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(54) **ROOF WINDOW COMPRISING AN INSULATING GLASS UNIT WITH UTILITY SPACE**

(57) The present disclosure relates to a roof window (1) for installation in a roof structure of a building. The roof window (1) comprises a frame arrangement (2) and an insulating glass unit that is supported by the frame arrangement (2). The insulating glass unit comprises a first glass sheet (3a), a third glass sheet (3c), and a second intermediate glass sheet (3b) placed between the first glass sheet and the third glass sheet. A first insulating gap is provided between a major surface of the first, outer glass sheet, and a major surface (3b2) of the second, intermediate glass sheet (3b). The first insulating gap (4a) is sealed by means of a first edge seal (6a). A second insulating gap is provided between another major surface of the second, intermediate glass sheet, and a major surface of the third glass sheet. The second insulating gap (4b) is sealed by means of a second edge seal (6b). A side portion (8) of a major surface (3b2) of the second, intermediate glass sheet (3b) extends with a first distance (DIS1) past a side edge (7a) of the first glass sheet (3a) and past an outer side surface (6ae) of the first edge seal (6a) that faces away from the first insulating gap (4a), so as to provide an elongated utility space (10), such as a water drainage channel. The utility space overlaps said side portion (8) and is placed opposite to the outer side surface (6ae) of the first edge seal (6a).

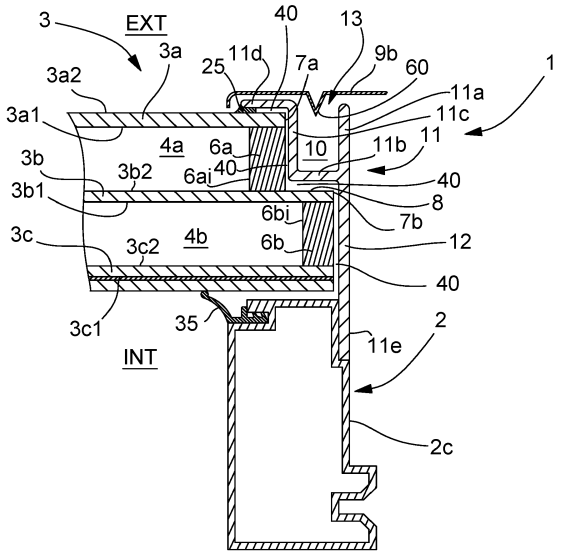

Fig. 4

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Description

[0001] The present disclosure relates to a roof window for installation in a roof structure of a building.

Background

[0002] Generally, roof windows for installation in a roof structure of a building are popular, since such roof windows may provide e.g. increased inflow of natural light/sunlight, help to provide heating, provide ventilation options and/or the like. However, such roof windows may require a more complex window design in order to assure sufficient water tightening and/or to facilitate installation of equipment such as electrical equipment. This may result in more space consuming window designs.

[0003] An example of a roof window design is disclosed in patent document EP 2 843 151 B1. This document discloses a roof window of the centre pivot type and comprising an insulated glass unit with four glass sheets and three heat-insulating spaces. EP 2 947 253 B1 discloses a space in the form of a water drainage channel for receiving condensed water that originates at the underside of a cover. The above solutions may provide drawbacks in relation to at least space consumption and/or sufficient water tightening/handling of water.

[0004] Some prior art solutions also comprises a water drainage channel placed at an upwardly facing outer surface of a movable frame of a roof window, where the channel is placed next to an insulated glass unit, and placed below a cover. This channel is configured to receive/collect rainwater entering in between the cover and the insulated glass unit during e.g. windy weather conditions.

[0005] The present disclosure may e.g. provide a space saving solution that may e.g. facilitate aesthetic advantages and at the same time provide an advantageous space at the roof window. In some embodiments of the present disclosure, advantages with regard to handling of water and/or improving heat insulation performance may additionally or alternatively be obtained.

Summary

[0006] The present disclosure relates to a roof window for installation in a roof structure of a building. The roof window comprises a frame arrangement, wherein said frame arrangement comprises a top profile, a bottom profile and two side profiles. The frame arrangement moreover comprises an insulating glass unit that is supported by the frame arrangement. The insulating glass unit comprises at least a first glass sheet, a third glass sheet, and a second intermediate glass sheet placed between the first glass sheet and the third glass sheet. The first glass sheet is configured to face the exterior of the building when the roof window is installed in said roof structure. A first insulating gap is provided between a major surface of the first, outer glass sheet and a major surface of the second, intermediate glass sheet, where said first insulating gap is sealed by means of a first edge seal. A second insulating gap is provided between another major surface of the second, intermediate glass sheet and a major surface of the third glass sheet. The second insulating gap is sealed by means of a second edge seal. A side portion of a major surface of the second, intermediate glass sheet extends with a first distance past a side edge of the first glass sheet and past an outer side surface of the first edge seal that faces away from the first insulating gap, so as to provide an elongated utility space. The elongated utility space overlaps the side portion and may be placed opposite to the outer side surface of the first edge seal.

[0007] The present disclosure provides a roof window with a space saving utility space solution, which may help to enable implementation of desirable aesthetic options such as enabling a more space saving frame design and/or a more space saving covering solution. The utility space is so to say integrated in the side structure of the insulating glass unit, for example at/along side parts of the insulating glass unit extending between a top and bottom of the of the glass unit, and/or at/along the top and/or bottom of the insulating glass unit.

[0008] The elongated utility space overlaps the said side portion of the major outer surface of the second, intermediate glass sheet, and thereby it is placed opposite to the side portion and next to the first edge seal. This provides a stepped edge configuration proximate the outer edge of the insulating glass unit, where the elongated utility space is integrated in the structure of the insulating glass unit.

[0009] The elongated utility space extends in a longitudinal direction that is parallel to the longitudinal direction of the side edge of the second, intermediate glass sheet that is located proximate to the side portion of the major surface of the of the second, intermediate glass sheet.

[0010] In embodiments of the present disclosure, the major surfaces of said glass sheets are arranged parallel to each other.

[0011] In embodiments of the present disclosure, the utility space may comprise an elongated opening at a position opposite to the said side portion of the major outer surface of the second, intermediate glass sheet, thereby providing that e.g. rain water may enter the utility space and/or providing that equipment may be placed in the utility space.

[0012] In preferred embodiments of the present disclosure, the elongated utility space may comprise of be a water drainage channel.

[0013] In some embodiments of the present disclosure, an outer side surface of the first edge seal that faces away from the first insulating gap may be placed opposite to the major surface of the second intermediate glass sheet, so as to provide the elongated utility space, which overlaps the side portion and is placed opposite to said outer side surface of the first edge seal.

[0014] In embodiments of the present disclosure, the surface area of the major surfaces of the exterior glass sheet is smaller than the surface area of the major surfaces of the second intermediate glass sheet and the third glass sheet. This provides room for one or more utility spaces according to embodiments of the present disclosure.

[0015] In one or more embodiments of the present disclosure, the second edge seal may be located opposite to, such as below, the elongated utility space.

[0016] This may help to provide an improved heat insulating solution as the second edge seal and the first edge seal are physically displaced/offset, "sideways" relative to each other. This may provide a reduced cold bridge when compared to solutions where the edge seals are placed substantially above each other. Hence, the risk of condensation at the interior surface of the insulated glass unit near the frame may be reduced.

[0017] In one or more embodiments of the present disclosure, the first distance may be larger than the width of the second edge seal.

[0018] In one or more embodiments of the present disclosure, the second insulating gap may overlap the width of the first edge seal.

[0019] This may provide improved heat insulating performance at the edge region of the insulated glass unit, as e.g. a cold bridge that may be provided through the first and second edge seals that may provide decreased heat insulation performance may be reduced.

[0020] In one or more embodiments of the present disclosure, the second insulating gap may fully overlap the width of the first edge seal.

[0021] The first edge seal and the second edge seal may thus be arranged un-overlapping (in their width direction) at opposing sides of the second, intermediate glass sheet. This provides advantages in relation to improving heat insulation capabilities at the edge region of the insulated glass unit.

[0022] The first and second edge seals may generally be elongated, extend parallel to each other, and be configured to seal insulating gaps at the same edge region of the insulating glass unit.

[0023] In one or more embodiments of the present disclosure, the second insulating gap may extend to a position below the said side portion of the major surface of the second, intermediate glass sheet.

[0024] The second edge seal is the one of the first and second edge seal that is proximate the interior of the building when the roof window is installed, and this second edge seal may be arranged further away from a centre plane of the insulated glass unit that extends perpendicular to the major glass sheet surfaces of the insulated glass unit than the first edge seal.

[0025] Both the first and second edge seal may preferably be placed at a part of the insulated glass unit that overlaps the frame arrangement, such as a movable frame, that supports the insulated glass unit.

[0026] In one or more embodiments of the present disclosure, the edge of the intermediate glass sheet and the exterior surface of the second edge seal may be placed opposite to the half, such as the third of the profile's width that is distal to the frame opening of the frame.

[0027] In one or more embodiments of the present disclosure, the overlapping distance with which the edge of the intermediate glass sheet and the exterior surface of the second edge seal overlaps the maximum width of the profile may be at least 40%, such as at least 55%, such as at least 80% of the maximum width of the frame profile.

[0028] In some embodiments of the present disclosure, the second insulating gap that is sealed by the second edge seal may overlap at least 30%. Such as at least 40%, such as at least 50%, such as at least 60% of the maximum width of the frame profile.

[0029] In one or more embodiments of the present disclosure, an elongated side cover may extends over and cover a part of the elongated utility space. Preferably, the elongated side cover may extend over at least a part of the width of said side portion of the major surface of the second, intermediate glass sheet.

[0030] Providing the cover to overlap the elongated utility space may provide improved water tightening/handling of rainwater and/or aesthetic advantages.

[0031] In roof windows, for example of the centre hung type, there is an increased need for water tightening, and this often comprises providing a cover that overlaps a part of the insulating glass unit along at least the sides and e.g. also the top of the insulating glass unit.

[0032] In one or more embodiments of the present disclosure, the cover may extend over the entire width the elongated utility space.

[0033] In one or more embodiments of the present disclosure, the elongated cover may overlap a part of the outer major surface of the first outer glass sheet. In other embodiments of the present disclosure, the elongated cover may be arranged to not overlap the outer major surface of the first outer glass sheet.

[0034] The cover may in embodiments of the present disclosure be a rainwater cover configured to guide rainwater towards e.g. the exterior of the insulated glass unit from a position above the frame arrangement that is not covered by the insulated glass unit.

[0035] In one or more embodiments of the present disclosure, the distance, such as the maximum distance, between a first plane defined by an outer surface of the side cover and a second plane defined by the outer major surface of the first, outer glass sheet may be less than 30 mm, such as less than 20 mm. In some, embodiments, the distance, such as the maximum distance, between a first plane defined by an outer surface of the side cover and a second plane defined by the outer major surface of the first, outer glass sheet may be less than 10 mm, such as less than 5 mm.

[0036] This provides a more space saving solution and may be enabled due to the utility space being located as defined above, to be integrated in the side structure of the insulated/insulating glass unit.

[0037] Said first and second planes may in embodiments of the present disclosure be substantially parallel.

[0038] In one or more embodiments of the present disclosure, the distance, such as the maximum distance, between an outer surface of the cover and a plane defined by the outer major surface of the first, outer glass sheet may be less than 50 mm, such as less than 20 mm, preferably less than 10 mm, such as 6 mm or less than 6 mm. This distance may be determined perpendicular to the outer major surface of the first, outer glass sheet.

[0039] In embodiments where the outer surface of the cover is curved or non-planar, the first plane defined by an outer surface of the cover may be defined from a point of the cover surface providing the maximum distance between that plane and the second plane defined by the major outer surface of the outer glass sheet, where these planes are substantially parallel.

[0040] The outer surface of the side cover may in embodiments of the present disclosure face away from the first plane.

[0041] In some embodiments of the present disclosure, said first and second planes may be substantially coinciding.

[0042] In some embodiments of the present disclosure, the outer surface of the cover and the outer major surface of the first, outer glass sheet or a pane overlapping part as defined in more details below, may be substantially flush.

[0043] In some embodiments of the present disclosure, said first plane may extend between the outer major surface of the first, outer glass sheet and a major surface of the second, intermediate glass sheet.

[0044] In one or more embodiments of the present disclosure, the elongated utility space may provide/be an elongated water drainage channel configured to guide rainwater along the longitudinal direction of the water drainage channel.

[0045] This provides a space saving and yet mechanically simple and efficient way of handing/guiding rainwater in a space saving manner.

[0046] The said rainwater may in embodiments of the present disclosure comprise wind driven water that enters the water drainage channel from a space between a cover and the insulating glass unit.

[0047] It is here noted that during low wind conditions, the rainwater may generally not enter the water drainage channel. However, when high winds occur, e.g. at least partly transverse to the longitudinal direction of said side edge of the of the first glass sheet, some rain water or in some situations, snow, may enter in between the cover and the insulated glass unit. This water will be collected by the water drainage channel and guided to a desired location, such as towards the bottom of the roof window where it may be guided further by means of a roofing and/or a gutter.

[0048] The drainage channel may guide the water along the drainage channel due to/by means of gravity.

[0049] In one or more embodiments of the present disclosure, the elongated utility space may additionally or alternatively be used as a wiring routing for electric systems such as power supply wires or control system wires and/or the like and/or be used for placement of equipment during e.g. retrofitting of equipment at the roof window.

[0050] In some embodiments of the present disclosure, the cover may comprise one or more elongated elevations, such as a ridge comprising a drip edge, that is placed opposite to the water drainage channel and/or or extends into the water drainage channel. This provides that water running on the underside of the cover may be forced to be released from the cover and drip into the water drainage channel. The one or more elevations comprising the drip edge, may in some embodiments of the present disclosure comprise a crest extending in a direction towards the water drainage channel. The ridge may in some embodiments of the present disclosure extend in the longitudinal direction of the cover and parallel to the longitudinal direction of the water drainage channel.

[0051] In one or more embodiments of the present disclosure, a guiding arrangement may be placed at the elongated utility space, and a guiding wall of the guiding arrangement may be placed opposite to the first edge seal so that the utility space is placed/located between the guiding wall and the first edge seal.

[0052] This provides an advantageous guiding of rainwater as the rainwater is contained between the first edge seal and the guiding wall. The guiding wall may hence provide one of the side surfaces facing towards the utility space.

[0053] In one or more embodiments of the present disclosure, the guiding arrangement may comprise a bottom part, such as a bottom wall, extending over said side portion of the major surface of the second, intermediate glass sheet.

[0054] This may e.g. provide a more weather resistant solution as the bottom wall in some embodiments of the present disclosure may provide water protection for protecting the side regions of the insulating glass from rainwater. The bottom wall may provide a cannel bed of the utility space.

[0055] In one or more embodiments of the present disclosure, the guiding arrangement may comprise a pane overlapping part which extends in over the outer/exterior major surface of the first, outer glass sheet.

[0056] This pane overlapping part may e.g. help to enable an improved water sealing solution.

[0057] The outer/exterior major surface of the first, outer glass sheet is preferably the surface that faces away from the first insulating gap.

[0058] In one or more embodiments of the present disclosure, the guiding arrangement may comprise a side part extending along the first edge seal, and the utility space may here be located between the side part and the guiding wall.

[0059] This side part may help to provide improved resistance against water, for example as the side part may

prevent for example water or parts in the utility channel from damaging the first edge seal and/or interconnections between the edge seal and the glass sheets.

[0060] The side part and bottom part of the guiding arrangement may e.g. in some embodiments be structurally interconnected, such as integrated in the same arrangement such as the same profile.

[0061] The said side part extending along the first edge seal may preferably be placed along and opposite to said outer side surface of the first edge seal.

[0062] In one or more embodiments of the present disclosure, a guiding wall, a bottom part and a side part may together provide a U-shaped utility space which overlaps said side portion and which is placed next to the first edge seal.

[0063] This may provide a utility space enclosed by the guiding arrangement, where an elongated opening is provided at a position opposite to said side portion of the major outer surface of the second, intermediate glass sheet.

[0064] In one or more embodiments of the present disclosure, said guiding wall, bottom part and side part together providing the U-shaped utility space may comprise or be the above mentioned guiding wall, bottom part and side part of the above mentioned guiding arrangement.

[0065] In one or more embodiments of the present disclosure, said pane overlapping part may provide a fixation, such as a mechanical fixation, of the insulating glass unit.

[0066] In one or more embodiments of the present disclosure, said bottom part may provide a fixation, such as a mechanical fixation, of the insulating glass unit.

[0067] In one or more embodiments of the present disclosure, said pane overlapping part may be fixated to the insulated glass unit. This may in further embodiments of the present disclosure be provided by means of a water tightening seal and/or adhesive.

[0068] In one or more embodiments of the present disclosure, said bottom part may be fixated to the insulated glass unit. This may in further embodiments of the present disclosure be provided by means of a water tightening seal and/or adhesive.

[0069] This may e.g. provide water tightening advantages and/or structural advantages. Additionally or alternatively, it may provide a space saving, mechanically advantageous and simple solution for fixating the insulated glass unit to the frame arrangement. The fixation of the pane overlapping part and/or said bottom part may e.g. be provided by means of an sealant or adhesive such as a structural adhesive or over-moulding, and/or by means of mechanical fastening means e.g. connected to a connection arrangement at the insulation glass unit.

[0070] The pane overlapping part and/or said bottom part may be fixated directly or indirectly to the insulated glass unit so as to provide a holding/fixation of the insulating glass unit at the frame.

[0071] Even if only one of the pane overlapping part and bottom part are fixated to the insulated glass unit, this may still provide a more safe solution as the other un-fixated overlapping part may provide a safety measure.

[0072] In one or more embodiments of the present disclosure, said pane overlapping part and/or said bottom part may provide a fixation, such as a mechanical fixation, of the insulating glass unit by means of a clamping force.

[0073] In one or more embodiments of the present disclosure, said pane overlapping part and said bottom part may provide a fixation, such as a mechanical fixation, of the insulating glass unit. In further embodiments of the present disclosure, said pane overlapping part and said bottom part may be fixated to the insulated/insulating glass unit.

[0074] If both the pane overlapping part and bottom part are fixated to the insulated glass unit at each their glass surface , this may provide an enhanced fixation, also since fixation is provided at two different, outwardly facing surfaces of the insulated glass unit instead of e.g. fixation at a single exterior surface of for example the first, outer glass sheet.

[0075] In some embodiments of the present disclosure, said bottom part may be the one that provides a holding of the insulated glass unit at the frame, such as is fixated to the insulated glass unit.

[0076] In one or more embodiments of the present disclosure, said guiding arrangement may be integrated in a holding arrangement. The holding arrangement may be configured to fixate the insulated glass unit at the frame arrangement. In some embodiments of the present disclosure, the holding arrangement may comprises a fixation part for fixating the holding arrangement to the frame arrangement by means of fixation means such as mechanical fixation means.

[0077] This may enable a space saving and mechanically simple, and yet space saving, holding solution for fixating the insulated glass unit to the frame arrangement, such as an elongated, structural frame profile.

[0078] The fixation means/ fastening means may in embodiments of the present disclosure comprise mechanical fastening means such as one or more of screws, pop rivets or nails. Additionally or alternatively the fixation means/ fastening means may comprise chemical fastening means such as an adhesive, such as a glue, or welding of the material.

[0079] In one or more embodiments of the present disclosure, the frame and the holding arrangement and the guiding arrangement can be one part i.e. unitary.

[0080] The holding arrangement may for example, in some embodiments of the present disclosure, comprise a holding profile.

[0081] In one or more embodiments of the present disclosure the holding arrangement may be integrated in/be unitary with, the frame profile.

[0082] In one or more embodiments of the present disclosure, the insulated glass unit comprises a plurality of said utility space extending along different sides of the

insulated glass unit. In some embodiments of the present disclosure, opposing, parallel utility spaces may be arranged at opposing parallel sides of the insulated glass unit. These sides may in some embodiments be at sides that extends between the top and bottom of the insulated glass unit. Additionally or alternatively, one of said guiding space may in some embodiments be arranged to extend along a top edge of the insulated glass unit.

[0083] Generally, it is understood that the top of the insulated glass unit (or for that matter the top of the roof window) is the part that is configured to face upwards when the window is installed in a roof with a roof pitch, such as a roof pitch above 15° or 17° such as above 30°. If the frame arrangement comprises a movable frame, this naturally is in the scenario where the movable frame is in a closed position.

[0084] In one or more embodiments of the present disclosure, the utility space may have a width of at least 5 mm, such as at least 9 mm, such as at least 14 mm, such as at least 20 mm.

[0085] This may provide space enough to be able to provide a useful utility space, such as a water drainage channel.

[0086] In embodiments of the present disclosure, the utility space has a width between 4 mm and 100 mm, such as between 5 mm and 50 mm, for example between 5 mm and 20 mm.

[0087] In embodiments of the present disclosure, the utility space may have a height of at least 5 mm, such as at least 8 mm, such as at least 10 mm, such as at least 15 mm

[0088] In embodiments of the present disclosure, said width of the utility space may be determined in a direction parallel to a major surface of the second, intermediate glass sheet, and perpendicular to the side edge of the second.

[0089] In one or more embodiments of the present disclosure, said width of the utility space may be a maximum width if the utility space.

[0090] In one or more embodiments of the present disclosure, the frame arrangement may comprise a fixation frame and a movable frame. The movable frame provides said support of the insulating glass unit and the movable frame is movably attached to the fixation frame by means of a hinge arrangement. In some further embodiments of the present disclosure, the roof window may be of the centre-hung type.

[0091] In centre-hung type roof windows, the hinge arrangement provides an axis of rotation for the movable frame that is placed between the top and the bottom of the sash. This provides that the movable frame is configured to be opened by the lower part/bottom part of the sash moving outwards, and the upper part/top part of the movable frame moves inwards into the building upon opening of the sash from a closed position.

[0092] It is understood that the axis of rotation may be arranged around the centre of side profiles of the movable frame. However, in some centre-hung configurations, the movable axis of rotation may also be displaced, towards the top or bottom part of the movable frame in order to pride a balancing of the weight of the movable frame.

[0093] In roof window of the centre-hung type, the fixation frame may surround movable frame.

[0094] In roof window of the centre-hung type, the maximum width of the movable frame may be less than the interior, minimum width of the frame opening of the fixation frame in order to allow top and bottom parts of the movable frame to move into the frame opening of the fixation frame when moving the movable frame to a closed position.

[0095] In roof window of the centre-hung type, the movable frame may be rotated so that the exterior surface of the insulating glass unit faces at least partly inwards towards the building, thereby enabling cleaning of that surface from the inside of the building.

[0096] In other embodiments of the present disclosure, the movable frame may be top hung.

[0097] In one or more embodiments of the present disclosure, said hinge arrangement may be connected to the fixation frame and moreover structurally connected to, such as directly connected to, the holding arrangement.

[0098] A major surface of the first, outer glass sheet may in some embodiments of the present disclosure face (and in some embodiments preferably abut) the first insulating gap. This may be a major surface located opposite to the exterior major surface of the first glass sheet that may be configured to face away from the interior of the building and may be subjected to wind and weather.

[0099] In one or more embodiments of the present disclosure, a major surface of the second, intermediate glass sheet may face (and preferably abut) the first insulating gap.

[0100] In one or more embodiments of the present disclosure, a major surface of the second, intermediate glass sheet may face (and preferably abut) the second insulating gap.

[0101] In one or more embodiments of the present disclosure, the third glass sheet may face (and preferably abut) the second insulating gap. The other major surface of the third glass sheet may in embodiments of the present disclosure face and abut a lamination layer /lamination inter layer or may face and abut the interior room of the building if the lamination layer and lamination glass is omitted, when the window is installed.

Figures

[0102] Aspects of the present disclosure will be described in the following with reference to the figures in which:

fig. 1 : illustrates a roof window of the center hung type, according to embodiments of the present disclosure,

fig. 2 : illustrates an insulating glass unit according to embodiments of the present disclosure,

fig. 3 : illustrates a roof window according to further embodiments of the present disclosure,

fig. 4 : illustrates a roof window comprising a guiding arrangement integrated in a profile according to embodiments of the present disclosure,

fig. 5 : illustrates a bottom wall that is fixated to a side portion of a major surface of an intermediate glass sheet according to embodiments of the present disclosure,

fig. 6 : illustrates a roof window comprising a an insulating glass unit comprising three insulating gaps, according to embodiments of the present disclosure,

fig. 7 : illustrates a roof window comprising a an insulating glass unit comprising three insulating gaps, according to further embodiments of the present disclosure,

fig. 8 : illustrates a roof window where a cover partly overlaps a utility space, according to embodiments of the present disclosure,

fig. 9 : illustrates a roof window comprising utility spaces at opposite sides of the roof window, according to embodiments of the present disclosure,

figs. 10-11 : illustrates an insulating glass unit according to various embodiments of the present disclosure,

fig. 12 : illustrates a building comprising a roof window according to embodiments of the present disclosure,

fig. 13 : illustrates an insulating glass unit according to further embodiments of the present disclosure, and

fig. 14 : illustrates a roof window where an insulating glass unit overlaps a the width of a frame profile with an overlapping distance, according to embodiments of the present disclosure.

Detailed description

[0103] Fig. 1 illustrates a roof window 1 according to embodiments of the present disclosure. The roof window 1 may also be known as a skylight. The roof window 1 comprises a frame arrangement 2, 20. The frame arrangement comprises a fixation frame 20 and a movable frame 2. The movable frame 2 provides a support of an insulating glass unit 3.

[0104] The movable frame 2 is movably attached to the fixation frame 20 by means of a hinge arrangement 30. In fig. 1, the roof window 1 is of the centre-hung type. In centre-hung type roof windows 1, the hinge arrangement 30 provides an axis of rotation RAX for the movable frame 2 that is placed between the top T and the bottom B of the sash/movable frame 2. This provides that the movable frame 2 is configured to be opened by the lower part/bottom part B of the movable frame moving outwards, away from the interior of the building in which the roof window 1 is installed, and the upper part/top part T of the movable frame 2 moves inwards into the building upon opening of the movable frame 2 from a closed position. It is understood that the axis of rotation RAX may be arranged around the centre of the lengths of the side profiles 2d, 2c of the movable frame. However, in some centre-hung configurations, the axis of rotation RAX may also be displaced towards the top or bottom part of the movable frame in order to e.g. provide a balancing of the weight of the movable frame 1. This is also understood as a centre hung roof window according to the present disclosure. Centre-hung windows may also be referred to pivot roof windows.

[0105] In roof window of the centre-hung type, the fixation frame 20 may surround movable frame 2. In roof windows 1 of the centre-hung type, the maximum width of the movable frame 2 may be less than the interior, minimum width of the frame opening of the fixation frame 20 in order to allow top T and bottom B parts of the movable frame 2 to move into the frame opening of the fixation frame 20 when moving the movable frame 2 to a closed position.

[0106] In other embodiments of the present disclosure, the movable frame 2 may be hinged in another way, for example top hung (not illustrated). In still further embodiments, the roof window may be of the type where the insulated glass unit is unmovable attached to a fixation frame.

[0107] The fixation frame 20 comprises parallel side profiles 20c, 20d, a top profile 20a and a bottom profile 20b placed parallel to the top profile. These profiles 20a-20d are elongated and together they provides a rectangular fixation frame opening 21.

[0108] The movable frame 2 comprises frame profiles comprising a top profile 2a, and a bottom profile 2b. These are placed parallel to each other. The movable frame 2 also comprises parallel side profiles 2c, 2d. These profiles 2a-2d are elongated and together they provide a rectangular frame opening in the movable frame 2, and light passes through this frame opening. The movable frame 2 supports an insulated glass unit. The insulated glass unit is fixated to the movable frame

2, and covers the frame opening of the movable frame 2 that is placed between the profiles 2a-2d of the movable frame.

[0109] The roof window 1 also comprises covers 9a, 9b. A roof window of the centre hung type 1 may comprise fixed covers 9a that is fixed to the fixation frame, preferably proximate the top TF of the fixation frame 20. Moreover, the window comprises movable covers 9b that are fixed to the movable frame 2 and moves together with the movable frame 2. These movable covers are often placed proximate the lower part/bottom part B of the movable frame 2. The width of the covers 9a, 9b overlaps profiles at the fixation frame 20 and also the movable frame 2 (see e.g. fig. 3) in order to improve water tightening. When the movable frame is in a closed position, the fixed covers 9a and the movable covers 9b may be placed in continuation of each other. The covers 9a, 9b extends along the sides of the roof window 1, between the top and bottom of the roof window 1. The covers 20 9a, 9b are exterior covers that are subjected to the weather

[0110] The roof window 1 may also comprise a top cover 9c that is arranged at the top TF of the fixation frame 20. This top cover 9c also overlaps the top T of the movable frame when the movable frame 2 is placed in a closed position. In fig. 1, the movable frame 2 is in an open position.

[0111] Fig. 2 illustrates schematically a cross sectional view of a side part of an insulated glass unit 3 according to embodiments of the present disclosure, for installation in a roof window 1 (not illustrated in fig. 1) according to embodiments of the present disclosure. The insulated glass unit 3 of fig. 2 comprises three glass sheets 3a-3c that have major surfaces 3a2, 3a1, 3b2, 3b1, 3c2, 3c1 placed parallel to each other. The insulating glass unit 3 comprises at least a first, outer glass sheet 3a, a third glass sheet 3c, and a second intermediate glass sheet 3b. The second intermediate glass sheet 3b is placed between the first glass sheet 3a and the third glass sheet 3c, Generally, the first glass sheet 3a may be configured to face the exterior EXT of the building (see fig. 3) when the roof window 1 is installed in a roof structure of the building and the insulated glass unit 3 is fixed to a fixed frame, or fixed to a movable frame 2 as in fig. 1 (when the movable frame 2 is in a closed position).

[0112] A first insulating gap 4a is provided between an inner, major surface 3a1 of the first, outer glass sheet 3a, and a major surface 3b2 of the second, intermediate glass sheet 3b. The first insulating gap 4a is sealed by means of a first edge seal 6a.

[0113] The major surface 3b2 of the second, intermediate glass sheet 3b may as illustrated face and preferably abut the first insulating gap 4a.

[0114] The major surface 3a1 of the first, outer glass sheet may as illustrated face and preferably abut the first insulating gap 4a.

[0115] A second insulating gap 4b is provided between another major surface 3b1 of the second, intermediate glass sheet 3b, and a major surface 3c2, of the third glass sheet 3c. The second insulating gap 4b is sealed by means of a second edge seal 6b.

[0116] The major surface 3b1 of the second, intermediate glass sheet 3b may face and preferably abut the second insulating gap 4b.

[0117] The edge seals 6a, 6b of the insulated glass unit 3 may in embodiments of the present disclosure comprise spacer bars. Such spacer bars, that may be common, comprises a metal profile, a composite profile, a structural foam or TPS (thermoplastic) and/or the like. Other spacer bars may be used. Spacer bar may in some embodiments comprise a desiccant for absorbing moisture. The edge seal 6a, 6b functions as a gas barrier sealant to keep an insulating gas (commonly agron) in the insulating gap 4a, 4b for the lifetime of the insulated glass unit. The edge seal(s) 6a, 6b may also structurally hold the glass panes 3a-3c joined as a single, insulating glass unit 3. As illustrated in figures described in more details below, the insulated glass unit may also comprise more than two insulated spaces, and hence more glass sheets.

[0118] One or more of the glass sheets 3a-3c may be thermally tempered or may be annealed glass sheets.

[0119] In fig. 2, the insulating glass unit 3 is a laminated glass unit, and hence, a further lamination glass sheet 3L is attached to the third glass sheet 3c surface 3c1 by means of a lamination layer LL, such as an adhesive. The lamination layer LL may for example comprise EVA (Ethylene Vinyl Acetate) or PVB (Polyvinyl butyral) and should be transparent to visible light so that sunlight can pass through the insulated glass unit. The lamination of the insulated glass unit provides safety, and may e.g. be advantageous in roof windows. Although the glass sheet 3c may be considered the inner glass sheet of the insulated glass unit 3, the lamination glass sheet 3L is often arranged as the innermost glass sheet of the window (when the movable frame, if present, is in a closed position), and may provide the major surface 3Li for facing, such as abutting, the interior of the building. This surface Li is placed opposite to the surface of the glass sheet 3L that is attached to the glass sheet 3c by means of the lamination lay LL.

[0120] The major surface 3c2 of the third glass sheet 3c may as illustrated face and preferably abut the second insulating gap 4a. The other major surface 3c1 of the third glass sheet may face and abut a lamination layer LL or may face and abut the interior room of the building if the lamination layer LL and lamination glass 3L is omitted.

[0121] The first glass sheet 3a comprises the major surface 3a2 that faces away from the first insulating gap 4a. This surface 3a2 may in some embodiments of the present disclosure be the major outer surface configured to face the exterior of the building (see fig. 3) when the movable frame 2 (see fig 1) is in a closed position, and may hence be subjected to weather such as rain, snow, hail and/or the like.

[0122] According to the present disclosure, a side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b extends with a first distance DIS1 past the side edge 7a of the first glass sheet 3a.

[0123] Generally the side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b may as illustrated extend past the outer side surface 6ae of the first edge seal 6a that faces away from the first insulating gap 4a. The first edge seal 6a also comprises an interior side surface 6ai that faces towards and abuts the gap 4a. The side surfaces surface 6ae, 6ai are opposing and extends between the glass sheet surfaces 3a1, 3b2.

[0124] This provides an elongated space 10 which overlaps the side portion 8 and is placed next to the first edge seal 6a.

[0125] In fig. 3, the first edge seal 6a is placed with the distance DIS2 (measured from surface 6ae) to the side edge 7b of the second, intermediate glass sheet 3b, thereby providing the elongated space 10 which overlaps the side portion 8 and is placed next to the first edge seal 6a.

[0126] The first distance DIS1 and the second distance DIS2 are in fig. 2 substantially equal, and the edge seal 6a surface 6ae of the first edge seal 6a that faces the space 10 is thus in fig. 2 substantially flush with the side edge 7a.

[0127] In other embodiments of the present disclosure (not illustrated), the edge seal 6a surface 6ae may be displaced relative to the side edge 7a.

[0128] The distances DIS1 and DIS2 may be defined from a plane PL4 that touches and extends in the longitudinal direction of the side edge 7b (see e.g. "LD" of fig. 10 or 11) of the second intermediate glass sheet 3b, and which extends perpendicular to a plane PL3 defined by/comprising the major surface 3b2 of the second intermediate glass sheet 3b.

[0129] The space 10 may be used for various purposes, and may hence be refered to as utility space 10.

[0130] In one or more embodiments of the present disclosure, the elongated space/ utility space 10 may be used as a wiring routing for electric systems such as power supply wires or control system wires and/or the like and/or may be used for placement of equipment during e.g. retrofitting of equipment at the roof window. In some situation, retrofitting of equipment at roof windows, or installing equipment before installation of the window, may be desired. Electrical wires such as power supply wires, control signal wires and/or the like may be needed. The elongated space 10 may be used for this, and hence enable a space saving solution.

[0131] As can be seen, the second edge seal 6b is located opposite to, (in the illustrated example below) the elongated utility space 10. The second edge seal 6b and the first edge seal are thus physically displaced/offset, "sideways" relative to each other. This may provide a reduced cold bridge and hence an improved heat insulation performance at the edge region of the insulated glass unit 3 when compared to solutions where the edge seals are placed substantially above each other.

[0132] In embodiments of the present disclosure, as for example illustrated in fig. 2, the first distance DIS 1 is larger than the width W2 of the second edge seal 6b.

[0133] In embodiments of the present disclosure, as for example illustrated in fig. 2, the second distance DIS 2 may be larger than the width W2 of the second edge seal 6b. The width W2 of the edge seal are determined/measured parallel to the plane PL3 and perpendicular to the plane P4.

[0134] In embodiments of the present disclosure, as for example illustrated in fig. 2, the second insulating gap 4b overlaps the first edge seal 6a. The second insulated gap 4b may at least partly overlap the first edge seal 6b. The magnitude of the overlap may be defined by the position of the inner side surface 6bi of the second edge seal 6b, that faces the gap 4b relative to the inner side surface 3ai position of the first edge seal 6a.

[0135] In some embodiments of the present disclosure, the first edge seal 6a and the second edge seal 6b are arranged un-overlapping (as illustrated in fig. 2) in their width direction at opposing sides 3b 1, 3b2 of the second, intermediate glass sheet 3b to seal the respective gaps 4a, 4b. This provides that the second insulating gap 4b fully overlap the width W4 of the first edge seal 6a. This is illustrated in fig. 2. It is naturally understood that the edge seals 6a, 6b are elongated and extends parallel to each other.

[0136] When the second insulated gap 4b overlaps fully or partly the width W4 of the first edge seal 6a, this may provide a reduced cold bridge between the interior and the exterior of the window when the insulated glass unit 3 is installed at the roof window. This may be caused by a longer "traveling path" for the heat (or cold) through the edge seals and/or a smaller area for direct heat transfer between the interior of the building and the exterior of the building through the edge seals 6a, 6b.

[0137] The edge seals 6a, 6b may be of substantially equal widths or different widths W2, W4.

[0138] In preferred embodiments of the present disclosure, the utility space 10 may be designed to be a water drainage channel. Various embodiments of the present disclosure where the utility space 10 is designed as a water drainage channel of a roof window 1 is described more details below, for example in relation to among others fig. 3.

[0139] Fig. 3 illustrates schematically a cross sectional view of a side part of a roof window 1, where an insulated glass unit 3 as described above in relation to fig. 2 is installed at a frame arrangement 2, in accordance with embodiments of the present disclosure.

[0140] The insulated glass unit 3 is attached to the frame arrangement 2, that either may be a movable frame 2 or a fixed frame. The side portion of the insulated/insulating glass unit 3 overlaps the elongated frame profile 2c so that both the edge seals 6a, 6b are placed opposite to the elongated frame profile 2c.

[0141] The illustrated side part 8 in fig. 2 (and other

figures of the present disclosure) is selected to be the right side, and hence it is here the elongated frame profile 2c that is illustrated. In other embodiments, it may be the other left side of the window (seen from the exterior) comprising the profile 2d, or the top part comprising the profile 2d. See e.g. fig. 1. A gasket 35 provides a tightening between the interior surface of the insulated glass unit 3 and the frame profile 2c.

[0142] The roof window 1 here comprises a guiding arrangement 11 placed at the elongated utility space 10 to guide water such as rain water along the drainage channel by means of gravity.

[0143] A guiding wall 11a of the guiding arrangement 11 is placed opposite to the first edge seal 6a so that the utility space 10 is placed between the guiding wall 11a and the first edge seal 6a surface 6ae, thereby providing the drainage channel.

[0144] Naturally, the guiding wall 11a may additionally or alternatively, in other or further embodiments of the present disclosure, be used for containing equipment, wires and/or the like (not illustrated) at the desired location in the utility space 10.

[0145] In some embodiments of the present disclosure, the guiding arrangement 11 may also comprise a bottom part 11b, such as a bottom wall, as illustrated in fig. 3. This bottom part 11b extends over the side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b. The bottom part may provide a cannel bed of the utility space 10.

[0146] Moreover, the guiding arrangement 11 may in embodiments of the present disclosure, as illustrated in fig. 3, comprise a pane overlapping part 11d which extends in over the outer major surface 3a2 of the first, outer glass sheet 3a that is placed proximate the exterior EXT of the building.

[0147] The guiding arrangement 11 may in some embodiments of the present disclosure, comprise a side wall part 11c extending along the first edge seal 6a surface 6ae. Hereby, the utility space 10 is located between the side part 11c and the guiding wall 11a.

[0148] The parts 11b, 11c occupies a part of the space 10 along/proximate the side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b, and next to the edge seal 6b, respectively. The parts 11b, 11c, and/or 11d may provide mechanical protection of the insulated glass unit and/or provide water protection.

[0149] As can be seen, the width W1 of the utility space 10 may in embodiments of the present disclosure be less/smaller than the distance DIS2 and/or DIS1 (DIS1 is however not indicated in fig. 3 to improve figure simplicity, see e.g. fig. 2). This may be due to the thicknesses of the parts 11c and the position of the interior surface of the part 11a that faces the utility space.

[0150] The utility space 10 may in embodiments of the present disclosure have a width W1 of at least 5 mm, such as at least 9 mm, such as at least 14 mm, such as at least 20 mm. In some embodiments of the present disclosure, the utility space 10 may have a width W1 between 4 mm and 100 mm, such as between 5 mm and 50 mm, for example between 5 mm and 20 mm.

[0151] The width W1 of the utility space 10 may be determined in a direction parallel to a major surface 3b2 of the second, intermediate glass sheet 3b and perpendicular to a plane PL4 (See fig. 2) that touches and extends in the longitudinal direction of the side edge 7b of the second intermediate glass sheet 3b.

[0152] If the part 11c is omitted, this may increase the utility space 10 width W1.

[0153] In embodiments of the present disclosure, the utility space 10 may have a height of at least 5 mm, such as at least 8 mm, such as at least 10 mm, such as at least 15 mm. The height may in embodiments of the present disclosure be defined perpendicular to a plane PL3 defined by/comprising the major surface 3b2 of the second intermediate glass sheet 3b (see fig. 2) from the surface of the bottom wall 11b (if present) or alternatively from the side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b. The height may be determined partly by the height of the edge seal 6a and the thickness of the glass sheet 3a, possibly with the thickness of the part 11b subtracted therefrom if present. This may be a minimum height of the utility space. by providing a larger/higher guiding wall 11a and a higher part 11c, the capacity of the utility space 11 may be increased.

[0154] The guiding wall 11a, bottom part 11b and side part 11c together provides a U-shaped utility space 10, which overlaps said side portion 8 and is placed next to the first edge seal 6a. Naturally, if the side part 11c is omitted, the utility space 10 will still be U-shaped. The utility space 10 comprises an elongated opening 13 at a position opposite to the said side portion 8 of the major outer surface of the second, intermediate glass sheet 3b, thereby providing that e.g. rain water may enter the utility space and/or providing that equipment may be placed in the utility space 10.

[0155] An elongated cover 9b (and/or 9c or 9a dependent on design) extends over and covers a part of the elongated utility space 10. See also fig. 1. This provides water tightening and/or advantageous handling of rainwater. In the example of fig. 3, the width of the cover 9b extends over and covers the entire width W1 the elongated utility space.

[0156] Wind driven water or snow RW that is illustrated by the dashed-dotted arrow may enter the water drainage channel 10 from a space 30 between the cover 9b and the insulating glass unit 3. The wind driven water or snow enters in between the cover and the insulated glass unit 3 in a direction transverse to the longitudinal direction of the drain channel 10, into the drain channel and flows therefrom towards the bottom of the window 1 due to gravity.

[0157] The guiding arrangement 11 as described above may in embodiments of the present disclosure be integrated in a holding arrangement 12, such as a holding profile. The holding arrangement 12 is configured to fix-

ate the insulating glass unit 3 at the frame arrangement 2, and the holding arrangement 12 comprises a fixation part 11e for fixating the holding arrangement 12 to the frame arrangement 2 by means of fixation means.

[0158] The fixation part 11e of the holding arrangement 12 is fixated to or at e.g. the exterior side of the frame profile 2c that is placed opposite to the frame opening provided by among others the frame profile 2c. This fixation may be provided by means of fastening means such as mechanical fastening means, for example screws, pop rivets, nails or clips (not illustrated), additionally or alternatively, an adhesive may be used.

[0159] The holding arrangement 12 comprising the guiding arrangement 11 may in embodiments of the present disclosure comprise or be, such as consist of, an extruded, pultruded or moulded profile, that is fixated to the insulating glass unit 3 after it has been manufactured (see e.g. fig. 4), or it may comprise a holding arrangement 12 that is moulded directly onto the insulated glass unit (as e.g. illustrated in fig. 3). The holding arrangement 12 may be made from a metal such as aluminium or steel, or a polymer such as a fibre reinforced polymer or the like.

[0160] The pane overlapping part 11d and/or the bottom part 11b may be fixated to the insulated glass unit 3. This may e.g. be provided by means of an adhesive connection.

[0161] The pane overlapping part 11d and/or the bottom part 11b may be configured so as to provide a fixation, such as a mechanical fixation, of the insulating glass unit 3, so as to fixate the insulating glass unit to the frame arrangement 2.

[0162] In some embodiments of the present disclosure, said pane overlapping part 11d and/or said bottom part 11b may provide a fixation, such as a mechanical fixation, of the insulating glass unit 3, for example by means of a clamping force.

[0163] The utility space 10 solution according to the present disclosure may help to provide a space saving solution.

[0164] For example, the distance DIS3, such as the maximum distance, between a first plane PL1 defined by an outer surface 9x of the side cover 9b and a second plane PL2 defined by/comprising the outer major surface 3a2 of the first, outer glass sheet 3a may be less than 30 mm, such as less than 20 mm, preferably less than 10 mm, such as less than 5 mm. The first and second planes PL1, PL2 are considered substantially parallel.

[0165] In one or more embodiments of the present disclosure, the distance DIS3, such as the maximum distance, between the outer surface 9x of the cover 9b and a plane PL2 defined by the outer major surface of the first, outer glass sheet may be less than 50 mm, such as less than 20 mm, preferably less than 10 mm, such as 6 mm or less than 6 mm. This distance DIS3 may be determined perpendicular to the outer major surface 3a2 of the first, outer glass sheet.

[0166] In fig. 3, the outer surface 9x of the cover is substantially plane. In embodiments where the outer surface 9x of the cover is curved or non-planar, the first plane PL1 defined by the outer surface 9x of the cover may be defined from a point of the cover surface providing the maximum distance between that plane PL1 and the second plane PL2 defined by the major outer surface of the outer glass sheet, where these planes are substantially parallel.

[0167] As can be seen, the outer surface 9x of the cover 9b may face away from the first plane PL1.

[0168] Additionally or alternatively, the utility space 10 solution according to the present disclosure enables a more space saving frame solution. As the utility space 10 is so to say integrated in the side part(s) of the insulated/insulating glass unit 3, there may not be a need for placing e.g. a water drainage channel at the frame arrangement, next to the outermost side of the insulated glass unit for handing e.g. wind driven rain and/or snow. Or at least the space consumption of such a drainage channel next to the outermost side of the insulated glass unit may be reduced. This enables providing a more narrow frame arrangement. For example, the width/thickness of the frame part 14, placed next to the second edge sealing 6b may be reduced.

[0169] This frame part 14 may hence have a width(Thickness that is less than 10 mm, such as less than 7 mm, for example less than 5 mm, such as around or less than 3mm. As can be seen, this may e.g. provide a more space saving, movable frame 2 solution, see for example fig. 8. For example, the width/thickness W3 of the frame part 14 opposite to the second edge seal 6b may in embodiments of the present disclosure be between 1 mm and 10 mm, such as between 1 mm and 7 mm, for example between 1 mm and 4 mm. This width/thickness W3 may be defined in a direction parallel to a major surface 3b1 of a glass sheet if the insulating glass unit 3.

[0170] In still further embodiments of the present disclosure (not illustrated), the holding arrangement 12 may be unitary with the overlapped profile 2c. Hence, in this embodiment, the holding arrangement 12, that may also comprise the guiding arrangement 11, may be an integrated part of the frame profile 2c. Thus, in this embodiment there may be no need for mechanical fastening means for fixating a fixation part 11e of the holding arrangement 12 to the frame profile 2c. Instead, the fixation part 11e and preferably also one or more of the parts 11b, 11a, 11c and/or 11d may here be integrated in/be unitary with, the frame profile 2c. This may be obtained by means of a moulding process and/or a welding/fusing process. For example, in some embodiments of the present disclosure, at least the guiding wall 11a, bottom part 11b and side part 11c that together provides a U-shaped utility space 10 opposite to the portion 8 may be integrated with/unitary with the fixation part 11e and the frame profile 2c, such as integrated with/unitary with an exterior wall of the frame profile 2c.

[0171] Fig. 4 illustrates schematically a cross sectional

view of a side part of a roof window 1, according to further embodiments of the present disclosure.

[0172] As can be seen, the guiding arrangement 11 is here integrated in a profile that is fixated to the insulating glass unit 3 after it has been manufactured (see e.g. fig. 4). The profile may here be a loose "stand-alone" profile that is attached to the insulating glass unit 3 by means of a sealant and/or an adhesive. This profile may comprise the same parts 11a, 11b, 11c, 11d as described above, but tolerance spaces 40 may be provided between one or more parts 11a, 11b, 11c, 11d of the profile and the insulated glass unit 3.

[0173] In fig. 4, the pane overlapping part 11d is fixated to the exterior major surface 3a2 of the insulating glass unit 3 by means of a sealing arrangement 25 additionally or alternatively, an adhesive such as an adhesive tape may be used (not illustrated).

[0174] Fig. 4 illustrates a further embodiment of the present disclosure where a drip edge 60 is provided at the cover 9b. The drip edge is provided by means of an elongated elevation, such as a ridge comprising/providing the drip edge 60. The drip edge is placed opposite to the water drainage channel 10 and may in further embodiments of the present disclosure (as illustrated) even extend into the water drainage channel. Hereby, water running on the underside of the cover 9b due to e.g. wind may be forced to be released from the cover 9 and drip into the water drainage channel 10. In fig. 4, the elevation comprising the drip edge 60 comprises a crest extending in a direction towards the water drainage channel 10. The ridge extends in the longitudinal direction of the cover 9 and parallel to the longitudinal direction of the water drainage channel 10.

[0175] Fig. 5 illustrates an embodiment of the present disclosure where the bottom wall 11b is fixated to the side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b by means of a sealant and/or an adhesive 36 such as an adhesive tape (not illustrated). This may provide the primary structural fixation of the insulating glass unit 3 to the profile comprising the guiding arrangement 11.

[0176] Fig. 5 moreover illustrates an embodiment of the present disclosure where the pane overlapping part 11d (se figs 3 or 4) is omitted from the guiding arrangement 11. A sealant 37, such as a resilient, adhesive joint, may be provided between the side part 11c, such as a sidewall, of the guiding arrangement 11 and the insulating glass unit 3.

[0177] This may help to even further reduce the height of the cover above the insulated glass unit.

[0178] Fig. 6 illustrates schematically a cross sectional view of a side part of a roof window 1 comprising an insulating glass unit 3 with three insulating gaps 4a-4c, according to further embodiments of the present disclosure.

[0179] In the embodiment of fig. 6, the side portion 8 of the major surface 3b2 of the intermediate glass sheet 3b extends with a distance DIS1 past both the side edge 7a of the a first, outer glass sheet 3a, and moreover past a side edge 7d of a further glass sheet 3d that is placed between the outer glass sheet 3a and the intermediate glass sheet 3b.

[0180] The side portion 8 of the major surface 3b2 of the second, intermediate glass sheet 3b also extends with a distance DIS2 past outer sides 6ae, 6ce of the first edge seal 6a and third edge seal 6c respectively that faces away from the respective insulating gap 4a, 4c, so as to provide the elongated utility space 10 that which overlaps the side portion 8 and is placed opposite to the outer side surfaces 6ae, 6ce of the edge seals 6c, 6a and the glass sheet edges 7d, 7a.

[0181] The third edge seal 6c is also, as edge seal 6a, displaced with a distance DIS2 to the plane PL4 as previously described.

[0182] In fig. 6, the height of the utility space 10 (if the guiding arrangement 11 was omitted) is at least the sum of the height of the two edge seals 6a, 6b, and the sum of the thickness of the glass sheets 3a, 3d.

[0183] Fig. 7 illustrates schematically a cross sectional view of a side part of a roof window 1 comprising an insulating glass unit 3 with three insulating gaps 4a-4c, according to embodiments of the present disclosure. If compared to the example(s) of fig. 2, 3 or 4, a further insulating gap 4c is placed proximate the frame profile 2c and overlaps the profile. The lamination glass sheet 3L is attached to the inwardly facing, major surface 3c1 as previously described, see e.g. fig. 2. The second insulating gap 4b is hence placed between the between the glass sheets 3b, 3d, between the gap 4a and the gap 4c. Here, the utility space 10 may be substantially corresponding to the utility space 10 described above in relation to the various embodiments of figs. 2-5. However, the further insulating gap 4c in fig 7 also overlaps the first edge seal 6a, and the edge seal 6c the further gap 4c is placed opposite to the second edge seal 6b so that the further edge seal 6c is located opposite to, such as below, the elongated utility space 10.

[0184] When comparing the embodiments of figs. 7 and/or 6 to the embodiment of for example fig. 2 or 3, heat insulation performance may e.g. be improved in the embodiments of figs. 6 or 7. In fig. 6, the capacity of the utility space is increased compared to the embodiments of for example figs. 2, 3, 4 and 7.

[0185] Fig. 8 illustrates an embodiment of the present disclosure, where the cover 9b only extends partly over the width W1 of the elongated utility space. In figs 3-7, the cover 9b extends over the entire width the elongated utility space, and preferably also overlaps the outer major surface of the insulated glass unit.

[0186] The side edge of the cover 9b is bended towards the utility space 10 to provide a drip edge 60 so water drips into the utility space that in fig. 8 is a water drainage channel. The drip edge may also provide protection from wind driven water.

[0187] As the cover does not need to overlap the outer surface 3a2 of the insulated glass unit 3, a more space

saving solution may be provided.

[0188] In some embodiments of the present disclosure, the outer surface 9x of the cover 8 and the outer major surface 9a2 may be substantially flush. In some embodiments of the present disclosure, the first and second planes PL1, PL2 as illustrated in fig. 3 may be substantially coinciding, which would be the case in fig. 8. Alternatively, in some embodiments of the present disclosure, the outer surface 9x of the cover 8 and the outer surface of the pane overlapping part 11d may be substantially flush.

[0189] In one or more embodiments of the present disclosure, the insulated/insulating glass unit 3 comprises a plurality of said utility space 10 extending along different sides of the insulated glass unit 3. In some embodiments of the present disclosure, opposing, parallel utility spaces 10 may be arranged at opposing parallel sides of the insulated glass unit. These sides may in some embodiments be at sides, such as hinged 30 sides, that extends between the top and bottom of the insulated glass unit. Such an embodiment is illustrated in fig. 9, which is a cross sectional, schematic view of a roof window 1 of the centre hung type, according to embodiments of the present disclosure. As can be seen, the outer glass sheet 3a has a width (see W5 in fig. 10) that is less than the width of the intermediate glass sheet 3b, and inner glass sheet 3c of the insulating glass unit 3. This reduction in width, together with first, parallel edge seals 6a that are both displaced towards the centre of the insulated glass unit when compared to the second edge seals 6b, provides elongated, parallel utility spaces 10, such as water drainage channels, at opposing sides of the insulated glass unit as also previously described. As also illustrated in fig. 1, covers 9 extends over and covers a part of the fixation frame 20 and the insulated glass unit, in this case to fully overlap the width W1 (see e.g. fig. 3) of the respective utility space 10.

[0190] The hinge arrangement 30 movably connects the movable frame 2 and the fixation frame 20, and as can be seen, the fixation frame 20 surround movable frame 2 as the window 1 is of the centre-hung type.

[0191] Fig. 10 illustrates an insulating glass unit 3 according to an embodiment of the present disclosure. Here, elongated, parallel utility spaces are placed at opposing sides of the insulating glass unit 3. The outer glass sheet 3a (see e.g. fig. 9) providing the major surface 3a2 has a width W5 that is smaller than the width W6 of the intermediate glass sheet 3b, thereby providing the utility space 10 above the respective surface portions 8. In fig. 10, the glass sheets of the insulating glass unit 3 have substantially the same length/height.

[0192] Fig. 11 illustrates a further embodiment of the present disclosure, substantially corresponding to the embodiment of fig. 10, but where a utility space 10 is moreover provided at a top part of the insulated glass unit 3. This top part is to be placed at the T of the window, such as the top T of a movable frame (See fig. 1. The longitudinal direction of the elongated utility space 10 at the top extends in a direction perpendicular to the longitudinal direction of the parallel utility spaces 10 at the opposing sides. At corner areas 80 of the glass unit 3 where the parallel utility spaces 10 and the utility space 10 at the top meet, a transition between the utility space 10 at the top and the parallel utility spaces 10 is provided, and water from the upper utility space may enter into one or both parallel utility spaces providing the surface 3a2 at this transition at the corner areas 80. The utility space 10 at the top may be placed so that a top cover (see fig 1, ref. 9c) overlaps it, as previously described , and hence, wind driven water entering in between the insulated glass unit 3 and the top cover will be collected by the utility space 10 at the top.

[0193] If utilizing the upper utility space 10 for e.g. cable guidance, wires may be bended around one or both upper corners of the outer glass sheet providing the outer surface 3a2.

[0194] As can also be seen, the height/length of the outer glass unit providing the major surface 3a2 is less than the height/length of the intermediate glass sheet (providing the edge 7b), so as to provide the upper/top utility space.

[0195] In figs. 10 and 11, the side edges 7a, 7b extends in a longitudinal direction LD, and that longitudinal direction LD is parallel to the longitudinal direction of the respective elongated utility space(s) 10.

[0196] Figs. 10 and 11 have the feature in common that surface area of the major surfaces 3a2, 3a1 of the exterior glass sheet 3a (see also these references in previous figures) is smaller than the surface area of the major surfaces 3b2, 3b1, 3c, 3c1 of the second intermediate glass sheet 3b, and the third glass sheet.

[0197] Fig. 12 illustrates schematically a roof window 1 according to embodiments of the present disclosure that is installed in the roof structure 110 of a building 100. Here, the roof window 1 installed in the roof structure 110 where the roof structure 110 has a roof pitch above 15°, such as above 25°, such as above 35°. When the movable frame of the roof window 1 is in a closed position (if the roof window comprises a movable frame), the outer glass sheet surface 3a2 will hence be placed with an angle relative to horizontal, that may be above above 15°, such as above 25°, such as above 35°.

[0198] Fig. 13 illustrates schematically an insulating/insulated glass unit 3 according to embodiments of the present disclosure. Here, the exterior surface 6ae of the first edge seal 6a that faces away from the insulating gap 4a, and the interior surface 6bi of the second edge seal 6b that faces towards the insulating gap 4b, are substantially flush. However, in some further embodiments of the present disclosure (not illustrated), the interior surface 6bi of the second edge seal 6b may be placed below and extend away from the first edge seal 6a. These two embodiments differs from the various embodiments of the present disclosure illustrated in e.g. figs. 2-9, where the insulating gap 4b fully overlaps the first edge seal 6a and extends beyond the exterior surface 6ae of the first edge

seal to a position below the utility space 10 where it ends/is terminated at the interior surface 6bi of the second edge seal 6b.

[0199] Fig. 14 illustrates schematically an embodiment of the present disclosure, where the edge 7b of the intermediate glass sheet 3b and the exterior surface 6be of the second edge seal 6b that seals the gap 4b overlaps OD1 a part, such as the major part, of the maximum width MW1 of the frame profile 2c.

[0200] This moves the interior surface 6bi further away from the line of sight LS where it gets possible to see through the insulating glass unit 3. The line of sight LS is where the transition between the visible part of the interior major surface 3Li of the insulating glass unit and the part of the surface that is hidden by the frame arrangement or gasket 2c, 2, 35 is provided. This may help to reduce condensation at the visible part of the interior major surface 3Li near the frame profile. In this example, the interior major surface is provided by the major interior surface 3Li of a lamination glass.

[0201] In some embodiments of the present disclosure (as illustrated in fig. 14), the edge 7b of the intermediate glass sheet and the exterior surface 6be of the second edge seal 6b may be placed opposite to the half, such as the third of the profile's 2c width MW1 that is distal to the frame opening FO of the frame.

[0202] In one or more embodiments of the present disclosure, the overlapping distance OD1 with which the edge 7b of the intermediate glass sheet 3b and/or the exterior surface 6be of the second edge seal 6b overlaps the maximum width MW1 of the profile 2c may be at least 40%, such as at least 55%, such as at least 80% of the maximum width MW1 of the frame profile 2c.

[0203] In some embodiments of the present disclosure, the second insulating gap 4b that is sealed by the second edge seal 6b may overlap OD2 at least 30%. Such as at least 40%, such as at least 50%, such as at least 60% of the maximum width MW1 of the frame profile 2c. In fig. 14, the second insulating gap 4b that is sealed by the second edge seal 6b overlaps approximately 50% of the maximum width MW1 of the frame profile 2c. Generally, OD1 may be larger than OD2, due to the width of the second edge seal 6b.

[0204] The edge 7b of the intermediate glass sheet 3b and the exterior surface 6be of the second edge seal 6b overlaps the maximum width MW1 of the profile 2c with a larger overlapping distance OD1 than the distance with which the edge 7a of the glass sheet 3a and the exterior surface 6ae of the first edge seal 6a overlaps the maximum width MW1 of the profile 2c.

[0205] Fig. 14 illustrates a further embodiment of the present disclosure, where the surface 90 of the frame profile 2c that faces the frame opening FO is arranged inclining towards the interior surface 3Li of the insulating glass unit 3. In other embodiments, such as the ones illustrated in figs. 3-9, the surface 90 is arranged substantially perpendicular to the surface 3Li.

[0206] As illustrated in fig. 14 and other figures according to the present disclosure, the frame profiles 2a-2d, 20a-20d (see fig. 1) may be hollow and comprise one or more interior spaces 95 that are enclosed by walls of the profile. This/these spaces 95 may be filled with a heat insulating material (not illustrated), and/or may comprise one or more air spaces for insulation purposes. In further embodiments, the interior 95 of the frame profiles may be massive, e.g. provided by a massive wood profile.

[0207] In certain embodiments of the present disclosure, the holding arrangement 12 and/or guiding arrangement 11 may be made from the same material as the overlapped profile 2a-2d wall(s), and e.g. be integrated therewith (as previously described) or be separate thereto (as previously described) and attached by means of mechanical fastening means.

[0208] In general, it is to be understood that the present disclosure is not limited to the particular examples described above but may be adapted in a multitude of varieties within the scope of the disclosure as specified in e.g. the claims. Accordingly, for example, one or more of the described and/or illustrated embodiments above may be combined to provide further embodiments of the present disclosure.

Claims

1. A roof window (1) for installation in a roof structure of a building, wherein the roof window (1) comprises:

- a frame arrangement (2, 20), wherein said frame arrangement (2, 20) comprises a top profile (2a), a bottom profile (2b) and two side profiles (2c, 2d), and
- an insulating glass unit (3) that is supported by the frame arrangement (2), wherein the insulating glass unit (3) comprises at least a first glass sheet (3a), a third glass sheet (3c), and a second intermediate glass sheet (3b) placed between the first glass sheet (3a) and the third glass sheet (3c), wherein the first glass sheet (3a) is configured to face the exterior (EXT) of the building when the roof window (1) is installed in said roof structure,

wherein a first insulating gap (4a) is provided between a major surface (3a1) of the first, outer glass sheet (3a), and a major surface (3b2) of the second, intermediate glass sheet (3b), and where said first insulating gap (4a) is sealed by means of a first edge seal (6a), wherein a second insulating gap (4b) is provided between another major surface (3b1) of the second, intermediate glass sheet (3b), and a major surface (3c2, 3d2) of the third glass sheet (3c, 3d), and where the second insulating gap (4b) is sealed by means of a second edge seal (6b),

wherein a side portion (8) of a major surface (3b2) of the second, intermediate glass sheet (3b) extends with a first distance (DIS1) past a side edge (7a) of the first glass sheet (3a) and past an outer side surface (6ae) of the first edge seal (6a) that faces away from the first insulating gap (4a), so as to provide an elongated utility space (10), such as a water drainage channel, which overlaps said side portion (8) and is placed opposite to the outer side surface (6ae) of the first edge seal (6a).

2. A roof window according to any of the preceding claims, wherein the second edge seal (6b) is located opposite to, such as below, the elongated utility space (10).

3. A roof window according to any of the preceding claims, wherein the second insulating gap (4b) overlaps the width (W4) of the first edge seal (6a).

4. A roof window according to any of the preceding claims, wherein the second insulating gap (4b) fully overlaps the width (W4) of the first edge seal (6a).

5. A roof window according to any of the preceding claims, wherein an elongated side cover (9a, 9b, 9c) extends over and covers a part of the elongated utility space (10).

6. A roof window according to claim 5, wherein the distance (DIS3), such as the maximum distance, between a first plane (PL1) defined by an outer surface (9x) of the side cover (9a, 9b, 9c) and a second plane (PL2) defined by the outer major surface (3a2) of the first, outer glass sheet (3a) is less than 30 mm, such as less than 20 mm, preferably less than 10 mm, such as less than 5 mm.

7. A roof window according to any of the preceding claims, wherein the elongated utility space (10) is an elongated water drainage channel configured to guide rainwater along the longitudinal direction of the water drainage channel.

8. A roof window according to any of the preceding claims, wherein a guiding arrangement (11) is placed at the elongated utility space (10), and wherein a guiding wall (11a) of the guiding arrangement (11) is placed opposite to the first edge seal (6a) so that the utility space (10) is placed between the guiding wall (11a) and the first edge seal (6a).

9. A roof window according to claim 8, wherein the guiding arrangement (11) comprises a bottom part (11b), such as a bottom wall, extending over said side portion (8) of the major surface (3b2) of the second, intermediate glass sheet (3b).

10. A roof window according to claim 8 or 9, wherein the guiding arrangement (11) comprises a pane overlapping part (11d) which extends in over the outer major surface (3a2) of the first, outer glass sheet (3a).

11. A roof window according to any of claims 8-10, wherein the guiding arrangement (11) comprises a side part (11c) extending along the first edge seal (6a), and wherein the utility space (10) is located between the side part (11c) and the guiding wall (11a).

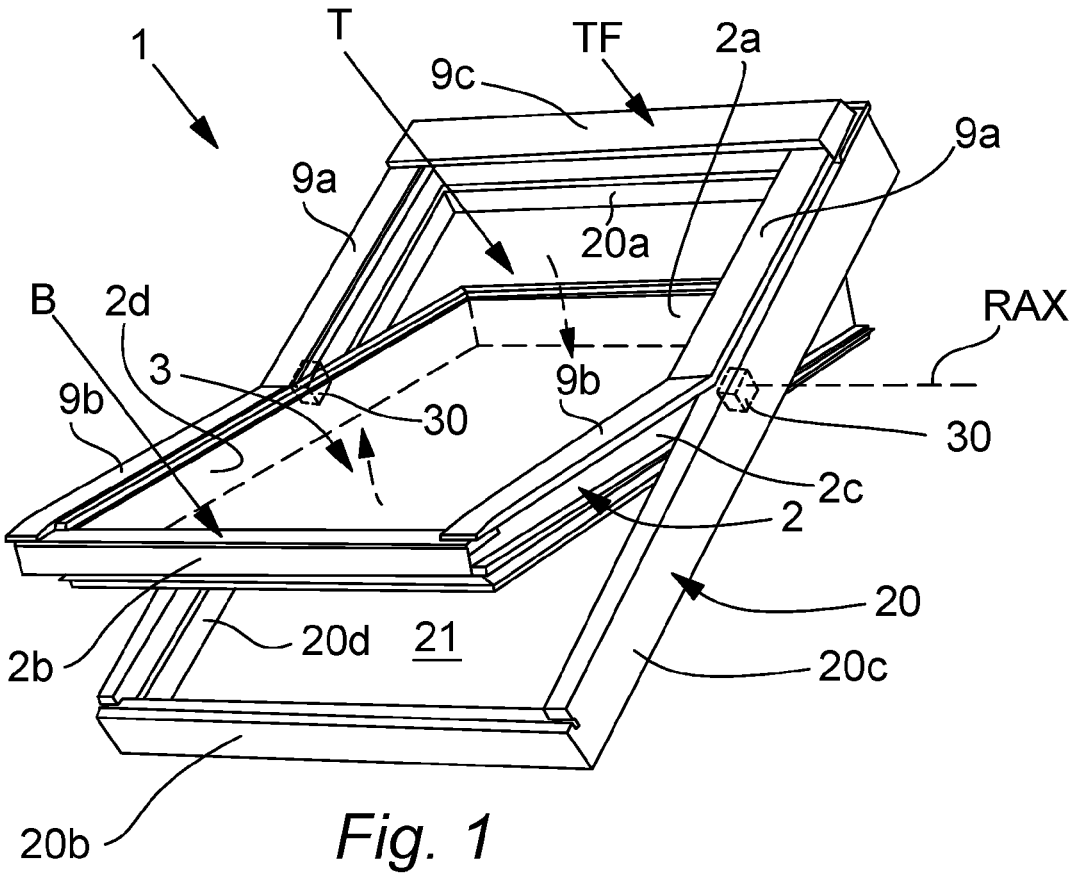
12. A roof window according to any of the preceding claims, wherein a guiding wall (11a), a bottom part (11b) and a side part (11c) together provides a U-shaped utility space (10) which overlaps said side portion (8) and is placed next to the first edge seal (6a).

13. A roof window according to any of claims 9-10, wherein said pane overlapping part (11d) and/or said bottom part (11b) provide a fixation, such as a mechanical fixation, of the insulating glass unit (3), and/or wherein said pane overlapping part (11d) and/or said bottom part (11b) is/are fixated (25, 36) to the insulated glass unit (3).

14. A roof window according to any of claims 8-13, wherein said guiding arrangement (11) is integrated in a holding arrangement (12), preferably a holding profile, wherein the holding arrangement (12) is configured to fixate the insulated glass unit at the frame arrangement (2), preferably wherein the holding arrangement (12) comprises a fixation part (11e) for fixating the holding arrangement (12) to the frame arrangement (2) by means of fixation means such as mechanical fixation means.

15. A roof window according to any of the preceding claims, wherein the utility space has a width (W1) of at least 5 mm, such as at least 9 mm, such as at least 14 mm, such as at least 20 mm.

16. A roof window according to any of the preceding claims, wherein the frame arrangement comprises a fixation frame (20) and a movable frame (2), where the movable frame (2) provides said support of the insulating glass unit (3), wherein the movable frame (2) is movably attached to the fixation frame by means of a hinge arrangement (30), such as wherein and wherein the roof window (1) is of the centre-hung type.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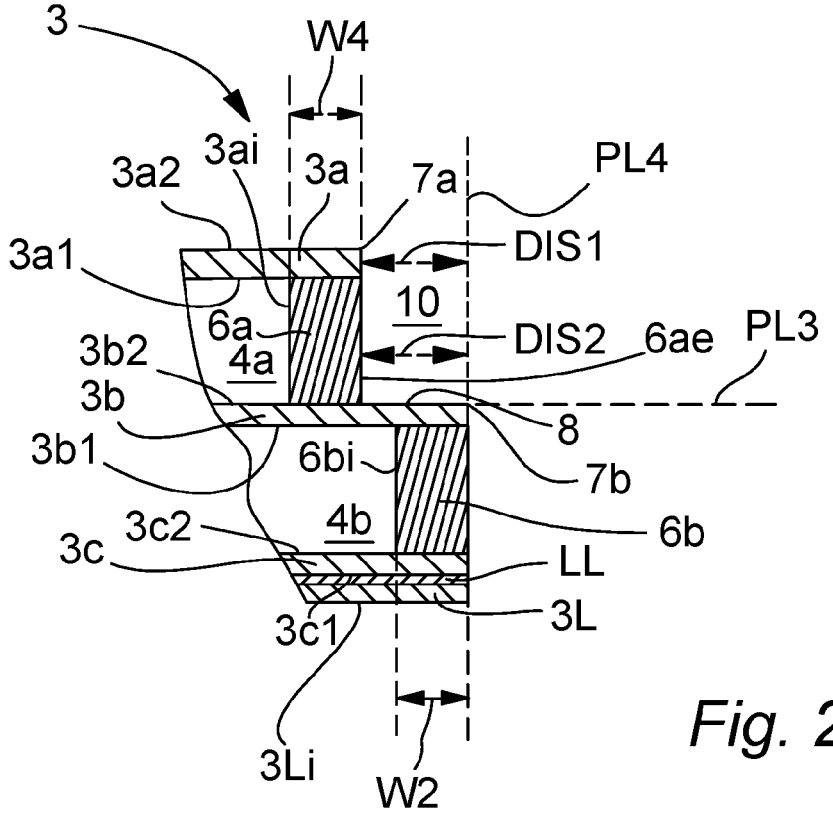
20b

Fig. 1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PL4
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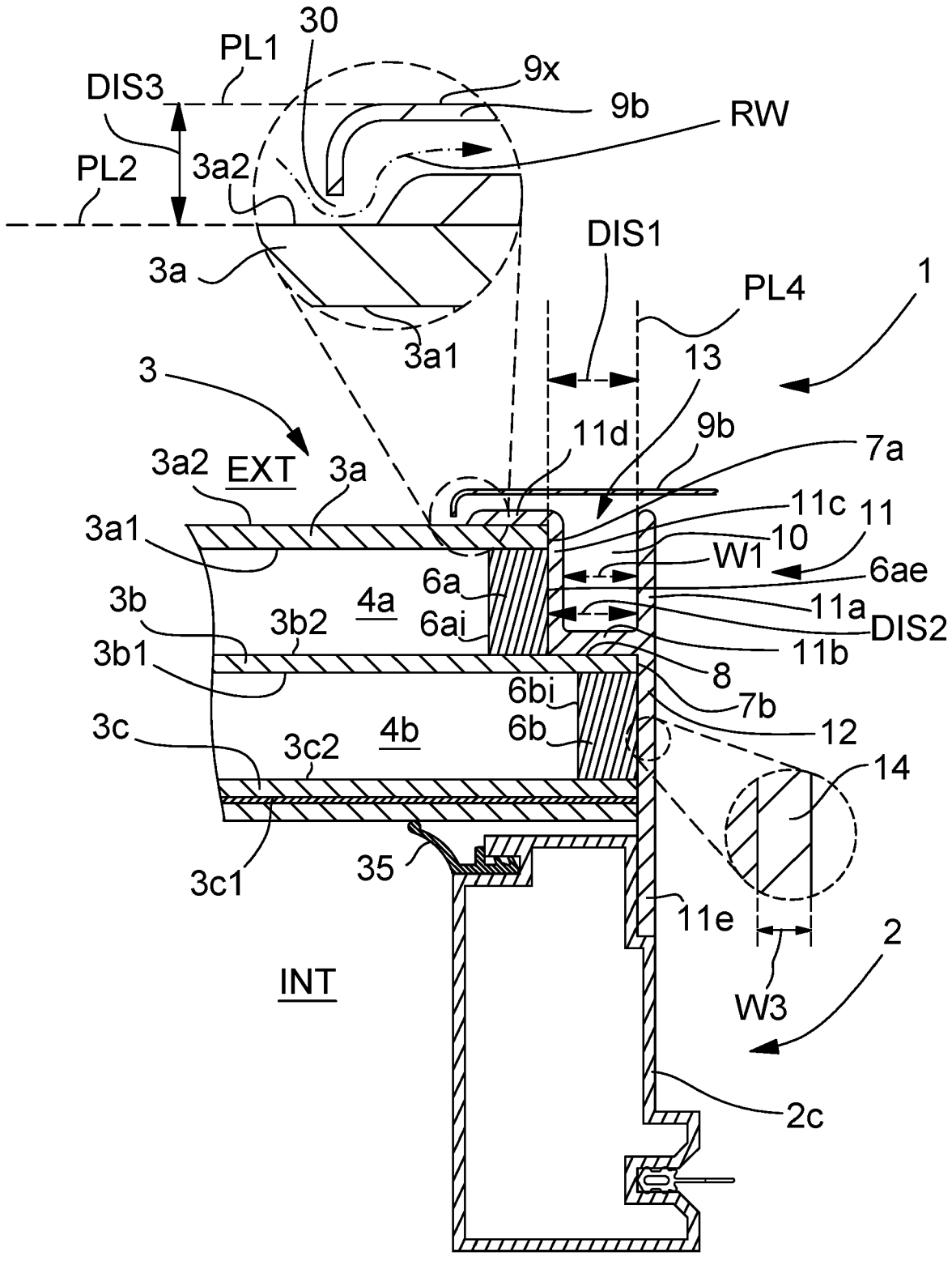
W2

Fig. 2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7a
3a2
EXT
3a
11c
11
3a1
10
W1
6ae
6a
3b
4a
11a
DIS2
3b2
6ai
3b1
11b
8
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14
35
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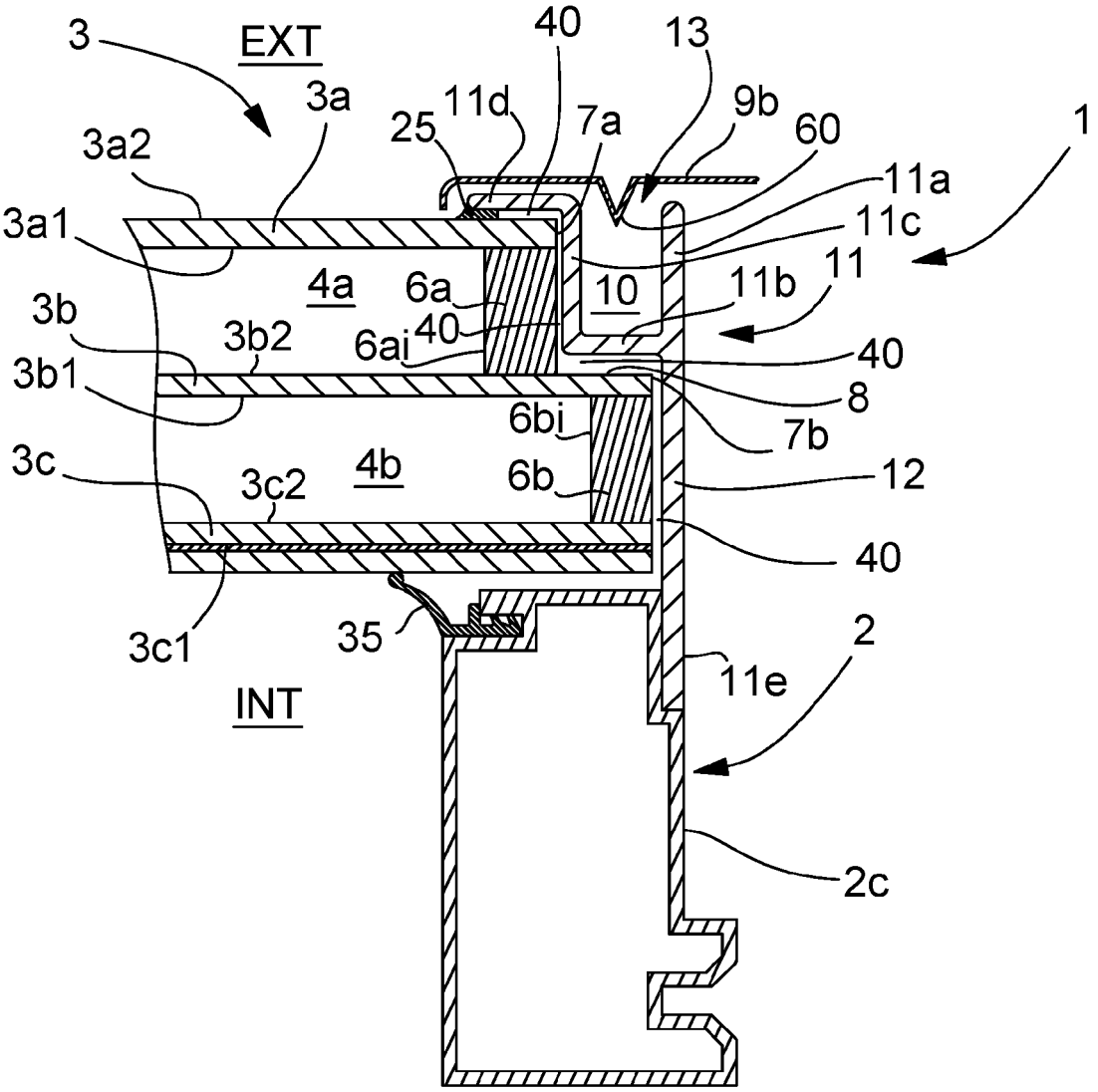
2
INT
W3
2c

Fig. 3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INT
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Fig. 4

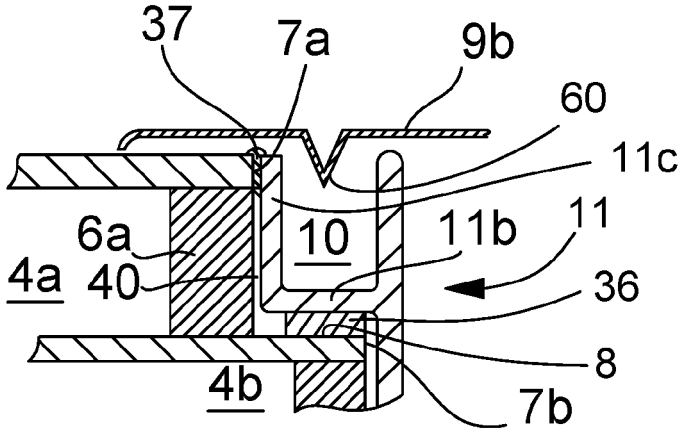
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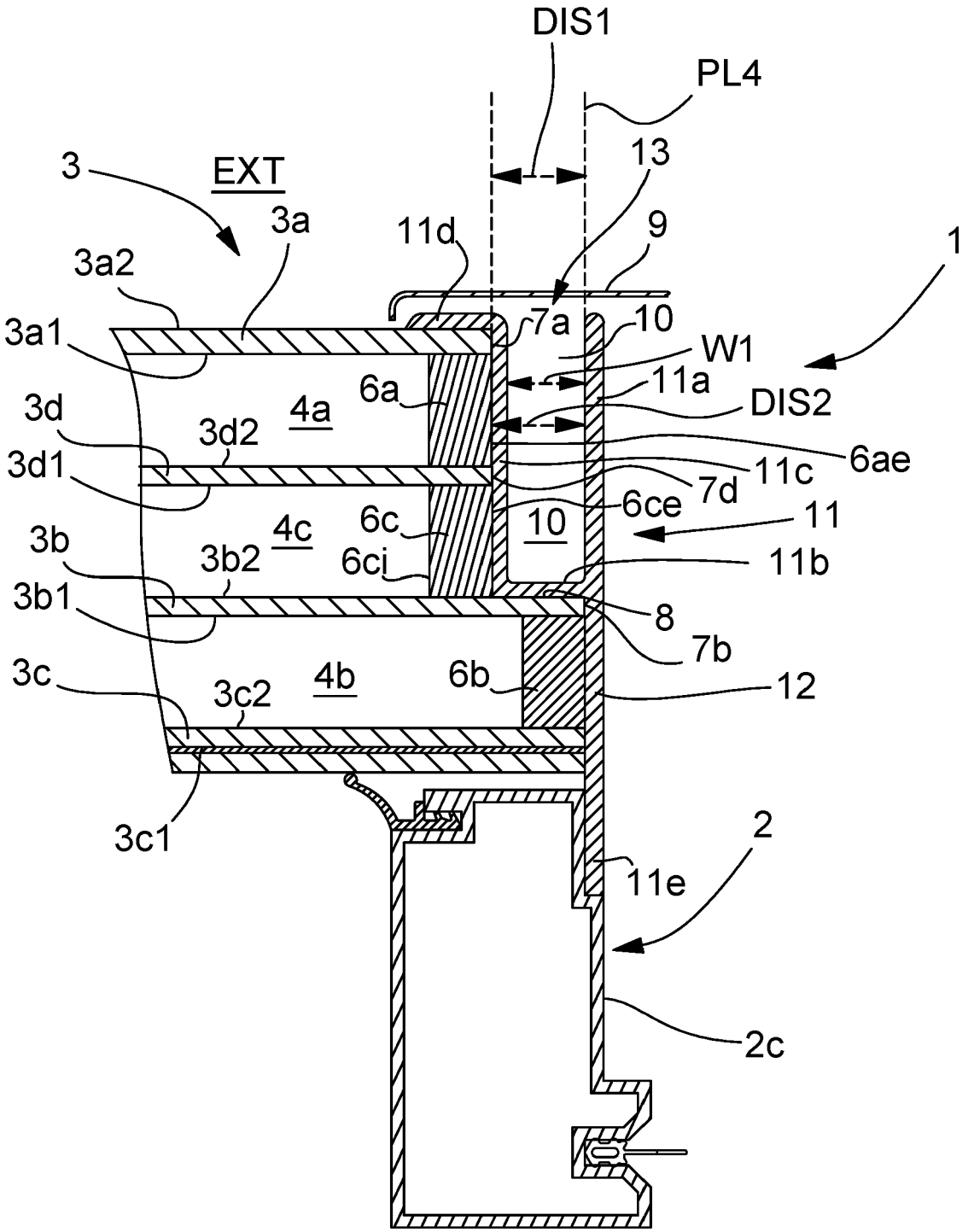
Fig. 5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3d1
11c
7d
6ce
11
6c
10
4c
3b
3b2
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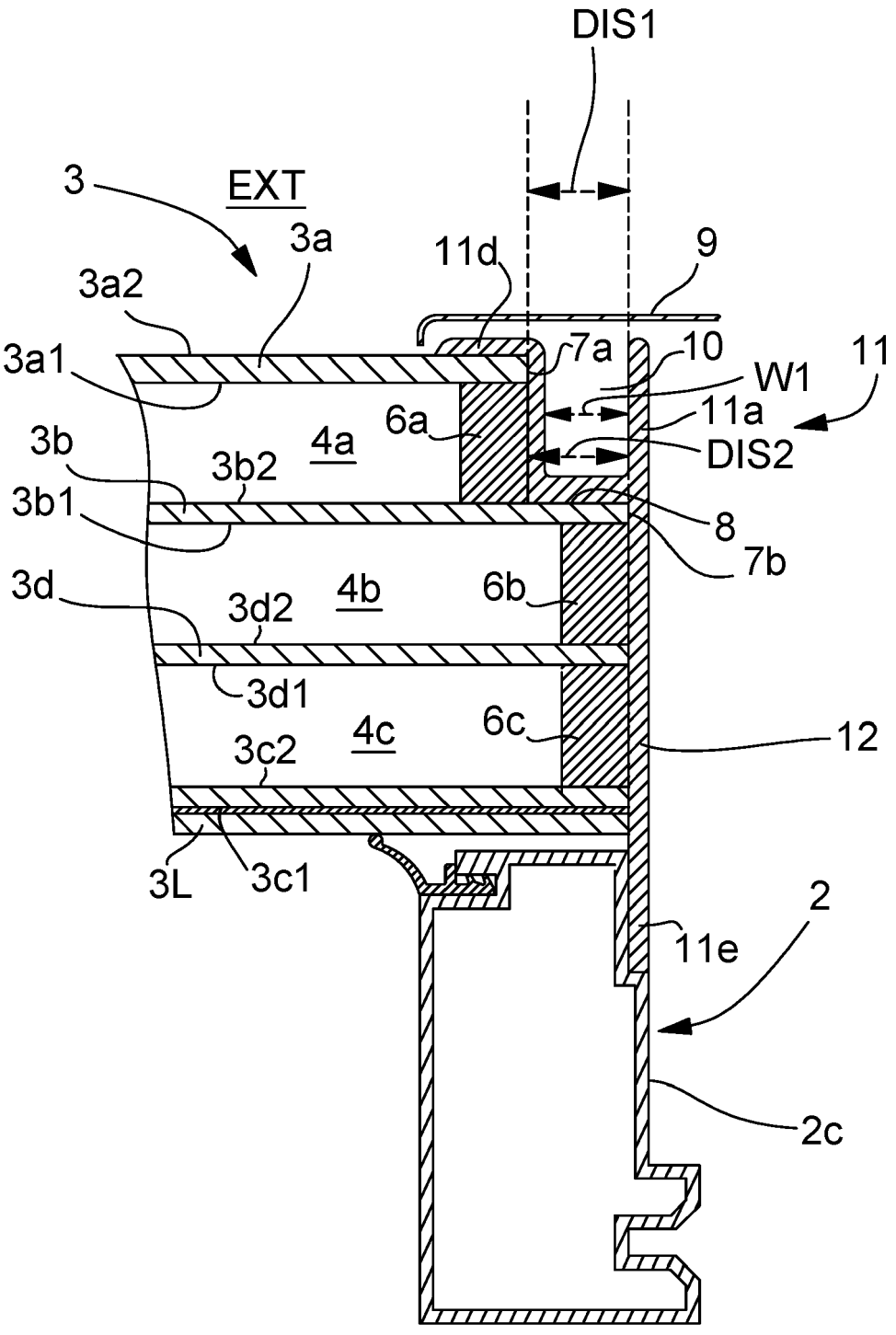
Fig. 6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3b2
3b1
8
7b
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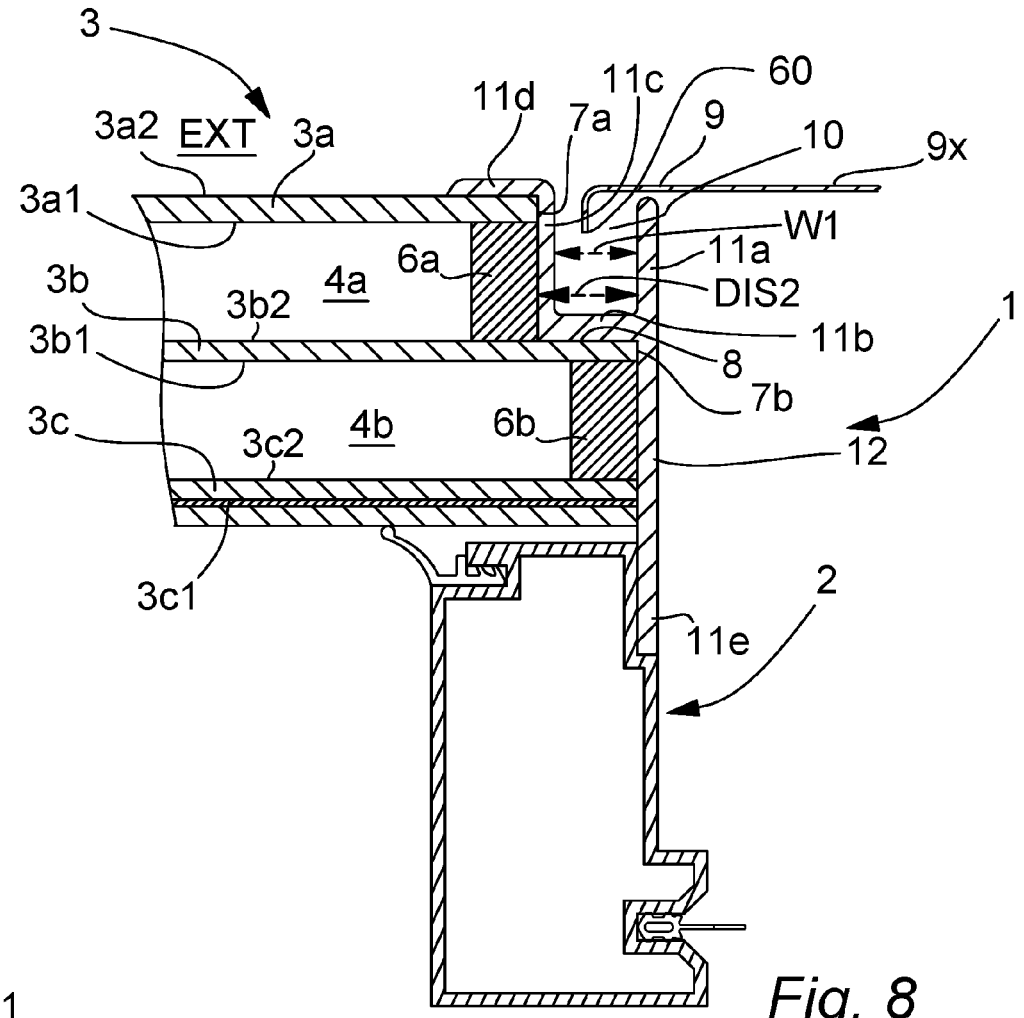
2c

Fig. 7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3b2
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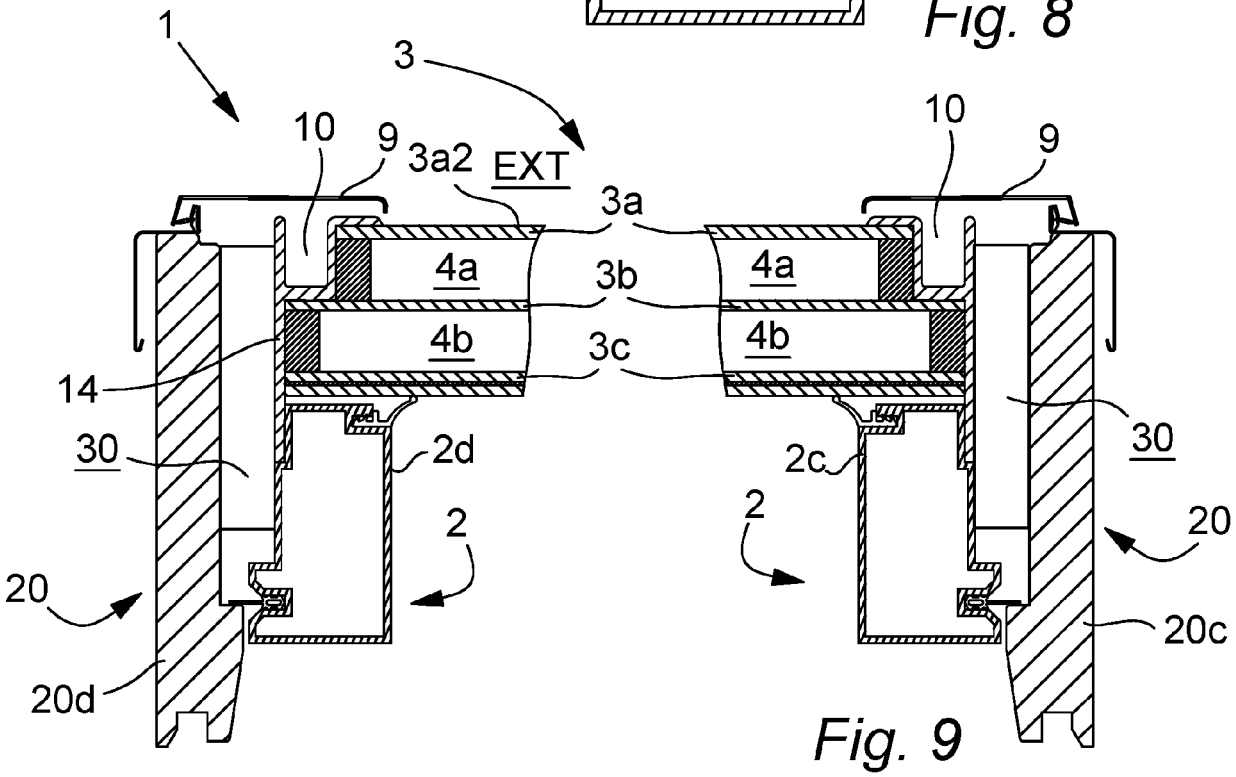
2
11e

Fig. 8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2d
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20
20d
2c
20c

Fig. 9

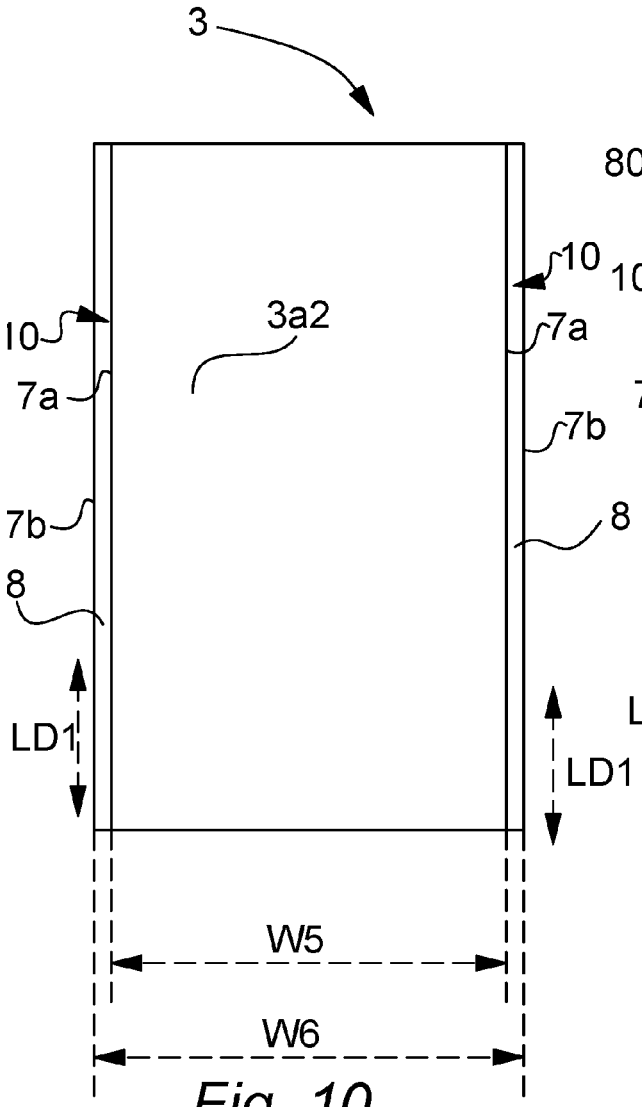


Fig. 10

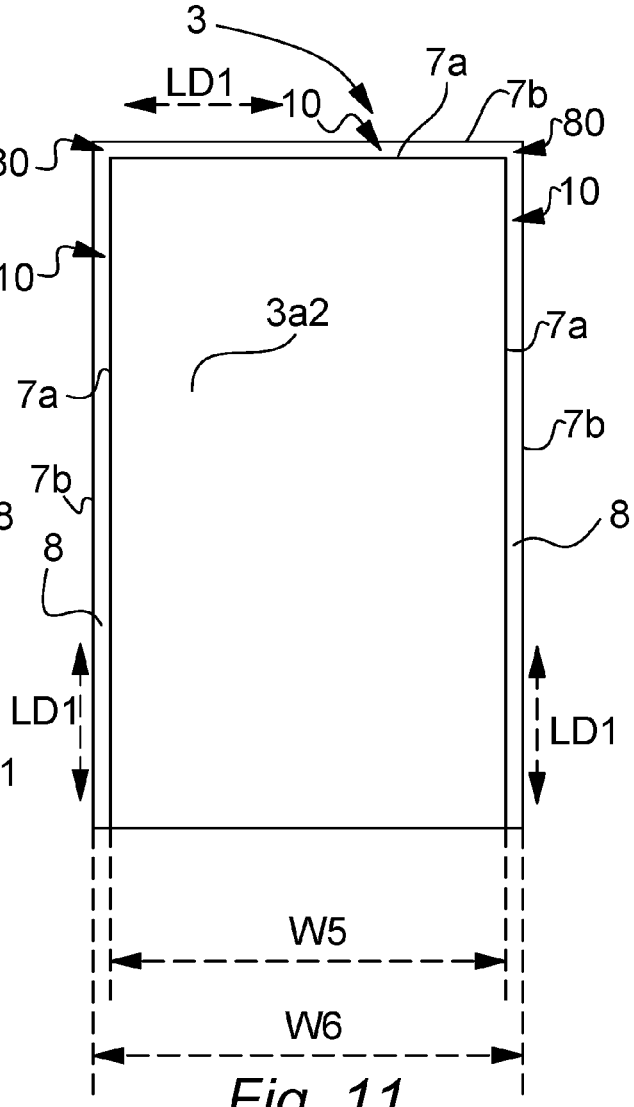


Fig. 11

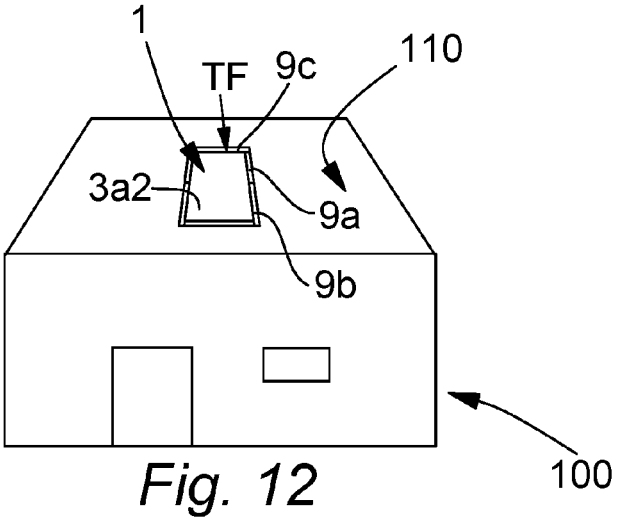


Fig. 12

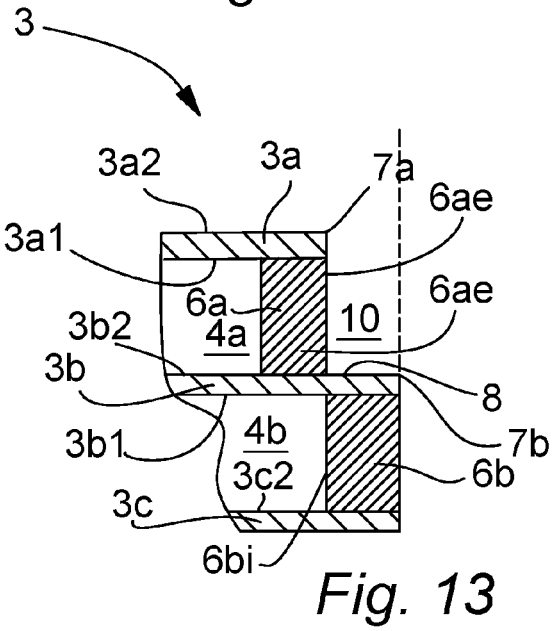
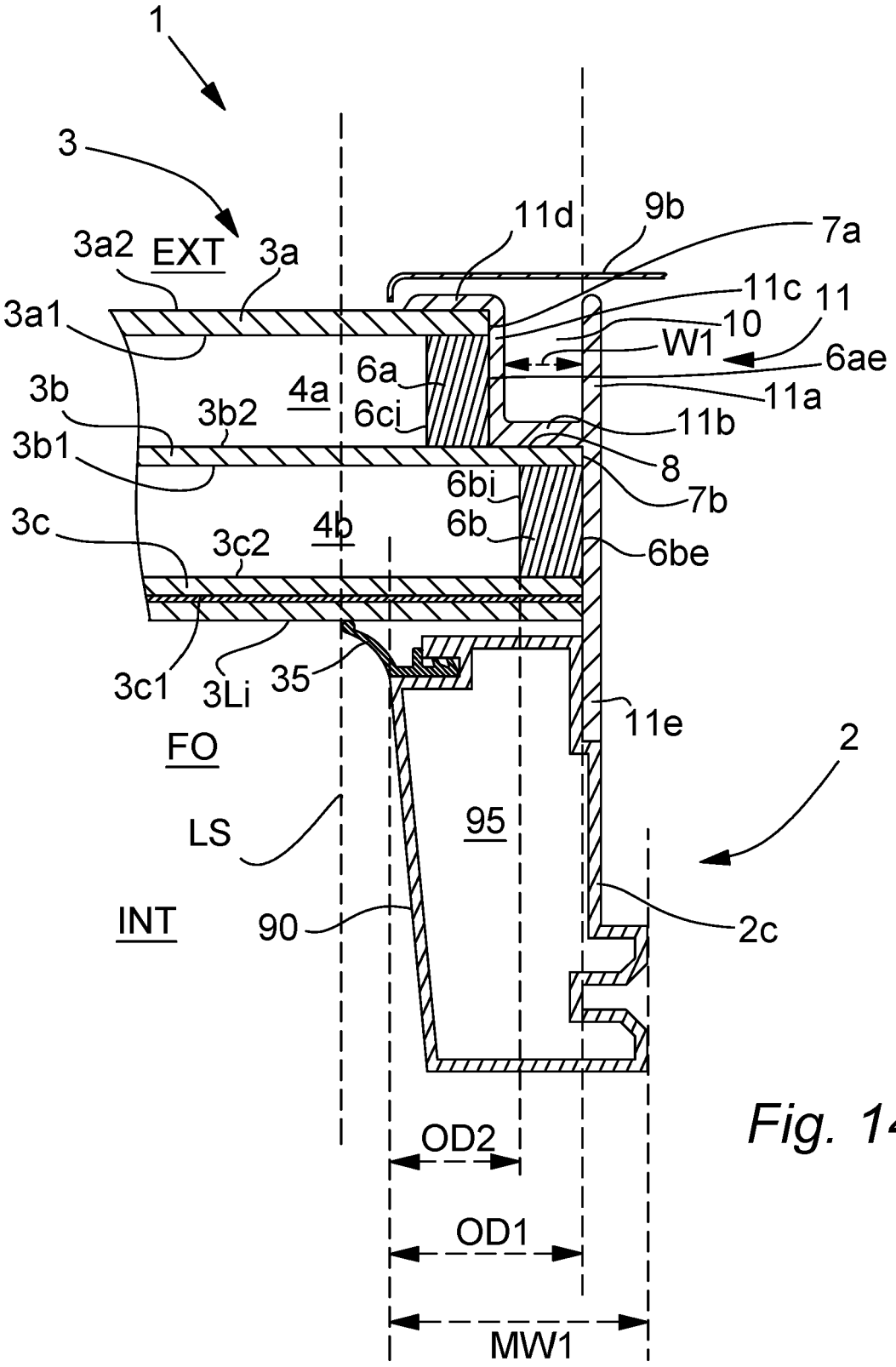


Fig. 13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FO
LS
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INT
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2c
OD2
OD1
MW1

Fig. 14

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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 9649

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 2 947 253 A1 (ROTO FRANK AG [DE]) 25 November 2015 (2015-11-25) * figure 2 *	1-16	INV. E04D13/03 E06B3/66 E04D13/035
A	CN 214 117 278 U (SHENZHEN STYLE DECORATION CO LTD) 3 September 2021 (2021-09-03) * figures *	1-16	
A	EP 3 795 770 A1 (VKR HOLDING AS [DK]) 24 March 2021 (2021-03-24) * figure 2 *	1-16	

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	19 September 2022	Demeester, Jan

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19-09-2022

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		PL 2947253 T3	29-12-2017
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EP 3795770 A1	24-03-2021	NONE	

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- EP 2843151 B1 **[0003]**
- EP 2947253 B1 **[0003]**