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(54) **INSULATION BOARD**

(57) The present invention relates to an insulation board for being assembled on the roof of a construction, wherein said insulation board gives form to a self-ventilated air chamber in conjunction with said roof. The invention also relates to a method of assembly of at least one pair of said insulation boards, a structure assembled from two or more of said insulation boards being obtained.

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Description

OBJECT OF THE INVENTION

[0001] The present invention relates to an insulation board for being assembled on the roof of a construction, wherein said insulation board gives form to a self-ventilated air chamber in conjunction with said roof. The invention also relates to a method of assembly of at least one pair of said insulation boards, a structure assembled from two or more of said insulation boards being obtained.

BACKGROUND OF THE INVENTION

[0002] The roof of a building can be insulated by means of two different solutions known in the state of the art.

[0003] First, insulation is possible by means of which is referred to as a conventional roof, arranging an insulating board on the roof slab of the building, and arranging on said board a series of additional layers, such as a vapor barrier, slope formation, waterproofing layers, or surface finishing layers, for example, by means of pavement.

[0004] Another option for insulating is obtained by means of what is referred to as an inverted roof. In this case, the slope formation is arranged on the roof slab of the building, with waterproofing and thermal insulation layers being added thereafter. Then heavy-duty protection, such as gravel or concrete, is positioned on the thermal insulation to prevent it from being lost due to adverse conditions such as the air, to prevent it from moving, and also to provide a better surface for walking on should that be necessary.

[0005] Both solutions are suitable for climates with low or medium solar radiation, given that they are intended for palliating the effects of the air temperature or of air condensation on the roofs of buildings.

[0006] Nevertheless, in climates with high solar radiation, such as tropical or subtropical climates, the present solutions are ineffective given that the solar radiation striking heavy-duty finish materials of this type with a high thermal inertia produces, in these cases, temperatures exceeding air temperatures which are furthermore maintained over long periods of time.

[0007] This means that the roof of the insulated building is exposed, for long periods of time, to the effects of high solar radiation, leading to an inefficient insulation of the building at issue caused by overheating due to the mentioned high solar radiation.

DESCRIPTION OF THE INVENTION

[0008] The present invention proposes a solution to the aforementioned problems by means of an insulation board according to claim 1 and a method of assembly of two of said insulation boards according to claim 13. Preferred embodiments of the invention are defined in the dependent claims.

[0009] A first inventive aspect provides *an insulation board for being assembled on the roof of a construction, comprising:*

- *a body defining a plane (X) and comprising a first surface and a second surface opposite the first surface,*
- *a plurality of protrusions with a base on the first surface,*

wherein:

- *the second surface comprises at least one slot at a first end and at least one projection at a second end that are complementary to one another, and*
- *each slot defines a space configured for housing a projection of an adjacent insulation board, maintaining a separation between each slot and projection so as to give form to a ventilation opening.*

[0010] The present insulation board, configured by means of a plane (X), protects the roof, or the waterproofing of said roof, against receiving direct solar radiation, while at the same time allows, through the combination of the plurality of protrusions of the insulation board and of the ventilation opening defined in the space between a slot and the corresponding projection of two adjacent insulation boards, ventilation of this roof, therefore configuring a self-ventilated insulation board.

[0011] Throughout this document, the term "self-ventilated board" will be understood as corresponding to a board which allows, by means of its configuration, the formation of a chamber that allows housing a fluid, for example air, on the roof of a building, allowing the continuous circulation of an air flow over the surface of the roof of the building.

[0012] That is, the insulation board of this first inventive aspect simultaneously allows insulating the building in question, as well as configuring a ventilated chamber housing a fluid, for example air, between the insulation board and the actual roof of the building, which is permanently ventilated and prevents direct radiation of the Sun on said roof.

[0013] This ventilated chamber, preferably ventilated air chamber, is obtained first from the separation caused by the plurality of protrusions of the insulation board. That is, the plurality of protrusions positioned on the first surface create a space between said first surface and the roof of the building to be insulated which allows housing a volume of air.

[0014] The insulation board is thereby positioned on the surface of the roof of the building through the support of said plurality of protrusions, the second surface therefore being exposed to direct solar radiation. In turn, the insulation board is preferably immobilized under a heavy-duty protection, such as gravel or concrete, applied on said insulation boards or incorporating during manufac-

ture a layer of lightweight concrete or any other material having these characteristics on the actual exposed surface of the insulation board.

[0015] These protrusions, configured in a grid pattern on the first surface, can be obtained by means of a molding, extrusion, or forming method, among others.

[0016] Additionally, secondly the volume of air generated between the first surface of the insulation board and the surface of the roof of the building is kept self-ventilated by means of the tongue-and-grooving configured by means of a slot of an insulation board and the corresponding projection of an adjacent insulation board, in the operative position, which allow the continuous renewal of the volume of air housed in the space defined between said first surface and the roof of the building to be insulated.

[0017] In a particular embodiment, the ventilation opening is obtained by means of the partial overlapping of two adjacent insulation boards.

[0018] This configuration of the insulation board allows it to be assembled with at least two adjacent boards, connected on one side, by means of a slot positioned at the first end, and on the other hand, with a projection positioned at the second end of the insulation board. This assembly allows preventing, along the attachment perimeter of these adjacent insulation boards, direct solar radiation from entering and hitting the roof of the building through a partial separation between each slot and projection. That is, spaces or open areas are formed between each slot and projection of two adjacent insulation boards.

[0019] Advantageously, a configuration of this type of insulation board allows obtaining a flat and lightweight panel, having dimensions that can be handled by an operator for being installed on the roof of the building.

[0020] Additionally, and as a more advantageous feature, said configuration allows obtaining a self-ventilated insulation by means of an airstream that prevents direct solar radiation from entering and hitting the roof of the building while at the same time it allows reducing the temperature of said roof and the thermal inertia of the insulation board itself, as well as preventing the air from condensing on the actual roof of the building, the insulation board also acting as a vapor barrier for said roof. In turn, these effects increase the energy efficiency of the building.

[0021] The design of the present insulation board allows it to be manufactured by repetition of the same type of board, so it is therefore a low-cost manufacturing process.

[0022] In a particular embodiment, the first end and the second end are opposite ends. That is, the at least one slot and the at least one projection are positioned at opposite ends of the plane formed by the insulation board, the assembly thereof with two adjacent insulation boards, one at each end, thereby being allowed.

[0023] In a particular embodiment, the body is essentially configured as a parallelepiped, comprising four ends, and wherein two of the ends of the second surface are first ends with slots and the other two ends of the second surface are second ends with projections.

[0024] This configuration of the insulation board, which allows an identical assembly with adjacent boards on all four of its sides, prevents direct solar radiation from entering and hitting the roof of the building along the entire perimeter of said insulation board.

[0025] In a particular embodiment, the plurality of protrusions is perpendicular to plane (X). This allows the space created as a chamber housing a fluid between the first surface and the roof of the building to be homogenous over the entire area of said first surface.

[0026] In a particular embodiment, the protrusions are distributed across the entire first surface of the body, which improves the support of the insulation board on the roof of the building, said board being more stable.

[0027] In a particular embodiment, the plurality of protrusions comprise a flat end opposite the base thereof configured for being supported on a roof (C) of a construction. This allows said protrusions to be completely and stably supported on the flat surface of the roof of the building on which the insulation board is installed.

[0028] In a particular embodiment, two adjacent protrusions of one and the same insulation board are separated from one another by a space, said space defining a chamber (Q) configured for housing a fluid, preferably air.

[0029] In a particular embodiment, the ventilation opening allows the passage of an air flow from the chamber (Q) to outside the insulation board. That is, there is direct fluid communication between the chamber defined between the roof of the building and the insulation board and the outside of the insulation board, i.e., ambient air.

[0030] In a particular embodiment, the slot and the projection are configured such that when said projection is housed in the slot the ventilation opening has a zigzag configuration, a zigzag-shaped path being generated for air coming from the outside of the board into the chamber (Q).

[0031] In a particular embodiment, the protrusions are integral with the first surface, such that the formation of the insulation board is continuous and there is no coupling between said first surface and each of the protrusions.

[0032] In a particular embodiment, the protrusions integral with the first surface are obtained either through a forming process to give form to the body of the insulation board or by means of sunken-relief.

[0033] This advantageously allows obtaining a single part, without couplings or attachment elements, where it may be more resistant and allows being manufactured from various materials, such as clay, cement with fibers, plastics, or rubbers, etc., ecological materials for the most part.

[0034] Additionally, this type of configuration allows better stacking between boards, and it allows replacing the heavy-duty protection required on its outer surface

with filler materials in the gaps created as a consequence of the sunken-relief configuration such as dirt, gravel, water, concrete, etc.

[0035] In a particular embodiment, the ventilation opening goes straight from the chamber to the outside, and its path is flared, configuring an additional space or chamber through which air can circulate from the roof (C) to the outside of the insulation board.

[0036] In a second inventive aspect, the invention provides a *method of assembly of two insulation boards, comprising the following steps:*

a) providing two insulation boards according to the first inventive aspect,
b) resting the plurality of protrusions of the first one of the insulation boards such that they are supported on a roof (C) of a construction,
c) positioning the second one of the insulation boards adjacent to the first one of the insulation boards,
d) housing each projection of one of the ends of the second one of the insulation boards in a slot of one of the ends of the first one of the insulation boards, and
e) resting the plurality of protrusions of the second one of the insulation boards such that they are supported on the roof (C) of the construction.

[0037] By means of repetition, this method allows the installation of successive boards adjacent to the last board that was assembled, said installation being performed by one and the same operator.

[0038] In a particular embodiment, to carry out steps b) and e) the insulation boards are set up on the roof of the building, being kept in their stable position by the weight of the heavy-duty protection applied on said insulation boards or by incorporating during manufacture a thin layer of lightweight concrete or any other material on said insulation boards.

[0039] In a particular embodiment, the method of the second inventive aspect additionally comprises the step of:

f) covering the second surface of the body of each of the insulation boards with heavy-duty protection or self-protective finish.

[0040] In a particular embodiment, steps c) to e) of the method of this second inventive aspect are repeated successively with an additional insulation board, thereby configuring an assembly of insulation boards across the entire roof (C) of the construction.

[0041] All the features and/or steps of the methods described in this specification (including the claims, description, and drawings) can be combined in any combination, with the exception of combinations of such mutually exclusive features.

DESCRIPTION OF THE DRAWINGS

[0042] These and other features and advantages of the invention will become apparent from the following detailed description of a preferred embodiment, given only by way of illustrative and non-limiting example in reference to the attached figures.

Figures 1A-1b	These figures show a perspective view from an upper and lower viewpoint, respectively, of an embodiment of an insulation board.
Figure 2	This figure shows a plan view of the embodiment of the insulation board shown in Figures 1A and 1B.
Figure 3	This figure shows a section view of the embodiment of the insulation board shown in the preceding figures.
Figure 4	This figure shows a plan view of the assembly of two insulation boards according to an embodiment of said insulation board shown in the preceding figures.
Figures 5A-5B	These figures show a section view and a detail of said section view, respectively, of the assembly shown in Figure 4.
Figures 6A-6B	These figures show a plan view and a front view, particularly a section view, respectively, of the assembly of another embodiment of an insulation board.
Figure 7	This figure shows a perspective view of the embodiment of the insulation board shown in Figures 1A and 1B, assembled on a roof of a building.

DETAILED DESCRIPTION OF THE INVENTION

[0043] Figures 1A and 1B show a perspective view of an embodiment of the insulation board (1).

[0044] In particular, Figure 1A shows, from an upper viewpoint, the perspective view of an embodiment of an insulation board (1).

[0045] In this figure, the body (2) configuring the insulation board (1) can be observed, said body being a regular parallelepiped, with a repeated configuration along all four of its sides.

[0046] This figure shows the second surface (2.2) of the board (1), which defines plane (X), said second surface (2.2) comprising a finish which allows receiving any other material if it were needed. This second surface (2.2) is in direct contact with the outer or ambient air or, in case of receiving any other material, in contact with said ambient air through the additional material.

[0047] As can be observed in this figure, the four sides of the body (2) comprise projections (4.2) and/or slots (4.1) which allow it to be assembled with adjacent insulation boards (1) on all sides of said body (2). The insulation board (1) shown is symmetrical.

[0048] Additionally, a plurality of protrusions (3) can be observed on the side opposite the side shown in this Fig-

ure 1A, depicted by means of the discontinuous lines present on the second surface (2.2).

[0049] These protrusions (3) can be observed clearly in Figure 1B, which shows the same perspective view of the insulation board (1), this time from a lower viewpoint.

[0050] In this case, this allows distinguishing the first surface (2.1) of the body (2), on which the protrusions (3) are uniformly distributed.

[0051] The configuration of projections (4.2) and slots (4.1) present along the edges of the four sides of the body (2) which allow coupling with the corresponding insulation boards (1) positioned adjacently thereto can also be observed in this figure.

[0052] Figure 2 shows in greater detail the particular configuration of the slots (4.1) on each of the sides of the body (2). Said slots (4.1) are machined on the second surface (2.2) and extend along part of the thickness of the body (2).

[0053] Additionally, the projections (4.2), which are also configured on the second surface (2.2) and positioned after each slot (4.1), a homogeneous tongue-and-grooving thus being defined on the four sides of the body (2), are shown.

[0054] The configuration of both the slots (4.1) and the projections (4.2) on the body (2) of the board (1) is a flat configuration, according to defined plane (X) of the body (2).

[0055] Figure 3 shows the section view of the same body (2) which can be observed in the preceding figure (Figure 2), one of the sides of said body (2) thus being seen.

[0056] Again, the configuration of the projections (4.2) on the second surface (2.2), as well as the slot (4.1) machined on said second surface (2.2) can be seen.

[0057] The plurality of protrusions (3) with a flat base (3.1), uniformly distributed on the first surface (2.1) and positioned perpendicular to said first surface (2.1), can also be observed in this figure.

[0058] As can be observed in this figure, there is defined between two adjacent protrusions (3) the space of a chamber (Q) which allows housing a volume of air between both protrusions (3) and the roof (C) of the building (not shown in this figure) on which all the bases (3.1) of the protrusions (3) are supported in a situation of use of the board (1). All the chambers (Q) defined between pairs of protrusions (3) are communicated with one another, therefore the space formed by the different chambers (Q) being a single common space.

[0059] The volume of air housed between pairs of protrusions (3) is uniform, since said protrusions (3) are homogeneous and uniformly distributed on the second surface (2.2). Said chambers (Q) are communicated with one another, being a common space between all the protrusions (3) and the roof (C).

[0060] Figure 4 shows the plan view of the assembly of two insulation boards (1). Said assembly takes place by means of coupling one side of each board (1), the assembly of three additional boards (1) on the remaining sides of each of the boards (1) shown being possible.

[0061] The coupling of both flat boards (1) allows defining a parallel surface at the same level, keeping plane (X) defined for each of the boards (1).

[0062] As shown in the center of the figure, the two boards (1) are coupled through the configuration of slots (4.1) and projections (4.2) on the side to be coupled of each body (2) of board (1), positioned in a corresponding manner, matching up the slots (4.1) of one of the boards (1), on the left in the figure, with the projections of the adjacent board (1), on the right in the figure.

[0063] After the coupling of each pair of said elements (4.1, 4.2), the formation of the ventilation opening (5) as a free space defined between the slot (4.1) and its corresponding projection (4.2) can be observed.

[0064] This coupling and the configuration of the ventilation opening (5) are shown in Figure 5A, this figure being the section view of the same assembly shown in Figure 4.

[0065] In this case, as well as in Figure 5B, which shows a detail view of the coupling of both bodies (2) through a partial overlap of both insulation boards (1), it can be observed how the ventilation opening (5) is defined with a zigzag-shaped path, communicating the first surfaces (2.1) with the outside of the second surfaces (2.2) of both bodies (2), thereby allowing air flow.

[0066] Additionally, the possibility of coupling an additional insulation board (1) on the slot (4.1) of the board (1) positioned on the right side of the figure, as well as another additional insulation board (1) on the projection (4.2) of the board (1) positioned on the left side of the figure can be observed in Figure 5A.

[0067] Figure 7 shows a plurality of insulation boards (1) configured according to the preceding embodiment, once said boards have been assembled on the roof (C) of the building.

[0068] It can particularly be observed how boards (1) adjacent to one another form ventilation openings (5) through which there circulates the air coming from the common chamber generated between the surface of the roof (C) and the first surface (2.1) of each board (1) due to the space generated between said surfaces by the plurality of protrusions (3).

[0069] Moreover, Figures 6A and 6B show a second embodiment of an insulation board (1).

[0070] In particular, Figure 6A shows a plan view of two adjacent insulation boards (1) already assembled together through the coupling of one side of each body (2) of each of the boards (1). This coupling of both flat boards (1) allows defining a parallel surface at the same level, keeping plane (X) defined for each of the boards (1), as occurred in the assembly of Figures 5A and 5B.

[0071] As shown in the center of the figure, the two boards (1) are coupled through the configuration of slots (4.1) and projections (4.2) on the side to be coupled of each body (2) of board (1), positioned in a corresponding manner, and said slots (4.1) alternating with said projections (4.2) along the perimeter of each body (2).

[0072] After the coupling of each pair of said elements (4.1, 4.2), the formation of the ventilation opening (5) as a free space defined between the slot (4.1) and its corresponding projection (4.2) can be observed, similarly to the configuration of Figure 5A.

[0073] The mentioned coupling and the resulting ventilation opening (5) are shown in the section view in Figure 6B, said section view being a front detailed view of the coupling of both bodies (2).

[0074] In this case, the integral configuration of each insulation board (1) is shown, wherein each protrusion (3) is integral with the surface of the body (2), with no attachments or couplings between them. This allows the protrusions (3) to be distributed homogeneously and continuously, formed directly on the first surface (2.1) of each board (1). Like in the preceding examples, these protrusions (3) form a continuous cavity (Q) through which there circulates air between the roof (C) on which they are assembled and the outside.

[0075] Again, and through a partial overlap of both insulation boards (1), it can be observed how the ventilation opening (5) is defined with a straight path, where said path is flared in one area, an intermediate additional cavity being formed between the first surface (2.1) of each board (1) and the outside. This opening (5) comprising the mentioned flaring of its path allows the communication of the first surfaces (2.1) with the outside of the second surfaces (2.2) of both bodies (2), thereby allowing air flow from the chamber (Q) formed on the roof (C) of the building.

Claims

1. An insulation board (1) for being assembled on the roof (C) of a construction, comprising:

- a body (2) defining a plane (X) and comprising a first surface (2.1) and a second surface (2.2) opposite the first surface (2.1),
- a plurality of protrusions (3) with a base on the first surface (2.1),

wherein:

- the second surface (2.2) comprises at least one slot (4.1) at a first end (2.2.1) and at least one projection (4.2) at a second end (2.2.2) that are complementary to one another, and
- each slot (4.1) defines a space configured for housing a projection (4.2) of an adjacent insulation board, maintaining a separation between each slot (4.1) and projection (4.2) so as to give form to a ventilation opening (5).

2. The insulation board (1) according to claim 1, whereat the first end (2.2.1) and the second end (2.2.2) are opposite ends.

3. The insulation board (1) according to any of the preceding claims, wherein the body (2) is essentially configured as a parallelepiped, comprising four ends, and wherein two of the ends of the second surface (2.2) are first ends (2.2.1) with slots (4.1) and the other two ends of the second surface (2.2) are second ends (2.2.2) with projections (4.2).

4. The insulation board (1) according to any of the preceding claims, wherein the plurality of protrusions (3) is perpendicular to plane (X).

5. The insulation board (1) according to any of the preceding claims, wherein the protrusions (3) are distributed across the entire first surface (2.1) of the body (2).

6. The insulation board (1) according to any of the preceding claims, wherein the plurality of protrusions (3) comprise a flat end (3.1), opposite the base thereof, configured for being supported on a roof (C) of a construction.

7. The insulation board (1) according to any of the preceding claims, wherein two adjacent protrusions (3) are separated from one another by a space, said space defining a chamber (Q) configured for housing a fluid.

8. The insulation board (1) according to the preceding claim, wherein the ventilation opening (5) allows the passage of an air flow from the chamber (Q) to outside the insulation board (1).

9. The insulation board (1) according to any of the preceding claims, wherein the slot (4.1) and the projection (4.2) are configured such that when said projection (4.2) is housed in the slot (4.1) the ventilation opening (5) has a zigzag configuration.

10. The insulation board (1) according to any of the preceding claims, wherein the plurality of protrusions (3) are integral with the first surface (2.1).

11. The insulation board (1) according to claim 10, wherein the plurality of protrusions (3) are obtained by means of giving form to the body (2).

12. The insulation board (1) according to any of claims 10 or 11, wherein the ventilation opening (5) has a flared configuration.

13. A method of assembly of two insulation boards (1), comprising the following steps:

a) providing two insulation boards (1) according to any of claims 1 to 12,
b) resting the plurality of protrusions (3) of the

first one of the insulation boards (1) such that they are supported on a roof (C) of a construction,

c) positioning the second one of the insulation boards (1) adjacent to the first one of the insulation boards (1),

d) housing each projection (4.2) of one of the ends of the second one of the insulation boards (1) in a slot (4.1) of one of the ends of the first one of the insulation boards (1), and

e) resting the plurality of protrusions (3) of the second one of the insulation boards (1) such that they are supported on the roof (C) of the construction.

14. The method of assembly according to claim 13, additionally comprising the step of:

f) covering the second surface (2.2) of the body (2) of each of the insulation boards (1) with heavy-duty protection or self-protective finish.

15. The method of assembly according to any of claims 13 and 14, wherein steps c) to e) are repeated successively with an additional insulation board (1), thereby configuring an assembly of insulation boards (1) across the entire roof (C) of the construction.

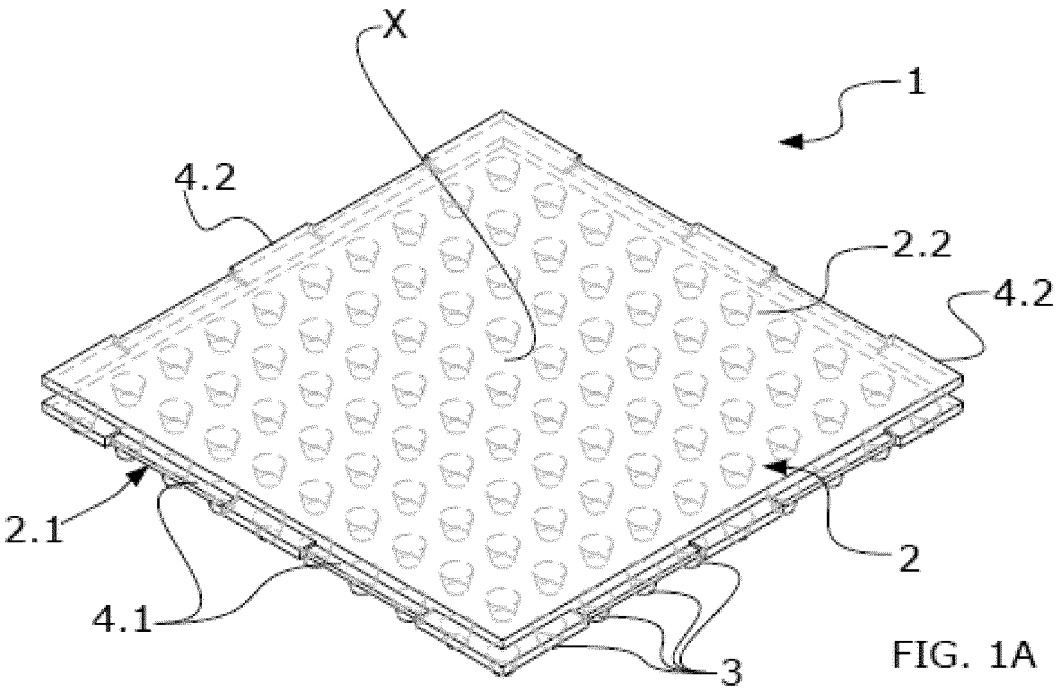

FIG. 1A

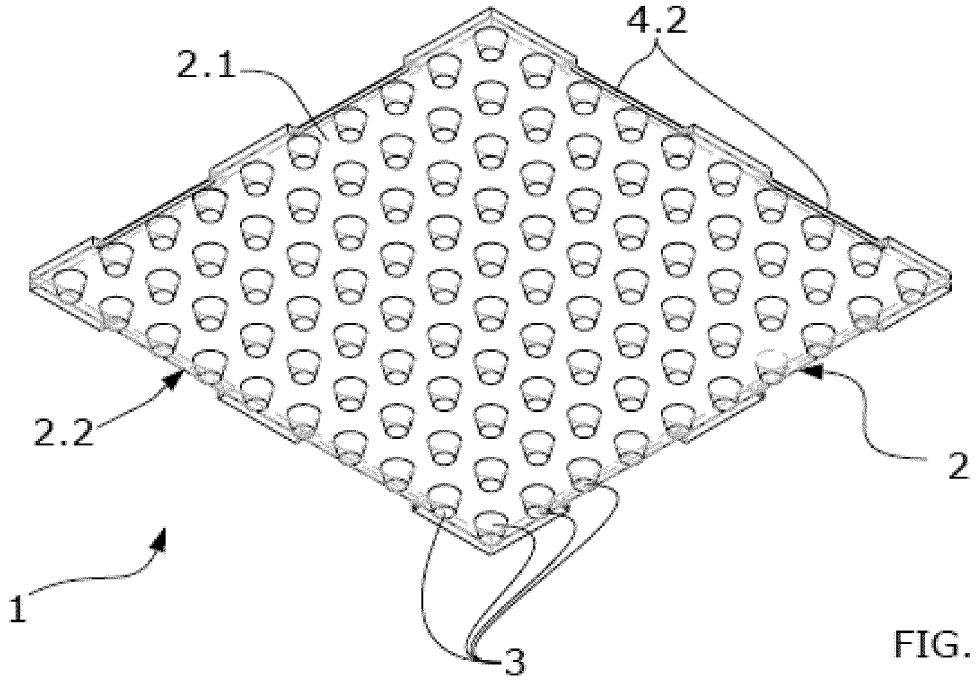

FIG. 1B

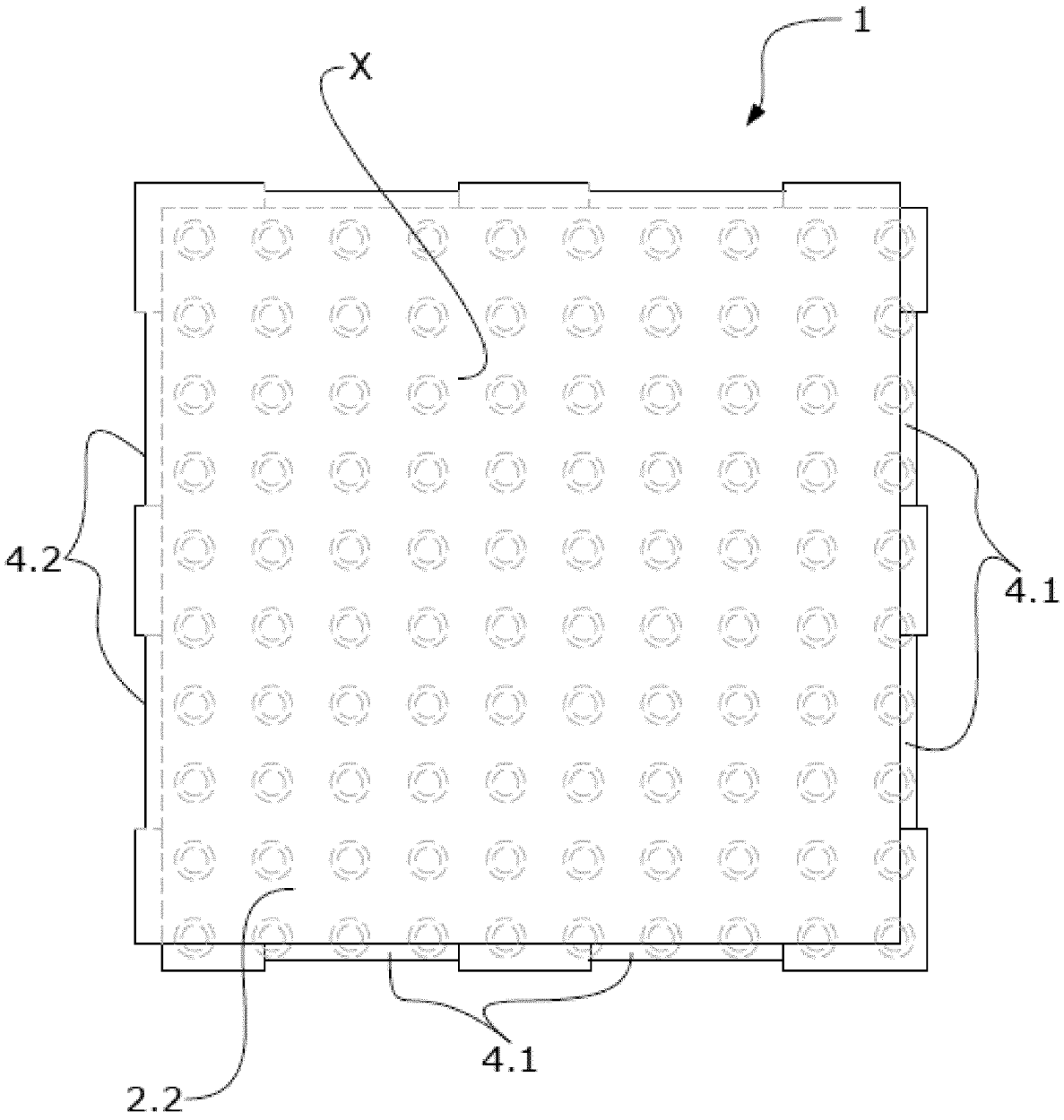

FIG. 2

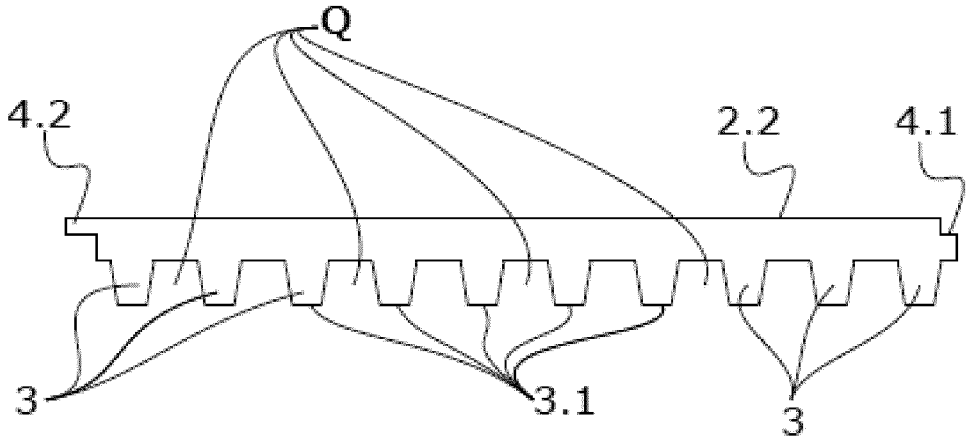

FIG. 3

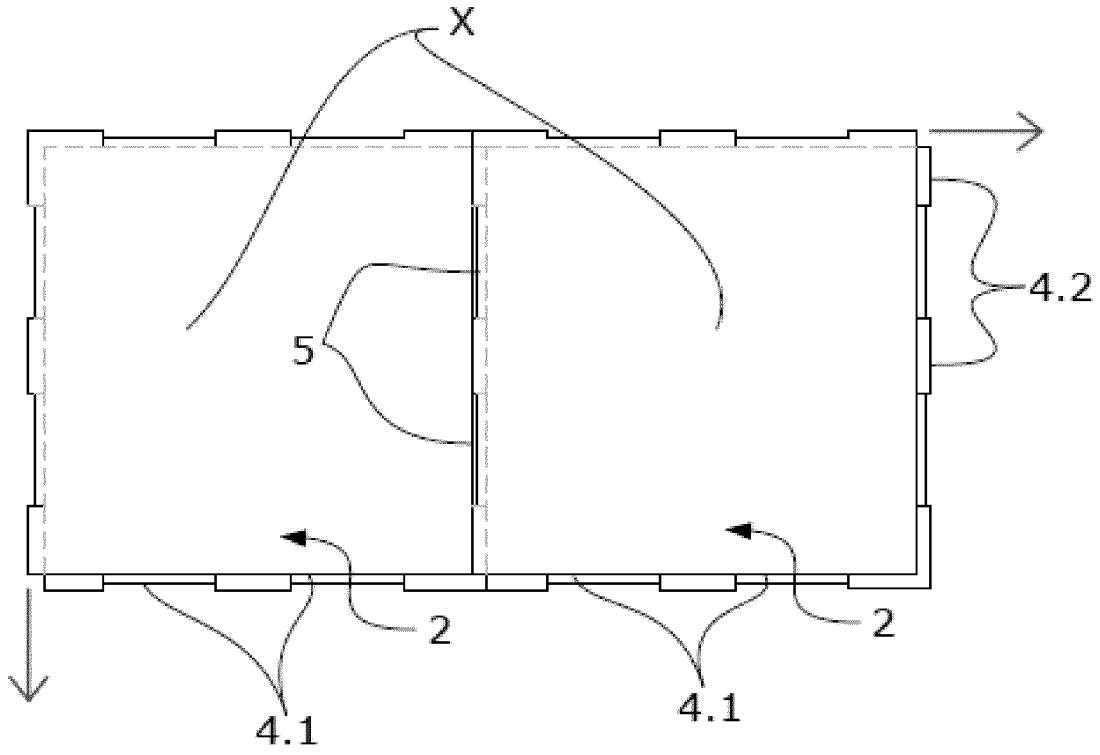

FIG. 4

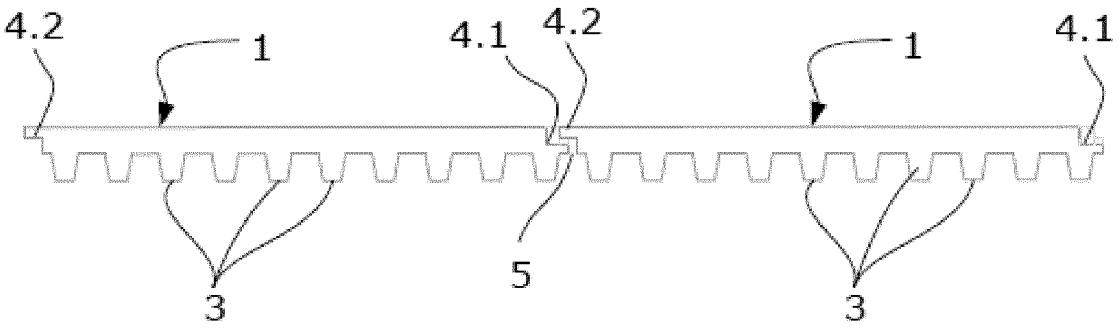

FIG. 5A

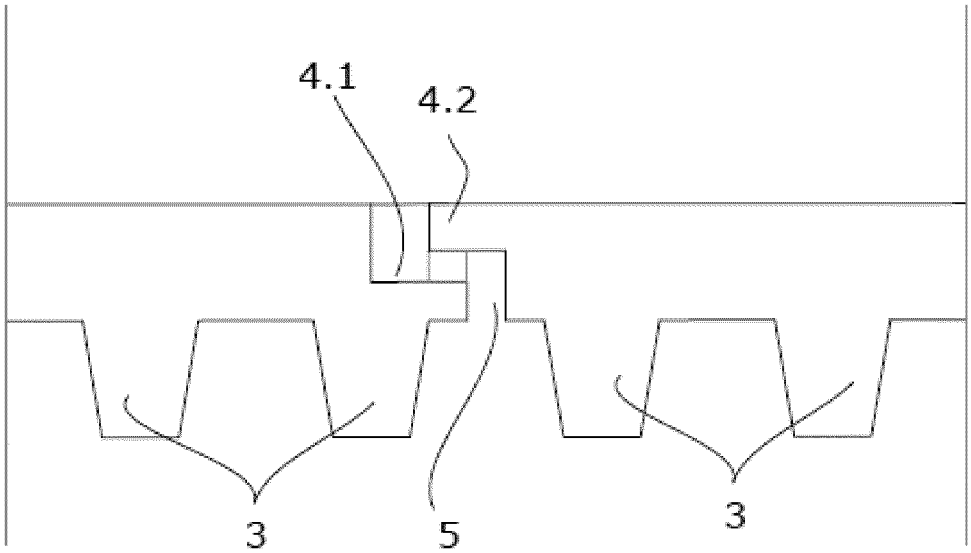

FIG. 5B

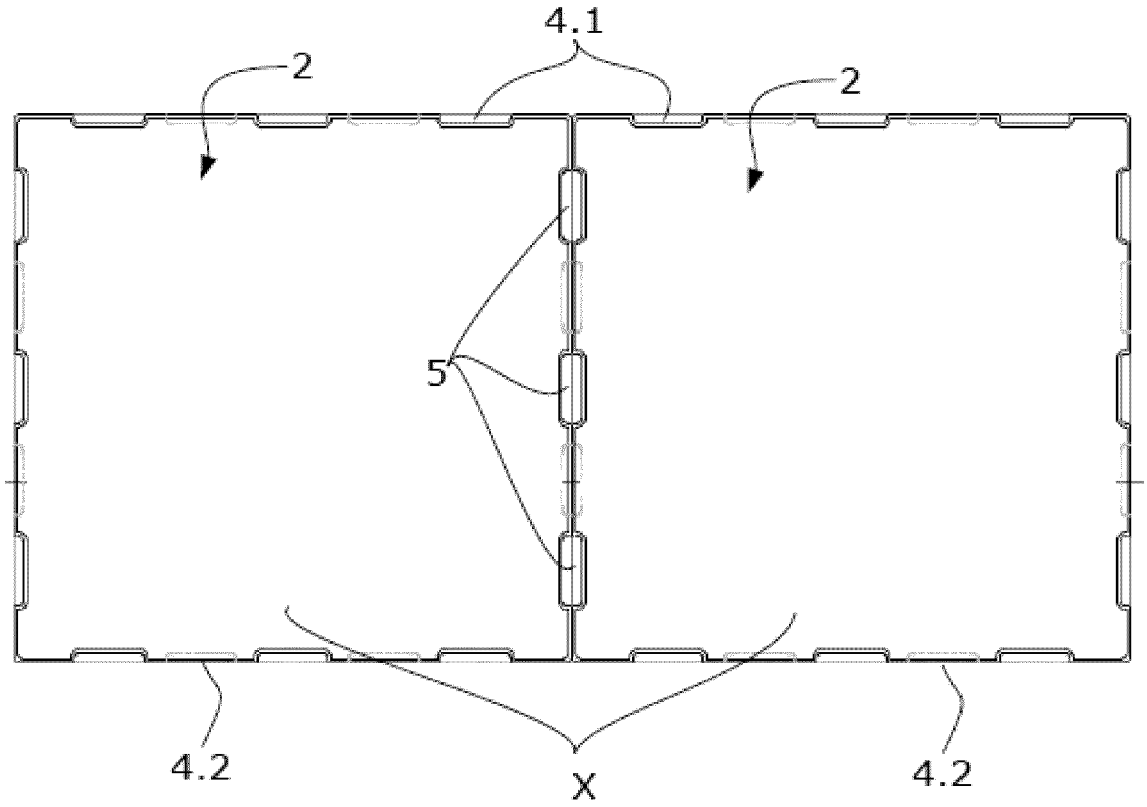

FIG. 6A

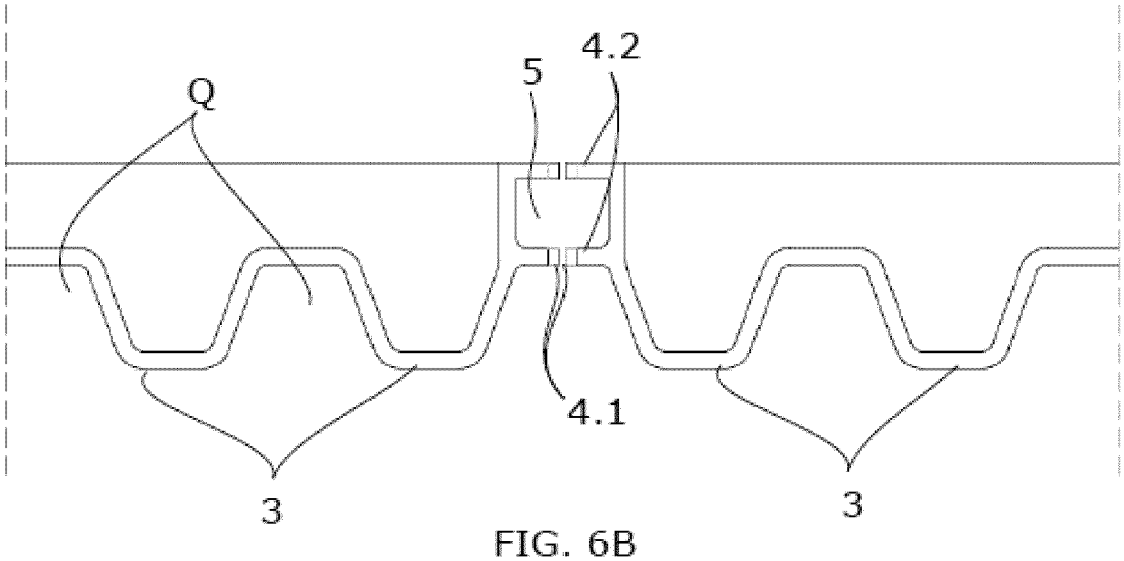

FIG. 6B

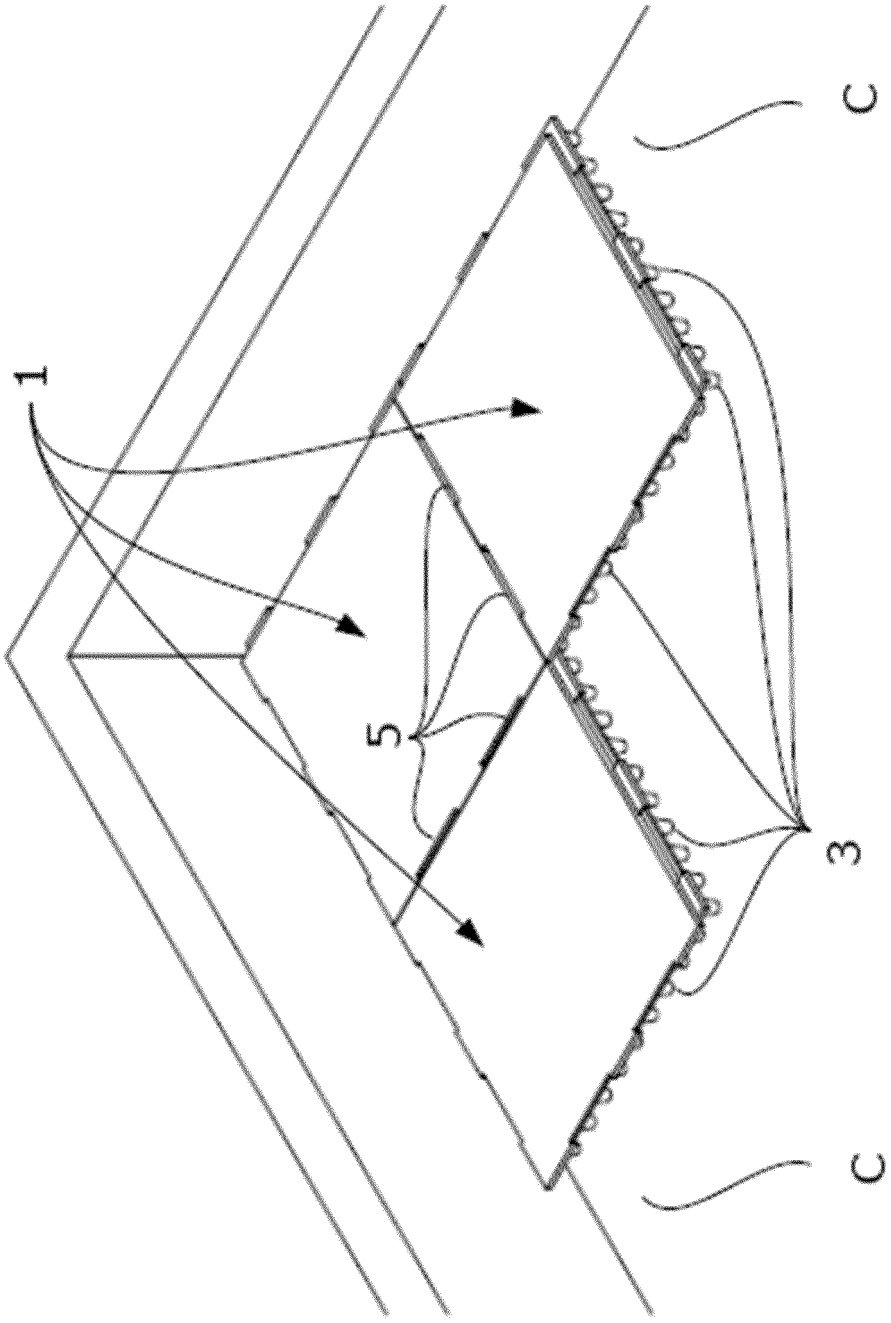

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 20 38 2488

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			E04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 October 2020	Leroux, Corentine

CATEGORY OF CITED DOCUMENTS

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