(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 955 421 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.11.1999 Bulletin 1999/45

(51) Int. Cl.[6]: **E04C 2/288**

(21) Application number: **99201398.7**

(22) Date of filing: **06.05.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **06.05.1998 IT MI980978**

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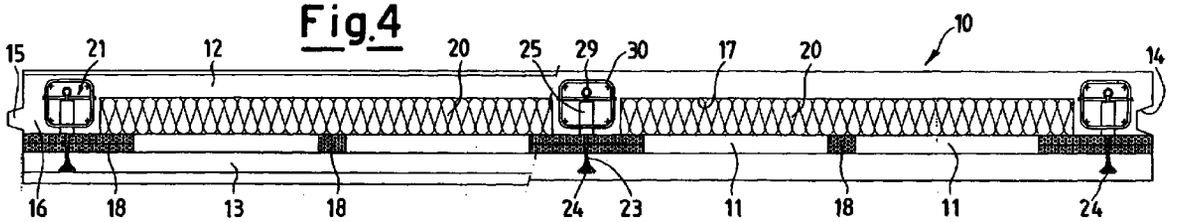
(54) Thermal cut-off panel with a continuous insulation, and its production process

(57) A thermal cut-off panel with a continuous insulation, comprising an inner wall (12) and an outer wall (13), appropriately armed (30) and with an insulating material inserted between them. According to the invention, said insulating material inserted between said inner wall (12) and outer wall (13) is constituted by two different insulating materials (18, 20) having a different transmittance.

Fig.4



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Description

[0001] This invention refers to a thermal cut-off panel with a continuous insulation, without thermal bridges and with a possible ventilation, as well as to a production process for the same.

[0002] The construction branch, especially that dealing with the construction of prefabricated elements, uses panels of the most diverse shapes and compositions.

[0003] These panels are, apart from their esthetic appreciation, subject to an ever keener demand for precise thermal and hygrometric performances and a high insulating capacity, both against hot and cold weather, while being in any aimed for a maximum cost reduction.

[0004] The general scope of this invention is to solve the mentioned technical problems in an extremely simple, economical and particularly functional manner, for the final purpose of producing a panel capable of offering an optimum degree of insulation without thermal bridges and at the same time of allowing, with an eventual summer ventilation, to eliminate the accumulation of heat inside a building.

[0005] In view of the above scope according to this invention, it was planned to produced a thermal cut-off panel with a continuous insulation, endowed with the characteristics outlined in the enclosed claims.

[0006] A production process for such a thermal cut-off panel with a continuous insulation was also developed.

[0007] The structural and functional characteristics of this invention and its advantages compared to the known state of the art will become even clearer and more evident from a review of the following description, in reference to the attached drawings, showing examples of thermal cut-off panels with a continuous insulation and ventilation produced according to the invention, in which:

- Figure 1 is longitudinal cross-section of an example of a thermal cut-off panel with a continuous insulation according to this invention in a first embodiment, called an aerated form,
- Figure 2 is a longitudinal cross-section of an example of a thermal cut-off panel with a continuous insulation according to this invention in a second embodiment, called a ventilated form,
- Figure 3 is an enlarged and partially sectionalized view of an extremity, taken along the lines III-III of Figure 2,
- Figure 4 is an enlarged transversal sectional view along the lines IV-IV of Figures 1 and 2,
- Figure 5 is an enlarged transversal sectional view taken along the lines V-V of Figures 1 and 2,
- Figure 6 is an enlarged, partial longitudinal sectional view taken along the lines VI-VI of Figures 1 and 2,
- Figures 7-13 show the processing phases used to produce a thermal cut-off panel with a continuous insulation according to this invention,
- Figure 14 repeats the longitudinal section of Figure 1,
- Figure 15 is an enlarged, partially sectionalized view of an extremity of the panel shown in Figure 3,
- Figure 16 is an enlarged cross-sectional view taken along the lines XVI-XVI of Figure 14,
- Figure 17 is an enlarged partially sectionalized longitudinal view taken along the lines XVII-XVII of Figure 14, and
- Figure 18 is a longitudinal sectional view taken along the lines XVIII-XVIII of Figure 2.

[0008] With reference to the drawings, a thermal cut-off panel with a continuous insulation without thermal bridges and the possibility of aeration or ventilation is indicated, in its overall form in the examples shown, by the reference number 10.

[0009] In the example given in the figures, the panel 10 provides for four longitudinal chambers 11, which are non-continuous but transversally interrupted on their head sections and opposite the lifting hooks.

[0010] The panel 10 according to the invention, fitted with internal chambers, in this example also includes a supporting inner wall 12 and a supporting outer wall 13, made of concrete and appropriately fitted with armatures, as seen in the simplified drawings offered only for exemplifying purposes and indicated by the number 30 in its various views.

[0011] Moreover, the longitudinal borders of each panel 10 are generally fitted on one side with a continuous hollow 14 and on the other side, in a complementary section and form, with a projecting rib 15, which produce the continuity of a wall formed by multiple panels 10.

[0012] The inner supporting wall 12 is essentially fitted with three thickened longitudinal ribs 16, projecting from the inner wall 12 toward the outer wall. These ribs 16 support, in addition to the armatures 30, some mobile and some fixed suspending elements, which will be better explained in the course of the description.

[0013] The three ribs 16 also provide a few hollow recesses 17, which are in this example shown as a pair set in a longitudinal direction.

[0014] The outer supported wall 13 is on the other hand substantially smooth, despite the fact that parts of several of the mentioned mobile and fixed suspending elements are resting on it.

[0015] It should be noted that in this invention the longitudinal ventilation chambers 11 are formed by the particular casting of two different types of insulating material.

[0016] These chambers 11 are in fact formed by a first insulating material 18, which is arranged in the shape of fillets spaced out between each other, extended longitudinally and appropriately bounded at their extremities by finishing heads 19. These fillets are made of an insulating material of low conductivity, for example of

expanded polyurethane.

[0017] Moreover, the inner wall 12, which contains the two mentioned hollow recesses 17, also holds further elements of an insulating material 20 of a different type, made for example of expanded polystyrene or other material.

[0018] These elements 20 are made in the form of lightening and insulating plates, and are usually made of low-density polystyrene. This second type of insulating material usually serves the function of lightening the weight, and is of low cost.

[0019] The insulating elements 18, which are in the form of fillets made of the first type of insulating material, are provided in pairs at each point of emplacement, where the thickened longitudinal ribs 16 of the inner wall 12 have been provided. These fillets 18 have on the other hand a double thickness at their points of emplacement, where they are arranged directly between the outer wall 13 and the second type of insulating material 18 inserted into the recesses 17.

[0020] It should therefore be noted that there is no point nor area of contact between the inner wall 12 and the outer wall 13, due to the complete separation of the two insulating materials 18 and 20, which are in certain areas superposed to each other, thus avoiding any kind of thermal bridge. This happens for example opposite the lateral borders of the recesses 17, which offer an area of superposition and interpenetration between the insulating materials.

[0021] The arrangement of the two insulating materials, one of which has about half the transmittance of the other, allows the unit to provide a uniform insulation.

[0022] As mentioned above, some connectors are placed opposite the three longitudinal ribs 16 of the inner wall 12.

[0023] These are for instance mobile connecting elements, indicated in their overall form by the number 21, and fixed connecting elements indicated in their overall form by the number 22.

[0024] The mobile connecting elements 21 comprise in a simplified form a rope 23 with a frayed open end 24 buried in the material of the outer wall 13 and a second extremity 29 fixed to a bushing 25 firmly attached and buried in the inner supporting wall 12 in the rib 16.

[0025] The bushing 25 ends in this application next to the fillets 18 of the first insulating material, so that the out-coming rope 23 leaves it a possibility to slide between the two walls 12, 13 of the panel. This possibility of sliding between the supporting and the supported layer without inducing deformations is favored by the presence of the two fillets 18 made of an insulating material of reduced transmittance but of equal thickness.

[0026] The fixed connecting elements 22 are installed at other points of the longitudinal ribs 16 of the inner walls 12 and portions of the outer wall 13, facing each other.

[0027] These connecting elements 22 provide pins 26 and spring elements 27 which may eventually allow only a slight shifting along the axis of the pins, in a direction perpendicular to the walls 12 and 13 of the panel 10.

[0028] It can be seen that thanks to the presence of the two insulating materials it is possible to vary the thickness of the supporting panel up to considerable heights, or to vary the thickness of the insulating material itself, while still maintaining the thickness of the inner and outer panels and the presence of the ventilated air chambers 11 mentioned above.

[0029] The presence of the two insulating materials of different transmittance also allows varying the degree of insulation. It is in fact possible to proportionally increase both the thickness of the insulating material of a lower transmittance as well as the thickness of the insulating material of a higher transmittance. According to the invention, these insulating materials are generally sized in a thickness directly proportional to their transmission.

[0030] The process leading to the production of a panel according to the first example of this invention is shown in a simplified manner in the Figures 7-13.

[0031] These figures show the main phases of such a process, which can be summarized as follows:

[0032] In a first phase, shown in Figure 7, an armature grid 41 fitted with a fastening section for supports (42) is set into an appropriately profiled and shaped caisson 40.

[0033] In the second phase shown in Figure 8, the supported outer wall 13 is then cast so as to fill out the armature grid 41.

[0034] It is generally not necessary to carefully flatten this first cast.

[0035] This achieves (Figure 9) the positioning of the fillets 18 (produced as two separate elements), which are in this case set up longitudinally and spaced out from each other, so as to later also shape the four longitudinal chambers 11.

[0036] As shown in Figure 10, the plates 20 are then laid down above the fillets 18, so as to achieve a complete separation between the inner and outer walls. The plates 20, which are lightweight and insulating, are in fact resting on the fillets 18 and produce a complete insulation inside the thermal cut-off panel with a continuous insulation.

[0037] Further portions of the connectors 43 and cages of the armature 44 of the stiffeners are installed at this point (Figure 11).

[0038] Figure 12 shows the way the positioning of a second armature grid 45 is performed.

[0039] The concrete casting of the inner supporting wall 12 is finally undertaken, which covers the armature grid 45 and completes the panel (Figure 13).

[0040] The removal of the caisson 40, done after an appropriate time, releases the panel in a ready-to-use condition.

[0041] This prefabrication presupposes that the various layers of concrete are cast in a horizontal fashion, so as to produce the chambers and other holes in an

economical manner, thus saving on insulating material.

[0042] The insulating material constituting the fillets arranges itself in an almost peripheral fashion, as also seen in Figure 6, so that a complete insulation is achieved by a panel constructed in this manner.

[0043] The figures 14-17 show a few views of a panel according to the invention, in which no ventilation is provided.

[0044] For the sake of simplicity, equal elements are indicated by equal reference numbers.

[0045] It can be seen that in this case, in addition to the longitudinal fillets 18, some transversal fillets 18' are also present next to the heads as well as in the intermediate areas, as shown in the figures.

[0046] In any case, some closed chambers 111 are formed, which lighten the panel and render it more insulated, while increasing the thermal cut-off. Any thermal bridges are in fact eliminated.

[0047] This kind of design can in any case achieve an aeration, by applying passing holes 32 to the extremities in the headers 19. This prevents the formation of condensation.

[0048] The shaping process is rather similar to that previously described for a ventilated panel with open longitudinal chambers.

[0049] This also makes it easier to produce the panel, because it omits the difficult insertion of insulating material between the flanks of the caisson. According to the invention, the fillets are positioned easily and precisely against the flanks of the caisson, whatever its length.

[0050] The fillets advantageously remain at the same width, regardless of the change in panel width.

[0051] This achieves, according to this invention, a panel endowed with an ideal thermal cut-off.

[0052] Any thermal bridges have in fact been eliminated, achieving a high degree of insulation. By detaching the inner from the outer wall, moreover, the structure according to the invention eliminates any potential fissuring and deformation.

[0053] The arrangement of the two insulating materials used to create the longitudinal chambers also generates an optimal ventilation of the panel.

[0054] The aeration or ventilation eliminate the internal condensation problem, which is particularly penalizing during the winter, and prevents heating the inner space formed by the panels of the invention during the summer, thus preventing any accumulation of radiation heat, which would end up raising the temperature of the internal environment.

[0055] The presence of air chambers makes it possible to achieve a high fire resistance, while preventing the risk of explosion due to the sublimation of the polystyrene.

[0056] The above description with reference to the figures evidences the type of inventive structure of a panel designed to form a ventilated thermal cut-off according to this invention.

[0057] This therefore achieves the purpose outlined in the preface of the description.

[0058] The embodiments of such a panel constituting a ventilated thermal cut-off may naturally differ from that shown only for exemplifying and non-limiting purposes in the drawings, just as the materials constituting the insulating materials may differ.

[0059] The scope of protection of the invention is at any rate defined by the enclosed claims.

Claims

1. A thermal cut-off panel with a continuous insulation comprising an inner wall (12) and an outer wall (13), appropriately armed (30), in which an insulating material is inserted, characterized in that said insulating material inserted between said inner wall (12) and outer wall (13) is constituted of two different insulating materials (18, 20) having a different transmittance.

2. A panel composed according to claim 1, characterized in that said two different insulating materials (18, 20) are suitable for forming, by their opposite positioning, a multiple number of chambers (11, 111).

3. A panel composed according to claim 2, characterized in that said chambers (11, 111) are communicating toward the outside by aerating holes (32).

4. A panel composed according to claim 2, characterized in that said multiple chambers are ventilation chambers (11) opening toward the outside.

5. A panel composed according to claim 4, characterized in that said ventilation chambers (11) have a longitudinal extension.

6. A panel composed according to claim 1, characterized in that said internal wall (12) provides for recesses (17) for one (20) of the said two different insulating materials (18, 20).

7. A panel composed according to claim 1, characterized in that said one (18) of the said two different insulating materials (18, 20) is made in the form of fillets of different thickness.

8. A panel composed according to claim 7, characterized in that a constant insulation is achieved by alternating the fillets (18) and plates (20).

9. A panel composed according to claim 8, characterized in that said constant insulation is achieved by applying said fillets (18) and plates (20) of a different thickness.

10. A panel composed according to claim 1, character-

ized in that one (18) of the said two different insulating materials (18, 20) is produced in the form of fillets and that some mobile connecting elements (21) are present between said internal (12) and external walls (13).

11. A panel composed according to claim 10, characterized in that said mobile connecting element (21) comprises a rope (23) with one frayed extremity (24) buried in said supported outer wall (13) and a second extremity (29) attached to a bushing (25) buried in said supporting inner wall (12).

12. A panel composed according to claim 10, characterized in that said mobile connecting element (21) is placed within ribs (16) extending from said supporting wall (12) toward said supported wall (13).

13. A panel composed according to claim 1, characterized in that one (18) of said two different insulating materials (18, 20) exhibits a transmittance which is about half of the transmittance of the other (20) of the said two different insulating materials (18, 20).

14. A process for the production of a thermal cut-off panel with a continuous insulation in a caisson (40) characterized in that it comprises the following phases:

- arranging an armature grid (41) fitted with a fastening portion of supports (42) within said caisson (40),
- producing the cast of an outer supported wall (13) incorporating said armature grid (41),
- positioning fillets (18) made of a first, low conductivity insulating material and laying them down in a longitudinal, spaced-out sense,
- arranging plates (20) made of lightening insulating material, on top of said fillets (18),
- positioning further portions of connectors (43) and armature cages (44),
- positioning a second armature grid (45), and
- producing the cast of an inner supporting wall (12) incorporating said armature grid (45).

15. A process according to claim 14, characterized in that said fillets (18) are arranged in a longitudinal sense to create chambers (11) which are likewise longitudinal and open toward the outside.

16. A process according to claim 14, characterized in that said fillets (18) are arranged in a longitudinal and transversal sense so as to create closed chambers (111).

17. A process according to claim 14, characterized in that said fillets (18) and said plates (20) are arranged so as to achieve a complete separation between said inner and outer walls.

Fig.1

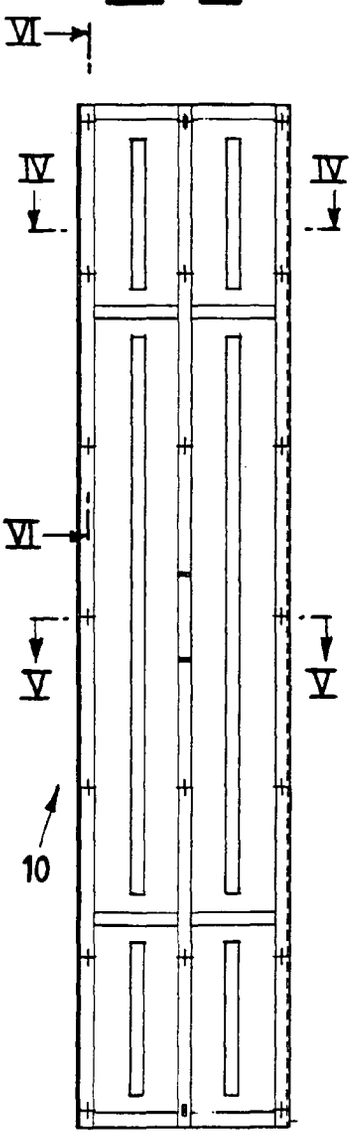


Fig.2

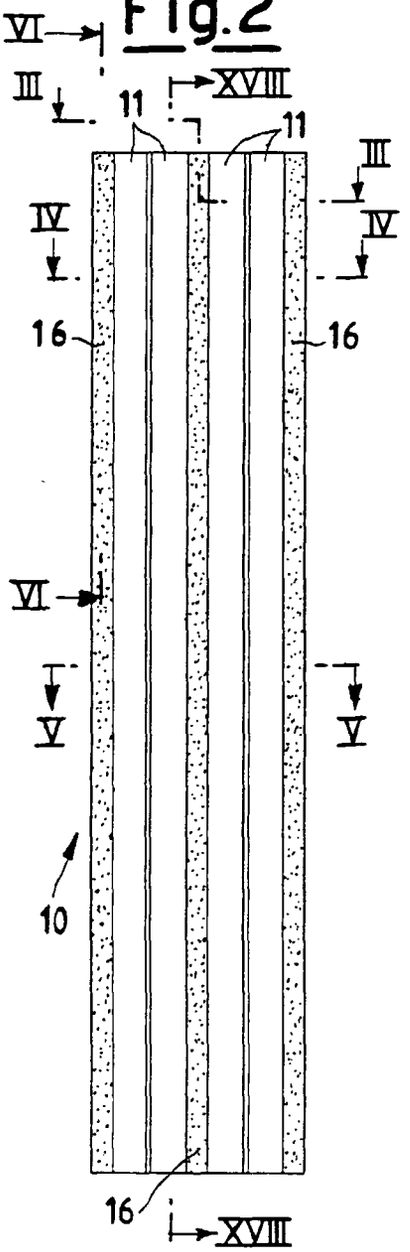
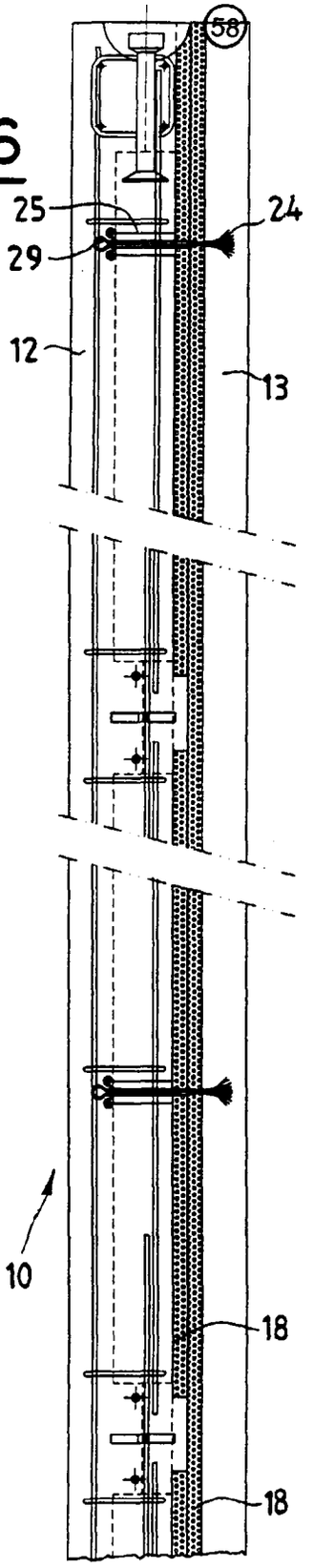


Fig.6



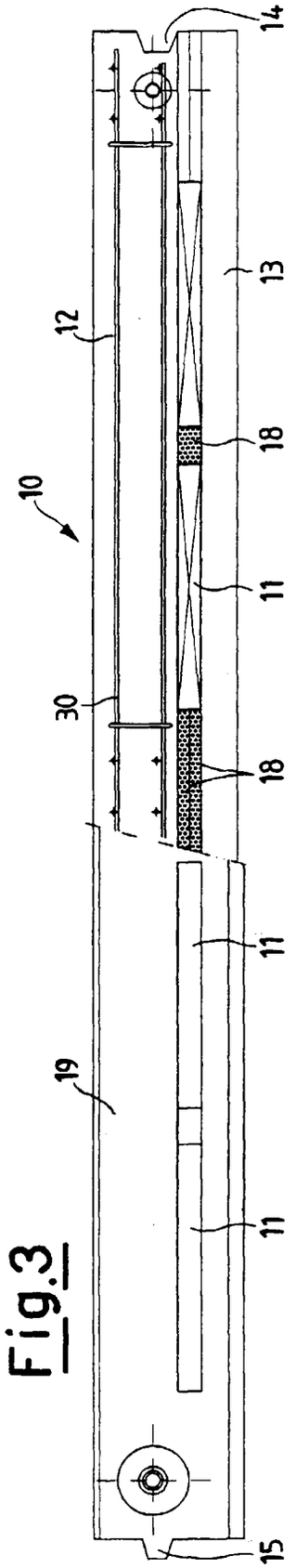


Fig.3

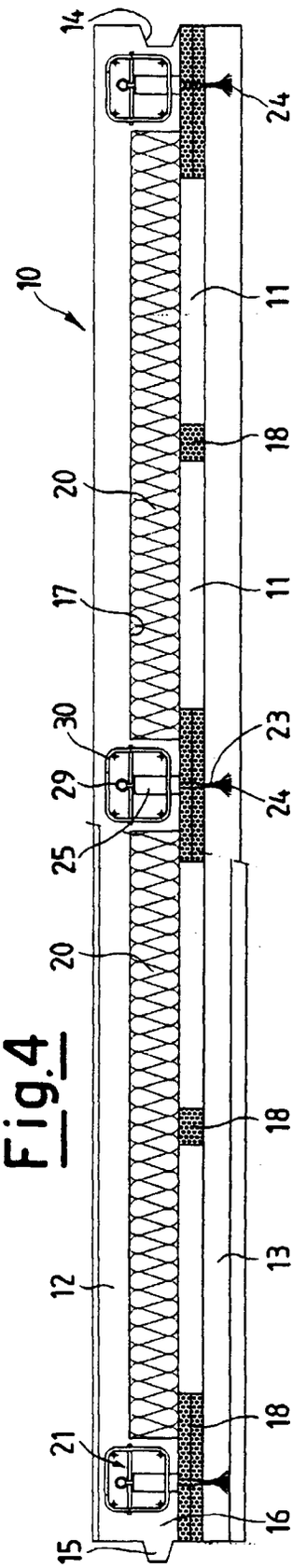


Fig.4

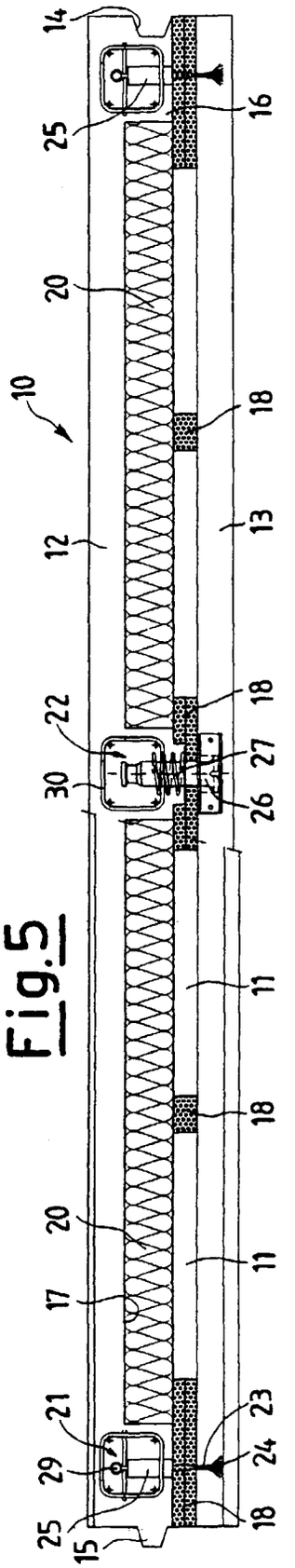


Fig.5

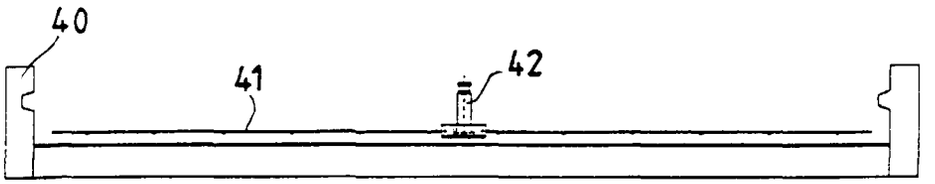


Fig.7

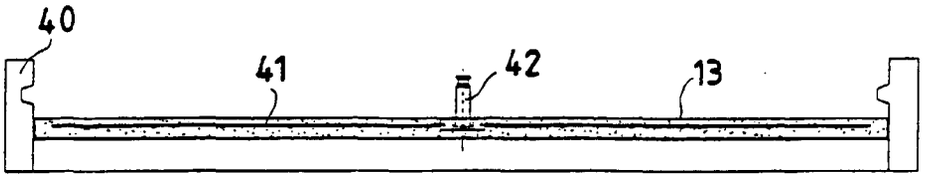


Fig.8

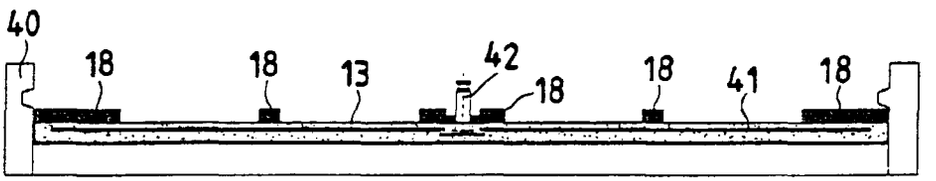


Fig.9

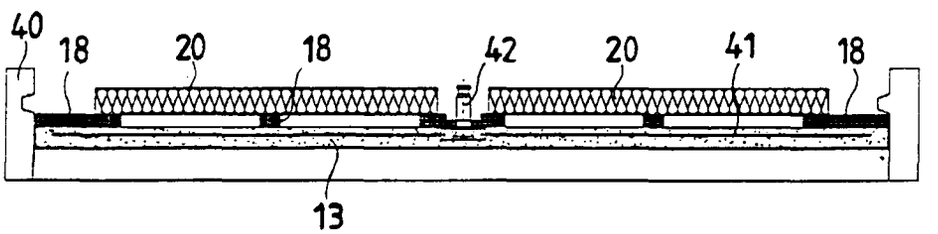


Fig.10

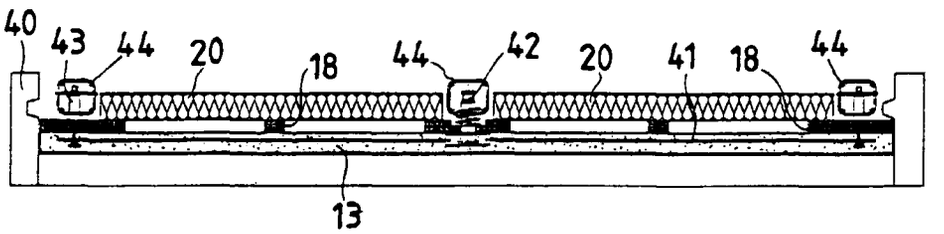


Fig.11

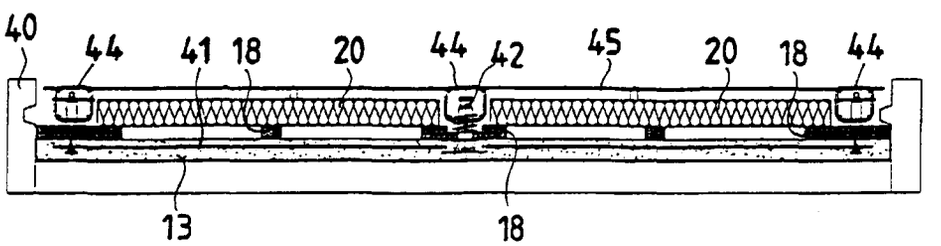


Fig.12

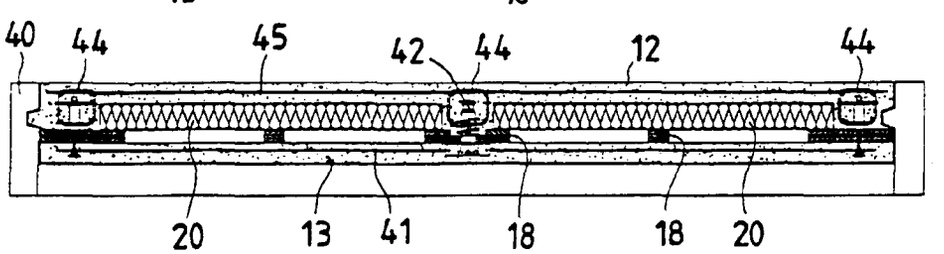
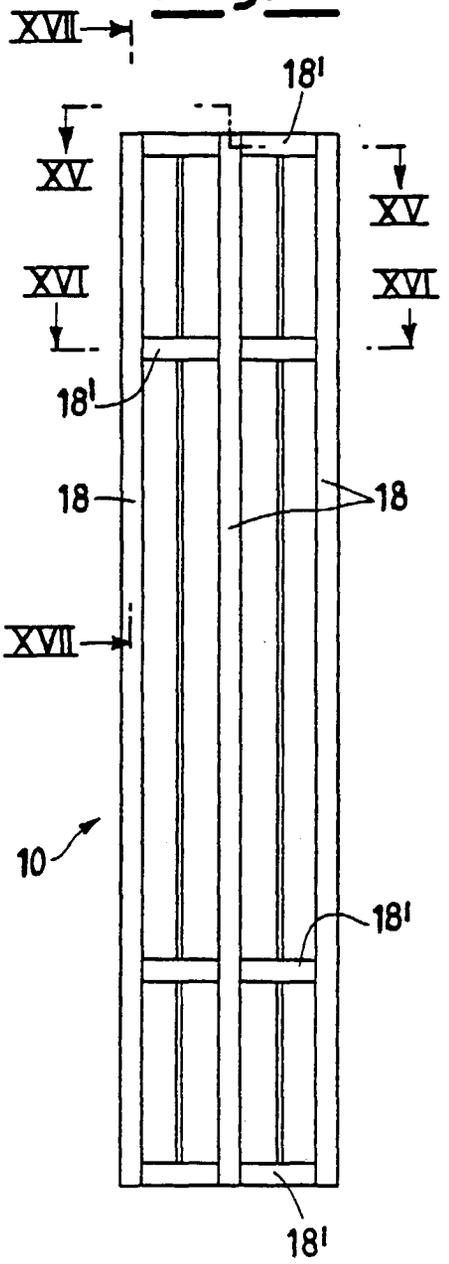


Fig.13

Fig.14


XVII
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XV
XV
XVI
XVI
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18
18
XVII
10
18'
18'

Fig.17

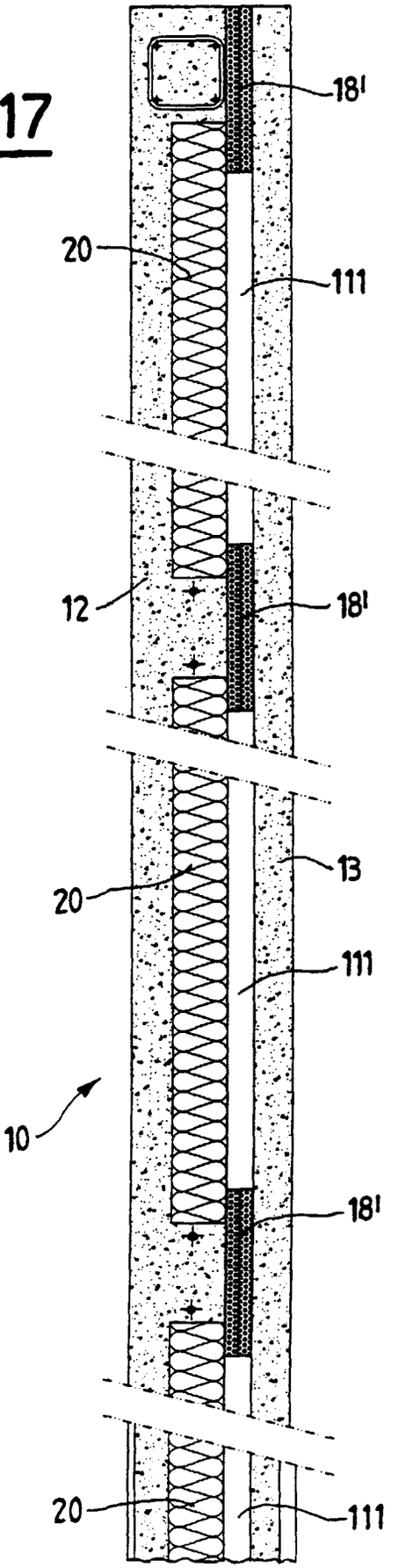
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Fig.15

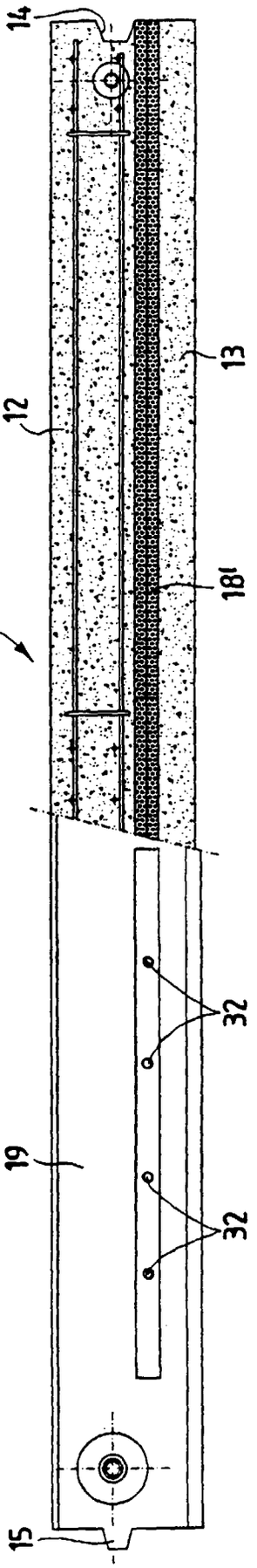

Fig.16

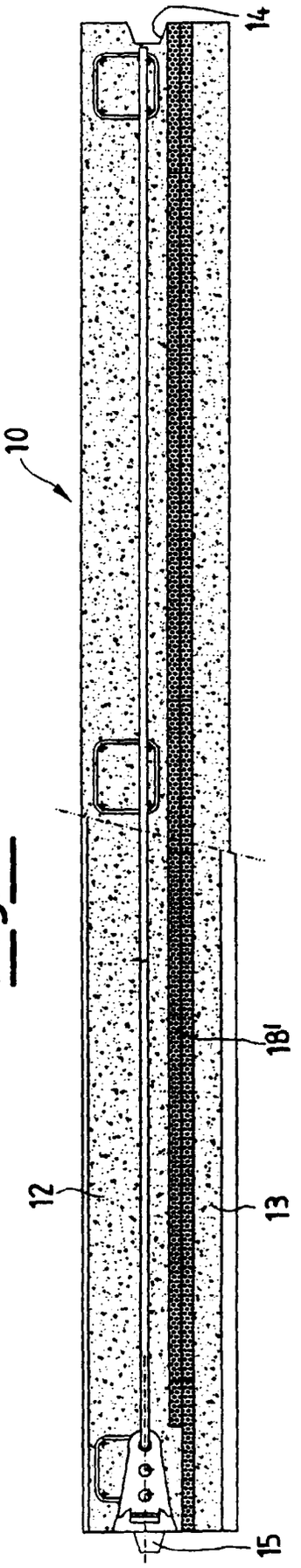

Fig.18