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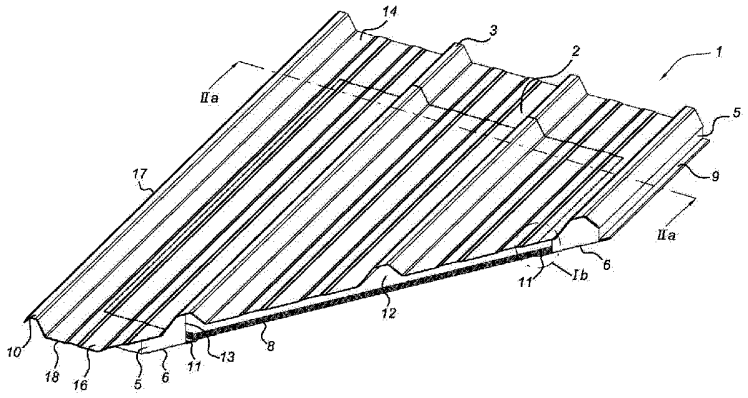
(54) **Light transmitting roof panel.**

(57) The invention relates to a roof panel, comprising a base plate, a top plate and a thermally insulating layer between the base plate and the top plate, forming a layered structure, the roof panel further comprising a window portion provided within the layered structure, the window portion being formed within an opening defining a peripheral edge, wherein the opening extends through the top plate and the base plate, and wherein the opening is closed by at least a translucent top sheet at the top plate. The invention furthermore relates to a method for manufacturing such a roof panel.



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LIGHT TRANSMITTING ROOF PANEL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a light transmitting roof panel, in particular a profiled roof panel that passes through daylight. The invention further relates to a method for manufacturing such a roof panel.

2. Description of the Related Art

In commercial and industrial building flat, curved or inclined roofs are more and more constructed with thermally insulated roof panels, also called sandwich panels. A top side of the insulated roof panels is usually a profiled corrugated steel plate and the bottom side is usually a flat or slightly profiled steel plate, aluminium foil or polyester plate. Between the top side and the bottom side a thermally insulating layer of polyurethane (PUR) foam, polyisocyanurate foam (PIR), mineral wool or any other thermally insulating material, is provided.

Transmission of daylight through the roof is preferred in most industrial or agricultural buildings, like stables. Translucent roof panels with a similar profile as the sandwich panels can be used to provide daylight transmission. For constructional purposes, it is desired that the translucent roof panels and the sandwich panels can be connected in a water- and wind tight manner. This can be achieved by using translucent profiled roof panels. A disadvantage of using single layer roof panels is that the insulation properties of the roof as a whole will decrease. Alternatively, double-skinned roof panels with improved thermal insulation properties in relation to single layer roof panels are improved. Additionally, such double-skinned roof panels can be adjusted to have a similar thickness as the sandwich panels.

The translucent roof panels can be arranged in a window arrangement, in which the translucent roof panel is embedded at three or four sides within an arrangement of opaque roof panels. Alternatively, the translucent roof panels in the ridge-to-gutter arrangement are embedded at a maximum of two sides between parallel opaque roof panels. In both arrangements, the translucent roof panels and the opaque roof panels are connected and sealed with respect to each other.

Publication FR2660683 describes a double-skinned roof panel to allow light transmission, having a rigid foam frame to reinforce the panel. The rigid frame has profiled longitudinal members and wedges mounted on transverse members to constitute the reinforcement of the panel. An upper translucent skin is adhesively bonded to the longitudinal members and to the wedges which engage in the corresponding ribs of the skin and a lower translucent skin is adhesively bonded to the base of the frame.

Such a light transmitting double-skinned roof panel has a number of disadvantages. First, relatively thin upper and lower translucent skins are used, such that the thermal insulation of the roof decreases at the location of the light transmitting double-skinned roof panel. Second, in order to have a watertight connection between the profiled upper skin and the frame, the profiled longitudinal members and the wedges on the transverse members should have a perfect fit with the profile of the upper skin. Third, a watertight and draught-proof connection between the known light transmitting double-skinned roof panel and opaque roof panels is not easy to achieve, as in practice it is difficult to achieve a perfect match between the upper and lower skins of the adjacent light transmitting and opaque roof panels, respectively. Due to this disadvantage, light transmitting roof panels are sometimes abandoned to secure a draught-proof roof construction. Additionally, if the described light transmitting roof panel is used in a window arrangement, it is desired that the transverse members of the frame and the beams of the roof frame coincide in order to have good connection between the roof panels and the roof frame. A further disadvantage of such translucent roof panels is that the rigid foam frame may not give sufficient rigidity for use in a ridge-to-gutter arrangement or when relatively long panels with a width to length ratio of at least 1:2 up to 1:12 or higher are used.

It would therefore be desirable to provide an insulated light transmitting roof panel that alleviates at least some of the perceived inconveniences of the prior art.

BRIEF SUMMARY OF THE INVENTION

According to the invention there is provided a roof panel, comprising a base plate, a top plate, and a thermally insulating layer between the base plate and the top plate, forming a layered structure, the roof panel further comprising a window portion provided within the layered structure, the window portion being formed within an opening defining a

peripheral edge, wherein the opening extends through the top plate and the base plate, and wherein the opening is closed by a translucent top sheet at the top plate and a translucent base sheet at the base plate.

The roof panel is a thermally insulating panel comprising a layered structure having a base plate, a top plate and a thermally insulating layer in between the base and the top. Usually, such roof panels are opaque and therefore do not allow light, in particular daylight, to pass through a roof made of such panels.

An opening is provided within the layered structure, the opening forming a through-hole from the base plate to the top plate. The opening has a peripheral edge and is enclosed by the layered structure along the entire periphery. The layered structure, and in particularly the thermally insulating layer, can be provided with a peripheral rim, which can hide at least the thermally insulating layer from view. The opening can be closed with at least a translucent top sheet, and preferably with a translucent base sheet as well, to form a window portion in the roof panel. The translucent top sheet and translucent base sheet are preferably separate sheets connected to the layered structure. Alternatively, the top and base sheets can be opposite surfaces of an integral translucent panel, such as a multiwall polymer panel, provided within the opening. The thermally insulating layer can comprise a thermally insulating material, such as mineral wool, but preferably a thermally insulating foam, such as PUR or PIR. Translucent means that the material comprises in the translucent base and top sheet is able to transmit light, i.e. does not fully block incoming light, such as an opaque material, up to being transparent.

The advantage of a window portion in the roof panel is that the window portion is surrounded by the opaque layered structure. When a roof panel with a window portion is connected to a second roof panel having a similar layered structure, with or without a window portion, the top plates and base plates of the respective roof panels will match. In addition, the thermally insulating layer can comprise a thermally insulating material at at least the outer peripheral edge of the roof panel, such that upon connection to the second roof panel, the thermally insulating material at the peripheral edges may abut. Hereby, that a watertight and draught-proof connection between the roof panels can be established and additionally allow for a light transmitting window portion in the roof panel.

The window portion or opening can have any shape, such as a circle or a polygon, such as a square or a triangle, with or without rounded corners. Additionally, the peripheral edge can be substantially perpendicular to the top and base plates, respectively, or have an angle with at least one of the top and base plate, for example either a converging peripheral edge towards the base plate or a diverging peripheral edge towards the base plate, as seen from the top plate.

The top plate of the roof panel is preferably provided with a first extending part, which part extends beyond the thermally insulating layer at at least one side, preferably at at least a first longitudinal side and a first transversal side. The first extending part acts as an overlay with other similar roof panels, such that a watertight and draught-proof connection between the roof panels is facilitated. Additionally, the base plate can be provided with a second extending part extending beyond the thermally insulating layer at at least one side, preferably a second longitudinal side opposite the first longitudinal side.

Preferably, the translucent base sheet does not extend beyond the surface of the base plate. The top plate can be a steel plate, preferably a profiled corrugated steel plate. The base plate can be a flat or slightly profiled steel sheet, aluminium foil or polyester plate. Between the top plate and the base plate a thermally insulating layer comprising at least one of polyurethane (PUR) foam, polyisocyanurate foam (PIR), mineral wool and any other thermally insulating material, is provided.

According to an embodiment, between at least one of the base plate and translucent base sheet, and the top plate and the translucent top sheet, a sealing element is provided to prevent environmental contaminants to enter a space between the translucent sheets.

The translucent top sheet and translucent base sheet can be separated by a space, preferably filled with a gas, such as air. To avoid ingress of environmental contaminants, such as moisture, dirt or insects, and thereby avoiding a decrease of the translucency of the window portion, between at least one of the base plate and translucent base sheet, and the top plate and the translucent top sheet is provided with a sealing element.

According to a further embodiment, the translucent base sheet is a multiwall polymer plate.

A multiwall polymer plate is used to enhance the thermal insulation properties of the roof panel at the location of the window portion. The thermal insulation properties of the multiwall polymer plate depend on the material of choice, the thickness of the plate and the wall structure within the plate. The thickness of the multiwall polymer plate is limited by the minimum thickness of the layered structure along surface of the top plate, especially when the top plate is a corrugated plate having a profile, such that the multiwall base plate does not extend beyond the top plate at any location of the top plate.

Preferably a polycarbonate multiwall plate is used. Alternatively, a multiwall poly(methyl methacrylate) (PMMA) plate. The walls of the multiwall plates can either be parallel and/or perpendicular to the surface of the plate. Furthermore, it is possible to use honeycomb structures with vertical channels made from translucent polypropylene (PP) film or cellophane. Alternatively, multiwall glass plates, such as double-glazed panels, can be used.

The translucent top sheet can either comprise or be constructed from a translucent foil with suitable mechanical properties and a good resistance against environmental circumstances. An example of such a foil is bi-orientated polyethyleneterephtalate (BOPET), having a thickness up to 1.0 mm, preferably around 0.1 mm.

The roof panel, in particular the layered structure without the first extending and second extending parts, can have a first width dimension and a first length dimension with a width to length ratio of 1:1 to 1:12 or higher, where the first width dimension preferably ranges from 0.50 to 2.0 meter, such that the first length dimension can range from 0.50 to 24 meter or longer. The opening is enclosed by a frame of the layered structure extending from the peripheral edge of the opening to a longitudinal and/or transverse side of the roof panel. The opening can have a second width and/or second length dimension of up to 75-90%, preferably about 80%, of the first width and/or first length dimension of the roof panel, respectively. The frame formed of the layered structure has a third width dimension, which preferably is at least 5% of the first width and/or first length dimension of the roof panel, preferably about 10%, to ensure sufficient rigidity of the roof panel and a maximised window opening for transmitting light through the roof panel. When roof panels with a longitudinal and/or transverse first extending part as described above, are used, the third width dimension of the frame is preferred to be at most equal to a length of the first extending part of an adjacent roof

panel, thereby preventing overlap of the first extending part with the window portion of the roof panel. The length of the first extending part is measured from the side of the roof panel to an end of the first extending part. Preferably, the length of the first extending part is between 50 to 150 mm.

In case it is desired to have multiple window openings in a longitudinal direction and/or a transverse direction, the window openings can be separated by a transverse part and/or a longitudinal part. These parts, extending between the peripheral edges of two neighbouring openings, can have a similar or larger width dimension as the third width dimension of the roof panel, such that these parts have sufficient rigidity and strength to support the weight of at least the translucent base plate. Multiple window openings can be used for relatively long roof panels to ensure sufficient rigidity, or to provide better connection of the roof panel to beams of a roof construction at the transverse and/or longitudinal part in combination with optimal transmission of light through the roof panel.

The roof panel can also have a thickness dimension, which is mainly defined by the thickness of the thermally insulating layer. The thickness of the thermally insulating layer is defined as the smallest distance between the base and top plate in the layered structure, in particular when at least one of the top plate and the base plate are a profiled plate. The thickness depends on the desired insulating properties of the roof panel and the thermally insulating material used and can range from 30 up to 150 mm.

The translucent base sheet can have a flat surface facing away from the top plate. Alternatively, the surface facing away from the top plate can be a profiled surface. The translucent top sheet can comprise a polycarbonate sheet.

According to an embodiment, the base plate is provided with at least one outlet element to allow moisture to exit the space between the translucent base sheet and translucent top sheet. Water vapor can enter the space between the translucent top sheet and the translucent base sheet in several ways. In particular, water vapor can enter the channels of the translucent multiwall base sheets, especially when polycarbonate permeable to water, is used. Water vapor can condensate under certain thermal conditions to visible drops of water. In inclined roof panels these drops of water will flow downwards to the lowest part of the window panel. The roof panel according to the invention allows evaporation or drainage of the above described condensed water drops by at least one outlet element, such as small holes or a valve element, provided at

the base plate of the layered structure, preferably in the support flange of the base plate supporting the translucent base sheet.

According to a preferred embodiment, the base plate has a support flange extending inwardly into the opening to support the translucent base sheet. To facilitate the connection between the base plate and the translucent base sheet, a support flange is provided to support the translucent base sheet, such that the translucent base sheet can be connected to the support flange. When such a support flange is provided, it is preferred that the above described the outlet element is provided in the support flange.

It is preferred that the top plate is a corrugated plate having a profile. Additionally, the translucent top sheet can comprise a connection region extending at least partially beyond the peripheral edge of the opening, wherein the connection region connects the translucent top sheet and the top plate of the layered structure. The translucent top sheet can have a flat surface facing away from the roof panel, preferably having a connection region that overlaps with the top plate such that connection between the translucent top sheet and the top plate is facilitated.

According to a further embodiment, the translucent top sheet has a similar profile to the top plate along at least the connection region, such that the connection region and the top plate have a form fit connection. Preferably, the translucent top sheet has a similar profile to the top plate across the surface facing away from the top plate, including the connection region, to provide for a form fit connection with the top plate. Alternatively, the translucent top sheet can have flat surface facing away from the top plate at the location of the opening in the layered structure and a profiled connection region to establish a form fit conncection with the top plate. The connection between the top plate and the connection region can further be established by any suitable connection element, such as an adhesive. This can be additional to the form fit connection.

The invention also relates to a method for manufacturing a roof panel as described above, comprising:

- providing a layered structure comprising a base plate, a top plate; and a thermally insulating layer between the base plate and the top plate;
- providing an opening in the layered structure through the top plate, base plate and thermally insulating layer, the opening defining a peripheral edge;

- closing the opening with at least a translucent top plate at the top plate of the layered structure, thereby forming a window portion in the layered structure.

According to an embodiment of the method, the opening can be made in a ready-made roof panel having a layered structure by cutting a first shape having a first size in the top plate. Subsequently, a second shape having a second size is cut in the base plate, while being centered with respect to the first shape. Then the cut out shapes of both the top plate and the base plate are removed, while also removing the thermally insulating layer between the top plate and base plate.

According to another embodiment, the opening can be made while manufacturing the layered structure forming the roof panel. In that case, a first opening, having a first size and forming a first shape, is provided in a first plate forming the top plate, and a second opening, having a second size and forming a second shape, is provided in a second plate forming the base plate. The second plate and the first plate can be placed at a distance different from zero with respect to each other, thereby centering the first and second openings with respect to each other. To this purpose, the base plate and top plate can be provided in a mould, such that the first and second openings are centered with respect to each other. The thermally insulating material can then be provided between the top plate and base plate by injecting a foam inside the mould. Alternatively, a layer of thermally insulating material already having an opening or in which an opening can be cut similar in shape and size as the openings in the top plate can be provided between the top plate and base plate.

The first shape and the second shape used in the above described embodiments of the method, can be similar in form and size. Preferably, the second size is smaller than the first size, such that the supporting flange can be formed from the base plate. Additionally, the peripheral edge of the formed opening can be adjusted by cutting or sawing the thermally insulating layer at the peripheral edge thereof.

Preferably, the method comprises closing the opening with a translucent base sheet at the base plate of the layered structure.

According to a further embodiment, the method comprises

- providing an inwardly extending support flange into the opening at the base plate of the layered structure to support the translucent base sheet,
- connecting the translucent base sheet to the support flange.

According to another embodiment, the translucent top sheet comprises a connection region extending beyond the peripheral edge of the opening, the method comprising connecting the connection region to the top plate of the layered structure. The connection between the top plate and the translucent top sheet is facilitated by the use of a connection region at the translucent top sheet extending beyond the peripheral edge of the opening. The connection can than be established by connecting the overlapping connection region of the translucent top sheet to the top plate by a connecting element, such as bolts, nails or the like, or an adhesive. An adhesive could also have the function of sealant between the top plate and the translucent top sheet.

According to a further embodiment of the method, the top plate is a corrugated plate having a profile and the translucent top sheet has a similar profile to the top plate along at least the connection region, the method comprising establishing a form fit connection between the top plate of the layered structure and the translucent top sheet through an overlap of the connection region and the top plate.

According to another embodiment, the method comprises providing a sealing element between at least one of the base plate and translucent base sheet, and the top plate and the translucent top sheet, to prevent environmental contaminants to enter a space between the translucent sheets.

According to another embodiment, the method comprises providing the base plate with at least one outlet element to allow moisture to exit the space between the translucent base sheet and translucent top sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the invention will be appreciated upon reference to the following drawings of a number of exemplary embodiments, in which:

Figure 1a shows a schematic drawing of an embodiment of a roof panel according to the invention.

Figure 1b shows a detail of Fig. 1a.

Figure 2a shows a cross section of the roof panel of fig. 1a along line II-II.

Figure 2b shows a detail of Fig. 2a.

Figure 3a-c show an embodiment of the method for manufacturing the roof panel of fig. 1.

Figure 4a and b show another embodiment of a roof panel according to the invention.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

Figure 1a and b show a schematic drawing of an embodiment of a roof panel 1 according to the invention. The roof panel 1 comprises a layered structure of a top plate 4, a thermally insulating layer 5 and a base plate 6. A window portion 2 is provided within the layered structure as an opening through the top plate 4, insulating layer 5 and base plate 6, the opening defining a peripheral edge 13. The opening is closed with a translucent base sheet 8 at the base plate 6, and with a translucent top sheet 3 at the top plate 4. The translucent top sheet 3 and the top plate 4 are both corrugated sheets having a similar profile. As the translucent top sheet 3 overlays the top plate 4, the profiles of the translucent top sheet 3 and the top plate 4 provide for a form fit connection. Additionally, the connection between the translucent top sheet 3 and the top plate 4 can be secured with an adhesive or other connective element.

The translucent base plate 8 can have various thicknesses, ranging from a thin single walled sheet to a multiwall plate having a thickness comparable to the thickness of the insulating layer 5. Preferably, the translucent base plate 8 is a multiwall plate made of a translucent polymer material, preferably polycarbonate. Due to the use of a profiled translucent top plate, a space 12 is created within the opening.

The translucent base plate 8 is connected to the layered structure at the base sheet 6 via a support flange 11 protruding into the opening of the window portion 2. Between the support flange 11 and the translucent base plate 8 a sealing element 7 is provided to have a sealing connection between the support flange 11 and the translucent base plate 8. The translucent base plate 8 can be connected to the sealing element 7 with an adhesive. Alternatively, the translucent base plate 8 can be pressed against the sealing element 7 by means of relatively rigid clamping elements (not shown) provided within the space 12 between the translucent base plate 8 and the translucent top plate 3.

The support flange 11 is provided with at least one outlet element 15 to allow moisture to exit the space 12 between the translucent base sheet 8 and translucent top sheet 3. Water vapor can enter the space 12 between the translucent top sheet 3 and the translucent base sheet 8 via the channels of the translucent multiwall base sheet 8, especially when the translucent base sheet 8 is made of polycarbonate, which is

permeable to water. Water vapor can condensate under certain thermal conditions to visible drops of water. When the roof panel 1 is used in an inclined orientation in a roof, these drops of water can flow downwards to the lowest part of the window portion 2. The roof panel 1 allows evaporation or drainage of the above described condensed water drops by at least one outlet element 15, such as small holes or a valve element, preferably a one-way valve, provided in the support flange 11 of the base plate 6 supporting the translucent base sheet 8 and more preferably in at least the part of the support flange 11 at the lowest part of the window portion 2 when the roof panel 1 is positioned in an inclined orientation.

The top sheet 4 has a first extending part 10, acting as an overlay, extending beyond the insulating layer 5 at a longitudinal side 17. Additionally, the top sheet 4 has an overlay 16 extending beyond the insulating layer at a transversal side 18. The overlay 10, 16 facilitates the connection between two roof panels in either a longitudinal or transverse direction, as the overlay 10, 16 has a similar profile as the top plate of the subsequent roof panel.

At the base plate 6, a second extending part 9 can be provided at a longitudinal side opposite the longitudinal overlay 10 of the top plate. The second extending part 9 ensures a watertight and draught-proof connection between two subsequent roof panels in a roof.

Figure 2a and b show a cross-section of the roof panel of fig. 1 along line II-II. It is shown that the translucent top sheet 3 has a similar profile to the top plate 4, at least along a connection region 14 extending at least partially beyond the peripheral edge of the opening. The connection region 14 connects the translucent top sheet and the top plate of the layered structure at least by a form fit. Additionally, an adhesive or other suitable connection means can be provided to secure and/or seal the connection between the translucent top sheet 3 and the top plate 4.

Figure 3a-c show an embodiment of the method for manufacturing the roof panel 1 of fig. 1. A roof panel 1 has a layered structure comprising a base plate 6, a top plate 4 and a thermally insulating layer 5 between the base plate 6 and the top plate 4. The roof panel 1 is provided with an opening 19 within the layered structure through the top plate 4, base plate 6 and thermally insulating layer 5, the opening 19 defining a peripheral edge 13. The opening 19 is provided with an inwardly extending support

flange 13 into the opening 19 at the base plate 6 of the layered structure to support and connect a translucent base sheet 8.

The opening is closed with a translucent top sheet 3 at the top plate 4 of the layered structure, thereby forming a window portion 2 in the layered structure, as shown in Fig. 1a. The opening is furthermore is closed with the translucent base sheet 8 at the base plate 6 of the layered structure. The translucent top sheet 3 comprises a connection region 14 extending beyond the peripheral edge 13 of the opening 19. The connection region 14 is used to connect the translucent top sheet to the top plate of the layered structure.

Figure 4a and b show another embodiment of a roof panel according to the invention. Fig. 4a shows a roof panel 1 having a top plate 4, a base plate 6 and an insulating material 5 in between. The roof panel 1 has an opening 19 and a further opening 20 through the layered structure. The openings 19 and 20 are both provided with a peripheral edge 13 and a support flange 11. In between the opening 19 and the further opening 20, a transverse part 22 is provided. This transverse part 22 separates the opening 19 and the further opening 20, but also provides a connection area for connection to a roof beam (not shown) of a roof construction. In addition, such a transverse part 22 improves the rigidity and strength of the roof panel 1 in relation to a similar roof panel having one large opening.

Fig. 4b shows the construction of a window portion within each opening 19, 20. The opening 19 is closed at the base plate 6 by a translucent base sheet 8, that is supported by and connected to the support flange 11. The further opening 20 is closed at the base plate 6 by a further translucent base sheet 21, which is supported by and connected to the support flange 11 within further opening 20. The openings 19, 20 are closed at the top plate 4 by a translucent top sheet 3, which also covers the transverse part 22. Alternatively, the top sheet 3 can be separated into a first top sheet to close the opening 19 and a second top sheet to close the further opening 20 (not shown).

LIST OF PARTS

1. Roof panel
2. Window portion
3. Translucent top sheet
4. Top plate
5. Thermally insulating layer
6. Base plate
7. Sealing element
8. Translucent base sheet
9. Second extending part
10. Longitudinal first extending part
11. Support flange
12. Space
13. Peripheral edge
14. Connection region
15. Outlet element
16. Transverse first extending part
17. Longitudinal side
18. Transverse side
19. Opening
20. Further window portion
21. Further translucent base sheet
22. Transverse part

CONCLUSIES

1. Dakpaneel (1), omvattende:
- een basisplaat (6);
- een bovenplaat (4);
- een thermisch isolerende laag (50) tussen de basisplaat en de bovenplaat, daarbij een gelaagde structuur vormend;
- een raamdeel (2) voorzien in de gelaagde structuur, waarbij het raamdeel is gevormd in een opening (19) gedefinieerd door een omtreksrand (13), welke opening zich door de bovenplaat en de onderplaat uitstrekt; en
- ten minste een translucent bovenblad (3) dat bij de bovenplaat de opening afsluit, waarbij het translucente bovenblad een verbindingsgebied (14) omvat dat het translucente bovenblad (3) en de bovenplaat (4) van de gelaagde structuur met elkaar verbindt,
met het kenmerk, dat het translucente bovenblad (3) zich in wezen over de gehele bovenplaat (4) uitstrekt.

2. Dakpaneel volgens conclusie 1, waarbij de opening is gesloten door een translucent basisblad (8) bij de basisplaat (6).

3. Dakpaneel volgens conclusie 2, waarbij het translucente basisblad (8) een multiwandige polymere plaat is.

4. Dakpaneel volgens conclusie 2 of 3, waarbij tussen ten minste een van de basisplaat en het basisblad, en de bovenplaat en het bovenblad, een afdichtelement (7) is voorzien voor het voorkomen dat omgevingsverontreinigingen een ruimte (12) tussen de translucente bladen binnentreden.

5. Dakpaneel volgens conclusie 2, 3 of 4, waarbij de basisplaat is voorzien van ten minste een uitlaatelement (15) dat toestaat dat vocht de ruimte (12) tussen het translucente basisblad (8) en het translucente bovenblad (3) verlaat.

6. Dakpaneel volgens een der voorgaande conclusies, waarbij de basisplaat (6) een steunflens (11) bezit, welke zich inwaarts in de opening uitstrekt voor het ondersteunen van het translucente basisblad (8).

7. Dakpaneel volgens conclusie 5 en 6, waarbij het uitlaatelement (15) is voorzien in de steunflens (11).

8. Dakpaneel volgens een der voorgaande conclusies, waarbij de bovenplaat (4) een geprofileerde plaat met een profiel is.

9. Dakpaneel volgens een der voorgaande conclusies, waarbij het translucente bovenblad (3) een overeenkomstig profiel heeft met de bovenplaat (4) langs ten minste het verbindingsgebied (14), zodat het verbindingsgebied (14) en de bovenplaat een vormverbinding hebben.

10. Werkwijze voor het vervaardigen van een dakpaneel volgens een der conclusies 1-9, omvattende:
- het verschaffen van een gelaagde structuur omvattende een basisplaat (6), een bovenplaat (4); en een thermisch isolerende laag (5) tussen de basisplaat en de bovenplaat;
- het verschaffen van een opening (19) in de gelaagde structuur door de bovenplaat, basisplaat en thermisch isolerende laag, waarbij de opening een omtreksrand (13) definieert; en
- het sluiten van de opening met ten minste een translucent bovenblad (3) bij de topplaat van de gelaagde structuur, daarbij een raamdeel (2) in de gelaagde structuur vormend.

11. Werkwijze volgens conclusie 10, omvattende het sluiten van de opening met een translucent basisblad (8) bij de basisplaat van de gelaagde structuur.

12. Werkwijze volgens conclusie 11, omvattende

- het verschaffen van een zich inwaarts in de opening van de basisplaat van de gelaagde structuur uitstrekkende steunflens (11) bij de basisplaat voor het ondersteunen van het translucente basisblad; en
- het verbinden van het translucente basisblad aan de steunflens.

13. Werkwijze volgens een der conclusies 10-12, waarbij de stap van het verschaffen van een opening in de gelaagde structuur omvat:
- het snijden van een eerste vorm met een eerste afmeting in de bovenplaat;
- het snijden van een tweede vorm met een tweede afmeting in de basisplaat op een gecentreerde locatie ten opzichte van de eerste vorm,
- het verwijderen van de bovenplaat, basisplaat en thermisch isolerende laag ter plaatse van de eerste en tweede vormen uit de bovenplaat en onderplaat, daarbij de opening in de gelaagde structuur vormend.

14. Werkwijze volgens een der conclusies 10-12, waarbij de stappen van het verschaffen van een gelaagde structuur en een opening in de gelaagde structuur omvat:
- het snijden van een eerste opening met een eerste vorm in de bovenplaat en een tweede opening met een tweede vorm in de basisplaat;
- het plaatsen van de basisplaat en bovenplaat op een afstand anders dan nul ten opzichte van elkaar, daarbij de eerste en tweede openingen centrerend ten opzichte van elkaar;
- het verschaffen van de thermisch isolerende laag tussen de bovenplaat en de basisplaat.

15. Werkwijze volgens conclusie 13 of 14 wanneer afhankelijk van conclusie 12, waarbij het verschaffen van de zich inwaarts uitstrekkende steunflens bij de basisplaat omvat het snijden van de tweede vorm in een tweede afmeting dat kleiner is dan de eerste afmeting van de eerste vorm.

16. Werkwijze volgens een der conclusies 13-15, waarbij de tweede vorm overeenkomstig is met de eerste vorm.

17. Werkwijze volgens een der conclusies 10-16, waarbij het translucente bovenblad een verbindingsgebied (14) omvat, welke zich ten minste gedeeltelijk voorbij de omtreksrand van de opening uitstrekt, waarbij de werkwijze omvat het verbinden van het verbindingsgebied aan de bovenplaat van de gelaagde structuur.

18. Werkwijze volgens conclusie 17, waarbij de bovenplaat een geprofileerde plaat met een profiel is en het translucente bovenblad een overeenkomstig profiel heeft langs ten minste het verbindingsgebied, waarbij de werkwijze omvat het tot stand brengen van een vormgesloten verbinding tussen de bovenplaat van de gelaagde structuur en het translucente bovenblad door een overlap van het verbindingsgebied en de bovenplaat.

19. Werkwijze volgens een der conclusies 10-18, omvattende het verschaffen van een afdichtelement (7) tussen ten minste een van de basisplaat en het translucente basisblad, en de bovenplaat en het translucente bovenblad, voor het voorkomen dat omgevingsverontreinigingen een ruimte (12) tussen de translucente bladen binnentreden.

20. Werkwijze volgens een der conclusies 10-19, omvattende het verschaffen van de basisplaat met ten minste een uitlaatelement (15) dat toestaat dat vocht de ruimte (12) tussen het translucente basisblad en het translucente bovenblad verlaat.

Fig. 1a

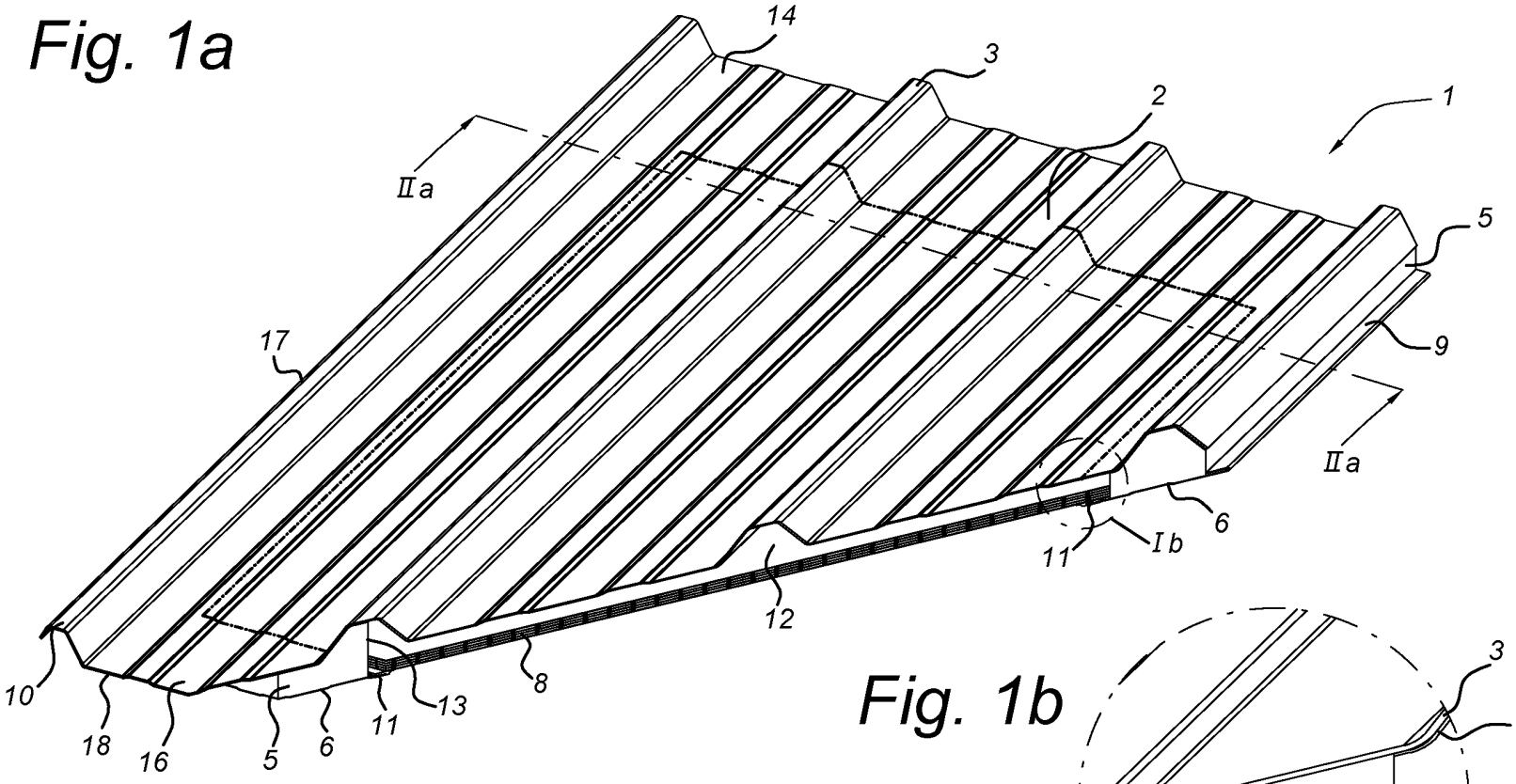


Fig. 1b

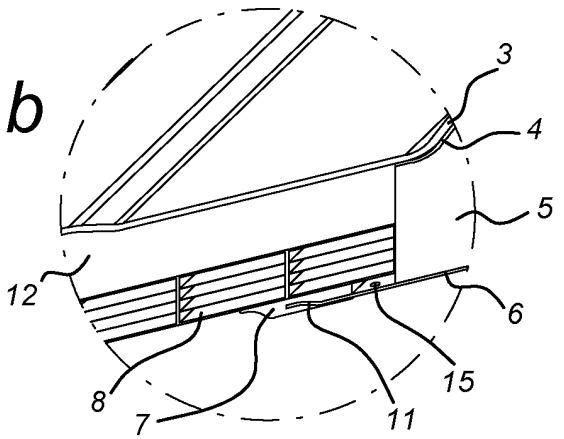


Fig. 2a

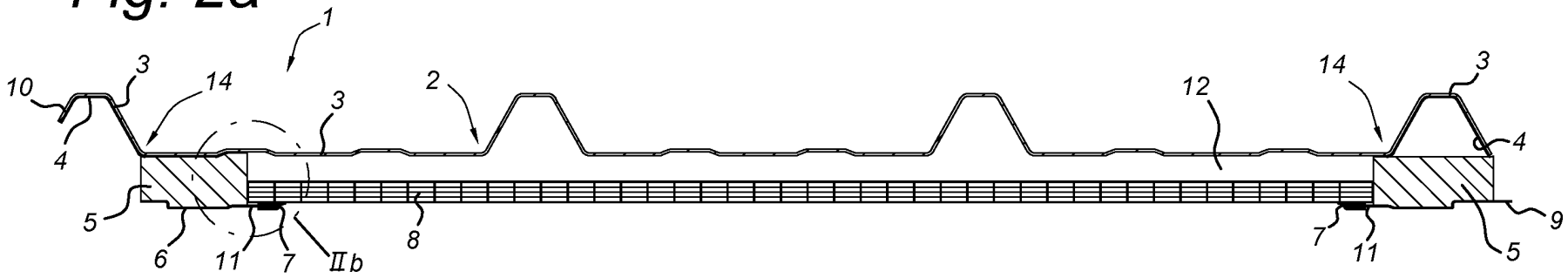


Fig. 2b

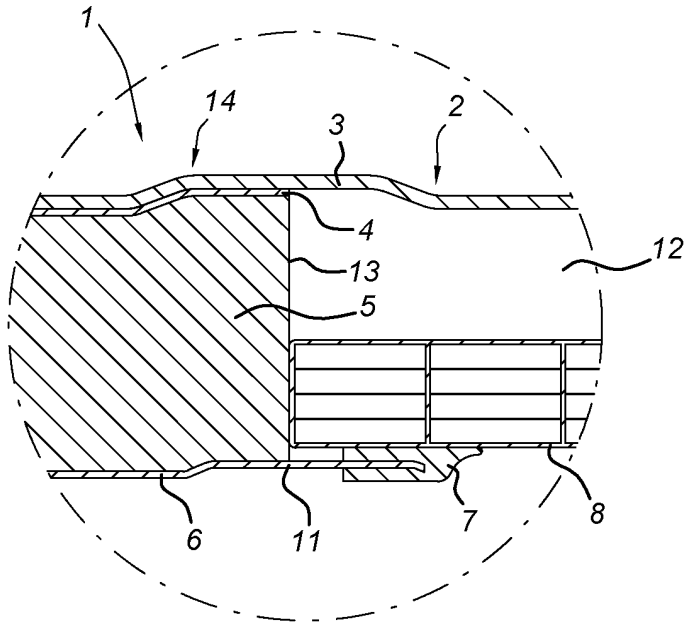


Fig. 3a

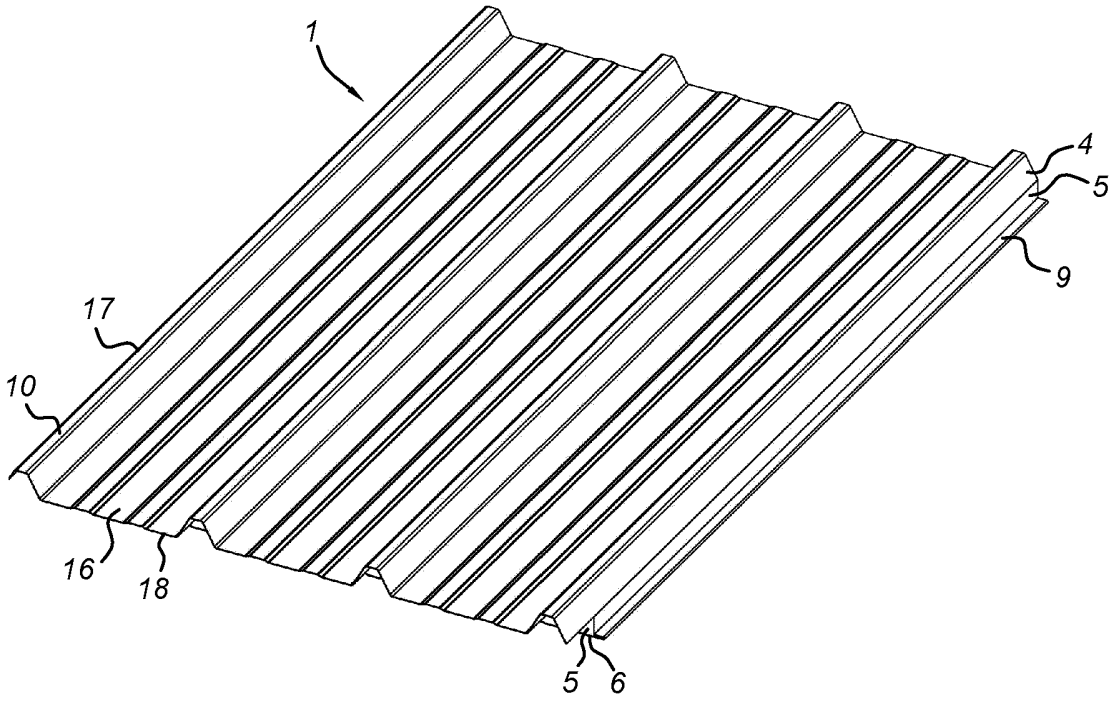


Fig. 3b

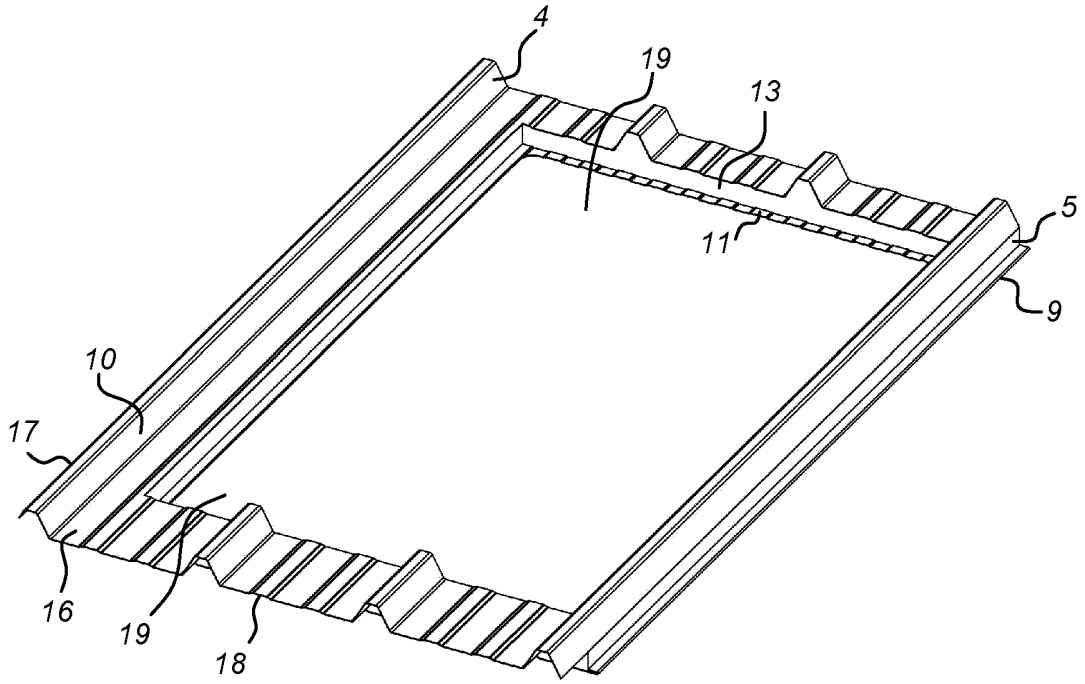


Fig. 3c

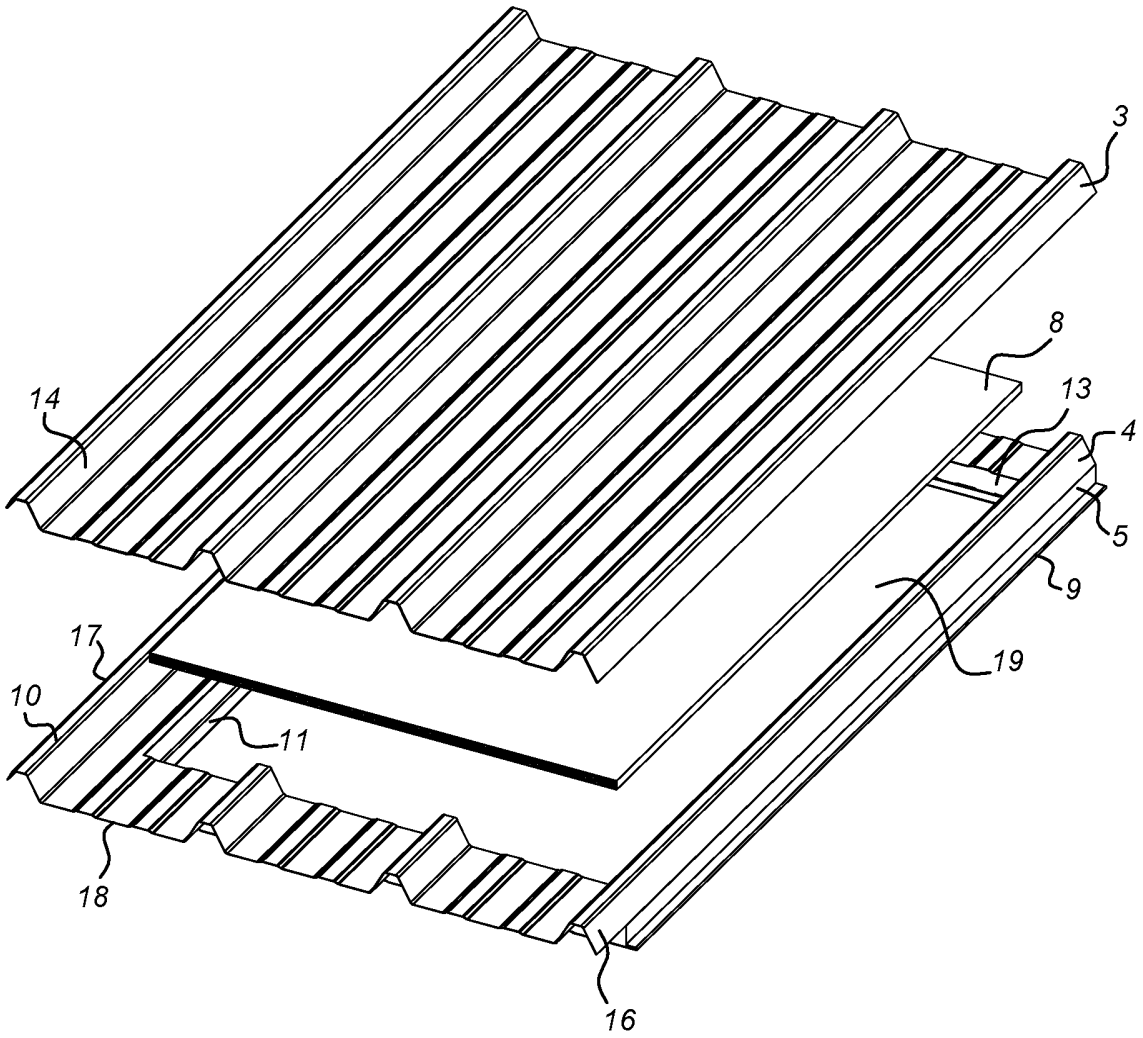


Fig. 4a

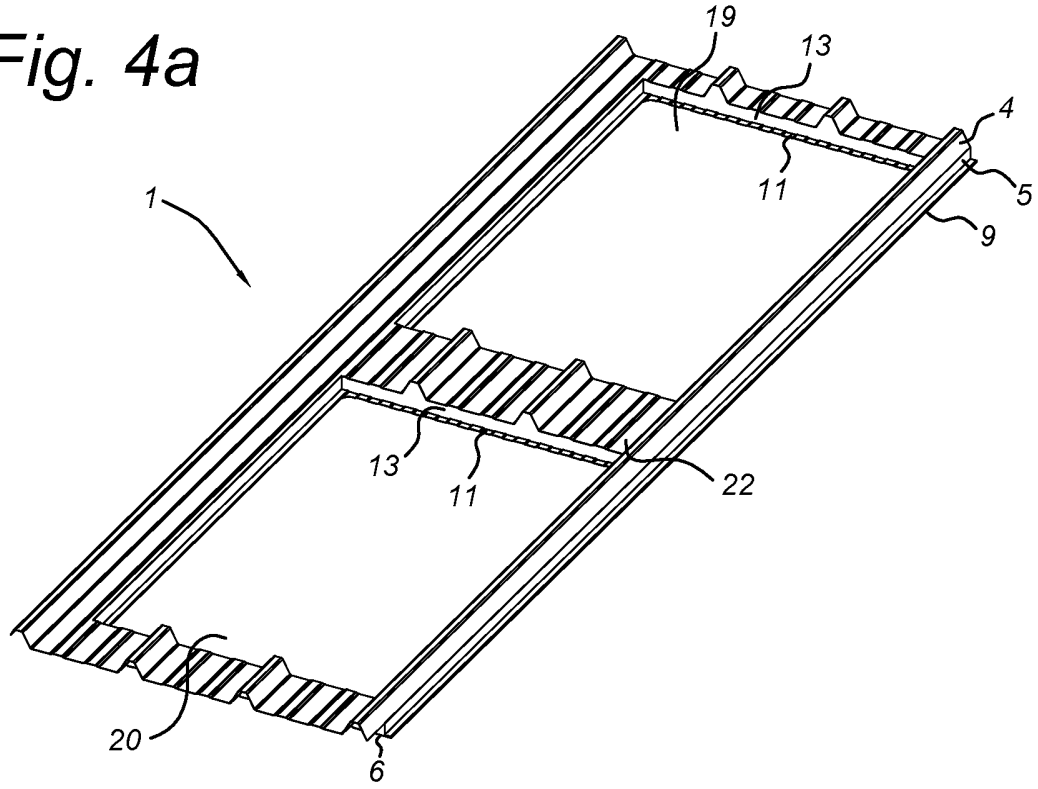
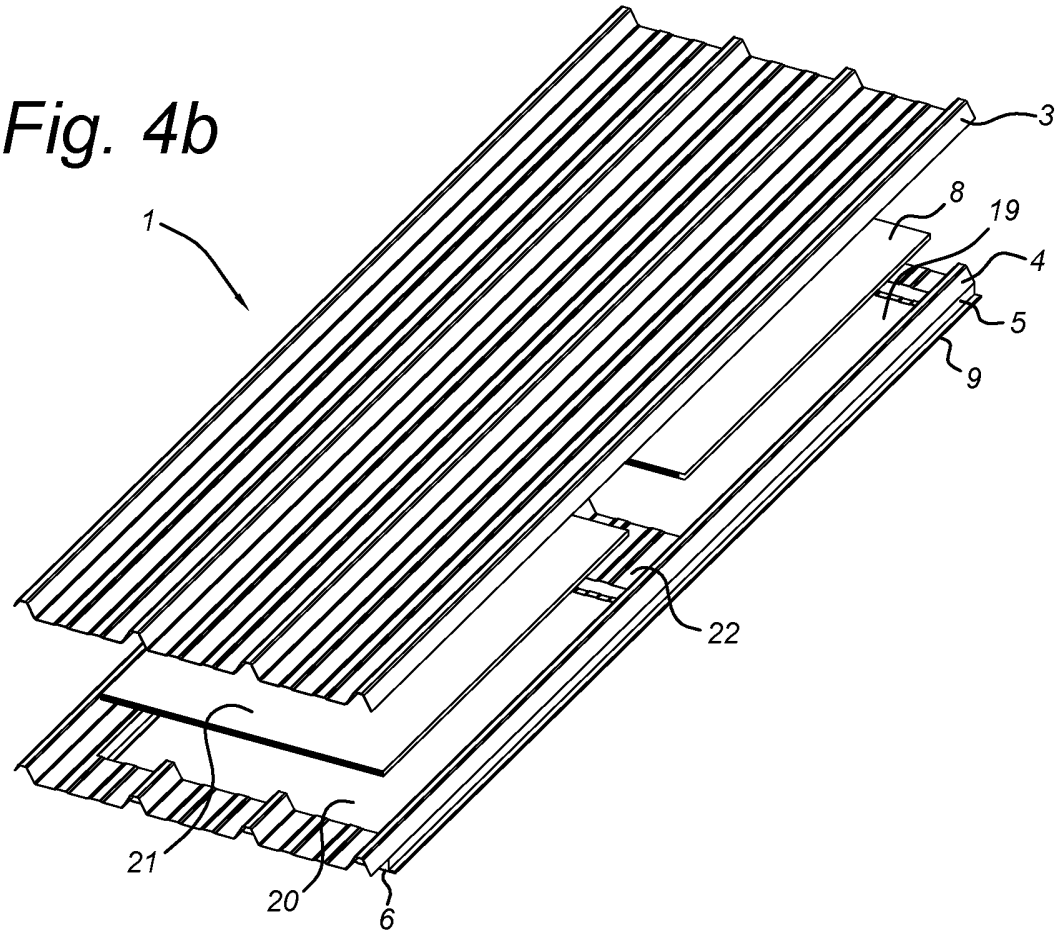


Fig. 4b



SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	P6049469NL
Nederlands aanvraag nr. **2012246**	Indieningsdatum **12-02-2014**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Atlas Acomfa B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **19-04-2014**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN 61834**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

E04D3/35 **E04D13/03**

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**E04D**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III. ☐ **GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES** (opmerkingen op aanvullingsblad)

IV. ☐ **GEBREK AAN EENHEID VAN UITVINDING** (opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2012246

A. CLASSIFICATIE VAN HET ONDERWERP
INV. E04D3/35 E04D13/03
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
E04D

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
EPO-Internal

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X Y	DE 38 32 995 A1 (BUESSGEN HERBERT [DE]) 23 november 1989 (1989-11-23) * het gehele document *	1-4,6,8, 11-14, 16,20 9,10,18, 19

X Y	GB 2 455 632 A (KINGSPAN RES & DEV LTD [IE]) 17 juni 2009 (2009-06-17) * figuren 1, 2, 3a *	1,3,4,8, 11,14,17 2,12

Y	US 2010/269426 A1 (RICHTER STEPHEN [US] ET AL) 28 oktober 2010 (2010-10-28) * samenvatting; figuur 3 *	2,12

A	GB 2 453 150 A (HAMBLESIDE DANELAW LTD [GB]) 1 april 2009 (2009-04-01) * figuur 1 *	1-21

	-/--	

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
7 oktober 2014	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Demeester, Jan

1

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2012246

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	WO 2007/011561 A2 (BUTLER MANUFACTURING CO [US]; MCCLURE RICHARD [US]) 25 januari 2007 (2007-01-25) * figuur 6 *	1-21

Y	DE 36 38 615 A1 (IMC ACRYLGUSS GMBH [DE]) 26 mei 1988 (1988-05-26)	9,10,18, 19
A	* figuur 1 *	1

A	US 4 621 472 A (KLOKE WERNER [CA]) 11 november 1986 (1986-11-11) * figuur 8 *	5,7,21

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek: NL 2012246

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
DE 3832995 A1	23-11-1989	GEEN	
GB 2455632 A	17-06-2009	GB 2455632 A	17-06-2009
		IE 20080999 A1	05-08-2009
		WO 2009077998 A1	25-06-2009
US 2010269426 A1	28-10-2010	GEEN	
GB 2453150 A	01-04-2009	GEEN	
WO 2007011561 A2	25-01-2007	CA 2615429 A1	25-01-2007
		CN 101258292 A	03-09-2008
		JP 2009501287 A	15-01-2009
		US 2008190050 A1	14-08-2008
		US 2009223148 A1	10-09-2009
		WO 2007011561 A2	25-01-2007
DE 3638615 A1	26-05-1988	GEEN	
US 4621472 A	11-11-1986	GEEN	

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN61834	12.02.2014		NL2012246

International Patent Classification (IPC)
INV. E04D3/35 E04D13/03

Applicant
Atlas Acomfa B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Demeester, Jan

Application number

WRITTEN OPINION

NL2012246

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	4, 5, 7, 9, 10, 15, 18, 19, 21
	No:	Claims	1-3, 6, 8, 11-14, 16, 17, 20
Inventive step	Yes:	Claims	5, 7, 15, 21
	No:	Claims	1-4, 6, 8-14, 16-20
Industrial applicability	Yes:	Claims	1-21
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1	DE 38 32 995 A1
D2	GB 2 455 632 A
D3	US 2010/269426 A1
D4	GB 2 453 150 A
D5	WO 2007/011561 A2
D6	DE 36 38 615 A1
D7	US 4 621 472 A

2 **Independent claims 1 and 11 - novelty objections (D1 and D2)**

2.1 **D1 (fig. 1-3, especially fig. 3 and description, column 1, line 58 - column 2, line 43)** discloses: *een dakpaneel met een basisplaat (1), een bovenplaat (2) en een isolatielaag (10). Het dakpaneel omvat verder een raamdeel (fig. 3, element 21-23) in een opening (7), die zich uitstrekt door de bovenplaat (2) en de basisplaat (1). De opening (7) is gesloten door een translucent bovenblad (22) bij de bovenplaat (2).*

2.2 **D2 (fig. 1, 2 and 3a)** discloses: *een dakpaneel met een basisplaat (11), een bovenplaat (10) en een isolatielaag (13). Het dakpaneel omvat verder een raamdeel (5) in een opening (3), die zich uitstrekt door de bovenplaat (10) en de basisplaat (11). De opening (3) is gesloten door een translucent bovenblad (4) bij de bovenplaat (10).*

2.3 Therefore, the subject-matter of claim 1 is not new over each of the documents D1 and D2.

2.4 The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent method claim 11, which therefore is also considered not new.

3 **Dependent claims**

Dependent claims 2-4, 6, 8-10, 12-14, 16-20 do not meet the requirements of novelty and/or inventive step:

- Claims 2 and 12 are not new over D1, fig. 3: plate 23 is situated close to base plate 1. Moreover, claims 2 and 12 are not inventive over D2; it is obvious to provide a lower translucent base sheet, e.g. in order to improve the insulation properties (see e.g. teaching of D3).
- Claims 3 and 20 are not new: see D1, fig. 3, sealing 25 and see D2, fig. 24
- Claim 4 is not inventive over D1 or D2: using a muti-wall polymer plate for the translucent base sheet is only an obvious selection/alternative (see e.g. teaching of D3, fig. 3 and paragraph 0033: polycarbonate structured sheeting / see also teaching of D4, fig. 1, panel 3: honeycomb panel)
- Claims 6, 13 and 16 are not new: D1, fig. 3 discloses such a flange (surface 8). Moreover D5, fig. 6 (see flange supporting plate 220) and D4, fig. 1 (rooflight liner sheet 2 is supported on both sides) disclose such a supporting flange construction.
- Claim 8 is not new over D1 and D2
- Claims 9, 10, 18 and 19 are not inventive over the combination of D1 and D6. D6 (fig. 1) teaches to realise the connection by a transparent top sheet (1) having the same shape as the top plate (4).
- Claims 14 and 17 are not new over D1 and D2

4 The combination of **all the features of claims 1, 2 and 5** is neither known from, nor rendered obvious by, the available prior art. The reasons are as follows:

- Starting from D1, it is not directly obvious to provide such an outlet element in between support surface 8 and base sheet 1 due to the presence of intermediate insulation material. Moreover, in the field of roof panels it is more obvious to provide weep holes at the transversal edge of a roof construction (see e.g. D7, fig. 8, openings 59 and 60).
- Starting from D2, it is not obvious to provide such an outlet element in the base plate 11, because condensation on translucent plate 4 stays within the borders of frame 5. An outlet element in base plate 11 would thus not provide a solution.

*****

(J. Demeester)