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(54) **A ROOF WINDOW COMPRISING A SASH WITH PROFILE ELEMENTS AND IMPROVED WEATHER-PROOFING PROPERTIES**

(57) In a roof window (1) comprising a frame (2), a sash (3), and a pane (4), the frame (2) and (3) each comprises a set of members (21, 22, 31, 32, 33), in which each sash member (31, 32, 33) comprises a profile element (31a, 32a) of which at least the profile elements (31a, 32a) of the top sash member (31) and the two side sash members (32, 33) are formed as a set of longitudinal profiles of substantially uniform cross-section, in which adjacent profile elements (31a, 32a) form a mitred joint in an assembled condition of the sash (3), and in which a corner key (39) is provided at an interior side of the profile elements (31a, 32a) at each mitred joint. An adhesive pad (39c) is provided to cover the respective mitred joint from the interior side of the profile elements (31a, 32a) such that the adhesive pad (39c) is inserted between the corner key (39) and the profile elements (31a, 32a) in the assembled condition of the sash (3).

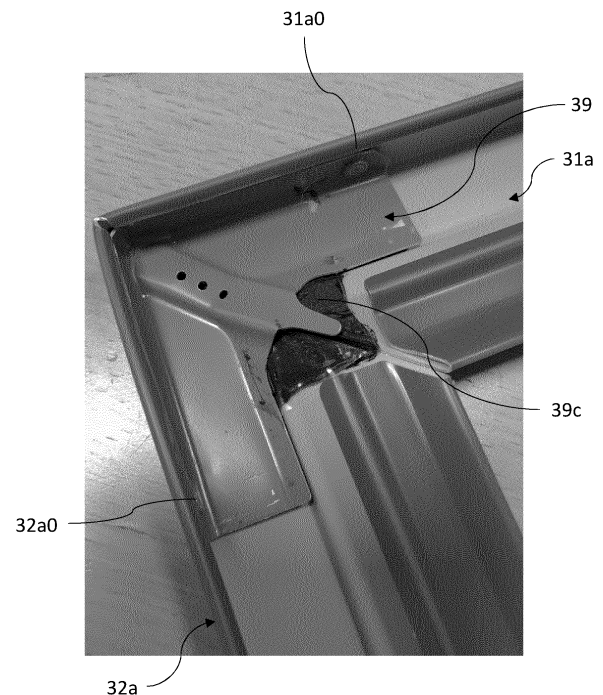


Fig. 11

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Description

Technical Field

[0001] The present invention relates to a roof window comprising a frame, a sash, and a pane, the frame and sash each comprising a set of members, in which each sash member of said set of members comprises a profile element of which at least the profile elements of a top sash member and two side sash members of said set of members are formed as a set of longitudinal profiles of substantially uniform cross-section, in which adjacent profile elements form a mitred joint in an assembled condition of the sash, and in which a corner key is provided at an interior side of the profile elements at each mitred joint.

Background Art

[0002] Roof windows to be installed in inclined roof surfaces come in a variety of types. When selecting a roof window type for a specific installation location in a building, parameters such as operability, thermal properties, weather-tightness, and suitable finishing to the interior of the building are typically given substantial weight; however, it is also often desired and in some areas in fact necessary to factor in the external appearance as well. This applies in particular when installing roof windows in conservation areas, in which building regulations may demand that the roof windows meet standard or local requirements. Thus, certain requirements apply depending on whether the installation concerns a newly fitted roof window, or to replace an existing window or rooflight as part of a renovation or refurbishment project.

[0003] The windows or rooflights of past times were typically made of cast iron with single glass pane pieces, separated by one or more cast iron glazing bars, and the thermal efficiency of these roof windows or rooflights left room for improvement. To fulfil the energy performance required by modern day building regulations, conservation roof windows are typically provided with an insulating pane, while at the same time setting out to mimic the look of traditional rooflights.

[0004] In many installation situations it is a further requirement that the conservation roof window is able to be installed with a "low profile", i.e. that the height of the parts of the roof window protruding above the surrounding roofing is as small as possible. This is particularly pronounced in buildings with substantially flat roofing materials, such as slate or shingle. With the low height and ensuing close proximity to the surface of the roofing, particular challenges relating to weatherproofing present themselves.

Summary

[0005] With this background, it is therefore an object of the invention to provide a roof window which is particu-

larly focused on improved weatherproofing.

[0006] This and further objects are achieved with a roof window of the kind mentioned in the introduction which is furthermore characterised in that an adhesive pad is provided to cover the respective mitred joint from the interior side of the profile elements such that the adhesive pad is inserted between the corner key and the profile elements in the assembled condition of the sash.

[0007] By providing an adhesive pad at the intersection between the top and sides of the sash, improved tightness is obtained in the crucial corner area of the roof window. In addition to providing tightness against entry of precipitation and other moisture from the exterior, the adhesive pad also offers a barrier to any sealing material present on the interior side of the profile elements and thus prevents outflow or seeping of such material to the exterior side of the profile elements.

[0008] In an embodiment, in which each profile element of the top sash member and the two side sash members comprises a head portion, the dimensions of the adhesive pad are chosen such that a length and a width of the adhesive pad is each larger than a width of the head portion of the profile element. In this way, sufficient coverage of the entire area at the joint at the corner is able to be covered at all times, since the adhesive pad may be formed to cover any profiling or irregularities of the profile elements. Since the adhesive pad is positioned on the interior side, any superfluous material will be substantially hidden from view from the exterior.

[0009] The adhesive pad may in principle have any suitable shape. In one embodiment, the shape of the adhesive pad is substantially rectangular, preferably square. In particular during manufacture and handling, such a shape is advantageous, minimising waste and optimising usage of the material at the joint between the profile elements.

[0010] Depending on the desired geometry of the profile elements, the mitre joint may in principle assume any suitable angle; however, it is preferred that mutually facing ends of the profile elements form an angle of 45° in the assembled condition. For profile elements having the same width throughout, this angle contributes to facilitated manufacturing since all three profile elements may be formed as one contiguous unit into which cuts are made at the corners and to a harmonic appearance in the assembled condition.

[0011] In one embodiment, the adhesive pad comprises a layer of butyl rubber, preferably covered by protective coated release layers on both sides in a supply condition, more preferably with a thickness of 1 to 3 mm, most preferably about 2 mm.

[0012] In a further embodiment, the corner key provided at each mitred joint to overlap the associated adhesive pad is generally L-shaped with two perpendicular legs, each leg being adjoined by a depending skirt on a first side, said depending skirt being provided with at least one secondary opening configured to interact with a

protrusion on an outer portion of the profile element. In this way, optimum tightness at the corners is achieved.

[0013] In another embodiment directed to improving the overall tightness of the roof window relative to weathering, an exterior sealing plane between the sash and the frame is defined by an interface unit comprising a set of interface elements located at a top frame member and side frame members, of which a top interface element defines a gap along the top frame member towards each side frame member, said gap being located substantially opposite a hinge assembly of the roof window, and wherein a separate hinge gasket is provided on the sash to substantially match said gap. In this way, it is possible to carry out smooth operation of the roof window, i.e., opening and closing of the sash relative to the frame, while at the same time maintaining appropriate tightness to the area of the hinges.

[0014] In a further development of this embodiment, the hinge gasket comprises a sealing portion protruding beyond the profile element of the top sash member in the assembled condition of the roof window. Any water or other precipitation will thus be efficiently deflected and prevented from entering the interior of the roof window.

[0015] Facilitated mounting and safe retention in the assembled condition without the use of separate fastening means are made possible by an embodiment in which the hinge gasket comprises an anchor portion forming a connection with the profile element of the top sash member in the assembled condition of the roof window, the anchor portion being preferably retained by a fourth bend of the profile element of the top sash member, said fourth bend being provided in the area of an outer portion adjoining a head portion of the profile element of the top sash member.

[0016] In a further embodiment, the hinge gasket comprises an overlap portion overlapping the corner key and the adhesive pad in the assembled condition of the roof window. This measure has proven to improve the tightness even further.

[0017] The principles according to the invention are applicable to arbitrary configurations of the frame and sash structures; however, an embodiment which offers optimum flexibility as regards the glazing element forming the pane of the roof window comprises the features that the profile element of the bottom sash member comprises a head portion, an adjoining inner portion and an adjoining outer portion, and said head portion is located on the interior side of the pane. This configuration has proven particularly advantageous for the use of stepped panes comprising traditional insulating panes and vacuum insulated glass (VIG) units.

[0018] While the configuration of the roof window is in principle sufficiently robust to withstand any forces to which the roof window is subjected in use without jeopardising the integrity of the structure of the roof window, it may nevertheless be desired to provide safety measures to accommodate for instance extreme weather conditions. In one embodiment which is particularly ad-

vantageous in this regard, the sash comprises guard means configured to enable interaction with the pane. Since roof windows are typically positioned in inclined roofs, any disintegration of the pane or parts of the sash could at least theoretically involve the risk of sliding off the roof. With such guard means in place, the risk is lowered significantly or even eliminated.

[0019] In one embodiment, said guard means comprise at least one step bracket connected to the head portion of the profile element of the bottom sash member, and wherein each at least one step bracket comprises a base section fastened to the head portion and an upstanding section protruding substantially perpendicularly from the base section past a bottom edge portion of the pane towards the exterior such that an exterior top of the upstanding section is located at or above a plane of the roof window defined by an exterior surface of the pane, each step bracket preferably comprising a set of openings in the base section. This provides for a mechanically simple solution, in that the step bracket is able to effectively block any movement of the pane or parts thereof in case of at least partial disintegration.

[0020] In embodiments in which the pane comprises a vacuum insulated glass unit having at least a first VIG sheet and at least one second and/or third VIG sheet, and the first VIG sheet is positioned to the exterior and comprises a bottom edge portion, it is preferred that the upstanding section of the step bracket is located at a distance from the bottom edge portion of the first VIG sheet of the VIG unit. Such a distance ensures that the step bracket or brackets do(es) not interfere with the pane edge during normal use but still offers the safety measure aimed at by the incorporation of the guard means.

[0021] In order to conceal the step bracket(s) at least partially, it is advantageous if each step bracket is positioned opposite a respective glazing bar, each step bracket being optionally partially concealed by an end plug of the associated glazing bar.

[0022] Other presently preferred embodiments and further advantages will be apparent from the subsequent detailed description and drawings.

Brief Description of Drawings

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

Fig. 1 is a perspective view of a roof window, seen from an exterior side;

Fig. 2 is a perspective view of the roof window of Fig. 1 with a cover assembly;

Fig. 3 is an exploded perspective view of an upper corner of the sash of a prior art roof window;

Fig. 4A is a cross-sectional view of the top of a prior art roof window, with the sash in an open position;

Fig. 4B is a partial perspective view of an upper corner of the frame of a prior art roof window;

Fig. 5A is a partial perspective view of the bottom of a prior art roof window, with the sash in an open position;

Fig. 5B is a partial perspective view of the sash of the roof window of Fig. 5A;

Fig. 5C is a partially exploded perspective view of the sash of the roof window of Fig. 5A;

Fig. 5D is a perspective sectional view of details of the sash of the roof window of Fig. 5A;

Fig. 6 is a partial perspective view of details of the sash in an embodiment of the invention;

Fig. 7 is a view corresponding to Fig. 6, including further details;

Figs. 8 and 9 are perspective views, seen from different angles, of a corner key;

Figs. 10 to 12 are photographs representing parts of the sash of the roof window in embodiments of the invention during various stages of assembly;

Fig. 13 is a partial perspective view of the roof window in an embodiment of the invention;

Fig. 14 shows a hinge gasket forming part of the roof window in an embodiment of the invention;

Fig. 15 shows a partial perspective view of the bottom of a roof window in an embodiment of the invention;

Fig. 16 a perspective view of a detail of the roof window of Fig. 15; and

Fig. 17 is a cross-sectional view of the roof window of Fig. 15.

Description of Embodiments

[0024] In the following detailed description, presently preferred embodiments 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.

[0025] 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 the 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 to 5D

[0026] Referring initially to Figs. 1 and 2, a roof window 1 is shown. In the initial general description of Figs. 1 and

2, the shown roof window 1 is representative of an embodiment of the invention and of the prior art as shown and described in Applicant's international application WO 2023/186238 A1.

[0027] Figs. 3 to 5D show details of the prior art roof window in the embodiments of the WO document; only details of relevance to the present invention are shown and will be described in detail. Elements having the same or analogous function as in the present invention are denoted by the same reference numerals in the drawing figures, unless indicated by ' for highlighting differences.

[0028] The roof window 1 is intended to be installed in an inclined roof surface (not shown) and 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 and a bottom frame member. Correspondingly, the sash 3 comprises a set of members forming a set of sash members including a top sash member 31, two side sash members 32, 33 and a bottom sash member.

[0029] 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 surface 4e of the pane 4 defines a plane of the roof window 1 in an assembled condition of the roof window 1. 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. 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.

[0030] An interior pane surface 4i, cf. Fig. 5B, 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 4e of the pane 4 by means of adhesive strips 45a as shown in Fig. 3. A glazing bar cover (not shown) may be fitted on the interior pane surface 4i. In wide roof windows, it is also possible to have more than one glazing bar, for instance two glazing bars dividing the pane into three sections.

[0031] Referring briefly also to Fig. 4A and 5A, 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. 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 by means of a hinge assembly 9 present in a gap between the top sash member 31 and the top frame member 21, and between the side sash member 32 and the side frame member 22. 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.

[0032] Further details shown in Fig. 1 include an operating assembly 5 to bring the sash 3 to the desired open position and vice versa, here shown as a manual hand winder or screw jack. Other operating assemblies may be present as well.

[0033] Also shown in Fig. 1 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.

[0034] Moreover, an insulating frame 7 is shown in Fig. 1. Insulation by an insulating frame is optional and may be provided along only some of the frame members or as shown surrounding all four members of the frame 2.

[0035] In the mounted condition of the roof window 1, a covering assembly 10 forms a weatherproof transition to the surrounding roofing material (not shown) as indicated in Fig. 2.

[0036] Referring to Figs. 3 and 4 for a description of the structure of the sash 3:

Common to all sash members 31, 32, 33 of the sash 3 of the prior art roof window and of embodiments of the roof window 1 according to the invention is that each sash member comprises a profile element, an intermediate element, and an inner element forming a connection between the profile element and the inner element in the assembled condition of the sash 3. Visible in Fig. 3 are profile elements 31a, 32a of the top sash member 31 and the right-hand side sash member, respectively, an intermediate element 31b of the top sash member 31a, and an inner element 32c and an intermediate element 32b of the side sash member 32. In the prior art example shown and in the embodiment of the invention to be described below, the profile elements 31a, 32a of the top sash member 31 and the side sash member 32, 33 are formed as a set of longitudinal profiles of substantially uniform cross-section. The intermediate element 32b is connected to the profile element 32a, and to the inner element 32c, partly by means of engagement means (not shown), partly by means of additional fastening means 30x.

[0037] The length of the profile element 31a of the top sash member 31 is chosen in accordance with the dimensions of the pane 4 and the desired manner of joining the profile element 31a to the profile elements 32a of the side sash member 32, 33, here the longitudinal profiles form mitred joints between the profile element 31a of the top sash member 31 and the respective profile element 32a of the side sash members 32, 33 in the assembled condition of the sash 3. A second bend of each profile element 31a, 32a, to be described in further detail below, has as its function to accommodate a sealing 4p relative to the exterior surface 4e of the pane 4e (while the sealing 4p is formed to be deformable and possibly resilient, i.e. as is customary in sealings, the sealing 4p is able to be deformed when coming into abutment with another component, here the pane 4; this is not reflected in the figures

since they generally show elements in their undeformed condition). Pane clips 4t are placed at suitable distances from each other along a top edge portion and side edge portions of the pane 4.

[0038] To ensure a tight joint at the mitred joints, a corner key marked 39' in the prior art view of Fig. 5 is provided at each mitred joint. During manufacture, in an assembly step, a sealant 39b' is applied.

[0039] Referring to Figs. 4A and 4B for a brief description of the frame 2:

At the top and sides of the frame 2, an exterior sealing plane between the sash 3 and the frame 2 is defined by an interface unit generally designated 8 and comprising interface elements 81, 82 along the top frame member 21 and the side frame members 22.

[0040] A top frame coupling plate 96 of a coupling unit forming part of the hinge assembly 9 is mounted to the top frame member 21.

[0041] Turning now to Figs. 5A and 5B, additional features of the prior art roof window 1 include the configuration of the pane 4, the configuration of the bottom sash member 34, and sealing features in the embodiments of WO 2023/186238 A1.

[0042] The pane 4 comprises an exterior sheet 41 and at least one interior sheet, here two interior sheets 42, 43 placed in contact with each other. The pane 4 is here a so-called stepped pane in which the exterior sheet 41 comprises an extended portion 41a extending beyond a bottom edge portion 42b of the interior sheets 42, 43 to a bottom edge portion 41b of the exterior sheet 41. A spacer 47 is provided between the most exterior interior sheet 42 and the exterior sheet 41 along all edge portions.

[0043] The bottom sash member 34 comprises a profile element 34a, an intermediate element 34b and an inner element 34c. While the major parts of the profile elements 31a, 32a, 33a of the top and side sash member 31, 32, 33 are located on the exterior side 4e of the pane 4, the profile element 34a of the bottom sash member 34 is located on the interior side 4i of the pane 4. The profile element 34a is connected to the intermediate element 34b and in turn to the inner element 34c of the bottom sash member 34. The profile element 34a comprises a head portion 34a1, an adjoining inner portion 34a2 and an adjoining outer portion 34a3.

[0044] Turning now in particular to Figs. 5C and 5D, the connection between the intermediate element 34b and the inner element 34c of the bottom sash member 34 will be described in detail.

[0045] Just as the intermediate elements 31b, 32b, 33b described in the above, the intermediate element 34b comprises a base portion 34b1 extending substantially in the height direction and a head portion 34b2 extending at an angle to the base portion 34b1. The base portion 34b1 is provided with the engagement means 34b3 on an inner surface, facing an outer surface of the inner element 34c. The engagement means of the base portion 34b1 comprises a protruding portion 34b3 to engage with a selec-

tive one groove 34c1, 34c2 of the inner element 34c of the bottom sash member 34. Additional fastening means 30y are provided to fasten the intermediate element 34b to the inner element 34c of the bottom sash member 34, in openings 34b6 in stepped section 34b4, which is offset in the inwards direction by offsetting bend 34b5 relative to the remaining section of the base portion 34b1.

[0046] In the embodiment shown, the intermediate element 34b of the bottom sash member 34 comprises a set of fittings. Two such sets may be provided along the length of the bottom sash member 34.

[0047] Each set of fittings comprises a connecting fitting provided with the engagement means configured to form a structural connection with the inner element 34c in one of at least two distinct positions in the height direction. The connecting fitting comprises a first fitting part 34b0 and a second fitting part 34b10. The first fitting part 34b0 comprises the engagement means and the second fitting part 34b10 is configured to be connected to the first fitting part 34b0 to function as a spacer between the outer surface of the inner element 34c of the bottom sash member 34 and the first fitting part 34b0. To connect the first and second fitting parts 34b0, 34b10 with each other, the second fitting part 34b10 is provided with at least one resilient hook 34b11 configured to interact with a corresponding opening 34b12 in the first fitting part 34b0. The head portion 34b2 of the intermediate element 34b of the bottom sash member 34 is received in a slit 34a5 of an inner portion 34a2 of the profile element 34a of the bottom sash member 34 in the assembled condition of the sash 3.

[0048] A sash sealing profile 30p1 is provided in the outer side of the inner element 34c of the bottom sash member 34 to interact with the inner side of the opposite bottom frame member 24, to form an intermediate sealing plane together with counterpart sash sealing profiles along the other sash members.

[0049] A profile element sealing 34p is provided on the profile element 34a of the bottom sash member 34 to be in contact with the outer side of the bottom frame member 24 in the closed position of the sash 3, thus forming part of the exterior sealing plane.

[0050] Furthermore, end plugs 38 are shown and have the function of closing off the profile elements 32a and 32c of the side sash members 32, 33 and the glazing bar 45.

Embodiments of the invention - Figs. 6 to 17

[0051] Turning first to Fig. 6 for a description of the configuration and application of an adhesive pad 39c in an embodiment of the invention. A counterpart photograph is shown in Fig. 10.

[0052] The adhesive pad 39c is provided to cover the mitred joint from the interior side of the profile elements 31a, 32a in the assembled condition of the sash 3. That is, the profile elements 31a, 32a are first brought to form the mitred joint by placing the respective mitred edges in

contact with each other and then, the adhesive pad 39c is applied to cover the mitred joint and thereby hold the profile elements 31a, 32a together, at least temporarily. In the embodiment shown, the mutually facing ends of the profile elements 31a, 32a form an angle of 45°.

[0053] The shape and dimensions of the adhesive pad 39c may be related to the configuration of the profile elements 31a, 32a as follows:

In the embodiment shown, the profile element 32a comprises a head portion 32a1 and an adjoining outer portion 32a3.

[0054] The head portion 32a1 is substantially parallel to the plane of the roof window 1 in the assembled condition of the roof window 1, and the adjoining outer portion 32a3 is substantially perpendicular to the head portion 32a1.

[0055] As indicated in Fig. 6, the dimensions of the adhesive pad 39c are in the embodiment shown chosen such that a length LA and a width WA of the adhesive pad 39c is each larger than a width WH of the head portion 32a1 of the profile element 32a.

[0056] In the embodiment shown, the adhesive pad 39c is substantially rectangular, namely square, i.e. LA equals WA. The chosen dimensions depend on the dimensions and configuration of the profile elements 31a, 32a, but values including a width WA in the range 30 to 60 mm and a length 30 to 60 mm have proven to fulfil the function of the adhesive pad 39c adequately. In the embodiment shown, WA and LA are both about 42 mm.

[0057] For the remaining details of the profile element 32a, reference is made to Fig. 10 for ease of reading. Each of the longitudinal profiles forming the profile elements 31a, 32a of the top sash member 31 and the side sash members 32, 33 comprises (description for side sash member 32 only):

An inner portion 32a2 adjoining the head portion 32a1. The dimensions are chosen such that the inner portion 32a2 overlaps the pane 4 in the assembled condition of the sash 3. The head portion 32a1 of the profile element 32a is configured to protrude to the exterior relative to the exterior surface of the pane 4e in the assembled condition of the sash 3.

[0058] The inner portion 32a2 is inclined from the head portion 32a1 relative to the head portion 32a1 and extends from a transition portion 32a7 adjoining the head portion 32a1 inwards and to the interior, towards the exterior surface 4e of the pane 4 in the assembled condition of the sash 3.

[0059] The inner portion 32a2 is adjoined by a first bend 32a4 configured to be located at or near the exterior surface of the pane 4e and is adjoined by a second bend 32a5 and a third bend 32a6. In the area of the first, second and third bends, a longitudinal trough is formed, which accommodates the sealing 4p.

[0060] In the area of the outer portion 32a3, a fourth bend 32a8 is provided. Correspondingly, outer portion 31a3 and fourth bend 31a8 of the profile element 31a of the top sash member 31 are indicated.

[0061] The configuration of the profile element 32a makes it possible to provide a secure engagement with the respective intermediate element 31b, 32b.

[0062] For the material and thickness of the adhesive pad 39c, a variety of options is available. However, forming the adhesive pad 39c by a layer of butyl rubber has proven particularly valuable. Butyl is known for its resistance to high temperatures, abrasion-resistant properties and not least its weather-proofing properties. To improve handling during assembly of the sash 3 of the roof window 1, the butyl layer is preferably covered by protective coated release layers on both sides in a supply condition. During the assembly process the release layer on the side facing the mitred joint 31a, 32a is removed. The outer release layer can be left on the adhesive pad 39c thus making the handling easier and the manual positioning of the adhesive pad can be done easily. The thickness of the adhesive pad 39c typically lies in the range 1 to 3 mm, of which 2 mm has proven to function well.

[0063] In the assembled condition of the sash 3, the adhesive pad 39c is overlapped by a corner key 39 at each mitred joint between neighbouring profile elements 31a, 32a. In comparison to the counterpart corner key 39' of the prior art of the above-mentioned WO document, the corner key 39 of the present invention could in principle have a less elaborate configuration since the application of a sealant 39b' may be made redundant due to presence of the adhesive pad 39c of the invention.

[0064] Notwithstanding, the corner key 39 of the shown embodiment has a comparable shape as in the prior art and as shown in Figs. 8 and 9, i.e. a generally L-shaped configuration with two perpendicular legs 39a1, each leg 39a1 being adjoined by a depending skirt 39a4 on a first side, each said depending skirt 39a4 being provided with a secondary opening 39a5.

[0065] Furthermore, in the embodiment shown, the legs 39a1 are divided by a channel 39a2. In the channel 39a2, a set of primary openings 39a3 is provided.

[0066] In order to fit the profile of the profile elements 31a, 32a, each leg 39a1 is adjoined by an inclined section 39a6 on a second side.

[0067] The channel 39a2 ends in a tongue 39a7, optionally adjoining an inclined channel section 39a8.

[0068] In the embodiment shown, each corner key 39 is configured to be mechanically connected to the respective adjacent profile elements 31a, 32a in that the secondary openings 39a5 are configured to interact with a respective protrusion 31a0, 32a0 on the outer portion 32a3 of the profile element 31a, 32a as indicated in Fig. 11; the protrusion 31a0 of the profile element 31a of the top sash member 31 and a protrusion 33a0 of the profile element (not indicated) of the other side sash member 33 are shown in Fig. 13. The protrusions 31a0, 32a0, 33a0 may be formed by clinching, for instance by TOX® technology.

[0069] The manufacture and assembly of the sash 3 may in principle take place in any suitable manner. In the

following, one presently preferred method will be described:

In a first step, a set of three longitudinal profiles is provided. The longitudinal profiles may for instance be formed as a single profile length of an extruded material such as metal, for instance aluminium. Other materials and manufacturing processes are conceivable, including roll forming of steel or other metals, or of a composite material.

[0070] Secondly, mitre shapes are formed at mutually facing ends of the longitudinal profiles, here at 45°. If the longitudinal profiles are formed from a single length, and if convenient, the mitre shapes may be formed in a coherent length by aptly formed incisions to form inner corners at the intersection between the top and the sides.

[0071] A pane 4 of suitable dimensions is provided.

[0072] The sets of four inner elements and four intermediate elements are provided.

[0073] The longitudinal profiles 31a, 32a are now placed in an upside-down position on an assembly table to form a profile element frame structure constituting three sides of a rectangle. This typically takes place by guiding elements fixable to the assembly table corresponding to the outer circumference of the sash.

[0074] As shown in Figs. 10 to 12, a set of two adhesive pads 39c is provided and placed on top of the formed mitred joints. The respective corner key 39 is placed on top of the adhesive pads 39c and brought into mechanical engagement with the profile elements 31a, 32a as described. If desired, a sealant corresponding to sealant 39b' may be applied to the corner key 39 before placing the corner key 39 on top of the adhesive pad 39c. If this is the case, the adhesive pad 39c acts as a barrier preventing the material of the sealant to seep out of the mitred joint and onto the exterior surface of the sash 3.

[0075] The pane 4 is placed within the profile element frame structure thus formed, and the profile element structure is connected to the inner elements, optionally via the intermediate elements, to form the sash. During this procedure, the intermediate elements at the top and sides are typically inserted into the counterpart profile elements. The inner elements may as described above be connected to each other to form an inner element frame structure, which is placed on the pane, following which the intermediate elements are connected to the respective inner elements.

[0076] An additional feature of the invention will now be described with initial reference back to Fig. 5 showing details of the prior art frame 2. As mentioned in the above, an exterior sealing plane between the sash 3 and the frame 2 is defined by the interface unit 8 comprising the interface elements 81, 82 located at the top frame member 21 and side frame members 22. The top interface element 81 defines a gap 81a along the top frame member 21 towards each side frame member, as indicated in Fig. 5 for side frame member 22. The gap 81a is located substantially opposite the hinge assembly 9 of the roof window 1 such that the interface element 81 at the top

frame member 21 ends at a distance from the corner of the frame 2, i.e. the intersection between the top frame member 21 and the side frame member 22. This is done in order not to impede the movement of the sash 3 relative to the frame 2 during opening and closing.

[0077] Referring now to Figs. 12 to 14, it is seen how a separate hinge gasket 899 is provided on the sash 3 to substantially match the gap 81a so to say.

[0078] The hinge gasket 899 comprises a sealing portion 899a protruding beyond the profile element 31a of the top sash member 31 in the assembled condition of the roof window 1 as is visible in Fig. 13.

[0079] The hinge gasket 899 furthermore comprises an anchor portion 899b as shown in Fig. 14. The anchor portions 899b forms a connection with the profile element 31a of the top sash member 31 in the assembled condition of the roof window 1. While the connection could in principle be carried out in any suitable way, the anchor portion 899b is here retained by the fourth bend 31a8 of the profile element 31a of the top sash member 31, the fourth bend 31a8 being provided in the area of the outer portion 31a3 adjoining the head portion 31a1.

[0080] Finally, the hinge gasket 899 comprises an overlap portion 899c overlapping the corner key 39 and the adhesive pad 39c in the assembled condition of the roof window 1, as indicated in Fig. 11. This configuration has proven to show particularly excellent weatherproofing properties in the roof window 1.

[0081] Turning now to Figs. 15 to 17, further aspects of the roof window will be described in some detail. Elements having the same or analogous function as in the above-described embodiments will be denoted by the same reference numerals. Only elements relevant to the description of the further aspects are shown and only differences relative to such embodiments will be described in detail. Some details may be omitted for the sake of clarity.

[0082] While the configuration of the roof window is in principle sufficiently robust to withstand any forces to which the roof window is subjected in use without jeopardising the integrity of the structure of the roof window, it may nevertheless be desired to provide safety measures to accommodate for instance extreme weather conditions.

[0083] One such safety measure could be provided in the form of guard means configured to enable interaction with a glazing element of the roof window 1. Such glazing element may be in the form of an insulating pane corresponding to the pane 4 of the above-described embodiment, or in a pane 4v as depicted in Figs. 15 to 17. The guard means are applicable to any type of pane.

[0084] The pane 4v of the embodiment of Figs. 15 to 17 comprises a vacuum insulated glass (VIG) unit having at least a first VIG sheet 4v1 and at least one second and/or third VIG sheet 4v2, 4v3, here one first VIG sheet 4v1 forming an exterior sheet and the exterior side of which constitutes the exterior surface 4i of the pane 4v, a second VIG sheet 4v2 and a third VIG sheet 4v3. Vacuum

insulated glass (VIG) units typically include two or more sheets of glass, spaced by an array of support structures e.g. spacers or pillars distributed between the sheets. The sheets are sealed with a side sealing at the periphery to provide an evacuated space (i.e., vacuum) located between the glass panes. The evacuated space is sealed at a reduced pressure such as 0.001 millibars or less in order to ensure an insulating effect of the VIG unit. To prevent sagging and contact between adjacent sheets, the support structures can serve as discrete spacers between adjacent sheets.

[0085] In the configuration of the profile element 34a of the bottom sash member 34 as shown, both in the above-described embodiments and the embodiment of Figs. 15 to 17, the bottom sash member 34 comprises head portion 34a1 and adjoining inner and outer portions 34a2, 34a3, the head portion 34a1 being located on the interior side 4i of the pane 4; 4v.

[0086] Here, the guard means comprise at least one step bracket 300 connected to the head portion 34a1 of the profile element 34a of the bottom sash member 34.

[0087] As shown in more detail in Fig. 16, the step bracket 300 comprises a base section 300a fastened to the head portion 34a1 and an upstanding section 300b protruding substantially perpendicularly from the base section 300a past a bottom edge portion 4v1b of the pane 4v towards the exterior. The upstanding section 300b should have a sufficient height so as to act as a hindrance for the pane 4v, or at least for the first VIG sheet 4v1, in the case of damage and disintegration of the structure of the pane 4v or other parts of the sash 3. In this way, a mechanical stop is provided at the bottom of the sash 3, thus preventing accidental sliding of parts of or the entire pane 4v.

[0088] It is advantageous that the height of the step bracket 300 is such that an exterior top of the upstanding section 300b of the step bracket 300 is located at or above the plane of the roof window 1 defined by the exterior surface 4e of the pane 4v.

[0089] The step bracket 300 may be formed as a moulded element of a metal or composite material. The step bracket 300 could be connected to the bottom sash member 34 in any suitable manner; here, the step bracket 300 comprises a set of openings 300c in the base section 300a to receive mechanical fastening means in the form of screws or rivets driven into the head portion 34a1 of the profile element 34a of the bottom sash member 34.

[0090] As seen most clearly from the cross-sectional view of Fig. 17, the upstanding section 300b of the step bracket 300 is located at a distance from the bottom edge portion 4v1b of the first VIG sheet 4v1 of the VIG unit forming the pane 4v. Such distance may for instance be around 1 to 5 mm, preferably around 2 mm, which ensures that the step bracket or brackets 300 do(es) not interfere with the pane edge during normal use but still offers the safety measure aimed at by the incorporation of the guard means.

[0091] The step bracket 300 of the embodiment shown furthermore comprises an inclined section 300d. In addition to providing improved strength properties in the case of an impact, should the pane 4v move within the sash 3, the inclined section 300d offers the possibility of at least partially concealing the step bracket 300 behind the end plug 38 of the associated glazing bar 45.

List of reference numerals

[0092]

1	roof window		
2	frame		
	21 top frame member		
	22 side frame member		
	24 bottom frame member		
3	sash		
	30p1 sash sealing profile		
	30x additional fastening means		
	30y additional fastening means		
	31 top sash member		
	31a profile element of top sash member		
	31a0 protrusion		
	31a1 head portion		
	31a3 outer portion		
	31a8 fourth bend		
	32 side frame member		
	32a profile element of side sash member		
	32a0 protrusion		
	32a1 head portion		
	32a2 inner portion		
	32a3 outer portion		
	32a4 first bend		
	32a5 second bend		
	32a6 third bend		
	32a7 transition portion		
	32a8 fourth bend		
	32b intermediate element		
	32c inner element		
	33 side frame member		
	33a0 protrusion		
	34 bottom sash member		
	34a profile element		
	34a1 head portion		
	34a2 inner portion		
	34a3 outer portion		
	34a4 groove		
	34a5 slit		
	34b intermediate element		
	34b0 first fitting part of connecting fitting		
	34b1 base portion		
	34b2 head portion		
	34b3 engagement means / protruding portion		
	34b4 stepped section		
	34b5 offsetting bend		
	34b6 opening		
	34b10 second fitting part of connecting fitting		
		5	34b11 resilient hook
			34b12 openingf
			34c inner element
			34p profile element sealing
			38 end plug
			39 corner key
			39' corner key (prior art)
			39a1 leg
			39a2 channel
		10	39a3 primary opening
			39a4 depending skirt
			39a5 secondary opening
			39a6 inclined section
			39a7 tongue
		15	39a8 inclined channel section
			39b' sealant (prior art)
			39c adhesive pad
			300 step bracket
			300a base section
		20	300b upstanding section
			300c openings
			300d inclined section
		4	pane
			4e exterior pane surface
		25	4i interior pane surface
			4p sealing
			4t pane clip
			41 exterior sheet
			41a extended portion
		30	41b bottom edge portion of exterior sheet
			42 interior sheet
			42b bottom edge portion of interior sheet(s)
			43 additional interior sheet
			45 glazing bar
		35	45a adhesive strips
			47 spacer
		4v	pane / vacuum insulated glass (VIG) unit
			4v1 first VIG sheet
			4v1b bottom edge portion of first VIG sheet
		40	4v2 second VIG sheet
			4v3 third VIG sheet
		5	operating assembly
		6	mounting bracket
		7	insulating frame
		45	8 interface unit
			81 top element of interface unit
			81a gap
			82 side element of interface unit
		899	hinge gasket
		50	899a sealing portion
			899b anchor portion
			899c overlap portion
		9	hinge assembly
			96 top frame coupling plate
		55	10 covering assembly
		WH	width of head portion
		WA	width of adhesive pad
		LA	length of adhesive pad

Claims

1. A roof window (1) comprising a frame (2), a sash (3), and a pane (4; 4v), the frame (2) and sash (3) each comprising a set of members (21, 22, 24, 31, 32, 33, 34), in which each sash member (31, 32, 33, 34) of said set of members comprises a profile element (31a, 32a, 34a) of which at least the profile elements (31a, 32a) of a top sash member (31) and two side sash members (32, 33) of said set of members are formed as a set of longitudinal profiles of substantially uniform cross-section, in which adjacent profile elements (31a, 32a) form a mitred joint in an assembled condition of the sash (3), and in which a corner key (39; 39) is provided at an interior side of the profile elements (31a, 32a) at each mitred joint, **characterised in that** an adhesive pad (39c) is provided to cover the respective mitred joint from the interior side of the profile elements (31a, 32a) such that the adhesive pad (39c) is inserted between the corner key (39) and the profile elements (31a, 32a) in the assembled condition of the sash (3).
2. A roof window (1) according to claim 1, wherein each profile element (31a, 32a) of the top sash member (31) and the two side sash members (32, 33) comprises a head portion (31a1, 32a1), and wherein the dimensions of the adhesive pad (39c) are chosen such that a length (LA) and a width (WA) of the adhesive pad (39c) is each larger than a width (WH) of the head portion (31a1, 32a1) of the profile element (31a, 32a).
3. A roof window (1) according to any one of the preceding claims, wherein the shape of the adhesive pad (39c) is substantially rectangular, preferably square.
4. A roof window (1) according to any one of the preceding claims, wherein mutually facing ends of the profile elements (31a, 32a) form an angle of 45° in the assembled condition.
5. A roof window (1) according to any one of the preceding claims, wherein the adhesive pad (39c) comprises a layer of butyl rubber, preferably covered by protective coated release layers on both sides in a supply condition, more preferably with a thickness of 1 to 3 mm, most preferably about 2 mm.
6. A roof window (1) according to any one of the preceding claims, wherein the corner key (39) provided at each mitred joint to overlap the associated adhesive pad (39c) is generally L-shaped with two perpendicular legs (39a1), each leg (39a1) being adjoined by a depending skirt (39a4) on a first side, said depending skirt (39a4) being provided with at least one secondary opening (39a5) configured to interact with a protrusion (31a0, 32a0) on an outer portion (32a3) of the profile element (31a, 32a).
7. A roof window (1) according to any one of the preceding claims, wherein an exterior sealing plane between the sash (3) and the frame (2) is defined by an interface unit (8) comprising a set of interface elements (81, 82) located at a top frame member (21) and side frame members (22), of which a top interface element (81) defines a gap (81a) along the top frame member (21) towards each side frame member (22), said gap (81a) being located substantially opposite a hinge assembly (9) of the roof window (1), and wherein a separate hinge gasket (899) is provided on the sash (3) to substantially match said gap (81a).
8. A roof window (1) according to claim 7, wherein the hinge gasket (899) comprises a sealing portion (899a) protruding beyond the profile element (31a) of the top sash member (31) in the assembled condition of the roof window (1).
9. A roof window (1) according to any one of claims 7 and 8, wherein the hinge gasket (899) comprises an anchor portion (899b) forming a connection with the profile element (31a) of the top sash member (31) in the assembled condition of the roof window (1), the anchor portion (899b) being preferably retained by a fourth bend (31a8) of the profile element (31a) of the top sash member (31), said fourth bend being provided in the area of an outer portion (31a3) adjoining a head portion (31a1) of the profile element (31a) of the top sash member (31).
10. A roof window (1) according to any one of claims 7 to 9, wherein the hinge gasket (899) comprises an overlap portion (899c) overlapping the corner key (39) and the adhesive pad (39c) in the assembled condition of the roof window (1).
11. A roof window (1) according to any one of the preceding claims, wherein the profile element (34a) of the bottom sash member (34) comprises a head portion (34a1), an adjoining inner portion (34a2) and an adjoining outer portion (34a3), and wherein said head portion (34a1) is located on the interior side (4i) of the pane (4; 4v).
12. A roof window (1) according to any one of the preceding claims, wherein the sash (3) comprises guard means configured to enable interaction with the pane (4; 4v).
13. A roof window (1) according to claims 11 and 12, wherein said guard means comprise at least one step bracket (300) connected to the head portion (34a1) of the profile element (34a) of the bottom sash

member (34), and wherein each at least one step bracket (300) comprises a base section (300a) fastened to the head portion (34a1) and an upstanding section (300b) protruding substantially perpendicularly from the base section (300a) past a bottom edge portion (41b; 4v1b) of the pane (4; 4v) towards the exterior such that an exterior top of the upstanding section (300b) is located at or above a plane of the roof window (1) defined by an exterior surface (4e) of the pane (4; 4v), each step bracket (300) preferably comprising a set of openings (300c) in the base section (300a).

14. A roof window (1) according to claim 13, wherein the pane (4v) comprises a vacuum insulated glass (VIG) unit having at least a first VIG sheet (4v1) and at least one second and/or third VIG sheet (4v2, 4v3), wherein the first VIG sheet (4v1) is positioned to the exterior and comprises a bottom edge portion (4v1b), and wherein the upstanding section (300b) of the step bracket (300) is located at a distance from the bottom edge portion (4v1b) of the first VIG sheet (4v1) of the VIG unit.
15. A roof window (1) according to claim 13 or 14, wherein the roof window (1) comprises at least one glazing bar (45), preferably comprising an end plug (38), and wherein each step bracket (300) is positioned opposite a respective glazing bar (45), each step bracket (300) being optionally partially concealed by the end plug (38) of the associated glazing bar (45).

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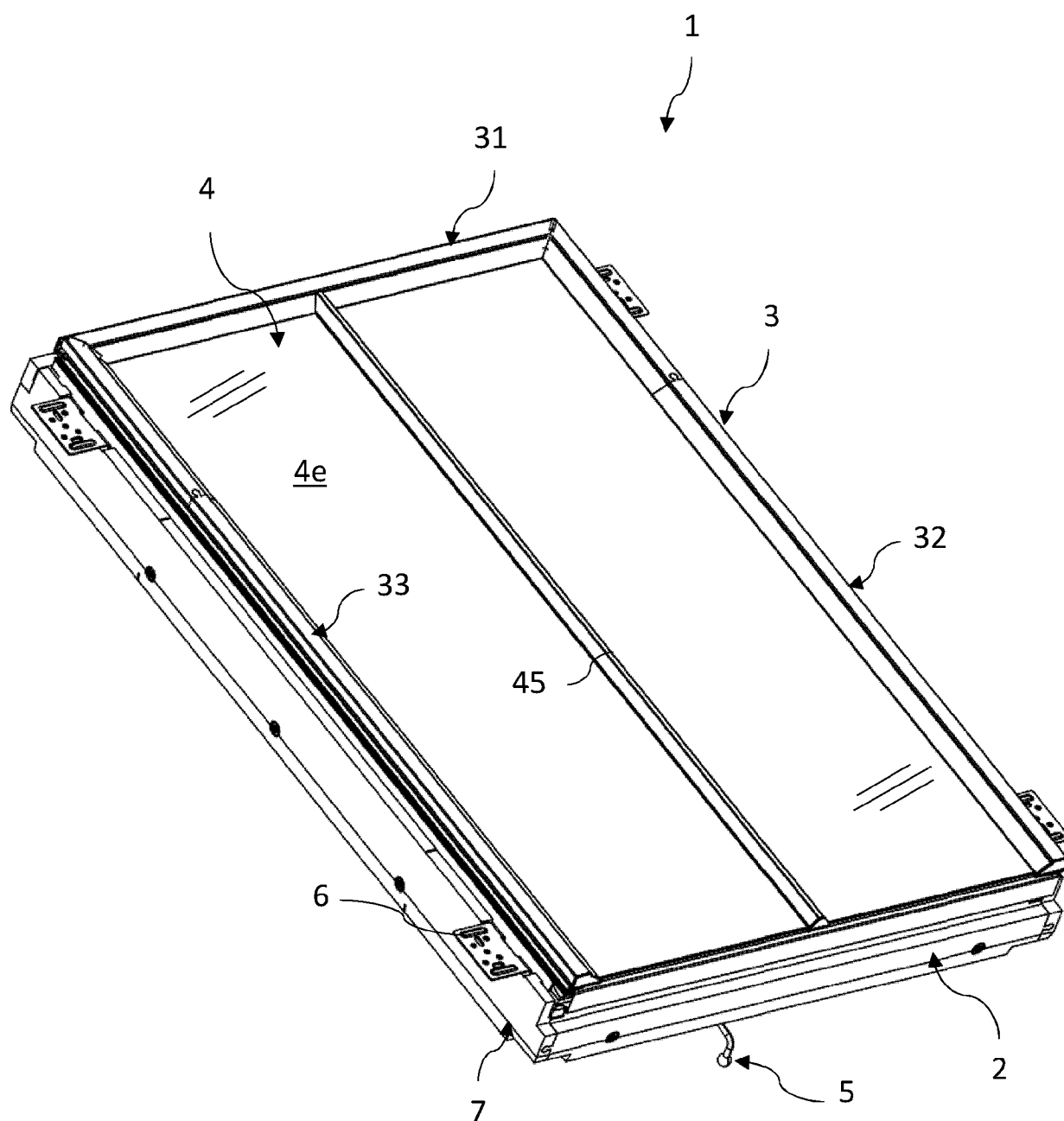


Fig. 1

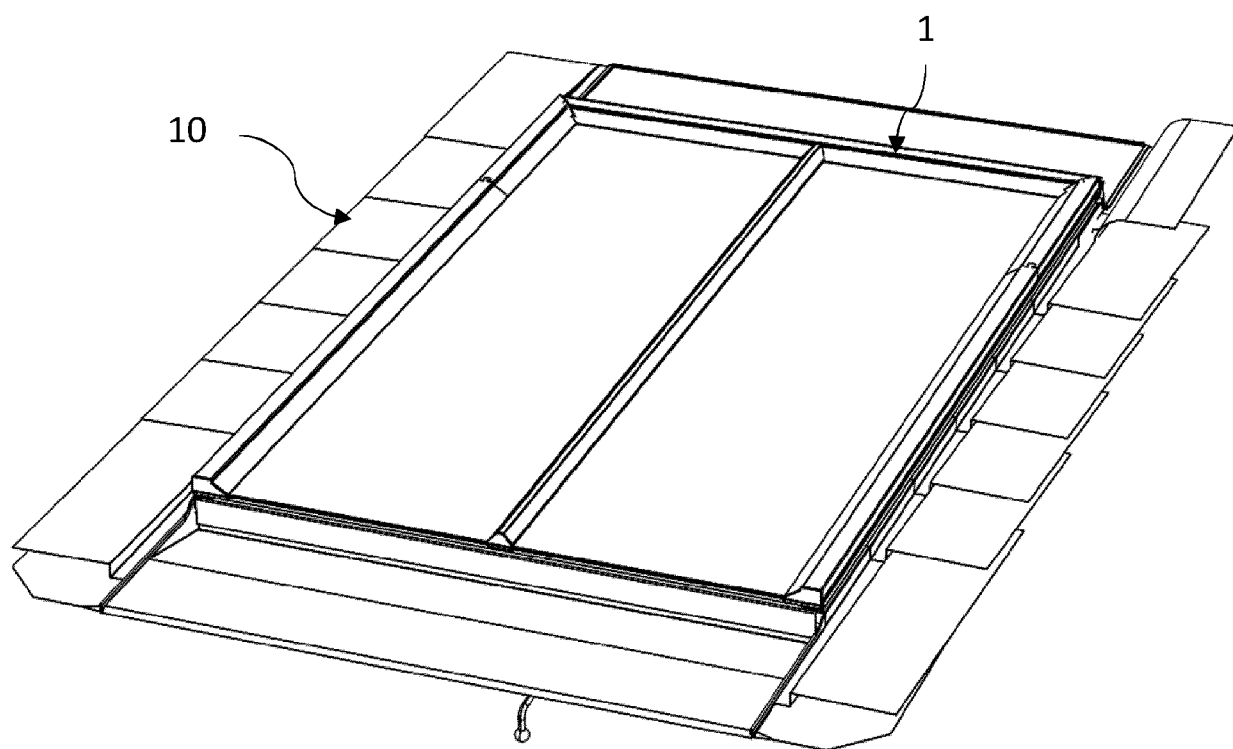


Fig. 2

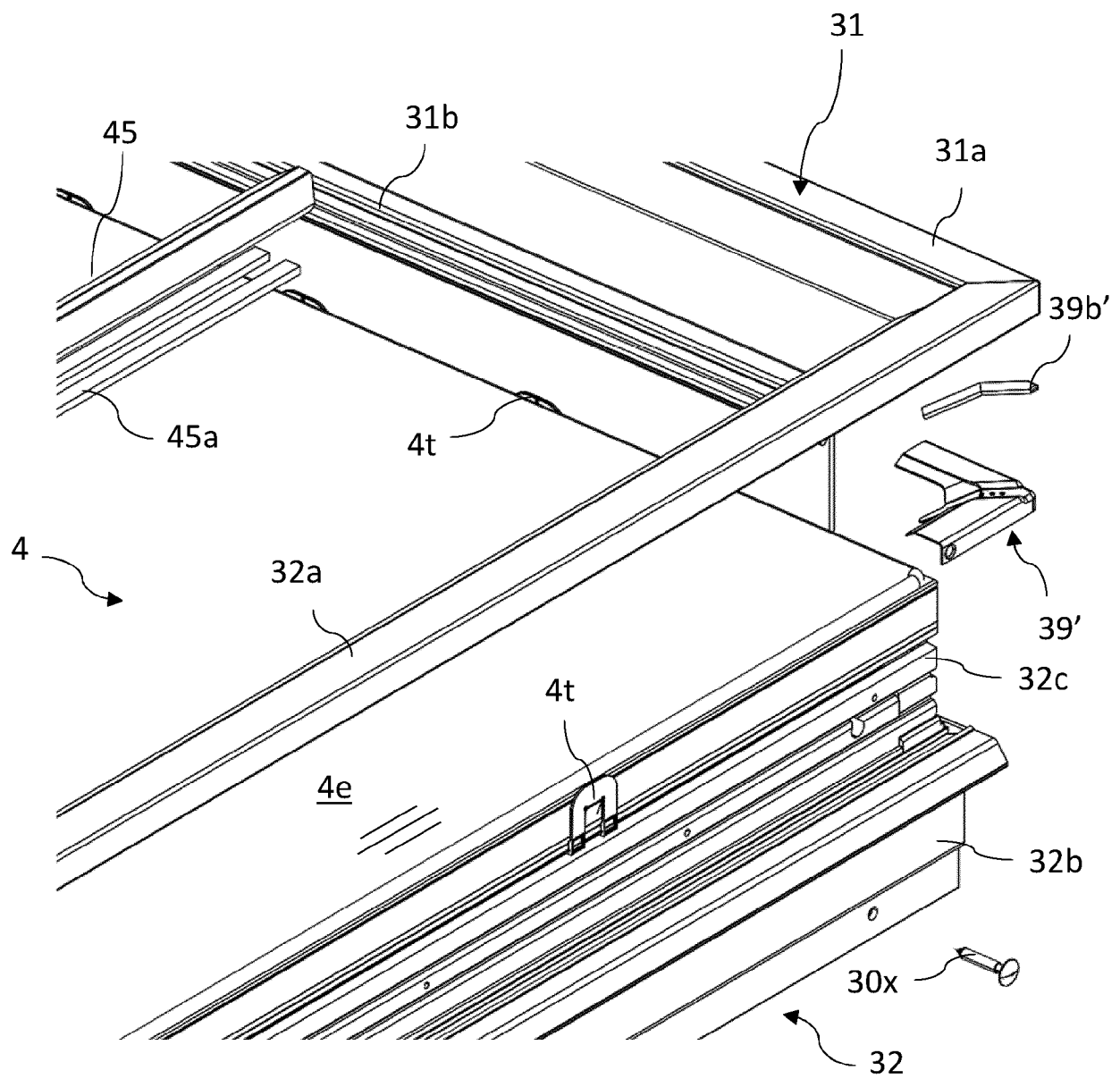


Fig. 3 (PRIOR ART)

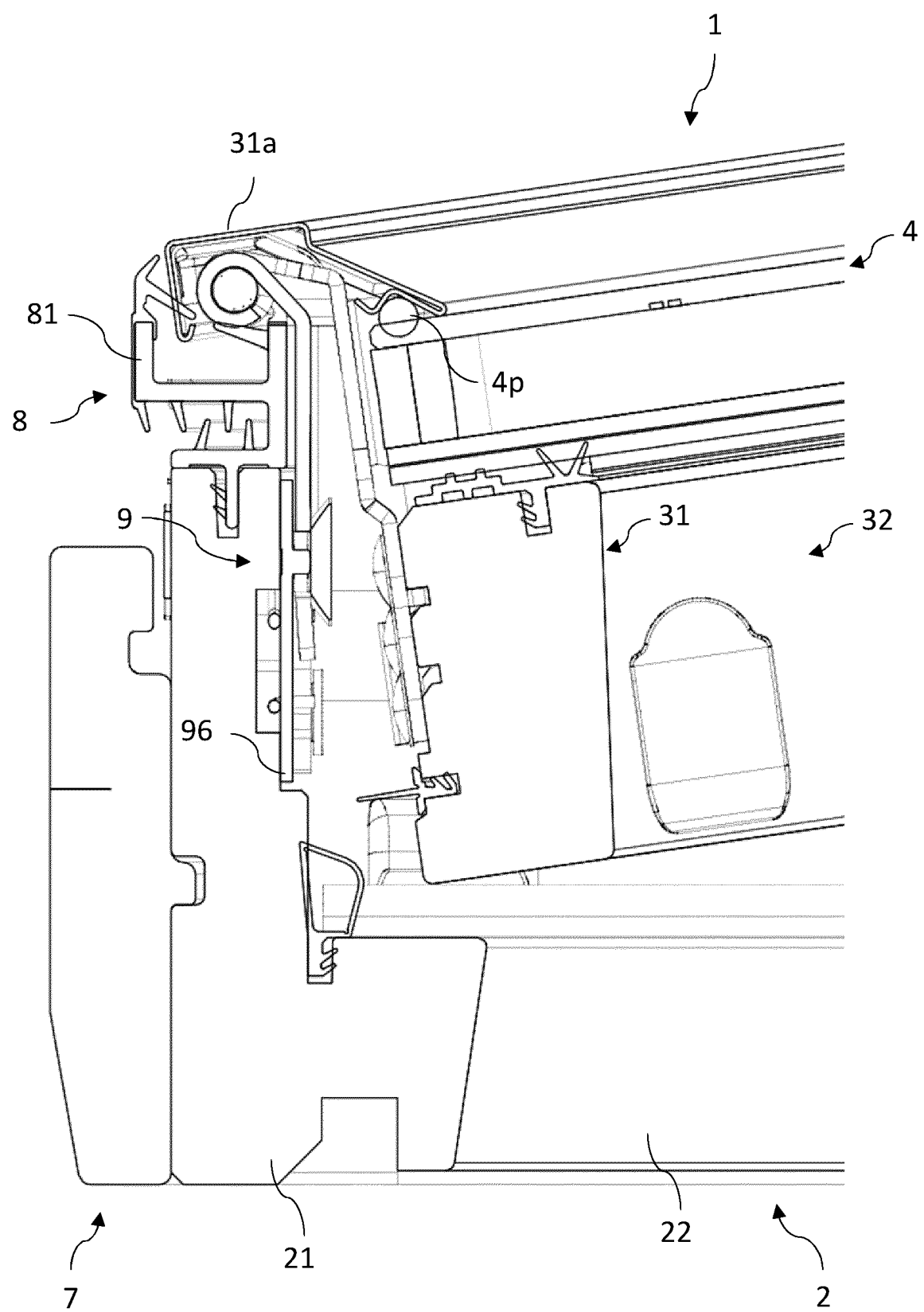


Fig. 4A (PRIOR ART)

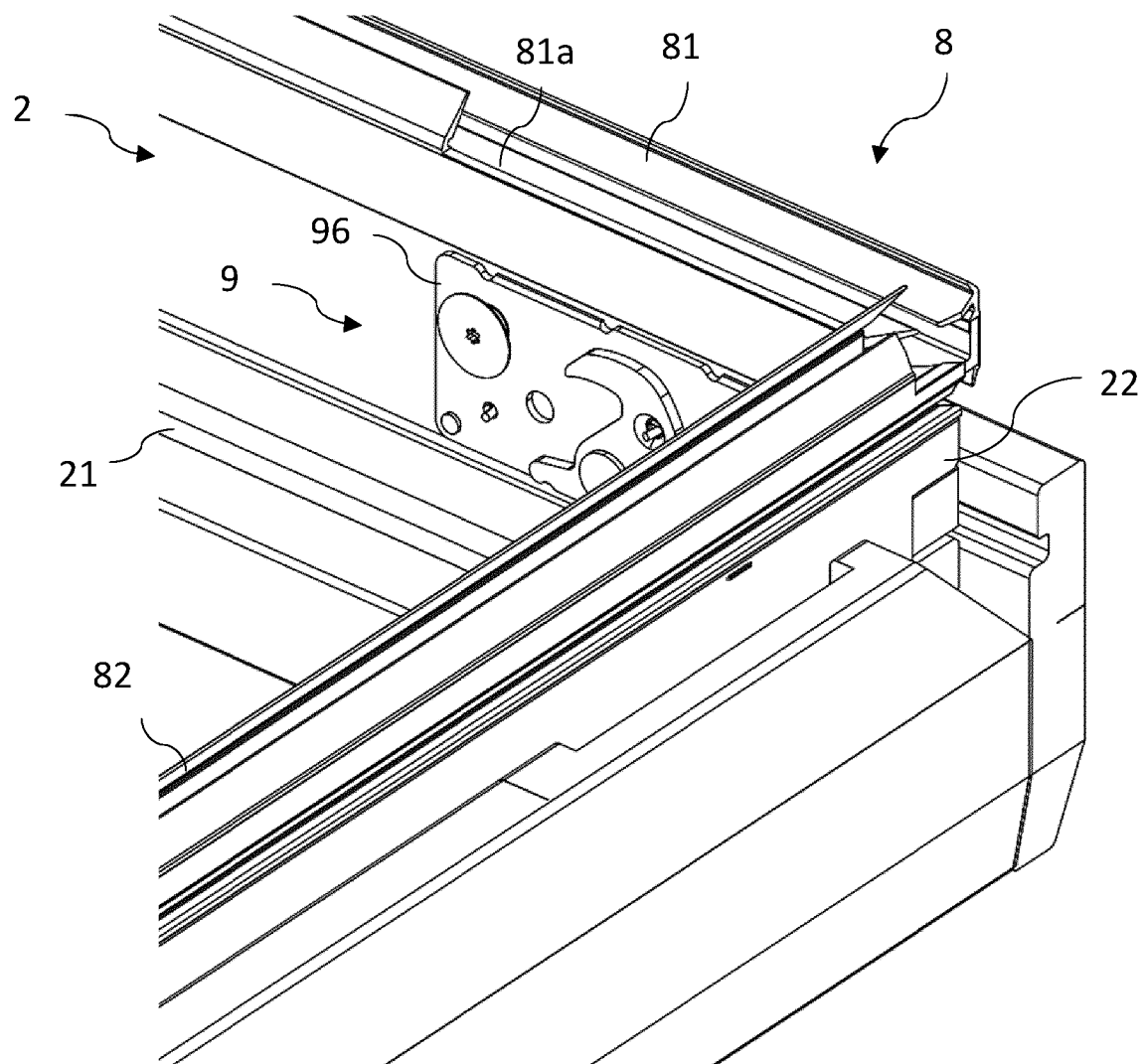


Fig. 4B (PRIOR ART)

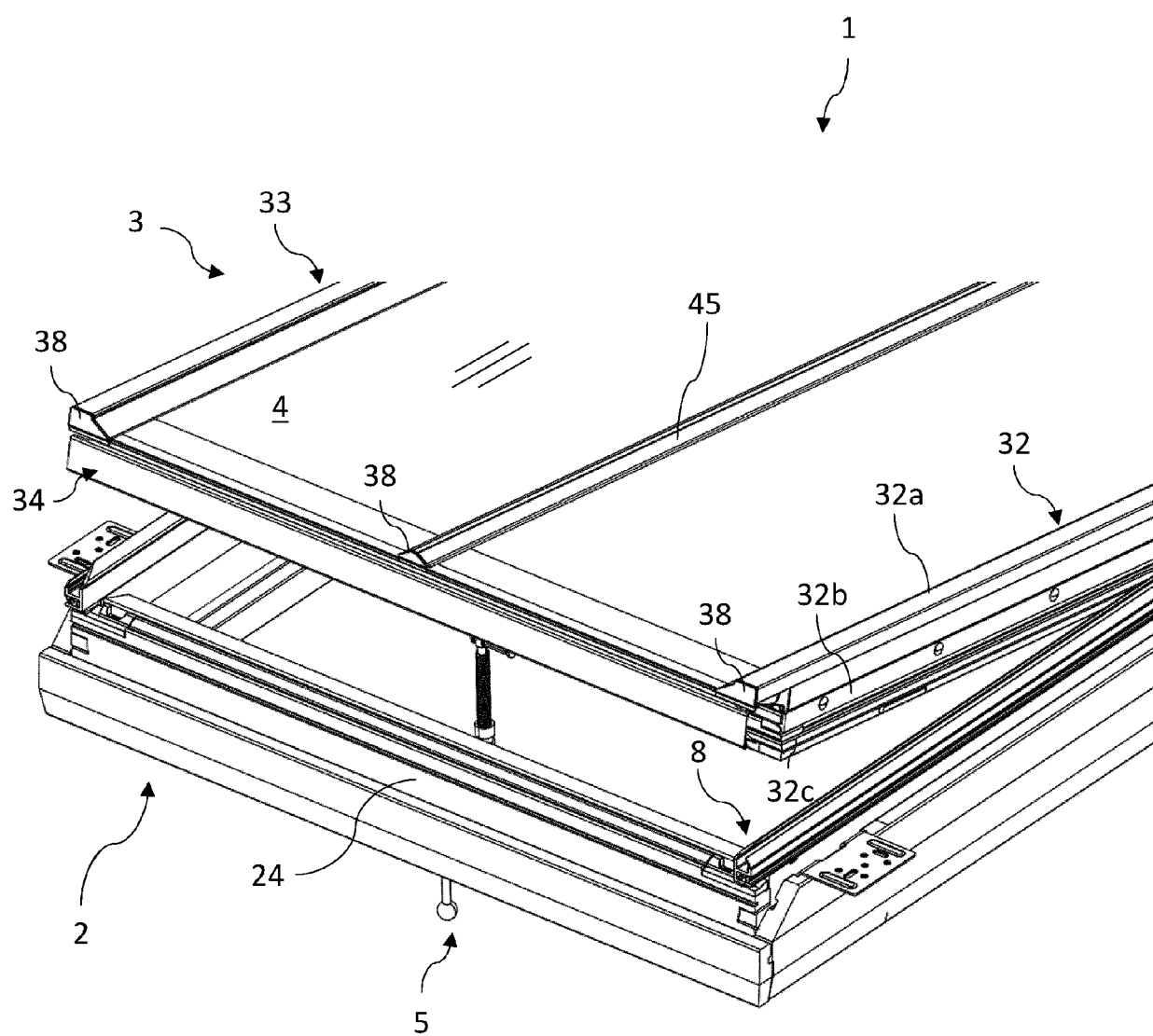


Fig. 5A (PRIOR ART)

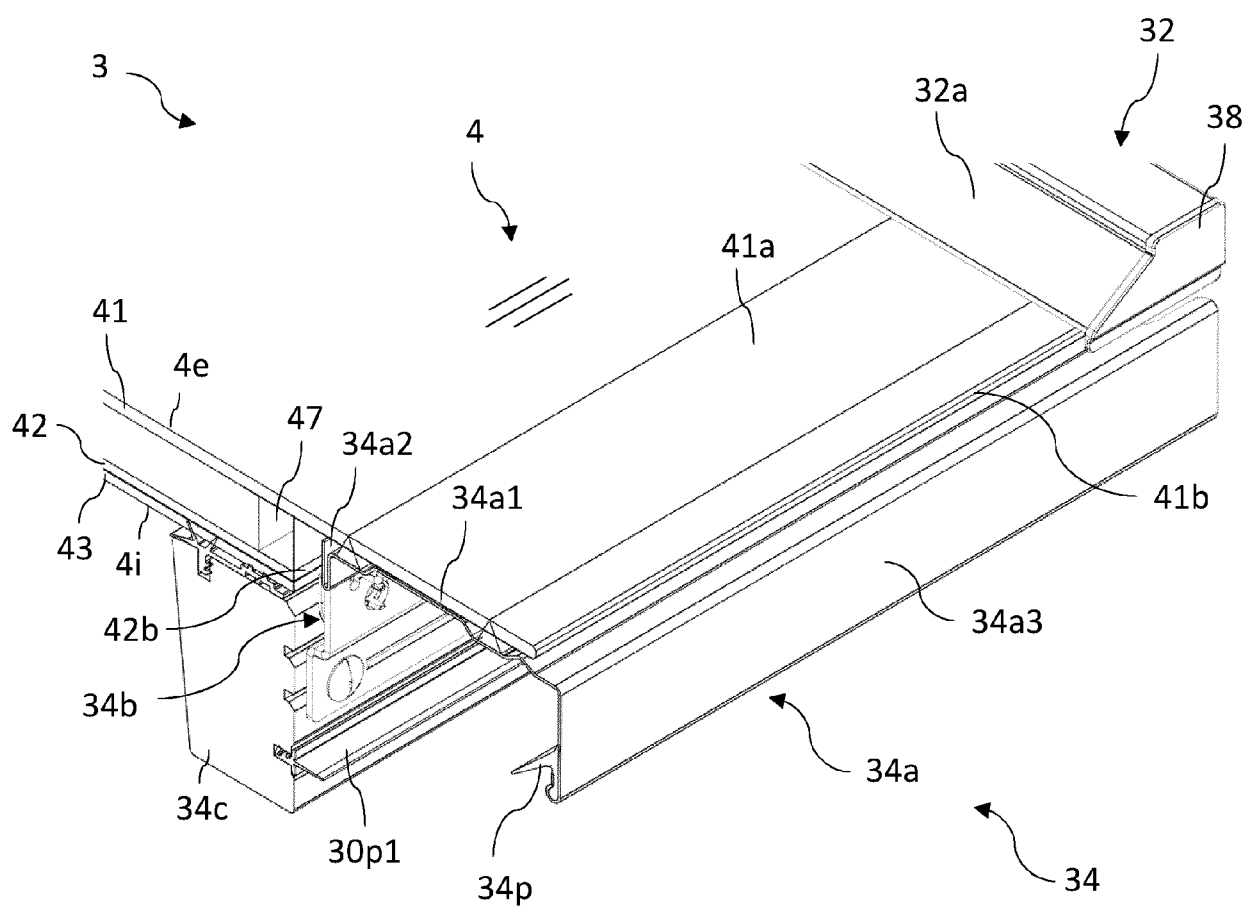


Fig. 5B (PRIOR ART)

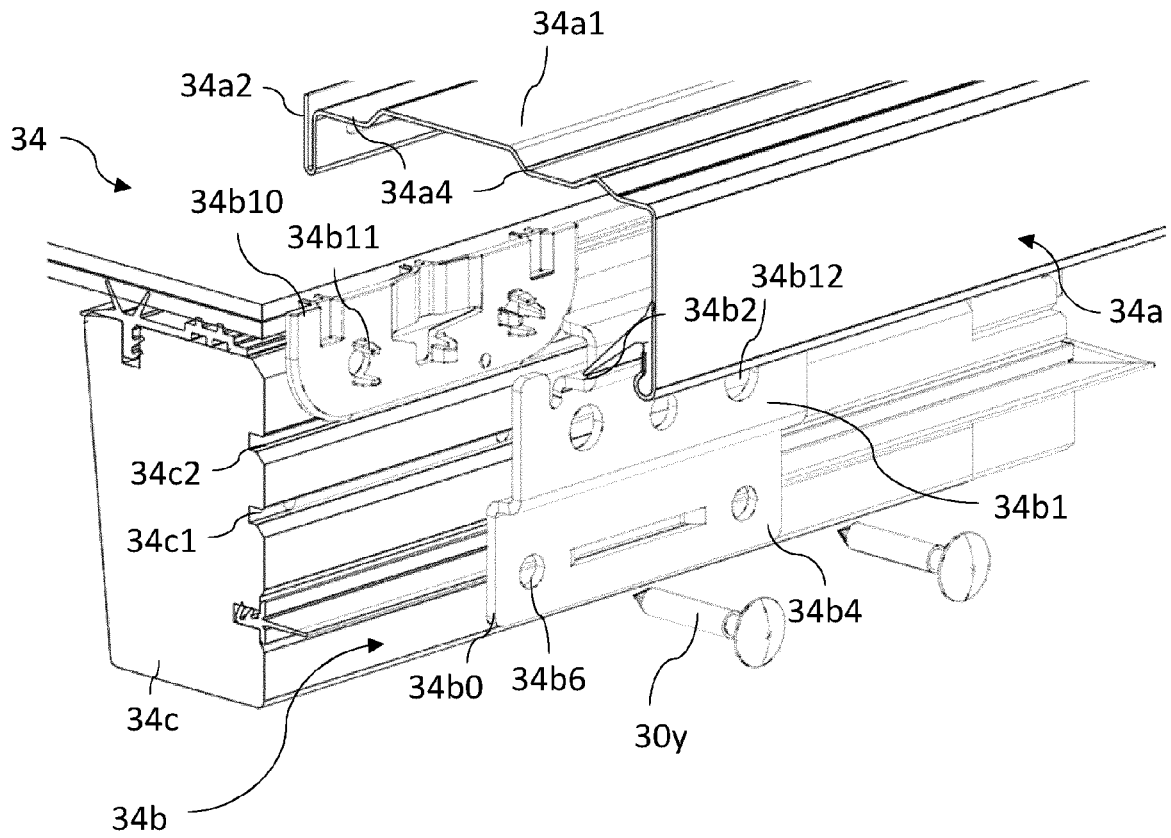


Fig. 5C (PRIOR ART)

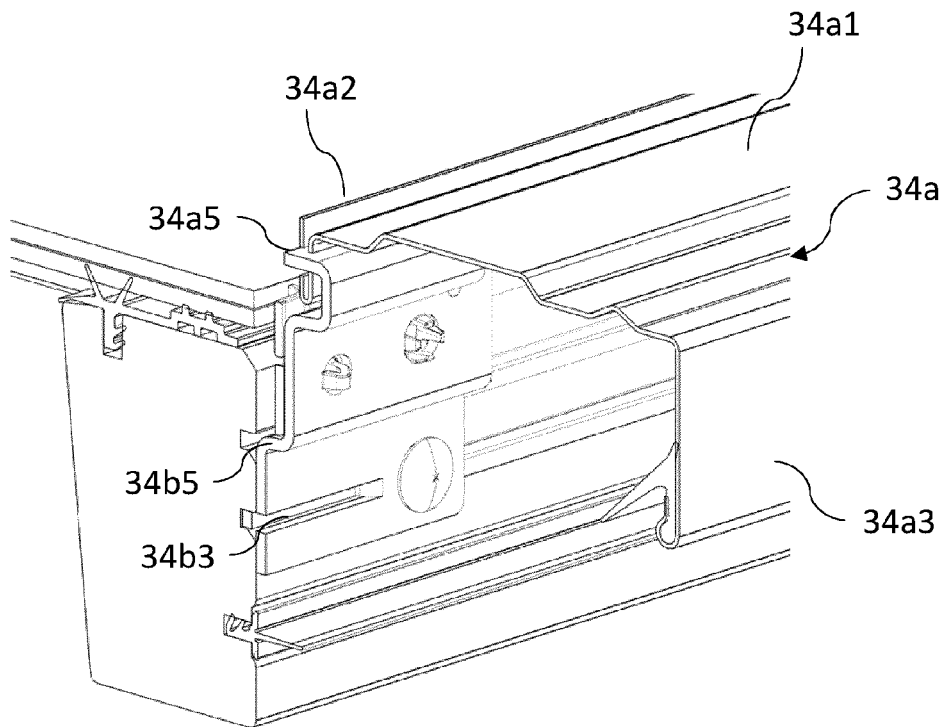


Fig. 5D (PRIOR ART)

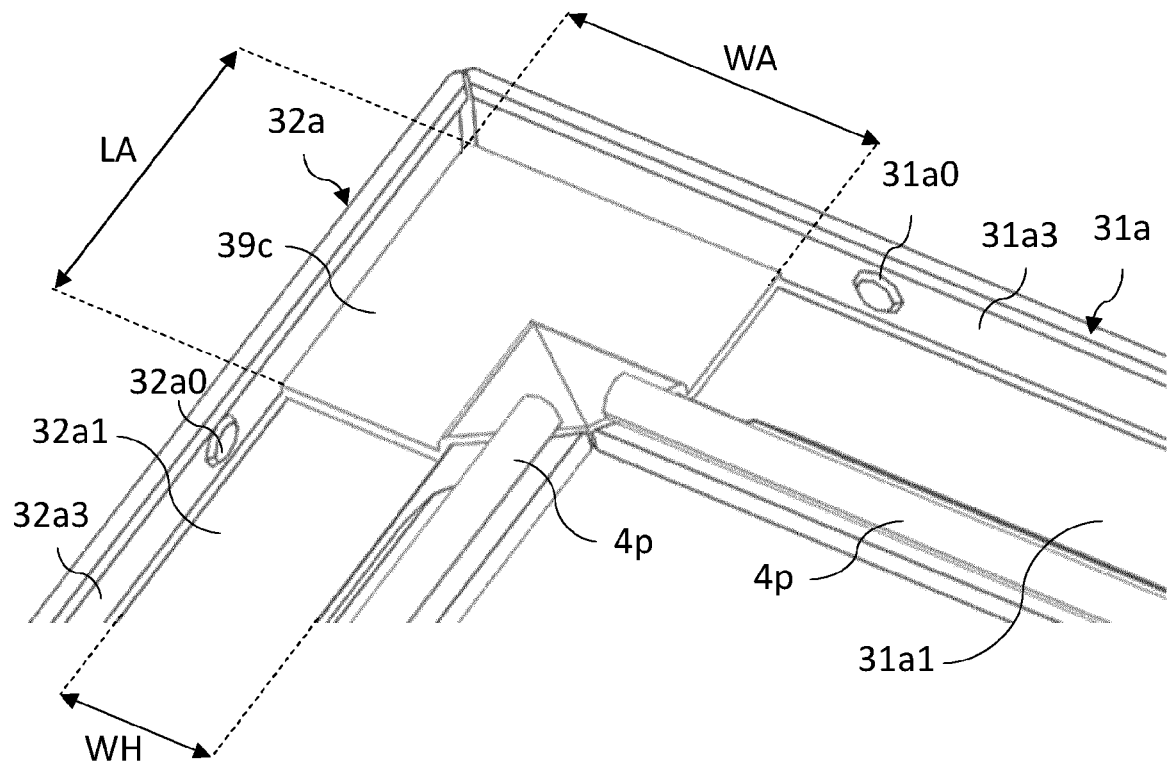


Fig. 6

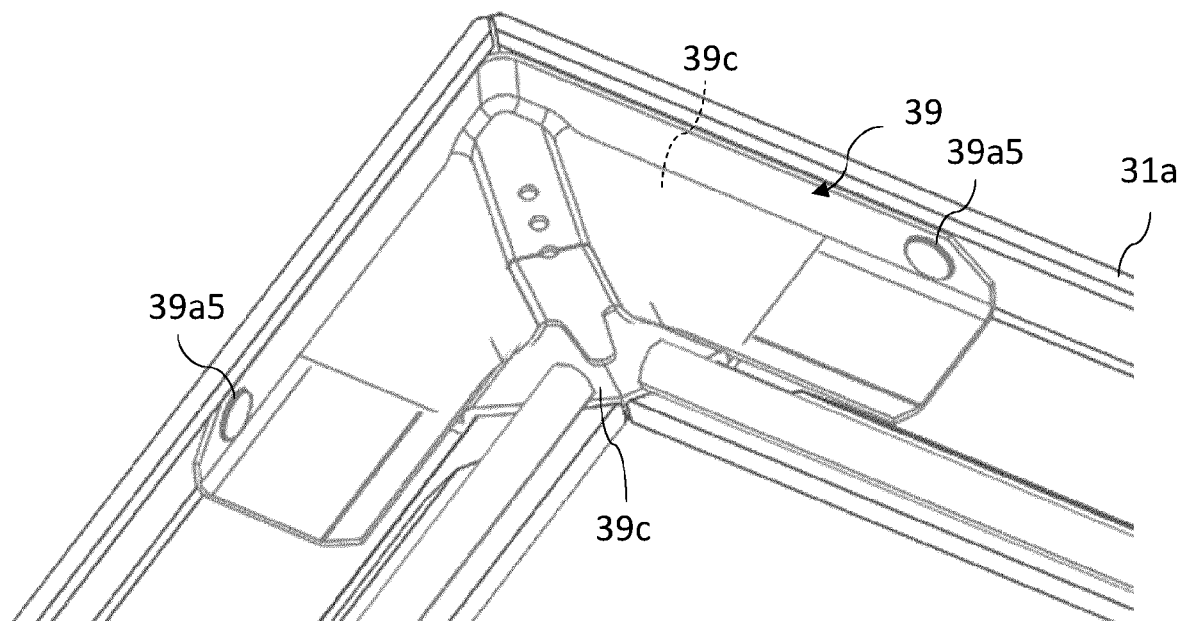


Fig. 7

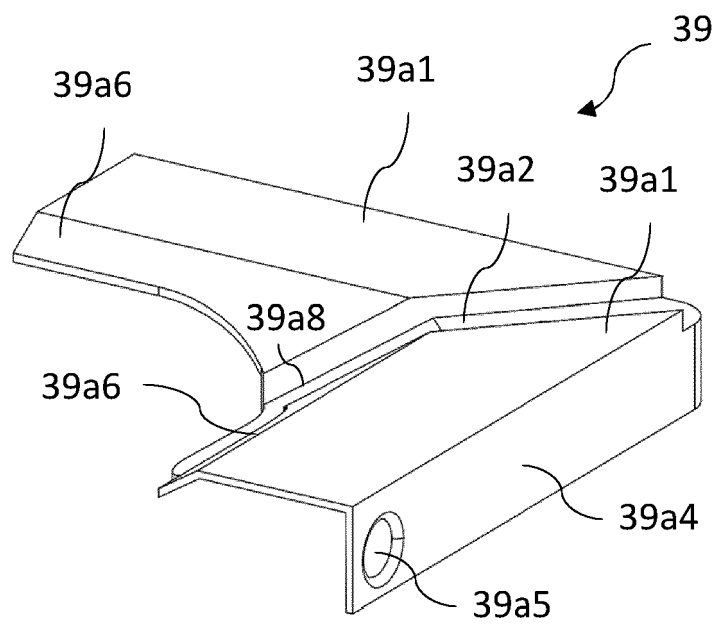


Fig. 8

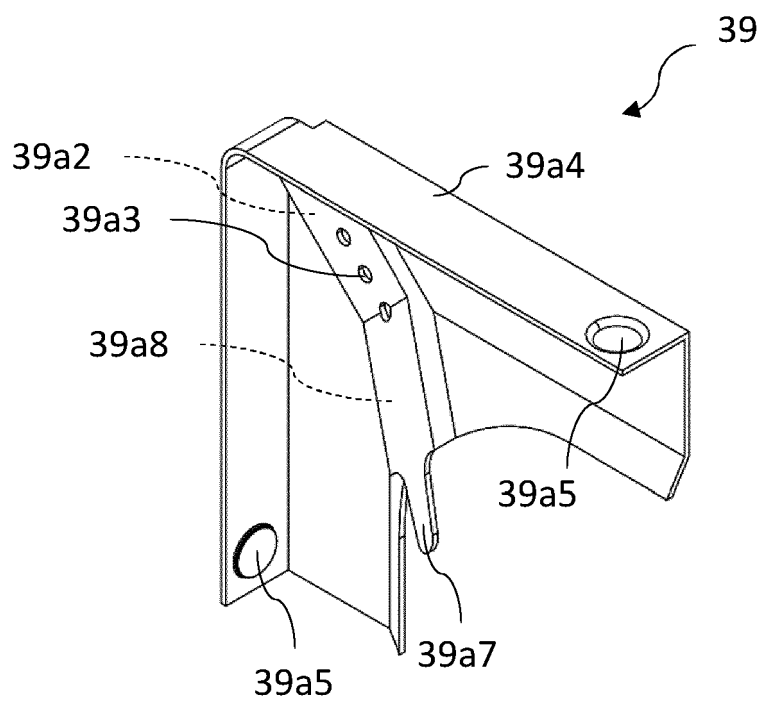


Fig. 9

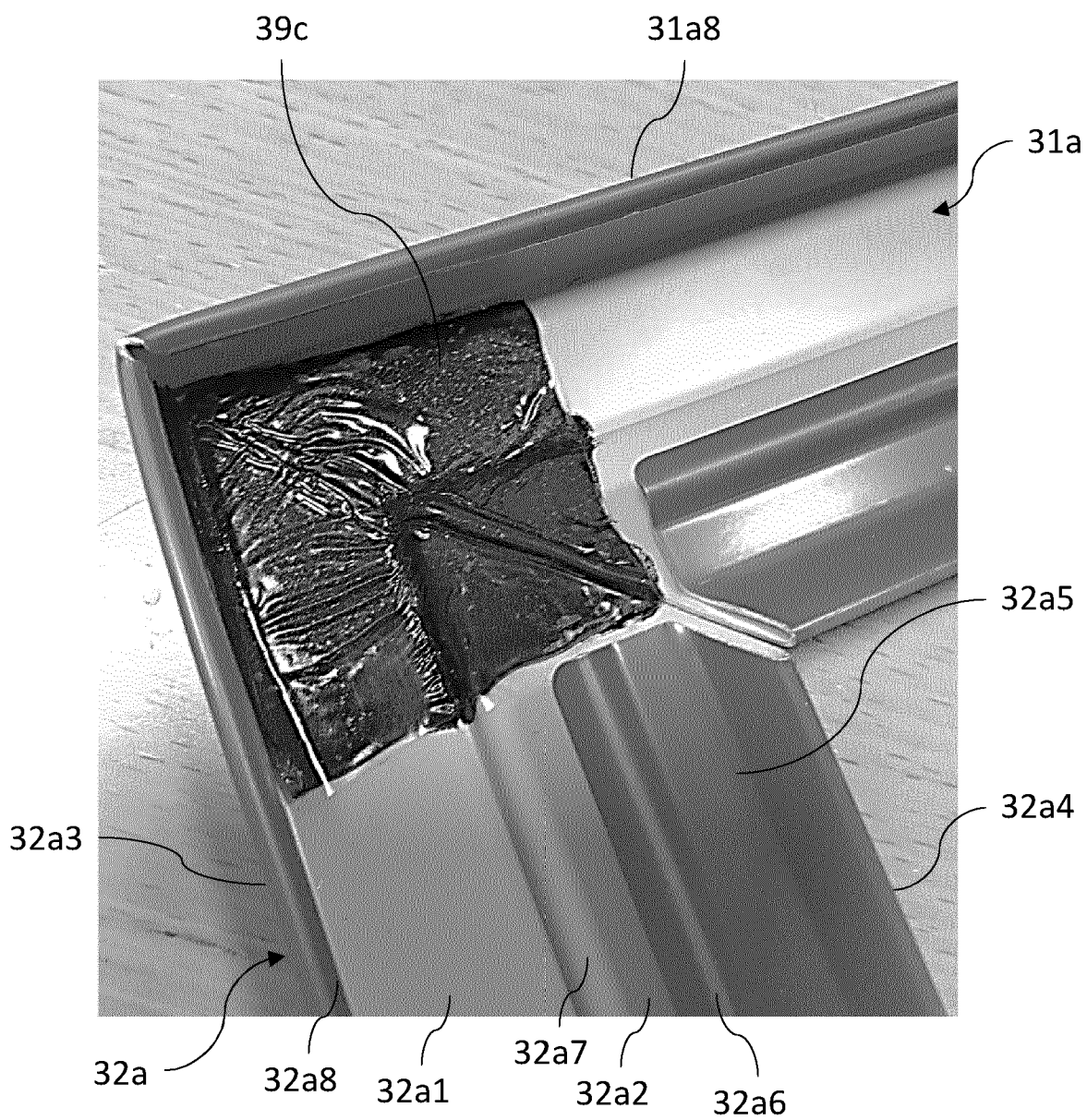


Fig. 10

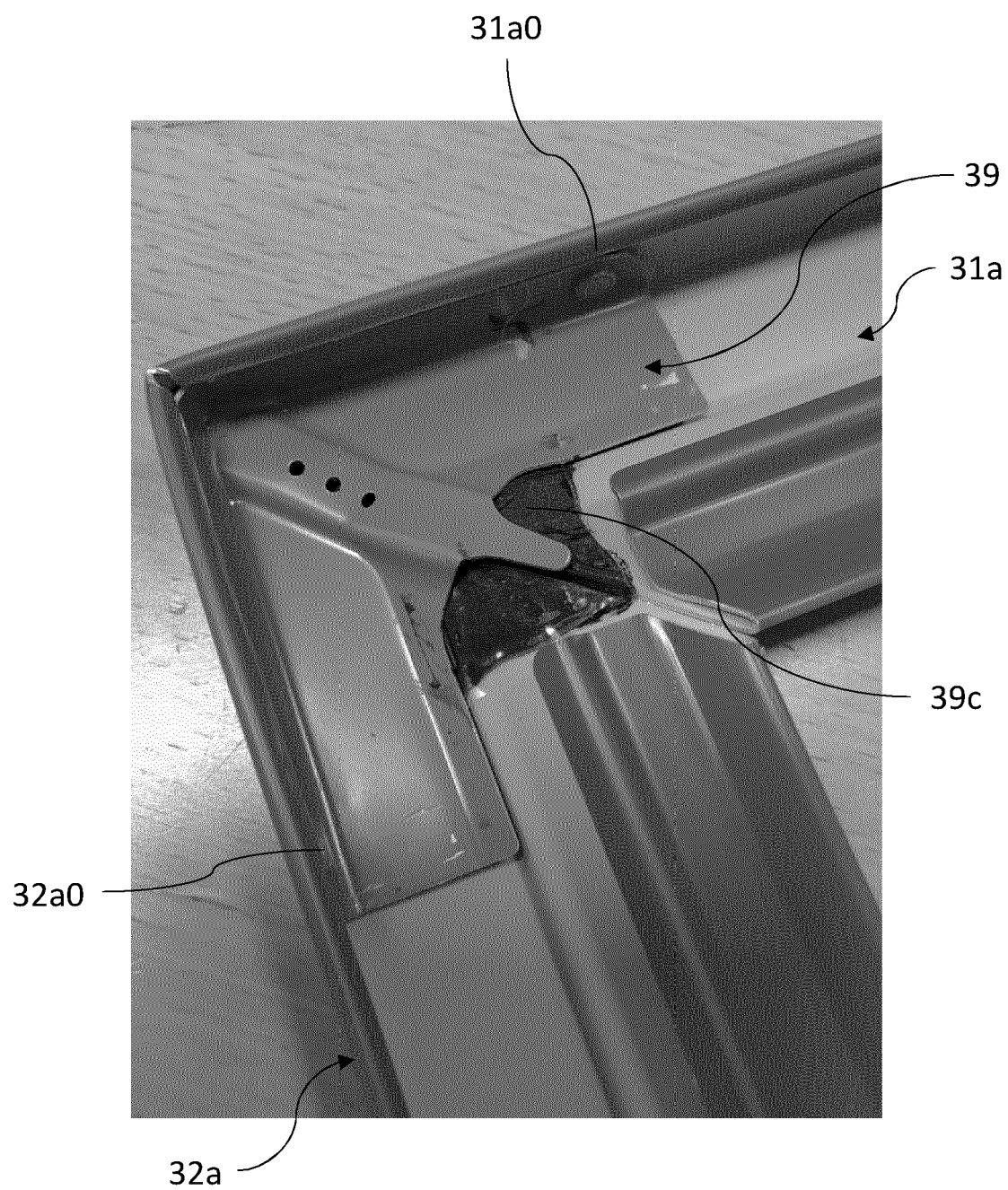


Fig. 11

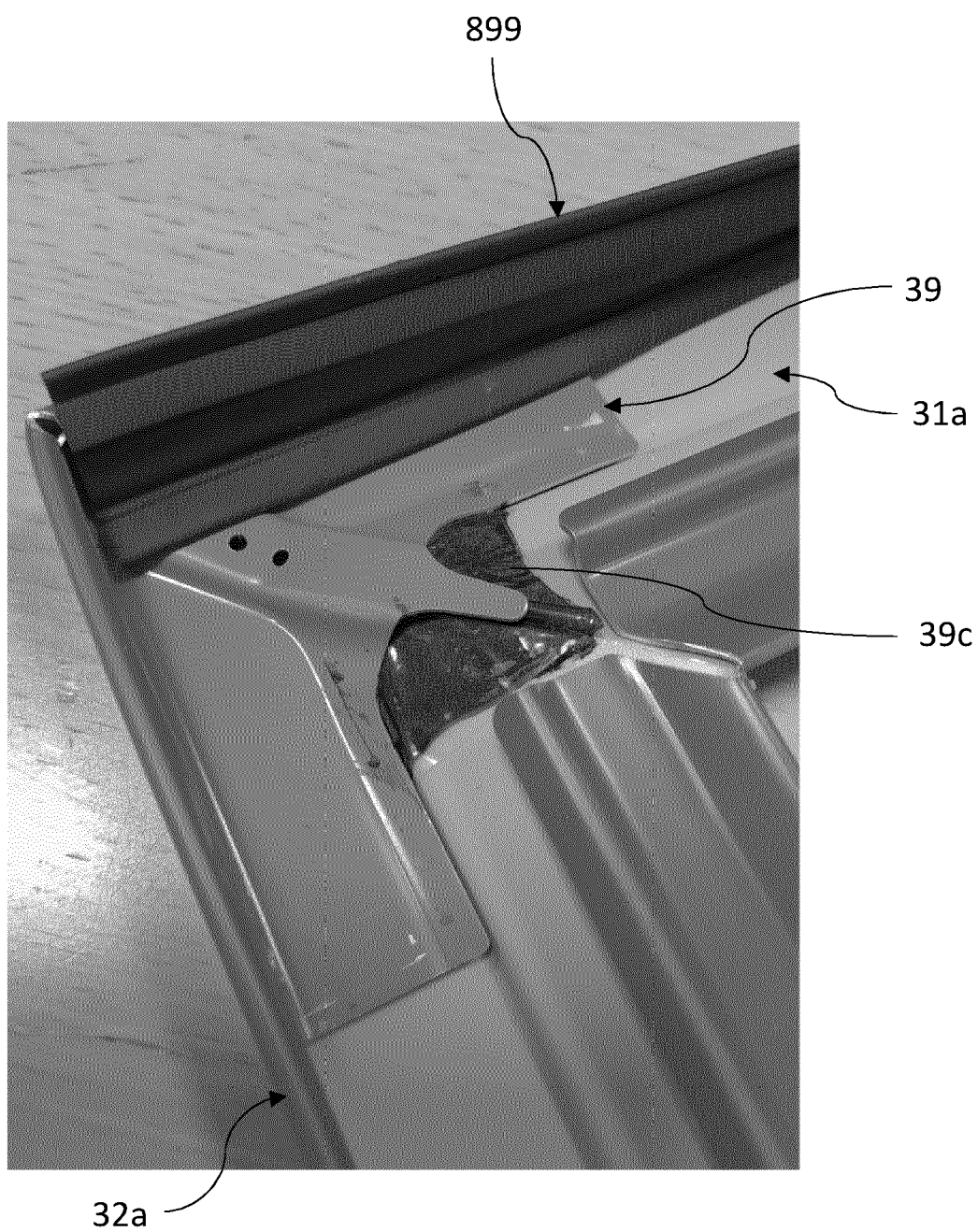


Fig. 12

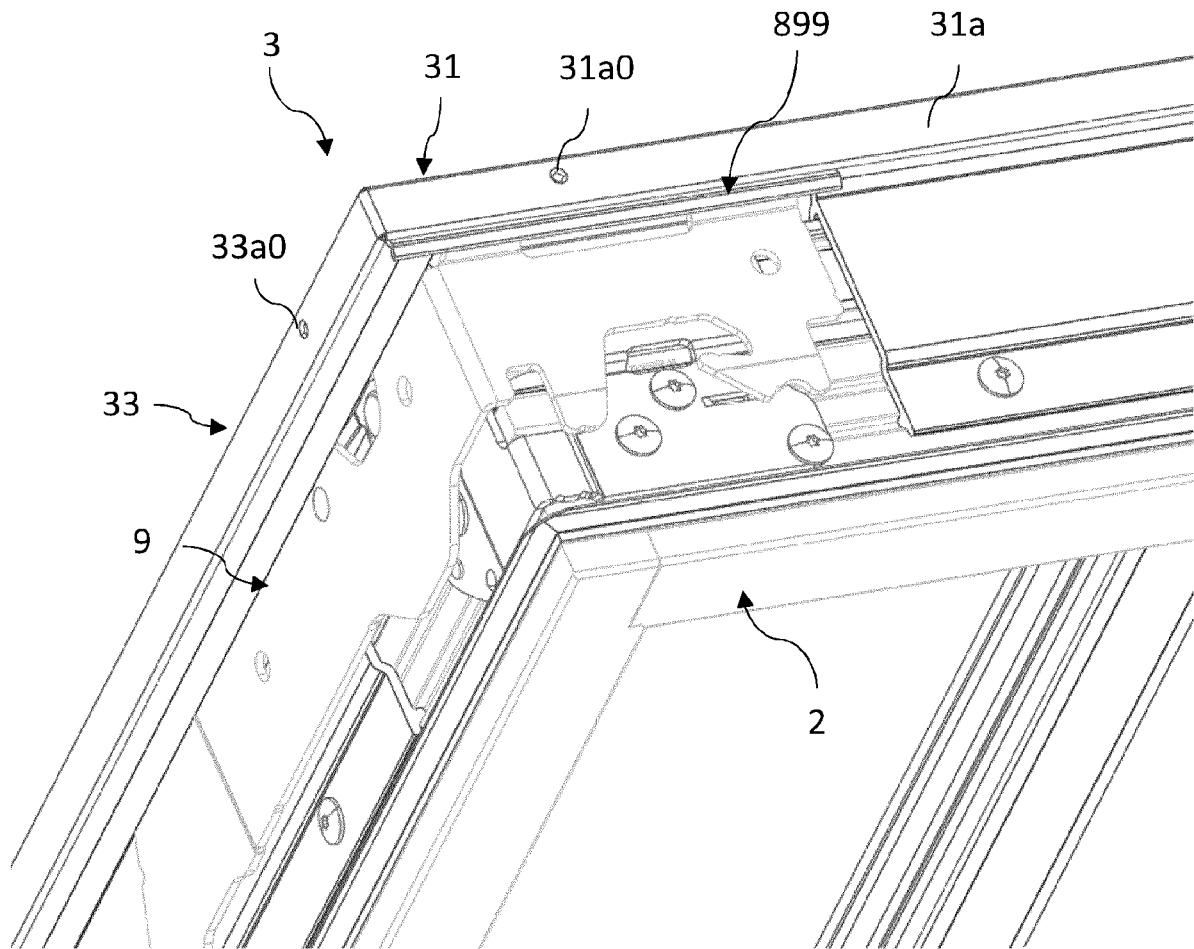


Fig. 13

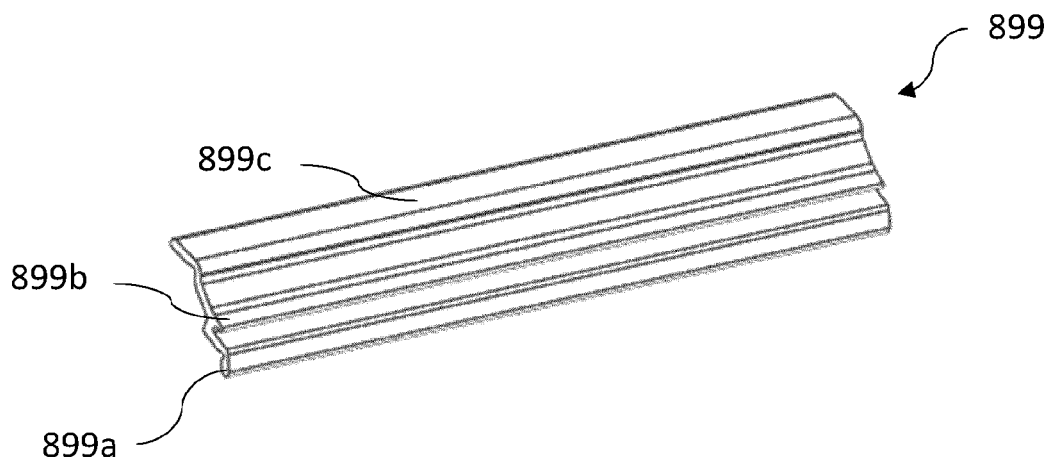


Fig. 14

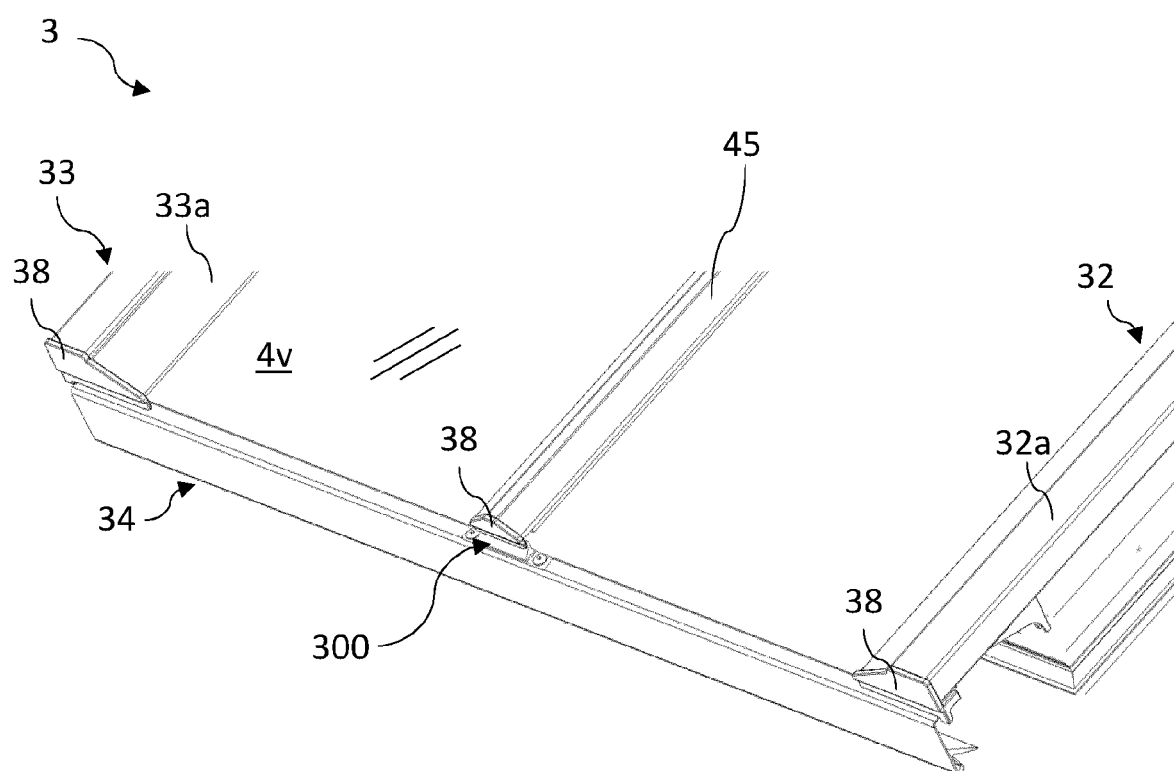


Fig. 15

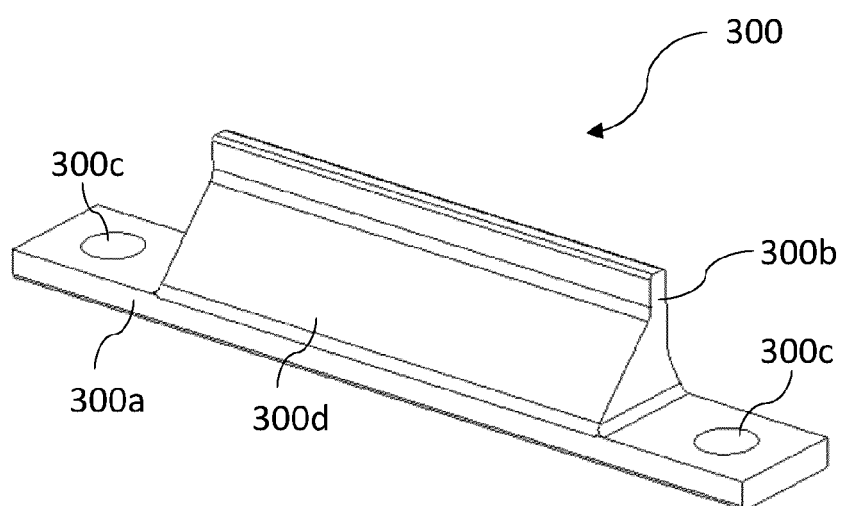


Fig. 16

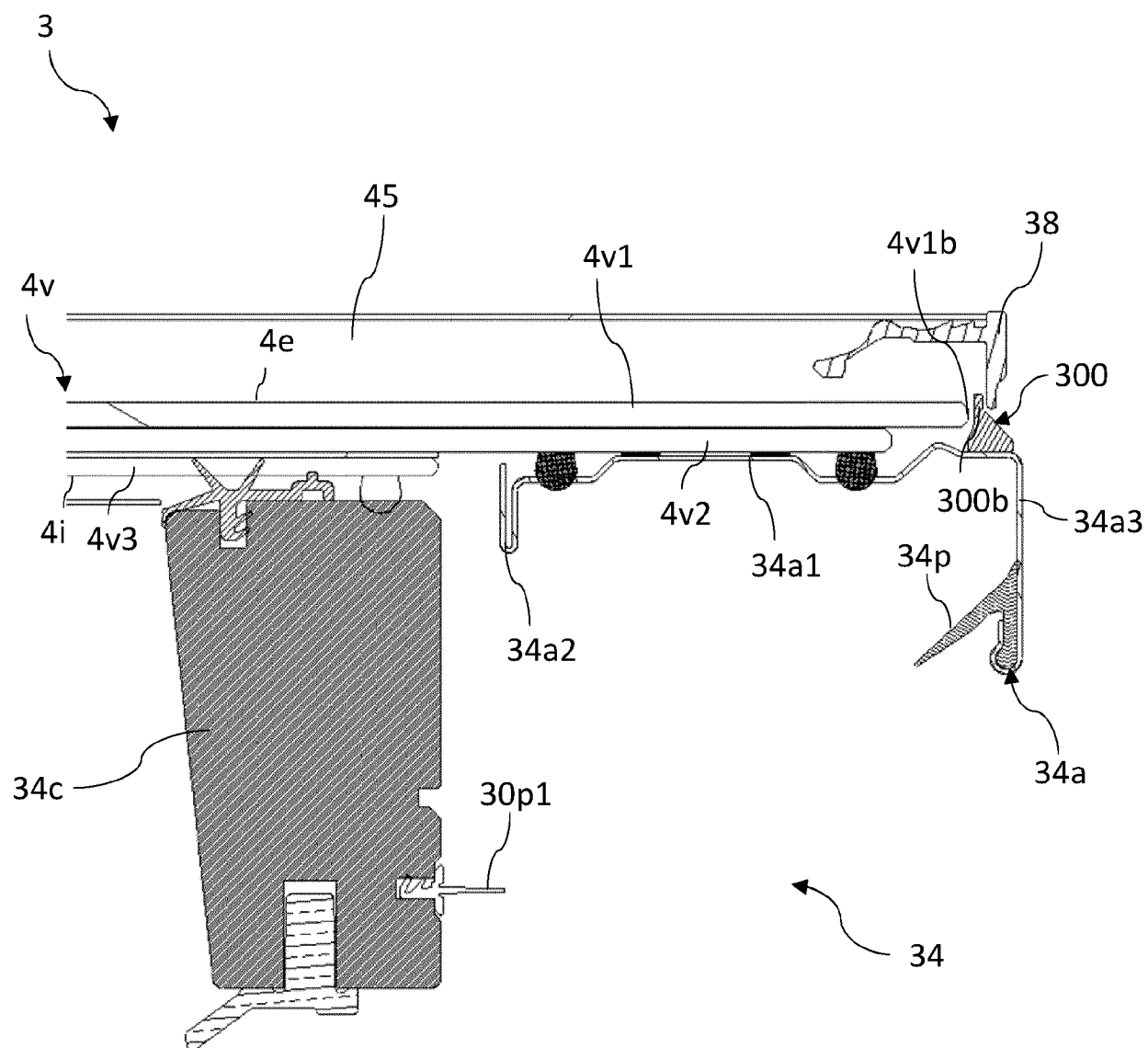


Fig. 17



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Application Number

EP 25 18 8920

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The Hague		7 November 2025	Leroux, Corentine
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