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

(11) EP 4 446 511 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.10.2024 Bulletin 2024/42

(21) Application number: **24167281.5**

(22) Date of filing: **28.03.2024**

(51) International Patent Classification (IPC):
E04B 5/08 *(2006.01)* ***E04B 5/26*** *(2006.01)*
E04B 1/76 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E04B 5/266; E04B 1/7654; E04B 5/08

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **12.04.2023 NL 2034547**
20.07.2023 NL 2035442

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(54) METHOD AND APPLICATION MODULE FOR POST-INSULATING A BUILDING WITH A CANTILEVERED SYSTEM FLOOR AND A POST-INSULATED CANTILEVERED SYSTEM FLOOR

(57) The present invention relates to a method for post-insulating a cantilevered, already insulated system floor with pre-formed insulation elements on the underside with a trapezoidal free space formed by a top side as a small base, two legs extending from the top side, each with the small base subtending an angle greater than or equal to 90 degrees, each leg terminating in a free end, and an imaginary underside as the large base, the method comprising the step of attaching a multiple insert modules in and/or under the free space, wherein the free space is completely closed off by the insert modules of insulation modules and/or is partially or at least substantially completely filled. The invention further relates to such an insert module and a system floor post-insulated according to the method.

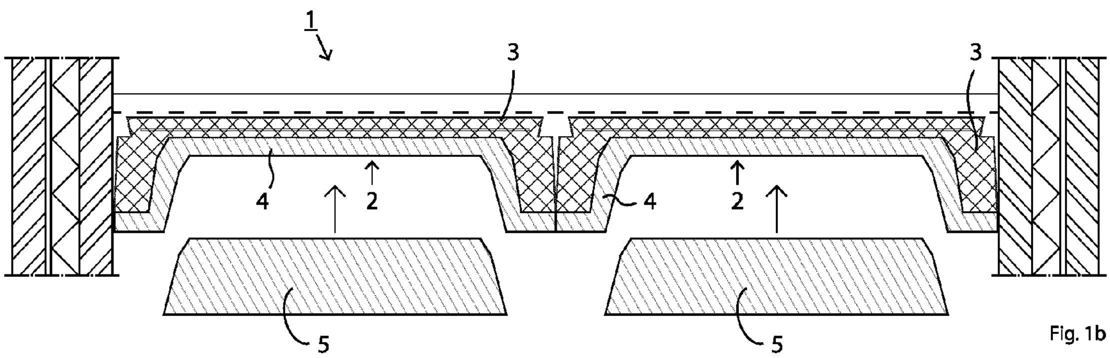

Fig. 1b

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Description

[0001] According to a first aspect, the present invention relates to a method for post-insulating a building with a cantilevered system floor of a type corresponding to a ribbed floor or a PS insulation floor, which system floor is provided on the underside with thermal insulation material in the form of an isosceles trapezium that defines a trapezoidal free space that extends over a length or width of the system floor, or at least part of the length or width of the system floor. The trapezoidal free space has a contour formed with a top as a small base, two legs extending from the top, each subtending an angle with the small base that is greater than or equal to 90 degrees, each leg ending in a free end, and an imaginary underside as a large base. If the angles subtended by the small base and the legs are both 90 degrees, then the trapezoidal space is a rectangular space, as a special form of the trapezoidal space. The legs can also be kinked, where two or more such trapezoidal spaces are defined above each other if a horizontal line extending between two kinks is considered as a large basis for a space located above that horizontal line and as a small basis for a space located below that horizontal line space.

[0002] In this document, post-insulation is defined as applying an extra layer of insulation against "old" insulation that has been present for years, in order to ensure that the joint old and extra insulation meet the higher insulation requirements and/or to further improve the past built and insulated building. This is fundamentally different from applying insulation to a (concrete) floor element during production of the floor elements or the modular provision of (concrete) floor elements and separate insulation elements that are applied in close succession during the (new) construction of a building. After all, with such a method the floor and insulation elements are manufactured separately, but they are designed to fit to each other. Post-insulation, on the other hand, involves custom-made post-insulation that must be applied against old insulation. (New) construction also includes a renovation in which a completely new (concrete) floor is installed as a replacement in an existing building.

[0003] Over the years, insulation requirements imposed on buildings have become increasingly strict. While an RC value of 1.3 was sufficient for a residential home in the Netherlands in the 1980s, an RC value of at least 3.7 is currently the standard for newly built residential homes. And now that energy costs are rising, regardless of legal requirements the need to take (energy) cost-saving measures increases,.

[0004] The post-insulation of system floors of the described type is known. In a known method, an insulating foil is applied between the legs of the trapezoidal space over the entire length or width of the system floor or floor elements thereof. The insulating foil then defines, with the underside of the system floor thus post-insulated, a closed air-filled chamber corresponding at least substantially to the trapezoidal free space. This does not always lead to the desired insulation result. The working space is limited, especially in crawl spaces and the insulation foil must be hung tightly on the existing system floor. In addition, the insulation foil can easily tear or otherwise become damaged, causing the closed air-filled chamber to no longer be completely sealed, to leak and thus to lose its insulating capacity. The insulation foil is also difficult to apply, at least in a way that reliably insulates the floor.

[0005] The present invention aims to provide a method with which a type of system floor described in the introduction can be post-insulated in a simple and reliable manner. To this end, the invention provides a method for post-insulating a building with a cantilevered system floor of a type corresponding to a ribbed floor or a PS insulation floor, which system floor is provided on the underside with pre-formed insulation elements with an isosceles trapezoidal contour that defines a trapezoidal free space formed by a top as a small base, two legs extending from the top, each of which subtends an angle greater than or equal to 90 degrees with the small base, each leg terminating in a free end, and an imaginary underside as a large base, the method comprising the step of:

- attaching a plurality of at least substantially form-retaining insert modules of insulating material in line with each other under and/or in the free space, wherein the free space is closed and/or partially or at least essentially completely filled over at least substantially the entire length thereof by the plurality of insert modules. As appears from the definition of the invention, and will be explained in more detail below, an insert module, also referred to in this document as an insert, also includes a sheet of insulating material that extends completely under the trapezoidal free space(s) and in in fact defines its large base, even if it is not literally placed in the free space. Shape-retaining means that the insert module retains its shape as long as no substantial force or machining operation is exerted on it. This is in contrast to an insulating foil described in the introduction, which changes shape at the slightest touch.

[0006] In a first preferred basic embodiment, the method further comprises the steps of:

- determining a width of the pre-formed insulating elements, i.e. the base including a horizontal distance over which the free ends of the legs of the pre-formed insulating elements, and any possible flanges extending laterally and horizontally from the free ends extend,
- providing plate-shaped insert modules made of insulating material with an insulation value of less than 1.0 W/mK, preferably less than 0.5 or less than 0.1 W/mK, and even more preferably less than 0.07 or 0.05 W/mK, and with a width that corresponds to one time or an integer multiple of the width of the pre-

formed insulation elements,

- arranging one or more of the plate-shaped insert modules against the free ends of the legs of the preformed insulation elements,

wherein the step of attaching the insert modules coincides with or is performed after the step of mounting.

[0007] An advantage of (using) such plate-shaped insert modules in a method is that they can easily be cut from (larger) insulation plates and can be placed against the free ends of the preformed insulation elements and attached thereto. The plate-shaped insert modules have an insulation value as defined hereabove. In addition, the trapezoidal spaces are formed into closed air-filled chambers, which also have an insulating value. This makes the method, for example the step of providing plate-shaped insert modules, relatively simple compared to more complexly shaped insert modules.

[0008] In an alternative second preferred basic embodiment, the method according to the invention comprises the steps of:

- determining the dimensions of the trapezoidal free space;
- forming at least substantially form-retaining insert modules of insulating material, with a cross-section that corresponds to the shape of at least a lower part of the free space of the system floor and with a certain length. At least the lower part of the trapezoidal free space is filled with insulating material. Any remainder of the trapezoidal free space above the insert module forms a closed air-filled chamber. If an insert module does not fill any remaining trapezoidal free space above the insert module, such a method provides, as with the first basic embodiment, a lower insulation section formed by insulating material and above it an upper insulation section closed by an air-filled space.

[0009] In the second preferred basic embodiment, it is preferable that, in the step of forming dimensionally stable insert modules of insulating material, insert modules with a cross-section that corresponds to the shape of at least substantially the entire free space of the system floor and to a certain length are manufactured. Insulating material of the insulation module has a higher insulation value than a closed air-filled space. Thus, in order to achieve a certain insulation value, the height of an insert module that fills the entire free space can be smaller than the sum of the height of an insert module that does not fill the entire free space plus the height of the above-closed with air filled space. On the other hand, to achieve a certain insulation value, the height of an insert module that does not fill the entire free space can be less than the height of only one insert module that fills the entire free space plus the height of the closed air-filled space above it. Moreover, with an insert module that does not fill, or at least need to fill, the entire free space, the dimensions of the insert module need only correspond to the dimensions of the lower part of the free space of the system floor. An insert module can then be used for system floors with different free spaces.

[0010] The scope of protection of the invention also includes a method in which a composite insert module is used, for example a plate that is attached to the free ends of the legs with a smaller plate on the plate that fits, possibly ample, into the free space of the pre-formed insulation. Or an integral insert module of which an upper part does not correspond to the contour of the pre-formed insulation elements, but is narrower and therefore fills part of the free space. If the trapezoidal free space extends across the width of a system floor, then the width in the text above may be interpreted as the length of the system floor.

[0011] In general, the trapezoidal contour on the underside of a system floor of the described type is the same for the entire system floor. With a system floor, several trapezoidal spaces with the same contour generally extend next to each other. More specifically, the contour of a system floor from a particular supplier is generally always the same, or there are only a few variants. This means that the first step, determining the dimensions of the trapezoidal free space, only needs to be performed once per system floor, or even only once for a system floor from a specific supplier. For floors, or projects where a large number of system floors need to be realized, step two does not have to be carried out again and again. Insert modules for commonly used system floors could even be manufactured in stock. All of this falls within the scope of the present invention, as the dimensions are determined at least once before molding and the insert modules are molded at least once before mounting. The insert modules can easily be introduced into a crawl space and, due to the shape corresponding to the trapezoidal free space, can be easily and snugly attached in the trapezoidal free space. Once attached, the risk of insulation leakage is zero. An insulated system floor can thus be post-insulated simply and reliably and the aim of the present invention has been achieved.

[0012] French patent application FR 2 895 001 A describes a factory method for manufacturing an insulating padding for plank floors, designed in a way that responds to mechanical and thermal constraints, by optimizing functions and of the first material, for a weight, an installation size and a cost reduction, thus providing great simplicity. The filling is realized by a manufacturing method in which the supporting structure of the filling is provided by forming a first plastic cellular material and a filling structure of the filling is provided by a second forming of a second plastic cellular material, whereby the plastic cellular materials can be identical to a different density. The supporting structure forms the top of the infill and is a support collar that rests against the edge profile of the beams and the overlapping tongue. The filling structure forms the underside of the filling and provides the final shape. This therefore concerns the manufacture of a composite filler piece of two parts that are manufactured separately but are matched to each other so that they can be installed as joint insulation at the same time or shortly after each other during (new) construction. The two structures have a different function, namely a supporting function and a filling function. The present invention differs from FR 2 895 001 in that it concerns post-insulation, where the preformed insulation elements with an isosceles trapezoidal contour form part of an original system floor that was installed more than a year, often more than ten or 20 years earlier. applied. The insert module according to the present invention is manufactured independently of the preformed insulating elements to the extent that the dimensions of the existing insulating elements must be recorded as part of a floor of an existing building, and the insert modules are manufactured in a years later step on the basis of the recorded dimensions. In FR 2 895 001 A, the step of determining the dimensions of the trapezoidal space is unnecessary and is therefore not disclosed in FR 2 895 001 A. The step is also not implicitly part of the method from FR 2 895 001 A, because the supporting structure and the filling structure are designed together. In the present invention, the isolation elements and the insert modules are not designed together, hence the step of sizing the existing first design (isolation element) is necessary for the later second design (insert module).

[0013] Austrian patent AU 391 906 B describes a method in which air conduction channels are defined at the underside of a floor, which is partially or completely designed as underfloor heating supplied by warm air, by heat insulation elements arranged at the underside of the floor. The present invention differs from AU 391 906 B in that in the invention temperature-heat exchange between the top floor and the insulation structure located below it for insulation is minimized, while in AU 391 906 B, although partly with insulation elements, a heat exchange for heating is optimized. This method therefore actively heats with flowing air, while the present invention provides passive insulation. In the version where the free space is completely filled with insulation material. In the embodiment in which the free space is closed over at least substantially its entire length by the plurality of insert modules, this is done by means of the trapped stagnant air between the old and new insulation.

[0014] French patent FR 390 761 describes a method for applying an intermediate layer in a room with an arched ceiling against which cardboard and asbestos have been applied as sound insulation. A concrete slab is hung in the space below the ceiling to create a suspended ceiling with a void above it. This document does not relate to a cantilevered, system floor of a type corresponding to a ribbed floor or a PS insulation floor. The concrete slabs may not be considered to be insulation elements according to the invention. Moreover, the insulation value of concrete is more than 1.0 W/m K.

[0015] US patent US 9,249,571 B1 describes an insulation system for reducing heating of a building by means of frangible thermal insulation panels against a vertical wall of a building. The vertical wall is not a system floor and is not provided with preformed insulation elements with an isosceles trapezoidal contour.

[0016] If an empty space is created between insulation elements and insert modules when attaching the insert modules, this empty space is preferably completely closed off from the environment. That is to say, no communication can take place between the empty space and the environment, whereby the environment can include a crawl space under the insulation floor, but also a pipe through which air can flow into and/or out of the empty space or can be forced.

[0017] It is preferable that the insulation material of the insert modules corresponds to the insulation material of the existing system floor. A more or less uniform insulating floor is thus formed, whereby relatively old insulating material applied during construction of the building and relatively new insulating material from the insert modules can alternate.

[0018] It is preferred that the insulation material comprises a cured plastic foam material, such as PUR or EPS. Cured plastic foam material, preferably of the closed cell type, is light and therefore easy to handle in possibly low crawl spaces of a building, and also has very good insulation properties.

[0019] To form a relatively thick insulation layer, i.e. an insulation layer that extends below the insulation layer of the existing system floor, the system floor comprises two or more trapezoidal free spaces extending parallel to each other and next to each other, and when forming the form-retaining insert modules form an extra layer of insulating material on the underside corresponding to the long base of the trapezoidal space, which extends beyond the corresponding leg of the trapezoidal shape on at least one side. In this way, even better insulation can be provided with virtually the same effort. After all, the number of modules can be chosen the same compared to a method in which "only" the existing trapezoidal free space is filled. Preferably, the insert modules comprise an Omega-like trapezoidal contour, with the open space of the Omega being filled.

[0020] It is preferable that the trapezoidal shape of the trapezoidal free space has a center of gravity, and the extra layer of insulating material extends parallel to the bases of the trapezoidal shape over a distance equal to the distance between the centers of gravity of two adjacent trapezoidal free spaces. Thus, when attaching insert modules in adjacent trapezoidal spaces at the bottom, a continuous extra layer of insulation material is formed.

[0021] Alternatively or additionally, after installing insert modules, insulation plates are placed against the underside of insert modules, which then extend parallel to the basis of the trapezoidal space, now filled with one or more insert modules. The underside of a post-insulated system floor extends essentially in one plane and an even thicker insulation layer can easily be formed on the underside with plates of insulating material.

[0022] It is preferable that the determined length of an insert module is in the range of 20 to 200 cm, preferably in the range of 30-150 cm, furthermore preferably in the range of 54-74 cm or 110-130 cm. Here a trade-off can be made between a relatively small specific length that increases manageability and a relatively large specific length that minimizes the number of inserts to be attached. It is also conceivable that inserts with different specific lengths are used, for example with a shorter specific length in order to completely fill a length of a trapezoidal free space.

[0023] In the method according to the present invention it is preferable that an insert module is attached in the trapezoidal free space using an adhesive material, such as a suitable glue or sealant. In general, insulating material that is suitable for insert modules according to the present invention can be easily glued, for example to the same or comparable insulating material that is located on the underside of a system floor. This is particularly advantageous because there is sometimes little working space (height) in a crawl space. Place an insert module on the ground, apply glue to it, and then press the insert module into place in the trapezoidal free space.

[0024] Naturally, alternative or additional mounting methods are conceivable. For example, an insert module can be secured in the trapezoidal free space using pins. As a rule, cured foam material can easily be pierced with a mounting pin to be anchored in the existing layer of insulation material.

[0025] In a preferred embodiment, forming the form-retaining insert modules from insulating material comprises the steps of:

- providing a, preferably cube-shaped, block of insulating material; and
- processing the block, preferably by cutting, until it has at least substantially the cross-section that corresponds to the shape of at least a lower part of the free space of the system floor and with a certain length. For example, cutting can be carried out with a filament. Usually, insulation modules for new construction are manufactured in large quantities using molds. However, post-insulation often involves custom work for one or a few floors, and forming the insert modules through machining is cheaper than manufacturing them using a specific, custom-made mold.

[0026] It is conceivable that the trapezoidal free space between ribs extending in the longitudinal direction extends in a transverse direction to the ribs oriented in the longitudinal direction, such as showing parts projecting in the transverse direction and downwards, such as in a ribbed floor, and whereby adapted insert modules are provided with recesses corresponding to the protruding parts. The ribs would otherwise make it difficult to properly attach insert modules that are poorly-adapted to the free space. By providing specifically adapted insert modules, the method according to the present invention can also be used with a ribbed floor or a type of system floor corresponding to its shape.

[0027] In a preferred method according to the present invention, the insert modules are introduced through a hole in a floor into a crawl space of a building and are attached to the underside of a system floor. Since the insert modules are relatively light and dimensionally stable, they can in fact easily be thrown into the crawl space.

[0028] According to a second aspect, the present invention relates to an insert module, formed according to the first two steps of the second preferred basic embodiment, designed for attachment in a shape-corresponding free space of an insulating floor. The insert module solves the same prior art problem as the method according to the present invention.

[0029] According to a third aspect, the present invention relates to a cantilevered system floor post-isolated according to the first aspect of the invention, originally already comprising a layer of insulation material on the underside, wherein trapezoidal free spaces at the underside of the system floor are closed by plate-shaped inserts as defined in claim 4 or are filled with insert modules according to the second aspect of the invention.

[0030] The invention will be explained below with reference to the attached drawing with preferred embodiments of the present invention. In the drawing shows:

Figure 1a shows a schematic cross-sectional view of part of a system floor to be insulated according to the present invention;
Figure 1b shows a schematic cross-sectional view according to Figure 1a and two insert modules, prior to the installation of the insert modules;
Figure 1c shows a schematic cross-sectional view of the system floor from Figure 1a, b against which the insert modules from Figure 1b are attached;
Figure 2 shows a perspective side view of an insert according to the present invention;
Figures 3a-c show schematic cross-sectional views of a part of the system floor from figure 1, against which another embodiment of inserts is attached;
Figure 4 shows a perspective side view of an alternative insert module according to the present invention;
Figures 5a-c show schematic cross-sectional views of part of an alternative system floor after insulating or after insulating according to the present invention;
Figures 6a-c show schematic cross-sectional views of part of an alternative system floor after insulating or after insulating according to the present invention;
Figures 7a-c show schematic cross-sectional views of part of another alternative system floor after insulating or after insulating a system floor according to the present invention; and
Figures 8a-c show schematic cross-sectional views of part of yet another alternative system floor according to the present invention after insulating or after

insulating.

[0031] Now looking at Figure 1a, a schematic perspective cross-sectional view is shown of part of a system floor 1, in this case of the ribbed floor 1 type, that is, a cantilevered system floor of prefabricated floor elements 2 that are applied in a span direction of the floor 1. The floor elements 2 have a load-bearing part 3 of reinforced concrete with a cross-section in the shape of a trapezoid with a small base at the top and legs extending divergently from the small base. That is, the legs each form an angle of more than 90 degrees with the small base. In fact, the cross-section of the concrete supporting part 3 of this exemplary embodiment is formed by two such trapeziums located one above the other. The floor elements 2 further have an EPS insulation part 4 that is mounted on the underside of the concrete part 3. In fact, in this exemplary embodiment, the cross-section of the EPS insulation part 4 is also formed by two trapeziums located one above the other, each with the small base at the top and legs extending divergently from the small base, each of which forms an angle of include more than 90 degrees. Although in this embodiment there are in fact two trapeziums one above the other, the free space between the legs of the trapeziums is formed, with the imaginary large base at the bottom of the upper trapezium forming the imaginary small base at the top of the lower trapezium, the space referred to here as a trapezoidal space. The floor elements 2 are supported at their front and rear ends with the insulated legs of the insulation part 3 of a floor element 2 on cross beams, which are not shown in the drawing for the sake of clarity.

[0032] In ribbed floors currently on the market, the insulation part fills the entire space between the legs of the U of the concrete part. However, figure 1a shows a precursor of this, in which a layer of EPS insulating material of approximately uniform thickness is typically provided as insulating part 4 on the inside of the U-shaped concrete supporting part 3 and at the free ends of the legs of the U. Thus, a ribbed floor 1, once placed, was completely provided with insulating material on the underside. Figure 1a shows such a floor with two floor elements 2 in width. In the past, countless houses have been built with these precursors as floor elements.

[0033] With rising energy costs and insulation requirements for homes and other buildings, the insulation value of a ribbed floor manufactured in this way is no longer sufficient. Or, at least, there is a need to re-insulate such a floor. A known post-insulation consists of placing foil or cloths between the legs of the trapezoidal insulation part 4, and/or between the free ends of the legs of the relevant trapezoidal insulation part 4. As a result, the inside of the trapezoidal insulation part 4 becomes, as it were, protected against air flow to and from the underside of the floor elements 2 by forming chambers. This is quite cumbersome.

[0034] According to the invention, for post-insulation of the ribbed floor 1 from figure 1a, the outer contour on the underside of the floor element 2, i.e. of the downwardly open (stacked) trapezoid shape, is determined. This can be done at the location of a building that needs to be insulated. It is also possible that the specifications of the dimensions, and in particular the cross-sectional profile of the underside of the floor elements, are already known. EPS inserts 5 are then manufactured as an insert module, the outer circumference of which corresponds to the contour on the underside of the floor element 2. These EPS inserts 5 are placed under the ribbed floor 1 (see figure 1b), often in a crawl space or basement, and attached to the underside of the floor elements 2. This can be done simply by means of pins inserted through an insert and the existing insulation, or by means of an adhesive suitable for EPS. When the EPS inserts 5 are fixed in place, a higher insulation value is provided to the ribbed floor 1'.

[0035] Although, provided that (the accessibility of) the space under the ribbed floor allows it, it is conceivable that an insert has a certain length that corresponds to the length of a floor element 2, in practice inserts with a relatively small specific length will be chosen. which are fitted closely together under a floor element, such that a floor element 2 is ultimately provided with inserts 5 over (almost) its entire length. Inserts 5 can also be used with different specific lengths, on the one hand to limit the number of inserts 5 and on the other hand to be able to provide a floor element 2 with inserts 5 over its entire length.

[0036] Figure 2 shows a perspective side view of an EPS insert 5 from the example of Figure 1. Such an insert 5 can be obtained by means of injection molding in a mold or with machining techniques. It does not matter how it is manufactured, as long as the external shape at the top 5a and side edges 5b of the EPS insert 5 matches the contour at the bottom of the floor element 2 in question. The bottom 5c of the insert 5 is straight, so that after post-insulation a space present under the ribbed floor 1' has a flat ceiling or top wall.

[0037] Figures 3a-c show how ribbed floor 1 from figure 1a can be post-insulated according to the present invention with other inserts 15, so that the floor has an even higher insulation value after post-insulation. The ribbed floor 1 requires no further explanation. The shape/dimensions are also known from figures 1. However, in this case, at the bottom of the inserts 15, at least compared to inserts 5 from figures 1b,c, there is an extra layer of insulating material in the shape of a trapezium of which the small and large base are the same length and the legs extend downwards at an angle of more than 90 degrees. In other words, the extra layer of insulation material has the shape of a rectangle.

[0038] From the comparison of Figure 3c with Figure 1c it can easily be deduced that with one and the same method, but with different shapes of the inserts, a thicker insulation layer is provided on the post-insulated ribbed floor 1".

[0039] Figure 4 shows a perspective side view of an

EPS insert 15 from Figure 3. Such an insert 15, like insert 5, can be obtained by means of injection molding in a mold or by machining operations on a block of insulation material. The external shape at the top 15a and side edges 15b of the EPS insert 15 connect to the outer contour at the bottom of the relevant floor element 2. To provide an even higher insulation value than with the method according to figure 1 and the insert 5 from figure 2, an additional layer 17 of insulating material is located below the part 16 corresponding to a trapezoidal free space, which in Figure 4 is bounded by a dotted line. The underside 15c of the insert 15 is straight again, so that after post-insulation, a space 1" under the ribbed floor has a flat ceiling.

[0040] Figures 5a-c schematically show a method according to the present invention in combination with a PS insulation floor 21. The PS insulation floor 21 is also composed of floor elements 22 that extend over a length in a building. The floor elements 22 are composed of a rib 23 and an EPS insulation section 24. In this case, two insulation sections rest on one load-bearing concrete rib 23.

[0041] With the PS insulation floor 21, a load-bearing concrete rib 23 does not, as in the previous exemplary embodiment, span the entire width of an insulation section 24. But the bottom of the insulation section 24 is again in the shape of a double, stacked trapezium, the bottom of which trapezoidal part has the shape of a rectangle.

[0042] As in the first exemplary embodiment, ready-made inserts 25 are provided, which are fixed in the trapezoidal spaces defined by the insulation sections, in order to provide a post-insulated PS floor 21'.

[0043] Perhaps unnecessarily, Figures 6a-c show a combination of the basic form for post-insulating a PS insulation floor 21 from Figures 5a-c and providing the thickened insulation as in Figures 3a-c, by applying inserts 35 with a custom shape instead of inserts 25.

[0044] Figures 7a-c show schematic cross-sectional views of a part of a ribbed floor 1/1‴ to be insulated or that is post-insulated, respectively, according to the present invention. Figures 7a-c show how ribbed floor 1 from figure 1a can be post-insulated according to the present invention with other inserts 45, so that the floor has an even higher insulation value after post-insulation. The ribbed floor 1 requires no further explanation. The shape/dimensions are also known from Figures 1. However, in this case the insert 45 has the shape of a sheet of insulating material. The insert 45, together with insulation part 4 of the floor element 2, closes off an air chamber 46. Both the insert 45 and chamber 46 increase the insulation value of the original ribbed floor 1. Although no dimensions may be derived from the figures, to obtain a certain insulation value, cetiris paribus, an insulation plate 45 is required that is thicker than the extra layer 17 of insert 15 from Figures 3, because the insulation value of chamber 46 is lower than that of trapezoidal part 16 of insert 15.

[0045] Figures 8a-c show schematic cross-sectional views of part of yet another alternative system floor to be insulated according to the present invention. Figures 8a-c schematically show a method according to the present invention in combination with a PS insulation floor 21. However, in comparison with Figures 4 and 5, an insert 55 is used here, of which an upper part of the trapezoidal part 16 is omitted. The insert 55, together with insulation part 4 of the floor element 2, closes an air chamber 56. Both insert 55 and chamber 56 increase the insulation value of the original PS insulation floor 21. This is also possible with a ribbed floor. To obtain a certain insulation value, cetiris paribus, an insulation board 55, the extra layer of which is thicker than the extra layer 17 of insert 15 from Figures 3 is required., because the combined insulation value of the "truncated" trapezoidal part and the chamber 56 is lower than that of trapezoidal part 16 of insert 15.

[0046] After explanation of the embodiments described above, it will be clear that many variants of the method according to the invention, which may or may not be obvious to the skilled person, are conceivable within the scope of protection defined in the following claims. The load-bearing parts of the system floor can be made of another suitable load-bearing material, such as wood or plastic. The insulation material of the insulation parts and the inserts does not have to be cured EPS. Many other insulation materials from which form-retaining elements can be made and which are suitable for attachment to a comparable material are conceivable. The term trapezoidal in this document may be interpreted broadly. For example, the space directed downwards between the legs of the already present insulating material can have the shape of a single, double or multiple trapezoid. It is important that the space is suitable for inserting inserts. For example, in the context of the present invention, an arch may be regarded as trapezoidal, whereby instead of a base and legs in the form of straight lines subtending an angle, curved lines flow smoothly into each other and with some imagination approximate a trapezoidal shape. The bottom of an insert does not have to be flat, or extend parallel to the small base. In that case it is a trapezoid with extra material at the bottom in a, here undefined, shape.

[0047] The exemplary embodiments are based on a ribbed floor and a PS floor. Other types of floors, insulated floors with a downward-facing insulation layer that defines trapezoidal openings, can also be post-insulated using a method according to the present invention.

Reference figure list

[0048]

1	ribbed floor
2	floor element
3	concrete load-bearing part of floor element
4	insulation part of floor element

5	insert
5a	top of 5
5b	side edge of 5
5c	bottom of 5
15	insert
15a	top of 15
15b	side edge of 15
15c	bottom of 15
16	trapezoidal part of 15
17	extra layer of 15
21	PS insulation floor
22	floor element
23	concrete load-bearing part of floor element
24	insulation part of floor element
25	insert
35	insert
45	insert
46	locked chamber
55	insert
56	locked chamber

Claims

1. Method for post-insulating a building with a cantilevered, already insulated system floor of a type corresponding to a ribbed floor or a PS insulation floor, which system floor is provided on the underside with pre-formed insulation elements with an isosceles trapezoidal contour that defines a trapezoidal free space formed by a top as a small base, two legs extending from the top, each of which subtends an angle greater than or equal to 90 degrees with the small base, each leg terminating in a free end, and an imaginary underside as a large base, the method comprising the steps of:

- determining a width of the preformed insulating elements, i.e. the base including a horizontal distance over which the free ends of the legs of the preformed insulating elements extend,
- providing insert modules of insulation material with a width that corresponds to one time or an integer multiple of the width of the preformed insulation elements,
- attaching a plurality of at least substantially form-retaining insert modules of insulating material to the free ends of the legs of the preformed insulating elements, in line with each other, connecting under and/or in the free space, wherein the free space extends over at least substantially its entire length is closed and/or partially or at least substantially completely filled by the plurality of insert modules,

wherein the step of attaching the insert modules coincides with, or is performed after, the step of applying.

2. Method according to claim 1, wherein, if an empty space is created between insulation elements and insert modules when attaching the insert modules, this empty space is completely closed off from the environment.

3. Method according to claim 1 or 2, wherein the insulating material of the insert modules corresponds to the insulating material of the existing system floor, and/or wherein the insulating material comprises a cured plastic foam material, such as PUR or EPS.

4. Method according to one or more of claims 1 to 3, the method further comprising the steps of:

- determining the dimensions of the trapezoidal free space;
- forming form-retaining insert modules of insulating material, with a cross-section that corresponds to the shape of at least a lower part of the free space of the system floor and with a certain length.

5. Method according to claim 4, wherein in the step of forming form-retaining insert modules from insulating material, insert modules with a cross-section that corresponds to the shape of at least substantially the entire free space of the system floor and with a certain length are manufactured.

6. Method according to claim 4 or 5, wherein the system floor comprises two or more trapezoidal free spaces extending parallel to each other and next to each other, and when forming the form-retaining insert modules, at an imaginary underside corresponding to the long base of the trapezoidal space an additional layer of insulating material is formed that extends beyond the corresponding leg of the trapezoid shape on at least one side.

7. according to claim 6, wherein the trapezoidal shape of the trapezoidal free space has a center of gravity, and the additional layer of insulating material extends parallel to the bases of the trapezoidal shape over a distance equal to the distance between the centers of gravity of two adjacent trapezoidal free space spaces.

8. Method according to one or more of the preceding claims, wherein, after insertion modules have been fitted, insulation plates are applied to the underside of insert modules, which then extend parallel to the bases of the trapezoidal space, now filled with one or more insert modules.

9. Method according to one or more of the preceding claims, wherein the determined length is in the range of 20 to 200 cm, preferably in the range of 30-150 cm, furthermore preferably in the range of 54-74 cm or of 110-130 cm.

10. Method according to one or more of the preceding claims, wherein an insert module is attached in the trapezoidal free space using an adhesive material, such as a suitable glue or sealant, and/or wherein an insert module is secured in the trapezoidal free space using pins.

11. Method according to one or more of claims 5-10, wherein forming the form-retaining insert modules of insulating material comprises the steps of:

- providing a, preferably cube-shaped, block of insulating material; and
- processing the block, preferably by cutting, until it has at least substantially the cross-section that corresponds to the shape of at least a lower part of the free space of the system floor and with a certain length.

12. Method according to one or more of the preceding claims, wherein the trapezoidal free space preferably has parts projecting in the transverse direction and downwards, such as with a ribbed floor, and where adapted insert modules are provided with recesses corresponding to the projecting parts, and/or wherein the insert modules are introduced into a crawl space of a building through a hole in a floor and are attached to the underside of a system floor.

13. Method according to one or more of the preceding claims, wherein the steps of determining a width of the preformed insulating elements, providing insert modules of insulating material and attaching a plurality of at least substantially form-retaining insert modules of insulating material, be carried out at least one year, preferably at least five years, furthermore preferably at least ten years or 15 years after the system floor has been provided,

14. Insert module, formed according to claim 1, designed for attachment in a shape-corresponding free space of an insulating floor.

15. Cantilevered system floor post-insulated according to a method of one or more of claims 1 to 13, the system floor originally already comprising a layer of insulation material on an underside, wherein trapezoidal, originally free spaces at the underside of the system floor are closed by plate-shaped inserts as defined in claim 1 or filled with insert modules according to claim 14.

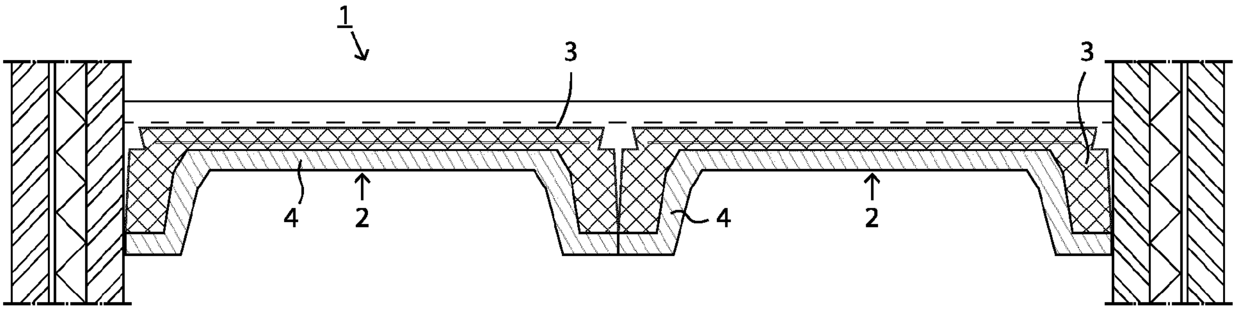

Fig. 1a

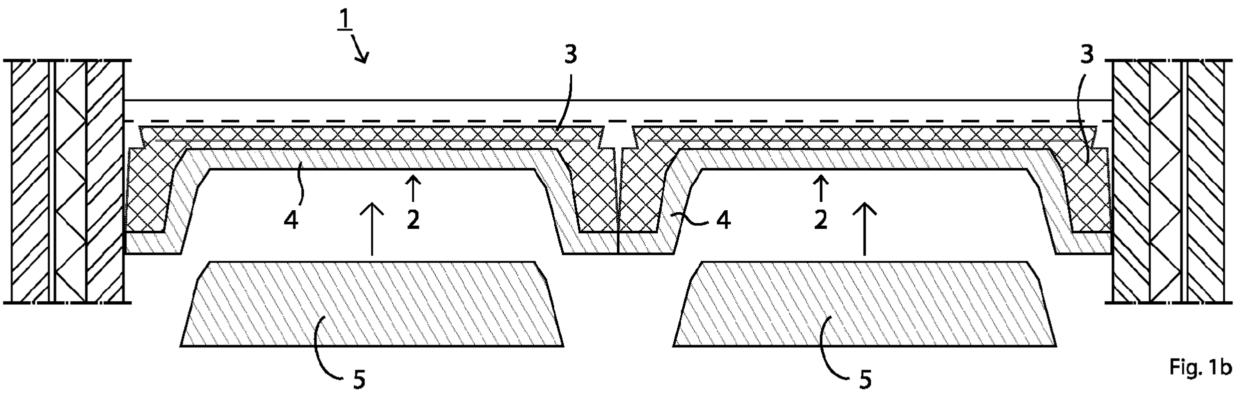

Fig. 1b

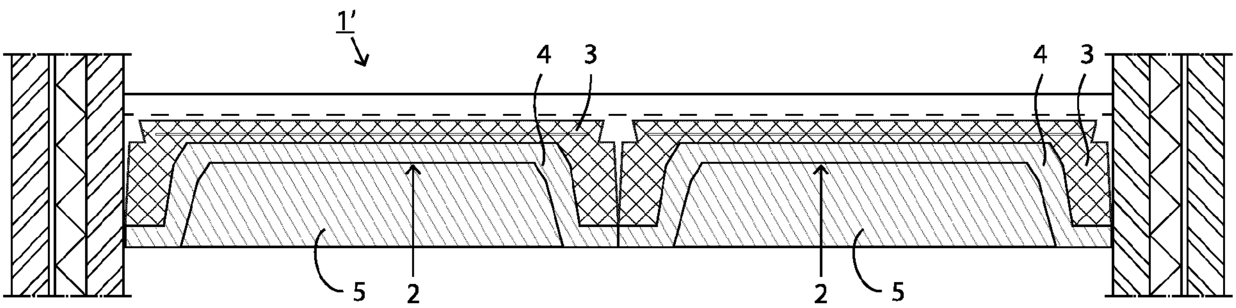

Fig. 1c

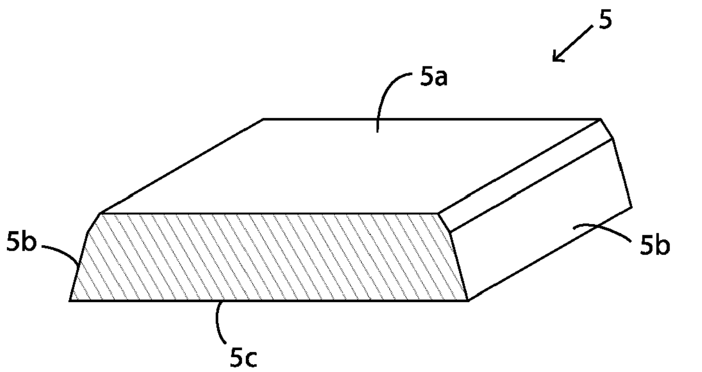

Fig. 2

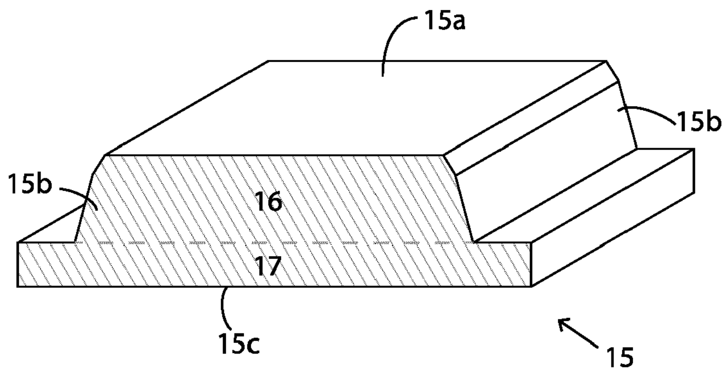

Fig. 4

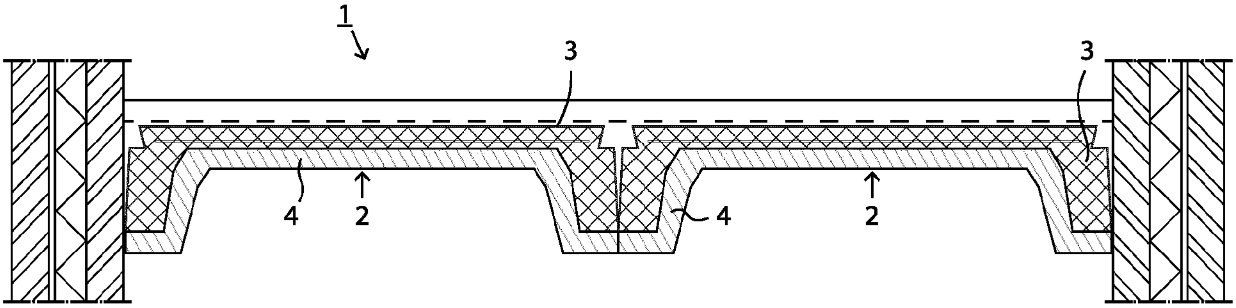

Fig. 3a

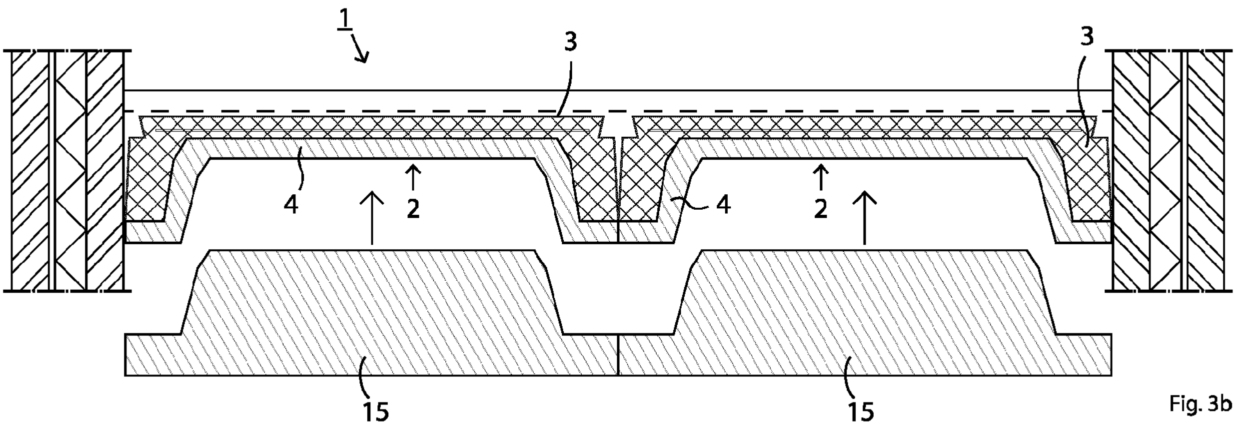

Fig. 3b

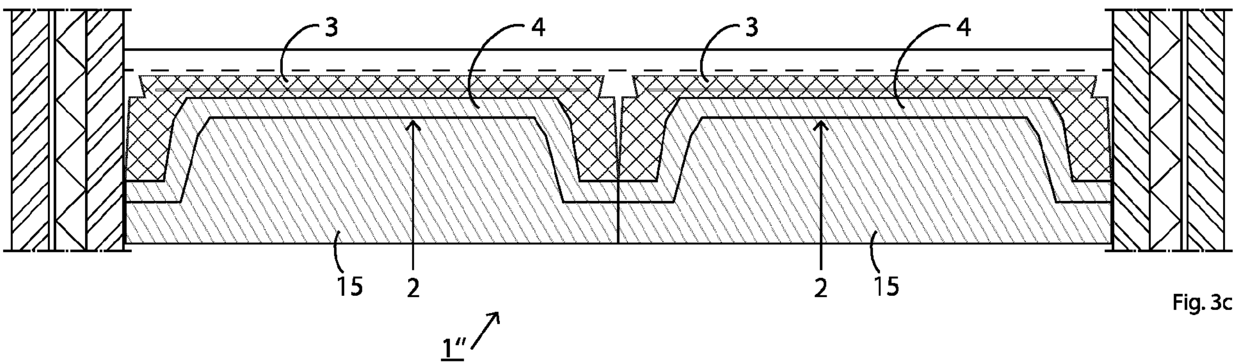

Fig. 3c

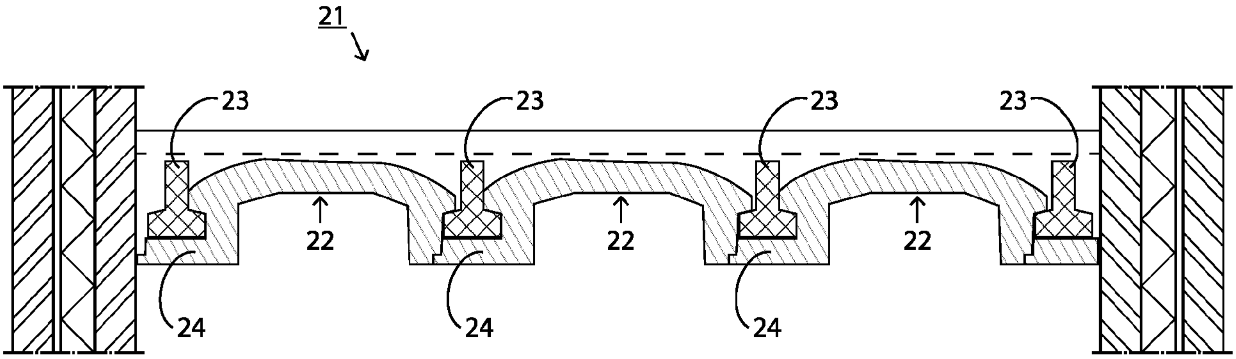

Fig. 5a

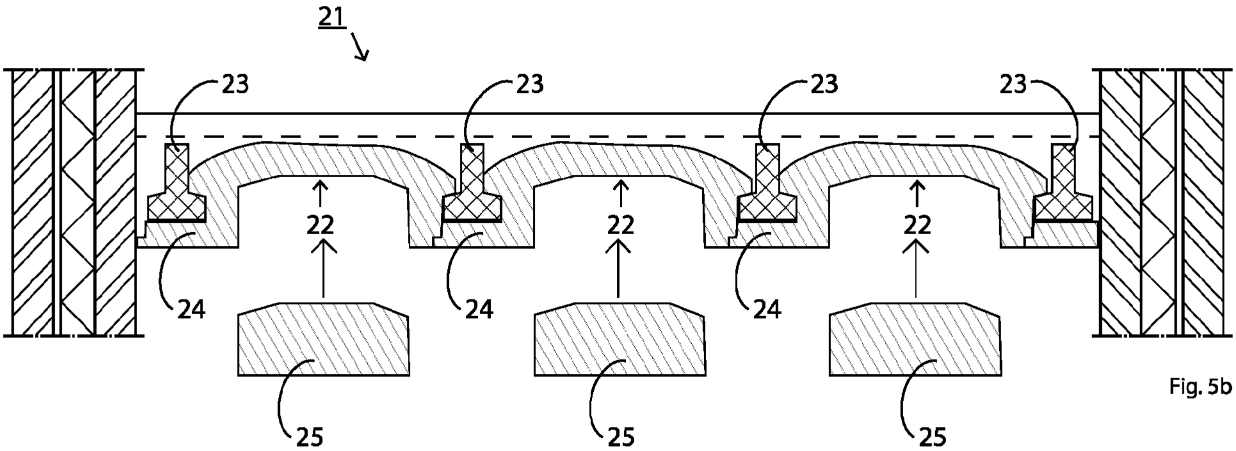

Fig. 5b

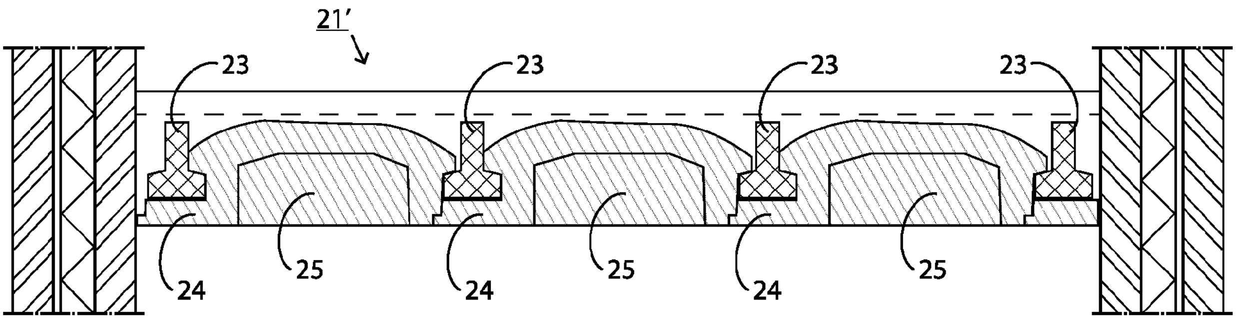

Fig. 5c

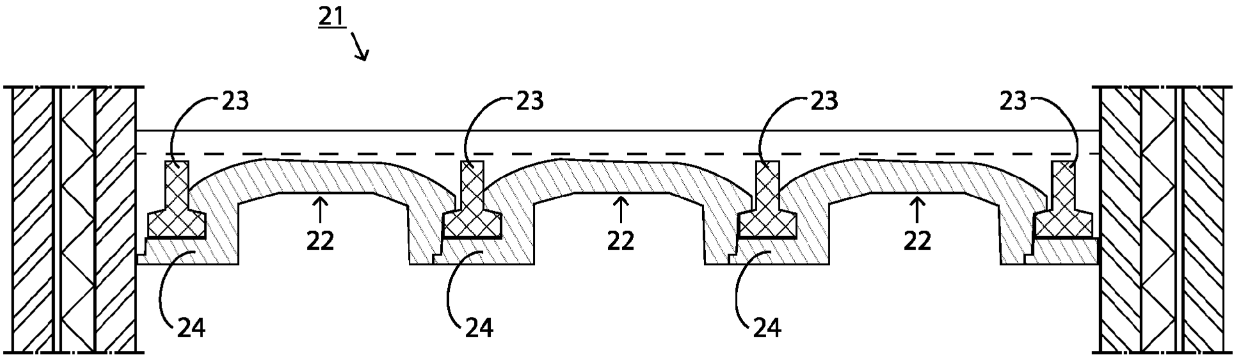

Fig. 6a

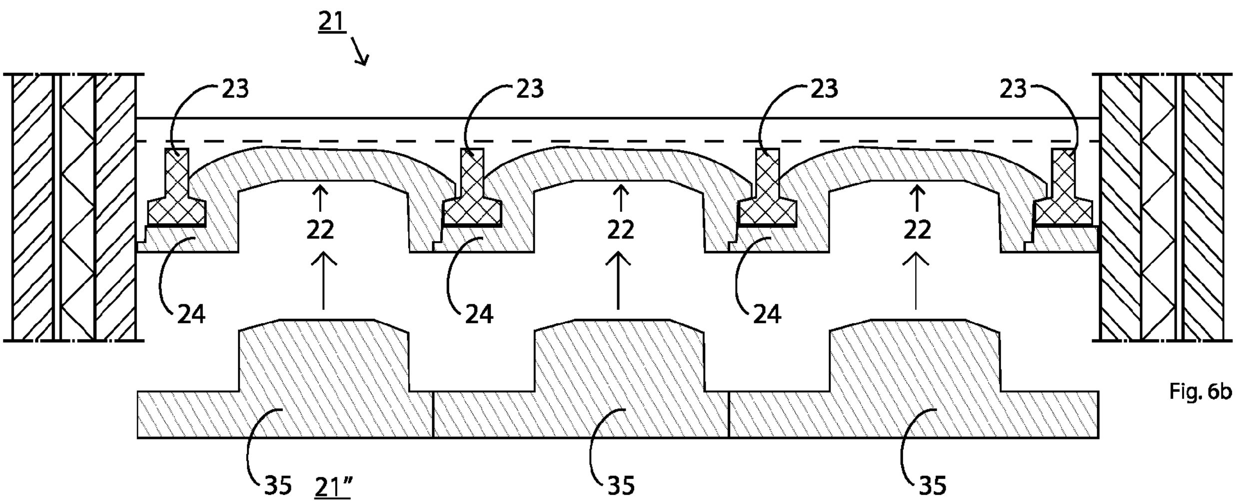

Fig. 6b

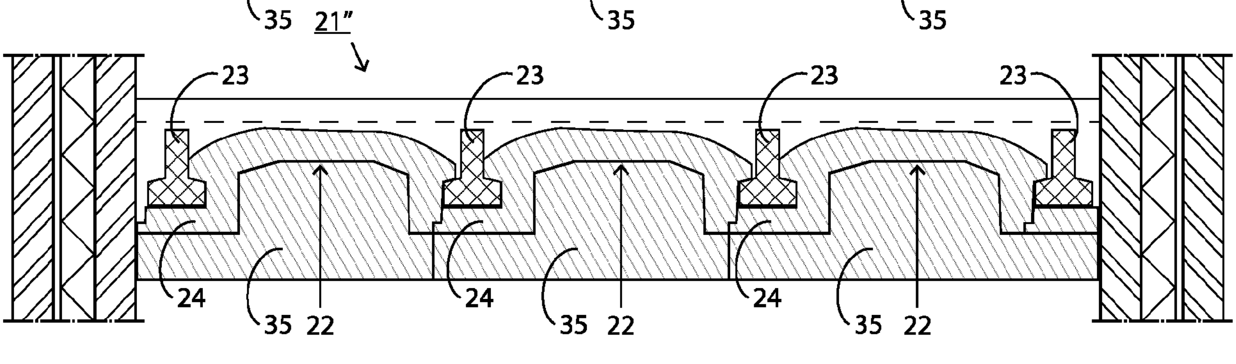

Fig. 6c

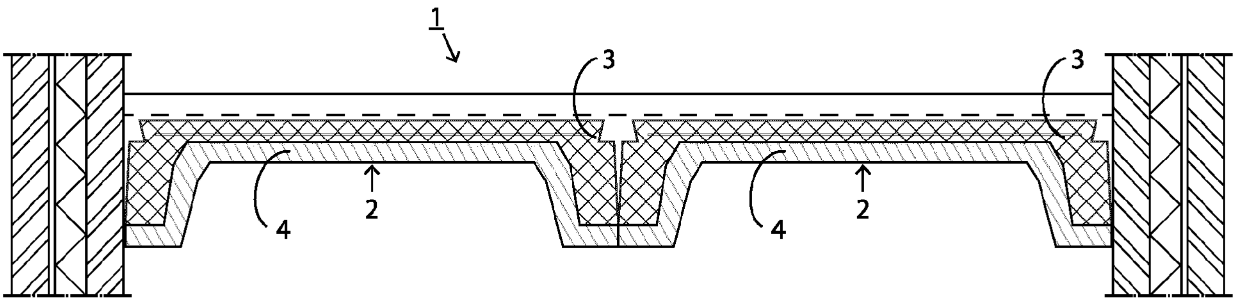

Fig. 7a

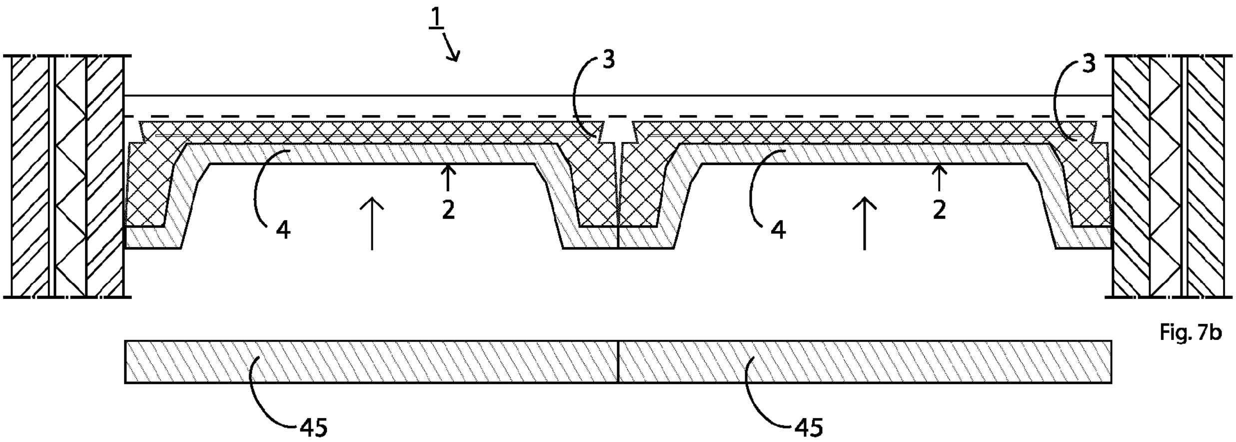

Fig. 7b

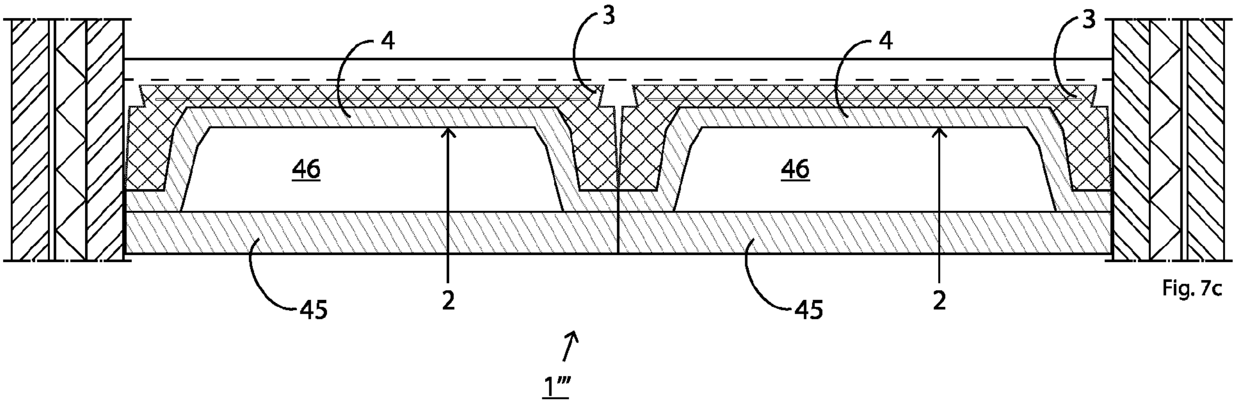

Fig. 7c

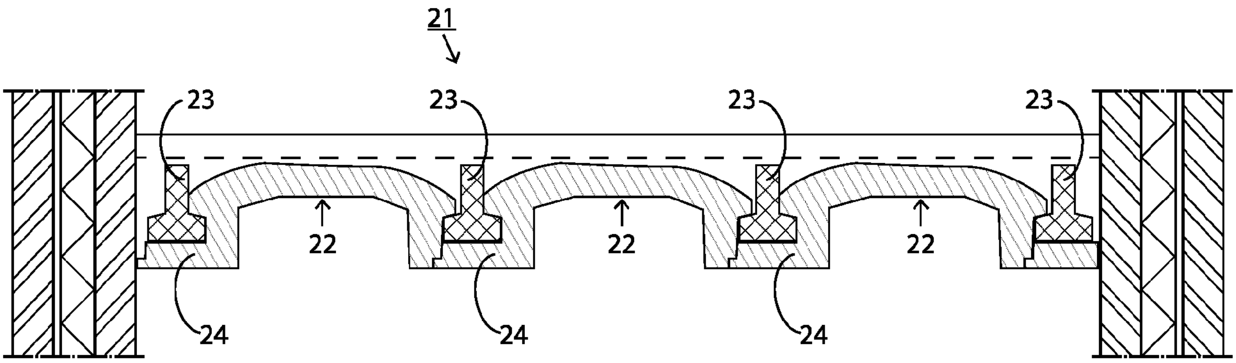

Fig. 8a

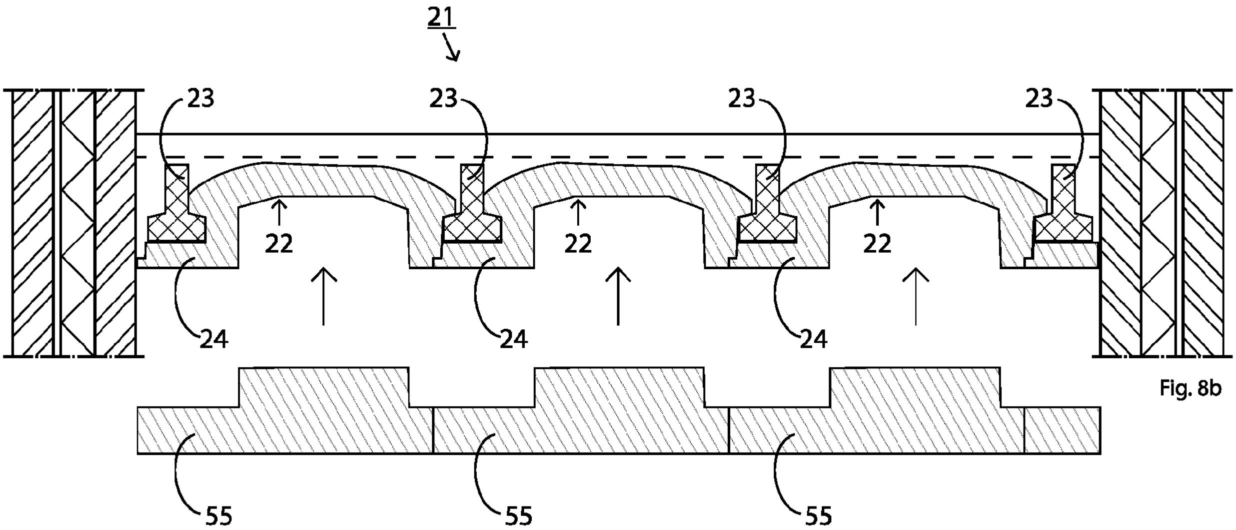

Fig. 8b

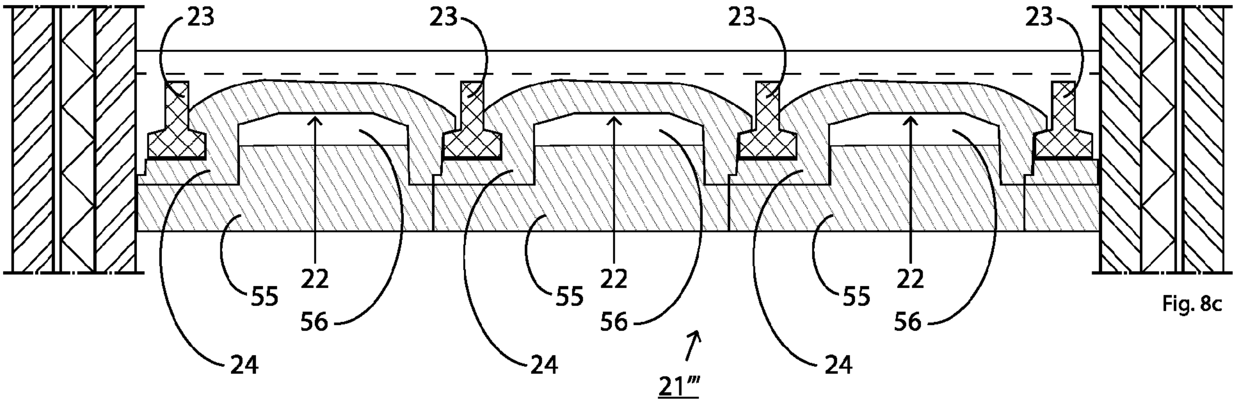

Fig. 8c

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EUROPEAN SEARCH REPORT

Application Number
EP 24 16 7281

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 895 001 A1 (RECTOR LESAGE SA [FR]) 22 June 2007 (2007-06-22) * figures 1-7 * * page 5, line 13 - line 16 * * page 8, line 20 * * page 6, line 19 - line 23 * * page 7, line 20 - line 22 * * page 10, line 24 - line 29 * -----	1-15	INV. E04B5/08 E04B5/26 E04B1/76
X	AT 391 906 B (MESZAROS PETER ING [AT]) 27 December 1990 (1990-12-27) * figures 1-10 * -----	1-15	
X	US 9 249 571 B1 (WHITE ARTHUR PAUL [US]) 2 February 2016 (2016-02-02) * figures 1-27 * -----	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	1 August 2024	Petrinja, Etiel

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01-08-2024

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