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(54) Coupling between two sandwich-panels, sandwich-panel and modular building system based thereon.

(57) The invention relates to a coupling between two sandwich panels (1, 2), each comprising:

an insulating layer (3) which is covered on its one side with a first metal plate (4) and on its other side with a second metal plate (5), and

a prismatic connecting edge (10) for coupling by means of screws (13) of another like panel to the connecting edge. The invention proposes the embodiment of a coupling with sealing means (17) for coupling to each other, in the area of the connecting edges, of both the first (4) and both the second plates (5) respectively of both panels.

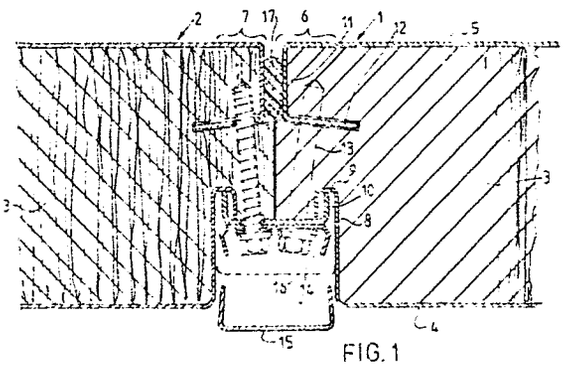

FIG. 1

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Coupling between two sandwich-panels, sandwich-panel and modular building system based thereon

The invention relates to a coupling between two sandwich panels, each comprising:

an insulating layer which is covered on its one side with a first metal plate and on its other side with a second metal plate, and

a prismatic connecting edge for coupling by means of screws of another like panel to the connecting edge. The invention proposes the embodiment of a coupling with sealing means for coupling to each other, in the area of the connecting edges, of both the first and both the second plates respectively of both panels.

In a variant the coupling displays the feature that the respective first and/or the second plates of both panels are coupled to each other such that the coupling can absorb a bending moment in at least one direction. This means that the co-acting first and/or second plates of both panels are joined to each other such that they can absorb tensile forces and/or pressure forces in the plane of the relevant plates transversely of the lengthwise direction of the prismatic connecting edges.

A very simple sealing which is nevertheless capable of absorbing to a limited extent the tensile forces and/or pressure forces displays the characteristic that the first and/or second plates each have a bent portion and that a sealing strip is present between portions bent facing each other. Such a sealing strip, for example serving as a vapour barrier, can take the form of a strip of foam material with a strongly adhesive wear resistant acrylate adhesive mass. This sealing strip can be applied to the bent portions in the factory where the panels are manufactured. The use of a sealing strip has the further advantage that dimensional tolerances in the panel and/or in the bearing construction can be absorbed without this having an adverse effect on the quality of the join.

A very simple coupling, which is naturally sealing and is moreover eminently capable of absorbing tensile forces and pressure forces, displays the feature that the first and/or the second plates of both panels overlap each other at least partially.

A preferred embodiment of the coupling according to the invention has the feature that the first plate and the second plate of a panel are joined to each other by means of at least one of the above mentioned screws. It is hereby noted that the relevant screws then fulfil the dual function of joining together adjoining panels and ensuring the integrity of a panel under the most varied load conditions.

The relevant screws may also serve to fasten the relevant panels to a bearing construction, for which purpose they then have a great length such that they protrude with the end away from the head outside the panel concerned. Given by way of example is the use of self-boring and self-tapping screws, which are per se known.

Use is made in a variant of a clamping member screwed into clamping position on respective first and/or second plates that are connected to each other. Such a clamping member can take diverse forms, for instance that of a flat clamp strip or of a clamp strip with a U-shaped cross section for co-operation with corresponding prismatic recesses of the relevant first and/or second plates.

In this latter embodiment use can be made of a sealing strip fitted between the clamping member and the associated surface of the plates.

The heads of the screws can with advantage be accessible from one side. This embodiment may be of importance when the panels are not accessible from the other side, for example when they are used as a lining for an existing wall.

The invention is further related to a sandwich panel evidently intended as component of a coupling according to the invention as specified above.

Such a sandwich panel lends itself easily to construction and dimensioning such that each individual panel of a wall built up from these panels can be separately placed and removed, without it being necessary to unscrew a part of the wall or the whole wall.

Finally, the invention relates to a modular construction system built up on the basis of the panels according to the invention. What must also be understood under panels in this context is a module element consisting of two wall panels according to the invention that connect to each other at a required angle.

It is remarked also in this latter context that in the case where two panels are coupled against each other these two panels can, as a consequence of the stiffening sandwich effect of the two metal skins, form together with the insulation a self-supporting span structure. The normal addition of a separate bearing construction therefore becomes superfluous.

The invention will now be elucidated with reference to the annexed drawings, in which:

Fig. 1 shows a cross section through a coupling between two sandwich panels;

fig. 2 shows a cross section through a corner construction with sandwich panels according to the invention;

fig. 3 is a partly broken away perspective view of the coupling as in fig. 1;

fig. 4 shows an alternative;

fig. 5 shows a building constructed from sandwich elements according to the invention;

fig. 6 is a partly broken away perspective view through VI-VI in fig. 5;

fig. 7-12 inclusive are cross sections through different couplings between two sandwich panels; and

fig. 13 is a partly broken away perspective view of a last embodiment.

Fig. 1 shows the coupling between two sandwich panels 1, 2. These panels each comprise in this preferred embodiment a layer of insulation material 3 covered on both sides with a metal plate 4, 5. Panel 1 has a connecting edge 6 that is identical to the connecting edge 7 of panel 2 located opposite. These connecting edges 6, 7 will be described in detail later.

As will be apparent from fig. 1 the layer of insulating material 3 of each of both panels 1, 2 is partially free at the location of the connecting edge 6, 7. In the connected situation of both panels 1, 2 as shown in fig. 1 the layers of insulating material 3, 3 of both panels 1, 2 adjoin each other.

A description of the above mentioned connecting edges now follows. For the sake of convenience only the connecting edge 6 of panel 1 is described here. The first metal plate 4 comprises a first part 8 bent inward at a right angle and connecting thereto a generally U-shaped, bent back second part 9 for co-operation with a generally U-shaped coupling bracket 10 between the two panels. The second metal plate 5 comprises a first part 11 bent inward at a right angle and connecting thereto a second part 12 bent inward approximately at a right angle, which part serves for screwing in position therein of a screw 13 placed through a hole intended for that purpose in coupling bracket 10.

It is pointed out that in the embodiment drawn here the screw does not extend past the second metal plate 5. Shown in fig. 3, and particularly in fig. 4, is an embodiment in which the connecting screw has a length such that it can serve for attachment of the relevant panel to a building construction.

Placed on the coupling bracket or brackets is a more or less U-shaped strip 14 over which can be pushed a protective cover 15 which entirely covers the heads 16 of screws 13.

At the position of the connecting edge 6 the insulation layer 3 protrudes further than the first right angled bent part 11 of the second metal plate 5 such that after coupling of the two panels 1, 2 between the first right angled bent parts 11 facing each other, space is available for accommodation of a sealing strip 17.

Fig. 2 shows a coupling between sandwich panels according to the invention in an alternative embodiment. In this embodiment a first panel 18 displays a connecting edge 19 which is complementary to the connecting edge 20 of a second panel 21.

The first metal plate 22 of the first panel comprises a first part 23 bent inward at a right angle and connecting thereto a part 24 bent outward at a right angle. The second panel 21 comprises a connecting edge 20 of which the first metal plate 25 comprises a first part 26 bent inward at a right angle and connecting thereto a second part 28 bent outward at a right angle and protruding outside the insulation layer 27, which part is to be placed against the corresponding second part 24 of the first panel 18. Using a screw 72 the two panels 18, 21 are coupled to each other.

Wholly analogous to the construction as in fig. 1 the second metal plates 29, 30 of panels 18, 21 display first parts 31, 32 bent inward at a right angle, between which space is available for receiving the sealing strip 17.

Fig. 3 shows in schematic, perspective view the construction as in fig. 1. Corresponding elements are also designated with the same reference numerals as therein. The screws 13 protrude in this embodiment outside the second metal plate 5 and serve as coupling elements to a building construction 33. In addition covering means 34 are present which on the one hand prevent the ingress of drip water and on the other enable ventilation of the insulation layer 3, as is indicated schematically with arrows 35.

Fig. 4 shows by and large the same coupling as shown in fig. 3, with the understanding that in this case the connecting edges 6, 7 extend in horizontal direction, while further the upper panel 36 is in curved form. With respect to this other construction the covering means 37 are also adapted.

Fig. 5 shows a building 38 consisting of panels according to the invention.

In respect of this, fig. 6 shows, be it only by way of example, a detail from fig. 5. Following the elucidation on the basis of the figures 1 and 3, the construction shown in fig. 6 will not require explanation. Two aspects deserve some attention, however.

Firstly, it is noted that the panels 39, 40 are open at the bottom so that the insulating layer 3 is in ventilating contact with the surrounding environment. The metal plates 4, 5 protrude beneath the insulating layer 3, with the result that drip water cannot be drawn up. The panels 39, 40 are formed with a fold so that they serve on the one hand as part of an upright wall and on the other as part of a roof. The upper edges 41 of the panels are coupled in the manner shown in fig. 6. The construction is always such that the insulation layers in the

diverse components adjoin one another. As a result of the vapour-tight construction of the inner skin the insulating layer 3 is not, however, in ventilating contact with the indoor environment. Vapour accumulation as a result of condensation in the insulating layer is prevented as a result.

The construction shown ensures good water run-off, partly as a consequence of a ridge protective cover 42.

Fig. 7 shows a coupling between two sandwich panels 43, 44. These panels 43, 44 are the same as the panels 1 and 2 as according to fig. 1. Corresponding elements in fig. 7 are therefore also designated with the same reference numerals as in fig. 1.

The coupling according to fig. 7 comprises only one row of screws 45 which are inserted through holes intended for this purpose in the U-shaped coupling bracket 10 and the U-shaped strip 14. The screw co-acts with a T-profile 46 having a more or less U-shaped body 47 into which the screw 45 grips and which is provided to this end with longitudinal ribs. The ends of the T-profile 46 co-acting with the second metal plates 5 display curved portions 48, thus enabling a great clamping force. As is further shown in fig. 7, space is in this way left available for accommodating sealing strips 49, which always ensure the seal fitting of the coupling. It will be apparent that the embodiment shown in fig. 7 can absorb a comparatively large bending moment in both directions. This embodiment is in this sense superior to that as according to fig. 1, in which, owing to the weak coupling between the second metal plates 5, only a relatively small tensile force between both metal plates is possible.

Fig. 8 shows the coupling between two panels 50, 51 with connecting edges 52, 53. For the sake of convenience only the connecting edge 52 of panel 50 is described here. The first metal plate 54 comprises a first part 55 bent inward at a right angle and connecting thereto a bent back part 56. The second metal plate 57 comprises a first part 58 bent inward at a right angle and connecting thereto a second part 59 bent inward at a right angle. Located between the second parts 56 and 59 is a strip 60 with compression strength.

In the recess formed by the parts 55, 56 is situated a plastic sealing profile 61 onto which screws 63, 64 can grip by means of a pressure plate 62, these screws co-acting respectively with the part 59 and the rear plate 57 of panel 51, and the screw 64 protruding so far that it can be used for coupling the panels 50, 51 to a bearing construction (not drawn).

The plastic sealing profile 61 further displays a form such that the protective cover 15 can be inserted therein.

Located between the bent parts 58 of both panels 50, 51 is a sealing strip 65.

Fig. 9 shows a coupling between two panels 66, 67 which have in principle the same construction as the panels 50, 51 according to fig. 8. In this embodiment the bent parts 58 as in fig. 8, which in fig. 9 are designated with 58', are however shorter and the strip 60 with compression strength designated by 60' is thicker.

Fig. 10 shows the coupling between two panels 68, 69. This coupling has the same construction as that shown in fig. 2. The bent parts 31, 32 as in fig. 10 lie closer however to the bent parts 23, 26. Hereby achieved is that the insulating layer 27 of panel 68 can run straight, in contrast to the embodiment of fig. 2, in which this layer has to be stepped.

Fig. 11 shows the coupling between two panels 70, 71. Otherwise than in fig. 10 the second metal plate 73 of panel 70 has a first part 74 bent inward at a right angle and connecting thereto a second part 75 bent inward at a right angle. The second plate 76 of panel 71 comprises a first part 77 bent inward at a right angle and connecting thereto a second part 78 bent outward at a right angle. The parts 74, 75 and 77, 78 are formed complementarily in the manner shown in fig. 11, such that after fitting of a connecting screw 79 through associated holes in the second bent parts 24, 28, which screw 29 grips into the second bent parts 75, 78, a coupling with great bending rigidity is ensured. This coupling is moreover wholly sealing without making use of additional sealing means.

Fig. 12 shows a coupling between two panels 80, 81.

The first metal plate 82 of panel 80 comprises a first part 83 bent inward at a right angle and connecting thereto a part 84 bent outward at a right angle. The second plate 85 comprises a first part 86 bent inward at a right angle and connecting thereto a second part 87 bent outward at a right angle, this part being longer than the first part 86, such that when coupled to an identical connecting edge of the panel 81 the respective parts 84, 87 of both panels 80, 81 overlap each other. It will be apparent that as a result of the configuration shown the compression strength between the respective first plates and the second plates is ensured. The tensile strength is ensured by inserting screws 88 through the respective second parts. It is noted that in the embodiment according to fig. 12 use could also be made of a protective cover 15 as in fig. 1. If desired, the recessed portion 89 may also be omitted, with the result that the protruding parts of screws 88 can be used for fixing panels 80, 81 in position on a bearing construction.

Fig. 13 shows the coupling between two panels 90, 91. This coupling forms a combination of the

embodiments of fig. 7 and fig. 11. Corresponding elements are therefore again designated with the same reference numerals as therein.

As will further be seen in fig. 13 the bent second parts 75, 78 are coupled partially to each other and to the coupling bracket 10 by means of screws 45, and partially coupled only to each other by shorter screws 92.

Use can advantageously be made for the sandwich panels according to the invention of an insulating layer of mineral wool with compression and tensile strength which is adhered to the first and second metal plates over their whole surface.

A number of embodiments have in common that after coupling of the panels the insulating layers of both panels may be connected to each other via a free space. This can be of importance for ventilation purposes and vapour transport.

The invention further procures panels and couplings between said panels which guarantee a great integrity of the constructions, even under extreme conditions such as heavy, mechanical loading and thermal load, for instance in the case of fire.

As has already been shown for example with reference to fig. 13, diverse aspects of the constructions described may be combined with one another, whereby the panels and their couplings can satisfy determined specifications in accordance with the wishes of the user.

Claims

1. Coupling between two sandwich panels, each comprising:

an insulating layer which is covered on its one side with a first metal plate and on its other side with a second metal plate, and

a prismatic connecting edge for coupling by means of screws of another like panel to said connecting edge,

characterized by

sealing means for coupling to each other, in the area of said connecting edges, of both the first and both the second plates respectively of both panels.

2. Coupling as claimed in claim 1, **characterized in that** the first and/or the second plates respectively of both panels are coupled to each other such that said coupling can absorb a bending moment in at least one direction.

3. Coupling as claimed in claim 1, **characterized in that** the first and/or the second plates each have a bent portion and that a sealing strip is present between portions bent facing each other.

4. Coupling as claimed in claim 1, **characterized in that** the first and/or the second plates of both panels overlap each other at least partially.

5. Coupling as claimed in claim 1, **characterized in that** the first plate and the second plate of a panel are joined to each other by means of at least one of the above mentioned screws.

6. Coupling as claimed in claim 1, **characterized by** a clamping member screwed into clamping position on first and/or second plates that are connected to each other.

7. Coupling as claimed in claim 6, **characterized by** a sealing strip fitted between the clamping member and the relevant surface of the plates.

8. Coupling as claimed in claim 1, **characterized in that** the heads of the screws are accessible from one side.

9. Sandwich panel evidently intended as component of a coupling as claimed in any of the foregoing claims.

10. Modular construction system **characterized by** sandwich panels as claimed in claim 9.

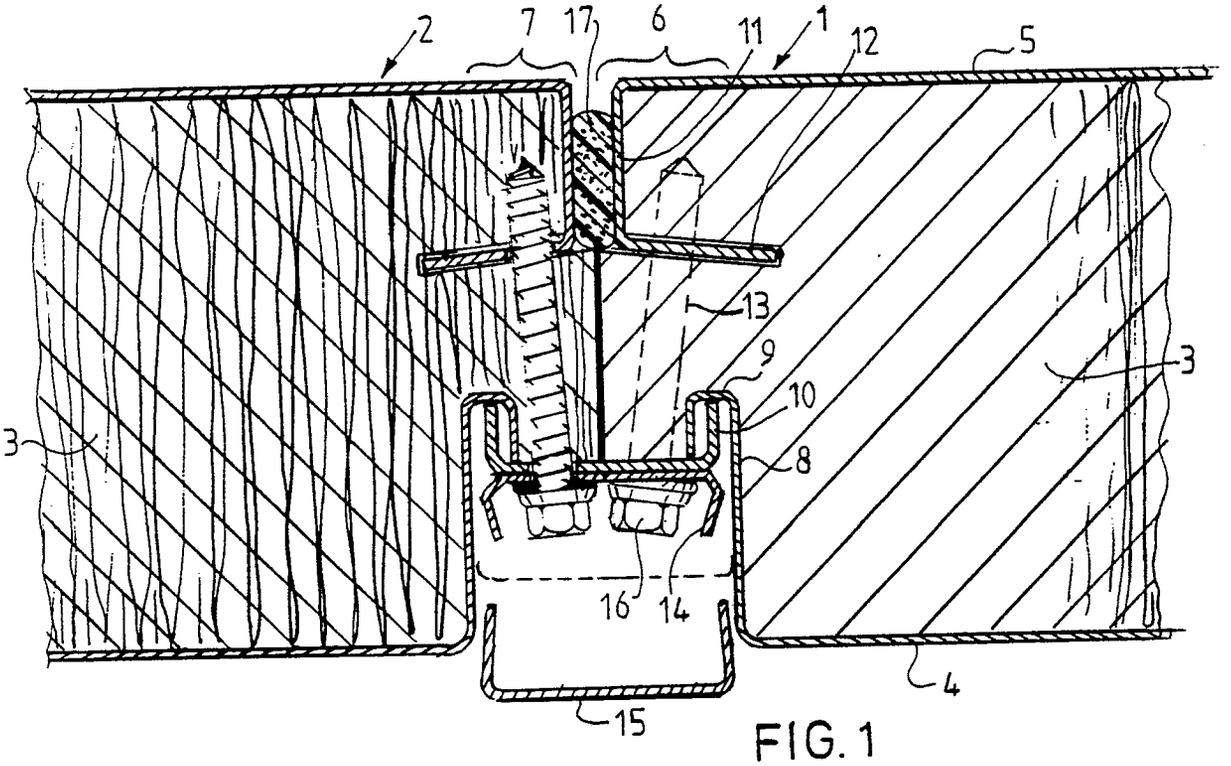
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FIG. 1

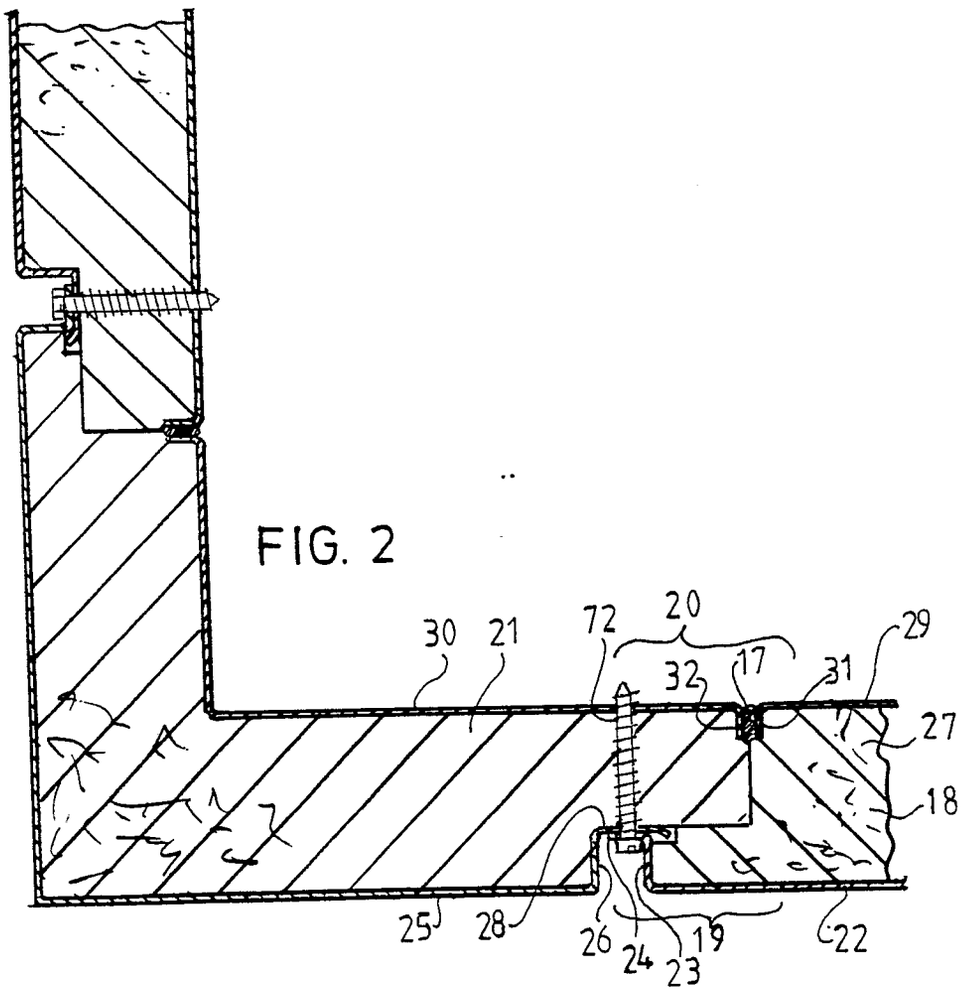
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FIG. 2

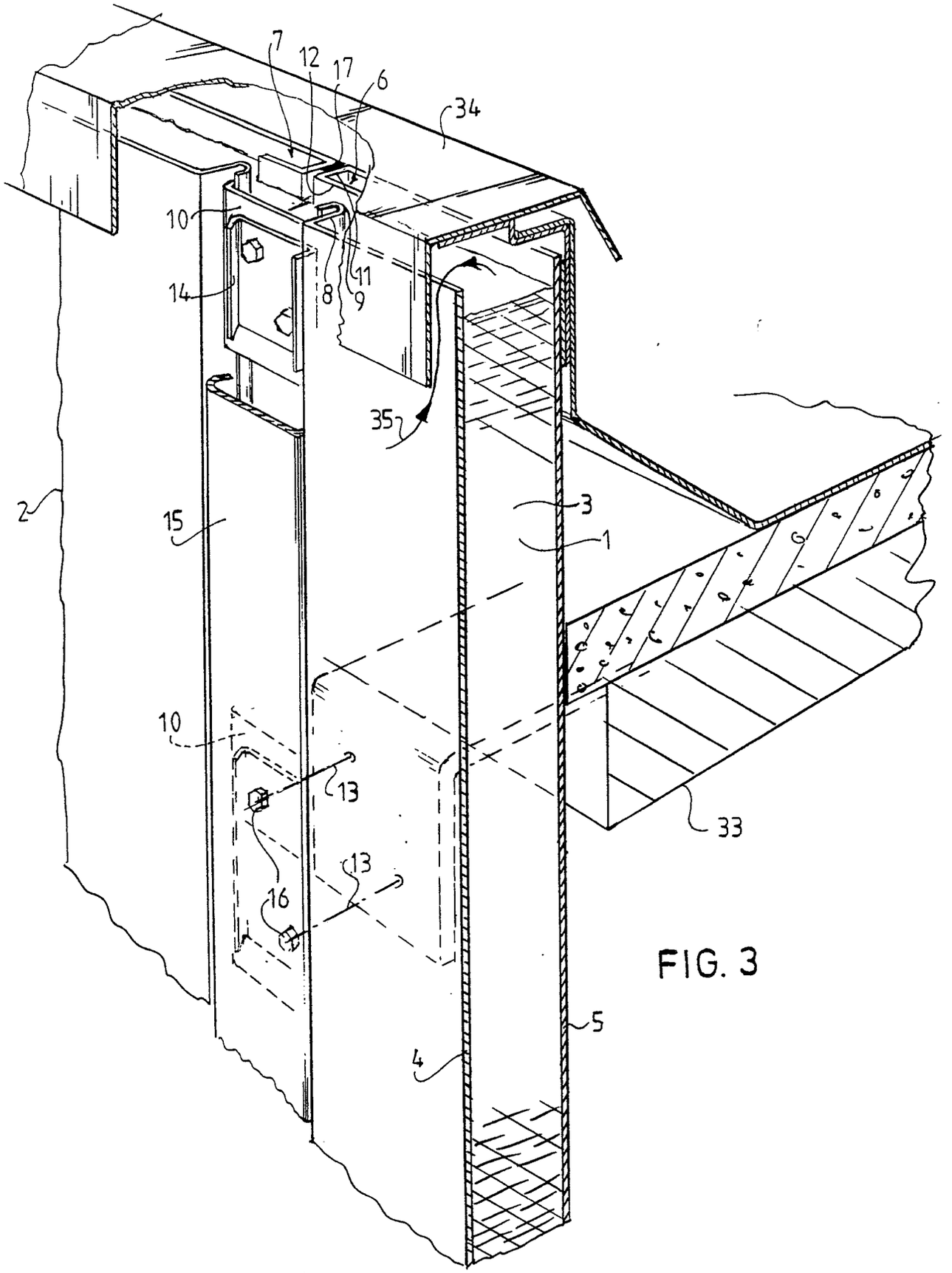

FIG. 3

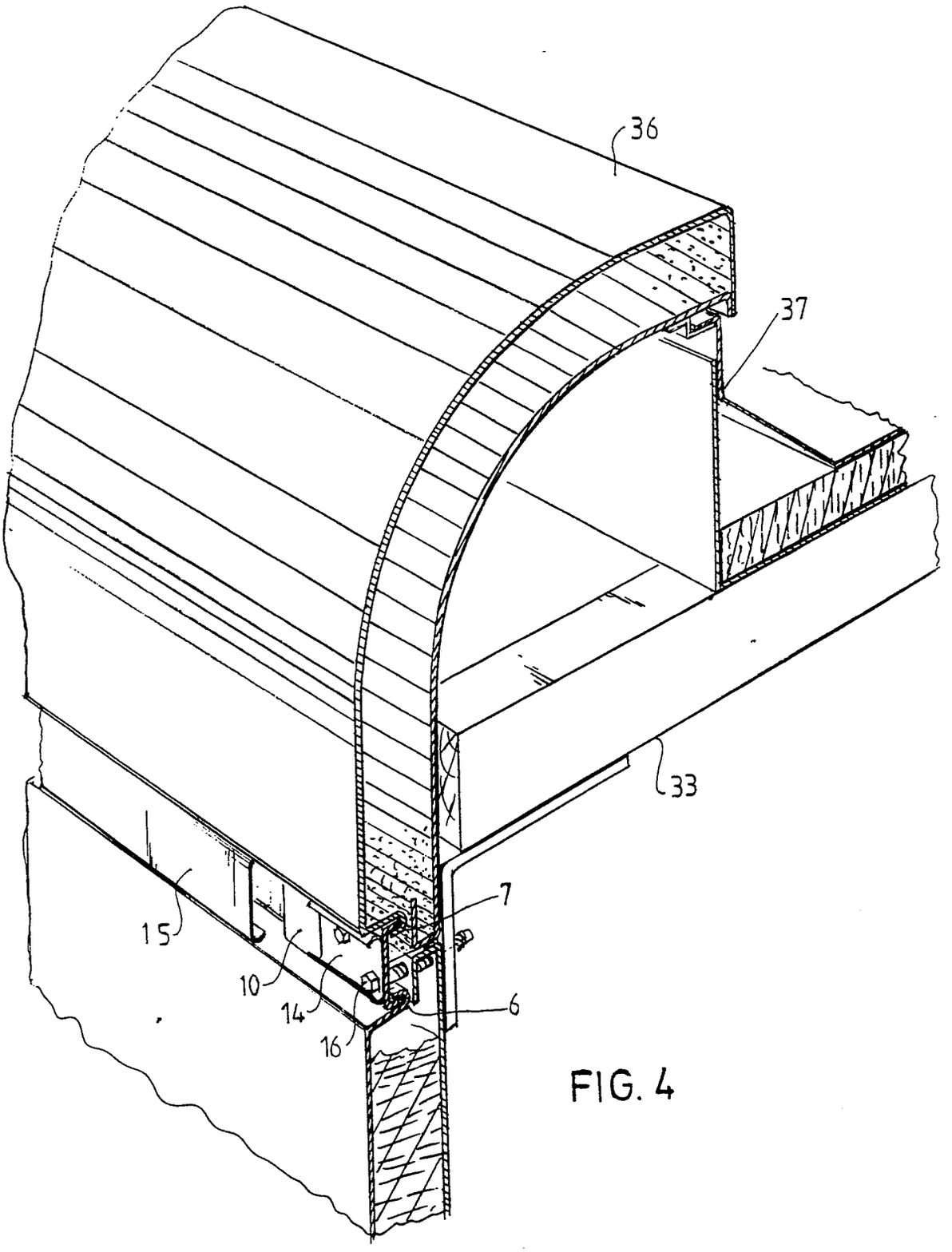

FIG. 4

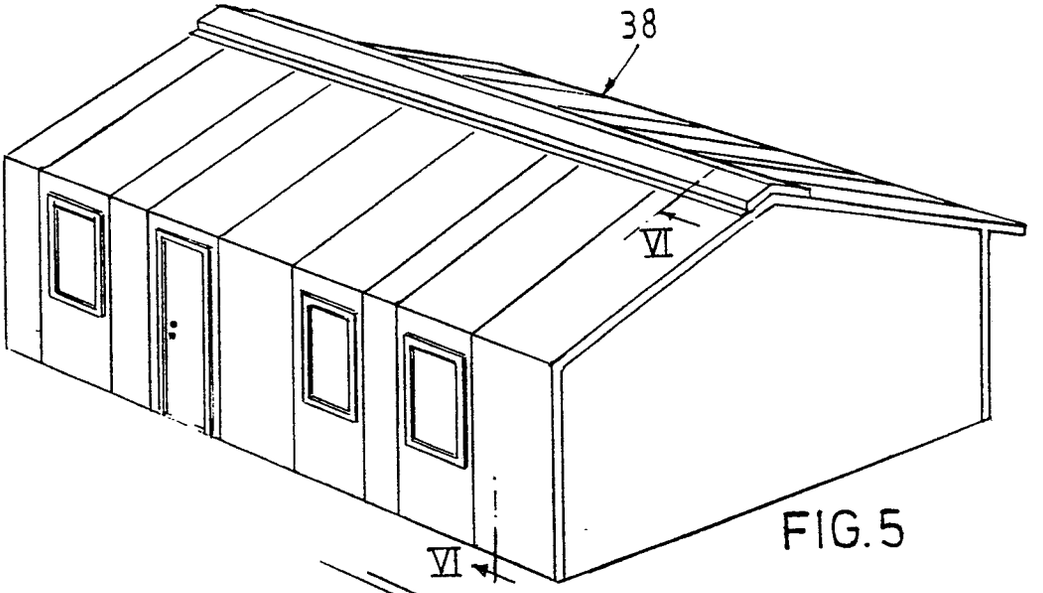

FIG.5

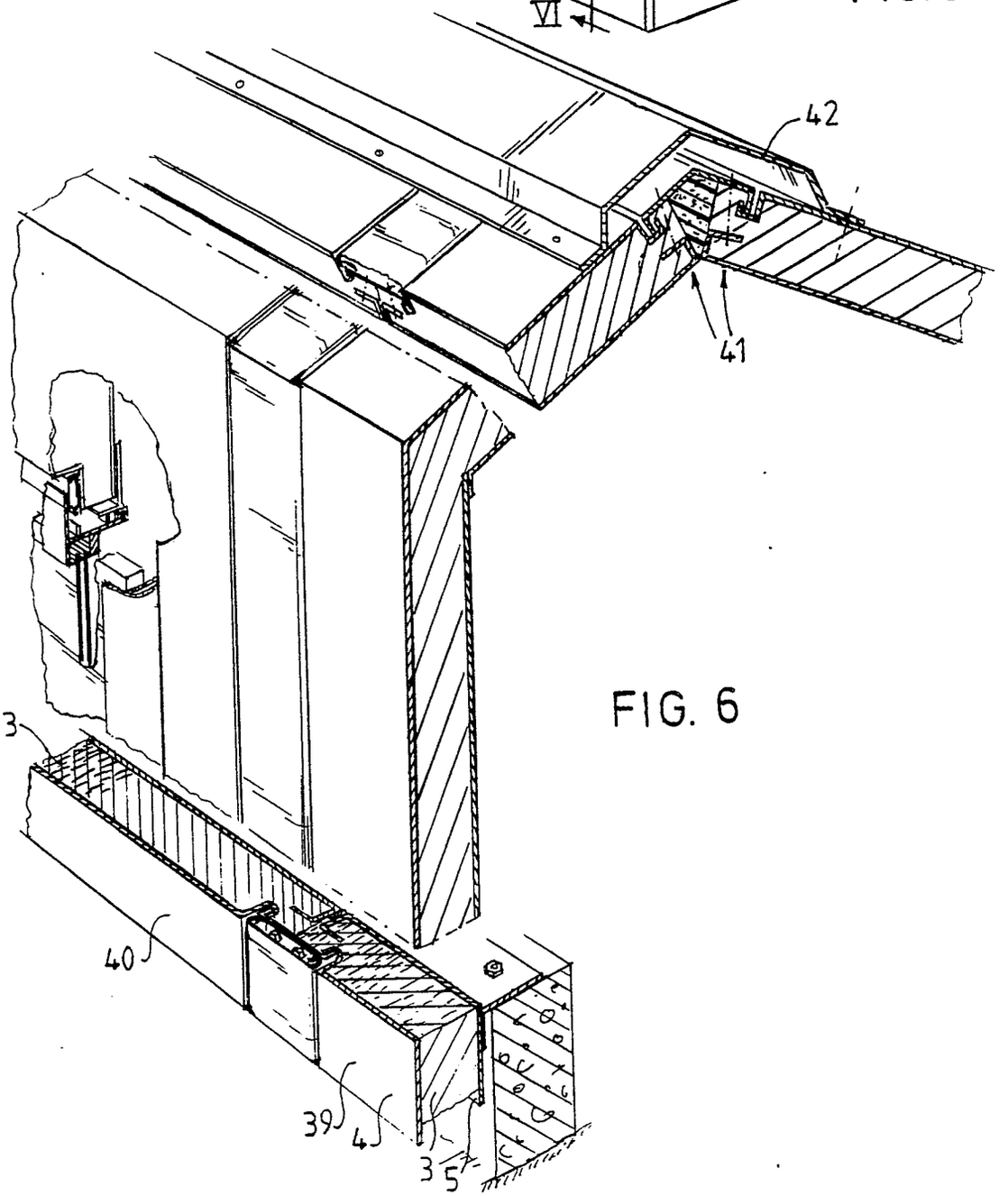

FIG. 6

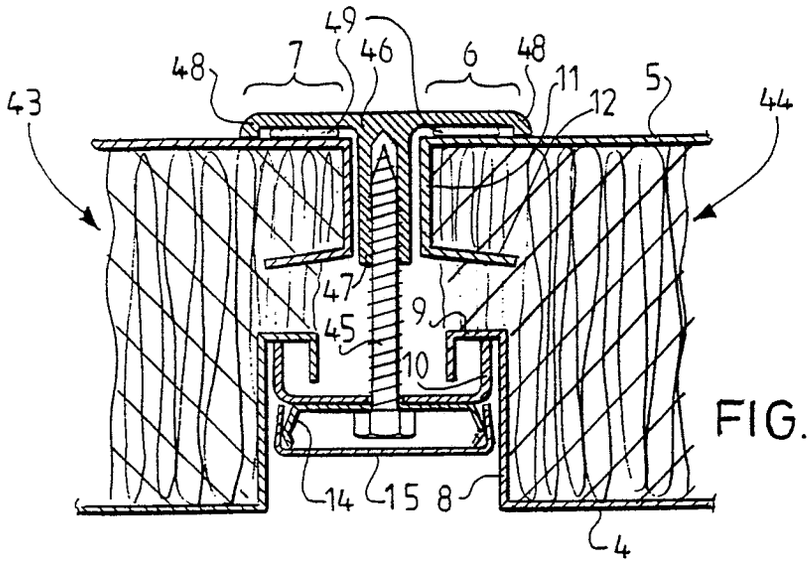

FIG. 7

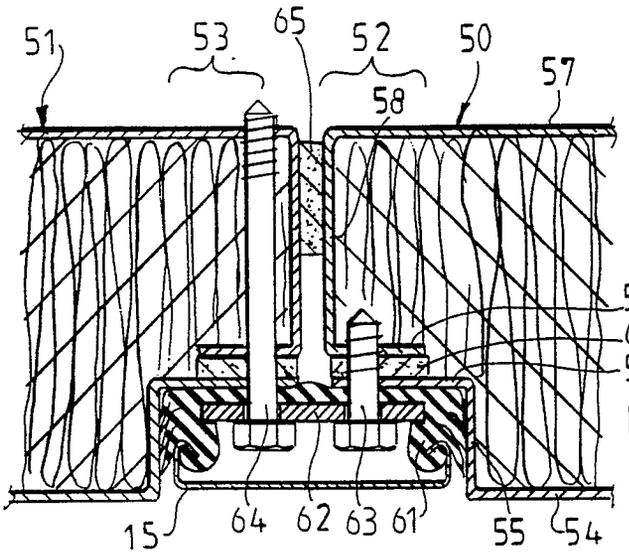

FIG. 8

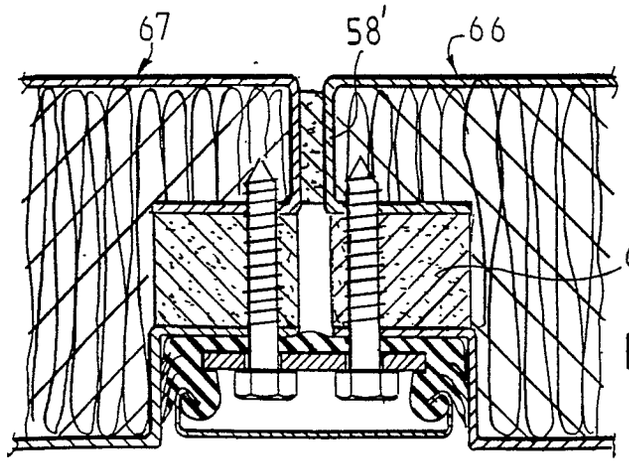

FIG. 9

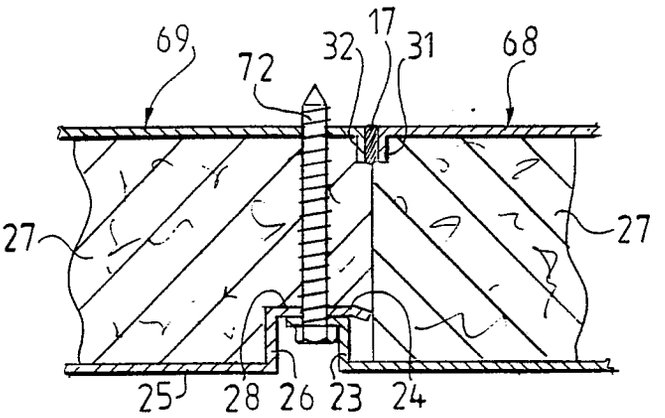

FIG. 10

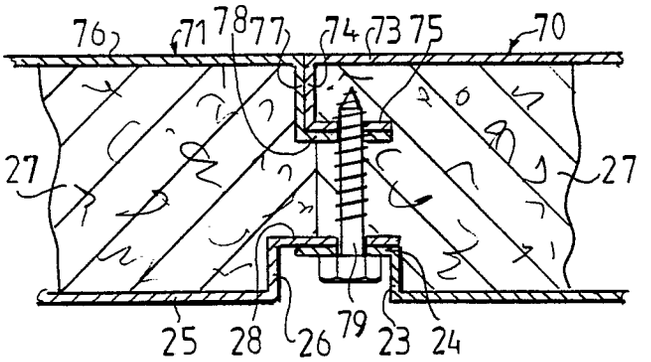

FIG.11

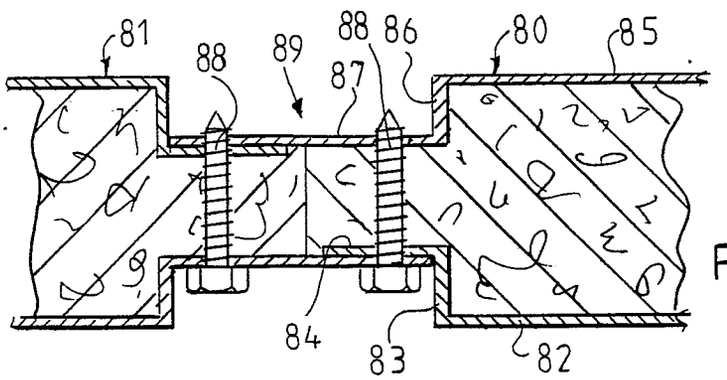

FIG.12

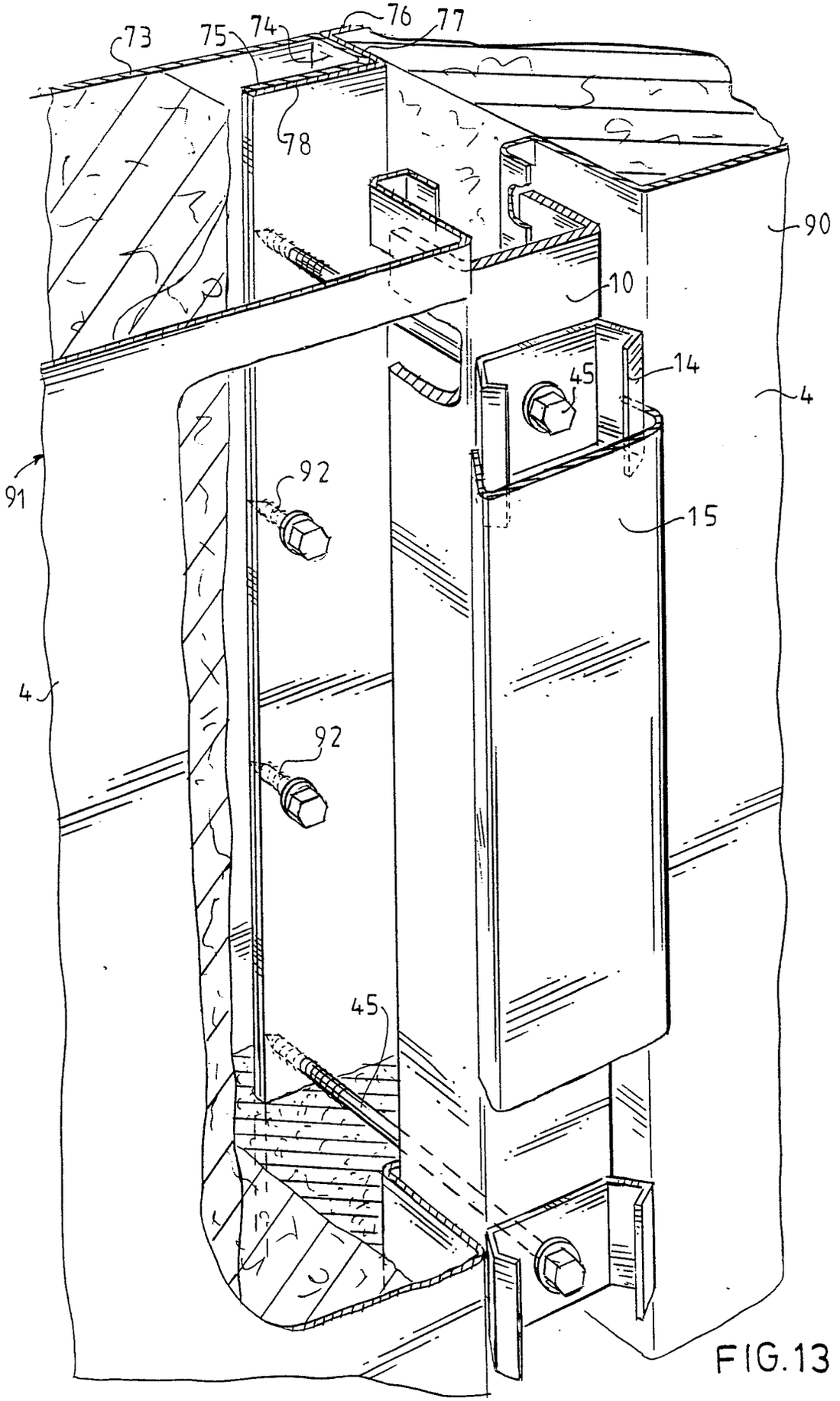

FIG.13

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 20 0827

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.4)
X	FR-A-2 173 113 (ALCAN RESEARCH AND DEVELOPMENT LTD) * Page 2, line 30 - page 3, line 18; page 4, lines 1-38; figures *	1	E 04 C 2/26
A		5,6,7,8,9,10	
A	DE-A-2 600 792 (HOESCH WERKE AG) * Page 10, line 12 - page 11, line 20; figures *	2,3,4,5	
A	FR-A-2 536 802 (PERFIL EN FRIO SA)		
A	DE-U-8 531 798 (LIGNOMAT GmbH)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 04 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12-07-1988	VANDEVONDELE J.P.H.

CATEGORY OF CITED DOCUMENTS

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