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(54) Self-supporting light-weight insulation panel

Leichte selbsttragende Isolierplatte

Panneau isolant léger autoportant

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(56) References cited:
BE-A2- 874 574 **FR-A1- 2 180 826**
FR-A1- 2 292 817 **GB-A- 556 460**
US-A- 3 043 730 **US-A- 3 773 604**

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Description

[0001] The invention is directed to a self-supporting light-weight insulation panel for use as a construction panel in buildings, a use of such insulation panel and an arrangement comprising such insulation panel and a support structure, to which the insulation panel is fastened.

[0002] Self-supporting insulation panels of this kind are used as construction panels in buildings. Typically these panels have an enclosure defined by two rigid planar faces - a back face and a front face, which are connected by at least two longitudinal side faces - a right face and a left face. Such enclosure is manufactured from rigid material, in most cases of metal or wood. The enclosure provides for the self-support characteristic of the panel. In order to enhance the thermal insulation between the two planar faces the hollow interior of the enclosure is filled with insulation material. The material used for the insulation purposes ranges from mineral fibres to foam. In some cases also bulk material is used for filling the hollow interior of such housing. From prior art it is also known, to integrate longitudinal reinforcement members within the insulation material. Self-supporting insulation panels of this kind are disclosed for example in US 4,981,003 and US 4,844,975.

[0003] The prior art insulation panels are used for light-weight wall constructions for buildings or to provide insulated walls for temperature-regulated rooms, such like walk-in coolers or freezers.

[0004] The reinforcement members, if used, are typically fastened to at least one face - the front face or the back face - of the housing. In US 4,844,975 A it is suggested, that the reinforcement members are only attached to one face and that these do not contact the other face in order to omit cold bridges by way of the reinforcement members, which are typically manufactured from sheet metal.

[0005] According to US 4,981,003 A the reinforcement members are completely integrated into the insulating body and therefore spaced from both planar faces - the front face and the back face - of the insulating body.

[0006] A further self-supporting roof panel is disclosed in BE 898 919. This prior art self-supporting insulation panel comprises an insulating body manufactured as foamed material, which could be a polyurethane (PU)-foam. Elongate members are integrated into the foam with a small distance to the longitudinal side faces. These are arranged being directed in the longitudinal extension of the insulating body. These elongate members extend through the full length of the insulating body. This prior art panel further comprises at its bottom end a wooden board, which is arranged in a cutout section of the insulating body in a transverse direction to the extension of the elongate member arranged flush with the transverse side face of the insulating body. In order to hold in place the wooden board this is fastened either to the elongate member or to an L-shaped crossbar integrated into the PU-foam and linking the two elongate members. The longer leg of such crossbar is arranged parallel to the two planar faces of the insulating body. The crossbar is arranged with its longer leg to be approximately in the middle of the width of the wooden board. In the preferred embodiment the elongate members and the crossbar are steel profiles. The wooden board is used as mounting base to fasten battens thereon, which extend in the direction of the elongate members. The wooden board is thus used to receive the shear load resulting from tiles resting on roof laths mounted on the battens. According to this prior art a second wooden board may be arranged at the top end of the insulation panel in the same manner.

[0007] For insulation purposes the wooden board does not contact the elongate members. Therefore these and the crossbars are concealed within the insulating body, making it difficult to properly identify, where to apply a screw to fasten the wooden board to its mounting base. This mounting is vital, because otherwise the shear forces received by the wooden board would not be transferred into the elongate members.

[0008] US 3,773,604 A discloses a light-weight structural panel for cryogenic applications, which comprises a core having an upper and a lower face and at least one layer formed by a series of balsa beams in spaced relation and a series of slabs of synthetic thermal insulating material disposed in the spacings in between. The thermal insulating material may be, among others, a foam plastic material. One embodiment shows a three-layer structure, where the beams in neighbouring layers are displaced by 60° with respect to each other.

[0009] FR 2 292 817 A1 discloses a construction panel with a series of elongate wooden members having a small cross-section and being arranged in parallel on a first surface of the panel. These wooden members are capable of supporting fasteners like nails, hooks or the like. They are embedded in a isolating foam material. The second surface of the panel is formed by a load-bearing plate, which may also be made of wood. The panel may be enclosed by a wooden frame. Optionally, intermediate stiffening members may be disposed between the plate and the wooden members, arranged perpendicular to the wooden members.

[0010] GB 556,460 A discloses a panel member, which may be used in vehicle structures or for floorboards, bulkheads or the like. The panel member comprises two sheets of fibrous material separated by stringers of fibrous material, all of which are impregnated and/or bonded with synthetic resins and consolidated under heat and pressure. Two sets of stringers may be placed perpendicular to each other and may form a series of cells, which may optionally be filled with low density material like synthetic foam.

[0011] FR 2 180 826 discloses a structural building panel with a core and a pair of cover elements fixed to the core. The core comprises a plurality of strips e.g. made of wood. Two sets of strips are disposed so that the strips in each set

are in parallel to each other and at an angle to the other set of strips. Thus, the two sets support each other in an orientation perpendicular to the cover when the cover is fixed to the core. Each strip may have a series of notches into which other strips are inserted to establish a secure connection.

[0012] In the light of the prior art discussed above, it is an object of the invention to provide a self-supporting light-weight insulation panel, which is easier to manufacture and also may be used for a larger variety of applications.

[0013] This object is met by a self-supporting light-weight insulation panel with the features of claim 1.

[0014] The concept of this self-supporting insulation panel is quite different to the concept of prior art insulation panels of the kind. A self-supporting insulation panel according to the invention does not need any rigid facings enclosing a cavity, in which an insulating material is introduced. With this self-supporting insulation panel structural beams are utilized. Typically these are designed as rafters/joists/beams. The structural beams are laid out in such a manner that they provide the load-bearing capacity of the insulation panel and that these also provide for the principal self-supporting characteristic of the panel in the direction of the longitudinal extension of the beams. Providing the load-bearing capacity of the insulation panel means, that the full load of the panel and possible weight it supports is carried by the structural beams and transferred into a bearing or a support, to which the panel is fastened and/or resting on. Due to this concept no facings and no enclosure is needed to provide for the major load-bearing capacity. Therefore, these may be made up of, if at all, also by flexible members, for example multi-foil facings. Since the structural beams provide the major load-bearing capacity, all other members incorporated into the insulation panel do not need to comply with these requirements of the panel. Of course, further members of the insulation panel add to the carrying capacity, but it remains with the structural beams to provide the load-bearing capacity or at least the major load-bearing capacity. Since the beams are arranged with distance to one typically planar face of the insulating body, the beams do not result in any cold bridges.

[0015] The structural beams are integrated in and connected to the insulating body. The integration of the structural beams is not complete since the beam may protrude with a certain portion of its height from the first planar face of the insulating body or it may be arranged with at least part of one of its faces flush with this first planar face of the insulating body. The connection of the structural beams to the insulating body may be achieved in many ways. When using a polymer foam, such as polyurethane foam, as insulating body, the connection may be achieved by the intrinsic forces of the foaming material during the production process. The intrinsic forces are the bonding forces of the foaming material prior to its completely cured state. These bonding forces may be used to provide an adhesive connection between the structural beams and the insulating body. This implies that the structural beams are positioned in place in a mould or on a conveyor (if manufactured in a continuous production line), when the foaming material is introduced resp. therein or thereon for expanding and curing. It is also possible to use an adhesive in order to bond the beams to the insulating body or even to use mechanical connection members. Depending on the rigidity of the material of the insulating body the beams may also be held in place simply by a clamping force resulting from the insulating body and applied to the beams being integrated into the insulating body. Also a combination of these connection types is possible.

[0016] Furthermore, the concept of the claimed self-supporting insulation panel allows, that it is possible to manufacture the insulating body as one single member. This enhances the structural integrity of the panel in particular in transverse direction to the extension of the structural beams.

[0017] The structural beams are designed to provide a mounting base for a fastener, in particular a mechanical fastener, either to fasten something to the panel or to fasten the panel to something else, for example a support. The design of the structural beams is in such a way that, when using for example a screw as a fastener, its fixing (threaded) section may completely be introduced into the beam as far as the fixing section protrudes from the support. This implies that the structural beams have a certain height and a certain width in order to accommodate the fixing section of such fastener. The benefit of this design of the structural beams is, that these may be mounted to a support structure without needing to drive fasteners through the complete panel. With this novel panel it is only necessary to introduce one or more fasteners into the structural beams. Typically the fasteners are introduced into the side of the beams being arranged flush with the insulating body or protruding therefrom. In most cases such fastener will be driven into a structural beam in the direction of its height. This fastener is fixed to the support structure either directly or indirectly, e.g. by means of a metal profile. In case the structural beam protrudes from the insulating body such fastener may also be introduced into one of the protruding sections of the other sides of the beam. According to another embodiment such insulation panel is mechanically fastened to a support structure by using a hook-type fastener, which is introduced into the insulating body next to a structural beam in such a manner, that the hook section rests on the face of the structural beam, which is arranged with a distance to the second face of the insulating body. The fastening section of such hook-like fastener is then fixed to a support structure.

[0018] The possibilities to fasten the self-supporting insulation panel to something else, for example a support structure, shows, that this insulation panel allows fixing in such a manner, that the structural beams of the insulation panel are held with a force pulling it towards the other element, for example the support structure. With this concept no cold bridges occur due to fastening the insulating panel to a support structure. Still further, with this measure it is not possible to accidentally compress the insulating body in due course of mounting the panel, which would result in a reduction of

insulation, which is encountered with the insulation panel disclosed in BE 898919.

[0019] The self-supporting light-weight insulation panel according to the invention carries load-receiving members at its face, from which the structural beams are spaced,. In case the structural beams are integrated into the insulating body from its first face, then the load-receiving members will be integrated at the second face. Such load-receiving members may be of the kind of battens being arranged in the transverse direction to the direction of the structural beams. The load-receiving members are arranged parallel or substantially parallel to each other and are spaced with a distance from each other. The load-receiving members are also integrated into the insulating body in the same manner as the structural beams are integrated into the insulating body. This means that at least part of one face of such load-receiving members is arranged flush with a face of the insulating body. The set of load-receiving members typically comprises at least three members. At least one of these members, preferably though the majority of the members - if not all - are arranged with their longitudinal side faces with a distance to both side faces of the insulating body. The intention with this measure is that these load-receiving members are integrated in and in contact with the insulating body at least at three of their sides. Due to the number of load-receiving members and in particular their integration into the insulating body, shear forces are effectively absorbed, without needing to have the load-receiving members be rigidly connected to the structural beams. Load introduced into the load-receiving members, which load may for example be the weight of roof tiles or other roof coverings, will be distributed through the insulating body, collected and deflected by the structural beams into a supporting structure, to which the beams are fastened to and/or resting on.

[0020] This self-supporting insulation panel is made up of number of individual structural beams, a number of load-receiving members arranged oblique or perpendicular to the longitudinal extension of the structural beams and the insulating body, to which the structural beams and the load-receiving members are connected to. With this concept no mechanical fasteners are needed to hold together the individual members - beams and load-receiving members - in their relative position to each other as a framework. Therefore, the insulating body has besides its insulating functionality also a structural functionality. This also comprises the ability of the insulating body to absorb shear forces introduced through the load-receiving members.

[0021] According to one embodiment, the load-receiving members are arranged to be perpendicular to the direction of extension of the structural beams. Such arrangement is preferred with an insulation panel of basically rectangular or square shape. Should such panel have another geometry, for example a trapezoid or a triangle-like geometry, then the load-receiving members may also be arranged with another angle in respect to the longitudinal extension of the structural beams.

[0022] In one embodiment of a self-supporting insulation panel with such load-receiving members the load-receiving members are not in contact with the structural beams. In such embodiment the set of structural beams and the set of load-receiving members are spaced in the direction of the thickness of the insulating body from each other by insulating material defining the insulating body.

[0023] According to another embodiment of such kind of a self-supporting light-weight insulation panel the set of load-receiving members are in contact with the structural beams. In such case it may be advantageous to provide notches in the structural beams, into which the load-receiving members are introduced, and/or to provide notches in the load-receiving members, into which the structural beams are inserted. In case of a contact between the structural beams and the load-receiving members, it is possible to arrange a spacer between the areas of contact. Such spacer is preferably manufactured from a material having a higher insulation capacity than the material the structural beams and/or the load-receiving members are made of. Such spacers may be of plastic or of any appropriate foamed material. It will be understood that, depending on the material of the insulating body, the load distribution from the load-receiving members into the structural beams is better if the load-receiving members are in contact with the structural beams - directly or by way of an intersected spacer.

[0024] The side faces of the insulating body may be finished for a joint fitting arrangement with an adjacent insulation panel. Here, another advantage of the invention may be encountered. The joint fitting arrangement may easily be adapted to the insulating body, in particular in a certain variety of geometries. In prior art panels having rigid longitudinal side faces as part of an enclosure, the panel cannot be provided that easily with such a joint fitting arrangement.

[0025] Typically the structural beams extend substantially over the full length of the insulating body. It is also possible that the structural beams are designed to be longer than the full length of the insulating body and that they protrude from one or both of the side faces of the insulating body. In this case, these sections of the structural beams may be used as connection or fastening parts or as parts of the beams, which are connected to a counter bearing, for example a purlin or a rafter.

[0026] The invention will be described in the following in more detail with reference to the accompanying figures. These show:

Fig. 1: a self-supporting insulation panel according to one embodiment of the invention in an exploded view;

Fig. 2: the insulation panel of figure 2 in a perspective view;

Fig. 3: a close-up detail of still a further embodiment of a self-supporting insulation panel according to the invention;

Fig. 4: a close-up detail of another embodiment of a self-supporting insulation panel according to the invention;

5 **Fig. 5:** still another embodiment of a self-supporting insulation panel according to the invention;

Fig. 6: structural beams of a self-supporting insulation panel and transverse arranged load-receiving members for an insulation panel according to the invention, depicted without insulating body; and

10 **Fig. 7:** exemplary embodiments of the geometry of load-receiving members to be arranged in a transverse direction to the extension of the structural beams of a self-supporting insulation panel.

[0027] A self-supporting insulation panel 1 comprises in the embodiment depicted in figure 1 a set of elongated structural beams 2, which set of structural beams comprises the number of two beams 2. The beams 2 of the depicted
15 embodiment have a rectangular cross-sectional geometry as to be seen in the transverse side face 3 of the perspective view of figure 2. In the depicted embodiment the beams 2 are manufactured from wood. The structural beams 2 may therefore be referred to as rafters/joists/beams. In the depicted embodiment this implies that the structural beams have a width and a height sufficient to embed that part of a treaded section of a fastening screw, which is intended to be used for mounting the panel 1 to a support structure. The insulation panel 1 further comprises an insulating body 4, which in
20 this embodiment is a polymer foam body, in particular a polyurethane (PU) foam body.

[0028] The mechanical properties of the structural beams 2 are designed, in that these are responsible for the load-bearing capacity of the insulation panel 1. In the depicted embodiment, the load-bearing direction is in the direction of the longitudinal extension of the structural beams 2. The structural beams 2 are arranged parallel and with distance to each other. The distance at which the structural beams 2 are spaced from each other will be designed in regard of the
25 load, which this insulation panel 1 needs to carry or withstand. It will be understood that implementing more beams with a smaller distance to each other will enhance the load-bearing capacity of the panel. The structural beams are spaced from the longitudinal side faces 5, 6 of the insulating body 4.

[0029] As to be seen in the figure the insulating body 4 has a first planar face 7 and a second planar face 8 on the opposite side thereof. In the depicted embodiment the self-supporting insulation panel 1 is manufactured as a flat body.
30 It is also possible to design such self-supporting insulation panel with a curvature.

[0030] The structural beams 2 of this embodiment are arranged with one of their small longitudinal side faces 3.1 in a flush arrangement with the planar face 7 of the insulating body 4. The side face 3.2 opposite to the side face 7 of the beams 2 is arranged with a suitable distance from the planar face 8 of the insulating body 4 in order to avoid a cold bridge between the two faces 7, 8 of the insulating body 4. It will be noted that due to this measure the insulating body
35 4 may be manufactured as one single body, which is the fact with this embodiment. This is of benefit in respect of an enhanced load distribution and structural integrity of the insulation panel 1. The polymer foam making up the insulating body 4 of the insulation panel 1 shows a rigidity, which may also be addressed as stiffness. Both elements - the structural beams 2 and the insulating body 4 - are connected to each other, which is necessary for the purposes of the insulation panel 1. Various means may be applied in order to connect the structural beams 2 with the insulating body 4. By integrating
40 the structural beams 2 at least in part into the insulating body 4 a sufficient surface area is provided for applying easy conductible connecting methods and shear forces will be distributed over the complete contact area. In the present embodiment the insulating body 4 is foamed around the structural beams 2. Here, the intrinsic adhesion properties of the PU-foaming material during the production process are used to adhere the insulating body 4 to the faces of the structural beams 2 being in contact with the insulating body 4. For a person skilled in the art it will be evident, that other
45 measures may be utilized, such as applying an adhesive to attach the insulating body 4 to the structural beams 2 or a combination of different adhesive connecting methods.

[0031] The longitudinal side faces 5, 6 of the insulating body 4 show a shiplapped finishing. This is used for a joint fitting arrangement of the depicted insulation panel 1 with a second one, both arranged with their longitudinal side faces in contact with the side face shown.

50 [0032] Further, the insulation panel 1 comprises a set of load-receiving members 9. The batten-like load-receiving members 9 are elongate members, which are manufactured from wood according to this embodiment. Of course, the load-receiving members may also be manufactured from other suitable materials, for example from a high density foam. The individual load-receiving members 9 are arranged parallel with each other and spaced from each other.

[0033] The load-receiving members 9 are, as viewed in figures 1 and 2, of smaller dimensions than the structural beams 2. The load-receiving members 9 are integrated into the insulating body 4 in the same manner as this has been described for the structural beams 2. As to be seen from figure 2 the load receiving members 9 are integrated into the insulating body 4 from the opposite planar face - the face 8 - from which the beams 2 are integrated into the insulating body 4. Figure 2 shows the arrangement of the load-receiving members 9 and the beams 2, both being integrated into

the insulating body 4. The load-receiving members 9 of the depicted embodiment are not in direct contact with the structural beams 2. Further, it will be noted, that the majority of the load-receiving members 9 making up the set of load-receiving members are integrated into the insulating body with their longitudinal side faces with distance to both transverse side faces of the insulating body 4.

[0034] The load-receiving members 9 are used as mounting base for laths 10 which in turn carry in a transverse direction to the laths 10 further laths holding for example tiles. In such application the self-supporting light-weight insulation panel 1 would be used as a roof insulating panel, where the laths 10 act as counter battens. Due to the integration of the load-receiving members 9 into the insulating body 4 shear forces are effectively absorbed by the insulating body 4 and transferred to the structural beams 2.

[0035] In the embodiment of figures 1 and 2 the planar faces 7, 8 of the inserting body 4 are covered with a flexible facing 12. It will be understood, that applying such facings, which may be of various kind, is optional. In the present embodiment these flexible facings are used for dimensional stability and low lambda purposes.

[0036] Instead of the flexible facings 11, 12 of the embodiment as depicted in figures 1 and 2, other facings may be used, such as rigid facings, sheet-like coverings, boards, slabs or foils or any combination of these may be used.

[0037] Figure 3 shows in a perspective view an insulation panel 13 according to another embodiment. Basically the insulation panel 13 as depicted in figure 3 is identical to the insulation panel 1 of figures 1 and 2. Therefore, these descriptions also apply to the insulation panel 13. The insulation panel 13 differs from the insulation panel 1 in that the structural beams 2.1 are not integrated as to their full height into the insulating body 4.1. The beams 2.1 are integrated into the insulating body 4.1 by about 75% of their height. This means, that 25% of the height of the structural beams 2.1 protrudes from the planar back-face of the insulating body 4.1. Also with this embodiment the structural beams 2.1 provide the load-bearing capacity of the insulation panel 13. The protruding sections of the beams 2.1 may be used for example either to space the insulation panel from another construction element and/or to provide a base for fastening other parts. In respect of the height of the structural beams 2.1 it is preferred that at least 50% of the height is integrated into the insulating body 4.1. This provides for sufficient contact surface to the structural beams 2.1 and the insulating body 4.1 to withstand shear.

[0038] Yet another insulation panel 14 is depicted in figure 4 in a similar perspective view as the insulation panel 13 of figure 3. Principally the insulation panel 14 shows the features of the insulation panel 1. Therefore these descriptions also apply to the insulation panel 14. The insulation panel 14 differs from the insulation panel 1 in the geometry of the cross-section of its load-receiving members 9.1. Whereas the load-receiving members 9 of the insulation panel 1 show a rectangular cross-section and are arranged with one of their wider faces parallel to the planar faces of the insulating body 4, the load-receiving members 9.1 show a T-beam-like cross-section. Also other profiled load-receiving members may be utilised, for example with an L-cross-sectional geometry. Such geometry like for example T- or L-shaped geometries in the cross-section increases the contact surface of the load-receiving members 9.1 with the insulating body 4.2. With such increased contact area, in which the load-receiving members 9.1 are connected to the insulating body 4.2, this panel 14 will even resist higher shear forces introduced into the load-receiving members 9.1.

[0039] The insulation panel 14 further differs from those described in the previous embodiments, in that the structural beams 2.2 of this insulation panel 14 are in contact with the load-receiving members 9.1 being arranged perpendicular to the extension of the structural beams 2.2. In the embodiment of figure 4 the load-receiving members 9.1 show notches introduced into the base face 15 of the T-cross-section at the intended intersections of the load-receiving members 9.1 with the structural beams 2.2.

[0040] Figure 5 depicts yet another self-supporting insulation panel 16, which is very similar to the insulation panel 13 of figure 3. Therefore, the description of insulation panel 13 also applies to the insulation panel 16. The insulation panel 16 differs from the insulation panel 13 in that its load-receiving members 9.2 do not extend over the full width of the insulating body 4.3. In the embodiments described to figures 1, 2, 3 and 4 the insulation panels 1, 13 and 14 comprise load-receiving members 9, 9.1 which are extending over the full width of the respective insulating body 4, 4.1. In the embodiment of figure 5 the load-receiving members 9.2 being arranged in a transverse direction to the extension of the structural beams 2.3 are elongate sections of wooden strips placed above the structural beams 4.3. Also here the load-receiving members 9.2 are used as a mounting base to attach for example counter battens.

[0041] The load-receiving members of any of the embodiments described above are dimensioned in such a way that the expected shear forces can be taken up by the insulation panel.

[0042] Figure 6 depicts by way of an example sections of structural beams 2.4 and by way of an example one load-receiving member 9.3 traversing the extension of the structural beams 2.4. In this embodiment, shown without the insulating body, the structural beams 2.4 show notches 17 introduced into their face, facing towards the load-receiving member 9.3. Figure 6 shows the structural beams 2.4 and the load-receiving member 9.3 in an exploded view. In practice, the load-receiving member 9.3 is introduced with its lower section into the notches 17 of the structural beams 2.4. The same type of notches are made use of in the insulation panel 14 of figure 4 described above, in which embodiment these notches are introduced into the load-receiving member 9.1. In another embodiment, not shown in the figures, a spacer is arranged to make contact with both the load-receiving member 9.3 and the structural beams 2.4. When using a spacer

this may be designed to fittingly receive the top section of a structural beam and the lower section of the load-receiving member. In this embodiment it is not necessary to use notches, in order to hold in place the load-receiving members on the structural beams when applying the insulation material around these members.

[0043] By way of example the structural beams 2.4 and the load-receiving member 9.3 show different kinds of openings as cut-outs. These are introduced for weight-saving aspects or further improvement of the insulating performance of the self-supporting insulation panel to be manufactured with these members. It will be understood, that the different geometries of the openings are depicted as examples and that typically one type of opening will most likely be used throughout the longitudinal extension of a beam 2.4 and/or a load-receiving member 9.3. Of course, also openings with a different geometry as the depicted ones may be utilized. The major load bearing capacity and the principle self-supporting characteristic of the insulation panel will be provided by the structural beams 2.4.

[0044] Figure 7 by way of an example shows a number of sections of load-receiving members differing in their cross-sectional geometry. These exemplary depicted sections show some possible geometries of load-receiving members. Other geometries are also possible. The examples in figure 7 show, that a wide variety of load-receiving members as to their cross-sectional geometry may be used depending on the aspects they are utilized for.

[0045] The structural beams and, if used, the load-receiving members may be utilized as fastening base, into which fasteners, for example nails or screws may be introduced either to fasten a certain part to the insulation panel itself or to fasten the insulation panel to some other construction, for example to rafters or purlins in a pitched roof. In a preferred embodiment the insulation panels are used as insulating roof construction panels. Nevertheless, such insulation panels may also be used to erect walls.

[0046] In those cases, in which the structural beams, when arranged flush with one face of the insulating body, are not visible because this face of the insulating body is covered, it is advantageous that the outside of the covering shows some kind of markings resembling the extension of the structural beams. It is then easy to identify those sections of the panel, which may be used as fastening or mounting base. The same is possible on a covering, which covers load-receiving members.

[0047] A self-supporting light-weight insulation panel of the kind described is preferably manufactured in a continuous manufacturing process. In a continuous production line according to one possibility to manufacture such self-supporting insulation panel, the structural beams are placed on a conveyor with their longitudinal extension pointing into the direction of transport. The load-receiving members are placed on the structural beams or vice versa. In case the load-receiving members are to be in direct contact with the structural beams, they may be held together by applying an adhesive between them. There are suitable techniques for placing and/or holding the load-receiving members in place, when this arrangement is transported by the conveyor belt into the laminator. The insulation material, for example a PU foamable mixture is laid down just before the laminator. The laminator has a side container system (fixed or movable shoulders) following the direction of transport. These define the transverse extension of the applied insulation foam. This system is preferably equipped with a non-stick surface, for example a certain structure of the surfaces or a release spray supplied from nozzles at the entrance of the laminator. In order to define the thickness of the insulating body the laminator may be equipped with a top conveyor belt. In case the structural beams are not arranged flush with the typically planar face of the insulating body, the conveyor belt will be constructed in such a manner that there are grooves, in which the structural beams can be inserted. The depth of these grooves will be dimensioned equivalent to the protrusion of the structural beams from the face of the insulating body.

[0048] Should one or both planar faces of the insulating body be covered with a flexible facing for example a multi-foil laminate, this may be applied during the foaming process. Then the facings will be adhered to the insulating body due to the intrinsic forces of the foaming material during the production process.

[0049] Although the invention has been described with an insulating body being a PU foam, other materials may be used to make up the insulating body, in particular other polymeric foams such as expanded polystyrene (EPS), polyisocyanurate (PIR) foam or phenol formaldehyde foam (PF).

Reference Numerals

[0050]

1	insulation panel
2, 2.1, 2.2, 2.3, 2.4	structural beam
3	face
3.1	small longitudinal face
3.2	small longitudinal face
4, 4.1, 4.2, 4.3	insulating body
5	side face
6	side face

	7	planar face
	8	planar face
	9, 9.1, 9.2, 9.3	load-receiving member
	10	laths
5	11	facing
	12	facing
	13	insulation panel
	14	insulation panel
	15	base face
10	16	insulation panel
	17	notch

Claims

- 15
1. Self-supporting light-weight insulation panel for use as a construction panel in buildings with
- a single member insulating body (4, 4.1, 4.2, 4.3) defining the geometry of the panel, having a length and a width, and having a first face (7) and a second face (8) arranged opposite to the first face (7), whereas the direction of insulation is from the first face (7) to the second face (8) or vice versa, and
 - a set of elongate members being arranged parallel or substantially parallel and with a distance to each other, each member extending at least substantially over the full length of the single member insulating body (4, 4.1, 4.2, 4.3),
 - the elongate members being provided as non-metallic structural beams (2, 2.1, 2.2, 2.3, 2.4) responsible for the major load bearing capacity and the principal self-supporting characteristic of the insulation panel (1, 13, 14, 16) in the direction of the longitudinal extension of the beams,
 - the structural beams (2, 2.1, 2.2, 2.3, 2.4) being integrated into and connected to the single member insulating body (4, 4.1, 4.2, 4.3), except for at least part of one of their faces, which face (3.1) is arranged to be flush or substantially flush with the first face (7) of the single member insulating body (4, 4.2) or which face is arranged to protrude from the first face of the single member insulating body (4.1, 4.3), whereas the opposite side of the beams is spaced from the second face (8) of the single member insulating body (4, 4.1, 4.2, 4.3),
 - the structural beams (2, 2.1, 2.2, 2.3, 2.4) being designed to provide a mounting base for a fastener,
 - the insulation panel (1, 13, 14, 16) further comprising a set of elongate load-receiving members (9, 9.1, 9.2, 9.3) arranged parallel or substantially parallel and with distance to each other, but in an angled direction to the set of structural beams (2, 2.1, 2.2, 2.3, 2.4), of which set of load-receiving members (9, 9.1, 9.2, 9.3) at least one load receiving member (9, 9.1, 9.2, 9.3) is arranged with its longitudinal side faces with distance to both transverse side faces (5, 6) of the single member insulating body (4, 4.1, 4.2, 4.3),
 - the load-receiving members (9, 9.1, 9.2, 9.3) also being integrated into and connected to the single member insulating body (4, 4.1, 4.2, 4.3), except for at least part of one of its longitudinal faces, which is arranged to be flush or substantially flush with the second face (8) of the single member insulating body (4, 4.1, 4.2, 4.3) or which is arranged protruding from the second face (8) of the single member insulating body (4, 4.1, 4.2, 4.3), whereas the opposite side of these members is spaced from the first face (7) of the single member insulating body (4, 4.1, 4.2, 4.3).
- 45
2. Insulation panel according to claim 1, **characterized in, that** the load-receiving members (9, 9.1, 9.2, 9.3) are not being mechanically fastened to the structural beams (2, 2.1, 2.2, 2.3, 2.4).
3. Insulation panel according to claim 1 or 2, **characterized in, that** at least one of the structural beams (2.4) and/or load-receiving members (9.3) are perforated.
- 50
4. Insulation panel according to one of the claims 1 to 3, **characterized in, that** the set of structural beams (2.2, 2.4) and/or the set of load-receiving members are provided with notches (17) at the intersections of the members of the two sets, whereas into each notch (17) a load-receiving member (9.3) or a beam respectively is introduced.
- 55
5. Insulation panel according to one of claims 1 to 3, **characterized in, that** the set of structural beams (2, 2.1, 2.2, 2.3, 2.4) and the set of load-receiving members (9, 9.1, 9.2, 9.3) are not in direct contact with each other.
6. Insulation panel according to claim 5, **characterized in, that** spacers are arranged in such a way that at least at

some intersections of a structural beam with a load-receiving member, a spacer is in contact with a beam and a load-receiving member.

7. Insulation panel according to one of the claims 1 to 6, **characterized in, that** the structural beams (2, 2.1, 2.2, 2.3, 2.4) and the load-receiving members (9, 9.1, 9.2, 9.3) are composed of one of following, non-metallic materials: wood, plastic, ceramic, or high density foam or a combination of these.
8. Insulation panel according to one of the claims 1 to 7, **characterized in, that** the single member insulating body (4, 4.1, 4.2, 4.3) is a polymer foamed body and that the structural beams (2, 2.1, 2.2, 2.3, 2.4) and the load receiving members (9, 9.1, 9.2, 9.3) are adhered to the insulating body (4, 4.1, 4.2, 4.3) using the intrinsic forces of the foaming material during the production process.
9. Insulation panel according to one of the claims 1 to 8, **characterized in, that** the single member insulating body (4, 4.1, 4.2, 4.3) has an edge finishing suitable as joint fitting arrangement of the insulation panel (1, 13, 14, 16) to an adjacent insulation panel (1, 13, 14, 16).
10. Insulation panel according to one of claims 1 to 9, **characterized in, that** the first face (7) and/or the second face (8) of the single member insulating body (4, 4.1, 4.2, 4.3) is/are covered with a facing (11, 12), which facing may be flexible.
11. Insulation panel according to any of the claims 1 to 10, **characterized in, that** the first and/or the second face of the single member insulating body is covered with a rigid facing, or a sheet-like covering.
12. Insulation panel according to any of the claims 1 to 11, **characterized in, that** the first and/or the second face of the single member insulating body is covered with a board, slab, foil or any combination of these.
13. Insulation panel according to one of the claims 1 to 12, **characterized in, that** at least one of the structural beams extends at one side of the single member insulating body beyond the extension of this body.
14. Use of an insulation panel according to one of the claims 1 to 13, **characterized in, that** the insulation panel is a roof or wall construction panel.
15. Arrangement of an insulation panel according to one of the claims 1 to 14 and a support structure to which the insulation panel is fastened, **characterized in, that** the panel is fastened to the support structure with mechanical fastening means interacting with at least one structural beam of the insulation panel applying a pulling force to that structural beam in the direction of the support structure.

Patentansprüche

1. Selbsttragende Leichtisolierplatte zur Verwendung als eine Bauplatte in Gebäuden mit

- einem einteiligen isolierenden Körper (4, 4.1, 4.2, 4.3), der die Geometrie der Platte definiert, mit einer Länge und einer Breite und mit einer ersten Fläche (7) und einer zweiten Fläche (8), die gegenüber der ersten Fläche (7) angeordnet ist, wobei die Richtung der Isolierung von der ersten Fläche (7) zu der zweiten Fläche (8) oder umgekehrt erfolgt, und
- einem Satz von länglichen Teilen, die parallel oder im Wesentlichen parallel und mit einem Abstand zueinander angeordnet sind, wobei sich jedes Teil wenigstens im Wesentlichen über die gesamte Länge des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) erstreckt,
- wobei die länglichen Teile als nichtmetallische Strukturträger (2, 2.1, 2.2, 2.3, 2.4) bereitgestellt sind, die für die Haupttragfähigkeit und die selbsttragende Haupteigenschaft der Isolierplatte (1, 13, 14, 16) in der Richtung der Längserstreckung der Träger verantwortlich sind,
- wobei die Strukturträger (2, 2.1, 2.2, 2.3, 2.4) in den einteiligen isolierenden Körper (4, 4.1, 4.2, 4.3) integriert und mit diesem verbunden sind, mit Ausnahme von wenigstens einem Stück einer ihrer Flächen, wobei die Fläche (3.1.) angeordnet ist, um bündig oder im Wesentlichen bündig mit der ersten Fläche (7) des einteiligen isolierenden Körpers (4, 4.2) zu sein, oder wobei die Fläche angeordnet ist, um von der ersten Fläche des einteiligen isolierenden Körpers (4.1, 4.3) hervorzustehen, während die gegenüberliegende Seite der Träger von der zweiten Fläche (8) des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) beabstandet ist,

- wobei die Strukturträger (2, 2.1, 2.2, 2.3, 2.4) konstruiert sind, um eine Grundplatte für eine Befestigung bereitzustellen,
 - wobei die Isolierplatte (1, 13, 14, 16) ferner einen Satz von länglichen lastaufnehmenden Teilen (9, 9.1, 9.2, 9.3) umfasst, die parallel oder im Wesentlichen parallel und mit Abstand zueinander, jedoch in einer abgewinkelten Richtung zu dem Satz von Strukturträgern (2, 2.1, 2.2, 2.3, 2.4), angeordnet sind, wobei von dem Satz von lastaufnehmenden Teilen (9, 9.1, 9.2, 9.3) wenigstens ein lastaufnehmendes Teil (9, 9.1, 9.2, 9.3) mit seinen Längsseitenflächen mit Abstand zu beiden Querseitenflächen (5, 6) des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) angeordnet ist,
 - wobei die lastaufnehmenden Teile (9, 9.1, 9.2, 9.3) ebenso in den einteiligen isolierenden Körper (4, 4.1, 4.2, 4.3) integriert und mit diesem verbunden sind, mit Ausnahme von wenigstens einem Stück einer ihrer Längsflächen, die angeordnet ist, um bündig oder im Wesentlichen bündig mit der zweiten Fläche (8) des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) zu sein, oder die angeordnet ist, um von der zweiten Fläche (8) des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) hervorzustehen, während die gegenüberliegende Seite dieser Teile von der ersten Fläche (7) des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) beabstandet ist.

2. Isolierplatte nach Anspruch 1, **dadurch gekennzeichnet, dass** die lastaufnehmenden Teile (9, 9.1, 9.2, 9.3) nicht mechanisch an den Strukturträgern befestigt sind (2, 2.1, 2.2, 2.3, 2.4).
3. Isolierplatte nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Strukturträger (2.4) und/oder die lastaufnehmenden Teile (9.3) perforiert sind.
4. Isolierplatte nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der Satz von Strukturträgern (2.2, 2.4) und/oder der Satz von lastaufnehmenden Teilen an den Schnittpunkten der Teile der zwei Sätze mit Kerben (17) versehen sind, wobei in jede Kerbe (17) ein lastaufnehmendes Teil (9.3) beziehungsweise ein Träger eingebracht ist.
5. Isolierplatte nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der Satz von Strukturträgern (2, 2.1, 2.2, 2.3, 2.4) und der Satz von lastaufnehmenden Teilen (9, 9.1, 9.2, 9.3) nicht in direktem Kontakt miteinander stehen.
6. Isolierplatte nach Anspruch 5, **dadurch gekennzeichnet, dass** die Abstandshalter derart angeordnet sind, dass wenigstens an einigen Schnittpunkten von einem Strukturträger mit einem lastaufnehmenden Teil, ein Abstandshalter mit einem Träger und einem lastaufnehmenden Teil in Kontakt steht.
7. Isolierplatte nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Strukturträger (2, 2.1, 2.2, 2.3, 2.4) und die lastaufnehmenden Teile (9, 9.1, 9.2, 9.3) aus den folgenden, nichtmetallischen Materialien zusammengesetzt sind:
 Holz, Kunststoff, Keramik oder Schaumstoff mit hoher Dichte oder einer Kombination dieser.
8. Isolierplatte nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** der einteilige isolierende Körper (4, 4.1, 4.2, 4.3) ein polymergeschäumter Körper ist und dass die Strukturträger (2, 2.1, 2.2, 2.3, 2.4) und die lastaufnehmenden Teile (9, 9.1, 9.2, 9.3) unter Verwendung der Eigenkräfte des Schaumstoffmaterials während des Produktionsvorgangs an den isolierenden Körper (4, 4.1, 4.2, 4.3) angeklebt werden.
9. Isolierplatte nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** der einteilige isolierende Körper (4, 4.1, 4.2, 4.3) eine als Verbindungsbeschlaganordnung geeignete Kantenverarbeitung der Isolierplatte (1, 13, 14, 16) an einer angrenzende Isolierplatte (1, 13, 14, 16) aufweist.
10. Isolierplatte nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** die erste Fläche (7) und/oder die zweite Fläche (8) des einteiligen isolierenden Körpers (4, 4.1, 4.2, 4.3) mit einer Verkleidung (11, 12) bedeckt ist/sind, wobei die Verkleidung flexibel sein kann.
11. Isolierplatte nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** die erste und/oder die zweite Fläche des einteiligen isolierenden Körpers mit einer starren Verkleidung oder einer flächenartigen Verkleidung bedeckt ist.
12. Isolierplatte nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** die erste und/oder die zweite Fläche des einteiligen isolierenden Körpers mit einem Brett, einer Tafel, einer Folie oder einer beliebigen Kombination

derer bedeckt ist.

13. Isolierplatte nach einem der Ansprüche 1 bis 12, **dadurch gekennzeichnet, dass** wenigstens einer der Strukturträger sich auf einer Seite des einteiligen isolierenden Körpers über die Erstreckung dieses Körpers erstreckt.
14. Verwendung einer Isolierplatte nach einem der Ansprüche 1 bis 13, **dadurch gekennzeichnet, dass** die Isolierplatte eine Dach- oder Wandplatte ist.
15. Anordnung einer Isolierplatte nach einem der Ansprüche 1 bis 14 und einer Stützstruktur, an der die Isolierungsplatte befestigt ist, **dadurch gekennzeichnet, dass** die Platte an der Stützstruktur mit mechanischen Befestigungsmitteln, die mit wenigstens einem Strukturträger der Isolierplatte zusammenwirken, die eine Zugkraft auf diesen Strukturträger in der Richtung der Stützstruktur ausübt, befestigt ist.

Revendications

1. Panneau isolant léger autoportant destiné à être utilisé comme panneau de construction de bâtiments présentant

- un corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3) définissant la géométrie du panneau, ayant une longueur et une largeur, et ayant une première face (7) et une seconde face (8) disposée à l'opposé de la première face (7), alors que le sens de l'isolation va de la première face (7) à la seconde face (8) ou inversement, et

- un ensemble d'éléments allongés disposés en parallèle ou sensiblement en parallèle et à distance les uns des autres, chaque élément s'étendant au moins sensiblement sur toute la longueur du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3),

- les éléments allongés étant fournis sous forme de chevrons structurels non métalliques (2, 2.1, 2.2, 2.3, 2.4) responsables de la plus grande partie de la portance et de l'essentiel de la propriété autoportante du panneau isolant (1, 13, 14, 16) dans le sens de l'étendue longitudinale des chevrons,

- les chevrons structurels (2, 2.1, 2.2, 2.3, 2.4) étant intégrés à l'intérieur du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3) et reliés à celui-ci, hormis au moins une partie de l'une de leurs faces, laquelle face (3.1.) est disposée de manière à affleurer, ou affleurer sensiblement, la première face (7) du corps isolant formé d'un seul élément (4, 4.2), ou laquelle face est disposée de manière à faire saillie à partir de la première face du corps isolant formé d'un seul élément (4.1, 4.3), alors que le côté opposé des chevrons est espacé de la seconde face (8) du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3),

- les chevrons structurels (2, 2.1, 2.2, 2.3, 2.4) étant conçus pour fournir un socle de montage pour une attache,

- le panneau isolant (1, 13, 14, 16) comprenant en outre un ensemble d'éléments récepteurs de charge allongés (9, 9.1, 9.2, 9.3) disposés en parallèle ou sensiblement en parallèle et à distance les uns des autres, mais dans une direction inclinée par rapport à l'ensemble de chevrons structurels (2, 2.1, 2.2, 2.3, 2.4), duquel ensemble d'éléments récepteurs de charge (9, 9.1, 9.2, 9.3) au moins un élément récepteur de charge (9, 9.1, 9.2, 9.3) est disposé de telle manière que ses faces latérales longitudinales sont placées à une certaine distance des deux faces latérales transversales (5, 6) du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3),

- les éléments récepteurs de charge (9, 9.1, 9.2, 9.3) étant également intégrés à l'intérieur du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3) et reliés à celui-ci, hormis au moins une partie de l'une de leurs faces longitudinales, qui est disposée de manière à affleurer, ou affleurer sensiblement, la seconde face (8) du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3), ou qui est disposée en saillie à partir de la seconde face (8) du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3), alors que le côté opposé de ces éléments est espacé de la première face (7) du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3).

2. Panneau isolant selon la revendication 1, **caractérisé en ce que** les éléments récepteurs de charge (9, 9.1, 9.2, 9.3) ne sont pas attachés mécaniquement aux chevrons structurels (2, 2.1, 2.2, 2.3, 2.4).

3. Panneau isolant selon la revendication 1 ou 2, **caractérisé en ce qu'**au moins l'un des chevrons structurels (2.4) et/ou des éléments récepteurs de charge (9.3) est perforé.

4. Panneau isolant selon l'une des revendications 1 à 3, **caractérisé en ce que** l'ensemble de chevrons structurels (2.2, 2.4) et/ou l'ensemble d'éléments récepteurs de charge sont dotés d'encoches (17) aux intersections des éléments des deux ensembles, alors que dans chaque encoche (17) un élément récepteur de charge (9.3) ou un chevron, respectivement, est introduit.

5. Panneau isolant selon l'une des revendications 1 à 3, **caractérisé en ce que** l'ensemble de chevrons structuraux (2, 2.1, 2.2, 2.3, 2.4) et l'ensemble d'éléments récepteurs de charge (9, 9.1, 9.2, 9.3) ne sont pas en contact direct l'un avec l'autre.
- 5 6. Panneau isolant selon la revendication 5, **caractérisé en ce que** les entretoises sont agencées de telle manière qu'au moins à certaines intersections d'un chevron structurel et d'un élément récepteur de charge, une entretoise est en contact avec un chevron et un élément récepteur de charge.
- 10 7. Panneau isolant selon l'une des revendications 1 à 6, **caractérisé en ce que** les chevrons structuraux (2, 2.1, 2.2, 2.3, 2.4) et les éléments récepteurs de charge (9, 9.1, 9.2, 9.3) sont composés d'un des matériaux non métalliques suivants :
le bois, le plastique, la céramique, ou la mousse haute densité, ou une combinaison de ceux-ci.
- 15 8. Panneau isolant selon l'une des revendications 1 à 7, **caractérisé en ce que** le corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3) est un corps expansé en polymère et que les chevrons structuraux (2, 2.1, 2.2, 2.3, 2.4) et les éléments récepteurs de charge (9, 9.1, 9.2, 9.3) sont collés au corps isolant (4, 4.1, 4.2, 4.3) grâce aux forces intrinsèques du matériau en expansion lors du processus de production.
- 20 9. Panneau isolant selon l'une des revendications 1 à 8, **caractérisé en ce que** le corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3) présente une finition des bords convenant à servir de disposition de raccord d'assemblage du panneau isolant (1, 13, 14, 16) à un panneau isolant adjacent (1, 13, 14, 16).
- 25 10. Panneau isolant selon l'une des revendications 1 à 9, **caractérisé en ce que** la première face (7) et/ou la seconde face(s) (8) du corps isolant formé d'un seul élément (4, 4.1, 4.2, 4.3) est/sont recouverte(s) d'un revêtement (11, 12), lequel revêtement pouvant être flexible.
- 30 11. Panneau isolant selon l'une quelconque des revendications 1 à 10, **caractérisé en ce que** la première et/ou la seconde face(s) du corps isolant formé d'un seul élément est/sont recouverte(s) d'un revêtement rigide, ou d'un moyen de recouvrement de type feuille.
- 35 12. Panneau isolant selon l'une quelconque des revendications 1 à 11, **caractérisé en ce que** la première et/ou la seconde face(s) du corps isolant formé d'un seul élément est/sont recouverte(s) d'une planche, dalle, tôle ou de toute combinaison de ceux-ci.
- 40 13. Panneau isolant selon l'une des revendications 1 à 12, **caractérisé en ce que** l'un au moins des chevrons structuraux s'étend d'un côté du corps isolant formé d'un seul élément au-delà de l'étendue de ce corps.
- 45 14. Utilisation d'un panneau isolant selon l'une quelconque des revendications 1 à 13, **caractérisé en ce que** le panneau isolant est un panneau de construction de toiture ou de mur.
- 50 15. Disposition d'un panneau isolant selon l'une des revendications 1 à 14 et structure de support à laquelle le panneau isolant est attaché, **caractérisé en ce que** le panneau est attaché à la structure de support à l'aide de moyens de fixation mécanique coopérant avec au moins un chevron structurel du panneau isolant en exerçant une force de traction sur ce chevron structurel en direction de la structure de support.
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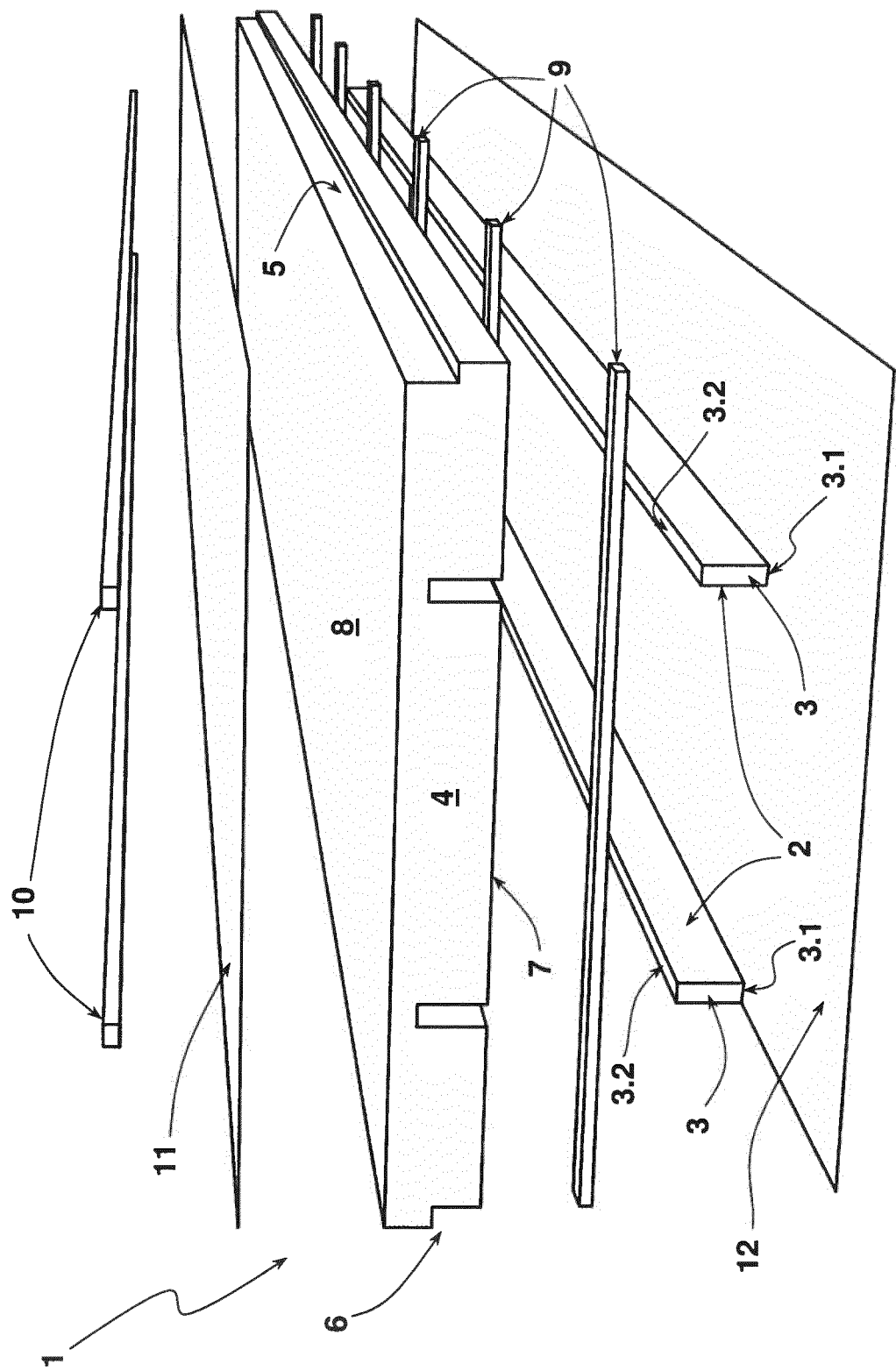


Fig. 1

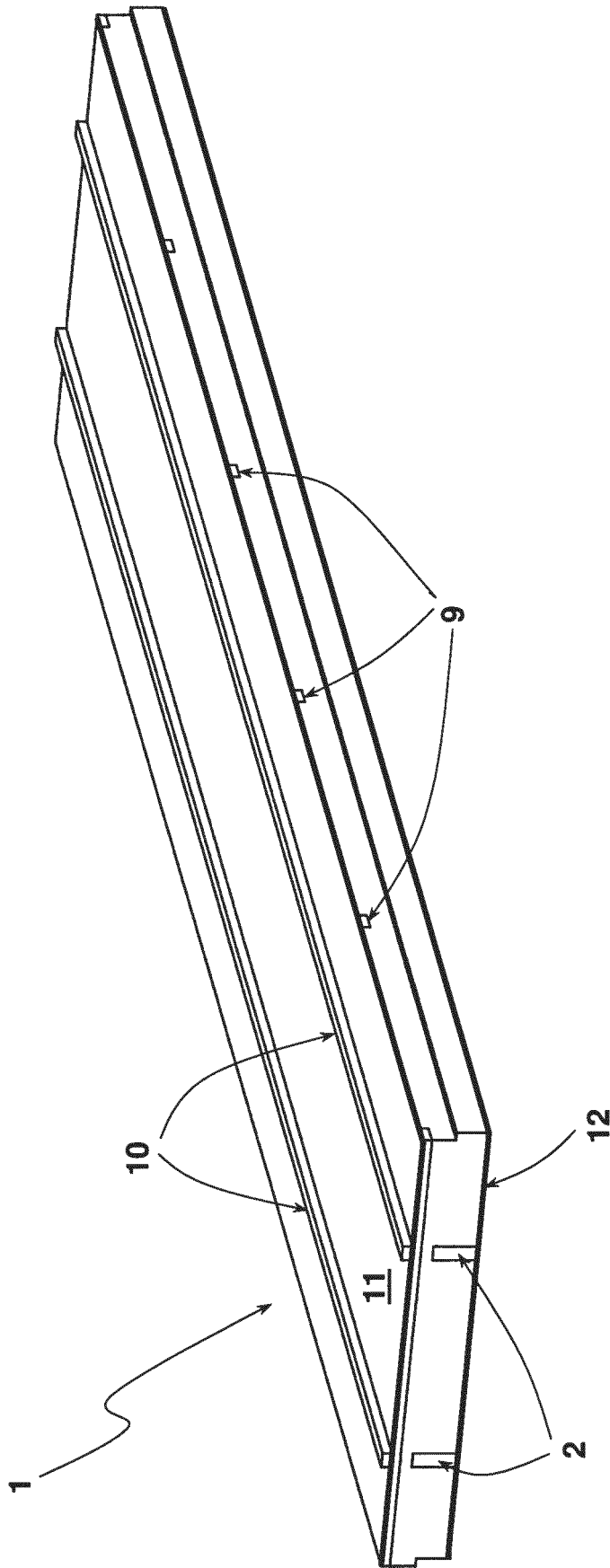


Fig. 2

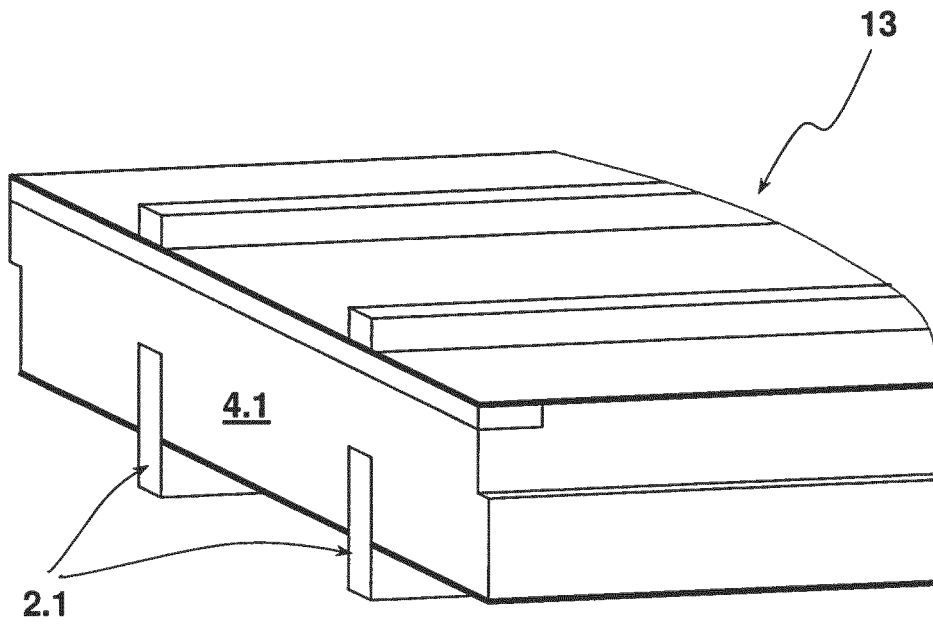


Fig. 3

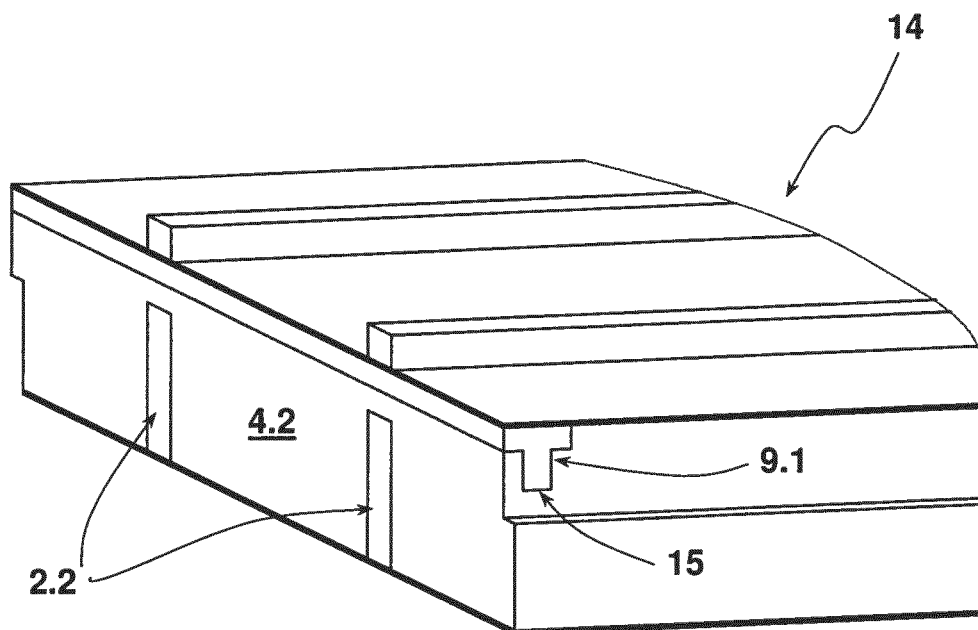


Fig. 4

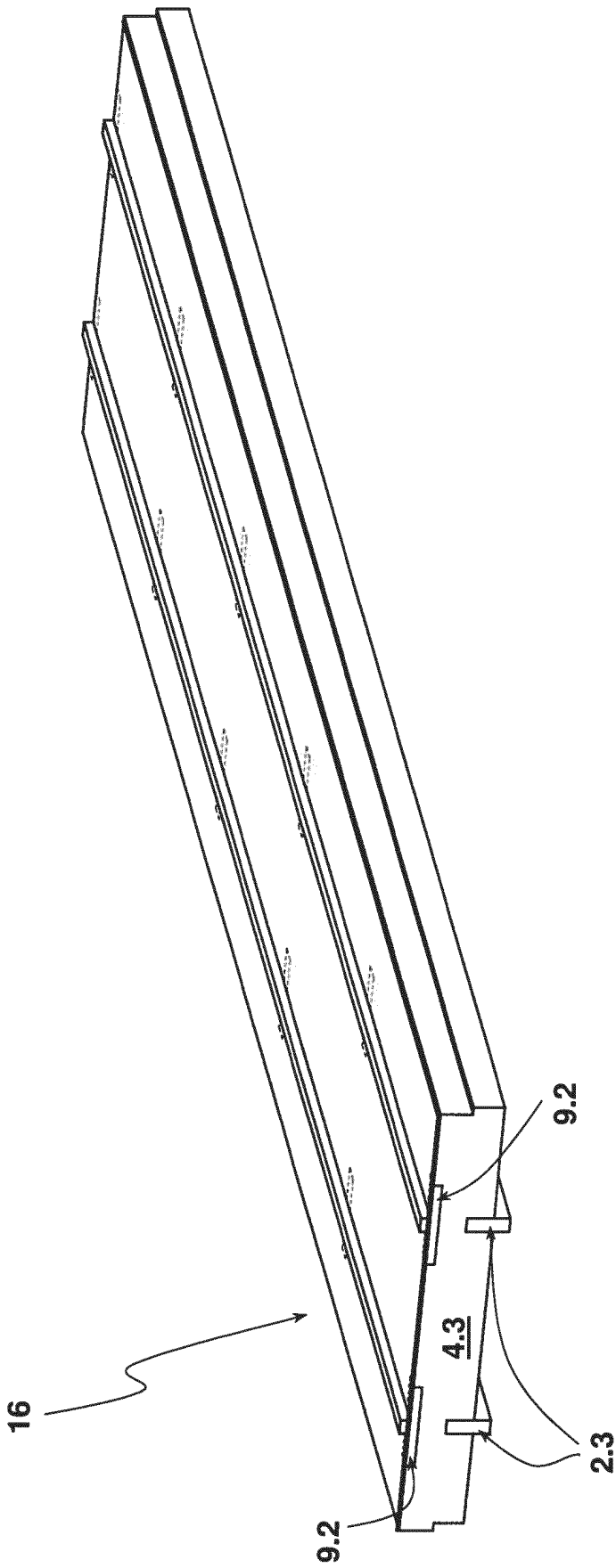


Fig. 5

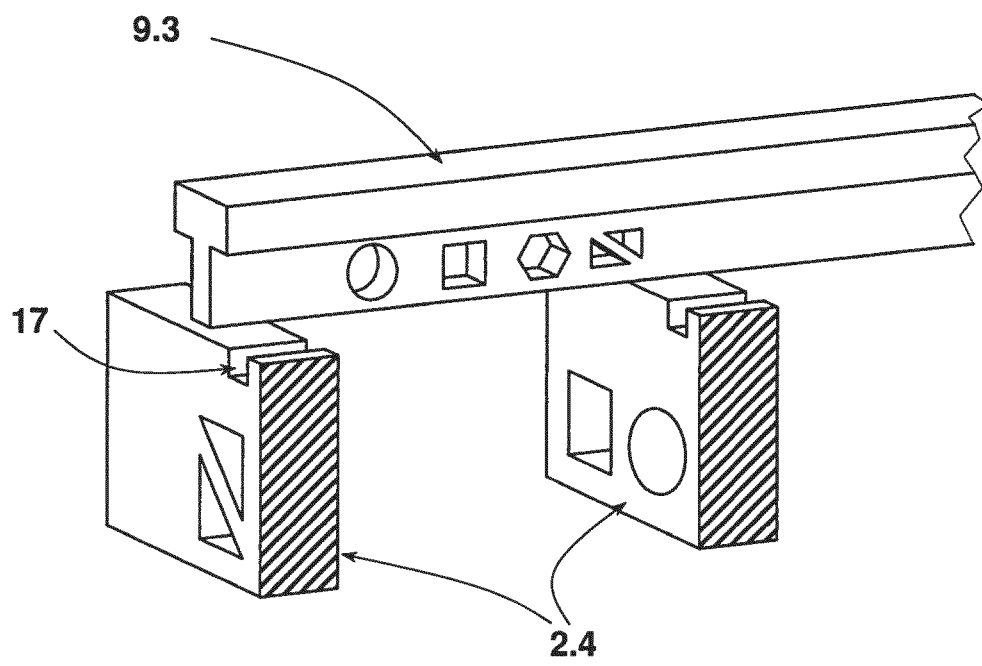


Fig. 6

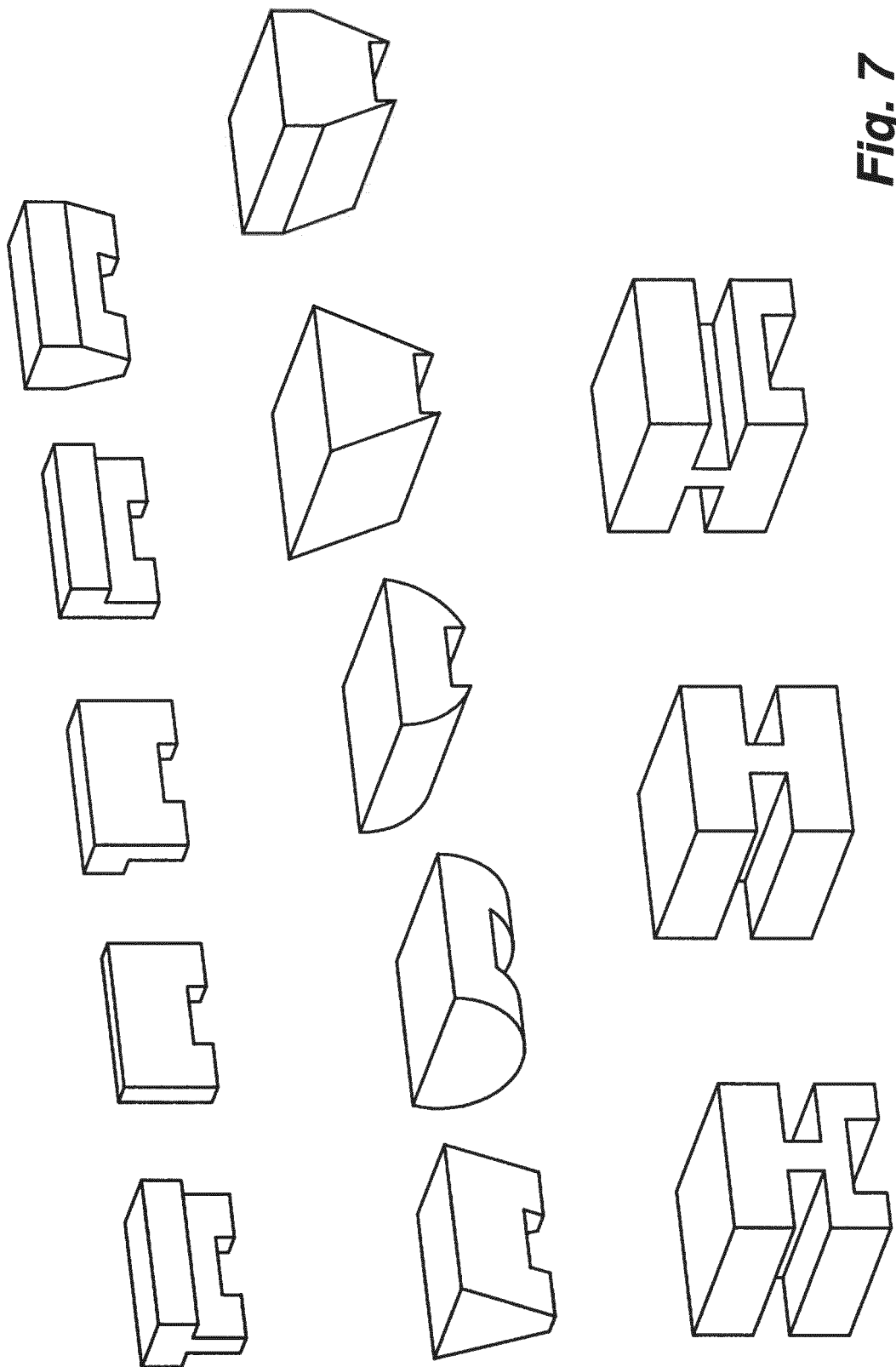


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4981003 A [0002] [0005]
- US 4844975 A [0002] [0004]
- BE 898919 [0006] [0018]
- US 3773604 A [0008]
- FR 2292817 A1 [0009]
- GB 556460 A [0010]
- FR 2180826 [0011]