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(54) **A SKYLIGHT WINDOW FRAME FOR BEING INSTALLED IN OR ON A ROOF OF A BUILDING,
A SYSTEM COMPRISING A SKYLIGHT WINDOW AND A METHOD FOR FASTENING A
SKYLIGHT WINDOW FRAME**

(57) A skylight window frame for being installed in or on a roof of a building, a system comprising a skylight window and a method for fastening a window frame.

The present invention relates to a skylight window frame for being installed in or on a roof of a building, the skylight window frame comprising a pre-formed hole adapted to receive a fastener for attaching the window frame to the roof. The invention further relates to a system comprising skylight window with such a skylight window frame and a method for installing a skylight window with such a frame.

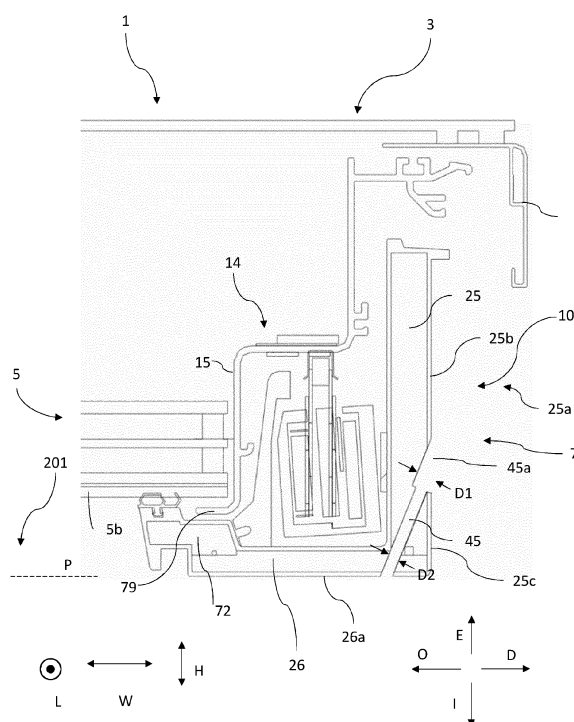


Fig. 3

Description

[0001] The present invention relates to a skylight window frame for being installed in or on a roof of a building, comprising four frame side members, the frame side members delimiting a frame opening and defining a frame plane extending in a longitudinal direction and a lateral direction, a first of the frame side members extending along a first peripheral side of the frame opening in the longitudinal direction, a second of the frame side members extending along a second peripheral side of the frame opening in a lateral direction, each frame side member having a frame height extending in a height direction, the height direction being perpendicular to the frame plane, the first frame side member comprising a first leg, the first leg extending substantially in the height direction, and a second leg, extending substantially in the lateral direction, wherein the first leg has an outer side, the outer side facing away from the frame opening, wherein the second leg has an interior side configured to face an interior of the building in an installed position of the skylight window frame, the outer side having a major outer surface and optionally a curb flange located at a lower portion of the outer side adjacent to the interior side, the first frame side member comprising a pre-formed hole adapted for receiving a fastener, such as a screw or nail.

[0002] The invention also relates to a system comprising a skylight window and a method of fastening a window frame onto a roof structure.

Background Art

[0003] There is often a desire to position one or more skylight windows in or on 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.

[0004] Inclined skylight windows are typically built into an opening in an inclined roof structure, the roof having with an angle above 15 degrees, with a substantial part of the inclined skylight window being 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.

[0005] Skylight windows of these types often comprise a window frame, an insulating glazing unit (IGU), a weather shield, and potentially a window sash, if the skylight window is openable. The window frame may be denoted a skylight window frame.

[0006] The window frame may comprise curb flanges, such curb flanges being positioned at an outer side of the window frame at a lower portion of the window frame,

the lower portion being the adjacent to the exterior roof side in an installed position of the window frame. The curb flanges generally extend along the frame side members. The curb flanges may have inclined surfaces, whereby the curb flanges may serve as roofing felt mounting surfaces, preventing a roofing felt from being mounted with a 90 degree bend, the roofing felt possibly acting as a flashing.

[0007] These curb flanges are sometimes used for fastening the skylight window to the roof, by mounting fasteners through the inclined surface of the curb flange. Alternatively, such skylight windows may be fastened to the roof by brackets, such as angle brackets, mounted to the window frame and roof.

[0008] When fastening such skylight windows it may be troublesome to obtain secure and proper fastening of the skylight window to the roof or load-bearing structure of the roof. Furthermore, in complicated window or roof structures, it may be difficult to reach specific parts of the skylight window and fasten those firmly to the roof. Hence, erroneous or inadequate fastening of the skylight window to the roof may cause an incorrect installation resulting in many subsequent problems, such as water leakage, instability of window etc.

Summary of the invention

[0009] On this background, it is a primary object of the present invention to provide a skylight window frame, facilitating proper and secure attachment of a skylight window to a roof of a building. In addition, an object of the invention is to provide a skylight window frame that can potentially be used in both skylight windows which require a curb and skylight windows which do not require a curb flange.

[0010] According to the invention, these and further objects are met by a skylight window frame according to the introduction, which is furthermore characterized in that the pre-formed hole extends from the major outer surface of the first leg of the first frame side member towards the interior side of the second leg in a direction which is inclined in relation to the frame plane.

[0011] One non-limiting advantage that is gained by such a pre-formed hole is the facilitation of secure and proper attachment of the skylight window frame and therefore, of the window to the roof.

[0012] By the provision of a pre-formed hole, an installer is provided with a guide for inserting a fastener, the fastener attaching the window frame to the roof, ensuring correct positioning of the fastener and facilitating the installation of the skylight window. The pre-formed hole extending from the major outer surface of the first leg toward the interior side of the of second leg may have the effect of the fastener, which is to be mounted in the pre-formed hole, extending through the main structure of the first frame side member, the main structure being the first and second leg, thus securely fastening the window frame and skylight window to the roof and/or load-

bearing structure of the roof.

[0013] The inclination of the pre-formed hole in relation to the frame plane may have the effect of the pre-formed hole being easily accessible to the installer of the skylight window. The inclination may further allow the window frame to be fastened to a structure located beneath the window frame, such structures could be a load-bearing structure of the roof, such as a rafter. The inclination further necessitates the use of long fasteners, which may offer a secure and stable attachment to the roof. The inclination of the pre-formed hole may in the installed skylight window provide good resistance toward vertical forces, such as wind suction, reducing the risk of the skylight window frame being pulled off of the roof. In some embodiments, the inclination of the pre-formed hole may hinder water from entering the pre-formed hole in which the fastener is mounted in an installed position of the window frame.

[0014] A skylight window comprising a window frame according to the invention may further allow for flexibility in any assembly of the skylight window prior to installation. As the pre-formed hole is positioned in the major outer surface of the first leg, an inner portion of the first frame side member and an exterior end of the first leg, may be available for mounting of an insulating glazing unit, a weather shield or a potential sash.

[0015] A further advantage of the invention may be that the same window frame may be used for a skylight window for an installation requiring a curb flange as well as for an installation which does not require a curb flange. The pre-formed hole of the skylight window frame allows the skylight window frame to be securely fastened to the roof even without a curb flange.

[0016] The integrated pre-formed hole may also reduce the overall footprint of the skylight window, as the window frame does not need protruding flange elements or brackets for fastening. This may allow for multiple skylight window units to be placed next to each other in proximity on the same roof structure.

[0017] Throughout this text the term "interior" is used to indicate that something is intended to face the interior of the building in or on which the window frame is installed, in an installed position of the window frame. The term "exterior" is used to indicate that something is intended to face in a direction opposite to the interior of the building in or on which the window frame is installed. The terms "inner" and "outer" are used to indicate that something is intended for facing towards or away from, respectively, the frame opening; similarly the terms "inward" and "outward" are used to indicate the directions towards or away from, respectively, the frame opening.

[0018] The skylight window may generally comprise a window frame having four frame side members, the frame side members supporting an insulating glazing unit (IGU) having multiple layers of glazing, said IGU having an exposed interior major surface for facing an interior of said building the interior pane comprising a side surface extending substantially along the first frame side

member, said IGU further having an exterior major surface facing towards an exterior of the skylight window, wherein a first of the frame side members has a frame height extending in a height direction, the height direction being substantially perpendicular to at least one of the major surfaces of the IGU, the first of the frame side members extending in a longitudinal direction along the side surface of the interior pane. The window frame has an interior side, the interior facing in the interior direction in an installed position of the skylight window and an outer side facing away from the IGU.

[0019] The term IGU is an abbreviation of "Insulating Glazing Unit" and is a concept well-known to the skilled person.

[0020] The IGU may have multiple layers of glass or glazing, which layers may define a potentially sealed volume or spacing between them, the spacing potentially comprising an inert gas, an aerogel, or a vacuum. The IGU may in a conventional manner comprise one, two, three or more layers of glazing, i.e. layers of glass, polycarbonate or the like, or glass panels, which may be positioned at a distance from each other to form one or more spacings or cavities between them. This spacing may be filled with a gas or may hold a vacuum to improve insulation properties of the IGU. 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 may be a lower major surface of a lowermost of the layers of glazing. Sealing and/or supporting members or spacers may be provided at one or more of four peripheral sides of the IGU between the layers of glazing and may form a so-called spacer frame. The sealing and/or supporting members may distance adjacent layers of glazing from each other and may together with lateral edges of the layers of glazing form respective side or lateral surfaces of the IGU. These side surfaces may be substantially plane and/or extend substantially in the height direction as defined herein.

[0021] The sash, if any, 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. The sash being outwardly hung may be achieved by using a rotary hinge positioned at a 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.

[0022] 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.

[0023] The skylight window may comprise a weather shield attached to the frame or the sash, if any, so as to protect a window portion of the skylight window, the window portion comprising the sash, if any, the frame and the IGU.

[0024] The weather shield may be provided as a unitary structure, which is detachably 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, the weather shield comprising a weather shield pane. 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. Further, it allows for the weather shield to be replaced if damaged. The weather shield may be mounted on the window portion to protect it from the elements and preventing rain and other precipitation from entering into gaps or slots in the roof or the window portion. Alternatively, the exterior major surface of the IGU may act as a weather shield as it is exposed to the exterior. The exterior major surface of the IGU acting as weather shield can allow for a shorter skylight window in the height direction as it eliminates the need for a separate weather shield.

[0025] The weather shield may comprise a weather shield pane positioned on an exterior side of the IGU.

[0026] 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.

[0027] In the following, the weather shield may be understood as a transparent cover member, preferably a dome of glass or a clear polymer.

[0028] The weather shield may be provided without a sealed gas-filled spacing between the weather shield pane and the IGU.

[0029] The four frame side members delimit the frame plane such that the four frame side members border the frame plane. The first frame side member has a length in the longitudinal direction, a height in the height direction and a width in the lateral direction. The first leg of the first frame side member extends in the height direc-

tion and substantially defines the height of the first frame side member. The second leg of the first frame side member extends in the lateral direction and substantially defines a width of the first frame side member. The interior side of the second leg is parallel to the frame plane and faces the interior of the building in an installed position of the window frame. The interior side faces an exterior roof surface in the installed position of the window frame.

[0030] The outer side of the first frame side member has a major outer surface. The term "major" is here used to indicate that the surface forms a major part of the surface area of the outer side. The outer side of the first leg may comprise other outer surfaces which form a minor part of the surface area. The optional curb flange of the outer side of the first leg, if any, is located at lower portion of the outer side adjacent to the interior side. The term "lower portion" refers to the height direction and in the installed position of the window frame on the roof, where the curb flange, if any, is located at lower portion of the outer side.

[0031] Such an optional curb flange may generally comprise a bottom flange surface, a side flange surface, and an inclined flange surface, the inclined flange surface connecting the bottom and side flange surfaces, the curb flange being adapted for extending along the longitudinal extent of the first side frame member in the installed position of the skylight window frame, the bottom flange surface being positioned in abutment with an exterior surface of the roof and the side flange surface being positioned in abutment with the major outer surface of the first side frame member, whereby said inclined flange surface functions as a roofing felt mounting surface.

[0032] The term "pre-formed" is used to indicate that the hole is provided prior to a fastener being inserted in the window frame.

[0033] The pre-formed hole is adapted to receive a fastener, such as a screw or nail. Such a pre-formed hole may have a substantially circular cross-section having a diameter. The diameter may be approximately 1 mm to 20 mm, such as 1 mm to 15 mm or 1 to 10 mm, preferably the diameter is approximately 3 to 8 mm.

[0034] The pre-formed hole of the first frame side member may have a first diameter at the major outer surface and a second diameter toward the interior side of the second leg, wherein the second diameter is smaller than the first diameter. This may have the effect of providing an initial space with the first diameter which can accommodate a head of the fastener, and a second space with the second diameter which cannot accommodate the head of the fastener. In this way, the fastener may be inserted in the pre-formed hole without the fastener head protruding from the major outer surface.

[0035] The pre-formed hole has a length in the direction which is inclined in relation to the frame plane. The length of the pre-formed hole may be configured to extend partly through the first frame side member, in which case the pre-formed hole is a blind hole. A suitable length

of the pre-formed hole may be 10 mm to 100 mm, such as 10 to 80 mm.

[0036] The inclined direction of the pre-formed hole may be perpendicular to the longitudinal direction.

[0037] The first frame side member may comprise a plurality of pre-formed holes corresponding to the pre-formed hole of the invention. The plurality of pre-formed holes may be distributed along the length of the first frame side member.

[0038] The width of the of first frame side member may be approximately 50 to 200 mm, such as 100 to 200 mm or 100 to 170 mm. Preferably the width of the first frame side member is approximately 100 to 170 mm, more preferably approximately 100 to 150 mm.

[0039] The interior side of the second leg of the first frame side has a width in the lateral direction. The width of the interior side may be approximately 50 to 100 % of the width of the first frame side member, such as approximately 60 to 90 %, preferably the width of the interior side of the second leg is approximately 75 to 85 % of the width of the first frame side member.

[0040] In an embodiment, the major outer surface of the first leg is substantially perpendicular to the frame plane, such as the major outer surface forming an angle of 80 to 90 degrees with the frame plane.

[0041] In such an embodiment the major outer surface is substantially perpendicular to the plane of the roof surface in the installed position of the window frame and/or to the frame plane

[0042] In an embodiment, the pre-formed hole is a through-hole.

[0043] The pre-formed through-hole extends from the major outer surface of the first leg to the interior side of the second leg, through the first frame side member.

[0044] This may have the effect of further facilitating the fastening of the window frame to the roof. The provision of a through hole allows for fastening of the window frame to roof without drilling in the window frame or the use of self-cutting screws which may be difficult to insert correctly.

[0045] In an embodiment, an opening of the pre-formed hole in the major outer surface, is positioned at approximately 20 to 100 mm from the interior side in the height direction, such as 20 to 80 mm, 30 to 75 mm or 30 to 60 mm.

[0046] This may have the effect of providing a pre-formed hole in which a fastener will be mounted in the main structure of the first leg and second leg of the first frame side member, providing a secure attachment of the skylight window frame to the roof. Such positions of the pre-formed hole may further provide an installer of the window frame with a pre-formed hole which is conveniently accessible.

[0047] The opening of the pre-formed hole being positioned at a range from the interior side in the height direction, is to be interpreted as the opening being within such a range, and not as the opening spanning such a range. The span or radius of the opening in the height

direction is generally approximately equal to or less than the diameter of the fastener to be mounted.

[0048] In an embodiment, an angle between the pre-formed hole and the frame plane is in the range of approximately 10 to 80 degrees, such as 40 to 80 degrees, 55 to 75 degrees, preferably 60 to 70 degrees, 45 degrees, 65, degrees, 68 degrees or 70 degrees.

[0049] Such inclinations may have the effect of providing a pre-formed hole in which a fastener will be mounted in the main structure of the first leg and second leg of the first frame side member, providing a secure fastening of the skylight window frame. Such inclinations may further provide an installer of the window frame with a pre-formed hole which is conveniently accessible.

[0050] In an embodiment, the major surface of the outer side of the first leg is a substantially planar surface adjacent to the interior side of the second leg.

[0051] In such an embodiment the first frame side member does not comprise a curb flange element, as the major outer surface adjoins the interior side. The term "planar surface" is used to indicate that the major outer surface is flat and does not comprise substantial protrusions.

[0052] In an embodiment the planar major outer surface is approximately perpendicular to the interior side.

[0053] In an embodiment, the first frame side member comprises wood, metal, such as aluminium, and/or plastic, such as polyvinylchloride or polyurethane PUR, or fibre-reinforced plastic, or combinations thereof, the first frame side members preferably comprising a core of a wooden material encapsulated in PUR.

[0054] This may have the effect of providing a first frame side member which is rigid and strong and which can support the skylight window. A frame side member comprising a wooden core encapsulated in PUR may be rigid and strong due to the wooden core, and the PUR may protect the wooden core from adverse conditions such as water, humidity and/or sunlight.

[0055] The four frame side members may comprise wood, metal, such as aluminium, and/or plastic, such as polyvinylchloride or polyurethane PUR, or fibre-reinforced plastic, or combinations thereof, such as the four frame side members comprising a core of a wooden material encapsulated in PUR.

[0056] Fibre-reinforced plastic may be glass-fibre reinforced PUR.

[0057] A reinforcement, such as a metal insert, may be included in the pre-formed hole to facilitate attachment of the fastener. Such a reinforcement may be advantageous if the window frame is substantially made of a polymer material.

[0058] In an embodiment, the pre-formed hole comprises an inner geometry, such as a bushing.

[0059] This may have the effect of providing a pre-formed hole in which a screw can be securely and resiliently fastened, which may provide a secure attachment of the window frame to the skylight window.

[0060] In an embodiment, each of the four frame side

members comprises a pre-formed hole corresponding the pre-formed hole of the first frame side member, wherein the first frame side member has a cross-section perpendicular to the longitudinal direction, all four frame side members possibly having cross-sections corresponding to the cross-section of the first frame side member.

[0061] This may have the effect of providing a secure and stable attachment of the window frame to the roof, as all frame side members can be secured in the same way.

[0062] In such an embodiment the pre-formed holes of each respective frame side member extend toward the frame opening from respective peripheral sides of the frame opening, whereby the pre-formed holes of respective frame side members have different directions. The pre-formed holes of the respective frame side members having different directions may provide further secure attachment of the skylight window to the roof. The pre-formed holes having a similar configuration ensures that loads that may be carried are equally divided among the fasteners.

[0063] In a second aspect of the invention, a system is provided comprising a skylight window for being installed in or on a roof of a building, the system comprising: a skylight window comprising a skylight window frame, an insulating glazing unit IGU having multiple layers, a weather shield and possibly a window sash, the window sash, if any, having four sash side members, the frame side members or the sash side members, if any, supporting the IGU, the first of the frame side members and a first sash side member, if any, extending in the longitudinal direction along the first peripheral side of the IGU, the weather shield being attached to the skylight window frame or to the sash, if any, so as to protect a window portion of the skylight window, the window portion comprising the skylight window frame, IGU and the sash, if any.

[0064] The provision of the pre-formed holes in the window frame of the system may facilitate the installation of the system and may allow for a secure attachment of the system to the roof.

[0065] 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.

[0066] Such protrusion can help an installer install a

lining panel at the skylight window by guiding an upper end of the lining panel into contact with a first side of the protrusion, and may further ease the installation by hiding the upper end of said lining panel e.g. if the upper end is not flush with the interior side of the skylight window. The lining panel can be used to hide the skylight frame, for viewers, including insulation elements such as an insulating block and can thus, allow for improving the insulating properties of the skylight window as a whole.

[0067] 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.

[0068] 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.

[0069] 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.

[0070] 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.

[0071] Generally, one or more of the frame and/or potential 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 glassfibre reinforced PUR, and/or wood and/or metal such as aluminum or composites or combinations thereof.

[0072] In an embodiment, the system further comprises an adapter frame, the adapter frame comprising a plurality of adapter frame side members, the plurality of adapter frame side members delimiting an adapter frame opening and defining an adapter frame plane, the adapter frame plane extending in a longitudinal and lateral direction, a first of the adapter frame side members extending along a first peripheral side of the adapter frame opening in the longitudinal direction, the first adapter frame side member having a flange section extending in an exterior direction perpendicular to the adapter frame plane, the flange section having an inner flange surface, the inner flange surface extending in the exterior direction, the flange section having an outer flange surface opposite the inner flange surface, the first adapter frame side member having a support section extending from the flange section in an inward direction toward the adapter frame opening and perpendicular to the longitudinal direction, the support section having an exterior support surface facing in the exterior direction, an interior support surface located opposite the exterior support surface, the interior support surface facing in an interior direction, and an inner side surface of the support section opposite the flange section, the inner side surface connecting the interior and exterior support surfaces, wherein the inner flange surface adjoins the exterior support surface in an assembled state of the first adapter frame side member forming a receiving section, wherein the inner flange surface is configured for abutting at least part of the major

outer surface of the first frame side member and the exterior support surface is configured for supporting the skylight window frame by engaging with the interior side of the first frame side member.

[0073] By the provision of the pre-formed hole in the first frame side member, the window frame may be attached to the adapter frame in the installed position of the skylight window. A fastener inserted through the pre-formed hole may enter the support section of the first adapter frame side member in the installed position of the skylight window. This may have the effect of providing a secure attachment of the skylight window to the adapter frame.

[0074] The opening of pre-formed hole in the major outer surface is positioned such that it is free of the flange section of the first adapter frame side member in the installed position of the window frame, whereby the pre-formed hole is accessible to an installer.

[0075] In such an embodiment the first frame side member does not comprise a curb flange. The outer flange surface may be inclined in relation to the adapter frame plane, whereby the outer flange surface may function as a roofing felt mounting surface.

[0076] In an embodiment, an opening of the pre-formed hole in the major outer surface is covered by a separate curb flange element attached to the first frame side member in an installed position of the skylight window.

[0077] This may have the effect of preventing water from entering the pre-formed hole in an installed position of the skylight window, as the curb flange element covers the opening.

[0078] The term "separate curb flange" is used to indicate that the curb flange element is not part of the first frame side member. The curb flange element may be attached to the first frame side member, whereby it covers the opening of the pre-formed hole in the major outer surface. A suitable curb flange element has a bottom flange surface, a side flange surface, and an inclined flange surface, said inclined flange surface connecting said bottom and side flange surfaces, wherein the curb flange is adapted for extending along the length of said first side frame member in an installed position of the skylight window, said bottom flange surface being positioned in abutment with an outer surface of said roof and said side flange surface being positioned in abutment with said first side frame member, whereby said inclined flange surface functions as a roofing felt mounting surface.

[0079] In a third aspect of the invention, a method is provided for fastening a skylight window frame for being installed in or on a roof of a building comprising the steps of: providing a skylight window frame, positioning the skylight window frame in or on the roof, and fastening the skylight window frame to the roof and/or a load-bearing structure of the roof, by inserting a fastener through the pre-formed hole of the window frame.

[0080] By inserting the fastener through the pre-

formed hole of the window frame, the window frame is attached to the roof.

[0081] In an embodiment, the step of positioning the skylight window frame on the roof comprises positioning the skylight window frame on an adapter frame, and the step of fastening the skylight window frame comprises fastening the skylight window frame to the adapter frame, the adapter frame comprising a plurality of adapter frame side members, the plurality of adapter frame side members delimiting an adapter frame opening and defining an adapter frame plane, the adapter frame plane extending in a longitudinal and lateral direction, a first of the adapter frame side members extending along a first peripheral side of the adapter frame opening in the longitudinal direction, the first adapter frame side member having a flange section extending in an exterior direction perpendicular to the adapter frame plane, the flange section having an inner flange surface, the inner flange surface extending in the exterior direction, the flange section having an outer flange surface opposite the inner flange surface, the first adapter frame side member having a support section extending from the flange section in an inward direction toward the adapter frame opening and perpendicular to the longitudinal direction, the support section having an exterior support surface facing in the exterior direction, an interior support surface located opposite the exterior support surface, the interior support surface facing in an interior direction, and an inner side surface of the support section opposite the flange section, the inner side surface connecting the interior and exterior support surface, wherein the inner flange surface adjoins the exterior support surface in an assembled state of the first adapter frame side member forming a receiving section, wherein the inner flange surface is configured for abutting at least part of the major outer surface of the first frame side member and the exterior support surface is configured for supporting the skylight window frame by engaging with the interior side of the first frame side member.

[0082] In this way, the window frame may be attached to the adapter frame, thus ensuring a secure attachment to the roof.

[0083] In an embodiment, the method further comprises the attachment of a curb flange to the outer side of the first frame side member, the curb flange comprising a bottom flange surface, a side flange surface, and an inclined flange surface, the inclined flange surface connecting the bottom and side flange surfaces, wherein the curb flange is adapted for extending along a longitudinal extent of the first side frame member in an installed position of the skylight window, the bottom flange surface being positioned in abutment with an exterior surface of the roof and the side flange surface being positioned in abutment with the major outer surface of the first side frame member, whereby said inclined flange surface functions as a roofing felt mounting surface, the curb flange being provided so that it can be attached to and detached from the first frame side member.

[0084] In an embodiment, the skylight window and/or skylight window frame is for being on a flat roof, which may have an inclination equal to or less than 5 degrees relative to horizontal.

5 **[0085]** In an alternative embodiment the skylight window and/or skylight window frame is for being installed on an inclined roof, with an inclination equal to or more than 15 degrees relative to horizontal.

10 **[0086]** In another embodiment skylight window and/or skylight window frame is to be installed on a roof with an inclination between 5 and 15 degrees relative to horizontal.

15 **[0087]** Embodiments and advantages described with reference to one aspect of the invention also applies to the other aspect(s) disclosed herein unless otherwise stated.

Brief description of drawings

20 **[0088]** The invention will be described in more detail below by means of non-limiting examples of embodiments and with reference to the schematic drawings, in which

25 Figure 1 shows a perspective view from above of an embodiment of a skylight window according to the present invention installed on a roof,
Figure 2 shows a cross-sectional view of an embodiment of the skylight window comprising the first frame side member positioned on a roof, and
30 Figure 3 shows a cross-sectional view of another embodiment of the first frame side member.
Figure 4 shows a perspective view of an embodiment of a skylight window where a part of the window has been removed.

Detailed description of the invention

40 **[0089]** Fig. 1 shows an embodiment of a skylight window 1 according to the present invention positioned or installed substantially horizontally on 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, the window portion includes a transparent insulating 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. The window frame 7 delimits a frame opening 201.

50 **[0090]** 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. The first frame side member 10 and second frame side member 11 are shown in Fig. 1. A curb flange 40 is attached to the window frame 7.

55 **[0091]** The weather shield 3 is attached to the sash 6

so as to protect the window portion 4 of the skylight window 1. The weather shield 3 comprises a transparent weather shield pane 8 and a skirt 9, which cover the sash 6 and the IGU 5. In other embodiments, the skylight window 1 does not include the weather shield 3. 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. The weather 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 four frame side members. No sealed gas-filled spacing is provided between the weather shield pane 8 and the IGU 5; rather, this spacing is ventilated.

[0092] The flat roof 2 shown in Fig. 1 has a roof inclination of less than 10 % in relation to horizontal. The skylight window may however also be installed in an inclined roof.

[0093] Fig. 2 to 3 shows cross-sectional views of a part of a skylight window 1 displaying embodiments of the first frame side member 10, the skylight window 1 shown in Fig. 2 to 3 may be according to the embodiment of Fig. 1 unless otherwise stated in the following. In Fig. 2 the skylight window 1 is positioned on a roof 2, the skylight window 1 covering the opening in the roof. The IGU 5 is supported by a first sash side member 14 and the skylight has a weather shield 3, which is substantially flat in Fig. 2, 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 lateral direction. The second leg 26 extends from the first leg 25 in the lateral direction toward the frame opening 201. In this embodiment part of the interior side 26a is positioned on the roof 2, whereby the window frame is supported by the roof 2, and part of the interior side 26a extends above the opening in the roof. The IGU 5 has an exposed interior major surface 5b for facing an interior of the building in the closed position of the skylight window 1, the exposed interior major surface being of an interior pane of the IGU 5. The interior pane comprises a side surface 5s extending substantially along the first frame side member 10 and first sash side member 14. The IGU 5 further has an exterior major surface 5g facing towards an exterior in the closed position of the skylight window 1, wherein the first frame side member 10 has a frame height extending in a height direction H shown in Fig. 2. The height direction is parallel to the exterior direction E and substantially perpendicular to the major surfaces of the IGU 5 in the closed position of the skylight window 1.

[0094] The first frame side member 10 and the first sash side member 14 extend in a length or longitudinal direction L, also shown in Fig. 2, along the side surface 5s of the interior pane in the closed position of the IGU 5.

[0095] The first sash side member 14 has a supporting leg 79, the supporting leg 79 being positioned below the interior major surface 5b. The supporting leg 79 carries at least part of the weight of the IGU 5. The first sash side member 14 further has a first leg 15 connected to

the supporting leg 79. The first leg 15 extends in the longitudinal direction L and in the height direction H. The first leg 15 is generally plate-shaped and consists of only one single section of substantially solid material having a width in the lateral direction W of less than 1 cm.

[0096] The first frame side member 10 in Fig. 2 is substantially L-shaped having a first leg 25, the first leg 25 extending in the height direction H, and the second leg 26, the second leg 26 extending from a lower portion of the first leg 26 in the lateral direction W toward the IGU. The first frame side member further has a supporting section 72, the supporting section 72 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. 2, the supporting section 72 carries a structural load of the IGU 5 and the first sash side member 14. The supporting section 72 is connected to the second leg 26, and in an installed position of the skylight window 1 on a roof (not shown), the structural load from the IGU and the first sash side member 14, is transferred from the supporting section 72 to the second leg 26 and further to the roof (not shown). A sealing element 76 is provided between the supporting section 72 and the interior major surface 5b.

[0097] The outer side 25a of the first leg 25 faces away from the frame opening 201 and the interior side 26a of the second leg 26 faces in the interior of the building, in the interior direction D. The major outer surface 25b of the outer side 25a is both perpendicular and adjacent to the interior side 26a of the second leg 16.

[0098] The first frame side member 10 has a pre-formed hole 45. The pre-formed hole 45 extends from the major outer surface 25b toward the interior side 26a in a direction inclined in relation to frame plane P. 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.

[0099] A fastener (not shown) inserted through the pre-formed hole 45 would fasten the skylight window 1 to the roof 2 and the load-bearing structure of the roof 2a. Fig. 2 further shows a separate curb flange 40 positioned on the roof adjacent to the lower portion 15c of the outer side 25a. The curb flange has a bottom flange surface 41a, a side flange surface 41b, and an inclined flange surface 41c, the inclined flange surface connecting the bottom and side flange surfaces. The opening 45a of the pre-formed hole 45 in the major outer surface 25b 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. Roofing felt (not shown) may be mounted to cover part of the roof 2, the inclined outer surface 41c, part of the major outer surface 25b and the joints between the roof 2 and curb flange 40 and the major outer surface 25b, including the opening 45a, and the curb flange 40. In this embodiment the opening 45a is positioned above the curb flange 40, such that the opening 45a is free from the curb flange,

whereby the opening 45a is accessible to an installer (now shown). In an alternative embodiment, the opening 45a is covered by the curb flange 40, specifically the side flange surface 41b.

[0100] Fig. 3 shows a cross-sectional view of part of a skylight window 1, displaying the first frame side member 10. In Fig. 3, the pre-formed hole 45 has a first diameter D1 at the major outer surface 25b of the first leg 15, and a second diameter D2 at the interior side 26a of the second leg 16. The second diameter D2 is smaller than the first diameter D1.

[0101] In Fig. 3, the first frame side member 10 is shown as being made of a core material encapsulated in a second material.

[0102] Fig. 4 shows a perspective view from above of an embodiment of askylight window 1 installed in a roof 2, 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 Figs 2 and 3. The weather shield pane 8 here has been removed for clarity. Fig. 4 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.

[0103] Towards the interior, the spacing is delimited in Fig. 4 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. 4, 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.

List of reference numerals

[0104]

1	Skylight window
2	Roof
2a	Load-bearing structure
3	Weather shield
5	Insulating glazing unit IGU

5a	First peripheral side of the IGU
7	Skylight window frame
9	Weather shield skirt
10	First frame side member
5 11	Second frame side member
14	First sash side member
13	Second sash side member
15	First leg of sash
25	First leg of first frame side member
10 25a	Outer side of first leg
25b	Major outer surface
25c	Lower portion of first leg
26	Second leg of first frame side member
26a	Interior side of the second leg
15 40	Curb flange/curb flange element
41a	Bottom flange surface
41b	Side flange surface
41c	Inclined flange surface
45	Pre-formed hole
20 45a	Pre-formed hole opening
72	Supporting section of frame
76	Sealing element
79	Supporting leg of sash
201	Frame opening
25 P	Frame plane
L	Longitudinal direction
W	Lateral direction
H	Height direction
E	Exterior direction
30 D	Inward direction
I	Interior direction
O	Outward direction
D1	First diameter
D2	Second diameter

Claims

1. A skylight window frame (7) for being installed in or on a roof (2) of a building, comprising four frame side members (10, 11), the frame side members (10, 11) delimiting a frame opening (201) and defining a frame plane (P) extending in a longitudinal direction (L) and a lateral direction (W), a first of the frame side members (10) extending along a first peripheral side of the frame opening (201) in the longitudinal direction (L), a second of the frame side members (11) extending along a second peripheral side of the frame opening (201) in a lateral direction (W), each frame side member having a frame height extending in a height direction (H), the height direction (H) being perpendicular to the frame plane (P), the first frame side member (10) comprising a first leg (25), the first leg (25) extending substantially in the height direction (H), and a second leg (26), extending substantially in the lateral direction, wherein the first leg (25) has an outer side (25a), the

- outer side (25a) facing away from the frame opening (201),
 wherein the second leg (26) has an interior side (26a) configured to face an interior of the building in an installed position of the skylight window frame (7),
 the outer side (25a) having a major outer surface (25b) and optionally a curb flange (40) located at a lower portion (25c) of the outer side (25a) adjacent to the interior side (26a),
 the first frame side member (10) comprising a pre-formed hole (45) adapted for receiving a fastener, such as a screw or nail,
characterized in that
 the pre-formed hole (45) extends from the major outer surface (25b) of the first leg (25) towards the interior side (26a) of the second leg (26) in a direction which is inclined in relation to the frame plane (P).
2. A skylight window frame (7) according to claim 1, wherein the major outer surface (25b) of the first leg (25) is substantially perpendicular to the frame plane (P), such as the major outer surface (25b) forming an angle of 80 to 90 degrees with the frame plane (P).
 3. A skylight window frame (7) according to any one of the previous claims, wherein the pre-formed hole (45) is a through-hole.
 4. A skylight window frame (7) according to any one of the previous claims, wherein an opening (45a) of the pre-formed hole (45) in the major outer surface (25b), is positioned at approximately 20 to 100 mm from the interior side (26a) in the height direction (H), such as 20 to 80 mm, 30 to 75 mm or 30 to 60 mm.
 5. A skylight window frame (7) according to any one of the previous claims, wherein an angle (α) between the pre-formed hole (45) and the frame plane (P) is in the range of approximately 10 to 80 degrees, such as 40 to 80 degrees, 55 to 75 degrees, preferably 60 to 70 degrees, 45 degrees, 65, degrees, 68 degrees or 70 degrees.
 6. A skylight window frame (7) according to any one of the previous claims, wherein the first frame side member (10) comprises wood, metal, such as aluminium, and/or plastic, such as polyvinylchloride or polyurethane PUR, fibre-reinforced plastic, or combinations thereof, the first frame side member preferably comprising a core of a wooden material encapsulated in PUR.
 7. A skylight window frame (7) according to any one of the previous claims, wherein the major surface (25b) of the outer side (25a) of the first leg (25) is a substantially planar surface adjacent to the interior side (26a) of the second leg (26).
 8. A skylight window frame (7) according to any one of the previous claims, wherein the pre-formed hole (45) comprises an inner geometry, such as a bushing.
 9. A skylight window frame (7) according to any one of the previous claims, wherein each of the four frame side members comprises a pre-formed hole corresponding to the pre-formed hole (45) of the first frame side member (10), the first frame side member (10) having a cross-section perpendicular to the longitudinal direction (L), all four frame side members possibly having cross-sections corresponding to the cross-section of the first frame side member (10).
 10. A system comprising a skylight window (1) for being installed in or on a roof (2) of a building, the system comprising:
 - a skylight window (1) comprising a skylight window frame (7) according to any one of claims 1 to 9, an insulating glazing unit IGU (5) having multiple layers, a weather shield (3) and possibly a window sash (6),
 - the window sash (6), if any, having four sash side members (13, 14), the frame side members (10, 11) or the sash side members (13, 14), if any, supporting the IGU (5), the first of the frame side members (10) and a first sash side member (14), if any, extending in the longitudinal direction (L) along a first peripheral side of the IGU (5a),
 - the weather shield (3) being attached to the skylight window frame (7) or to the sash (6), if any, so as to protect a window portion (4) of the skylight window, the window portion (4) comprising the skylight window frame (7), IGU (5) and the sash (6), if any.
 11. A system according to claim 10, wherein an opening (45a) of the pre-formed hole (45) in the major outer surface (25b) is covered by a separate curb flange element (40) attached to the first frame side member (10) in an installed position of the skylight window (1).
 12. A method for fastening a skylight window frame (7) for being installed in or on a roof (2) of a building comprising the steps of:
 - providing a skylight window frame (7) according to any one of the claims 1 to 9,
 - positioning the skylight window frame (7) in or on the roof (2), and
 - fastening the skylight window frame (7) to the roof and/or a load-bearing structure of the roof (2a), by inserting a fastener through the pre-formed hole (45) of the first frame side member (10).

13. A method according to claim 12, further comprising the step of
- attaching a curb flange (40) to the outer side of the first frame side member (10), the curb flange (40) comprising a bottom flange surface (41a), a side flange surface (41b), and an inclined flange surface (41c), the inclined flange surface (41c) connecting the bottom and side flange surfaces (41a, 41b), wherein the curb flange (40) is adapted for extending along the longitudinal extent of the first side frame member (10) in the installed position of the skylight window (1), the bottom flange surface (41c) being positioned in abutment with an exterior surface of the roof and the side flange surface (41b) being positioned in abutment with the major outer surface (25b) of the first side frame member (10), whereby said inclined flange surface (41c) functions as a roofing felt mounting surface, the curb flange (40) being provided so that it can be attached to and detached from the first frame side member (10).

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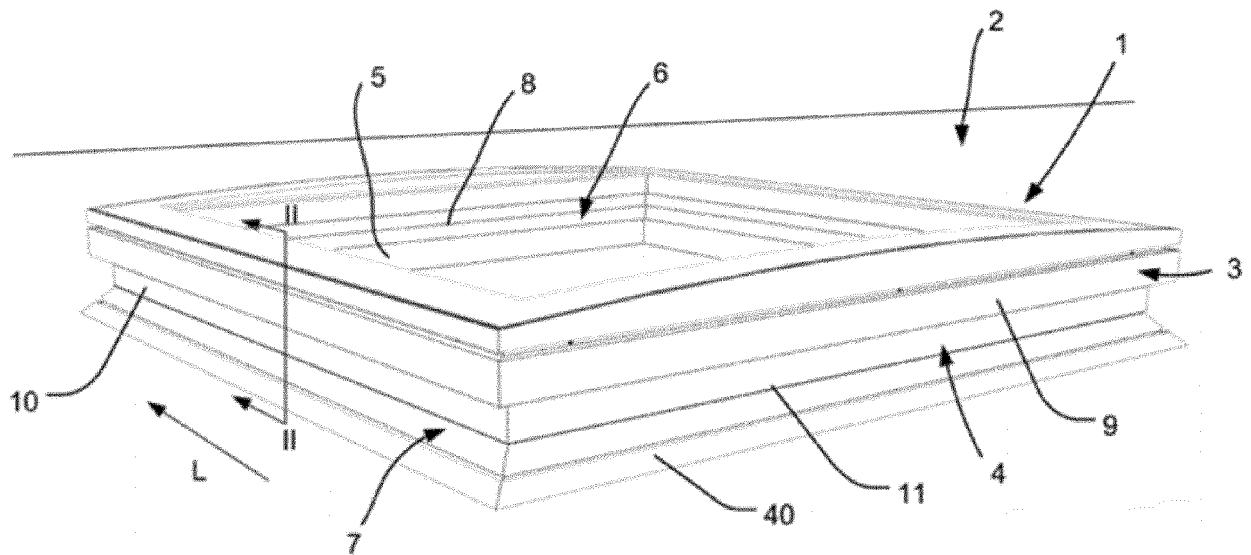


Fig. 1

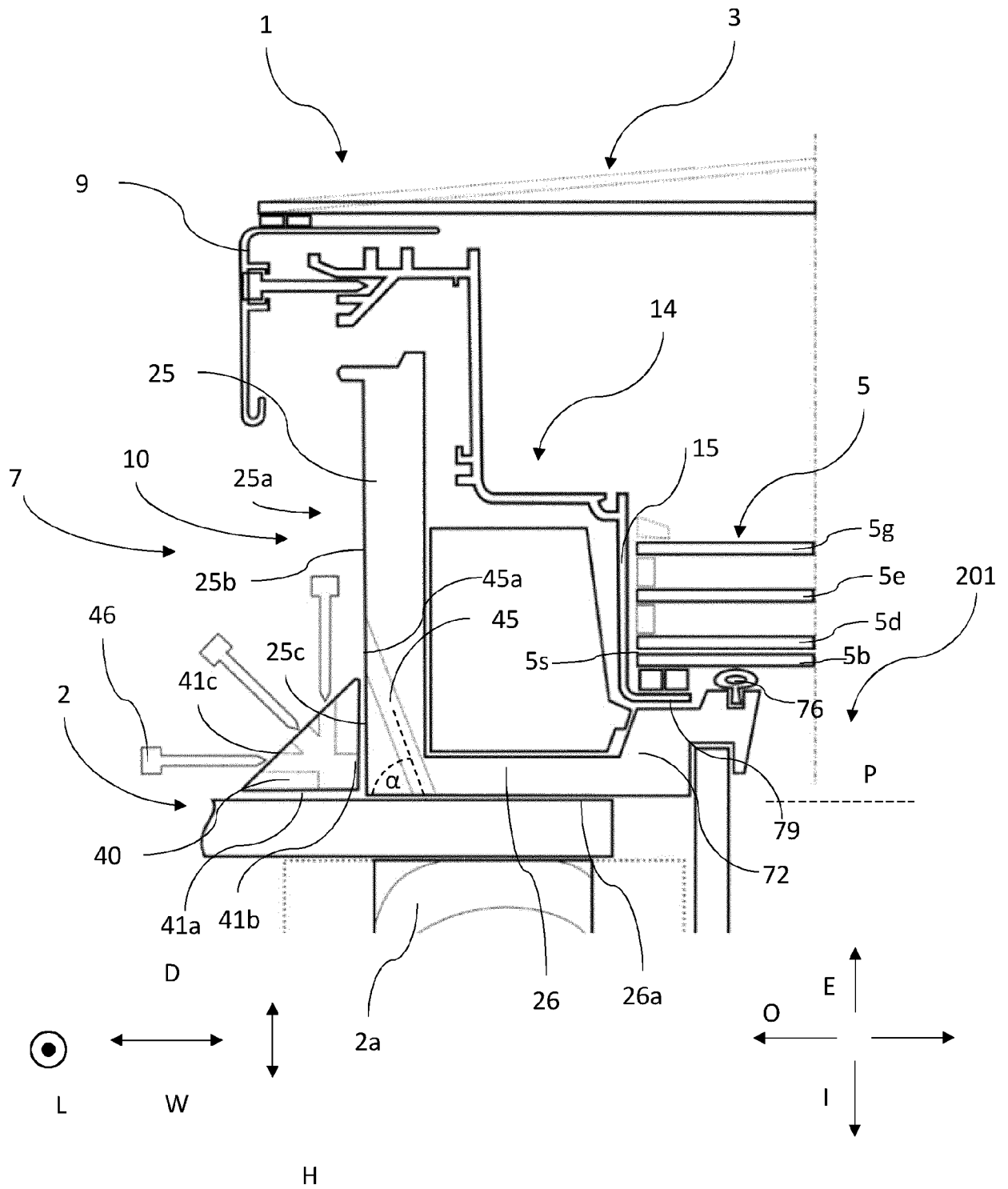


Fig. 2

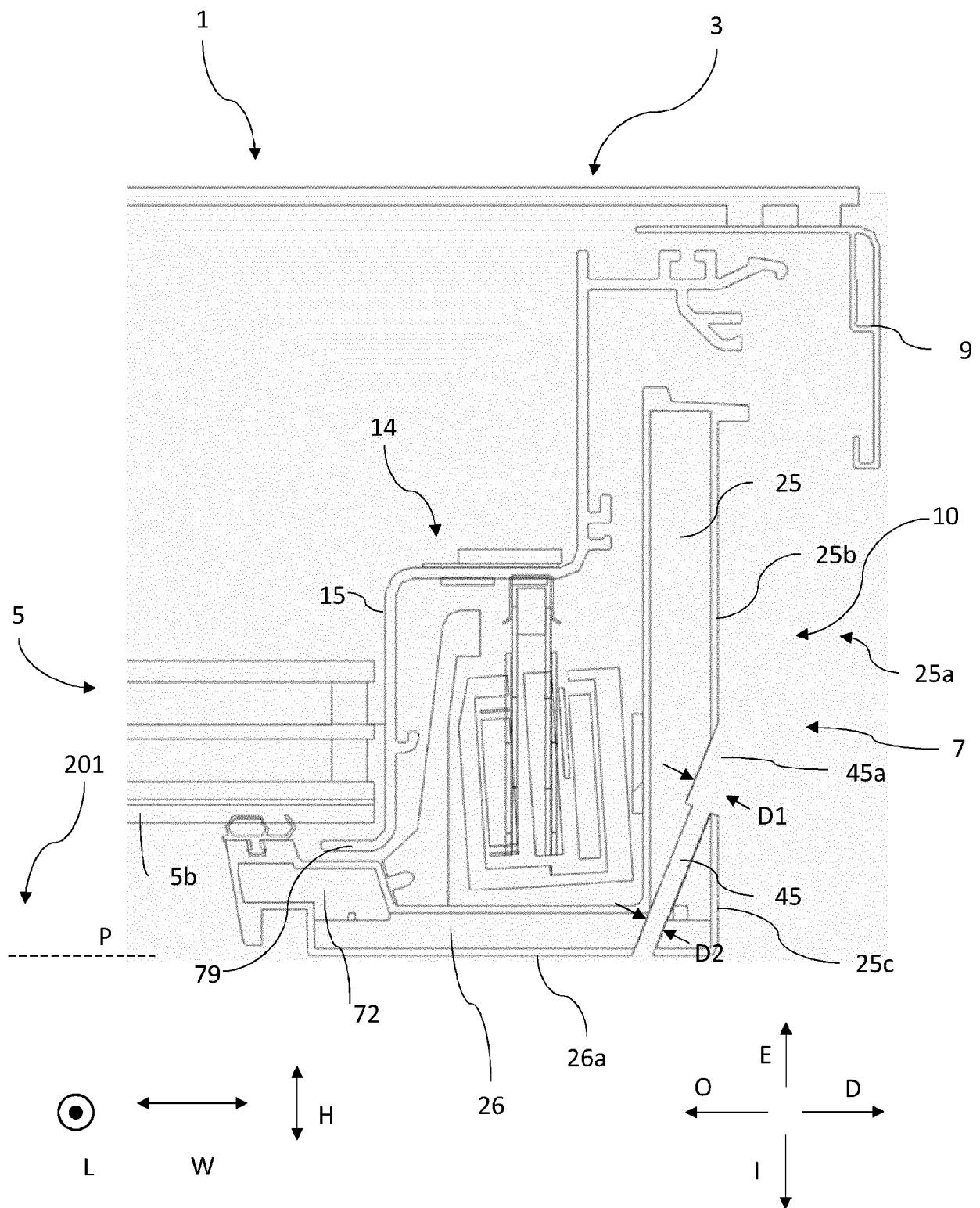


Fig. 3

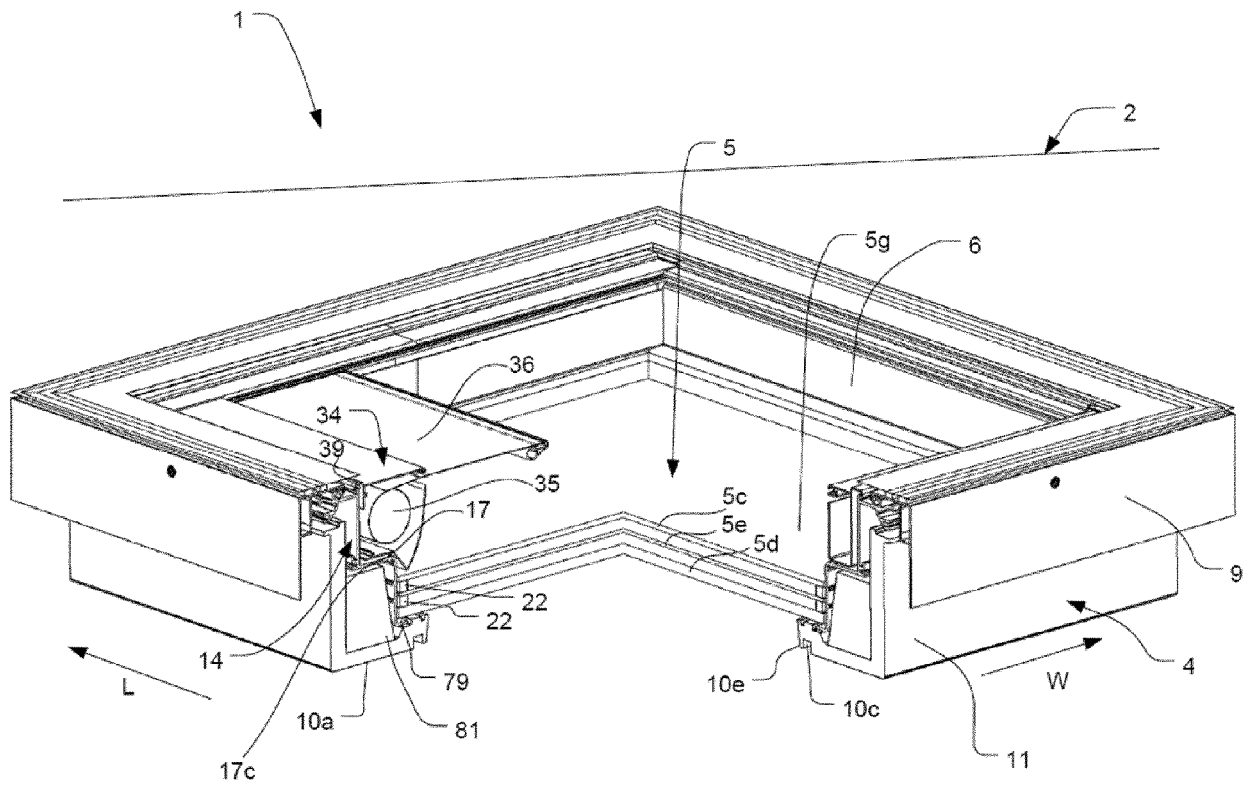


Fig. 4



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 15 5246

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		1 July 2020	Tran, Kim Lien
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 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
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