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(54) **Insulated panels for heated or cooled enclosures.**

(57) Undesirable heat transfer takes place through the edges of metal-clad insulating panels conventionally used for construction of heated or cooled enclosures such as ovens and fridges. There is also a need to allow for differential expansion between the inner and outer metal walls of such panels, particularly in high temperature applications. The inner and outer walls (2, 3) of metal cladding in a panel (1) according to the invention are connected to each other by a special joint around the margins of the panel (1). The joint consists of an outwardly directed trough (10) borne by one of the panel walls (2), and an intumed flange (12) on the other panel wall (3) which fits into the trough (10), but which is insulated therefrom by a strip of U-section material (11) covering the flange. A degree of inwards or outwards movement of the flange (12) relative to the trough (10) allows for differential expansion between the walls (2, 3). Various arrangements are disclosed for joining panels in line or at 90°.

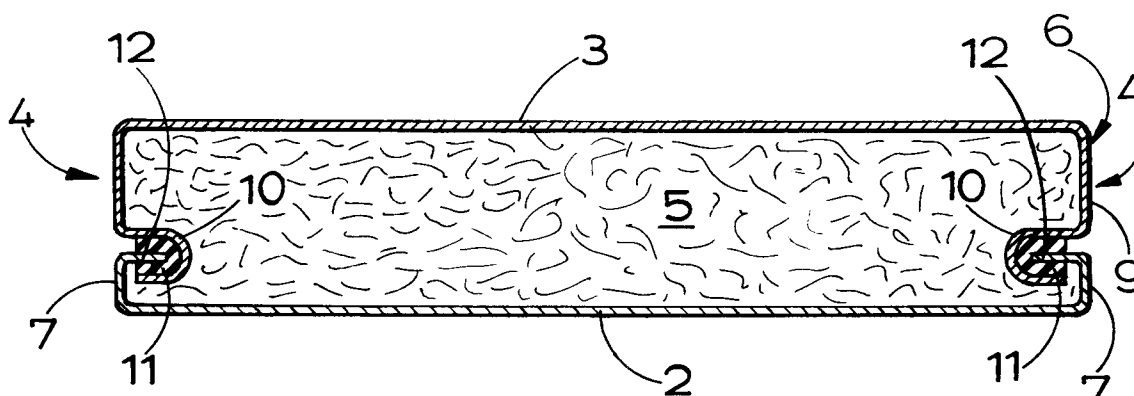


FIG. 2.

This invention relates to insulated panels for heated or cooled enclosures and particularly, but not exclusively, to panels forming at least one boundary surface of an enclosure in which a substantial temperature difference is required to be maintained, between the inside and outside of the enclosure, and where the panels comprise a metal cladding.

The invention is applicable to ovens, furnaces, driers, kilns, refrigerated enclosures and the like.

It is known for the panels in such applications to comprise two metal sheets or trays secured to the outer surfaces of a slab of insulating material such as, for example, mineral wool, with the edges of the panels finished off with strips of hard insulating board. Such panels are then affixed to a structural framework to form the required enclosure.

The known construction is simple and cheap but is relatively weak and, when the enclosure is for food products, unhygienic due to the dirt traps around the edges of the panels and those associated with the internal framework.

Alternatively it is known for the insulating material to be entirely encased in metal which gives the panels additional strength and makes them hygienic, but the continuous metal edges provide a heat path between the panel faces at different temperatures, thereby reducing the thermal insulating properties of the panel and, in the case of a heated enclosure, creating undesirable external surface temperatures.

Furthermore, where high temperature differences exist across the panel, problems arise with differential expansion leading to buckling, cracking and distortion. This is made worse if the material of the hotter face has a higher coefficient of thermal expansion than the cooler face, as is the case with austenitic stainless steel and mild steel.

According to the invention an insulated panel for use as one boundary surface or part of one boundary surface of a heated or cooled enclosure comprises first and second spaced-apart and substantially in register sheet metal walls with insulation material positioned therebetween, the first and second metal walls being connected together along or adjacent to an edge of the panel by a joint comprising an intumed metal flange rigidly connected with one of the metal walls and received in a metal trough rigid with the other metal wall, and opening outwardly of said edge, the flange extending substantially in a plane parallel to the first and second metal walls, the trough housing a strip of insulative material of substantially U-cross-section fitted on the flange.

The flange can move in the plane thereof relative to the trough as accommodated by the fit with the insulative strip.

Preferably the flange is a sliding fit with the insulative strip, but the strip could alternatively or in addition be permitted to be slidable relative to the trough.

The joint can allow for differential expansion be-

tween the first and second metal walls, yet provide a 'thermal break' against conduction through the metal edge connecting the metal walls.

The flange and trough may be formed integrally with the respective metal walls, or one or both may be formed from an independent strip of sheet metal that is rigidly secured, normally by welding, to the respective metal wall. The choice will be dictated by the assembly method adopted, manufacturing possibilities and appearance.

The panel may comprise an overlap flange which overlaps with an adjacent panel or door, the overlap flange being constituted by a portion of one of said metal sheets which extends in the plane of the sheet outwardly beyond said joint. The overlap flange may make a sliding engagement with an adjacent panel, to permit some relative movement between the overlap flange and the co-operating part of the adjacent panel, or the overlap flange may be arranged to effect a seal with a door, if necessary by the provision of a door sealing strip between the door and the overlap flange.

Panels in accordance with the invention may be attached to a framework with suitable fasteners or by welding to form the enclosure, or preferably the panels may be welded to each other by welding together adjacent inner walls. This dispenses with the requirement for a framework, resulting in a cost reduction and a cleaner uncluttered interior to the enclosure.

When two panels in accordance with the invention are joined together at 90° to each other the inner metal wall of one panel may be rigidly attached, preferably by welding, to the inner metal wall of the other panel, where the two inner walls meet.

In one embodiment one panel is placed with the inner wall of that panel in abutment with the edge of the other panel such that said one panel covers said edge, and the inner walls are welded together locally where they meet, at the junction between said edge and the inner wall of said other panel.

In another embodiment the two panels are positioned at 90° and such that the junctions between the adjacent edges of the panels and the respective inner walls are abutting, and said junctions are fixedly secured, preferably by welding, and an elongate corner cover is provided to cover over the gap that would otherwise exist between the panel edges.

The corner cover preferably effects a sliding connection with an edge wall of the respective panel, the sliding connection permitting relative sliding movement between the cover and the edge wall of the respective panel in the plane of the edge wall.

Various embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an insulative panel,

Figure 2 is a horizontal section of the panel of Fig-

ure 1,

Figure 3 is a transverse section through the sealing strip used in the panel of Figure 1,

Figure 4 is a perspective view of the components of the panel of Figure 1,

Figure 5 is a perspective view of the panel during one method of assembly,

Figure 6 shows the assembly of the finishing strip to the panel of Figure 1,

Figure 7 is a perspective view of another configuration of an insulative panel,

Figure 8 is a horizontal cross-section of the panel of Figure 7,

Figures 9 to 14 show details of an oven, constructed from panels in accordance with the invention, for cooking food products such as bread, in which:

Figure 9 is a vertical cross-section of a floor to side panel joint,

Figure 10 is a vertical cross-section of a roof to side panel joint,

Figure 11 is a vertical cross-section of a floor joint,

Figure 12 is a horizontal cross-section of a corner joint,

Figure 13 is a horizontal cross-section of a side panel and door, and

Figure 14 is a horizontal cross-section of a side panel showing an aperture for receiving a fan.

The panel 1 of Figures 1 to 3 comprises rectangular sheet metal inner and outer walls 2 and 3 respectively in register with each other and edge walls 4 connecting the inner and outer walls 2 and 3 around their peripheries to define a chamber containing heat insulation material 5. The edge walls 4 comprise an edge strip 6 folded from the material of outer wall 3, and an edge strip 7 folded from the material of inner wall 2, except along the bottom edge where, as shown in Figure 4, an independent channel-section strip 8 is employed.

Strip 6 comprises a planar portion 9 extending normal to the walls 2 and 3 and a trough-shaped portion 10 set inwardly of the panel from the planar portion 9, with the trough opening outwards of the panel edge.

A sealing strip 11 of U-section is fitted in the trough 10, and an inwardly directed flange 12, provided by an intumed lip on edge strip 7, is a sliding fit within the slot 13 defined between the limbs of the seal 11, the flange 12 extending in a plane which is substantially parallel to the planes of the inner and outer walls 2, 3.

Since the flange 12 can move slightly relative to the trough 10 in directions parallel to sheets 2, 3, the relative expansion and contraction of sheets 2, 3 with changing temperature difference is facilitated.

The sealing strip 11 is made, for this embodiment, of a high temperature elastomer with a low thermal

conductivity, such as silicone rubber.

The sealing strip 11 performs three functions: firstly it provides a thermal break between the inner and outer sheets 2, 3 of the panel; secondly it allows for expansion of the inner sheet 2 relative to the outer sheet 3; and thirdly it provides a seal between the two sheets of the panel preventing the ingress of dirt and the egress of the internal insulating material 5.

The joint, constituted by trough 10, flange 12 and seal 11, is fitted to all four sides of a panel to provide a strong stable construction yet with provision for relative expansion of the two sheets 2, 3.

A sequence of assembly of panels will now be described with reference to Figures 4, 5 and 6.

In Figure 4, the tray formed by outer wall 3 and edge portion 9 is filled with the correct thickness of insulating material 5. In Figure 5 the inner sheet 1 is being slid into position in the slots of the sealing strip 11. Figure 6 shows the loose folded edge strip 8 about to be placed in position to seal the open edge of the panel.

In the alternative panel of Figures 7 and 8, the same sealing strip 11 is used but the strip 11 is located next to the outer sheet 3 of the panel in a trough formed by a separate strip of metal 14. In this case the inner sheet 2 has a wide side edge 7 before being folded to form the flange 12. Strip 14 is of joggled cross-section and is welded to the rear of metal sheet 3.

The sequence of assembly can be similar to that described for the panel of Figure 1.

For large panels problems may be encountered in following the above assembly procedures due to excessive friction within the slot in the sealing strip. This effect may be reduced by using a suitable lubricant, or the assembly procedure may be modified by using closing strips, such as item 8 in Figure 4, on more than one side. This avoids the need for sliding one part over the other.

For high temperature applications where elastomers are not suitable for the sealing strip, it may be made in sectional form using a ceramic material such as a porcelain or aluminium oxide. In this case the sealing function will not be as effective but the expansion and thermal break functions will remain.

For refrigeration and cryogenic applications the inner and outer sheets are reversed, allowing the inner sheet to contract rather than expand.

Figures 9 to 14 should now be referred to for more detailed implementations of panels in accordance with the invention, showing how such panels can be connected together in an oven such as a bread oven. The incorporation of expansion joints in the panel edge structures similar to those described with reference to Figures 1 to 8 enables the relative expansion and contraction of the metal inner and outer oven walls to be accommodated.

Figures 9 to 14 show how this movement is ac-

commodated in connections between the panels, and such connections between the panels constitute further aspects of the present invention.

Figure 9 shows a connection between a side panel 15 and a floor panel 16 of the oven, and the arrangement for supporting panels 15 and 16 on a box-section plinth 17. The floor panel comprises sheet metal inner and outer walls 18, 19 respectively, the side panel comprising inner and outer metal walls 20, 21 respectively. Expansion joints 22, 23 are provided in the edges of the panels 15 and 16 respectively, and the inner walls 18 and 20 are welded at 24 in the corner where the extremity of inner wall 18 meets inner wall 20.

The trough portion 25 of joint 22 is formed from the sheet of outer wall 21 whereas the trough of joint 23 is defined by a joggled strip 26 and by wall 19 itself, the strip being welded to the inner face of wall 19 at 27.

The intumed flanges 28, 29 of the joints 22, 23 respectively are provided by channel-section sheet metal members 30, 31 respectively which are rigidly secured to the respective inner walls 20, 18 by welds at 32, 24 respectively.

It should be appreciated that in Figure 9, and also in Figures 10 to 14, abutting parts are not rigidly connected except where welds are shown and, accordingly, the parts can slide with respect to one another to accommodate changes in oven temperature. The insulation contained in the panels has been omitted from Figures 9 to 14.

In Figure 9 the material of the outer wall 19 of floor panel 16 extends horizontally outwards beyond joint 23 to provide a right-angle ledge 33 fitting over the plinth 17 and extending under the joint 22, with sliding contact being provided with the strip 30.

Figure 10 shows a connection between a roof panel 35 and the side panel 15. Parts corresponding to those of Figure 9 have been given corresponding reference numerals. The connection between panels 15 and 35 is closely similar to that between panels 15 and 16 in Figure 9, but the right-angle portion 33 in Figure 9 is replaced in Figure 10 by a plain flange 36 which is a coplanar extension of the outer wall 19 of roof panel 35, the flange 36 making sliding contact with the strip 30.

As in the connection of Figure 9, the connection in Figure 10 between the two panels provides a rigid, welded connection between the inner walls 18 and 20 where they meet, but the outer walls 19, 21 are connected only by way of sliding joints.

Figure 11 shows a connection between two juxtaposed floor panels 37, 38. The material of the inner walls 39 is continuous with a respective vertical edge portion 40 which terminates in a respective horizontal flange 41 of a respective expansion joint 42, the edge portions 40 being slidable relative to each other except at weld 43 which provides a smooth connection

between the inner walls 39.

The troughs of joints 42 are provided in this case by a respective joggled strip 44 in conjunction with the margin 45 of the respective outer sheet 46. Since the panels 37, 38 are rigidly connected only along the line of weld 43, differential expansion of the edge portions 40 and outer walls 46 is accommodated.

The connection of Figure 11 is also used for connecting roof panels of the oven, walls 46 then being uppermost.

Figure 12 shows a connection between the side panels 15, shown in Figures 9 and 10, and an end panel 47. In this case, as distinct from the connections shown in Figures 9 and 10, one panel does not overlap significantly with the other panel. Rather, a corner cover is provided by an elongate sheet metal connector 48 comprising a substantially quadrant-shaped outer wall portion 49 and radially inwardly directed flanges 50, 51 which slidably engage with the edge portions 34, 57 respectively of the panels 15, 47, a respective slot to receive the flange being defined by a respective joggled strip 53 welded at 54 to the respective edge portion 34, 57.

The vertical corner cavity 55 contained within the corner cover 48 is filled with the same insulation material as is contained within the various panels.

The material of the inner wall 20 of the end panel 47 extends beyond the plane of edge portion 34 to define a connecting flange 56 which abuts with an edge portion 57 of panel 15 that is bent from the material of the inner wall 58 of end panel 15. A joggled strip 59 provides the vertical flange 28 of joint 22 and a connecting flange 60 bearing against flange 56 and welded thereto at free edge 61.

Weld 62 is provided between the panel inner walls 20, 58 where they meet, and an adjacent weld 63 connects strip 59 with wall 20.

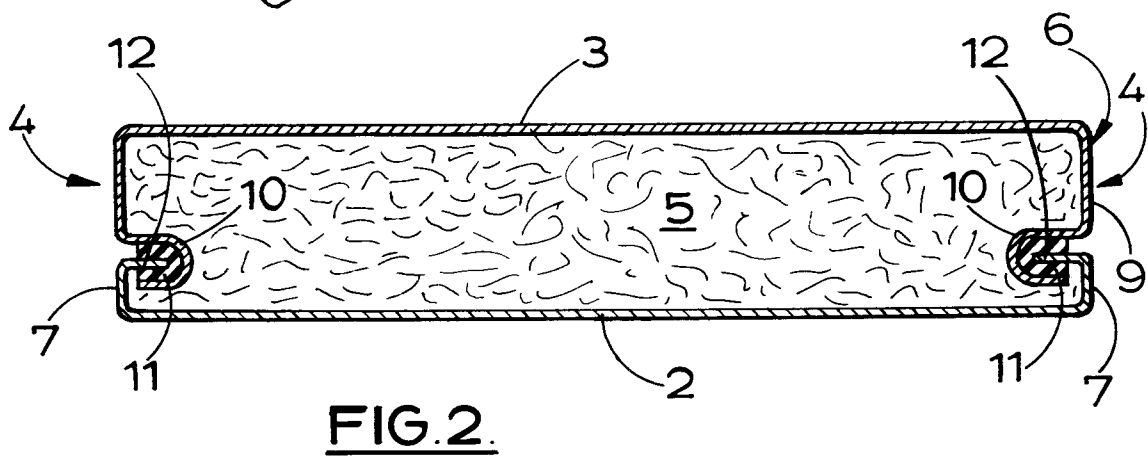
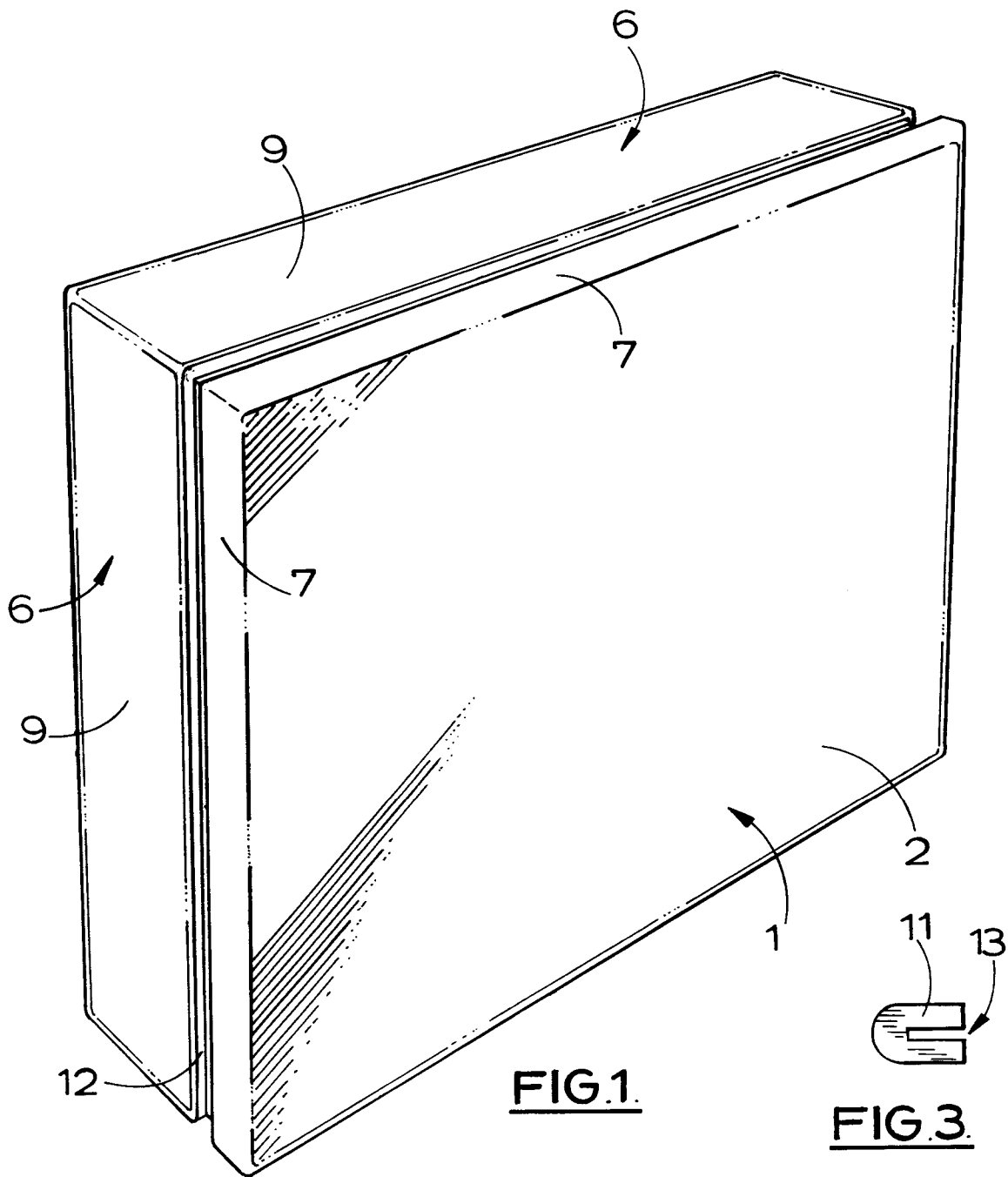
Figure 13 shows a rectangular door panel 64 incorporating expansion joints 65 and constructed essentially as the panel of Figures 1 and 2, the door being accommodated in an opening 66 provided between two of the side panels 15 of the oven. Door seals 69 are provided on a seal flange 70, 71 in the plane of the internal wall 20.

Figure 14 shows a side panel 15 formed with a rectangular opening 72 to accommodate a rectangular fan unit. It is not necessary to provide an expansion joint in the sheet metal panel wall 73 bounding opening 72 since the relative expansion of inner and outer walls 20, 21 of the apertured panel 15 is accommodated by the expansion joints around the outer edges of panel 15. The strip providing wall 73 is simply welded at 74, 75 to the outer wall 21, lengths of bar 76 being welded in position internally of panel 15 to surround the opening 72 to provide a mounting flange for the fan unit.

Claims

1. An insulated panel for use as one boundary surface of one boundary surface of a heated or cooled enclosure comprising first and second spaced-apart and substantially in register sheet metal walls with insulation material positioned therebetween, characterised in that the first and second metal walls (2, 3; 18, 19; 20, 21; 39, 46) are connected together along or adjacent to an edge (4; 40; 31, 34) of the panel by a joint (22, 23; 42) comprising an inturned metal flange (12; 28, 29; 41) rigidly connected with one of the metal walls (2; 18; 20; 39) and received in a metal trough (10; 25, 26; 44) rigid with the other metal wall (3; 19; 21; 46), and opening outwardly of said edge (4; 40; 31, 34), the flange (12; 28, 29; 41) extending substantially in a plane parallel to the first and second metal walls (2, 3; 18, 19; 20, 21; 39, 46), the trough (10; 25, 26; 44) housing a strip (11) of insulative material of substantially U-cross-section fitted on the flange.
2. A panel as claimed in claim 1 in which the flange (12; 28, 29; 41) is a sliding fit with the insulative strip (11).
3. A panel as claimed in claim 1 in which the flange (12; 28, 29) and trough (10; 25, 26) are formed integrally with the respective metal walls (2, 3; 20, 21).
4. A panel (16; 15; 35) as claimed in any of the preceding claims comprising an overlap flange (33; 36; 56; 70) which is adapted to overlap with an adjacent panel (15; 47) or door (64), the overlap flange (33; 36; 56; 70) being constituted by a portion of one of said metal sheets (19, 20) which extends in the plane of the sheet outwardly beyond said joint.
5. A panel (16; 35; 35) as claimed in any one of claims 1 to 3 joined at 90° to a further such panel (15; 47), the inner metal wall (18; 58) of one panel (16; 35) being rigidly attached to the inner metal wall (20) of the other panel (15; 47), where the two inner walls meet.
6. Joined panels as claimed in claim 5 in which one panel (15) is placed with the inner wall (20) of that panel in abutment with the edge (31) of the other panel (16; 35) such that said one panel (15) covers said edge (31), and the inner walls (20, 18) are welded together locally where they meet, at the junction between said edge and the inner wall of said other panel.
7. Two joined panels (15, 47) each being as claimed

in any of claims 1 to 3, the two panels being positioned at 90° and such that the junctions between the adjacent edges (34, 57) of the panels and the respective inner walls (58, 20) are abutting, and said junctions are fixedly secured and an elongate corner cover (48) to cover over the gap that would otherwise exist between the panel edges (34, 57).



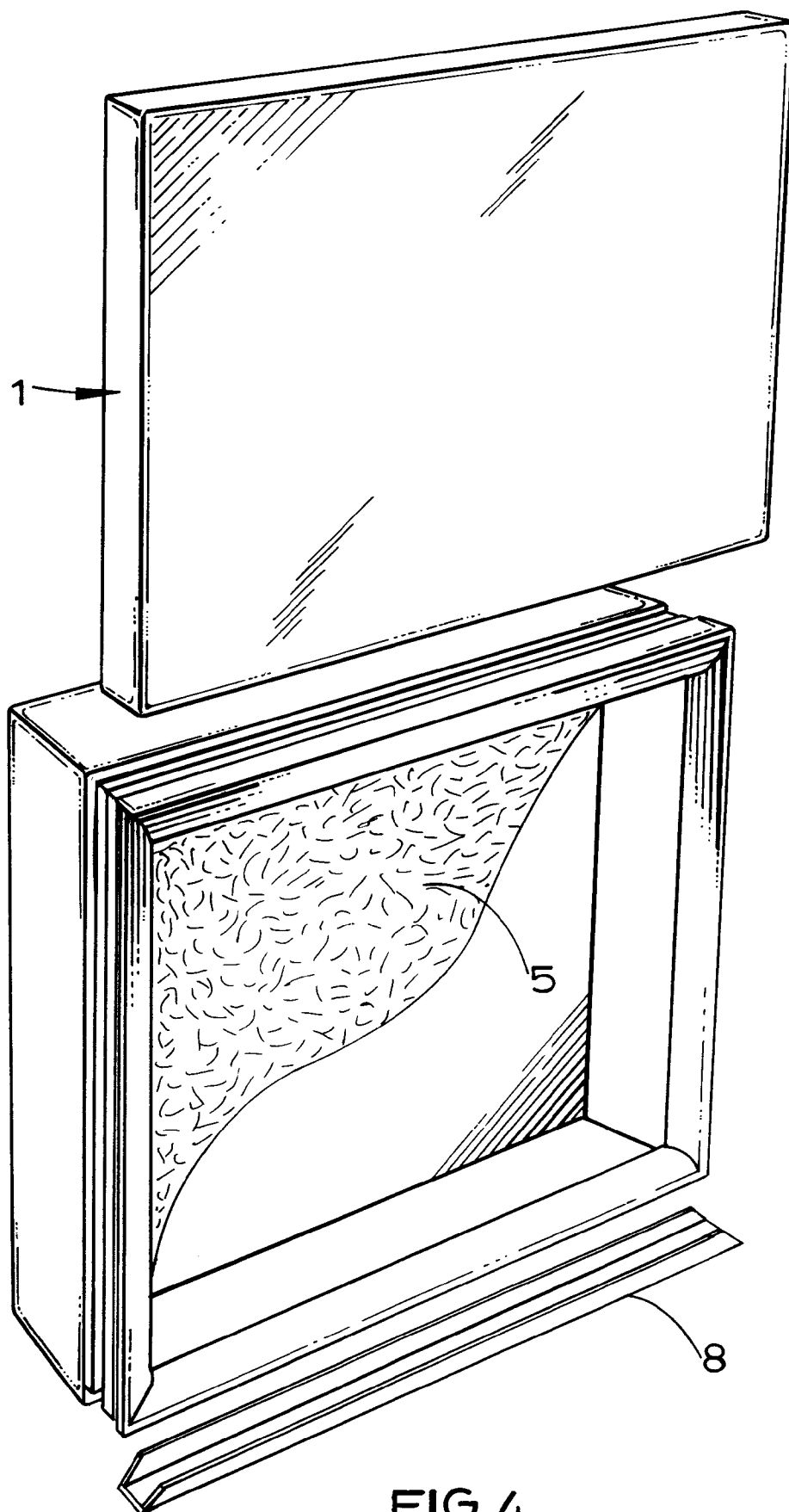


FIG. 4.

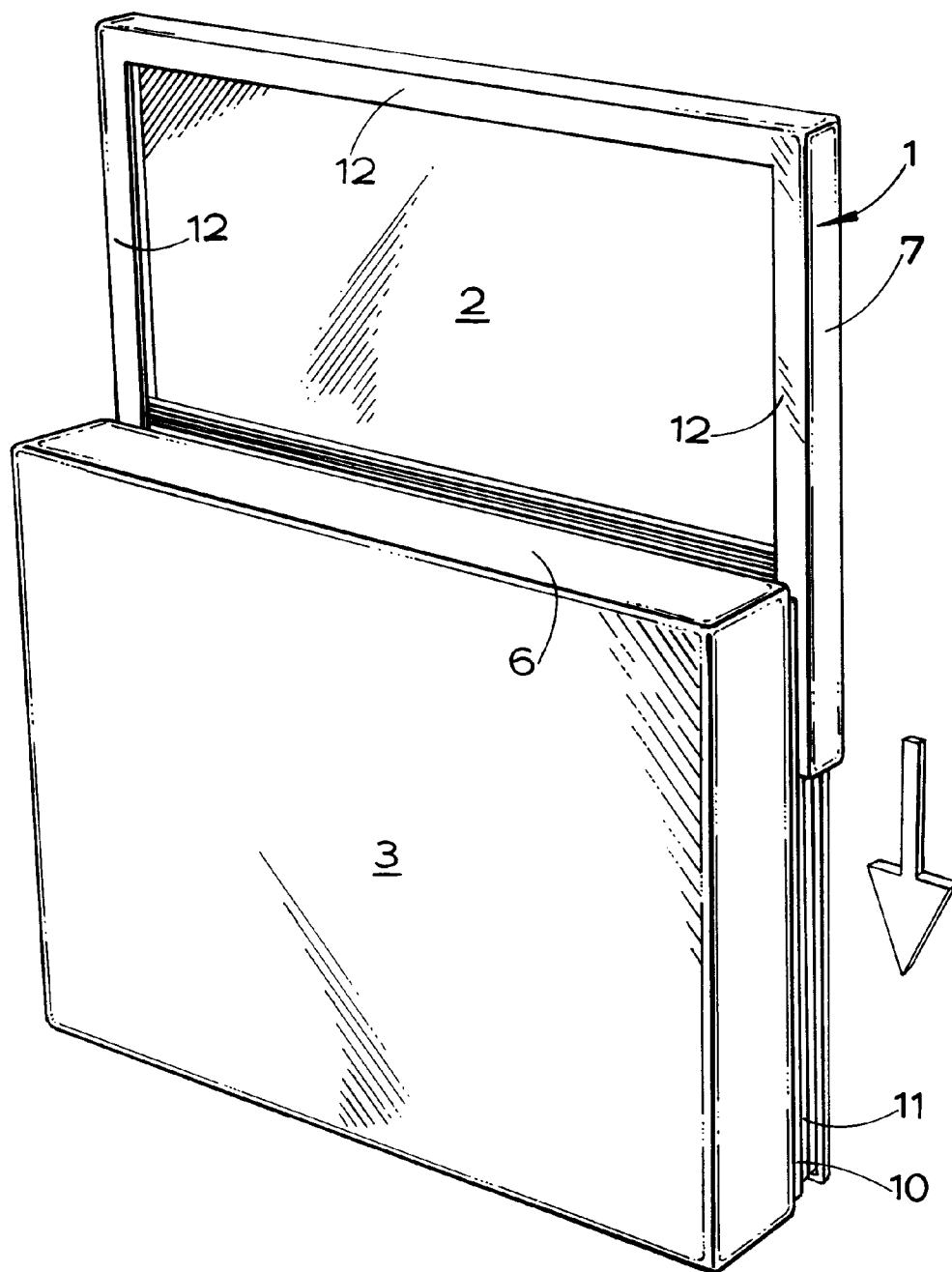
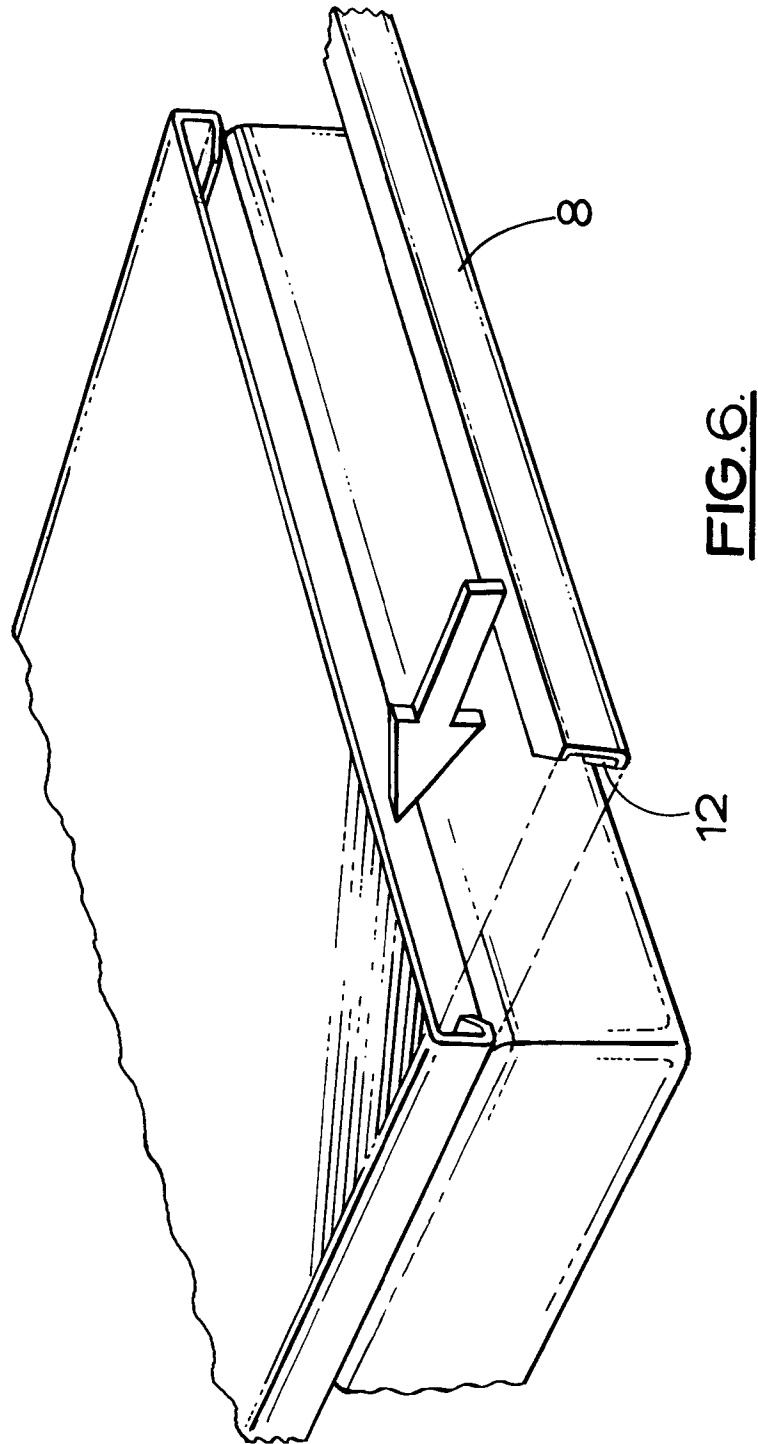


FIG. 5.



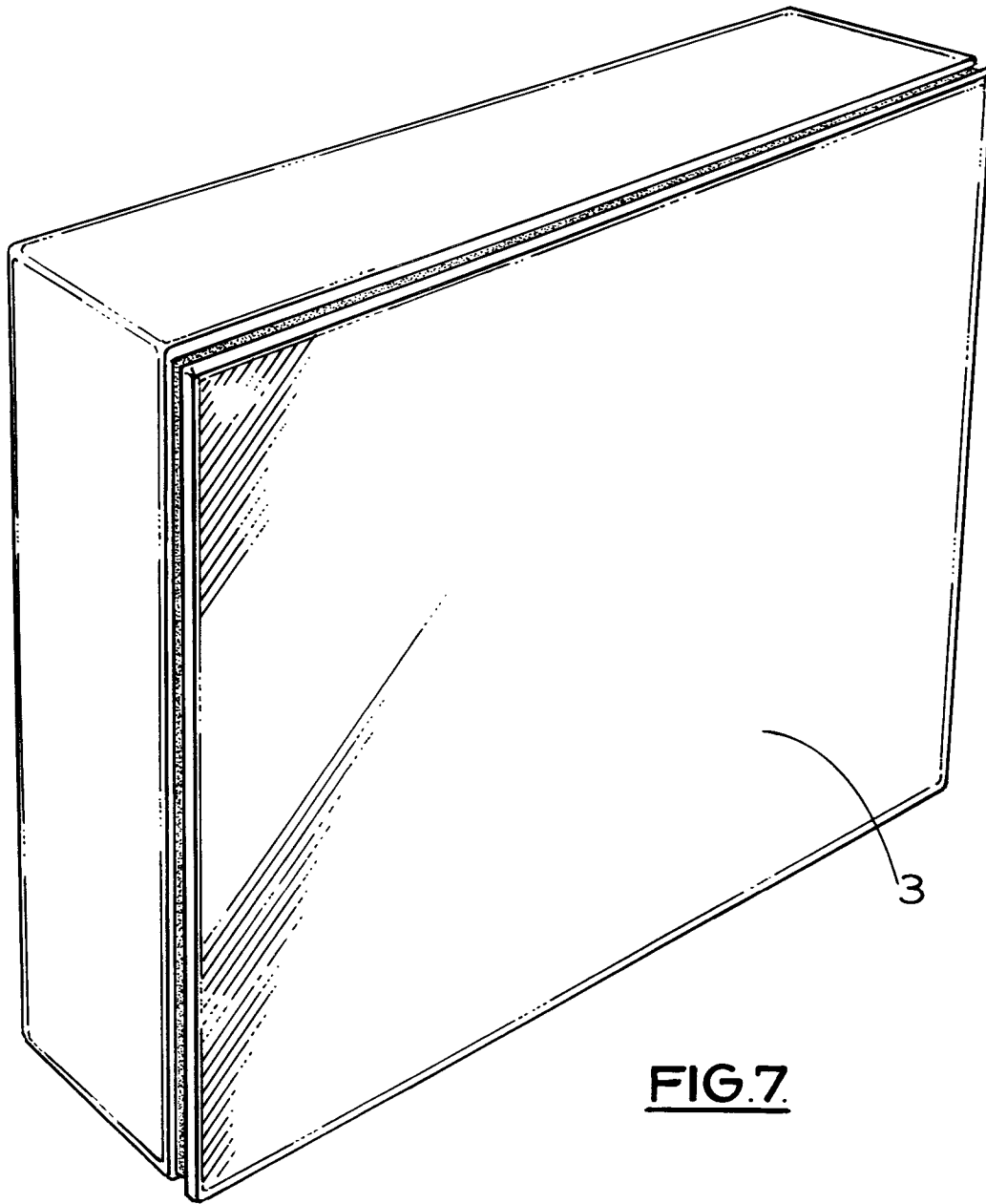


FIG. 7.

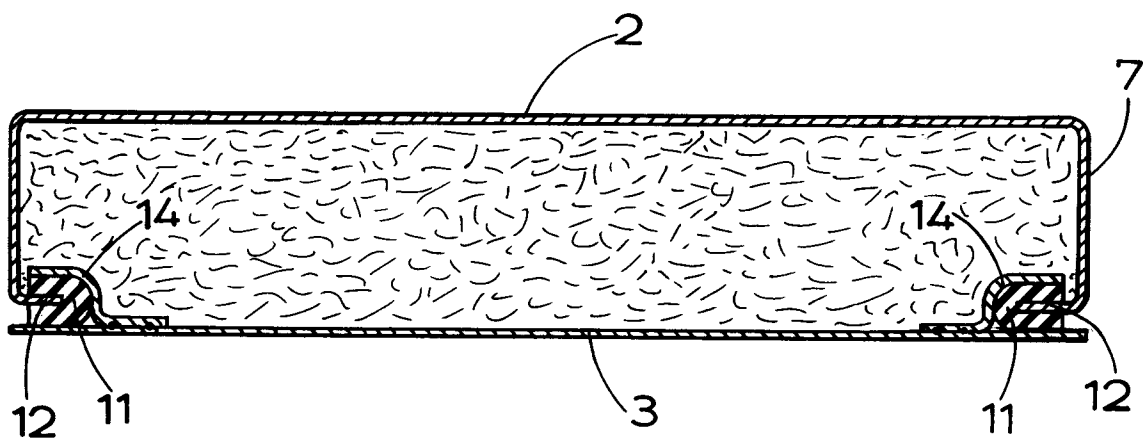


FIG. 8.

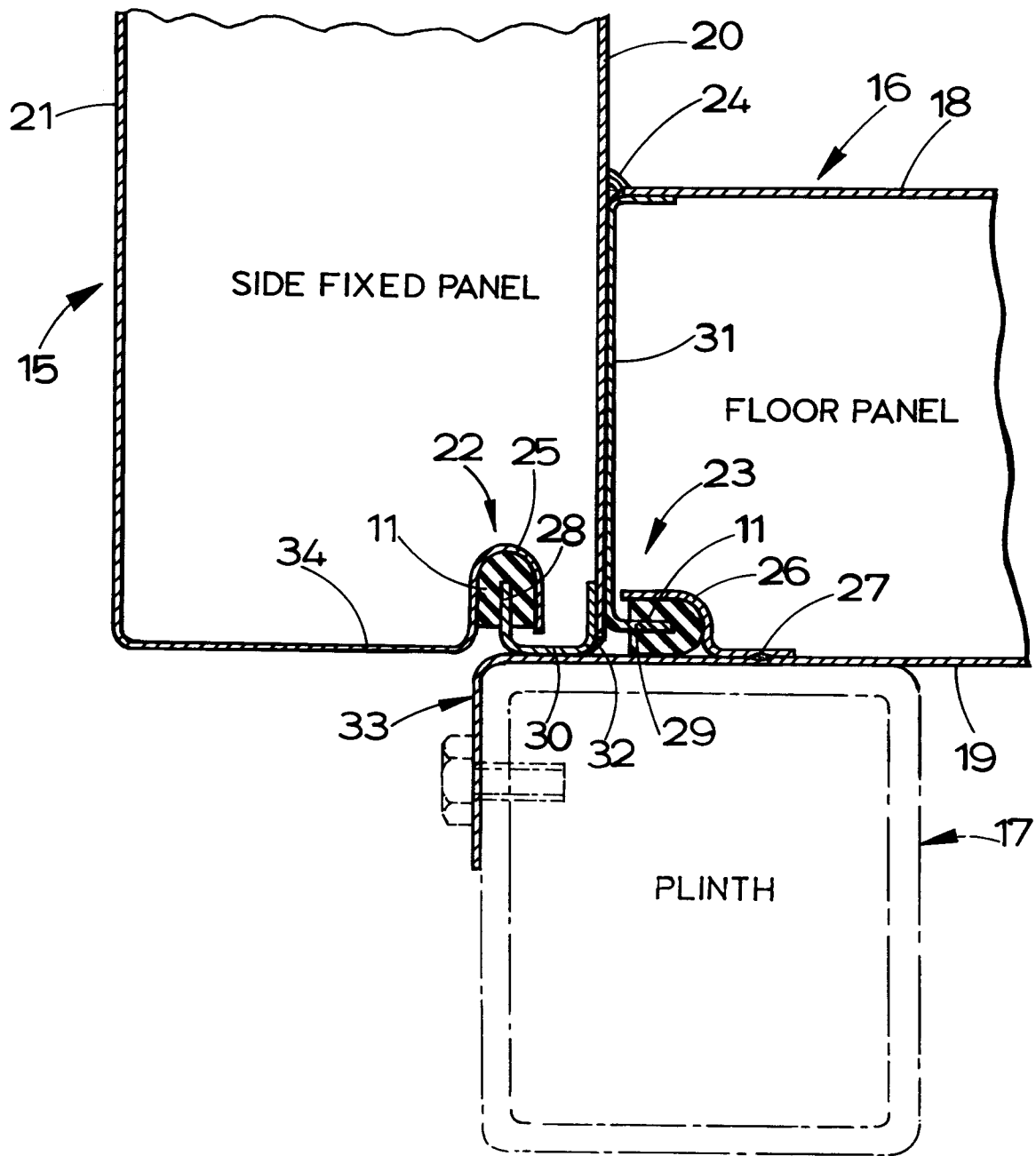


FIG.9.

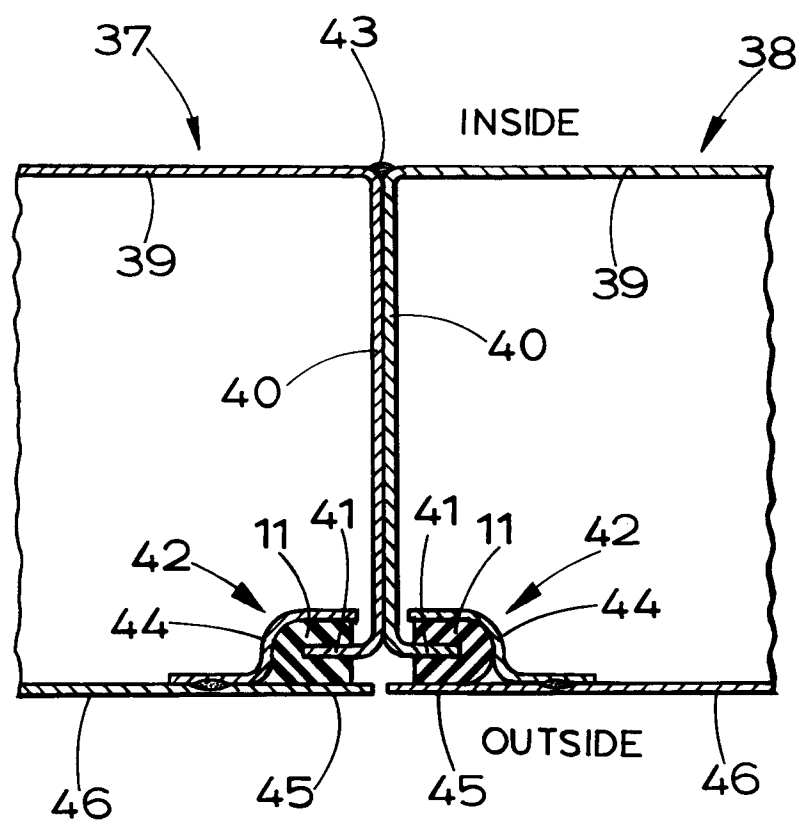


FIG.11.

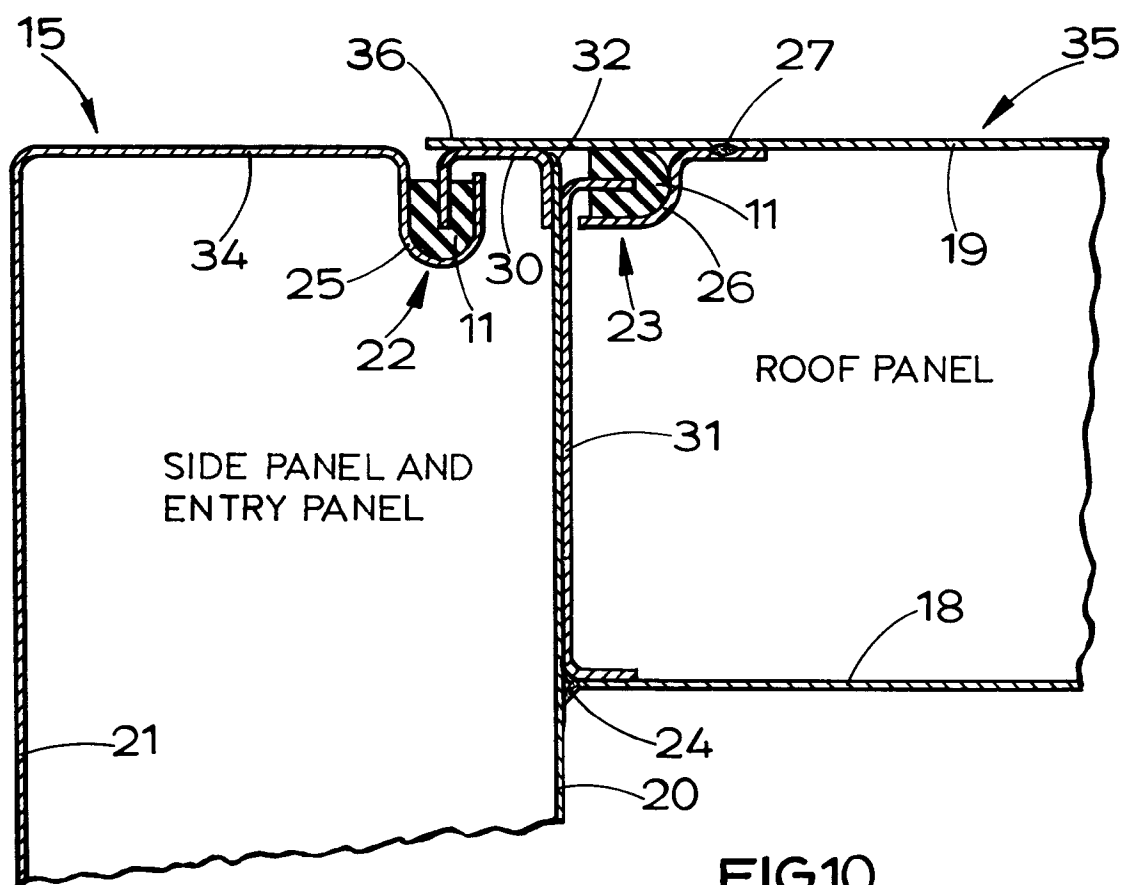


FIG.10.

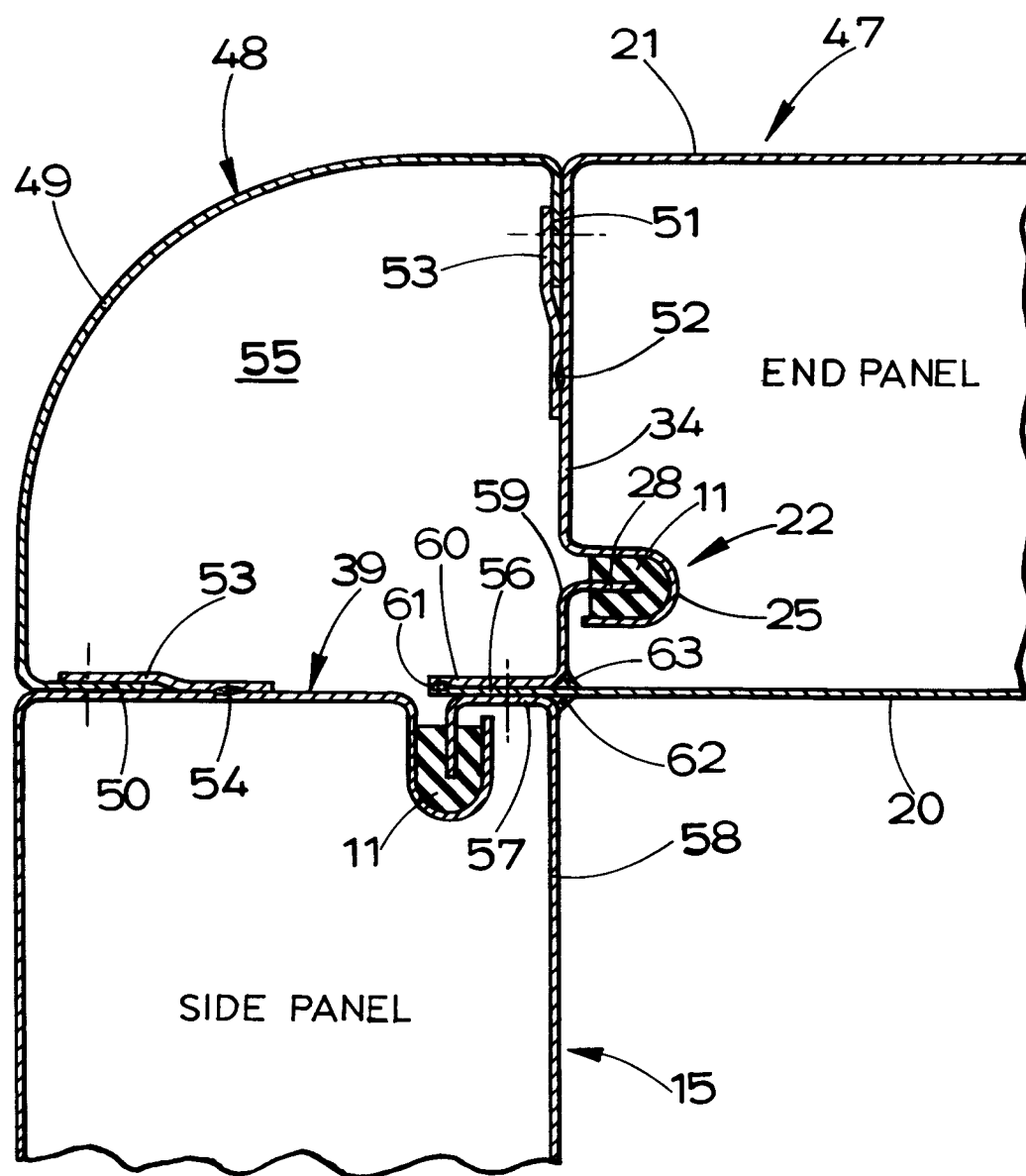


FIG.12.

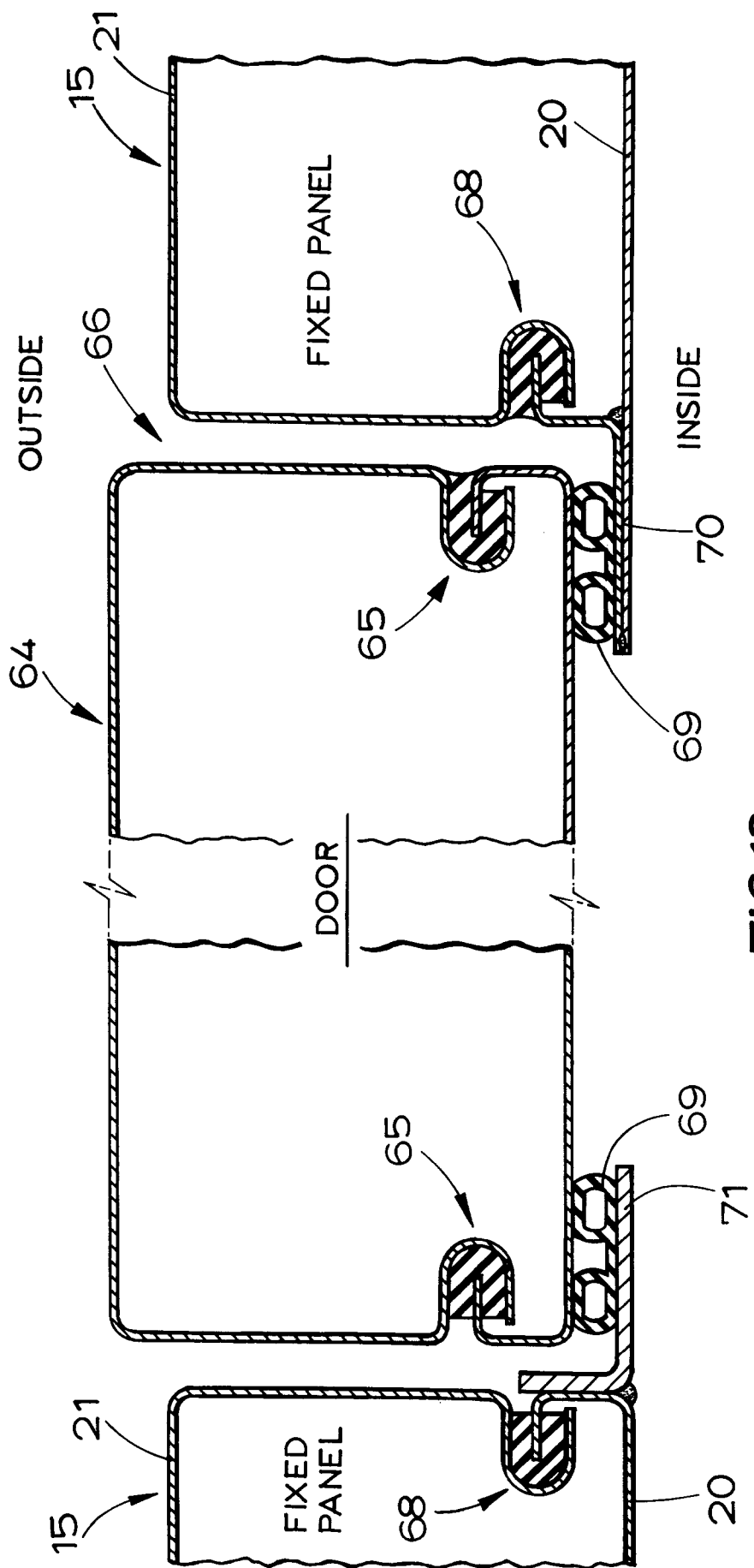


FIG.13.

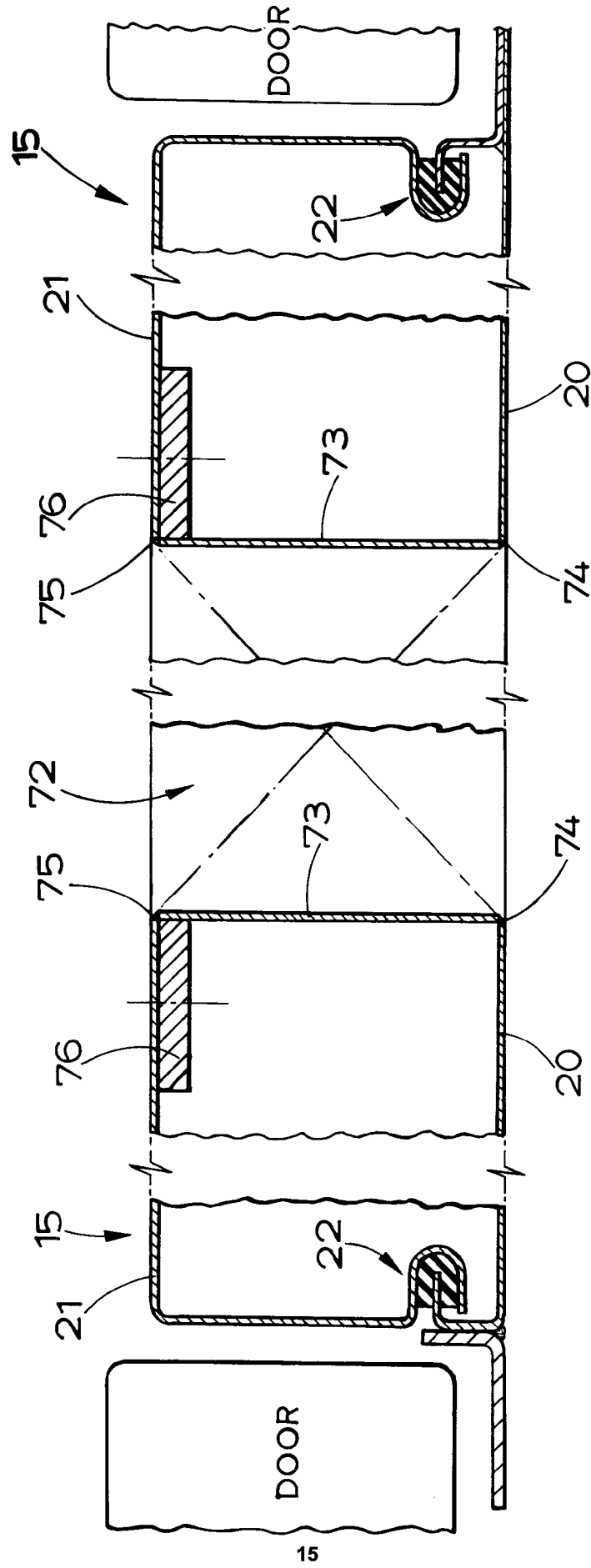


FIG. 14.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 31 0246

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-1 181 352 (KOLLER)	1	E04C2/26
Y	* page 1, left column, line 38 - page 2, left column, line 13 *	2-5,7	E04H5/10
A	* page 3, left column, line 23 - line 30; figures 1,2 *	2	

Y	DE-A-3 417 375 (GELUNA GESELLSCHAFT FÜR LUFTECHNIK UND APPARATENBAU M.B.H.)	2,3	
A	* page 6, line 24 - page 7, line 25; figures 1,2 *	4	

Y	DE-A-2 262 999 (WELSER OHG PROFILIER- UND STANZWERK)	4	
	* page 6, line 5 - page 8, line 15; figures 1,2 *		

Y	FR-A-2 332 401 (RIVA)	5,7	
	* page 5, line 27 - page 6, line 11; figures 3,4 *		

A	FR-A-1 259 540 (ETABLISSEMENTS INDUSTRIELS D. SOULE S.A.)	6	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
	* the whole document *		

A	FR-A-944 418 (MACDONALD)		E04C E04H E04B

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 JANUARY 1993	Examiner PORWOLL H.P.
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