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(54) **INSULATING PANEL AND METHOD FOR FIXING THEREOF**

(57) Insulating panel (3) intended to be clamped between two mutually opposing surfaces (11, 12), which insulating panel (3) comprises a thermally insulating plate (4), and wherein the insulating panel (3) further comprises at least one elastically compressible strip formed by an elastically compressible, flexible plate (6) which is attached to the rear side (5) of the thermally insulating plate (4) and which, in unbent state, protrudes over a side (7; 8) thereof, wherein the protruding part (9; 10) of the flexible plate (6) is intended, when the insulating panel (3) is clamped between the surfaces (11, 12), to be bent and elastically compressed against a side (7; 8) of the insulating panel (3). In this way, when the insulating panel (3) is placed between the surfaces (11, 12), the protruding part (9; 10) is bent and elastically compressed against the side (7; 8) so that the insulating panel (3) is clamped between the surfaces (11, 12) without the thermally insulating panel (4) needing to be folded.

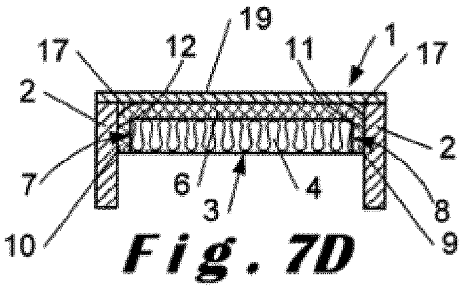

Fig. 7D

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Description

[0001] The present invention relates to an insulating panel intended to be clamped between two mutually opposing surfaces, and a method of clamping the insulating panel between two mutually opposing surfaces.

[0002] The insulating panel comprises a thermally insulating plate which has a compressive strength, measured to EN 826:2013, on deformation of 10 %, of at least 50 kPa, wherein said thermally insulating plate has a first and a second side, which sides lie mutually opposite each other and each have a height, and wherein the insulating panel furthermore comprises at least one elastically compressible strip which is intended to be compressed in order to clamp said thermally insulating plate by said sides between said surfaces, which strip also has a compressive strength, measured to EN 826:2013, on deformation of 10 %, of at most 40 kPa.

[0003] Such an insulating panel is used for example in building works in order to ensure adequate thermal insulation thereof. In these building works, a framework, such as boards or beams arranged at a distance from each other, is provided with a number of spaces in which insulating panels must be placed, wherein the framework thus serves as surfaces between which the panels must be placed. However, the spaces may have a multiplicity of sizes and forms in which sometimes obstacles such as electrical lines or waste pipes are arranged. The fitting of insulating panels in spaces of different sizes requires either the production of a specific insulating panel for each different space, or the use of an insulating panel which is sufficiently flexible to fit the different sizes.

[0004] EP 1 360 382 B1 discloses an insulating panel which solves this problem by providing strips of an elastically compressible material on the sides of a thermally insulating plate, and providing a cut in the thermally insulating plate whereby this can be folded around the cladding layer provided on the thermally insulating plate. Such an insulating panel can be folded so that it can be placed in the space, whereupon the plate is pressed flat and the strips of compressible material are compressed between the flat plate and the surfaces which define the space. In this way, the insulating panel is elastically clamped between the surfaces of the space.

[0005] A disadvantage of such an insulating panel is that the thermally insulating plate is foldable, whereby the panel, if a tensile force is exerted thereon, can come out of the space. So to ensure that the panels remain in the framework, these must be covered on their front side with a covering, for example a gypsum plasterboard or wooden laths.

[0006] Another disadvantage of such an insulating panel is that it cannot be clamped in the space without folding the plate. More specifically, if one tries to push the insulating panel into the space without the plate being folded, the compressible strips will press against the edges of the space, for example the beams. Because the compressible strips are also flexible, these are then bent so that they protrude partially on the front side of the plate. In this way, less compressible material is compressed between the thermally insulating plate and the solid surfaces, whereby the thermally insulating plate is secured less firmly. The compressible material furthermore spreads out on the front side of the insulating panel, which is less aesthetically pleasing than a flat finish. The protruding material must then be cut away, which is also time-consuming. To avoid these disadvantages, the known insulating panel is therefore intended to be fitted between the mutually opposing surfaces in the folded state. By then pressing the plate flat, a force is exerted on the compressible strips, whereby the strips are compressed and the thermally insulating plate is clamped elastically between the two surfaces.

[0007] Another disadvantage of such an insulating panel is that it is not possible to adapt the panel to a space which is smaller than the size of the thermally insulating plate alone in its flat state. Namely it is not possible to cut away part of the plate, since then the flexible strips will also be cut away, whereby the panel can no longer be clamped into the space.

[0008] It is an object of the present invention to provide an insulating panel which need not be folded before being clamped between two surfaces, and which offers the possibility of preventing the compressible strip or strips from spreading over the front side of the insulating panel when the insulating panel is pressed between the two surfaces.

[0009] This object is achieved by forming said strip by an elastically compressible, flexible plate which is attached to the rear side of said thermally insulating plate and which, in unbent state, protrudes at least over the first side, wherein the protruding part of said flexible plate is intended, when the insulating panel is clamped between said surfaces, to be bent and elastically compressed against said first side.

[0010] Because the flexible plate is attached on the rear side of the thermally insulating plate and protrudes on the first side thereof, when the insulating panel is placed between the surfaces, the flexible plate first comes into contact with the frame, for example the beams or boards which form the surfaces. When the panel is pressed further between the surfaces, the protruding part is bent against the first side, insofar as this has not already been bent against the first side. Then, in particular on the rear side of the thermally insulating plate, the space between the first side of the thermally insulating plate and the adjacent surface is completely filled with the compressible material. After bending of the protruding part, this part is also elastically compressed between the first side and the corresponding surface, so that the insulating panel is clamped between the surfaces, without the thermally insulating panel having to be folded. The insulating panel according to the invention is thus more rigid, lowering the risk that it will become detached from the surfaces again.

[0011] Furthermore, this insulating panel has the advantage that it can be used even if the distance between said surfaces is smaller than the width of the plate. Namely it is possible to cut away part of the thermally insulating plate without removing the flexible plate.

[0012] In an embodiment of the present invention, the insulating panel is provided with a further, elastically compressible strip which is intended to be compressed in order to clamp said thermally insulating plate by said sides between said surfaces, which further strip has a compressive strength, measured to EN 826:2013, on deformation of 10 %, of at most 40 kPa, wherein said further strip is formed by said flexible plate which, in unbent state, furthermore protrudes over the second side, wherein the further protruding part of said flexible plate is intended, when the insulating panel is clamped between said surfaces, to be bent and elastically compressed also against said second side.

[0013] In an alternative embodiment of the present invention, the insulating panel is provided with a further, elastically compressible strip which is intended to be compressed in order to clamp said thermally insulating plate by said sides between said surfaces, which further strip has a compressive strength, measured to EN 826:2013, on deformation of 10 %, of at most 40 kPa, wherein said further strip is formed by a further, elastically compressible, flexible plate which is attached to the rear side of said thermally insulating plate and which, in unbent state, also protrudes over the second side, wherein the further protruding part of said further flexible plate is intended, when the insulating panel is clamped between said surfaces, to be bent and elastically compressed also against said second side.

[0014] In both these embodiments, a protruding part is provided on both sides of the thermally insulating plate, whereby the insulating panel can be clamped against the surfaces at both edges. In addition, in the alternative embodiment, less material is required for clamping the insulating panel between the surfaces, since the entire rear side is not covered.

[0015] In a preferred embodiment of the present invention, said flexible plate is made of an acoustically insulating material, wherein said flexible plate, in unbent state, has a weighted sound reduction index, measured according to EN ISO 717-1:2013, of at least 6 dB, preferably at least 10 dB, and further preferably at least 12 dB.

[0016] In this embodiment, the insulating panel provides both thermal and acoustic insulation, whereby it is not necessary to provide a separate acoustic insulation.

[0017] In a further preferred embodiment of the present invention, said protruding part on said first side protrudes over a distance which is most equal to the height of the first side, preferably over a distance which is at most equal to 90 % of the height of the first side, and more preferably over a distance which is at most equal to 80 % of the height of the first side.

[0018] This has the advantage that the bent and compressed protrusion does not protrude over the front of the thermally insulating plate when clamped between the surfaces.

[0019] In yet a further preferred embodiment of the present invention, said flexible plate has a rear side which is formed by a cladding, preferably this cladding is substantially not stretchable in the direction in which said flexible plate protrudes, and more preferably the cladding is airtight and or water-repellent.

[0020] This has the advantage that the insulating panel is easier to handle. Because of the presence of the cladding, the flexible plate is also easier to cut to size if the insulating panel is too wide. A further advantage is that the cladding is preferably provided to reduce the friction between the flexible plate and the surfaces between which the panel must be clamped, whereby the insulating panel can be pressed more easily between the two surfaces, even if the compressible strip or strips must be compressed substantially.

[0021] In yet a further preferred embodiment of the present invention, the rear side of said thermally insulating plate is provided with a cladding layer on which said flexible plate is attached, which cladding layer is preferably a water-repellent layer, an air-permeable layer and/or a fire-resistant layer, or a combination thereof.

[0022] This has the advantage that such cladding layers need no longer be applied separately, which naturally reduces the total installation time required.

[0023] The invention also relates to a method for clamping an insulating panel as described above between two mutually opposing surfaces, wherein said thermally insulating plate is pushed between the two surfaces, wherein said protruding part is bent against the first side and elastically compressed between the first side and said surface.

[0024] During performance of this method, there is also no need to fold the insulating panel before clamping it between the surfaces.

[0025] In a preferred embodiment of the method according to the invention, before said thermally insulating plate is pushed between said surfaces, at least said thermally insulating plate is cut to size.

[0026] In this way, the insulating panel can also be used between two surfaces, the distance between which is smaller than the size of the thermally insulating plate.

[0027] The invention will be described in more detail below with reference to the following description and the attached drawings.

Figure 1 shows part of a roof in which insulating panels according to the invention are fitted.

Figure 2 shows a cross-section along line II-II of figure 1.

Figure 3 shows a cross-section along line III-III of figure 1.

Figure 4 shows a cross-section through an alternative embodiment, in which the insulating panels are fitted in a wooden frame wall instead of in a roof.

Figures 5A to 5J show in cross-section various embodiments of the insulating panels.

Figure 6A to 6D show in cross-section two further embodiments of the insulating panels, respectively in the non-fitted and in the fitted state.

Figure 7A to 7D show various phases in fitting an insulating panel as shown in figure 5A between two surfaces.

[0028] The present invention will be described below with reference to specific embodiments and with reference to certain drawings, but the invention is not restricted thereto and is defined solely by the claims. The drawings shown here are merely diagrammatic representations and not limitative. In the drawings, the dimensions of certain components may be shown exaggeratedly, which means that the parts concerned are not depicted to scale, purely for illustrative purposes. The dimensions and relative dimensions do not necessarily correspond to the actual practical embodiments of the invention.

[0029] The invention relates in general to an insulating panel for the (thermal and/or acoustic) insulation of walls. A typical area of application is for example the insulation of walls inside a building, e.g. the walls of rooms, attics or other spaces inside a building. The term "wall" comprises both side walls and top walls (ceilings), bottom walls (floors, in particular if for example only the floor of an attic must be insulated instead of the roof itself), also partition walls (infill walls). The insulating panels are normally used in the roof, but may in particular also be used for insulating the walls of a wooden frame building. Both the roof and the walls comprise a framework of parallel boards or beams, between which normally at least one thermally insulating panel is fitted. The structure of parallel beams is also used for floor insulation. Then typically rock wool is placed between these beams for thermal insulation.

[0030] The invention may however also be used for thermal and/or acoustic insulation in industrial applications, e.g. in walls of casings or housings for insulating generator sets (motor-driven generators) or HVAC systems (heating, ventilation and air conditioning) or generators. Another typical application area is the transport sector, for example in the insulation of cold walls of refrigerated transport, or for example the insulation of engine compartments of trucks or goods vehicles.

[0031] Figure 1 illustrates a front view of part of a wall or roof 1 with beams or boards 2, between which insulating panels 3 according to the invention are clamped.

[0032] Figures 2 and 3 illustrate how the insulating panels 3 are mounted in order to insulate a roof 1, respectively along lines II-II and III-III shown in figure 1. The roof 1 is formed by the roof tiles 18 which rest on tile battens 19 mounted on top of the supporting boards 2. It is also possible that a watertight film or watertight sheet material is fitted between the tile battens 19 and the boards 2, but this is not shown in the figures.

[0033] Figure 4 illustrates the fixing of the insulating panels 3 in an outer wall of a wooden frame building. The outer wall comprises a framework of upright beams 2, between which the insulating panels 3 are clamped. On the outside of the beams 2, preferably wooden panels 24 are fitted, for example plywood panels. On the inside of the beams 2, wooden panels 23 may also be mounted and may for example be finished further with gypsum plaster boards (not shown). On the outside of the wall 1, an outer facade 21 is provided with an air gap 22 between the wall 1 and the outer facade 21.

[0034] As illustrated in figures 5A to 5J, the insulating panels 3 are constructed from a thermally insulating plate 4, on the rear side 5 of which an elastically compressible, flexible plate 6 is at least partially attached. This flexible plate 6 has, at least on one of the sides 7, 8 of the thermally insulating plate 4, a protruding part 9, 10 which, as described in relation to figures 7A to 7D, is intended to clamp the insulating panel 3 between two surfaces 11, 12 formed by the boards or beams 2.

[0035] The thermally insulating plate 4 must be sufficiently hard for the insulating panel 3 to be sufficiently stiff, and for example not sag if it becomes wet when mounted in the roof. Specifically, the thermally insulating plate 4 must be sufficiently hard to give it a compressive strength, measured according to EN 826:2013, with deformation of 10 %, of more than 50 kPa, preferably more than 80 kPa, more preferably more than 100 kPa, and most preferably more than 120kPa.

[0036] The thickness d (see figure 5A) of the thermally insulating plate 4 is preferably between 2 cm and 24 cm, more preferably between 6 cm and 12 cm, and for example is around 8 cm. The thickness d may thus be selected as a function of the available space to be insulated and the desired thermal insulation value. The length and width of the thermally insulating plate 4 may vary, and it preferably has a standard length of for example 120 cm and a width or a number of widths which lie for example between 40 and 55 cm. Preferably, the thermally insulating plate 4 has a rectangular form.

[0037] In the different embodiments, the thermally insulating plate 4 may be made of various foam and/or fibre materials. The foam materials are for example expanded polystyrene foam (EPS), extruded polystyrene foam (XPS), phenol foam (PF), melamine foam or polyurethane foam (PUR), but preferably polyisocyanurate foam (PIR) which has a good thermal insulation value and can achieve the necessary hardness with a relatively low density. The foam material may furthermore comprise foamed glass. The fibre materials are for example based on rock wool. In addition, the thermally insulating plate 4 may also be made of other thermally insulating materials, for example aerogel or other insulating nanoporous materials. The thermally insulating plate may also consist of a VIP panel (vacuum insulated panel).

[0038] In one embodiment, the thermally insulating plate 4 has a lambda value, measured according to the method described in ASTM C-518-15, which is less than 0.1 W/m*K, preferably less than 0.06 W/m*K, and more preferably less than 0.04 W/m*K. Such values allow adequate thermal insulation to be provided depending on requirements.

[0039] The flexible plate 6 should be sufficiently flexible and elastically compressible for the insulation panel 3 to be clamped between the surfaces 11, 12. In other words, after being compressed, the flexible plate 4 should still offer sufficient strength to clamp the insulating panel 3 between the surfaces 11, 12. For this, the flexible plate 6 preferably has a pressure load, at 40 % compression (CLD) measured according to ASTM D-1056-14, of at least 0.5 kPa, preferably at least 2 kPa, more preferably at least 4 kPa and most preferably at least 5 kPa.

[0040] Specifically, the flexible plate 6 has a compressive strength, measured according to EN 826:2013, with a deformation of 10 %, which is less than 30 kPa, preferably less than 20 kPa, and more preferably less than 15 kPa, which allows the flexible plate 6 to be compressed easily.

[0041] Preferably, the flexible plate 6 is substantially not stretchable, or has a tensile strength, measured according to ISO 1798:2008, with an extension of 5 %, which is greater than 100 kPa, and preferably greater than 200 kPa. Such a tensile strength means that the insulating panel can easily be pressed between the boards or bars 2, wherein even if the surface of the boards or bars 2 is rough, the protruding ends of the flexible plate 6 are drawn between the boards or beams 2.

[0042] In various embodiments, the flexible plate 6 may be made of various supple materials, for example a supple foam material or a combination of hard foam materials and supple foam materials. These supple foam materials are for example PUR (polyurethane) foam, and in particular an agglomerated PUR foam. Such a foam may be produced by cutting or crushing pieces of waste foam into foam flakes, and gluing these foam flakes together. This can be achieved using a liquid glue which is applied to the foam flakes. Preferably, however, glue in the form of fusible fibres is used, which fibres are mixed with the foam flakes and glue the foam flakes together when heated. The fibres are preferably bicomponent fibres, i.e. fibres consisting of two components with different melting temperatures. Typically, these are so-called concentric casing/core bicomponent melt fibres. These consist of a core of a polymer with a high melting point, surrounded by a casing of a polymer with a lower melting point. When the fibre/foam flake mixture is heated, the casing melts, whereby the foam flakes are bonded together. The use of glue fibres offers the advantage that the foam flakes need be compressed less when glued together, which therefore allows lower densities.

[0043] In one embodiment, the flexible plate 6, in undeformed state, has a density which is greater than 20 kg/m^3, preferably greater than 30 kg/m^3, and more preferably greater than 40 kg/m^3.

[0044] In a preferred embodiment, the flexible plate 6 is acoustically insulating, so that the insulating panel 3 provides both thermal and acoustic insulation. For this, in unbent state, the flexible plate 6 has a weighted sound reduction index, measured according to EN ISO 717-1:2013, of at least 6 dB, preferably at least 10 dB, and further preferably at least 12 dB.

[0045] The thickness D (see figure 5A) of the flexible plate 6 is between 1 cm and 10 cm, and preferably is around 4 cm. The thickness D can thus be determined on the basis of the available space, which is also dependent on the application, as illustrated in figures 2 and 4, and also on the basis of the desired acoustic insulation.

[0046] Figure 5A illustrates an embodiment of the insulating panel 3. The panel 3 is symmetrical with two rectangular protruding parts 9, 10, wherein the entire rear side 5 of the thermally insulating plate 4 is covered by the flexible plate 6.

[0047] Figure 5B illustrates an alternative embodiment of an insulating panel 3. The panel 3 is symmetrical with two triangular protruding parts 9, 10, wherein the entire rear side 5 of the thermally insulating plate 4 is covered by the flexible plate 6.

[0048] Figure 5C illustrates an alternative embodiment of an insulating panel 3. The panel 3 is not symmetrical and has one rectangular protruding part 9 and one triangular protruding part 10, wherein the entire rear side 5 of the thermally insulating plate 4 is covered by the flexible plate 6.

[0049] Figure 5D illustrates an alternative embodiment of an insulating panel 3. The panel 3 has only one rectangular protruding part 9, wherein part of the rear side 5 of the thermally insulating plate 4 is not covered by the flexible plate 6.

[0050] Figure 5E illustrates an alternative embodiment of an insulating panel 3. The panel 3 is symmetrical with two rectangular protruding parts 9, 10 which are each formed by a flexible plate 6, 6', wherein part of the rear side 5 of the thermally insulating plate 4 is not covered by the flexible plate 6.

[0051] Figure 5F illustrates an alternative embodiment of an insulating panel 3 which is similar to the embodiment shown in figure 5D. The difference between the two is that the rectangular protruding part 9 is already bent and attached to the side 7. This fixing may take place in various ways, such as by gluing, taping or by mechanical fixing.

[0052] Figure 5G illustrates an alternative embodiment of an insulating panel 3. The panel 3 has a rectangular protruding part 9 which is already bent and attached to the side 7, and a triangular protruding part 10, with the rear side 5 completely covered. The thermally insulating plate 4 also has an obliquely oriented side 8 with a height H. Due to the oblique orientation of the side 8, its height H is greater than the thickness d of the thermally insulating plate 4.

[0053] Figure 5H illustrates an alternative embodiment of an insulating panel 3 which is similar to the embodiment shown in figure 5B. The difference is that the rear side of the flexible plate 6 is formed by a cladding 13. The advantage of this cladding 13 is that the flexible plate 6 can be cut to size and hence processed more easily. The cladding 13 can also be applied on both sides of the flexible plate.

[0054] Preferably, the cladding 13 is substantially not stretchable in the direction in which the flexible plate 6 protrudes, whereby during application of the insulating panel, the protruding parts 9, 10 of the flexible plate 6 are also drawn completely between the mutually opposing surfaces 11, 12 and the sides 7, 8 of the thermally insulating plate 4, even if the surfaces 11, 12 are rough and for example formed by unplaned wood. More preferably, the cladding 13 is airtight and/or water-repellent, so that in the case that the insulating panel 3 is used for insulating a roof (see figure 2), the flexible plate 6 does not absorb condensate.

[0055] Figure 5I illustrates an alternative embodiment of an insulating panel 3 which is similar to the embodiment shown in figure 5E. The difference between the two is that a cladding layer 14 is provided on the uncovered part of the rear side 5.

[0056] Figure 5J illustrates an alternative embodiment of an insulating panel 3 which is similar to the embodiment shown in figure 5A. The difference between the two is that a cladding layer 14 is provided, which forms the rear side 5 of the thermally insulating plate 4. This cladding layer 14 is preferably a water-repellent layer, an air-permeable layer, or a fire-resistant layer. Several layers may also be used. This has the advantage that a single insulating panel 3 combines various functions, whereby it is not necessary to apply the different layers successively.

[0057] Figure 6A to 6C illustrate a further alternative embodiment of the insulating panel 3, wherein a cladding layer 25 is attached to the front side of the thermally insulating plate 4. This cladding layer, like the cladding layer 14 in figure 5J, may also be a water-repellent, air-permeable or fire-retardant layer, or offer a combination of these properties. Preferably, the cladding layer 25 consists of the same material as the flexible plate 6.

[0058] In the embodiment according to figures 6A-6B, the cladding layer 25 protrudes over both sides 7, 8 of the thermally insulating layer 4. The cladding layer 25 here, in particular, like the flexible plate 6, is made of an elastically compressible material so that the cladding layer 25 can also be compressed between the surfaces 11, 12 when the panels are installed. In this embodiment, the flexible plate 6 on the rear side of the panel 3 protrudes over a distance which is at most equal to the height of the side 7, 8 of the thermally insulating plate 4, so that the protruding parts of the flexible plate 6 on the rear side of the cladding layer 25 can be pressed against the sides 7, 8 of the thermally insulating plate 4.

[0059] The embodiment according to figures 6C-6D differs from that according to figures 6A-6B in that the cladding layer 25 only extends up to the sides 7, 8 of the thermally insulating plate 4. The flexible plate 6 however protrudes also over the sides 7, 8, namely over a distance which is substantially equal to the sum of the height of the respective side of the thermally insulating plate 4 and the height of the side of the cladding layer 25, so that the flexible plate 6, after positioning of the insulating panel 3 between the two surfaces 11, 12, again completely fills the clear space to the side of the insulating panel 3 formed by the flexible plate 6.

[0060] The embodiments according to figures 6A and 6C have the advantage that the thermally insulating panel is better protected, which for example is desirable if this thermally insulating plate consists of a VIP panel. Also, better airtightness is ensured. The provision of a layer 25 also allows, for example, cabling to be integrated therein. Furthermore, an extra cladding layer 26 may be applied against layer 25, and protrude beyond layer 25 so that it can be attached to the layer 15 of the adjacent panel, for example by means of an adhesive strip or tape. This simplifies the installation for finishing the insulated walls. Layer 26 may e.g. be a damp-proof layer. Layer 26 may also be a visual finishing layer consisting e.g. of Gyproc, OSB, MDF or plywood. Preferably, in this embodiment, the thickness d of the thermally insulating panel and the thickness D of layer 6 and the thickness of layer 26 are selected such that the cavity between the surfaces 11, 12 is completely filled, whereby the acoustic and thermal insulation is further increased. This is illustrated in figures 6B and 6D.

[0061] The flexible plate 6 may be attached to the thermally insulating plate 4 in various ways, including gluing, taping or mechanical fixing to each other. Also, these plates 4, 6 can be attached to each other by melting of fusible fibres, in particular bicomponent fibres as described above; by laminating these together, for example using heat; or by producing these as one assembly by co-extrusion of the two plates 4, 6. Furthermore, it is clear that there are various ways of attaching these plates 4, 6 together.

[0062] As illustrated in figure 1, several insulating panels may be placed against each other in order thus to insulate the entire space between longitudinal beams 2. It is clear that each insulating panel 3 has, as well as two long sides 7, 8, two short sides 15, 16, wherein the short side 15 of one panel 3 is placed against the short side 16 of a following panel 3. In one embodiment, a tongue-and-groove system (as shown in figure 3) may be used so that the connection between the panels 3 is adequately sealed. However, this is not necessary because the flexible plate 6 may also protrude at its sides 15, 16 in order to seal gaps between adjacent panels 3.

[0063] Figure 7A to 7D show various phases in positioning an insulating panel, as shown in figure 5A, between two surfaces 11, 12 formed by the two boards 2. Figure 7A shows that the insulating panel 3 as a whole is wider than the distance L between the two surfaces 11, 12, but at the same time the width B of the thermally insulating plate 4 is less than the distance L, so that the thermally insulating plate 4 fits between the beams 2. Also, the sum of the width B of the thermally insulating plate 4 and the thickness D of each protrusion 9, 10 is greater than the distance L, so the protruding parts 9, 10 must be compressed when fitting the insulating panel 3 between the beams 2. When the insulating panel 3 is pushed further between the boards 2, the protruding parts 9, 10 of the flexible plate 6 are bent against the sides 7, 8, as shown in figure 7C. At the same time, the protruding parts 9, 10 are also compressed. Figure 7D shows the insulating panel 3 which has been pressed completely into the cavity between the boards 2, wherein the protruding parts 9, 10 are bent and elastically compressed between the surfaces 11, 12 and the sides 7, 8, so that the insulating panel 3 is clamped between the boards 2. Because the height of the boards 2 is greater than the total thickness of the insulating panels 3, the bent protruding parts of the flexible plate 6 must be moved along the mutually opposing surfaces 11, 12 of the boards 2. Here it is advantageous that the friction between the protruding parts of the flexible plate 4 and the boards 2 is reduced by providing a cladding on the rear side of the flexible plate 6. Furthermore, it is advantageous that the elongation of the flexible plate 6 is limited, so that the protruding parts stretch only minimally and thus are drawn between the boards 2.

[0064] Figure 7D also illustrates that there are two air zones 17, i.e. a part which is not filled, which is the direct result of the manner in which the insulating panel 3 is clamped between the beams 2. However, by providing the flexible plate 6 on the rear side 5, these air zones 17 are not located between the surfaces 11, 12 and the sides 7, 8 of the thermally insulating plate 4, but the air zones 17 are located at the height of the compressible flexible plate 6. In other words, the space between the surfaces 11, 12 and the sides 7, 8 of the thermally insulating plate 4 is almost completely filled by the protruding parts 9, 10, whereby the insulating panel 3 is clamped more firmly. Because the flexible plate consists of an elastically compressible material, any unevenness in the surface against which the insulating panel is pressed is levelled out without damaging the thermally insulating plate.

[0065] Also, it is clear that no fold line is necessary in the thermally insulating plate 4, nor does this plate have to be foldable in order to place the panel 3 between the boards or beams 2 and clamp it firmly.

[0066] To prevent the protruding parts 9, 10 from protruding on the front side after fitting of the insulating panel 3, the protruding parts 9, 10 protrude at the sides 7, 8 over a distance which is at most equal to the height H (indicated in figures 5F and 5G) of the corresponding side 7, 8. Preferably, the protruding parts 9, 10 protrude over a distance which is greater than 80 % of the height H and which more preferably is greater than 90 % of the height H. In many situations, the height H of the side 7, 8 is equal to the thickness d of the thermally insulating layer 4, but this need not always be the case, in particular if the thermally insulating plate has sloping sides, as illustrated in figure 5G. In addition, it is clear that the two protruding parts 9, 10 need not have the same thickness.

[0067] It is also possible to cut the insulating panel 3 so that the dimensions, and in particular the width of the panel, are adapted to the distance L between the boards 2. This cutting typically takes place in two phases. In the first phase, the thermally insulating plate 4 is cut to size, in particular so that this has a width which is smaller than the distance L, such that the insulating panel with the bent protruding parts of the compressible plate can be clamped firmly between the boards 2. In the second phase, the flexible plate 6 is then cut to size. This typically takes place by cutting away part of the protruding part 9, 10 which sits on the cut side of the thermally insulating plate. If the panel 3 must be cut to size, an embodiment in which a cladding 13 forms the rear side of the flexible plate 6 (as shown in figure 5H) is advantageous, because this simplifies the cutting.

[0068] Although certain aspects of the present invention are described in relation to specific embodiments, it is clear that these aspects may also be implemented in other forms.

Claims

1. An insulating panel (3) intended to be clamped between two mutually opposing surfaces (11, 12), which insulating panel (3) comprises a thermally insulating plate (4) which has a compressive strength, measured according to EN 826:2013, on deformation of 10 %, of at least 50 kPa, wherein said thermally insulating plate (4) has a first and a second side (7, 8), which sides (7, 8) lie mutually opposite each other and each have a height (H), and
   wherein the insulating panel (3) furthermore comprises at least one elastically compressible strip which is intended to be compressed in order to clamp said thermally insulating plate (4) by said sides (7, 8) between said surfaces (11, 12), which strip also has a compressive strength, measured according to EN 826:2013, on deformation of 10 %, of at most 40 kPa,
   characterised in that
   said strip is formed by an elastically compressible, flexible plate (6) which is attached to the rear side (5) of said thermally insulating plate (4) and which, in unbent state, protrudes at least over the first side (7),
   wherein the protruding part (9) of said flexible plate (6) is intended, when the insulating panel (3) is clamped between said surfaces (11, 12), to be bent and elastically compressed against said first side (7).

2. Insulating panel (3) according to claim 1, **characterised in that** the insulating panel (3) is provided with a further, elastically compressible strip which is intended to be compressed in order to clamp said thermally insulating plate (4) by said sides (7, 8) between said surfaces (11, 12), which further strip has a compressive strength, measured to EN 826:2013, on deformation of 10 %, of at most 40 kPa, wherein said further strip is formed by said flexible plate (6) which, in unbent state, further protrudes over the second

side (8), wherein the further protruding part (10) of said flexible plate (6) is intended, when the insulating panel (3) is clamped between said surfaces (11, 12), to be bent and elastically compressed against said second side (8), and wherein said further protruding part (10) of said flexible plate (6) preferably protrudes on said second side (8) over a distance which is at most equal to the height (H) of the second side (8), preferably over a distance which is at least equal to 80% of the height (H) of the second side (8) and more preferably over a distance which is at least equal to 90% of the height (H) of the second side (8).

3. Insulating panel (3) according to claim 1, **characterised in that** the insulating panel (3) is provided with a further, elastically compressible strip which is intended to be compressed in order to clamp said thermally insulating plate (4) by said sides (7, 8) between said surfaces (11, 12), which further strip has a compressive strength, measured to EN 826:2013, on deformation of 10 %, of at most 40 kPa, wherein said further strip is formed by a further, elastically compressible, flexible plate (6') which is attached to the rear side (5) of said thermally insulating plate (4) and which, in unbent state, protrudes over the second side (8), wherein the further protruding part (10) of said further flexible plate (6') is intended, when the insulating panel (3) is clamped between said surfaces (11, 12), to be bent and elastically compressed against said second side (8), and wherein said further protruding part (10) of said further flexible plate (6') preferably protrudes on said second side (8) over a distance which is at most equal to the height (H) of the second side (8), preferably over a distance which is at least equal to 80 % of the height (H) of the second side (8) and more preferably over a distance which is at least equal to 90 % of the height (H) of the second side (8).

4. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) is made of an acoustically insulating material, wherein said flexible plate (6), in unbent state, has a weighted sound reduction index, measured according to EN ISO 717-1:2013, of at least 6 dB, preferably at least 10 dB, and further preferably at least 12 dB.

5. Insulating panel (3) according to any of the preceding claims, **characterised in that** said protruding part (9) on said first side (7) protrudes over a distance which is most equal to the height (H) of the first side (7), preferably over a distance which is at least equal to 80 % of the height (H) of the first side (7), and more preferably over a distance which is at least equal to 90 % of the height (H) of the first side (7).

6. Insulating panel (3) according to any of the preceding claims, **characterised in that** the protruding part (9) of said flexible plate (6) is bent against and attached to the first side (7).

7. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) is substantially not stretchable, or has a tensile strength, measured according to ISO 1798:2008, with an extension of 5%, which is greater than 100 kPa, and preferably greater than 200 kPa.

8. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) has a rear side (5) which is formed by a cladding (13), which cladding (13) is preferably substantially not stretchable in the direction in which said flexible plate (6) protrudes, and which cladding (13) more preferably is airtight and/or water-repellent.

9. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) comprises a supple foam material, preferably a supple polyurethane foam, in particular an agglomerated polyurethane foam.

10. Insulating panel (3) according to any of the preceding claims, **characterised in that** the rear side (5) of said thermally insulating plate (4) is provided with a cladding layer (14) to which said flexible plate (6) is attached, which cladding layer (14) is preferably a water-repellent layer, an air-permeable layer and/or a fire-resistant layer.

11. Insulating panel (3) according to any of the preceding claims, **characterised in that** said thermally insulating plate (4) has no fold lines, and in particular is not foldable.

12. Insulating panel (3) according to any of the preceding claims, **characterised in that** said thermally insulating plate (4) comprises a foam material and/or a fibre material, in particular rock wool, wherein said foam material is preferably an expanded polystyrene foam, an extruded polystyrene foam, a phenol foam, a melamine foam, a polyurethane foam and/or a polyisocyanurate foam, and more preferably is a polyisocyanurate foam.

13. Insulating panel (3) according to any of the preceding claims, **characterised in that** said thermally insulating plate (4) has a lambda value, measured according to the method described in ASTM C-518-15, which is less than 0.1 W/m*K, preferably less than 0.06 W/m*K, and more preferably less than 0.04 W/m*K.

14. Insulating panel (3) according to any of the preceding claims, **characterised in that** said thermally insulating plate (4) has a compressive strength, meas-

ured according to EN 826:2013, with a deformation of 10 %, which is greater than 80 kPa, preferably greater than 100 kPa, and more preferably greater than 120 kPa.

15. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) has a compressive strength, measured according to EN 826:2013, with a deformation of 10 %, which is less than 30 kPa, preferably less than 20 kPa, and more preferably less than 15 kPa, and/or which is greater than 1 kPa, preferably greater than 2 kPa, and more preferably greater than 3 kPa.

16. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) has a pressure load, at 40 % compression, measured according to ASTM D-1056-14, of at least 0.5 kPa, preferably at least 2 kPa, more preferably at least 4 kPa and most preferably at least 5 kPa.

17. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) in undeformed state has a density which is greater than 20 kg/m^3, preferably greater than 30 kg/m^3, and more preferably greater than 40 kg/m^3.

18. Insulating panel (3) according to any of the preceding claims, **characterised in that** said thermally insulating plate (4) has a thickness of between 2 cm and 24 cm, preferably between 6 cm and 12 cm, and more preferably a thickness of around 8 cm.

19. Insulating panel (3) according to any of the preceding claims, **characterised in that** said flexible plate (6) has a thickness of between 1 cm and 10 cm, and more preferably a thickness of around 4 cm.

20. Insulating panel (3) according to any of the preceding claims, **characterised in that** said insulating panel (3) is clamped between said surfaces (11, 12), wherein at least the protruding part (9) is bent against the side (7) of the thermally insulating plate (4), and elastically compressed between said side (7) and one of said surfaces (11, 12).

21. Method for clamping an insulating panel (3) according to any of the preceding claims between two mutually opposing surfaces (11, 12), wherein said thermally insulating plate (4) is pushed between the two surfaces (11, 12), wherein said protruding part (9) is bent against the first side (7) and elastically compressed between the first side (7) and said surface (11).

22. Method according to claim 21, wherein the insulating panel (3) is provided with a further, elastically compressible strip, formed by said flexible plate (6) or by said further flexible plate (6') which protrudes further over the second side (8), wherein, when the thermally insulating panel (4) is pushed between the two surfaces (11, 12), said further protruding part (10) is bent against the second side (8) and elastically compressed between the second side (8) and said surface (12).

23. Method according to claim 21 or 22, **characterised in that** before said thermally insulating plate (4) is pushed between said surfaces (11, 12), at least said thermally insulating plate (4) is cut to size.

24. Use of the insulating panel (3) according to any of claims 1 to 20 for thermal and/or acoustic insulation in the building sector, the transport sector or other industrial applications.

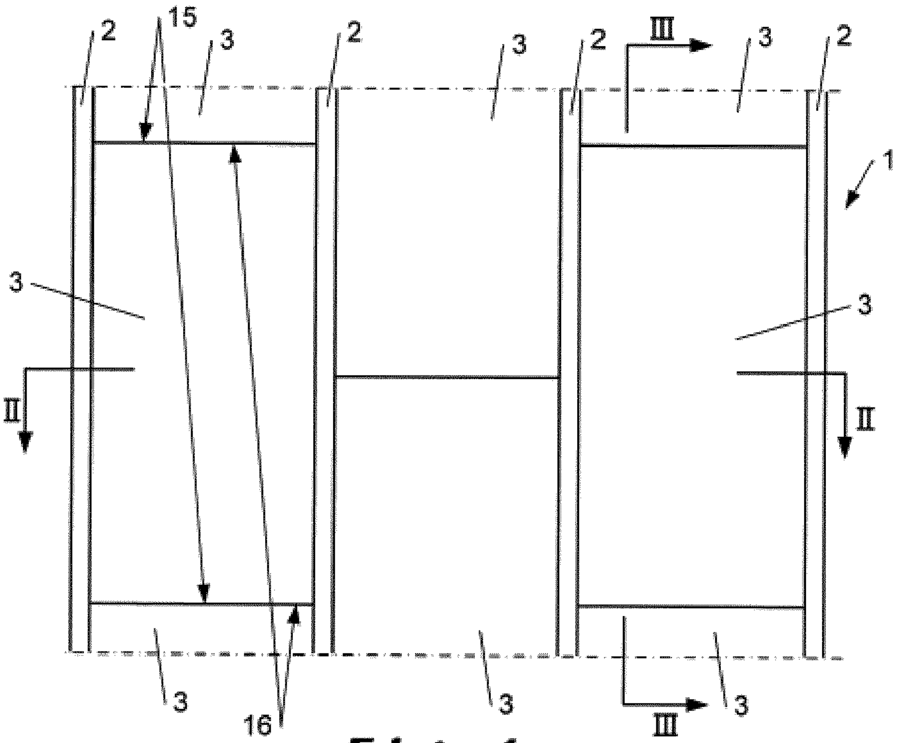
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Fig.1

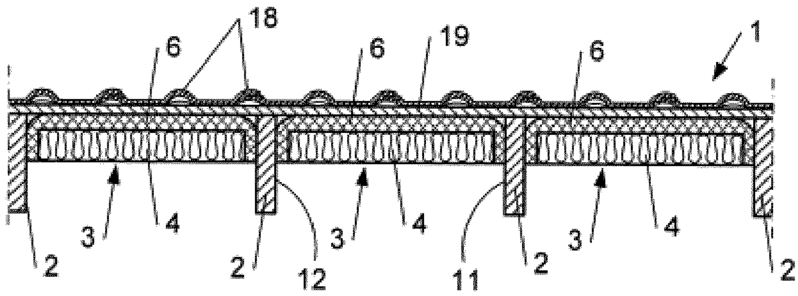
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Fig.2

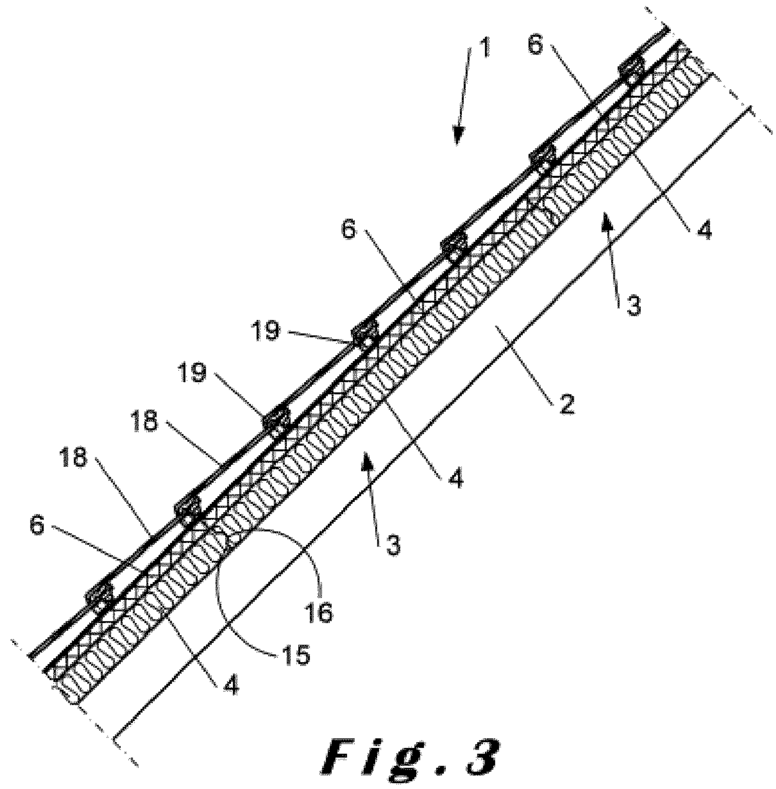

Fig. 3

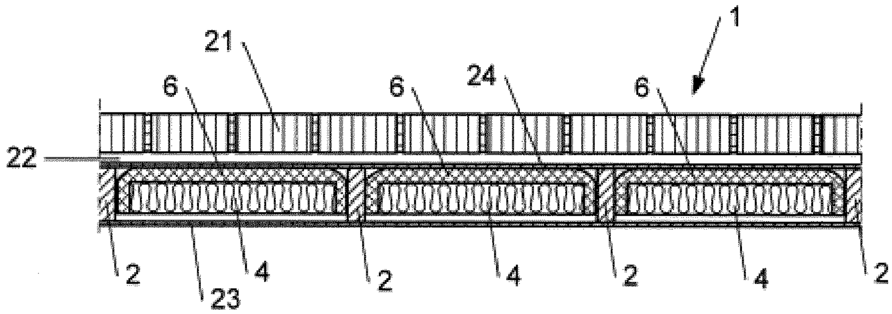

Fig. 4

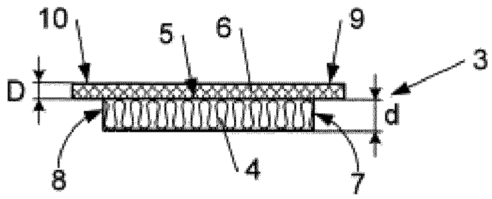

Fig. 5A

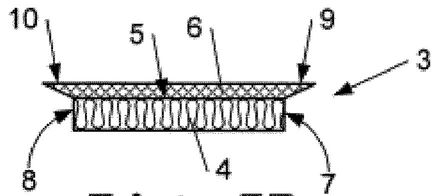

Fig. 5B

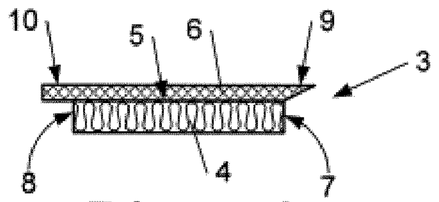

Fig. 5C

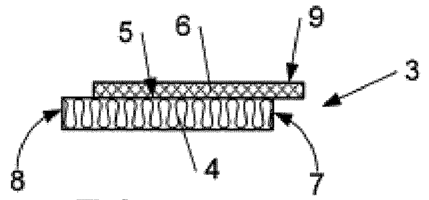

Fig. 5D

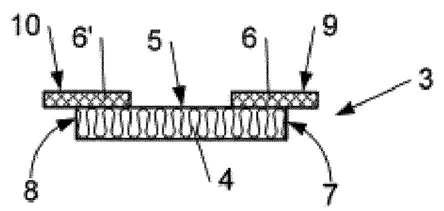

Fig. 5E

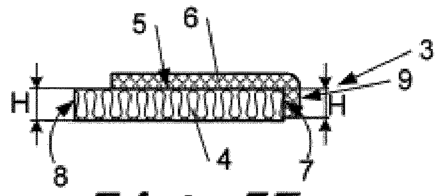

Fig. 5F

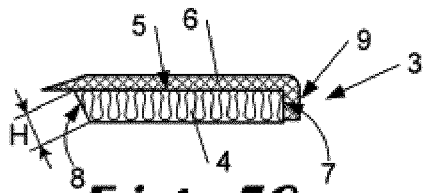

Fig. 5G

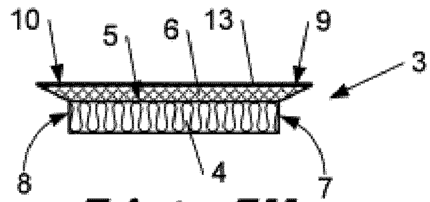

Fig. 5H

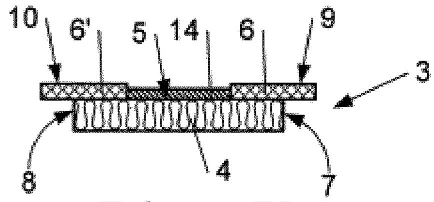

Fig. 5I

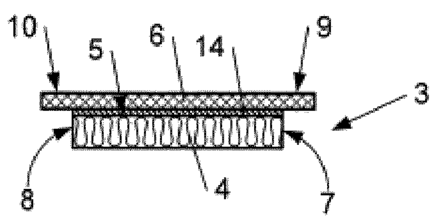

Fig. 5J

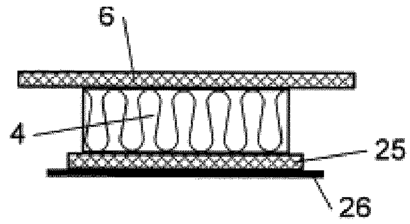

Fig. 6A

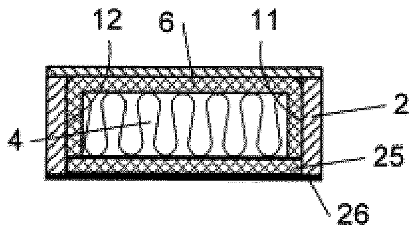

Fig. 6B

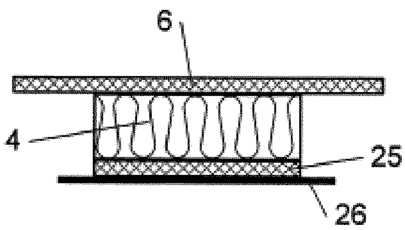

Fig. 6C

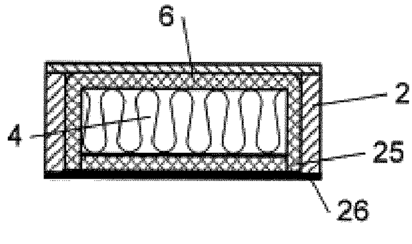

Fig. 6D

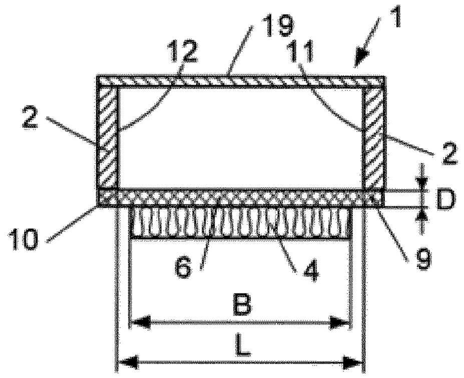

Fig. 7A

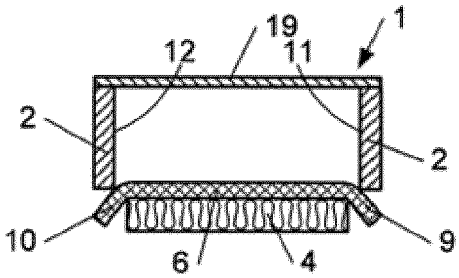

Fig. 7B

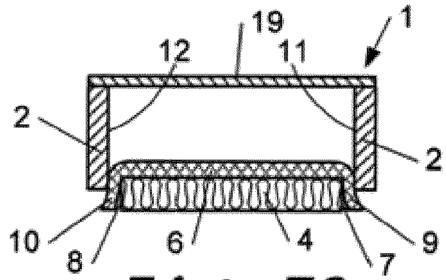

Fig. 7C

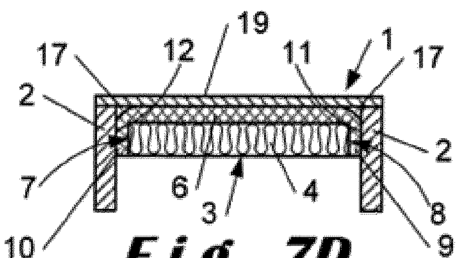

Fig. 7D

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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 5927

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 02/063112 A1 (DOW CHEMICAL CO [US]) 15 August 2002 (2002-08-15) * page 2, line 19 - page 24, line 21; figures 1-5B * -----	1-24	INV. E04B1/76 E04D13/16
A	EP 1 956 155 A1 (ROCKWOOL INT [DK]) 13 August 2008 (2008-08-13) * paragraph [0003] - paragraph [0037]; figures 1-8 * -----	1-24	
A	US 2006/201089 A1 (DUNCAN RICHARD S [US] ET AL) 14 September 2006 (2006-09-14) * paragraph [0015] - paragraph [0034]; figures 1-4 * -----	1-24	

TECHNICAL FIELDS SEARCHED (IPC)

E04B
E04D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	8 June 2018	Dieterle, Sibille

CATEGORY OF CITED DOCUMENTS

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08-06-2018

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