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(54) **BUILDING ENVELOPE**

GEBÄUDEHÜLLE

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EP 4 162 123 B1

Description

[0001] The present invention relates to an assembly of sandwich panels, intended for the construction of building envelopes, and more particularly intended for the construction of building roofs and walls, without being limited thereto. The present invention also relates to the method for the assembling of a building thereof.

[0002] It is known to assemble sandwich panels comprising an insulation layer between two metallic sheets to build walls or roofs. Each sandwich panel usually comprises, on one of its longitudinal edges, a male interlocking part and, on its opposite longitudinal edge, a female interlocking part such that the male and female interlocking parts interlock into one another when two panels are assembled.

[0003] Moreover, it is known to fasten, on the external side of the assembly of sandwich panels and in a removable manner, an exterior facade, such as sidings or cassettes. Nevertheless, the resistance to wind suction is not enough and the sandwich panels tend to break apart.

[0004] It is also known notably from WO2008129523 a panel comprising an external steel skin having a plurality of mountings for fixing cladding elements such as tiles to the panel to form an exterior facing. However, the external steel skin of the panel has a limited load capacity and tend to dislocate.

[0005] Similarly, it is known to anchor rails on the external side of the assembly of sandwich panels forming a roof to ease the fastening of photovoltaic modules or other kinds of solar equipment. However, here again, the resistance to wind suction is not enough and the sandwich panels can break apart.

[0006] It is also known from US5373678 an assembly of panels fastened to the building structure with a fastener whose body goes through the tenon-mortise system of the skin opposed to the building structure. Sandwich panels and assembly of panels are also known from EP2169129A1, US2019226204A1 and

[0007] US20100170173A1. Further, WO 2011/154929 A2 discloses a building according to the preamble of claim 1 and a process according to the preamble of claim 14.

[0008] The aim of the present invention is therefore to remedy the drawbacks of the prior art by providing a building comprising an assembly of sandwich panels which provides an improved resistance to dislocation and a better resistance to wind suction.

[0009] According to the invention, this aim is achieved by a building according to claim 1 and a process according to claim 14. Preferred features of the invention are defined in the dependent claims.

[0010] For this purpose, a first subject of the present invention consists of a building comprising a building structure and an assembly of at least a first panel and a second panel each extending along a longitudinal axis X and comprising an inner metallic tray, an outer metallic sheet and an insulation material sandwiched between the inner metallic tray and the outer metallic sheet and comprising a first longitudinal side and a second longitudinal side wherein the inner metallic tray comprises in cross-section perpendicular to the longitudinal axis:

- An inner central part substantially lying down in a plane P,
- A first inner flange extending from a first extremity of the inner central part along the first longitudinal side of the insulation material and comprising a U-shaped bend forming a main tenon extending in parallel to plane P and outwards,
- A second inner flange extending from a second opposite extremity of the inner central part along the second longitudinal side of the insulation material and comprising a U-shaped bend forming a main mortise extending in parallel to plane P and inwards, the main tenon and main mortise having shapes that allow their interlocking,

wherein the outer metallic sheet comprises in cross-section perpendicular to the longitudinal axis:

- an outer central part,
- a first outer flange extending from a first extremity of the outer central part along the first longitudinal side of the insulation material and comprising a U-shaped bend forming a secondary mortise extending inwards and in parallel to the main tenon,
- a second outer flange extending from a second opposite extremity of the outer central part along the second longitudinal side of the insulation material and comprising a U-shaped bend forming a secondary tenon extending outwards and in parallel to the main mortise, the secondary tenon and secondary mortise having shapes that allow their interlocking,

[0011] The first and second panels being bound by means of:

- The interlocking of the main tenon of the first panel with the main mortise of the second panel,
- The interlocking of the secondary mortise of the first panel with the secondary tenon of the second panel,

[0012] The first, respectively second, panel being bound to the building structure, which is adjacent to the inner metallic tray of the first, respectively second, panel, with fasteners (46) whose heads lie on the outer central part (26) of the outer metallic sheet of the first, respectively second, panel and whose bodies go through the outer central part (26) and through the inner central part (11) of the inner metallic tray of the first, respectively second, panel,
the building further comprising a metallic profile at least partially positioned on at least a part of the outer central parts (26) of the outer metallic sheets of the first and

second panels and fixed to the assembly of panels with a fastener whose body goes through the outer central part of the outer metallic sheet of the second panel, the main tenon of the first panel and the main mortise of the second panel.

[0013] The building according to the invention may also have the optional features listed below, considered individually or in combination:

- the base of the main tenon and the base of the secondary mortise are aligned in a plane perpendicular to plane P,
- the main tenon extends outwards beyond a plane perpendicular to plane P and comprising the first extremity of the outer central part,
- the base of the main mortise and the base of the secondary tenon are aligned in a plane perpendicular to plane P,
- the main mortise extends inwards beyond a plane perpendicular to plane P and comprising the second extremity of the outer central part,
- the outer central part comprises a longitudinal rib adjacent to the second extremity of the outer central part,
- the main mortise extends below the longitudinal rib,
- the first panel and the second panel are further bound by means of at least one stitching fastener whose body goes through the secondary mortise of the first panel and the secondary tenon of the second panel,
- the metallic profile extends perpendicularly to the longitudinal axis X of the panels,
- the metallic profile is a metallic sheet profile,
- the metallic profile is a profile intended and capable of being used as spacer between the assembly of panels and an external facing,
- the building envelope further comprises an external facing fastened to the metallic profile,
- the metallic profile is a profile intended and capable of being used as spacer between the assembly of panels and photovoltaic modules.

[0014] A second subject of the invention consists of a process for the assembling of a building according to the invention comprising:

- (i) providing a first panel and a second panel,
- (ii) fastening the first and second panels on a building structure so that they form an assembly of panels, the step (ii) comprising the sub-steps of:
    - Positioning the inner metallic tray of the first panel adjacent to the building structure,
    - Fastening the first panel to the building structure by driving a fastener through consecutively the outer metallic sheet and the inner metallic tray of the first panel,
    - Positioning the inner metallic tray of the second panel adjacent to the building structure so that the two panels are bound by means of:
        - o The interlocking of the main tenon of the first panel with the main mortise of the second panel,
        - o The interlocking of the secondary mortise of the first panel with the secondary tenon of the second panel,
    - Fastening the second panel to the building structure by driving a fastener through consecutively the outer metallic sheet and the inner metallic tray of the second panel.
- (iii) positioning at least a metallic profile on at least a part of the assembly of panels and fixing it to the assembly of panels with a fastener whose body goes through the outer central part of the outer metallic sheet of the second panel, the main tenon of the first panel and the main mortise of the second panel.

[0015] Other characteristics and advantages of the invention will be described in greater detail in the following description, which is provided purely for purposes of explanation and is in no way intended to be restrictive, with reference to:

- Figure 1, which is a perspective view of a building envelope made of an assembly of sandwich panels,
- Figure 2, which is a cross-section of one sandwich panel of the panel assembly according to one variant,
- Figure 3, which is a perspective view of the first longitudinal edge of a sandwich panel of Figure 1,
- Figure 4, which a perspective view of the second longitudinal edge of a sandwich panel of Figure 1,
- Figure 5, which a perspective view of the first and second longitudinal edges of a sandwich panel of Figure 1,
- Figure 6, which is a cross-section of one sandwich panel of the panel assembly according to a second variant,
- Figure 7, which is a perspective view of the first longitudinal edge of a sandwich panel of Figure 6,
- Figure 8, which is a perspective view of the second longitudinal edge of a sandwich panel of Figure 6,
- Figure 9, which is a cross-section of one sandwich panel of the panel assembly according to a third variant,
- Figure 10, which is a perspective view of the first longitudinal edge of a sandwich panel of Figure 9,
- Figure 11, which is a perspective view of the second longitudinal edge of a sandwich panel of Figure 9,
- Figure 12, which represents a perspective detailed view of the building envelope, showing a cross section view of the interlocking of two panels according to the second variant,

- Figure 13, which represents a cross-section of the interlocking following arrows A of Figure 12,
- Figure 14, which represents a cross-section of the interlocking following arrows B of Figure 12,
- Figure 15, which represents a cross-section of the interlocking following arrows B of a variant of Figure 12
- Figure 16, which represents a cross section view of the interlocking of two panels according to the third variant.

[0016] It should be noted that the terms "inward", "inwards", "outward" and "outwards" as used in this application refer to the positions and orientations of the different constituent elements of the panel in relation to the position of the insulation material. Consequently, if an element extends inwards, it extends in the direction of the insulation material. Similarly, if the element extends outwards, it extends in the opposite direction of the insulation material.

[0017] It should also be noted that, to ease the description, the panels will be described in relation to their usual position on a building. Consequently, the terms "inner" and "outer" as used in this application refer to this usual position. Accordingly, the outer sheet is facing the outside and the inner tray is facing the inside of the building. Consequently, the inner flange refers to the flange of the inner tray and the outer flange refers to the flange of the outer sheet. Nevertheless, the panels and the corresponding assembly can be positioned upside down on a building, i.e. with the outer sheet facing the inside of the building.

[0018] It should be noted that the terms "lower", "upper", "above", "below", "lowest", "highest", "top", "bottom"... as used in this application refer to the positions and orientations of the different constituent elements of the panel when the latter is lying on an horizontal plane.

[0019] Throughout the text, a sheet is understood to mean an element that has a flat shape, i.e., its thickness is low compared to its other dimensions. Generally speaking, its thickness is 500 to 4000 times lower than its width. The sheet may be made of a single material or a composite assembly. In the latter case, the sheet is a stack of a plurality of layers of the same material or different materials. The material in question may be, among others, a metallic material or a polymer. Steel, aluminum, copper and zinc may be cited as non-restricting examples of metallic materials. The sheet is preferably a metallic sheet. It is preferably made of previously galvanized and pre-coated steel to protect it against corrosion. The inner tray and the outer sheet are examples of sheets.

[0020] Within the framework of the disclosure, the sheet will preferably have been previously formed with the aid of any known forming method, including, by way of non-restricting examples, bending, forming, stamping and molding. In particular, the U-shaped bend described later on is an element of the panel whose manufacturing process is not limited to bending.

[0021] This forming leads among other things to the formation of ribs, stiffeners or grooves on the surface of the sheet. Throughout the text, a rib is understood to mean a projection formed on the surface of the sheet. The rib may have a trapezoidal shape or a rectangular, corrugated, sinusoidal or even omega shape, for example. It includes a top central part and two lateral wings. A stiffener is a rib of limited height, generally 10 to 30 times lower than a rib. Throughout the text, a groove is understood to mean a recess formed on the surface of the panel. The groove can have shapes similar to the ones offered for ribs. Ribs, stiffeners or grooves are generally placed in parallel to the longitudinal edges of the sheet notably to render the sheet more rigid.

[0022] With reference to Figure 1, the building envelope 1 is extending in a plane P and comprises an assembly 2 of at least two panels 3 (three panels 3 are represented in figure 1) bounded together with interlocking means that will be described below. Each panel 3 has a global rectangular shape and extends along a longitudinal axis X. Each panel 3 comprises four lateral edges: two opposite longitudinal edges 7 and two opposite transversal edges 8 extending perpendicularly to the axis X.

[0023] Each panel 3 comprises a rear face fastened to a building structure 45, and a front face to which metallic profiles 49 are fastened. In the variant illustrated on Figure 1, the metallic profiles 49, which are part of a suspended façade, extend perpendicularly to the longitudinal edges 7 of the panels 3 and are transversally positioned on the three panels 3 along their entire widths. Finally, an external facing 50, which is also part of the suspended façade, is fastened to the metallic profiles 49. The metallic profiles and the external facing will be both described in detail below.

[0024] With reference to Figure 2, the panel 3 first comprises an insulation material 6 sandwiched between an inner metallic tray 4 and an outer metallic sheet 5. The sides of the insulation material 6 thus form the longitudinal edges 7 and transversal edges 8 of the panel 3.

[0025] The insulation material 6 can be any material providing some insulation to the panel 3. It can be, by way of non-restricting examples, polyurethane foam, polyisocyanurate foam, phenolic foam, mineral wool. According to a variant, the insulation material 6 is a composite comprising a lower layer of mineral wool and an upper layer of foamed material.

[0026] The inner metallic tray 4 and the outer metallic sheet 5 are largely substantially flat. The substantially flat portions lie in plane P or in a plane parallel to plane P. Flanges 12, 19, 29, 36 extend from each of the lateral extremities of the flat portions along the longitudinal sides 9, 10 of the insulation material 6. The flanges 12, 19, 29, 36 thus cover partially the sides 9, 10. The uncovered part of each longitudinal side 9, 10 is preferably perpendicular to plane P to ease the interlocking of panels 3. Those two longitudinal sides of the insulation material 6 are further

called first 9 and second 10 longitudinal sides.

[0027] The inner metallic tray 4 is a metallic sheet of rectangular shape, comprising longitudinal edges and transversal edges, which has been formed at a previous stage. It comprises, in cross-section perpendicular to its longitudinal axis X, an inner central part 11 and two inner flanges 12, 19 extending from each extremity of the inner central part 11 along the longitudinal sides 9, 10 of the insulation material 6. The central part 11 substantially lies down flat in plane P. According to a variant of the invention, the inner central part 11 comprises stiffeners extending longitudinally to increase the stiffness of the metallic sheet.

[0028] As illustrated on Figures 3 and 5, the first inner flange 12 extends, from a first lateral extremity of the inner central part 11, along the first longitudinal side 9 of the insulation material 6 and comprises a U-shaped bend forming a main tenon 13 extending in parallel to the inner central part 11, i.e. parallel to plane P, and outwards. In particular, the first inner flange 12 comprises a first inner section 14 perpendicular to the inner central part 11, extending between the first lateral extremity of the inner central part 11 and the main tenon 13. According to a variant, the first inner section comprises a stiffener extending longitudinally to increase the stiffness of the section. In particular, the stiffener extends inwards so that a gasket can be added. According to another variant illustrated on Figure 7, the main tenon 13 is linked to the inner central part 11 by a L-shaped step 43.

[0029] Preferably, the first inner flange 12 also comprises a first inner end wing 15, located above the main tenon and perpendicular to it. This helps stiffening the first inner flange 12.

[0030] In particular, the main tenon 13 comprises two parallel branches 16, 17 linked by a U-turn 18. More preferably, the two parallel branches 9,10 have substantially the same length. The ratio between the width W1 of the main tenon 13 (measured along the Y axis) and its length L1 (measured along the Z axis, starting from the uncovered part of the first longitudinal side 9 of the insulation material) is preferably comprised between 0.07 and 0.75. Preferably, it is comprised between 0.1 and 0.3. Preferably, the width is comprised between 4mm and 30mm. The length of the main tenon is preferably comprised between 25mm and 70mm. Other dimensions of this main tenon will be described later on in relation to the secondary tenon of the outer metallic sheet.

[0031] Preferably, the main tenon 13 is located in the upper half of the first inner flange 12, i.e. the lowest portion of the main tenon is located in the upper half of the first inner flange. In particular, the first parallel branch 16 of the main tenon is located above half the height of the inner flange. Thanks to this position, the main tenon is close enough from the outer metallic sheet so that a fastener inserted from the outside (so that its head lies on the outer metallic sheet) can easily go through the main tenon without reaching the inner central part. Preferably, the ratio between the position P1 of the main tenon (i.e. the distance between the lowest portion of the main tenon and the inner central part measured along the Y axis) and the height H1 of the first inner flange is comprised between 0.5 and 0.9. More preferably, this ratio is comprised between 0.70 and 0.85.

[0032] As illustrated on Figures 4 and 5, the second inner flange 19 extends from the second lateral extremity of the inner central part 11, along the second longitudinal side 10 of the insulation material and comprises a U-shaped bend forming a main mortise 20 extending in parallel to the central part, i.e. parallel to plane P, and inwards. In particular, the second inner flange 19 comprises a second inner section 21 perpendicular to the inner central part, extending between the second lateral extremity of the inner central part 11 and the main mortise 20. According to a variant, the second inner section 21 comprises a stiffener extending longitudinally to increase the stiffness of the section. In particular, the stiffener extends inwards so that a gasket can be added. According to another variant illustrated on Figure 8, the main mortise is linked to the inner central part 11 by an external male protrusion 44, extending outwards beyond the vertical plane (i.e. plane perpendicular to plane P) comprising the base of the main mortise or beyond the vertical plane comprising the uncovered part of the second longitudinal side 10 of the insulation material. The size of the external male protrusion 44 is such that it can be received in the L-shaped step 43 linking the main tenon 13 to the inner central part 11 of an adjacent panel. The shapes of the L-shaped step 43 and of the external male protrusion 44 are adjusted so that a fastener head can be positioned between them.

[0033] Preferably, the second inner flange also comprises a second inner end wing 22, located above the main mortise and perpendicular to it. This helps stiffening the second inner flange 19.

[0034] The main tenon 13 and main mortise 20 have shapes that allow their interlocking when one panel is assembled with an adjacent panel. Preferably, their shapes are substantially complementary and their dimensions are such that:

- The width W2 of the main mortise 20 (measured along the Y axis) is substantially equal to the width W1 of the main tenon 13,
- The length L2 of the main mortise (measured along the Z axis, starting from the uncovered part of the second longitudinal side 10 of the insulation material) is superior or substantially equal to the length L1 of the main tenon (measured along the Z axis, starting from the uncovered part of the second longitudinal side 10 of the insulation material),
- The position P2 of the main mortise (i.e. the distance measured along the Y axis between the lowest portion of the main mortise and the inner central part) is substantially equal to the position P1 of the main tenon.

[0035] Preferably, the shape and dimensions of the main tenon are such that it perfectly fits into the main mortise. By "perfectly fits" it is meant that the main tenon and the main mortise are substantially in contact to one another except in areas where a gasket is added for sealing purposes, such as airtightness or thermal insulation. In particular, the main mortise 20 comprises two parallel branches 23, 24 linked by a U-turn 25. More preferably, the two parallel branches 23, 24 have substantially the same length. The internal distance between the two parallel branches 23, 24 is equal to the external distance between the two parallel branches 16, 17 of the main tenon. The U-turn 18 of the main tenon and the U-turn 25 of the main mortise are preferably separated by a gap allowing the insertion of a gasket, positioned in the U-turn of the main mortise before assembling of the panels. The gasket can be, among others, of an elastomeric material which is preferably shaped to substantially conform to the shape of the main mortise on assembly, PVC foam, PU foam, PVC hollow section joint or of an intumescent material, such as a mineral fibre based mat incorporating phosphate or exfoliating graphite.

[0036] The ratio between the width W2 of the main mortise 20 and its length L2 is preferably comprised between 0.07 and 0.75. Preferably, it is comprised between 0.1 and 0.3. Preferably, the width is comprised between 4mm and 30mm. The length of the main mortise is preferably comprised between 25mm and 70mm. Other dimensions of this main mortise will be described later on in relation to the secondary mortise of the outer metallic sheet.

[0037] Preferably, the main mortise 20 is located in the upper half of the second inner flange 19, i.e. the lowest portion of the main mortise is located in the upper half of the second inner flange. In particular, the first parallel branch 23 of the main mortise is located above half the height of the inner flange. Thanks to this position, the main mortise is close enough from the outer metallic sheet so that a fastener inserted from the outside (so that its head lies on the outer metallic sheet) can easily go through the main mortise without reaching the inner central part. Moreover, in the case where the insulation material is a composite comprising a lower layer and an upper layer of a different material, the lower layer can be easily inserted below the main mortise and held in place by the main mortise. Preferably, the ratio between the position P2 of the main mortise and the height H2 of the second inner flange is comprised between 0.5 and 0.9. More preferably, this ratio is comprised between 0.70 and 0.85. Preferably the gap between the main mortise and the outer metallic sheet 4 is at least of 40mm so that the panel provides enough thermal insulation.

[0038] Preferably, the ratio between the position P2 of the main mortise and the panel thickness Hp is comprised between 0.25 and 0.7. More preferably, the ratio between the position P2 of the main mortise and the panel thickness Hp is at least 0.25 and the ratio between the position of the mortise top and the panel thickness is at most 0.75. The position of the mortise top corresponds to the sum of P2 and W2. In other words, the main mortise is comprised in a portion of the sandwich panel located between 25 and 75% of the panel thickness. Thanks to this central positioning of the main mortise, the static loads are greatly increased. The panel thickness is meant to be the distance between the inner central part 11 of the inner metallic tray and the outer central part 26 of the outer metallic sheet (regardless of the possible ribs, stiffeners or grooves).

[0039] As illustrated on Figure 2, the outer metallic sheet 5 is a metallic sheet of rectangular shape, comprising longitudinal edges and transversal edges, which has been formed at a previous stage. It comprises, in cross-section perpendicular to its longitudinal axis X, an outer central part 26 and two outer flanges 29, 36 extending from each extremity of the outer central part 26 along the longitudinal sides 9, 10 of the insulation material 6. Preferably, most of the outer central part is lying down in a plane parallel to plane P. In one variant illustrated on Figures 3-5 and 7-8 where the panel 3 is intended to be used in façade, the outer central part 26 preferably comprises at least one longitudinal rib 27 on which an external facing 50, such as sidings, metallic sheet profiles, cassettes, decorative laminates, terracotta or clay tiles, can be easily fixed, directly or indirectly with the use of an additional metallic profile or secondary steel frame. Thanks to this longitudinal rib, the external facing can be fixed without secondary frame. The panel for façade can also comprise stiffeners. In another variant illustrated on Figures 9-11 where the panel is intended to be used for roofs, the outer central part 26 preferably comprises at least one longitudinal groove 28 so that repartition plates 55 and fastener heads can be hidden below the waterproof membrane to be applied on the roof. In another possible variant where the panel is intended for architectural purposes, the outer central part 26 preferably comprises stiffeners.

[0040] As illustrated on Figures 3 and 5, the first outer flange 29 extends from a first extremity of the outer central part 26, along the first longitudinal side 9 of the insulation material and comprises a U-shaped bend forming a secondary mortise 30 extending inwards and in parallel to the main tenon. By "secondary" it is meant that the corresponding mortise is significantly smaller than the main tenon. The secondary mortise is on the same longitudinal edge 7 of the panel than the main tenon. In other words, the secondary mortise is on the other longitudinal edge 7 of the panel than the main mortise. In particular, the ratio between the length L1 of the main tenon and the length L3 of the secondary mortise is comprised between 1.5 and 3.5. Thanks to the longer length of the main tenon, the fire resistance of the panel assembly is greatly improved. Moreover, it improves the static and dynamic loads of the panel assembly, and in particular the resistance to wind suction and the resistance to snow load. In particular, the first outer flange 29 comprises a first outer section 31 perpendicular

to the outer central part 26, i.e. perpendicular to plane P, extending between the first lateral extremity of the outer central part 26 and the secondary mortise 30.

[0041] Preferably, the first outer flange 29 also comprises a first outer end wing 32, located below the secondary mortise and perpendicular to it. This helps stiffening the first outer flange 29.

[0042] In particular, the secondary mortise 30 comprises two parallel branches 33, 34 linked by a U-turn 35. More preferably, the two parallel branches 33, 34 have substantially the same length. The ratio between the width W3 of the secondary mortise (measured along the Y axis) and its length L3 (measured along the Z axis, starting from the uncovered part of the first longitudinal side 9 of the insulation material) is preferably comprised between 0.1 and 0.7. Preferably, it is comprised between 0.15 and 0.35. Preferably, the width is comprised between 3mm and 7mm. The length of the secondary mortise is preferably comprised between 10mm and 30mm so that a fastener can easily go through it.

[0043] Preferably, the secondary mortise 30 and the main tenon 13 are positioned so that the base of the secondary mortise and the base of the main tenon are aligned in a plane perpendicular to plane P. By "base", it is meant the extremity of a mortise or a tenon opposed to its U-turn. In the case where the mortise or tenon comprises two parallel branches, the base is the extremity of the branches opposed to the U-turn. More preferably, in the case where the first inner flange 12 comprises a first inner end wing 15 and the first outer flange 29 comprises a first outer end wing 32, the first inner end wing 15 and the first outer end wing 32 are in a same plane perpendicular to plane P and corresponding to the uncovered part of the first longitudinal side 9 of the insulation material. In other words, the secondary mortise 30 and the main tenon 13 extend in opposite directions.

[0044] The main tenon 13 extends outwards beyond a plane perpendicular to plane P and comprising the first extremity of the outer central part 26, the extension being such that a fastener 51, whose body goes through the outer central part 26 of a second panel interlocked with the described panel along the first longitudinal edge 7 of the described panel, will also go through the main tenon 13 of the described panel. In particular, the main tenon extends beyond a plane perpendicular to plane P and comprising the first outer section 31 of the first outer flange. More particularly, the base of the main tenon is aligned with the first outer section 31 in a plane perpendicular to plane P. Even more particularly, in the case where the first inner flange 12 comprises a first inner end wing 15, the latter is aligned with the first outer section 31 in a plane perpendicular to plane P.

[0045] The second outer flange 36 extends from a second extremity of the outer central part 26, along the second longitudinal side 10 of the insulation material and comprises a U-shaped bend forming a secondary tenon 37 extending outwards and in parallel to the main mortise. By "secondary" it is meant that the corresponding tenon is significantly smaller than the main mortise. The secondary tenon is on the same longitudinal edge 7 of the panel than the main mortise. In other words, the secondary tenon is on the other longitudinal edge 7 of the panel than the main tenon. In particular, the ratio between the length L2 of the main mortise and the length L4 of the secondary tenon is comprised between 1.5 and 3.5. Thanks to the longer length of the main tenon, the fire resistance of the panel assembly is greatly improved. Moreover, it improves the static and dynamic loads of the panel assembly, and in particular the resistance to wind suction and the resistance to snow load. In particular, the second outer flange 36 comprises a second outer section 38 perpendicular to the outer central part 26, i.e. perpendicular to plane P, extending between the second lateral extremity of the outer central part 26 and the secondary tenon 37.

[0046] Preferably, the second outer flange 36 also comprises a second outer end wing 39, located below the secondary tenon and perpendicular to it. This helps stiffening the second outer flange 36.

[0047] The secondary tenon 37 and secondary mortise 30 have shapes that allow their interlocking when one panel is assembled with an adjacent panel. Preferably, their shapes are substantially complementary and their dimensions are such that:

- The width W3 of the secondary mortise 30 (measured along the Y axis) is substantially equal to the width W4 of the secondary tenon 37,
- The length L3 of the secondary mortise (measured along the Z axis, starting from the uncovered part of the second longitudinal side 10 of the insulation material) is superior or substantially equal to the length L4 of the secondary tenon,
- The position of the secondary mortise (i.e. the distance measured along the Y axis between the lowest portion of the secondary mortise and the inner central part) is substantially equal to the position of the secondary tenon.

[0048] Preferably, the shape and dimensions of the secondary tenon are such that it perfectly fits into the secondary mortise. By "perfectly fits" it is meant that the secondary tenon and the secondary mortise are substantially in contact to one another except in areas where a gasket has been added for sealing purposes, such as airtightness or thermal insulation. In particular, the secondary tenon 37 comprises two parallel branches 40, 41 linked by a U-turn 42. More preferably, the two parallel branches 40, 41 have substantially the same length. The external distance between the two parallel branches 40, 41 is equal to the internal distance between the two parallel branches 33, 34 of the secondary mortise. The U-turn 42 of the secondary tenon and the U-turn 35 of the secondary mortise are preferably separated by a gap allowing the insertion of a gasket, positioned in the U-turn of the secondary mortise before assembling of the pa-

nels. The gasket can be, among others, of an elastomeric material which is preferably shaped to substantially conform to the shape of the main mortise on assembly, PVC foam, PU foam, PVC hollow section joint or of an intumescent material, such as a mineral fibre based mat incorporating phosphate or exfoliating graphite.

[0049] The ratio between the width W4 of the secondary tenon (measured along the Y axis) and its length L4 (measured along the Z axis, starting from the uncovered part of the first longitudinal side 9 of the insulation material) is preferably comprised between 0.1 and 0.7. Preferably, it is comprised between 0.15 and 0.35. Preferably, the width is comprised between 3mm and 7mm. The length of the secondary mortise is preferably comprised between 10mm and 30mm, so that a fastener can easily go through it.

[0050] Preferably, the secondary tenon 37 and the main mortise 20 are positioned so that the base of the secondary tenon and the base of the main mortise are aligned in a plane perpendicular to plane P. More preferably, in the case where the second inner flange 19 comprises a second inner end wing 22 and the second outer flange 36 comprises a second outer end wing 39, the second inner end wing 22 and the second outer end wing 39 are in a same plane perpendicular to plane P and corresponding to the uncovered part of the second longitudinal side 10 of the insulation material. In other words, the secondary tenon 37 and the main mortise 20 extend in opposite directions.

[0051] The main mortise 20 extends inwards beyond a plane perpendicular to plane P and comprising the second extremity of the outer central part 26, the extension being such that a fastener 51, whose body goes through the outer central part 26, will also go through the main mortise 20, and, if a second panel is interlocked with the described panel along the first longitudinal edge 7 of the described panel, through the main tenon 13 of that second panel. In other words, the main mortise extends below the outer central part 26 of the outer metallic sheet 5. In particular, in the case where the outer central part 26 comprises a longitudinal rib 27 adjacent to the second extremity of the outer central part, the main mortise extends below the longitudinal rib so that an additional metallic profile can be at least partially positioned on the longitudinal rib and fixed to the panel thanks to a fastener whose body goes through the main mortise, as it will be described in more details later on.

[0052] In particular, the main mortise extends inwards beyond a plane perpendicular to plane P and comprising the second outer section 38 of the second outer flange 36. More particularly, the base of the main mortise is aligned with the second outer section 38 in a plane perpendicular to plane P. Even more particularly, in the case where the second inner flange 19 comprises a second inner end wing 22, the latter is aligned with the second outer section 32 in a plane perpendicular to plane P.

[0053] According to Figures 12 to 16, the bounding of a first panel 3 and a second panel 3a of the assembly of panels 2 in order to form the building envelope 1 will now be described.

[0054] In a first step, the inner metallic tray 4 of the first panel 3 is positioned adjacent to the building structure 45. The first panel 3 is then fastened to the building structure with an appropriate fastener 46, for example a screw. The fastener is inserted from the front face of the panel, i.e. it is driven through consecutively the outer metallic sheet 5 and the inner metallic tray 4, in particular through the outer central part 26 and the inner central part 11. Consequently, once the fastener has been inserted, its head lies on the outer metallic sheet, in particular on the outer central part, and its body goes through the outer metallic sheet and through the inner metallic tray, in particular through the outer central part and through the inner central part. In the case of the variant illustrated on Figure 12, this fastener 46 is inserted through the first panel 3 perpendicularly to the outer metallic sheet 5 in a portion parallel to plan P of said outer metallic sheet 5, more precisely in a groove of the outer central part 26, adjacent to the longitudinal rib 27. In the case of the variant illustrated on Figure 16, the screw is preferably inserted in the longitudinal groove 28 with the help of at least one repartition plate 55 and the assembly of panels is then covered with a waterproof membrane 56.

[0055] In a second step, the second panel 3a is provided and its inner metallic tray 4 is positioned adjacent to the building structure 45, along the first panel, so that the two panels 3, 3a are bound by means of:

- The interlocking of the main tenon 13 of the first panel with the main mortise 20 of the second panel,
- The interlocking of the secondary mortise 30 of the first panel with the secondary tenon 37 of the second panel.

[0056] The portion of the assembly 2 comprising the main tenon 13 of the first panel 3 interlocked with the main mortise 20 of the second panel 3a is called an interlocking area 47 of the two panels 3, 3a and is depicted in figure 12.

[0057] Thanks to the design of the main tenon 13 and main mortise 20, the fire resistance of the panel assembly is greatly improved. Moreover, the specifically designed tenon and mortise greatly improve the static and dynamic loads of the panel assembly, and in particular the resistance to wind suction and the resistance to snow load.

[0058] Thanks to the design of the secondary tenon 37 and the secondary mortise 30, the mechanical resistance of the panel assembly is further improved.

[0059] Then the second panel 3a is fastened to the building structure 45 with an appropriate fastener 46 as described above in relation with the first panel 3.

[0060] Optionally, as illustrated on Figures 12 and 13, the two panels 3, 3a are further bound by driving at least one stitching fastener 48 consecutively through the outer metallic sheet of the first panel, in particular through the

outer central part of the first panel, and through the secondary mortise 30 of the first panel and the secondary tenon 37 of the second panel. Consequently, once the fastener has been inserted, the two panels 3, 3a are further bound by means of at least one stitching fastener 48 whose head lies on the outer metallic sheet, in particular on the outer central part, of the first panel and whose body goes through the outer metallic sheet, in particular on the outer central part, of the first panel and through the secondary mortise 30 of the first panel and the secondary tenon 37 of the second panel. Thanks to this stitching of the two panels, in combination with the design of the main tenon 13 and main mortise 20, the fire resistance of the panel assembly is further improved. The stitching of the two panels is preferably done with stitching fasteners regularly spaced. More preferably, the fastener spacing is between 250mm and 500mm.

[0061] Of course and as depicted in Figure 1, more than two panels 3 may be bounded together in order to form a bigger assembly of panels 2, provided that said assembly 2 extends into the plane P. More broadly for an assembly of panels 2 comprising n panels 3, the k^{th} panel is first bounded to the $k\text{-}1^{th}$ panel that is already fastened to the building structure 45. Then the k^{th} panel is fastened to the building structure 45. The operation is repeated for the following panels 3 until the n^{th} panel is bounded to the $n\text{-}1^{th}$ panel and fastened to the building structure 45.

[0062] In a third step, at least one metallic profile 49 is at least partially positioned on at least a part of the assembly of panels 2. In particular, it is at least partially positioned on at least a part of the outer central parts 26 of the outer metallic sheets of the first and second panels. More precisely, it is at least partially positioned on a part of the assembly of panels 2 comprising the interlocked main tenon 13 and main mortise 20 of the different panels 3. In other words, it is at least partially positioned on the interlocking area 47 of the assembly of panels 2. Finally, the metallic profile 49 is fastened to the assembly of panels 2.

[0063] The metallic profiles 49 can be notably metallic sheet profiles, as part of an external facing, thin profiles used as spacers between the assembly of panels and an external facing or thin profiles used as spacers between the assembly of panels and photovoltaic modules.

[0064] In the variant illustrated on Figures 12 to 14 where the panels 3 are intended to be used as supports for a suspended façade, the metallic profiles 49 can be thin profiles used as spacers between the assembly of panels and an external facing 50. They have preferably the shape of an omega and comprise two opposite legs and a U-shaped central portion. This U-shaped central portion comprises a plane base and two branches extending from the opposite ends of the plane base. The angle between each branch and the plane base is preferably comprised between 100 and 130 degrees, which represents a good compromise between stiffness and stacking capability.

[0065] The metallic profiles 49 are regularly spaced and extend perpendicularly to the longitudinal axis X of each panel 3. In other words, the metallic profiles are parallel to each other and extend perpendicularly to the longitudinal edges 7 of the panels 3 (see Figure 1). As depicted in Figure 1, and in a non-limitative manner, the length of the metallic profile 49 is about three times the width of each panel 3. In addition, and in order to optimally strengthen the assembly comprising three panels 3, the building envelope 1 comprises five metallic profiles 49 regularly and longitudinally spaced.

[0066] In the variant illustrated on Figure 16 where the panels 3 are intended to be used on a roof as supports for a photovoltaic system, the metallic profiles 49 can be thin profiles used as spacers between the assembly of panels and photovoltaic modules 57, such as rails, extruded or not. They can have various forms and shapes and the man skilled in the art will know which profile has to be selected for a specific installation.

[0067] Each metallic profile 49 is fastened to the assembly of panels 2 with a plurality of profile fasteners 51, for example screws. The profile fastener is inserted from the front face of the panel, i.e. it is driven consecutively through the outer metallic sheet 5 of the second panel 3a, in particular through the outer central part of the second panel, and through the main tenon 13 of first panel 3 and the main mortise 20 of the second panel 3a. Consequently, once the fastener has been inserted, its head is adjacent to the outer metallic sheet, in particular to the outer central part, of the second panel and its body goes through the metallic profile 49, the outer central part 26 of the second panel 3a and both through the main tenon 13 of panel 3 and the main mortise 20 of the adjacent panel 3a, as illustrated on figure 14. By "go through", it is meant that the fastener body is present on both sides of the main mortise, respectively of the main tenon. In the case where the main tenon and the main mortise have parallel branches, the fastener goes through both parallel branches of the main mortise, respectively the main tenon. By doing so, the profile fastener 51 will penetrate five steel layers of the panels 3, 3a, thus providing better pull out resistance. Moreover, the profile fasteners 51 act as stitching screws and further prevent the opening of the main tenon / main mortise interlock during fire.

[0068] Optionally, and as illustrated on Figure 14, an external facing 50 is provided and fastened to the metallic profiles 49. In this example, this external facing 50 is a corrugated metallic sheet panel with a periodic pattern comprising a decorative section 53 and a fastening section 54. The decorative section 53 is chevron-shaped while the fastening section 54 is a rectangular plane base. A first longitudinal edge of the rectangular plane base 54 extends from a longitudinal edge of the chevron-shape section 53, while a second opposite longitudinal edge of the rectangular plane based 54 extends from a longitudinal edge of the chevron-shape section 53 of an adjacent periodic pattern. Both the rectangular plane base 54 and the chevron-shaped section 53 of each periodic pattern are extending perpendicularly to the

longitudinal edges of the panels 3.

[0069] The external facing 50 is fastened, with facing fasteners 52, for example screws, to the metallic profiles 49, in particular to the plane base of the U-shaped central portion of the metallic profiles.

[0070] As the external facing 50 is thus fixed on the inner metallic tray 4 through the metallic profiles 49, and in particular through the profile fastener 51 connected to the main tenon 13 of panel 3 and the main mortise 20 of the adjacent panel 3a, the static and dynamic loads of the suspended façade are significantly increased, and in particular the resistance to wind suction. It notably allows the installation of external facings with very heavy self-weight, such as terracotta.

[0071] In the case illustrated on Figure 15, where an external facing 50 is fixed directly on the assembly of sandwich panels, without the use of an additional profile or secondary steel frame, i.e. where the external facing acts as the metallic profile 49, the profile fastener 51 is used to fix the external facing on the inner metallic tray 4. It is inserted in the assembly of sandwich panels 2 from the outside so that its head lies on the external facing and its body goes through the main tenon 13 of panel 3 and the main mortise 20 of the adjacent panel 3a. As the external facing is thus fixed on the inner metallic tray, the static and dynamic loads of the façade are significantly increased, and in particular the resistance to wind suction.

[0072] Other shapes of external facing are of course possible, as long as it can be fixed on the metallic profiles 49 or directly on the panels 3. It can be for example, sidings, wall facing, cassettes, decorative laminates, mineral composites, terracotta or clay tiles.

[0073] Alternatively, and as illustrated on Figure 16, photovoltaic modules 57 are provided and fastened to the metallic profiles 49.

Claims

1. Building comprising a building structure and an assembly (2) of at least a first panel and a second panel (3) each extending along a longitudinal axis X and comprising an inner metallic tray (4), an outer metallic sheet (5) and an insulation material (6) sandwiched between the inner metallic tray (4) and the outer metallic sheet (5) and comprising a first longitudinal side (9) and a second longitudinal side (10) wherein the inner metallic tray comprises in cross-section perpendicular to the longitudinal axis:

- An inner central part (11) substantially lying down in a plane P,
- A first inner flange (12) extending from a first extremity of the inner central part along the first longitudinal side of the insulation material and comprising a U-shaped bend forming a main tenon (13) extending in parallel to plane P and outwards,
- A second inner flange (19) extending from a second opposite extremity of the inner central part along the second longitudinal side of the insulation material and comprising a U-shaped bend forming a main mortise (20) extending in parallel to plane P and inwards, the main tenon and main mortise having shapes that allow their interlocking,

wherein the outer metallic sheet (5) comprises in cross-section perpendicular to the longitudinal axis:

- an outer central part (26),
- a first outer flange (29) extending from a first extremity of the outer central part along the first longitudinal side of the insulation material and comprising a U-shaped bend forming a secondary mortise (30) extending inwards and in parallel to the main tenon,
- a second outer flange (36) extending from a second opposite extremity of the outer central part along the second longitudinal side of the insulation material and comprising a U-shaped bend forming a secondary tenon (37) extending outwards and in parallel to the main mortise, the secondary tenon and secondary mortise having shapes that allow their interlocking,

The first, respectively second, panel being bound to the building structure, which is adjacent to the inner metallic tray of the first, respectively second, panel, with first fasteners (46) whose heads lie on the outer central part (26) of the outer metallic sheet of the first, respectively second, panel and whose bodies go through the outer central part (26) and through the inner central part (11) of the inner metallic tray of the first, respectively second, panel, the building further comprising a metallic profile (49) at least partially positioned on at least a part of the outer central parts (26) of the outer metallic sheets of the first and second panels and fixed to the assembly of panels with a second fastener (51) whose body goes through the outer central part (26) of the outer metallic sheet of the second panel, the building being **characterized in that** The first and second panels are bound by means of:

- The interlocking of the main tenon (13) of the first panel with the main mortise of the second panel (20),
- The interlocking of the secondary mortise (30) of the first panel with the secondary tenon (37) of the second panel,

and **in that** the second fastener (51) goes through the main tenon (13) of the first panel and the main mortise (20) of the second panel.

2. Building according to claim 1 wherein the base of the main tenon (13) and the base of the secondary mortise (30) are aligned in a plane perpendicular to plane P.

3. Building according to any one of claims 1 or 2 wherein the main tenon (13) extends outwards beyond a plane perpendicular to plane P and comprising the first extremity of the outer central part (26).

4. Building according to any one of the preceding claims wherein the base of the main mortise (20) and the base of the secondary tenon (37) are aligned in a plane perpendicular to plane P.

5. Building according to any one of the preceding claims wherein the main mortise (20) extends inwards beyond a plane perpendicular to plane P and comprising the second extremity of the outer central part (26).

6. Building according to any one of the preceding claims wherein the outer central part (26) comprises a longitudinal rib (27) adjacent to the second extremity of the outer central part.

7. Building according to claim 6 wherein the main mortise (20) extends below the longitudinal rib (27).

8. Building according to any one of the preceding claims wherein the first panel and the second panel (3) are further bound by means of at least one stitching fastener (48) whose body goes through the secondary mortise (30) of the first panel and the secondary tenon (37) of the second panel.

9. Building according to any one of the preceding claims wherein the metallic profile extends perpendicularly to the longitudinal axis X of the panels.

10. Building according to any one of the preceding claims wherein the metallic profile (49) is a metallic sheet profile.

11. Building according to any one of claims 1 to 9 wherein the metallic profile (49) is a profile intended and capable of being used as spacer between the assembly of panels (2) and an external facing (50).

12. Building according to claim 11 further comprising an external facing (50) fastened to the metallic profile (49).

13. Building according to any one of claims 1 to 9 wherein the metallic profile (49) is a profile intended and capable of being used as spacer between the assembly of panels (2) and photovoltaic modules (57).

14. A process for the assembling of a building according to any one of claims 1 to 13 comprising:

- (i) providing a first panel (3) and a second panel (3),
- (ii) fastening the first and second panels (3) on a building structure (45) so that they form an assembly of panels (2), the step (ii) comprising the sub-steps of:

  ◦ Positioning the inner metallic tray (4) of the first panel (3) adjacent to the building structure (45),
  ◦ Fastening the first panel to the building structure by driving a first fastener (46) through consecutively the outer metallic sheet (5) and the inner metallic tray of the first panel,

the process being **characterized in that** it comprises the further steps of:

◦ Positioning the inner metallic tray (4) of the second panel (3) adjacent to the building structure so that the two panels are bound by means of:

  ▪ The interlocking of the main tenon (13) of the first panel with the main mortise of the second panel (20),
  ▪ The interlocking of the secondary mortise (30) of the first panel with the secondary tenon (37) of the second panel,

o Fastening the second panel to the building structure by driving a fastener (46) through consecutively the outer metallic sheet and the inner metallic tray of the second panel,

- (iii) positioning at least a metallic profile (49) on at least a part of the assembly of panels (2) and fixing it to the assembly of panels with a second fastener (51) whose body goes through the outer central part (26) of the outer metallic sheet of the second panel, the main tenon (13) of the first panel and the main mortise (20) of the second panel.

Patentansprüche

1. Gebäude, umfassend eine Gebäudestruktur und eine Anordnung (2) aus mindestens einer ersten

Platte und einer zweiten Platte (3), die sich jeweils entlang einer Längsachse X erstrecken, und eine innere Metallschale (4), ein äußeres Metallblech (5) und ein Isoliermaterial (6), das zwischen die innere Metallschale (4) und das äußere Metallblech (5) eingefügt ist, und umfassend eine erste Längsseite (9) und eine zweite Längsseite (10), wobei die innere Metallschale im Querschnitt senkrecht zur Längsachse verläuft und Folgendes umfasst:

- ein inneres Mittelteil (11), das im Wesentlichen in einer Ebene P liegt,
- einen ersten inneren Flansch (12), der sich von einem ersten Ende des inneren Mittelteils entlang der ersten Längsseite des Isoliermaterials erstreckt und eine U-förmige Biegung umfasst, die einen Hauptzapfen (13) bildet, der sich parallel zu der Ebene P und nach außen erstreckt,
- einen zweiten inneren Flansch (19), der sich von einem zweiten, gegenüberliegenden Ende des inneren Mittelteils entlang der zweiten Längsseite des Isoliermaterials erstreckt und eine U-förmige Biegung umfasst, die ein Hauptzapfenloch (20) bildet, das sich parallel zu der Ebene P und nach innen erstreckt, wobei der Hauptzapfen und das Hauptzapfenloch Formen aufweisen, die ihr Ineinandergreifen ermöglichen,

wobei das äußere Metallblech (5) in einem Querschnitt senkrecht zu der Längsachse Folgendes umfasst:

- ein äußeres Mittelteil (26),
- einen ersten äußeren Flansch (29), der sich von einem ersten Ende des äußeren Mittelteils entlang der ersten Längsseite des Isoliermaterials erstreckt und eine U-förmige Biegung umfasst, die ein sekundäres Zapfenloch (30) bildet, das sich nach innen und parallel zu dem Hauptzapfen erstreckt,
- einen zweiten äußeren Flansch (36), der sich von einem zweiten gegenüberliegenden Ende des äußeren Mittelteils entlang der zweiten Längsseite des Isoliermaterials erstreckt und eine U-förmige Biegung umfasst, die einen sekundären Zapfen (37) bildet, der sich nach außen und parallel zu dem Hauptzapfenloch erstreckt, wobei der sekundäre Zapfen und das sekundäre Zapfenloch Formen aufweisen, die ihr Ineinandergreifen ermöglichen,

wobei die erste bzw. zweite Platte mit ersten Befestigungselementen (46), deren Köpfe auf dem äußeren Mittelteil (26) der äußeren Metallplatte der ersten bzw. zweiten Platte liegen und deren Körper durch das äußere Mittelteil (26) und durch das innere Mittelteil (11) der inneren Metallplatte der ersten bzw. zweiten Platte verlaufen, mit der Gebäudestruktur verbunden ist, die an die innere Metallplatte der ersten bzw. zweiten Platte angrenzt, das Gebäude ferner umfassend ein Metallprofil (49), das zumindest teilweise auf zumindest einem Teil der äußeren Mittelteile (26) der äußeren Metallbleche der ersten und der zweiten Platte positioniert ist und mit einem zweiten Befestigungselement (51), dessen Körper durch den äußeren Mittelteil (26) des äußeren Metallblechs der zweiten Platte verläuft, an der Gesamtheit der Platten befestigt ist, wobei das Gebäude **dadurch gekennzeichnet ist, dass**
die erste und die zweite Platte durch Folgendes befestigt sind:

- die Verriegelung des Hauptzapfens (13) der ersten Platte mit dem Hauptzapfenloch der zweiten Platte (20),
- die Verriegelung des sekundären Zapfenlochs (30) der ersten Platte mit dem sekundären Zapfen (37) der zweiten Platte,

und dass das zweite Befestigungselement (51) durch den Hauptzapfen (13) der ersten Platte und das Hauptzapfenloch (20) der zweiten Platte verläuft.

2. Gebäude nach Anspruch 1, wobei die Basis des Hauptzapfens (13) und die Basis des sekundären Zapfenlochs (30) in einer Ebene senkrecht zu der Ebene P ausgerichtet sind.

3. Gebäude nach einem der Ansprüche 1 oder 2, wobei sich der Hauptzapfen (13) nach außen über eine Ebene hinaus erstreckt, die senkrecht zu der Ebene P ist und das erste Ende des äußeren Mittelteils (26) bildet.

4. Gebäude nach einem der vorherigen Ansprüche, wobei die Basis des Hauptzapfenlochs (20) und die Basis des sekundären Zapfens (37) in einer Ebene senkrecht zur Ebene P ausgerichtet sind.

5. Bauwerk nach einem der vorherigen Ansprüche, wobei sich das Hauptzapfenloch (20) nach innen über eine Ebene senkrecht zu der Ebene P erstreckt und das zweite Ende des äußeren Mittelteils (26) umfasst.

6. Gebäude nach einem der vorherigen Ansprüche, wobei das äußere Mittelteil (26) eine Längsrippe (27) angrenzend an das zweite Ende des äußeren Mittelteils umfasst.

7. Gebäude nach Anspruch 6, wobei sich das Haupt-

zapfenloch (20) unterhalb der Längsrippe (27) erstreckt.

8. Gebäude nach einem der vorherigen Ansprüche, wobei die erste Platte und die zweite Platte (3) ferner durch mindestens ein Heftungselement (48) verbunden sind, dessen Körper durch das sekundäre Zapfenloch (30) der ersten Platte und den sekundären Zapfen (37) der zweiten Platte verläuft.

9. Gebäude nach einem der vorherigen Ansprüche, wobei sich das Metallprofil senkrecht zu der Längsachse X der Platten erstreckt.

10. Gebäude nach einem der vorherigen Ansprüche, wobei das Metallprofil (49) ein Metallblechprofil ist.

11. Gebäude nach einem der Ansprüche 1 bis 9, wobei das Metallprofil (49) ein Profil ist, das als Abstandhalter zwischen der Plattenanordnung (2) und einer Außenverkleidung (50) verwendet werden soll und kann.

12. Gebäude nach Anspruch 11, ferner umfassend eine Außenverkleidung (50), die an dem Metallprofil (49) befestigt ist.

13. Gebäude nach einem der Ansprüche 1 bis 9, wobei das Metallprofil (49) ein Profil ist, das als Abstandhalter zwischen der Plattenanordnung (2) und Solarmodulen (57) verwendet werden soll und kann.

14. Verfahren zum Zusammenbau eines Gebäudes nach einem der Ansprüche 1 bis 13, umfassend:

- (i) Bereitstellen einer ersten Platte (3) und einer zweiten Platte (3),
- (ii) Befestigen der ersten und der zweiten Platte (3) an einer Gebäudestruktur (45), sodass sie eine Anordnung von Platten (2) bilden, wobei der Schritt (ii) die folgenden Teilschritte umfasst:

o Positionieren der inneren Metallschale (4) der ersten Platte (3) angrenzend an die Gebäudestruktur (45),
o Befestigen der ersten Platte an der Gebäudestruktur durch Eintreiben eines ersten Befestigungselements (46) durch das äußere Metallblech (5) und die innere Metallschale der ersten Platte, wobei das Verfahren **dadurch gekennzeichnet ist, dass** es die folgenden weiteren Schritte umfasst:

o Positionieren der inneren Metallschale (4) der zweiten Platte (3) angrenzend an die Gebäudestruktur, sodass die zwei Platten miteinander verbunden sind:

- Ineinandergreifen des Hauptzapfens (13) der ersten Platte mit dem Hauptzapfenloch der zweiten Platte (20),
- Ineinandergreifen des sekundären Zapfenlochs (30) der ersten Platte mit dem sekundären Zapfen (37) der zweiten Platte,

o Befestigen der zweiten Platte an der Gebäudestruktur, indem ein Befestigungselement (46) nacheinander durch das äußere Metallblech und die innere Metallschale der zweiten Platte getrieben wird,

- (iii) Positionieren mindestens eines Metallprofils (49) auf mindestens einem Teil der Plattenanordnung (2) und Befestigen desselben an der Plattenanordnung mit einem zweiten Befestigungselement (51), dessen Körper durch das äußere Mittelteil (26) des äußeren Metallblechs der zweiten Platte, den Hauptzapfen (13) der ersten Platte und das Hauptzapfenloch (20) der zweiten Platte verläuft.

Revendications

1. Bâtiment comprenant une structure de bâtiment et un assemblage (2) d'au moins un premier panneau et un second panneau (3) s'étendant chacun le long d'un axe longitudinal X et comprenant un plateau métallique intérieur (4), une feuille métallique extérieure (5) et un matériau isolant (6) pris en sandwich entre le plateau métallique intérieur (4) et la feuille métallique extérieure (5) et comprenant un premier côté longitudinal (9) et un second côté longitudinal (10) dans lequel le plateau métallique intérieur présente une section transversale perpendiculaire à l'axe longitudinal :

- Une partie centrale intérieure (11) sensiblement couchée dans un plan P,
- Un premier rebord intérieur (12) s'étendant à partir d'une première extrémité de la partie centrale intérieure le long du premier côté longitudinal du matériau isolant et comprenant un coude en forme de U formant un tenon principal (13) s'étendant parallèlement au plan P et vers l'extérieur,
- Un deuxième rebord intérieur (19) s'étendant à partir d'une deuxième extrémité opposée de la partie centrale intérieure le long du deuxième côté longitudinal du matériau isolant et comprenant un coude en forme de U formant une mortaise principale (20) s'étendant parallèlement au plan P et vers l'intérieur, le tenon principal et la

mortaise principale ayant des formes qui permettent leur emboîtement,
dans lequel la feuille métallique extérieure (5) présente une section transversale perpendiculaire à l'axe longitudinal :

- une partie centrale extérieure (26),
- un premier rebord extérieur (29) s'étendant à partir d'une première extrémité de la partie centrale extérieure le long du premier côté longitudinal du matériau isolant et comprenant un coude en forme de U formant une mortaise secondaire (30) s'étendant vers l'intérieur et parallèlement au tenon principal,
- un deuxième rebord extérieur (36) s'étendant à partir d'une deuxième extrémité opposée de la partie centrale extérieure le long du deuxième côté longitudinal du matériau isolant et comprenant un coude en forme de U formant un tenon secondaire (37) s'étendant vers l'extérieur et parallèlement à la mortaise principale, le tenon secondaire et la mortaise secondaire ayant des formes qui permettent leur emboîtement,

Le premier, respectivement le deuxième, panneau étant lié à la structure du bâtiment, qui est adjacente au plateau métallique intérieur du premier, respectivement du deuxième, panneau, par des premières fixations (46) dont les têtes se trouvent sur la partie centrale extérieure (26) de la feuille métallique extérieure du premier, respectivement du deuxième, panneau et dont les corps traversent la partie centrale extérieure (26) et la partie centrale intérieure (11) du plateau métallique intérieur du premier, respectivement du deuxième, panneau, le bâtiment comprenant en outre un profilé métallique (49) au moins partiellement positionné sur au moins une partie des parties centrales extérieures (26) des feuilles métalliques extérieures des premier et deuxième panneaux et fixé à l'assemblage de panneaux par une deuxième fixation (51) dont le corps traverse la partie centrale extérieure (26) de la tôle métallique extérieure du deuxième panneau, le bâtiment étant **caractérisé en ce que**
Le premier et le deuxième panneau sont liés par :

- L'emboîtement du tenon principal (13) du premier panneau avec la mortaise principale du second panneau (20),
- L'emboîtement de la mortaise secondaire (30) du premier panneau avec le tenon secondaire (37) du second panneau,

et **en ce que** la deuxième fixation (51) traverse le tenon principal (13) du premier panneau et la mortaise principale (20) du deuxième panneau.

2. Bâtiment selon la revendication 1 dans lequel la base du tenon principal (13) et la base de la mortaise secondaire (30) sont alignées dans un plan perpendiculaire au plan P.

3. Bâtiment selon l'une quelconque des revendications 1 ou 2, dans lequel le tenon principal (13) s'étend vers l'extérieur au-delà d'un plan perpendiculaire au plan P et comprenant la première extrémité de la partie centrale extérieure (26).

4. Bâtiment selon l'une quelconque des revendications précédentes dans lequel la base de la mortaise principale (20) et la base du tenon secondaire (37) sont alignées dans un plan perpendiculaire au plan P.

5. Bâtiment selon l'une quelconque des revendications précédentes dans lequel la mortaise principale (20) s'étend vers l'intérieur au-delà d'un plan perpendiculaire au plan P et comprenant la deuxième extrémité de la partie centrale extérieure (26).

6. Bâtiment selon l'une quelconque des revendications précédentes, dans lequel la partie centrale extérieure (26) comprend une nervure longitudinale (27) adjacente à la deuxième extrémité de la partie centrale extérieure.

7. Bâtiment selon la revendication 6, dans lequel la mortaise principale (20) s'étend sous la nervure longitudinale (27).

8. Bâtiment selon l'une quelconque des revendications précédentes dans lequel le premier panneau et le second panneau (3) sont en outre liés au moyen d'au moins une fixation par agrafage (48) dont le corps traverse la mortaise secondaire (30) du premier panneau et le tenon secondaire (37) du second panneau.

9. Bâtiment selon l'une quelconque des revendications précédentes dans lequel le profilé métallique s'étend perpendiculairement à l'axe longitudinal X des panneaux.

10. Bâtiment selon l'une quelconque des revendications précédentes dans lequel le profilé métallique (49) est un profilé de feuille métallique.

11. Bâtiment selon l'une quelconque des revendications 1 à 9 dans lequel le profilé métallique (49) est un profilé destiné à être utilisé comme entretoise entre l'assemblage de panneaux (2) et un parement exté-

rieur (50).

12. Bâtiment selon la revendication 11 comprenant en outre un parement extérieur (50) fixé au profilé métallique (49).

13. Bâtiment selon l'une quelconque des revendications 1 à 9 dans lequel le profilé métallique (49) est un profilé destiné à être utilisé comme entretoise entre l'assemblage de panneaux (2) et des modules photovoltaïques (57).

14. Processus d'assemblage d'un bâtiment selon l'une quelconque des revendications 1 à 13, comprenant :

- (i) fournir un premier panneau (3) et un second panneau (3),
- (ii) fixer les premier et deuxième panneaux (3) sur une structure de bâtiment (45) de manière à former un assemblage de panneaux (2), l'étape (ii) comprenant les sous-étapes suivantes :

  - o Positionner le plateau métallique intérieur (4) du premier panneau (3) de manière adjacente à la structure du bâtiment (45),
  - o Fixer le premier panneau à la structure du bâtiment en enfonçant une première fixation (46) à travers consécutivement la feuille métallique extérieure (5) et le plateau métallique intérieur du premier panneau, le procédé étant **caractérisé en ce qu'**il comprend les étapes supplémentaires suivantes :

    - o Positionner le plateau métallique intérieur (4) du second panneau (3) de manière adjacente à la structure du bâtiment de manière à ce que les deux panneaux soient liés au moyen de :

      - L'emboîtement du tenon principal (13) du premier panneau avec la mortaise principale du second panneau (20),
      - L'emboîtement de la mortaise secondaire (30) du premier panneau avec le tenon secondaire (37) du second panneau,

    - o Fixer le second panneau à la structure du bâtiment en enfonçant une fixation (46) à travers consécutivement la feuille métallique extérieure et le plateau métallique intérieur du second panneau,

- (iii) positionner au moins un profilé métallique (49) sur au moins une partie de l'assemblage de panneaux (2) et le fixer à l'assemblage de panneaux à l'aide d'une seconde fixation (51) dont le corps traverse la partie centrale extérieure (26) de la feuille métallique extérieure du second panneau, le tenon principal (13) du premier panneau et la mortaise principale (20) du second panneau.

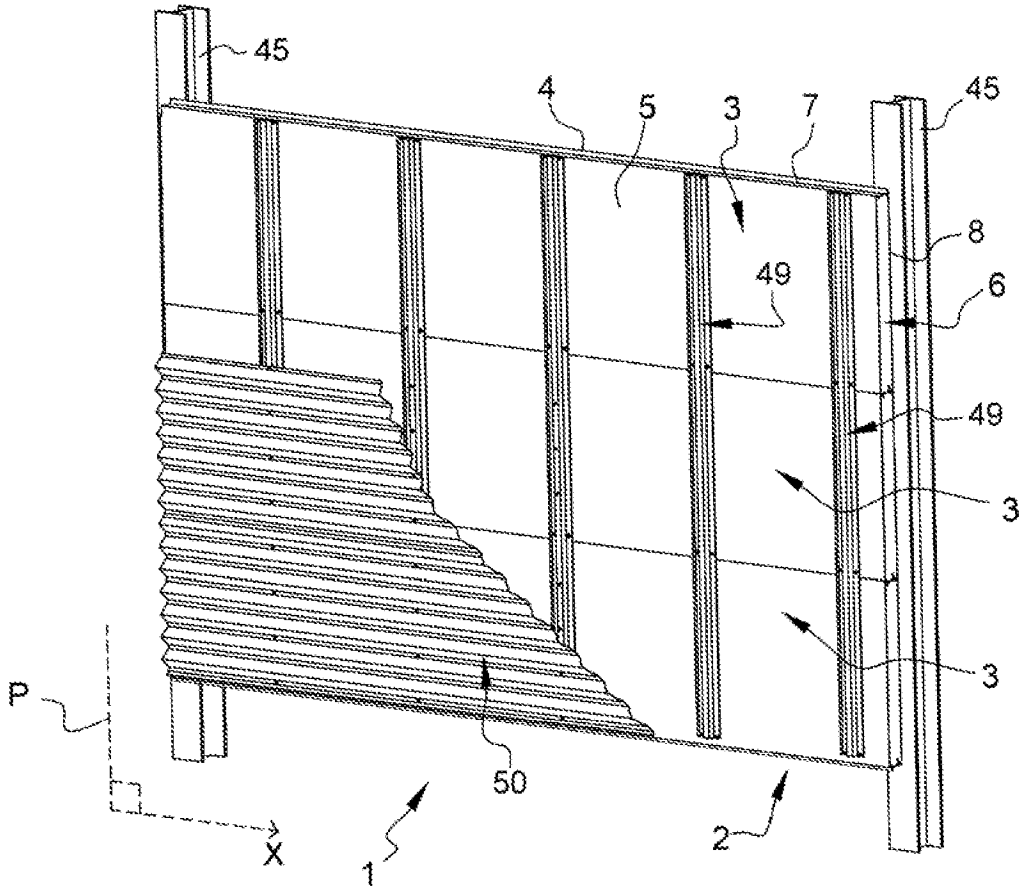


Figure 1

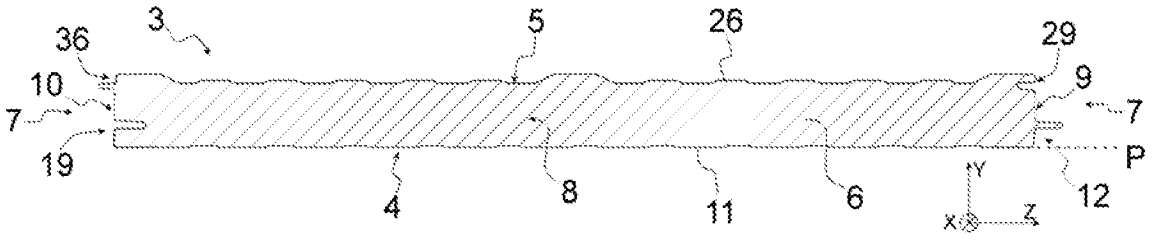
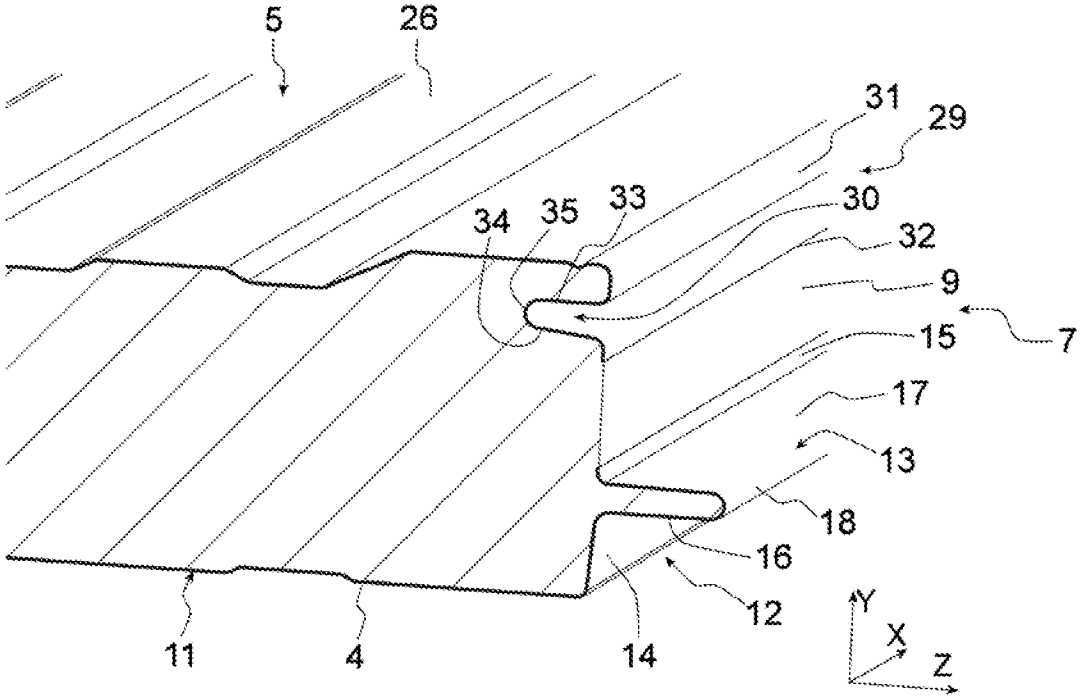


Figure 2



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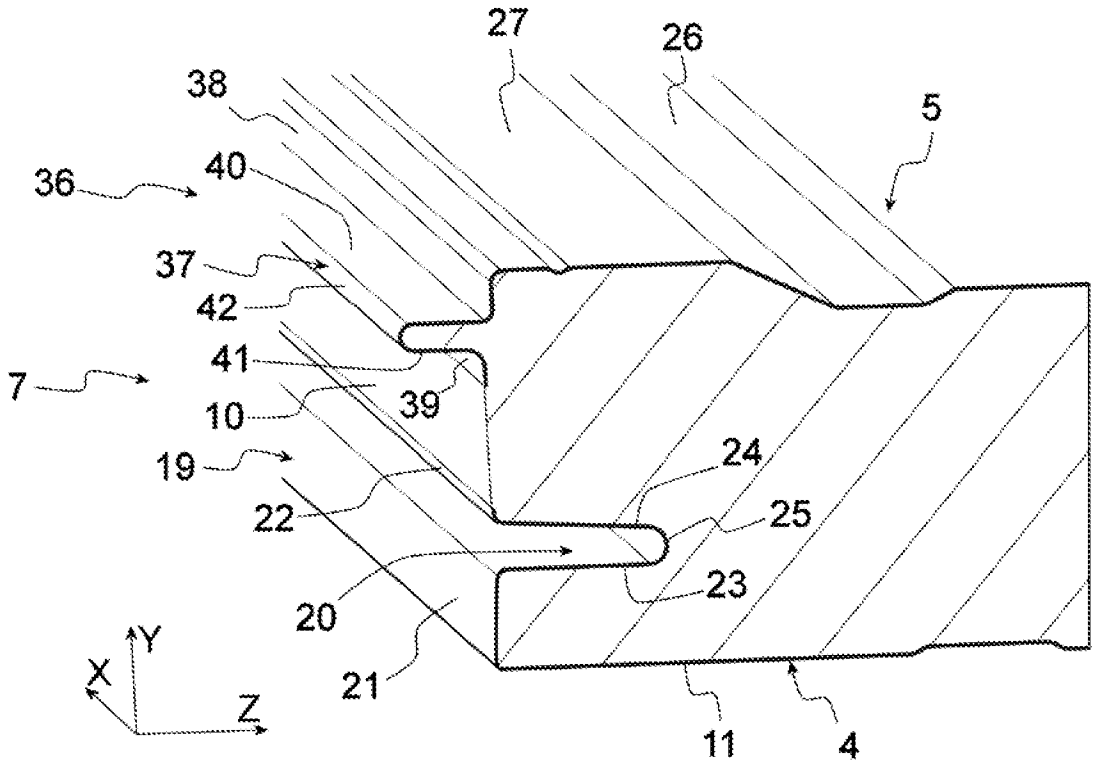

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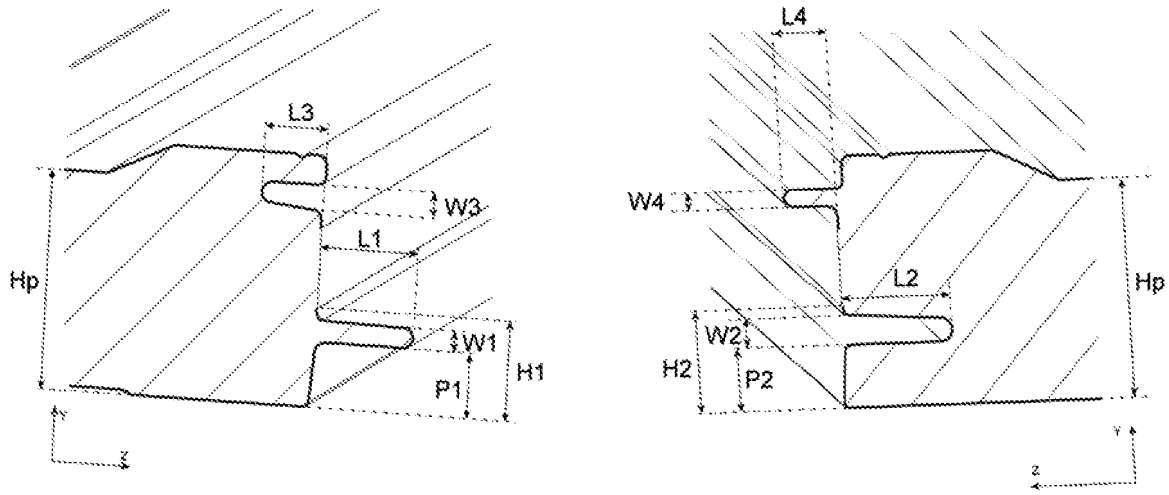

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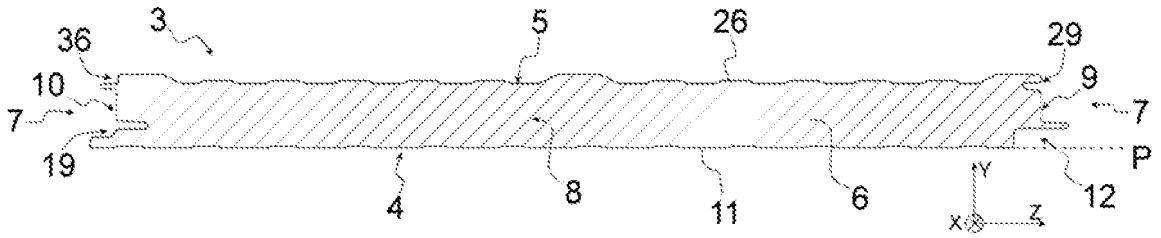

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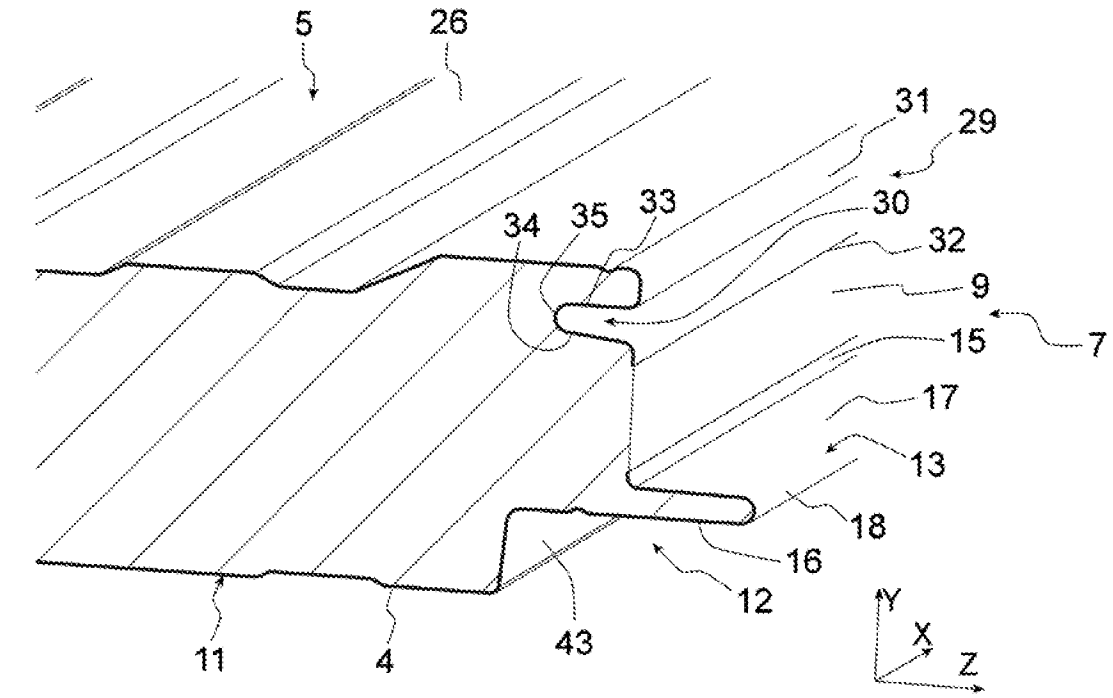

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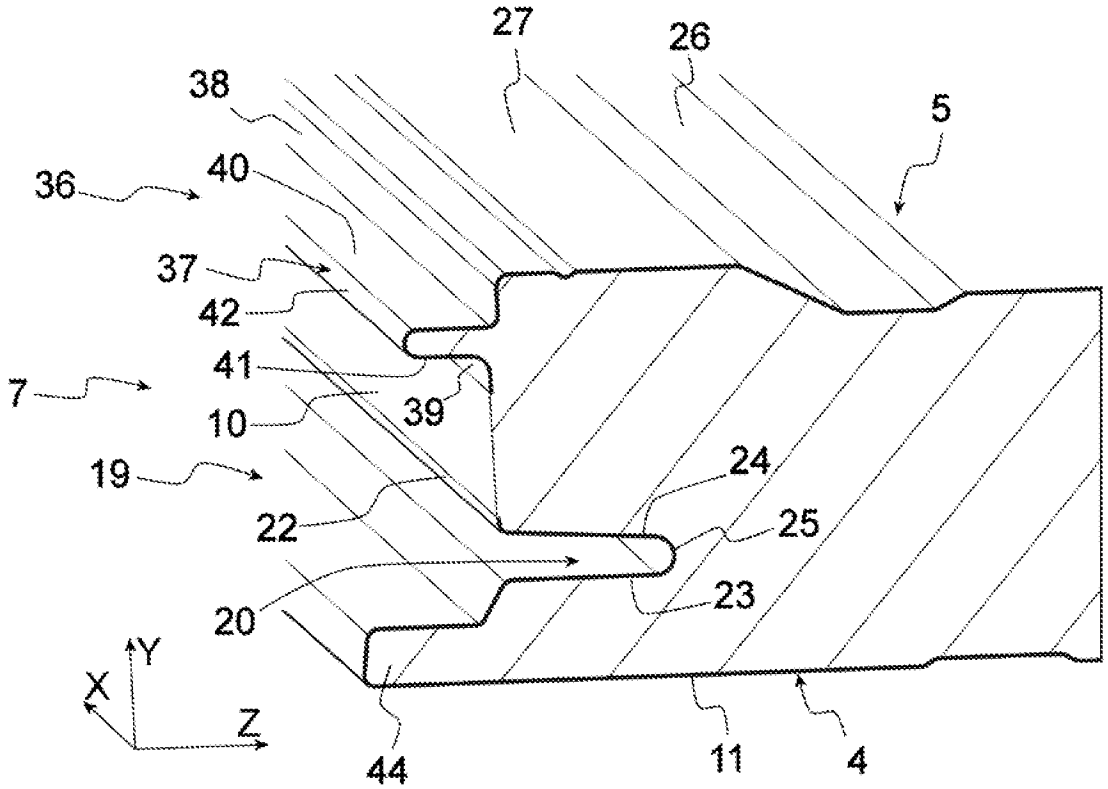

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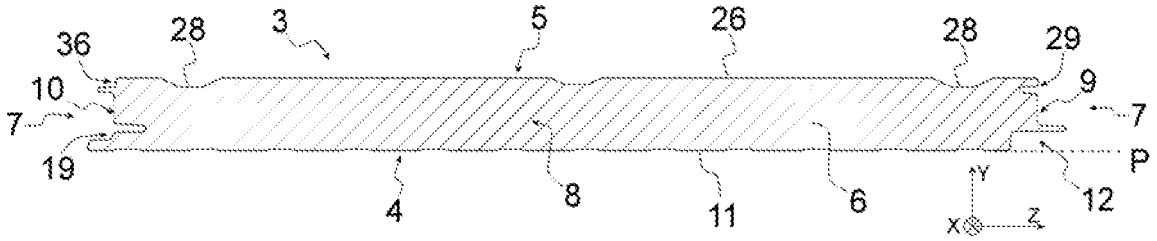

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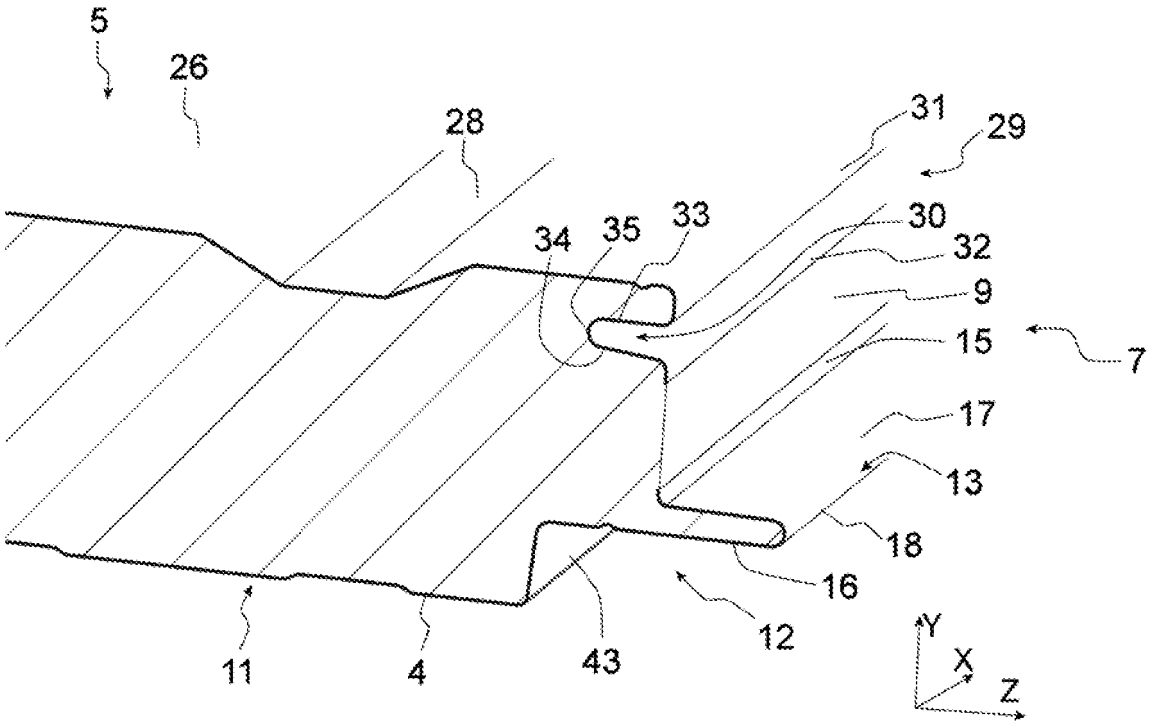

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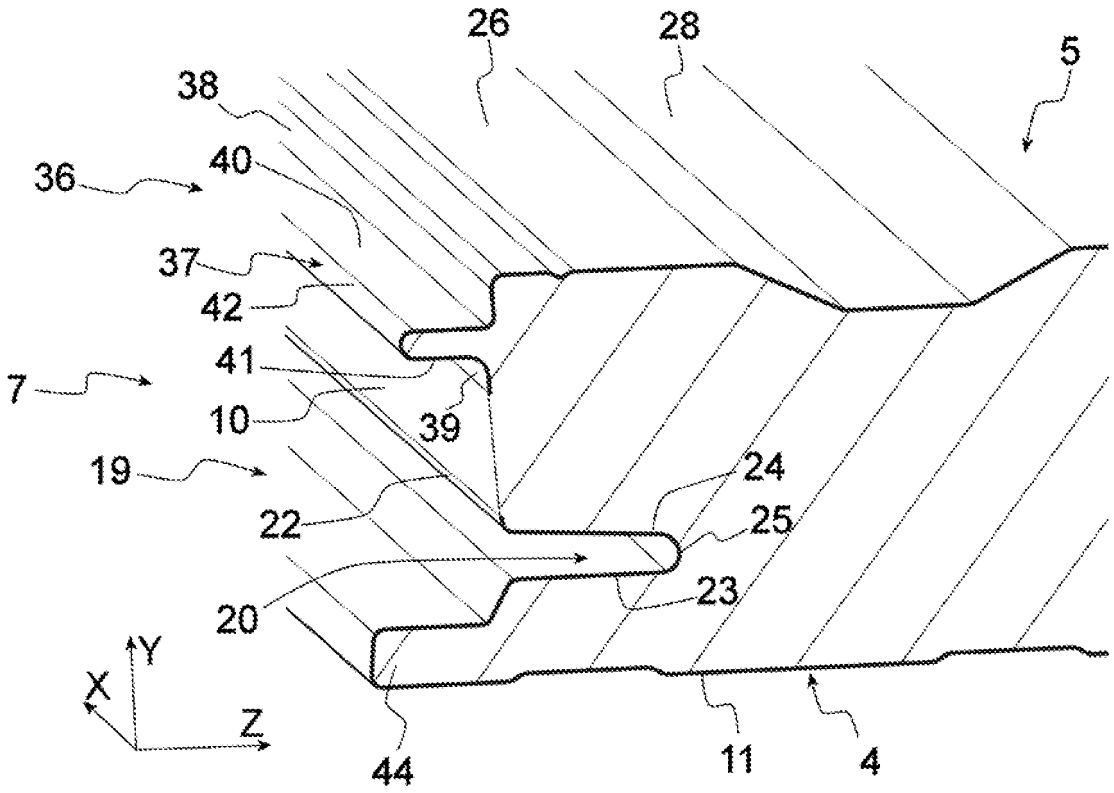

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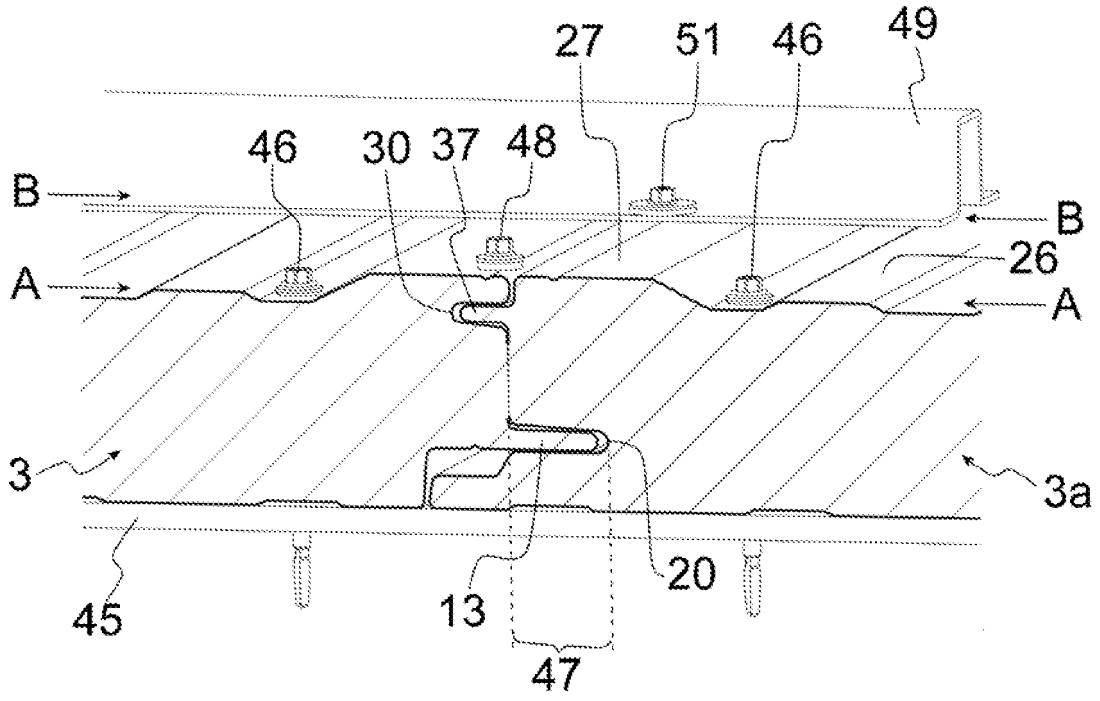
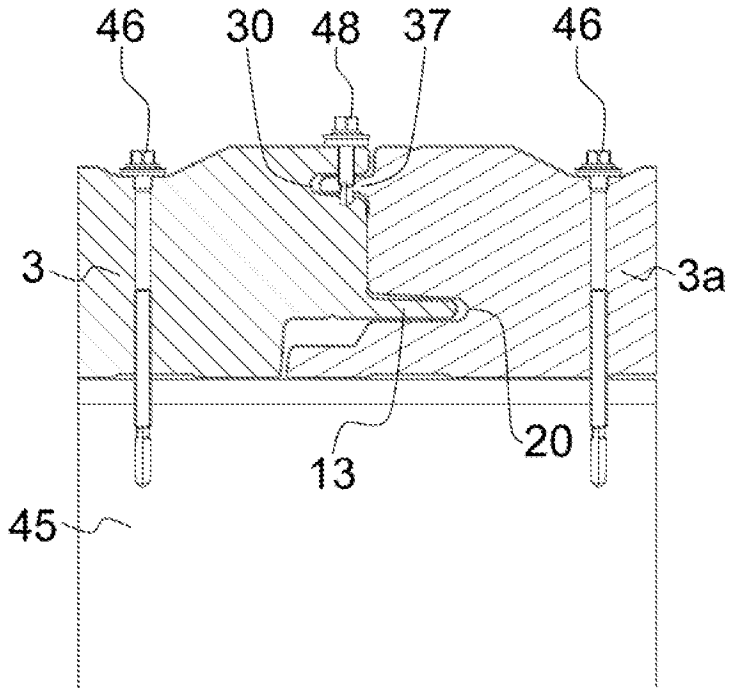


Figure 12



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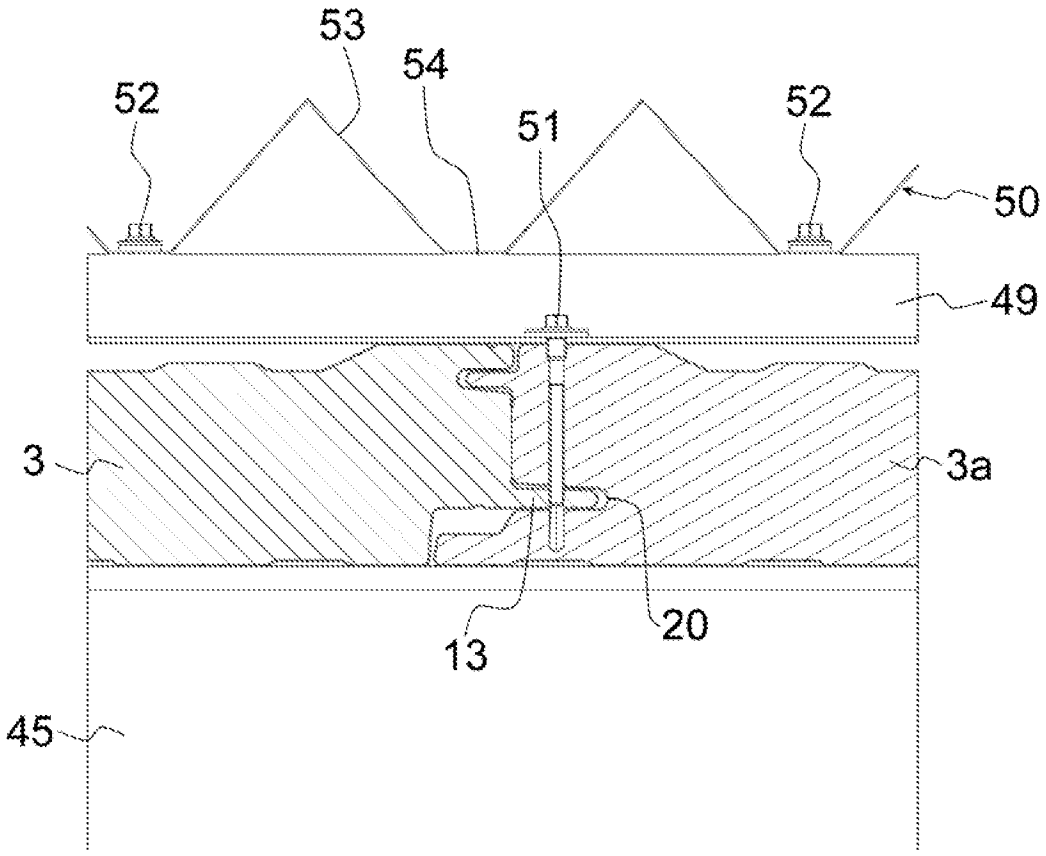

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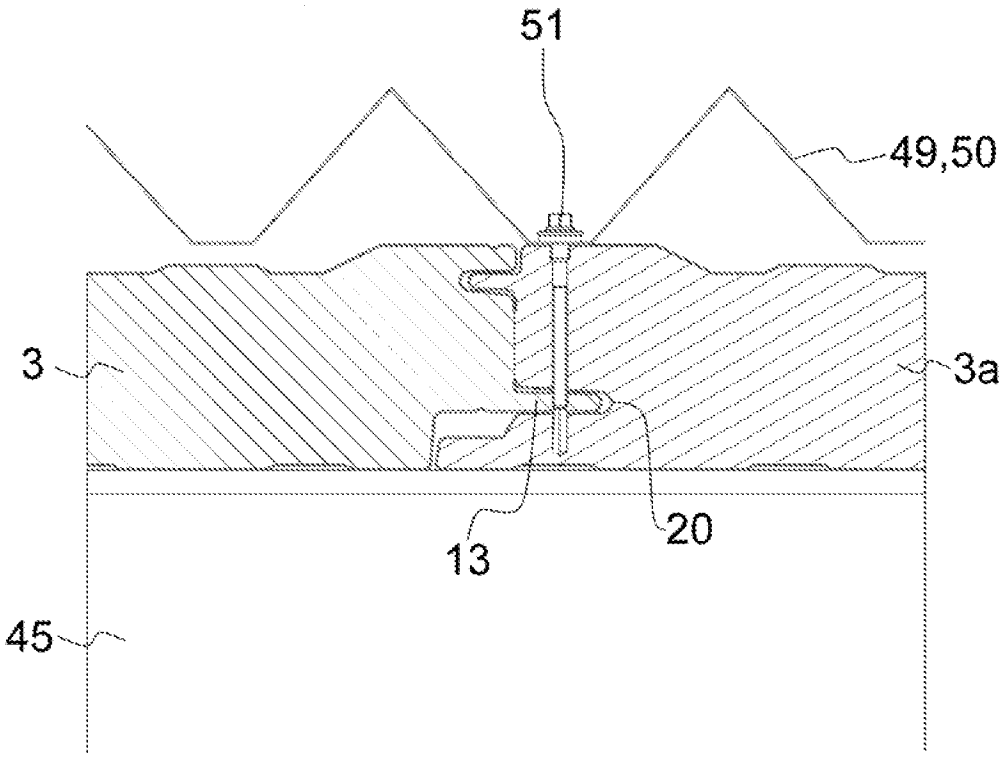

Figure 15

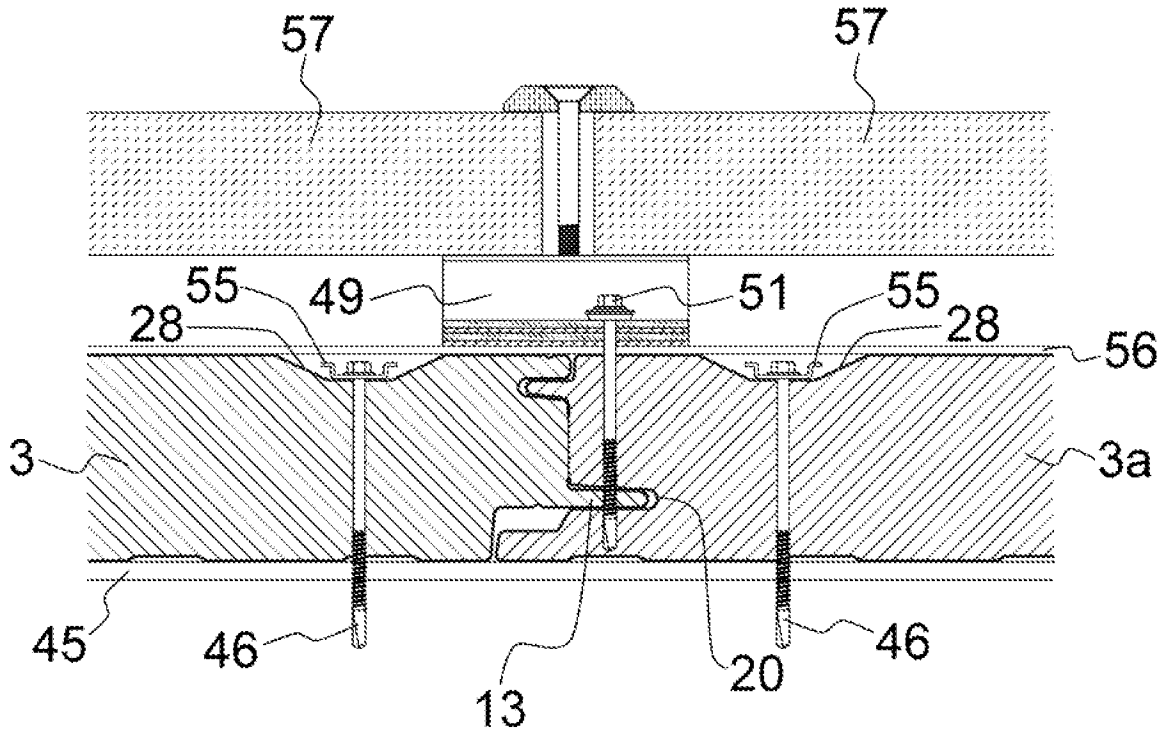

Figure 16

REFERENCES CITED IN THE DESCRIPTION

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