

12 **EUROPEAN PATENT APPLICATION**

21 Application number: 80302519.6

51 Int. Cl.³: **E 04 D 13/14**
E 04 D 13/03

22 Date of filing: 24.07.80

30 Priority: 27.07.79 GB 7926267

43 Date of publication of application:
04.02.81 Bulletin 81/5

84 Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

71 Applicant: **COLT INTERNATIONAL HOLDINGS A.G.**
Baarerstrasse 59
CH-6300 Zug(CH)

72 Inventor: **Faulkner, Geoffrey**
5, Firglen Drive Yateley
Nr. Camberley Surrey(GB)

72 Inventor: **Hiles, Maurice Arthur Fredrick**
Tewin Lodge Tewin Water
Hertfordshire(GB)

74 Representative: **Slight, Geoffrey Charles et al.**
Graham Watt & Co. Riverhead
Sevenoaks Kent TN13 2BN(GB)

54 **A method of mounting ventilators, lights and the like in sealed relation to an opening and a preformed sealing material for use in such a method.**

57 A method of mounting a piece of equipment (20) in sealed relation to an opening (16, 17) in cladding (10, 12) of a building, for example a ventilator in a roof. Conventional flashing between the top transverse edge of a base flange (21) of the equipment and the cladding (10, 12) is replaced by a preformed sealing material (34), sandwiched between the top transverse edge of the base flange (21) and the cladding (10, 12), and a fillet or fillets (50) of an initially pourable or shapable sealing material, formed along the top transverse edge of the base flange (21), which becomes sealed to the preformed sealing material (34) and the cladding (10, 12) after hardening or setting thereof. The preformed sealing material (34) is profiled at its underside to accommodate the profile of the cladding, and may also be provided with depending sealing lips or bands (36, 37 - Fig. 5) to improve sealing. The preformed sealing material (34) may be in elongate strip form or alternatively it may be composed of separate segments (45) assembled together (Figs. 4 and 6). The preformed material (34) and the fillet forming sealing material (50) may comprise a polyurethane elastomer.

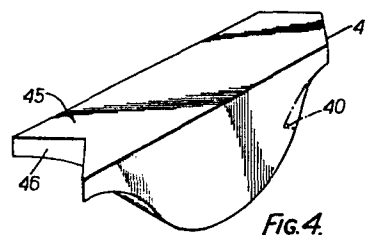


Fig. 4.

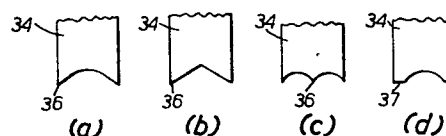


Fig. 5.

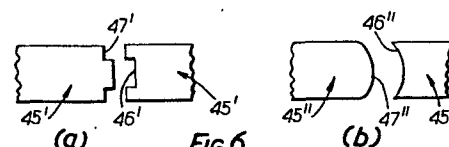


Fig. 6.

EP 0 023 415 A2



- 2 -

The present invention relates to mounting equipment on buildings and concerns more particularly, but not exclusively, the mounting of ventilators on buildings.

5 Industrial buildings may be clad with corrugated sheeting of many different transverse profiles. To provide proper weathering, the sheeting is overlapped, a bottom or down-slope transverse edge portion of each sheet overlying a top, transverse edge portion of the
10 next lower or down-slope sheet, and so on. The sheets also have longitudinal, overlapping edge portions at their side edges, extending in the direction of their corrugations each sheet having, for example, a corrugation along one side edge overlying a corrugation of the adjacent
15 side edge of the adjacent sheet, and all the sheets being similarly arranged.

 In order to mount a ventilator on a building clad with sheeting in the manner just described, it is necessary to provide a hole in the sheeting and to
20 flash the top, transverse edge of the mounting flange of the ventilator to the building. Thus, where the ventilator is to be mounted at the top of a roof slope immediately next to the roof ridge, a flashing strip is provided extending transversely, i.e. along the slope
25 of the roof, the flashing strip underlying the roof ridge cap along an up-slope edge portion of the strip and overlying the ventilator frame along a down-slope edge portion of the strip. In this manner, _____



- 3 -

water draining downwardly over the flashing strip is carried onto the outside of the ventilator frame and drains downwardly thereover.

5 If it is desired to mount the ventilator further down the roof slope, a sealing plate may be provided having a transverse edge portion at its down-slope edge overlying a top, transverse edge portion of the ventilator frame, the transverse up-slope edge portion of the plate being flashed to the ridge cap in the manner
10 described in the immediately preceding paragraph. Alternatively, the top, transverse edge portion of the ventilator frame may be flashed to a transverse lower edge portion of one or more of the roof sheets using a flashing strip. In the latter case, the constraint
15 imposed on the positioning of a ventilator is often inconvenient. On the other hand, the provision of an over long sealing plate is expensive. Also, the plate itself has to be fixed to the roof structure which creates further sealing problems.

20 As so far described, nothing has been said concerning the sealing of the ventilator frame to the roof sheeting along its downwardly sloping side edges and along its bottom, transverse edge. To effect these seals, sealing strips are provided between the
25 underside of the ventilator frame and the outside surface of the roof sheeting, there being, for example, one continuous, plane or sheet-form sealing strip held compressed between the underside of the frame and a

corrugation ridge of the roof sheeting extending adjacent each downwardly sloping side edge of the ventilator frame and one profiled sealing strip, profiled to interfit with the corrugations of the roof sheeting, 5 extending adjacent the bottom, transverse edge of the ventilator frame and held compressed between the frame and the roof sheeting.

Instead of overlapping sheeting, profiled, metal decking is sometimes used to roof industrial buildings. 10 Such decking may extend, in one piece, from the eaves to the roof ridge and in this case, a special upstand or duct has to be provided in the decking to define each roof ventilation opening, the duct walls upstanding from the general plane of the decking on the outside of 15 the roof to carry the ventilator, and in this way to effect sealing of the opening in the roof. The formation of such special ventilator upstands is costly and is preferably carried out prior to the installation of the decking.

20 An object of the present invention is to provide an improved method and means for sealing a piece of equipment to a simple opening formed in cladding of a building which avoids the use of a flashing strip or an upstand.

25 The present invention provides, in one aspect thereof, a method of mounting a piece of equipment in sealed relation to an opening in cladding of a building which includes the steps of securing the piece of

equipment to the building, over the opening, with the interposition of preformed sealing material between a base flange of the equipment and the outside of the cladding, the preformed sealing material entirely

5 surrounding the opening, forming a fillet or fillets of settable or hardenable material along the top, transverse edge of the base flange in contact with the preformed sealing material deployed adjacent that edge, and then allowing or causing the fillet material to set or harden.

10 Preferably, the fillet or fillets is or are formed to at least the level of the top, transverse edge of the upper surface of the base flange.

In the case where the opening has a top, transverse edge which includes overlapping sheet edge portions of

15 the cladding, the method of the present invention may further include sealing the gap between said overlapping sheet edge portions adjacent the upper edge of the fillet.

The present invention further includes preformed sealing material for use with the method of the present

20 invention, for deployment adjacent the top, transverse edge of the opening, the sealing material having a plane upper surface to engage under the ventilator base flange, and a profiled bottom surface, profiled in at least one of two directions at right angles, in said one direction to

BAD ORIGINAL



- 6 -

provide depending sealing lips or sealing bands and in the other direction, if necessary, to shape the lips or bands in conformity with the transverse profile of the cladding. The preformed sealing material may be
5 in elongated strip form, the strip being elongated in the direction of the lips or bands.

In this case, the lips or bands may include at least one step extending in said one direction to shape the lips or bands in conformity with the edge of an
10 overlying, longitudinal edge portion of a cladding sheet of the building.

Alternatively, the preformed sealing material may be in the form of correspondingly shaped segments, the lips or bands extending between ends of the segments
15 shaped to interlock with one another transversely of the lips or bands when the segments are assembled end-to-end.

In this case, one or more of the segments may have lips or bands including at least one step extending in said one direction to shape the lips or bands on the
20 segment in conformity with the edge of an overlying, longitudinal edge portion of a cladding sheet of the building.

The present invention still further provides the preformed sealing material of the invention, in
25 combination with settable or hardenable fillet forming material, when sold as a kit for mounting a piece of equipment to the cladding of a building over an opening in the cladding, the preformed sealing material and the

settable fillet forming materials being compatible materials for the purpose intended and being constituted as will now be described.

5 The fillet forming material should be chosen of a material, which, when hardened or set, will bond to the intended cladding and to the preformed sealing material so as to form a waterproof seal with the cladding and with the preformed sealing material.

10 The fillet forming material preferably has additional properties. Thus, the fillet forming material is preferably temperature stable when set, over a temperature range of -20°C to 80°C . Preferably also, it is stable to ultra-violet light and has fire retardant properties.

15 The fillet forming material may comprise a pourable composition with a working time sufficient for it to be correctly placed and levelled before it sets and it should set without substantial contraction.

20 Alternatively, the fillet forming material may comprise a shape maintaining, shapable composition with a working time sufficient for it to be correctly placed and shaped before it sets and, again, it should set without substantial contraction.

25 Preferably, both the fillet forming material and the preformed sealing material comprise a polyurethane elastomer.

Specific embodiments of the present invention in both its method and apparatus aspects, will now be described by way of example, and not by way of limitation, with reference to the accompanying drawings in which:-

30 Fig. 1 is a cross-section of a roof structure showing a ventilator mounted thereon by a method in accordance with the present invention;



- 8 -

Fig. 2 is a view of the ventilator looking up the slope of the roof structure;

Fig. 3 is a plan view of the ventilator shown in Figs. 1 and 2;

5 Fig. 4 is a perspective view of a preformed segment of sealing material in accordance with the present invention;

10 Figs. 5(a) to (d) are cross-sections showing different profiles of the bottom surface of the segment shown in Fig. 4;

Figs. 6(a) and (b) show different interlocking end shapes for preformed segments of sealing material in accordance with the present invention; and

15 Fig. 7 is an elevation of a preformed strip of sealing material in accordance with the present invention.

With reference now to the accompanying drawings, a sloping roof structure 10 of a building is clad with corrugated sheets 12 overlapped at their longitudinal side edges, as best seen in Fig. 2. The sheets are
20 supported on purlins 14 which in turn carry an inner ceiling structure or lining 15. A trunking 16 defines a ventilation opening extending through the roof structure to a simple opening 17 cut in the sheeting 12. A ventilator 20 having a surrounding base flange 21 extending
25 outwardly on all four sides of the ventilator casing 22 is bolted to the roof sheeting in conventional fashion. Plane sealing strips 30 are interposed between the ridges of two corrugations of the roof sheeting, and the flange 21

- 9 -

along the downwardly sloping sides of the ventilator seen in Figs. 1 and 3 and a profiled sealing strip 32 is interposed between the outside of the roof sheeting and the flange 21 at the transverse, down-slope edge of the ventilator seen in Fig. 2. The bottom surface of the strip 32 is profiled to interfit with the corrugations of the roof sheeting.

As so far described, the method of mounting the ventilator to the outside of the roof sheeting is conventional.

Instead of flashing the top, transverse edge of the base flange 21 to the down-slope transverse edge of a roof sheet 12 or to a sealing plate in turn flashed to the ridge cap of the roof, a preformed strip 34 of sealing material is interposed between the base flange 21 and the outside of the roof sheeting along the top, transverse edge of the flange 21 so as to bridge the upper ends of the strips 30. The strip 34 may be in one piece, as illustrated in Fig. 7, having a plane upper surface 35 to engage the flat under surface of the base flange and a profiled bottom surface shaped in conformity with the corrugations of the roof sheeting and transversely of the strip, preferably as shown in Fig. 5(a) or Fig. 5(b) or Fig. 5(c) or Fig. 5(d) so as to present depending sealing lips 36 or sealing bands 37 to engage the outside of the roof sheeting. Thus, the strip 34 may have a profiled bottom surface 38 profiled in two directions at right angles, in one direction to provide the depending



- 10 -

sealing lips 36 or bands 37 and in the other direction to shape the sealing lips or sealing bands in conformity with the transverse profile of the roof sheeting. However, the strip 34 may be profiled only in said other direction, the strip being rectangular in cross-section so as to appear flat on the bottom as seen in Fig. 5.

The bottom surface 38 of the strip has at least one step 40 extending in said one direction, transversely of the strip to conform the bottom surface of the strip to the shape of the overlapped sheet portions seen in Fig. 2.

Where the strip 34 is provided with more than one step 40, the distance between the steps is made equal to the distance between the overlapped sheet portions for which the strip 34 is designed. Thus, the strip 34 is preformed to a predetermined shape depending upon the particular contour and dimensions of the corrugated roof sheeting with which it is to be used. Such a strip, or a strip with only one step 40, may be cut transversely into segments and the segments butt jointed end-to-end in a different order in order to position a step at the location of each roofing sheet overlap bounding the ventilation opening. A strip 34 having only one step 40 would have a length equal to the width of corrugated roof sheet for which it was designed.

As an alternative, the strip 34 may be composed of preformed segments 45 of sealing material shaped as shown in Fig. 5 for example, having ends 46 and 47 shaped

to interlock with one another transversely of the sealing lips 36 or the sealing bands 37 as seen in Fig. 3.

Instead of having chevron-shaped complementary ends 46, 47, the segments 45 may have interlocking ends as shown
5 in Fig. 6(a) or Fig. 6(b). Many other different shapes e.g. a dovetail shape, are, of course, possible to meet the segment interlocking requirement which is provided to ensure that the segments 34 do not easily slip out of an aligned end-to-end position and so as to present a longer
10 leakage path for water between adjacent ends of adjacent segments.

To prevent standing water accumulating in the corrugations of the roof sheeting against the up-slope face of the strip 34, a fillet 50 of settable or
15 hardenable sealing material is poured along the top, transverse edge of the base flange 21 in contact with the strip 34 and the fillet hardened or allowed to set. As seen in Fig. 1, the fillet 50 is poured to the height of the transverse up-slope edge of the upper surface of the
20 base flange 21 to carry water onto the upper surface of the base flange so that it can continue to drain downwardly over the outside of the roof structure.

Finally, settable or hardenable sealing material, indicated at 55 in Fig. 3 by double cross hatching, is
25 injected into the space between the longitudinal overlapping sheet edge portions of the sheets 12 at the transverse, up-slope edge of the opening 17. Injection is performed through a hole 56 formed in the outer sheet 12 using any convenient form of sealing material injector.

The fillet 50 is preferably chosen of a material which, when hardened or set, forms a waterproof seal with the roof sheeting and with the strip 34. To achieve such waterproofing, the fillet is required to bond to the roof sheeting and to the strip 34. The material forming the fillet 50 preferably has additional properties. Thus, the material is preferably temperature stable when hardened or set, over a temperature range of -20°C to 80°C . Preferably also, the fillet material is stable to ultra violet light and has fire retardant properties.

It is desirable in the present example, that the fillet should comprise a pourable composition with a working time sufficient for it to be correctly placed and levelled before it sets. It should set without substantial contraction. Conveniently, the material to form the fillet may comprise a polyurethane elastomer as used also for the strip 34 to which stabilisers, such as u.v. absorbers and carbon black, fillers and fire retardants have been added. A suitable formulation is:

	<u>pph.</u>	<u>Source</u>
Polyol (40%)	29.6	PM735X <u>ex</u> Bostik Ltd.
Tribromocresol, glycidyl ether	2.0	BROC <u>ex</u> Albright & Wilson
Triaryl phosphate	4.0	Albright & Wilson
Filler	60.9	
Antidegradant	0.3	Tinuvin P & Tinuvin 770 <u>ex</u> Ciba-Geigy Ltd.
Bis-(4-isocyanatophenyl)methane	3.2	Upjohn

It is advantageous, for improved adherence between the fillet and asbestos or iron roof sheets to prime the roof



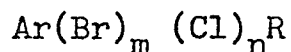
- 13-

sheets with an aqueous acid, e.g. polyacrylic acid or polyphosphoric acid prior to pouring the fillet.

The preformed sealing strip 34 or segments 45 are suitably manufactured from a mouldable elastomer which has a low bulk modulus (typically less than 6 MPa, preferably less than 3 MPa), a low compression set, or residual strain (typically less than 0.15, preferably less than 0.10 and most preferably less than 0.05), and a delayed recovery (typically greater than 0.7 sec, preferably greater than 2 sec and most preferably greater than 10 sec). It is preferred, by reason of its ease of moulding and the ready, reproducible variation which may be attained in its properties, that the elastomer is a polyurethane elastomer which, in order that the above properties are attained, suitably has a low branch molecular weight and very low degree of cross-linking. Such a polyurethane elastomer may be prepared by reacting a diisocyanate, typically bis(4-isocyanatophenyl)methane or tolylene diisocyanate, with a stoichiometric excess of a blend of polyols wherein the molar ratio total OH:NCO is from 5:1 to 1.22:1. Suitably, the polyol blend comprises a major amount, preferably greater than 60% of the polyol blend, of a higher, preferably greater than 1200, average molecular weight polyol with a corresponding amount of a lower, preferably less than 600, average molecular weight polyol with a corresponding amount of a lower, preferably less than 600, average molecular weight polyol. A suitable such polyol blend is supplied as PM735X by

Bostik Limited.

The strip 34 may be rendered non-burning or self-extinguishing by incorporating in one or both of the reactive components, preferably the polyol blend, at least one halogenated aromatic compound of the formula:



wherein:

Ar represents an aromatic, preferably carbocyclic, valent group;

R represents a hydroxyl group or a monovalent substituted or unsubstituted hydrocarbyl or hydrocarboxyl group;

m is 3 or more; and

n is 0, 1 or 2.

The aromatic group is preferably derivable from benzene, toluene, xylene, naphthalene or anthracene; R is preferably a substituted or unsubstituted, straight or branched chain alkyl, alkoxy, alkenyl, or alkenoxy. Suitable substituents may be halogen atoms or the epoxy group. A particularly suitable such group is the epoxy-substituted alkoxy group, the glycidyl group. Such a group is reactive with the polyurethane elastomer, its prepolymers and monomers, thereby binding the fire retardant compound to the elastomer obviating its loss by leaching. Examples include pentabromophenol, tribromophenol, tribromotoluene, pentabromotoluene, chlorodibromotoluene, chlorodibromo-phenyl allyl ether, dibromonaphthalene, 2,4 - dibromo-1-methylnaphthalene, tribromocresol and its

- 15 -

glycidyl ether.

It is especially preferred to include, as co-fire-retardant, a triaryl phosphate. Such a co-retardant is preferably present in an atomic ratio of Br:P of 3:1 to 1:1.

This invention is applicable to mounting equipment such as ventilators, lights, flues, air intakes and exhausts and so on, on buildings clad with any known form of sheeting or decking of metal, asbestos or otherwise, and these terms are to be taken to extend to box rib sheeting, trough rib sheeting, combined sheeting, and sheeting cladding or tiles sold under such trade names as SNAPRIE, MAGNUM, TROFSEC, FURAL, BUTLERIB, BANTILE, MONAD, FORT, ATLAS, TRAFFORD ALCAN and WATFORD.

Where the equipment is to be mounted on a wall of the building, the composition to compose the fillet is formulated with a stiffer, shapable, shape maintaining consistency to enable it to be correctly placed, and to retain its place, using a trowel, instead of being pourable. In all other respects the fillet material is preferably formulated as hereinbefore described in the specific embodiment.

Instead of injecting sealing material into the space at 55, a longitudinal fillet of settable or hardenable sealing material 55' may be formed along the edge of the overlying sheet 12 before the fillet 50 is formed. The longitudinal fillet should extend from the opening 17 to a height or level above the top of the intended fillet 50 generally as shown in Fig. 3.

- 16 -

It is to be appreciated that the fillet or fillets 50 as described with reference to the accompanying drawings provide a back-up for the strip 34 or the segments 45 designed absolutely to guarantee sealing.

5 To this end, not only do the fillets 50 function ideally, to prevent the accumulation of water in the roof corrugations on the up slope side of the strip 34 or the segments 45, by running off the water, but also they function ideally to prevent water actually reaching the
10 upslope face of the strip 34 or the segments 45.

Neither of these functions is, however, absolutely essential to an effective sealing performance when using a polyurethane elastomer of the preferred kind as specifically described. Thus, when using such an
15 elastomer to form the strip 34 or the segments 45, its ability to conform to the shape of the surfaces between which it is interposed and its very low compression set enables the fillet or fillets 50 to be omitted altogether, if desired, or, if not omitted, the fillet or fillets may
20 be formed of any suitable material which nevertheless does not necessarily form a waterproof seal with the roof sheeting and with the strip 34. In the latter case the fillet or fillets function simply to run off the water or most of the water from the upslope face of the strip
25 34 or the segments 45. Such omission is possible even where the mounting is subject to vibration due to traffic or machinery operating, which is surprising.

- 17 -

Claims:

1. A method of mounting a piece of equipment (20) in sealed relation to an opening (16, 17) in cladding (10, 12) of a building, which method includes
5 the steps of securing the piece of equipment (20) to the building, over the opening, with the interposition of sealing material (30, 32) between a base flange (21) of the equipment and the outside of the cladding (10, 12), characterised by arranging a preformed
10 sealing material (34, 45) between the top transverse edge of the base flange (21) and the cladding (10, 12), forming a fillet or fillets (50) of a settable or hardenable material along the top transverse edge of the base flange (21) in contact with the preformed
15 sealing material (34, 45) and the cladding (10, 12), and allowing or causing the fillet material to set or harden.

2. A method as claimed in claim 1 characterised by forming the fillet or fillets of a
20 settable or hardenable sealing material whereby the fillet or fillets form a waterproof seal with the cladding (10, 12) and the preformed sealing material (34, 45).

3. A method of mounting as claimed in
25 claims 1 or 2, characterised by forming the fillet or

- 18 -

fillets (50) at least to the level of the top transverse edge of the upper surface of the base flange (21).

4. A method of mounting as claimed in
5 claims 1, 2 or 3, and for use when the top transverse edge of the opening (17) includes overlapping sheet edge portions of the cladding (12) characterised by sealing (55 or 55') any gap between the overlapping sheet edge portions for a pre-determined length
10 adjacent the opening (17).

5. A method of mounting as claimed in claim 4, characterised by injecting a settable or hardenable sealant (55) into the gap via a hole (56) formed in the outermost overlapping sheet edge of the cladding (12)
15 after formation of the fillet or fillets (50).

6. A method of mounting as claimed in claim 4, characterised by forming a longitudinal fillet (55') along an edge portion of the outermost cladding sheet (12) before formation of the fillet or fillets
20 (50) along the top transverse edge of the base flange (21).

7. A method of mounting as claimed in any one of the preceding claims, characterised by employing a pourable settable or hardenable sealing material to
25 form the fillet or fillets (50), which pourable

- 19 -

material is appropriately placed and levelled.

8. A method of mounting as claimed in any one of the preceding claims characterised in that the preformed sealing material (34, 45) and the settable
5 or hardenable sealing material (50) are comprised of a polyurethane elastomer.

9. A preformed sealing material for use in a method as claimed in any one of the preceding claims, characterised in that the sealing material (34) is
10 elongate and has a substantially plane first surface (35) adapted to engage the equipment base flange (21) and a second surface (38) adapted to engage the cladding (10, 12) in a sealing manner.

10. A preformed sealing material as claimed
15 in claim 9, characterised in that the second surface (38) is profiled in a direction perpendicular to the length of the sealing material (34) to provide sealing lips (36) or sealing bands (37).

11. A preformed sealing material as claimed in
20 claim 9 or claim 10, characterised in that it is comprised of elemental segments (45) adapted (46, 47) to be assembled together to form an elongate member.

12. A kit of parts for mounting a piece of equipment in relation to an opening in cladding of a
25 building characterised by a preformed sealing material

- 20 -

(34 or 45) as claimed in claims 9, 10 or 11 and a
settable or hardenable fillet forming material of a
composition compatible with and bondable to the
cladding and the preformed sealing material whereby to
5 form a waterproof seal therewith.

13. A kit of parts as claimed in claim 12
characterised in that the preformed sealing material
and the cladding material are comprised of a
polyurathane elastomer.

10 14. A method of mounting a piece of
equipment in sealed relation to an opening in cladding
of a building including the steps of securing the
piece of equipment to the building, over the opening,
with the interposition of preformed sealing material
15 between a base flange of the equipment and the outside
of the cladding characterised in that the preformed
sealing material (34 or 45) deployed adjacent the
top transverse edge of the base flange is composed of
a polyurathane elastomer of a low bulk modulus less
20 than 6 MPa, a low compression set or residual strain
less than 0.15 and a delayed recovery after
compression greater than 0.7 seconds.

1/2

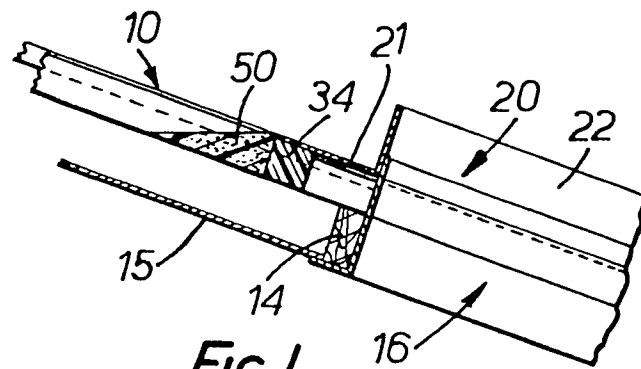


FIG. 1.

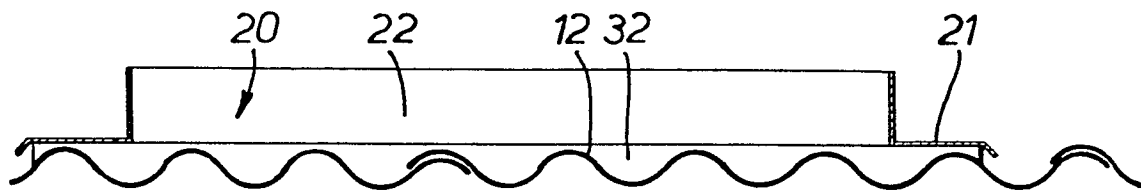


FIG. 2.

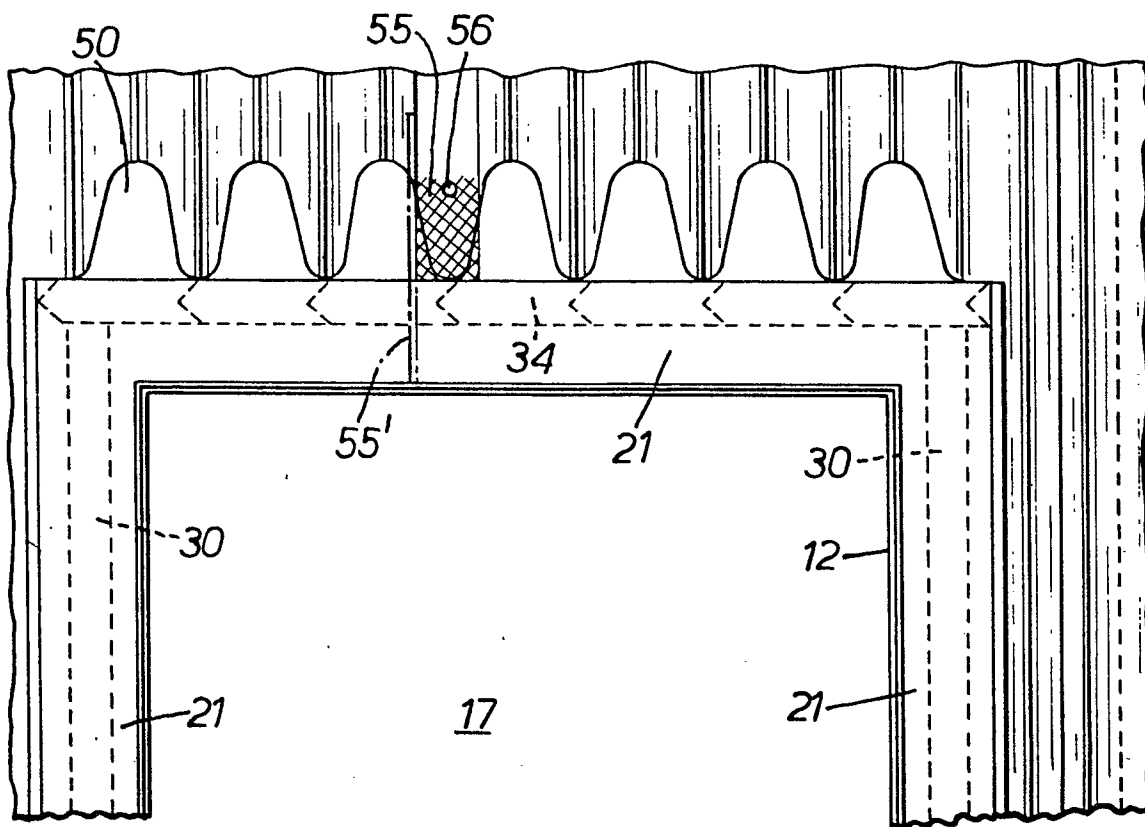


FIG. 3.

2/2

