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

(72) Inventors:
- **BLICHFELDT, Asbjørn Skyum**
  2970 Hørsholm (DK)
- **GRØNBÆK, Kristian Strand**
  2970 Hørsholm (DK)

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

(54) **A ROOF WINDOW COMPRISING A FRAME WITH A FLASHING SOCKET AND A SEALING MEMBER, AND A METHOD FOR WEATHER-PROOFING A JOINT BETWEEN A ROOF WINDOW AND A ROOF STRUCTURE**

(57) A roof window comprising a frame with a flashing socket and a sealing member, and a method for weather-proofing a joint between a roof window and a roof structure.

A roof window configured for being mounted in a roof structure comprising a roofing material, said roof window comprising a frame and a sash carrying a pane, where the frame comprises a plurality of frame members together defining a frame opening and a frame plane and each frame member extends in a length direction and a height direction, which height direction is perpendicular to the frame plane, wherein the frame comprises a flashing socket with a separate sealing member for receiving flashing members.

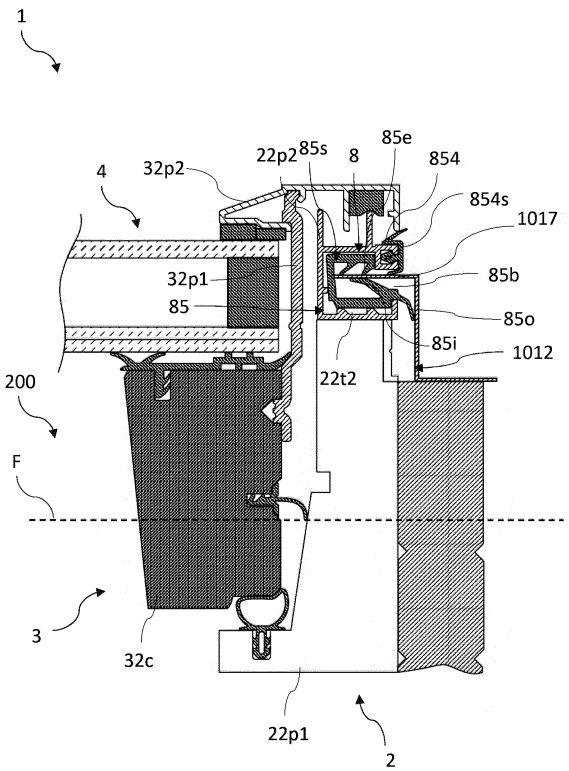

Fig. 7

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Description

Technical Field

[0001] The present invention relates to a roof window configured for being mounted in a roof structure comprising a roofing material, said roof window comprising a frame and a sash carrying a pane, where the frame comprises a plurality of frame members together defining a frame opening and a frame plane and each frame member extends in a length direction and a height direction, which height direction is perpendicular to the frame plane. The invention further relates to a method for weatherproofing a joint between a roof window and a roof structure.

Background Art

[0002] When mounting roof windows in roof structures and opening needs to be formed in the roof structure, whereby interrupting the weather-proofing of the building provided by the roofing material. The roof window itself is weather-proof, but to re-establish the weather-proofing of the building, the joint between a roof window and a roof structure needs to be sealed. Flashing members are used for this purpose, each flashing member having a first leg extending along an outer side of the frame of the roof window and a second leg extending over the roof structure, thereby bridging and covering any gaps present between the roof window and the roofing material. To keep the flashing members in place, they are usually attached both to the frame of the roof window and to the roof structure. This is easily done when both the roof window frame and the roof structure are made from wood, and the roof window projects above the roofing material, but there is a desire for alternative solutions allowing a wider range of applications.

Summary of Invention

[0003] With this background, it is an object of the invention to provide a roof window and a method by which flashing members can be attached in an alternative way while still ensuring good weather-proofing.

[0004] This and further objects are achieved with a roof window where at least one of the frame members comprises a flashing socket extending in the length direction of the at least one frame member and having a socket opening facing away from the frame opening, which flashing socket houses a separate sealing member extending in the length direction of the at least one frame member and forming a sealing groove having a groove opening facing away from the frame opening; said flashing socket having an interior face facing away from the roof structure, an exterior face facing toward the roof structure and an end face positioned opposite to the flashing socket opening; and said sealing member having an interior leg associated with the interior face of the flashing socket, and an exterior leg associated with the exterior face of the flashing socket, and an end leg associated with the end face of the flashing socket; wherein the sealing member is provided with a plurality of sealing protrusions configured for engaging the least one flashing member when the flange of the flashing member is received in the sealing groove.

[0005] By the provision of a flashing socket in the frame and sealing member inside the flashing socket, and the sealing member forming a sealing groove, a flange of at least one flashing member can be received in the sealing groove allowing the flashing members to be attached without the use of screws or like fasteners penetrating into the material of the frame member. The sealing member may both contribute to weather-proofing and to holding the flashing member by friction, but additional attachment may be preferred or necessary.

[0006] By the groove opening facing away from the frame opening the flashing member can be mounted by displacement in a direction parallel to the frame plane, rather than by displacement in the height direction as is common in the prior art.

[0007] Together the provision of the flashing socket and the sealing groove thus provide a reliable, alternative way of mounting and attaching a flashing member, which is especially suited for situations where the roof window is mounted deep in the roof structure, and/or where mounting by displacement in the height direction is disadvantageous, for example when replacing flashing members where space is limited.

[0008] The fact that a socket houses a sealing member is not be understood as meaning that the sealing member must be entirely inside the socket. Sections of the sealing member may extend outside the socket, one example being that a sealing lip extends away from the socket, another that a part of the sealing member extends over an outer side of the frame member to protect the frame member or for attachment purposes.

[0009] A position or structure is said to be "interior" when it is positioned toward the roof structure in an installed state of the roof window as seen in the height direction and is said to be "exterior" when it is positioned toward an exterior of a building comprising the roof structure, also as seen in the height direction.

[0010] A frame member may be an integrally formed member. Alternatively, a frame member may comprise multiple profiles attached to each other so as to form the frame member, such as a metal or plastic profile attached to a wooden profile. The flashing socket for the sealing member may conceivably be provided in any of such profiles, but it may be preferred that the flashing socket is provided close to an exterior surface of the frame member, such that the flashing covers a majority of an outer side of the frame member extending above the roof structure.

[0011] The sash may be movable in relation to the frame, i.e. the window is openable, by way of a hinge.

[0012] In some embodiments, at least one sealing

protrusion of the plurality of sealing protrusions is an outward sealing protrusion which protrudes from the groove opening in a direction away from the frame opening. Such an outward sealing protrusion may engage the flashing member at a position outside of the sealing groove of the sealing member, providing additional sealing and/or an improved engagement with the flashing member. Additionally, or alternatively, an outward sealing protrusion may serve to deflect wind, water, and dirt away from the groove opening and/or from an opening in the frame member. Such an outward sealing protrusion will typically extend from an edge of the interior leg of the sealing member at the groove opening.

[0013] As described above, flashing members may generally comprise an L-shape having a first leg for extending upwards along an outer side of the frame away from the roof structure and a second leg for extending outwards over the roof structure away from the frame. A flashing member for use with the roof window according to the invention will also comprise a flange extending to be received in the sealing groove, i.e. at an angle to the first leg, typically in parallel to the second leg. An outward sealing protrusion extending from an edge of the interior leg of the sealing member at the groove opening may engage the first leg of such a flashing member. This may especially be advantageous for flashing installations, where two or more flashing members are arranged partially overlapping along the length of the frame member. If one such an overlapping flashing member is inadvertently deformed, for example during installation, a gap may be formed between two adjacent flashing members, and strong winds or capillary force may force water droplets through the gap. An outwards projecting sealing protrusion engaging the first leg of a flashing member may retain such water droplets, preventing them from penetrating into the roof structure or reaching sensitive parts of the roof window and may possibly guide water droplets towards a drainage opening.

[0014] The outward sealing protrusion may form an angle with the frame plane. The angle may be in the range of 15 to 60 degrees, preferably 20 to 55 degrees, more preferably 25 to 50 degrees. The angle may be such the outward sealing protrusion extends in an interior direction toward the roof structure or such that the outward sealing protrusion extends in an exterior direction away from the roof structure.

[0015] In some embodiments, at least one sealing protrusion of among the plurality of the sealing protrusions is an interior inwards sealing protrusion, which interior sealing protrusion is positioned on the interior leg of the sealing member and protrudes into the sealing groove. The interior inwards sealing protrusion extends in a direction toward the frame opening. In this way the interior inwards sealing protrusion engages the flange of the flashing member from below. The interior inwards sealing protrusion may extend from the edge of the interior leg. The interior inwards sealing protrusion forms an angle to the frame plane, which angle may be in the range of 15 to 60 degrees, preferably 20 to 55 degrees, more preferably 25 to 50 degrees. The interior inwards sealing protrusion may extend in parallel continuation of the outwards sealing protrusion, whereby the angles formed by said two protrusions to the frame plane are substantially equal. The interior inwards sealing protrusion may have a length such that it extends at least 50 % of a height of the sealing groove, preferably 50 to 70 % of the height of the sealing groove. This is understood to mean that if the length of the interior inwards sealing protrusion and the height of the groove opening are projected onto the height direction, the former forms at least 50 % of the latter. The height of the sealing groove may be the height of the part of the end leg of the sealing member which delimits the sealing groove.

[0016] A sealing protrusion having a height constituting at least 50% of the height of the sealing groove is referred to as a major sealing protrusion, whereas a minor protrusion generally extends less than 50 % of the height of sealing grove, preferably 30 to 45 % of the height of the sealing groove.

[0017] The interior inwards sealing protrusion may be the only sealing protrusion protruding into to the sealing groove from the interior leg. It has been found that a single interior inwards sealing protrusion on the interior leg formed as described above, provides good sealing performance by itself at this position. In this way the sealing member design is simplified, and manufacturing cost and complexity is reduced compared to a sealing member having several sealing protrusions on the interior leg.

[0018] In some embodiments, at least two of the sealing protrusions are exterior inwards sealing protrusions, which exterior sealing inwards protrusions are positioned on the exterior leg of the sealing member and protrude into the sealing groove. In this way, the exterior inwards sealing protrusion engages the flange of the flashing member from above and may press the flashing member towards the roof structure, thereby keeping it in place. The exterior sealing inwards protrusions may extend in a direction toward the frame opening. This may facilitate mounting of the flashing member by guiding it into the sealing groove and/or reducing friction. The exterior inwards sealing protrusions form an angle to the frame plane, which angle may be in the range of 45 to 75 degrees, preferably 50 to 70 degrees, more preferably 55 to 65 degrees.

[0019] If both the exterior inward sealing protrusions and one or more interior inward sealing protrusions project towards the frame opening, they may form a funnel shape, guiding the flange into place in the sealing groove. The exterior inward sealing protrusions may be minor protrusions as described above. It is generally preferred for the exterior inwards protrusions and the interior inwards protrusion(s) to have a length so as to form an overlap in the height direction to ensure a tight contact between the sealing member and the flange of the flashing member. A first of the exterior inwards sealing protrusions is preferably position at an exterior edge of the

exterior leg of the sealing member, which exterior edge extends at the groove opening.

[0020] In preferred embodiments, a number of sealing protrusions, which are positioned on the exterior leg of the sealing member and protrude into the sealing groove, exceeds a number of sealing protrusions, which are positioned on the interior leg and protrude into the sealing groove. In this case, the sealing protrusions are said to be arranged asymmetrically. In this way the number of protrusions is minimized while still providing the desired sealing effect, thereby potentially reducing material consumption and cost. In a preferred asymmetrical arrangement, there is the single major interior inwards sealing protrusion and two or three minor exterior inwards sealing protrusions.

[0021] The flashing socket of the frame and the sealing member generally forms a U-shaped cross-section perpendicular to the length direction, which is open in a direction away from the frame opening. The cross-sections may be curvilinear or rectilinear. Ensuring a good fit between the flashing socket and the sealing member contributes to achieving proper sealing, but with a snug fit between flashing socket and sealing member it can be a challenge to position the sealing member correctly in the flashing socket. Hence, in some embodiments, the sealing member and/or the flashing socket comprise structures to aid in fitting the sealing member properly into the flashing socket.

[0022] The sealing member may comprise a weakening, such as an indentation, which facilitates a collapse of the sealing member as it is inserted into the flashing socket. The weakening may extend in the length direction. The weakening may be formed in the end leg of the sealing member, whereby the exterior and interior legs of the sealing approach each other as the sealing member collapses. Sealing members are generally made from a resilient material, allowing the sealing member to assume a non-collapsed state once the insertion in the flashing socket is complete, and thus engage the flashing socket. If an indentation in the end leg is provided in a surface of the sealing member facing the sealing groove, it may be positioned such that the flange of the flashing member is received in the indentation when fully inserted, thereby also providing a further seal and/or contributing to positioning the flange.

[0023] An indentation in the sealing member may be formed in a surface facing the flashing socket, which may also facilitate fitting of the sealing member into the flashing socket. This indentation may be formed at a junction between two of the legs of the sealing member, preferably at the junction of the interior leg and the end leg.

[0024] The flashing socket may comprise ribs protruding from one or more of the interior face, exterior face, and end face of the flashing socket. These ribs may also facilitate fitting of the sealing member into the flashing socket by providing the sealing member with structural stability. In one embodiment, one or more ribs extend from one face of the sealing member to another, so that one or more channels is/are formed between the rib and a face of the sealing member and/or between ribs. Such channels may provide insulating properties and/or structural stability.

[0025] In some embodiments, the frame comprises a second, supplemental socket arranged above the flashing socket opening. The supplemental socket extends in the length direction of the at least one frame member and has a socket opening facing away from the frame opening. The supplemental socket houses a separate supplemental sealing member extending in the length direction of the at least one frame member.

[0026] The supplemental socket may be positioned such that a part of the frame member delimiting the supplemental socket also delimits the socket opening of the flashing socket. The supplemental socket may also be positioned such that a part of the frame member delimiting the supplemental socket narrows the flashing socket opening of the flashing socket compared to a free height inside the flashing socket. Such a narrowing may be beneficial for sealing capability but may also make it difficult to fit the first sealing member into the flashing socket, in which case the structures to aid in insertion describe above are particularly advantageous.

[0027] In some embodiments, a separate supplemental sealing member housed in the supplemental socket has an anchoring section, which extends into the supplemental socket. The supplemental sealing member further comprises an exterior section extending away from the roof structure and configured for sealing against a covering member or a cladding member of a cladding assembly. The cladding assembly is provided to cover the sash of the roof window toward the exterior, the cladding members covering joints between sash members and frame members and the covering members extending between the cladding members and the covering members. Some roof windows, however, are without cladding members or covering members. By providing the supplemental socket and second sealing member, a space between the sash and the frame of the roof window facing away from the frame opening may be protected. As will be described in the detailed description, in some roof windows the sash comprise sash profile elements, where a second sash profile element is positioned above the frame and covers the frame toward the exterior, and in such roof windows the exterior section of the supplemental sealing member may sealing against this second sash profile element.

[0028] An exterior sealing section of a second sealing member may engage an inwards face of a cladding member (or second sash profile element), which inwards face faces towards the frame opening. In one embodiment, this is achieved by an exterior section comprising a first leg extending inwards toward the frame opening and a second leg extending outwards from an inwards end of the first leg, away from the roof structure and the frame opening, preferably at an acute angle with respect to the first leg. The exterior section may alternatively engage a

most interior point of an outer portion of the cladding member or second sash profile element, which outer portion forms an outer side of the cladding member or second sash profile element facing away from the frame opening. The supplemental sealing member may further comprise an interior sealing section extending from the anchor section toward the roof structure and configured for engaging the flange of the flashing member when this is inserted into the flashing socket. In some embodiments, the interior sealing section is configured to extend across at least part of the flashing socket opening of the flashing socket whereby insertion of the flange of the flashing member into the first sealing member pushes the interior sealing section of the supplemental sealing member into the flashing socket, providing a seal between flashing socket and flange. As will be appreciated the flashing and supplemental sockets with their respective sealing members thus provide a complete sealing assembly for sealing the joint between frame and roof structure and the joint between frame and sash, respectively. This sealing assembly may allow for reducing the size of the cladding members, or second sash profile elements, while maintaining weatherproofing, which is desirable in some roof window designs. If the roof window is fixed, i.e. the sash is not able to move relative to the frame, the sealing members of the flashing socket and supplemental socket may be integrally formed.

[0029] A second aspect of the invention relates to a method for weather-proofing a joint between a roof window and a roof structure comprising a roofing material, said roof window comprising a frame and a sash carrying a pane, where the frame comprises a plurality of frame members) together defining a frame opening and a frame plane and each frame member extends in a length direction and a height direction, which height direction is perpendicular to the frame plane,

where a flange of at least one flashing member is inserted in a direction parallel to the frame plane into a sealing groove, said sealing groove being formed by a separate sealing member extending in the length direction of the at least one frame member and having a groove opening facing away from the frame opening, said groove opening receiving the flange of the at least one flashing member, and said sealing member being a separate member housed in a flashing socket of the at least one of the frame members, said flashing socket extending in the length direction of the at least one frame member and having a socket opening facing away from the frame opening, said flashing socket having an interior face facing away from the roof structure, an exterior face facing toward the roof structure and an end face positioned opposite to the flashing socket opening, and said sealing member having an interior leg associated with the interior face of the flashing socket, and an exterior leg associated with the exterior face of the flashing socket, and an end leg associated with the end face of the flashing socket, and

where, during the insertion, a plurality of sealing protrusions of the sealing member engages the flange of the least one flashing member.

[0030] All embodiment and advantages described above with reference to the first aspect of the invention also applies to the second aspect of the invention.

Brief Description of Drawings

[0031] In the following description embodiments of the invention will be described with reference to the drawings, in which

Fig. 1 is a perspective view of a roof window in an embodiment of the invention;
Fig. 2 is a perspective view of a roof window in another embodiment of the invention;
Fig. 3 is a cross-sectional view of a side of a roof window in a further embodiment of the invention, corresponding to a cross-section along the line III-III in Fig. 2;
Fig. 4 is a view corresponding to Fig. 3, of an alternative embodiment of the invention;
Fig. 5 is a view corresponding to Fig. 3, of a still further embodiment of the invention;
Fig. 6 is a perspective view of a roof window in a still further embodiment of the invention;
Fig. 7 is a cross-sectional view of a side of a roof window in yet another embodiment of the invention, corresponding to a cross-section along the line VII-VII in Fig. 1;
Fig. 8 is a perspective cross-sectional view of a side of a roof window in yet another embodiment of the invention, corresponding to a cross-section along the line VII-VII in Fig. 1;
Fig. 9 is a cross-sectional view of a top of a roof window in yet another embodiment of the invention, corresponding to a cross-section along the line IX-IX in Fig. 1;
Fig. 10 is a cross-sectional view on a larger scale of details of Fig. 9;
Fig. 11 is a cross-sectional view on a larger scale of details of Fig. 9;
Fig. 12 is an exploded perspective view of a sash and a frame of a roof window in an embodiment incorporating a hinge assembly;
Fig. 13 is a partial perspective view of a top of a roof window in another embodiment incorporating a hinge assembly;
Fig. 14 is a partial perspective view of a top of a roof window in a further embodiment incorporating a hinge assembly;
Fig. 15A is an exploded perspective view of details of a hinge assembly of a roof window in a still further embodiment incorporating a hinge assembly;

Fig. 15B is a perspective view of the details of the hinge assembly of Fig. 15A;
Fig. 16A is a plan view of a detail of a hinge assembly of a roof window in yet another further embodiment incorporating a hinge assembly;
Fig. 16B is a cross-sectional view showing the detail of Fig. 16A;
Fig. 17 is a partial perspective view of a hinge assembly of a still further embodiment of the roof window according to the invention;
Figs. 18A and 18B are perspective views from different angles, of a hinge assembly in an embodiment of the roof window according to the invention;
Figs. 19A and 19B, 20A and 20B, 21A and 21B are views from different angles, of a hinge assembly in different embodiments of the roof window according to the invention; and
Fig. 22 is a cross-sectional view of the bottom of a roof window in a still further embodiment of the invention.

Description of Embodiments

[0032] In the following detailed description, a preferred embodiment of the present invention will be described. However, it is to be understood that features of the different embodiments are exchangeable between the embodiments and may be combined in different ways, unless anything else is specifically indicated. It may also be noted that, for the sake of clarity, the dimensions of certain components illustrated in the drawings may differ from the corresponding dimensions in real-life implementations.

[0033] It is noted that terms such as "up", "down", "left-hand", "right-hand", "exterior", "interior", "outer", "inner" are relative and refers to the viewpoint in question. In general, when referred to an exterior side, this relates to a side of a roof window in a mounted condition facing the outdoors or external side of the building. Conversely, an interior side refers to a side facing the internal side of the building, i.e. typically a subjacent room including any light shaft. Terms such as "outwards" and "inwards" are directions generally perpendicular to an interior-exterior direction, taking as its base point a centre of the roof window.

General description of a roof window - Figs 1 and 2

[0034] Referring initially to Figs 1 and 2, a roof window 1 is shown. The roof window 1 is intended to be installed in an inclined roof surface (not shown).

[0035] The roof window 1 comprises a frame 2, a sash 3, and a pane 4. The frame 2 comprises a set of frame members including a top frame member 21, two side frame members 22, 23 and a bottom frame member 24. Correspondingly, the sash 3 comprises a set of sash members including a top sash member 31, two side sash members 32, 33 and a bottom sash member 34. While the frame 2 and sash 3 are described as rectangular structures, some principles of the presented concepts may be applicable to other geometrical shapes as well.

[0036] The pane 4 comprises a number of edge portions generally associated to members of the sash 3 as will be described in further detail below. When in a closed position, an exterior pane surface defines a plane of the roof window 1 in an assembled condition of the roof window 1, corresponding to a sash plane. The assembled condition of the roof window 1 is achieved when main components of the frame 2 and sash 3 have been assembled and the frame 2 and sash 3 are connected to each other, for instance in an installed position when the roof window 1 is ready for use in the mounted condition. Correspondingly, an assembled condition of the sash 3 is achieved once main components of the sash 3 have been assembled, and an assembled condition of the frame 2 when main components of the frame 2 are assembled.

[0037] An interior pane surface faces the interior, typically a room of a building subjacent the roof surface in which the roof window 1 is installed. A glazing bar 45 is fitted to the exterior surface of the pane. It is conceivable to fit a counterpart glazing bar cover on the interior pane surface. Although less practical, it would also be possible to have a two-part pane with two pane halves divided by a throughgoing glazing bar. In wide roof windows, it is also possible to have more than one glazing bar, for instance two glazing bars dividing the surface of the pane visible from the exterior into three sections etc.

[0038] The pane 4 is in the embodiment shown as a two-layer insulating glazing unit, but may comprise three layer, or be a single-sheet glazing unit, or a vacuum insulated glass. The pane 4 may be stepped, i.e. an exterior sheet comprises an extended portion extending beyond a bottom edge portion of an interior sheet.

[0039] In the embodiments shown, the sash 3 is openable relative to the frame 2, to obtain one or more open positions. In such open positions, the sash 3 and pane 4 are moved out of the plane of the roof window 1 as defined by the frame 2 such that the sash plane forms an angle with the frame plane. As will be described in the following, the sash 3 is shown as being tophung, i.e. during normal use, the sash 3 is rotated about a substantially horizontal hinge axis at or near the top frame member 21 and top sash member 31. It is however conceivable to apply some principles of the presented concepts for roof windows on different types of windows having other opening patterns or being provided as fixed skylights.

[0040] Further details shown in Figs 1 and 2 include an operating assembly 5, here shown as a manual hand-winder or screwjack. Other operating assemblies may be present as well.

[0041] Also shown is a representative mounting bracket 6 forming part of a plurality of mounting brackets forming a load-transferring connection between the roof window 1 and a surrounding roof structure (not shown). Such a roof structure may include rafters and battens, plywood, or other construction materials. Other mounting devices are conceivable.

[0042] Finally, an insulating frame 7 is shown. Insulation by an insulating frame is optional and may be provided along only some of the frame members or as shown surrounding all four frame members 21, 22, 23, 24.

[0043] In the following description of various embodiments, elements having the same or analogous function carry the same reference numerals throughout. Suitable variations and modifications will be apparent to the person skilled in the art.

Sash and frame structure - Figs 3 to 7

[0044] Referring now first to the cross-sectional view of Fig. 3, the configuration of the members of the frame 2 and sash 3 will be described by the representative side frame member 22 and side sash member 32. It is to be understood that the other frame and sash members have a corresponding configuration; differences will be emphasised and described in further detail as appropriate.

[0045] Thus, in the embodiment of Fig. 3, the side sash member 32 comprises a first sash profile element 32p1 and the side frame member 22 comprises a first frame profile element 22p1 and a second frame profile element 22p2.

[0046] Each first sash profile element 32p1 and first frame profile element 22p1 is formed by a continuous moulding process. In the embodiment shown, the first sash profile element 32p1 and the first frame profile element 22p1 are formed by extrusion of a thermoplastic material, here polyvinyl chloride (PVC). Other manufacturing methods and polymer materials may be suitable as well.

[0047] The second frame profile element 22p2 comprises an interface section 8 configured to interact with one or more external components. In the embodiment of Fig. 3, the second frame profile element 22p2 is a substantially L-shaped metal component with an outer end comprising the interface section 8.

[0048] In the embodiment of Fig. 3, the side sash member 32 comprises a second sash profile element 32p2 in addition to the first sash profile element 32p1.

[0049] Turning now briefly to Fig. 4, which shows an alternative embodiment of the invention, the side sash member 32 is composed by only the first sash profile element 32p1.

[0050] In order for the parts of the roof window 1 which are mainly visible from the exterior to be afforded a desired appearance, the exterior or outwards facing profile elements of the sash 3 in the embodiments shown have a metal or metal-like appearance so as to resemble a traditionally styled cast iron window. The outwards facing profile elements are represented by the first sash profile element 32p1 in the embodiment of Fig. 4 and the second sash profile elements 32p2 in the embodiment of Fig. 3, respectively.

[0051] In the embodiment of Fig. 3, the second sash profile element 32p2 is provided as a longitudinal profile of a metal material, here aluminium but could also be steel or another metal.

[0052] In the embodiment of Fig. 4, the first sash profile element 32p1, which is here the only constituent main component of the sash member 32, is provided with a metal colouring on the surfaces visible to the exterior. Alternatively, the metallic look could be achieved by a metal coating or film and be present on all surfaces facing the exterior.

[0053] Whether the first or second sash profile elements are provided by a metal material, or by a plastic or composite material, it is also possible to combine materials in a continuous manufacturing process such as co-extrusion, co-moulding etc. by the addition of heat or light reflective or absorbing elements.

[0054] While extruded PVC profiles generally offer satisfactory strength and deformation properties, in particular when as shown provided with suitably positioned dividing walls 22w, 32w as is customary in the field, one or more reinforcement elements are advantageously provided in at least some of the first sash and frame profile elements. Thus, as indicated in Figs. 3 and 4, the first sash profile element 32p1 and the first frame profile elements 22p1 each comprises a reinforcement element 22r, 32r in the embodiments shown. Such reinforcement elements are suitable for offering reinforced fastening support but may also be used as strengthening elements to increase the stiffness and resistance to bending.

[0055] In Figs. 3 to 5, circumferential walls of the extruded profiles are indicated as being of a larger thickness compared to dividing walls of a mutually uniform thickness; however, such dividing walls may have varying thickness and also be provided with larger thickness than the circumferential walls. The thickness of the walls also depends on the material used and the manufacturing process; in for instance pultrusion and co-extrusion of composite materials, the thickness is typically larger.

[0056] As to the choice of materials in the embodiments shown in Figs. 3 to 5, it is possible to utilise recycled PVC on internal elements such as dividing walls and reinforcement elements of the frame and sash member. As such internal elements are not visible in the finished product, the appearance of the recycled PVC is of less or no significance. Outer surfaces may be comprised by virgin PVC, or by recycled PVC which has been provided with the desired appearance.

[0057] The reinforcement element 22r in the frame side member 22 is accommodated in the space formed between one of the dividing walls 22w and the outer circumferential wall of the first frame profile element 22p1 and primarily functions as a fastening support of the second frame profile element 22p2. The reinforcement element 22r may be an elongate element extending substantially throughout the length of the frame side member 22 or be in the form of intermittently positioned pieces.

[0058] In the embodiment of Fig. 3, the reinforcement element 32r of the sash side member 32 functions primarily as a fastening support for the second sash profile

element 32p2.

[0059] In the embodiment of Fig. 4, the reinforcement element 32r has a larger extension in the height direction compared to the Fig. 3 counterpart and thus adds to the stiffness and integrity of the side sash member 32 to provide additional support to portions of the side sash member 32 encasing the pane 4.

[0060] Further details indicated in Fig. 3 include tracks in the circumferential walls of the first frame and sash profile elements 22p1 and 32p1 of the side frame member 22 and side sash member 32, respectively. In the embodiment shown, the first sash profile element 32p1 and first frame profile element 22p1 comprise tracks 22t1, 32t1, 32t2 configured to accommodate sealing profiles.

[0061] The relationship between the interface section 8 of the second frame profile element 22p2 of the side frame member 22 will be described in more detail below.

[0062] Turning now to the embodiment of Fig. 5, it is seen how the interface section 8 of the second frame profile element 22p2 of the side frame member 22 comprises an upstanding flange configured to cooperate with the covering assembly 10, namely with a side flashing member 1012 forming part of an external flashing assembly. Forming the interface section 8 with an upstanding flange of the second frame profile element 22p2 itself allows for flexible options for the user, since for instance a traditional flashing by a material such as lead is easily folded over the flange of the interface section 8.

[0063] One example of an embodiment, in which such interface units are incorporated at the top and sides of the roof window 1 is shown in Fig. 6. Here, the second frame profile element 21p2 of the frame top member 21 and the second frame profile element 23p2 of the other frame side member 23 are indicated as well. The interface sections at the top and sides are configured to cooperate with external flashing assembly, in a way corresponding to the side flashing member 1012 shown in Fig. 5.

[0064] A further detail of the embodiment shown in Fig. 6 includes that the interface section 8 of the second frame profile element 24p2 of the bottom frame member 24 forms part of the covering assembly 10 itself, namely by constituting a bottom flashing member 1014.

[0065] Turning now to Fig. 7, an embodiment is shown in which the second sash profile element 32p2 of the side sash member 3 is formed by an extruded metal material which is connected to the first sash profile element 32p1 which is here formed by pultrusion, i.e. another continuous moulding process than the extruded PVC profiles of the embodiments shown in Figs. 3 to 5. Specifically, the first sash profile element 32p1 is formed by pultrusion of a composite material incorporating resin and glass fibre.

[0066] To form the interior facing surfaces of the sash with a harmonic appearance, an inner element 32c of for instance wood is provided and connected to the first sash profile element 32p1 which thereby acts as an intermediate element.

[0067] In this embodiment, the first frame profile element 22p1 may be provided substantially as in the embodiments shown in Figs. 3 to 5. The second frame profile elements 22p2 is here provided as an extruded profile of a metal or composite material and comprises a track 22t2 comprised in the interface section 8. The interaction with the side flashing member 1012 of the covering assembly 10 will be described in further detail in the following.

Flashings and interfaces - Figs 7 to 10

[0068] Turning now to Fig. 7 which shows a cross-section of a roof window 1 where the frame 2 comprises a flashing socket 85 which houses a separate sealing member 85s which forms a sealing groove in which a flange 1017 of a side flashing member 1012 is arranged. Fig. 8 shows details of a similar roof window. Figs 9 and 10 show similar views but of the top of the roof window 1 corresponding to view IX in Figs 1 and 2. These figures are described collectively. The flashing socket 85 is provided is provided in an interface section 8 of the frame 2, which interfaces with second sash profile elements 31p2, 32p2 covering the frame member which forms part of the frame 2. The interface section 8 here forms a separate frame profile element 22p2 joined to the frame 2, but the interface section could also be integrally formed with the remaining part of the associated frame member. The flashing socket 85 is seen to be formed by the track 22t2 of the frame, but in this context will be referred to as the flashing socket 85 to denote its purpose. The flashing socket 85 has socket opening 85b which faces away from the frame opening 200 whereby the flange 1017 of the flashing member 1012 can be inserted into the flashing socket 85 in a direction parallel to a frame plane F as shown in Figs. 7 and 8. The frame members 21, 22, 23, 24 define the frame plane F and a frame opening 200 between the frame members, which is best seen in Fig. 2. In Figs 9 and 10 a diverter rail 103 for diverting water and water coming down from the roof, is inserted into the flashing socket 85, but in the installed state of the window a flashing member is also inserted in the flashing socket alongside the diverter rail 103. The flashing socket 85 has an interior face 851 facing away from the roof structure (not shown), an exterior face 853 facing toward the roof structure and an end face 852 which connects the interior face 851 and exterior face 852. The end face 852 is provided opposite to the opening 85b. The interior face 851, end face 852 and exterior face 853 delimit the flashing socket 85 and they engage the sealing member 85s. One or more of the interior face 851, end face 852 and exterior face 853 may be provided with ribs 851r, 852r that protrude into the flashing socket 85 and engage the sealing member 85s as show in Figs. 7 and 8. The ribs extend along the flashing socket 85 in the length direction. Providing these ribs provide a drainage channels in between the ribs for draining away water, such as condensate. The ribs may also facilitate mounting the sealing member 85s in the flashing socket 85.

[0069] The sealing member 85s in the flashing socket 85 also has an opening (also at 85b) facing away from the

frame opening 200 allowing the flashing member to be inserted in a sealing groove defined by the sealing member. The position of the sealing groove is also at reference 85. The sealing member 85s has an interior leg 85s1 which is associated with the interior face 851 of the flashing socket 85, i.e. it engages the interior face 851. Similarly, an end leg 85s2 is associated with the end face 852 and an exterior leg 85s3 is associated with the exterior face 853. The sealing member 85s is provided a plurality of the sealing protrusions which engage the flashing member 1012 or diverter rail 103 received in the sealing member 85s. An outwards sealing protrusion 85o is provided on the interior leg 85s1 and projects away from the frame opening 200 out of the flashing socket 85. The outwards sealing protrusion 85o engages a first leg 1012l of the flashing member 1012 when the flange 1017 is inserted into the flashing socket. Fig. 8 shows a view at an overlap between two side flashing members 1012. Typically these two flashing members 1012 are fit snugly, hindering water ingress, but these flashing members may inadvertently become deformed during installation, thereby creating a gap through which water can enter, e.g. because of wind. The outwards sealing protrusion 85o provides a seal against water which may enter through such a gap.

[0070] As shown in Fig 10 the outwards sealing protrusion 85o forms an angle a1 with the frame plane F, which in this embodiment is about 30 degrees. The angle a1 is measured in a state wherein the outwards sealings protrusion is not deformed by the flashing member 1012. The interior leg 85s1 of the sealing member 85s further comprise an interior inwards sealing protrusion 85i which protrudes into the sealing groove toward the frame opening 200. The interior inwards sealing protrusion 85i engages the flange 1017 received by the sealing member 85s from below. In the embodiments shown, the interior inwards sealing protrusion 85i extends at an angle to the frame plane F which angle is equal to the angle a1 of the outwards sealing protrusion 85o, as the interior inwards sealing protrusion 85i extends in continuation of the outwards sealing protrusion 85o. It has been found that providing a single sealing protrusion on the interior leg which protrudes into the sealing groove offers the desired sealing. The interior inwards sealing protrusion 85i is in these embodiment a major sealing protrusion as a projection of the interior inwards sealing protrusion 85i onto the height direction constitutes more than 50 % of the height of the sealing groove. The height h85s2 of the sealing groove is indicated in Fig. 10 and is the height of the part of the end leg 85s2 which delimits the sealing groove. References to dimensions, incl. height and length, of sealing protrusions herein refer to an undeformed state of the sealing member and its protrusions, i.e. when the flashing members are not inserted in the sealing groove.

[0071] The exterior leg 85s3 of the sealing member is provided with two exterior inwards sealing protrusions 85e which form the remaining sealing protrusions of the sealing member 85s. The exterior inwards sealing protrusions 85e protrude into the sealing groove toward the frame opening 200 and at an angle a2 to the frame plane F. The angle a2 is these embodiments about 60 degrees as shown in Fig. 10. It is advantageous that the number of sealing protrusions on the exterior leg 85s3 which protrude into the sealing groove exceeds the number of sealing protrusions on the interior leg 85s1 which protrude into the sealing groove, as the top of the flashing is more exposed. This arrangement of sealing protrusions is referred to as asymmetric, and in preferred embodiments, the interior leg is provided with the single interior inwards sealing protrusion 85i and the exterior leg 85s3 is provided with at least two exterior inwards sealing protrusions 85e. The exterior inwards sealing members 85e are here minor sealing protrusion, the length of which, when projected on to the height direction, extends less than 50 % of the height H85s2 of the sealing groove. As is best seen in Fig. 8, the sealing protrusions of the sealing member 85 are arranged to overlap in the space where the flange 1017 of the flashing member 1012 is received.

[0072] The sealing member 85s is provided with structures to facilitate fitting the sealing member 85s into the flashing socket 85. Indentation 85w2 is provided in the end leg 85s2 and extends along the length of the sealing member 85s. The indentation is a weakening of the sealing member, which allows the sealing member 85s to collapse when inserting the sealing member 85s into the flashing socket 85. The indentation 85w2 may also form a track to receive the part of the flashing member which is inserted into the sealing member 85s, increasing the sealing effect of the sealing member 85s. Hence, the indentation 85w2 is preferably arranged at a position in the height direction, at which the flange 1017 of the flashing member 1012 is received by the sealing member 85s. Another indentation 85w1 is provided in a surface of the sealing member 85s which faces the flashing socket 85. In the embodiment shown, the indentation 85w1 is provided at junction of the interior leg 85s1 and end leg 85s2 of the sealing member. This indentation 85w1 facilitates fitting the sealing member, provided a track for air displacement during fitting of the sealing member, which is especially helpful for embodiments of the flashing socket 85 without ribs 851r1, 852r as in Fig. 9.

[0073] The interface section 8, which is here embodied by profile elements 22p2, also has a supplemental socket 854 above the opening 85b of the flashing socket 85 as seen in the height direction. In the embodiments shown, the supplemental socket 854 is positioned to overlap with the flashing socket 85, thereby reducing a height H85b of the opening 85b of flashing socket 85 compared the height of the end face 852 of the flashing socket 85. This helps retaining the sealing member 85s in the flashing socket 85. The supplemental socket 854 is fitted with a supplemental sealing member 854s which has an anchor section 854a extending into the supplemental socket 854 to retain it therein. The supplemental socket 854 further has an interior section 85i which extends toward the roof

structure (not shown) to engage the flange 1017 of the flashing member 1012. The interior section 854i can deform such that it extends into the flashing socket 85 along the flange 1017 as shown in Fig. 7. This is enabled by an indentation positioned between the interior section 854 and anchor section 854a as shown in Fig. 8. The supplemental sealing socket 854s further has an exterior section 854e which extends away from the roof structure (not shown) and engages the profile element 31p2, 32p2 to seal a gap between the frame 2 and the profile element 31p2, 32p2. In the embodiment shown, the exterior section 854e is formed by two segments extending at angle to each other to achieve the desired point of contact to the second sash profile elements 31p2, 32p2. The point of contact is here the part of the profile elements 31p2, 32p2 which is proximal to the frame 2 and forms an outer side of the profile elements 31p2, 32p2 and is most interior (i.e. proximal to the frame 2).

Fittings and operators - Figs 9 to 22

[0074] In the following, the connection between the sash 3 and the frame 2 by means of a hinge assembly 9 will be described in detail.

[0075] The term "connected to" implies that the component in question is in a condition, state or position in which the component in question is in fact connected to a part, whereas "connectable to" is intended to encompass such conditions, states and positions in which the component in question may be connected to the relevant part but is not necessarily in connection with the part.

[0076] During opening of the sash 3, the sash 3 is rotated by means of the hinge assembly 9 at least a first hinge axis α at the top frame and sash members 21, 31 to an open position in which the sash plane forms an angle with the frame plane.

[0077] Furthermore, the hinge assembly 9 comprises a hinge unit and a coupling unit as will be described in the following, in which the coupling unit is connected the hinge unit in the mounted condition and comprises locking means to prevent unintentional release of the connection between the sash 3 and the frame 2.

[0078] The hinge assembly 9 is located within an outer circumference of the frame 2 and sash 3, meaning that no parts of the hinge assembly 9 protrude beyond the periphery of the roof window 1 in the mounted condition.

[0079] Referring now to Figs. 9 and 11, in which the structure of the frame 2 and the sash 3 substantially correspond to the one described for the frame side member 22 and side sash member 32 in connection with Fig. 7. Thus, the top sash member 31 comprises an exterior or second sash profile element 31p2 and an interior or first sash profile element 31p1, and the top frame member 21 comprises an interior or first frame profile element 22p1 formed by a continuous moulding process, and an exterior or second frame profile element 22p2. The exterior sash profile element 31p2 of the top sash member 31 overlaps the associated interior frame profile element 22p1 of the top frame member 21 in the closed position and in the open position of the sash 3.

[0080] In the embodiment shown, the hinge unit of the hinge assembly 9 comprises a frame hinge part 21hp formed in the second frame profile element 21p2 of the frame top member 21 and a sash hinge part 31hp formed in the second sash profile element 31p2 of the sash top member 31.

[0081] The coupling unit of the hinge assembly 9 here comprises locking means in the form of a hinge inlay 990 configured to be accommodated between the frame hinge part 21hp and the sash hinge part 31hp in the assembled condition so as to hold the sash hinge part 31hp in engagement with the frame hinge part 21hp. The hinge inlay 990 is formed as an elongate component of an elastic material and extends from a first end to a second end such that the first hinge axis is located between the first end and the second end.

[0082] Referring now to Fig. 12, the general concept of providing the hinge assembly 9 with a hinge unit 91 which in an installation position is connected to the sash 3 and a coupling unit 95 which is connected to the frame 2 is illustrated. During installation, the hinge unit 91 is brought into engagement with the coupling unit 95, thereby ensuring the connection between the sash 3 and the frame 2.

[0083] The hinge unit 91 thus comprises a frame hinge part 92 connected to or connectable to the top frame member 21 and/or the side frame member 22, 23 and a sash hinge part 93 connected to the top sash member 31 and/or the side sash member 32, 33. The coupling unit 95 of the hinge assembly 9 is connected to or connectable to the frame 2 and configured to be connected to the hinge unit 91 in the mounted condition of the roof window 1.

[0084] In this way, it is possible to start from an installation condition of the roof window 1, in which the hinge unit 91 is connected to the sash 3 and the coupling unit 95 is connected to the frame 2, to a mounted condition in that the coupling unit 95 and the hinge unit 91 being configured to assume the following positions relative to each other:

i) at least one intermediate position; and
ii) a final position, corresponding to the mounted condition of the roof window 1.

[0085] In the below embodiments, the coupling unit 95 comprises a top frame coupling plate 96 connected to the frame 2 at a top corner of the top frame member 21 and one side frame member 23.

[0086] Furthermore, the frame hinge part 92 and the sash hinge part 93 are connected to each other by means of a hinge pin 94 defining the first hinge axis α in the mounted condition of the roof window 1.

[0087] In the embodiment of Fig. 13, the frame hinge part 92 and the sash hinge part 93 each comprises an angled plate section 928, 929 at the hinge pin 94. The top frame coupling plate 96 comprises a first coupling plate

receiving structure 968a and a second coupling plate receiving structure 968b to receive a frame hinge part guide pin 928a and a frame hinge part engagement means 928b, respectively, to provide the locking means preventing unintentional release of the connection between the sash 3 and the frame 2 in the mounted condition. The top frame coupling plate 96 is shown in broken lines to illustrate the engagement between the coupling unit 95 and the hinge unit 91 more clearly.

[0088] During installation, the sash 3 with the hinge unit 91 is brought into a suitable position to allow the frame hinge part guide pin 927a to enter into engagement with the first coupling plate receiving structure 968a and the frame hinge part engagement means 928b into engagement with the second coupling plate receiving structure 968b. As indicated, the frame hinge part engagement means 928b comprises a locking tongue to provide the locking engagement, which may be released by for instance inserting a tool to depress the locking tongue.

[0089] In the alternative embodiment of Fig. 14, the top frame coupling plate 96 of the coupling unit 95 comprises a first and a second coupling plate pin 969a1, 969a2 configured to receive a first and second hinge unit recess 919a, 919b, respectively. The hinge unit 91 here comprises locking means in the form of a locking arm 911 configured to interact with at least one of the first and second coupling plate pins 969a1, 969a2 in the mounted condition, the top frame coupling plate 96 preferably comprising a coupling plate receiver 969b to guide the hinge unit 91 during installation.

[0090] In the embodiment of Figs. 15A and 15B, the coupling unit 95 instead of a top coupling plate comprises a side frame coupling plate 97 connected to a side frame member of the frame 2 and comprising a base section 971 configured to interact with a frame hinge base plate 921, wherein the base section 971 of the side frame coupling plate 97 comprises a first and a second pin 971x, 971y to engage with a first and second slit 921x, 921y, respectively, in the frame hinge base plate 921. Locking means are provided in the form of a locking device 98 connectable to the side frame coupling plate 97 or the frame hinge base plate 921 to lock the engagement between the first pin 971x and the first slit 921x and/or between the second pin 971y and the second slit 921y.

[0091] An example of an embodiment of such a locking device 98 is shown in Figs. 16A and 16B, in which the locking device 98 comprises a locking split 980 cooperating with the first pin 971x.

[0092] Referring now to the embodiments shown in Figs. 17 to 21B, it will be described how the coupling unit 95 and the hinge unit 91 are configured to assume at least two intermediate positions by means of at least a first intermediate engagement portion and a second intermediate engagement portion, even up to five intermediate positions.

[0093] For the general configuration of such a hinge assembly 9, reference is made to Applicant's published international application WO 2023/186246 A1.

[0094] In these embodiments, the top frame coupling plate 96 is provided with coupling plate engagement means in the form of a hook element 964 comprising an arm 964a with a hook 964b and connected to a base section 961 of the top frame coupling plate 96 in a rotational joint 964c.

[0095] Two engagement pins 962, 963 are provided on the base section 961 to interact with respective recesses 926b, 926a in the frame hinge base plate 921. The frame hinge base plate 921 is connected to a frame hinge side flange 924 connected to an inner side of the side frame member 22. At the free end of the frame hinge side flange 924, a secondary hinge pin 927 is provided. In this way, the hinge assembly 9 provides for means to allow the sash 3 to be rotated about a substantially horizontal second hinge axis at a distance from the top frame member 21 and the top sash member 31.

[0096] The sash hinge part 93 comprises a sash hinge base plate 931 connected to an outer side of the top sash member 31. The sash hinge base plate 931 is connected to a sash hinge side flange 934 connected to an inner side of the side sash member 32.

[0097] Further details shown but not described in detail include an opening restrictor 925 provided by an arm rotatably connected to a sash or frame member, the arm comprising a track engaging with a pin on a frame or sash member, or on the hinge unit itself. The arm 9251 is rotatably connected to the sash hinge side flange 934 in a rotatable joint 9252, and wherein the pin 9254 interacting with the track 9253 is provided on the frame hinge side flange 924.

[0098] The hook element 964 comprises a plurality of intermediate engagement portions configured to cooperate with a protrusion 926e on the frame hinge base plate 921 constituting the counterpart frame hinge part engagement means.

[0099] In the embodiment shown, the hook element 964 is biased towards its locking position in that a spring (not shown), received in a spring-receiving opening 964d in the arm 964a. A final engagement portion 964g is provided, in which the roof window 1 is in a fully assembled condition and ready for use.

[0100] The intermediate engagement portions 964h, 964i, 964j, 964k, 964l are provided as a plurality of indentations in the side of the hook element 964 facing the frame hinge part engagement means 926. The plurality of indentations thus constitute sequential engagement portions. One or more of the indentations are formed by a curve prompting the hook element 964 to move in one direction, namely towards the final engagement position, assisted by the bias from the spring. However, the hook element 964 is at the same time not allowed to move backwards. In this way, the plurality of indentations function as a ratchet.

[0101] As indicated in Fig. 21A, the first intermediate engagement portion 964h comprises an indentation larger than an indentation comprised in the second inter-

mediate engagement portion 964i in the embodiment shown.

[0102] Referring finally to Fig. 22, the sash 3 is in this embodiment openable relative to the frame 2 within a predefined opening angle by means of operating assembly 5 connected to the sash 3 and the frame 2, here at the bottom sash and frame members. In the embodiment shown, the operating assembly 5 comprises a manual operator in the form of a lever handle 58 and an electric operator 59, which may for instance be solar powered. The electric operator 59 is not shown in detail but may include a chain operator or a pantograph operator. The electric operator 59 is provided as auxiliary equipment. During daily use, either the lever handle 58 or the electric operator 59 is in use. In order to allow switching between the operators, the connection between the manual operator 58 of the operating assembly 5 and the sash 3 and/or frame 2 is releasable and the connection between the electrical operator 59 and the sash 3 and/or frame 2 is releasable.

List of reference numerals

[0103]

1 roof window
2 frame

- 21 top frame member
- 21hp frame hinge part
- 21p2 second frame profile element
- 22 side frame member
- 22p1 first frame profile element
- 22p2 second frame profile element
- 22t1 track
- 22t2 track
- 23 side frame member
- 24 bottom frame member
- 24p2 second frame profile element

3 sash

- 31 top sash member
- 31hp sash hinge part
- 32 side sash member
- 32c inner element
- 32p1 first sash profile element
- 32p2 second sash profile element
- 32r reinforcement element
- 32t1 track
- 32t2 track
- 32w dividing wall
- 33 side sash member
- 34 bottom sash member

4 pane
45 glazing bar
5 operating assembly

- 58 manual operator
- 59 electric operator

6 mounting bracket
7 insulating frame
8 interface section

- 85 flashing socket
- 85b opening of the flashing socket
- 85e exterior inwards sealings protrusion
- 85i interior inwards sealing protrusion
- 85o outwards sealing protrusion
- 85s separate sealing member
- 85s1 interior leg
- 85s2 end leg
- 85s3 exterior leg
- 85w1 indentation
- 85w2 weakening/indentation
- 851 interior face
- 851r rib
- 852 end face
- 852r rib
- 853 exterior face
- 854 supplemental socket
- 854s supplemental sealing member
- 854a anchor section
- 854e exterior section
- 854i interior section
- a1 angle of outwards sealing protrusion
- a2 angle of interior inwards sealing protrusion
- H85 height flashing socket opening
- H85s2 height of sealing groove

9 hinge assembly

- 91 hinge unit
- 911 locking arm
- 919a1 first hinge unit recess
- 919a2 second hinge unit recess
- 92 frame hinge part
- 921 frame hinge base plate
- 925 opening restrictor
- 926 engagement means of frame hinge part
- 927 secondary hinge pin
- 928a frame hinge part engagement means
- 928 frame hinge part engagement means
- 929 angled plate section
- 93 sash hinge part
- 931 sash hinge base plate
- 934 sash hinge side flange
- 939 angled plate section
- 94 hinge pin
- 95 coupling unit
- 96 top frame coupling plate
- 961 base section
- 962 bolt
- 963 bolt
- 964 hook element

964a arm
964b hook
965c rotational joint
965d spring-receiving opening
965g final engagement portion
964h first intermediate engagement portion
964i second intermediate engagement portion
964j final engagement portion
964k second intermediate engagement portion
964l second intermediate engagement portion
968a first coupling plate receiving structure
968b second coupling plate receiving structure
969a1 first coupling plate pin
969a2 second coupling plate pin
969b coupling plate receiver
97 side frame coupling plate
971 base section
971x first pin
971y second pin
98 locking device
980 locking split

10 covering assembly

1012 side flashing member
1012l first leg
1014 bottom flashing member

α first hinge axis

Claims

1. A roof window (1) configured for being mounted in a roof structure (11) comprising a roofing material (112), said roof window (1) comprising a frame (2) and a sash (3) carrying a pane (4), where the frame (2) comprises a plurality of frame members (21, 22, 23, 24) together defining a frame opening (200) and a frame plane (F) and each frame member extends in a length direction (L) and a height direction, which height direction is perpendicular to the frame plane (F),

at least one of the frame members comprising a flashing socket (85) extending in the length direction of the at least one frame member and having a socket opening (85b) facing away from the frame opening (200), which flashing socket houses a separate sealing member (85s) extending in the length direction of the at least one frame member and forming a sealing groove having a groove opening facing away from the frame opening,
said flashing socket (85) having an interior face (851) facing away from the roof structure (112), an exterior face (853) facing toward the roof structure and an end face (852) positioned opposite to the flashing socket opening (85b), and said sealing member (85s) having an interior leg (85s1) associated with the interior face (851) of the flashing socket, and an exterior leg (85s3) associated with the exterior face (85s1) of the flashing socket, and an end leg (85s2) associated with the end face (85s1) of the flashing socket,
wherein the sealing member (85s) is provided with a plurality of sealing protrusions (85o, 85i, 85e) configured for engaging the least one flashing member (1011, 1012, 1012, 1014) when the flange (1017) of the flashing member is received in the sealing groove.

2. A roof window according to claim 1, wherein at least one sealing protrusion of the plurality of sealing protrusions is an outward sealing protrusion (85o) which protrudes from the flashing socket opening (85b) in a direction away from the frame opening (200).

3. A roof window according to claim 2, wherein the outwards sealing protrusion (85o) forms an angle (a) with the frame plane (F), said angle being in the range of range of 15 to 50 degrees, preferably 20 to 45 degrees, more preferably 25 to 40 degrees.

4. A roof window according to claim 2 or 3, wherein the outwards sealing protrusion (85eo) extends from the interior leg (85s1) of the sealing member.

5. A roof window according to any one of the preceding claims, wherein at least one sealing protrusion of among the plurality of the sealing protrusions is an interior inwards sealing protrusion (85i), which interior sealing protrusion (85i) is positioned on the interior leg (85s1) of the sealing member and protrudes into the sealing groove in a direction toward the frame opening (200) and at an angle to the frame plane (F), preferably wherein the angle is range of 15 to 50 degrees, more preferably 20 to 45 degrees, and even more preferably 25 to 40 degrees.

6. A roof window according to claim 5 and any one of claims 2 to 4, wherein the interior inwards sealing protrusion (85i) extends in continuation of the outwards sealing protrusion (85o), preferably at the same angle to the frame plane (F) as the outwards sealing protrusion.

7. A roof window according to any one of claim 5 to 6, wherein a size of a projection of the interior inwards protrusion (85i) onto the height direction constitutes at least 50 % of a size of a projection of the end leg (85s2) of the sealing member onto the height direction.

8. A roof window according to any one of claim 5 to 7, wherein the interior inwards sealing protrusion (85i) is the only sealing protrusion on the interior leg (85s1) of the sealing member.

9. A roof window according to any one of the preceding claims, wherein at least two of the sealing protrusions are exterior inwards sealing protrusions (85e), which exterior sealing inwards protrusions (85e) are positioned on the exterior leg (85s3) of the sealing member and protrude into the sealing groove in a direction toward the frame opening (200) and at an angle (a2) to the frame plane (f), preferably wherein the angle is range of 40 to 80 degrees, more preferably 50 to 70 degrees, and even more preferably 55 to 65 degrees.

10. A roof window according to any one of the preceding claims, wherein a number of sealing protrusions, which are positioned on the exterior leg (85s3) of the sealing member and protrude into the sealing groove, exceeds a number of sealing protrusions, which are positioned on the interior leg (85s1) and protrude into the sealing groove.

11. A roof window according to any one of the preceding claims, wherein the sealing member (5s) comprises a weakening (85w2) in the end leg (85s2), preferably wherein the weakening is an indentation, and/or
wherein the sealing member comprises an indentation (85w1) formed in a surface of the sealing member (85s), which surface engages the flashing socket (85), preferably wherein the indentation (85wl) is formed at a junction between two legs (851, 852, 853) of the sealing member.

12. A roof window according to any one of the preceding claims, wherein the one or more of the exterior face (85s3), interior face (85s1), and end face (85s2) of the flashing socket (85) comprise(s) one or more ribs (851r, 852r) protruding into the flashing socket (85).

13. A roof window according to any one of the preceding claims, wherein the frame member (21, 22, 23, 24) comprises a supplemental socket (854) having a socket opening facing away from the frame opening (200) and housing a separate supplemental sealing member (854s), wherein the supplemental socket (854) is positioned above the flashing socket opening (85).

14. A roof window according to claim 13, wherein the supplemental socket (854) is arranged so as to narrow the flashing socket opening (85b) of the flashing socket (85), compared to a height of the end face (852) of the flashing socket.

15. A roof window according to any one of claims 13 to 14, wherein the supplemental sealing member 854s comprises an anchoring section (85a), which extends into the supplemental socket (854), an exterior section (854e) extending from the anchoring section away from the roof structure (112) and engaging a profile (32) covering the frame member, and an interior section (854i) extending from the anchoring section toward the roof structure (112) and configured for engaging the flange (117) of the flashing member when this is inserted into the flashing socket.

16. A method for weather-proofing a joint between a roof window (1) and a roof structure (11) comprising a roofing material (112), said roof window (1) comprising a frame (2) and a sash (3) carrying a pane (4), where the frame (2) comprises a plurality of frame members (21, 22, 23, 24) together defining a frame opening (200) and a frame plane (F) and each frame member extends in a length direction (L) and a height direction, which height direction is perpendicular to the frame plane (F),

where a flange (1017) of at least one flashing member (1011, 1012, 1014) is inserted in a direction parallel to the frame plane (F) into a sealing groove, said sealing groove being formed by a separate sealing member (85s) extending in the length direction of the at least one frame member and having a groove opening facing away from the frame opening, said groove opening receiving the flange of the at least one flashing member, and said sealing member (85s) being a separate member housed in a flashing socket (85) of the at least one of the frame members, said flashing socket extending in the length direction of the at least one frame member and having a socket opening (85b) facing away from the frame opening (200), said flashing socket (85) having an interior face (851) facing away from the roof structure (112), an exterior face (853) facing toward the roof structure and an end face (852) positioned opposite to the flashing socket opening (85b), and said sealing member (85s) having an interior leg (85s1) associated with the interior face (851) of the flashing socket, and an exterior leg (85s3) associated with the exterior face (85s1) of the flashing socket, and an end leg (85s2) associated with the end face (85s1) of the flashing socket, and
where, during the insertion, a plurality of sealing protrusions (85o, 85i, 85e) of the sealing member (85s) engages the flange (1017) of the least one flashing member (1011, 1012, 1012, 1014).

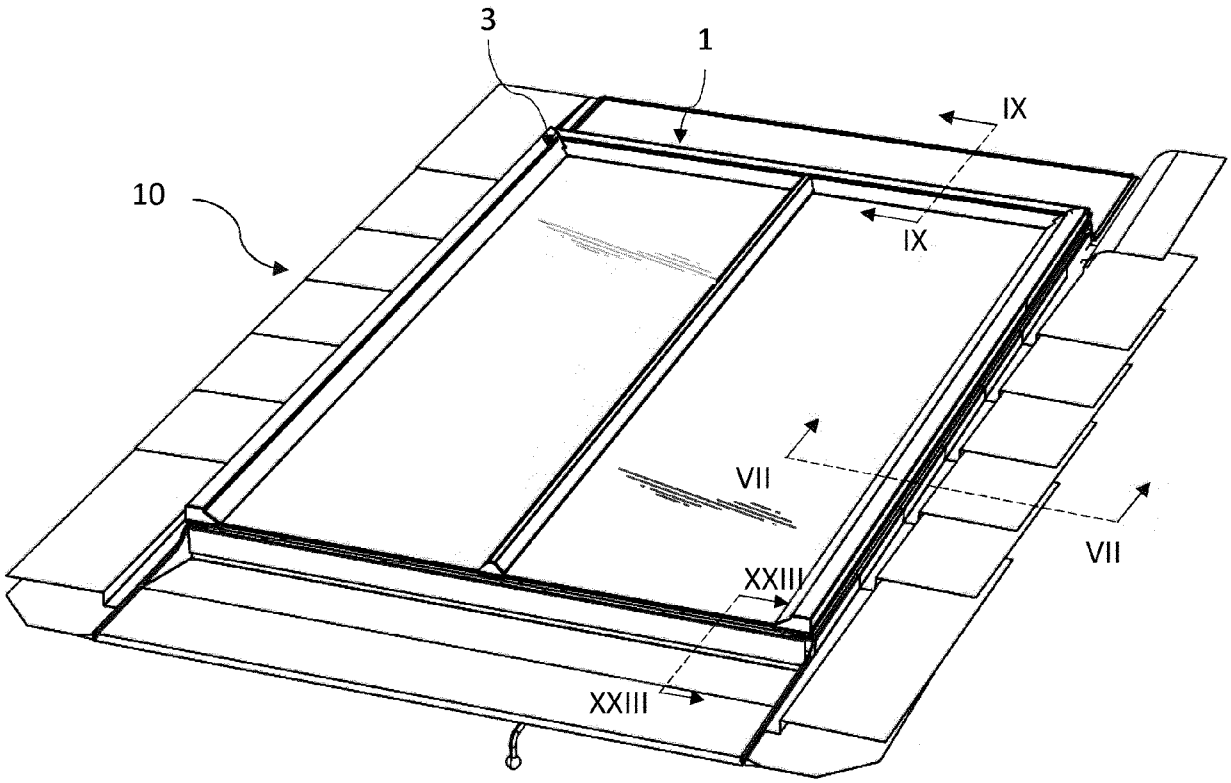

Fig. 1

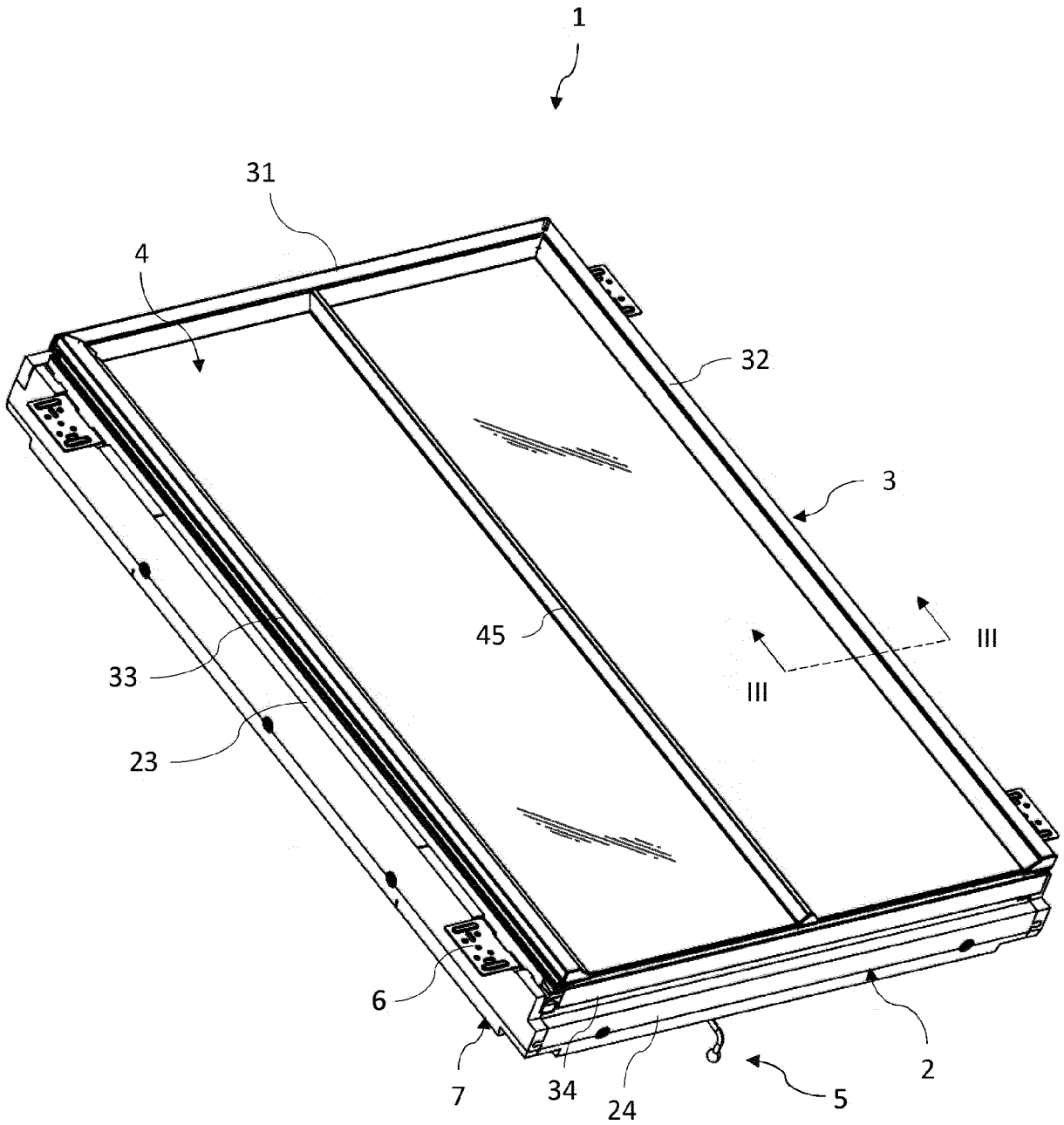

Fig. 2

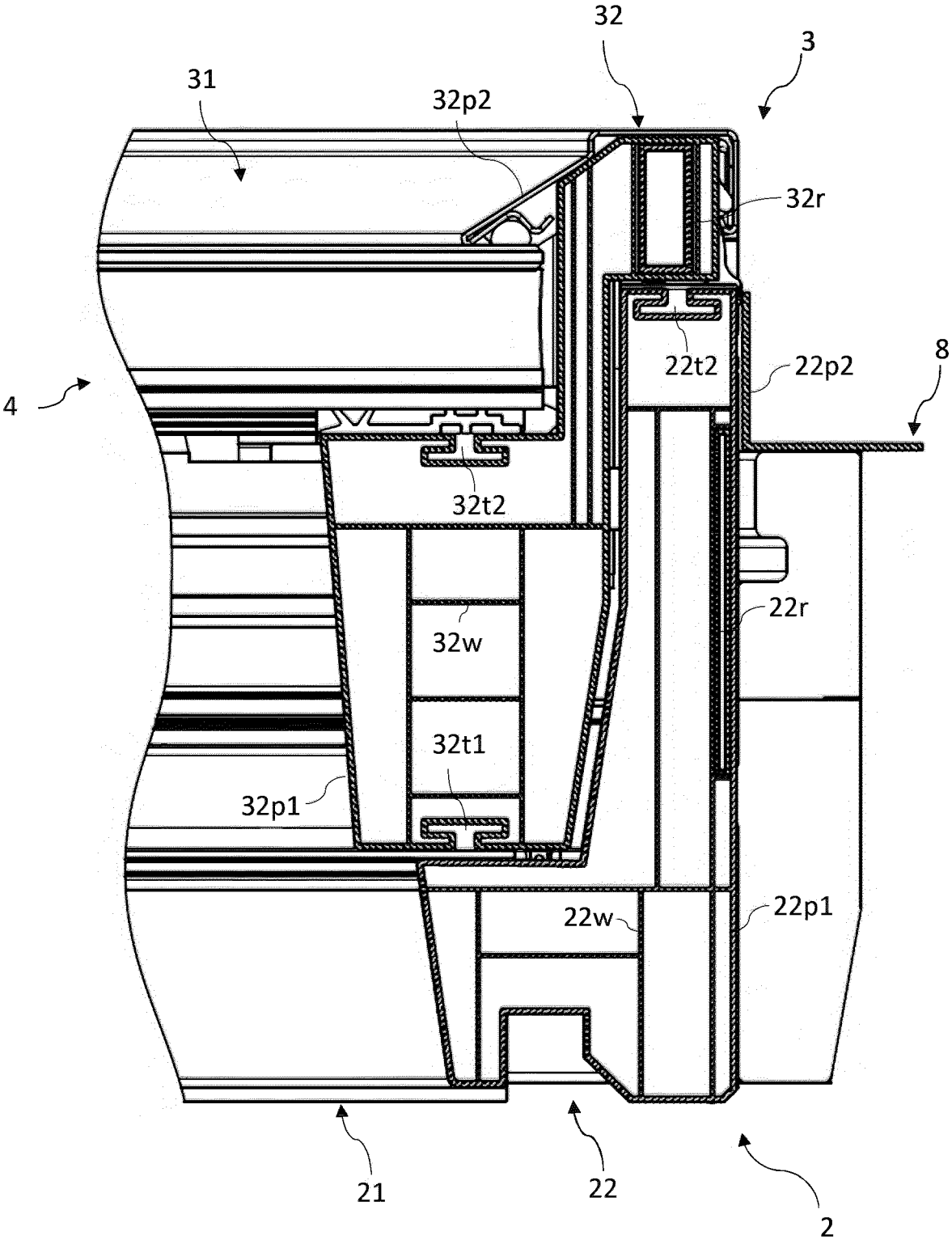
32
3
31
32p2
32r
22t2
22p2
8
4
32t2
22r
32w
32t1
32p1
22w
22p1
21
22
2

Fig. 3

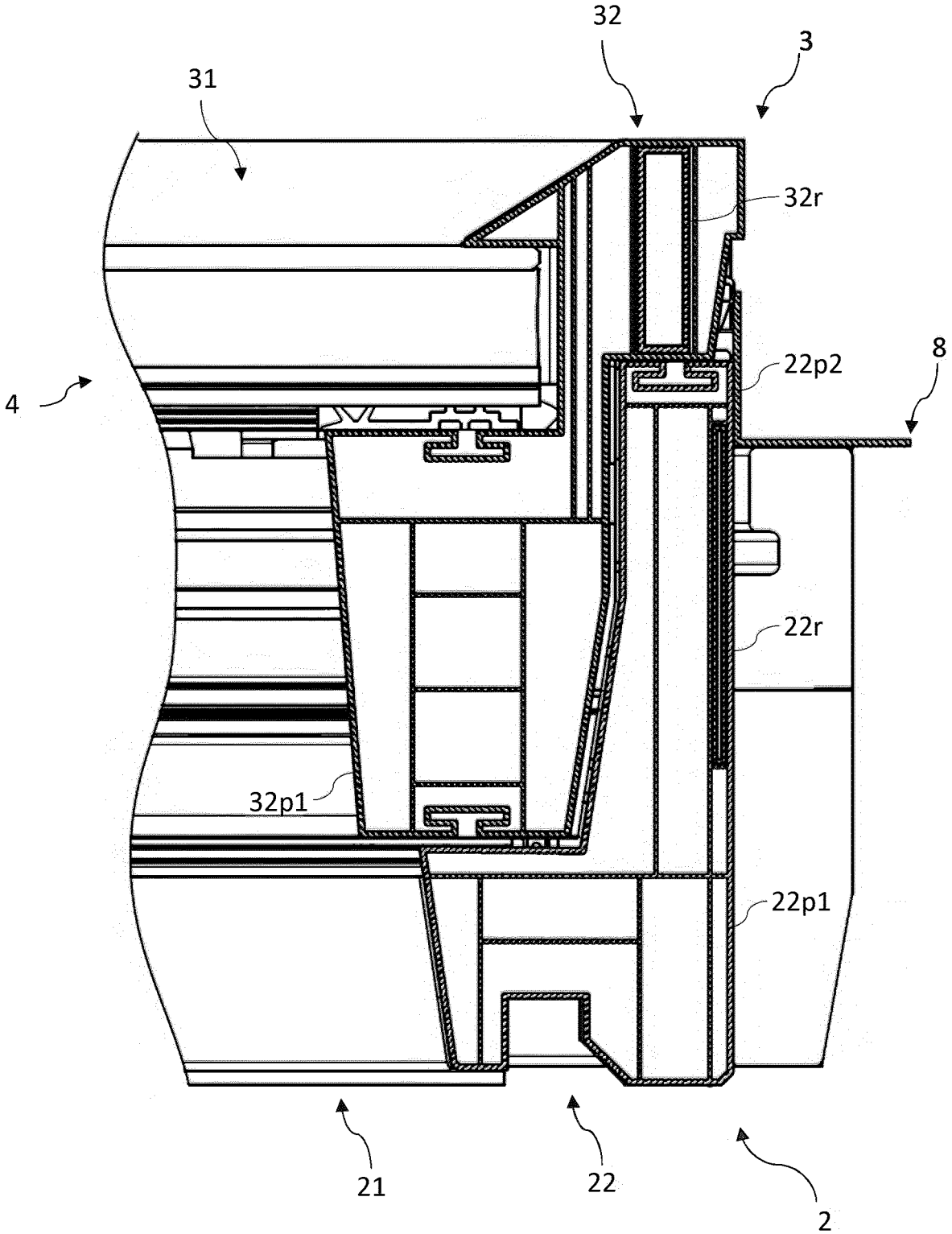

Fig. 4

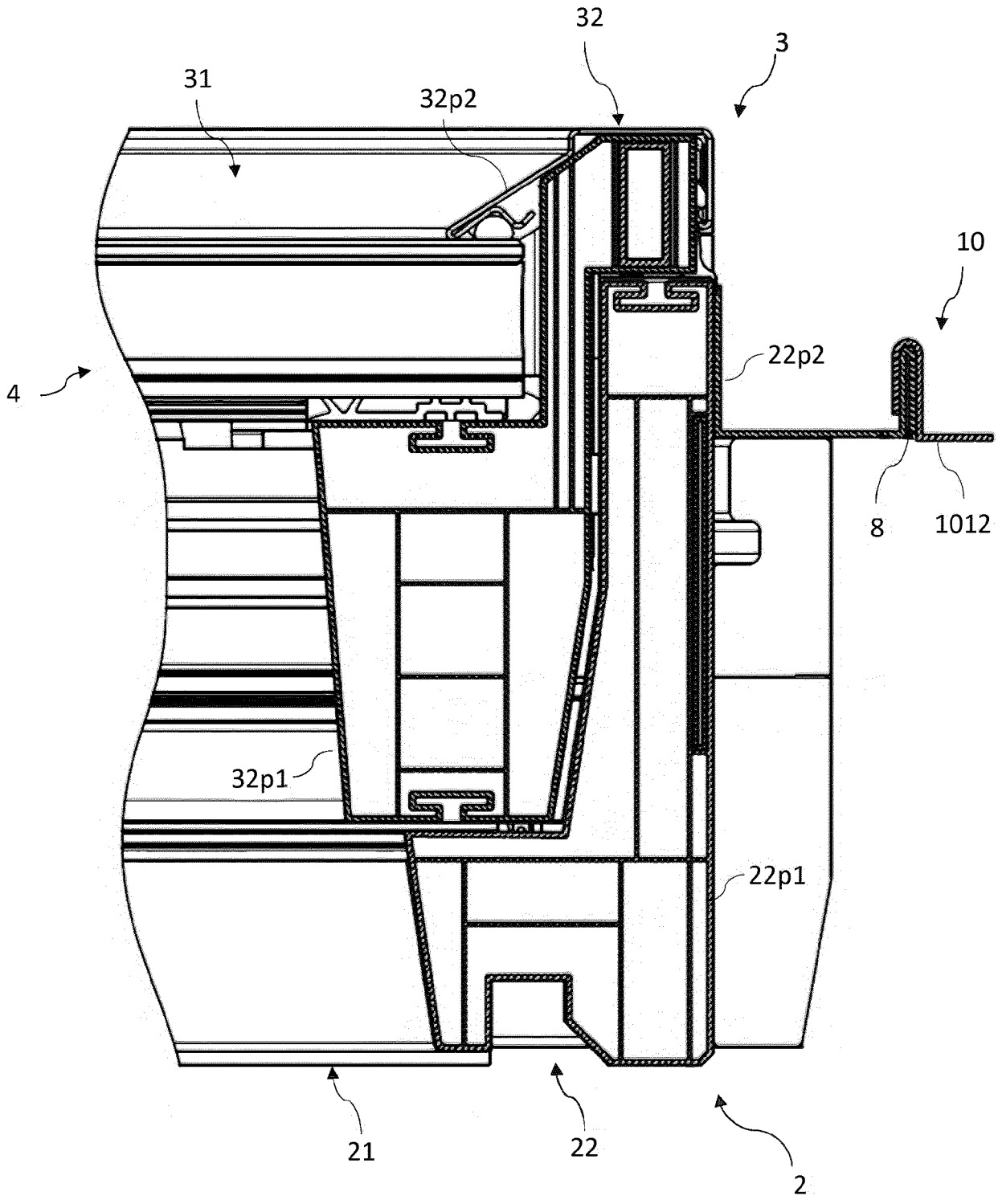

Fig. 5

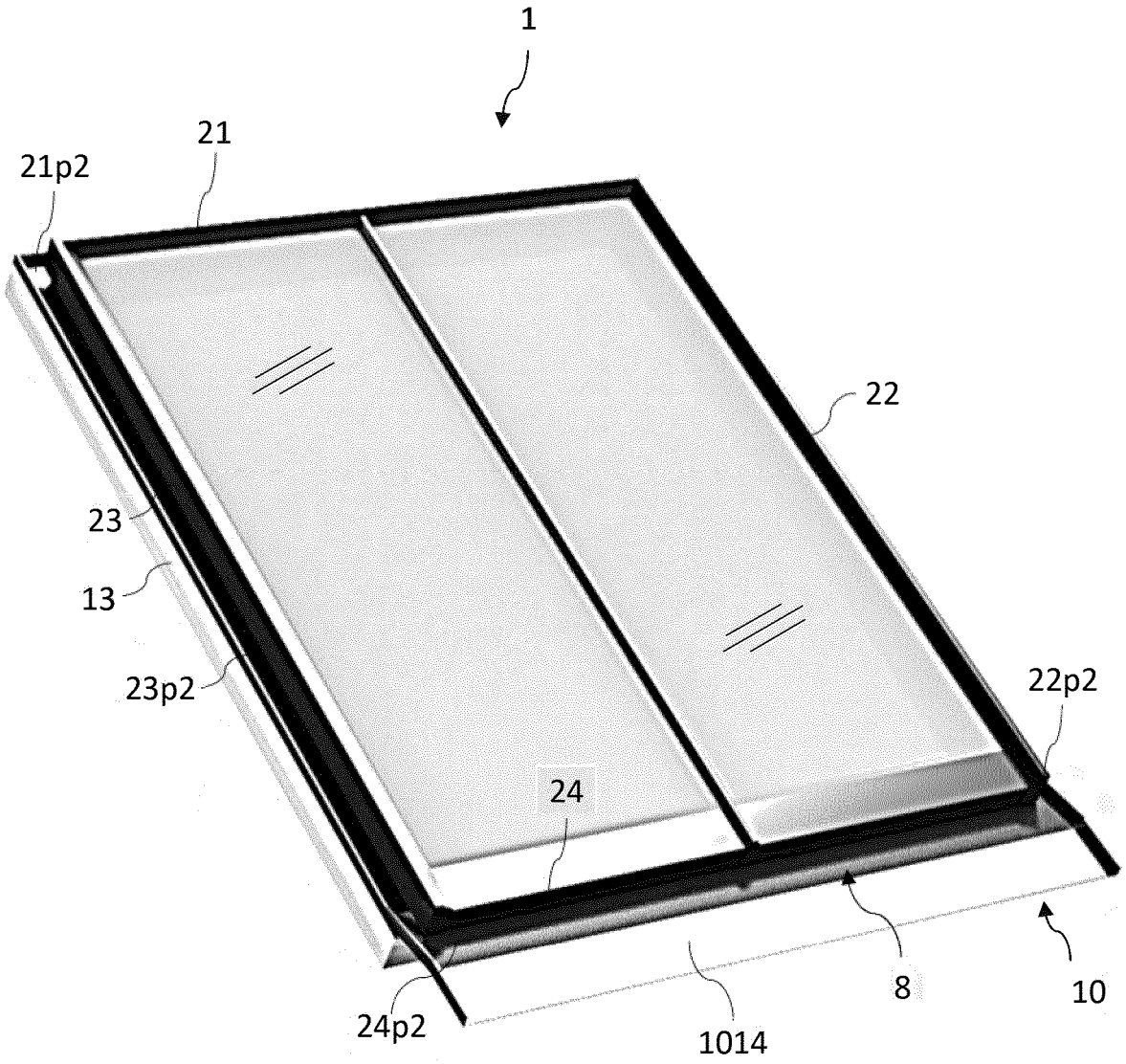

Fig. 6

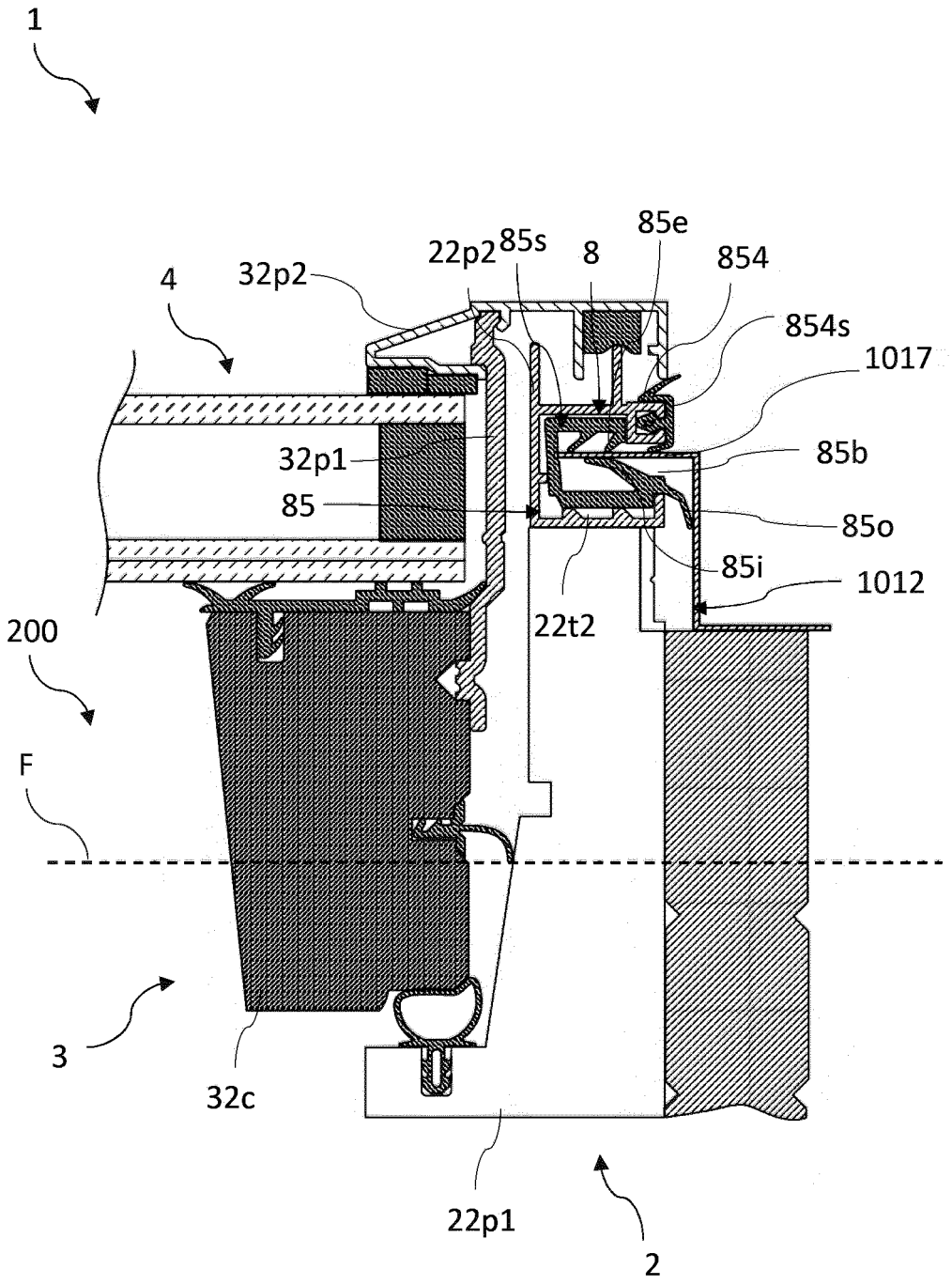
1
4
32p2
22p2
85s
8
85e
854
854s
1017
85b
32p1
85
85o
85i
1012
22t2
200
F
3
32c
22p1
2

Fig. 7

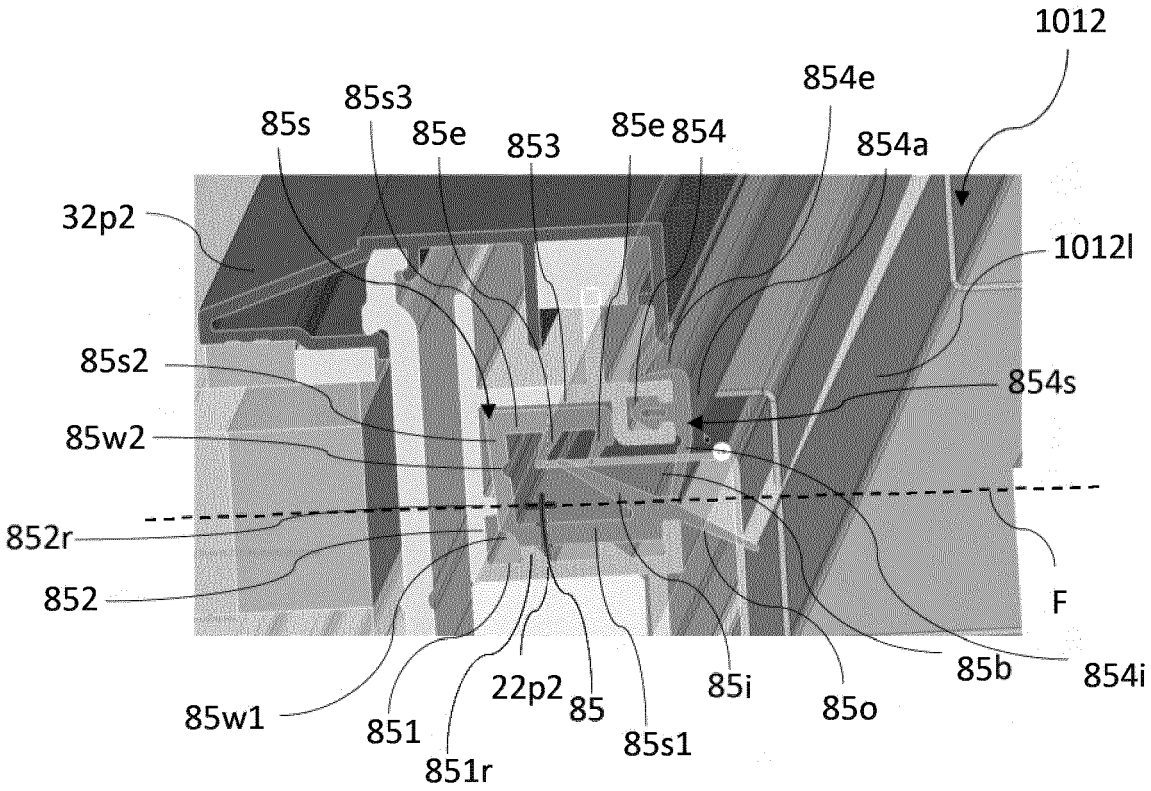
1012
854e
85s3
85s
85e
853
85e
854
854a
32p2
1012l
85s2
854s
85w2
852r
852
F
85b
854i
85w1
851
22p2
85
85i
85o
85s1
851r

Fig. 8

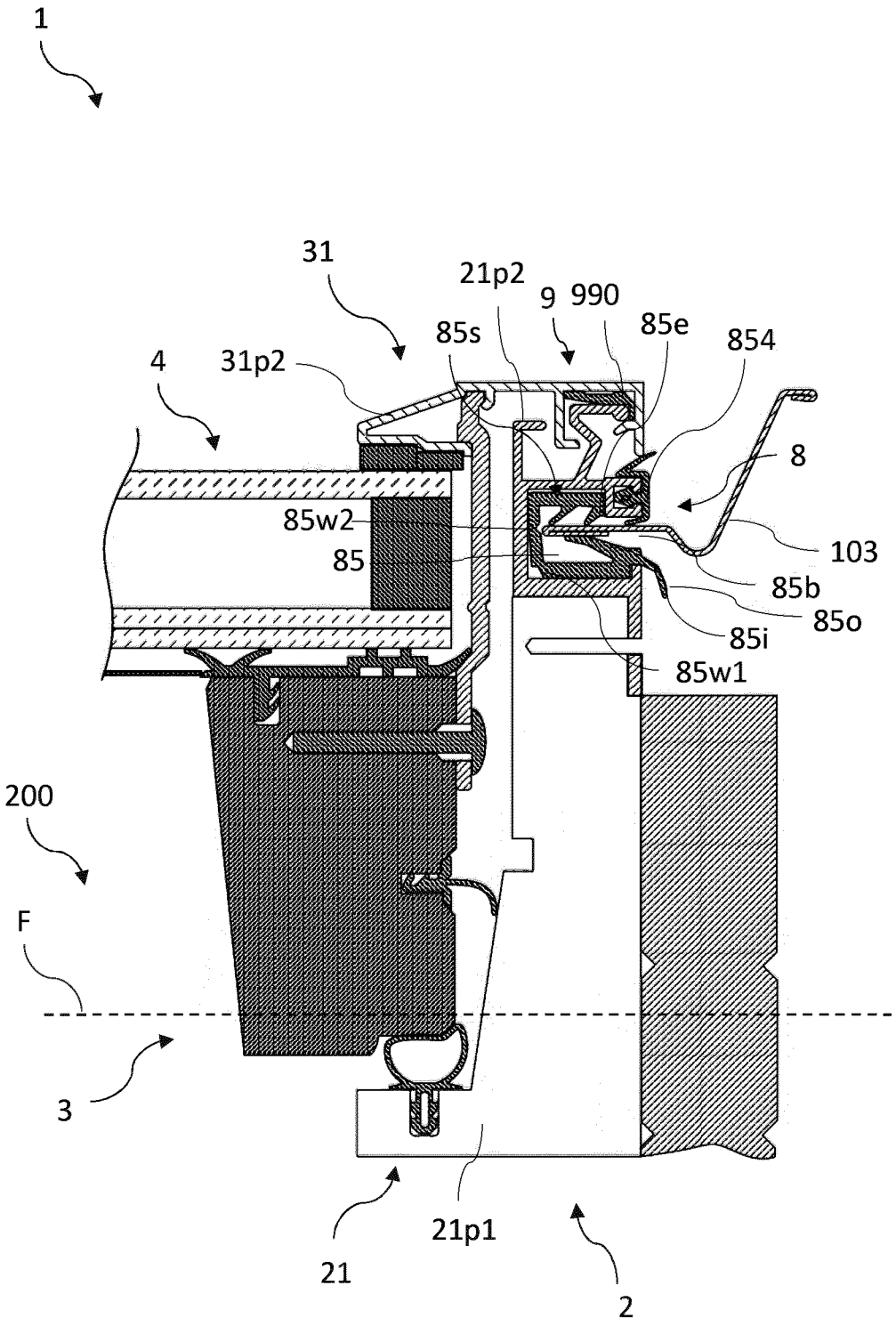
1
31
21p2
9
990
85e
854
85s
4
31p2
8
85w2
103
85
85b
85o
85i
85w1
200
F
3
21
21p1
2

Fig. 9

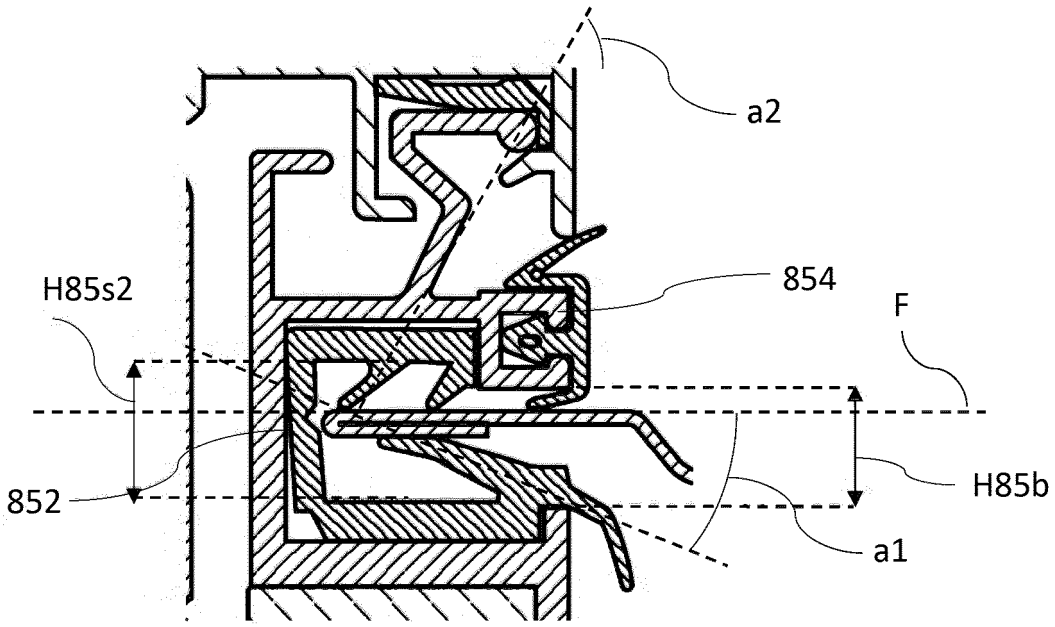

Fig. 10

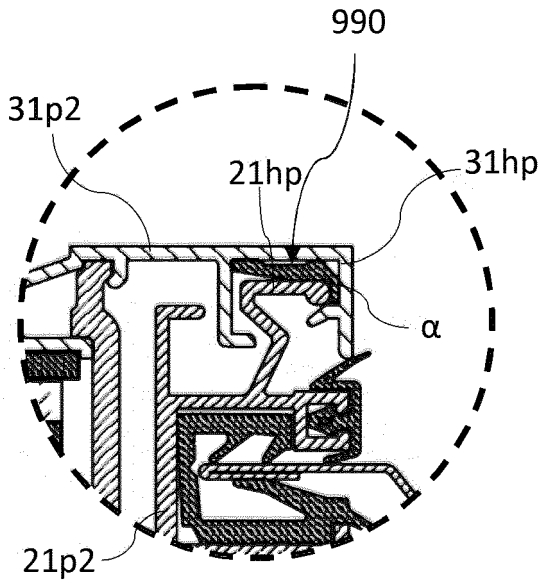

Fig. 11

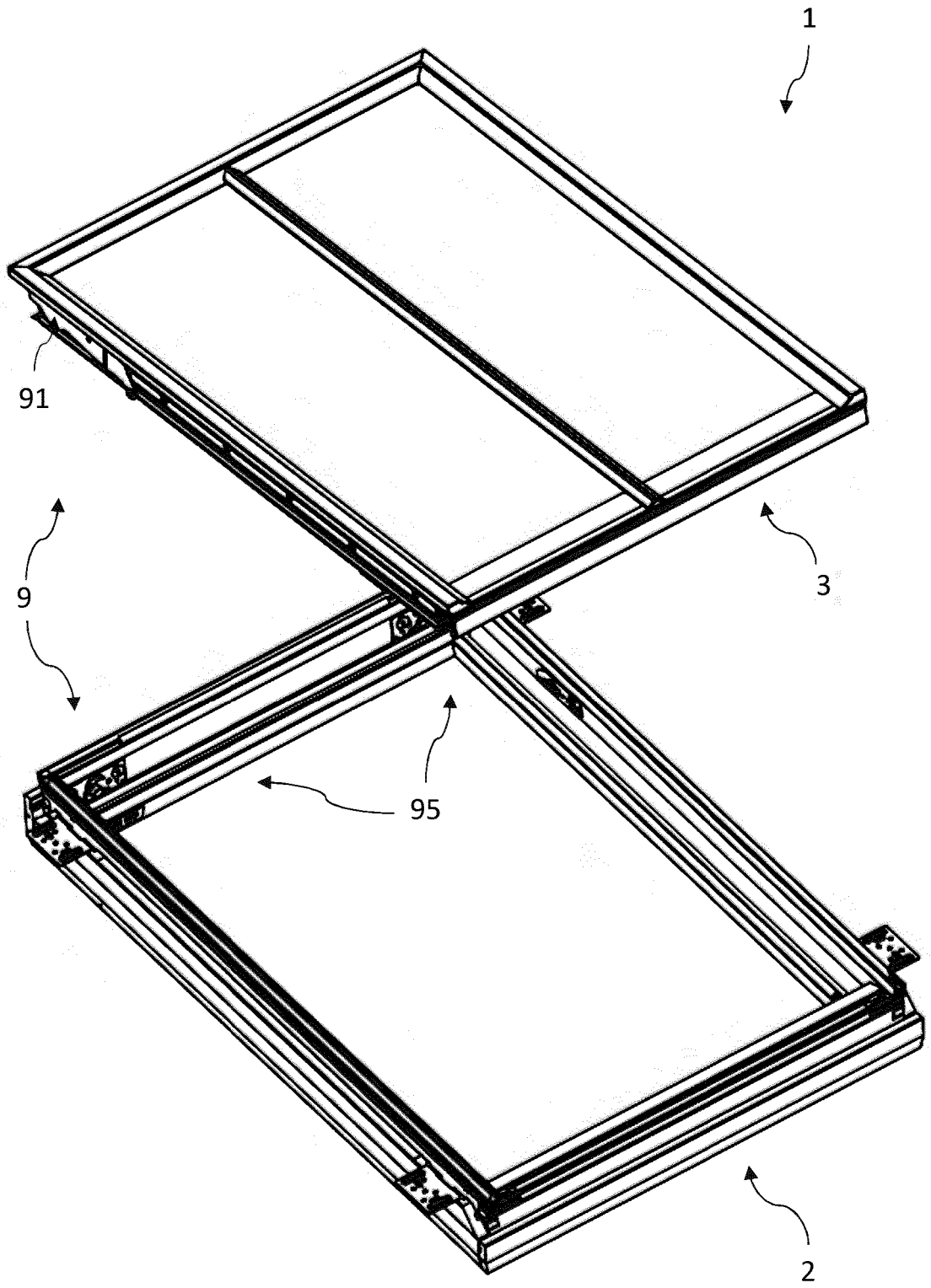

Fig. 12

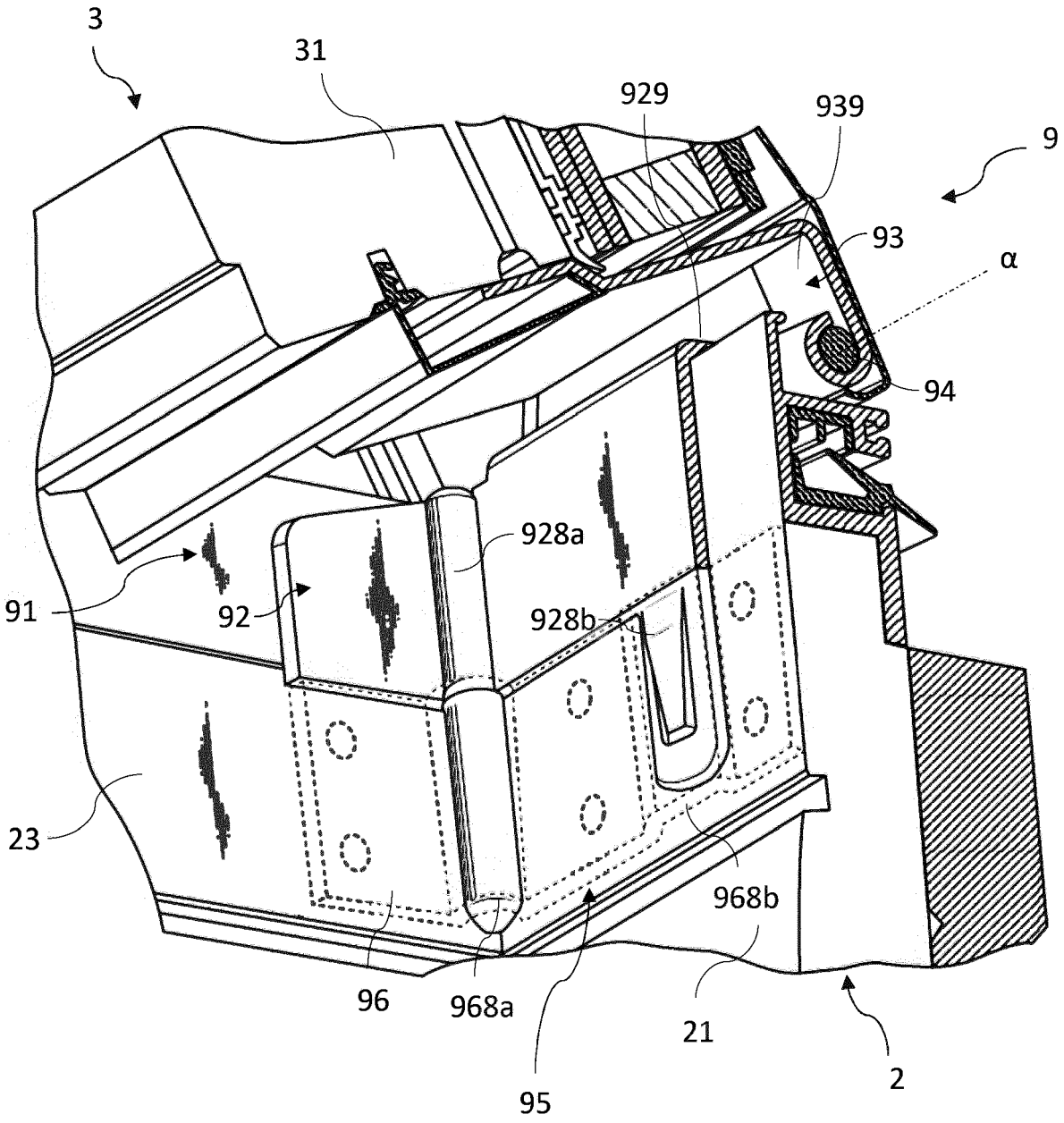

Fig. 13

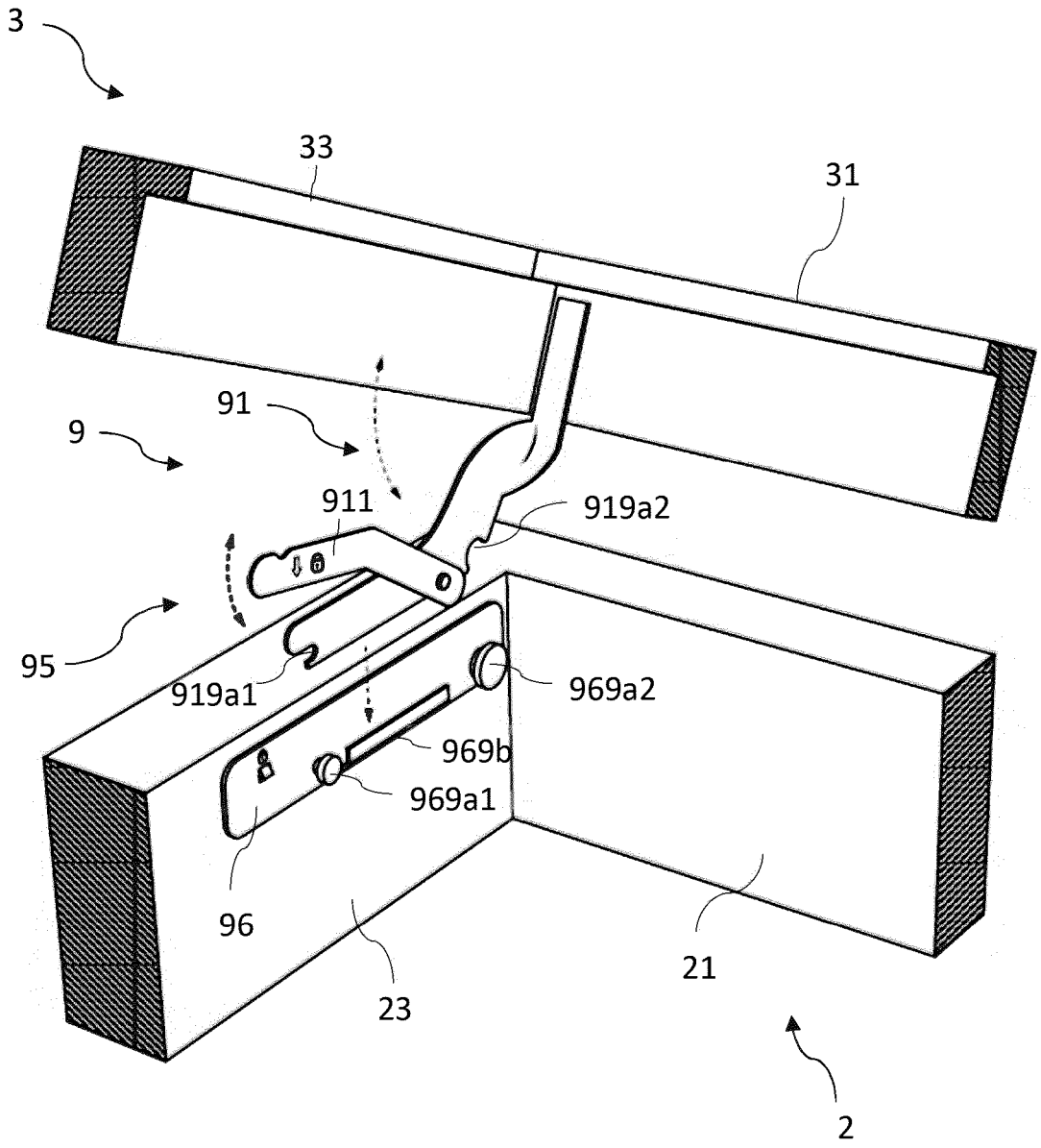

Fig. 14

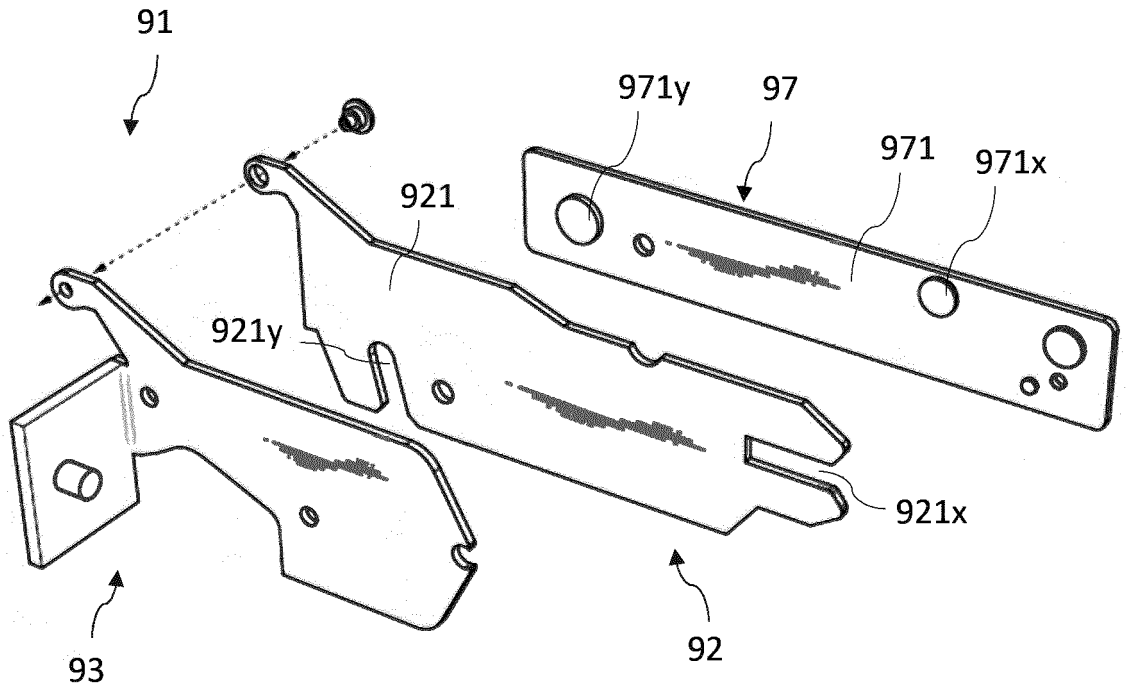

Fig. 15A

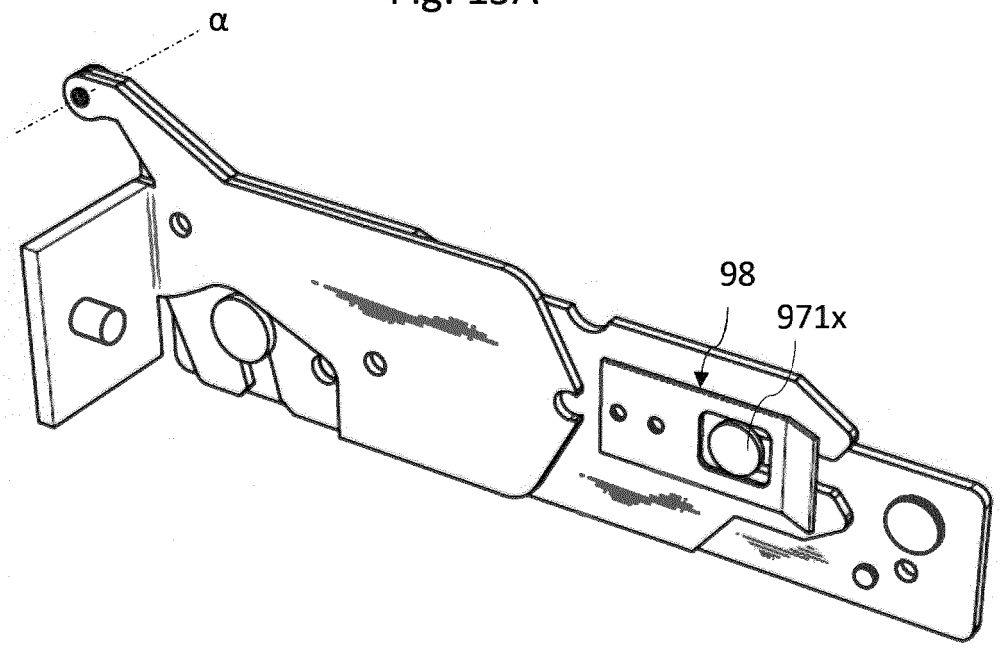

Fig. 15B

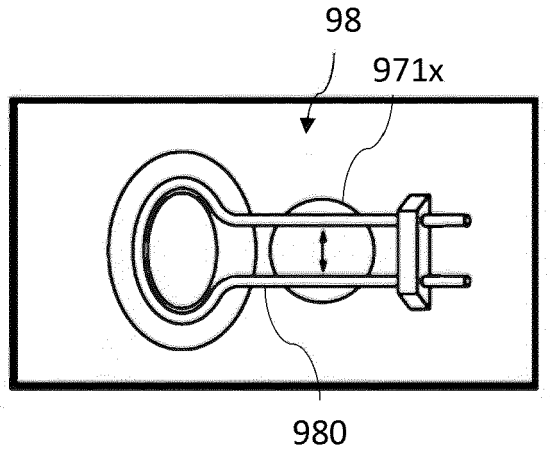

Fig. 16A

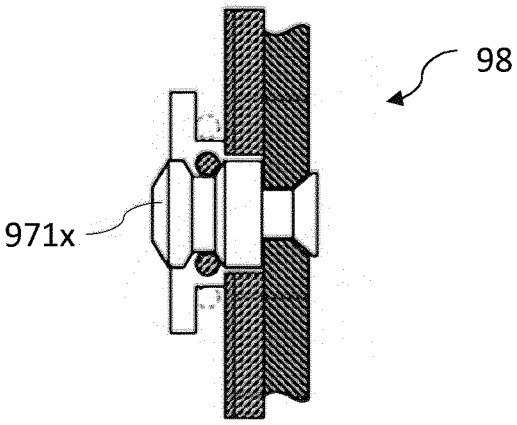

Fig. 16B

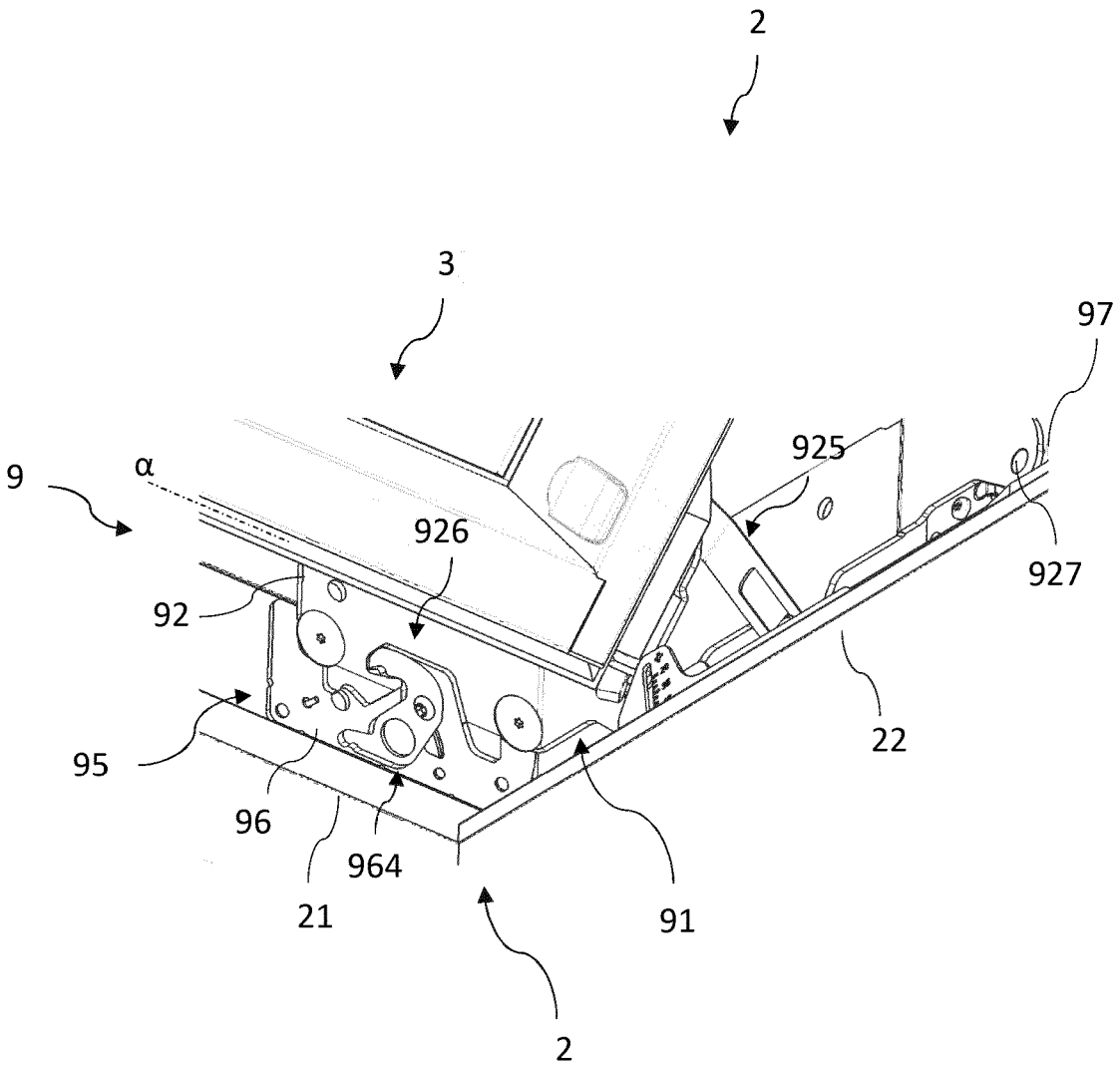

Fig. 17

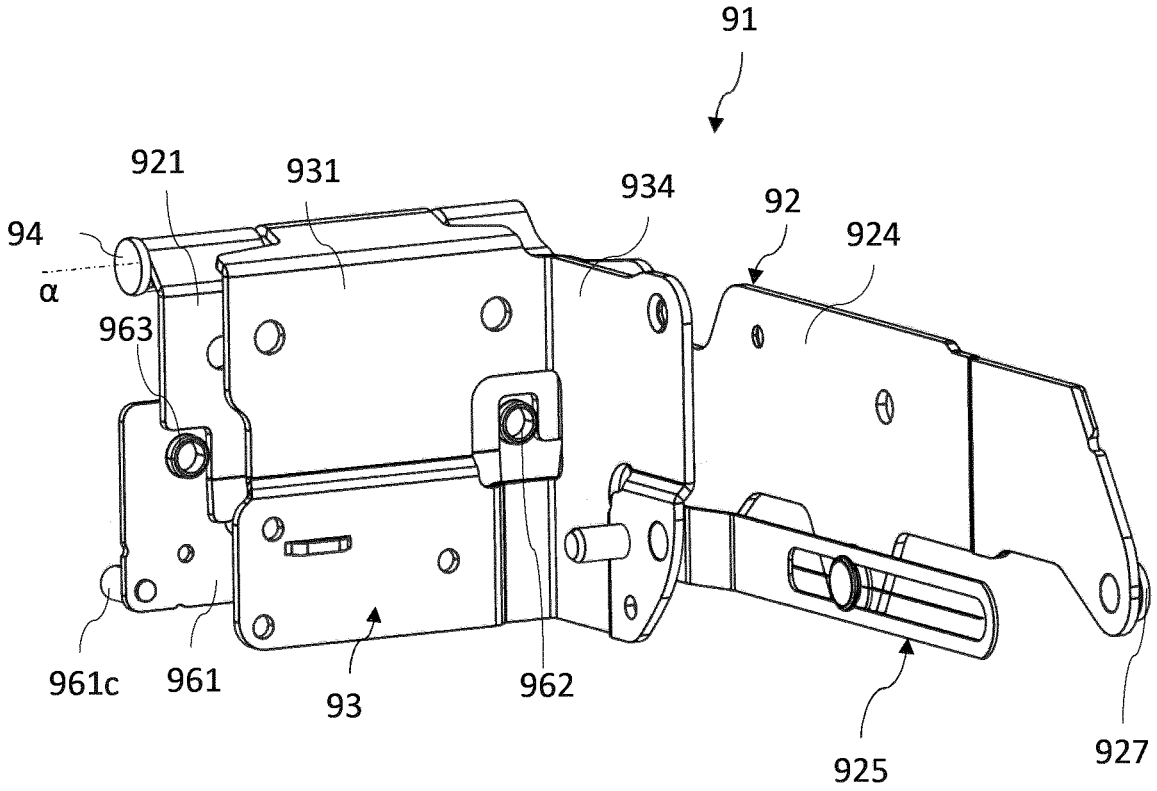

Fig. 18A

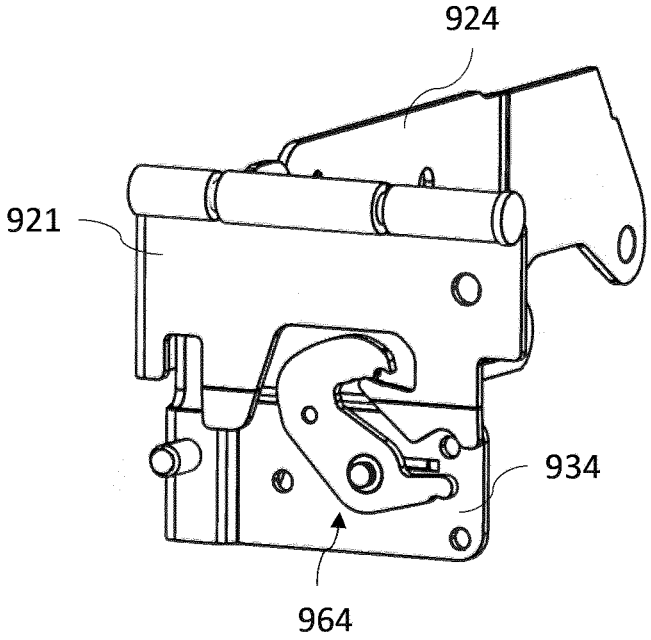

Fig. 18B

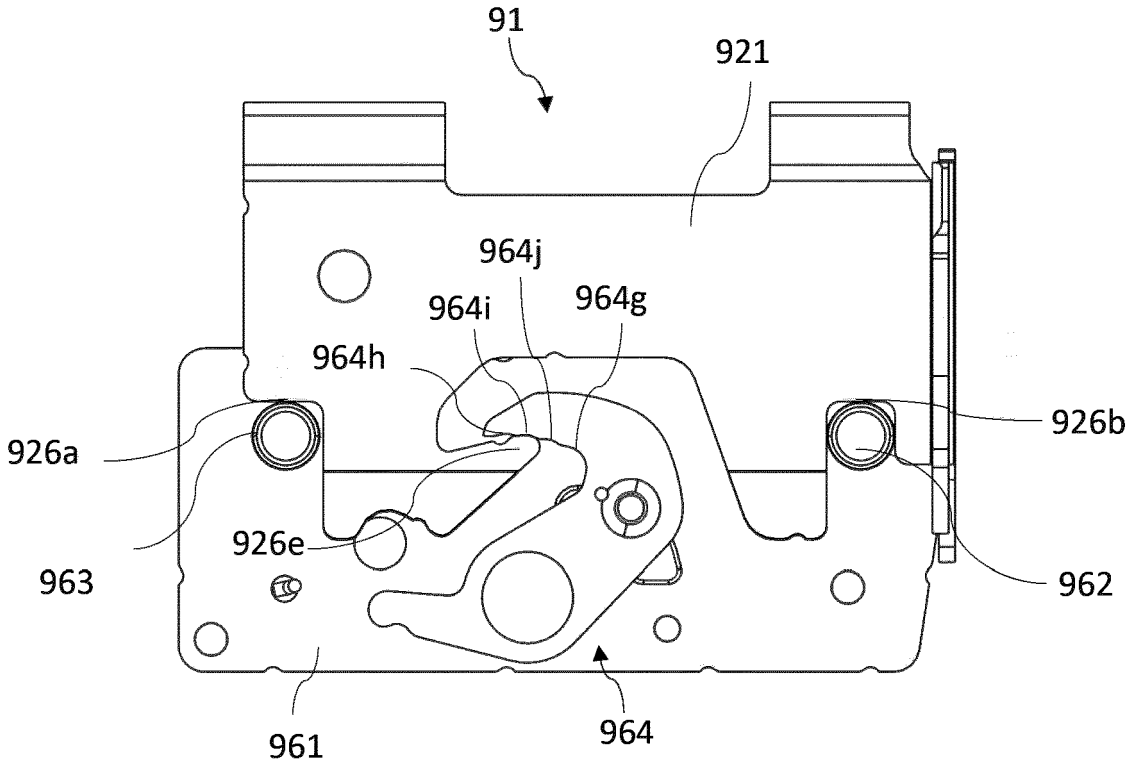

Fig. 19A

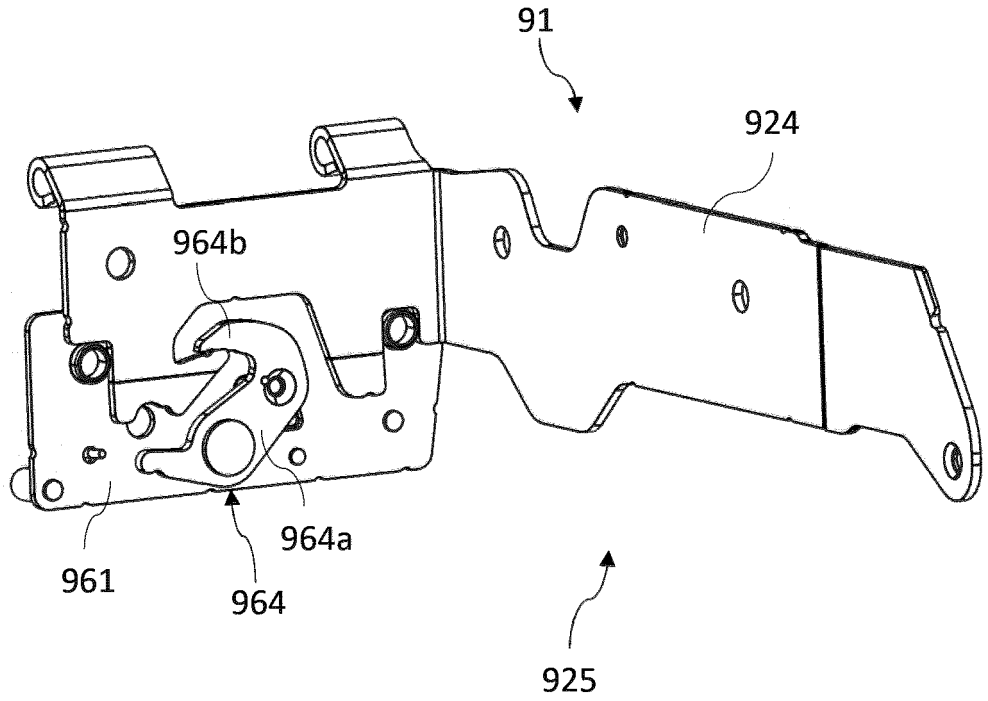

Fig. 19B

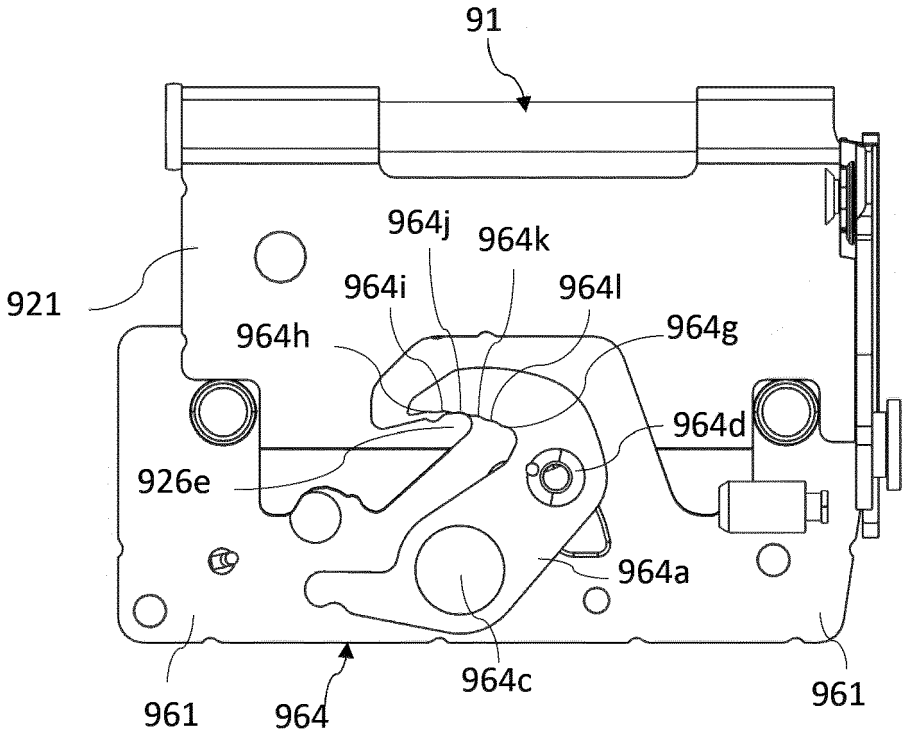

Fig. 20A

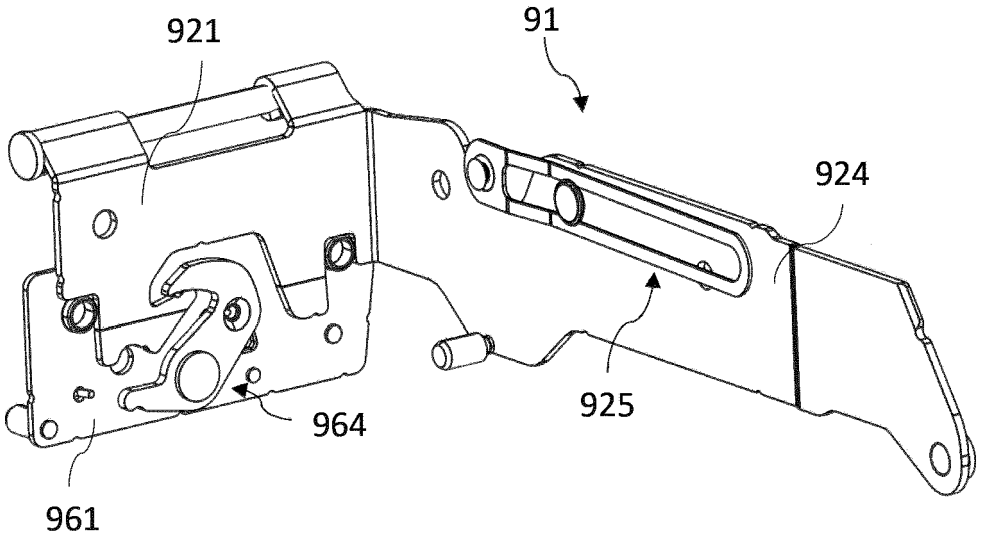

Fig. 20B

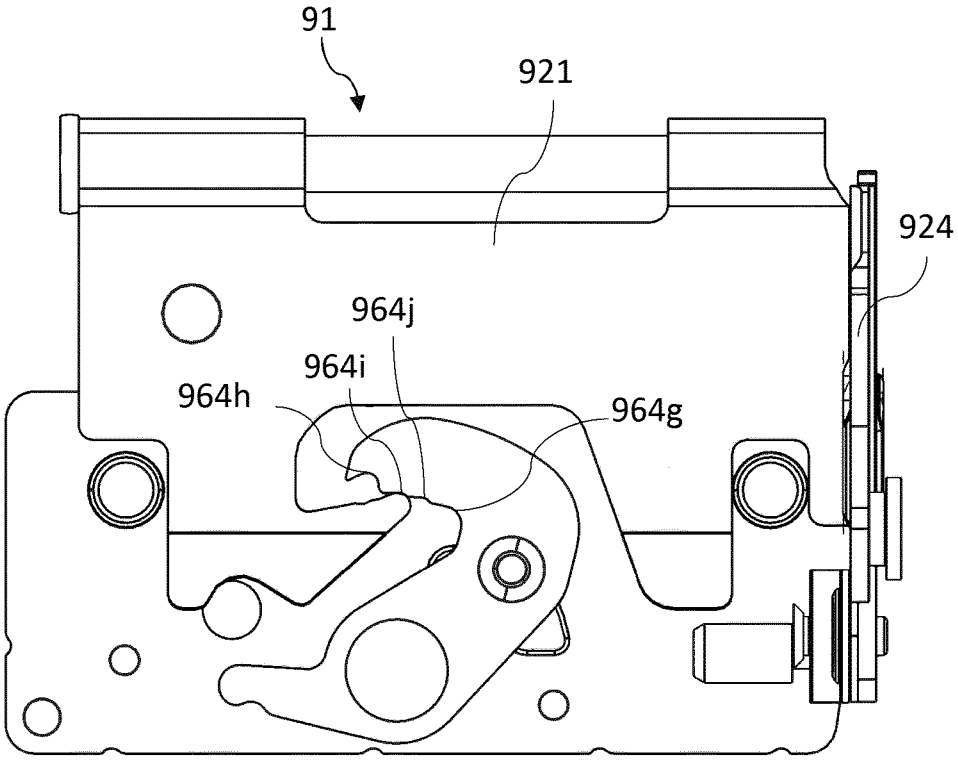

Fig. 21A

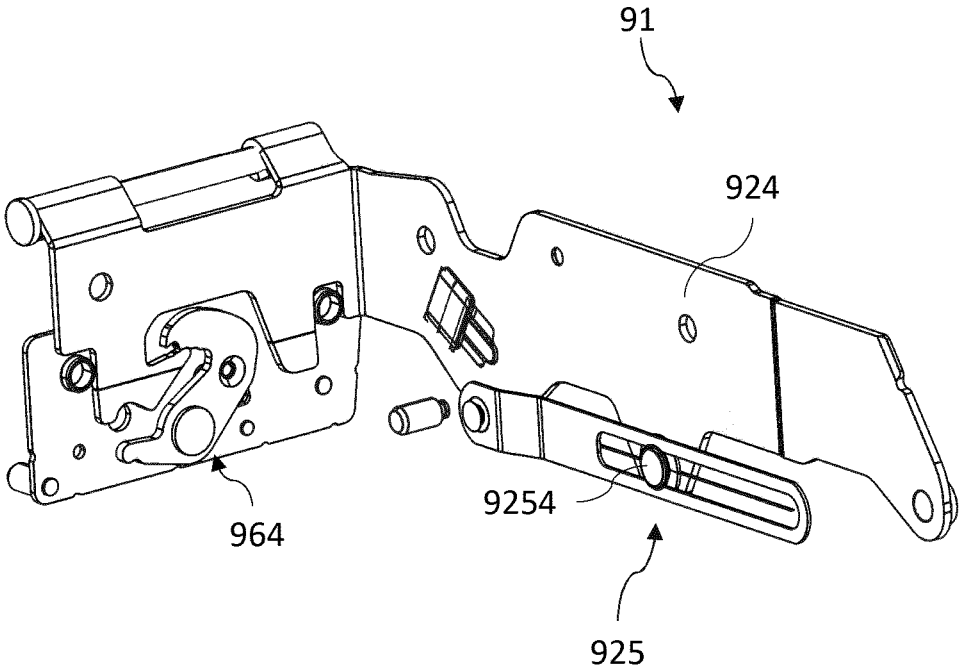

Fig. 21B

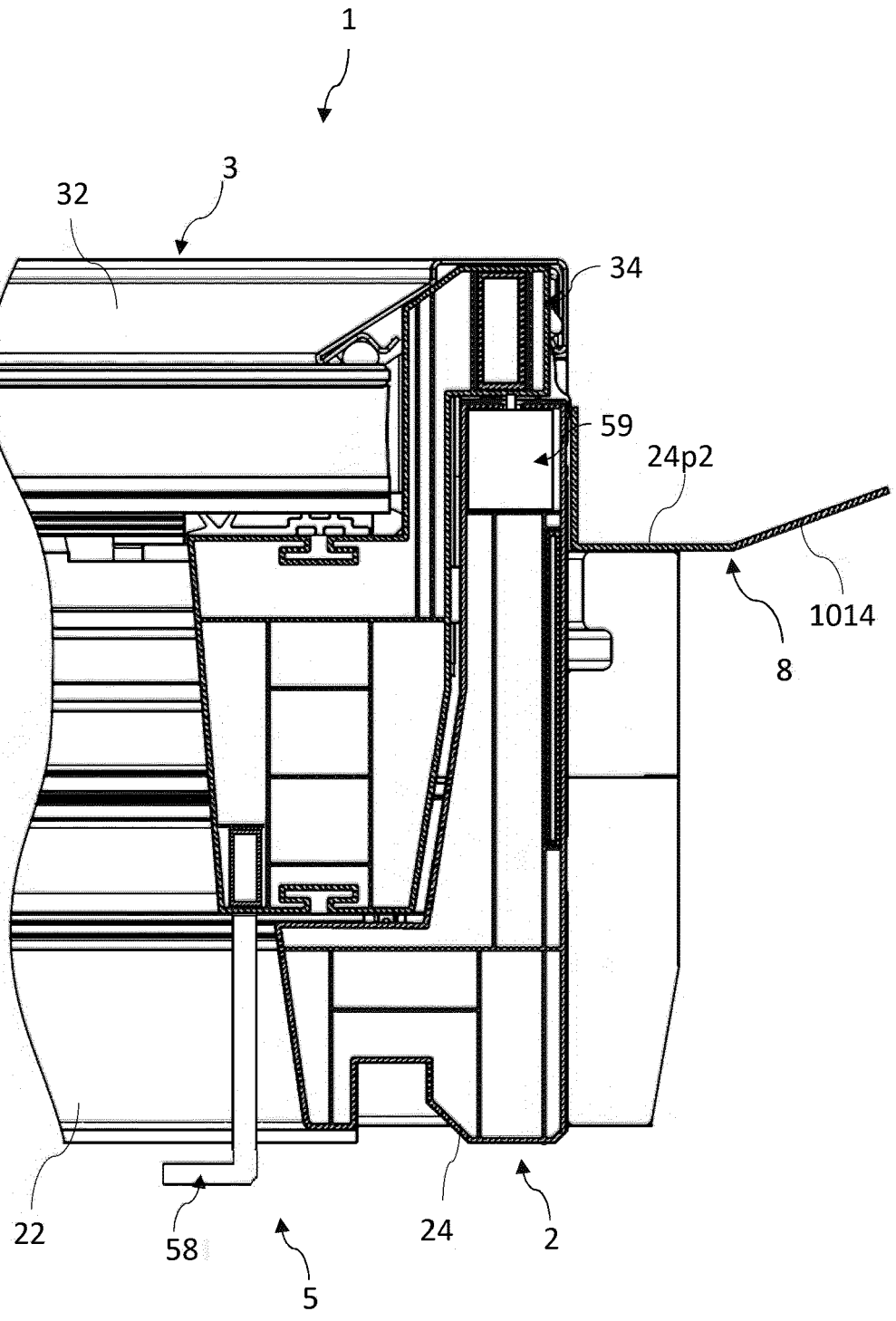

Fig. 22

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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 4128

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 430 943 A (VIRIDIAN CONCEPTS LTD [GB]) 11 April 2007 (2007-04-11) * figures 4-8 *	1-12,16	INV. E04D13/03 E04D13/14
A	US 5 148 643 A (SAMPSON ROBERT [US] ET AL) 22 September 1992 (1992-09-22) * figures *	1-15	
A	US 5 575 115 A (LINDGREN CLAES [DK] ET AL) 19 November 1996 (1996-11-19) * figure 11 *	1-15	
A	US 10 277 161 B2 (VIRIDIAN CONCEPTS LTD [GB]) 30 April 2019 (2019-04-30) * figures 2-10 *	13-15	

TECHNICAL FIELDS SEARCHED (IPC)

E04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 January 2025	Demeester, Jan

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08-01-2025

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2430943 A	11-04-2007	EP 1937911 A1	02-07-2008
		GB 2430943 A	11-04-2007
		US 2009031640 A1	05-02-2009
		WO 2007034171 A1	29-03-2007
US 5148643 A	22-09-1992	NONE	
US 5575115 A	19-11-1996	NONE	
US 10277161 B2	30-04-2019	EP 3205952 A2	16-08-2017
		GB 2541927 A	08-03-2017
		US 2017070182 A1	09-03-2017

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Patent documents cited in the description

- WO 2023186246 A1 **[0093]**