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(54) **A FLAT-ROOF SKYLIGHT WINDOW AND A WEATHER SHIELD THEREFOR**

(57) A flat-roof skylight window comprising a window portion and a separate weather shield, wherein the weather shield comprises a weather shield pane, which is curved outwardly in relation to the window portion, the weather shield pane comprising two opposed substantially straight peripheral edges and two opposed curved peripheral edges, the weather shield pane further comprising a curved bottom surface facing the window portion and having four bottom corners positioned in an imaginary bottom plane (P1), an apex line or peak line (X) extending between said two curved edges where the bot-

tom surface of the weather shield pane has the largest distance to the bottom plane (P1), a connecting line (L1) connecting two of said bottom corners, the connecting line (L1) extending substantially in parallel to the apex line (X), the apex line (X) and the connecting line (L1) being positioned in an imaginary inclination plane (P2), wherein an angle between the bottom plane (P1) and the inclination plane (P2) is between 1 and 10 degrees. A weather shield for being mounted on the window portion for forming a flat-roof skylight window according to the above.

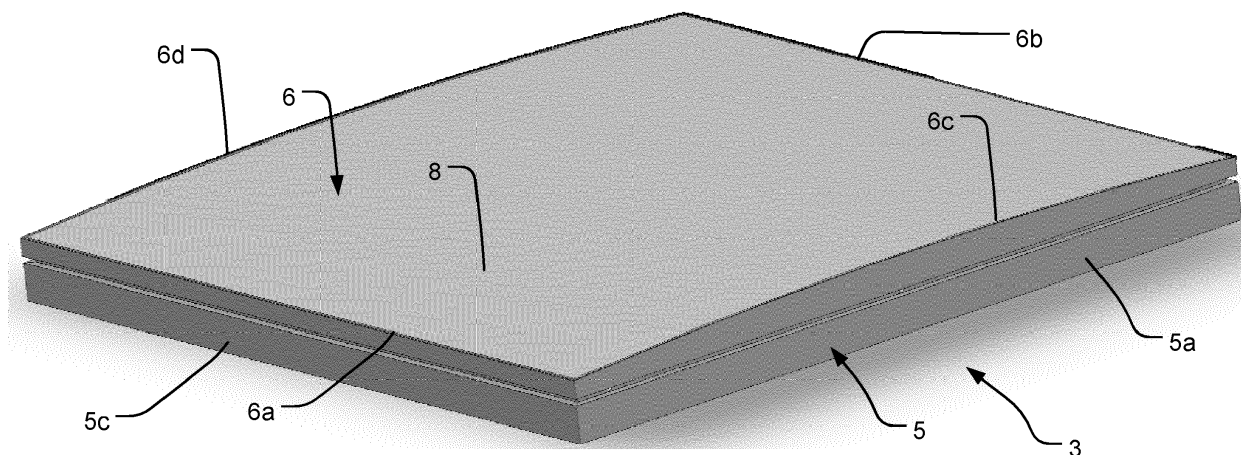


Fig. 2

Description

Field of the invention

[0001] The present invention relates in a first aspect to a flat-roof skylight window for being positioned substantially horizontally in a flat roof, the skylight window comprising a window portion and a weather shield, which is mounted on the window portion to cover and weather protect the window portion in a mounted state of the skylight window.

[0002] The invention relates in a second aspect to a weather shield for use in the skylight window according to the first aspect of the invention.

Background of the invention

[0003] There is often a desire to position one or more skylight windows in a flat roof of a building, i.e. where the roof has substantially no inclination or only a very small inclination. This may give rise to a variety of challenges.

[0004] If a skylight window of a type, which is used in inclining roofs and with a flat, insulating windowpane, is positioned in a flat roof, gravity will pull the pane downwards so that the pane will curve slightly downwards towards a centre thereof with a lowest point typically at a centre of the pane. If no weather shield is present, rain water will typically be collected at and near the lowest point to create, for example, a pool of water. Typically, also dirt will accumulate on the windowpane, especially at or near the centre thereof. This may limit the view through the windowpane from inside the building as the water and dirt disturb the visibility through the windowpane. Further, the pane may become a structural weak point, especially also with regards to snow loads.

[0005] One way to improve dewatering and prevent accumulation of snow on the windowpane is to angle the skylight window and the windowpane to provide a slope similar to a window positioned in an angled roof. This may be done by raising one side member of a frame and/or sash of the window so that the windowpane is angled with respect to horizontal. However, by angling the windowpane, one side member of the frame and/or sash will be higher than the opposing side, and the two side members at the sides will also slope. Hereby, the raised sash member and/or frame member as well as the sloping side members connected thereto may disturb the view through the windowpane compared to if the window were positioned horizontally. Also, raising one of the side members requires more sash and/or frame material, is cumbersome to construct and mount in the roof, and may create an undesired aesthetical appearance of the building since the windows will be more visible from the outside and look differently when they project upwards in a sloping manner from the flat roof.

[0006] PL 401880 discloses a flat roof skylight window with a windowpane and no weather shield.

[0007] In some alternative prior art solutions, a flat-roof

skylight window positioned horizontally comprises a transparent weather shield, usually of a cast plastics material such as acrylic or polycarbonate and positioned above a window portion that comprises the frame and/or sash as well as the windowpane. The weather shield typically covers an entire top surface and has a curved dome-shaped top surface so that collection of rain water, snow and the like on the top surface is lessened since it may run along sloped sides of the weather shield and onto the roof. The weather shield typically covers the entire window portion and may generally protect the window portion and the interior of the building from a range of weather loads or influences, including wind and precipitation, such as rain, snow, hail, etc. The weather shield may also provide supplementary insulation of the skylight window, i.e. of the window portion and the weather shield. The weather shield is typically attached to a frame and/or a sash of the window portion.

[0008] Use of a weather shield as described may have several drawbacks. Typically, the shape of the weather shield, due to its curvature or shape, distorts light and thus the view through the window and/or allows significantly less light to pass through the window. Some prior art weather shields comprise a skirt, which extends on all sides of the weather shield to cover the sash and/or frame of the window portion, this skirt often getting in the way of opening the window by hitting parts of the window portion or the roof.

[0009] The shape and size of the prior art weather shields also often result in large wind loads on the weather shield and thus the window portion and/or the roof, making it necessary to dimension strength and stiffness of the weather shield, window portion and roof accordingly.

[0010] An example of a flat-roof skylight window with a weather shield is disclosed in applicant's WO 2009/080026 A relating to a flat-roof skylight window with a dome-shaped weather shield covering an insulating window portion, the specification thereof being incorporated herein in its entirety.

[0011] US 8,375,657 discloses an insulated glazing unit in which one of the glazing layers of a pane thereof is curved.

[0012] WO 08085072 A discloses a skylight window for sloped roofs and with a curved windowpane.

Summary of the invention

[0013] On this background it is an object of the first aspect of the present invention to provide a flat-roof skylight window according to the introduction in which it is possible to reduce assembly of water and dirt on an upper or outer surface of the weather shield. Another object is to reduce distortion of the view through the skylight window. Another object is to provide a skylight window, which can be made openable. Another object is to balance a precipitation dispersing effect with wind load characteristics of a skylight window.

[0014] In the first aspect of the invention, these and further objects are met by a flat-roof skylight window for being positioned substantially horizontally in a flat roof, the skylight window comprising

a window portion with an optional window sash, a window frame and an insulating windowpane mounted in the window sash or window frame, and

a weather shield, which is mounted on the window portion for covering and weather protecting the window portion in a mounted state of the skylight window, wherein the weather shield comprises a weather shield pane, which is curved outwardly in relation to the window portion,

the weather shield pane comprising two opposed substantially straight peripheral edges and two opposed curved peripheral edges,

the weather shield pane further comprising a curved bottom surface facing the window portion and having four bottom corners positioned in an imaginary bottom plane P1,

an apex line or peak line X extending between said two curved edges where the bottom surface of the weather shield pane has a largest distance to the bottom plane P1, a connecting line L1 connecting two of said bottom corners, the connecting line L1 extending substantially in parallel to the apex line X,

the apex line X and the connecting line L1 being positioned in an imaginary inclination plane P2,

wherein an angle α between the bottom plane P1 and the inclination plane P2 is between 1 and 10 degrees.

[0015] In the present specification, the term "curved" may be understood as having a non-linear shape, potentially without sudden or sequential steps.

[0016] The weather shield may be provided separately from the window portion.

[0017] The weather shield may be substantially symmetric about the apex line X.

[0018] By providing a flat-roof skylight window with a weather shield of the type mentioned above, water masses larger than droplets will typically run off the weather shield pane so that pools of water will not collect on a top surface of the weather shield pane. The outward curvature of the weather shield pane may increase the moment of inertia of the weather shield pane, whereby the force of gravity on the weather shield pane will not pull a centre of the weather shield pane lower than the edges of the weather shield pane so that rain water falling on the weather shield pane will not create a pool at the centre of the weather shield pane. Therefore, pools of water and to a large degree assembly of dirt on the top surface of the weather shield pane may be avoided. For some glass type surfaces, individual droplets do not run off unless an angle of an inclined top surface thereof is above 20 degrees or so. However, assembly of pools of water and dirt at an area of a top surface of the weather shield pane is avoided or largely avoided with the skylight window according to the invention. At the same time, the inclination of the weather shield pane is small enough to affect

or distort the view through the weather shield pane and thus through the skylight window only to a small degree, typically small enough to not be noticeable to persons within a building in the roof of which the skylight window is mounted. The inventor of the present invention has thus found that, surprisingly, acceptable water dispersing, minimized distortion of the view through the skylight window and minimized use of weather shield and window portion material may be achieved with the skylight window according to the invention.

[0019] Size and weight of a weather shield of the skylight window according to the invention may be made relatively small compared to the weather shields of the prior art, making it easier to open and saving on material. Also, due to the minimal extent that the weather shield pane projects upwardly in the mounted position of the skylight window, wind loads on the weather shield will be smaller and, thus, strength and stiffness requirements in relation to all parts of the skylight window as well as the roof in which it is potentially mounted will be reduced.

[0020] The inventor has found that due to its curvature as defined above, the weather shield pane will have a structural load capacity able to withstand larger loads both from wind and snow. Additionally, the weather shield pane can be relatively cheaply manufactured, even from stiffer and harder materials, such as glass or hardened glass, which may further increase the structural integrity of the skylight window and improve view through the window while achieving the above advantages.

[0021] Preferably, the curvature of the weather shield pane may be so that in an entire area of a top surface of the weather shield pane, the top surface slopes upwardly, specifically in two top surface areas on both sides of the apex line, so that no depressions, and preferably also no horizontal areas, exist in or at the top surface. But note that the apex line itself may extend substantially horizontally in the mounted position of the skylight window. The apex line may generally extend linearly.

[0022] The weather shield of the skylight window according to the invention may further comprise a weather shield skirt supporting the weather shield pane and extending at one or more side edges of the weather shield pane to further seal the window portion from the surroundings and/or avoid or lessen entrance of water and/or dirt into the window portion. One or more sealing elements may be located between the skirt and the weather shield pane. The weather shield skirt may comprise four side skirt members, specifically two pairs of opposed side skirt members, and these four side skirt members may be positioned to substantially form a rectangle. The side skirt members may each be substantially plane and/or extend substantially linearly and/or may take the form of profiled skirt members, potentially comprising or consisting of aluminium. The weather shield skirt may be attached to the window portion, specifically to the window frame or the window sash of the window portion so as to place the weather shield pane in position above the window portion.

[0023] The plane P1 may be substantially parallel to a plane of the window portion windowpane. The skirt members may extend substantially at respective right angles to the plane P1. One or more of the side skirt members may support a respective peripheral edge, i.e. a side edge, of the weather shield pane. The weather shield pane may thus comprise four corresponding side edges.

[0024] The weather shield pane may be embedded or mounted in and/or attached to the weather shield skirt. A cushioning member and/or an adhesive, such as glue, or an adhesive member, such as an adhesive tape, may be provided between edges of the weather shield pane and supporting surfaces of the weather shield skirt. Additionally or alternatively, the weather shield pane may be attached to the weather shield skirt by clamping or other mechanical means. The weather shield side skirt members may each be an aluminium profile. The weather shield pane may be positioned with its two straight peripheral edges substantially parallel with two opposed side skirt members and with its two curved peripheral edges extending along or adjacent to other two opposed side skirt members.

[0025] The weather shield pane preferably has a substantially constant thickness along an entire pane area, a distance between a top surface and the bottom surface of the weather shield pane potentially being substantially constant over an entire area of the weather shield pane. This further prevents distortion of the view through the skylight window. This thickness may be 3 mm to 7 mm, preferably 4 mm to 6 mm. An entire upper or lower surface area of the weather shield pane may be 0.5 m² to 10 m², preferably 0.7 to 6 m², more preferred 0.8 to 4 m².

[0026] The shape of the weather shield pane in a cross-sectional plane can be concave, parabolic, cylindrical or elliptic cylindrical. The curved edges of the weather shield pane may substantially follow an arc, e.g. an elliptic or circular arc, and the pane may follow an arc, e.g. an elliptic or circular arc, in a cross section taken along a cross-sectional plane extending substantially at a right angle to a plane through which the apex line X extends and at a right angle to the plane P1.

[0027] The weather shield pane may comprise only one single layer of glazing. The insulating windowpane of the window portion may comprise at least two layers, for example two or three layers, of glazing mounted in the window sash or the window frame, potentially with an inert gas between them. The window frame and or the window sash may have four side members that may be positioned substantially rectangularly. A glazing of the window portion including the windowpane may take the form of a so-called IGU (Insulating Glazing Unit).

[0028] The skylight window according to the invention may be openable. This may be achieved with a window portion that in itself is openable, whereby the window sash may open in relation to the window frame. The weather shield may be attached to the window sash of the window portion so that the window sash and the weather shield move and/or rotate together to open in

relation to the window frame. This may be achieved by the window sash rotating along one of the window frame side members during opening of the skylight window, one side sash member being rotatably attached to the window frame along the said window frame side member. The weather shield may be mounted on the window portion in such a manner that the weather shield follows the window sash in an opening movement by the window sash in relation to the window frame. A chain drive system may be provided to achieve the opening and closing movements. The weather shield according to the second aspect of the present invention makes it possible to design the skylight window so that it can be opened more easily in the described manner, see further below.

[0029] The weather shield pane is preferably a windowpane and/or preferably is transparent and/or translucent, i.e. allows light to pass through it. Preferably, at least 50, 60, 70, 80 or 90 percent of visible light is allowed to pass through the weather shield pane.

[0030] The angle α between the bottom plane P1 and the inclination plane P2 is preferably between 1 and 8 degrees, more preferred 1 and 6 degrees, more preferred 2 and 6 degrees, more preferred 2 and 5 degrees, more preferred 2 and 4 degrees, more preferred between 2.5 and 3.5 degrees, most preferred about 3 degrees.

[0031] The apex line may have a distance to the plane P1 of 5 to 100 mm, preferably 10 to 80 mm, more preferred 15 to 40 mm. Additionally or alternatively, the apex line may follow a centre line, which may be linear, of the weather shield pane. Additionally or alternatively, the apex line may extend in parallel with one or both of the straight edges of the weather shield pane. Additionally or alternatively, the apex line may extend at a length substantially identical to a length of one or both of the straight edges of the weather shield pane.

[0032] The weather shield pane, the window sash and/or the window frame may have an overall rectangular or quadratic shape.

[0033] The skylight window according to the invention may be mounted in a flat roof so that the plane P1 is substantially horizontal and or the windowpane of the window portion is substantially horizontal. The angle of the plane P1 and/or of the windowpane of the window portion to horizontal in the mounted state may be 0 to 5 degrees, 0 to 4 degrees, 0 to 3 degrees, 0 to 2 degrees or 0 to 1 degrees.

[0034] The window portion according to the first aspect of the present invention may be that of the skylight window (i.e. the part of the structure positioned beneath the weather shield) shown and explained in relation to Figs 1 and 2 of the above-mentioned WO 2009/080026 A, the weather shield of the skylight window according to the present invention replacing the weather shield of Figs 1 and 2 of WO 2009/080026 A. Attachment of a weather shield skirt to the weather shield sash may be accomplished in a similar manner.

[0035] In an embodiment of the skylight window according to the invention, the weather shield pane is

shaped substantially as a cylinder shell segment curving outwardly in relation to the window portion.

[0036] The cylinder shell segment may be a circular cylinder shell segment so that the curved peripheral edges of the weather shield pane substantially follow a circular arc. A radius of the circular cylinder shell segment may be 2.5 to 15 m, 5 to 12 m, 7 to 10 m or 7.5 or 8.5 m.

[0037] The cylinder shell segment need not necessarily be of a circular cylinder, but may be of other cylinder shapes. It is preferred that the cylinder shell segment curves outwardly along an entire curve of the cylinder shell segment so that precipitation is not collected in pockets of the surface of the weather shield pane, see also above.

[0038] By providing a weather shield pane of this design, the structural benefits of cylinder shell shaped structures are made use of in the weather shield pane, e.g. the moment of inertia of the weather shield pane is increased, thus improving strength and stiffness of the flat-roof skylight window.

[0039] Alternatively, the curvature of the weather shield pane is substantially parabolic. In any case, it is preferred that the curvature of the weather shield pane does not comprise any sequential steps, i.e. immediate or sudden changes of curvature that may disturb the view through it.

[0040] In an alternative to this embodiment, a substantially parabolic weather shield pane is provided. Hereby, manufacturing of the weather shield pane may be simplified as a flat pane that can simply be fixed at two opposed straight side edges and a force applied at the centre, whereby the pane will curve outwardly. This is especially a structural possibility due to the relatively low angle α . Thus, manufacturing costs can be reduced.

[0041] In another embodiment the weather shield pane is made of or comprises glass, preferably hardened glass. A weather shield glass pane may be moulded or cast to assume its final, curved shape or it may be cast first, e.g. in a substantially plane shape, and then subsequently deformed to assume its curved shape.

[0042] By using glass compared to plastic, which is traditionally used in weather shields in flat-roof skylight windows, the weather shield becomes more wear resistant, as glass is less prone to scratching, denting and the like, and because glass has typically better structural characteristics, such as strength, hardness and stiffness. Scratches and dents will increase the roughness of the weather shield pane surface so that water will more likely be retained on the surface of the weather shield if the weather shield pane is made of plastic. Comparably, especially the dome-shaped plastic weather shields of the prior art would be expensive to manufacture in glass.

[0043] In another embodiment the weather shield pane is coated on a top surface thereof with a coating which enhances the dewatering properties of the top surface by lowering the surface tension properties, lowering the surface roughness or affecting other physical properties of the top surface. The coating may be a self-clean coat-

ing and/or a hydrophobic coating and/or may contain titanium dioxide.

[0044] In another embodiment a length and width of an imaginary rectangle defined by the four bottom corners of the weather shield pane are larger than a corresponding length and width, respectively, of the window frame.

[0045] By extending the weather shield pane farther out than the window frame of the window portion of the flat-roof skylight window, water from the upper surface of the weather shield pane may be led to outside peripheral edges of the window portion while, for example, using side skirt members that extend at substantially right angles to the plane P1. Thus, the risk of water entering into the window portion or the building through the window portion is decreased.

[0046] The second aspect of the invention provides a weather shield for being mounted on a window portion for forming a flat-roof skylight window according to any one of the above embodiments, the weather shield comprising

a weather shield pane comprising two opposed substantially straight peripheral edges and two opposed curved peripheral edges, and

a weather shield skirt supporting the weather shield pane and comprising two opposed first side skirt members, each of the first side skirt members supporting one of said curved edges, wherein each of the first side skirt members comprise a base portion, said base portions extending substantially in parallel with each other, each said base portion extending substantially along a full length of a respective one of said two curved edges, at least one of said first side skirt members further comprising a first supporting leg, the first supporting leg extending in an inward direction from and at an angle to an inner surface of the respective base portion of said one of the first side skirt members, said inner surface facing the other of said first side skirt members, one of said curved edges of the weather shield pane resting on a supporting surface of said first supporting leg, wherein said supporting surface extends along said one of the curved edges in a curve substantially corresponding to a curve along which said curved edge extends.

[0047] With the second aspect of the invention it is possible to provide superior support of a curved edge of a weather shield pane by means of the first supporting leg, the supporting surface of the first supporting leg following the curve of the weather shield pane at the respective curved edge thereof. Thus, surprisingly, a well-supported weather shield pane with a curved edge may be provided in a simple manner. The advantages of a curved weather shield pane with two curved side edges are described above in connection with the explanation of first aspect of the invention.

[0048] The first supporting leg comprises a supporting surface, which may be an upper or top surface, i.e. an upper supporting area of some size shaped according to a curved peripheral bottom surface of the weather shield

pane and in direct or indirect contact (indirect contact e.g. including presence of intermediate adhesion and/or sealing elements) with the weather shield pane so as to spread a gravity load of the pane on a larger area and thereby reduce forces on the pane itself as well as on the first supporting leg.

[0049] Furthermore, sealing between the weather shield pane curved edge and the first side skirt member may be easily achieved. Some options will be explained below. Thus, a tight weather shield with good dewatering properties may be readily arrived at.

[0050] The curved edge resting on the supporting surface is intended to include that a peripheral lower area or portion of a bottom surface of the weather shield pane rests on the supporting surface. The curved peripheral edges of the weather shield pane may alternatively be denoted "curved peripheral portions or areas" of the weather shield pane. These curved peripheral portions may each comprise a bottom surface area in contact with the first supporting leg(s).

[0051] Similar to in the first aspect of the invention, the weather shield pane of the weather shield according to the second aspect of the invention may further comprise a curved bottom surface intended to face a window portion and having four bottom corners positioned in an imaginary bottom plane P1, an apex line or peak line X extending between said two curved edges where the bottom surface of the weather shield pane has the largest distance to the bottom plane P1, a connecting line L1 connecting two of said bottom corners, the connecting line L1 extending substantially in parallel to the apex line X, the apex line X and the connecting line L1 being positioned in an imaginary inclination plane P2, wherein an angle α between the bottom plane P1 and the inclination plane P2 is between 1 and 10 degrees. The angle α may be within the preferred angle intervals mentioned above. Hereby, advantages similar to those above in relation to the first aspect of the invention may be achieved.

[0052] In the context of the second aspect of the invention, the inward direction, in which the first supporting leg extends, may be a direction from the respective base portion towards a spacing enclosed by the weather shield pane and the skirt and/or a direction towards the other of said base portions. Similarly, the inner surface of the base portion may be defined as the surface facing said interior spacing and/or the other base portion.

[0053] One or both of the base portions of the first side skirt members may extend substantially in a plane. These two planes may be substantially parallel with each other. The base portion(s) and/or the entire skirt may incline slightly outwardly in a downward direction, i.e. in a direction towards the intended position of the window portion. Thus, water running off the pane onto the base portion or skirt may be led along an outer surface of the base portions or skirt, away from a window portion positioned beneath the weather shield and potentially onto a roof surface.

[0054] Generally, the opposed first side skirt member

may be provided as a mirrored version of the first side skirt member. The opposed first side skirt member may similarly comprise a like first supporting leg that also extends inwardly. This opposed first supporting leg may be in the form of a mirrored version of the first supporting leg, which in a similar manner supports the other curved edge of the weather shield pane.

[0055] As previously indicated the curved edge of the weather shield resting on the supporting surface of the first supporting leg does not necessarily rule out that a member such as a sealing member or adhesive is positioned between the curved edge (specifically a surface area at the curved edge) and the supporting surface, i.e. the supporting surface is not necessarily in direct contact with the weather shield pane.

[0056] The weather shield skirt may further comprise two second, opposed side skirt members. The first and second side skirt members may be positioned in a rectangular shape to form a rectangular or quadratic weather shield skirt. The first side skirt members may be positioned at substantially right angles to the second side skirt members.

[0057] One or both of the second side skirt members may comprise a base portion and/or a first supporting leg similar to the base portion and first supporting leg, respectively, of the first side skirt members and supporting a respective one of the straight peripheral or side edges of the weather shield pane. These supporting legs may extend substantially in a plane so as to fit the straight edges. These supporting legs may similarly extend in an inward direction from and at an angle to an inner surface of a respective base portion of a respective of the side skirt members, one of said straight edges of the weather shield pane resting on a supporting surface of each of said supporting legs. This supporting surface may be substantially plane and/or may follow a curve of a peripheral portion of the bottom surface of the weather shield pane near its straight edges. The first supporting leg(s) of the first and/or second skirt member(s) may extend from and at a substantially right angle to the base portion.

[0058] The first supporting leg of the first side skirt member may be attached to the respective base portion; it may be attached at a top of the respective base portion or at a distance from the top of the base portion. It may also be integral with the base portion, i.e. provided as part of a unitary first side skirt member. This may also apply to the second side skirt members.

[0059] The weather shield pane may be embedded in and/or attached to the weather shield skirt. For this purpose, an adhesive or an adhesive member, such as glue or an adhesive tape, may be provided between one or more of the peripheral edges of the weather shield pane and the respective supporting surface(s) of the side skirt members so as to attach the weather shield pane in or to the weather shield skirt using adhesion. Alternatively, the weather shield pane may be attached to the weather shield skirt using clamping or other mechanical means.

[0060] The weather shield side skirt members may be

provided as or comprise aluminium profiles, which may be extruded, and may be in the form of unitary or integral profiles from which the respective first supporting leg (and/or second supporting leg, see below) may be bent and/or provided during potential extrusion of the profiles. This may provide for light-weight and weather resistant side skirt members which may be produced with low costs.

[0061] In an embodiment of the weather shield according to the second aspect of the invention the supporting surface of the first supporting leg extends over at least half of a full length of said curved edge. The supporting surface of the first supporting leg may extend over at least 70 % or 90 % of a full length of said curved edge.

[0062] The supporting surface may comprise two or more smaller supporting surface portions that may be separated in a length of the supporting surface by interruptions, such as recesses or the like, in which case the supporting surface itself can be considered to be an accumulated surface of said smaller surface portions.

[0063] The more the leg curvature corresponds to the curved edge of the weather shield pane, the better the weather shield pane may be supported, and the less sealant and/or adhesive has to be used between the weather shield pane and the first supporting leg, and the lower the risk of water entering the inside of the weather shield may be. It is preferred that substantially an entire length of the respective curved edge is supported on the supporting surface. However, the supporting surface may extend 30 % to 100 % of a length of the respective curved edge, this interval more preferred being 50 % to 100 %, more preferred 70 % to 100 %, more preferred 80 % to 100 %, more preferred 90 % to 100 %, most preferred substantially 100 %.

[0064] In another embodiment the first supporting leg comprises a lower portion and an adapter element, the adapter element comprising the supporting surface, wherein said adapter element is arranged between said lower portion and said curved edge of the weather shield pane. Hereby, the adapter element may adapt an easily manufactured first supporting leg lower portion, which may be plane, to correspond to the curved shape of the curved edge. The lower portion may be a tongue attached to or integral with the base portion.

[0065] The adapter element may be an element separate from the remaining parts of the first side skirt member. The adapter element may be substantially crescent-shaped, potentially with a substantially straight bottom surface, which may abut an upper surface of the lower portion, and a curved upper surface constituting the supporting surface of the first supporting leg. It may be attached to the base portion and/or the lower portion using attachment members, e.g. clips, screws or bolts. The adapter element, base portion and/or lower portion may accordingly comprise attachment holes for insertion and attachment of the attachment members. The attachment members may form part of or be attached to the adapter element and may comprise a snap-lock system for snap-

locking the attachment members in the attachment holes. The adapter element may be manufactured from a material, which may be resilient, flexible and/or comprise a plastics material, potentially to improve absorption of forces in the adapter element. Correspondingly, the lower portion or tongue may provide a spring effect to further improve force absorption. This may especially be achieved in case of a substantially plane plate-shaped plane lower portion, which at one longitudinally extending edge is attached to or integral with the base portion.

[0066] In another embodiment the first supporting leg comprises a bent portion, which is bent inwardly from the material of the base portion of the side skirt member. In this embodiment the above-mentioned bent portion may be or comprise the lower portion or tongue of the supporting leg, which bent portion is bent inwardly from the material of the base portion of the side skirt member. Alternatively, the entire first supporting leg may be the entire bent portion.

[0067] By providing a bent portion that forms or comprises the first supporting leg, such that the curved peripheral edge is supported by this, water on the surface of the weather shield pane may dewater from the weather shield pane onto an outer surface of the side skirt member.

[0068] The bent portion of the current embodiment may be the lower portion of the previous embodiment, an adapter element of the first supporting leg also being provided as described above. However, an adapter element as described above need not be provided in the current embodiment. Instead, it may be advantageous to dispose of the adapter element and, instead, allow the bent portion of the first supporting leg to include the supporting surface on which the curved edge of the weather shield pane rests. Thus, the bent portion of the supporting leg may be plate-shaped and may be shaped to, in at least a portion of its length corresponding to the extent of the supporting surface, follow a curvature of the curved edge of the weather shield pane. (The latter may also be the case even if the adapter element of the previous embodiment is included.) This may be especially advantageous with the weather shield according to the first aspect of the present invention due to the relatively small curvature of the weather shield pane since with larger curvatures, deformations in the first side skirt member during bending of the first side skirt member may become so large that it would be too difficult to maintain the shape of the base portion and/or the bent portion during bending. With such a curved bent portion it may especially be advantageous as described above to provide one or more interruptions, such as recesses, along a length of the bent portion and/or in the lower portion of the first supporting leg since this may lessen deformations during bending.

[0069] Generally, the first side skirt member may be provided as an overall plate-shaped member, which has been deformed so as to provide the first supporting leg or the bent portion with a curvature in a longitudinal direction, i.e. a direction extending along a length of the

curved edge of the weather shield pane.

[0070] In another embodiment a gutter recess is provided in the first supporting leg such as to act as a gutter for water potentially entering through a gap between the weather shield pane and the first side skirt member.

[0071] By providing a gutter recess in the first supporting leg, the weather shield may protect an inside spacing of the weather shield, i.e. a window portion beneath, in case of wear of a sealing element or an adhesive element or the side skirt members themselves, resulting in water penetrating the connection between the weather shield pane and the side skirt member. In this case, water may be collected in the gutter recess and will therefore not penetrate between the weather shield pane and the side skirt member and potentially onto or into the window portion.

[0072] In the current embodiment the first supporting leg may comprise an upward step at a distance from the base portion so that the gutter recess extends between the upward step and the base portion, this upward step potentially extending substantially in parallel to the base portion. Alternatively, the first supporting leg may at a first distance from the base portion comprise a downward step and immediately after or at a second, longer distance from the base portion comprise an upward step so that the gutter recess is formed between the two steps. Again, these steps may potentially extend substantially in parallel to the base portion.

[0073] The gutter recess may in all cases comprise a bottom surface, which may be a part of a surface of the first supporting leg or of the above-mentioned lower portion/tongue or the above-mentioned bent portion. In the last mentioned design with two steps, the bottom surface of the gutter may be provided between the two steps. The one or two steps may be bent at substantially right angles, and further steps may be present.

[0074] At an end of the first supporting leg facing away from the base portion, the first supporting leg may comprise a resting portion on which the weather shield pane and/or on which the above-mentioned adapter element rests. This resting portion may be provided so that the gutter recess is located between the base portion and the resting portion. The resting portion may have a substantially linear or a curved profile, and the supporting surface may be provided as an upper surface or part of an upper surface of the resting portion. The first supporting leg as such and/or the resting portion may follow the curvature of the respective curved edge of the weather shield pane, at least over a part of the length of the curved edge, and/or the above-mentioned adapter element may be provided between the resting portion and the curved edge of the weather shield pane.

[0075] In another embodiment the side skirt member comprises a second supporting leg, the second supporting leg extending inwardly from an inner surface of said base portion, a sealing element being positioned to seal a gap between the weather shield pane and the base portion of the first side skirt member, the second support-

ing leg supporting the sealing element. The sealing member is preferably elastic and may be of a resilient plastics material or silicone.

[0076] With the second supporting leg an efficient sealing between the weather shield pane and the side skirt member may be achieved. Elastic properties of the sealing element may ensure a tight connection between the weather shield pane and the base portion, thus further decreasing the risk of water entering between the weather shield pane and the first side skirt member. Furthermore, provision of a flexible sealing member may provide a cushioning between the weather shield pane and the first side skirt member. The sealing member may be oblong and/or may extend to cover a recess or gap between the weather shield pane and the base portion. This recess may extend substantially along an entire length of the respective curved edge of the weather shield pane. A similar recess may extend along the other edges of the weather shield pane, and a similar sealing element may extend in those recesses as well.

[0077] The second supporting leg may be positioned above the first supporting leg, i.e. closer to a top end of the base portion of the first side skirt member. The second supporting leg may be positioned at a distance from the first supporting leg. The second supporting leg may be attached to or integral with the base portion, and it may be attached at the top end of the base portion or at a distance from the top end of the base portion. It is preferred that the second supporting leg is located between the said top end of the base portion and the first supporting leg.

[0078] Similar to the first supporting leg, an adapter element as described above for the first supporting leg may be provided for the second supporting leg. This second adapter element may similarly comprise a curved upper surface, which may be a supporting surface for supporting the sealing element, and it may be substantially identical to or a mirrored version of the first adapter element. The second supporting leg may be without an adapter element and shaped in a longitudinal direction to follow a curve of the curved edge of the weather shield pane.

[0079] Similar to the first supporting leg as described above, the opposed first side skirt member may comprise a like second supporting leg that also extends inwardly. This opposed second supporting leg may be in the form of a mirrored version of the second supporting leg having a like function at the opposed curved edge of the weather shield pane.

[0080] If the weather shield skirt further comprises two second, opposed side skirt members positioned at straight edges of the weather shield pane, these second side skirt members may as well potentially comprise a similar second supporting leg similar to the described second supporting leg of the first side skirt member(s) and potentially extending substantially linearly. These second supporting legs of the second side skirt members may extend substantially in respective planes so as to

correspond to the straight edges of the weather shield pane and may similarly extend in an inward direction from and potentially at an angle to an inner surface of a respective base portion of each of the second side skirt members.

[0081] If adapter element(s) are provided for the first and/or second leg as described above, and the weather shield skirt further comprises two second, opposed side skirt members, all four side skirt members may be manufactured from one side skirt member starting element or blank. Thus, the adapter elements may be used to adapt the first and/or second supporting leg to the curvature of the curved edges of the weather shield pane.

[0082] The second supporting leg may extend from and at a substantially right angle to the base portion. Alternatively, the supporting leg may extend at an angle to the base portion of 45 to 90 degrees, preferably 70 to 90 degrees.

[0083] In another embodiment a top end of the base portion of the first side skirt member is shaped with a curvature so as to at least along a part of the top end follow a curvature of that curved edge of the weather shield pane which is supported by the first side skirt member.

[0084] Hereby, sealing properties are enhanced and it may be made possible to provide a sealing member, such as the above-mentioned sealing member, between an area at the top end of the base portion and the respective curved edge of the weather shield pane, especially if the above-mentioned second supporting leg also follows a curve of the curved edge of the weather shield pane.

[0085] A curvature of the top end of the base portion may follow the curvature of the curved edge of the weather shield pane along substantially an entire length of the curved edge.

[0086] The weather shield pane may comprise a curved bottom surface with four bottom corners positioned in an imaginary bottom plane P1, and the curved top end of the first side skirt member may be provided at substantially the same level from this bottom plane as the respective curved edge of the weather shield pane, specifically at the level of a top end of this curved edge. Hereby, a sealing member may be positioned between the top end of the base portion and the curved edge of the weather shield pane.

[0087] In the current embodiment, if the weather shield skirt further comprises two second, opposed side skirt members, all four side skirt members may be manufactured and/or punched from one side skirt member starting element or blank, as mentioned above. Thus, adapter elements may be used to adapt the first and/or second supporting leg to the curvature of the curved edges of the weather shield pane, and the top ends of the first side skirt members may be cut or punched so as to follow the curvature of the respective curved edges of the weather shield pane, and corresponding top ends of the second side skirt members may be cut or punched so as to follow the respective substantially straight edges of the weather

shield pane.

[0088] In another embodiment the weather shield is mounted on a window portion so as to form a flat-roof skylight window and so that in a mounted state of the skylight window the weather shield covers and weather protects the window portion.

[0089] In an embodiment of the first aspect of the invention a flat-roof skylight window according to the first aspect of the invention is provided, wherein the weather shield is a weather shield according to the second aspect of the invention. Hereby, combined advantages of the first and second aspects of the invention may be arrived at.

[0090] In both the first and second aspects of the invention the weather shield skirt may be cast or moulded, e.g. injection moulded, specifically reaction injection moulded (RIM). The entire skirt may be integrally cast or each of the four side skirt members may be individually cast. The skirt may be cast or integrally cast around the weather shield pane whereby the weather shield skirt will adapt to the shape of the weather shield pane edges and may further provide a self-sealing structure.

[0091] It is generally noted that any reference signs in the claims and in the above description of embodiments of the invention are not intended to limit the scope of the claims, e.g. to any of the detailed embodiments described in the following.

The drawings

[0092] In the enclosed drawings, which show non-binding examples of embodiments of the first and second aspects of the present invention,

Fig. 1 is a perspective view of an embodiment of a flat-roof skylight window according to the first aspect of the invention mounted in a flat roof and comprising an embodiment of a weather shield according to the second aspect of the invention,

Fig. 2 is a detailed perspective view of the weather shield of Fig. 1,

Fig. 3 is a side view of a weather shield pane of the weather shield of Fig. 1,

Fig. 4 is an exploded perspective view of the weather shield of Fig. 1,

Figs 5a and 5b are an inside and an outside plane view, respectively, of a first side skirt member of the weather shield of Fig. 1,

Fig. 6 is a side view of the first side skirt member of Figs 5a and 5b seen from the left in Fig. 5a,

Fig. 6a is a cross sectional side view of the first side skirt member of Figs 5a and 5b seen from the same angle as in Fig. 6,

Fig. 7 is a side view corresponding to that of Fig. 6 with a weather shield pane supported on a first supporting leg of the side skirt member of Figs 5a and 5b, Fig. 8 is a side view corresponding to that of Fig. 7 of a second side skirt member of the weather shield

of Fig. 1 seen from the left in Fig. 4 with a weather shield pane supported on a first supporting leg of the second side skirt member,

Fig. 9 is a perspective view of an alternative embodiment of the first side skirt member of Figs 5a and 5b with a weather shield pane supported on a first supporting leg of the first side skirt member,

Fig. 9a is a cross sectional side view corresponding to that of Fig. 6a of the first side skirt member of Fig. 9, Figs 10a and 10b are schematic side views seen from the left in Fig. 4 of alternative embodiments of the second side skirt member of Fig. 8 with a weather shield pane supported on a first supporting leg of the second side skirt member,

Fig. 11 is a perspective view of an alternative embodiment of the weather shield of Fig. 1 having an integrally moulded skirt,

Fig. 12 is a view corresponding to the view of Fig. 11 of an alternative embodiment of the weather shield of Fig. 11 with a moulded skirt and in a pre-assembled state, and

Fig. 13 shows a perspective cross sectional view taken along the line XIII-XIII of Fig. 12 of the weather shield of Fig. 12 in an assembled state.

Description of detailed embodiments of the invention

[0093] Fig. 1 shows an embodiment of a flat-roof skylight window 1 according to the first aspect of the invention mounted in a flat roof 2 and comprising a weather shield 3 according to the second aspect of the invention.

[0094] The skylight window 1 comprises a window portion 1 a that is visible in Fig. 1 behind a weather shield pane 6, specifically two side sash members of four side sash members of a window sash 4a of the window portion 1 a are visible through the pane 6. The window portion 1 a also comprises a frame 4b with four side frame members of which two are visible in Fig. 1, each side frame member being positioned along and at an outside of a respective one of the four side sash members. The window portion 1 a also comprises an insulating windowpane 1 b mounted in the window sash 4a beneath the weather shield pane 6. A person skilled in the art will be able to devise how to mount the window portion 1 a, specifically the window frame 4b of the window portion 1 a, in the roof 2. The window portion 1 a may be in the form of the skylight window (i.e. the part of the structure positioned beneath the weather shield) shown and explained in relation to Figs 1 and 2 of WO 2009/080026 A, the weather shield 3 of the skylight window 1 according to the embodiments shown in the drawings replacing the weather shield of Figs 1 and 2 of WO 2009/080026 A. In a not shown alternative, the window portion 1a does not comprise a window sash, but only a window frame, and the windowpane is mounted in the window frame.

[0095] The weather shield 3 is provided as a unitary structure, which is separate from the window portion 1 a. The weather shield 3 is mounted on the window portion

1 a for covering and weather protecting the window portion 1 a in a mounted state of the skylight window 1. The weather shield pane 6 is curved outwardly, i.e. upwardly in Fig. 1, in relation to the window portion 1 a, see further below. The weather shield pane 6 is a transparent windowpane of hardened glass.

[0096] The weather shield 3 and details thereof are shown in more detail in Figs 2 to 8.

[0097] The weather shield pane 6 comprises two opposed substantially straight peripheral edges 6a, 6b and two opposed curved peripheral edges 6c and 6d. The weather shield pane 6 further comprises a curved bottom surface 7 facing the window portion 1 a and having four bottom corners 7a, 7b, 7c and a further bottom corner not visible in the views of the figures, these four corners being positioned in an imaginary bottom plane P1, see Fig. 3. These bottom corners are the bottom points of the corners where the respective edges 6a to 6d meet. The pane 6 further comprises an opposed, curved top surface 8, the two surfaces 7 and 8 having essentially the same shape and curvature.

[0098] The curvature of the bottom surface 7 follows the following geometric definitions according to the first aspect of the invention:

[0099] As shown in Fig. 3, an apex line or peak line X extends horizontally, i.e. in a depth direction of Fig. 3, between the two curved edges 6c and 6d where the bottom surface 7 has the largest distance to the bottom plane P1. A connecting line L1, see Fig. 3, connects the bottom corner 7a with the bottom corner not visible in the figures, the connecting line L1 extending substantially in parallel to the apex line X, i.e. in a depth direction in Fig. 3. The apex line X and the connecting line L1 are positioned in an imaginary inclination plane P2, also shown in Fig. 3. The planes P1 and P2 intersect in the line L1. An angle α shown in Fig. 3 is defined between the bottom plane P1 and the inclination plane P2. This angle α is 3 degrees in the embodiment shown. The plane P1 is substantially parallel to a plane of the window portion 1 a windowpane 1 b. The weather shield pane 6 is shaped substantially as a cylinder shell segment curving outwardly in relation to the window portion 1a. Specifically, each of the two surfaces 7, 8 have the shape of a cylinder shell segment. The cylinder shell segment is a circular cylinder shell segment so that the curved peripheral edges 6c, 6d of the weather shield pane 6 substantially follow a circular arc, see especially Fig. 3. A radius of the circular cylinder shell segment is about 8.5 m. Note that this entails that the curved edges 6c, 6d also substantially follow a circular arc, the pane 6 also following a circular arc in a cross section taken along a cross-sectional plane extending substantially at a right angle to a plane through which the apex line X extends and at a right angle to the plane P1.

[0100] The curvature of the weather shield pane 6 is so that the top surface 8 of the pane 6 slopes upwardly in an entire area of this top surface 6 in top surface 8 areas on both sides of the apex line X so that no depressions and no horizontal areas exist in or at the top surface

6. However, the apex line X extends substantially horizontally in the mounted position of the skylight window 1.

[0101] The weather shield pane 6 is substantially symmetric about the apex line X.

[0102] The weather shield 3 further comprises the weather shield skirt 5 supporting the weather shield pane 6 and extending along the four side edges 6a to 6d of the weather shield pane 6 to seal the window portion 1 a from the surroundings and/or avoid or lessen entrance of water and/or dirt into the window portion 1a. The weather shield skirt 5 comprises four side skirt members 5a, 5b, 5c and 5d that are positioned to substantially form a square when seen from above. The skirt members 5a, 5b, 5c and 5d are assembled to form the skirt 5 in an essentially known manner by use of corner keys 5e, see Fig. 4.

[0103] The weather shield skirt 5 is attached to the window portion 1 a in a not shown manner, specifically to the window frame 4a and/or to the window sash 4b, so as to place the weather shield pane 6 in position above the window portion 1 a. A person skilled in the art will be able to devise how to accomplish this.

[0104] The side skirt members 5a to 5d, specifically base portions thereof, extend substantially at right angles to the plane P1, each supporting a respective one of the peripheral side edges 6a to 6d of the pane 6 so that the weather shield pane 6 is embedded and mounted in the weather shield skirt 5. Thus, the weather shield pane 6 is positioned with its two straight peripheral side edges 6a, 6b substantially in parallel with the two side skirt members 5c, 5d, respectively, and with the two curved peripheral side edges 6c, 6d extending along or adjacent to the other two side skirt members 5a, 5b, respectively.

[0105] The weather shield pane 6 has a substantially constant thickness along an entire pane area, i. e. a distance between the top surface 8 and the bottom surface 7 is substantially constant over an entire area of the weather shield pane 6, see Fig. 3. This thickness is about 5 mm. An entire surface area of the top and bottom surfaces 7, 8, respectively, is about 2 m², a length and width of the pane 6 being about 1.4 m, respectively.

[0106] The insulating windowpane 1b of the window portion 1a comprises three layers of glazing mounted in the window frame 4b and with an inert gas between them. The window frame 4b and window sash 4a side members are respectively positioned substantially in a square. The window portion glazing is a so-called IGU (Insulating Glazing Unit).

[0107] The skylight window 1 may be made to be openable, which may be achieved in the following manner: The window portion 1a is in itself openable, whereby the window sash 4a can open in relation to the window frame 4b. The weather shield 3 is attached to the window sash 4a of the window portion 1 a so that the window sash 4a and the weather shield 3 move together and open in relation to the window frame 4b. This is achieved by the window sash 4a rotating along one of the window frame side members during opening of the skylight window 1,

the window sash 4a being rotatably attached to the window frame 4b along the said window frame side member. Thus, the weather shield 3 is mounted on the window portion 1 a in such a manner that the weather shield 3 follows the window sash 4a in an opening movement by the window sash 4a in relation to the window frame 4b. A chain drive system may be provided to drive or achieve the opening and closing movements.

[0108] The apex line X has a distance to the plane P1 of about 10 to 80 mm, preferably 15 to 40 mm, follows a transverse centre line of the weather shield pane 6 and extends in parallel with the straight edges 6a, 6b of the weather shield pane 6. The apex line X extends at a length substantially identical to a length of each of the straight edges 6a, 6b of the weather shield pane 6.

[0109] The height from the plane P1 to the top of the weather shield pane 6 surface 8 is between 1-4% of a total pane 6 width when this height is measured at the apex line X. The skylight window 1 is mounted in the flat roof 2 so that the plane P1 and the windowpane 1b are positioned substantially horizontally.

[0110] The weather shield glass pane 6 has been moulded or cast to assume its final, curved shape. The weather shield pane 6 is coated on the top surface 8 thereof with a coating which enhances the dewatering properties of the top surface by lowering the surface tension properties. The coating is a self-clean and hydrophobic coating that contains titanium dioxide.

[0111] A length and width of an imaginary rectangle defined by the four bottom corners, including the bottom corners 7a, 7b and 7c, of the weather shield pane 6 are larger than a corresponding outer length and width, respectively, of the window frame 4b of the window portion 1 a, see Fig. 1.

[0112] The side skirt members 5c to 5d are best seen in Fig. 4. The side skirt members 5a and 5b are mirrored versions of each other, and the side skirt members 5c and 5d are mirrored versions of each other. The side skirt member 5a comprises a base portion 10 that extends in parallel with an opposed, mirrored base portion 11 of the opposed side skirt member 5b. The base portions 5a, 5b extend substantially along a full length of the two curved edges 6c and 6d, respectively.

[0113] The side skirt member 5a is shown in more detail in Figs 5a to 7, to which reference is made in the following.

[0114] The side skirt member 5a comprises a first supporting leg 12, the corresponding, mirrored supporting leg 13 of the opposed side skirt member 5b being visible in Fig. 4. The first supporting leg 12 extends in an inward direction from and at an angle to an inner surface 14 of the base portion 10, which inner surface 14 faces the opposed side skirt member 5d. The curved edge 6c of the weather shield pane 6 rests on a supporting surface 15 of the first supporting leg 12, see Figs 6a and 7. The supporting surface 15 extends along the curved edge 6c in a curve substantially corresponding to the curve along which the curved edge 6c extends. The supporting sur-

face 15 of the first supporting leg 12 is an upper surface or upper support area of some size shaped according to a peripheral area of the curved bottom surface 7 of the weather shield pane 6 at the edge 6c thereof. The supporting surface 15 is in indirect contact with the weather shield pane 6 as shown in Fig. 6a so as to spread part of the gravity load of the pane 6 on the surface area 15 and thereby reduce forces on the pane 6 itself as well as on the first supporting leg 12. A flexible adhesive sealing and cushioning element 50 is provided between the supporting surface 15 and the bottom surface 7 of the pane 6, see Fig. 6a, this element 50 extending along substantially an entire length of the edge 6c. See the description of Figs 10a and 10b below regarding the details of the element 50, which may comprise one or more of the elements 46, 47 and 49 of Figs 10a and 10b.

[0115] The inward direction in which the first supporting leg 12 extends is a direction from the base portion 10 towards an interior spacing 16 enclosed by the weather shield pane 6, the skirt 5 and the window portion 1 a. It is also a direction towards the opposed base portion 11.

[0116] The base portions 10, 11 each extend substantially in a plane. However, at a lower part of the base portions 10, 11, projections are included for providing sealing between the skirt 5 and the window frame 4b and/or the window sash 4a. These projections are of types known to a person skilled in the art and will not be described in detail. The two planes in which the base portions 10, 11 generally extend are substantially parallel with each other and are substantially vertical.

[0117] The first supporting leg 12 is attached to the base portion 10 at an inner end and at a distance from a top end 17 thereof.

[0118] The supporting surface 15 of the supporting leg 12 extends over substantially a full length of the curved edge 6c so that substantially an entire length of the curved edge 6c is supported on the supporting surface 15.

[0119] The first supporting leg 12 comprises a plane tongue or lower portion 12a and an adapter element 12b, the adapter element 12b comprising the supporting surface 15 and being arranged between the lower portion 12a and the (bottom surface 7 area at the) curved edge 6c. The adapter element 12b adapts the plane lower portion 12a to correspond to the curved shape of the (bottom surface 7 area at the) curved edge 6c. The lower portion 12a extends upwardly at an angle slightly different from a right angle to the base portion 10, specifically the inner surface 14 thereof. This angle may generally be 1 to 20 degrees or 2 to 7 degrees. The lower portion 12a is attached to and integral with the base portion 10 so that the lower portion 12a and the base portion 10 forms one unitary member manufactured as an integral extruded aluminium profile. The base portions and lower portions or first supporting legs of the other skirt members 5b, 5c and 5d are similar unitary profiles. The unitary profiles are in the present embodiment and may also in other embodiments generally be extruded aluminium profiles

that may subsequently be punched in shape, especially along the top ends, including top end 17, of the base portions.

[0120] The adapter element 12b is and may also generally be an element separate from the base portion 10. The adapter element 12b is substantially crescent-shaped, see Fig. 5a, with a substantially straight bottom surface, which abuts an upper surface of the lower portion 12a, and a curved upper surface constituting the supporting surface 15. The adapter element 12b may be attached to the base portion 10 and/or to the lower portion 12a using attachment members (not shown), e.g. clips, screws or bolts. The adapter element 12b, base portion 10 and/or the lower portion 12a may accordingly comprise attachment holes (not shown) for insertion and attachment of the attachment members. The attachment members may form part of or be attached to the adapter element and may comprise a snap-lock system for snap-locking the attachment members in the attachment holes. The adapter element 12b is manufactured from a resilient, flexible plastics material, specifically cut/punched or moulded plastic (ASA). Together with the lower portion 12a a spring effect is thus provided, which improves absorption of the forces from the pane 6 on the supporting leg 12.

[0121] The side skirt member 5c is shown in more detail in Fig. 8, the reference numbers of similar or like elements of Fig. 8 being the reference numbers of Figs 5a to 7 multiplied with 10. The side skirt member 5d is a mirrored version of the side skirt member 5c and functions in the same manner.

[0122] Referring to Fig. 8, the side skirt member 5c comprises, similar to the side skirt member 5a, a base portion 100 and a first supporting leg 120 similar to the base portion 10 and the first supporting leg 12 of the side skirt member 5a, the side skirt member 5c similarly supporting the (bottom surface area at the) straight edge 6b of the weather shield pane 6. The supporting leg 120 extends, similar to the supporting leg 12, substantially in a plane and at a slight angle in the inward direction and from an inner surface 140 of the base portion 100 so as to fit the slightly angled bottom surface at the straight edge 6b of the pane 6 (this bottom surface being substantially straight at this small peripheral area of the pane 6 bottom surface 7). The (bottom surface at the) straight edge 6b of the weather shield pane 6 rests on an upper supporting surface 150 of the first supporting leg 120. No adapter element like the adapter element 12b is needed here since the pane 6 does not curve along its straight edges 6a, 6b.

[0123] A person skilled in the art will appreciate that all side skirt members 5a to 5d can thus be manufactured from one side skirt member starting element or blank. The lower portion 12a of the side skirt member 5a can thus be of the same shape and size as the supporting leg 120 of the side skirt member 5c. The side skirt member 5c only subsequently needs to be punched at its top end 170 to correspond to the straight edge 6b of the pane

6. The side skirt member 5a is correspondingly punched at its top end 17 to correspond to the curved edge 6c of the pane 6, and the adapter element 12b is attached to the lower portion 12a of the supporting leg 12 to form part of the supporting leg 12. Thus, the adapter element 12b may be used to adapt the supporting leg 120 into the supporting leg 12.

[0124] Figs 9 and 10 show an alternative embodiment of the side skirt member 5a of Figs 5a and 5b, denoted 105a. In Fig. 9 100 has been added to the reference numbers for the side skirt member 5a for identical elements or elements of the same function compared to the side skirt member 5a. Only differences from the side skirt member 5a will be described in the following.

[0125] A first supporting leg 112 is constituted by a bent portion bent inwardly from the material of a base portion 110 of the side skirt member 105a and thus extends from a top end 117 of the base portion 110. Again, the curved edge 6c is supported on an upper supporting surface 115 of the supporting leg 112 that follows the curvature of the pane 6 at the curved edge 6c. Thus, the adapter element 12b as described above need not be present in this embodiment. At the edge 6c of the pane 6 an adhesive tape 150 and a cushioning silicone sealing element 151 are provided between the surface 115 and the bottom surface 7 of the pane 6.

[0126] The supporting leg 112 is plate-shaped and shaped to follow the curvature of the edge 6c along the entire length of the edge 6c of the pane 6. This embodiment is especially advantageous with the relatively small curvature of the pane 6 since with larger curvatures, deformations in the side skirt member 105a during bending may be so large that it would be too difficult to maintain the shape of the base portion 110 or the supporting leg 112 during bending.

[0127] Note that, similar to the side skirt member 5a, the side skirt member 105a comprises a base portion 112a (not of the supporting leg in this embodiment) that may be used as the supporting leg 12 for the side skirt member 5c so that all side skirt members 5a to 5d may be manufactured from the same blank as explained above.

[0128] Also note that, generally, the edges 6a to 6d of the pane 6 may be rounded as the edge 6a shown in Figs 9 and 9a or straight as the edge 6a shown in Figs 7 and 8.

[0129] The weather shield pane 6 surface 8 defines the skylight window top surface, and substantially no parts such as skirt members obstruct or cover the surface 8.

[0130] Fig. 10a shows an alternative embodiment 105c of the second side skirt member 5c of Fig. 8. In Fig. 10a, 100 has been added to the reference numbers used for the side skirt member 5c for identical elements or elements of the same function compared to the side skirt member 5c. Only differences from the side skirt member 5c will be described in the following.

[0131] The weather shield pane 6 is supported on and in indirect contact with a first supporting leg 220 of the

side skirt member 105c. A gutter recess 40 is provided in the supporting leg 220 such as to act as a gutter collecting water potentially entering between the weather shield pane 6 and a base portion 200. The supporting leg 220 comprises an upward step 41 at a distance from the base portion 200 so that the gutter recess 40 extends between the upward step 41 and an inner surface 240 of the base portion 200, this upward step 41 extending substantially in parallel to the base portion 200. The gutter recess 40 comprises a bottom surface, which is a part of an upper surface of the supporting leg 220. The step 41 forms two substantially right angles of the supporting leg 220.

[0132] At a right end of the supporting leg 220 facing away from the base portion 200, the supporting leg 220 comprises a resting portion 48 on which the weather shield pane 6 indirectly rests. This resting portion 48 is provided so that the gutter recess 40 is located between the base portion 200 and the resting portion 48. The resting portion 48 has a substantially linear and plane profile, and a supporting surface 250 is provided as an upper surface of the resting portion 48.

[0133] The skirt member 105c also comprises a second supporting leg 42, which extends integrally with, inwardly from and at a substantially right angle to an inner surface 240 of the base portion 200. An elastic sealing element in the form of a silicone joint or seam 44 is positioned to seal a gap between the pane 6 and the inner surface 240 of the base portion 200, the supporting leg 42 supporting the sealing element 44 via a support element 45. The support element 45 is of a resilient plastics material. The supporting leg 42 supports the sealing element 44 to keep it in place between the pane 6 and the base portion 200. The members 44 and 45 are oblong and extend to cover an oblong recess or gap between the pane 6 and the base portion 200. This recess and the elements 44 and 45 extend substantially along an entire length of the curved edge 6b of the pane 6. If similar side skirt members are used along the other edges of the pane 6, a similar recess may extend along those edges, and a similar sealing element may extend in those recesses as well.

[0134] The supporting leg 42 is positioned above the supporting leg 220 between the top end 170 of the base portion 200 and the supporting leg 220. The supporting leg 42 is positioned at a distance from the top end 170 and the supporting leg 220.

[0135] An adhesive tape 46 is provided between the pane 6 and the supporting surface 250 to adhere the pane 6 to the side skirt member 105c. Next to the adhesive tape, a silicone member 47 is positioned to provide cushioning and sealing between the pane 6 and the supporting surface 250.

[0136] Fig. 10b shows an embodiment similar to that shown in Fig. 10a, but which has been slightly modified in that the elements 46 and 47 have been replaced by a thinner cushioning and adhesive tape 49, which may be of the type 3M® VHP, and the resting portion 48 is shifted

slightly upwards so that it lies in the same plane as the supporting leg 42.

[0137] A not shown alternative embodiment of the side skirt member 5a shown in Figs 5a to 7 is modified to a structure similar to the structure of the side skirt member 105c as shown in Fig. 10a or Fig. 10b. Accordingly, a similar starting element or blank, i.e. an aluminium profile, similar to the side skirt member 205c forms a base portion and a supporting leg of the modified side skirt member 5a. However, whereas the base portion 200 of the side skirt member 105c at its top end 170 is punched to substantially follow the straight edge 6b of the pane 6, similar to in the embodiment of Figs 5a to 7 the base portion of the modified side skirt member 5a at its top end is punched to be curved to substantially follow the curved edge 6c of the pane 6. The modified design of the side skirt member 5a also comprises a gutter recess, a step and a resting portion similar to the gutter recess 40, step 41 and resting portion 48, respectively, as shown in Fig. 10a or Fig. 10b. In the modified design of the side skirt member 5a an adapter element similar to the adapter element 12b is provided on an upper surface of the resting portion so as to similarly provide a curved supporting surface similar to the supporting surface 15. In the modified design of the side skirt member 5a the members 46, 47 and 49 of Figs 10a and 10b may potentially be disposed of, or one or more of these members may be positioned between the supporting surface and the bottom surface of the pane 6. Furthermore, a similarly shaped, but somewhat thinner adapter element, may be positioned on an upper surface of a second supporting leg of the modified design of the side skirt member 5a, which corresponds to the supporting leg 42, so as to similarly provide a curved upper supporting surface of the second supporting leg that follows the curved side edge 6c. In an alternative of this modified design of the side skirt member 5a, one or both of its supporting legs are modified so that one or both by themselves, i.e. without the use of an adapter element, are curved so as to follow the curved side edge 6c of the pane 6.

[0138] Fig. 11 shows an alternative embodiment of the weather shield 3 of Figs 1 to 8. 200 has been added to the reference signs of the embodiment of the weather shield shown in Fig. 11, which is thus denoted 203 and comprises a weather shield skirt 205. The skirt 205 in this embodiment is a unitary structure of side skirt members 205a to 205d, which are integrally reaction injection moulded (RIM) from a plastics material, specifically PUR (polyurethane), around the pane 6 so as to fit very precisely with the edges of the pane 6. The weather shield pane 6 of this embodiment is identical to the previous embodiments.

[0139] Figs 12 and 13 show a slightly modified embodiment of the weather shield 205 of Fig. 11. Another 100 has been added to the reference signs of this embodiment of the weather shield, which is thus denoted 303 and comprises a weather shield skirt 305. Only differences compared to the embodiment of Fig. 11 will be de-

scribed in the following. The skirt 305 is premoulded, i.e. moulded before insertion or mounting of the pane 6 along the arrows of Fig. 12. As is seen in Fig. 13, the side skirt member 305b comprises a supporting leg 312, which is similar to the supporting leg 12 in Figs 5a to 7, but positioned at a distance from a top edge 317 of a base portion 310. By moulding the skirt 305, it is a simple matter to allow the supporting leg 312 to curve along the curved bottom surface 7 and the curved edge 6c of the pane 6. Thus, no bending of the side skirt member 305b and no adapter element are necessary here. The opposing side skirt member 305a has a mirrored structure of the side skirt member 305b. Similar to in the previous embodiments, the side skirt members 305c and 305d comprise straight supporting legs, each corresponding to the curved supporting leg 312.

[0140] The embodiment of Fig. 11 may comprise supporting legs similar to the supporting legs of the embodiment of Figs 12 and 13. The side skirt members of Figs 11 to 13 may generally comprise elements similar to in any one of the previous embodiments, including a second supporting leg and a gutter recess that may have identical functions.

[0141] A height, i.e. in an up-down direction of Fig. 1 or 3, of any one of the side skirt members described above may generally be 50 to 200 mm, preferably 60 to 150 mm, more preferred 80 to 100 mm.

[0142] A person skilled in the art will appreciate that the above-described detailed embodiments may be combined to form other embodiments falling within the scope of the present invention.

Claims

1. A flat-roof skylight window for being positioned substantially horizontally in a flat roof, the skylight window comprising
a window portion with an optional window sash, a window frame and an insulating windowpane mounted in the window sash or window frame, and
a weather shield, which is mounted on the window portion for covering and weather protecting the window portion in a mounted state of the skylight window,
wherein the weather shield comprises a weather shield pane, which is curved outwardly in relation to the window portion,
the weather shield pane comprising two opposed substantially straight peripheral edges and two opposed curved peripheral edges,
the weather shield pane further comprising a curved bottom surface facing the window portion and having four bottom corners positioned in an imaginary bottom plane P1,
an apex line or peak line X extending between said two curved edges where the bottom surface of the weather shield pane has a largest distance to the

- bottom plane P1,
a connecting line L1 connecting two of said bottom corners, the connecting line L1 extending substantially in parallel to the apex line X,
the apex line X and the connecting line L1 being positioned in an imaginary inclination plane P2,
wherein an angle α between the bottom plane P1 and the inclination plane P2 is between 1 and 10 degrees.
2. A flat-roof skylight window according to claim 1, wherein the weather shield pane is shaped substantially as a cylinder shell segment curving
 3. A skylight window according to any one of the previous claims, wherein said weather shield pane is made of glass, preferably hardened glass.
 4. A skylight window according to any one of the previous claims, wherein the weather shield pane is coated on a top surface with a coating which enhances the dewatering properties of the top surface by lowering the surface tension properties, lowering the surface roughness or effecting similar properties of the top surface.
 5. A skylight window according to any one of the previous claims, wherein a length and width of an imaginary rectangle defined by the four bottom corners of the weather shield pane are larger than a corresponding length and width, respectively, of the window frame.
 6. A weather shield for being mounted on a window portion for forming a flat-roof skylight window according to any one of the previous claims, the weather shield comprising
a weather shield pane comprising two opposed substantially straight peripheral edges and two opposed curved peripheral edges, and
a weather shield skirt supporting the weather shield pane and comprising two opposed first side skirt members, each of the first side skirt members supporting one of said curved edges, wherein each of the first side skirt members comprise a base portion, said base portions extending substantially in parallel with each other, each said base portion extending substantially along a full length of a respective one of said two curved edges,
at least one of said first side skirt members further comprising a first supporting leg, the first supporting leg extending in an inward direction from and at an angle to an inner surface of the respective base portion of said one of the first side skirt members, said inner surface facing the other of said first side skirt members, one of said curved edges of the weather shield pane resting on a supporting surface of said first supporting leg,
wherein said supporting surface extends along said one of the curved edges in a curve substantially corresponding to a curve along which said curved edge extends.
 7. A weather shield according to claim 6, wherein the supporting surface of the first supporting leg extends over at least half of a full length of said curved edge.
 8. A weather shield according to claim 6 or 7, wherein said first supporting leg comprises a lower portion and an adapter element, the adapter element comprising the supporting surface, wherein said adapter element is arranged between said lower portion and said curved edge of the weather shield pane.
 9. A weather shield according to any one of claims 6 - 8, wherein the first supporting leg comprises a bent portion, which is bent inwardly from the material of the base portion of the side skirt member.
 10. A weather shield according to claim 9, wherein a gutter recess is provided in the first supporting leg such as to act as a gutter for water potentially entering through a gap between the weather shield pane and the first side skirt member.
 11. A weather shield according to any one of claims 6 - 9, wherein the side skirt member comprises a second supporting leg, the second supporting leg extending inwardly from an inner surface of said base portion, a sealing element being positioned to seal a gap between the weather shield pane and the base portion of the first side skirt member, the second supporting leg supporting the elastic sealing element.
 12. A weather shield according to claim 6, 7, 8, 10 or 11, wherein said weather shield skirt is cast or moulded.
 13. A weather shield according to any one of claims 6 - 12, wherein a top end of the base portion of the first side skirt member is shaped with a curvature so as to at least along a part of the top end follow a curvature of that curved edge of the weather shield pane which is supported by the first side skirt member.
 14. A weather shield according to any one of claim 6 - 13, wherein the weather shield is mounted on a window portion so as to form a flat-roof skylight window and so that in a mounted state of the skylight window the weather shield covers and weather protects the window portion.
 15. A flat-roof skylight window according to any one of claims 1 - 5, wherein the weather shield is according to any one of claims 6 - 14.

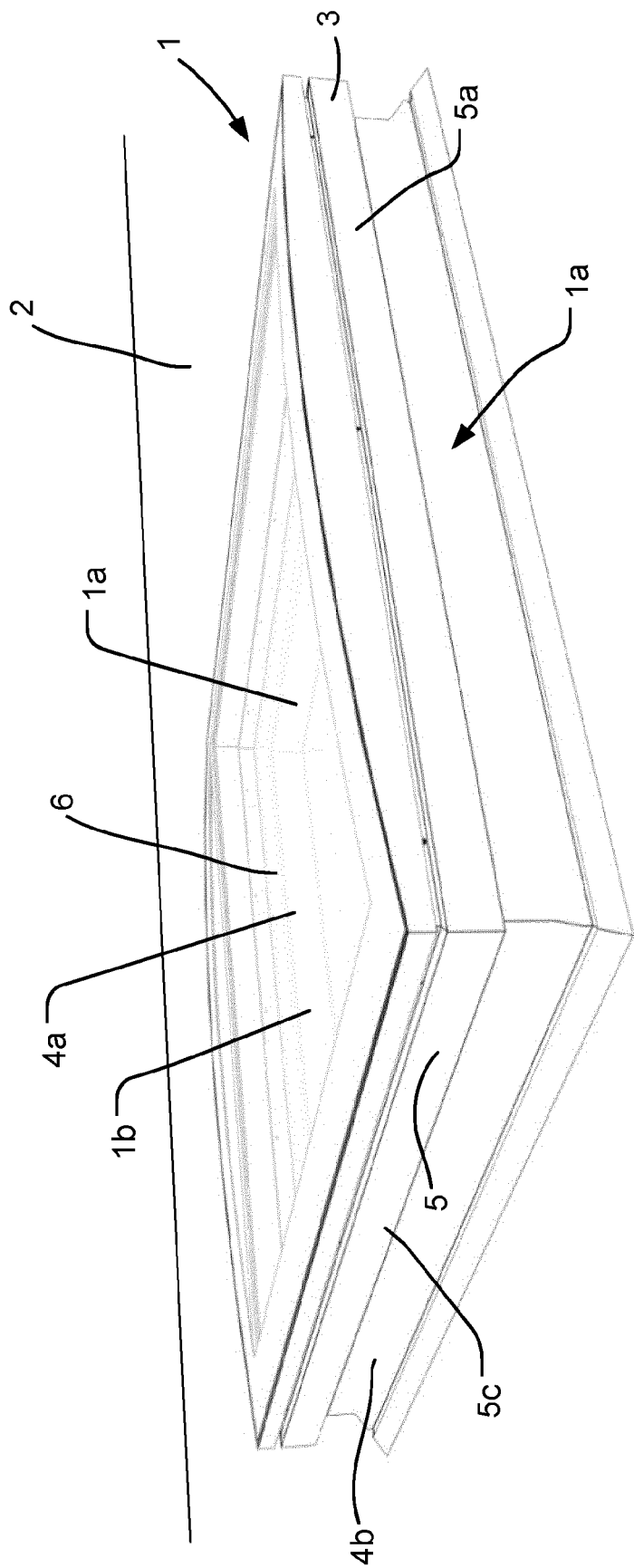
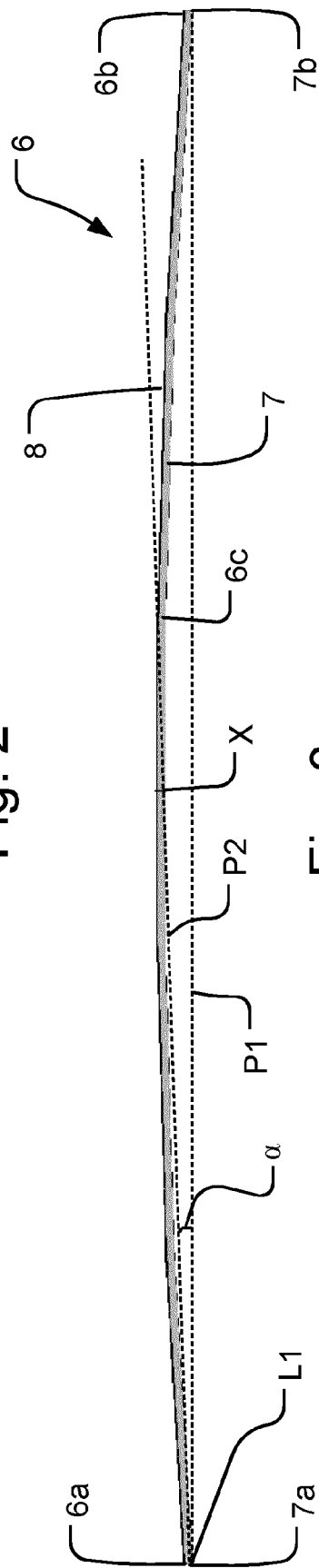
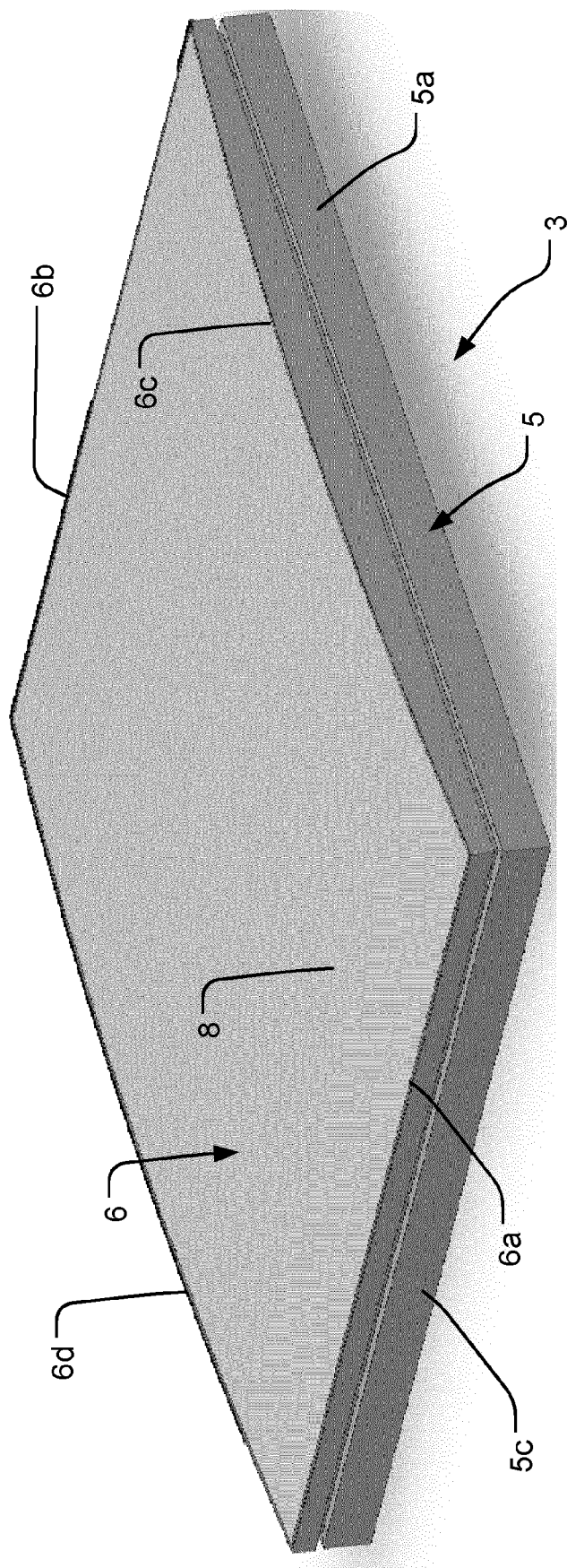


Fig. 1



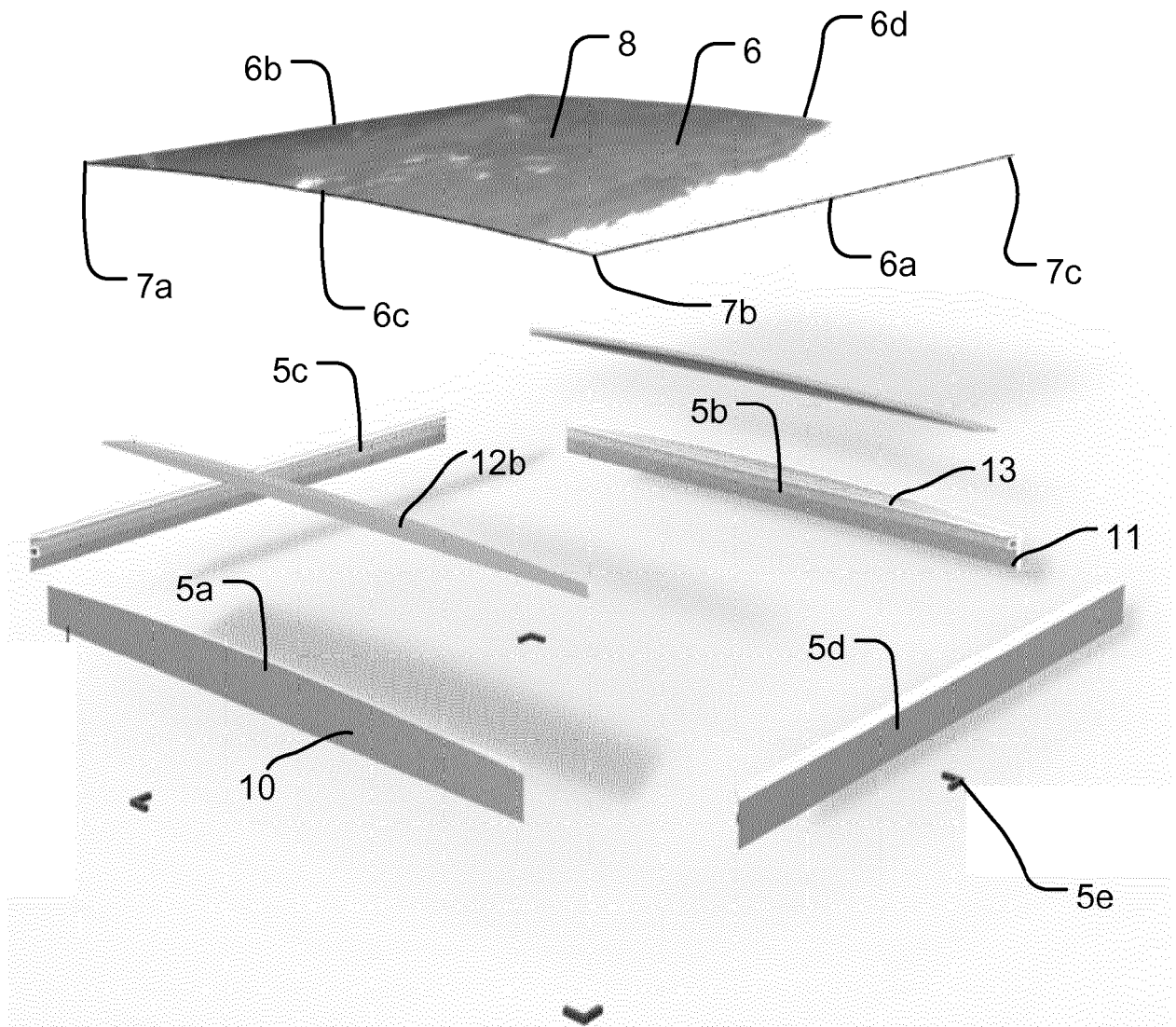


Fig. 4

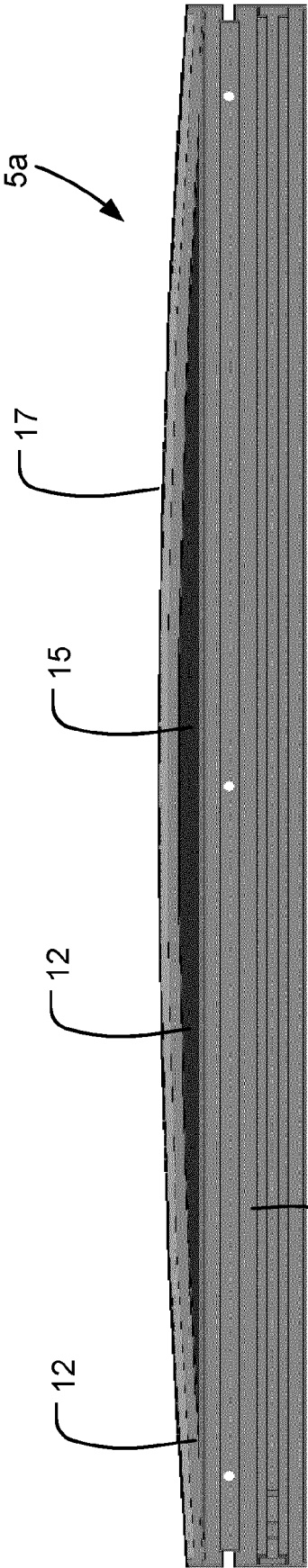


Fig. 5a

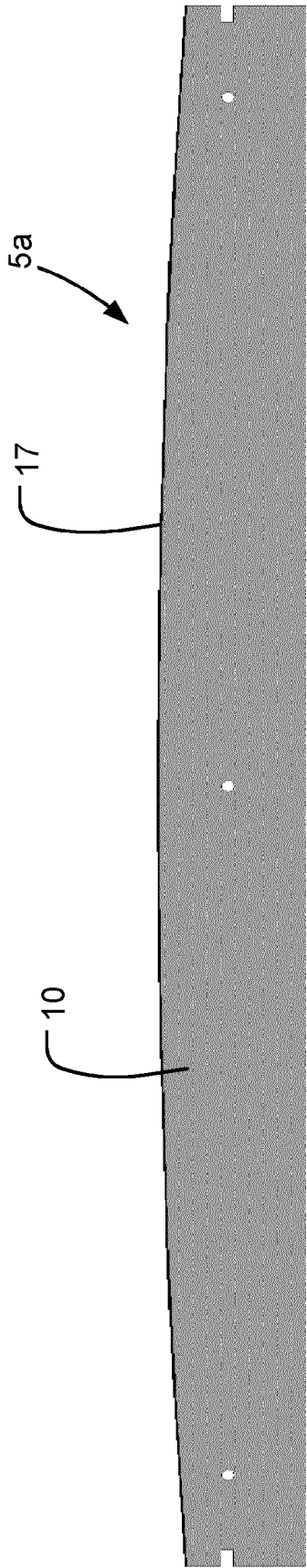


Fig. 5b

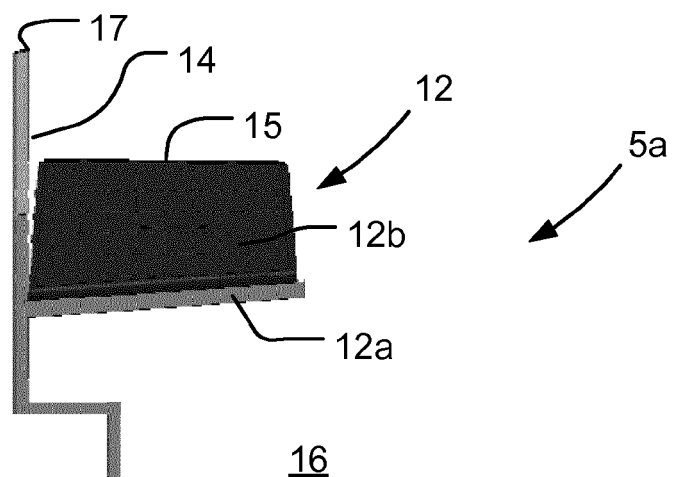


Fig. 6

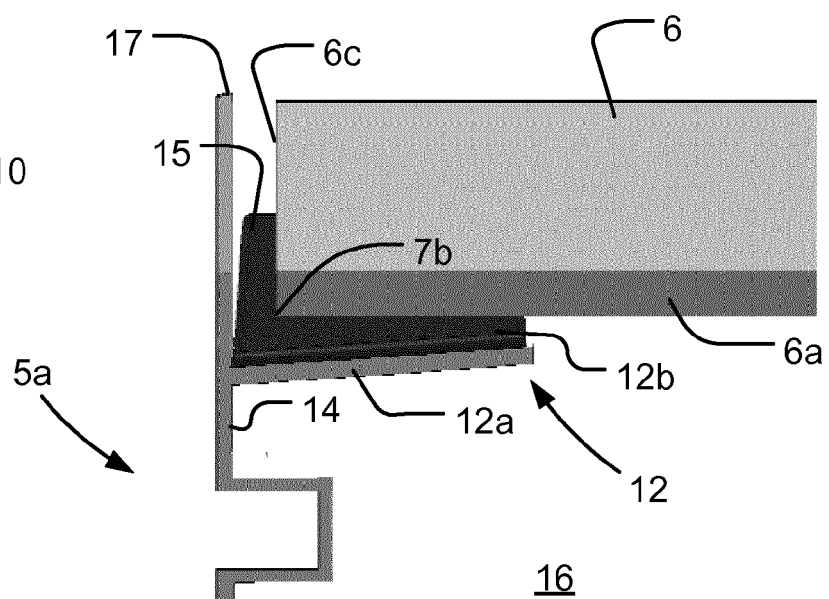


Fig. 7

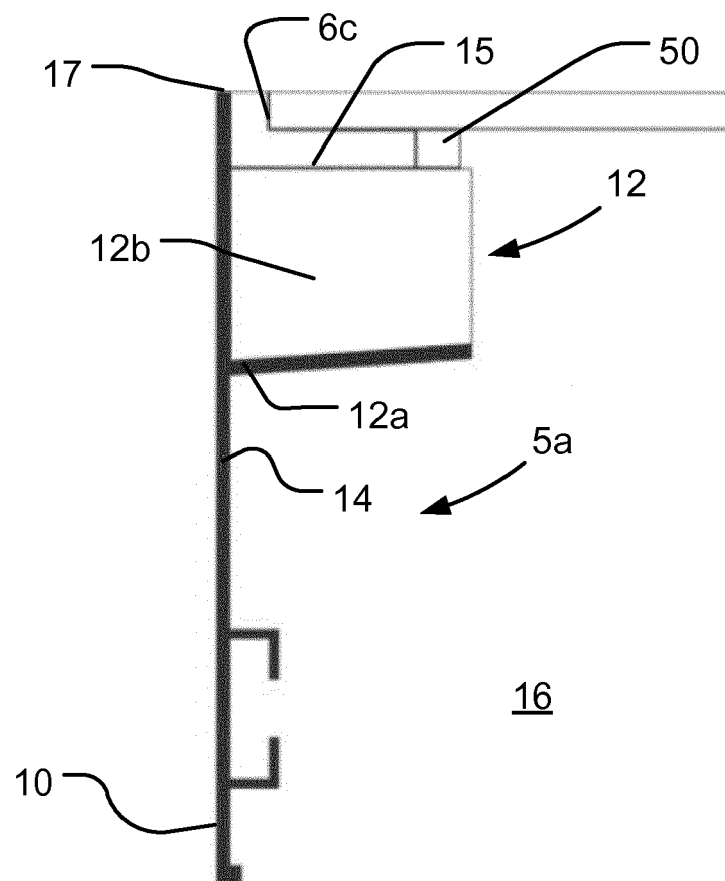
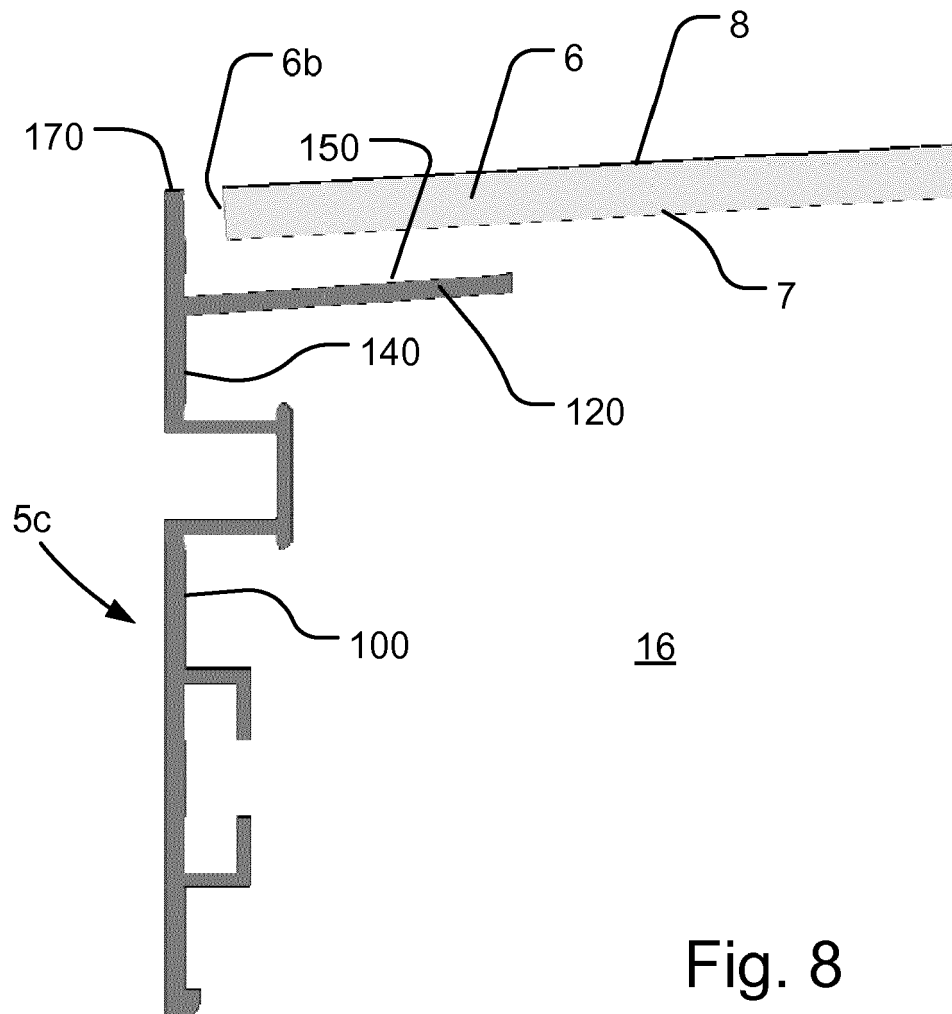


Fig. 6a



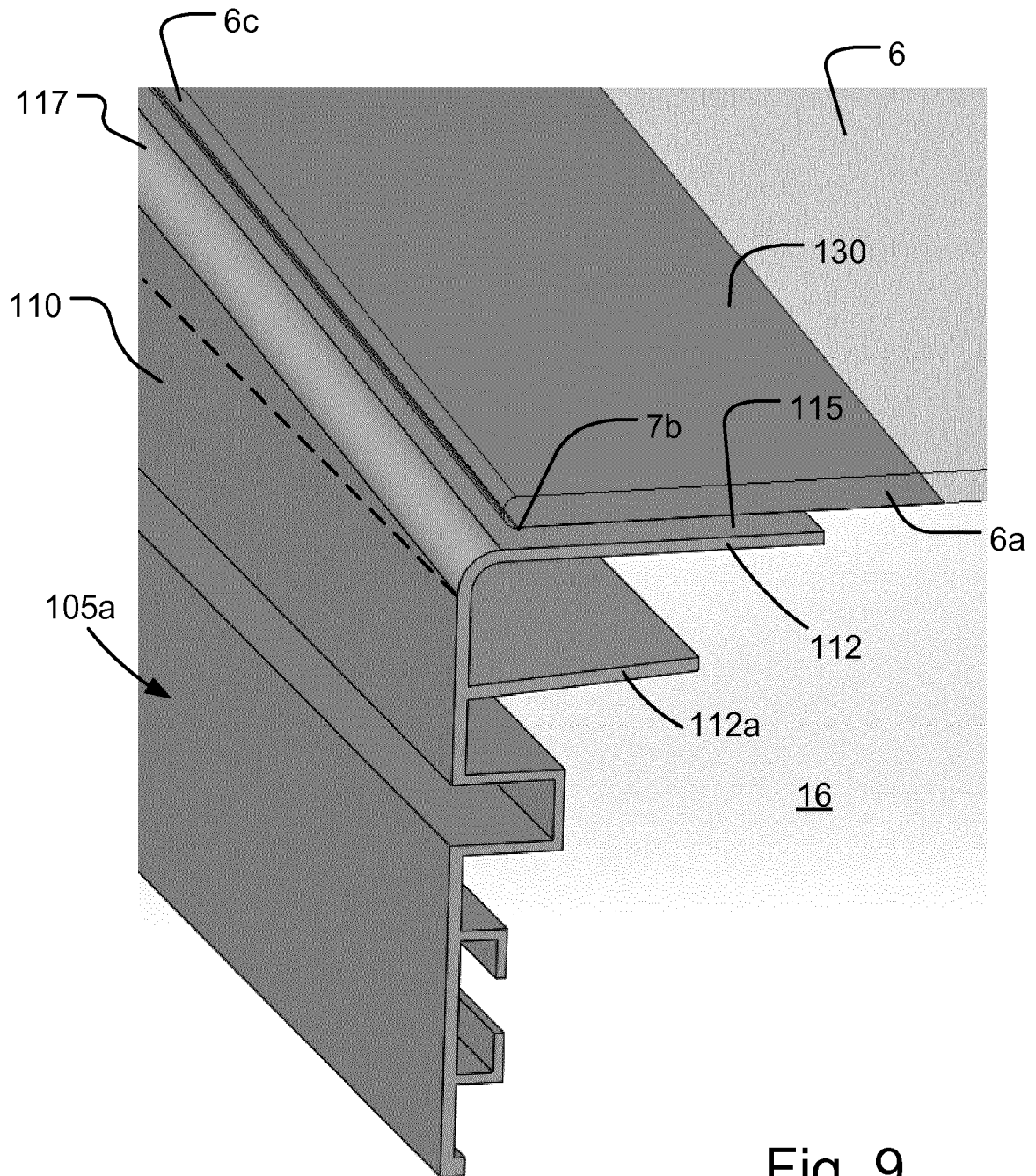


Fig. 9

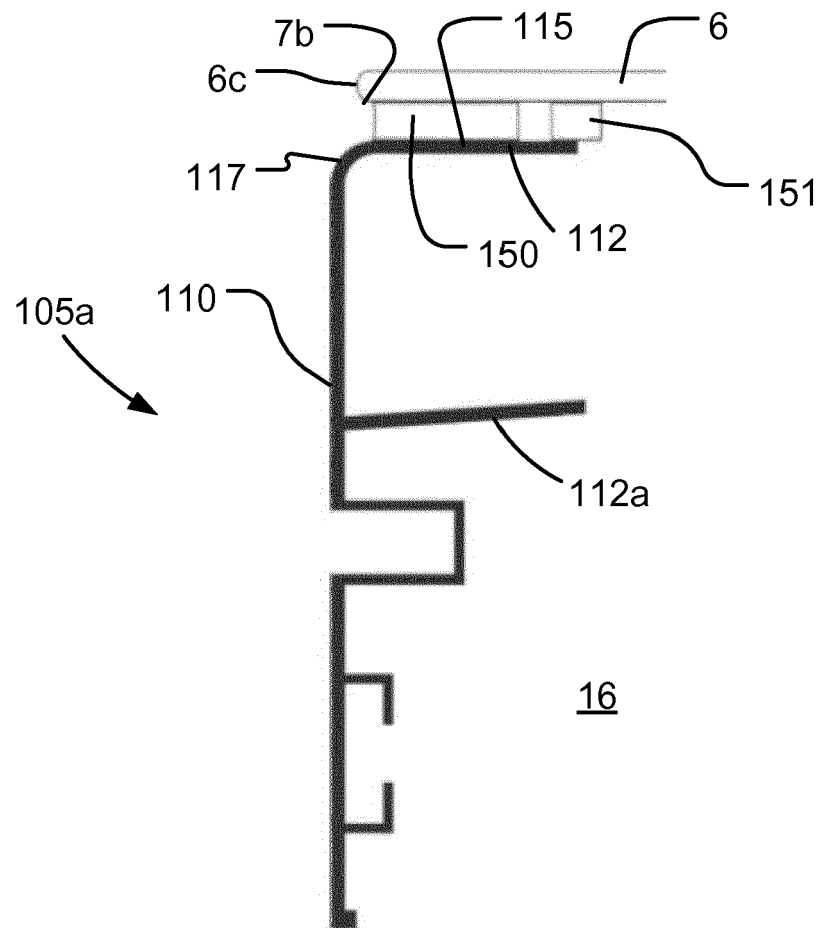


Fig. 9a

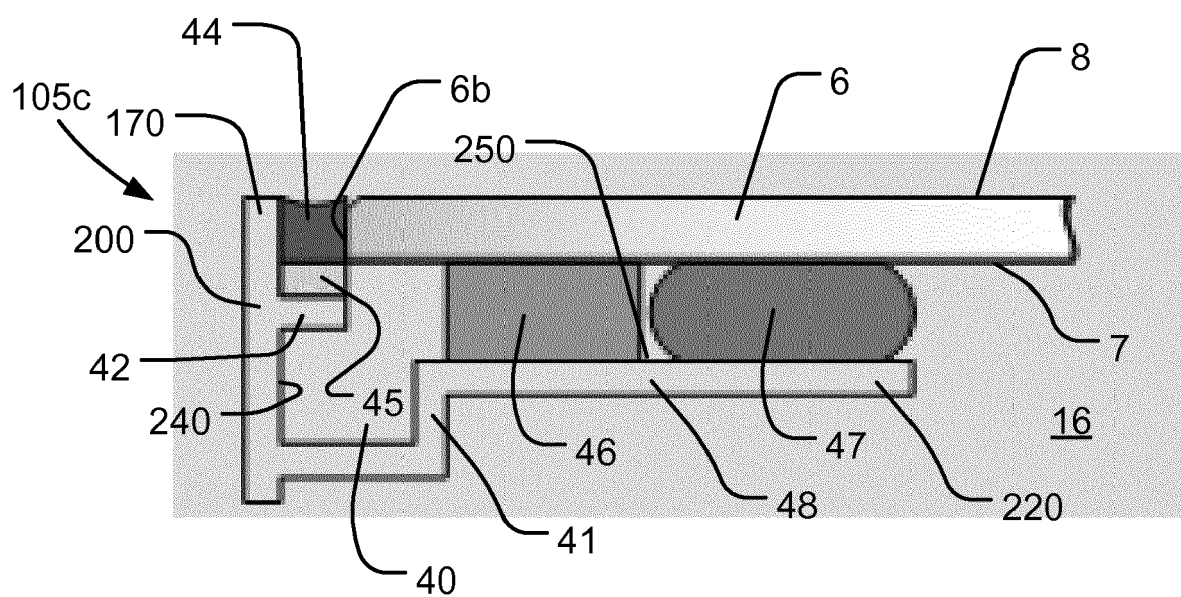


Fig. 10a

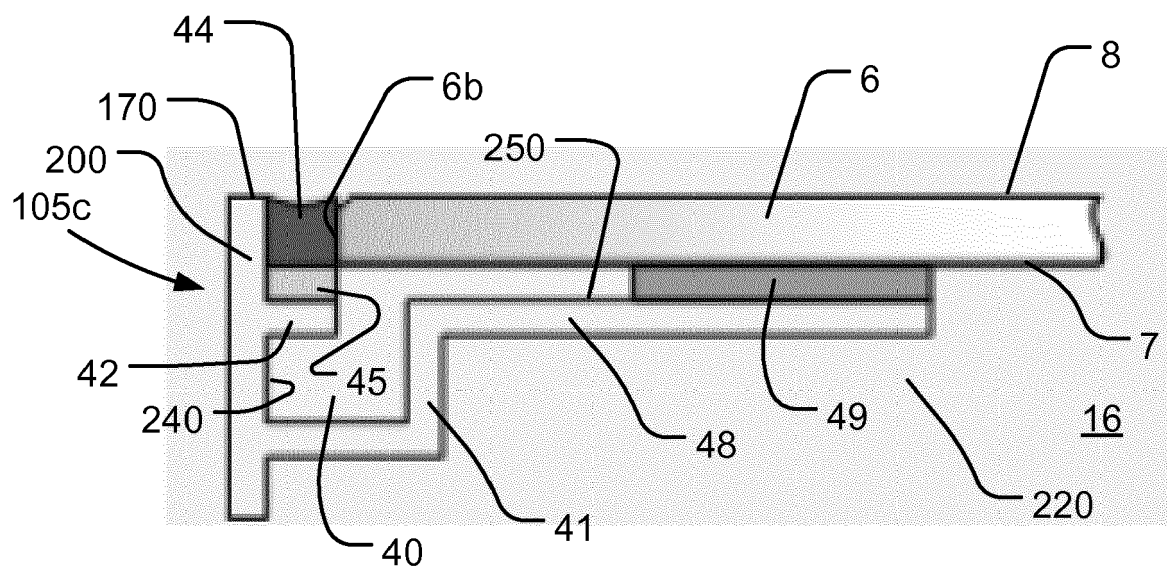


Fig. 10b

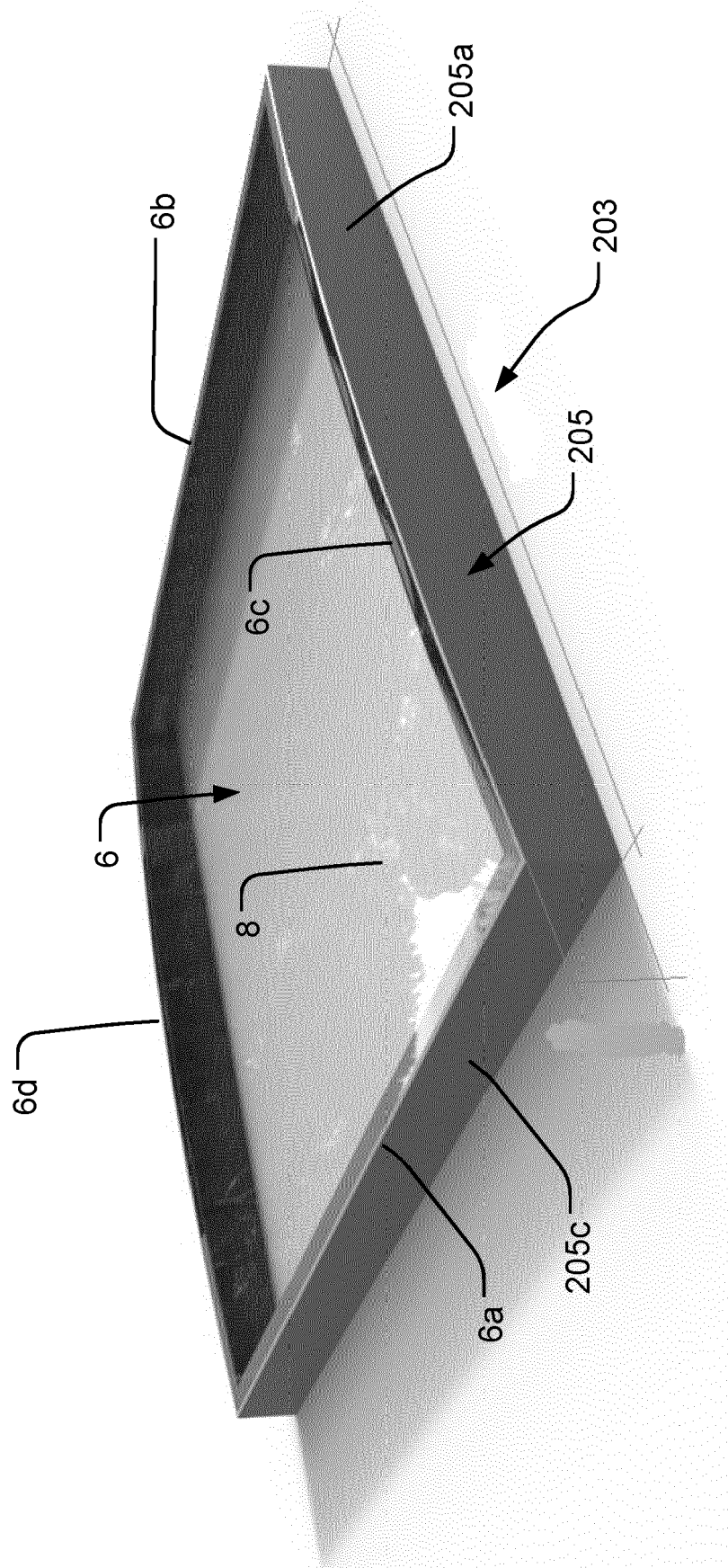
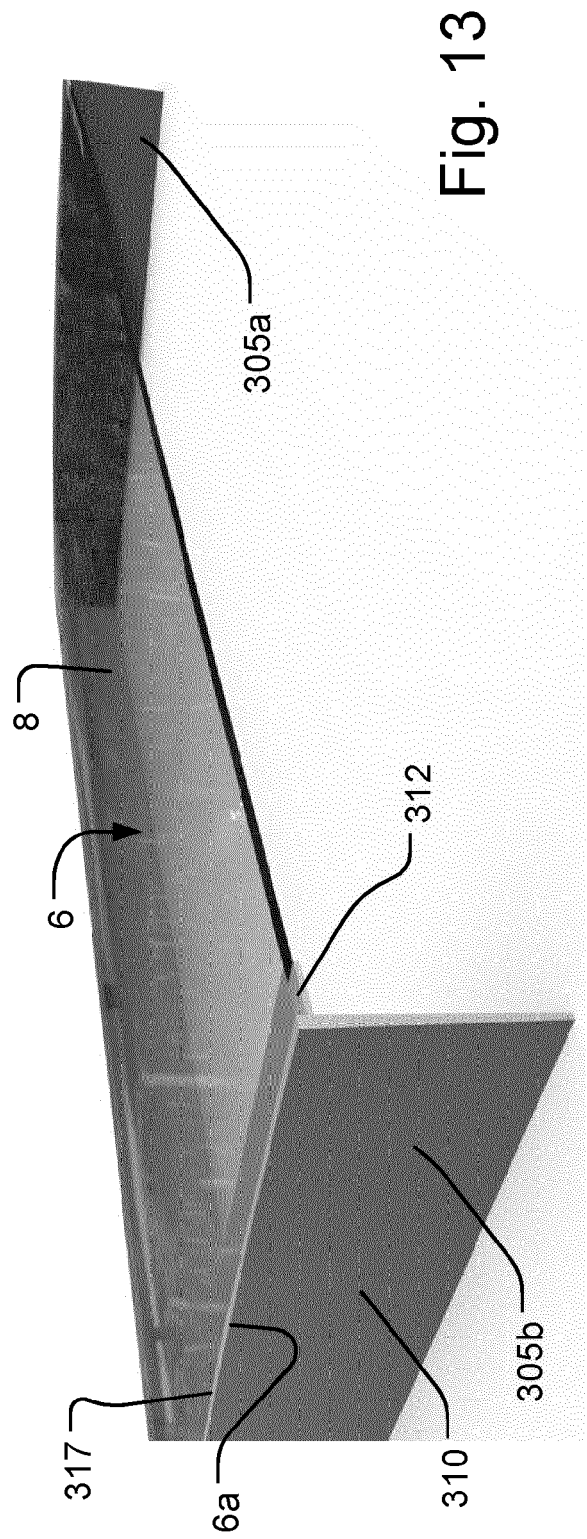
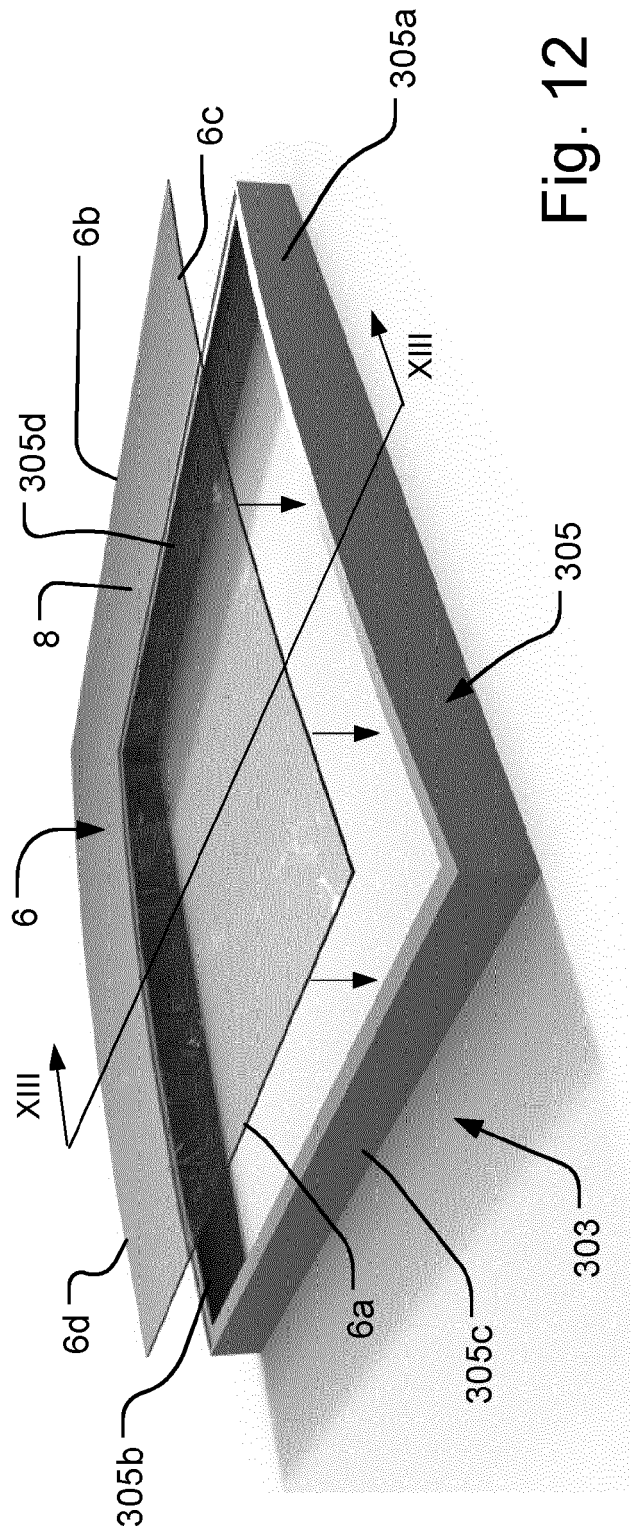


Fig. 11





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Place of search The Hague		Date of completion of the search 5 July 2016	Examiner Bauer, Josef
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