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(54) **A ROOF WINDOW ARRANGEMENT COMPRISING A PLURALITY OF SASH STRUCTURES AND A COMMON FRAME, AND INCLUDING A COVERING ASSEMBLY, AND METHOD OF MANUFACTURING SUCH A ROOF WINDOW ARRANGEMENT**

(57) In the roof window arrangement, a plurality of window units (21, 22, 23) are arranged in a side-by-side configuration and a covering assembly (5) is provided. At least one covering (512, 513) associated to one window unit (22, 21, 23) is configured to function as a covering of that one window unit (22, 21, 23) and of a neighbouring window unit (21, 23, 22).

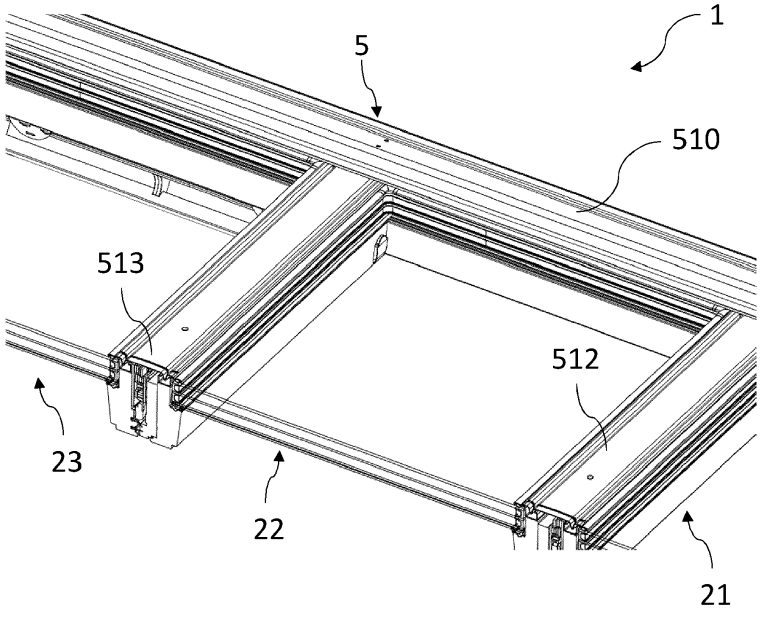


Fig. 12

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## Description

### Technical Field

**[0001]** The present invention relates to a roof window arrangement comprising a plurality of window units in a side-by-side configuration and a covering assembly including a set of coverings for each window unit, each window unit comprising at least one pane-carrying frame and a pane. The invention furthermore relates to a method of manufacturing a roof window arrangement.

### 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 published international application WO 2004/055291 A1 and 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, and/or the bottom frame member of the upper window unit is located adjacent to the top frame member of the lower 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.

**[0004]** In a more elaborate roof window arrangement, shown and described in Applicant's German utility model registration No. 20 2018 100 516 and European patent No. EP3406818B1. In the latter document, corresponding to commercial counterpart VELUX® Dormer, two rows of each three window units are connected to a respective frame structure positioned at an obtuse angle relative to each other such that the roof window arrangement protrudes from the roof surface.

**[0005]** The standard roof windows constituting the window units of the prior art roof window arrangements are installed with a relatively small distance between adjacent side frame members, typically about 18 mm, which leaves sufficient space for trimmers etc. Common to all of the above roof window arrangements is that the window units are protected from the weather by means of a covering assembly comprising a combination of flashing, cover and cladding elements which provide a weathertight transition to the surrounding roofing and ensure tightness around each window unit and between adjacent window units. Even though the prior art covering assemblies function well, they are dependent on a relatively large number of tailor-made components that must be manufactured, stored, transported, and assembled at the building site.

### Summary of Invention

**[0006]** With this background, it is therefore an object of the invention to provide a roof window arrangement which is more simple and cost-effective.

**[0007]** In a first aspect, this and further objects are achieved with a roof window arrangement of the kind mentioned in the introduction which is furthermore characterised in that at least one covering of a set of coverings associated to one window unit is configured to function as a covering of that one window unit and of a neighbouring window unit, that at least one window unit of the roof window arrangement comprises a pane-carrying frame in the form of an openable sash which opens about a hinge axis defined by a set of hinges, and that the set of coverings associated to each said at least one window unit comprises two side sash coverings to cover a lower portion of the sash from the hinges and downwards, preferably also a separate bottom sash covering, at least one of said side sash coverings being configured to function as a covering of a neighbouring window unit.

**[0008]** By providing a roof window arrangement with the above characteristics, a simpler configuration is achieved. Easier assembly of the roof window is provided, since fewer coverings need to be installed. With this configuration, multiple windows may be mounted easily as one. This leads to easier installation, as well as reduced manufacturing costs due to the fewer coverings required.

**[0009]** The configuration may lead to a flexible roof window arrangement, where the roof windows can open independently from each other. Furthermore, this solution may enable thinner frames which improve the aesthetic appearance of the window and do not obstruct the outdoor view. It may also improve the daylighting conditions inside the room as the net glazing area may be increased.

**[0010]** The provision of a separate bottom sash covering may allow for enhanced tightness of the system while retaining the flexibility in the construction of the roof window arrangement.

**[0011]** In an embodiment, at least one window unit may comprise at least one side frame covering configured to function as a covering of a neighbouring window unit. This facilitates the easier assembly of the roof window arrangement. The side frame covering may comprise a snap lock part, which may allow for an easy mounting providing a snap effect.

**[0012]** In another embodiment, three window units may be comprised including a first window unit with a

pane-carrying frame in the form of an openable sash with a top member, two side members, and a bottom member. A second window unit with a fixed pane-carrying frame with a top member may be comprised, two side members, and a bottom member, as well as a third window unit with a pane-carrying frame in the form of an openable sash with a top member, two side members, and a bottom member, such that the second window unit is positioned between the first window unit and the third window unit. This embodiment enables a compact arrangement of three windows.

**[0013]** Alternatively, the set of coverings associated to the second window unit may comprise two side frame coverings configured to function as a covering of the first window unit and the third window unit, preferably also a separate bottom pane-carrying frame covering. This minimizes the number of elements required for the roof window arrangement.

**[0014]** In an embodiment, the set of coverings associated to the first window unit and the third window unit each may comprise two side sash coverings, of which the one side sash covering closest to the second window unit may be configured to function as a covering of the second window unit. This helps achieve a flexible roof window arrangement, where openable and/or fixed windows may be enabled.

**[0015]** In another embodiment, the set of hinges of each of the first window unit and the third window unit may comprise two sash hinge parts connected to the respective openable sash. Two frame hinge parts may be provided on the second window unit to act as a respective counterpart to the sash hinge part of the first window unit and the third window unit, respectively. This provides a stable and robust arrangement. Other types of fasteners, such as latches, toggle clamps, case fittings, may also be comprised.

**[0016]** In an embodiment, a common frame may be provided to act as a single, stationary frame of all of the plurality of window units in side-by-side configuration, said common frame being configured to be built into a roof surface. Reduced manufacturing costs and frame profiles may be achieved due to the utilization of one single common frame for all the window units.

**[0017]** In an embodiment, the covering assembly may comprise a top casing and at least one side frame covering connected to the common frame.

**[0018]** Alternatively, the common frame may be provided with at least one frame hinge part for an openable window unit. This may allow for an openable window unit offering a flexible window solution.

**[0019]** In another embodiment, the covering assembly may comprise a top casing connected to the common frame and spanning all three window units, a first side frame covering and a fourth side frame covering connected to the common frame, a second side frame covering and a third side frame covering connected to the second window unit, and two side sash coverings connected to each of the first window unit and third window unit. Preferably each of the window units may be provided with a separate bottom sash or pane-carrying frame covering, more preferably also secondary side frame coverings and a secondary bottom frame covering. This embodiment may allow a more versatile solution with different possibilities of arranging the window units.

**[0020]** The side frame coverings may act as claddings to the side sash coverings. The side frame coverings may be fixed, while the side sash coverings may comprise an openable portion that is tilted.

**[0021]** In an embodiment, at least one tower fitting may be connected to the second window unit to provide support for the top casing. Each tower fitting may comprise at least one screw tower and engagement means to engage with the second window unit. Tower fittings allow for a stable and secure connection to the window units. The screw tower may fixate and orientate the tower fitting on the second window unit. In an alternative embodiment, the tower fitting is a snap anchor fitting configured to cooperate with a snap lock part connected to the top casing. Other types of fittings may also be used, such as simpler clips or locks. Alternatively, the tower fitting may comprise both a snap anchor fitting and a screw tower fitting.

**[0022]** In another embodiment, the second window unit may comprise two frame members connected to the pane-carrying frame.

**[0023]** In some embodiments, the two frame members of the second window unit may extend between the top and the bottom of the common frame, preferably such that each frame member has a surplus length relative to the pane-carrying frame in order to allow accommodation of an end portion within the common frame. This leads to a more stable and robust connection with the common frame.

**[0024]** In other embodiments, each tower fitting may comprise a base with two upstanding screw towers and the engagement means may comprise two legs depending from the base and configured to straddle a frame member of the second window unit, preferably also an opening in the base to allow the introduction of fastening means. An easier assembly of the window units may thus be achieved.

**[0025]** In an embodiment, at least one cap member may be connected to the second window unit to provide a sealing at the bottom of the second window unit and the neighbouring first window unit and third window unit. Each cap member may comprise at least one flange to form a transition between the second window unit and the respective neighbouring first window unit and third window unit and engagement means to engage with the second window unit. A more tight connection among the plurality of the window units is thus provided allowing for a safe roof window arrangement.

**[0026]** Alternatively, each cap member may comprise a base from which the flange protrudes, an end portion depending from the base, and wherein the engagement means may comprise a leg depending from the base, a shoulder portion configured to abut a frame member of

the second window unit, and a trough formed between an upstanding portion and the flange to interact with components of the second window unit. The components preferably may include a part of a bottom pane-carrying frame covering and a glazing bead. More preferably the cap member may comprise a first sealing portion and a second sealing portion configured to abut a frame member of the second window unit. This allows for a water tight arrangement, creating a sealing between the cap member and the window. The flange may allow the guidance of water away from the window. The flange may also be provided with a side wing, which may be formed as a protrusion being adjacent to the base. The side wing may create a seal between the cap member and the window and prevent water and/or wind from running and/or blowing into the construction along the flange. The flange may further comprise a front tower and/or a front wing, which may block water and/or wind from blowing into the construction. The cap member may also comprise a side tower being located adjacent to the second sealing portion, which may act as a wind breaker. The side tower may also act as a fixation between the cap member and the window improving the sealing. The cap member may comprise a top sealing flap, which may be provided adjacent to the upstanding portion. The top sealing flap may create a right angle with the upstanding portion and may comprise a guide tower. The guide tower may give stiffness to the top sealing flap and prevent wrong mounting of the gasket of the pane-carrying frame bottom member relative to the cap member. The cap member may comprise a side skirt extension adjacent to the leg, which may be dependent from the shoulder portion.

**[0027]** In another embodiment, a frame hinge part may be connected to a respective frame member of the second window unit to act as a respective counterpart to the sash hinge part of the first window unit and the third window unit, respectively. A frame hinge part may be connected to the common frame to act as a respective counterpart to the sash hinge part of the first window unit and the third window unit, respectively. Thus, a stable and robust connection between the neighbouring window units is provided.

**[0028]** In some embodiments, the ratio between a second thickness of the combined thicknesses of a side member of the pane-carrying frame and the associated frame member of the second window unit as defined between an edge of the pane and an outer circumference of the frame member, and a corresponding thickness of a side member of the sash of the neighbouring first window unit or third window unit may lie in the range 1.2 to 2, preferably between 1.25 and 1.75, more preferably around 1.5. Alternatively, the ratio may lie in the range 1 to 1.2.

**[0029]** In some embodiments, a distance between panes of neighbouring windows may lie in the range 50 to 100 mm, more preferably around 75 mm.

**[0030]** In another embodiment, the sum of the first thickness and the second thickness may be about 90 to 99% of the distance between the panes. The overall appearance of the roof window arrangement may be slimmer, enhancing the view towards the exterior.

**[0031]** In an embodiment, the second side frame covering and the third side frame covering connected to the second window unit each have a width which may be larger than a predefined width of the first side frame covering and a fourth side frame covering connected to the common frame, preferably about 20 to 100% larger, more preferably about 50% larger. The width may also be 10 to 20% larger.

**[0032]** In principle, the advantages of shared coverings apply to any number of juxtaposed window units, starting from only two and up to an entire array of for instance 10 window units. However, in a presently preferred embodiment, said plurality of window units comprises three window units including a first window unit with a pane-carrying frame in the form of an openable sash with a top member, two side members, and a bottom member, a second window unit with a fixed pane-carrying frame with a top member, two side members, and a bottom member, and a third window unit with a pane-carrying frame in the form of an openable sash with a top member, two side members, and a bottom member, such that the second window unit is positioned between the first window unit and the third window unit, wherein a common frame is provided to act as a single, stationary frame of all of the plurality of window units in side-by-side configuration, said common frame being configured to be built into a roof surface, and wherein the openable sash of the first window unit and of the third window unit, and the fixed pane-carrying frame of the second window unit are provided as substantially identical standard components, the second window unit comprising fixing means to fixate the pane-carrying frame to the common frame. Thus, in combination with the advantages of shared coverings, this embodiment provides for the additional advantage of using standard component sashes, together with a common frame. This has a positive impact on costs and resources for manufacture, storage, transport, and installation perspectives.

**[0033]** In a second aspect, a method of manufacturing a roof window arrangement is provided.

**[0034]** Other presently preferred embodiments and further advantages will be apparent from the subsequent detailed description and drawings.

## Brief Description of Drawings

**[0035]** In the following description embodiments of the invention will be described with reference to the schematic drawings, in which

Fig. 1 is an isometric view of a roof window arrangement in an embodiment of the invention;

Fig. 2 is a perspective view of a covering assembly in an embodiment of the roof window arrangement of the invention;

Fig. 3 is a perspective view, on a larger scale, of a top casing of the covering assembly of Fig. 2;
Fig. 4 is an isometric view of a frame of the roof window arrangement of Fig. 1;
Fig. 5 is an exploded isometric view of three window units of the roof window arrangement of Fig. 1;
Fig. 6 is a perspective view of a frame of a roof window arrangement in an embodiment of the invention;
Fig. 7 is a perspective view of a fixed window unit of a roof window arrangement in an embodiment of the invention;
Fig. 8 is a sectional view, on a larger scale, of the window unit of Fig. 7;
Fig. 9 is a sectional view, on a still larger scale, of the window unit of Figs 7 and 8 installed as a neighbouring window unit to an openable window unit of a roof window arrangement in an embodiment of the invention;
Fig. 10 is a perspective view of an openable window unit of a roof window arrangement in an embodiment of the invention;
Fig. 11 is a partial perspective view of another openable window unit of a roof window arrangement in an embodiment of the invention;
Fig. 12 is a partial perspective cross-sectional view of the upper part of the roof window arrangement in an embodiment of the invention;
Fig. 13 is a partial perspective view of the lower part of a roof window arrangement in an embodiment of the invention, with some details removed for clear reading;
Fig. 14a is an exploded partial perspective view of the roof window arrangement of Fig. 12, with some details removed for clear reading;
Fig. 14b is an end view of a side frame covering in an embodiment of the invention;
Fig. 15 is a partial perspective view of the upper part of a roof window arrangement in an embodiment of the invention, with some details removed for clear reading;
Fig. 16 is a partial perspective view, on a larger scale of the roof window arrangement of Fig. 15;
Fig. 17a is a perspective view, on a still larger scale, of a tower fitting of the roof window arrangement of Figs 15 and 16;
Figs 17b and 17c are perspective views of a tower fitting, from different angles, in an alternative embodiment of the invention;
Fig. 18 is a partial perspective view of the lower part of a roof window arrangement in an embodiment of the invention, with some details removed for clear reading;
Figs 19 and 20 are perspective views, from different angles, of a cap member of the roof window arrangement of Fig. 18;
Fig. 21 is a perspective sectional view of the lower part of a roof window arrangement in an embodiment of the invention; and
Figs 22 to 25 are perspective views, from different angles, of a cap member in alternative embodiments of the roof window arrangement according to the invention;
Fig. 26 is a partial perspective view of the lower part of a roof window arrangement in an embodiment of the invention, with some details removed for clear reading; and
Fig. 27 is a partial perspective view, on a still larger scale, of a detail of the roof window arrangement of Fig. 26.

## Description of Embodiments

**[0036]** In the figures of the drawings, embodiments of a roof window arrangement according to the invention are shown.

**[0037]** Referring initially to Fig. 1, a roof window arrangement 1 is presented, comprising a plurality of window units 21, 22, 23 configured side-by-side, and as seen from the interior of a room of a building with a roof surface (not shown), in which the roof window arrangement 1 is installed. In the embodiment shown, three window units 21, 22, 23 are present, but other configurations are conceivable. For instance, two window units or any other number may be provided in the roof window arrangement. Each window unit 21, 22, 23 comprises a pane-carrying frame 211, 221, 231 and a pane 214, 224, 234. A common frame 10 acts as a single, stationary frame of all of the plurality of window units 21, 22, 23 in side-by-side configuration. The common frame 10 is configured to be built into the roof surface and connected to the underlying roof structure by means of a set of fittings represented by mounting bracket 3.

**[0038]** A covering assembly generally designated 5 is shown as well. The covering assembly 5 provides covering for each window unit as will be described in further detail below.

**[0039]** Fig. 2 shows an embodiment of the covering assembly 5. The covering assembly 5 may be used in the roof window arrangement 1 of Fig. 1. In the embodiment shown, the covering assembly 5 comprises a top casing 510, a first side frame covering 511, a second side frame covering 512, a third side frame covering 513, and a fourth side frame covering 514. Furthermore, four side sash coverings 5211, 5212, 5231, 5232 are provided, and three separate bottom sash or pane-carrying frame covering 5213, 5223, 5233 in the embodiment shown. The covering assembly 5 may comprise further elements as well, including secondary frame coverings, and flashing elements.

**[0040]** Referring now also to Figs 3 to 20, the top casing 510 of the covering assembly 5 in the embodiment shown is configured to be connected to a frame top member 11 of the common frame 10 and spanning all three window units 21, 22, 23 in the mounted condition. The first side frame covering 511 is connected to one frame side member 12 and the fourth side frame covering 514 is connect-

ed to another frame side member 13 of the common frame 10. A frame top member 11 extends between the frame side members 12, 13 at the top of common frame 10 as defined by the mounted condition of the roof window arrangement 10, and a frame bottom member 14 at the bottom.

**[0041]** The dimensions of the window units forming part of the roof window arrangement may be chosen in accordance with specific installation conditions, including the area of the room of the building, the available roof surface etc. In the below configuration with three window units, the overall outer measures of the common frame amount to a width wf of ca. 1840 mm and a height hf of 1180 mm, whereas three windows having the same size panes would have required a combined width about 2160 mm. Thus, the same pane area requiring only about 85% of the width of three windows installed side-by-side.

**[0042]** In another configuration, a roof window arrangement comprising two window units having a larger individual width is considered; whereas two ordinary roof windows built in side-by-side would have required a combined width of 1740 mm, a roof window arrangement according to the invention would require only about 1496 mm, thus amounting to about 86% of width of two ordinary roof windows.

**[0043]** In the embodiment shown in these figures, the three window units 21, 22, 23 have the following configuration:

**[0044]** The first window unit 21 has a pane-carrying frame in the form of an openable sash 211 with a top member 2111, two side members 2112 and 2113, and a bottom member 2114, the second window unit 22 has a fixed pane-carrying frame 221 with a top member 2211, two side members 2212, 2213, and a bottom member 2214, and a third window unit 23 has a pane-carrying frame in the form of an openable sash 231 with a top member 2311, two side members 2312 and 2313, and a bottom member 2314. The second window unit 22 is positioned between the first window unit 21 and the third window unit 23.

**[0045]** The openable sash 211, 231 of the first and third window units 21 and 23 opens about a hinge axis $\alpha$ (shown in Fig. 10) defined by a set of hinges 212, 213, 232, 233. The hinges may be of any suitable kind, here shown as pivot hinges as for instance disclosed in Applicant's EP 1 038 083 B1, EP 1 781 883 B1, EP 2 770 146 A1 and EP 2 770 149 A1, or as a so-called pantograph hinge as described in Applicant's -pending international application WO 2017/076416 A1. The set of hinges of each of the first window unit 21 and the third window unit 23 comprises two sash hinge parts 212, 213, 232, 233 connected to the respective openable sash 211, 231.

**[0046]** In the embodiment shown, the openable sash 211, 231 of the first window unit 21 and the third window unit 23 and the fixed pane-carrying frame 221 of the second window unit 22 are provided as substantially identical standard components. In order to provide the openable functionality of the first and third window units, and to increase the stability of the common frame, the second window unit 22 comprises fixing means to fixate the pane-carrying frame 221 to the top member 11 and the bottom member 14 of the common frame 10.

**[0047]** The second side frame covering 512 and the third side frame covering 513 are connected to the second window unit 22 as shown in Fig. 7, and two side sash coverings 5211, 5212 and 5231, 5232 are connected to a respective one of the first window unit 21 and third window unit 23. Each of the window units 21, 22, 23 is provided with a respective separate bottom sash or pane-carrying frame covering 5213, 5223, 5233.

**[0048]** At least one of the side frame coverings 512, 513, 5212, 5231 of a set of coverings associated to one window unit 22, 21, 23 functions as a covering of that one window unit 22, 21, 23 and of a neighbouring window unit 21, 23, 22. All in all, four coverings are used rather than six (three times two) for each of the side sash coverings and the side frame coverings.

**[0049]** In the embodiment shown, the set of coverings associated to each window unit 21, 23 comprises two side sash coverings 5211, 5212 and 5231, 5232 to cover a lower portion of the respective sash 211, 231 from the hinges and downwards. A separate bottom sash covering 5213, 5233 is also shown. The side sash coverings 5211, 5212 and 5231, 5232 are configured to function as a covering of a neighbouring window unit, here of the second window unit 22 interposed between the first window unit 21 and the third window unit 23.

**[0050]** The covering assembly 5 here also comprises secondary side frame coverings 531, 532 and a secondary bottom frame covering 533. As mentioned in the above, flashing elements (not shown) may be provided to ensure a weather-tightness transition to the surrounding roofing.

**[0051]** In the embodiment shown, the fixing means of the second window unit 22 comprises two frame members 225, 226 connected to the pane-carrying frame 221. The two frame members 225, 226 of the second window unit 22 extend between the top and the bottom of the common frame 10, such that each frame member 225, 226 has a surplus length relative to the pane-carrying frame 221 in order to allow accommodation of an end portion within the common frame 10.

**[0052]** The frame hinge part 222, 223 is connected to a respective frame member 225, 226 of the second window unit 22 to act as a respective counterpart to the sash hinge part 213, 232 of the first window unit 21 and the third window unit 23, respectively. A frame hinge part 112, 113 is connected to the respective side members 12, 13 of the common frame 10 to act as a respective counterpart to the sash hinge part 212, 233 of the first window unit 21 and the third window unit 23, respectively.

**[0053]** With particular reference to Fig. 9, it is illustrated how the window unit of Figs 7 and 8 is installed as a neighbouring window unit to an openable window unit of a roof window arrangement. The ratio t2 : t1 between a

second thickness t2 of the combined thicknesses of a side member 2213 of the pane-carrying frame 221 and the associated frame member 225 of the second window unit 22 which is defined as between an edge of the pane 224 and an outer circumference of the frame member 225, and a corresponding thickness t1 of a side member 2312 of the sash 231 of the neighbouring first window unit or third window unit 23 lies in the range 1.2 to 2. The most preferred values of this range are between 1.25 and 1.75, and even more preferably around 1.5. A distance dp between panes 224, 234 of neighbouring windows lies in the range 50 to 100 mm, more preferably around 75 mm. The sum of the first thickness t1 and the second thickness t2 is about 90 to 99% of the distance dp between the panes

**[0054]** As shown in Fig. 12 and Fig. 14b, the second side frame covering 512 and the third side frame covering 513 connected to the second window unit 22 both have a width which is larger than a predefined width of the first side frame covering 511 and a fourth side frame covering 514 connected to the common frame 10. This width is preferably about 20 to 100% larger, more preferably about 50% larger.

**[0055]** In principle, these side frame coverings 512, 513 may take any suitable shape. However, for practical and aesthetic reasons, a substantially symmetrical design is preferred, for instance as shown in more detail in Fig. 14b, in which the side frame covering 512 is shown with a centre portion 5120 and a right-hand and a left-hand groove 5121 and 5122, respectively, which are located near the edge of the respective pane of the first and second window units 21 and 22. A snap lock part 5123 is fastened to the underside of the side frame covering 512. The snap lock part 5123 may for instance be formed as in the embodiment of Applicant's international published application WO 2013/050043 A1. It is noted that such snap lock parts may be provided also on other components of the covering assembly 5.

**[0056]** Correspondingly, the gasket present at the sides of the window units could have an increased width relative to the gasket width of an ordinary window. This applies in particular to the gaskets present at the sides of the second window unit 22, which are exposed when the sash of the respective first and/or third window units 21 and 23 are open. In Fig. 7, an extra-wide gasket 2252 is indicated on the frame member 225 of the second window unit 22. Further details of this gasket are shown in Figs 26 and 27.

**[0057]** Referring to Figs 13 and 14a, details of the fixing of the second window unit 22 to the common frame 10 will be described. The frame top member 11 is provided with two apertures 1021 and 1022 to receive the frame members 225 and 226 (not visible in Fig. 14). Here, frame member 225 comprises a protrusion 2251. Other details in Fig. 14a include a striking plate 103 for cooperating with locking means (not shown) of the first window unit 21, and an insulating element 109. These measures are well known to the skilled person. At the bottom of the roof window arrangement 1, similar or other fixing means may be present. In the embodiment shown, spacers 1023 are provided on the frame bottom member 14 for abutment of the bottom member 2214 in the mounted condition.

**[0058]** Returning again to the covering assembly, Fig. 15 illustrates the upper part of the roof window arrangement, wherein a set of tower fittings 54 is connected to the second window unit 22 to provide support for the top casing 510.

**[0059]** As illustrated in Fig. 17a, each tower fitting 54 comprises one screw tower 544, 545 and engagement means 542, 543, 546 to engage with the second window unit 22. Each tower fitting 54 comprises a base 541 with two upstanding screw towers 544, 545 and the engagement means comprise two legs 542, 543 depending from the base 541 and configured to straddle a frame member 225, 226 of the second window unit 22, and an opening 546 in the base 541 to allow the introduction of fastening means as shown in Fig. 16.

**[0060]** An alternative tower fitting 54 is shown in Figs 17b and 17c, in which a snap anchor tower 547 is provided. The snap anchor tower 547 is configured to cooperate with a snap lock part (not shown) fastened to the top casing 510. The snap lock part may for instance have a configuration corresponding to the snap lock part 5123 connected to the side frame covering 512 of Fig. 14b. A set of tower fittings 54 and snap lock parts may be arranged over the width of the roof window arrangement. The tower fitting 54 of Fig. 17b has a base 541 intended to abut a window unit of the roof window arrangement. In the embodiment shown, one tower fitting 54 is intended to abut the frame member 225, 226 of the second window unit 22, but additional or alternative positions are conceivable. An opening 546 is provided in the base 541 for receiving fastening means, here represented by a screw. In order to operate the snap lock part (not shown), for instance to release the snap lock, an access opening 549 is provided, to give access to releasing the snap lock part interacting with a snap lock edge 5481 shown in Fig. 17c.

**[0061]** Fig. 18 shows the lower part of the roof window arrangement and the provision of a cap member 56. Figs 19 and 20 show the cap member 56 of the roof window arrangement in more detail, which is connected to the second window unit 22 providing a sealing at the bottom of the second window unit 22 and the respective neighbouring first window unit 21 and third window unit 23. The cap member 56 is present in a left-hand and a mirror-inverted right-hand version. In the following, the cap member 56 at the transition between the second window unit 22 and the first window unit 21 will be described. Fig. 21 shows a perspective sectional view from another angle, showing the interaction between the cap member 56 and the bottom pane-carrying frame covering 5223.

**[0062]** In the embodiment shown, the cap member 56 comprises one flange 564 to form a transition between the second window unit 22 and the neighbouring first window unit 21 and engagement means to engage with the second window unit 22. Similar means may be pro-

vided at the other side. The position of the cap member 56 and flange 564 are also shown in Fig. 7. In one embodiment, the bottom covering 5223 of the pane-carrying frame of the second window unit 22 could from the outset be produced with side flanges, which are removed and replaced by the flange 564 of the cap member 56 at the respective end. The cap member 56 comprises a base 561 from which the flange 564 protrudes, an end portion 563 depending from the base 561, a first leg 562 and a second leg 574. The engagement means comprise the base 561, the first leg 562 and the second leg 574 are configured to abut the frame member 225. The cap member 56 is in the embodiment shown slid on the frame member 225 such that an entire end portion of the end member 225 is surrounded by the engagement means 561, 562, 563, 574. In the embodiment shown, the frame member 225 is provided with an end portion (not shown in detail) with a lower height relative to the remaining portion of the frame member 225. In order to accommodate the cap member 56 on the remaining portion of the frame member 225, a shoulder portion 565 is provided such that the shoulder portion 565 is located at a higher level than the base 561 and is connected to the base 561 via a step portion 5651. The cap member 56 also comprises a first bottom sealing flap 568 and a second bottom sealing flap 569 configured to abut the secondary bottom frame covering 533 of the covering assembly 5. Since the secondary bottom frame covering 533 in the embodiments shown is through-going, i.e. extends the full width of the three window units, the first and second bottom sealing flaps 568 and 569 abut the same element, thus providing a particularly tight connection. A trough 567 is formed between an upstanding portion 566 and the flange 564 to interact with components of the second window unit 22, including a part 5223a of the bottom pane-carrying frame covering 5223 and a glazing bead 5224, as shown in Fig. 18. A sealing rib 570 is comprised in the trough 567 to enable a water tight connection. A top sealing flap 572 is also comprised in the cap member 56, which is adjacent to the upstanding portion 566. As shown in Fig. 21, the top sealing flap 572 abuts the bottom pane-carrying frame covering 5223 in the mounted condition. The upstanding portion 566 of the trough 567 also comprises a guide tower 571 which provides stiffness to the top sealing flap 572. The flange 564 further comprises a front tower 573 at one end of it, which acts as blocking water and/or wind from blowing into the construction. The front tower 573 thus substantially blocks the slit formed between the bottom pane-carrying frame covering 5223 and the adjacent bottom sash covering 5213, when the first window unit 21 is in the closed position. Also visible in Fig. 21 are a gasket 2215 of the bottom member 2214 of the pane-carrying frame 221 of the second window unit 22 and an insulating element 2216. The gasket 2215 and the insulating element 2216 are known per se and are described in more detail in Applicant's German utility model DE 20 2012 009 491 U1. Thus, the top sealing flap 572 provides a seal between the cap member 56 and the bottom pane-carrying frame covering 5223, and the guide tower 571 ensures correct mounting of the gasket 2215 relative to the cap member 56.

**[0063]** Referring now to Figs 22 to 24, a further embodiment of the cap member 56 is shown. Only differences relative to the embodiment described in connection with Figs 18 to 21 will be described in detail. Thus, in the embodiment shown, parts are provided to assist in blocking water or wind, and/or improve the mechanical performance of the cap member 56: a side tower 5741 is provided on the second leg 74. A first and a second side wing 5641 and 5642 are provided on the flange 564. A front wing 5631 is provided on the end portion 563 of the cap member 56. On the underside of the cap member 56, a fixation tower 5611 is present as shown in Fig. 24.

**[0064]** Referring to Fig. 25, an alternative embodiment of the cap member 56 is shown. Here, the second leg 574 has an extension portion 5742 and a rear rib 5743, both of which contributing to improving the sealing properties of the cap member 56.

**[0065]** Figs. 26 and 27 show an alternative embodiment of the roof window arrangement, making use of a particular configuration of the gasket 2252 indicated schematically in Fig. 7. The gasket 2252 extends between the lower end of the glazing bead 5224 of the second window unit 22 and up to a position at or near the frame hinge part 222 and provides a main sealing surface 2252a towards the side sash covering 5212 to block water entering into the window construction. The gasket 2252 is furthermore formed with a depending leg 2252b extending inwards from the main sealing surface 2252a and provided with an internal sealing profiling 2252c. Finally, an engagement flange 2252 is provided for engagement with the glazing bead 5224 and the right-hand side of which interacts with the cap member 56. Also visible in Fig. 26 is a glazing bead 5214 of the first window unit 21.

**[0066]** 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**

**[0067]**

| | |
|---|---|
| 1 | roof window arrangement |
| 10 | common frame |
| 11 | frame top member |
| 12 | frame side member |
| 13 | frame side member |
| 14 | frame bottom member |
| 1021 | aperture |
| 1022 | aperture |
| 1023 | spacer |
| 103 | striking plate |
| 109 | insulating element |
| 112 | frame hinge part (left) |

113 frame hinge part (right)

21 first window unit
211 pane-carrying frame / sash
2111 top member
2112 side member
2113 side member
2114 bottom member
212 sash hinge part (left)
213 sash hinge part (right)
214 pane
218 ventilation flap

22 second window unit
221 pane-carrying frame
2211 top member
2212 side member
2213 side member
2214 bottom member
2215 gasket of bottom member of pane-carrying frame
2216 insulating element
222 frame hinge part (left)
223 frame hinge part (right)
224 pane
225 frame member (left)
2251 protrusion on frame member
2252 extra-wide gasket
2252a main sealing surface
2252b depending leg
2252c internal sealing profiling
2252d engagement flange
226 frame member (right)

23 third window unit
231 pane-carrying frame / sash
2311 top member
2312 side member
2313 side member
2314 bottom member
232 sash hinge part (left)
233 sash hinge part (right)
234 pane
238 ventilation flap

3 mounting bracket

5 covering assembly
510 top casing
511 first side frame covering
512 second side frame covering
5120 centre portion
5121 right-hand groove
5122 left-hand groove
5123 snap lock part
513 third side frame covering
514 fourth side frame covering
5211 side sash covering (first window unit)
5212 side sash covering (first window unit)
5213 bottom sash covering (first window unit)
5214 glazing bead (first window unit)
5223 bottom pane-carrying frame covering (second window unit)
5223a part of bottom pane-carrying frame covering (second window unit)
5224 glazing bead
5231 side sash covering (third window unit)
5232 side sash covering (third window unit)
5233 bottom sash covering (third window unit)
531 secondary side frame covering
532 secondary side frame covering
533 secondary bottom frame covering
54 tower fitting
541 base
542 leg
543 leg
544 first screw tower
545 second screw tower
546 opening
547 snap anchor tower
548 entry opening
5481 snap lock edge
549 access opening
55 support element
56 cap member
561 base
5611 fixation tower
562 first leg
563 end portion
5631 front wing
564 flange
5641 first side wing
5642 second side wing
565 shoulder portion
5651 step portion
566 upstanding portion
567 trough
568 first bottom sealing flap
569 second bottom sealing flap
570 sealing rib
571 guide tower
572 top sealing flap
573 front tower
574 second leg
5741 side tower
5742 extension portion
5743 rear rib

hf height of frame

wf width of frame

hwu height of window unit

wwu width of window unit

| | |
|---|---|
| $\alpha$ | hinge axis |
| da | distance (from top to hinge axis) |
| dp | distance (between panes) |
| t1 | first thickness |
| t2 | second thickness |

## Claims

1. A roof window arrangement (1) comprising a plurality of window units (21, 22, 23) in a side-by-side configuration and a covering assembly (5) including a set of coverings for each window unit, each window unit comprising at least one pane-carrying frame (211, 221, 231) and a pane (214, 224, 234),
**characterised in that**
at least one covering (512, 513, 5212, 5231) of a set of coverings associated to one window unit (22, 21, 23) is configured to function as a covering of that one window unit (22, 21, 23) and of a neighbouring window unit (21, 23, 22), and
wherein at least one window unit (21, 23) of the roof window arrangement comprises a pane-carrying frame in the form of an openable sash (211, 231) which opens about a hinge axis ($\alpha$) defined by a set of hinges (212, 213, 232, 233), and wherein the set of coverings associated to each said at least one window unit (21, 23) comprises two side sash coverings (5211, 5212, 5231, 5232) to cover a lower portion of the sash (211, 213) from the hinges and downwards, preferably also a separate bottom sash covering (5213, 5233), at least one of said side sash coverings (5211, 5212, 5231, 5232) being configured to function as a covering of a neighbouring window unit (22).

2. A roof window arrangement according to claim 1, wherein at least one window unit (22) comprises at least one side frame covering (512, 513) configured to function as a covering of a neighbouring window unit (21, 23).

3. A roof window arrangement according to any one of the preceding claims, wherein said plurality of window units comprises three window units (21, 22, 23) including a first window unit (21) with a pane-carrying frame in the form of an openable sash (211) with a top member (2111), two side members, and a bottom member, a second window unit (22) with a fixed pane-carrying frame (221) with a top member (2211), two side members (2212, 2213), and a bottom member (2214), and a third window unit (23) with a pane-carrying frame in the form of an openable sash (231) with a top member (2311), two side members (2312), and a bottom member, such that the second window unit (22) is positioned between the first window unit (21) and the third window unit (23).

4. A roof window arrangement according to claim 3, wherein the set of coverings associated to the second window unit (22) comprises two side frame coverings (513, 514) configured to function as a covering of the first window unit (21) and the third window unit (23), preferably also a separate bottom pane-carrying frame covering (5223), and preferably
wherein the set of coverings associated to the first window unit (21) and the third window unit (23) each comprises two side sash coverings (5211, 5212, 5231, 5232), of which the one side sash covering (5212, 5231) closest to the second window unit (22) is configured to function as a covering of the second window unit (22), more preferably
wherein the set of hinges of each of the first window unit (21) and the third window unit (23) comprises two sash hinge parts (212, 213, 232, 233) connected to the respective openable sash (211, 231), and wherein two frame hinge parts (222, 223) are provided on the second window unit (22) to act as a respective counterpart to the sash hinge part (213, 232) of the first window unit (21) and the third window unit (23), respectively.

5. A roof window arrangement according to any one of the preceding claims, wherein a common frame (10) is provided to act as a single, stationary frame of all of the plurality of window units (21, 22, 23) in side-by-side configuration, said common frame (10) being configured to be built into a roof surface and comprising a top member (11), two side members (12, 13) and a bottom member (14), preferably
wherein the covering assembly comprises a top casing (510) and at least one side frame covering (511, 514) connected to the common frame (10), more preferably
wherein the common frame (10) is provided with at least one frame hinge part (112, 113) for an openable window unit (21, 23).

6. A roof window arrangement according to claim 5 to when dependent on any one of claims 3 to 4, wherein the covering assembly comprises a top casing (510) connected to the common frame (10) and spanning all three window units (21, 22, 23), a first side frame covering (511) and a fourth side frame covering (514) connected to the common frame (10), a second side frame covering (512) and a third side frame covering (513) connected to the second window unit (22), and two side sash coverings (5211, 5212, 5231, 5232) connected to each of the first window unit (21) and third window unit (23), preferably each of the window units (21, 22, 23) is provided with a separate or common bottom sash or pane-carrying frame covering

(5213, 5223, 5233), more preferably also secondary side frame coverings (531, 532) and a secondary bottom frame covering (533).

**7.** A roof window arrangement according to claim 6, wherein at least one tower fitting (54) is connected to one of said window units to provide support for the top casing (510), each tower fitting (54) comprising at least one mounting tower (544, 545; 547) and engagement means (542, 543, 546; 541; 546) to engage with the window unit, said mounting tower being a screw mounting tower (544, 545) or a snap anchor tower (547).

**8.** A roof window arrangement according to any one of claims 5 to 7, wherein at least one window unit (22) is provided with fixing means to interact with the frame top member (11) and the frame bottom member (14), preferably
wherein the fixing means are associated to the second window unit (22) and comprises two frame members (225, 226) connected to the pane-carrying frame (221), preferably
wherein the two frame members (225, 226) of the second window unit (22) extend between the frame top member (11) and the frame bottom member (14) of the common frame (10), preferably such that each frame member (225, 226) has a surplus length relative to the pane-carrying frame (221) in order to allow accommodation of an end portion within the common frame (10), more preferably
wherein each tower fitting (54) comprises a base (541) with two upstanding screw towers (544, 545) and the engagement means comprise two legs (542, 543) depending from the base (541) and configured to straddle a frame member (225, 226) of the second window unit (22), preferably also an opening (546) in the base (541) to allow the introduction of fastening means.

**9.** A roof window arrangement according to any one of claims 6 to 8, wherein at least one cap member (56) is connected to the second window unit (22) to provide a sealing at the bottom of the second window unit (22) and the neighbouring first window unit (21) and third window unit (23), each cap member (56) comprising at least one flange (564) to form a transition between the second window unit (22) and the respective neighbouring first window unit (21) and third window unit (23) and engagement means (561, 562, 563, 565, 566, 567, 574) to engage with the second window unit (22), preferably
wherein each cap member (56) comprises a base (561) from which the flange (564) protrudes, an end portion (563) depending from the base (561), a first leg (562) and a second leg (574), the engagement means comprising the base (561), the first leg (562), the second leg (574), and the end portion (563) being configured to abut a frame member (225, 226) of the second window unit (22), the first leg (562) preferably depends from the base (561) and the second leg (574) being preferably formed as an extension of the flange (564), and wherein the cap member (56) more preferably comprises a shoulder portion (565) connected to the base (561) via a step portion (5651) and configured to abut a frame member (225, 226) of the second window unit (22), more preferably
wherein a trough (567) is formed between an upstanding portion (566) and the flange (564) to interact with components of the second window unit (22), said components including a part (5223a) of a bottom pane-carrying frame covering (5223) and a glazing bead (5224), the trough (567) preferably comprising a sealing rib (570), a guide tower (571) and a top sealing flap (572), preferably
wherein said cap member (56) also comprises a first bottom sealing flap (568) and a second bottom sealing flap (569) configured to abut a secondary bottom frame covering (533) of the covering assembly (5), and more preferably
wherein at least one side tower (5741) is provided on the second leg (74) and/or at least one side wing (5641, 5642) is provided on the flange (564) and/or at least one front wing (5631) is provided on the end portion (563) of the cap member (56).

**10.** A roof window arrangement according to any one of claims 8 to 9 when dependent on claim 4, wherein a frame hinge part (222, 223) is connected to a respective frame member (225, 226) of the second window unit (22) to act as a respective counterpart to the sash hinge part (213, 232) of the first window unit (21) and the third window unit (23), respectively, and a frame hinge part (112, 113) is connected to the common frame (10) to act as a respective counterpart to the sash hinge part (212, 233) of the first window unit (21) and the third window unit (23), respectively, preferably
wherein the ratio (t2 : t1) between a second thickness (t2) of the combined thicknesses of a side member (2213) of the pane-carrying frame (221) and the associated frame member (225) of the second window unit (22) as defined between an edge of the pane (224) and an outer circumference of the frame member (225), and a corresponding thickness (t1) of a side member (2312) of the sash (231) of the neighbouring first window unit or third window unit (23) lies in the range 1.2 to 2, preferably between 1.25 and 1.75, more preferably around 1.5, preferably
wherein a distance (dp) between panes (224, 234) of neighbouring windows lies in the range 50 to 100 mm, more preferably around 75 mm, more preferably
wherein the sum of the first thickness (t1) and the second thickness (t2) is about 90 to 99% of the distance (dp) between the panes.

**11.** A roof window arrangement according to any one of claims 6 to 20, wherein the second side frame covering (512) and the third side frame covering (513) connected to the second window unit (22) each have a width which is larger than a predefined width of the first side frame covering (511) and a fourth side frame covering (514) connected to the common frame (10), preferably about 20 to 100% larger, more preferably about 50% larger.

**12.** A roof window arrangement according to any one of the preceding claims, wherein said plurality of window units comprises three window units (21, 22, 23) including a first window unit (21) with a pane-carrying frame in the form of an openable sash (211) with a top member (2111), two side members, and a bottom member, a second window unit (22) with a fixed pane-carrying frame (221) with a top member (2211), two side members (2212, 2213), and a bottom member, and a third window unit (23) with a pane-carrying frame in the form of an openable sash (231) with a top member (2311), two side members (2312, 2313), and a bottom member (2314), such that the second window unit (22) is positioned between the first window unit (21) and the third window unit (23), wherein a common frame (10) is provided to act as a single, stationary frame of all of the plurality of window units (21, 22, 23) in side-by-side configuration, said common frame (10) being configured to be built into a roof surface, and wherein the openable sash (211, 231) of the first window unit (21) and of the third window unit (23), and the fixed pane-carrying frame (221) of the second window unit (22) are provided as substantially identical standard components, the second window unit (22) comprising fixing means to fixate the pane-carrying frame (221) to the top member (11) and the bottom member (14) of the common frame (10).

**13.** A roof window arrangement according to claim 1, wherein each window unit of the plurality of window units of the roof window arrangement comprises a pane-carrying frame in the form of an openable sash which opens about a hinge axis defined by a set of hinges, and wherein the set of coverings associated to each said window unit comprises at least one side sash covering to cover a portion of the sash, preferably also a separate bottom sash covering, at least one of said side sash coverings being configured to function as a covering of a neighbouring window unit.

**14.** A method of manufacturing a roof window arrangement according to claim 12, comprising the steps of:

providing three pane-carrying frames as substantially standard components,
providing a common frame,
providing one of the pane-carrying frames with fixing means configured to interact with the common frame and designating this unit the second window unit, and
designating each of the other pane-carrying frames the first and the third window unit, respectively.

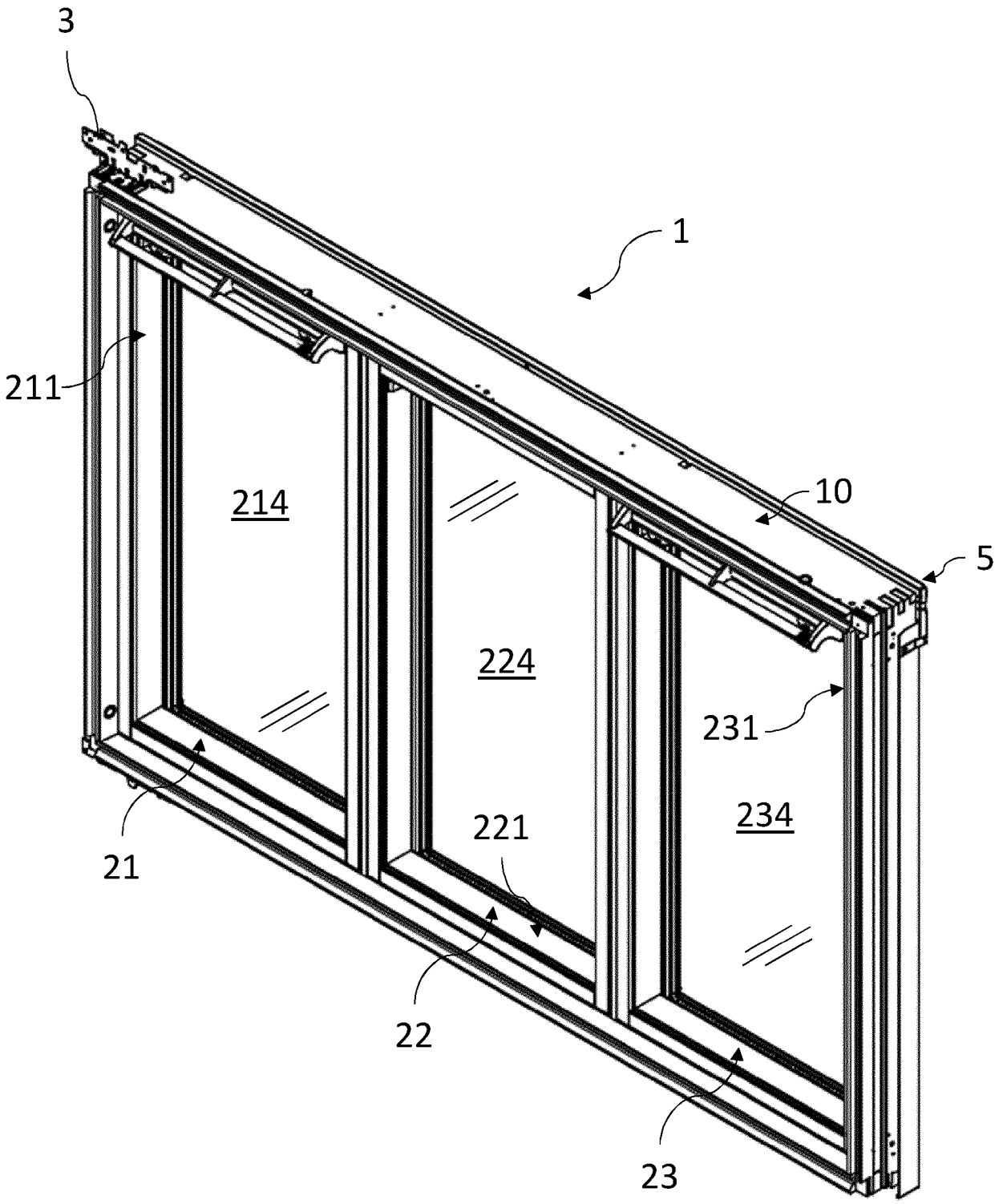


Fig. 1

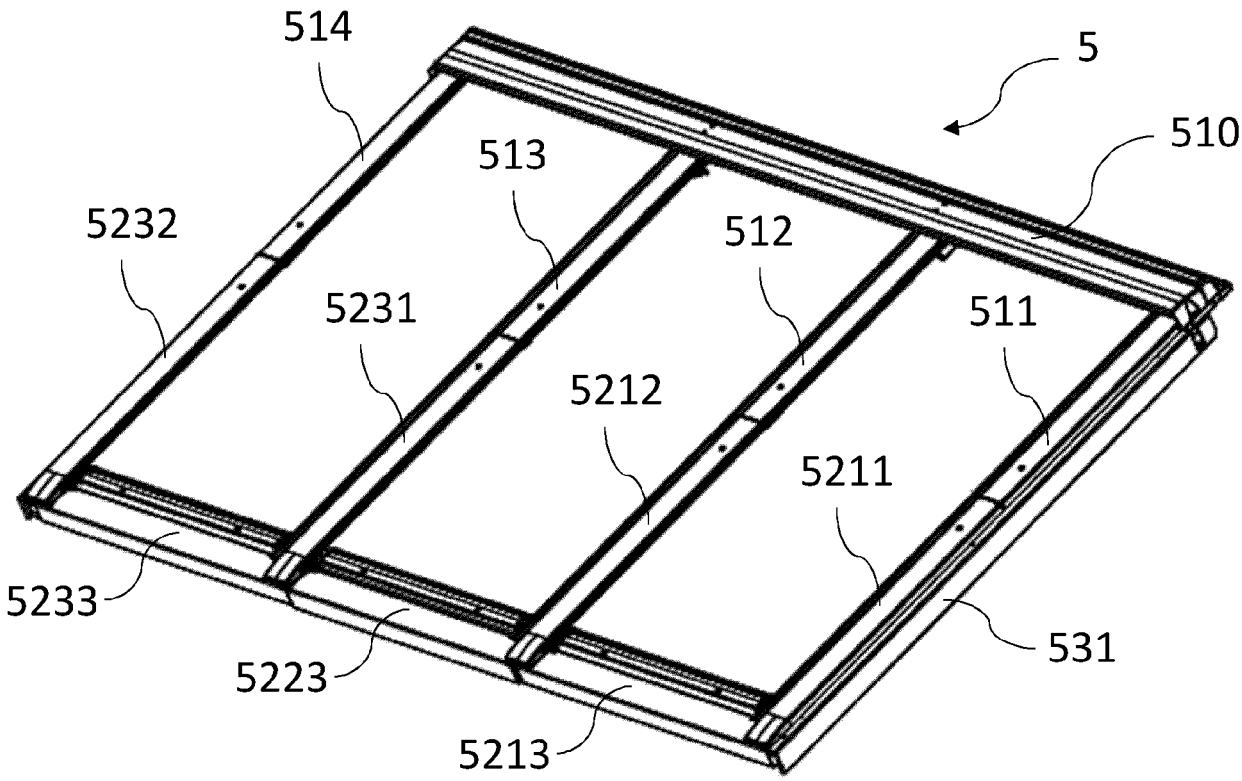


Fig. 2

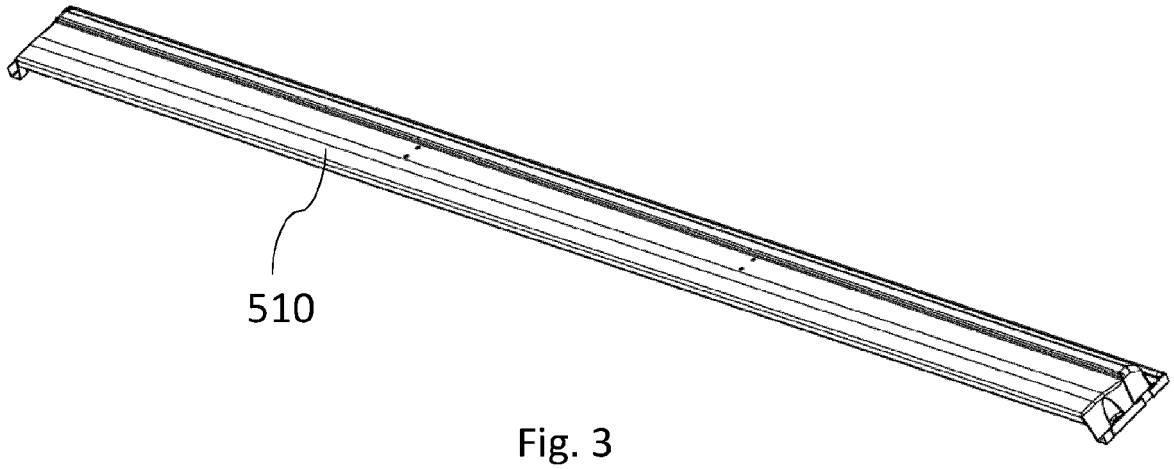


Fig. 3

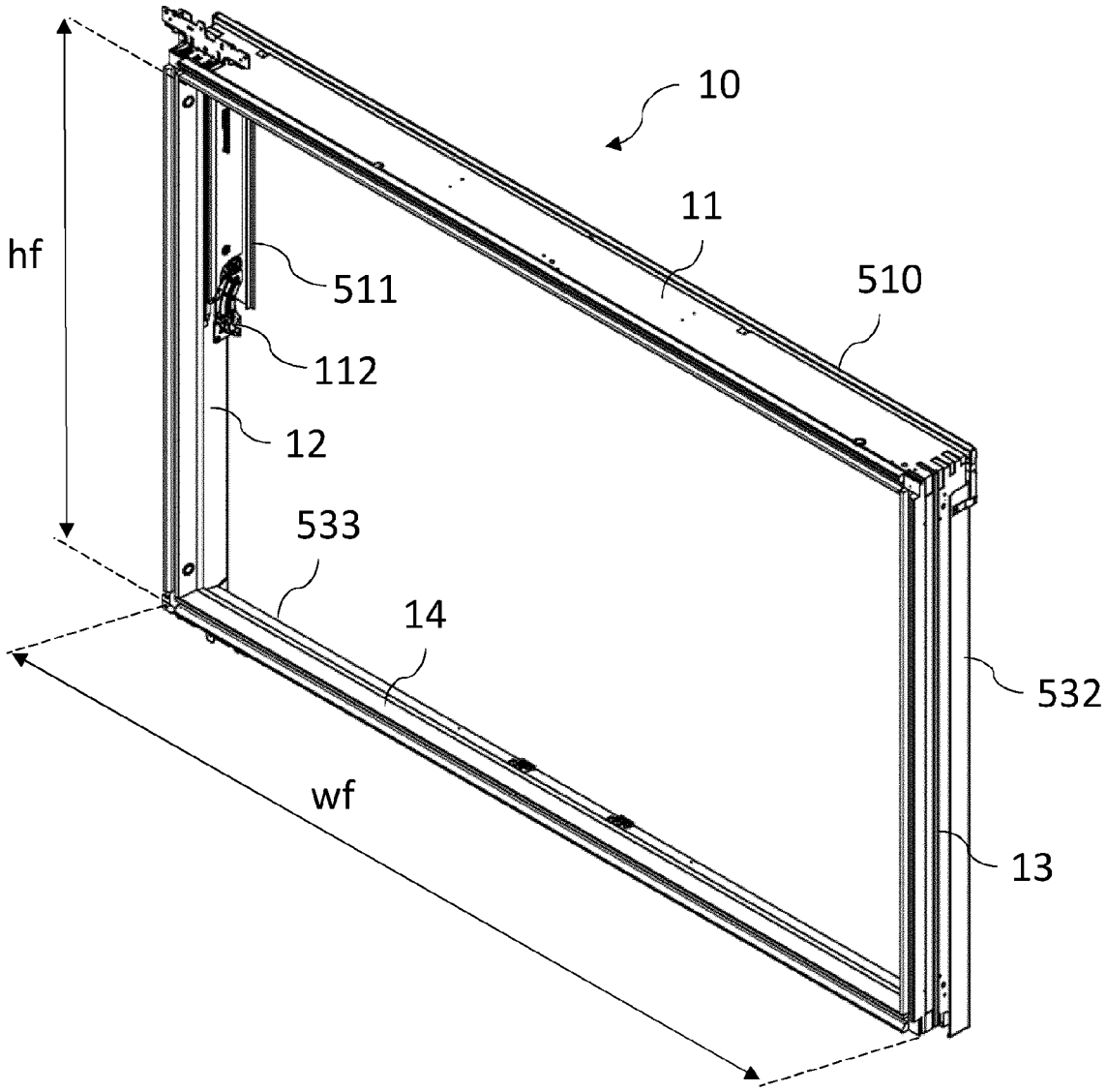


Fig. 4

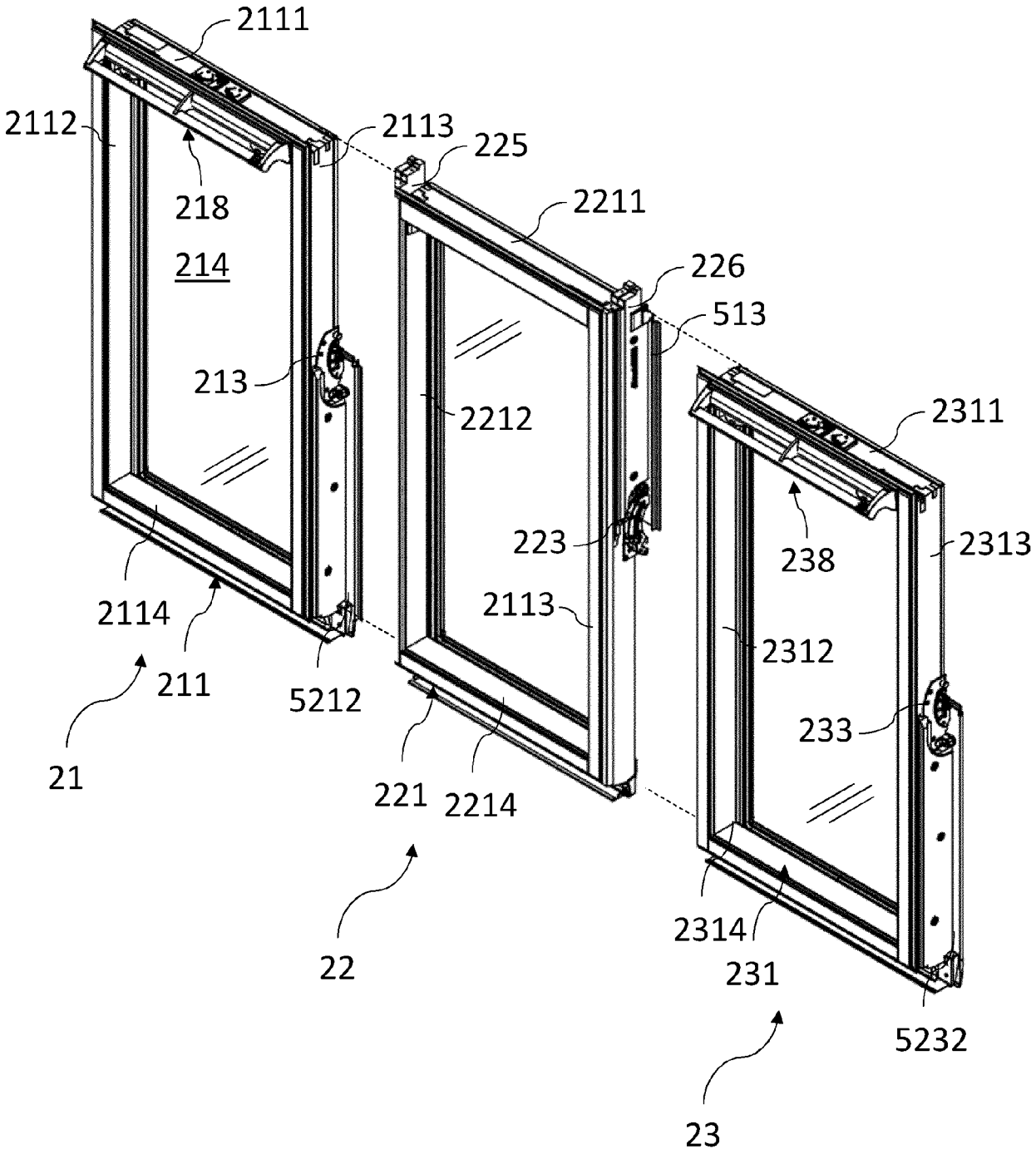
2111
2112
2113
225
218
214
2211
226
513
213
2212
2311
223
238
2313
2114
2113
211
2312
5212
233
21
221
2214
22
2314
231
5232
23

Fig. 5

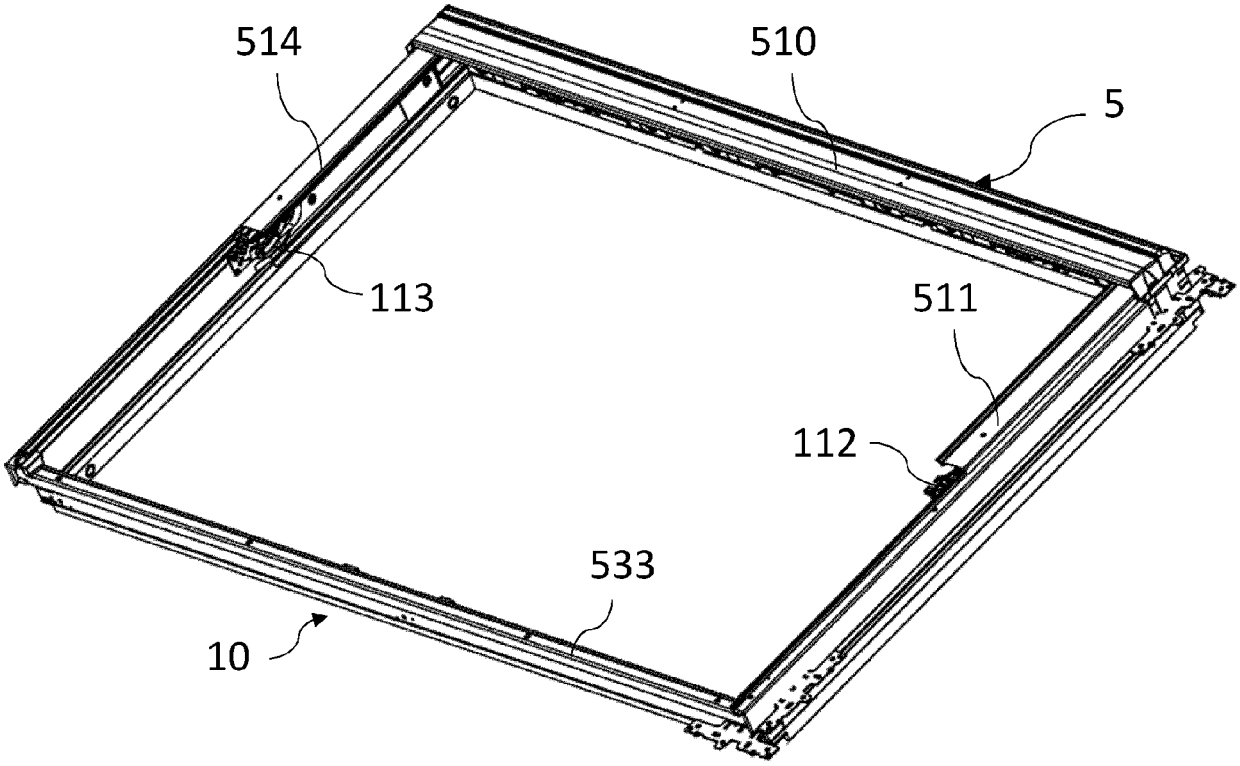
514
510
5
113
511
112
533
10

Fig. 6

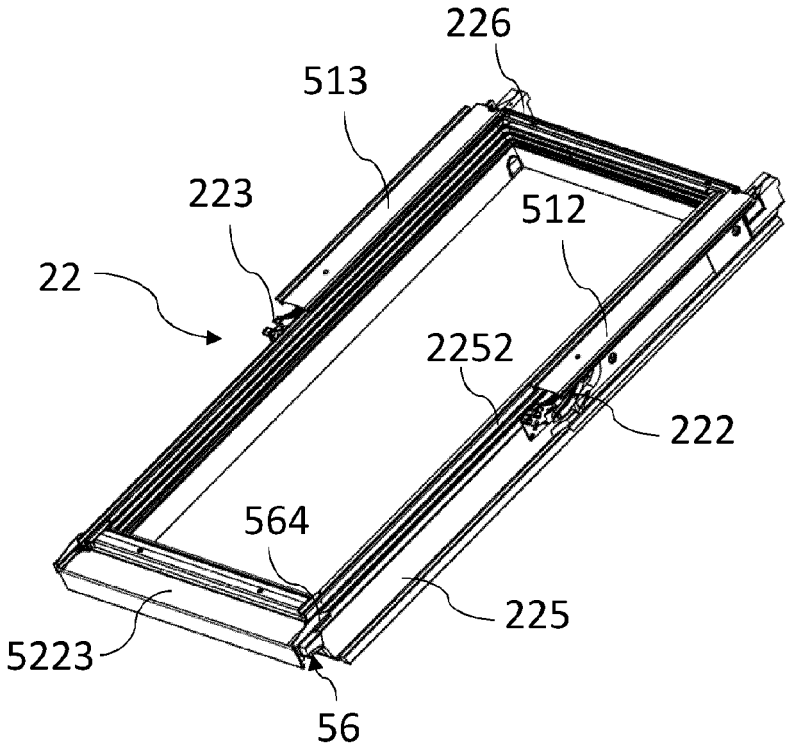
226
513
223
512
22
2252
222
564
225
5223
56

Fig. 7

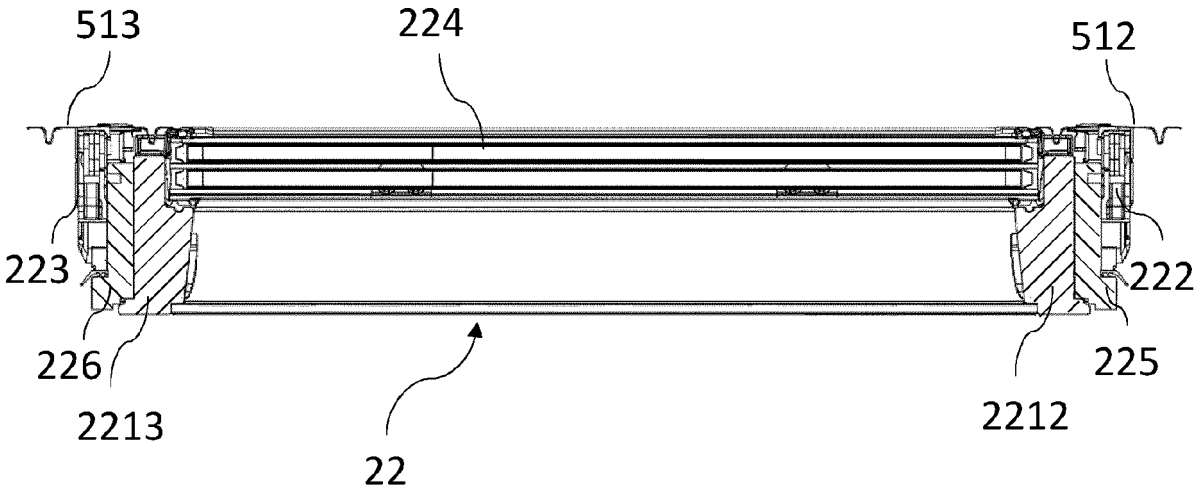
513
224
512
223
222
226
225
2213
2212
22

Fig. 8

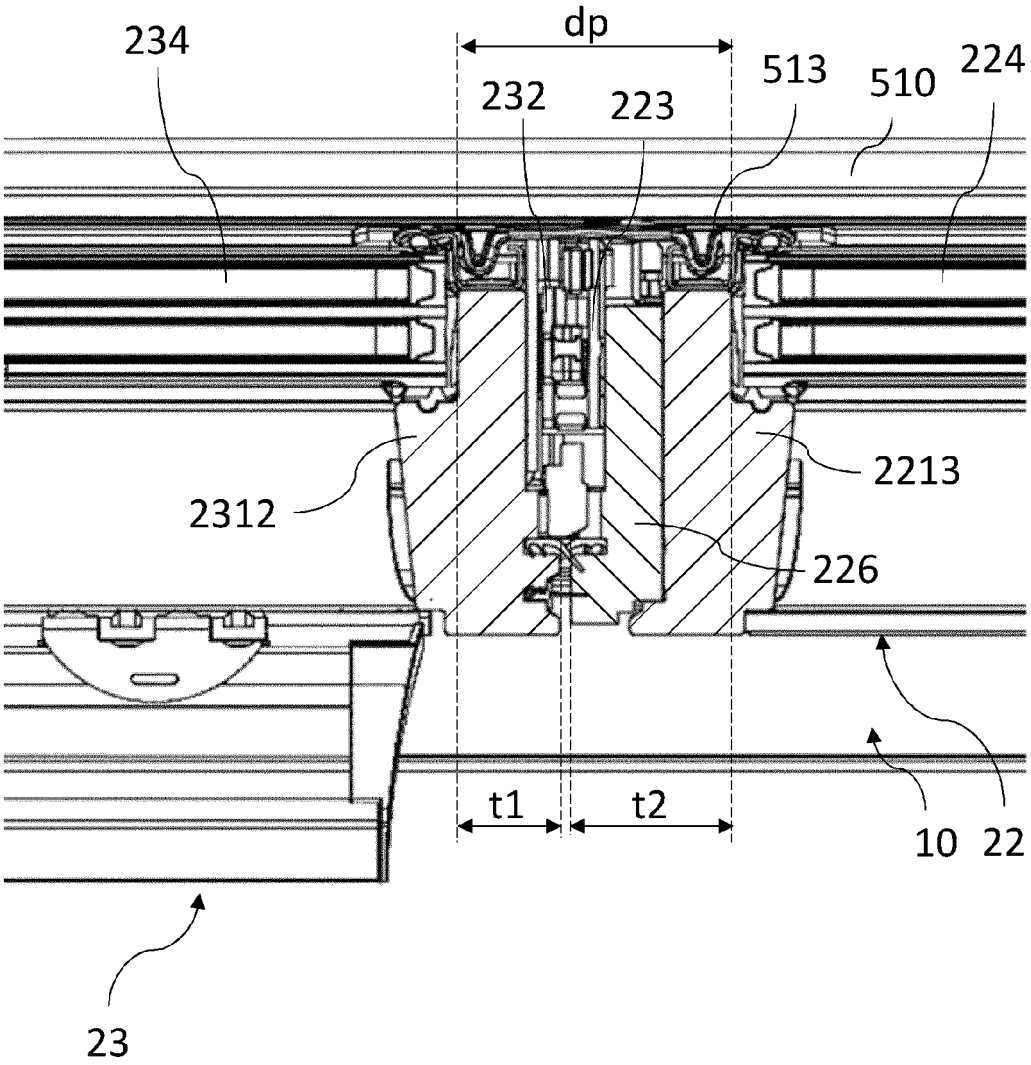
dp
234
232
223
513
510
224
2213
2312
226
t1
t2
10
22
23

Fig. 9

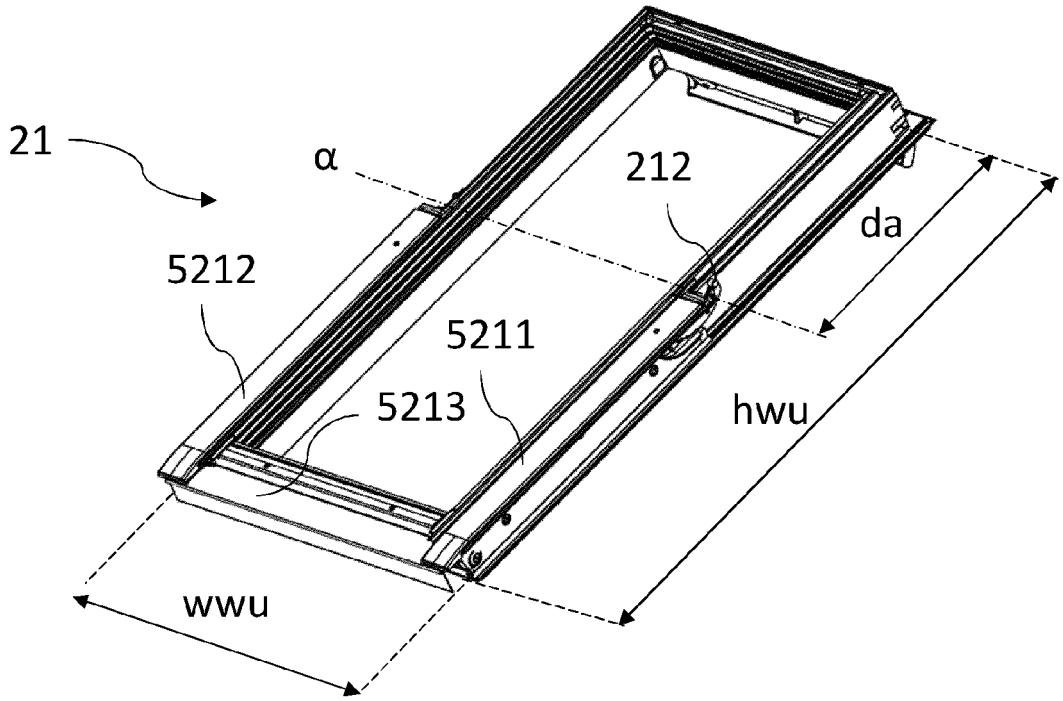


Fig. 10

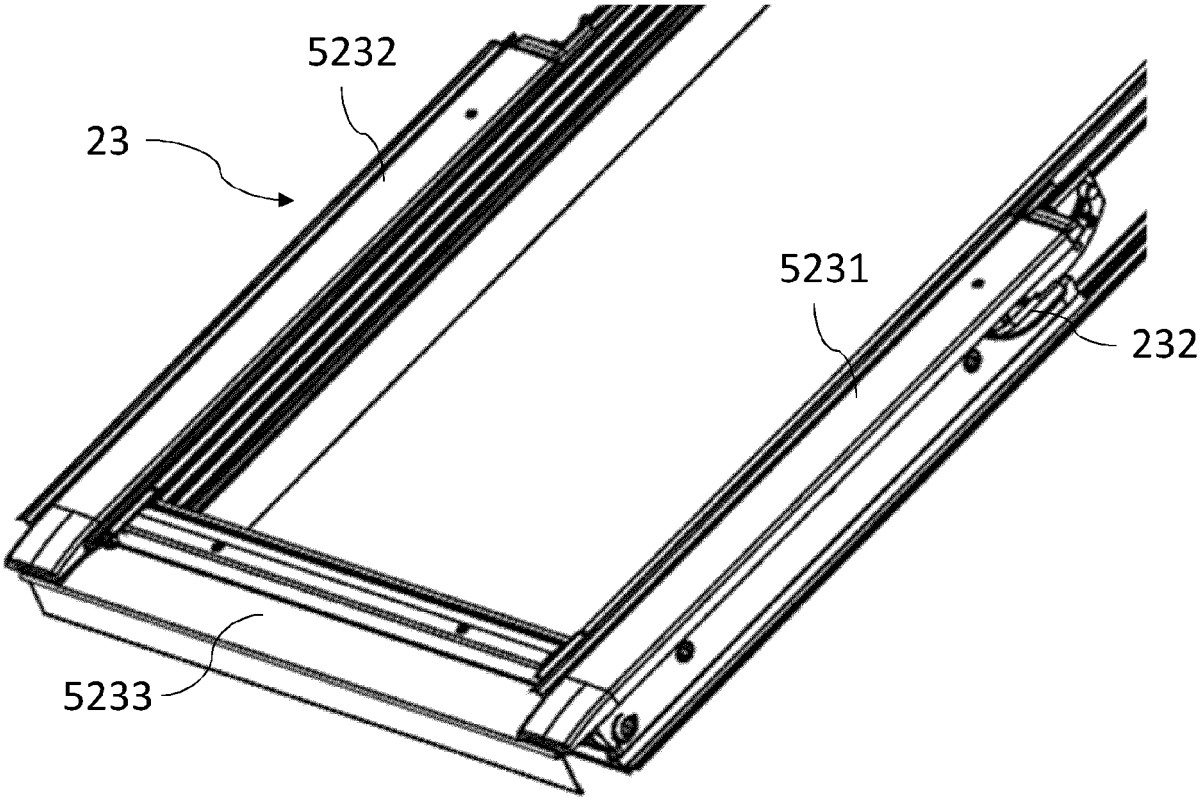


Fig. 11

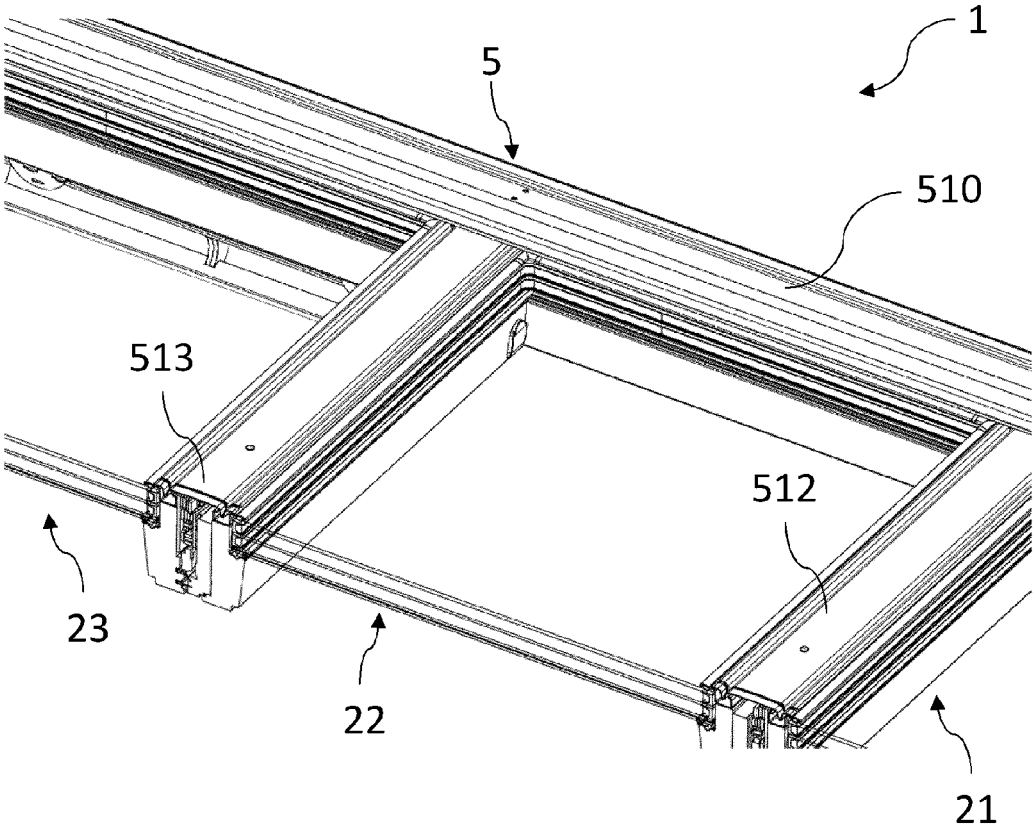


Fig. 12

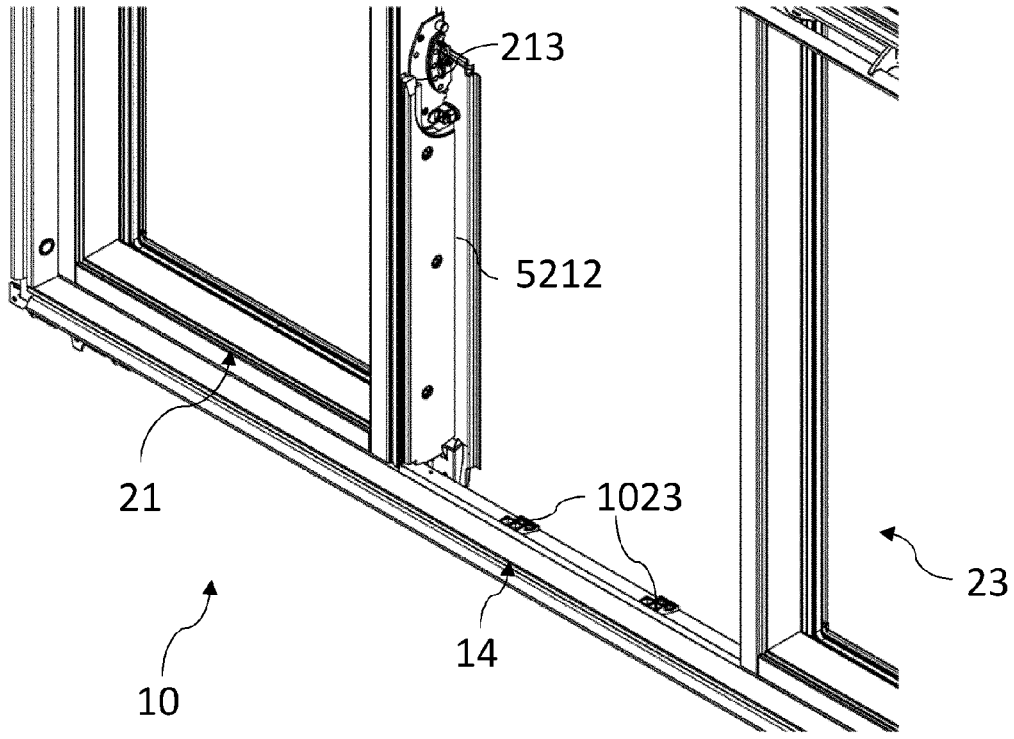


Fig. 13

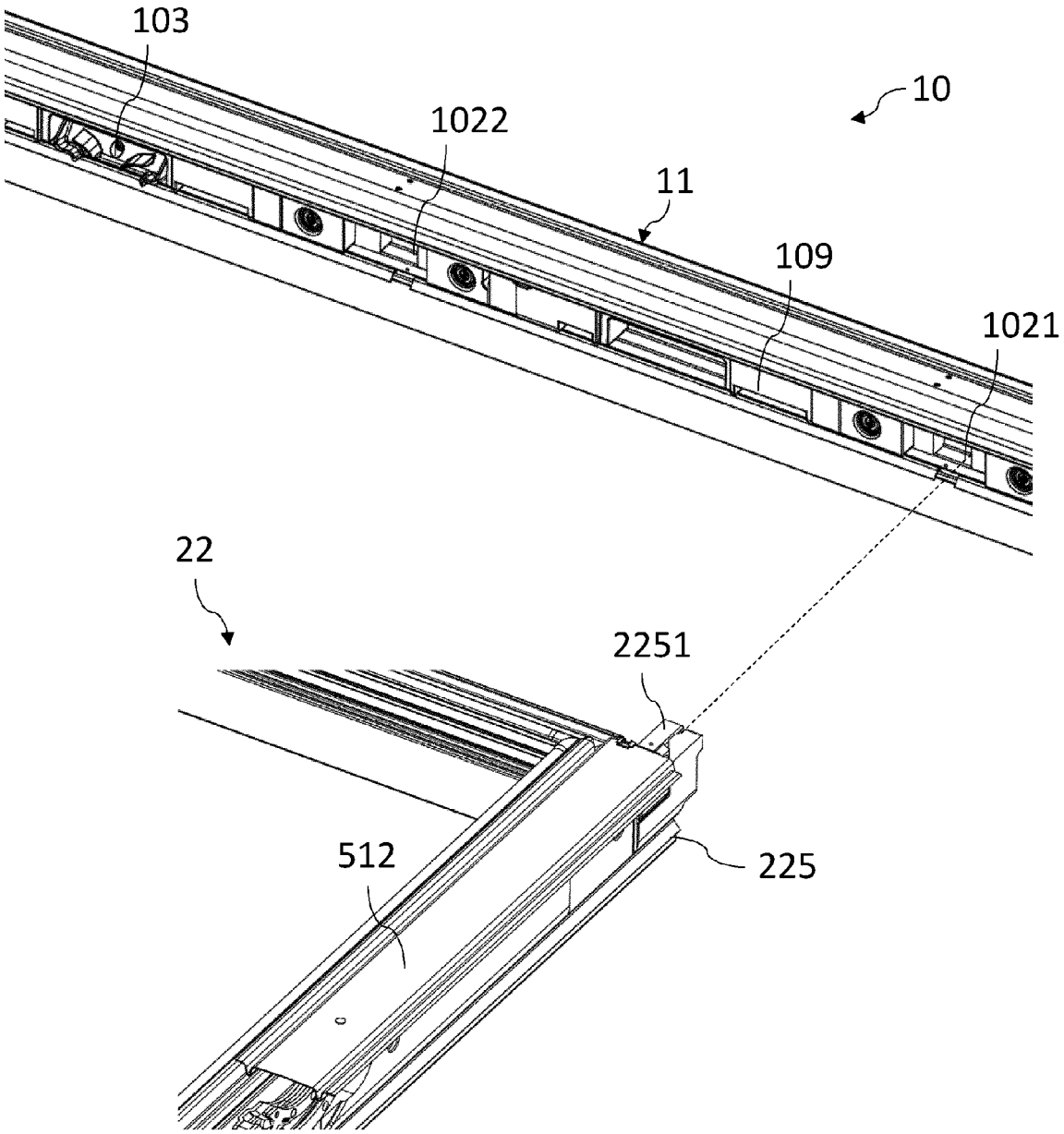


Fig. 14a

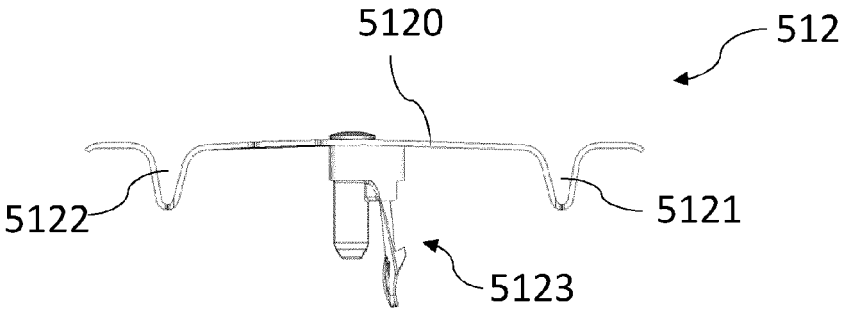


Fig. 14b

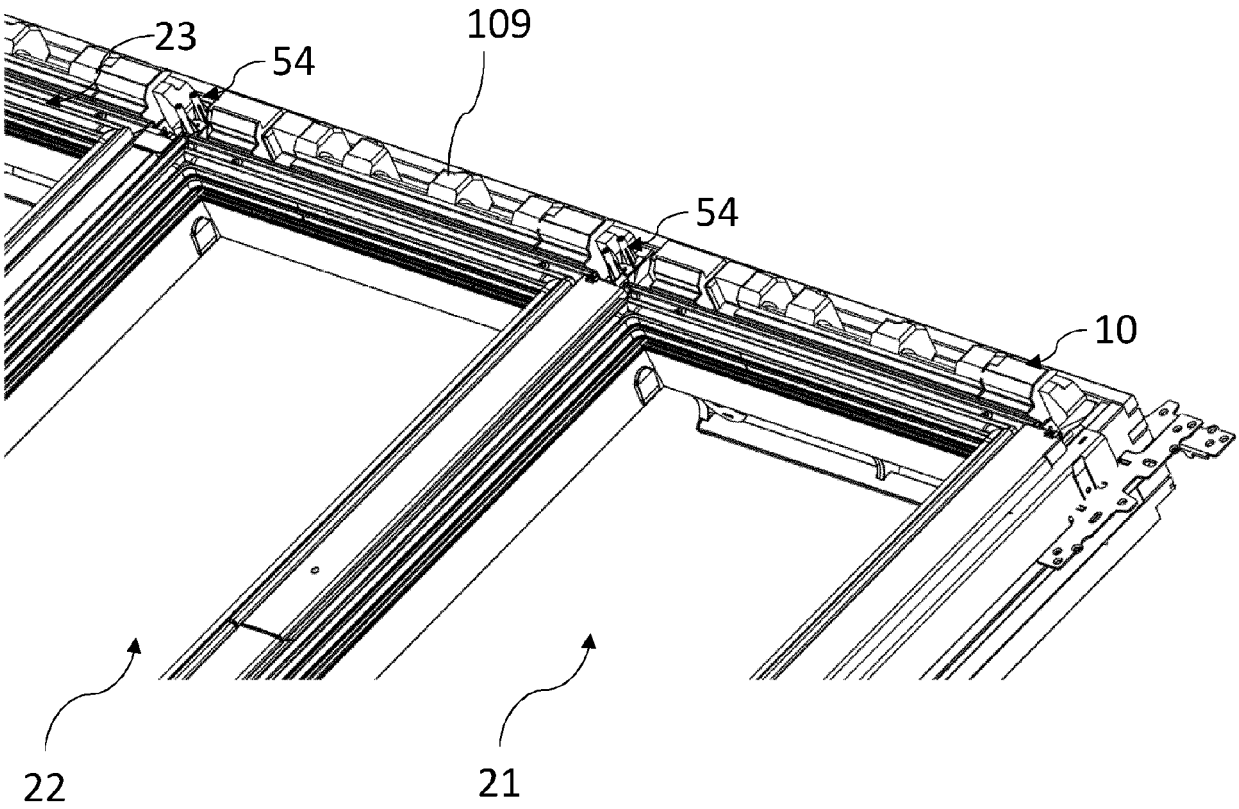


Fig. 15

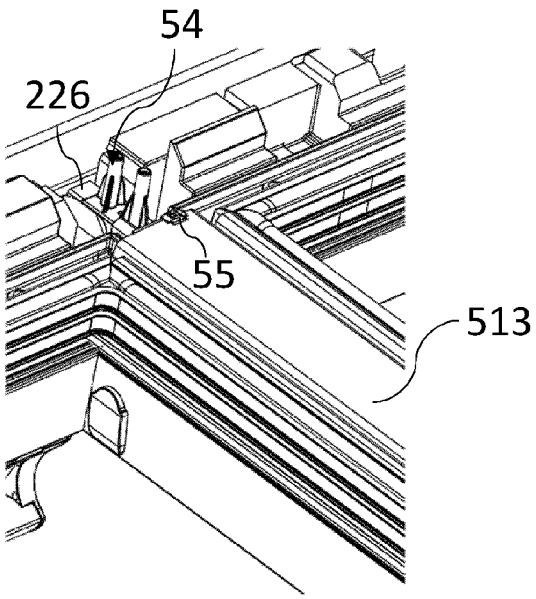


Fig. 16

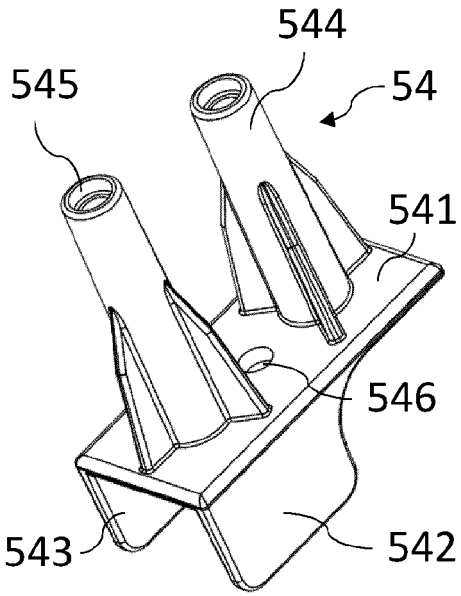


Fig. 17a

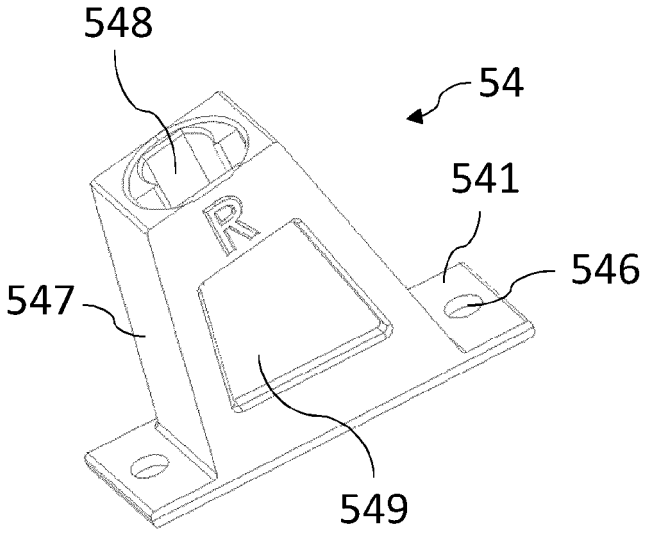


Fig. 17b

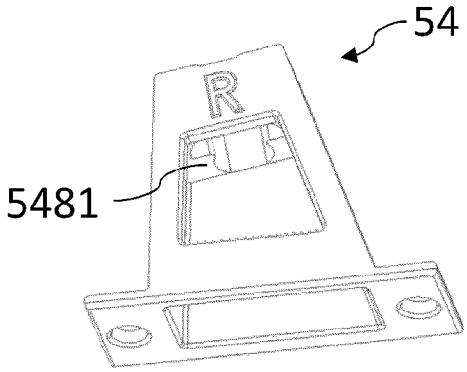


Fig. 17c

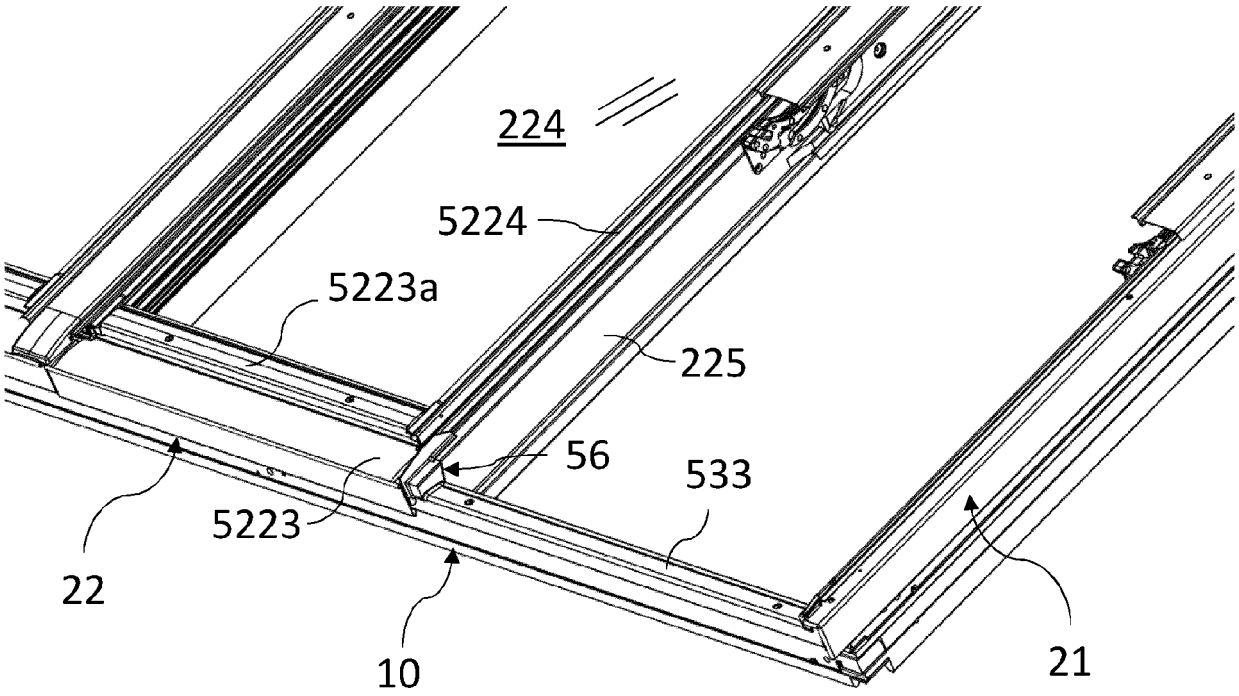


Fig. 18

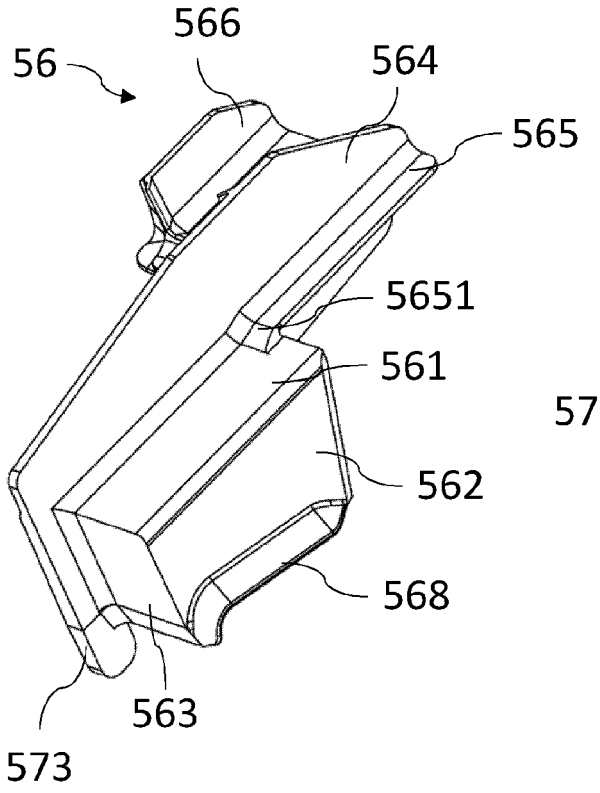


Fig. 19

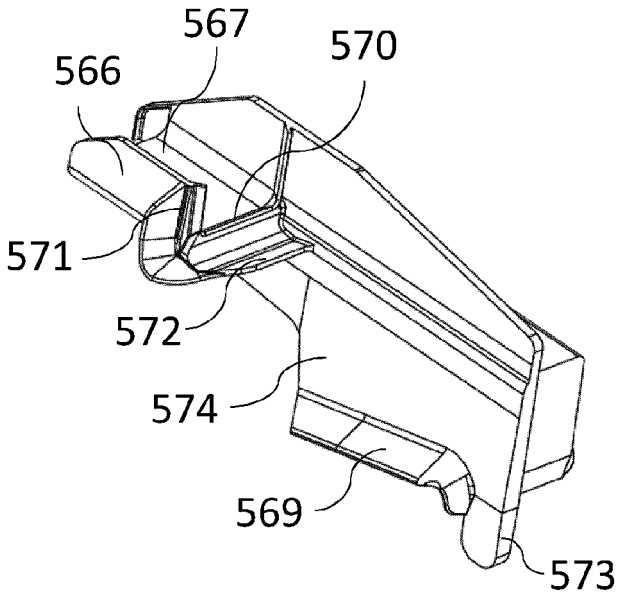


Fig. 20

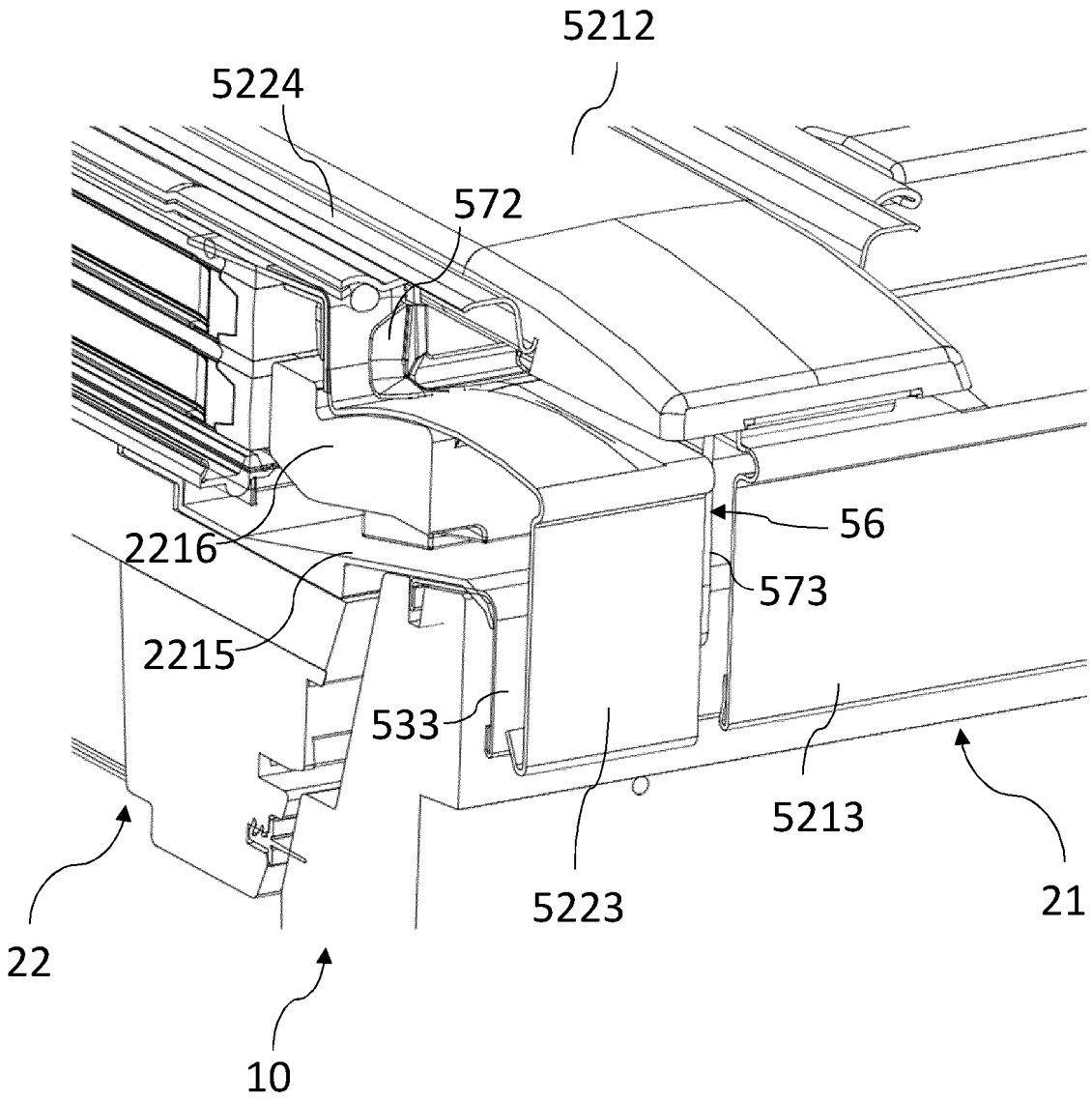


Fig. 21

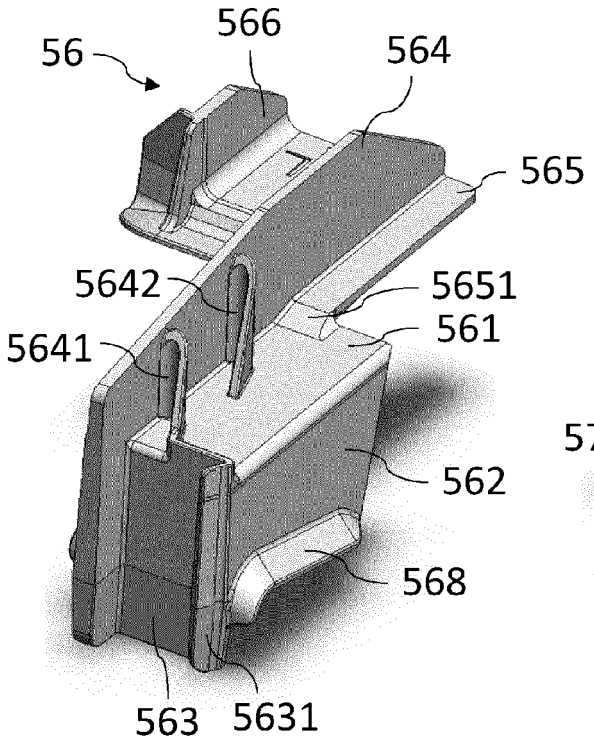


Fig. 22

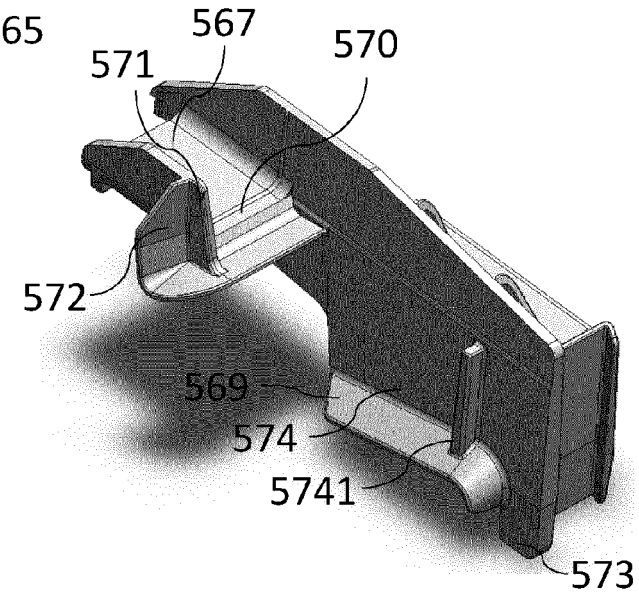


Fig. 23

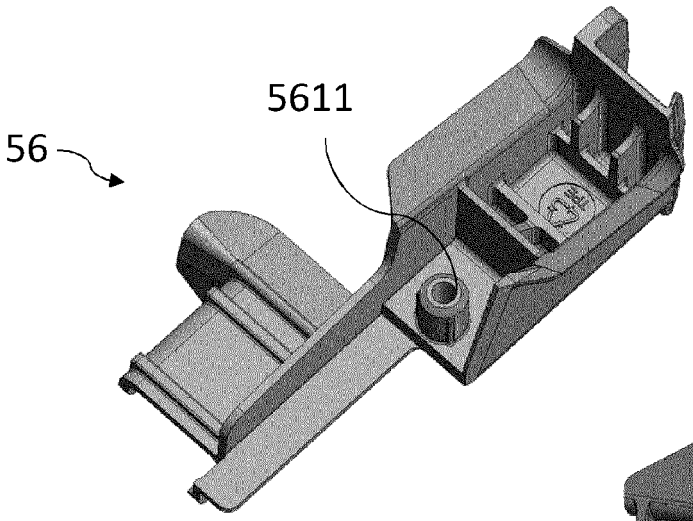


Fig. 24

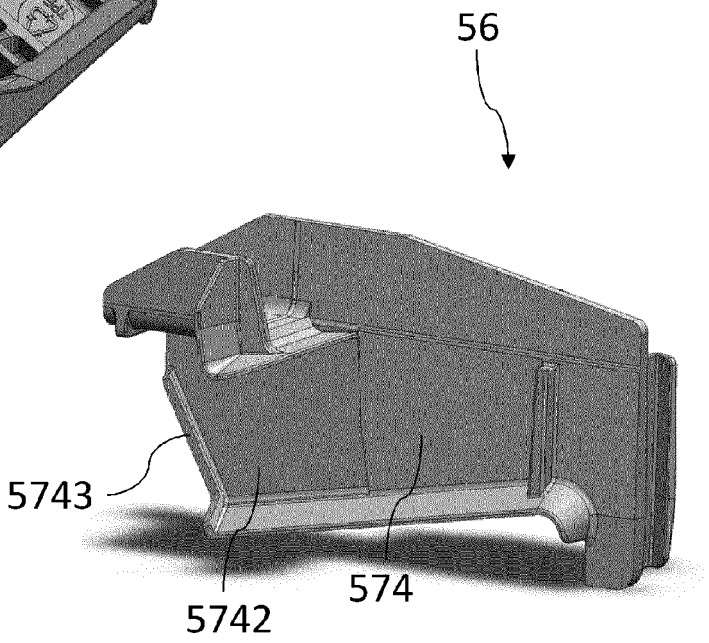


Fig. 25

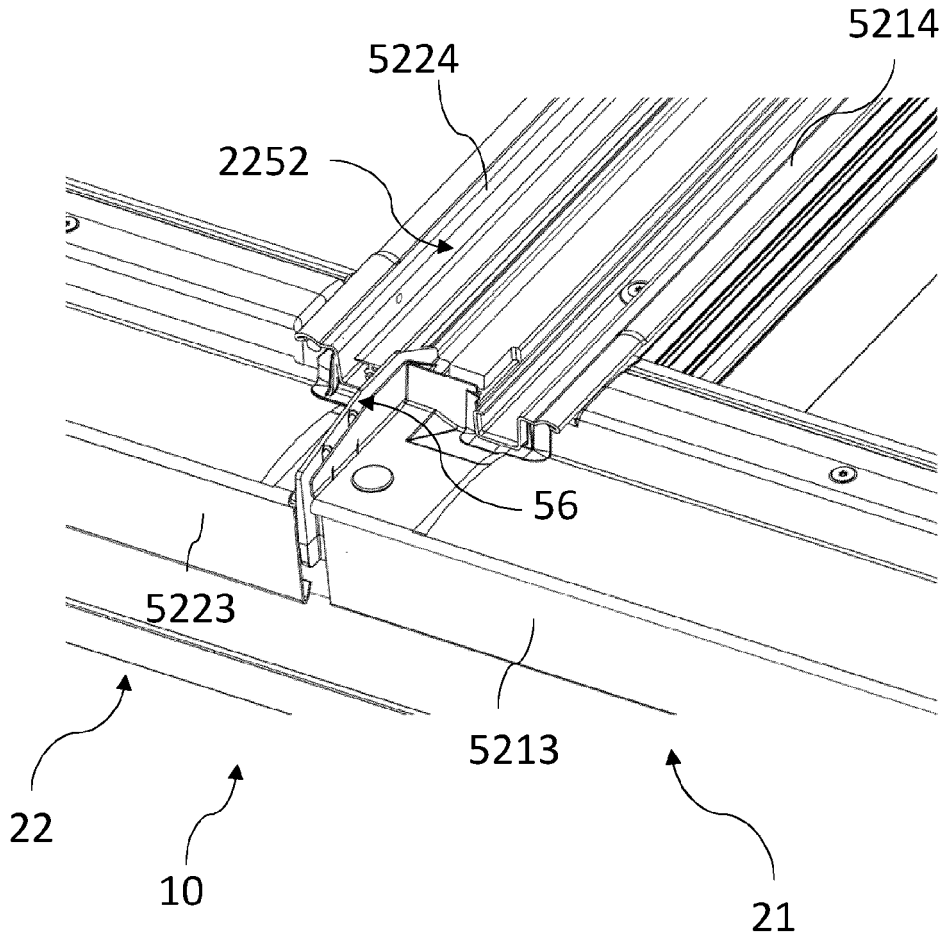
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Fig. 26

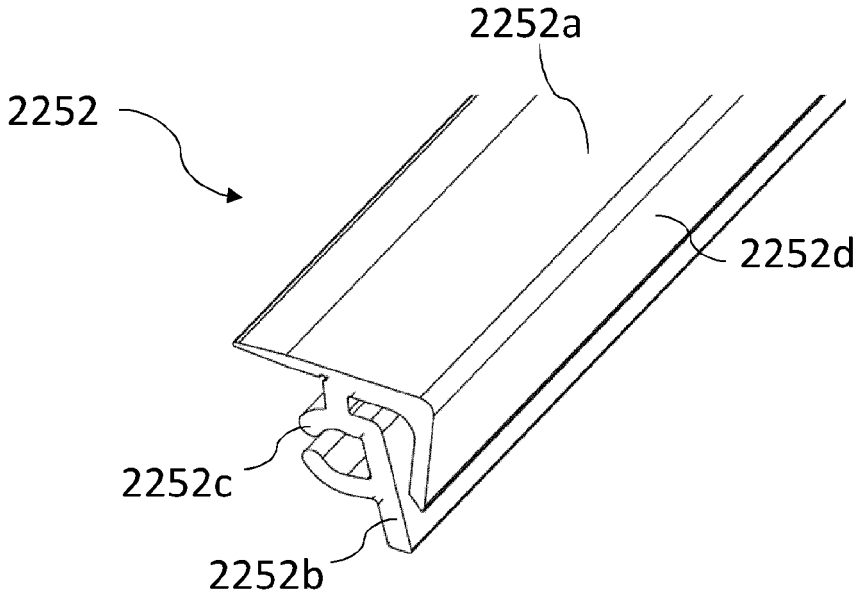
2252a
2252
2252d
2252c
2252b

Fig. 27

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# EUROPEAN SEARCH REPORT

Application Number
EP 20 20 9938

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X<br>A | GB 2 204 627 A (FREDERICK SAGE COMPANY LIMITED) 16 November 1988 (1988-11-16)<br>* figures 1,3,5 *<br>* page 9, paragraph 2d *<br>* page 5, line 33 - page 6, line 3 *<br>* page 12, paragraph 2d *<br>----- | 1-9, 11-14<br>10 | INV.<br>E04D13/03<br>E04D13/147<br>E04D13/035 |
| X<br>A | EP 2 472 026 A1 (VKR HOLDING AS [DK])<br>4 July 2012 (2012-07-04)<br>* paragraph [0025]; figure 11 *<br>----- | 1,2,5-7, 9,11,13<br>10 | |
| A | DE 91 02 461 U1 (E. LANGE [DE])<br>23 May 1991 (1991-05-23)<br>* figure 1 *<br>----- | 1 | |

TECHNICAL FIELDS SEARCHED (IPC)

E04D

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 17 March 2021 | Tran, Kim Lien |

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17-03-2021

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| GB 2204627 A | 16-11-1988 | NONE | |
| EP 2472026 A1 | 04-07-2012 | CN 202577774 U | 05-12-2012 |
| | | EP 2472026 A1 | 04-07-2012 |
| | | PL 2472026 T3 | 31-01-2019 |
| DE 9102461 U1 | 23-05-1991 | NONE | |

EPO FORM P0459

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### Patent documents cited in the description


- WO 2004055291 A1 **[0003]**
- EP 1581706 B1 **[0003]**
- DE 202018100516 **[0004]**
- EP 3406818 B1 **[0004]**
- EP 1038083 B1 **[0045]**
- EP 1781883 B1 **[0045]**
- EP 2770146 A1 **[0045]**
- EP 2770149 A1 **[0045]**
- WO 2017076416 A1 **[0045]**
- WO 2013050043 A1 **[0055]**
- DE 202012009491 U1 **[0062]**