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(54) **A SKYLIGHT WINDOW**

(57) A skylight window (1) for being installed in or on a roof (2) of a building is disclosed. It comprises a window frame (7) having four frame side members (10), where at least some of said frame side members comprise a groove (50) configured to receive an edge of a lining panel. An Insulating Glazing Unit (IGU) (5) is supported on the window frame, and a weather shield pane (3) is arranged to protect the window frame (7) and the IGU (5). An exposed frame surface (77) of the frame side member extends between the groove (50) and the IGU (5), said exposed frame surface having a first edge (771) at the groove and a second edge (773) at an interior side of the IGU, where an overall width between the first edge and the second edge measured perpendicular to the longitudinal direction of 40 mm or less.

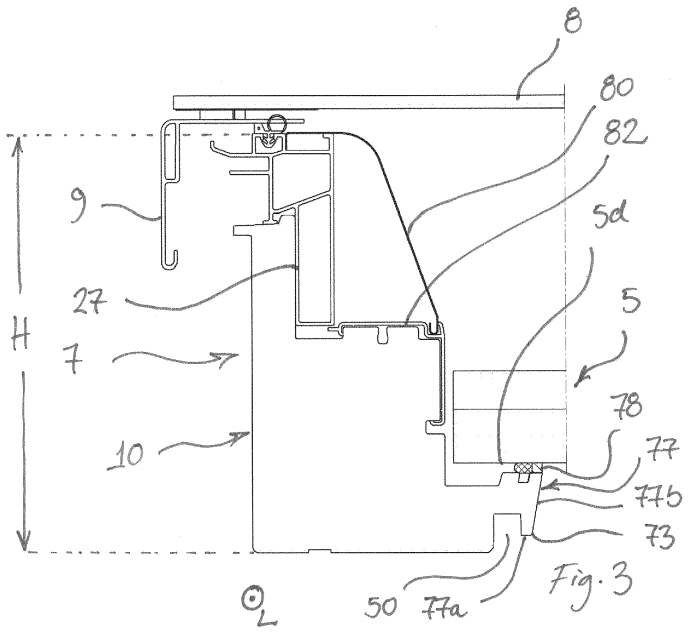

Fig. 3

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Description

Technical Field

[0001] The present invention relates to a skylight window for being installed in or on a roof of a building, wherein the skylight window comprises:

a window frame having four frame side members delimiting a frame opening and defining a frame plane, and where at least some of said frame side members comprise a groove configured to receive an edge of a lining panel and extending in a longitudinal direction of the respective frame side member, an Insulating Glazing Unit (IGU) supported on the window frame and covering the frame opening with an exposed interior surface of the IGU extending between the frame side members, said IGU comprising at least two translucent layers with a sealed space between them, where an inert gas, such as argon or krypton, or a vacuum is present in the space(s) between the translucent layers, and

a weather shield pane configured to protect a window portion of the skylight window, said window portion comprising the window frame and the IGU, and said weather shield pane being located at a distance from an exterior side of the IGU so that a space is present between them,

where the window frame has an overall height in a height direction perpendicular to the frame plane, and where each frame side member has a longitudinal direction extending along a peripheral side of the IGU.

Background Art

[0002] The use of skylight windows originates from industry buildings, where it was desired to provide more daylight to the interior of the building in a cost-efficient way. Many industry buildings are made with substantially flat roofs and the most cost-efficient way to provide more daylight in such a building was to cut a hole in the roof and cover it with a translucent or transparent material. Over the years proper skylight windows were developed with a particular view to improving the water tightness by improving the exterior integration of skylight windows with the roofing covering of the roof structure and improving thermal insulation of the skylight window has also been a focus area. Interior integration with ceilings etc. has, however, not been given much attention, and it is also desired to increase the amount of daylight reaching the interior of the building relative to the pane area.

Summary of Invention

[0003] With this background, it is therefore an object of the invention to provide to provide an alternative skylight window according to the introduction which with improved interior properties.

[0004] This and further objects are achieved with a roof window of the kind mentioned in the introduction, which is furthermore characterised in that an exposed frame surface of the frame side member extends between the groove and the IGU, said exposed frame surface having a first edge extending in the longitudinal direction along the groove and a second edge extending in the longitudinal direction along an interior side of the IGU, and that the exposed frame surface has an overall width between the first edge and the second edge measured perpendicular to the longitudinal direction of 40 mm or less.

[0005] By providing an exposed frame surface, which is 40 mm or less, the IGU comes very close to the lining panel, which covers the inwards facing surface created in the roof structure when making the opening in the roof. This has several advantages. Firstly, that the distance travelled by the daylight after passing through the IGU is low, potentially leading to an increased amount of light reaching the room below the skylight window. Secondly, that the majority of the window frame can be made from materials, which are not suitable for being exposed towards the interior of the building, for example because they are not resistant to UV radiation or not easily cleaned. Thirdly, that the skylight window itself appears less bulky when seen from the inside. Fourthly, that a possible difference between colour or texture of the exposed frame surface and of the lining panel will not be easily seen.

[0006] The overall width is to be understood as the total distance between the first edge and the second edge measured along the exposed surface. As the exposed surface may be composed of two or more sections extending in continuation of each other, the width is not necessary measured along a straight line but may be the total of the widths of the two or more sections. Minor irregularities, such as holes for the reception of screws, pins, or like fasteners, are, however, not to be considered when determining the overall width.

[0007] In one embodiment, the exposed frame surface has an overall width in the interval of 3-38 mm, specifically in the interval of 12-36 mm, and more specifically in the interval of 18-24 mm.

[0008] It is presently preferred, that the exposed frame surface has an overall width between the first edge and the second edge measured perpendicular to the longitudinal direction being 30% or less of the overall frame height (H), such as 20% or less of the overall frame height (H).

[0009] As also mentioned above the exposed frame surface may be curved and/or composed of two or more sections extending in continuation of each other when seen in a cross-section perpendicular to the longitudinal direction of the frame side member. This may allow the distance between the first edges of two frame side members located on opposite sides of the IGU to be larger than the distance between the second edges thereof. This means that the two lining panels attached to these

side frame members will be slightly retracted in relation to the frame opening and that the area between the lining panels in parallel with the frame plane may be larger than the exposed interior surface of the IGU. This may contribute to increasing the amount of daylight reaching the room underneath the skylight window as less light will be blocked by the lining panel and as the exposed frame surface may reflect light into the room. Similar advantages may be achieved by the exposed frame surface being inclined with respect to the height direction so that the second edge is located at a distance from the first edge in a direction parallel to the frame plane. It is presently preferred that this distance is 15mm or less to achieve an optimal transition between the exposed frame surface and the lining panel.

[0010] The exposed frame surface may be provided with light reflecting coating.

[0011] In one embodiment, each frame side member comprises a first leg projecting in the height direction along an edge of the IGU and a second leg projecting substantially in parallel with the frame plane along an interior side of the IGU. This allows the IGU to be located deep in the window frame, the second legs serving only to support the IGU, while other features of the window frame can be associated with the first legs of the frame side members. As described above, a deep location of the IGU has advantages with respect to light admission but may also contribute to improved thermal insulating properties of the skylight window.

[0012] The embodiment with a first leg and a second leg may result in each frame side member having a cross-sectional shape resembling the letter L in a plane extending perpendicular to the longitudinal direction. It is, however, also possible to provide each frame member with a third leg projecting opposite the second leg, i.e. away from the frame opening. Such a third leg may contribute to the stability of the window frame in the mounted state and/or be used for the attachment of a roofing material to the window frame. A third leg to which a roofing material is connected is also known as a curb flange and usually has a triangular cross-sectional shape in a plane perpendicular to the longitudinal direction.

[0013] In one embodiment, the IGU extends beyond the groove in a direction parallel to the frame plane, so that the groove is located underneath an interior side of the IGU when seen in the height direction. This provides good thermal insulating properties as the IGU will usually provide better insulation than most common frame materials. Another potential advantage is that the edge of the IGU will be hidden from view from inside the building, which may not only be advantageous from an aesthetic point of view. It may also allow an increased inflow of light, since the distance keepers, sealings, and protective maskings usually found at the edges of an IGU will be located above the frame side members, not on the exposed interior surface of the IGU.

[0014] The IGU may be connected to the window frame by an adhesive bond, such as an adhesive applied directly onto the window frame and/or the IGU or adhesive tape applied to one or both surfaces to be joined. It is also possible to use a glue or to locally soften the material of the window frame so that it may adhere to the surface of the IGU. Adhesion promoters may be applied to the window frame and/or the IGU, one example being the application of a masking on the IGU, another being a roughening of the surface of the frame side member to which the IGU is to be attached. The adhesive or glue bond may be supplemented with a mechanical retainment of the IGU. The adhesive bond provides better mechanical rigidity of the window by allowing a uniform transmission of loads from the IGU to the window frame, whereby the IGU will hinder deformation of the window frame. The adhesive bond also ensures a durable air tightness of the window by providing a continuous airtight connection along the periphery of the IGU. Furthermore, the adhesive bond enhances the burglary resistance as it will not be immediately possible for a burglar to detach the IGU from the window frame.

[0015] The frame side member may in principle be made from any suitable material, but in one embodiment at least one of them comprises an extruded profile with hollow chambers, preferably made from polyvinylchloride (PVC), or a pultruded profile, made for example from polyurethane (PUR) reinforced with glass fibres. Insulating members, made for example from expanded polystyrene (EPS) or mineral wool may be arranged in the hollow chambers or recesses in the frame side members.

[0016] The weather shield pane may be curved, forming a dome above the IGU and the window frame, protecting them from precipitation, dirt, etc., but it is also possible to use a planar weather shield pane. It may be of glass or clear polymer and may comprise only a single layer.

[0017] In one embodiment the height of the space between the weather shield pane and the IGU is bigger than the height of the IGU measured in the height direction, and the space is filled with ambient air. It is, however, also possible to have a shorter distance between the weather shield pane and the IGU and/or to provide an inert gas, such as argon, an aerogel, or a vacuum in the space between them.

[0018] The weather shield pane may be provided as a unitary structure, which is detachably attached to the window frame. This may have the effect of providing for easy access to clean the IGU and/or be of advantage during installation of the skylight window, e.g. when positioning or attaching the window frame or when attaching roofing felt to cover a joint between the window frame and the roof structure. Mechanical fasteners or fittings are preferably used for fastening a weather shield pane to the window frame in a detachable manner.

[0019] In some embodiments, the skylight window further comprises a weather shield skirt extending along an edge of the weather shield pane. The weather shield skirt preferably extends toward the interior down to or past a most exterior surface of the frame side member. The

weather shield skirt preferably extends along all sides of weather shield pane, i.e. surrounding the window frame on an outward side of all four sides of the window frame.

[0020] The weather shield skirt may comprise an L-shaped profile, wherein one leg of the L-shape is attached to the exterior or interior side of the weather shield pane and the other extends down along an outer surface of the frame side member.

[0021] Weather shield skirt may be manufactured from or include metal and/or may be attached to the weather shield pane by means of an adhesive.

[0022] The translucent layers of the IGU may be of glass or a polymer, such as polycarbonate, and for most purposes they are preferably transparent. One or more of the layers may be laminated and/or tempered.

Brief Description of Drawings

[0023] In the following description embodiments of the invention will be described with reference to the schematic drawings, in which

Fig. 1 shows a perspective view of a skylight window,
Fig. 2 shows a cross-sectional view along the line II-II in Fig. 1,
Fig. 3 shows a cross-sectional view of a skylight window according to a first embodiment of the invention,
Fig. 4 shows the cross-sectional view in Fig. 3 with more details,
Fig. 5 shows a cross-sectional view of a skylight window according to a second embodiment of the invention,
Fig. 6 shows a cross-sectional view of a skylight window according to a third embodiment of the invention, and
Fig. 7 shows a cross-sectional view of a skylight window according to a fourth embodiment of the invention.

Description of Embodiments

[0024] Referring initially to Figs 1 and 2, a prior art skylight window 1 is shown installed on a flat roof 2 of a building and covering an opening (not shown) in the roof. The skylight window 1 comprises a weather shield 3 protecting a window portion 4, which includes an Insulating Glazing Unit (IGU) 5 and a frame 7 supporting the IGU. A roofing felt (not shown) may in a conventional manner be positioned to seal the joint between the window frame 7 and the roof 2. In this embodiment an inclined curb flange 40 is provided on the window frame 7 for this purpose.

[0025] The weather shield 3 is attached to the window frame 7 so as to protect the window portion 4 of the skylight window 1. The weather shield 3 comprises a transparent weather shield pane 8 and a weather shield skirt 9, which projects down towards the roof 2 along outer sides of the window frame 7 on all four sides of the window frame 7. In this embodiment the weather shield pane 8 is flat, but it may also be slightly curved.

[0026] In Fig. 1, the entire window frame 7 is positioned above the exterior surface of the roof 2, said frame resting on the roof surface, but it may also be positioned so that a part of the window frame 7 is embedded in the roof, i.e. positioned below the exterior roof surface level.

[0027] The space between the IGU 5 and the weather shield pane 8 may be sealed and filled with an inert gas to provide the skylight window with desired thermal insulating properties, but in the embodiments shown in the drawing the space is ventilated.

[0028] As is seen in Fig. 2 the frame side member 10 of the window frame 7 of the prior art skylight window comprises a hollow-box structure, which can for example be made from polyvinylchloride (PVC) by extrusion, and blocks of insulating material 81 are inserted in some of the hollow boxes.

[0029] The weather shield pane 8 is attached to an exterior side 10t of the frame side member 10 and the IGU 5 is supported by a leg 72 of the window frame extending in an inwards direction. A sealing gasket 76 is arranged between the frame leg 72 and the interior major surface 5d of the IGU 5.

[0030] On the interior surface 10a of the frame side member 10 a groove 50 is provided for receiving a lining panel (not shown). As is well known to the skilled person, lining panels are used for covering the inwards facing surface of the opening in the roof structure, i.e. the surface extending between a ceiling on the interior side of the building and the skylight window, and will therefore not be described in further detail here.

[0031] When a lining panel is mounted in the lining panel reception groove 50 only the surface 77 of the frame side member 10 extending from the groove to the the interior major surface 5d of the IGU will be visible from the interior of the building on which the skylight window 1 is mounted. This surface 77 is referred to as the exposed frame surface 77 and is delimited by a first edge 771 extending along the groove 50 and a second edge 772 extending along the interior side of the IGU 5.

[0032] Turning now to Fig. 3, a cross-sectional view corresponding to Fig. 2 but showing a window according to the invention is shown. In this figure as well as in Fig. 2 and Figs 5-7 the frame member etc. extending perpendicularly to the one shown, i.e. in the background in a true cross-section, have been removed for clarity reasons.

[0033] Throughout this description, the same reference numbers will be used for features having substantially the same function, even if they are not identical, and only differences between the different embodiments will be described in detail.

[0034] In comparison to the prior art window in Fig. 2, the IGU 5 of the window in Fig. 3 is positioned considerably deeper in the window frame 7 and the width of the exposed frame surface 77, i.e. the distance between the lining panel reception groove 50 and the interior major

surface 5d of the IGU is considerably smaller. The IGU is attached to the window frame 7 by a strip of adhesive material 78 replacing the sealing gasket 76 in the prior art window.

[0035] In this embodiment the exposed frame surface 77 is composed of first section 77a adjacent to the groove 50 and a second section 77b adjacent to the IGU 5 meeting at an edge 73 and extending in continuation of each other, but it could have been straight or following a continuous curve.

[0036] The total width, also called the overall width, of the exposed frame surface 77 measured perpendicular to the longitudinal direction L of the frame side member 10, i.e. in plane with the paper in Fig. 3, is 36 mm, said first section 77a measuring 5 mm and said second section 77b measuring 31 mm. This corresponds to about 20% of the overall height H of the window frame 7.

[0037] The deep position of the IGU compared to the prior art window in Fig. 2 provides improved thermal insulating properties and makes room for a screening device, such as a roller blind (not shown), to be mounted in the protected spacing between the weather shield pane 8 and the IGU 5.

[0038] With the exposed frame surface 77 being comparatively short, most of the window frame 7 is hidden from view, which not only has aesthetic advantages, but also gives design freedom as described above. As is seen in Fig. 4, showing a more detailed view of a window as in Fig. 3, this may allow the load bearing frame side member 20 to be designed as a fairly slim L-shaped profile, where a block of insulating material 81 is arranged between the vertical leg 25 of the frame side member 10 and the IGU 5, but the space occupied by the block of insulating material 81 could also be occupied by other things, such as a screening device, a motor for driving a screening device, or a ventilation unit.

[0039] In this embodiment the weather shield pane 8 is supported by a hollow frame extension profile 27 attached to the vertical leg 25 of the frame side member 10, but it could also have been supported directly on the load bearing frame side member 20.

[0040] Cover members 80, 82 cover the frame extension profile 27 and the block of insulating material 81, respectively, protecting them from view and from UV radiation.

[0041] Whereas the weather shield skirt 9 is shown as attached to the exterior side of the weather shield pane 8 in Fig. 2, it is here attached to the interior side of the weather shield.

[0042] Fig. 5 shows a second embodiment of the invention, where the overall shape of the window frame 7 is the same as in Fig. 3 and Fig. 4, but where the frame extension profile 27 and the cover member 82 have been replaced by one continuous stepped profile 14. The profile 14 supports the weather shield pane 8 and extends down to the IGU 5, where a leg 79 of the stepped profile 14 extends underneath the outermost edge of IGU. This embodiment allows the skylight window to also be provided in an openable version, where the IGU is attached to the stepped profile 14 instead of to the window frame 7 and where the stepped profile 14 is connected to the window frame 7 by one or more hinges (not shown). Is this way the same components can be used for both fixed and openable skylight windows.

[0043] A further embodiment of the invention is shown in Fig. 6. Here the lining panel reception groove 50 is located higher on the frame side member 10 such that the main part of the window frame 7 is positioned below the IGU 5, but the exposed frame surface 77 remains substantially the same.

[0044] The weather shield pane 8 is here curved and located closer to the IGU 5, and this skylight window too can be made openable by connecting the frame extension profile 27 to the load bearing frame side member 20 using one or more hinges (not shown), such that the frame extension profile 27 can be used as a sash.

[0045] A still further embodiment of the invention is shown in Fig. 7. Whereas the exposed frame surface 77 has been inclined in the embodiments shown in Figs 3-6, it is here composed of a horizontal first section 77a adjacent to the groove 50 and a vertical second section 77b adjacent to the IGU 5.

[0046] Moreover, the weather shield pane 8 is here attached to the IGU 5 rather than to the window frame 7.

Claims

1. A skylight window (1) for being installed in or on a roof (2) of a building, wherein the skylight window (1) comprises:

   a window frame (7) having four frame side members (10) delimiting a frame opening and defining a frame plane, and where at least some of said frame side members comprise a groove (50) configured to receive an edge of a lining panel and extending in a longitudinal direction of the respective frame side member,
   an Insulating Glazing Unit (IGU) (5) supported on the window frame and covering the frame opening, said IGU comprising at least two translucent layers (5c-5e) with a sealed space between them, where an inert gas, such as argon or krypton, or a vacuum is present in the space(s) between the translucent layers, and
   a weather shield pane (3) configured to protect a window portion (4) of the skylight window (1), said window portion (4) comprising the window frame (7) and the IGU (5), and said weather shield pane being located at a distance from an exterior side of the IGU so that a space is present between them,
   where the window frame has an overall height (H) in a height direction perpendicular to the frame plane, and where each frame side mem-

ber has a longitudinal direction extending along a peripheral side (5a) of the IGU,
characterised in that
an exposed frame surface (77) of the frame side member extends between the groove (50) and the IGU (5), said exposed frame surface having a first edge (771) extending in the longitudinal direction along the groove and a second edge (773) extending in the longitudinal direction along an interior side of the IGU, and that the exposed frame surface (77) has an overall width between the first edge and the second edge measured perpendicular to the longitudinal direction of 40 mm or less.

2. A skylight window according to claim 1, wherein the exposed frame surface is curved and/or composed of two or more sections extending in continuation of each other.

3. A skylight window according to claim 1 or 2, wherein the exposed frame surface is inclined with respect to the height direction so that the second edge is located at a distance from the first edge in a direction parallel to the frame plane.

4. A skylight window according to claim 3, wherein the distance between the first edge and the second edge in a direction parallel to the frame plane is 15mm or less.

5. A skylight window according to one or more of the preceding claims, wherein each frame side member comprises a first leg projecting in the height direction along an edge of the IGU and a second leg projecting substantially in parallel with the frame plane along an interior side of the IGU.

6. A skylight window according to 7, where each frame side member comprises a cross-sectional shape resembling the letter L in a plane extending perpendicular to the longitudinal direction.

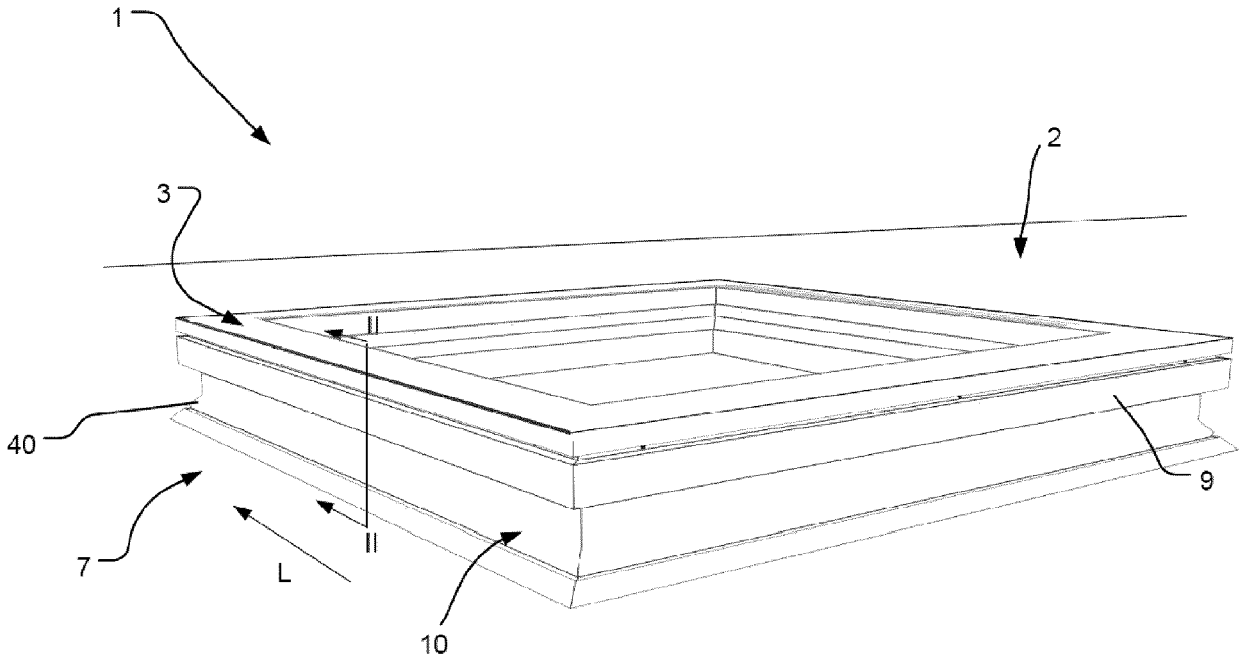
7. A skylight window according to claim 5 or 6, wherein the IGU extends beyond the groove in a direction parallel to the frame plane, so that the groove is located underneath an interior side of the IGU when seen in the height direction.

8. A skylight window according to one or more of the preceding claims, wherein the IGU is connected to the window frame by an adhesive bond.

9. A skylight window according to one or more of the preceding claims, wherein each frame side member comprises an extruded profile with hollow chambers, preferably made from polyvinylchloride (PVC), or a pultruded profile, made for example from polyurethane reinforced with glass fibres.

10. A skylight window according to one or more of the preceding claims, wherein the height of the space between the weather shield pane and the IGU is bigger than the height of the IGU measured in the height direction, and wherein the space is filled with ambient air.

11. A skylight window according to one or more of the preceding claims, wherein the exposed frame surface has an overall width between the first edge and the second edge measured perpendicular to the longitudinal direction being 30% or less of the overall frame height (H), such as 20% or less of the overall frame height (H).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9
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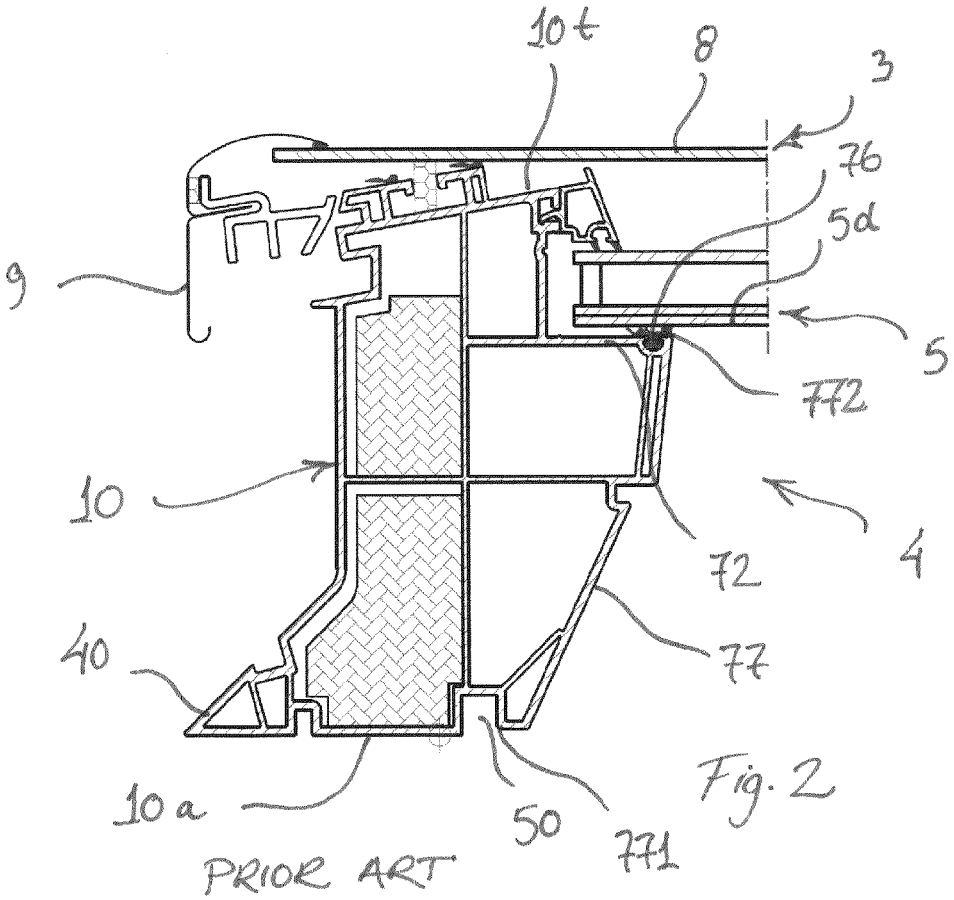
Fig. 1


10t
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PRIOR ART

Fig. 2

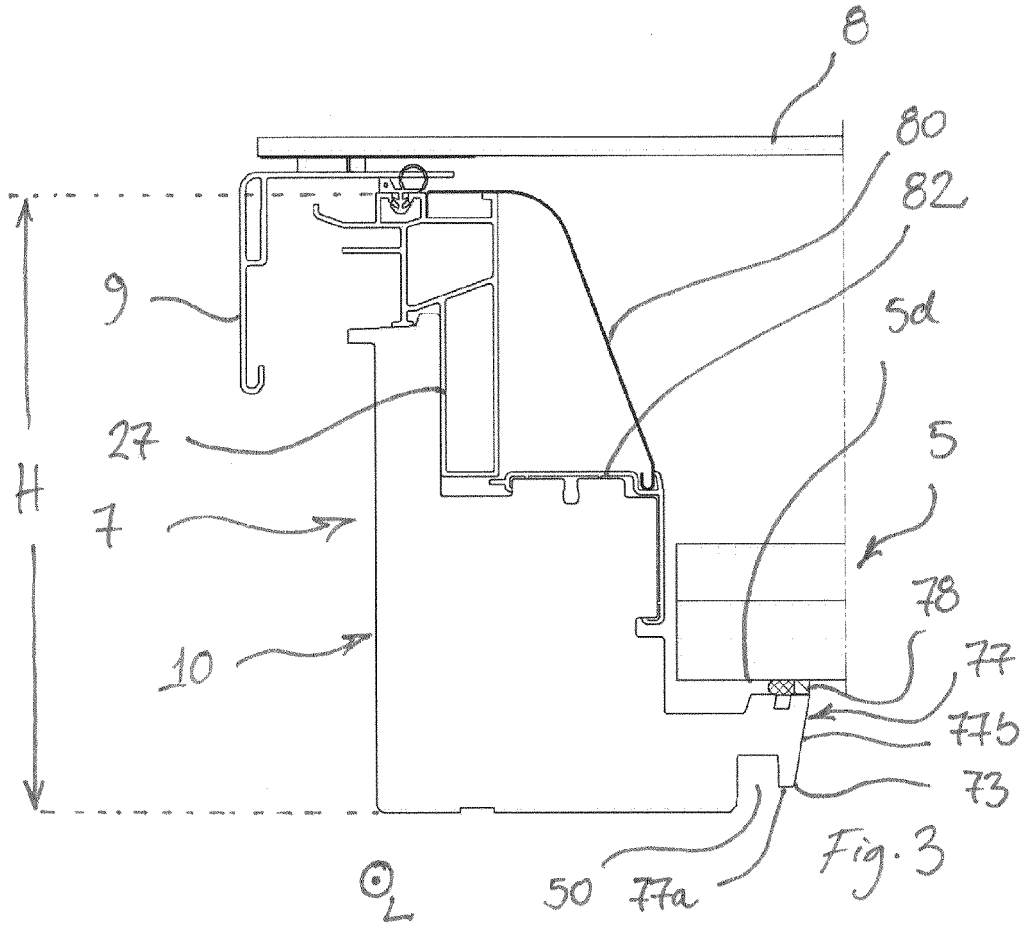
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Fig. 3

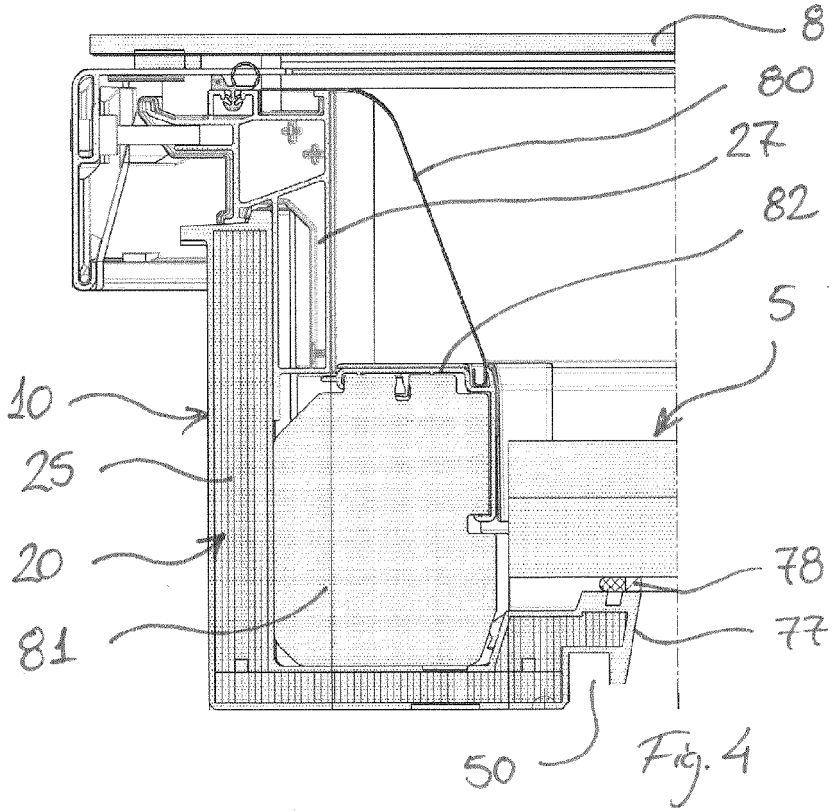
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Fig. 4

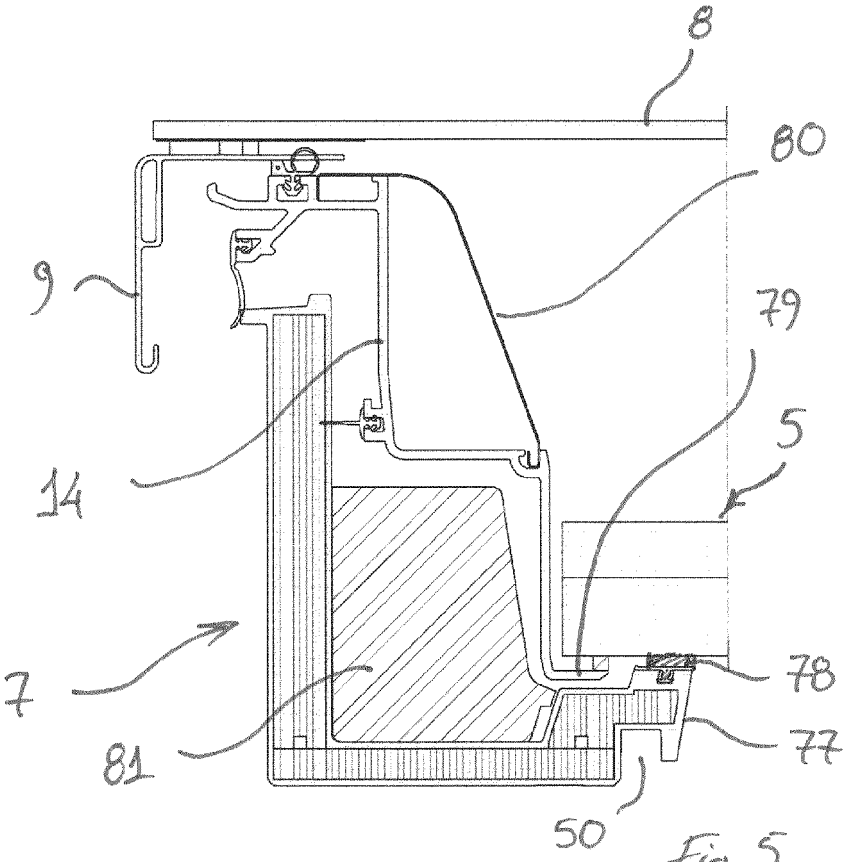

Fig. 5

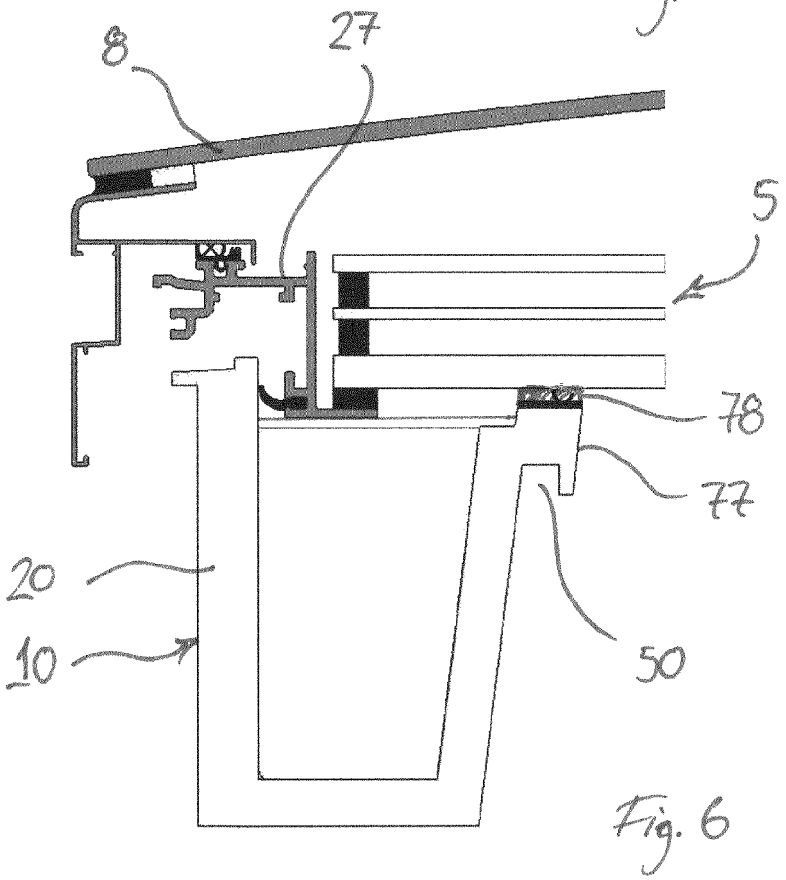

Fig. 6

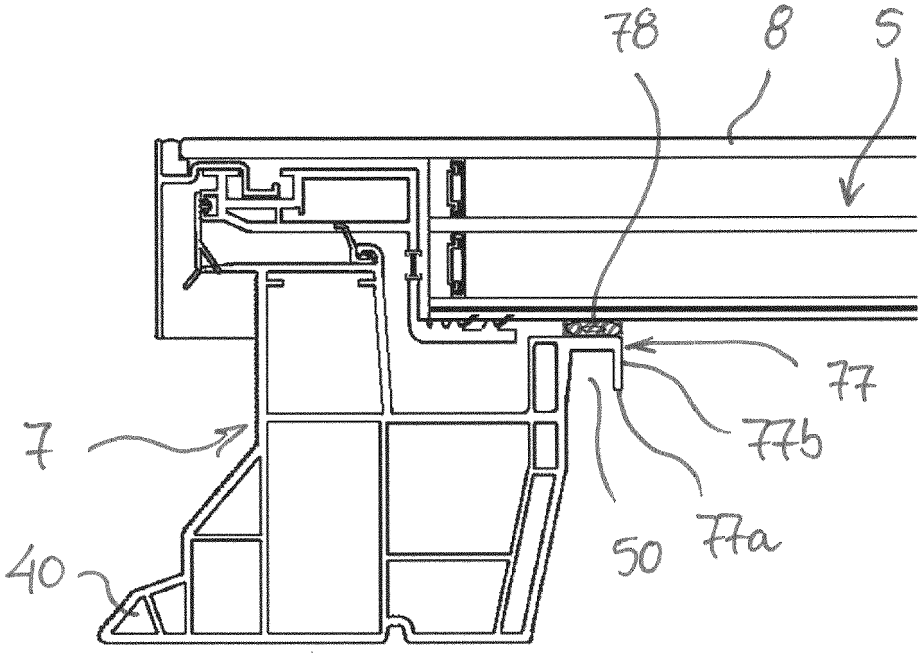

Fig. 7