

(19)



(11)

EP 4 023 834 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.07.2022 Bulletin 2022/27

(51) International Patent Classification (IPC):
E04D 13/03 ^(2006.01) **E04D 12/00** ^(2006.01)
E04B 1/26 ^(2006.01)

(21) Application number: **21216881.9**

(52) Cooperative Patent Classification (CPC):
E04D 13/031; E04B 1/2608; E04B 1/2612;
E04D 12/006

(22) Date of filing: **22.12.2021**

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

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(54) **A ROOF WINDOW SYSTEM WITH A MOUNTING ASSEMBLY AND METHOD OF INSTALLING SUCH A ROOF WINDOW SYSTEM**

(57) A roof window system with a mounting assembly and method of installing such a roof window system.

The roof window system (1) comprising two window units (11, 12) is configured to be built in side by side in a roof structure (2) of a roof, in particular comprising an inclined roof surface, a support assembly (3) configured

to be fastened to the roof structure (2) and to which the window units (11, 12) are to be connected. The support assembly (3) comprises a set of support beams (31, 32) to be mounted horizontally, and a set of mounting brackets (4).

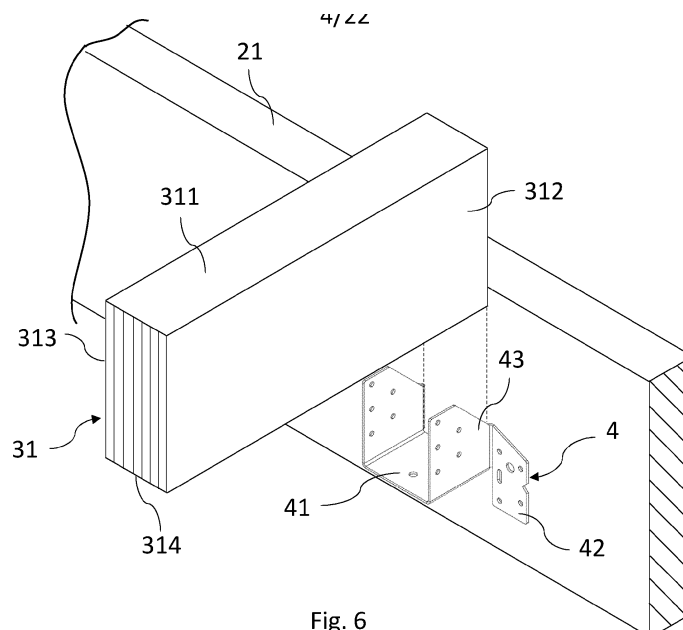


Fig. 6

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Description

Technical Field

[0001] The present invention relates to a roof window system comprising at least two window units configured to be built in side by side in a roof structure of a roof, in particular comprising an inclined roof surface, said roof window system furthermore comprising a support assembly configured to be fastened to the roof structure and to which the window units are to be connected. The invention furthermore relates to a method of installing a roof window system.

Background Art

[0002] Roof windows to be installed in inclined roof surfaces come in a variety of types, and are either installed as stand-alone window units, in which all sides of the roof window borders on the roofing, or in configurations in which several window units are built together to combine into larger arrays providing a larger light influx into a room of a building, and in which only outer sides of the outermost window units border on the surrounding roofing.

[0003] Typical configurations of twin or quadruple roof window arrangements installed side-by-side and/or above each other, respectively, are shown and described in Applicant's European patent No. EP 1 581 706 B1. The window units are typically standard roof windows in which the right side frame member of the left-hand window unit is located adjacent to the left side frame member of the right-hand window unit. In a roof structure comprising rafters and battens, at least one rafter and a number of battens will typically need to be removed to provide a sufficiently large aperture in the roof surface and roof structure, specially designed gap trimmers are normally mounted between the window units and fastened to the roof structure in order to ensure sufficient strength and support for the roof window arrangement. This is also shown in commercial products VELUX® EBY and VELUX® EKY, where two window units are connected to a respective frame structure and gap trimmers positioned in an inclined roof surface.

[0004] Common to all the above roof window arrangements is that the gap trimmer placed in between the window units renders the installation process challenging for an unexperienced installer, and the installation is time consuming even for experienced installers. Therefore, there is room for improvement in terms of installation conditions.

Summary of Invention

[0005] With this background, it is therefore an object of the invention to provide a roof window system which is more simple, cost-effective and with a reduced installation time and complexity.

[0006] This and further objects are achieved with a roof

window system of the kind mentioned in the introduction which is furthermore characterised in that said support assembly comprises a set of support beams configured to be mounted substantially horizontally in said roof structure, and that at least one of a top member and a bottom member of each window unit are intended to be connected with at least one of said set of support beams in a mounted condition of the roof window system.

[0007] Providing a roof window system with the above characteristics, a simpler configuration is achieved. Thus, the roof window system comprises only the set of support beams mounted horizontally when installed, and no other support beams are present. Easier assembly of the roof window is provided when using only support beams that are horizontally mounted in a roof structure instead of a vertically mounted beam. With this configuration, two window units may be mounted almost as easily as a single roof window. This leads to a reduction of the overall installation time and cost. Furthermore, this solution makes it possible to provide a more compact system and a less evident spacing structure in between window units, which improves the aesthetic appearance of the window and a less obstructed view to the exterior. It may also improve the daylighting conditions inside the room since no gap trimmer placed between the window units and protruding into the room needs to be present. Finally, by the roof window system according to the invention, better possibilities of disassembly and re-use is achieved, thus contributing to the overall circularity of the components of the roof window system. The material of the support beams may in principle be chosen arbitrarily, as long as the material has sufficient strength and wear properties. Typically, a wooden material is chosen, and may include laminated wooden beams such as Glulam beams, Kerto® beams etc. which are dimensionally stable, strong and light-weight.

[0008] In a presently preferred embodiment, the set of support beams comprises an upper support beam and a lower support beam, the bottom member of each window unit being intended to be connected with the lower support beam and the top member of each window unit being intended to be connected with the upper support beam, preferably by means of a set of window installation brackets. By the provision of support beams above and below the window units, as seen in the inclination of the roof, particularly flexible installation conditions are achieved, independently of the configuration of the roof structure and positioning of the window units.

[0009] While the support beams could in principle be fastened to the roof structure in any suitable way, it is presently preferred that the connection between the support assembly and the roof structure is carried out by a set of mounting brackets. This facilitates the installation process further, since following any required measurements, the installer may then in a first step easily fasten the mounting brackets to the roof structure at suitable opposing positions, for instance by screws or nails into rafters, and in a second step each support beam is in-

serted in the mounting brackets to extend substantially horizontally.

[0010] In a preferred development, the mounting bracket comprises a base, at least one leg and at least one upstanding flange. In this way, adequate means for fastening of the mounting bracket to the roof structure and abutment surfaces for the support beam are provided.

[0011] In a further preferred embodiment, two upstanding flanges are provided and each is connected to the base at a first transition edge of said upstanding flange and each at least one leg is connected to the respective upstanding flange at a second transition edge of said upstanding flange, said first transition edge being preferably perpendicular to said second transition edge. By forming a direct connection between the upstanding flange and the leg, a particularly stable mounting bracket is achieved, ensuring a reliable load transfer from the roof window system to the roof structure.

[0012] Preferably, each leg comprises an inner free side edge portion in extension of the second transition edge of said upstanding flange such that an upper section of each said leg extends above a plane of the base and a lower section of each said leg extends below the plane of the base. In this way, easy access to the leg is ensured, since the lower section is accessible to the installer, even after the support beam has been installed, while at the same a sufficiently large contact surface between the leg or legs of the mounting bracket is achieved.

[0013] In yet further preferred developments, the base, each leg and each upstanding flange comprises at least one hole or aperture adapted to receive fastening means such as screws. The holes or apertures may take any suitable shapes, including elongate in one or more directions to allow for adjustability of the position of the mounting bracket, and sizes to accommodate different sizes of fastening means, typically screws or nails.

[0014] In this regard, it is particularly preferred that in embodiments where each leg comprises an upper and a lower section, each leg is provided with a plurality of holes and apertures such that at least one hole or aperture is located in the upper section and at least one hole or aperture in the lower section. Thus, the mounting brackets may be fastened to the roof structure at such a position that a minimum of fastening elements such as screws or nails are located close to the top of the roof structure, typically a rafter or vertical trimmer. By this arrangement, the zone of the roof structure close to the window units is rendered free of fastening elements. This is advantageous for a number of reasons, since the available space and installation conditions for auxiliary equipment such as insulation and vapour barrier collars are not impeded.

[0015] By a yet further presently preferred embodiment, the roof window system is made even further flexible and may be installed in a variety of different configurations of the roof structure, for instance comprising a plurality of rafters and battens, and optionally at least one

trimmer. In this embodiment, each support beam is configured to be connected to two rafters, one rafter and a vertical trimmer, or two vertical trimmers.

[0016] In a development of embodiments comprising a set of mounting brackets, each mounting bracket is configured to be connected to a rafter or a vertical trimmer by said at least one leg such that the base protrudes from the rafter or vertical trimmer and supports a bottom surface of the respective support beam, preferably perpendicularly, and each upstanding flange protrudes from the rafter or vertical trimmer and supports a side surface of the respective support beam, preferably perpendicularly. This provides for a particularly stable structure and optimum conditions for the load transfer from the roof window system to the roof structure.

[0017] In order to ascertain that the roof window system is suitably positioned relative to for instance flashing arrangements ensuring a tight transition to the surrounding roofing, a top surface of each support beam is advantageously substantially flush with an upper side of the battens of the roof structure in the mounted condition of the roof window system.

[0018] In a second aspect of the invention, a method of installing a roof window system from a supply condition to the mounted condition is devised. The method comprises the steps of: connecting the support beams of the support assembly to the roof structure, and connecting the window units to the support beams of the support assembly or the to the roof structure. Thus, with only a limited number of steps, the roof window system is readily installed in the roof structure.

[0019] For such embodiments in which the set of support beams comprises an upper support beam and a lower support beam, and the connection between the support assembly and the roof structure is carried out by a set of mounting brackets, the step of connecting the support beams to the roof structure is carried out after the set of mounting brackets have been connected to the roof structure.

[0020] Other presently preferred embodiments and further advantages will be apparent from the subsequent detailed description and drawings.

Brief Description of Drawings

[0021] 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 structure and a simplified view of the roof window system in an embodiment of the invention;

Fig. 2 is a perspective view of the roof structure and of a support assembly of the roof window system in an embodiment of the invention;

Fig. 3 is a longitudinal sectional view of the roof window system in an embodiment of the invention;

Figs 4 and 5 are cross-sectional views of embodi-

ments of the roof window system according to the invention;

Fig. 6 is an end perspective view of a support beam in an embodiment of the invention;

Fig. 7 is an end lateral view of a support beam in an embodiment of the invention;

Fig. 8 and Fig. 9 are perspective views, from different angles, of a mounting bracket in an alternative embodiment of the roof window system according to the invention;

Fig. 10 is a perspective view of the roof window system in an embodiment of the invention;

Fig. 11 is a perspective view of the embodiment of the roof window system of Fig. 10 during installation into a roof structure;

Fig. 12 is a detailed view of the roof window system of Fig. 11;

Fig. 13 is a perspective view of another embodiment of the roof window system during installation into a roof structure;

Fig. 14 is a detailed view of the roof window system of Fig. 13 installed in a roof structure;

Fig. 15 is an exploded isometric view of the insulating assembly of the roof window system in an embodiment of the invention;

Figs 16 and 17 are perspective views, from different angles, of the transition member of the insulating assembly in embodiments of the invention;

Figs 18 and 19 are plan views of the transition member of the insulating assembly in embodiments of the invention;

Figs 20 to 23 are perspective views, from different angles, of the stabilizing rail in embodiments of the invention;

Fig. 24 is a partial perspective view of the top part of details of a roof window system in an embodiment of the invention;

Fig. 25 is a partial perspective view of the top bottom of details of a roof window system in another embodiment of the invention;

Fig. 26 is a cross-sectional view of a cover assembly of a roof window system in an embodiment of the invention;

Fig. 27 is a close-up of details of Fig. 27;

Fig. 28a and Fig. 28b show an example of a prior art cover assembly;

Fig. 29 is a perspective view of the cover assembly in an embodiment of the invention;

Fig. 30 is a close-up of details of Fig. 29; and

Figs 31 and 32 are perspective views, from different angles, of a tool for dismounting the cover assembly in an embodiment of the roof window system according to the invention; and

Figs 33 and 34 are perspective views, from different angles, of a tool for dismounting the cover assembly in an embodiment of the roof window system according to the invention.

Description of Embodiments

[0022] In the figures of the drawings, embodiments of a roof window system according to the invention are shown.

[0023] Referring initially to Fig. 1, a roof structure 2 and a simplified view of the roof window system 1 in an embodiment of the invention are shown. The roof window system 1 comprises two window units 11, 12 configured side-by-side.

[0024] A window unit can consist of a single window including frame, sash and pane etc. and/or comprise of more than one single window. It could be two windows placed over and under each other as seen in an inclination of the roof or positioned arbitrarily in extension of each other in the roof surface, and preferably having a common width and thus individual height. Each such window in an over and under configuration could also have unique features relating to the frame, sash and pane etc. It could be a fixed frame with a pane, a frame with a sash being fixed or able to turn around a centre, top, bottom or side axis. Alternatively or additionally, the frame could hold a ventilation device, solar panel etc. Also such a window unit could be of different size, e.g. width, compared with another unit to be placed in the side by side configuration.

[0025] Each window unit 11, 12 here comprises an openable roof window of a well-known configuration, including a sash hinged in a frame representing the respective window unit by a top member 111, 121, two side members 112, 113, 122, 123, and a bottom member 114, 124. A combined width W of the roof window system 1 is the combination of the width of first window unit W1, the dimension of a spacing SP between the two window units 11, 12, and the width of second window unit W2. The common height H of the roof window system 1 is the height of any of window units 11, 12. It is noted that the individual widths of the first and second window units need not be identical; however, the height is a common height H.

[0026] The roof structure 2 comprises rafters 20, 21 and battens 22. In order to obtain an adequately dimensioned aperture for the roof window system 1 and at the same time at least retain the structural integrity of the roof structure 2, an upper horizontal trimmer 23, a lower horizontal trimmer 24 and a vertical trimmer 25 are installed. To aid in the subsequent installation of a support assembly 3 of the roof window system 1 in the roof structure 2, auxiliary batten pieces 28 are installed opposite the intended position of an upper support beam 31 and a lower support beam 32, respectively, which form part of the support assembly 3 to be described in further detail below.

[0027] Fig. 2 is a perspective view of the roof structure 2 and of a support assembly 3 of the roof window system 1 as seen from the interior. The roof structure 2 furthermore comprises an underroofing 26 placed over the rafters 20, 21 and below the battens 22. The support assem-

bly 3 is shown as from the interior of a building and comprises a set of support beams, here an upper support beam 31 and a lower support beam 32, configured to be mounted substantially horizontally in said roof structure 2 such that the top member 111, 121 and the bottom member 114, 124 of each window unit 11, 12 are intended to be connected with the respective support beam 31, 32 in a mounted condition of the roof window system 1, for instance by using window installation brackets connected to the frame and battens, respectively.

[0028] Fig. 3 is a sectional view and shows in more detail the upper support beam 31 and lower support beam 32 in relation to the window unit 11. Visible in Fig. 3 is a lining panel 95 which at one edge is received in a groove 17 in the top member 111 of the first window unit 11. It is noted that such groove 17 is circumferential and present in all members of the frame of the roof windows constituting the window units. It is also shown that the lining panel 95 is allowed to form a bend between a first portion near the window unit 11 and a second inclined portion such that a diverging clearing is formed. By the bend, sufficient insulation is present in the area near the lining panel 95.

[0029] The upper and lower parts of the insulating assembly 5 can be seen placed between the top frame member 111 and the upper support beam 31 and the bottom frame member 114 and the lower support beam 32. Also it is shown how the underroofing 26 is arranged with respect to the upper and lower support beams 31, 32 and how a supplementary underroof collar 96 is arranged over the battens 22 and connected to the top frame member 111 and how it is arranged under the lower batten 22 below the window unit 11 and connected to the bottom frame member 114 of the window unit 11. The underroof collar 96 is brought into overlap with the underroofing 26. Furthermore, a vapour barrier membrane 27 forms part of the roof structure 2 such that the insulation is protected from moisture from the interior. A supplementary vapour barrier collar 97 is also provided, which at one edge portion is connected to the window units 11, 12 and at an opposite edge portion to the vapour barrier membrane 26. Also visible in Fig. 3 are two installation battens 29, of which the uppermost installation batten 29 is positioned to extend between the upper support beam 31 and the upper horizontal trimmer 23, and the lowermost installation batten 29 between the lower support beam 32 and the lower horizontal trimmer 24.

[0030] Also visible in Fig. 3 is a flashing arrangement 91 at the top and a flashing arrangement 94 at the bottom which provide a weather-tight transition between the window units 11, 12 and the surrounding roofing together with further flashing arrangements 92 and 93 indicated in Figs 4 and 5.

[0031] Fig. 6 and Fig. 7 are respectively an end perspective view of one of the support beams, here upper support beam 31, at its connection to the rafter 21. The support beam 31 has a top surface 311, a side surface 312, a side surface 313, and a bottom surface 314. The

support beam 31 is inserted in a mounting bracket 4 comprising a base 41, an upstanding flange 43 on either side of the base 41, and two legs 42 each connected to a flange 43. The mounting bracket 4 is in turn fastened to the rafter 21 by suitable fastening means. The material of the support beams may in principle be chosen arbitrarily, as long as the material has sufficient strength and wear properties. Typically, a wooden material is chosen, and may include laminated wooden beams such as Glulam beams, Kerto® beams etc. which are dimensionally stable, strong and light-weight.

[0032] Further details of the mounting bracket 4 in the embodiment shown will be described in further detail with particular reference to Figs 8 and 9. Here, it is shown that the base 41 comprises a first edge 411 and a second edge 412. Each upstanding flange 43 is connected to, in the embodiment shown perpendicularly to, the base 41 at a first transition edge 431 of the upstanding flange 43 and each leg 42 is connected to the respective upstanding flange 43 at a second transition edge 432 of the upstanding flange 43. In the embodiment shown, the first transition edge 431 is perpendicular to the second transition edge 432.

[0033] Each leg 42 comprises an inner free side edge portion 422 in extension of the second transition edge 432 of the upstanding flange 43 such that an upper section of each said leg 42 extends above a plane of the base 41 and a lower section of each said leg 42 extends below the plane of the base 41. As indicated, the legs 42 have a relatively large extension in the height direction, perpendicular to the longitudinal direction of the rafter 21. In this way, it is possible to fasten the mounting brackets 4 at such a position that a minimum of fastening elements such as screws or nails are located close to the top of the rafter. In turn, the zone surrounding the window units 11, 12 in the roof structure 2 is rendered free of fastening elements which is advantageous for a number of reasons, including the overall mounting as well as insulation and other climate adaptability properties.

[0034] The base 41, each leg 42 and each upstanding flange 43 comprises at least one hole or aperture adapted to receive fastening means such as screws or nails. Here, each leg 42 is provided with a plurality of holes and apertures 426, 427, 428 such that at least one hole or aperture is located in the upper section and at least one hole or aperture in the lower section. This provides for flexibility in the selection of holes for fastening of the mounting bracket 4 to the rafter 21. A hole 413 in the base 41 is intended to receive fastening means such as a screw driven into the support beam 31 or 32 once it has been introduced between the upstanding flanges 43. The upstanding flanges 43 are also provided with a set of holes 436 serving also to receive screws to be driven into the support beam 31 and 32.

[0035] The installation of the roof window system in the roof structure 2 comprising a plurality of rafters 20, 21 and battens 22, and optionally at least one trimmer 23, 24, 25 is performed substantially as follows with par-

tical reference to Fig. 6:

Each mounting bracket 4 is connected to a rafter 21 or a vertical trimmer 25 by legs 42 such that the base 41 protrudes from the rafter 21 or vertical trimmer 25 and supports a bottom surface 314 of the respective support beam 31, 32. In case there are no trimmers, all mounting brackets 4 are connected to rafters; in case there are trimmers on either side, all mounting brackets are connected thereto. The connection advantageously takes place perpendicularly as shown. In the fastened condition, each upstanding flange 43 protrudes from the rafter 21 or vertical trimmer 25 as the case may be. Thereby, it supports a side surface 312, 313 of the respective support beam 31, 32, as shown perpendicularly.

[0036] Referring briefly again to Fig. 7, the top surface 311 of each support beam 31, 32 is in the configuration shown substantially flush with an upper side of the battens 22 of the roof structure 2 in the mounted condition of the roof window system 1. As mentioned in the above, this positioning is made possible by the particular configuration of the mounting brackets 4, in particular of the legs 42.

[0037] While the support assembly 3 has now been installed by means of the mounting brackets 4 as indicated in the above embodiments, the aperture in the roof structure 2 is preferably provided with insulation and the window units 11 and 12 are prepared for installation. As shown in Fig. 10, stabilizing rails 6, 6b of a stabilizing assembly is connected to the respective window unit 11, 12 and window installation brackets 15 are connected to the window units in a manner known per se. Turning now to Fig. 11, an insulating assembly 5 is shown connected to the roof structure 2.

[0038] For the description of the stabilizing assembly and the insulating assembly of the roof window system according to the invention, reference is first made jointly to Figs 4, 10, 11 and 12, in which a roof window system comprising two window units 11 and 12 configured to be mounted with a gap G of the spacing SP of about 100 mm is shown. Secondly, reference is made jointly to Figs 5, 13 and 14 in which a roof window system comprising two window units 11 and 12 configured to be mounted with a gap G of the spacing SP of about 18 mm is shown. Details of the respective stabilizing assembly and insulating assembly will be described in the following.

[0039] Fig. 15 shows an exploded isometric view of the insulating assembly 5 of the roof window system 1. The insulating assembly 5 comprises two side members 52, 53, a plurality of top and bottom members including at least a first and a second top member 511, 512, a first and a second bottom member 541, 542, and two transition members 55, 56, which together form a single insulating frame 50.

[0040] Each side member 52, 53 has a length corresponding substantially to the common height H of the window units 11, 12, and each member 511, 512, 541, 542 of the top and bottom members has a length corresponding substantially to the respective width W1, W2

of the window units 11, 12.

[0041] Each transition member 55, 56 is configured to be positioned between facing ends 5115, 5125 of the first and second top members 511, 512, and the at least first and second bottom members 541, 542, respectively.

[0042] In the installed condition of the insulating assembly 5, the two side members 52, 53, the top and bottom members 511, 512, 541, 542, and the two transition members 55, 56 extend along a periphery of the window units 11, 12 including the top members, the outer side members 112, 123 of the window units 11, 12 and span the combined width W and the common height H and depth D of the roof window system.

[0043] In the embodiment shown, each member of the plurality of top and bottom members 511, 512, 541, 542 is formed as a standard insulating frame piece comprising an insulating element 5121 and a supporting rail 5122 having a uniform cross-section. The term "standard insulating frame piece" encompasses components of commercially available insulating frames fitting a counterpart roof window of a pre-defined size, for instance within a size range of products. The configuration of an insulating frame piece is well-known per se, for instance from Applicant's EP 2 677 092 B1. As is also known as such, the insulating assembly 5 furthermore comprises a set of four connector brackets 57 configured to connect the side members 52, 53 to a respective top and bottom member 511, 541, 512, 542. The supporting rail 5122 of the standard insulating frame piece constituting each member of said plurality of top and bottom members 511, 512, 541, 542 has engagement means, preferably in the form of an opening, configured to engage with corresponding engagement means of the connector bracket 57, preferably comprising a barb or lug.

[0044] Referring now to Figs 16 to 19, each transition member 55, 56 comprises an insulating element 551 and an engagement element 552 configured to bring the transition member 55, 56 into engagement with the associated top and bottom members 511, 512, 541, 542 at the respective facing ends 5115, 5125 thereof. Referring now also to Figs 12 and 13, the insulating element 551 comprises an enlarged lower section 5511 and an upper section 5512, the enlarged lower section 5511 being provided with an inclined edge 5513 such that a ledge 5514 is formed in the transition area between the upper and lower sections 5512, 5511. The ledge 5514 may in principle have any suitable configuration but preferably surrounds at least in part the upper section 5512 on an inner face and end faces as shown. Here, the engagement element 552 comprises an L-shaped clip with a first leg 5521 and a second leg 5522, the first leg 5521 being configured to be received in receiving means of the insulating element 551, which may take the form of a slot 5515 in an outer side of the upper section 5512 of the insulating element 551. The second leg 5522 of the L-shaped clip comprises engagement means configured to engage with corresponding engagement means of the member of said plurality of top and bottom members 511, 512, 541, 542.

The engagement means here comprises a barb or lug 5523. To ensure continuity, the shape of the transition member 55, 56 is adapted to the shape of the member of said plurality of top and bottom members 511, 512, 541, 542.

[0045] Depending on the selected spacing SP between neighbouring window units 11, 12, a width wb, wk and a depth db, dk of the transition member 55, 56 is chosen. Comparing Figs 18 and 19, two different sizes are shown. In principle, the transition members could be chosen to span the spacing between facing sides of neighbouring roof windows placed at an arbitrary distance from each other. Typically, some standard distances are foreseen, but in principle, the insulating assembly could be provided for spacings ranging from almost contact within the neighbouring roof windows to 500 mm within the neighbouring roof windows. In the embodiments shown, two standardized widths of 100 mm and 18 mm are described

[0046] The insulating element 551 of each transition member 55, 56 is advantageously made from a dimensionally stable material having good thermal insulating properties, preferably a polymer foam, such as extruded polyethylene (PE), polypropylene (PP), polyurethane (PU), polyvinylchloride (PVC), expanded polystyrene (EPS), extruded polystyrene (XPS) or mineral wool.

[0047] In the installation situation shown in Fig. 10, the insulating assembly 5 is configured to cooperate with the stabilizing rail 6 positioned in the spacing SP between neighbouring window units 11, 12 in the mounted condition of the roof window system such that the stabilizing rails 6 and 6b are - at least in part - in abutment with the two transition members 55, 56.

[0048] In a supply condition, the insulating assembly 5 is supplied as an unassembled kit, in which the two side members 52, 53 and the plurality of top and bottom members 511, 512, 541, 542 are packaged together, preferably in parallel with each other, and each of the two transition members 55, 56 is connected to a respective one of the at least first and second top members 511, 512 and the at least first and second bottom members 541, 542. Alternatively, the transition members 55, 56 could be provided separately. Although the transition members 55, 56 are shown as separate members, they could optionally be integrally connected to the top and/or bottom members either in a configuration where the transition member 55, 56 is partly integrated into one of the first and second top/bottom members 511, 512, 541, 542 or in a configuration where the transition member 55, 56 is fully integrated into both of the first and second top/bottom members 511, 512, 541, 542 thus forming a continuous top/bottom member.

[0049] Turning now to Figs 20 and 21, a first embodiment of the stabilizing rail 6 is shown. It is noted that a substantially identical, mirror-imaged second stabilizing rail 6b is provided as well. Where appropriate, reference will also be made to a second embodiment of the stabilizing rail 1006 of Fig. 22 and a third embodiment of the

stabilizing rail 2006 of Fig. 23, and to the interaction between respective insulating profiles of the stabilizing rails 6, 6b; 1006 of the stabilizing assembly and the transition member 55 of the insulation assembly 6 shown in Figs 24 and 25, respectively. Only differences between the embodiments will be described in detail.

[0050] Just as the overall configuration of the stabilizing assembly itself, each stabilizing rail 6, 6b; 1006, 1006b; 2006, 2006b has a generally longitudinal extension and comprises at least a strengthening profile 62, 62b; 1062, 1062b; 2062, 2062b.

[0051] One or both stabilizing rails of a set comprises an insulating profile 61 fastened to the strengthening profile 62. The strengthening profile 62 comprises means for connection to the side member 113 of one window unit 11 of neighbouring window units 11, 12. Correspondingly, the strengthening profile 62b of the second stabilizing rail 6b comprises means for connection to the side member 122 of the other window unit 12 of the roof window system. Here, the insulating profile 61 has such a thickness tk, tb and depth dk, db that it substantially spans half of the gap G of the spacing SP between facing side members 113, 122 of neighbouring window units 11, 12 in the mounted condition of the roof window system 1. In this way, the insulating profiles 61 and 61b together span the gap G of the spacing SP.

[0052] The strengthening profile 62 comprises a connection flange 621 with connection means 623, 624, 625, 626 for the connection of the stabilizing rail 6; 1006; 2006 to the window unit 11. In the embodiment shown, the connection means comprise a set of lugs 623 protruding from a surface of the connection flange 621 configured to face and match holes in the side member 113 of the window unit 11 to which the stabilizing rail 6; 1006; 2006 is connected. Furthermore, the connection means comprise at least one set of holes 624, 625 and/or set of apertures 626 for receiving fastening means and/or fittings, the position and number of the at least one set of holes or apertures 624, 625, 626 preferably depending on the common height H of the roof window system 1 and also matching holes provided in the side member 113 of the window unit 11. Matching the connection means of the stabilizing rail 6; 1006; 2006 with holes in the side members of the window units facilitates correct positioning and mounting. One example of fastening means is screws 627 indicated in Figs 10 and 13. The number and position of the fastening means may be chosen in accordance with the height of the window units 11, 12, and thus of the roof window system 1, such that three sets of two screws 627 are provided to fasten the stabilizing rail 6 to the side member 113 of the first window unit 11 and the stabilizing rail 6b to the side member 122 of the second window unit 12, namely one set near the top, one set near the bottom and one set substantially centrally. In case the common height H is larger, more than three sets may be provided, and fewer than three sets of screws 627 may be provided, for instance as shown in Fig. 13.

[0053] Each stabilizing rail 6, 6b; 1006, 1006b; 2006, 2006b has a length which is chosen in accordance with other dimensions of the roof window system 1, typically as substantially corresponding to the common height H of the roof window system 1. At least the insulating profile 61 is chosen to have a length corresponding to the full length of the stabilizing rail 6 but the strengthening profile 62 has a length which is shorter than the full length of the stabilizing rail 6, such as to leave an end portion at each end of the stabilizing rail 6 in which the insulating profile 61 protrudes beyond opposing ends of the strengthening profile 62, the length of said end portions being preferably about 10 to 60 mm, more preferably about 40 mm.

[0054] Referring now in particular to Fig. 24, it is seen how the ledge 5514 of the transition member 55 cooperates with the shoulder 613 and cut-out portion 614 of the insulating profile 61 at the top of the roof window system, and also at the inclined edge 5513 with the facing edge 5115 of the first top member 511 of the insulating assembly 5 (and correspondingly at the other side of the other stabilizing rail 6b).

[0055] Correspondingly, at the bottom of the roof window system in the embodiment of Fig. 25, the insulating profile 1061 of the first stabilizing rail 1006 is shown in interaction with the transition member 56. The thickness tb of the insulating profile 61 which spans substantially the gap G of the spacing SP between neighbouring window units 11, 12 corresponds in substance to the width wb as defined by the upper section 5512 of the transition member 56.

[0056] Also clearly visible in this figure is the configuration of the second stabilizing rail 1006b in the mounted condition. This second stabilizing rail 1006b comprises only strengthening profile 1062b, which is mounted reversely on the window unit 12 as compared with the strengthening profile 1062 mounted on the window unit 11.

[0057] In general, the strengthening profile 62 of the stabilizing rail 6; 1006 comprises a fastening flange 622 extending substantially perpendicularly to the connection flange 621, thus forming an L-shape, the fastening flange 622 being fastened to the insulating profile 61 at an under side, facing away from the connection flange 621, preferably by means of adhesion. Here, the insulating profile 61 of the stabilizing rail 6; 1006; 2006 comprises a base section 611 defining said pre-defined thickness tk, tb. The insulating profile 61 of the stabilizing rail 6 comprises a ledge 612 and a shoulder portion 613 above the base section 611, and wherein the fastening flange 622 is positioned on the ledge 612 such that an upper side of the fastening flange 622 is substantially flush with an upper side of the shoulder portion 613.

[0058] In the second embodiment shown in Fig. 23, the insulating profile 2061 of the stabilizing rail 2006 comprises a base section 2611 defining said pre-defined thickness tb and an upper section 2615 having a smaller thickness, and wherein the connection flange 2621 of the

strengthening profile 2062 comprises a folded flange portion 2627, the connection flange 2621 and the folded flange portion 2627 form fastening surfaces relative to the upper section 2615 of the insulating profile 2061.

[0059] The insulating profile 61 of the stabilizing rail 6 is made from a dimensionally stable material having good thermal insulating properties, preferably a polymer foam, such as extruded polyethylene (PE), polypropylene (PP), polyurethane (PU), polyvinylchloride (PVC), expanded polystyrene (EPS), extruded polystyrene (XPS) or mineral wool. For instance, the same material as for the insulating assembly 5 may be chosen.

[0060] The strengthening profile 62 is made from any suitable material which is capable of performing the function of a reinforcing rail, e.g. with properties like a gusset. Typically, a composite or metal material, such as steel.

[0061] Referring now to Figs 26 and 27, a first embodiment of a cover assembly is shown, in a disengaged and an engaged position, respectively. The cover assembly is intended to cover the spacing between facing sides of neighbouring roof windows placed at an arbitrary distance from each other. Typically, some standard distances are foreseen, but in principle, the cover assembly could be provided for spacings ranging from a contact within the neighbouring roof windows to 500 mm within the neighbouring roof windows. In the embodiment shown, a standardized width of the gap G of the spacing SP of 100 mm is described. The person skilled in the art would be aware of necessary adaptations to the cover assembly to accommodate other dimensions.

[0062] The cover assembly comprises a set of receiver brackets 7 configured to be connected to the facing side members 113, 122 of neighbouring window units 11, 12 and a cover plate 8 configured to be brought into releasable engagement with the set of receiver brackets 7. For comparison a prior art cover arrangement of a commercially available product traded under the name VELUX® Dormer is shown in Fig. 28a and Fig. 28b.

[0063] Referring briefly to Fig. 29, the set of receiver brackets 7 here includes four items. The number may be chosen in dependence of the height of the window units and hence of the roof window system; however, four receiver brackets have been found appropriate for most sizes window units.

[0064] As shown, each receiver bracket 7 is adapted to be installed in a groove 17 in adjacent frame members 113, 122 of neighbouring window units 11, 12. This groove 17 is as mentioned in the above circumferential and typically provided in the frame of most roof windows. Where the groove 17 at the top, bottom and outermost frame members serves to receive the lining panel 95, the groove 17 of the adjacent frame members serves to receive the receiver brackets 7. Each receiver bracket 7 comprises a base portion 70 from which a set of two second mounting elements 71 protrude to form rounded shapes, a second engagement portion 72 being here formed near an end of the respective second mounting element 71. Furthermore, each receiver bracket 7 com-

prises a leg 73 at an end of the second engagement portion 72 opposite the base portion 70. The engagement portions 72 and the legs 73 are advantageously symmetrically placed such that the position can be reversed up-side-down. Each leg 73 is received in the groove 17 of the respective frame member 113, 122. In order to fasten the legs 73 to the material of the frame member, one or more holes 74 are provided in each leg 73 as shown in Fig. 30 in which two holes 74 are provided and configured to receive fastening means such as screws (not shown).

[0065] The cover plate 8 comprises a base portion 80 from which a set of two first mounting elements 81 protrude, a first engagement portion 82 being preferably formed near a free end of the respective first mounting element 81.

[0066] The cover plate 8 comprises an additional leg 83, preferably provided with a hook 84. Referring to Fig. 27 showing the engaged position, it is seen that the hook 84 is placed close to the frame members such that the entry to the groove 17 is also covered. It is furthermore seen that a side edge 801 of the base portion is located beyond the position of the respective first mounting element 81. In this way, the cover element 8 overlaps not only the entire spacing SP but also the portion of the side members 113, 122 in which the groove 17 is located.

[0067] Common to all frame members in the embodiment shown, however, is that the circumferential groove 17 also receives the vapour barrier collar 97. The exact configuration of the vapour barrier collar 97 could in principle be chosen in any suitable way but it is preferred that that not only the top, bottom and outermost side members of the window units are provided with portions of the vapour barrier collar 97, but also the spacing SP between facing side members of the two neighbouring window units 11 and 12 as indicated in Fig. 26. The vapour barrier collar 97 is here formed as a strip spanning the spacing SP between the neighbouring window units 11 and 12. In order to provide a tight sealing, a gasket 971 is included in the vapour barrier collar 97. The legs 73 of the receiver bracket 7 are thus positioned such that the gasket 971 is squeezed between the leg 73 and the bottom of the groove 17.

[0068] To ensure the releasable engagement, the cover plate 8 comprises a first mounting element 81 and the receiver bracket 7 comprises a complementary second mounting element 71, and the first mounting element and the second mounting element are adapted to be brought into contact with one another. The first mounting element 81 and the second mounting element 71 comprises such complementary shapes that movement of the cover plate 8 relative to the receiver bracket or receiver brackets 7 in a mounting direction is possible while movement in the opposite direction is at least temporarily prevented by a first engagement portion 82 on the first mounting element 81 brought into engagement with a second engagement portion 72 on the second mounting element 71 to ensure a snap or clip engagement. In principle the first mounting element 81 and the second mounting element 71 could

be provided at one longitudinal edge of the cover plate 8 and the receiver bracket 7, respectively; however, it is preferred that they as shown are symmetrically placed along both side edges.

[0069] In the embodiment shown, the first and second engagement portions 82, 72 are formed as mutually co-operating shapes including a protrusion, an indent, a wave shaped, a barb, a hook-shaped element, a catch-shaped element, a T-shaped cross-section, a V-shaped cross section and an arrow-shaped cross section or any combination thereof. The dimensions of the various parts are typically chosen in accordance with the material chosen. It is also seen that the first mounting element 81 forms an angle α with a direction perpendicular to the base portion 80 of the cover plate 8. The angle α is small, typically about 2 to 5°, and ascertains that safe guidance of the cover plate 8 over the receiver brackets 7 is ensured.

[0070] The first mounting elements 81 may be said to have the form of a track configured to be guided over and to be received, partially or fully, by the second mounting elements 71.

[0071] Once the desired number of receiver brackets 7 have been connected to the facing side members 113, 122, by introducing screws or other fastening means through the holes 74 in the legs 73 and further into the side members 113, 122, the cover plate 8 is placed such that the first mounting elements 81 with the respective first engagement portions 82 are guided over the second mounting elements 71 of the receiver brackets 7, until the first engagement portions 82 snap behind the second engagement portions 72. During this operation, the legs 73 also function as a stop of the movement such that the installer will experience a clear indication, for instance in the form of a distinct sound, that the mounted condition has been reached.

[0072] Each receiver bracket 7 is made of a robust material such as metal or an alloy or a plastic compound or a combination thereof, preferably extruded. The cover plate 8 is typically made of a metal or an alloy or a plastic compound or wood a combination thereof.

[0073] While the cover plate 8 may in principle be disengaged from the receiver bracket or brackets 7 in any suitable way, a demount tool 85 is provided in an embodiment of the roof window system according to the invention. As shown in Figs 31 and 32, the demount tool 85 comprises a substantially plane base 850. From the base 850, a first flange 851 protrudes at a rounded section 852, ending in an edge 8511. A second flange 853 protrudes from the base 850 at a distance from the first flange 851. The second flange 853 ends in an edge 8531 slightly beyond the edge 8511 of the first flange 851. A grip opening 854 is provided in the base 850.

[0074] In case it is desired to remove the cover plate 8, the first flange 851 of the demount tool 85 is introduced into the gap behind the leg 83 of the cover plate 8, at the position of the hook 84. During this operation, the second flange 853 of the demount tool 85 overlaps the base por-

tion 80 of the cover plate in the area of the side edge 801 while the base 850 of the demount tool 85 is substantially perpendicular to the plane of the base portion 80. The user then rotates the demount tool 85 outwards, i.e. in the direction away from the base portion 80 of the cover plate 8, by way of a lever rotating about the rounded section 852 which in turn abuts a surface of the side member 113, 122 in question. The applied moment releases the engagement between the cover plate 8 and the receiver bracket 7. If needed, the process is repeated at the position of each receiver bracket 7 and at both side edges 801 of the cover plate 8.

[0075] Another embodiment of a demount tool 86 is shown in Figs 33 and 34. The demount tool 86 comprises a base 860. From the base 860, a flange 861 protrudes while a handle portion 864 is formed oppositely to the flange 861. In case the cover plate 8 is to be removed, the flange 861 of the demount tool 86 is introduced into the gap behind the cover plate 8 and the engagement between the cover plate 8 and the receiver bracket 7 is released by handling the demount tool 86. An opening 865 is provided in the handle portion 864 in order to allow hanging the demount tool 86 on for instance a hook in-between uses. On the back side of the demount tool 86, shown in Fig. 34, reinforcement ribs 866 are provided to incur rigidity to the demount tool 86.

[0076] The invention is not limited to the embodiments shown and described in the above, but various modifications and combinations may be carried out.

List of reference numerals

[0077]

- | | | |
|---|--------------------------------|--|
| 1 | roof window system | |
| | 11 first window unit | |
| | 111 top member | |
| | 112 side member | |
| | 113 side member | |
| | 114 bottom member | |
| | 12 second window unit | |
| | 121 top member | |
| | 122 side member | |
| | 123 side member | |
| | 124 bottom member | |
| | 15 window installation bracket | |
| | 17 groove | |
| 2 | roof structure | |
| | 20 rafter | |
| | 21 rafter | |
| | 22 batten(s) | |
| | 23 upper horizontal trimmer | |
| | 24 lower horizontal trimmer | |
| | 25 vertical trimmer | |
| | 26 underroofing | |
| | 27 vapour barrier membrane | |
| | 28 auxiliary batten piece(s) | |
| | 29 installation batten(s) | |

- | | |
|-------|--|
| 3 | support assembly |
| | 31 upper support beam |
| | 311 top surface |
| | 312 side surface |
| 5 | 313 side surface |
| | 314 bottom surface |
| | 32 lower support beam |
| 4 | mounting bracket |
| | 41 base |
| 10 | 411 first edge |
| | 412 second edge |
| | 413 hole in base |
| | 42 leg(s) |
| | 421 bottom edge |
| 15 | 422 inner free side edge portion |
| | 423 upper edge |
| | 424 outer edge |
| | 425 notch |
| | 426 hole(s) in leg |
| 20 | 427 oblong aperture |
| | 428 larger hole in leg |
| | 43 upstanding flange(s) |
| | 431 first transition edge of upstanding flange |
| | 43 to base 41 |
| 25 | 432 second transition edge of upstanding flange 43 to leg 42 |
| | 433 inclined edge portion |
| | 434 upper edge |
| | 435 outer edge |
| 30 | 436 hole(s) in upstanding flange(s) |
| 5 | insulating assembly |
| | 50 insulating frame |
| | 511 first top member |
| | 5115 facing edge |
| 35 | 512 second top member |
| | 5121 insulating element |
| | 5122 supporting rail |
| | 5125 facing edge |
| | 52 side member |
| 40 | 53 side member |
| | 541 first bottom member |
| | 542 second bottom member |
| | 55 transition member |
| | 551 insulating element |
| 45 | 5511 enlarged lower section |
| | 5512 upper section |
| | 5513 inclined edge |
| | 5514 ledge |
| | 5515 slot |
| 50 | 552 engagement element |
| | 5521 first leg |
| | 5522 second leg |
| | 5523 lug |
| | 56 transition member |
| 55 | 57 connector bracket |
| 6, 6b | stabilizing rail |
| | 61, 61b insulating profile |
| | 611 base section |

612 ledge
 613 shoulder
 614 cut-out (top)
 615 cut-out (bottom)
 62, 62b strengthening profile
 621 connection flange
 622 fastening flange
 623 set of lugs
 624 set of holes (top)
 625 set of holes (bottom)
 626 set of apertures
 627 fastening means (screws)
 1006 stabilizing rail (2nd embodiment)
 1061 insulating profile
 1062 strengthening profile
 1006b second stabilizing rail
 1062b strengthening profile of second stabilizing rail
 2006 stabilizing rail (3rd embodiment)
 2061 insulating profile
 2611 base section
 2616 upper section
 2062 strengthening profile
 2621 connection flange
 2627 folded flange portion
 2006b second stabilizing rail
 7 receiver brackets
 70 base portion
 71 second mounting element
 72 second engagement portion
 73 leg
 74 hole(s)
 8 cover plate
 80 base portion
 801 side edge of base portion
 81 first mounting element
 82 first engagement portion
 83 leg
 84 hook
 85 demount tool
 850 base
 851 first flange
 8511 edge of first flange
 852 rounded section
 853 second flange
 8531 edge of second flange
 854 grip opening
 86 demount tool (other embodiment)
 860 base
 861 flange
 864 handle portion
 865 opening
 866 reinforcement ribs
 91 flashing arrangement
 92 flashing arrangement
 93 flashing arrangement
 94 flashing arrangement
 95 lining panel

96 underroof collar
 97 vapour barrier collar
 971 gasket
 SP spacing
 5 G gap
 D depth
 HWU common height of window units
 W1 width of first window unit
 W2 width of second window unit
 10 W combined width
 DWU common depth of window units
 wk width (large)
 wb width (small)
 dk depth (large)
 15 db depth (small)
 tk thickness (large)
 tb thickness (small)
 α angle

20

Claims

1. A roof window system (1) comprising at least two window units (11, 12) configured to be built in side by side in a roof structure (2) of a roof, in particular comprising an inclined roof surface, said roof window system (1) furthermore comprising a support assembly (3) configured to be fastened to the roof structure (2) and to which the window units (11, 12) are to be connected,
characterised in that said support assembly (3) comprises a set of support beams (31, 32) configured to be mounted substantially horizontally in said roof structure (2), and that at least one of a top member (111, 121) and a bottom member (114, 124) of each window unit (11, 12) are intended to be connected with at least one of said set of support beams (31, 32) in a mounted condition of the roof window system (1).
2. A roof window system (1) according to claim 1, wherein the set of support beams comprises an upper support beam (31) and a lower support beam (32), the bottom member (114, 124) of each window unit (11, 12) being intended to be connected with the lower support beam (32) and the top member (111, 121) of each window unit (11, 12) being intended to be connected with the upper support beam (31), preferably by means of a set of window installation brackets (15).
3. A roof window system (1) according to any one of the preceding claims, wherein the connection between the support assembly (3) and the roof structure (2) is carried out by a set of mounting brackets (4).
4. A roof window system (1) according to claim 3,

wherein each mounting bracket (4) comprises a base (41), at least one leg (42) and at least one upstanding flange (43).

5. A roof window system (1) according to claim 4, wherein two upstanding flanges (43) are provided and each is connected to the base (41) at a first transition edge (431) of said upstanding flange (43) and each at least one leg (42) is connected to the respective upstanding flange (43) at a second transition edge (432) of said upstanding flange (43), said first transition edge (431) being preferably perpendicular to said second transition edge (432). 5
6. A roof window system (1) according to claim 5, wherein each leg (42) comprises an inner free side edge portion (422) in extension of the second transition edge (432) of said upstanding flange (43) such that an upper section of each said leg (42) extends above a plane of the base (41) and a lower section of each said leg (42) extends below the plane of the base (41). 10
7. A roof window system (1) according to any one of claims 4 to 6, wherein the base (41), each leg (42) and each upstanding flange (43) comprises at least one hole or aperture adapted to receive fastening means such as screws. 15
8. A roof window system (1) according to claim 6 and 7, wherein each leg (42) is provided with a plurality of holes and apertures (426, 427, 428) such that at least one hole or aperture is located in the upper section and at least one hole or aperture in the lower section. 20
9. A roof window system (1) configured to be installed in a roof structure (2) comprising a plurality of rafters (20, 21) and battens (22), and optionally at least one trimmer (23, 24, 25), wherein each support beam (31, 32) is configured to be connected to two rafters, one rafter (21) and a vertical trimmer (25), or two vertical trimmers. 25
10. A roof window system (1) according to any one of claims 3 to 9, wherein each mounting bracket (4) is configured to be connected to a rafter (21) or a vertical trimmer (25) by said at least one leg (42) such that the base (41) protrudes from the rafter (21) or vertical trimmer (25) and supports a bottom surface (314) of the respective support beam (31, 32), preferably perpendicularly, and each upstanding flange (43) protrudes from the rafter (21) or vertical trimmer (25) and supports a side surface (312, 313) of the respective support beam (31, 32), preferably perpendicularly. 30
11. A roof window system (1) according to claim 9 or 10, 35

wherein a top surface (311) of each support beam (31, 32) is substantially flush with an upper side of the battens (22) of the roof structure (2) in the mounted condition of the roof window system (1).

12. A method of installing a roof window system (1) according to any one of claims 1 to 11 from a supply condition to the mounted condition, comprising the steps of:
 - connecting the support beams (31, 32) of the support assembly (3) to the roof structure (2), and
 - connecting the window units (11, 12) to the support beams (31, 32) of the support assembly (3) or the to the roof structure (2).
13. The method of claim 12, wherein the set of support beams comprises an upper support beam (31) and a lower support beam (32), and the connection between the support assembly (3) and the roof structure (2) is carried out by a set of mounting brackets (4), whereby the step of connecting the support beams (31, 32) to the roof structure (2) is carried out after the set of mounting brackets (4) have been connected to the roof structure (2). 40

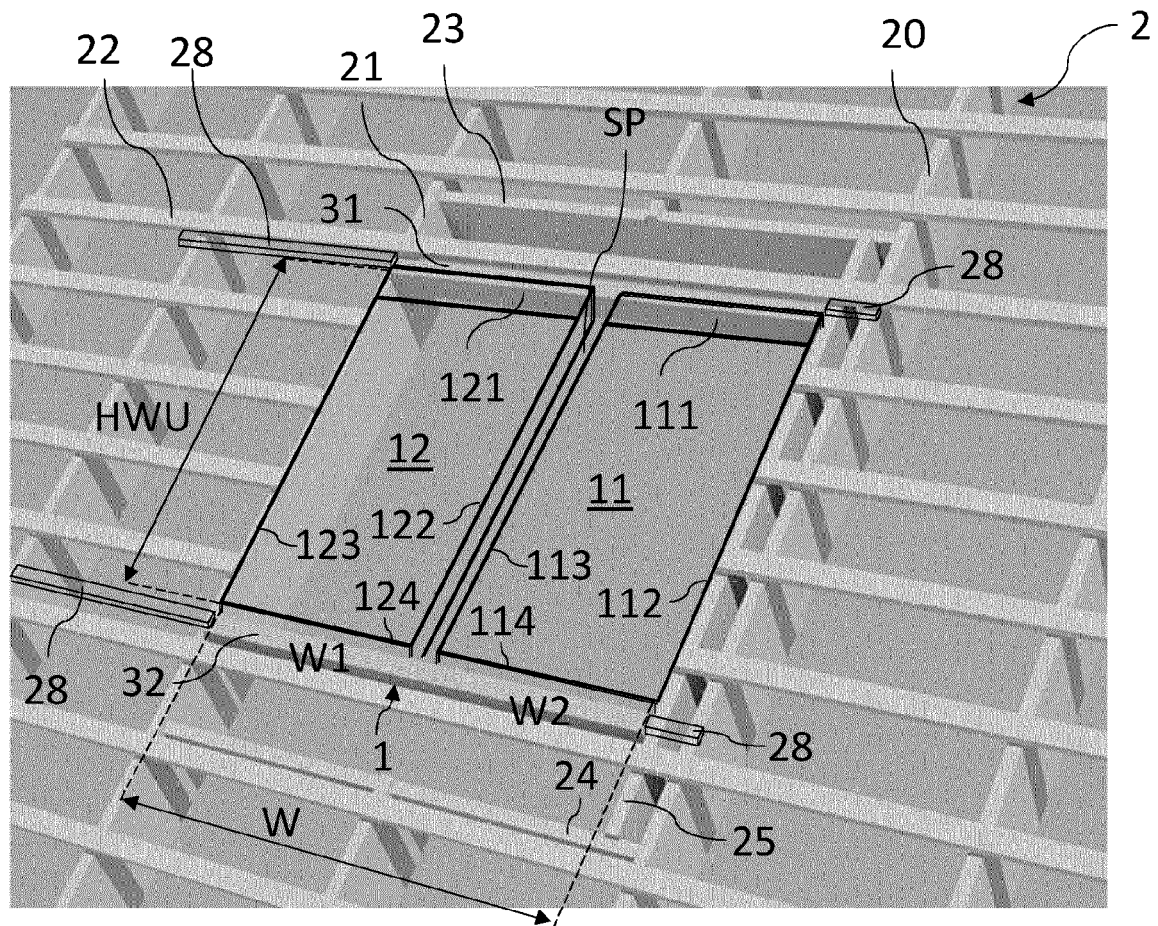


Fig. 1

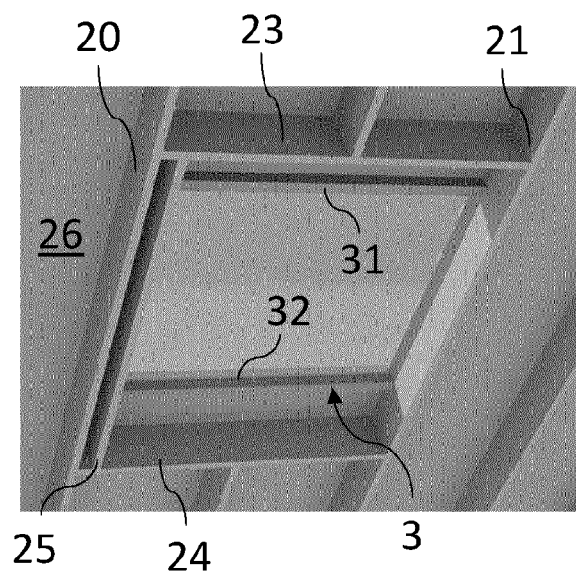


Fig. 2

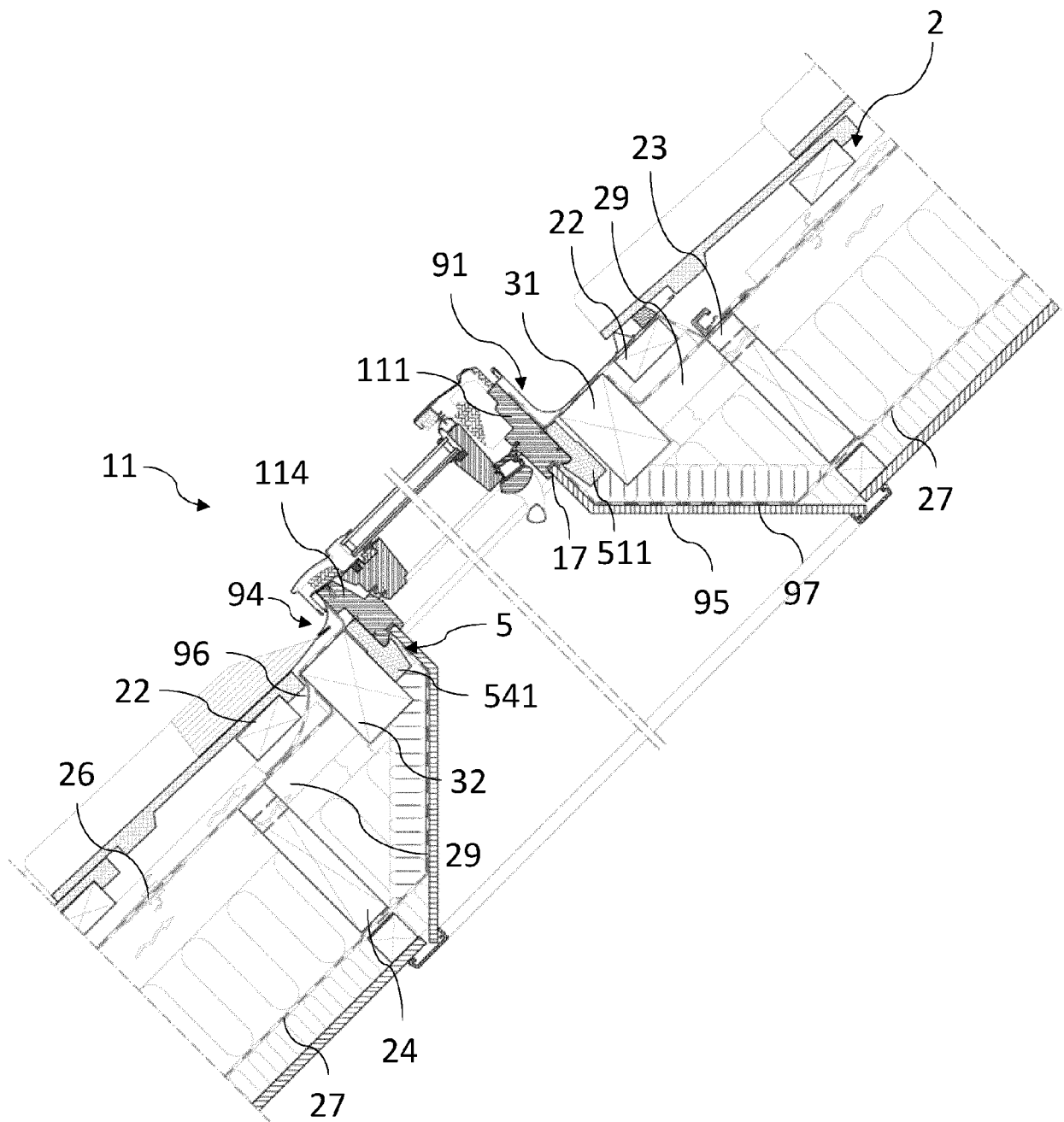


Fig. 3

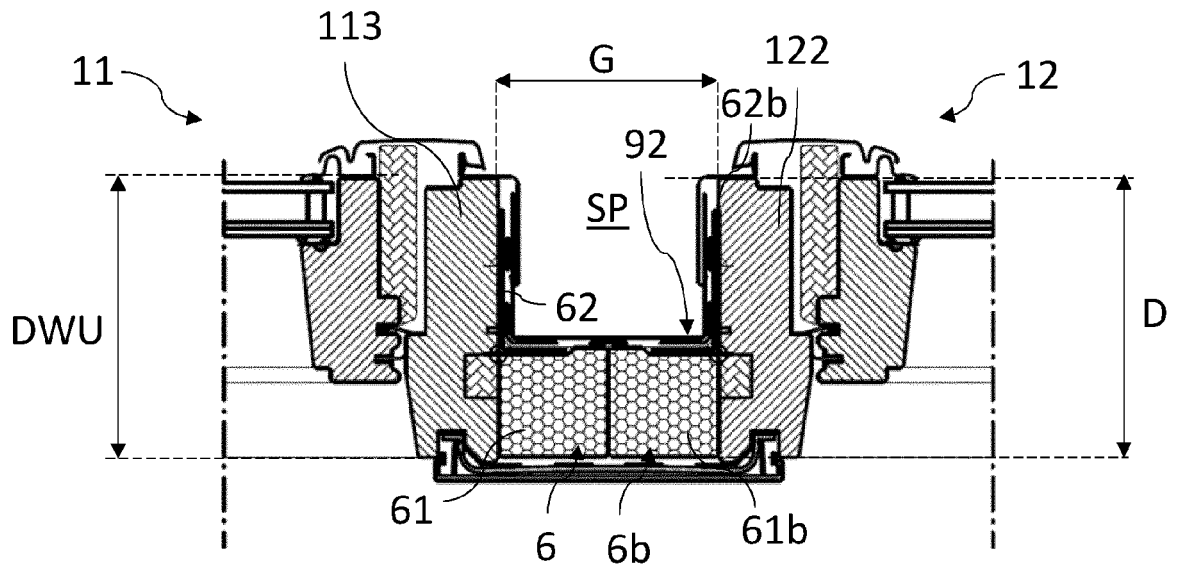


Fig. 4

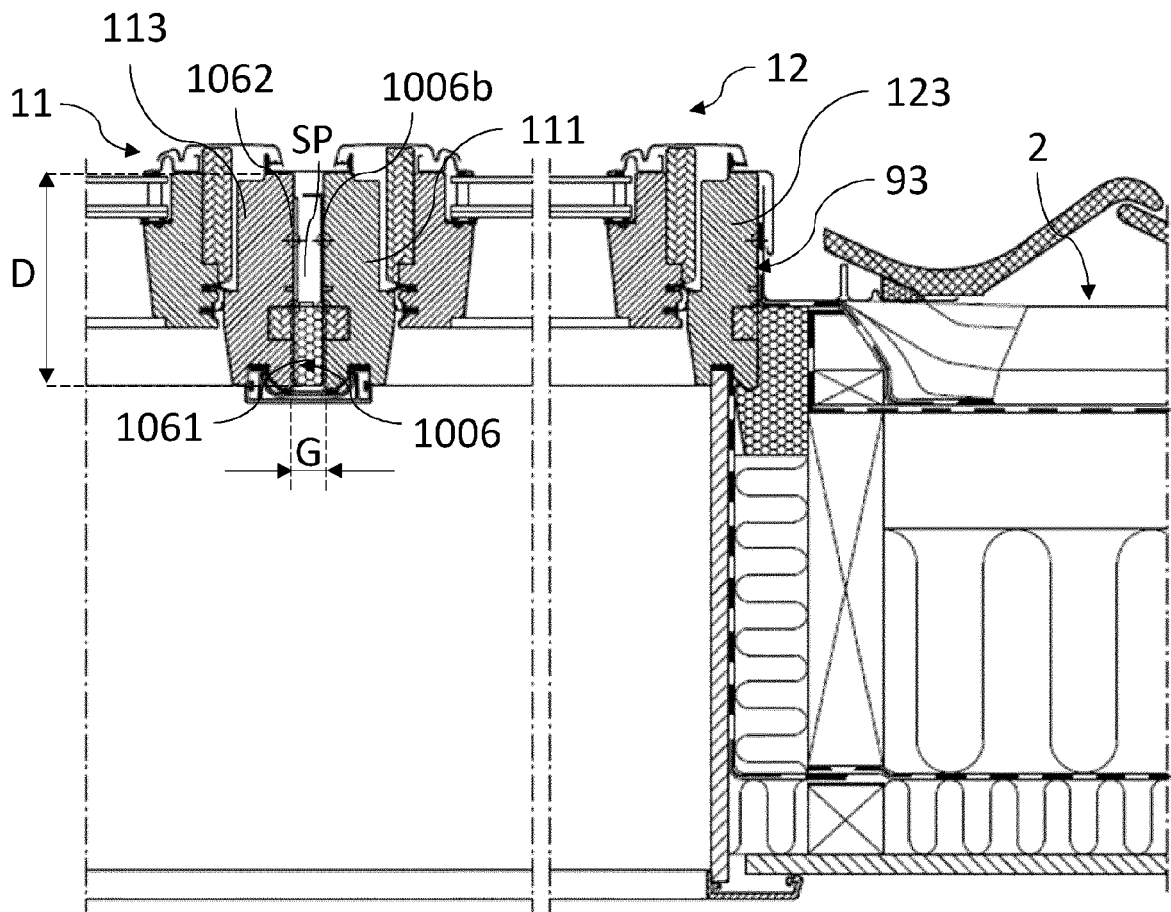


Fig. 5

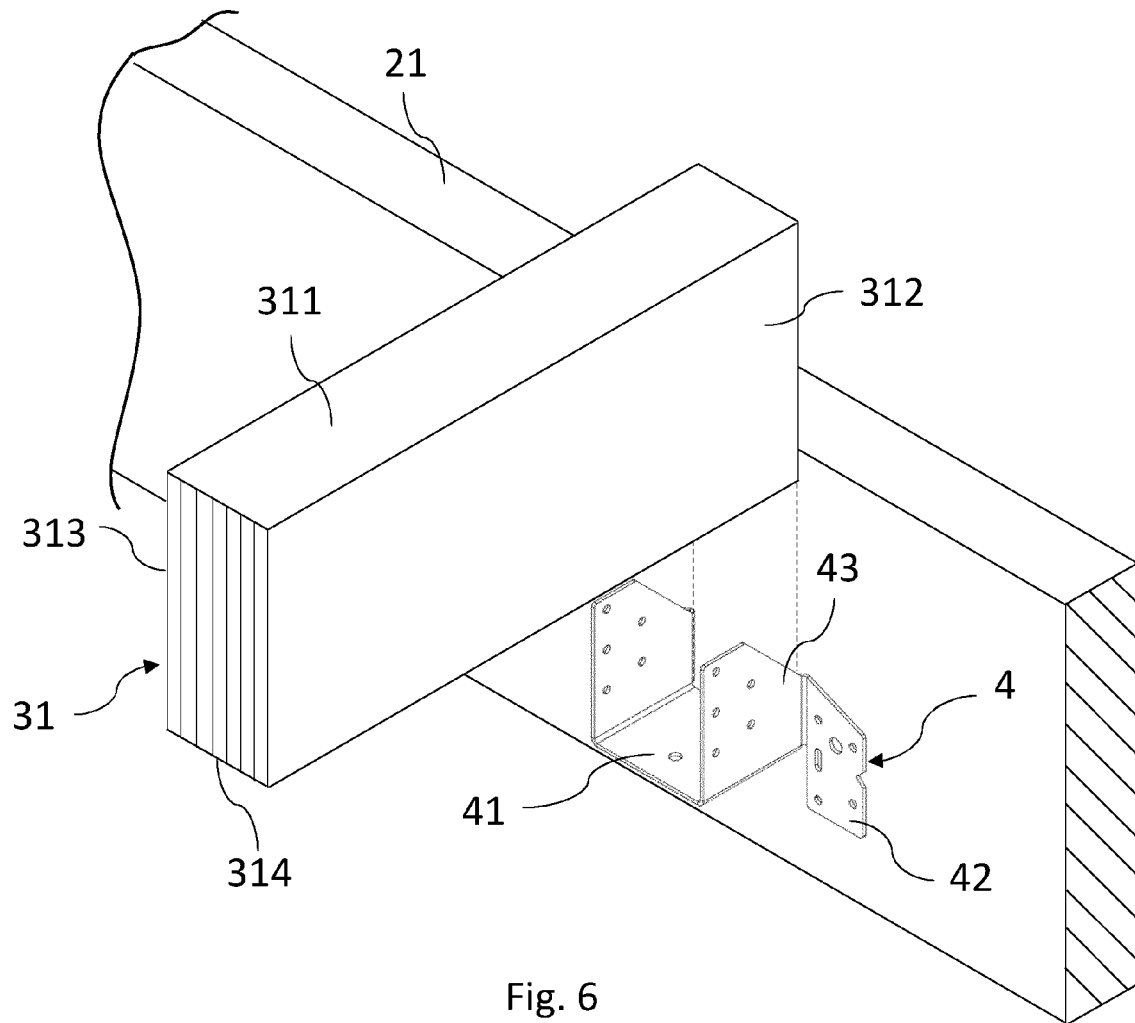


Fig. 6

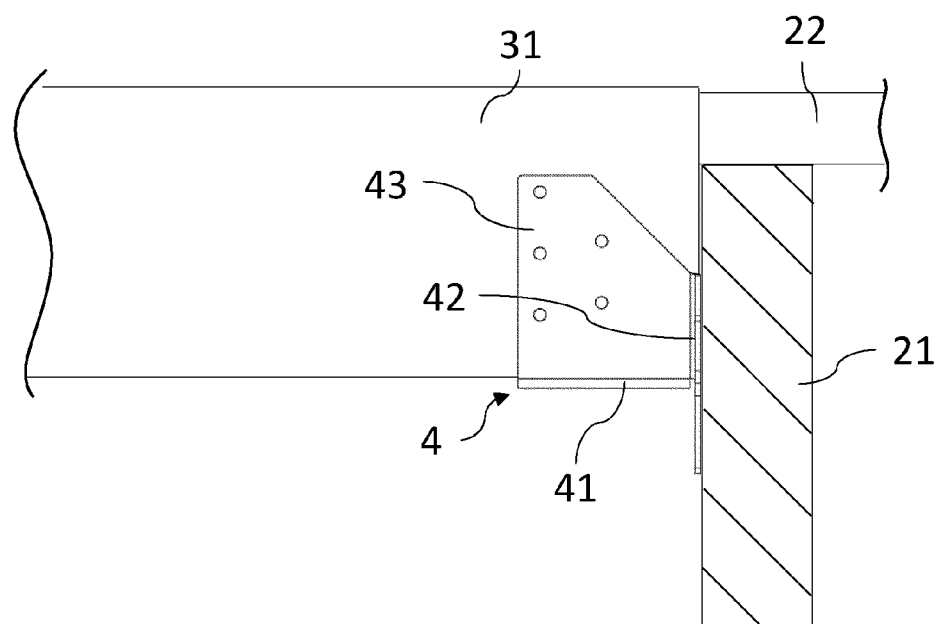


Fig. 7

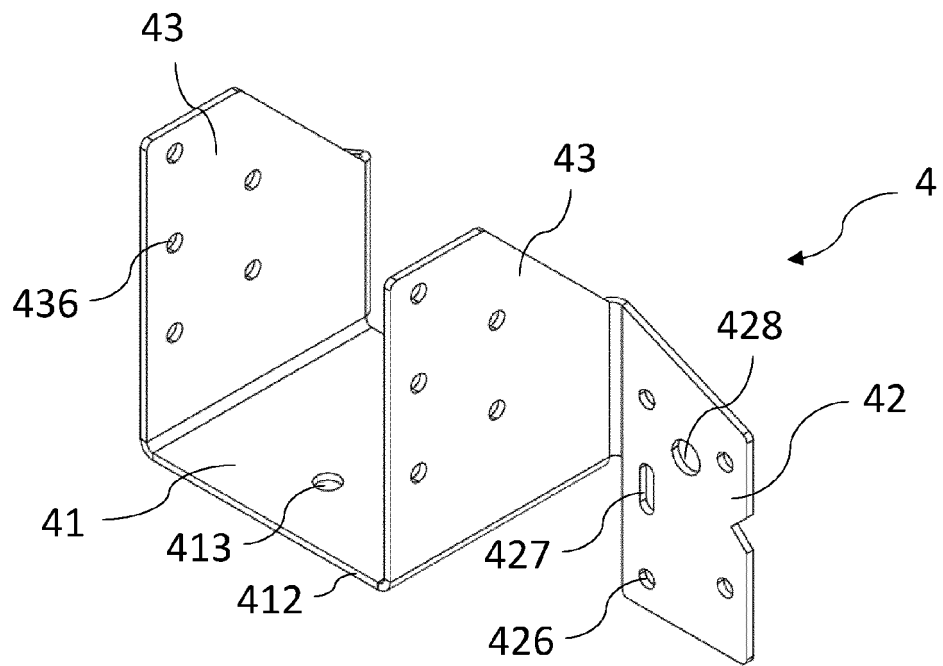


Fig. 8

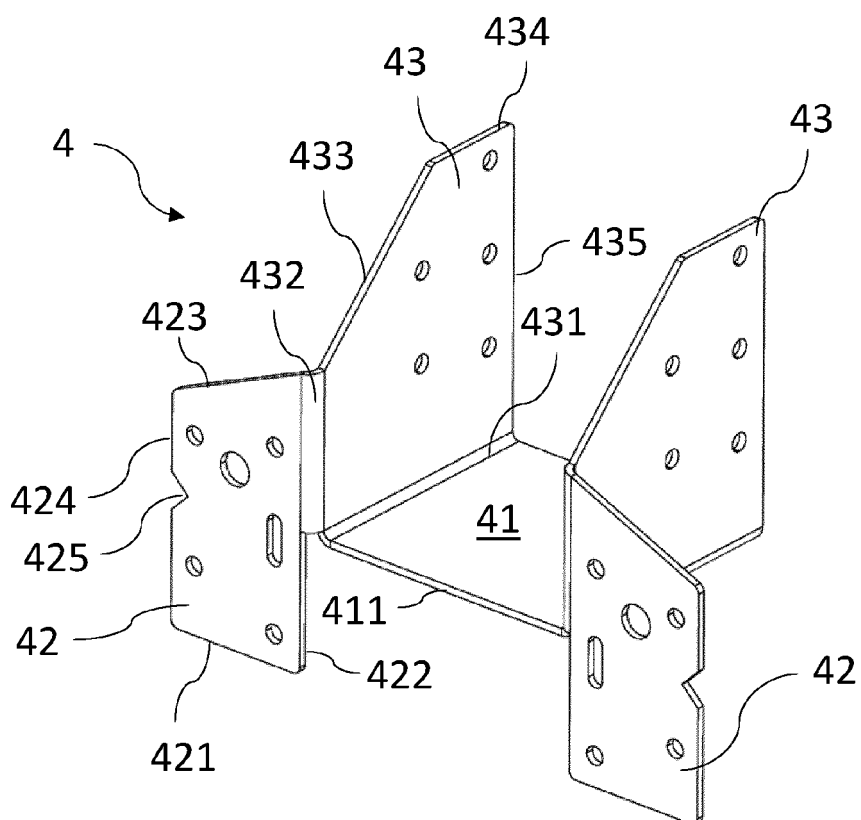


Fig. 9

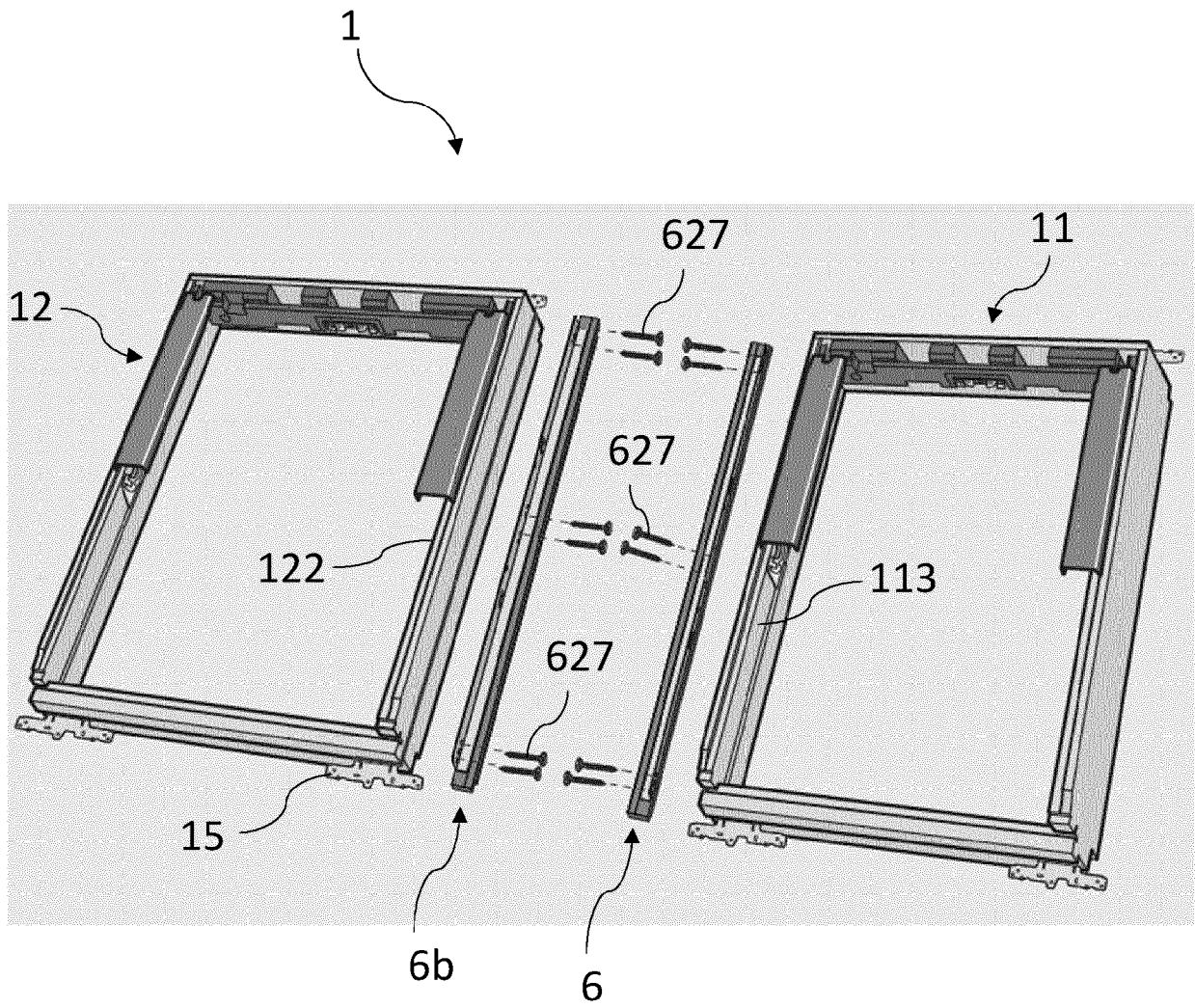
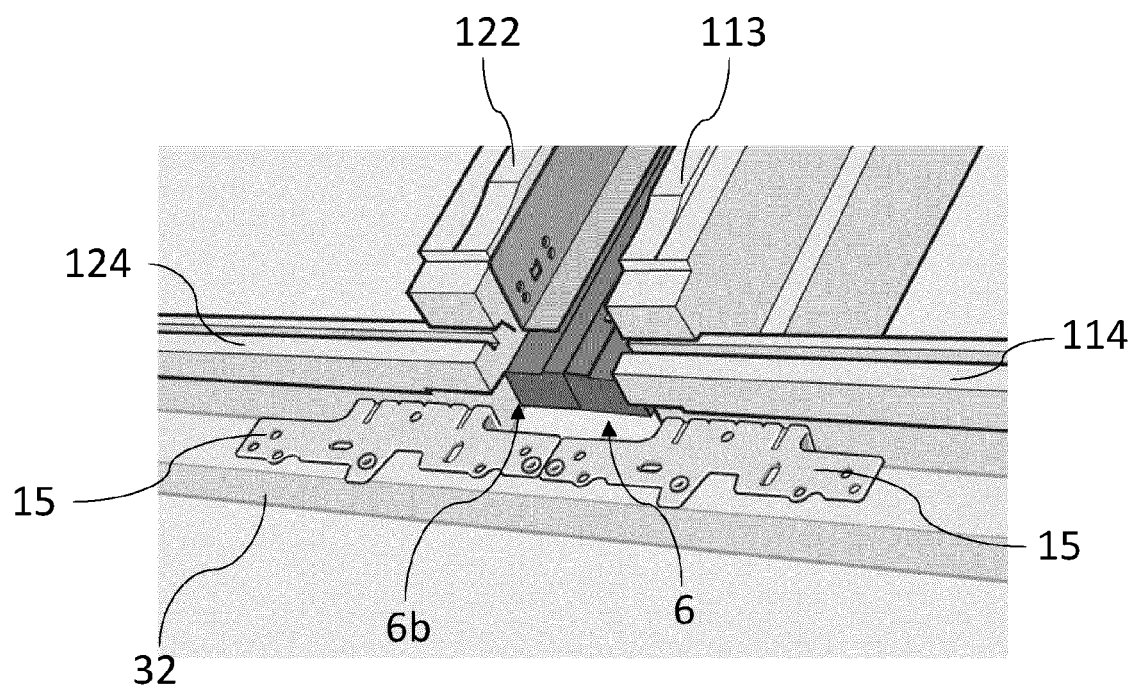
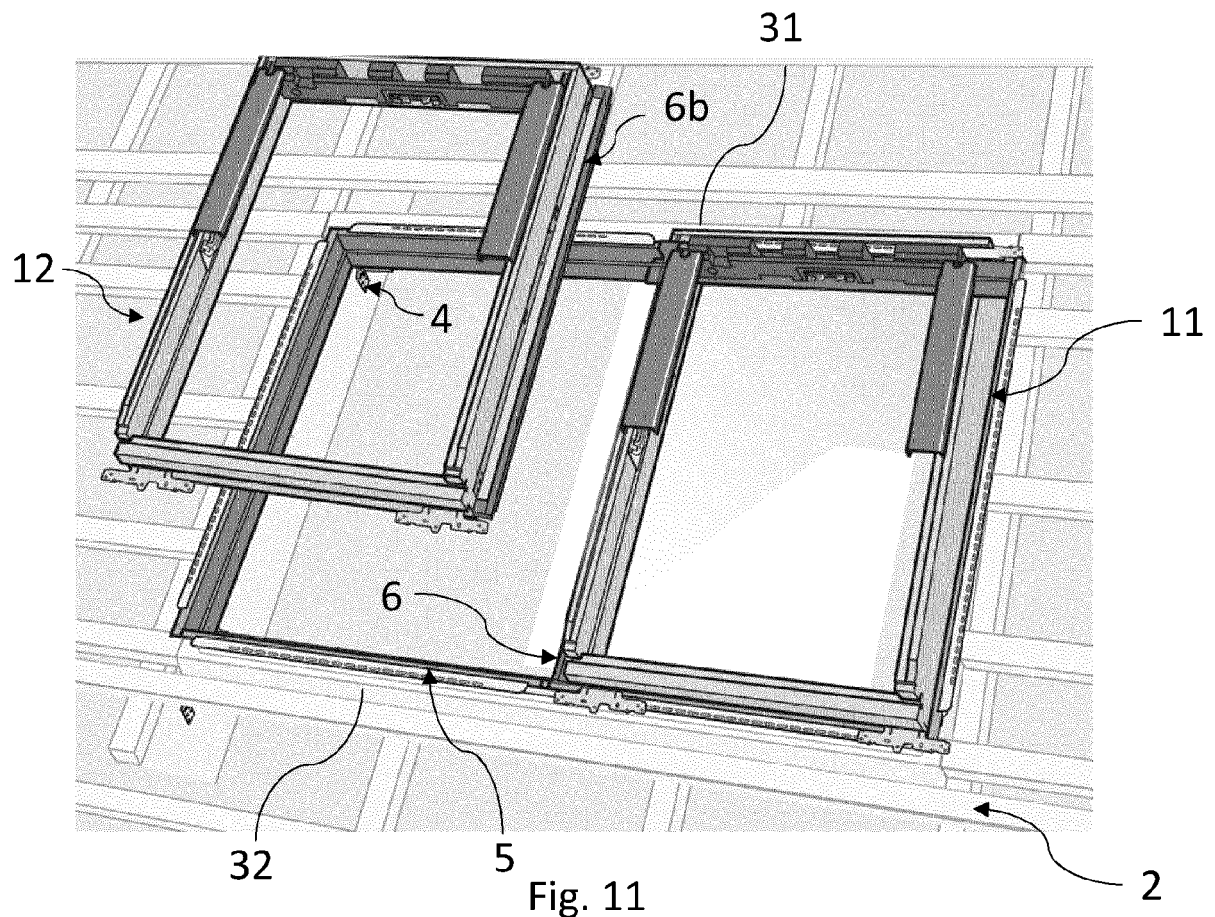


Fig. 10



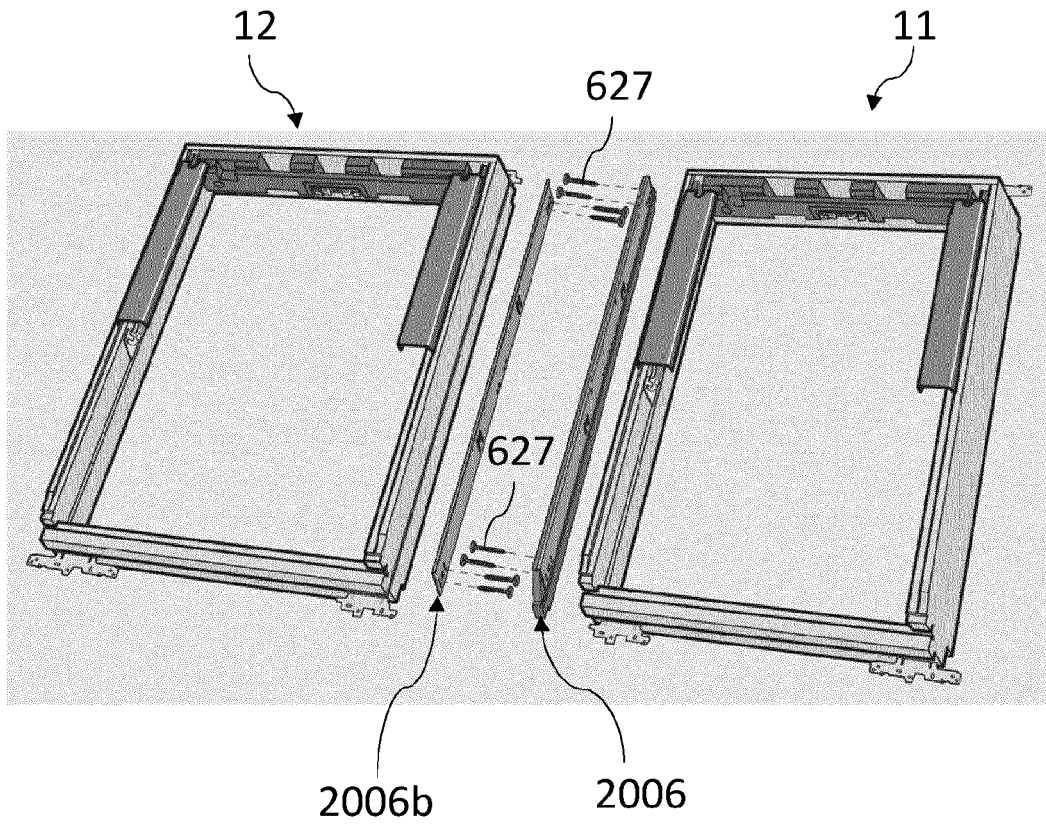


Fig. 13

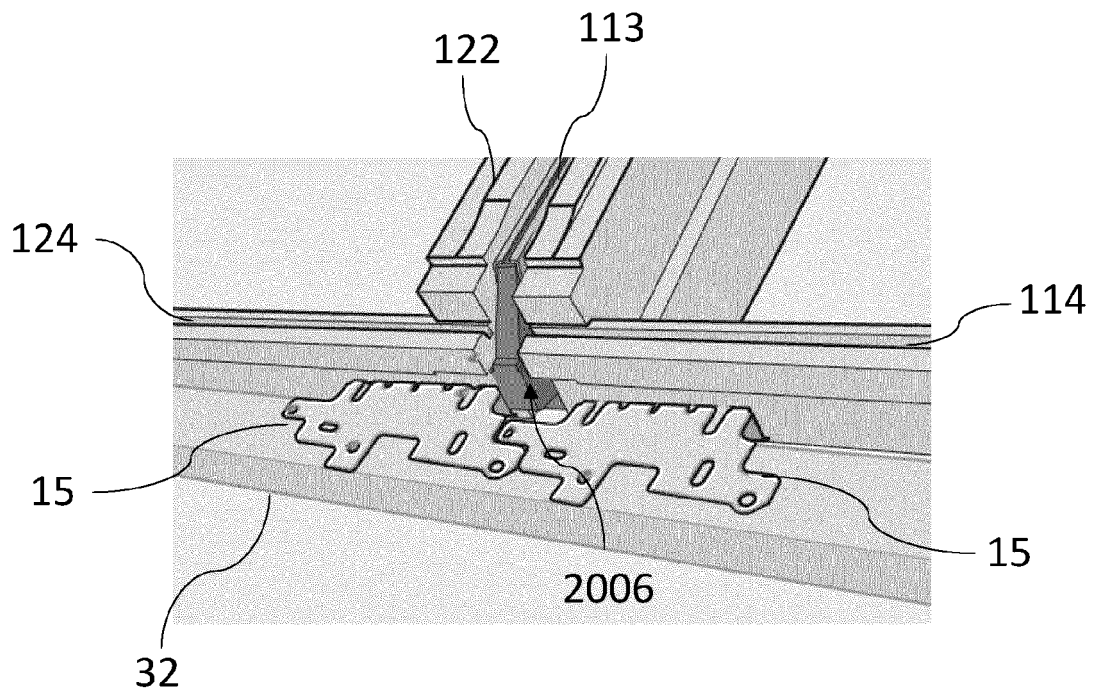


Fig. 14

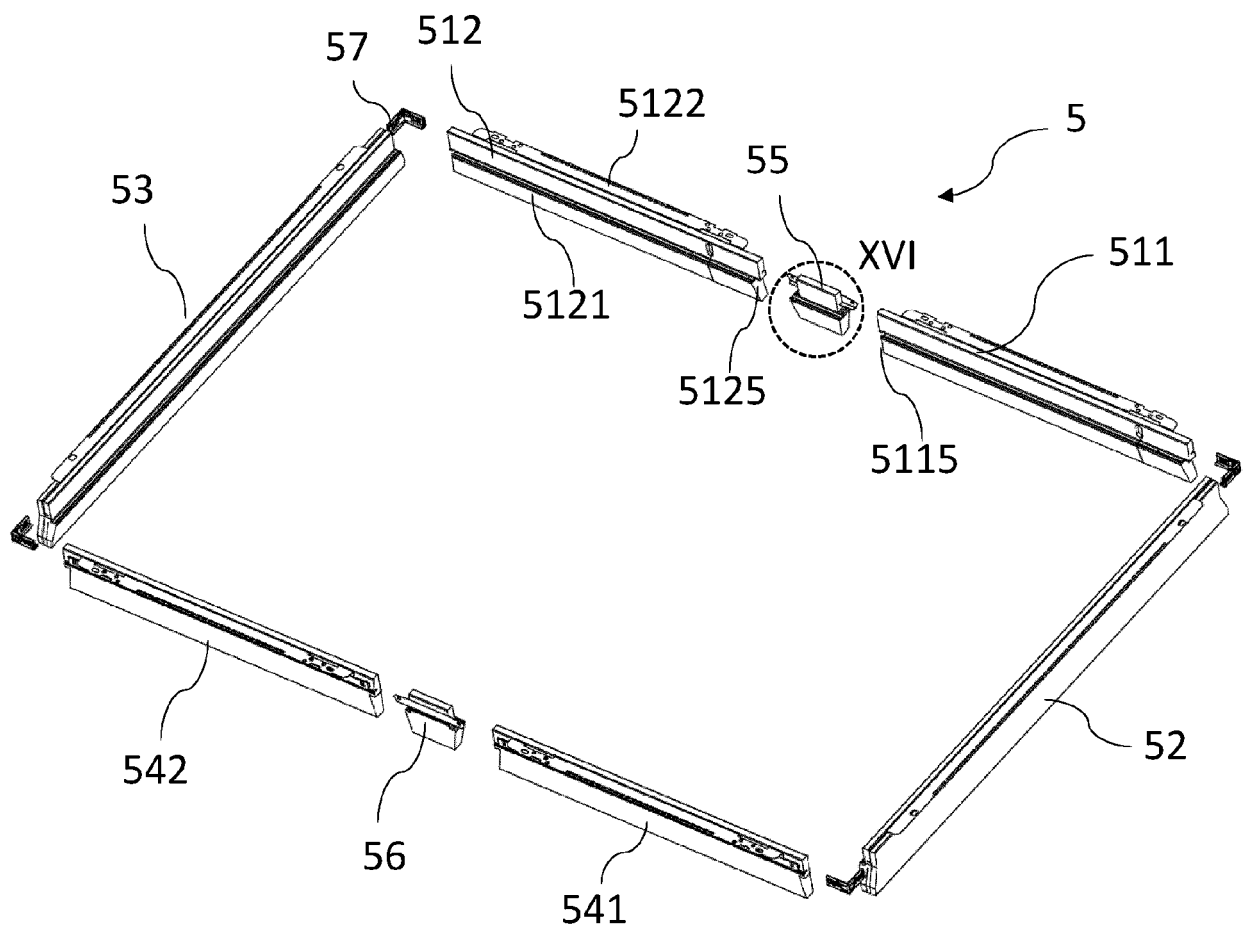


Fig. 15

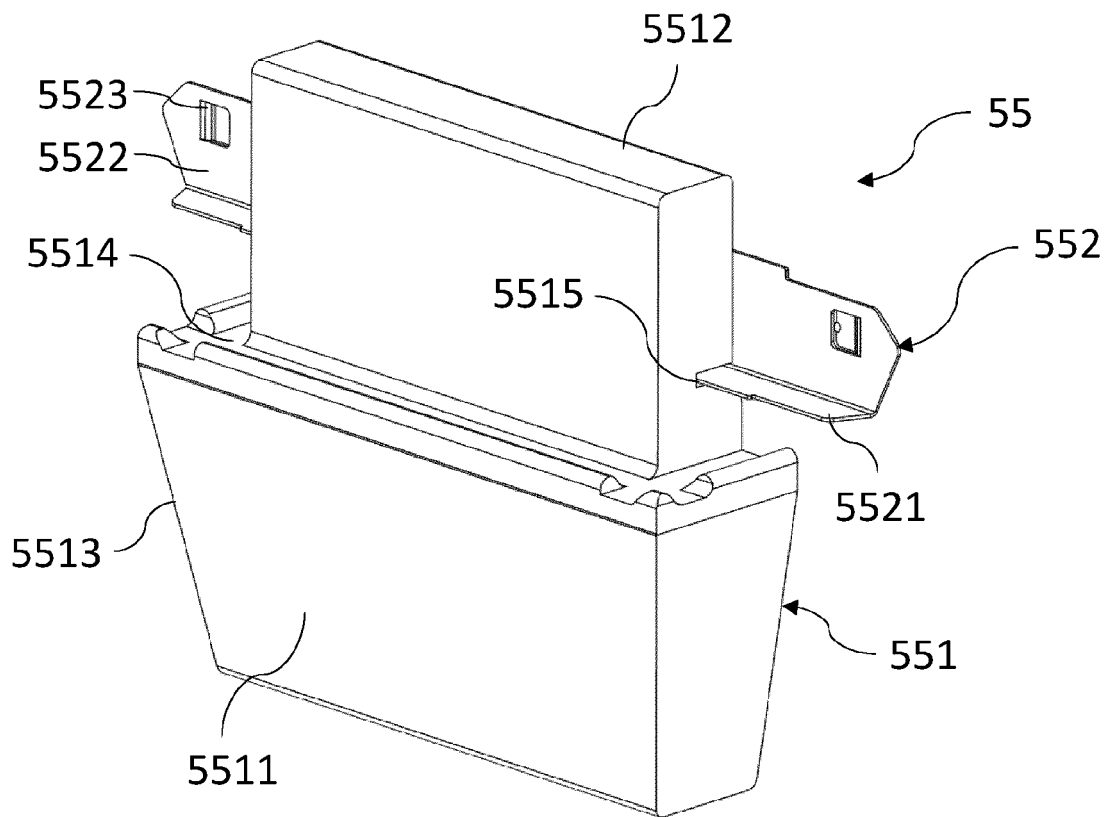


Fig. 16

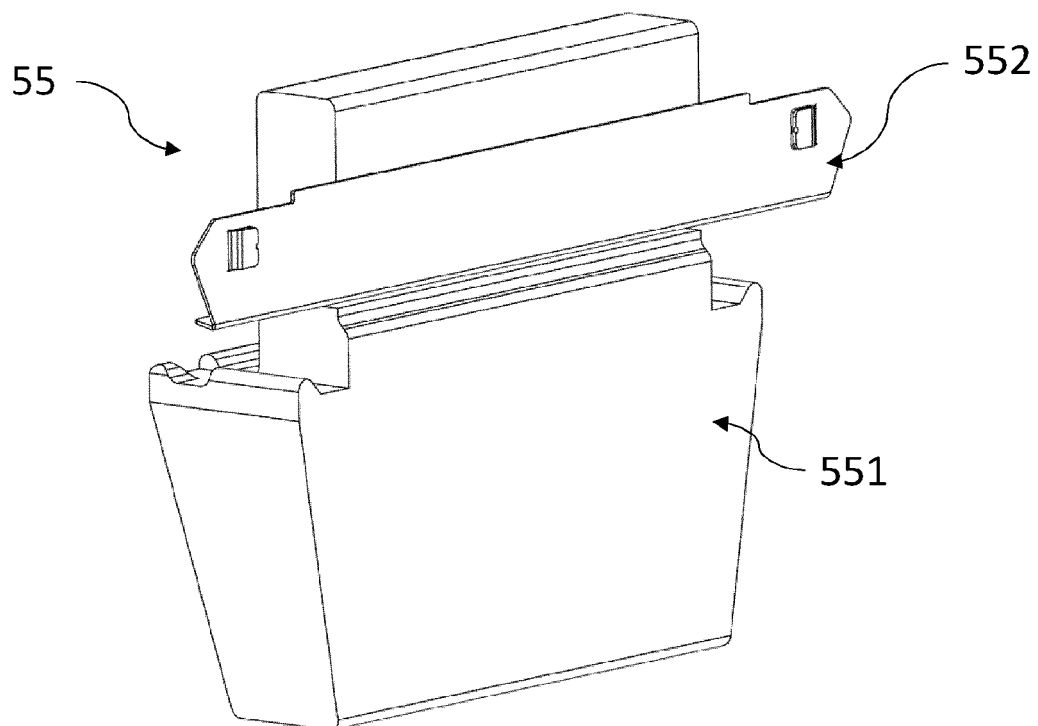


Fig. 17

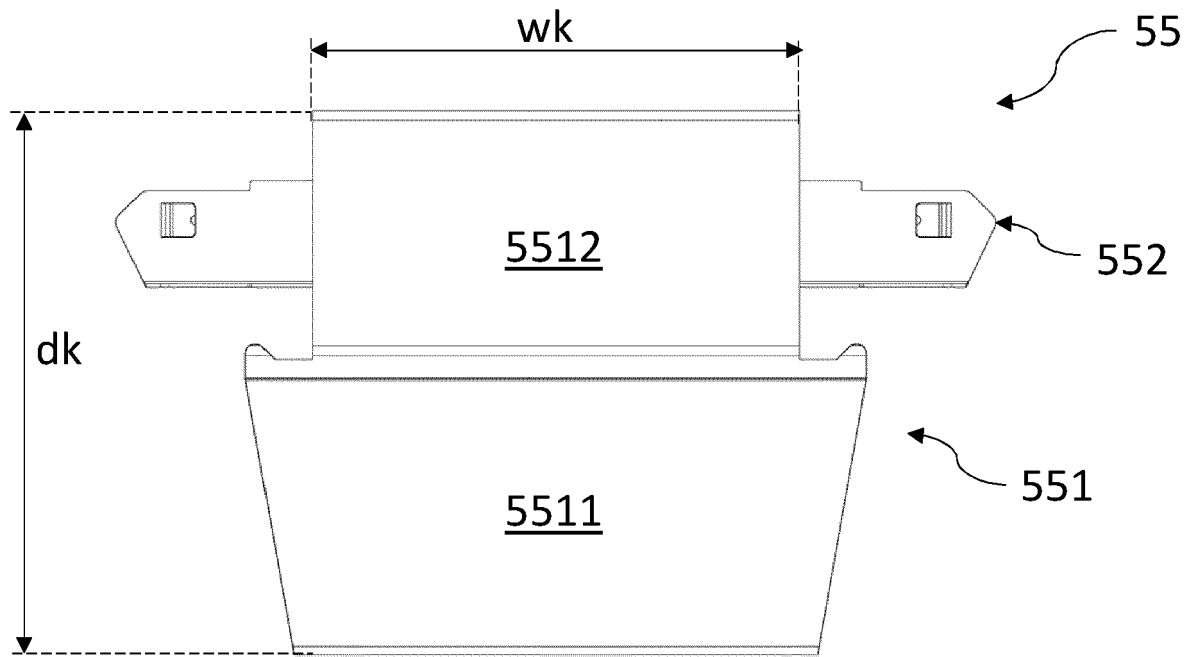


Fig. 18

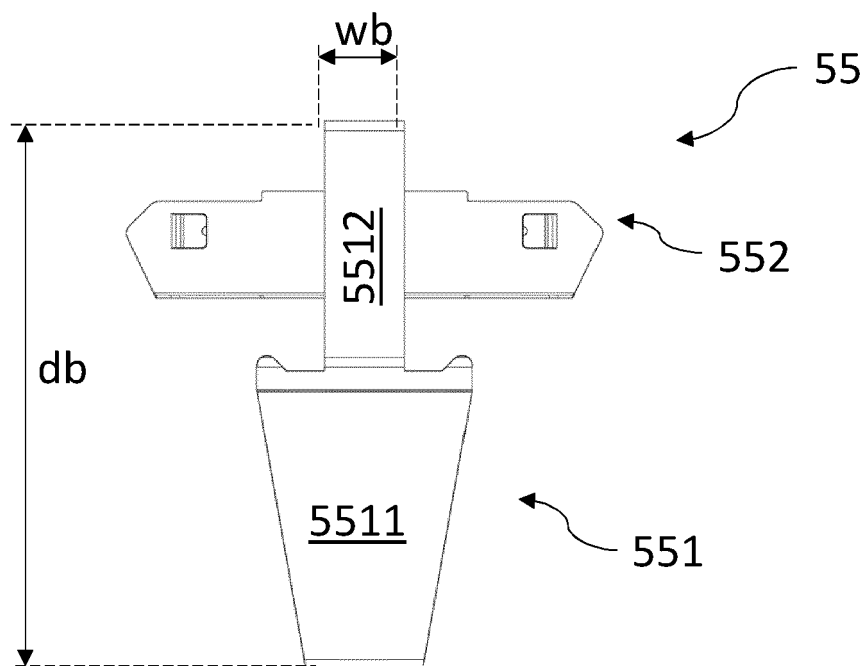


Fig. 19

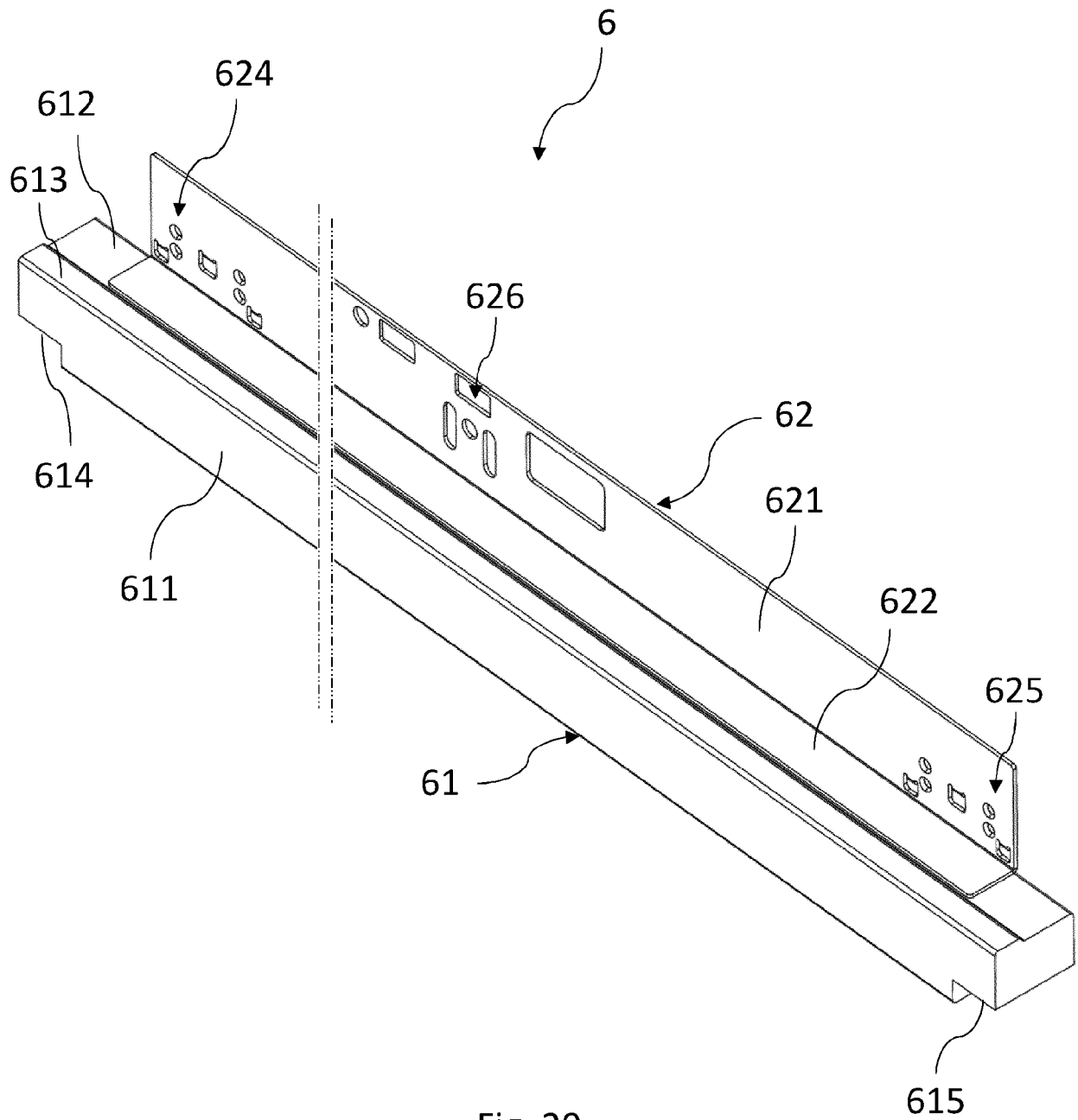


Fig. 20

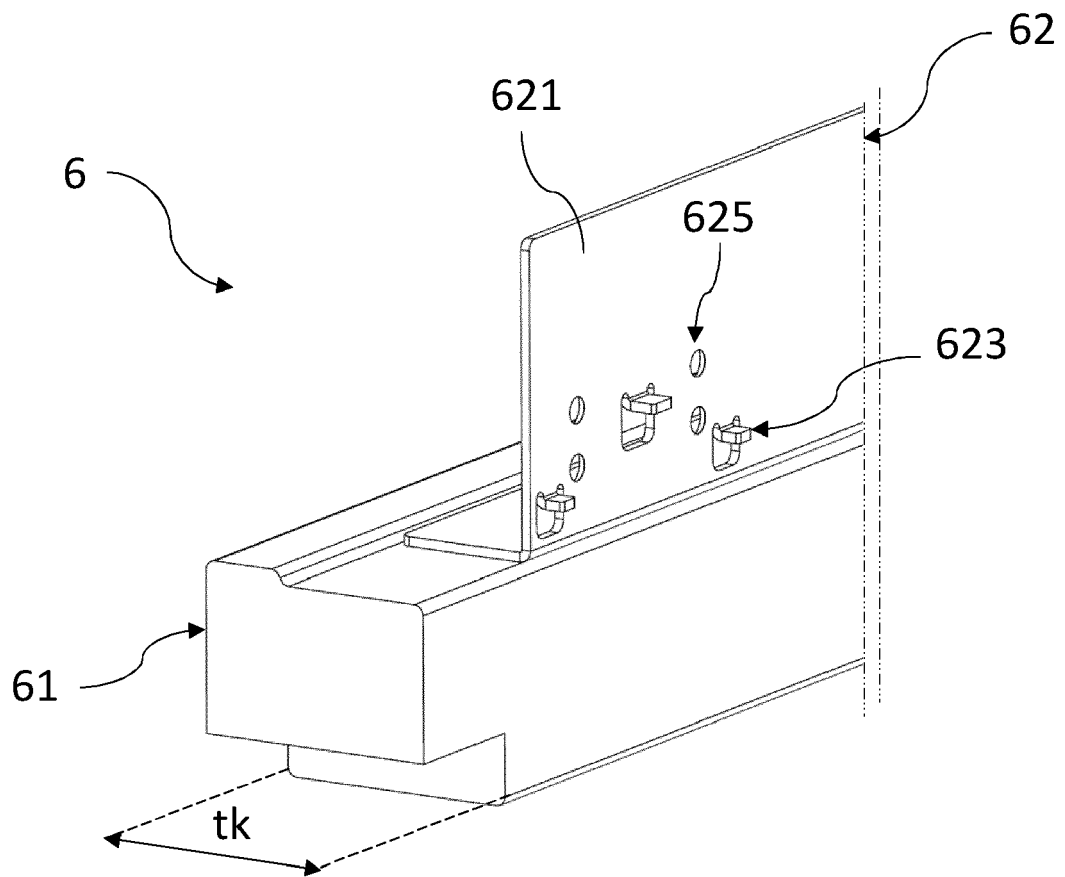


Fig. 21

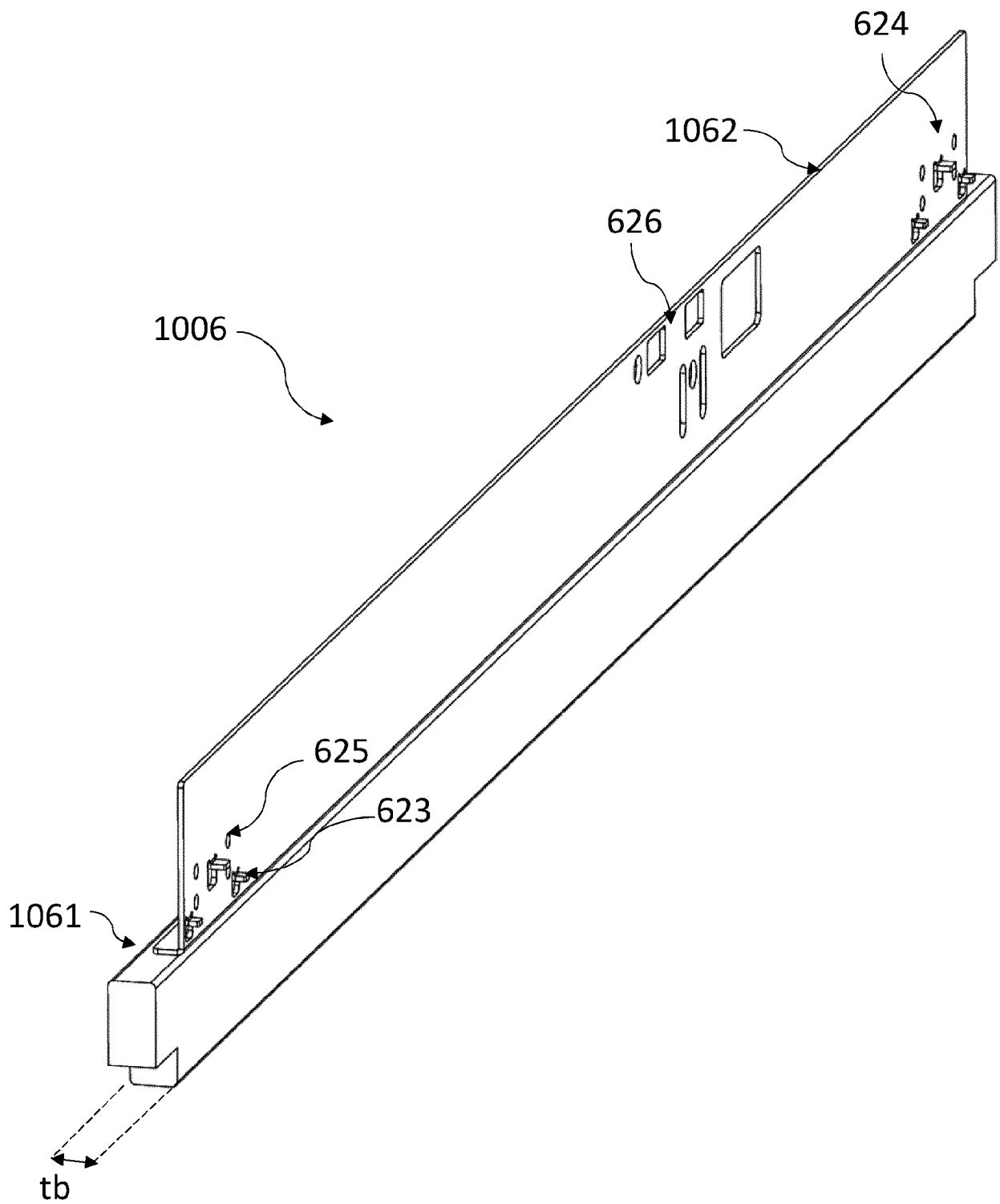


Fig. 22

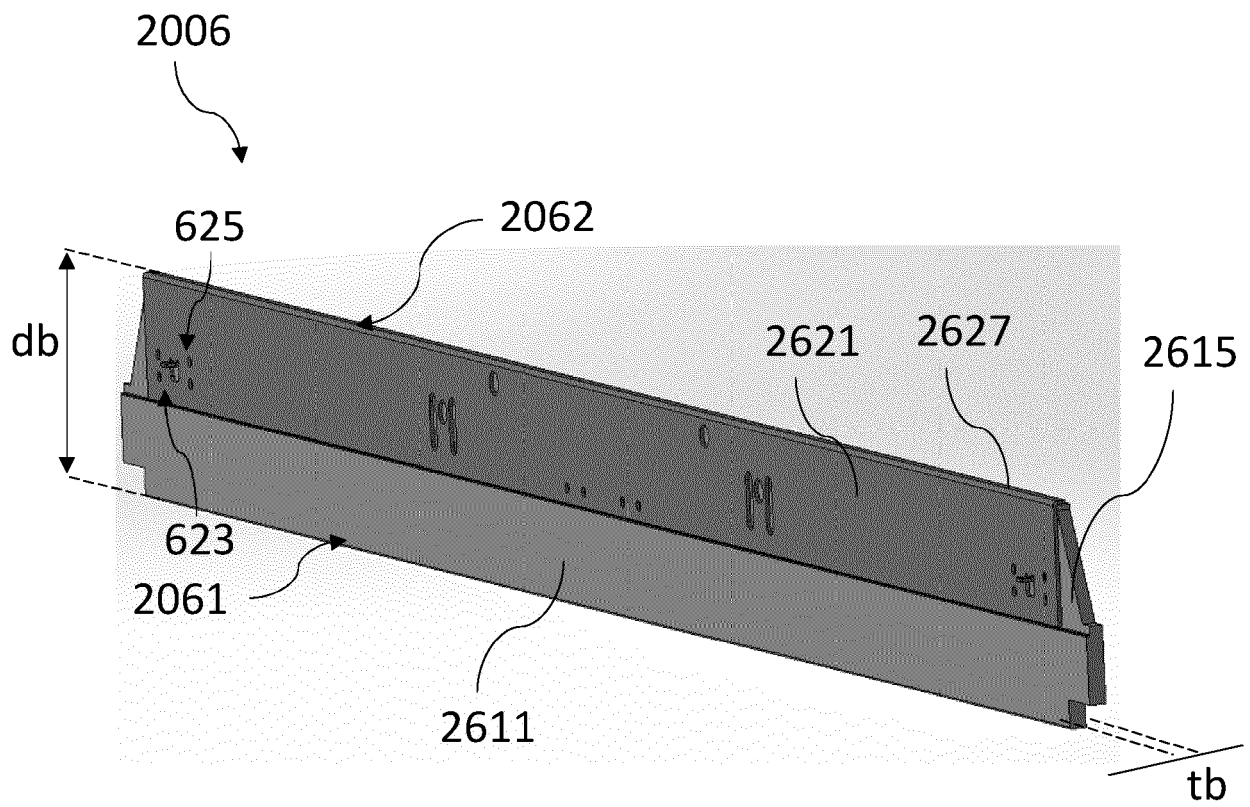


Fig. 23

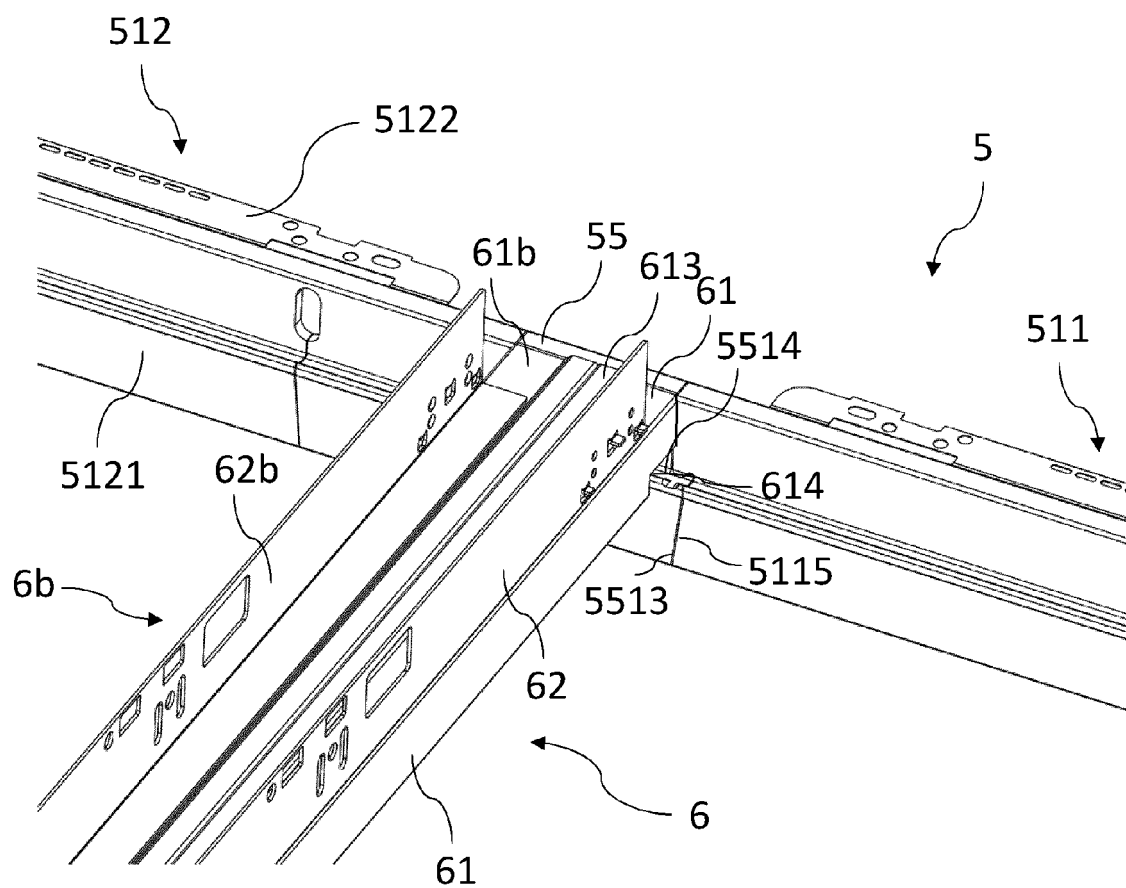


Fig. 24

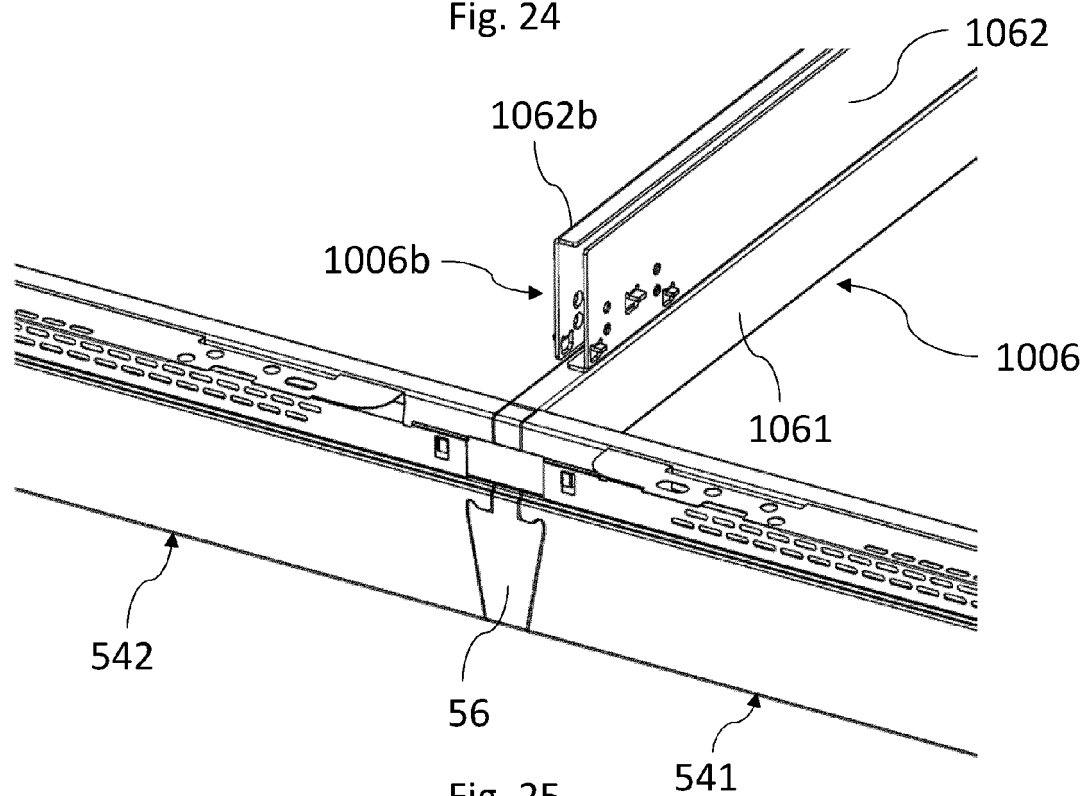


Fig. 25

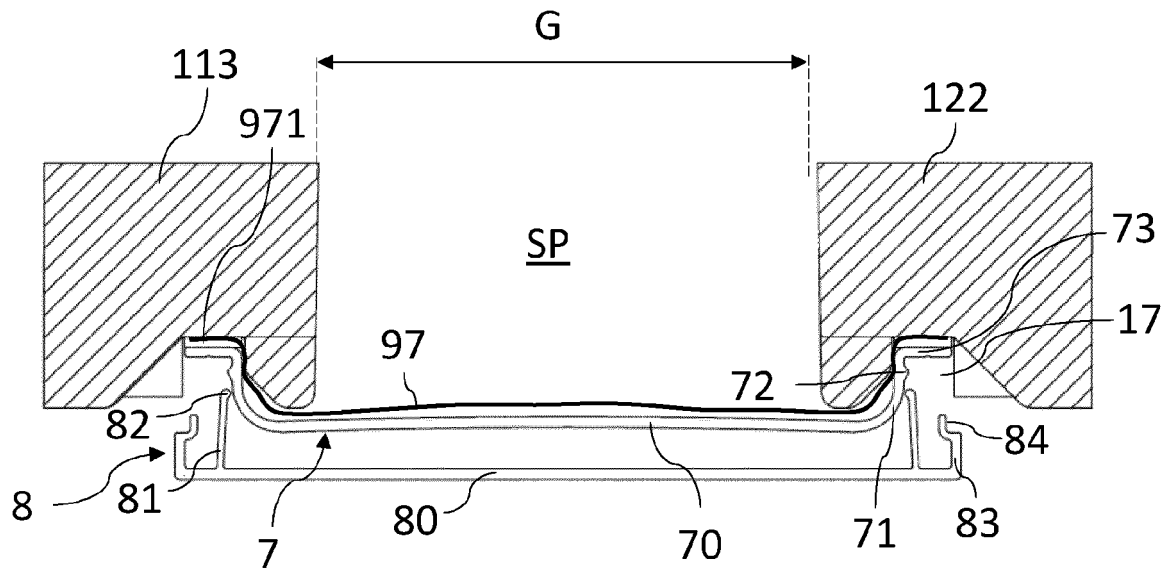


Fig. 26

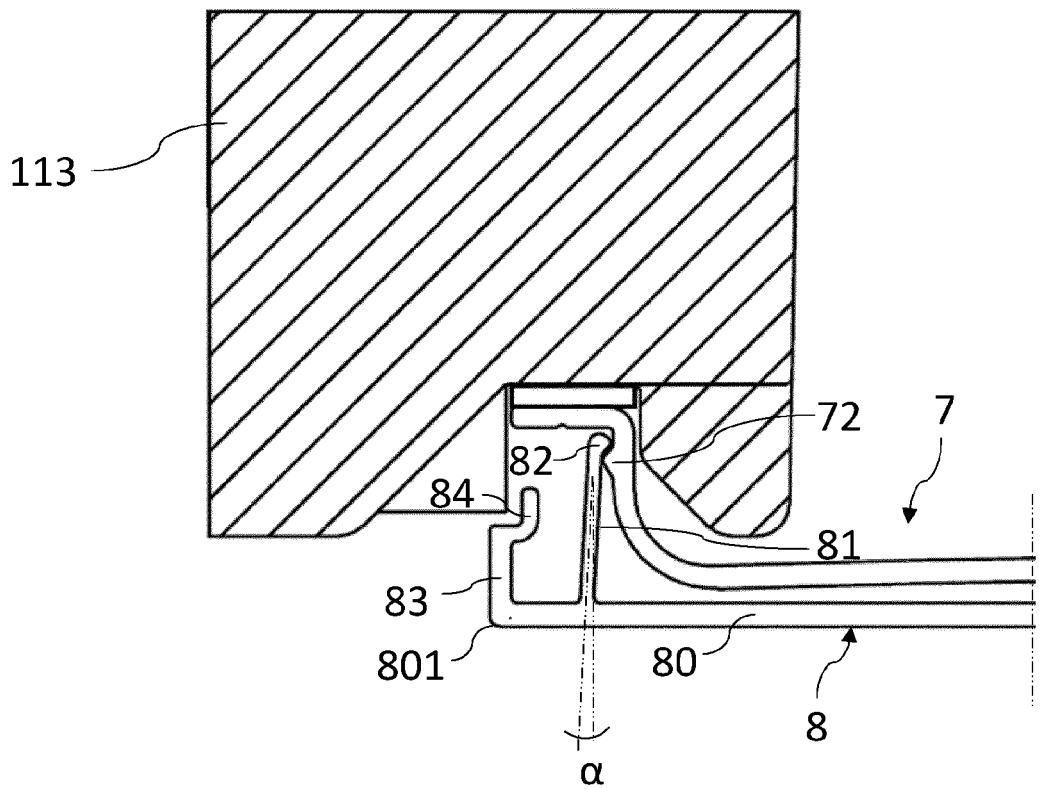


Fig. 27

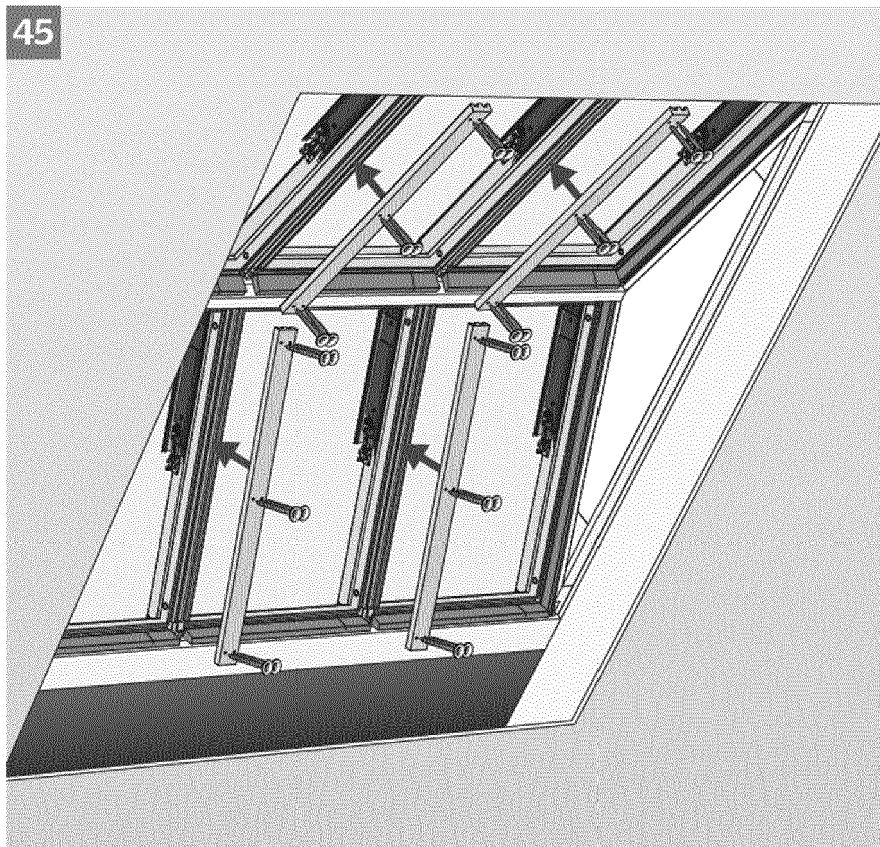


Fig. 28a (PRIOR ART)

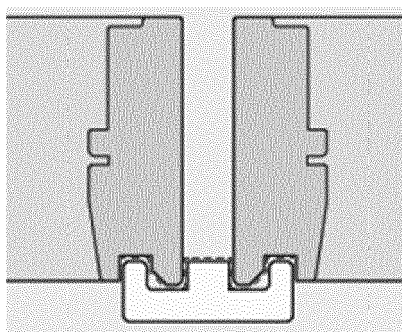


Fig. 28b (PRIOR ART)

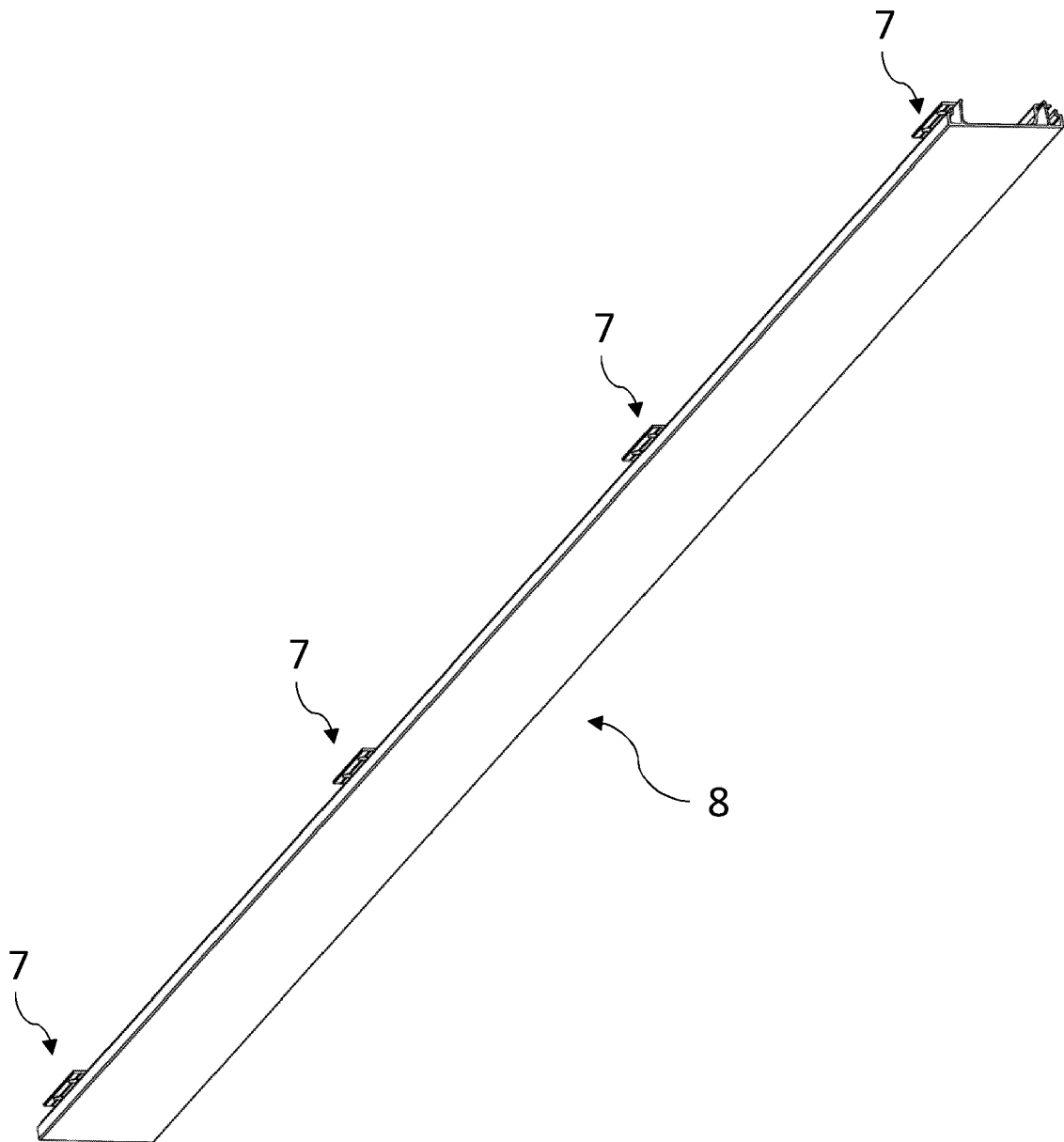


Fig. 29

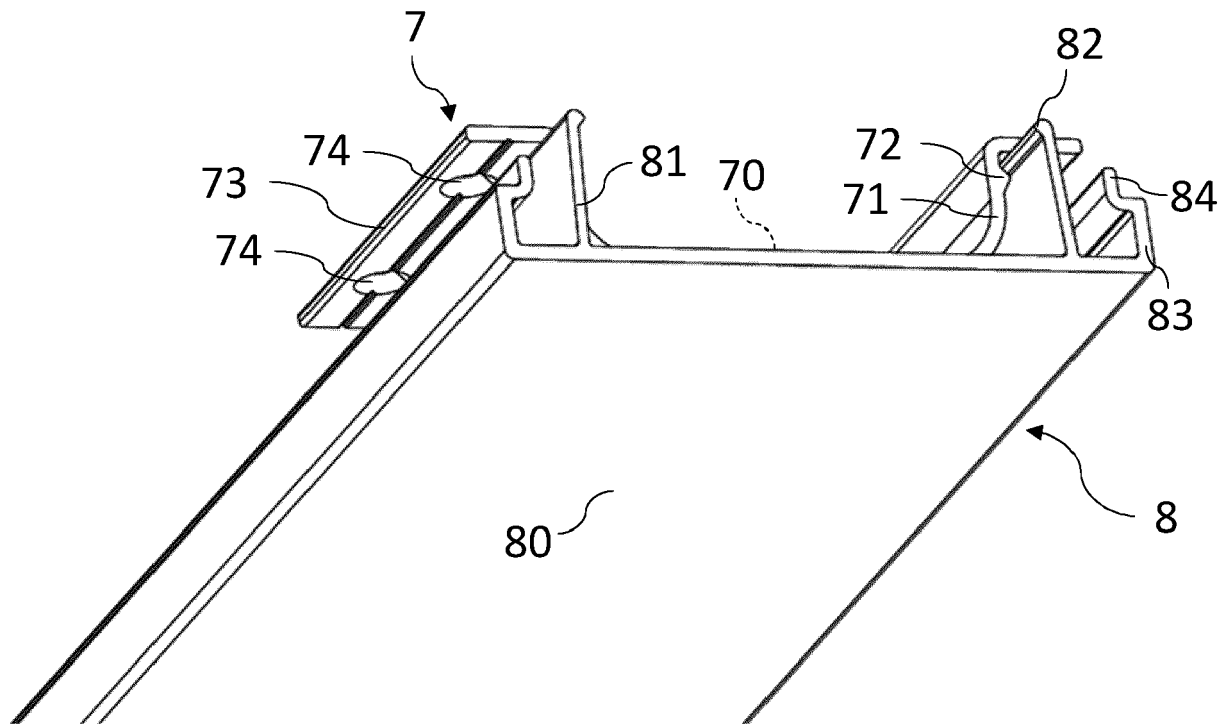


Fig. 30

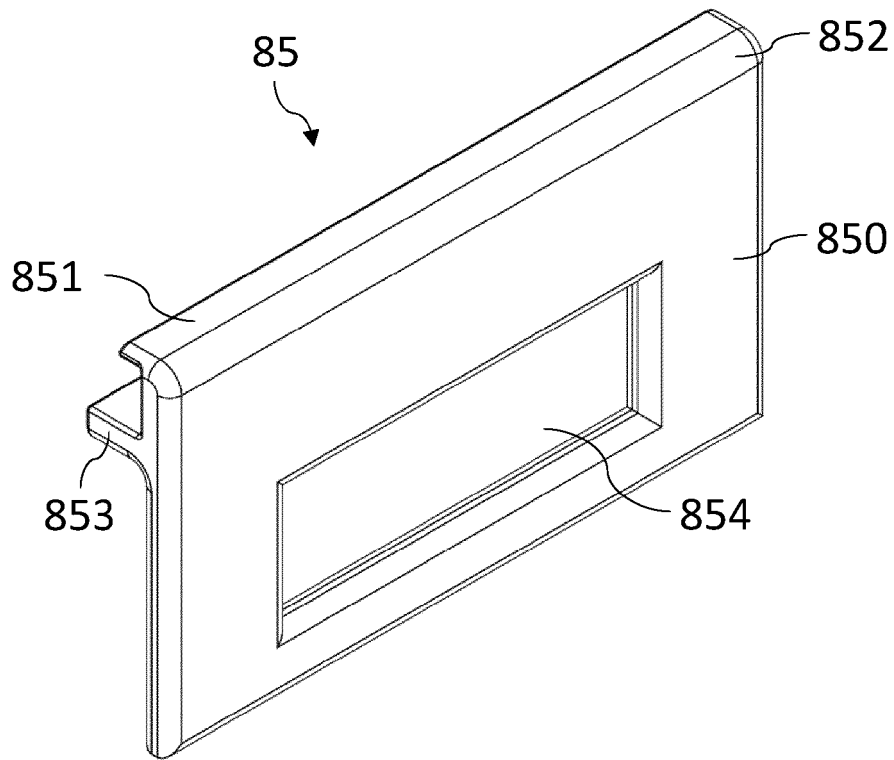


Fig. 31

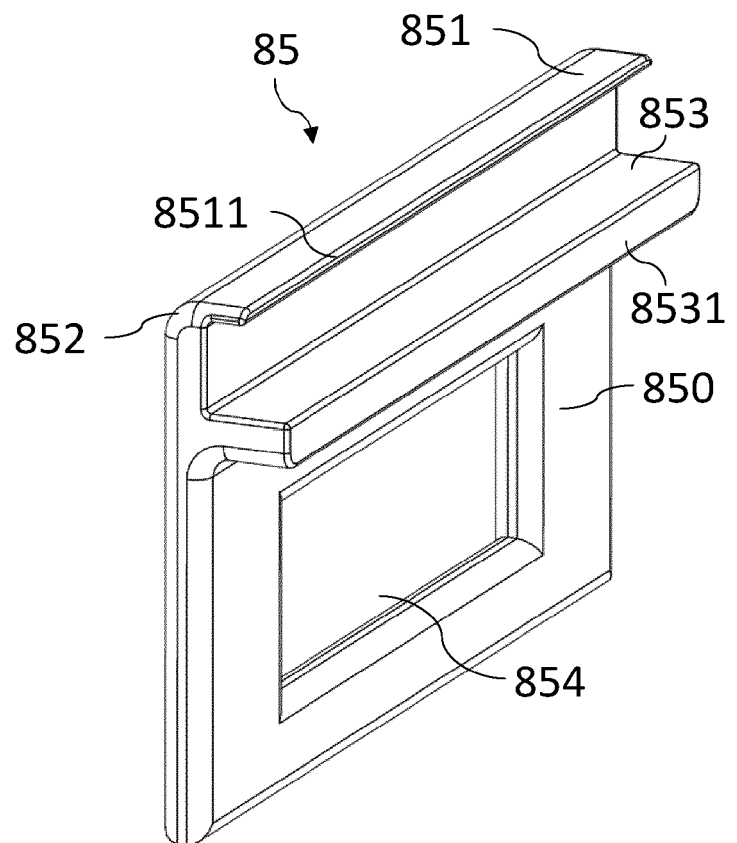
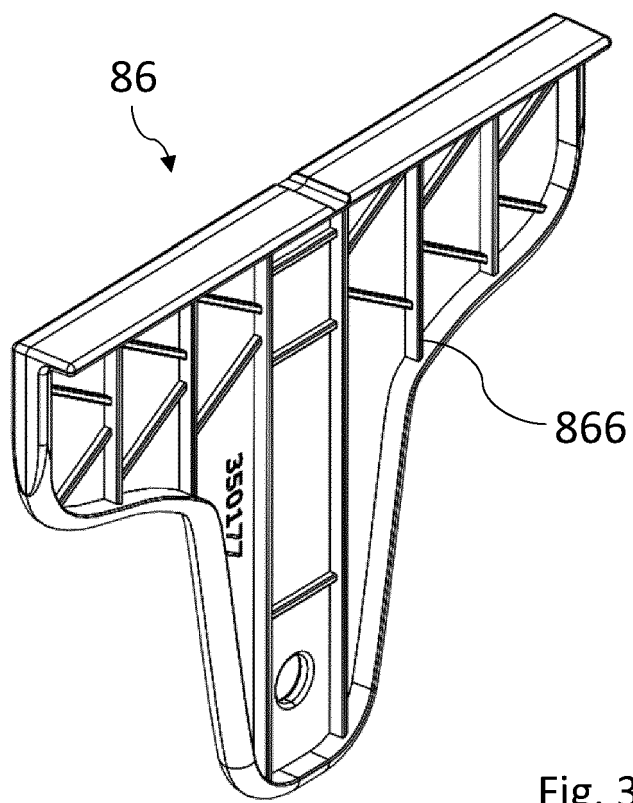
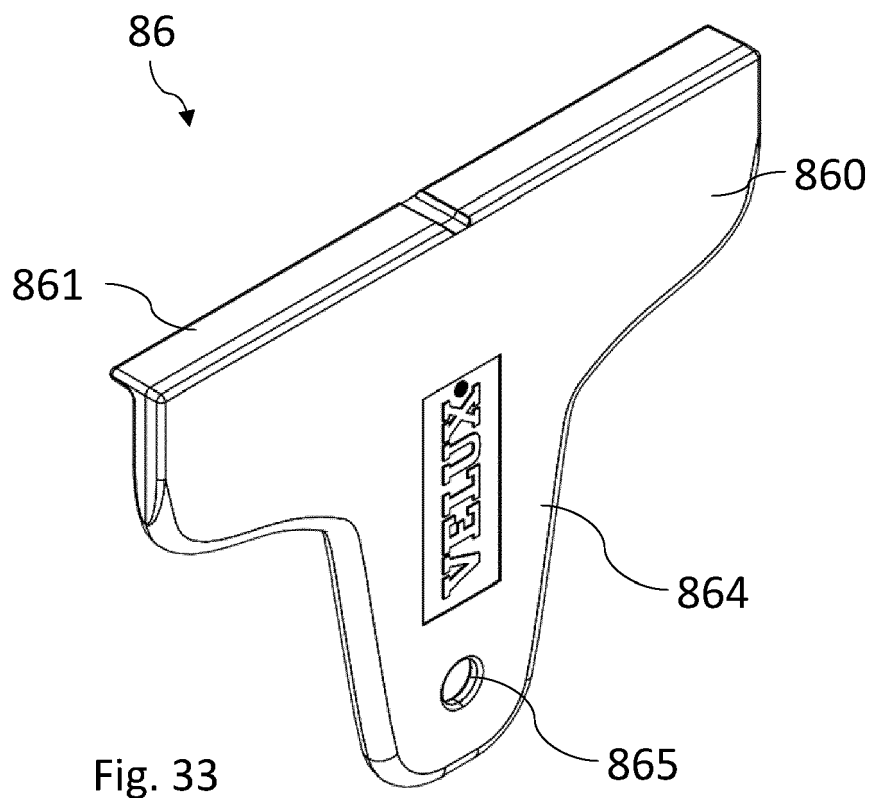


Fig. 32





EUROPEAN SEARCH REPORT

Application Number

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Y	* figures 1-3 *	3-5, 7, 10, 13	E04B1/26
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			E04D E04B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 3 May 2022	Examiner Leroux, Corentine
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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