(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 783 164 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.02.2021 Bulletin 2021/08

(51) Int Cl.:
E04D 13/03 *(2006.01)*

(21) Application number: **20155241.1**

(22) Date of filing: **03.02.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **VKR Holding A/S**
2970 Hørsholm (DK)

(72) Inventors:
- **Bertram, Jacob**
2970 Hørsholm (DK)
- **Grønborg, Kristian Nitzsch**
2970 Hørsholm (DK)
- **Kristensen, Lars**
2970 Hørsholm (DK)
- **Østergaard, Iben Bjerre**
2970 Hørsholm (DK)
- **Pedersen, Rasmus Klercke**
2970 Hørsholm (DK)

(74) Representative: **AWA Denmark A/S**
Strandgade 56
1401 Copenhagen K (DK)

Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **A SKYLIGHT WINDOW**

(57) A skylight window comprising a window frame, a window sash, a weather shield, and an IGU, wherein at least a portion of a first leg of a first sash side member is generally plate-shaped and consists of one single section of substantially solid material which has a thickness of less than 1 cm.

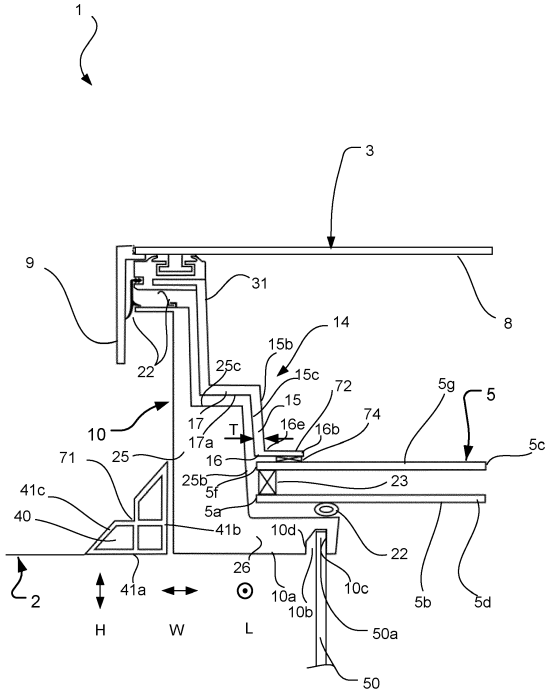

Fig. 2

EP 3 783 164 A1

Description

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

a window frame having four frame side members,
a window sash having four sash side members supporting an Insulating Glazing Unit (IGU) having multiple layers of glazing, said window sash being movable in relation to the window frame between an open and a closed position of the skylight window,
a weather shield attached to the sash so as to protect a window portion of the skylight window, the window portion comprising the sash, the frame and the IGU,
a first of the frame side members being associated with a first of the sash side members, said first frame and sash side members extending in a respective longitudinal direction substantially in parallel with a respective peripheral side of the IGU,
said IGU having an exposed interior major surface for facing an interior of said building in an installed position of the skylight window,
said IGU further having an exposed exterior major surface facing in an opposite direction towards an exterior in said installed position of the skylight window,
where said weather shield extends across substantially the entire exposed exterior major surface,
wherein in a closed position of said skylight window said first sash side member extends in a longitudinal direction substantially in parallel with said first frame side member,
said first sash side member having a first leg connected to a supporting section of the first sash side member supporting the IGU, the first leg extending in said longitudinal direction and extending substantially in a height direction substantially perpendicularly to at least one of said major surfaces of the IGU,
said first leg having a thickness in a width direction extending perpendicularly to said length and height directions.

Background

[0002] There is often a desire to position one or more skylight windows in a roof of a building in order to allow daylight to reach the interior of the building. This, however, may give rise to a variety of challenges.

[0003] Inclined skylight windows are typically built into an opening in an inclined roof structure with an angle above 15 degrees with a substantial part of the inclined skylight window is positioned within the inclined roof structure in an installed position. Flat-roof skylight windows are generally installed on top of the exterior side of flat roofs of buildings, where the inclination of the roof is less than 5 degrees with respect to a horizontal plane of the roof. In general, flat-roof skylight windows are installed to cover an opening in the roof, i.e. a substantial part of the flat-roof skylight window extends above an exterior side of the flat roof structure in an installed position.

[0004] Furthermore, skylight windows of this type often comprise a dome-shaped weather shield attached to the sash. During an opening movement, the weather shield typically follows the movement of the sash. The main purpose of the dome or weather shield is to protect the sash and frame from the weather and to avoid accumulation of precipitation and dirt on the IGU.

[0005] It is common today to use a skylight window in flat roofs and potentially cover the window portion with a dome-shaped weather shield. One example of this type of skylight window is disclosed in WO 2009/080026 A1. This roof window comprises a standard VELUX ® outwardly hung window, to the sash of which a dome-shaped weather shield is attached.

[0006] Window sashes have typically comprised box structures consisting of hollow spacings as an attempt to provide structural support and thermal insulation through cavities. A typical example of such structures is presented in US2010269426. Windows comprising such sashes have typically a quite rough appearance, while limiting the view. What is more, these windows are usually associated with high materials and processing costs in terms of manufacturing the window sash.

[0007] In general, skylight windows of the prior art may be associated with relatively poor insulating properties and/or limited entry of light into an interior of the building on which the flat-roof skylight window is installed, as well as limited visibility through the window from the interior of the building as well as limited compatibility with different roof angles as mentioned above. The poor insulating properties may be attributed to the manner, in which flat-roof skylight windows are installed on a roof structure of a building which generally results in a larger proportion of the window portion structure being exposed to the surrounding environment. Furthermore, with a weather shield attached to the top of the skylight, there are more layers of glazing which may result in a long travel path for light entering the flat-roof skylight window before reaching the interior of the building.

[0008] On this background it may be an object of the present invention to provide a skylight window according to the introduction in which the insulation properties are improved.

[0009] A further object of the invention may be to provide a skylight window with improved light entry and/or in which view through the window is improved. In addition, another objective of the invention would be to provide a slimmer window sash having lower manufacturing costs and a more lightweight structure.

[0010] According to the invention, these and further objects are met by a skylight window according to the introduction, characterized in that at least a portion of said first leg of the first sash side member is generally plate-shaped, consisting of one single section of sub-

stantially solid material having a said thickness less than 1 cm.

[0011] The term "plate-shaped" may be understood as the first sash side member being generally flat.

[0012] The term "substantially solid material" may be understood as no cavities and/or hollow spacings are comprised in the material structure.

[0013] Coatings on the material can still be allowed, however, as long as there is no substantial cavity between the different material layers. The term "substantial cavity" may be understood as any cavity being created between two material layers exceeding e.g. 1mm.

[0014] In other words, said portion of the first leg does not include other sections, which surround or extend in parallel with said single section so that a core spacing is formed between them within said first leg as it is known from the extruded sash and frame profiles, made for example from aluminium or polymer, which are used in many traditional windows.

[0015] The portion of said first leg having a thickness less than 1 cm of the first leg may correspond to any estimable part that comprises the first leg.

[0016] The term "thickness" of said first leg refers to the extent that the first leg extends in the direction of the width dimension, being perpendicular to the height and length dimensions, as defined previously.

[0017] The first leg having a thickness less than 1 cm may have the advantage of allowing the IGU to extend closer to the frame side members as the thickness of material extending along the peripheral sides of the IGU is reduced. This may have the effect of improving the insulation properties of the skylight as the relative area of the superior insulating IGU is increased compared to other parts of the skylight. Moreover, this will lead to a more lightweight structure that can potentially be easier to manufacture and lead to cost savings with regards to the material use. Furthermore, the small thickness of the first leg will lead to a better appearance for the window, having an aesthetic superiority compared to conventional thicker window sash. Eventually, that will also lead to improved daylight conditions, as the daylight inlet may be increased due to the increase of the glazing area that the IGU covers. The thinner leg of the first sash side member may also facilitate the placement of two skylight windows side by side, due to their slimmer structure.

[0018] In some embodiments, the first leg of the sash may have a height to thickness ratio of at least 4:1. That means that the leg's height is substantially larger than the leg's width, which can also be perceived as a particularly thin oblong element. The height to thickness ratio may also be 5:1, 6:1, 7:1 etc. If the first leg extends between the interior major surface of the IGU and the exterior major surface of the IGU, i.e. along the outer side of the IGU at the peripheral side, having a thin first leg means that the IGU can come closer to the frame. This is turn means that the excellent insulating properties of the IGU can be exploited and potentially also that the light admitting area of the IGU, i.e. the area not covered by other parts of the skylight window, can become relatively bigger. In an embodiment the distance between a peripheral side of the IGU and an inner side of a frame side member extending substantially in parallel with said peripheral side of the IGU and facing towards the IGU is less than 20 mm, preferably less than 15 mm.

[0019] Reducing the thickness of the material extending along and/or on top of the peripheral sides of the IGU may also lead to significant cost savings with regards to the manufacturing of the window sash and the associated material costs.

[0020] In an embodiment the sash side members are connected to the exterior major surface of the IGU and extending away from the interior major surface of the IGU, i.e. not extending below the exterior major surface of the IGU in the mounted state. In this way the IGU will be positioned as deep as possible in relation to the roof structure, thereby potentially improving the insulating properties of the window.

[0021] The sash side member may further comprise a second leg and possibly further legs in order to allow a more complex structure. The second and/or possible further legs may also be substantially plate-shaped.

[0022] In an embodiment, the legs form a stepped profile, when the cross-section perpendicular to the longitudinal direction. An upper surface of the second leg may be denoted a step surface. A step profile may be achieved by making the sash side member with two, three or more legs where each leg is substantially perpendicular to an immediately preceding leg and/or an immediately following leg.

[0023] A stepped configuration of adjacent surfaces of the first sash and frame side members may thus be achieved by means of the stepped profile of the first sash side member as described and an associated stepped profile of the first frame side member according to the present embodiment. This stepped configuration may provide a labyrinth like structure of a potential between the sash and frame side member resulting in a less direct path for air, precipitation or dirt to pass between the interior and exterior of the building. The stepped profile also provides the possibility of placing sealing elements along the profile such that sealing is facilitated between two parallel surfaces i.e. a surface of the frame side member and a parallel sash side member. The sealing between the stepped profile of the sash and frame side member may further be aided by the load transfer of the load exerted by the IGU through the sash. Furthermore, insulating sealing members may conveniently be positioned between the first sash and frame side members at respective corners of the stepped configurations, e.g. as described in the above. Hereby, insulating and sealing properties of the skylight window may be further increased.

[0024] Such a step may also be used for supporting a screening device, such as a roller blind.

[0025] In an embodiment a second, third and/or fourth sash side member is/are substantially similar and/or

identical in shape and/or form and/or size and/or structure to the first sash side member.

[0026] The skylight window may comprise one or more thermal breaks being located in the sash side member. Thermal breaks are manufactured from a material of a lower thermal conductivity than other parts of the first sash side member. This may have the advantage of improving the insulation properties of the skylight window as a lower thermal conductivity through the supporting section or sash member may be achieved. The thermal break may be substantially made from or comprise a polymer or foam. The thermal breaks may be located on the sash side member, so that possible thermal bridges are avoided. In an embodiment a thermal break is provided at an exterior edge of the first leg located above the exterior major surface of the IGU when seen in the height direction, i.e. on the exterior side of the IGU.

[0027] In an embodiment at least some of the legs are attachable/detachable to/from each other. This would for example allow the first leg to be replaced with one of another height, so that the window sash has an adjustable height that could be used for different installation depth. In particular, the window sash will be able to adjust its height also based on the number of layers of glazing included in the IGU. For example, an IGU comprising two layers of glazing may require a shorter sash height than an IGU with three layers of glazing. In addition, the sash may also be adjusted for different frame sizes.

[0028] In an embodiment, the sash side member may comprise one or more recesses that may be adapted for securing one or more sealing elements (e.g. gaskets), said recesses may lead to a larger thickness of the sash side member in some limited areas, but the thickness should preferably not exceed 3 cm. The recesses may be in the form of a groove or an indentation on any of the legs of the first sash side member. Apart from securing the sealing elements, the recesses may also secure centering blocks that may be attached to the sash in order to carry load so that the sealing elements are not too heavily deformed and thus, damaged. The recesses may also be formed between projections, such as feathers extending in the longitudinal direction, and may include barbs or like elements designed to prevent the sealing elements from coming loose unintentionally.

[0029] In an embodiment, the first leg may comprise or substantially consists of metal, such as steel or aluminium and/or polymer. The metal structure may make the sash extremely resistant to high temperatures, which may arise due to high solar gains. Alternatively, the first leg may comprise or substantially consist of a polymer, which may be fibre reinforced, one example being a thermoset plastic polymer material comprising glass fibers. A thermal break may be comprised on the sash side member along with a metal discontinuity, having a different thermal conductivity, which will eventually lead to lower thermal losses through the sash.

[0030] The frame side members may have a bottom surface facing in a direction away from the interior major surface of the IGU, which bottom surface comprises a recess for receiving an upper part of a reveal panel or lining panel in said installed position of the skylight window, said recess comprising a first surface for abutting an inwardly facing interior surface of said reveal panel or lining panel when received in said recess.

[0031] The sash side members may be separate members or may be formed as one continuous member.

[0032] In general in this specification, in relation to the first sash side member, a length dimension may be defined as a dimension in which said longitudinal direction extends, a height dimension may be defined as a direction perpendicular to the length dimension and to major surfaces of the IGU, and a width dimension may be defined as a dimension perpendicular to the height and length dimensions. The width and length dimensions are thus parallel to the major surfaces of the IGU. Whereas the longitudinal direction extends in the length dimension, the width and height dimensions can be said to extend in transverse or lateral directions. The length dimension may also be denoted longitudinal direction. The width dimension may also be denoted width direction. The height dimension may also be denoted height direction.

[0033] Throughout this text the term "interior" is used to indicate that something is intended to face the interior of the building in which the skylight window is installed, in an installed position of the skylight window. The term "exterior" is used to indicate that something is intended to face in a direction opposite to the interior of the building in which the skylight window is installed, in an installed position of the skylight window. The terms "inner" and "outer" are used to indicate that something is intended for facing towards or away, respectively, from the opening in the frame of an assembled skylight window.

[0034] The terms "insulation", "insulating", "insulation properties" and "insulating properties" are to be understood in the sense of thermal insulation and thermal insulation properties and thermally insulating and insulating properties. However, other insulation may also be provided such as for example acoustic insulation.

[0035] As mentioned above, skylight windows for inclined roofs are typically built into the roof structure. This means that the frame and sash, i.e. most of the frame and sash structures, are embedded in the roof so that much, most or all of an outer surface of the frame facing away from the opening in the frame is positioned within the roof structure. The inventors of the present invention have realized that in inclined skylight windows installed in this way the insulation properties of the frame and sash are to a large extent not decisive for the total heat loss through the window. However, in skylight windows where the frame and sash are positioned higher than the level of the roof i.e. above the exterior surface of the roof, the typically inferior insulation properties of the frame and sash structures compared to those of the IGU are to a much lesser degree alleviated by the insulation properties of the roof structure. In prior art skylight windows of the above described type the IGU is typically the best

insulated part of the window, i.e. having the lowest thermal conductivity or "U-factor", unit W/(m2K), especially compared to the thermal conductivity of the frame and sash. Thus, the inventors have realized that it is important to minimize the area of the sash and frame through which heat energy will escape.

[0036] The IGU may have multiple layers of glass which define a volume comprising an inert gas or aerogels or vacuum. The IGU may in a conventional manner comprise one or, preferably two, three or more layers of glazing, i.e. layers of glass, polycarbonate or the like or glass panels, positioned at a distance from each other to form one or more spacings or cavities between them. This spacing may be filled with an inert gas or may hold a vacuum to improve insulation. One or more of the layers of glazing may have a low emissivity coating or coating stack. One or more of the layers of glazing may be laminated e.g. the interior layer of glazing. One or more of the layers of glazing may be tempered. Similarly, the weather shield pane may be tempered. The IGU may be see-through transparent to provide a view out.The exposed interior major surface of the IGU is in that case a lower major surface of a lowermost of the layers of glazing. Sealing and/or supporting members may be provided at one or more of four peripheral sides of the IGU between the layers of glazing. The sealing and/or supporting members may distance adjacent layers of glazing from each other and may together with lateral edges of the window glazing layers form respective side or lateral surfaces of the IGU. These side surfaces may be substantially plane and extend substantially in the height dimension as defined herein.

[0037] Hinges may be linear displacement mechanisms or multi-link mechanisms. The skylight window may be hinged to open in the exterior direction i.e. away from the interior of the building. The sash may be made movable in relation to the window frame by the sash being outwardly hung, i.e. being rotatable about an axis extending along one of the sash side members. Generally by outwardly hung it is to be understood that the sash moves outwards from the frame during opening. This is contrary to pivot hung skylights which move both outwards and inwards during opening and employ a different design. The sash being outwardly hung may be achieved by using a rotary hinge positioned at this sash side member and connecting this sash side member with an associated, adjacent frame side member. Alternatively or additionally, the sash may be parallel-displaceable so that all four sash side members shift upwardly or downwardly between the open and closed positions of the window in which case further or other hinges or the like connect the sash with the frame. The skylight window may be openable by a combination of a rotary movement and a shifting movement or other movement paths of the sash in relation to the frame.

[0038] The exposed interior major surface of the IGU may be a lower surface of the IGU and/or may face in a downwards direction towards an interior of the building in an installed position of the skylight window. The exposed interior major surface faces in a direction away from the weather shield.

[0039] The IGU comprises an exposed exterior major surface positioned oppositely from the exposed interior major surface and facing towards the outside, in an installed position of the skylight window. The exterior major surface may be substantially parallel with and/or may have substantially the same or the same shape and size as the interior major surface of the IGU. A distance between the two major surfaces defines a thickness of the IGU, which distance may be measured in the height dimension.

[0040] The IGU may have a rectangular shape and may have further second to fourth peripheral sides that each extends linearly along, potentially along substantially a total extent of, a corresponding respective sash member. The peripheral sides may define a shape of the IGU.

[0041] The four frame side members may together form a substantially rectangular shape. Additionally or alternatively, the four sash side members may together form a substantially rectangular shape. A rectangular shape of the four sash side members may be smaller than a rectangular shape of the four frame sash side members, which may allow the sash to be embedded within the frame.

[0042] The weather shield may be provided as a unitary structure, which is detachably attached to the to the sash. The weather shield may be attached detachably to the sash, providing for access to clean the IGU; this may also be of advantage during installation of the skylight window, e.g. when positioning or attaching the window portion or when attaching roofing felt to cover a potential gap between the frame and the roof structure.

[0043] The weather shield is mounted on the window portion to protect it from the elements and preventing rain and other downfall from entering into gaps or slots in the roof or the window portion.

[0044] The weather shield may comprise a weather shield pane that may be surrounded by a weather shield skirt that may extend on an outer side of all four sides of the frame, i.e. of the respective frame side members. The skirt may be manufactured from or include metal. The weather shield pane may curve upwardly in relation to the window portion or the IGU to allow for rain and snow to slide or flow off of the weather shield pane. Alternatively or additionally, the weather shield pane may be a transparent window pane that may be of glass or hardened glass. The weather shield pane may comprise only one single layer of glazing. In the following, the weather shield may be understood as a transparent cover member, preferably a dome of glass or a clear polymer.

[0045] The frame may enclose the sash in the closed position of the skylight window.

[0046] Respectively associated frame and sash side members may be positioned to be substantially parallel to each other in both the open and closed positions of

the skylight window.

[0047] The first sash and/or frame side member may extend substantially along an entire length of said first peripheral side or side surface of the IGU.

[0048] The first leg may have a height in the height dimension of at least 1.5, 1.8, 2 or 2.2 times a height or thickness of the IGU, where the height of the IGU as mentioned may be defined as a distance between its exposed exterior major surface and its exposed interior major surface. Additionally or alternatively, the first leg may have an inner side surface facing a side surface of the first peripheral side of the IGU, this inner side surface extending 1.3, 1.5, 1.8 or 2 times the height or thickness of the IGU.

[0049] The first sash side member may in general in all embodiments have a substantially uniform cross section along a length of the first sash side member in said longitudinal direction. Alternatively or additionally, the first frame side member may have a substantially uniform cross section along a length of the first frame side member in said longitudinal direction. One or more of the remaining sash and frame side members may similarly have substantially uniform cross sections in the same manner.

[0050] Generally, one or more of the frame and/or sash side members may comprise or be made substantially of polymer materials, such as plastic, specifically PVC (polyvinyl chloride), chlorinated PVC, PUR (polyurethane), fibre reinforced PUR such as glass fibre reinforced PUR, and/or wood and/or metal such as aluminium or composites or combinations thereof.

[0051] The first leg of the first sash side member may on a surface facing the IGU, which surface may substantially extend in the height dimension, comprise two or more grooves, the first groove being positioned at a first distance from the interior major surface of the IGU, the second groove being positioned at a second distance from the interior major surface of the IGU, which is different from distance between the first groove and the interior major surface of the IGU, the first and second grooves being adapted for receiving a fixation member which can be attached to or snap-locked to either one of the two grooves, the fixation member abutting the exterior major surface of the IGU so as to hold the IGU along said first peripheral side thereof, especially in the upward direction. Hereby the IGU may be exchanged with an IGU of different thickness by switching the fixation member to the other of the two grooves. In the present invention the IGU can be positioned lower in the window structure, which means that more room may be available for including larger thicknesses of the IGU and more grooves and thus options for IGU thicknesses. The fixation member may be manufactured of or comprise a plastic and/or sealing material and may comprise one or more projections that are adapted to be in abutment with the upper or exterior major surface of the IGU such as to hold this in place against the upper resting surface of the second or third leg in cases where the adherence of the supporting section to the exposed exterior major surface of the IGU is not the substantially only attachment of the first sash side member to the IGU. The fixation member may extend substantially along an entire length (in the longitudinal direction) of the first sash side member and/or the first peripheral side of the IGU. Similar fixation members may be attached to similar grooves of the one, two or three of the other sash side members along the other three peripheral sides of the IGU.

[0052] The sash side members may be interconnected at the corners of the respective sash by corner keys. The corner keys may be attached to respective sash side members in hollows thereof. The corner keys may be made substantially of of a rigid and hard material such as metals like aluminium, steel or wood. The corner keys act to prevent sash members from moving out of alignment with interconnected sash members respectively.

[0053] A chain drive, hinge or the like may be provided connecting the sash and frame for assisting in opening and closing the skylight window.

[0054] In this specification, generally one or more or all individual ones of the legs mentioned herein of the sash and frame members may be provided separately from each other, each leg potentially being attached to adjacent legs. Alternatively, where a leg is described as being attached to another leg, these two legs may be provided integrally or in one piece with each other.

[0055] In an embodiment of the present invention, said second leg extends as far as or farther than said secondary leg in said inward direction.

[0056] This may improve or further contribute to hiding parts of or the entire window when seen through the IGU from an interior of a building in the installed position of the window.

[0057] In an embodiment, an upper part of a reveal panel or lining panel is received in said recess, said first surface of said recess abutting said inwardly facing interior surface of said reveal panel or lining panel.

[0058] In an embodiment, said primary leg of said first frame side member extends as far as or farther in said upward direction than the location of said exterior major surface of the IGU.

[0059] This allows for positioning the IGU deeper or lower in the window structure. This reduces the area of the sash and frame through which heat energy escapes (or enters) from the interior of the building. Furthermore, improved light inflow and view through the skylight window are achieved.

[0060] In an embodiment, said first sash side member further has a third leg projecting from an inner end of said second leg in a direction away from said interior major surface of the IGU to provide a lower supporting surface which in the closed position of the window rests on a corresponding upper resting surface of the first frame side member. The direction away from said interior major surface of the IGU, in which direction the third leg projects, may extend substantially in the height dimension and/or may extend downwards, i.e. towards an in-

terior the building in an installed position of the skylight window.

[0061] Said inner end of the second leg may be positioned opposite from an outer end of the second leg, said outer end preferably being connected to the first leg at a position from which the second leg projects. Said inner end may be denoted a proximal end and said outer end a distal end with relation to the first leg.

[0062] The third leg of the first sash side member may provide additional support to the IGU, which is a typically relatively heavy component of the window. This means that it is possible to substantially reduce the strength and/or stiffness of the first and second legs of the first sash side member without compromising structural integrity of the first sash side member. As a consequence, the first and second legs may be made of smaller size, which again allows for positioning the IGU lower in the window structure as well as to use an IGU with a larger planar area, i.e. it extends further to the sides and so increase the relative area of IGU compared to the skylight window. This reduces the area of the sash and frame through which heat energy escapes from (or enters) the interior of the building.

[0063] The third leg may be provided in the form of a stiffening and/or strengthening leg, which substantially improves stiffness, strength, structural integrity and/or the like of the first sash side member. Accordingly, the third leg may affect stiffness, strength, moment of inertia and/or like structural properties of the first sash side member, including providing greater resistance to bending. Improved structural properties mean that the sash can hold a larger IGU or an IGU having a plurality of glazing layers.

[0064] Thus, by improving the structural properties of the sash in this manner, it has been found that when holding IGUs of substantially the same size and weight as in the prior art, it is possible to decrease the size of other legs of the sash, specifically the first and second legs. The IGU can be placed lower in the skylight window construction, and as such will improve the insulating properties of the skylight window.

[0065] Furthermore, due to the improved structural properties of the first sash side member the inventors have realized that inclusion of the third leg need not obstruct entry of light or the view through the IGU. On the contrary, since it is possible to position the IGU lower in the window structure, entry of light and view through the IGU may, in fact, be improved.

[0066] The third leg may comprise the only or substantially the only supporting surface or supporting point of the first sash side member resting on the frame in the closed position of the skylight window. Similarly, in one or more of the remaining three sash side members a corresponding third leg may comprise the only or substantially the only supporting surface or supporting point of the respective sash side member resting on the frame in the closed position of the skylight window. This may provide an improved ability to position and center the skylight window during closing thereof. Other contact points or contact surfaces between the sash and frame in the closed position of the skylight window, which contact surfaces are not carrying any substantial amount of the weight of the sash in the closed position of the skylight window, may include sealing members between associated sash and frame side members. An insignificant amount of a weight of the sash in the closed position of the window can be defined as less than 20, 10, 5, 3, 2 or 1 percent of a total weight of the sash the sash imposed by the first sash side member on the first frame side member. It is preferable that the only contact points between one, two, three or four of the sash side members to the associated frame side member are established by the abutment element(s) and potential sealing members, potentially a hinge and/or a chain drive for moving the sash. The abutment element (s) may be of or comprise an elastic material and/or a plastic material and/or a sealing material. The abutment element may be deformed in the closed position of the skylight window.

[0067] In case a rotary hinge and/or a chain drive is included in the skylight window, the rotary hinge and/or chain drive may also establish an indirect contact point between sash and frame, which may also carry part of the weight of the sash in both the closed and especially in the open position of the skylight window.

[0068] Alternatively, a lower supporting surface of the second leg may in the closed position of the window rest on a corresponding upper resting surface of the first frame side member. The first leg or the potential fourth leg mentioned further below may also or alternatively comprise a lower supporting surface that rests on a corresponding upper resting surface of the first frame side member in the closed position of the skylight window. An upper resting surface of the second or third leg on which the IGU rests may be provided as an upper resting surface in the form of one or more sealing members, which sealing members may be manufactured from a polymer material, may include glue and/or a sealing material and may extend in the longitudinal direction, potentially in substantially an entire length in the longitudinal direction of the first peripheral side of the IGU and/or of the second leg. The lower supporting surface of the first leg and/or of the second leg and/or of the third leg may be provided by one or more abutment elements attached to or forming part of one or both of the sash and frame. This abutment element(s) may be provided at a corner (corners) of the first sash and/or frame side member.

[0069] The side surface extending along said first peripheral side may potentially have an angle to the interior major surface of the IGU of approximately 90 degrees. Generally, each of the first, second and/or third legs may be substantially plate-shaped and/or oblong and/or have a flat shape, potentially so that they together form a step where an upper surface of the second leg may be denoted a step surface.

[0070] Generally, the first leg may extend longer, e.g. at least 1.5, 2, 2.5 or 3 times longer, in the height dimen-

sion than in the width dimension. Similarly, the second leg may extend longer, e.g. at least 1.5, 2, 2.5 or 3 times longer, in the width dimension than in the height dimension. Similarly, the third leg may extend longer, e.g. at least 1.5, 2, 2.5 or 3 times longer, in the height dimension than in the width dimension. Alternatively or additionally, the second leg may extend longer, e.g. at least 1.5, 2, 2.5 or 3 times longer, in the width dimension than the first leg and/or than the third leg. As explained above, it is possible to increase these ratios of the first and second leg due to the improved structural properties gained by the provision of the third leg, which makes it possible to position the IGU lower in the window structure and to extend further sidewards than would otherwise be the case. The distance the legs extend in a dimension may in this context by an overall and/or total and/or largest extent of the relevant leg.

[0071] Alternatively or additionally, generally, the extent in the length dimension of the first, second and third legs may be substantially equal to or 1 to 1.3 times the extent of the first peripheral side of the IGU in the length dimension. The extents measured also in this context and in general throughout the present specification may be an overall and/or total and/or largest extent of the leg in question in the relevant direction. Alternatively or additionally, the second leg may be defined as projecting from a surface of the first leg, which surface extends substantially in the height dimension and faces the IGU, and/or the third leg may be defined as projecting from a surface of the second leg, which surface extends substantially in the height dimension and is substantially perpendicular to the IGU. These latter surfaces may be imaginary, i.e. the relevant portions may be integral with each other at said imaginary surfaces. If these surfaces are imaginary, the surfaces may be denoted planes.

[0072] Generally, an angle between the first and second legs and/or between the second and third legs may be 70 to 110 degrees or 80 to 100 degrees or substantially 90 degrees. This angle may be measured between a surface of one leg adjacent or contiguous to a surface of the other leg and/or between a overall directions in which the respective legs extend.

[0073] Generally, the first leg may be attached to or formed integrally with the second leg, and/or the second leg may be attached to or formed integrally with the third leg.

[0074] The third leg may be positioned with a major part thereof being located beneath the first leg.

[0075] The lower supporting surface of the third leg may form part of the third leg and/or may be a lower surface of the third leg and/or may extend substantially in the width dimension.

[0076] The direction away from said exposed interior major surface of the IGU, in which direction the third leg projects, may extend substantially in the height dimension and/or may extend downwards, i.e. towards an interior the building in an installed position of the skylight window.

[0077] In general, in a cross section perpendicular to the length dimension or to the longitudinal direction the first leg and/or second leg and/or third leg may be substantually shaped as a rectangle, e.g. outer surfaces of the individual leg form an overall rectangular shape. However, the first leg may be substantially shaped as a trapezoid or a trapezium, an outer surface of the first leg extending substantially along a surface of the first frame side member (e.g. along a surface of the primary leg of the first frame member, which may be similarly inclined, see further below) being inclined, e.g. with 1 to 10 or 2 to 5 degrees, with respect to the height dimension. This inclination may be towards the second leg and/or may be in an outward and upward direction. An inward direction may generally in this specification be defined as a direction towards a centre of the IGU, and the outward direction may be a direction opposite to the inward direction, which directions extend in the width dimension. The first frame side member may comprise a side surface extending substantially in parallel with the the latter side surface of the first leg in the closed position of the window. A surface of the first leg extending along another surface of the first frame side member (e.g. along an upper surface or the step surface of the secondary leg of the first frame side member, see further below) may extend substantially in the width dimension. A surface positioned opposite from the latter surface of the first leg may be substantially parallel to the latter surface of the first leg in the closed position of the window. Another surface of the first leg, specifically a surface extending next to the side surface of the first peripheral side of the IGU, may connect the two latter surfaces of the first leg and/or may extend substantially in the height dimension. Similarly, the third leg may comprise a side surface facing a surface of the first frame side member and extending substantially in the height dimension, but may extend at an angle of 1 to 10 or 2 to 5 degrees with relation to the height dimension. The first frame side member may comprise a side surface extending substantially in parallel with the latter side surface of the third leg in the closed position of the window. The inclination in this context may be in a direction away from the second leg and/or may be in an outward and upward direction.

[0078] Said lower supporting surface of said third leg of the first sash side member and/or the corresponding upper resting surface of the first frame side member may extend substantially in the width dimension.

[0079] One or more sealing members may be provided at a corner formed between the second and third legs, this sealing member abutting the first frame side member in the closed position of the skylight window.

[0080] In an embodiment of the invention said first sash side member further has a fourth leg projecting from an upper end of said first leg in a direction away from from the IGU. Said direction away from the IGU may be in said width dimension and/or be said outward direction.

[0081] The fourth leg may provide a further lower supporting surface which in the closed position of the window

rests on a corresponding further upper resting surface of the first frame side member, specifically of the primary leg thereof mentioned further below.

[0082] Alternatively or additionally, the fourth leg may in the closed position of the window be positioned above the below mentioned primary leg of the first frame side member. A width of the fourth leg may substantially correspond to a width of this primary leg.

[0083] As is the case for the first, second and third legs, the fourth leg may be substantially plate-shaped or have a flat shape so that an upper surface thereof forms a further step surface similar to and potentially extending substantially in parallel with the step surface of the second leg.

[0084] Alternatively or additionally, the fourth leg may have an oblong shape in the width dimension and/or may extend longer, e.g. at least 1.5, 2, 2.5 or 3 times longer, in the width dimension than in the height dimension. Alternatively or additionally, the extent in the length dimension of the fourth leg may be substantially equal to or 1 to 1.3 times the extent of the first peripheral side of the IGU in the length dimension. Alternatively or additionally, the fourth leg may be defined as projecting from a surface of the first leg extending in the height dimension and facing away from the IGU. This surface may be imaginary in the manner described above.

[0085] An angle between the first and fourth legs may be 70 to 110 degrees or 80 to 100 degrees or substantially 90 degrees.

[0086] The fourth leg is preferably attached to or formed integrally with the first leg.

[0087] The fourth leg may extend along, preferably along a substantially entire length of, the first peripheral side of the IGU.

[0088] The fourth and second legs may extend substantially in parallel.

[0089] In a cross-section perpendicular to the length dimension or to the longitudinal direction the fourth leg may be substantually shaped as a rectangle. However, the fourth leg may be substantially shaped as a trapezoid or a trapezium, a surface of the fourth leg extending substantially along an upper surface of the first frame side member (e.g. along an upper surface of the primary leg of the first frame member, which may be similarly inclined, see further below) being inclined, e.g. with 1 to 10 or 2 to 5 degrees, with respect to the width dimension. This inclination may be in the inward and/or downward direction. The fourth leg may further comprise a first lateral side surface facing and/or attached to the first leg and potentially extending substantially in the height dimension and an opposite, substantially parallel side surface that may face in the outward direction. An upper surface of the fourth leg may extend substantially in the width dimension and may connect the two parallel surfaces thereof.

[0090] The fourth leg may have a height in the height dimension less than the thickness of the IGU and/or substantially equal to the height of the second leg.

[0091] One or more sealing members may be provided at a corner formed between the fourth and first legs, these sealing members abutting the first frame side member in the closed position of the skylight window. Alternatively or additionally, a sealing element may be attached to the fourth leg or to the first frame side member, the sealing element preferably covering an outwardly facing potential gap or a slot between the fourth leg and the first frame side member in the closed position of the skylight window.

[0092] In a development of the embodiment comprising a third leg, the IGU extends from an inner edge of the third leg towards the first leg in the width dimension to farther than half of an accumulated width of the first, second and third legs.

[0093] Hereby the IGU extends relatively far in the width dimension, which reduces heat transmission through the frame and sash and thus through the window as explained in the above. As explained, this is made possible due to the provision of the third leg, which allows for thinner first and second (and fourth) legs.

[0094] More preferred, the IGU extends from an inner edge of the third leg in the width dimension to farther than 0.6, most preferred farther than 0.7, of said accumulated width of the first, second and third legs.

[0095] In an embodiment the interior major surface of the IGU is positioned at a distance of less than 45 % of a total height of the first leg from said lower end of said first leg.

[0096] Hereby the IGU is positioned relatively deep in the window structure, i.e. in the downward direction, which similarly reduces heat transmission through the frame and sash and thus through the window as explained in the above. Again, this is made possible due to the provision of the third leg, which allows for thinner first and second legs.

[0097] The lower end of the first leg may be defined as the lowest position of the first leg in the height dimension and/or the end of the first leg from which the second leg projects.

[0098] More preferred the interior major surface of the IGU is positioned at a distance of less than 40, 35, 32 or 30 % of the total height of the first leg from said lower end of said first leg.

[0099] In another development of the embodiment comprising a third leg, the third leg has an oblong shape in the height dimension.

[0100] The oblong shape of the third leg may be defined as the height of the third leg being at least 1.5, 2, 2.5 or 3 times longer than the width thereof. Additionally or alternatively, the third leg may extend in the height dimension 1, 1.5, 2 or 2.5 times a height of the second leg. Additionally or alternatively, the third leg may have a height of 0.3 to 1, 0.3 to 0.8, 0.4 to 0.7 or 0.4 to 0.6 times a height of the first leg. Additionally or alternatively, a height of the third leg may be 0.5 to 1.5, 0.7 to 1.3 or 0.8 to 1.2 times a width of the second leg.

[0101] In an embodiment the first frame side member comprises a primary leg with a surface extending next to

and along a side surface of said first leg of the first sash side member, said side surface of said first leg facing substantially away from said first peripheral side of the IGU, and a secondary leg extending along a surface of said second leg of said first sash side member, which surface faces substantially away from said interior major surface of the IGU.

[0102] In an embodiment, the cross-sectional shape of the first frame side member and the first sash side member may have a stepped profile, where the frame side member may comprise primary, secondary, tertiary or more legs where each leg may be substantially perpendicular to an immediately preceding leg and the immediately following leg, such that a step like structure is formed. Similarly, the first sash side member may comprise a first, second, third or more legs, where each leg may be substantially perpendicular to an immediately preceding leg and the immediately following leg, such that a step like structure is formed. Generally, each of the primary, secondary and/or tertiary legs may be substantially plate-shaped and/or oblong and/or have a flat shape, potentially so that they together form a step where an upper surface of the second leg may be denoted a step surface. Similarly the the first, second and/or third legs may be substantially plate-shaped and/or oblong and/or have a flat shape, potentially so that they together form a step where an upper surface of the second leg may be denoted a step surface.

[0103] A stepped configuration of adjacent surfaces of the first sash and frame side members may thus be achieved by means of the stepped profile of the first sash side member as described and an associated stepped profile of the first frame side member according to the present embodiment. This stepped configuration may provide a labyrinth like structure between the sash and frame side member, resulting in a less direct path for air, precipitation or dirt to pass between the interior and exterior of the building. The stepped profile also provides the possibility of placing sealing elements along the profile such that sealing is facilitated between two parallel surfaces i.e. a surface of the frame side member and a parallel sash side member. Furthermore, insulating sealing members may conveniently be positioned between the first sash and frame side members at respective corners of the stepped configurations, e.g. as described in the above. Hereby, insulating and sealing properties of the skylight window may be further improved. This allows the force exerted through the sash corresponding to the weight of the IGU and sash to be utilized in compressing the sealing elements place between the frame side member and sash, to ensure optimal sealing.

[0104] In the embodiment comprising a third leg, the secondary leg of the first frame side member may further comprise a side surface, which may extend substantially in the height dimension, and which faces, is placed next to and/or extends along a side surface of the third leg of the first sash side member. Said side surface of the third leg of the first sash side member may similarly extend substantially in the height dimension and/or may face in the outwards direction. Said two side surfaces may be substantially parallel to each other in the closed position of the window and/or be inclined with 2-10 or 2-5 degrees in relation to the height dimension and/or they may extend in the length dimension and/or along substantially a total extent of the first sash and frame side members in the longitudinal direction.

[0105] In the embodiment comprising a third leg, the third leg may have an extent in the height dimension of at least 0.2, 0.3, 0.4 or 0.5 times an extent of the secondary leg in the height dimension.

[0106] In a development of the embodiment comprising a third leg, the first frame side member comprises a tertiary leg, which comprises said corresponding upper resting surface of the first frame side member on which said lower supporting surface of said third leg of the first sash side member rests in the closed position of the window.

[0107] The tertiary leg may in the closed position of the window be positioned below or immediately below the third leg of the first sash side member. A width of the tertiary leg may be 0.3 to 1 of a width of the third leg.

[0108] The tertiary leg may be substantially plate-shaped or have a flat shape so that an upper surface thereof forms a further step surface similar to and potentially extending substantially in parallel with the step surfaces of the primary and secondary legs. This step surface may be positioned beneath the abutment element explained further below.

[0109] The tertiary leg may have an oblong shape in the height dimension and/or may extend longer, e.g. at least 1.5, 2, 2.5 or 3 times longer, in the height dimension than in the width dimension. Alternatively or additionally, the extent in the length dimension of the tertiary leg may be substantially equal to or 1 to 1.3 times the extent of the first peripheral side of the IGU in the length dimension. Alternatively or additionally, the tertiary leg may be defined as projecting from a surface of the secondary leg extending in the width dimension and facing inwardly. This surface may be imaginary in the manner as mentioned above.

[0110] An angle between the secondary and tertiary legs may be 70 to 110 degrees or 80 to 100 degrees or substantially 90 degrees.

[0111] The tertiary leg is preferably attached to or formed integrally with the secondary leg.

[0112] The tertiary leg may extend along, preferably along a substantially entire length of, the first peripheral side of the IGU.

[0113] The tertiary and third legs may extend substantially in parallel in the closed position of the window.

[0114] The tertiary leg may project from the secondary leg substantially inwardly and/or in the width dimension.

[0115] The tertiary leg may form a third step surface, corresponding to the first and second step surfaces of the primary and secondary legs, respectively, which may be substantially parallel to the first and second step sur-

faces.

[0116] In a cross-section perpendicular to the length dimension or to the longitudinal direction the tertiary leg may be substantually shaped as a rectangle. However, the tertiary leg may be substantially shaped as a trapezoid or a trapezium, an inwardly facing surface of the tertiary leg being inclined, e.g. with 1 to 10 or 2 to 5 degrees, with respect to the height dimension. This inclination may be in the inward and/or the upward direction. The tertiary leg may further comprise a first lateral side surface facing and/or being attached to the secondary leg and potentially extend substantially in the height dimension and an opposite side surface that may face in the inward direction, the latter being the surface that may be inclined in relation to the height dimension. The resting surface or an upper surface of the tertiary leg may extend substantially in the width dimension and may connect the two lateral side surfaces thereof.

[0117] The tertiary leg may have a height in the height dimension less than the thickness of the IGU and/or less than that of the first, third, primary and/or secondary leg.

[0118] In the development of the embodiment comprising a third leg, an abutment element may be provided as part of said third leg of the first sash side member so that said abutment element provides said lower supporting surface of said third leg, and/or is provided as part of the first frame member so that said abutment element provides said corresponding upper resting surface of the first frame side member on which said lower supporting surface of said third leg rests in the closed position of the skylight window.

[0119] The abutment element may extend along substantially a total length of the first frame and/or sash frame side members and/or substantially along a total length of the third leg and or said lower surface of the third leg, these lengths being in the length dimension.

[0120] The abutment element is preferably a separate part attached to remaining parts of the tertiary leg. Furthermore, the abutment element may comprise an abutment surface, which includes or forms the resting surface on which the supporting surface of the third leg rests in the closed position of the skylight window. The abutment surface may in a position in which the third leg does not rest on it be inclined with an angle of 5 to 25 or 10 to 20 degrees with respect to the height dimension and/or may extend substantially linearly. Such an inclined abutment surface may help positioning or centering the sash in the frame during a closing movement. Accordingly or alternatively, the supporting surface of the third leg of the sash side member, which supporting surface is in abutment with the resting surface of the abutment element in the closed position of the skylight window, may comprise part of an outer side surface of the third leg as well as part of a lower surface of the third leg, these outer and lower surfaces of the third leg forming a lower, outer corner of the third leg. Hereby the third leg and thus the first sash side member are held by the abutment element both in the width dimension (outwardly) and in the height dimension (downwardly). Holding the sash in the width dimension helps centering and embedding the sash in the frame in the closed position of the skylight window, especially if all sash and frame side members are provided with a similar configuration.

[0121] The outer side of the first frame side member may be substantially flat. The outer side of the first frame side member may be adapted for receiving a curb flange or a cant strip.

[0122] In an embodiment, the skylight window may further comprise a motor-driven actuator comprising an elongated lifting element connecting the frame and the sash for moving the sash between the open position and the closed position, said elongated lifting element having a top end and a first position in which the skylight window is in the closed position and a second position in which the skylight window is in the open position. The top end of the elongated lifting element may abut or be attached to the sash. The motor-driven actuator may be positioned between the IGU and the frame in a direction parallel with the exposed interior major surface of the IGU in the closed position of the skylight window. The motor-driven actuator may be a chain actuator, the elongated lifting element may be a chain, and the top end may be a top end of a top joint of the chain. The lifting element in the closed position may be collapsed, rolled-up, folded-up, telescopically retracted or in another way compacted. The lifting element may be unrolled, unfolded, telescopically extended, or in another way extended in the open position.

[0123] The chain actuator may comprise a push-pull chain which can extend and retract to open and close the skylight window. Such a chain may be referred to as a trust chain as it may transmit a push force. The chain may be driven by an electric motor. A reduction gear may be provided. The reduction gear may comprise a worm and/or multiple gear drive. A final sprocket gear may engage the chain. A spindle may be used to drive the chain. The chain actuator may fold the chain when the chain is retracted and stored. The chain may be stored to substantially extend in a storing direction or such that one or more lengths of the chain extend substantially in a storing direction. The chain extending to open the skylight window may extend substantially perpendicularly to the storing direction. The storing direction may be the same as the longitudinal direction, in which case the chain may be stored to substantially extend in the longitudinal direction along a frame side member. This may provide a compact solution.

[0124] The chain actuator may be hidden inside a window frame or sash or otherwise arranged out of sight, e.g. outside a periphery of the skylight window. The chain actuator may be arranged in a spacing defined between the sash and the frame in the closed position of the skylight window. Preferably the chain actuator may be arranged inside a frame profile or inside a sash profile. The chain actuator may comprise an actuator housing. The chain may extend and retract through an opening in the

actuator housing. The actuator housing may be an elongated actuator housing. The actuator housing may extend substantially extend in parallel with the storing direction. The chain extending to open the skylight window may extend substantially perpendicularly to the actuator housing. The chain actuator housing may be hinged to the skylight window so the chain can tilt during movement such as extending and/ or retracting to open and/or close the skylight window. The chain actuator may be self-locking and support and/or hold the weight of sash and IGU. The chain actuator may also be assisted by a spring to carry some of the weight of sash and IGU. The chain actuator may comprise a locking mechanism and/or brake to lock-up the chain. Besides the compact design a chain actuator may have other advantages. The chain actuator may provide a stable opening force from the very beginning of the opening movement.

[0125] In embodiments where the secondary and tertiary legs of the frame side member are provided, the abutment element may form part of the secondary and/or of the tertiary leg of the first frame side member, and/or the abutment element may be attached to and/or abut one side the secondary leg and/or be attached to another part of the tertiary leg.

[0126] The abutment element may form a seal covering an opening or slot that would otherwise be provided between the third leg of the first sash side member and the tertiary leg of the first sash frame side member in the closed position of the skylight window.

[0127] A similar abutment element may be provided in a similar manner on or forming part of one, two or three of the remaining frame and/or sash side members. In this case, abutment elements with inclined surfaces in the manner described will help positioning and centering of the sash within the frame during closing of the skylight window.

[0128] The abutment element(s) may form the only or substantially the only resting point or resting surface of the sash or of one or more of the sash side members on the frame in the closed position of the skylight window. This provides a superior ability to position and center the skylight window during closing thereof. Other contact points between sash and frame in the closed position of the skylight window may include sealing members between associated sash and frame side members, but these sealing members preferably only carry an insignificant amount of the sash in the closed position of the window, i.e. less than 10, 5, 3, 2 or 1 percent. It is preferable that the only direct contact points between one, two, three or four of the sash side members to the associated frame side member are established by the abutment element(s) and potential sealing members. Generally, a sash side member is "associated" with a frame side member if they lie adjacent to each other in the closed position of the skylight window. In case a rotary hinge and/or a chain drive is/are included in the skylight window, the rotary hinge and/or chain drive may establish one or more indirect contact points or contact areas between sash and frame, which may also carry part of the weight of the sash in both the closed and especially in the open position of the skylight window.

[0129] In an embodiment a second, third and/or fourth sash side member is/are substantially similar and/or identical in shape and/or form and/or size and/or structure to the first sash side member.

[0130] In an embodiment a second, third and/or fourth frame side member is/are substantially similar and/or identical in shape and/or form and/or size and/or structure to the first frame side member.

[0131] In the latter two embodiments, all frame and/or side members, respectively, may have substantially identical cross sectional shapes in a cross section perpendicular to the length dimension associated with the first sash side member. Alternatively or additionally, all frame and/or sash side members, respectively, may be substantially identical to each other.

[0132] Thus, two or more of the four respective frame and sash side members may be similar or substantially identical to each other. This makes it cheaper to produce and may allow for optimal movement and positioning of the sash during opening and closing of the skylight window. Also, safe sealing may be provided between the sash and frame, simple mounting may be achieved and the structural properties of the frame and/or sash are the same on all sides of the skylight window.

[0133] In case the first sash side member comprises the above described fourth leg, the weather shield may be attached to the fourth leg. In case all four sash side members comprise the above described fourth leg, the weather shield may be attached to each of the fourth legs.

[0134] In alternative embodiments, the weather shield may be replaced by a flat window pane, which may be positioned to be substantially parallel to the window portion.

[0135] In another development of the embodiment comprising a third leg, the first frame side member further comprises a cover leg that covers the third leg in the closed position of the skylight window so as to at least partly or substantially hide the third leg when seen from below the interior major surface of the IGU.

[0136] Hereby the third leg, which is typically the only or the most visible element of the first sash side member when seen from inside the building, may be at least partly or completely hidden when seen from inside the building in an installed position of the window.

[0137] The cover leg may extend in the longitudinal direction along substantially an entire length of the first leg and/or the first sash side member.

[0138] In the embodiment where the first frame side member comprises a tertiary leg, the cover leg may form part of the tertiary leg or extend from an inward surface of the tertiary leg. The cover leg and the secondary and tertiary legs of the first frame side member may establish a longitudinally extending groove, potentially with the secondary leg and the cover leg defining sides thereof and the tertiary leg defining a bottom thereof, and into

which the third leg of the first sash side member is inserted or embedded when the sash moves to the closed position of the skylight window.

[0139] In an embodiment, the first frame side member further comprises a lining panel protrusion located lower than the exposed interior major surface of the IGU in the height direction, wherein the interior pane comprises a side surface extending substantially along the first frame and sash side members, wherein the lining panel protrusion protrudes away from the IGU, the lining panel protrusion comprising a first surface for abutting a surface of a reveal panel or lining panel so as to position the reveal panel or lining panel, and-wherein, in the closed position of the skylight window, the first surface of the lining panel protrusion in a lateral direction extending along the exposed interior major surface of the IGU is positioned farther away from the side surface of the interior pane than the supporting section.

[0140] The skylight window may comprise a removable lining panel protrusion and/or recess. The removable lining panel protrusion and/or recess may be separately affixed to the frame and may be a part that is separate from the frame i.e. not an integral part of the frame.

[0141] In an embodiment the skylight window is installed in or on a flat roof of a building to cover a roof opening of the roof, said exposed interior major surface of the IGU facing an interior of the building.

[0142] In an embodiment the skylight window is installed in or on an inclined roof of a building to cover a roof opening of the roof, said exposed interior major surface of the IGU facing an interior of the building.

[0143] A flat roof may be defined as a roof with a roof inclination, i.e. an inclination of a roof surface, of less than 5 degrees in relation to horizontal.

[0144] An inclined roof may be defined as a roof with a roof inclination. i.e. an inclination of a roof surface, of more than 5 degrees inclination in relation to horizontal.

[0145] The skylight window may be positioned so that a major part of or the entire frame and/or the entire sash are positioned above an upper roof surface level.

[0146] Interior and exterior major surfaces of the IGU may be substantially parallel in the closed position of the window with a plane defined by the roof surface or may have an inclination of less than 1, 2, 3, 4 or 5 degrees to said roof surface plane.

[0147] A person skilled in the art will appreciate that any one or more of the above embodiments and/or developments and/or options may be combined with each other to form further embodiments of the present invention.

Detailed Description

[0148] In the enclosed drawings, which show non-binding examples of embodiments of the present invention,

Fig. 1 is a perspective view from above of an embodiment of a skylight window according to the present invention installed in a roof,

Fig. 2 is a cross-sectional view showing another embodiment of the first sash side member of the skylight window 1 with a flat weather shield,

Fig. 3 is a cross-sectional view similar to that of Fig. 2 showing an alternative embodiment of a first sash side member of a skylight window 1.

Fig. 4 is a cross-sectional view of an embodiment of the first sash side member of the skylight window 1.

Fig. 5 is a cross-sectional view of an embodiment of the skylight window 1,

Fig. 6 is a perspective view of an embodiment of a skylight window 1 where a part of the window has been removed, and

Fig. 7 is a cross-sectional view of another embodiment of the skylight window 1.

[0149] Fig. 1 shows an embodiment of a skylight window 1 according to the present invention installed or positioned substantially horizontally in a flat roof 2 of a building and covering an opening in the roof. The skylight window 1 comprises a weather shield 3 and a window portion 4, which includes a transparent insulting glazing unit 5, abbreviated IGU, a sash 6 supporting the IGU 5, and a frame 7. The weather shield 3 comprises a transparent weather shield pane 8 and a skirt 9, which cover the sash and the IGU.

[0150] In this embodiment, both the entire sash 6 and the entire frame 7 are positioned above an upper roof surface, also denoted the exterior roof surface. The skylight window 1 may, however, also be positioned so that a part of the frame 7 and the sash 6 are positioned below the exterior roof surface level.

[0151] The flat roof 2 shown here has a roof inclination of less than 5 % in relation to horizontal. The skylight window may however also be installed in an inclined roof.

[0152] As is seen in Figs 2-4, the IGU 5 has an exposed interior major surface 5b facing downwards towards an interior of the building in the shown installed position of the skylight window 1 and an exposed exterior major surface 5g facing in the opposite direction towards the weather shielding pane 8 and the exterior. The interior and exterior exposed major surfaces of the IGU 5 are substantially parallel with a plane defined by the roof surface, i.e. the exterior roof surface level.

[0153] The frame 7 comprises four frame side members of which two 10, 11 are visible in Fig. 1, and one 10 is visible in Figs 2-4. Each frame side member is associated with one of four corresponding sash side members of which one 14 is visible in Figs 2-4. The frame side member 10 is associated with the sash side member 14 and both extend a longitudinal direction L along a first peripheral side 5a of the IGU 5. The four frame side members form a substantially rectangular shape and, similarly, the four sash side members form a substantially rectangular shape. In this embodiment each frame side member is positioned at an outer side of a respective

associated one of the four sash side members, i.e. on the side facing away from the IGU, so that the sash fits into the frame and the frame 7 encloses the sash 6 in the closed position of the skylight window 1.

[0154] The slightly curved weather shield pane 8 as seen in Fig. 1 extends over an entire roof opening (not shown), which opening the skylight window 1 is positioned to cover.

[0155] The shield pane 8 is surrounded by the weather shield skirt 9, which extends on an outer side of all four sides of the frame 7, i.e. of the respective frame side members, see Fig. 1.

[0156] The frame side member 10 is an embodiment of the first frame side member of the skylight window according to the invention. The sash side member 14 is an embodiment of the first sash side member according to the invention.

[0157] The window sash 6 supports the IGU 5 and is connected to the window frame 7 via hinges (not shown) so that it is movable in relation to the frame 7 between an open (not shown) and a closed position of the skylight window 1. The window is shown in the closed position in all of the figures.

[0158] In Fig. 2, the second leg 16 projects from a surface 15b of the first leg 15 in the width dimension, which surface 15b extends substantially in the height dimension and a third leg 17 projects from the surface 15c of the first leg 15, which surface 15c extends substantially in the height dimension and is substantially perpendicular to the interior major surface 5b of the IGU.

[0159] As shown in Fig. 2, an angle between the first 15 and second 16 legs and between the second and third legs 17 is substantially 90 degrees, respectively.

[0160] The first leg 15 is formed integrally with the second leg 16, and the third leg is formed integrally with the first leg 15.

[0161] The inner or distal end 16b of the second leg 16 is positioned oppositely from an outer or proximal end 16e of the second leg 16, said outer end 16e being connected to the first leg 15 at a location from which the second leg 16 projects.

[0162] The first 15 and a fourth 31 legs project in substantially opposite directions from the second 16 and third leg 17, these opposite directions both being substantially in the height dimension.

[0163] In relation to the sash side member 14 as shown in Fig. 2, a length dimension is defined as a dimension in which said longitudinal direction L extends, a height dimension is defined as a direction perpendicular to the length dimension and to the interior major surface of the IGU, and a width dimension is defined as a dimension perpendicular to the height and length dimensions. The width and length dimensions are parallel to the interior major surface of the IGU. The downward direction is the direction in the height dimension towards which the interior major surface 5b of the IGU 5 faces. The upward direction is a direction opposite to the downward direction. An inward direction is a direction in the width dimension towards a centre of the IGU 5 or towards the opposing sash side member 13 as shown in Fig. 1, and the outward direction is a direction opposite to the inward direction. This also applies to the other figures.

[0164] As may be seen, the frame side member 10 in this embodiment comprises a bottom surface 10a, which is level with the exterior roof surface of the roof 2. This bottom surface 10a faces downwards and comprises a recess 10b, which is an empty spacing that accomodates an upper part or upper end 50a of a reveal panel or lining panel 50 in the installed position of the skylight window 1. The remaining three frame side members are provided with similar recesses accomodating respective similar panels. These panels define the reveal or aperture or light well or light shaft, which extends through the roof 2 so as to cover side surfaces of an opening in the roof, which allows daylight to reach the interior of the building.

[0165] The recess 10 comprises a first surface 10c that abuts an inwardly facing surface of the lining panel 50. The IGU extends beyond said first surface 10c of the recess 10 in the width direction so that the peripheral side 5a of the IGU 5 is located on the outer side of the recess in the width direction.

[0166] The recess 10b comprises a second surface 10d positioned oppositely from said first surface for abutting an outwardly facing surface of said reveal panel or lining panel when received in said recess. The first and second surfaces 10c, 10d of the recess 10 extend substantially in the height dimension and are substantially linear. A distance between these first and second surfaces defines a width of the recess, which width corresponds to a width of the upper part 50a of the lining panel 50 in order to accommodate the lining panel upper part 50 in the recess 10b.

[0167] The weather shield 3 is here provided as a unitary structure, which is separate from but connected to the window portion 4, specifically to the sash 6 so as to move together with the sash 6 during the opening and closing movement thereof. The weather shield 3 is mounted on the window portion 4 for covering and weather protecting the window portion 4 in the installed state of the skylight window 1. The weather shield pane 8 is curved towards the exterior, i.e. upwardly in Fig. 1, in relation to the window portion 4. In other embodiments, a flat pane may be used to for the weather shield 3 as seen in Fig. 2. The weather shield pane 8 is transparent and here comprises only one single layer of glazing made for example of hardened glass.

[0168] The first leg 15 projects in an upwards direction away from the exterior major surface 5g of the IGU 5. The direction away from the exterior major surface 5g of the IGU 5, in which direction the first leg 15 projects, extends substantially in the height dimension and extends upwards, i.e. towards the exterior the building in the installed position of the skylight window 1.

[0169] As shown in Fig. 2, the first frame side member 10 comprises a primary leg 25 with a surface 25b extending next to and along a side surface 15c of the first leg

of the sash side member 14, said side surface 15c facing substantially away from the first peripheral side 5a of the IGU 5. The primary leg at a lower end thereof is connected to an outer end of a secondary leg 26. The lower end of the primary leg is positioned below the interior major surface 5b of the IGU 5. A stepped configuration of adjacent surfaces of the first sash side member 14 and first frame side member 10 is thus achieved by means of the stepped configuration of the first sash side member 14 and an associated stepped structure of the first frame side member 10. This stepped structure provides a labyrinth type structure acting to prevent dirt, water and contaminants from entering the interior of the building from an exterior of the building.

[0170] As seen in Fig. 2, in a cross section perpendicular to the length dimension or longitudinal direction L all legs 15, 16, 17, 25, 26 may each be substantially shaped as a rectangle. In this embodiment the first leg 15 of the sash side member is extending in the height direction, a surface 15c of the first leg 15 in the closed position of the window 1 extending along the surface 25b of the primary leg 25, both surfaces being slightly inclined with about 5 degrees with respect to the height dimension. This inclination is in an outward and upward direction in Fig. 2. The third leg 17 comprises a lower supporting surface 17a facing an upper surface 25c of the primary leg 25 and extends at an angle of about 90 degrees in relation to the height dimension. The surfaces 15c, 25b extend substantially in parallel in the closed position of the window 1.

[0171] In this embodiment, all sash and frame side members each have a substantially uniform cross section along a length of these in the longitudinal direction L, except possibly for holes being provided for the attachment of a locking assembly, hinges or the like. Local recesses may also be provided for accommodating hinges and the like.

[0172] Fig. 2 shows an embodiment where the second leg 16 comprises a supporting section 72 which is adhered to the exposed exterior major surface 5g of the IGU 5 by an adhesive 74. The adhesive may for example be a silane-terminated polyurethane (SPUR) adhesive, but may a silyl modified-polymer (SMP) adhesive or any other suitable adhesive may also be used. The adhesive may also be provided as an adhesive tape.

[0173] This may for example allow the adhesive tape to be pre-applied to the supporting section 72 with a covering strip remaining on the side meant for adhering to the exposed exterior major surface 5g of the IGU 5, such that the covering strip may simply be removed from the adhesive tape when it is time to adhere the supporting section 72 to the exposed exterior surface of the IGU 5g. This may allow the sash side member(s) to be prepared for adhesion to the IGU in advance of assembly of the skylight window and so allow optimisation of the production and assembly process. In this way sash side members may be provided ready to assemble in a kit or packaging e.g. during transportation or storage. The exposed interior major surface 5b of the IGU in this example abuts and seals on the sealing element 22 located on the frame side member 10.

[0174] Such as seen in Fig. 2, the adherence provided by the supporting section 72 being adhered to the exposed exterior major surface 5g of the IGU 5 may be the substantially only attachment of the first sash side member 14 to the IGU 5.

[0175] The first sash side member 14 may include a further supporting section (not shown) which is provided as a safety device that will catch the IGU in case the adherence between the supporting section 72 and the IGU 5 fails in the open position of the skylight window 1. The further supporting section may comprise a cushioning element to dampen any impact that may occur.

[0176] A third leg 17 projects from an upper end of the first leg 15 in an outwardly direction where a fourth leg 31 projects from an outer end of the third leg 17 in an upwards direction.

[0177] The third leg 17 shown in Fig. 2 has an oblong shape in the width dimension so that the width of the third leg 17 is more than 4 times wider than the height thereof. The third leg 17 extends in the width dimension more than the second leg 16. The height of the third leg 17 is about double the height of the second leg 16.

[0178] The window is here provided with a curb flange 40 that can be attached and detached to suit the given installation scenario, such as installation in a flat or inclined roof, or installation of two or more skylight windows 1 closely adjacent to each other in which case there may not be room for the curb flange.

[0179] The exposed interior major surface 5b of the IGU 5 abuts a sealing element 22 on the frame side member 10. That is, sealing between the IGU 5 and the frame side member 10 is achieved by a sealing element 22 sealing directly against the IGU 5. This allows the skylight window 1 to be provided without a sash side member extending along the exposed interior major surface 5b of the IGU 5. Thus the IGU 5 is positioned lower in the window structure i.e. closer to the interior of the building in which the window 1 is installed.

[0180] Fig. 3 shows the same cross sectional view as Fig. 2, but for a different embodiment of the invention. The weather shield 3 is here dome-shaped, whereas it was flat in Fig. 2.

[0181] As is seen in Fig. 3, the sash side member 14 has a first leg 15 extending along the first peripheral side 5a of the IGU 5, and a second leg 16 projecting from a lower end 15a of the first leg 15 in the lateral or width direction inwards underneath the IGU 5.

[0182] In Fig. 3 the second leg 16 includes a resting surface 16a on which said interior major surface 5b of the IGU 5 rests. The interior major surface 5b of the IGU is abuts a sealing member 78, which is manufactured from a resilient material and extends in the longitudinal direction L over substantially the entire length of the first peripheral side 5a of the IGU 5 or of the second leg 16. The upper resting surface 16a and/or the sealing member

may alternatively be moved further to the left in Fig. 3.

[0183] In this embodiment, all four sash side members have the structure as described for the sash side member 14 and the corresponding or associated four frame side members have the same structure as the frame side member 10, but this need not always be the case.

[0184] In Fig. 3, interior major surface 5b of the IGU 5 abuts a sealing element 22 in the closed position of the window 1, which sealing element 22 is a separately provided element forming part of the frame 7 and which is attached to the remaining parts of the frame 7. This sealing element 22 may be made of a resilient material enabling it to carry some load.

[0185] In the example shown in Fig. 3, the second leg 16 may comprise the only supporting point of the sash side member 14, which rests on the frame 7 in the closed position of the skylight window 1. Similarly, corresponding second legs of the remaining three sash side members each may comprise only one supporting point for the respective sash side member on the frame 4 in the closed position of the skylight window 1, except for the contact provided by the hinges or an abutment element.

[0186] Other contact points or contact surfaces between the sash 6 and frame 7 in the closed position of the skylight window 1, which contact surfaces are not carrying any substantial amount of the weight of the sash 6 (and IGU and weather shield 3) in the closed position of the skylight window 1, may include not shown sealing members between associated sash and frame side members. As is best seen in Fig. 3, the IGU 5 in a conventional manner comprises three layers of glazing 5c, 5d, 5e positioned at a respective distance from each other to form respective spacings or cavities between them. These spacings are in a conventional manner filled with a gas to improve insulation. The lowermost surface 5b constituting the exposed interior major surface is a lower major surface of the lowermost glazing layer 5d. Sealing and supporting members 23, 24 are provided at the peripheral side 5a of the IGU 5 between the layers 5c, 5d, 5e of glazing so that outer sides of the layers 5c, 5d, 5e and the sealing and supporting members 23, 24 define a side or lateral surface 5f of the IGU 5 together with the end surfaces of the glazing layers. This side surface is substantially plane and extends substantially in the height dimension shown in Fig. 3.

[0187] The IGU 5 has a rectangular shape and has further second to fourth peripheral sides that each extends along a corresponding respective sash and frame side member in a similar manner as described above for the sash side member 14.

[0188] In Fig. 3, the first leg 15 is positioned adjacent to the side surface 5f of the first peripheral side 5a of the IGU 5. The second 16 leg is positioned adjacent to the interior major surface 5b of the IGU 5. The first leg 15 extends along the side surface 5f, the latter having an angle to the interior major surface 5b of the IGU 5 of approximately 90 degrees. The distance in the width dimension between the peripheral side of the IGU 5a and surface 25b of the first frame side member extending substantially in parallel with said peripheral side of the IGU 5a and facing towards the IGU is 20 mm.

[0189] As can be seen in Fig. 3, the first leg 15 extends more than 4 times longer in the height dimension than in the width dimension. The extent in the length dimension of the legs 15, 16, 17 is substantially equal to the extent of the first peripheral side 5a of the IGU 5 in the length dimension, but preferably slightly longer in order to allow them to be interconnected at the corners of the sash. The extents measured in this context are a total or largest extent of the leg 15, 16, 17 in question in the relevant dimension.

[0190] The first leg 15 extends about 100 % of the distance between said exterior and interior major surface of the IGUs in the height direction from the exterior major surface of the IGU, i.e. having a height which is about twice the thickness of the IGU in the embodiment shown in Fig. 3.

[0191] In Fig. 3 the first leg 15 does not extend to cover said exterior major surface of said IGU. No part of the sash 14 and frame 10 extends over the exterior major surface of the IGU 5 in this embodiment. In the latter context, a fixation member 30 mentioned below is not considered part of the sash side member 14.

[0192] As seen in Fig. 3, the first leg 15 comprises on the surface 15b three grooves 28, 29, 80 the first groove 28 being positioned at a first distance from the interior IGU plane, the second groove 29 being positioned at a second, smaller distance from the interior major surface of the IGU, while the third groove 80 being positioned at a third, smaller distance from the interior major surface of the IGU. The first, second and third grooves 28, 29, 80 are adapted for receiving the fixation member 30, which can be attached to or snap-locked to either one of the two grooves 28, 29, 80 abutting the exterior major surface of the IGU 5 so as to hold the IGU 5 along said first peripheral side 5a thereof, especially in the upward direction. The fixation member 30 is positioned in the groove 80 in the shown embodiment. Hereby the IGU 5 may be exchanged with an IGU of larger thickness by switching the fixation member 30 to the other groove 29 or 28. The fixation member 30 is manufactured of a plastic and sealing material and comprises a projection adapted to be in abutment with the upper or exterior major surface 5g of the IGU 5 such as to hold this in place against the upper resting surface 16a of the second leg 16. The fixation member 30 extends substantially along an entire length (in the longitudinal direction L) of the first peripheral side 5a of the IGU 5. Similar fixation members are attached to similar grooves of the one, two or three of the other sash side members at the other three peripheral sides of the IGU 5.

[0193] A chain drive or the like (not shown) may be provided connecting the sash 6 and frame 7 for assisting in opening and closing the skylight window 1.

[0194] In the embodiment shown in Fig. 3, the sash side member 14 has a fourth leg 31 projecting from an

upper end of the first leg 15 in the outward direction away from the IGU 5 in the width dimension. The fourth leg 31 is in the closed position of the window 1 positioned above the primary leg 25 of the frame side member 10 as shown in Fig. 3.

[0195] In Fig. 3, as is the case for the legs 15, 16, 17, the fourth leg 31 has a flat shape so that an upper surface thereof forms a further upper step surface similar to and potentially extending substantially in parallel with the upper resting surface 16a of the second leg 16.

[0196] The fourth leg 31 has an oblong shape in the width dimension and extends more than 4 times longer in the width dimension than in the height dimension. The extent in the length dimension of the fourth leg 31 is substantially equal to about equal to or somewhat longer than the extent of the first peripheral side 5a of the window pane 5 in the length dimension.

[0197] In Fig. 3, an angle between the first 15 and fourth 31 leg is substantially 90 degrees.

[0198] The fourth leg 31 is formed integrally with the first leg 15.

[0199] The fourth and second legs 31, 16 extend or project substantially in parallel.

[0200] In the cross section shown in Fig. 3, the fourth leg 31 is substantually shaped as a rectangle, a surface 31 b of the fourth leg 31 extending substantially along an upper surface 25c of the primary leg 25 being parallel to the upper surface 25c.

[0201] The fourth leg has an overall or total height in the height dimension less than the thickness of the IGU 5.

[0202] The skirt 9 of the weather shield 3 is attached to each of the fourth legs of the four sash side members as seen in Fig. 1.

[0203] In Fig. 3, the sealing element 78 is made of an elastic, plastic and sealing material.

[0204] Similar sealing elements are provided in a similar manner on the remaining frame side members. The sealing elements form the only or substantially the only resting point or resting surface of the sash 6 (including the IGU 5 and the weather shield 3) on the frame 7 in the closed position of the skylight window 1.

[0205] Roofing felt (not shown) may in a conventional manner be positioned to seal between outer surfaces of the frame 7 and of the roof 2. These outer surfaces of the frame 7 are here formed by a curb flange of the frame 7. In Fig. 3 a curb flange 40 is shown, which curb flange 40 has an overall triangular shape and forms part of the frame side member 10. Similar curb flanges are here provided at the remaining frame side members.

[0206] In all the above-mentioned figures as well as the following one, the same reference numbers as in Figs 1-3 will be used for features having substantially the same function even if not they are not structurally identical.

[0207] Fig. 4 shows a cross-sectional view of the skylight window 1. The weather shield 3 is dome-shaped. The supporting section 72 of the first sash side member may extend further than shown in Fig. 4. It may also comprise a thermal break 75. The thermal break 75 may be made from a material of a lower thermal conductivity than other parts of the first sash side member 12 and is used to reduce any potential thermal bridges from the sash. The supporting section 72 may also comprise a material discontinuity to reduce the heat transfer at this point, hence the thermal break may be used to insulate the specific part of the sash side member. The supporting section may also comprise a fixation element 76, which fixation element 76 acts as support between the IGU and the first sash side member and/or may be made of a material that has insulating properties.

[0208] In Fig. 2, the first leg has a thickness in a width direction extending perpendicularly to said length and height directions which is denoted with T. The first leg 15 of the first sash side member is generally plate-shaped, consists of one single section of substantially solid material and at least a portion of the first leg has a said thickness less than 1 cm. The legs of the first sash side member 14 may be attachable or detachable from each other. The first leg 15 may comprise metal. The sash is made from a thermoset plastic polymer material comprising fibers, but could also comprise metal such as aluminium. This provides a siginficantly thinner sash which allows the IGU to be placed lower in the window structure and extend closer to the frame side member. The first leg having a thickness of less than 1 cm allows the distance between the peripheral side 5f of the IGU and the inner side surface 25b of the first frame side member 10 facing towards the IGU, to be less than 20 mm. This provides a significantly thinner sash which is particulaly advantagous when the sash extends along the exposed interior major surface of the IGU 5b and/or along a peripheral side of the IGU 5 as the reduction in material thickness allows the IGU to be positioned lower in the window structure and extend closer to the frame side member as seen in Figs 2-4. Positioning the IGU lower and making it extend further to the sides contrigutes to the overall insulating properties of the skylight window as IGUs generally have better insulating properties than the material used for the sash and frame.

[0209] In Fig.5, the IGU 5 is supported by a first sash side member 14 and the skylight has a weather shield 3, which is substantially flat here, with a weather shield skirt 9. The first leg 25 of the first frame side member 10 extends in the height direction and the second leg 26 of the first frame side member extends in the width direction. The second leg 26 extends from the first leg 25 in the width direction toward a frame opening 201. In this embodiment, part of the bottom surface 10a is positioned on the roof 2, whereby the window frame is supported by the roof 2, and part of the bottom surface 10a extends above the opening in the roof.

[0210] The first frame side member 10 and the first sash side member 14 extend in a length or longitudinal direction L, along the side surface 5f of the interior pane in the closed position of the IGU 5.

[0211] The first sash side member 14 has a supporting section 72, the supporting section 72 being positioned

below the interior major surface 5b. The supporting section 72 carries at least part of the weight of the IGU 5. The first sash side member 14 further has the first leg 15 connected to the supporting section 72. The first leg 15 extends in the longitudinal direction L and in the height direc-tion H. The first leg 15 is generally plate-shaped and consists of only one sin-gle section of substantially solid material having a thickness in the width direc-tion of less than 1 cm.

[0212] The first frame side member 10 in Fig. 5 is substantially L-shaped, the first leg 25 extending in the height direction H, and the second leg 26 extending from a lower portion of the first leg 26 in the width direction W toward the IGU. The first frame side member further has a supporting section 112, the supporting section 112 is connected to the second leg 26 and is positioned below the IGU 5 in the height direction H. In the closed position shown in Fig. 5, the supporting section 112 carries a structural load of the IGU 5 and the first sash side member 14. The supporting section 112 is connected to the second leg 26, and in an installed position of the skylight window 1 on the roof 2, the structural load from the IGU 5 and the first sash side member 14, is transferred from the supporting section 112 to the second leg 26 and further to the roof 2. A sealing element 22 is provided between the supporting section 112 and the interior major surface 5b.

[0213] The outer side 110a of the first leg 25 faces away from the frame opening 201 and the bottom surface 10a of the second leg 26 faces in the interior of the building, in the interior direction D. The major outer surface 110b of the outer side 110a is both perpendicular and adjacent to the bottom surface 10a of the second leg 26.

[0214] The first frame side member 10 has a pre-formed hole 45. The pre-formed hole 45 extends from the major outer surface 110b toward the bottom surface 10a in a direction inclined in relation to frame plane. In this embodiment, the pre-formed hole 45 is a through-hole. The pre-formed hole 45 forms an angle α with the frame plane. In this embodiment the angle α is approximately 70 degrees.

[0215] A fastener (not shown) inserted through the pre-formed hole 45 would fasten the skylight window 1 to the roof 2. Fig. 5 further shows a curb flange 40 positioned on the roof 2 adjacent to a lower portion of the outer side 110a of the first leg 25. An opening 45a of the pre-formed hole 45 in the major outer surface 110b is positioned above the curb flange 40. Fasteners 46 are shown to indicate the possible fastening of the curb flange 40 to the roof 2 and/or first frame side member 10. The curb flange 40 further com-prises tracks acting as screw guides. The tracks extend in a height, width and inclined direction with regards to the frame plane and are in this embodiment in the form of through holes. Roofing felt (not shown) may be mounted to cover part of the roof 2, the inclined outer surface 41 c, part of the major out-er surface 110b and the joints between the roof 2 and curb flange 40 and the major outer surface 110b and the curb flange 40.

[0216] Fig. 6 shows a perspective view from above of an embodiment of the skylight window 1 according to the present invention installed in a roof 2 (not shown), where a part of the window has been removed for illustration purpose. The window frame 7 and the window sash 6 correspond to the ones shown in Fig. 5. The weather shield pane 8 here has been removed for clarity. Fig. 6 also shows a screening device 34, which is mounted in a spacing delimited in the width direction W by the first 14 and second sash side members. It is to be understood that the second sash member is substantially identical to the first sash side member 14 so that the exterior sides of the sash side members together define an exterior side of the sash 6 which extends substantially in parallel to the exterior major surface 5g of the IGU 5.

[0217] Towards the interior, the spacing is delimited in Fig. 6 by the step surface 17c formed by the third leg 17 of the sash side member 14. The step surface 17c thus serves as a screening device support section extending from the first leg 15. The screening device 34 is here depicted as a roller curtain in which the screening body 36 is a covering cloth, which at least partially rolled up on a collection device 35 in the form of a collection roller in the first non-screening, end position, but which is here shown in a second, screening end position, where it is extended towards second sash side members for covering the IGU 5. The screening device 34 might, however, also be another type of blind or a shutter. In Fig. 6, also a fixation member 39 is attached to the first sash side member 14 and extending towards the second sash side member. The fixation member 39 contributes to retaining a top casing of the screening device 34 by preventing it from moving upwards, away from the exterior major surface 5g of the IGU.

[0218] Turning to FIG. 7, which shows another embodiment of the skylight window 1 without the weather shield, the IGU 5 in this embodiment comprises three layers of glazing 5c, 5e, 5d in the form of glass panels, positioned at a distance from each other by sealing members 23, 24 located at peripheral sides of the IGU between the layers of glazing to form two spacings 25. These spacings 25 are filled with inert gas to improve insulation. It should also be noted that the top layer of glazing 5c in this embodiment is larger than the other layers of glazing 5e, 5d of the IGU 5 and extends farther in the width direction, the layers of glazing however, may be of equal size in other embodiments.

[0219] The four sash side members made of pultruded glass fibre reinforced PUR support the IGU 5 which has multiple panes or layers of glazing 5c, 5d, 5e (the interior pane constitutes a layer of glazing of the IGU) and the sash 6 is connected to the window frame 7 via hinges (not shown) so that, in a conventional manner, it is movable (pivotable) in relation to the frame 7 between an open (not shown) and a closed position of the skylight window 1. Other hinges are also possible for example linear displacement or multi link mechanisms. The sky-

light window 1 is hinged here to open towards the exterior. The first sash side member 14 further has a sealing element 76 for abutting the exposed interior major surface 5b of the IGU 5 in the closed position of the skylight window 1.

[0220] In the closed position of the skylight window 1 here, the first frame side member 10 is located farther from a side surface 5s of the lowermost glazing layer 5d than the supporting section 72. This helps covering and hiding the supporting section 72 and the first sash side member 14 when viewing through the window 1 from the interior of a building, thus providing a clean and aesthetic appearance.

[0221] The first frame side member 10 has a total frame height HF extending in a height direction from the bottom surface 10a of the first frame side member 10 to a top surface 10t of the first frame side member 10, the height direction being substantially perpendicular to at least one of the major surfaces 5b, 5g of the IGU 5 in the shown closed position of the skylight window 1. The first frame side member 10 further has an interior part 78 extending below the exposed interior major surface 5b of the IGU and being located within the periphery of the lowermost glazing layer 5d, said interior part having a total height HI in the height direction. Similarly, the first sash side member 14 having a total sash height HS in the height direction. The total height of the supporting section 72 is denoted HL. The total height of the supporting leg HL in the embodiment shown in Fig. 7 is 10% of the total frame height HF.

[0222] The first frame side member 10 further comprises a lining panel protrusion 10e located lower than the exposed interior major surface 5b of the IGU 5 in the height direction. The lining panel protrusion 10e protrudes away from the IGU 5 and has a first surface 10c for abutting a surface of the reveal panel or lining panel 50 so as to position a reveal panel or lining panel 50 as shown in Fig. 7. The reveal or lining panel 50 covering the first frame side member 10 to provide a seamless and clean aesthetic when viewing through the skylight window 1 from an interior of the building.

[0223] In the closed position of the skylight window, the first surface 10c of the respective protrusion 10e of each embodiment in a lateral direction extending along the exposed interior major surface 5b of the IGU 5 is positioned farther away from the side surface 5s of the lowermost glazing layer 5d than the supporting section 72.

[0224] The first surface 10c of the lining panel protrusion 10e together with a second surface 10d of the first frame side member form the sides of a lining panel recess 10b, which is an empty spacing that accommodates an upper part or upper end of a reveal panel or lining panel 50 in the installed position of the skylight window 1. It should be noted that the skylight window in other embodiments does not comprise a lining panel recess, but may just comprise a lining panel protrusion 10e. It should also be noted that the skylight window may comprise a removable lining panel recess or protrusion 10e which is separatly affixed to the frame 10 and not an integral member of the frame.

[0225] A sealing member 22 for abutting the first sash side member 10 in the closed position of the skylight window 1 is located on a side of the first frame side member 14 that faces the sash 6 and abuts the first sash side member 14 in the closed position of the skylight window 1.

[0226] In this embodiment, the sash 6 is substantially made of aluminium. A thermal break 75 is comprised in the first sash member 14 and is located adjacent to the first peripheral side 5a of the IGU facing towards the spacing 25 that is formed between the lowermost glazing layer 5d of the IGU and the layer of glazing 5e.

[0227] As seen in Fig. 7, the entire supporting section 72 is located within the periphery of the window frame 7 and is substantially solid. The supporting section 72 constitutes the part of the first sash side member 14 that is located below the exposed interior major surface 5b of the IGU 5 and within the periphery of the lowermost glazing layer 5d of the IGU 5. In embodiments the supporting section 72 is positioned substantially at the lowermost portion of the sash side member 14. The supporting section 72 also has a width extending in the shown width direction which is perpendicular to the height direction and to the longitudinal direction L and has a ratio of the total height of the supporting leg HL to the total supporting leg width WL of 1:5 and a ratio of the total supporting leg width WL to total sash height HS ratio of 1:2. The total sash height HS is 45% of the total frame height HF and the total height of the interior part HI is 89% of the total frame height HF. The total height of the supporting leg HL in the embodiment shown in Fig. 7 is 7% of the total frame height HF.

Claims

1. A skylight window (1) for being installed in a roof of a building, the skylight window (1) comprising:

   a window frame (7) having four frame side members,

   a window sash (6) having four sash side members supporting an Insulating Glazing Unit (IGU) having multiple layers of glazing, said window sash being movable in relation to the window frame between an open and a closed position of the skylight window,

   a weather shield (3) attached to the sash so as to protect a window portion (4) of the skylight window, the window portion (4) comprising the sash, the frame and the IGU,

   a first of the frame side members being associated with a first of the sash side members, said first frame and sash side members extending in a respective longitudinal direction substantially in parallel with a respective first peripheral side

of the IGU,
said IGU having an exposed interior major surface (5b) for facing an interior of said building in an installed position of the skylight window,
said IGU further having an exposed exterior major surface (5g) facing in an opposite direction towards an exterior in said installed position of the skylight window,
where said weather shield (3) extends across substantially the entire exposed exterior major surface (5g),
wherein in a closed position of said skylight window said first sash side member extends in a longitudinal direction substantially in parallel with said first frame side member,
said first sash side member having a first leg (15) connected to a supporting section (72) of the first sash side member supporting the IGU, the first leg (15) extending in said longitudinal direction and extending substantially in a height direction substantially perpendicularly to at least one of said major surfaces of the IGU, said first leg having a thickness in a width direction extending perpendicularly to said length and height directions,
characterized in that
at least a portion of said first leg (15) of the first sash side member is generally plate-shaped, consisting of one single section of substantially solid material having a said thickness less than 1 cm.

2. A skylight window according to claim 1, wherein said first leg has a height to thickness ratio of at least 4:1.

3. A skylight window according to any of the preceding claims, where the distance between a peripheral side of the IGU and an inner side of a frame side member extending substantially in parallel with said peripheral side of the IGU and facing towards the IGU is less than 20 mm, preferably less than 15 mm.

4. A skylight window according to any of the preceding claims, where the sash side members are connected to the exterior major surface of the IGU and extending away from the interior major surface of the IGU.

5. A skylight window according to any of the preceding claims, where the sash side member further comprises a second leg and possibly further legs.

6. A skylight window according to claim 5, where the legs form a stepped profile when seen in a cross-section perpendicular to the longitudinal direction, where each leg may be substantially perpendicular to an immediately preceding leg and/or to an immediately following leg.

7. A skylight window according to claim 5, where at least some legs are attachable/detachable to/from each other.

8. A skylight window according to any of the preceding claims, where the skylight window comprises one or more thermal breaks being located in the sash side member, so that possible thermal bridges are avoided.

9. A skylight window according to any of the preceding claims, where the sash side member comprises one or more recesses adapted for securing one or more sealing elements.

10. A skylight window according to any of the preceding claims, where the first leg comprises or substantially consists of metal, such as steel or aluminium and/or polymer.

Amended claims in accordance with Rule 137(2) EPC.

1. A skylight window (1) for being installed in a roof of a building, the skylight window (1) comprising:

a window frame (7) having four frame side members,
a window sash (6) having four sash side members supporting an Insulating Glazing Unit (IGU) (5) having multiple layers of glazing, said window sash being movable in relation to the window frame between an open and a closed position of the skylight window,
a weather shield (3) attached to the sash so as to protect a window portion (4) of the skylight window, the window portion (4) comprising the sash, the frame and the IGU (5),
a first of the frame side members (10) being associated with a first of the sash side members (14), said first frame and sash side members extending in a respective longitudinal direction substantially in parallel with a respective first peripheral side of the IGU (5),
said IGU having an exposed interior major surface (5b) for facing an interior of said building in an installed position of the skylight window,
said IGU further having an exposed exterior major surface (5g) facing in an opposite direction towards an exterior in said installed position of the skylight window,
where said weather shield (3) extends across substantially the entire exposed exterior major surface (5g),
wherein in a closed position of said skylight window said first sash side member (14) extends in a longitudinal direction substantially in parallel

with said first frame side member (10),
said first sash side member (14) having a first leg (15) connected to a supporting section (72) of the first sash side member supporting the IGU, the first leg (15) extending in said longitudinal direction and extending substantially in a height direction substantially perpendicularly to at least one of said major surfaces of the IGU, said first leg having a thickness in a width direction extending perpendicularly to said length and height directions,
characterized in that
at least a portion of said first leg (15) of the first sash side member (14) is generally plate-shaped, consisting of one single section of substantially solid material having a said thickness less than 1 cm.

2. A skylight window according to claim 1, wherein said first leg (15) has a height to thickness ratio of at least 4:1.

3. A skylight window according to any of the preceding claims, where the distance between a peripheral side (5f) of the IGU and an inner side (25b) of a frame side member extending substantially in parallel with said peripheral side (5f) of the IGU and facing towards the IGU (5) is less than 20 mm, preferably less than 15 mm.

4. A skylight window according to any of the preceding claims, where the sash side members are connected to the exterior major surface (5g) of the IGU and extending away from the interior major surface (5b) of the IGU (5).

5. A skylight window according to any of the preceding claims, where the sash side member (14) further comprises a second leg (16) and possibly further legs.

6. A skylight window according to claim 5, where the legs form a stepped profile when seen in a cross-section perpendicular to the longitudinal direction, where each leg may be substantially perpendicular to an immediately preceding leg and/or to an immediately following leg.

7. A skylight window according to claim 5, where at least some legs are attachable/detachable to/from each other.

8. A skylight window according to any of the preceding claims, where the skylight window comprises one or more thermal breaks (75) being located in the sash side member (14), so that possible thermal bridges are avoided.

9. A skylight window according to any of the preceding claims, where the sash side member (14) comprises one or more recesses adapted for securing one or more sealing elements (76).

10. A skylight window according to any of the preceding claims, where the first leg (15) comprises or substantially consists of metal, such as steel or aluminium and/or polymer.

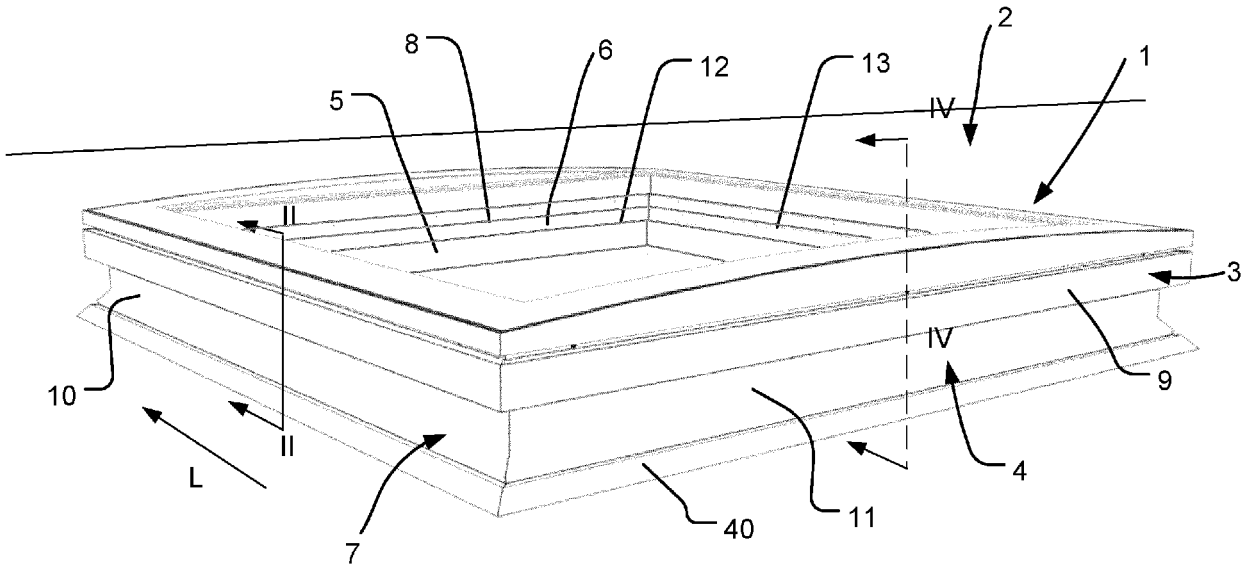

Fig. 1

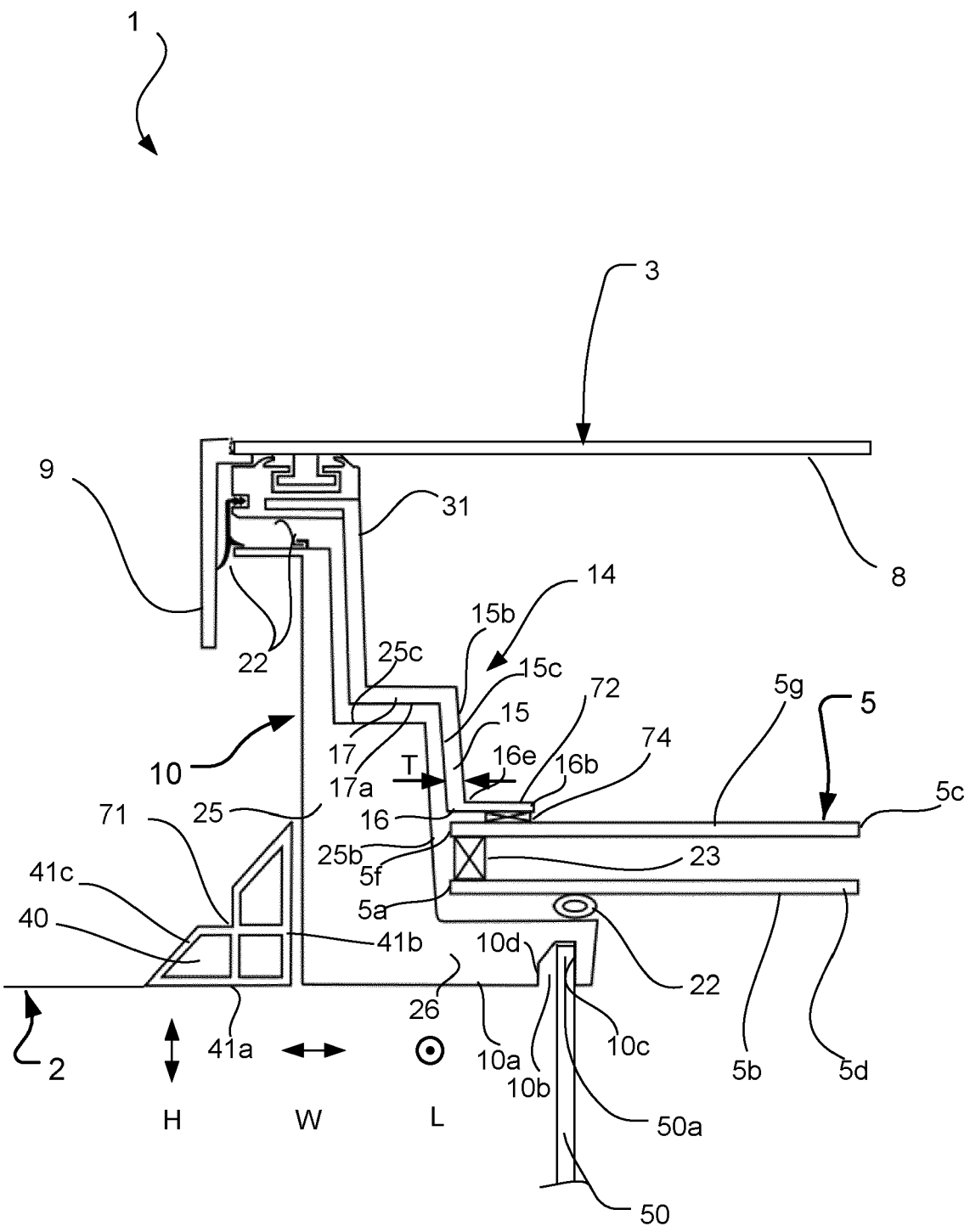
1
3
9
31
8
14
15b
22
25c
15c
72
5g
5
15
74
10
17
T
16e
16b
17a
5c
71
25
16
25b
23
41c
5f
5a
40
41b
10d
22
26
2
41a
10a
10c
5b
5d
10b
H
W
L
50a
50

Fig. 2

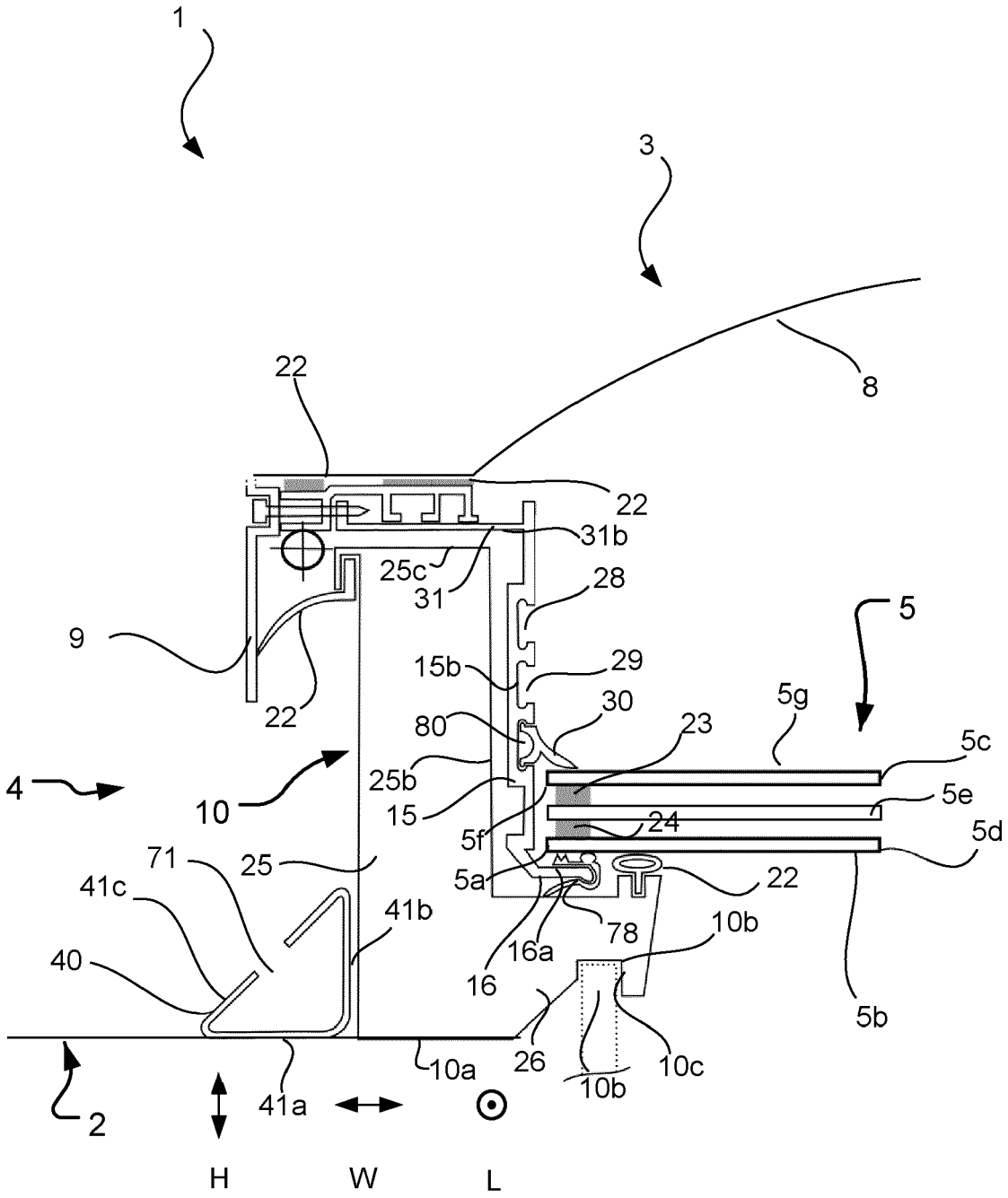
1
3
8
22
22
31b
25c
31
28
9
15b
29
5
22
80
30
23
5g
5c
4
10
25b
15
5e
24
5f
5d
71
25
5a
22
41c
41b
78
10b
40
16a
16
5b
26
10c
10a
10b
2
41a
H
W
L

Fig. 3

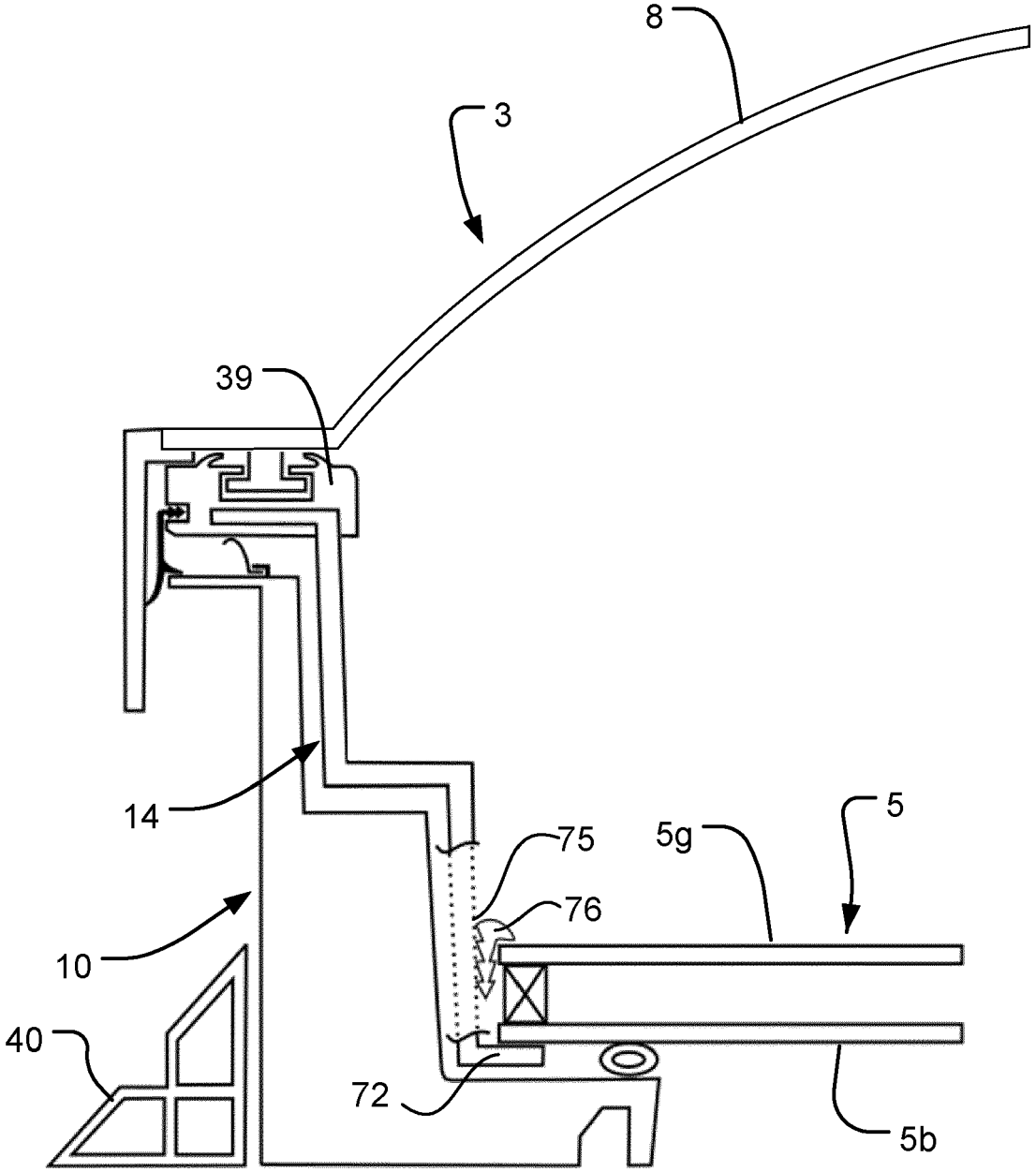

Fig. 4

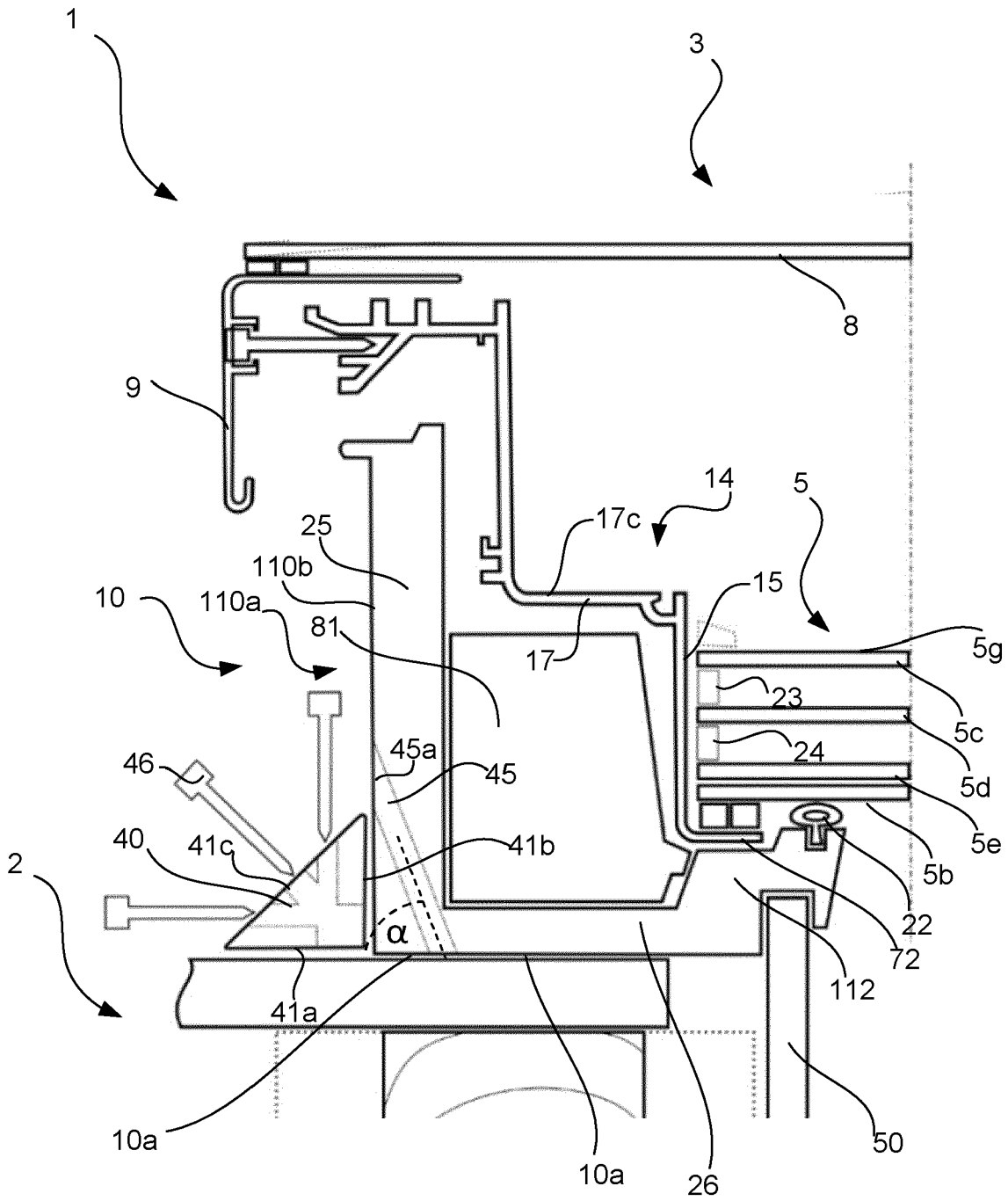
1
3
8
9
14
5
17c
25
110b
15
10
110a
81
17
5g
23
5c
24
5d
46
45a
45
5e
40
41c
41b
5b
2
α
22
72
112
41a
10a
10a
26
50

Fig. 5

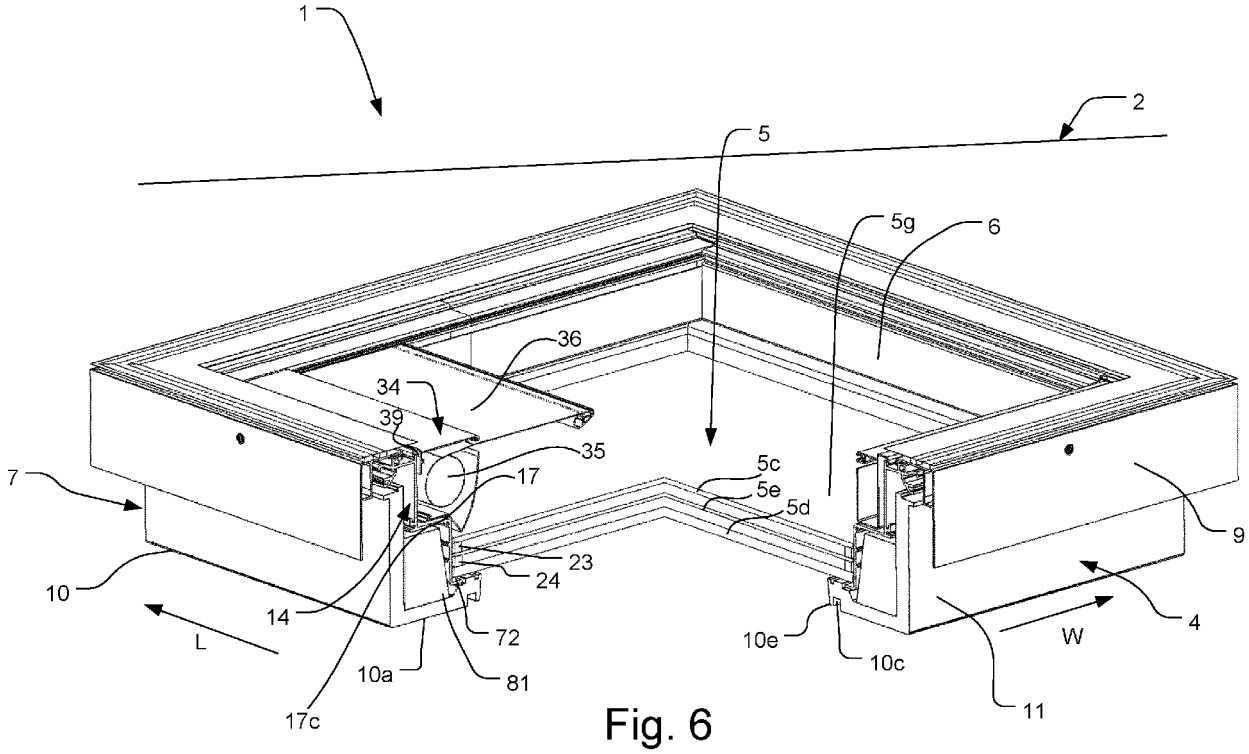
1
2
5
5g
6
36
34
39
35
17
5c
5e
5d
7
23
24
9
10
14
L
72
4
W
10e
10c
10a
81
11
17c

Fig. 6

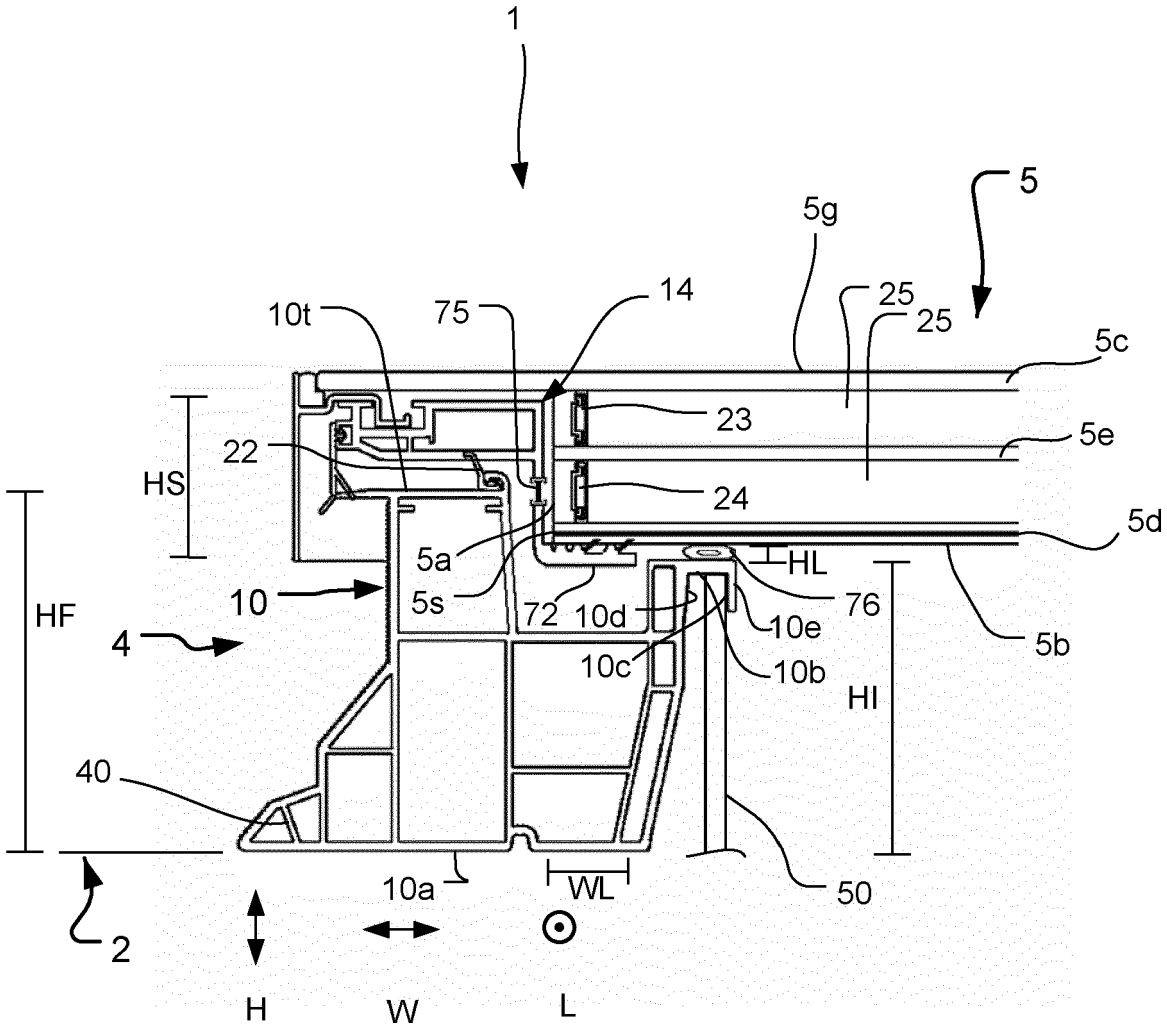
1
5
5g
14
10t
75
25
25
5c
23
5e
22
HS
24
5d
5a
HL
HF
10
5s
72
10d
76
10e
5b
4
10c
10b
HI
40
50
10a
WL
2
H
W
L

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 15 5241

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 346 071 A1 (VKR HOLDING AS [DK]) 11 July 2018 (2018-07-11) * figure 1 *	1-10	INV. E04D13/03
A	EP 3 396 100 A1 (FLOREK RYSZARD [PL]) 31 October 2018 (2018-10-31) * figures 2-3 *	1-10	
A,D	US 2010/269426 A1 (RICHTER STEPHEN [US] ET AL) 28 October 2010 (2010-10-28) * figure 2 *	1-10	
A	GB 2 514 119 A (GLAZING VISION LTD [GB]) 19 November 2014 (2014-11-19) * page 6; figures 1,3 *	1-10	
A	US 2004/139669 A1 (FEUCHT MARK ALBERT [US] ET AL) 22 July 2004 (2004-07-22) * paragraph [0021]; figure 5 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04D E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 July 2020	Leroux, Corentine

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 15 5241

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-07-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3346071 A1	11-07-2018	NONE	
EP 3396100 A1	31-10-2018	EP 3396100 A1	31-10-2018
		PL 126314 U1	05-11-2018
		PL 3396100 T3	31-10-2019
US 2010269426 A1	28-10-2010	NONE	
GB 2514119 A	19-11-2014	NONE	
US 2004139669 A1	22-07-2004	CN 1488024 A	07-04-2004
		DE 10295851 T1	24-12-2003
		GB 2388399 A	12-11-2003
		US 2004139669 A1	22-07-2004
		WO 02057563 A1	25-07-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2009080026 A1 **[0005]**
- US 2010269426 A **[0006]**