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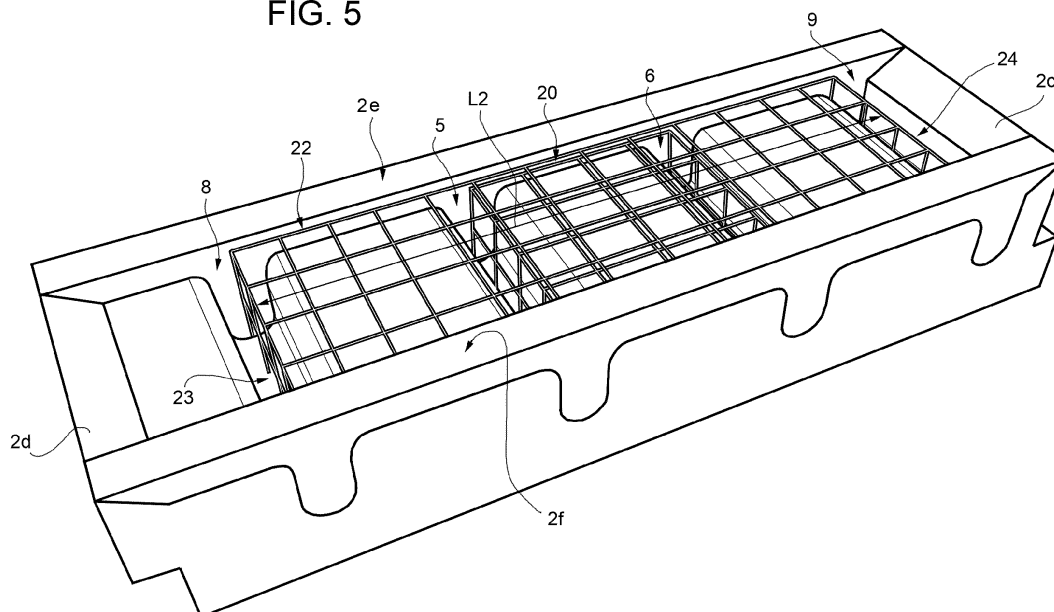
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(54) **Method of producing a modular construction insulating member, and modular member produced using such a method**

(57) A method of producing a modular construction insulating member, the method including the steps of : forming, in a flat panel (2) of insulating foam material, a depressed seat (4) which opens out at a first face (2-A) of the flat panel and has at least a first and second groove (5, 6); placing inside the depressed seat a C-shaped elongated reinforcing member (10) having a first lateral portion (13) housed in the first groove (5), and a second

lateral portion (14) housed in the second groove (6); forming a mixture of water, foam material particles, sand and cement, and pouring the mixture inside the depressed seat (4) so as to fill the grooves and the depressed seat and incorporate the reinforcing member (10); and allowing the mixture to harden. The outer surface of the hardened mixture defines a first face (30-A) of the modular insulating member, a second face (30-B) of which is defined by the second face of the flat panel (2).

FIG. 5



Description

[0001] The present invention relates to a method of producing a modular construction insulating member, and to the modular member produced using such a method.

[0002] The Applicant's Patent EP-B-810.335 describes a modular structure comprising : a number of C-shaped structural members, each having at least one layer of thermal insulating material and connecting portions; and connecting members interposed between at least two adjacent structural members and designed to cooperate with the connecting portions. The connecting members are made of thermal insulating material, which cooperates with and contacts the layers of thermal insulating material of the adjacent structural members to define with them a substantially seamless covering of the modular structure. Patent GB 2 355 024 describes a construction member comprising a polystyrene insulating portion.

[0003] The method of producing the construction insulating member will be described with reference to the attached drawings, in which :

Figure 1 shows a first step in the method according to the present invention;

Figure 2 shows a second step in the method according to the present invention;

Figure 3 shows a third step in the method according to the present invention;

Figure 4 shows a fourth step in the method according to the present invention;

Figure 5 shows a fifth step in the method according to the present invention;

Figure 6 shows a sixth step in the method according to the present invention;

Figure 7 shows a view in perspective of the construction insulating member produced using the method according to the present invention;

Figures 8, 9 and 10 show a number of insulating members used to pour a wall.

[0004] Firstly (Figure 1), a depressed seat 4 is formed in a flat rectangular panel 2 of insulating foam material, and opens out at a first face 2-A of panel 2.

[0005] Depressed seat 4 may be either molded or formed by hot drawing a parallelepiped-shaped panel of thermoplastic insulating foam material (e.g. polystyrene foam).

[0006] Depressed seat 4 has at least a first and second groove 5 and 6, which open out at a flat bottom wall 7 of depressed seat 4, extend towards a second face 2-B of flat panel 2, and extend substantially the whole length of flat panel 2 (in the drawings, panel 2 is illustrated shorter than its actual length for the sake of simplicity).

[0007] Grooves 5 and 6 may also be either molded or formed by hot drawing a parallelepiped-shaped panel of thermoplastic insulating foam material, together with de-

pressed seat 4.

[0008] Grooves 5 and 6 have a U-shaped cross section, are straight and equally spaced, and extend parallel to the long sides, and along the whole length, of flat rectangular panel 2.

[0009] A third and fourth groove 8 and 9, of the same size and arrangement as first and second groove 5 and 6, may also be formed on opposite sides of and in the same way as first and second groove 5 and 6.

[0010] Depressed seat 4 (Figure 2) is bounded by bottom wall 7; by two triangular-cross-section, integral raised edges 2c, 2d of panel 2, which extend along the long sides of panel 2; and by two sidewalls 2e, 2f (Figure 5), each defined by a flat wall of foam material (polystyrene foam) with a profile complementary to that of the shaped panel 2, so as to define opposite sides of depressed seat 4. In the example shown, in which the panel is shaped by hot drawing, the two sidewalls 2e, 2f are fixed to the panel after the hot drawing process. If the molding technique is employed, however, sidewalls 2e, 2f are obviously formed integrally with the panel.

[0011] In the method according to the present invention, an elongated reinforcing member 10 with a U-shaped cross section (Figure 3) is formed comprising a flat centre portion 12, and an integral first and second lateral portion 13, 14 parallel to each other and crosswise to flat centre portion 12.

[0012] The width L1 of flat centre portion 12 equals the spacing between grooves 5 and 6.

[0013] Elongated reinforcing member 10 is typically formed by shaping a rectangular portion of metal wire (e.g. square-mesh) netting using ordinary bending tools (not shown).

[0014] In the method according to the present invention, reinforcing member 10 (Figure 3) is placed inside depressed seat 4, with first lateral portion 13 inside first groove 5, second lateral portion 14 inside second groove 6, and centre portion 12 housed inside depressed seat 4 and resting on (or facing) bottom wall 7.

[0015] Typically but not necessarily, a further elongated reinforcing member 20 with a U-shaped cross section (Figures 4 and 5) is formed comprising a flat centre portion 22, and an integral first and second lateral portion 23, 24 parallel to each other and crosswise to flat centre portion 22.

[0016] Further elongated reinforcing member 20 is typically formed by shaping a rectangular portion of metal wire (e.g. square-mesh) netting using ordinary bending tools (not shown).

[0017] The width L2 of flat centre portion 22 equals the spacing between grooves 8 and 9, i.e. $L2 > L1$.

[0018] In the method according to the present invention, further reinforcing member 20 (Figures 4 and 5) is placed inside depressed seat 4, with first lateral portion 23 inside third groove 8, second lateral portion 24 inside fourth groove 9, and centre portion 22 housed inside depressed seat 4 and over centre portion 12 of reinforcing member 10.

[0019] A mixture 26 of water, foam material particles (e.g. polystyrene balls), sand and cement is formed.

[0020] The proportions by volume of mixture 26 may typically be as follows :

- 16.6% water
- 54.7% foam material particles
- 5.5% sand
- 23% cement
- 0.2% air-entraining agent

[0021] The liquid mixture 26 is poured into depressed seat 4 to fill grooves 5, 6, 8 and 9 and depressed seat 4, and to incorporate and cover both reinforcing members 10 and 20.

[0022] The mixture is poured to a level flush with the top edges of the two integral raised edges 2c, 2d, and with the two sidewalls 2e, 2f. During this operation, panel 2 is perpendicular to the vertical, and depressed seat 4 faces upwards.

[0023] Mixture 26 is then allowed (a few hours) to set.

[0024] When set, the outer surface of the mixture defines a flat first face 30-A of a modular insulating member 30 (Figure 6), a second face 30-B of which is defined by second face 2-B of flat panel 2.

[0025] A modular construction insulating member 30 is thus formed comprising a flat panel 2 of insulating foam material with a depressed seat 4 opening out at a first face 2-A of panel 2. Depressed seat 4 has at least a first and second groove 5 and 6, which open out at a bottom wall 7 of depressed seat 4, extend towards a second face 2-B of the panel, and extend substantially the whole length of the panel.

[0026] Modular member 30 also comprises an elongated reinforcing member 10, which has a first lateral portion 13 housed inside first groove 5, a second lateral portion 14 housed inside second groove 6, and a centre portion 12 housed inside depressed seat 4 and facing bottom wall 7.

[0027] Finally, modular member 30 comprises a hardened mixture of foam material particles and sand, which fills depressed seat 4 and grooves 5 and 6 to incorporate and cover reinforcing member 10. The surface of the hardened mixture defines a first face 30-A of modular insulating member 30, a second face 30-B of which is defined by second face 2-B of panel 2.

[0028] In the embodiment shown, at least a third and fourth groove 8 and 9 are provided on opposite sides of first and second groove 5 and 6

[0029] Modular member 30 also comprises a further elongated reinforcing member 20, which has a first lateral portion 23 housed inside third groove 8, a second lateral portion 24 housed inside fourth groove 9, and a flat centre portion 22 housed inside depressed seat 4 and over centre portion 12 of reinforcing member 10. The hardened mixture incorporates and covers both reinforcing members 10 and 20.

[0030] In a few steps not requiring any special equip-

ment, the method according to the present invention provides for producing a modular insulating member with the following advantages :

- 5 A. extremely light weight;
- B. a high degree of rigidity and strength (by virtue of reinforcing members 10 and 20 incorporated in the mixture and engaging grooves 5, 6 and 8, 9);
- 10 C. good thermal insulation (of varying thicknesses);
- D. good soundproofing;
- E. easy assembly.

[0031] As regards characteristic E), the cross section of modular member 30 is designed so that adjacent modular members 30 can be fitted together to form a wall of constant thickness (see Figures 6 and 8).

[0032] By superimposing a number of modular members, two walls P1, P2 (Figure 8) may be formed facing each other and defining a gap 50, into which metal reinforcement 52 may be inserted and concrete 54 poured. When so arranged, faces 30-A face outwards of the double wall, and form easy-to-plaster surfaces.

[0033] When pouring concrete 54, the modular members of the two walls P1, P2 may be held in place by metal connecting members 56 extending between facing modular members 30. The portion of connecting member 56 inside gap 50 is covered with a tubular sheath 58, so the connecting member (hereinafter referred to as 'blade') can be withdrawn to prevent forming thermal bridges.

[0034] More specifically (Figures 9 and 10), connecting member 56 comprises a strip-shaped, elongated, rectangular metal blade with elongated rectangular end openings 57. In actual use, when the metal blade is fitted through the facing modular members 30, its end portions 56a, 56b project from faces 30-A.

[0035] Each portion 56a, 56b of the blade fits to a respective lateral retaining member 60 designed to rest on face 30-A to prevent lateral movement of modular members 30 when pouring the concrete. More specifically, each lateral retaining member 60 comprises two straight, square-cross-section metal bars 62 parallel to each other and longer than the width of a modular member. Bars 62 are connected to each other by a U-shaped plate 63, which extends between facing first end portions 62a of bars 62 and has a flat centre portion in which is formed a rectangular opening (not shown) for housing a respective end portion 56a, 56b of the blade. End portion 56a, 56b of the blade and U-shaped plate 63 are locked to one another by a metal wedge 64, which fits through opening 57 and rests on plate 63 (alternatively, a hook, extending from plate 63 may be provided). A first end of lateral retaining member 60 is thus fixed to a blade. A second end of the lateral retaining member fits to the first end of an adjacent lateral retaining member. Accordingly, two different types of lateral retaining members, characterized by different distances between bars 62, are used, so that second end portions 62b of the bars of one lateral

retaining member 60 are located inwards/outwards of respective first end portions 62a of the adjacent lateral retaining member 60. In this way the lateral retaining members are movable telescopically with respect to one another.

Claims

1. A method of producing a modular construction insulating member, **characterized by** comprising the steps of :

- forming, in a flat panel (2) of insulating foam material, a depressed seat (4) which opens out at a first face (2-A) of the flat panel; said depressed seat (4) having at least a first and second groove (5, 6) which open out at a bottom wall (7) of the depressed seat, extend towards a second face (2-B) of the flat panel, and extend substantially the whole length of the flat panel;

- placing inside said depressed seat an elongated reinforcing member (10) having a first lateral portion (13) housed in said first groove (5), a second lateral portion (14) housed in said second groove (6), and a centre portion (12) housed in said depressed seat (4);

- forming a mixture of water, foam material particles, sand and cement, pouring said mixture inside said depressed seat (4) so as to fill said grooves and said depressed seat and incorporate said reinforcing member (10), and allowing said mixture to harden; the outer surface of the hardened said mixture defining a first face (30-A) of the modular insulating member, a second face (30-B) of which is defined by the second face of said flat panel (2);

the method comprising a step of forming at least a third and fourth groove (8, 9) located on opposite sides of the first and second groove (5, 6); the method also comprising the step of forming a further elongated reinforcing member (20) having a first lateral portion (23) housed in said third groove (8), a second lateral portion (24) housed in said fourth groove (9), and a centre portion (22) housed in said depressed seat and over the centre portion (12) of the reinforcing member (10);

said step of pouring said mixture comprising the step of covering both the reinforcing members (10, 20) so they are incorporated in the mixture.

2. A method as claimed in Claim 1, wherein said reinforcing member (10) is formed by shaping a portion of metal wire netting.
3. A method as claimed in Claim 2, wherein said reinforcing member (10) has a C-shaped cross section

4. A method as claimed in Claim 1, wherein said further reinforcing member (20) is formed by shaping a portion of metal wire netting.

5. A method as claimed in Claim 1 or 4, wherein said further reinforcing member (20) has a C-shaped cross section

6. A method as claimed in any one of the foregoing Claims, wherein said mixture has the following proportions by volume :

- 16.6% water
 - 54.7% foam material particles
 - 5.5% sand
 - 23% cement
 - 0.2% air-entraining agent

7. A method as claimed in any one of the foregoing Claims, wherein said grooves have a U-shaped cross section.

8. A method as claimed in any one of the foregoing Claims, wherein said grooves are straight.

9. A method as claimed in any one of the foregoing Claims, wherein said grooves extend equally spaced along the flat panel (2).

10. A modular construction insulating member, **characterized by** comprising :

- a flat panel (2) of insulating foam material, having a depressed seat (4) which opens out at a first face (2-A) of the flat panel; said depressed seat (4) having at least a first and second groove (5, 6) which open out at a bottom wall (7) of the depressed seat (4), extend towards a second face (2-B) of the flat panel, and extend substantially the whole length of the flat panel (2);

- an elongated reinforcing member (10) having a first lateral portion (13) housed in said first groove (5), a second lateral portion (14) housed in said second groove (6), and a centre portion (12) housed in said depressed seat and facing the bottom wall (7);

- a hardened mixture of foam material particles and sand, which fills the depressed seat and the grooves and incorporates said reinforcing member (10);

the surface of the hardened mixture defines a first face (30-A) of the modular insulating member (30), a second face (30-B) of which is defined by the second face (2-B) of said flat panel (2); and at least a third and fourth groove are provided on opposite sides of the first and second groove;

the modular insulating member (30) also com-

prises a further elongated reinforcing member (20) having a first lateral portion (23) housed in said third groove (8), a second lateral portion (24) housed in said fourth groove (9), and a centre portion (22) housed in said depressed seat (4) and over the centre portion (12) of the reinforcing member (10);
 said hardened mixture incorporating both the reinforcing members (10, 20).

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11. A method of producing a vertical supporting wall, the method comprising the steps of :

- forming a number of modular insulating members, each having a depressed seat (4) which opens out at a first face (2-A) of a flat panel (2) of insulating foam material; said depressed seat (4) having at least a first and second groove (5, 6) which open out at a bottom wall (7) of the depressed seat (4), extend towards a second face (2-B) of the flat panel, and extend substantially the whole length of the flat panel (2);
- forming an elongated reinforcing member (10) having a first lateral portion (13) housed in said first groove (5), a second lateral portion (14) housed in said second groove (6), and a centre portion (12) housed in said depressed seat and facing the bottom wall (7);
- forming a hardened mixture of foam material particles and sand, which fills the depressed seat and the grooves and incorporates said reinforcing member (10);
 the surface of the hardened mixture defining a first face (30-A) of the modular insulating member (30), a second face (30-B) of which is defined by the second face (2-B) of said flat panel (2);
- superimposing a first number of modular insulating members to form a first wall;
- superimposing a second number of modular insulating members to form a second wall;
- firmly connecting the first and second number of modular insulating members;
 the first and second wall facing each other and defining a gap (50) bounded by the adjacent second faces of said flat panels;
- inserting reinforcement inside said gap (50);
- pouring concrete into said gap (50) to form, when the concrete sets, a wall in which the first faces (30-A) of the modular insulating members face outwards of the wall and define an easy-finish surface.

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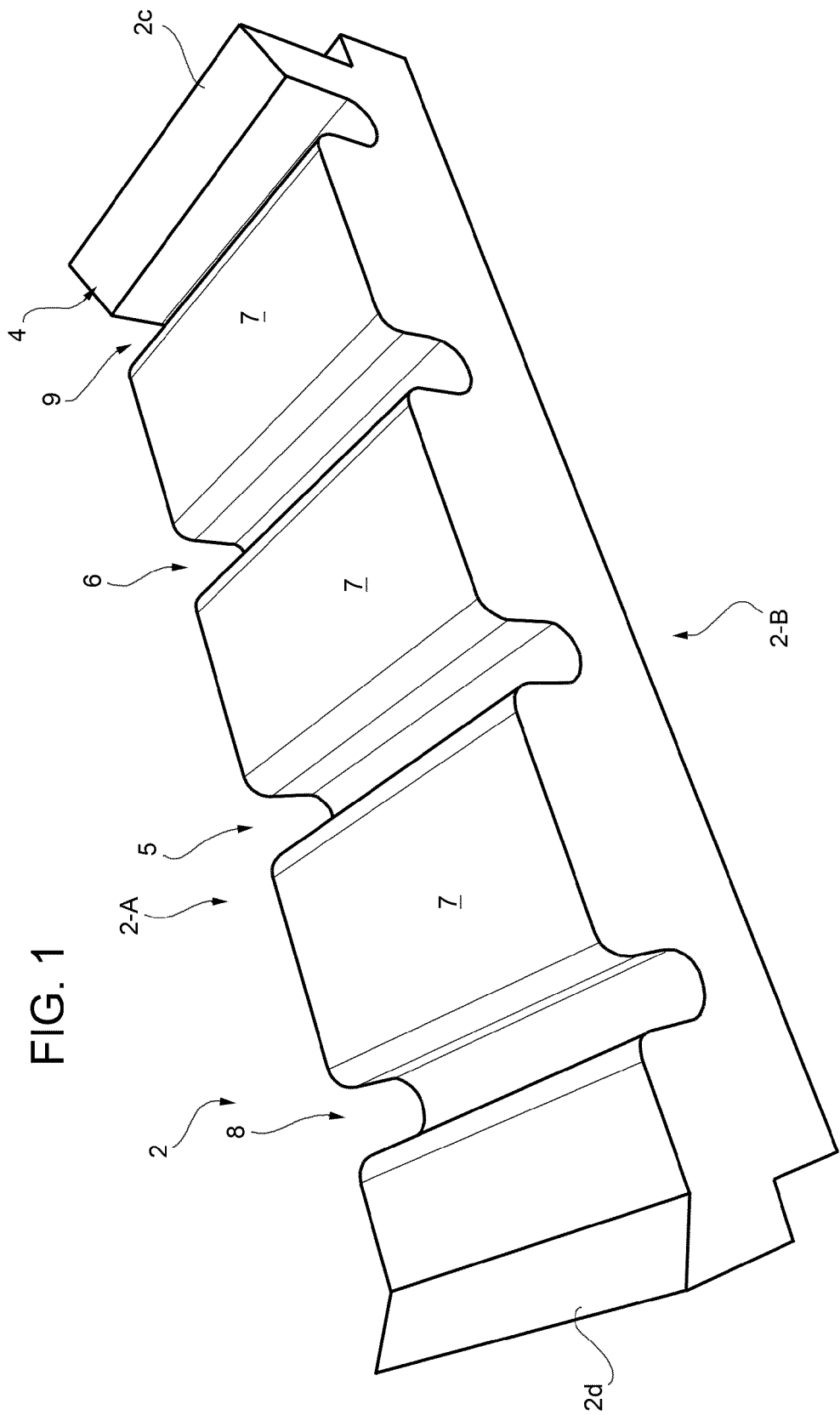


FIG. 2

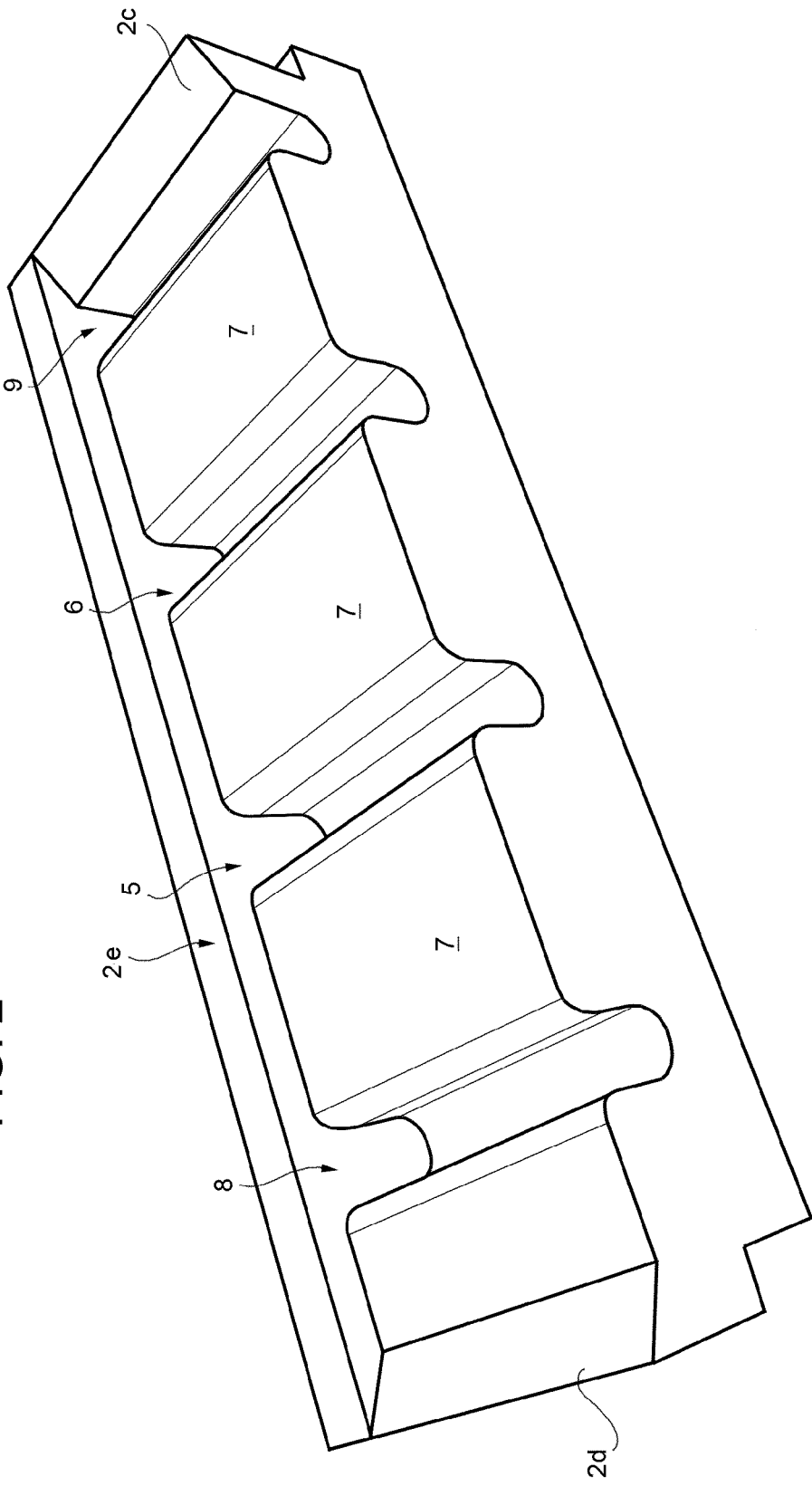
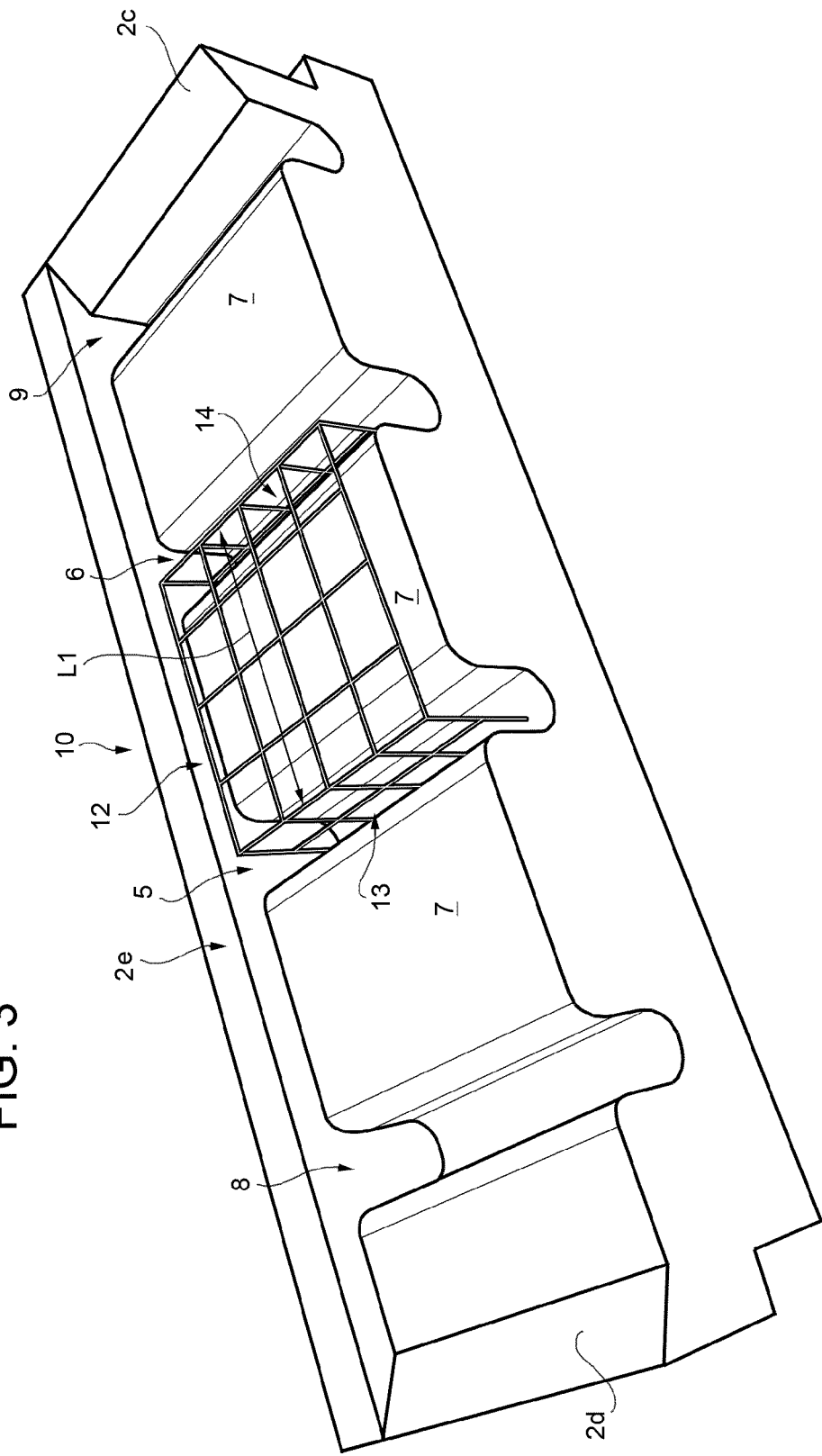
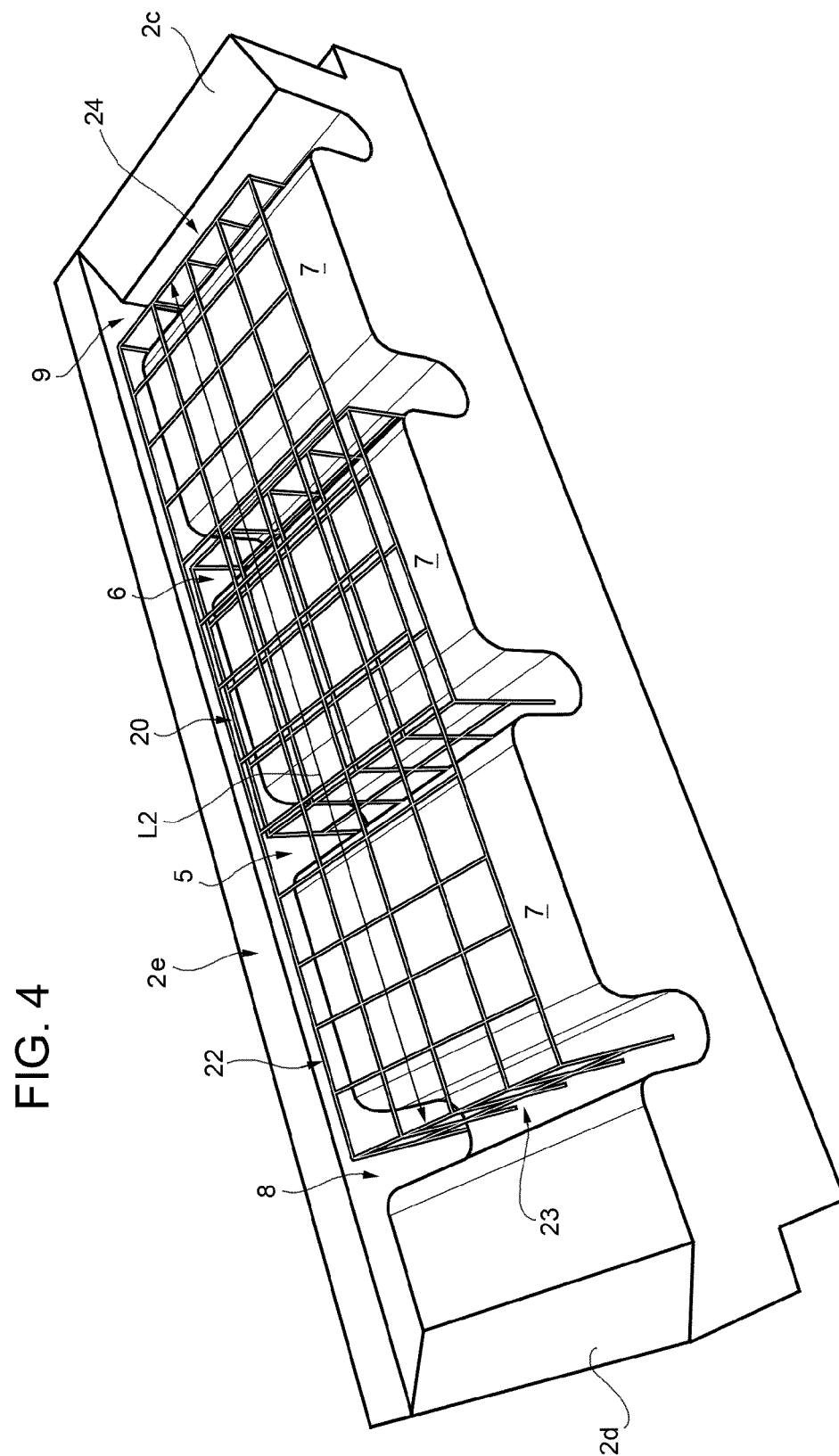
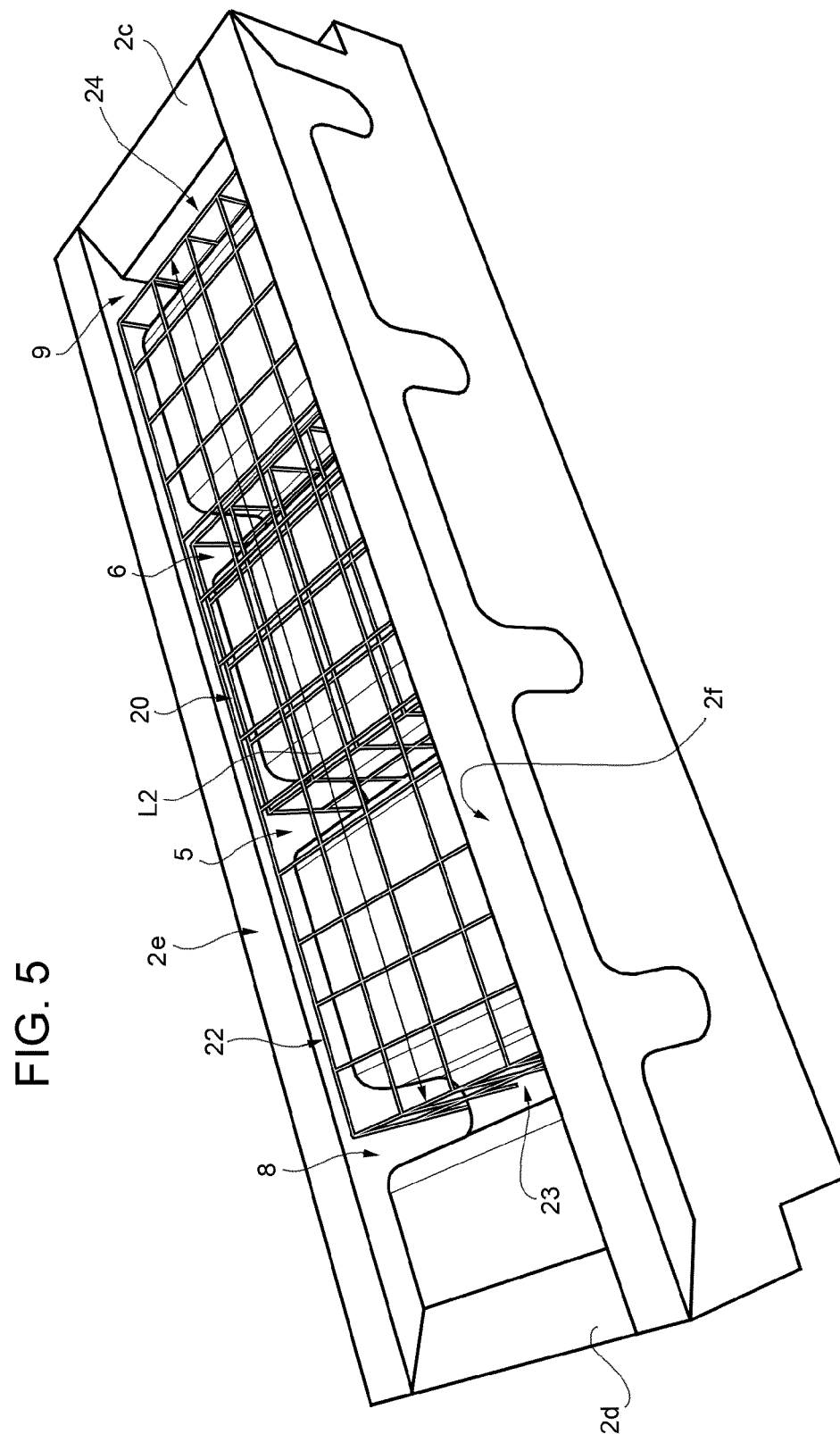


FIG. 3







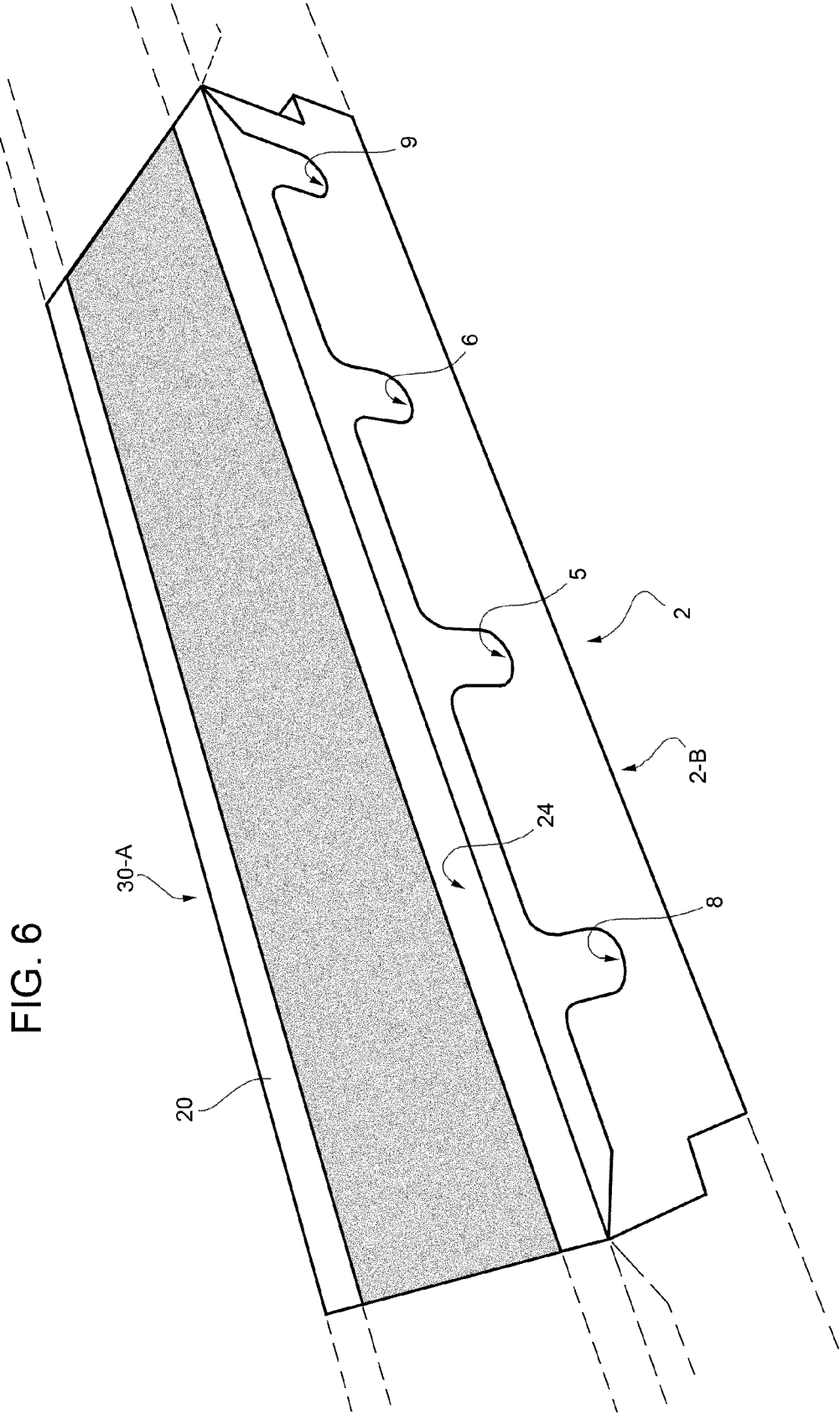


FIG. 7

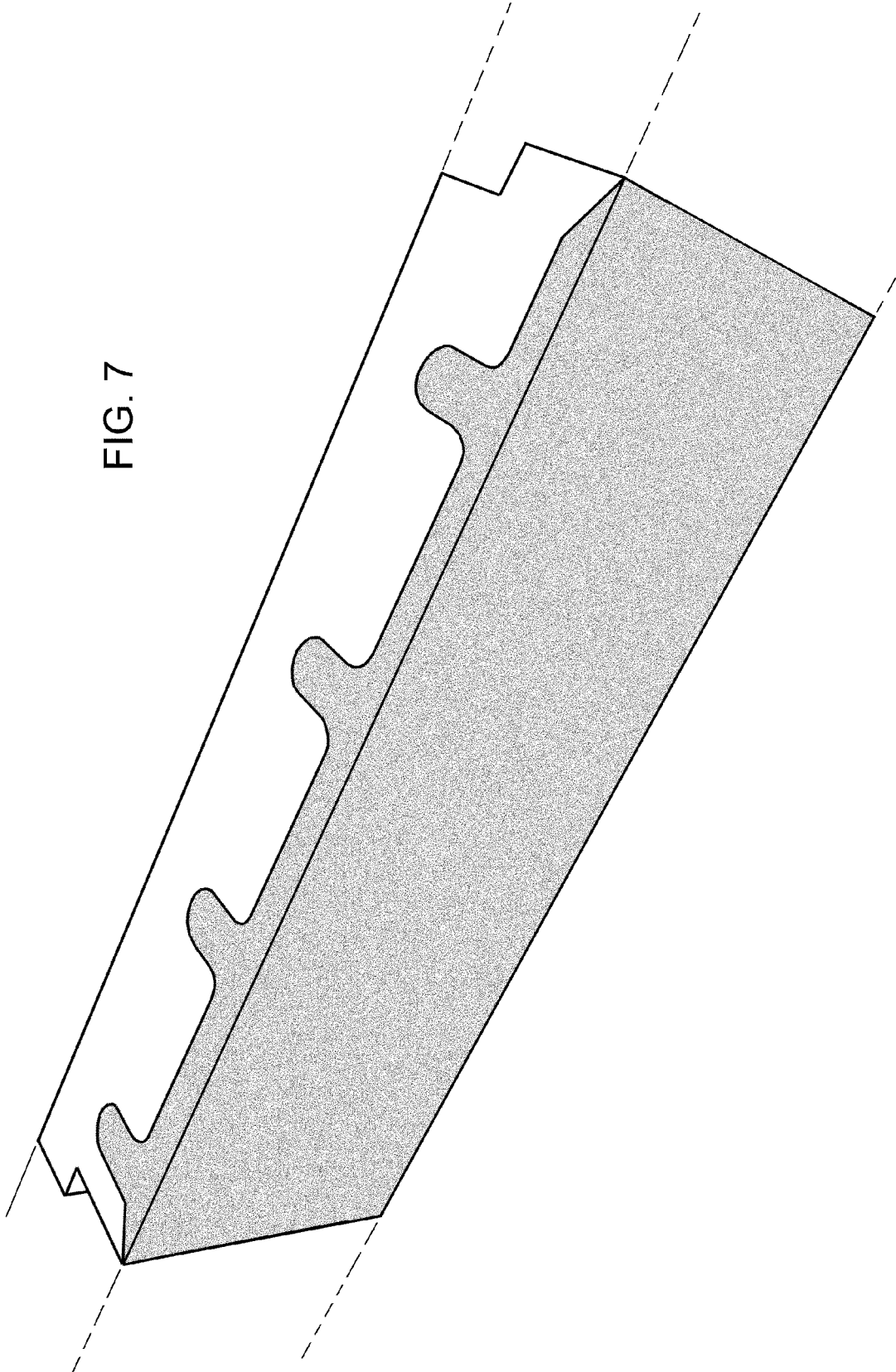
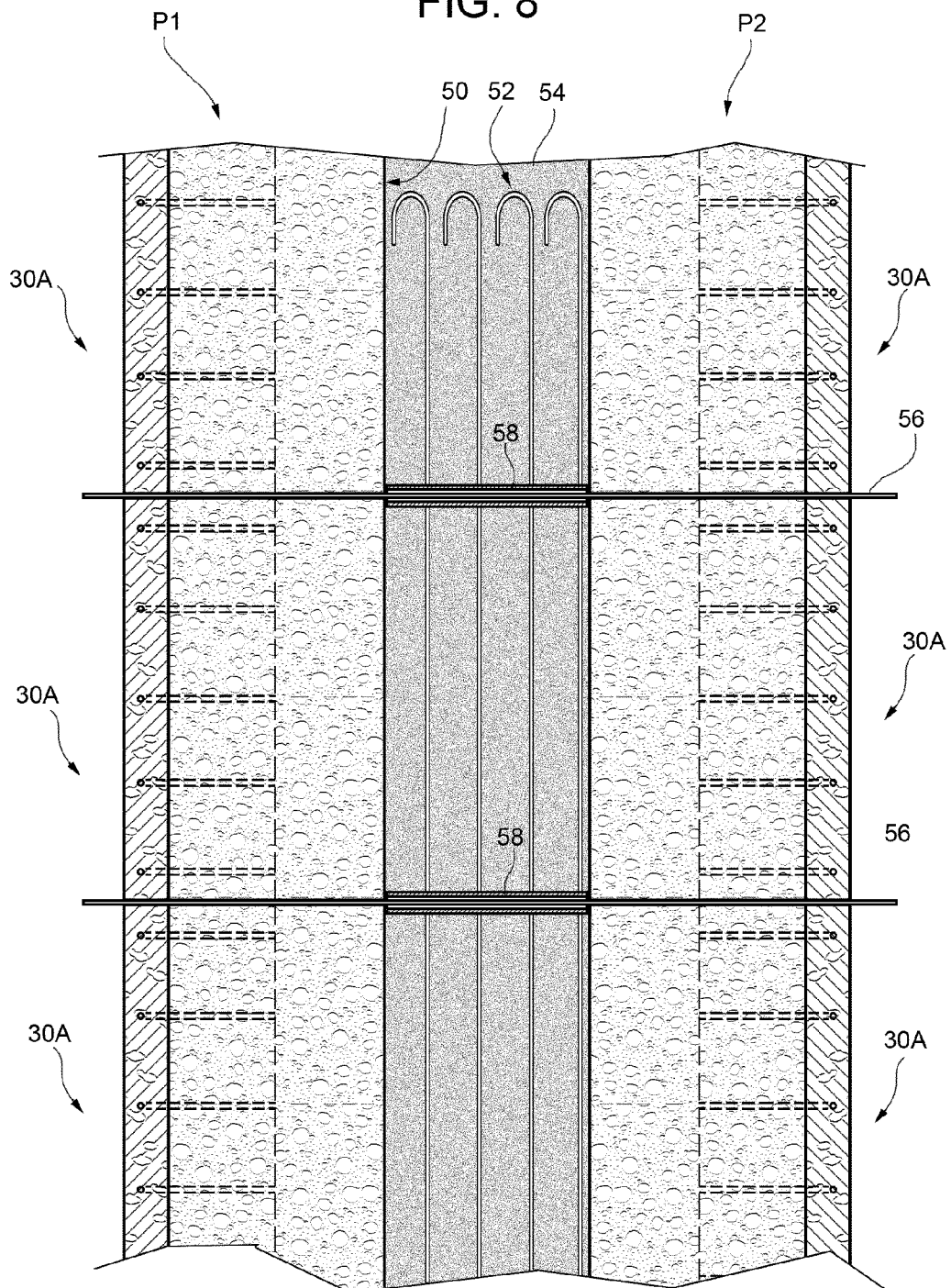


FIG. 8



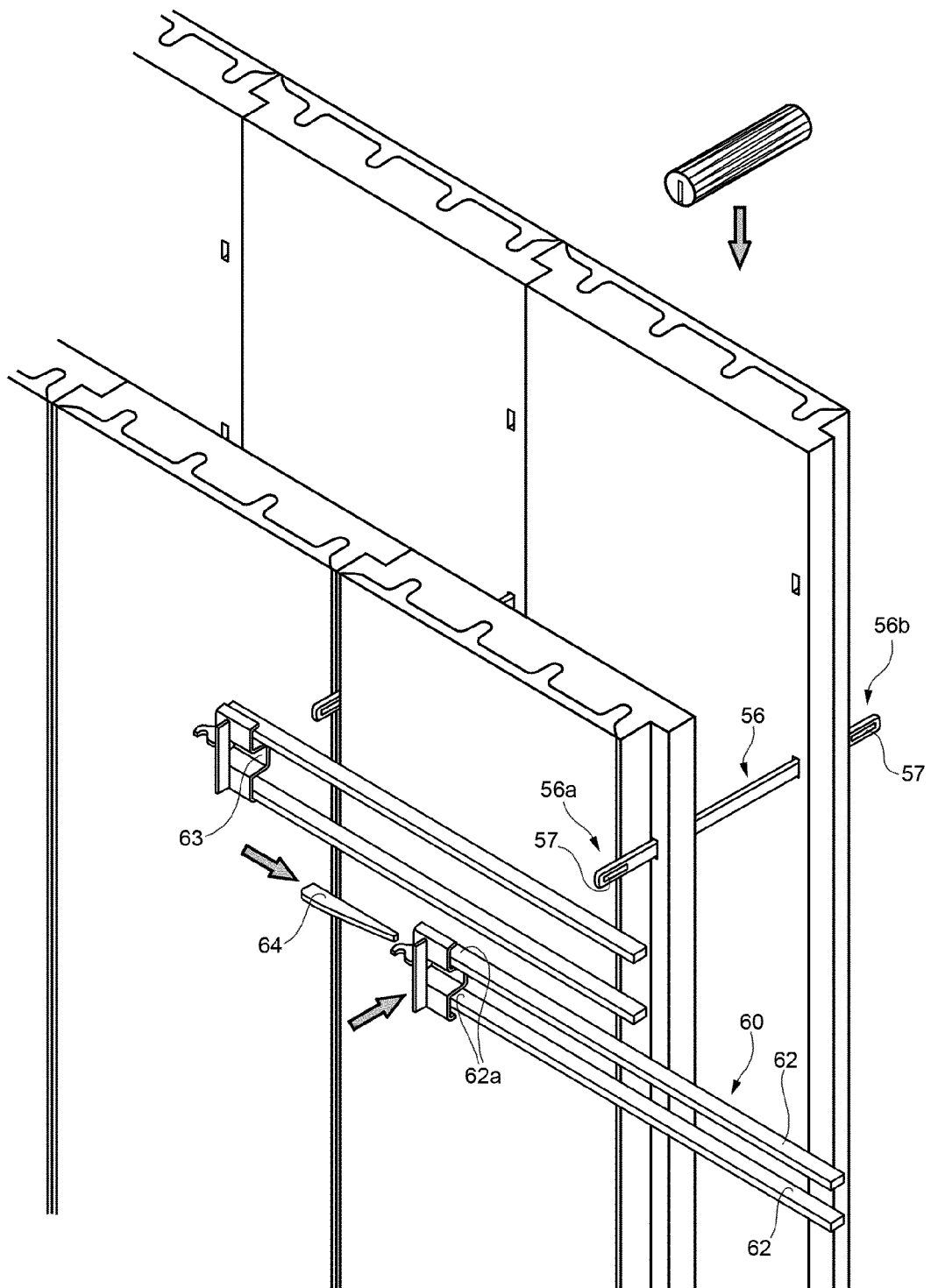


FIG. 9

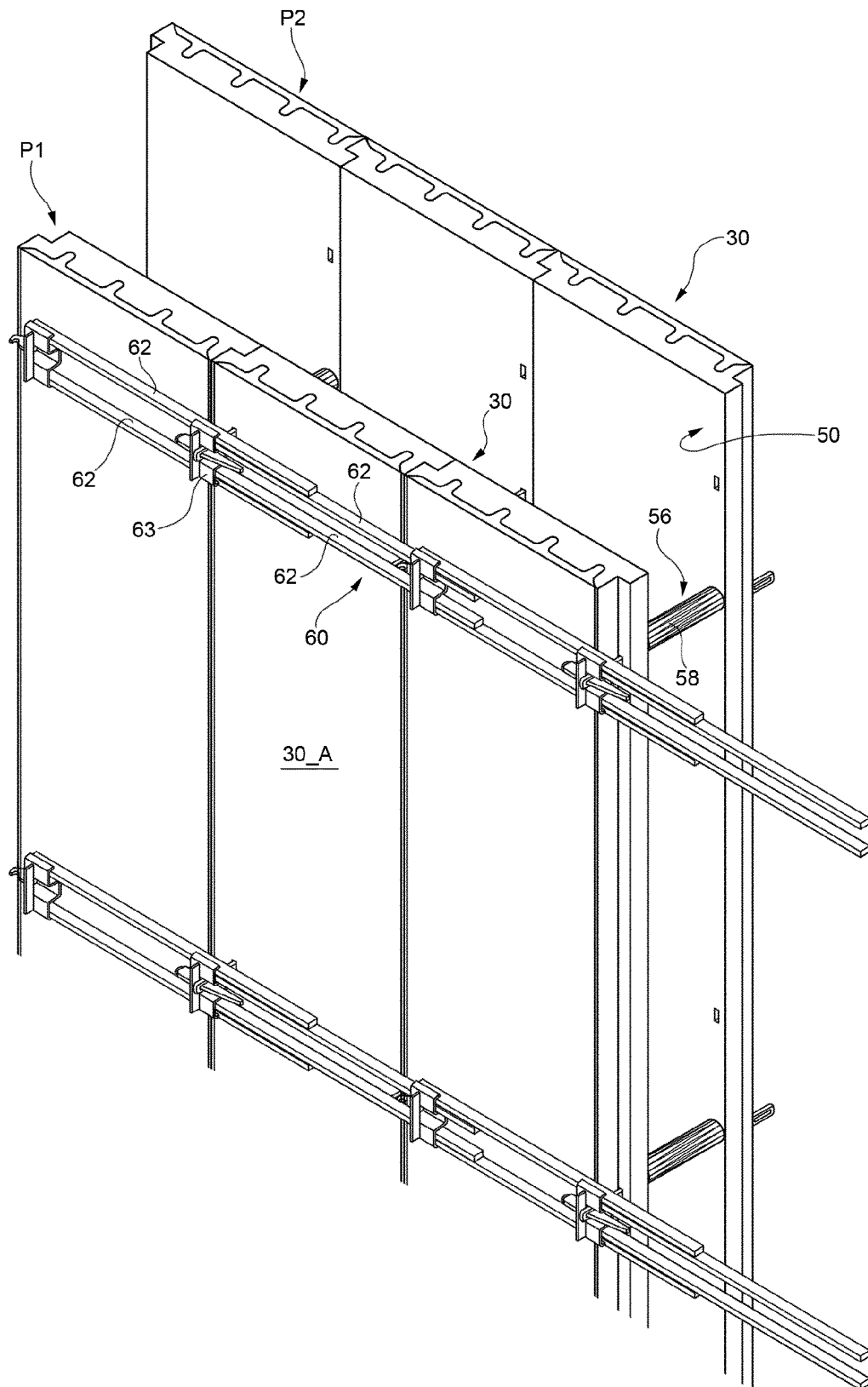


FIG. 10



EUROPEAN SEARCH REPORT

Application Number
EP 13 17 9195

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Place of search The Hague		Date of completion of the search 29 November 2013	Examiner Voltz, Eric
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 17 9195

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The members are as contained in the European Patent Office EDP file on
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