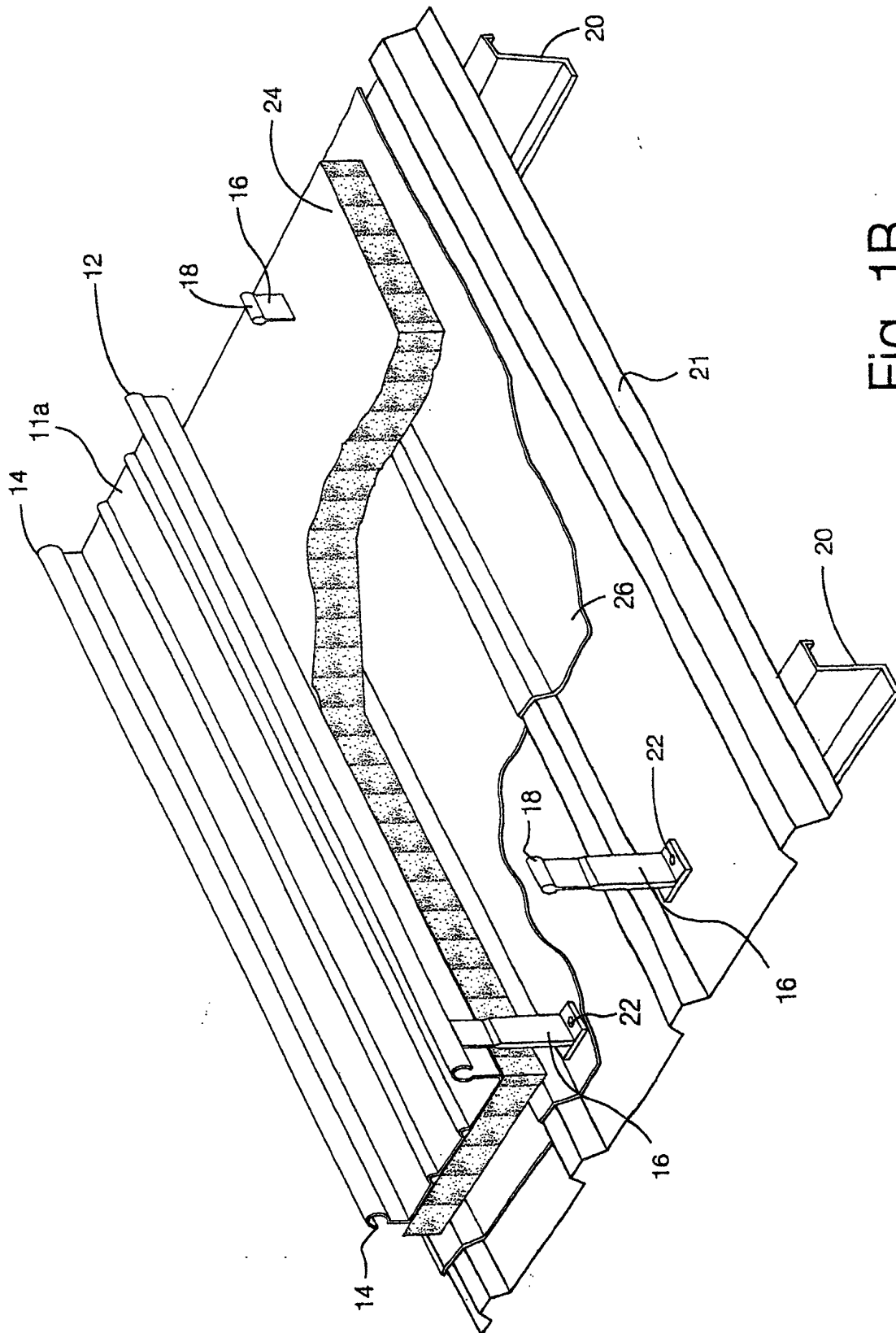


Fig. 1B

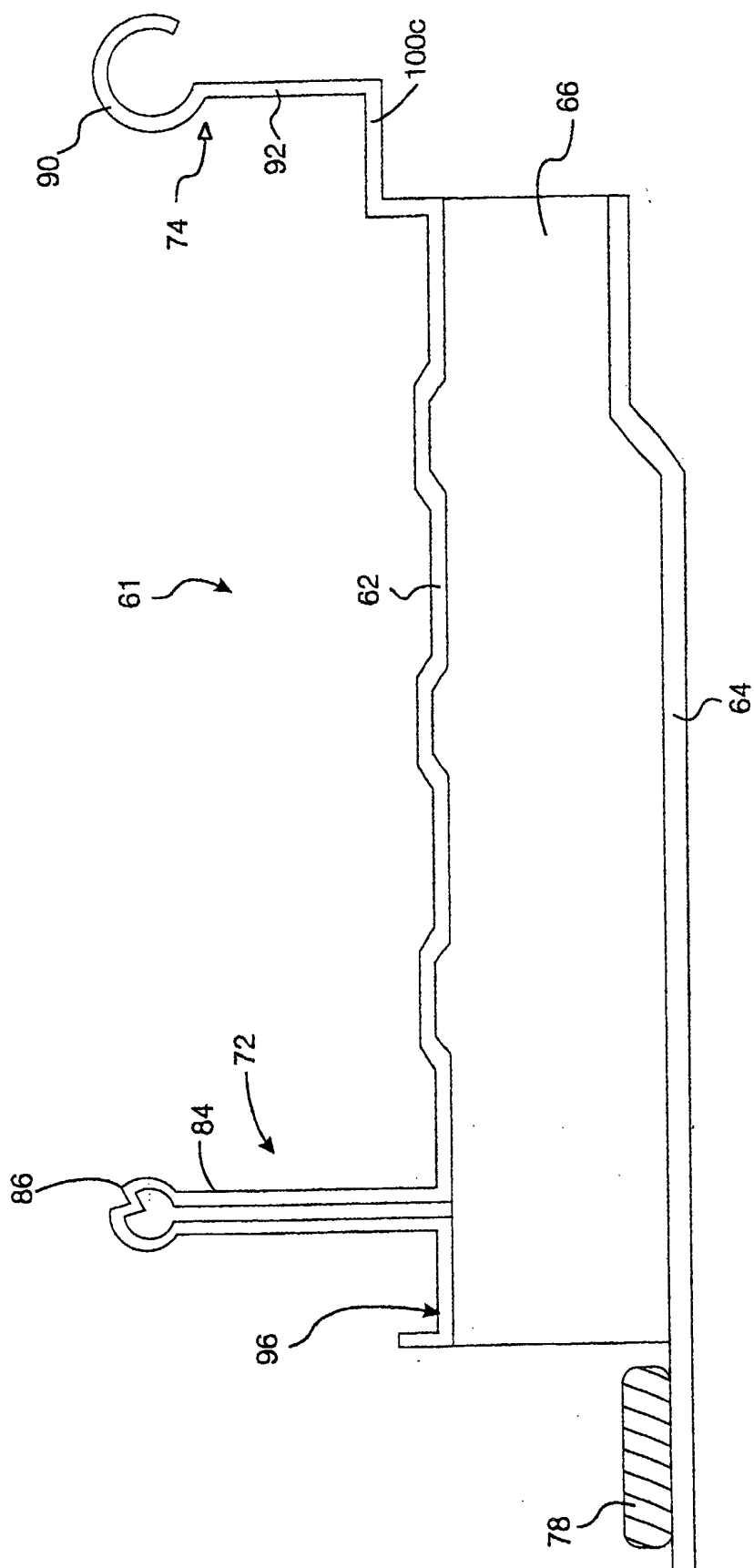


Fig. 2A

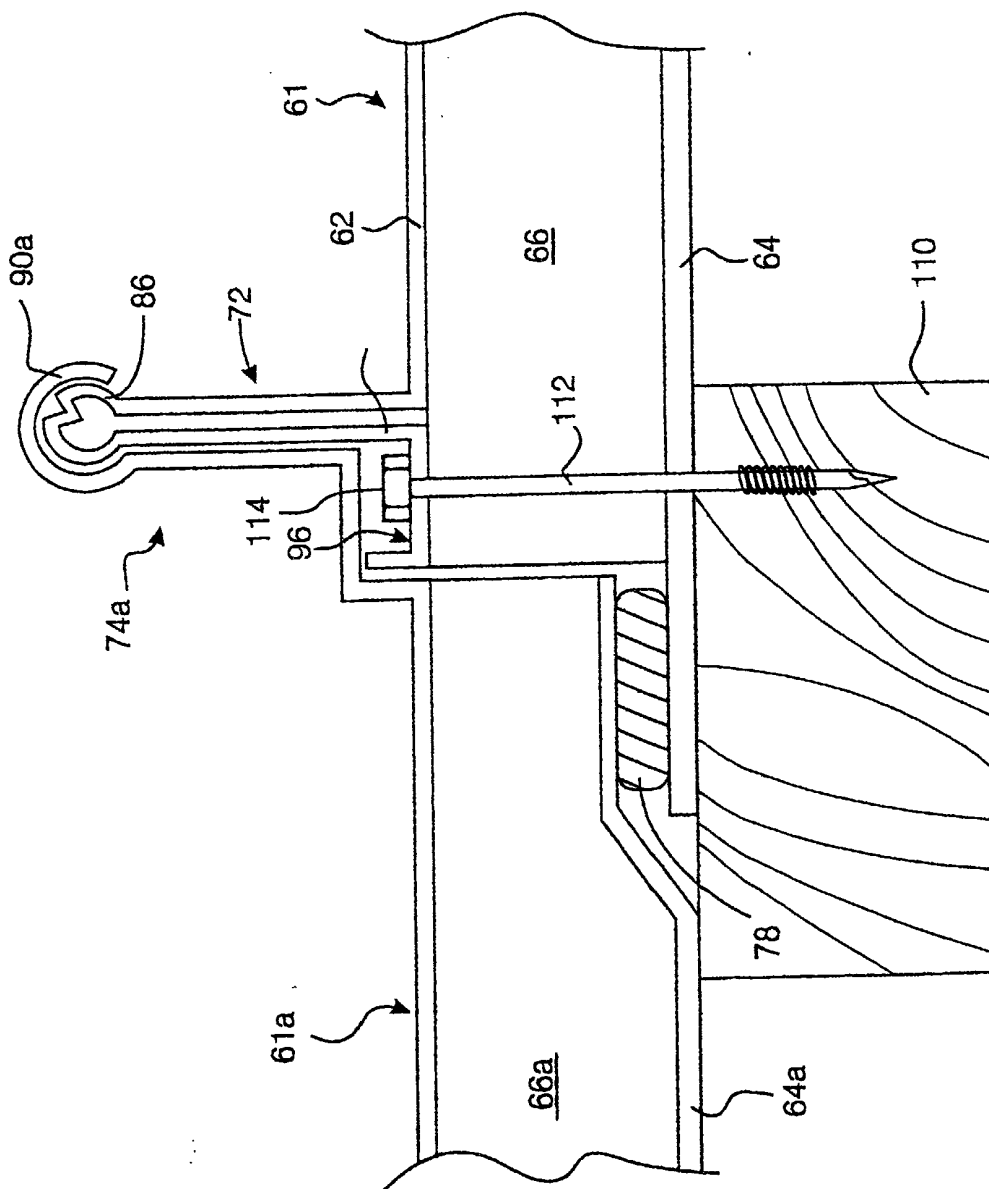
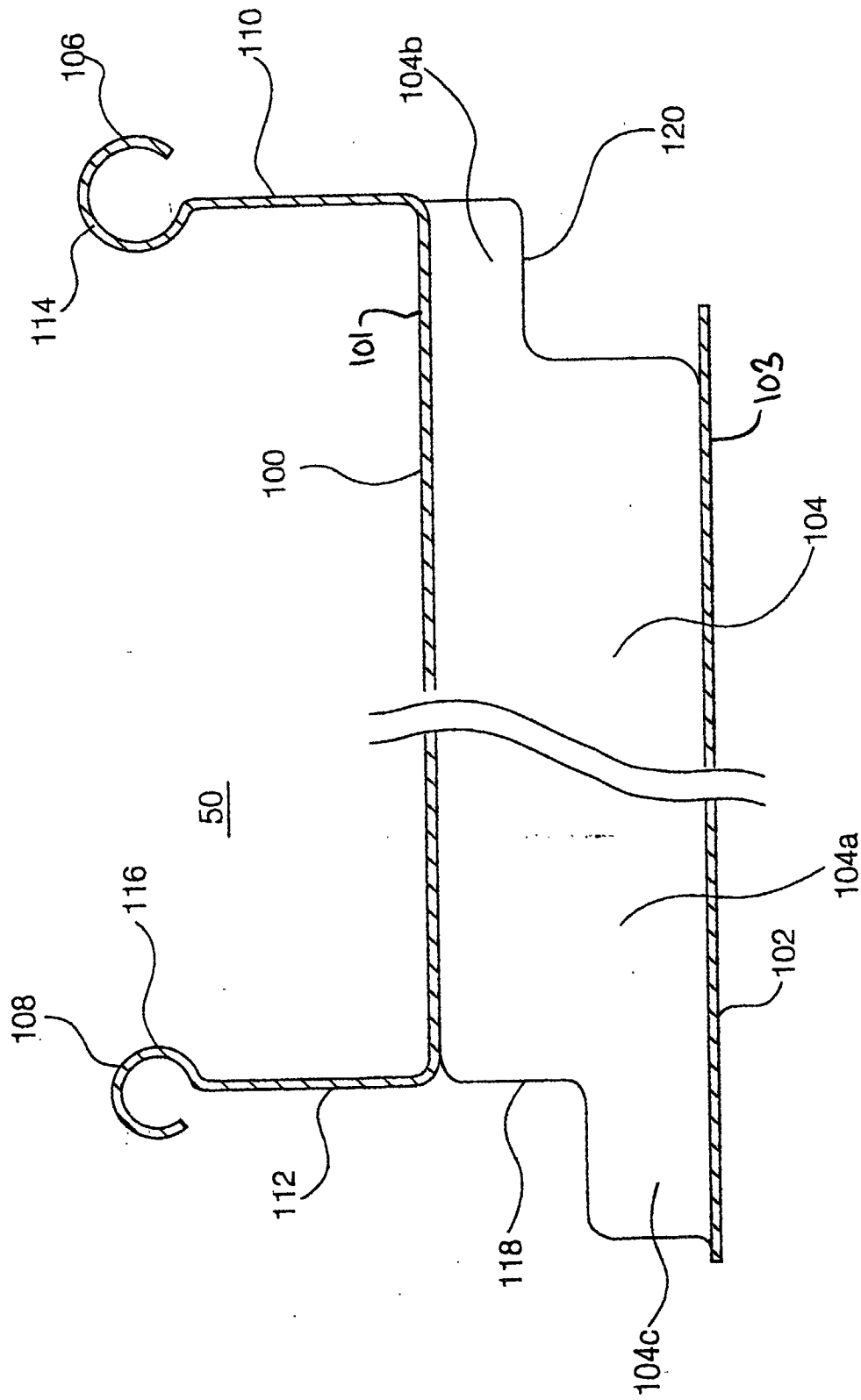


Fig. 2B



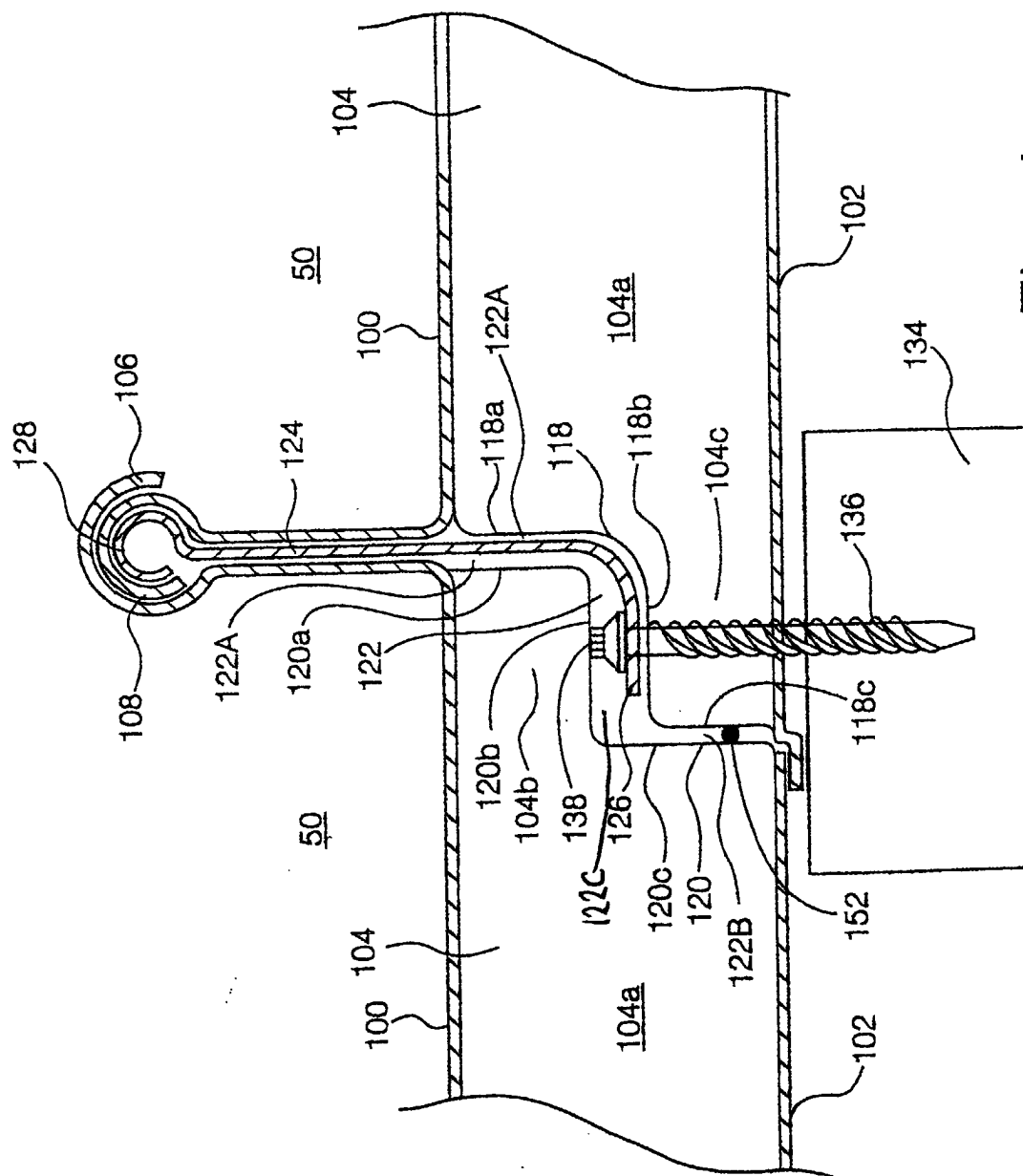


Fig. 4a

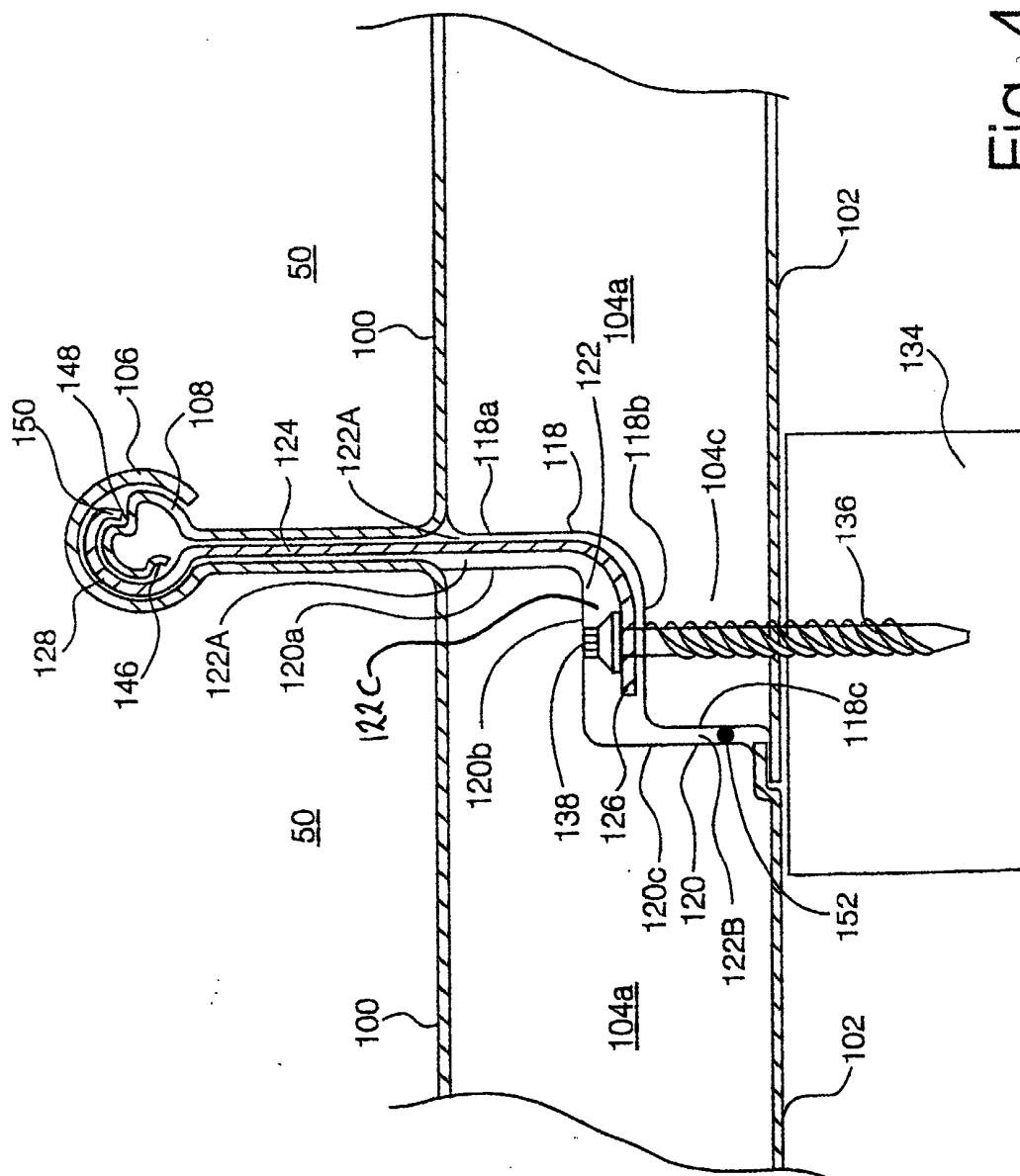


Fig. 4b

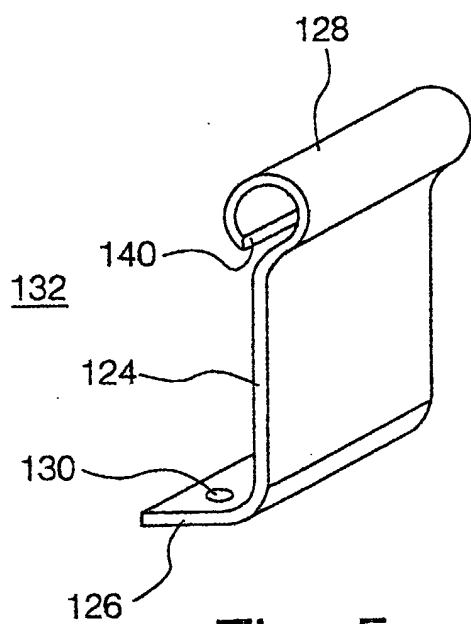


Fig. 5a

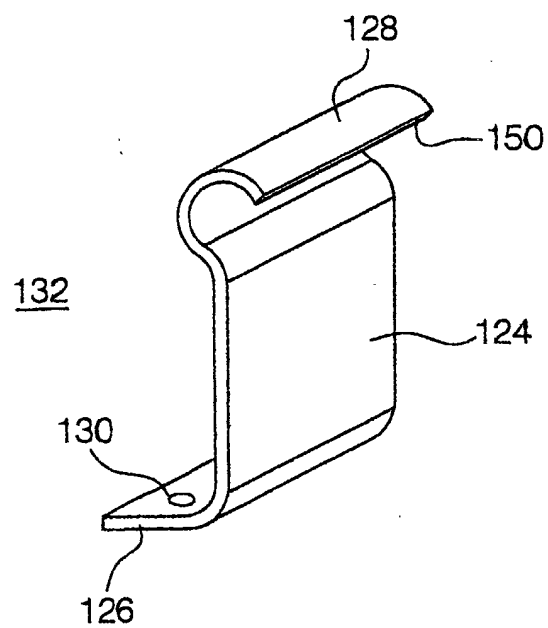


Fig. 5b

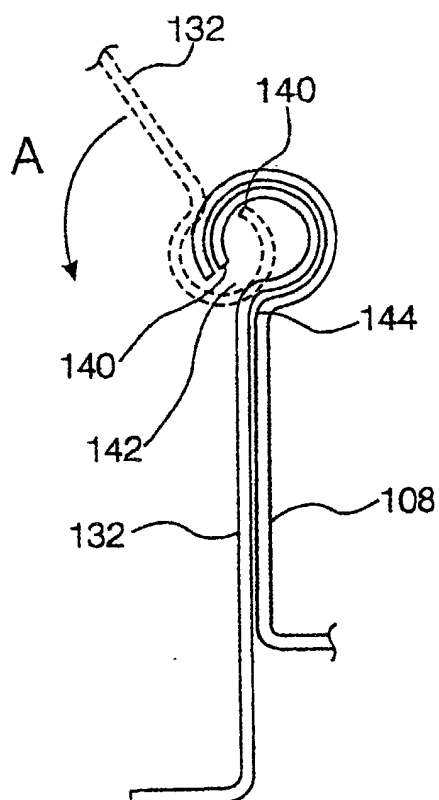


Fig. 6



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 01 30 9819

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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Y	* the whole document *	22,23	
A		2,3,13, 14,17,18	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E04D E04C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 February 2002	Examiner Demeester, J
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