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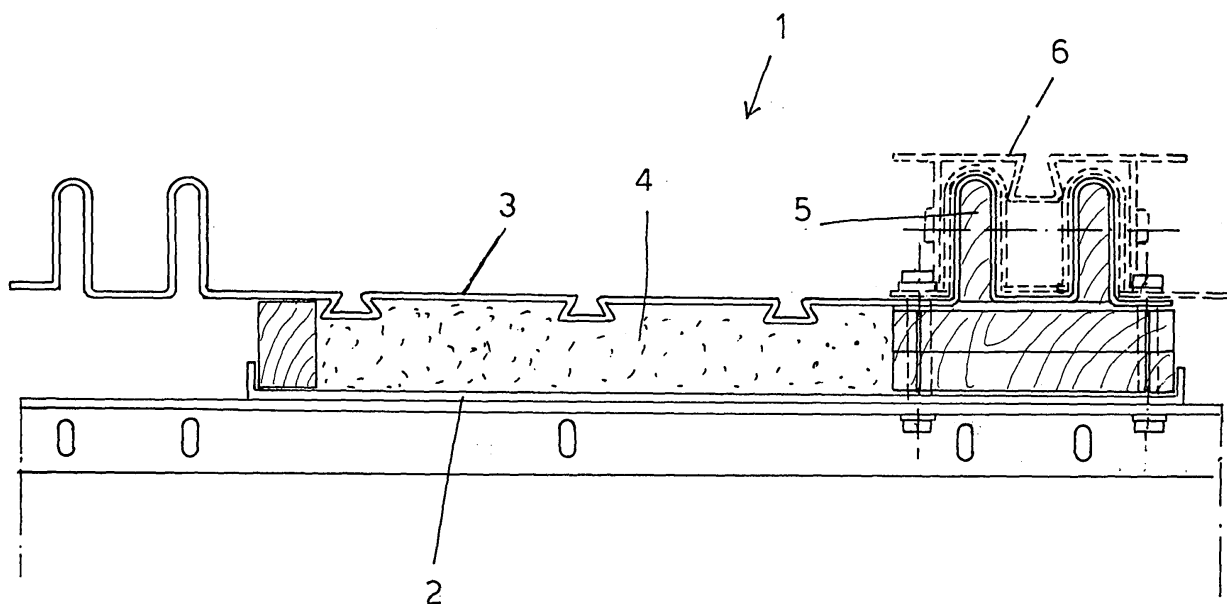
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### (54) Monolithic bearing construction for building fronts

(57) A monolithic bearing construction for building fronts comprises a thermal insulation panel, including an outer sheet metal element and an inner sheet metal element, and being characterized in that said outer and inner sheet metal elements of the thermally insulating

panel have a perimetrical or central geometry providing a double "omega" shape contour, adapted to receive a complementary composite bearing T-shape beam, made of a laminar wood material, reinforced by a steel L or omega-shape contour or section member.

FIG 1



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## Description

### BACKGROUND OF THE INVENTION

[0001] The present invention relates to a monolithic bearing construction for building fronts.

[0002] As is known, commercially available air ventilated building fronts require a curtain wall either for connecting thereto a grid or lattice construction supporting the front coating, or provide an IPE bearing construction for engaging therethrough the thermally insulating panels, by connecting the ventilated coating construction directly on the back of the IPE bearing construction.

[0003] This prior system, however, is affected by a lot of drawbacks, such as a comparatively high weight, since a brick has a weight of 150 kg/m<sup>2</sup> (3w and mtp having a weight from 23 to 30 kg/m<sup>2</sup>).

[0004] A further drawback is represented by the static loads on the floors, with a consequent increase of the steel material necessary for the construction.

[0005] Another drawback is the requirement to bring to the several floors materials of a comparatively large weight.

[0006] Another drawback is that it is necessary to use sealing materials and gasket along all the panel perimeters.

[0007] The used materials, in particular, have an accelerated ageing, with respect to all the other materials of the building front, because of the loss of the elasticity coefficient assuring the sealing to water.

[0008] Yet another drawback is due to infiltrations and seepage of air and water.

[0009] This problem, in particular, is a very important one and the UNI 7979 standard (which is being modified with rules much more limiting than the present ones) has provided a scale indicating the allowable infiltration and seepage limits.

[0010] Yet a further drawback is that thermal bridges are frequently formed.

[0011] In fact, each plug, screw, bolt represents a thermal bridge, and the transmittance phenomenon from the anchoring elements to the primary construction of the building can be reduced, but not fully eliminated.

[0012] Moreover, prior systems require a comparatively long assembling or installation time.

### SUMMARY OF THE INVENTION

[0013] Accordingly, the aim of the present invention is to provide such a monolithic bearing construction for building fronts overcoming the above mentioned drawbacks affecting the prior art.

[0014] Within the above mentioned aim, a main object of the invention is to provide such a bearing construction which allows to easily connect all types of front coatings, thereby providing a single monolithic bearing construction fitting the function of an integral and continuous thermally insulating envelope or coating for the overall build-

ing.

[0015] Yet another object of the present invention is to provide such a bearing construction solving, by a single solution, all the building static problems (operating loads), functional problems (sealing to water and air) and aesthetic problems (outer coatings of the front).

[0016] Yet another object of the present invention is to provide such a bearing construction allowing to eliminate all gaskets, sealing elements and perforations, which, in prior system, would cause infiltrations and thermal bridges representing a main cause of a high energy consume, and a thermal dissipation which can arrive at a 50% value.

[0017] According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a monolithic bearing construction for building fronts, comprising a thermally insulating panel including an outer sheet metal element and an inner sheet metal element, characterized in that said outer sheet metal element and inner sheet metal element have a perimetrical or central geometry defining a double omega-shape contour, adapted to receive therein a complementary composite bearing T-shape beam, made of a laminar reinforced wood material.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Further characteristics and advantages of the present invention will become more apparent hereinafter from the following detailed disclosure of a preferred, though not exclusive, embodiment of the invention which is illustrated, by way of an indicative, but not limitative, example in the accompanying drawings, where:

Figure 1 is a cross-sectional view of the inventive bearing construction arranged on a perimeter of a building;

Figure 2 is a further cross-sectional view of that same bearing construction, shown at a central region of the panel;

Figure 3 is a further vertical cross-sectional view showing the bearing beam associated to the subject construction;

Figure 4 is an exploded perspective view showing a perimetrical beam of the construction;

Figure 5 is a further perspective view showing the panel being coupled to a building floor slab;

Figure 6 is a further perspective view of a structural truss or arch beam;

Figure 7 is a further exploded perspective view of a central reinforced beam;

Figure 8 is a top plan cross-sectional view of the metal construction;

Figure 9 is a side cross-sectional elevation view showing a depressed truss construction;

Figure 10 is a view similar to figure 9, but showing the construction including a laminar curved wood element;

Figure 11 shows a modified embodiment of the inventive construction, including a triple gap; and Figure 12 shows another modified embodiment of that same construction including a delta beam made of a laminar wood material.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] With reference to the number references of the above mentioned figures, the bearing construction according to the invention, which has been generally indicated by the reference number 1, comprises, as main elements thereof, an inner sheet metal element 2 and an outer sheet metal element 3 encompassing a thermally insulating panel 4, thereby providing an omega-shape double contour.

[0020] The latter operates as a cooperating rib and base for engaging therein a complementary composite T or C-shape beam, made of a laminar wood material, and generally indicated by the reference number 5.

[0021] Said complementary beam 5 is advantageously reinforced by a steel L or omega-shape section member, generally indicated by the reference number 6.

[0022] This structural, load bearing and insulating cell (see figures 1 and 2) provides a continuous envelope, integrally extending on the building, and adapted to prevent any infiltrations or seepage of air and water, in such a high degree to meet all the enforcing standards, in particular the UNI 7979 standard.

[0023] For spans larger than 8 m or for buildings having a height larger than 60 m or with winds of 200 km/h, or for very high loads, the laminar material-steel bearing beam can be reinforced by additional steel section members 7, as shown in figure 7.

[0024] Said bearing beam, moreover, can be structurally modified by engaging in the cell a laminar wood material-steel beam of an arch or depressed truss type, generally indicated by the reference number 8 in figures 6, 9 and 10.

[0025] This beam will provide a reinforcement element to better support excess loads, since the laminar wood material and steel will distribute static stresses to the floor slabs, and the dynamic stress to the floor extrados.

[0026] The contact faces of the sheet metal elements and laminar wood material constructions will be preliminarily mechanically processed before their assembling, to prevent any sliding or creeping phenomena at the regions where the shearing and pulling stress on the fiber are of larger values.

[0027] In exceptional cases, the glueing, performed by epoxy resins, can be reinforced by using a reinforcement structural fiber lattice arrangement.

[0028] The subject system does not require any connection wall, since it is directly connected or latched to the building floors to which it will transmit all the operating loads.

[0029] Curtain walls are not used herein and the sys-

tem is a so-called "dry" system.

[0030] Due to the monolithic construction and overall load bearing capability of the panel or cell, the latter can be directly connected to the building floors, as is shown in figures 5 and 9, with a hang-up type of connection, a fixed-joint type of connection or a pressure type of connection.

[0031] With a suspended or restrained system, since the bottom uprights thereof are suspended, they will have their free end portions automatically aligned with the load wires of the structural uprights, thereby preventing any flexure instability phenomena due to the tip loads, from occurring.

[0032] The possibility of performing a suspending connection, together with the small weight of about 30 kg/m<sup>2</sup>, with the exception of the front coating, provides a system which can be advantageously used for seismic region buildings.

[0033] The continuous and integral restrained coupling of the two T or C structural beam will provide a great increase of the system stiffness, while providing a homogeneous distribution of the front loads; thus, an hyperstatic system is obtained, even for spans larger than 6 meters and for buildings having a height larger than 60 meters, with allowable rises or cambers meeting the requirements of the Circular M.LL.PP. 24/5/1982.

[0034] The pitch of 500/600/1000/1200 mm of the bearing beams engaged in the thermally insulating panel will greatly stiffen the overall construction and, consequently, will increase the moment of inertia and flexural moment of the bearing and structural cell of the overall envelope.

[0035] Moreover, the bearing cells can be assembled in their making shop, or in-situ, with consequent great assembling advantages.

[0036] In particular, this allows the building to be put out of the air or of the water in a very short time.

[0037] As stated, the construction according to the present invention is characterized in that it comprises therein a structural bearing vertical beam for the overall front.

[0038] By modifying the shape of the thermally insulating panel metal sheet elements, it is possible to make a bearing structural panel for the overall front.

[0039] This panel is thermally insulated and has a small weight.

[0040] Said panel, moreover, is adapted to replace the above mentioned curtain wall, thereby allowing all commercially available coatings to be easily coupled thereto.

[0041] The wind pressure will stress the subject bearing construction so that the outer fibers of the double T or C, which are perpendicular to the wind direction, operate under compression, whereas the inner fibers will operate under pulling.

[0042] In a case of a negative pressure, the functions of the fibers will be reversed.

[0043] The inner faces of the adjoining edge portions are provided with adhesive materials, and the restrained

connecting elements are reduced at the floor slabs and also for spans larger than 6.00 meters.

**[0044]** This is advantageous since it prevents the edge portions of the two C's from slipping with respect to one another, which would greatly reduce the mechanical inertia and flexural properties of the bearing construction, which would be excessively stressed by the shearing efforts generated by the torque stress which mainly occurs at the building corners.

**[0045]** The complex geometry of the outer structural C has been studied depending on its use, as a continuous alignment upright (x, y, z) for connecting-fixing and anchoring all types of commercially available coatings, with exposed to view latching assemblies, concealed latching assemblies, pressure latching assemblies or by assembling the constructional cells in the making shops or in situ.

**[0046]** The inventive construction can also be used for large weight coatings (for example of stone materials, solid bricks and so on), and for small weight coatings (panels and metal strips, ceramics materials, plate materials, laminate materials and so on).

**[0047]** The subject system allows to provide three air gaps, i.e. a ventilated gap, an air conditionable gap, and a sealed air gap which can be extended beyond the front, up to the building bridge of the roof, as shown in figure 11.

**[0048]** This possibility would involved an energy or power saving of at least 17%, allowing to save 5 kg gas oil for year for each surface m<sup>2</sup>.

**[0049]** The thermally insulating material mat 4, arranged between the panel metal sheet elements 2 and 3, which do not contact one another, fully eliminates possible thermal bridges, thereby providing constant thermal conductivity values, to stabilize the programmed thermal balance.

**[0050]** Moreover, the full and continuous separation of the two faces of the metal panel, provided by the thickness of the thermal insulating material, will prevent any condensation phenomenon from occurring, such as the so-called dew effect, on the inner interface of the panel.

**[0051]** In this connection it should be pointed out that the thermal bridge problem is common to all the steel or reinforced concrete or prefabricated constructions.

**[0052]** In order to solve this problem, the bearing construction according to the invention comprises a laminar wood material beam which, having a lambda value of 1 with respect to 70 of a steel material and 200 of an aluminium material, would provide a transmittance loss of practically zero.

**[0053]** Moreover, the construction according to the present invention has very good acoustic insulating characteristics: rock wool Rw 30/38 dB at 1250 Hz; and glass wool of 30 dB 1000 Hz at minimum, but susceptible to improvements according to the designing requirements.

**[0054]** The fire resistance of the subject construction can be classified as follows:

Class 0: for steel metal parameters;

Class 1: for aluminium parameters;

Class 0: for rock and glass wool thermally insulating materials;

Class 1: for polyurethane or polystyrene materials.

**[0055]** Since the construction according to the present invention provides that the panel is suspended and connected or latched only to the floor slab, it will reduce the throughgoing thermal bridge to the single latching or connection point, thereby nearly fully eliminating point thermal bridges affecting all the conventional constructions.

**[0056]** This solution, unique per se, nullify any increases of the thermal transmittance coefficient K, which can be calculated as having a value from 20% to 30%.

**[0057]** Moreover, the construction according to the present invention provides another very important advantage.

**[0058]** Actually, the dividing of the ventilated chamber into vertical continuous spaces, in the form of a fume shaft, will channel the ascending thermal flow from the air inlet mouth at the socle to the gutter one, without any side offset and thermal losses.

**[0059]** Accordingly, the chimney effect, which is the physical phenomenon constituting the base of the ventilated front logic, is exploited at a maximum degree, thereby providing an energy power as large as possible.

**[0060]** Yet another advantage is that the thermally insulating panel, which is fully protected by the metal coating, cannot be wetted by infiltrations of water, and this mainly for those building fronts which, being coated with stone or ceramics material plates and the like, have an open joint between adjoining plates.

**[0061]** Actually, it is well known that any thermally insulating panel, in a wetted condition, will increase its thermal transmittance by 50-60%, thereby deleteriously affecting or nullifying its thermal insulation properties and the related energy saving of the overall ventilated front.

**[0062]** With reference to figure 11, the ventilated front comprises three gaps generally indicated by the reference numbers 51, 52 and 53.

**[0063]** The gap 51 is formed between the outer coating plate 54 and outer sheet metal element 3 of the thermally insulating panel 55.

**[0064]** Figure 11, in particular, shows the T-shape beam 5, the inner sheet metal element 2, the ventilated gap 52, the L-shape section member for anchoring the construction to the building floor slabs, the air conditioned gap 53, the shim profiles 58, made of laminar wood, and, finally, the finishing inner plate 59.

**[0065]** The outer coating plate 54 is applied to a supporting section member 60, defining a lattice construction.

**[0066]** Figure 12 shows a modified embodiment of the subject monolithic bearing construction for building fronts, which comprises a thermally insulating panel 100, including an outer sheet metal element 103 and an inner sheet metal element 110, and characterized in that it further comprises a delta small beam 101 made of a laminar

wood material.

**[0067]** Said laminar wood material delta beam 101 comprises a connection or latching profile 110 for providing connection to the floor slabs, a plaster wall 102, an inner sheet metal element 103, a sealed air gap 104 and an outer sheet metal element envelope 103.

**[0068]** Is herein moreover provided an aligning section member or profile 106, a latching element 107 for providing connection to the outer coating 105 to which the front coating 108 is applied.

**[0069]** It has been found that the invention fully achieves the intended aim and objects.

**[0070]** In fact, the invention provides a monolithic bearing construction for building fronts, characterized by a modified geometry of the sheet metal elements forming the thermally insulating curtain panel, to embed therein a composite structural beam, made of a laminar wood material, and reinforced by a continuous steel section member.

**[0071]** This beam allows to connect any desired types of front coatings, thereby providing a single monolithic bearing construction operating as an integral continuous envelope, having very good thermally insulating properties, for the overall building.

**[0072]** Another very important advantage of the invention is that the invention allows to solve, by a single approach, all the static problems of the building (operation loads), as well as its functional problems (water and air sealing) and aesthetic problems (front outer coatings).

**[0073]** Yet another very important advantage is that the subject construction does not comprise gaskets, sealing elements and perforations susceptible to generate seepage and thermal bridges.

**[0074]** In practicing the invention, the used materials, as well as the contingent size and shapes, can be any, according to requirements.

## Claims

1. A monolithic bearing construction for building fronts, comprising a thermally insulating panel including an outer sheet metal element and an inner sheet metal element, **characterized in that** said outer and inner sheet metal elements have a perimetrical or central geometry defining a double omega-shape contour, adapted to receive a complementary composite bearing T-shape beam, made of a laminar wood material.
2. A construction, according to claim 1, **characterized in that** said composite laminar wood bearing T-shape beam is reinforced by a steel L or omega-shape section member.
3. A construction, according to claim 1 or 2, **characterized in that** said bearing beam is reinforced by supplementary steel section members.
4. A construction, according to one or more of the preceding claims, **characterized in that** said bearing beam has a modified construction including in the cell a beam made of a laminar wood material + steel material of an arch or depressed truss type.
5. A construction, according to one or more of the preceding claims, **characterized in that** the contacting faces between said sheet metal elements and laminar wood constructions are previously mechanically processed, before their assembling, to prevent any slipping phenomena from occurring at the point where the shearing and pulling efforts on the fibers are the greatest.
6. A construction, according to one or more of the preceding claims, **characterized in that** the elements of said construction are glued by epoxy resins reinforced by a structural fiber lattice arrangement.
7. A construction, according to one or more of the preceding claims, **characterized in that** said construction is directly coupled or latched to the building floors by a suspension, restrained or compression type of connection.
8. A construction, according to one or more of the preceding claims, **characterized in that**, as said construction is suspended or restrained, it comprises suspended bottom uprights having free end portions thereof self-aligned with the load wires of the structural uprights.
9. A construction, according to one or more of the preceding claims, **characterized in that** said construction comprises a continuous and integral restrained connection between two structural C's.
10. A construction, according to one or more of the preceding claims, **characterized in that** in said construction the inner faces of adjoining edge portions are provided with an adhesive material and **in that** the restraining latching means are reduced only at the floors and this also for large spans.
11. A construction, according to one or more of the preceding claims, **characterized in that** said construction comprises three construction air gaps, i.e. a ventilated gap, a climatizable gap and a sealed air gap, which can be extended beyond the front up to the ridge of the roof of said construction.
12. A construction, according to one or more of the preceding claims, **characterized in that** said construction comprises a ventilated chamber divided into vertical continuous spaces as a fume chimney, adapted to channel the ascending thermal flow from an air inlet mouth at the bottom thereof to a gutter portion,

without any offset and side thermal losses.

13. A monolithic bearing construction for building fronts,  
**characterized in that** it comprises three said air  
gaps (51, 52 and 53). 5
  
14. A monolithic baring construction, according to the  
preceding claim, **characterized in that** said air gap  
(5) is formed between an outer coating plate (54)  
and the outer sheet metal element (3) of the thermally 10  
insulated panel (55).
  
15. A monolithic bearing construction, according to  
claims 13 and 14, **characterized in that** said con- 15  
struction comprises a T-shape beam (5), an inner  
sheet metal element (2), a ventilated air gap (52), a  
L-shape section member for anchoring said con-  
struction to the building floors, a climatized or air con-  
ditioned air gap (53), shim section members (58) 20  
made of a laminar wood material and an inner fin-  
ishing plate (59).
  
16. A construction, according to one or more of claims  
13 to 15, **characterized in that** said outer coating 25  
plate (54) is applied to a supporting section member  
(60) forming a lattice construction.
  
17. A construction, according to one or more of the pre-  
ceding claims, **characterized in that** said construc- 30  
tion comprises a thermally insulating panel (100) in-  
cluding an outer sheet metal element (103) and an  
inner sheet metal element (110), **characterized in  
that** said construction comprises moreover a delta  
beam (101) made of a laminar wood material, said  
delta beam including a latching section member 35  
(110) for connection to the building floors, a plaster  
wall (102), an inner sheet metal element (103), a  
sealed air gap (104) and an outer sheet metal enve-  
lope (103). 40
  
18. A monolithic bearing construction for building fronts,  
according to preceding claim, **characterized in that**  
said construction comprises an alignment section  
member (106), a latching element (107) for providing  
connection to an outer coating (105), to which the 45  
coating of the front (108) is applied.

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FIG 1

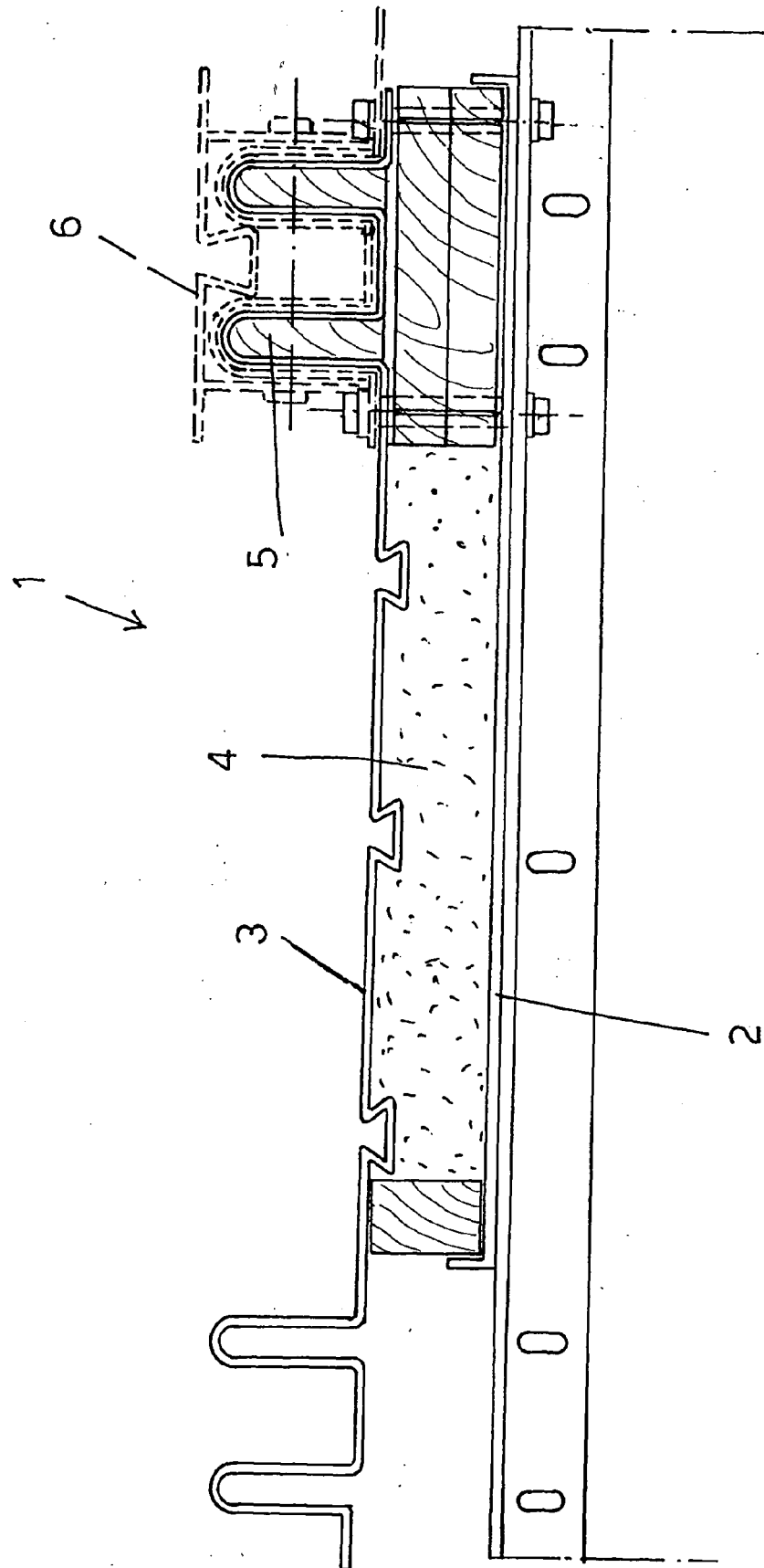
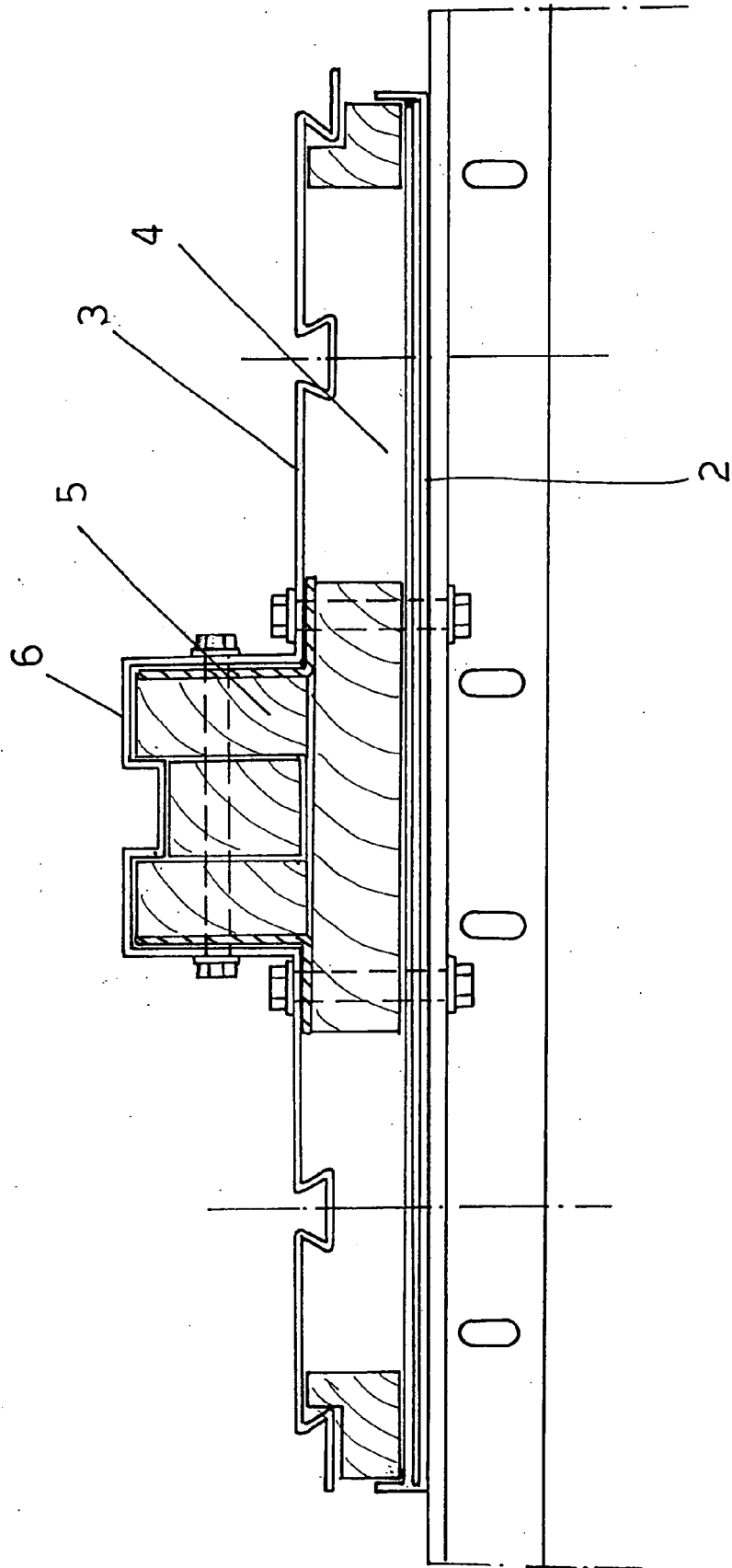


FIG 2



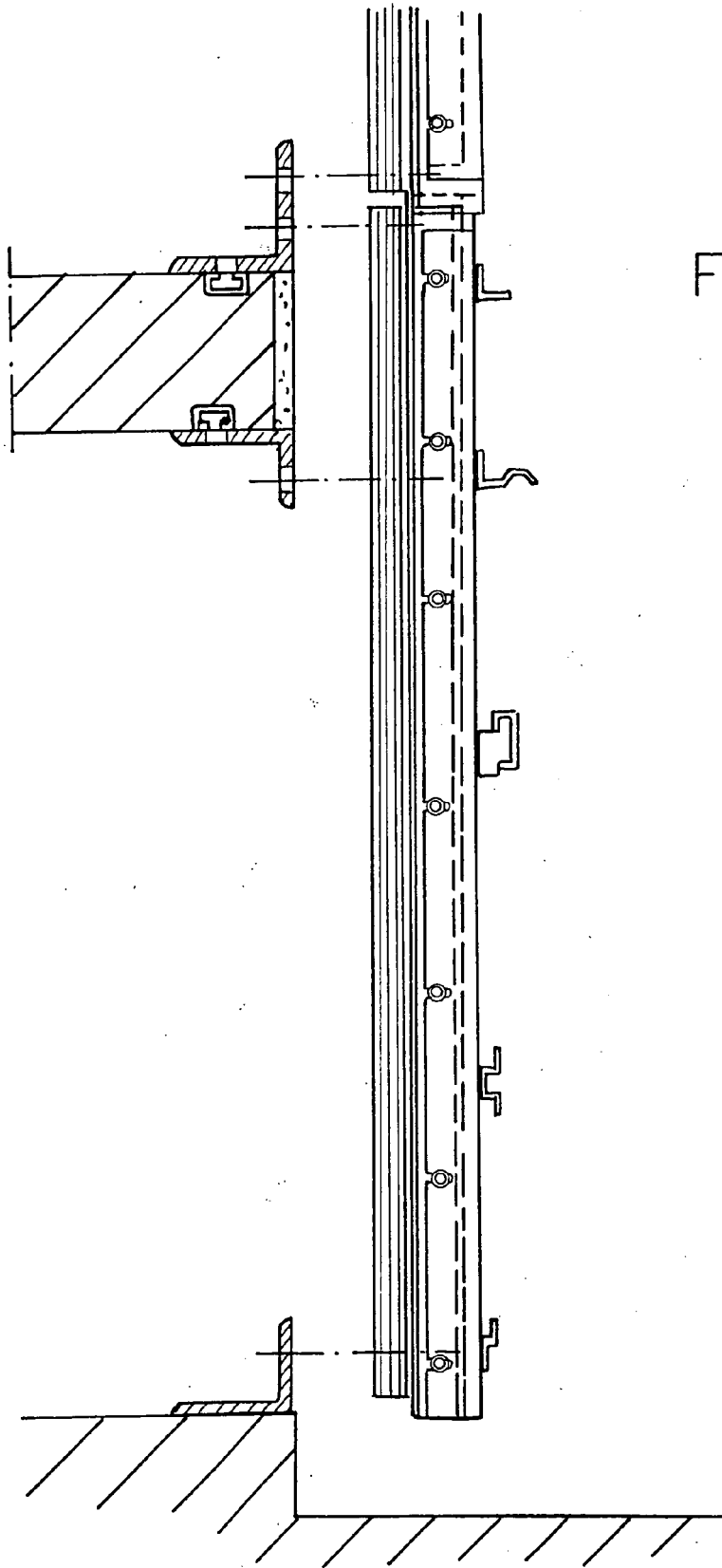


FIG 3

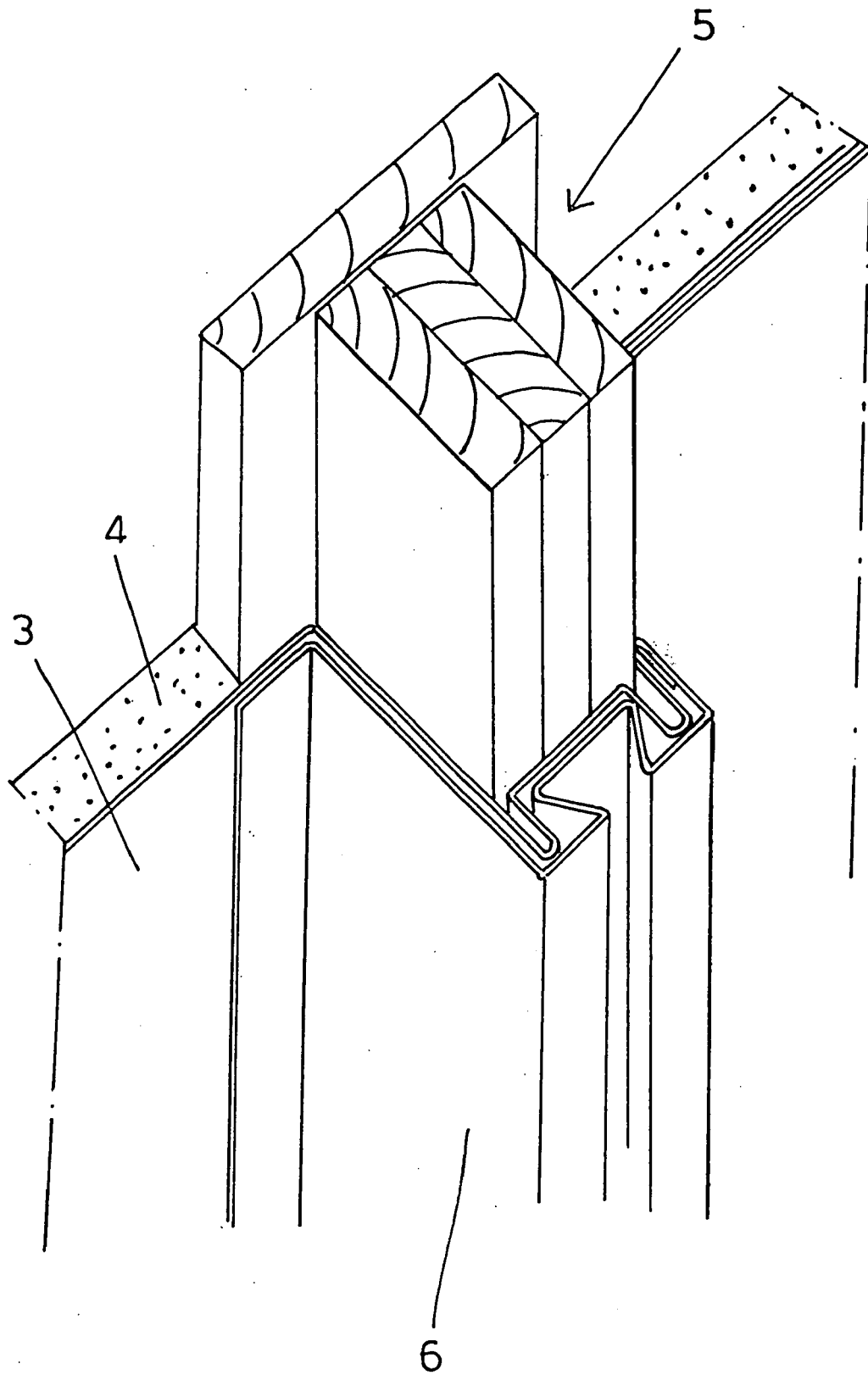


FIG 4

FIG 5

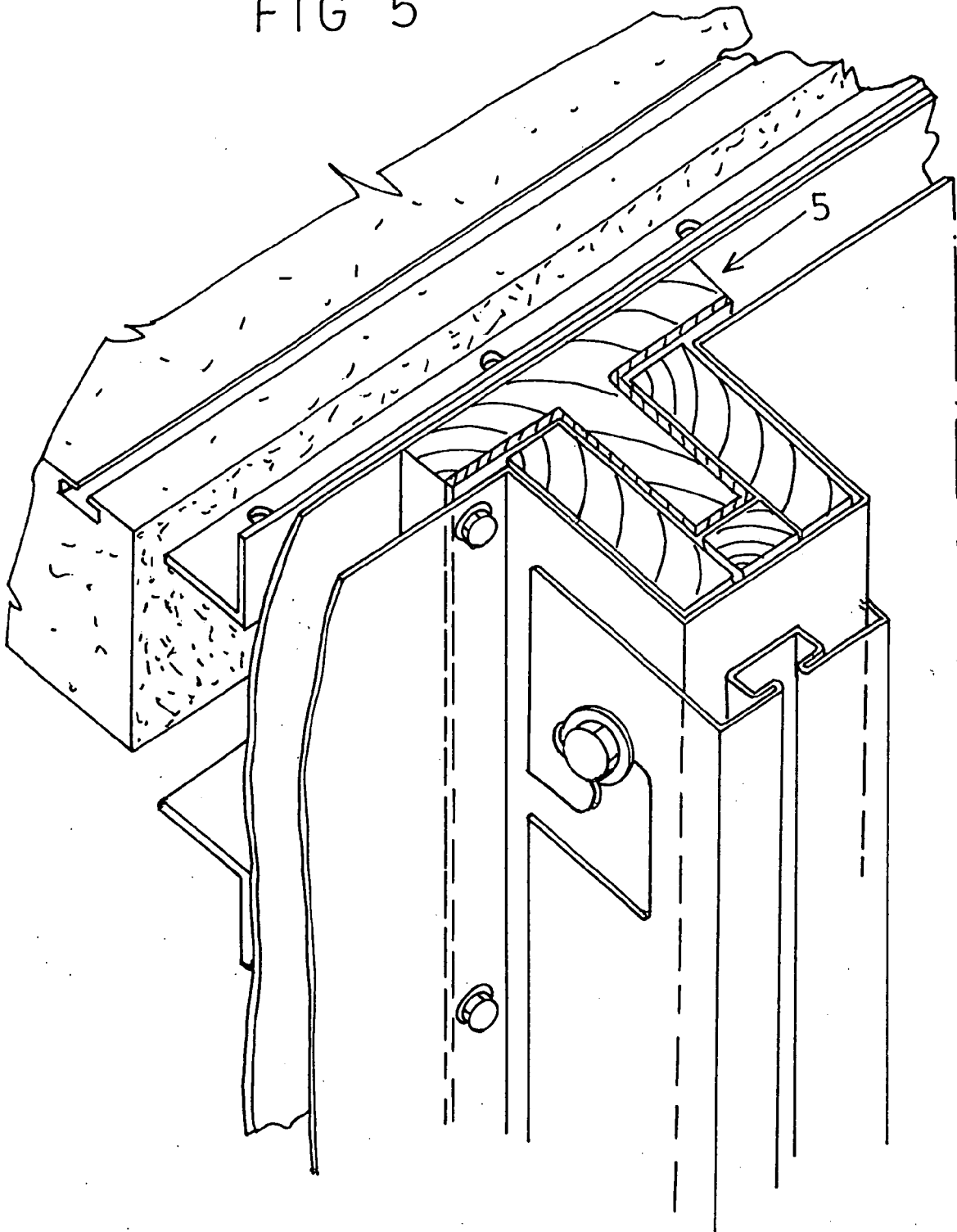
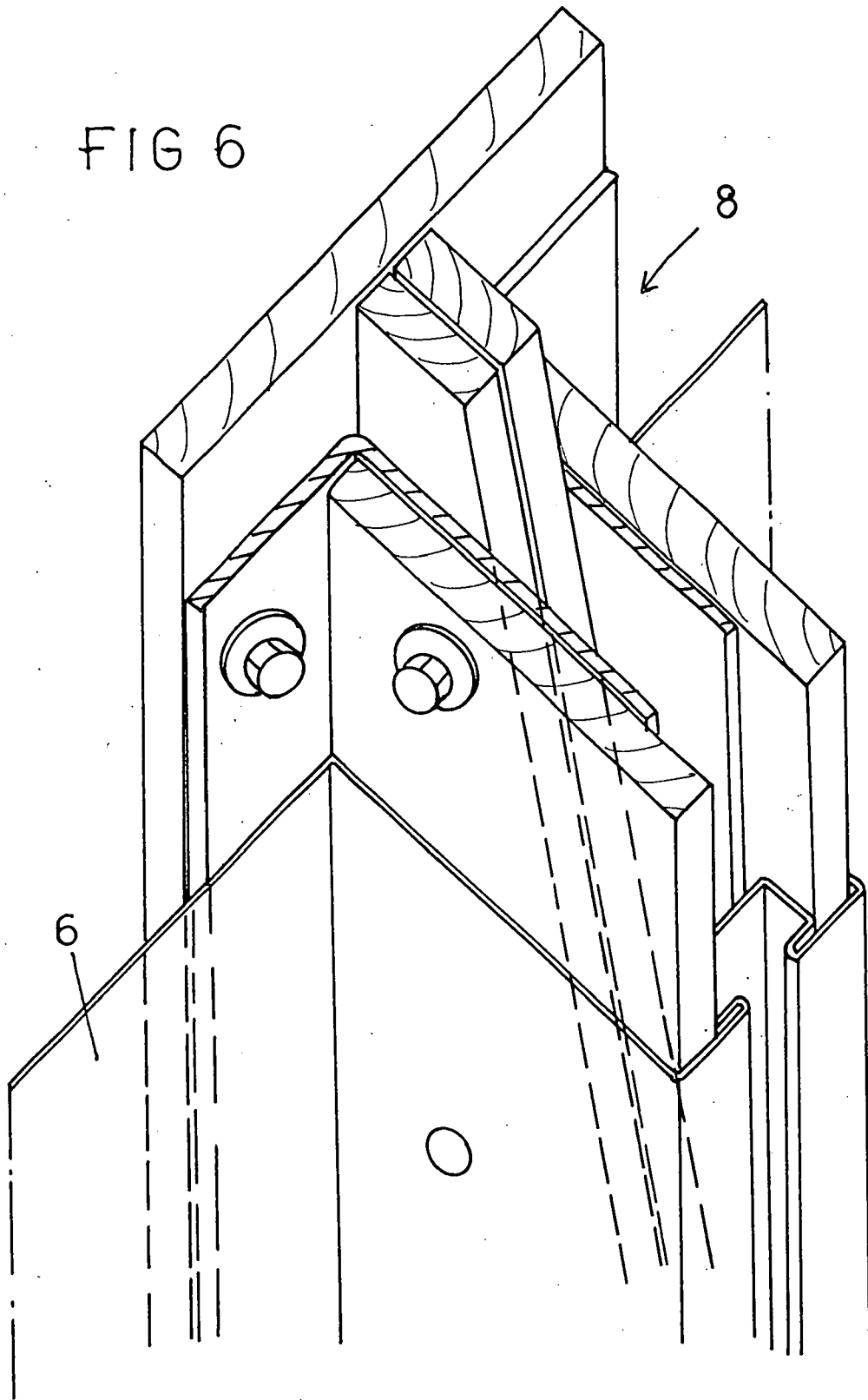


FIG 6



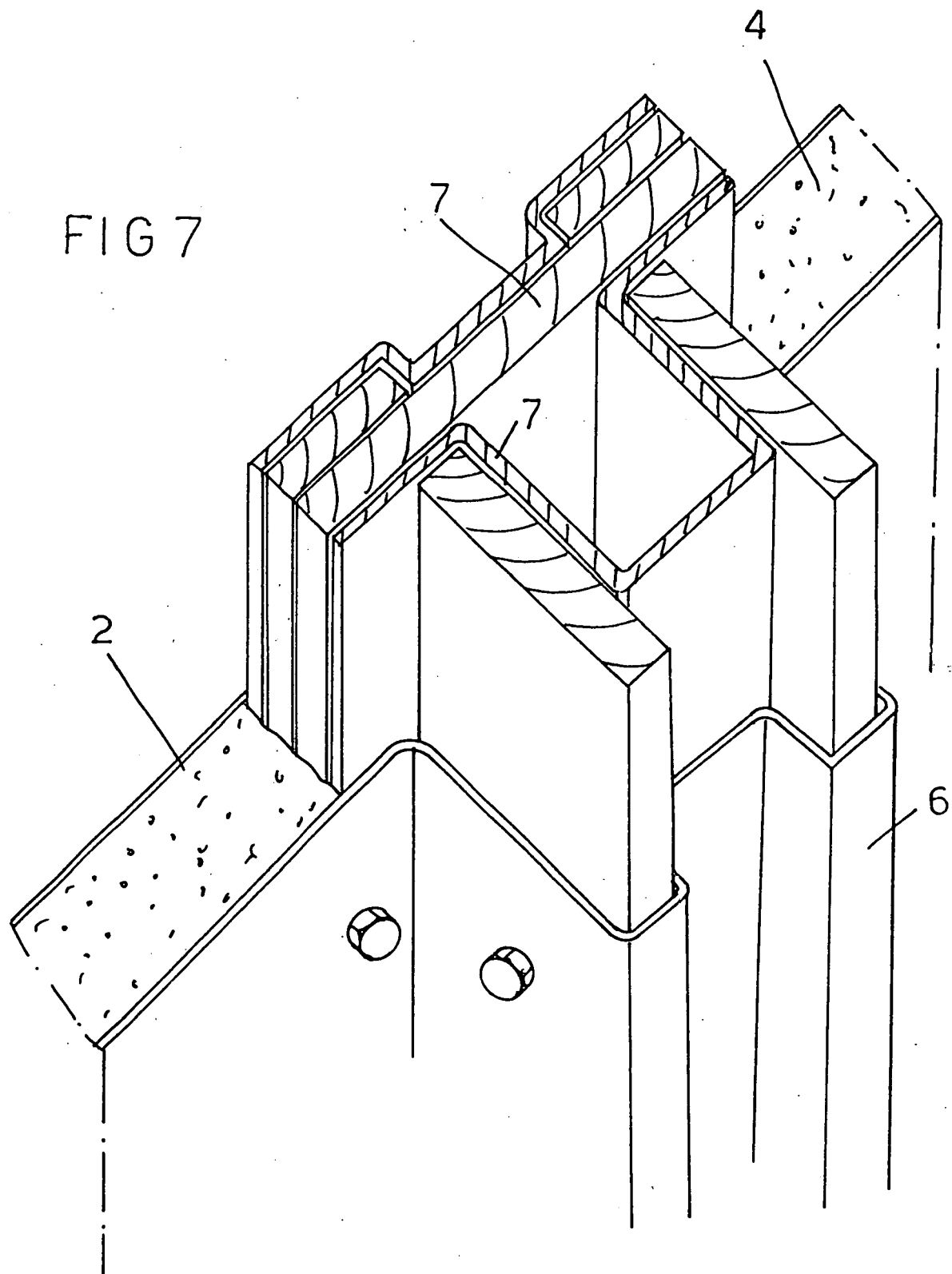
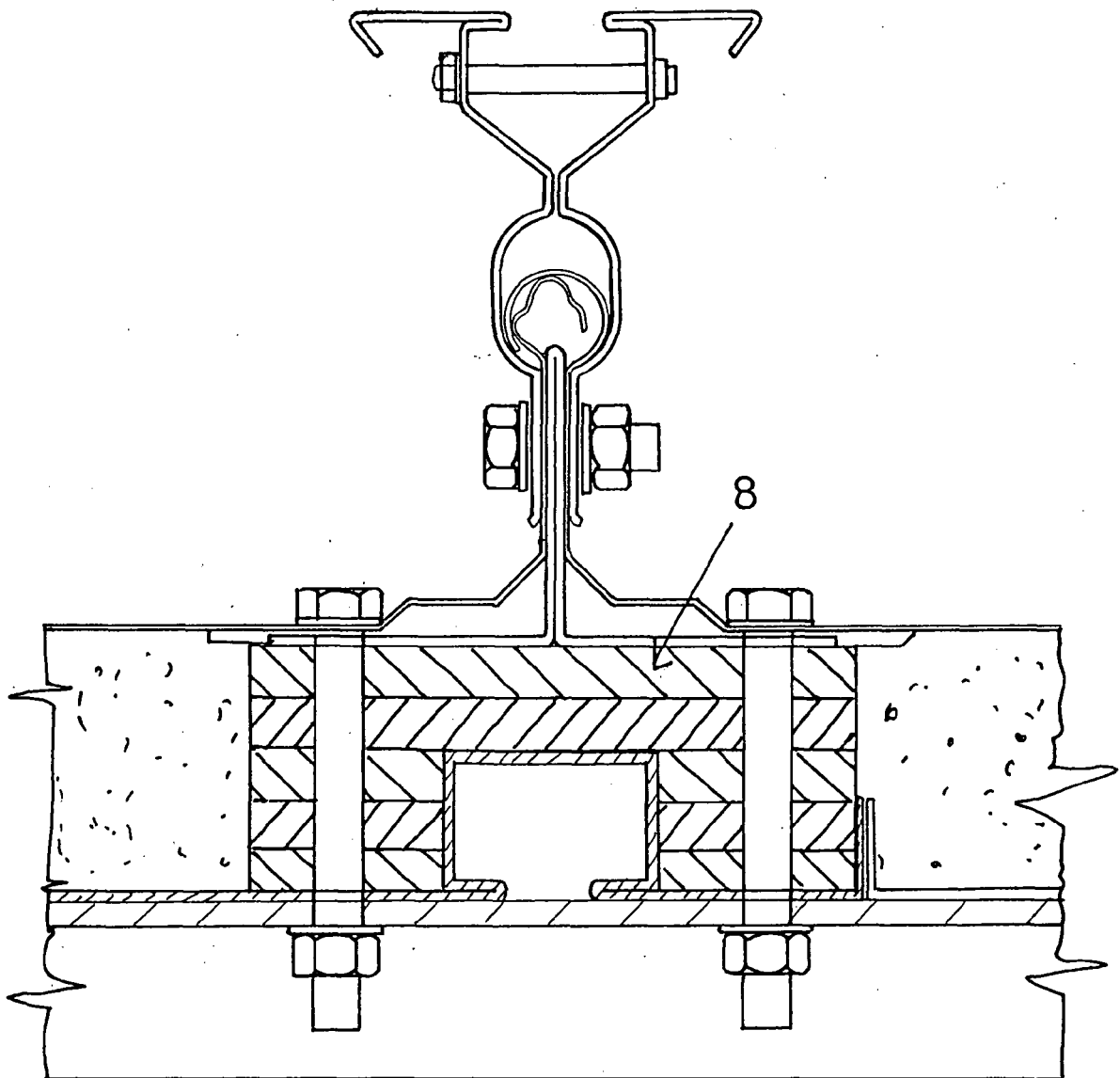
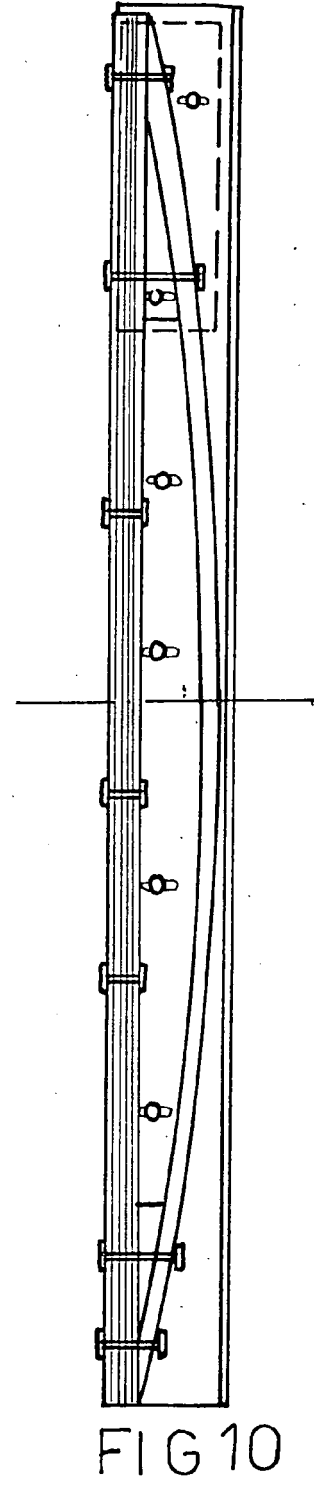
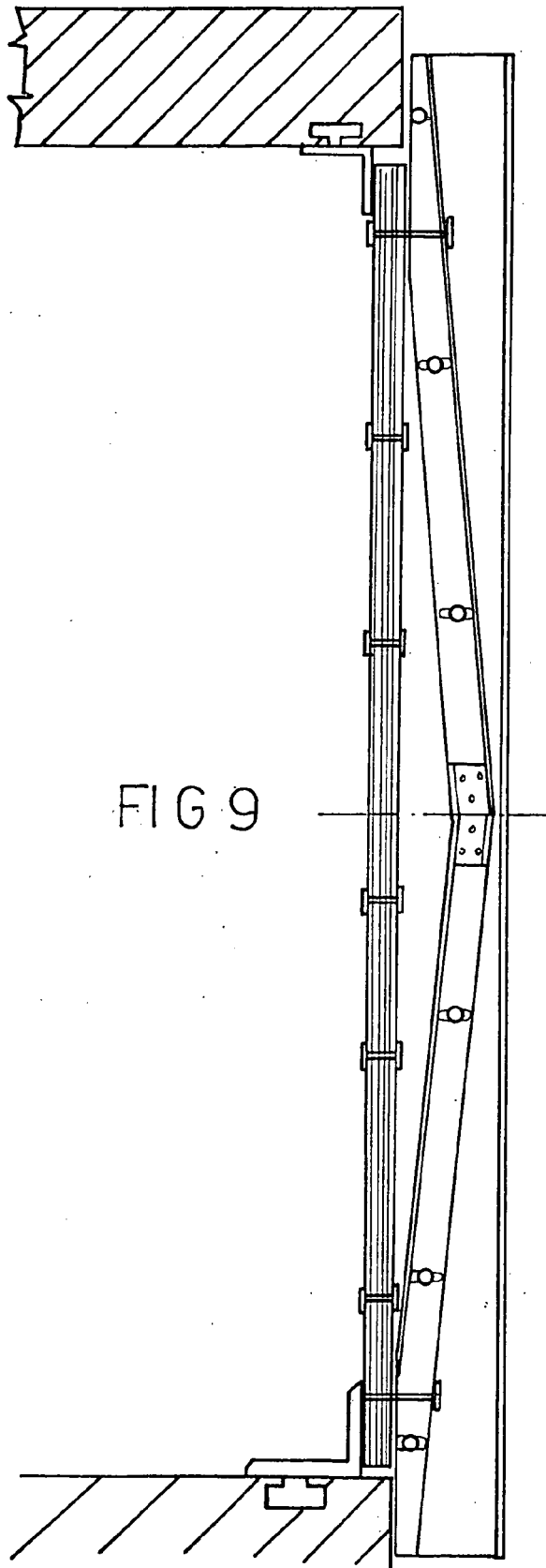


FIG 8





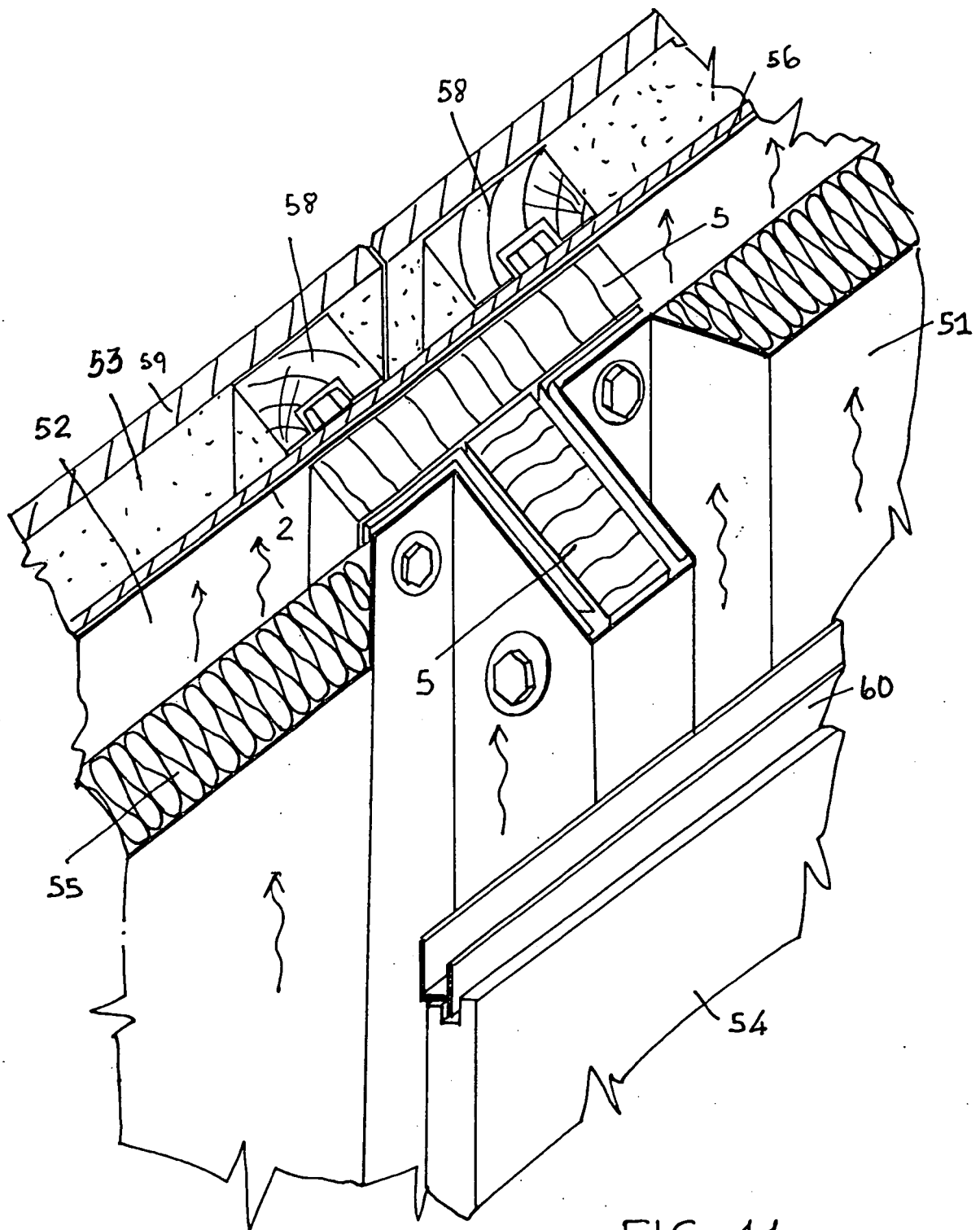


FIG. 11

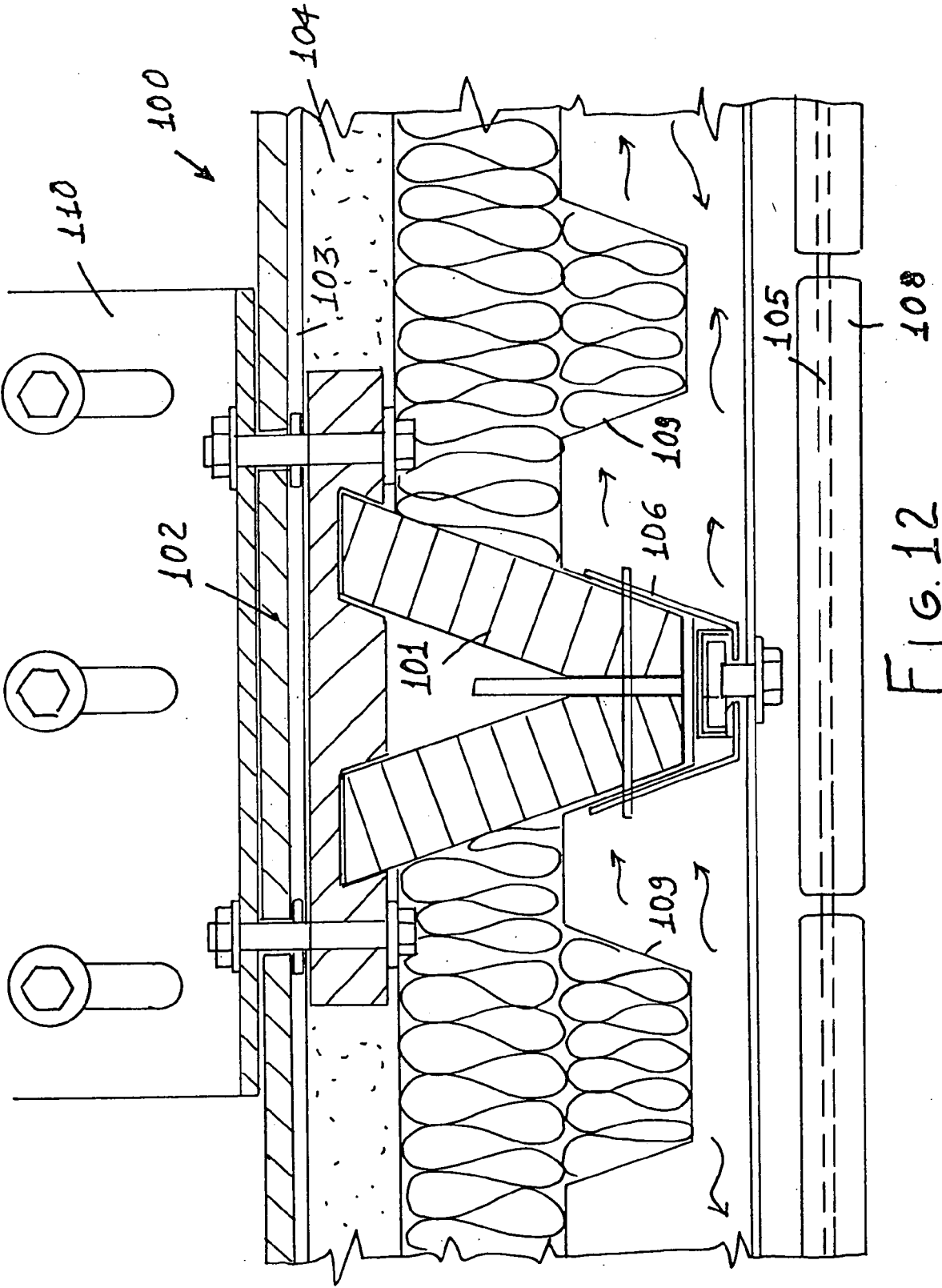


FIG. 12