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

(72) Inventor: **Holm, Michael Galsgård**
4000 Roskilde (DK)

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

(54) **A ROOF WINDOW INCLUDING A SET OF HINGES WITH IMPROVED MOVEMENT PATTERN**

(57) In the roof window having a frame (1) with frame members (11) and a sash (2) with sash members (21), carrying a pane (3), a set of hinges (10) connect the sash (2) with the frame (1). Each hinge (10) defines a hinge centre (c) and includes a frame hinge part (100) in connection with a frame side member (11) and a sash hinge part (200) in connection with a sash side member (21). The set of hinges (10) define a hinge axis (α). The sash (2) and frame (1) each has an interior side (21i, 11i) adapted to face the interior (8) of the building in the mounted condition and an exterior side (21e, 11e) adapted to face the exterior (7) of the building in the mounted condition. According to the invention, the hinge centre (c) of each hinge (10) is offset from the hinge axis (α), and the set of hinges is arranged such that the hinge centre (c) of each hinge (10) is located to the exterior of the exterior side (21e, 11e) of the sash (2) and frame (1) and the hinge axis (α) is located to the interior of the exterior side (21 e, 11 e) of the sash (2) and frame (1).

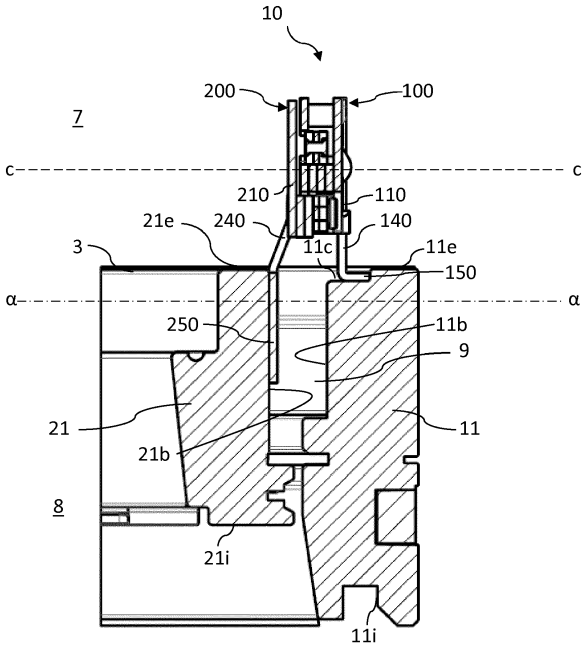

Fig. 6

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Description

Technical Field

[0001] The present invention relates to a roof window comprising a frame with a plurality of frame members defining a frame plane and adapted to be connected to a load-bearing structure of a roof of a building; a sash with a plurality of sash members and carrying a pane defining a sash plane; and a set of hinges connecting the sash with the frame to allow the sash plane to assume an angle relative to the frame plane, each hinge of said set of hinges defining a hinge centre and including a frame hinge part in connection with a frame side member and a sash hinge part in connection with a sash side member and configured to assume an angle relative to the frame hinge part, said set of hinges defining a hinge axis, the sash and frame each having an interior side adapted to face the interior of the building in the mounted condition and an exterior side adapted to face the exterior of the building in the mounted condition.

Background Art

[0002] Basically, roof windows may be provided in a number of varieties and include more or less complicated structures in order to allow opening of the sash and to fulfil other functions, such as ventilation, while permitting cleaning of the outside of the pane from inside the building. The varieties include roof windows of the pivoting type, the hinge axis being either located at the centre or displaced from the centre of the window, and top-hung roof windows that pivot for cleaning by means of an intermediate frame.

[0003] Over recent years, increasing demands to the insulating properties of such windows have entailed a relatively large weight of the pane due to the number of sheets in the glazing. In turn, this increases the moment to be exerted by the user when operating the window by tilting or pivoting the sash about the hinge axis. One solution to reduce the moment would be to move the entire hinge further down, i.e. towards the interior, in the structure. However, as the hinges themselves are traditionally formed by metal, placing the set of hinges at an interior position counteracts the insulating measures, and this solution is furthermore not possible or desirable in all applications.

Summary of Invention

[0004] With this background it is an object of the present invention to provide a roof window of the kind mentioned in the introduction with respect to the overall operability and insulating properties.

[0005] This and further objects are met by the provision of a roof window, which is characterised in that the hinge centre of each hinge of said set of hinges is offset from the hinge axis, and that the set of hinges is arranged such that the hinge centre of each hinge is located to the exterior of the exterior side of the sash and frame and the hinge axis is located to the interior of the exterior side of the sash and frame.

[0006] Providing the roof window with a set of hinges of this kind, mounted in an exterior position while so to say reversing the location of the hinge axis, has surprisingly turned out to offer satisfactory operational performance while increasing the thermal properties of the roof window. Increase of the ease of operation is at least partly due to the fact that the hinge axis may be brought relatively close to, if not coinciding with, the centre of gravity of the sash including the pane.

[0007] Hinges having an offset hinge axis relative to the main portion of the hinge itself are well-known as such; a typical example is the classic pivot hinge comprising a guidance and a slide rail defining an axis of rotation offset from the hinge centre. This particular type of pivot hinge is very well-known and is considered as constituting more or less "industry standard" within the field of roof windows. A set of such pivot hinges typically comes as standard on a roof window of the brand VELUX®. Alternative hinges include the so-called pantograph or linkage hinge providing a corresponding movement pattern.

[0008] Other presently preferred embodiments and further advantages will be apparent from the following detailed description and the dependent claims.

Brief Description of Drawings

[0009] The invention will be described in more detail below by means of nonlimiting examples of embodiments and with reference to the schematic drawing, in which

Fig. 1 is a perspective view of a prior art window;
Fig. 2 is a perspective view of a roof window according to a first embodiment of the invention;
Fig. 3 is a partial perspective view, on a larger scale, of a detail of the roof window of Fig. 2;
Fig. 4 is a partial perspective view, on a larger scale, of a detail of the roof window of Fig. 2;
Fig. 5 is a partial plan view, on a larger scale, of the roof window of Fig. 2;
Fig. 6 is a sectional view along the line VI-VI of Fig. 5;
Fig. 7 is a perspective view of a roof window according to a second embodiment of the invention;
Fig. 8 is a partial perspective view, on a larger scale, of a detail of the roof window of Fig. 7;
Fig. 9 is a partial plan view, on a larger scale, of the roof window of Fig. 7;
Fig. 10 is a sectional view along the line X-X of Fig. 9.

Description of Embodiments

[0010] In the following, embodiments of the inventive roof window will be described in further detail. For reference, a prior art roof window with a frame 1', a sash 2',

a pane 3' and a hinge 10' is shown in Fig. 1. Parts of the prior art roof window which are applicable also to a roof window according to the invention are described in Applicant's published European patent applications EP 2 770 146 A1 and EP 2 770 149 A1 to which reference is hereby explicitly made.

[0011] Thus, in a manner known per se, the roof window is intended to be built into a surface, which is inclined with respect to the horizontal, typically a roof, and the window will in the following be referred to as roof window. At a position between the top and centre of the window, there is a hinge connection between the frame 1' and the sash 2'. The hinge connection in Fig. 1 comprises a set of two prior art hinges, of which one hinge 10' is visible. The frame 1' and sash 2' is each formed by four members of which one frame side member 11' and one sash side member 21' are indicated. The sash 2' is openable with respect to the frame 1', as the sash 2' may be moved from a closed position, in which e.g. the sash side member 21' is substantially parallel with the frame side member 11', to an open position, in which the sash side member 21' forms an angle with the frame side member 11'. During this movement the sash 2' rotates about a hinge axis a' situated at the hinge connection. As indicated in Fig. 1, the hinge axis α' is located between a centre axis and the top of the roof window, preferably in the interval 1/3 to 2/3 of the distance between the centre axis and the top, most preferred substantially at 1/2 of the distance between the centre axis and the top. Other positions of the hinge axis is of course conceivable, for instance at the centre of the roof window.

[0012] From a closed position, the user operates the operating device of the window. The operating device typically comprises a handle (not shown) connected with the sash bottom member and/or an operating and locking assembly including a ventilation flap at the sash top member with a lock mechanism to interact with a striking plate on the frame top member. The set of hinges 10' exerts a moment on the sash 2', and in combination with the force, and hence moment, exerted by the user operating the operating device, the moment resulting from the weight of the sash 2' and pane 3' is overcome, along with any frictional forces present. All in all, the opening operation entails that the sash 2' is moved from a closed position to an open position as represented by Fig. 1, in which the sash plane forms an opening angle with the frame plane. Closing the window from the open position entails the opposite movement of the sash 2'. It is possible to position the sash 2' in a number of arbitrary opening positions, in which the sash 2' is held stable relative to the frame 1'. The sash 2' is also able to be rotated substantially through 180° to allow cleaning of the outside of the pane 3' from the inside of the building in which the roof window is installed.

[0013] When referring to the Figures, the terms up, down, upwards, downwards, top and bottom are taken relative to how the figures are displayed, that is having the frame arranged in a lying position with the exterior surfaces facing upwards. A front view is taken from the hinge and viewing towards the frame. A view from behind is therefore taken as viewed from the frame towards the hinge. A direction longitudinal is, if nothing else is mentioned, longitudinal along the length of the frame. It is to be understood that the arrangement shown in a horizontal orientation is not the normal orientation as the window is installed.

[0014] Referring now to Figs 2 to 6, a first embodiment of a roof window according to the invention will be described in detail. Elements having the same or analogous function as in the prior art are denoted by the same reference numerals without the 'mark.

[0015] The hinge 10 comprises a frame hinge part 100 and a sash hinge part 200 configured to assume an angle relative to the frame hinge part 100. The hinge 10 forms part of a set of hinges, of which the frame hinge part 100 of each hinge 10 is configured to be fastened to the frame side member 11 of the frame 1 of the roof window, at a location chosen to provide the desired position of the hinge axis α relative to the height direction of the roof window, i.e. parallel to the side members 11, 21 of the frame and sash, respectively, and the sash hinge part 200 is correspondingly configured to be fastened to the sash side member 21 as will be described in further detail below.

[0016] In the roof window according to the invention, the sash 2 and frame 1 each has an interior side 21 i, 11 i, respectively, adapted to face the interior, here indicated as an interior space 8, of the building in the mounted condition and an exterior side 21e, 11e, respectively adapted to face the exterior, here indicated as an exterior space 7, of the building in the mounted condition.

[0017] Additional components and parts of relevance include an inward frame surface 11 b and an interior frame surface 11i, and an outward sash surface 21 b and an interior sash surface 21 i. The inward frame surface 11 b and the outward sash surface 21 b delimit a gap 9 between the frame 1 and the sash 2.

[0018] Referring in particular to the cross-sectional view of Fig. 6, each hinge 10 of said set of hinges defines a hinge centre c. The hinge centre c represents the midpoint of the main operational parts of the hinge, applying to the geometry and/or weight. In the context of the description of the present embodiment, in which the frame hinge part 100 and the sash hinge part 200 each comprises a base plate 110, 210, which specifically is substantially plane, each base plate 110, 210 has a predefined circumference cf, cs, respectively, as shown in Figs 3 and 4. Thus, here the hinge centre c is defined as the geometrical centre of the predefined circumference cf, cs of the base plate 110, 210 of one of, or both, the frame and sash hinge parts 100, 200.

[0019] Thus, according to the present invention, the hinge centre c of each hinge 10 is offset from the hinge axis α, and the set of hinges is arranged such that the hinge centre c of each hinge 10 is located to the exterior of the exterior side 21e, 11e of the sash 2 and frame 1

and the hinge axis α is located to the interior of the exterior side 21 e, 11 e of the sash 2 and frame 1.

[0020] Whereas it lies within the capacity of the person skilled in the art to design the dimensions of the hinge components including a specific value of the offsetting of the particular hinge and combine with a suitable positioning of the hinge such that the hinge centre is located to the exterior of the sash and frame of the roof window, it is a prerequisite that the hinge axis α is located to the interior of the exterior side of the sash and frame.

[0021] In presently preferred embodiments, the distance between the hinge axis α and the hinge centre c lies in the range of 30 to 150 mm, preferably 45 to 120 mm, more preferably 60 to 90 mm. Here, the distance is about 65 mm.

[0022] The distance may be chosen in combination with suitable dimensions of the height of the base plate 110, 210 of the frame hinge part 100 and the sash hinge part 210, respectively. Typically, the height lies in the interval 40 to 80 mm, preferably 50 to 70 mm. The height of the base plate of the sash hinge part may be about 65 mm, somewhat larger than the height of the base plate of the frame hinge part which is typically about 55 mm.

[0023] With the correct configuration chosen, it is possible to position the hinge axis near or even at the centre of gravity of the sash including the pane.

[0024] The general principles underlying the invention are applicable to all kinds of hinges in which it is possible to provide a hinge axis which is offset from the hinge centre.

[0025] In one presently preferred embodiment, namely the first embodiment shown in Figs 2 to 6, the hinge 10 makes use of the operational principles common to one very well-proven type of hinge, viz. the pivot hinge including a guidance on the frame hinge part cooperating with a slide rail on the sash hinge part. Such pivot hinges are for instance disclosed in Applicant's EP 1 038 083 B1 and EP 1 781 883 B1, and are very versatile as regards operational areas and adaptation of components. Examples of roof windows incorporating such adapted hinges are shown in Applicant's published European patent applications EP 2 770 146 A1 and EP 2 770 149 A1. In the first embodiment of the present invention, the pivot hinge 10 is mounted in such a way that the concavity of the guidance and the slide rail faces the interior 8 of the roof window to provide the offset hinge axis α at a more interior position than the set of hinges 10. That is, the pivot hinge is mounted in a reverse or upside-down position relative to what is standard.

[0026] An alternative hinge is a pantograph hinge, in which the desired pattern of movements is provided by a linkage mechanism. The use of hinges including linkage mechanisms is traditionally most often known from the furniture field, but such hinges are also well-known to use for roof windows. Prior art examples include Danish patent No. 114 321, US patent No. 4,446,597, and Applicant's European patents EP 22 657 B1 and EP 89 813 B1. Such pantograph hinges also provide a hinge axis which is offset from the hinge centre. The same operation as described above and from here on is also true for the type of hinge described in the Applicant's international application published under WO 2017/076416 A1.

In another presently preferred embodiment, the second embodiment shown in Figs 7 to 10, the pantograph hinge 1010 defines a movement pattern providing the offset hinge axis α at a more interior position than the set of hinges 1010. This too entails a reverse or upside-down positioning of the hinge.

[0027] In the following, mounting of the hinge 10; 1010 to the roof window of the first and second embodiments will be described in further detail. Elements of the hinge in the second embodiment having the same or analogous function as counterpart elements of the hinge of the first embodiment are denoted by the same reference numerals to which 1000 has been added. The components of the window are denoted by the same reference numerals throughout the embodiments. Only differences between the two embodiments will be described in detail, wherever appropriate.

[0028] Referring in particular to Figs 5 and 6 for the first embodiment, and to Figs 9 and 10 for the second embodiment, the hinge 10; 1010 is connected to the frame 1 and the sash 2 by means of first mounting means and second mounting means. In both of the embodiments shown, the first mounting means comprises a first flange 140; 1140 in connection with the base plate 110; 1110 of the frame hinge part 100; 1100 and a second flange 150; 1150 in connection with the frame side member 11. The second mounting means comprises a first flange 240; 1240 in connection with the base plate 210; 1210 of the sash hinge part 200; 1200 and a second flange 250; 1250 in connection with the sash side member 21.

[0029] The connection between each first flange and the respective base plate may in principle be carried out in any suitable manner, but advantageously, and in the embodiments shown, the connection between the first flange 140, 240; 1140, 1240 and the respective base plate 110, 210; 1110, 1210 of the frame and sash hinge parts 100, 200; 1100, 1200 is integral.

[0030] In both of the embodiments, the respective base plate 110, 210; 1110, 1210 of the frame and sash hinge parts 100, 200; 1100, 1200 is substantially plane.

[0031] In the first embodiment, the first flange 140; 1140 of the first mounting means is substantially parallel to the plane of the base plate 110; 1110 of the frame hinge part 100; 1100.

[0032] This applies also to the first flange 1240 of the second mounting means in the second embodiment.

[0033] In the first embodiment, the first flange 240 forms an angle relative to the respective base plate 210. This allows the hinge 10 to be positioned more to the outwards.

[0034] The second flange 150; 1150 of the first mounting means in the first and second embodiments, and the second flange 1250 of the second mounting means of the second embodiment has an extension substantially

parallel to the frame and sash plane, respectively. In the embodiments shown, the second flange 150; 1150 of the first mounted means is connected to a recess 11c in the frame side member 11. Alternatively, these second flanges could alternatively be connected an exterior frame surface. The second flange 1250 of the second mounting means is connected to the exterior sash surface 21e of the sash side member. It is conceivable also to position this second flange 1250 in a recess.

[0035] In the first embodiment, the second flange 250 of the second mounting means has an extension substantially perpendicular to the sash plane and is connected to the outward sash surface 21 b.

[0036] In the first embodiment, third mounting means are furthermore provided in addition to the first and second mounting means, said third mounting means here comprising a first flange 160 in connection with the base plate 110 of the frame hinge part 100, and a second flange 170 in connection with the frame side member 11. Corresponding further mounting means may also be present on the sash frame part.

[0037] It should be noted that the above description of preferred embodiments serves only as an example, and that a person skilled in the art will know that numerous variations are possible without deviating from the scope of the claims.

List of reference numerals

[0038]

1 frame
- 11 frame side member
- 11 e exterior frame surface
- 11 b inward frame surface
- 11c recess
- 11i interior frame surface

2 sash
- 21 sash side member
- 21 e exterior sash surface
- 21 b outward sash surface
- 21 i interior sash surface

3 pane
7 exterior
8 interior
9 gap
10 hinge
- 100 frame hinge part
- 110 base plate
- 140 first flange of first mounting means
- 150 second flange of first mounting means
- 160 first flange of third mounting means
- 170 second flange of third mounting means
- 200 sash hinge part
- 210 base plate
- 240 first flange of second mounting means
- 250 second flange of second mounting means

1010 hinge
- 1100 frame hinge part
- 1110 base plate
- 1120 link
- 1140 first flange of first mounting means
- 1150 second flange of first mounting means
- 1200 sash hinge part
- 1210 base plate
- 1240 first flange of second mounting means
- 1250 second flange of second mounting means

α hinge axis
c hinge centre
cf circumference of base plate of frame hinge part
cs circumference of base plate of sash hinge part

Claims

1. A roof window comprising:

a frame (1) with a plurality of frame members (11) defining a frame plane and adapted to be connected to a load-bearing structure of a roof of a building;
a sash (2) with a plurality of sash members (21) and carrying a pane (3) defining a sash plane; and
a set of hinges (10; 1010) connecting the sash (2) with the frame (1) to allow the sash plane to assume an angle relative to the frame plane, each hinge (10; 1010) of said set of hinges defining a hinge centre (c) and including a frame hinge part (100; 1100) in connection with a frame side member (11) and a sash hinge part (200; 1200) in connection with a sash side member (21) and configured to assume an angle relative to the frame hinge part (100; 1100), said set of hinges (10; 1010) defining a hinge axis (α),
the sash (2) and frame (1) each having an interior side (21i, 11i) adapted to face the interior (8) of the building in the mounted condition and an exterior side (21e, 11e) adapted to face the exterior (7) of the building in the mounted condition,
characterised in that
the hinge centre (c) of each hinge (10; 1010) of said set of hinges is offset from the hinge axis (α), and that
the set of hinges is arranged such that the hinge centre (c) of each hinge (10; 1010) is located to the exterior of the exterior side (21e, 11e) of the sash (2) and frame (1) and the hinge axis (α) is located to the interior of the exterior side (21 e, 11 e) of the sash (2) and frame (1).

2. A roof window according to claim 1, wherein the frame hinge part (100; 1100) and the sash hinge part (200; 1200) each comprises a base plate (110, 210; 1110, 1210), preferably substantially plane, each base plate (110, 210; 1110, 1210) having a prede-

fined circumference (cf, cs), and wherein the hinge centre (c) is defined as the geometrical centre of the predefined circumference (cf, cs) of the base plate (110, 210; 1110, 1210) of at least one of said frame and sash hinge parts (100, 200; 1100, 1200).

3. A roof window according to claim 1 or 2, wherein the distance between the hinge axis (α) and the hinge centre (c) lies in the range of 30 to 150 mm, preferably 45 to 120 mm, more preferably 60 to 90 mm.

4. A roof window according to any one of claims 2 and 3, wherein the height of the base plate (110, 210; 1100, 1210) of the frame hinge part (100) and the sash hinge part (210), respectively, lies in the interval 40 to 80 mm, preferably 50 to 70 mm.

5. A roof window according to any one of the preceding claims, wherein each hinge of said set of hinges comprises a pivot hinge (10) having a guidance on the frame hinge part (100) cooperating with a slide rail on the sash hinge part (200) and mounted in such a way that the concavity of the guidance and the slide rail faces the interior (8) of the roof window to provide the offset hinge axis (α) at a more interior position than the set of hinges (10).

6. A roof window according to any one of claims 1 to 4, wherein each hinge of said set of hinges comprises a pantograph hinge (1010) having at least one link and defining a movement pattern providing the offset hinge axis (α) at a more interior position than the set of hinges (1010).

7. A roof window according to any one of the preceding claims, wherein the hinge (10; 1010) is connected to the frame (1) and the sash (2) by means of first mounting means (140, 150; 1140, 1150) and second mounting means (240, 250; 1240, 1250).

8. A roof window according to claim 7 when dependent on any one of claims 2 to 6, wherein the first mounting means comprises a first flange (140; 1140) in connection with the base plate (110; 1110) of the frame hinge part (100; 1100) and a second flange (150; 1150) in connection with the frame side member (11), and the second mounting means comprises a first flange (240; 1240) in connection with the base plate (210; 1210) of the sash hinge part (200; 1200) and a second flange (250; 1250) in connection with the sash side member (21).

9. A roof window according to claim 8, wherein the connection between the first flange (140, 240; 1140, 1240) and the respective base plate (110, 210; 1110, 1210) of the frame and sash hinge parts (100, 200; 1100, 1200) is integral.

10. A roof window according to claim 8 or 9, wherein the respective base plate (110, 210; 1110, 1210) of the frame and sash hinge parts (100, 200; 1100, 1200) is substantially plane and the first flange (140; 1140, 1240) is substantially parallel to the plane of the respective base plate (110, 210; 1110, 1210).

11. A roof window according to claim 8 or 9, wherein the respective base plate (110, 210; 1110, 1210) of the frame and sash hinge parts (100, 200; 1100, 1200) is substantially plane and the first flange (240) forms an angle relative to the respective base plate (210).

12. A roof window according to any one of claims 8 to 11, wherein the second flange (150; 1150, 1250) has an extension substantially parallel to the frame and sash plane, respectively.

13. A roof window according to claim 12, wherein the second flange (150; 1150, 1250) is connected to an exterior frame surface or exterior sash surface (21 e), or to a recess (11 c) in the frame side member (11) or sash side member.

14. A roof window according to any one of claims 8 to 11, wherein the second flange (250) has an extension substantially perpendicular to the frame and sash plane, respectively, and is connected to an inward frame surface or outward sash surface (21 b).

15. A roof window according to any one of claims 7 to 14, wherein third mounting means (160, 170) are provided in addition to the first and second mounting means, said third mounting means preferably comprising a first flange (160) in connection with the base plate (110) of the frame hinge part (100) or the sash hinge part, and a second flange (170) in connection with the frame side member (11) or the sash side member.

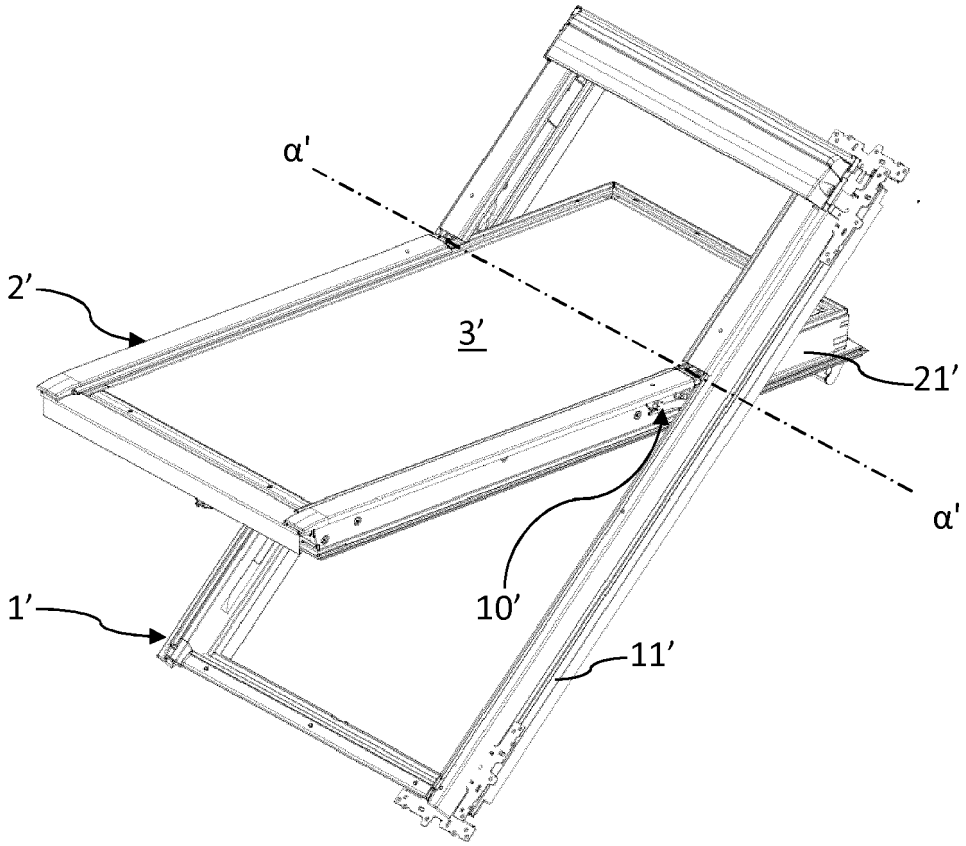


Fig. 1 (PRIOR ART)

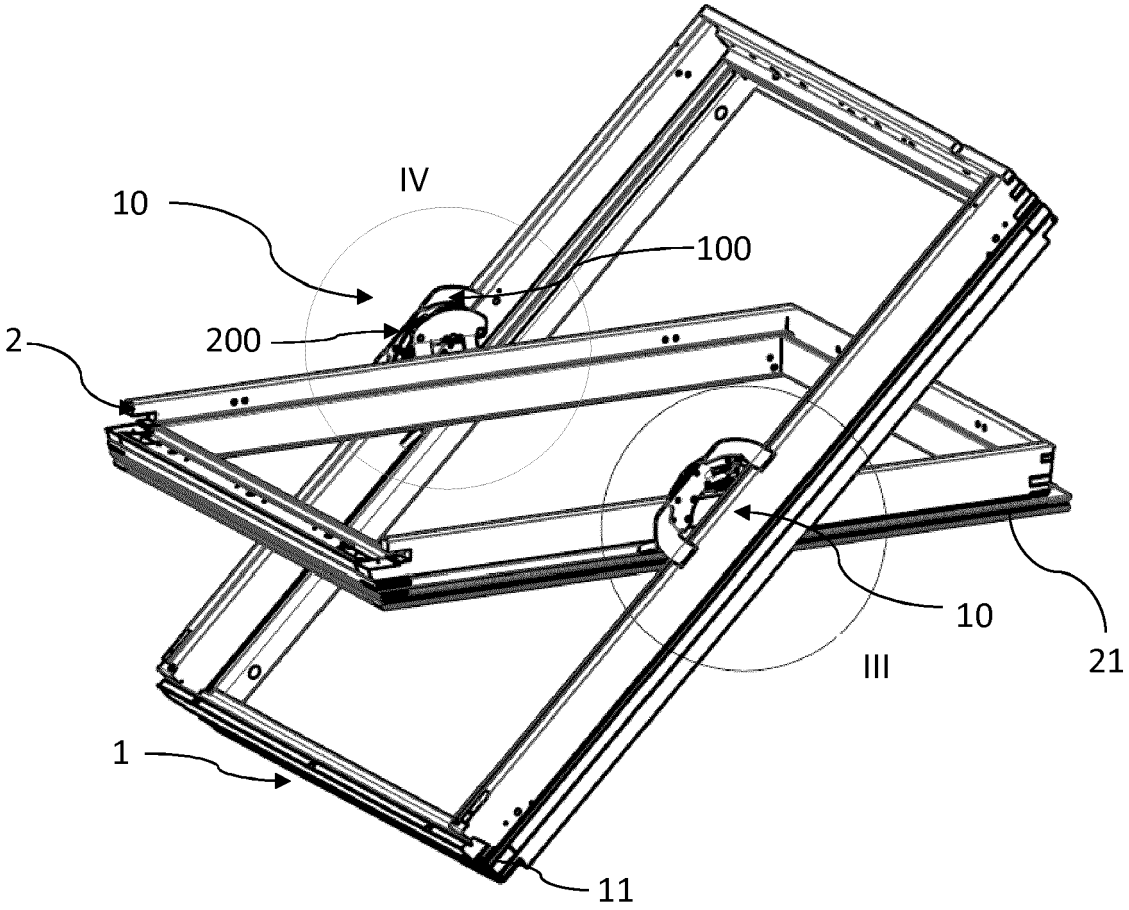


Fig. 2

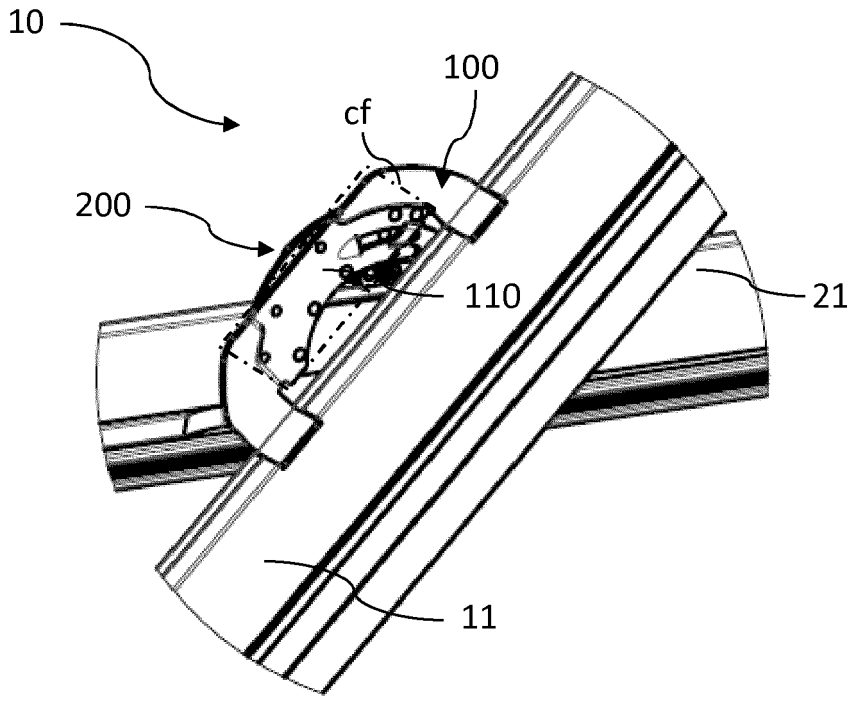


Fig. 3

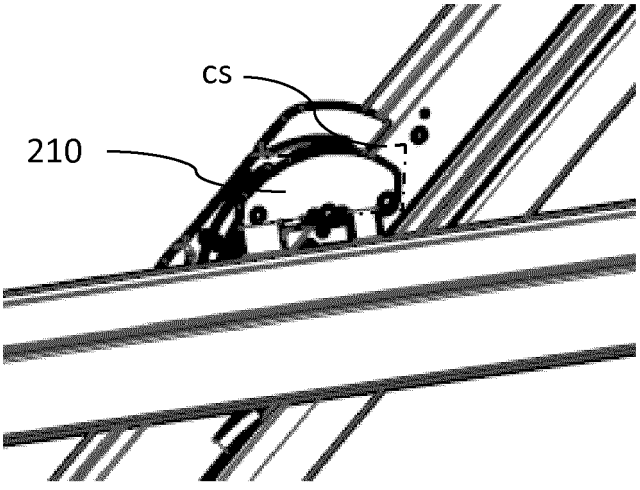


Fig. 4

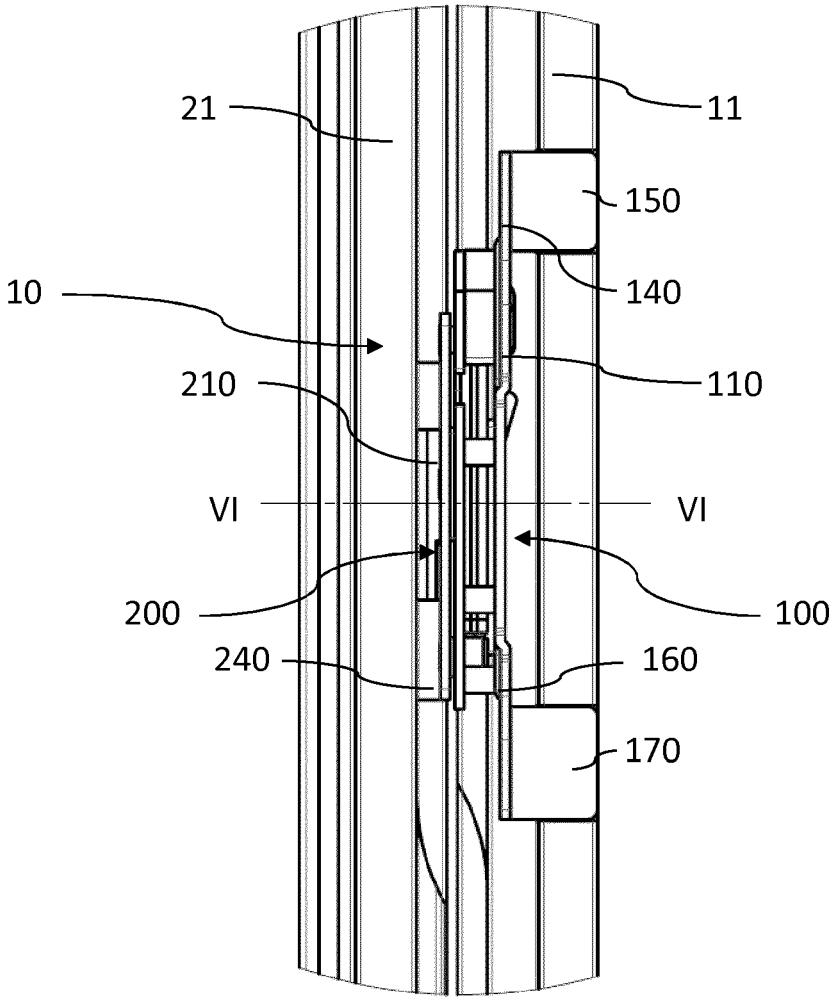
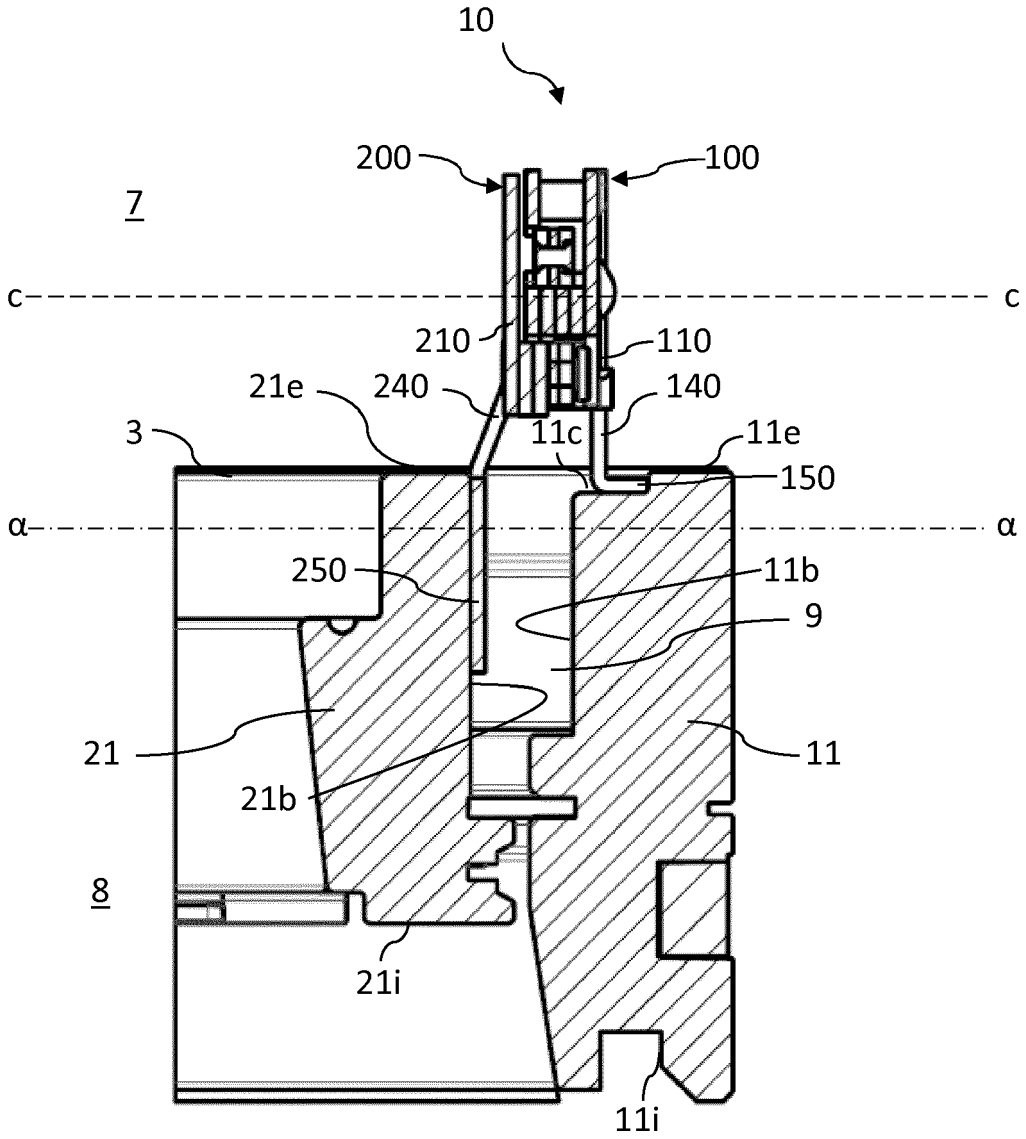


Fig. 5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200
100
7
c
c
210
110
21e
240
140
3
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11e
150
α
α
250
11b
9
21
11
21b
8
21i
11i

Fig. 6

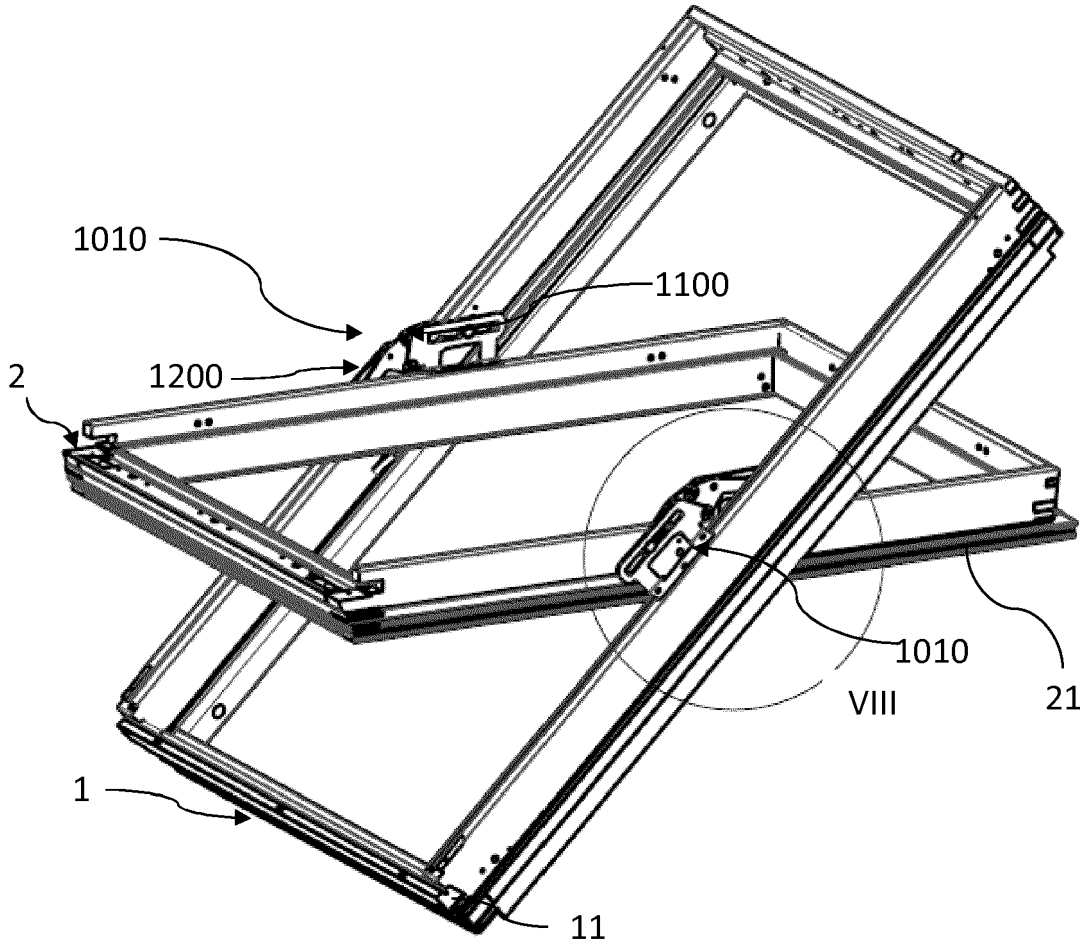


Fig. 7

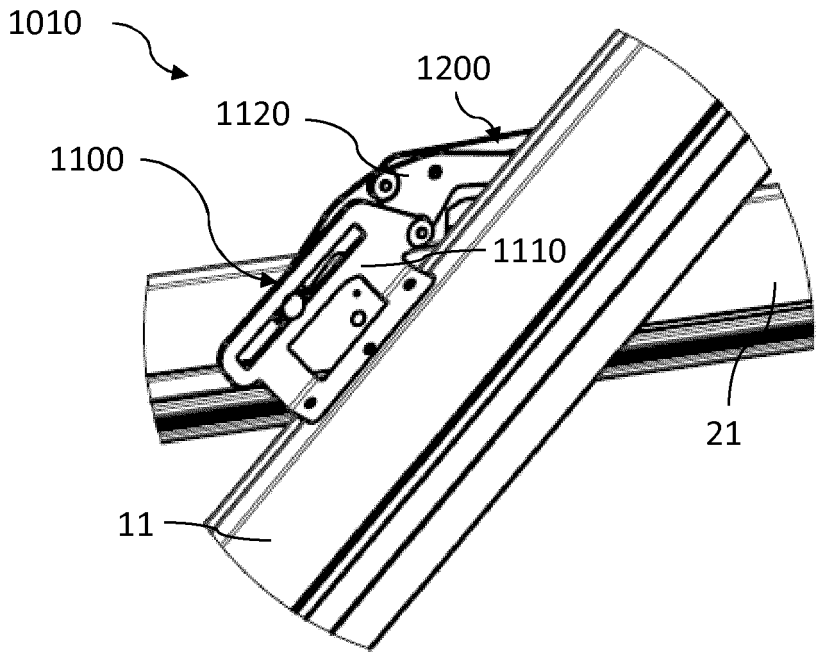


Fig. 8

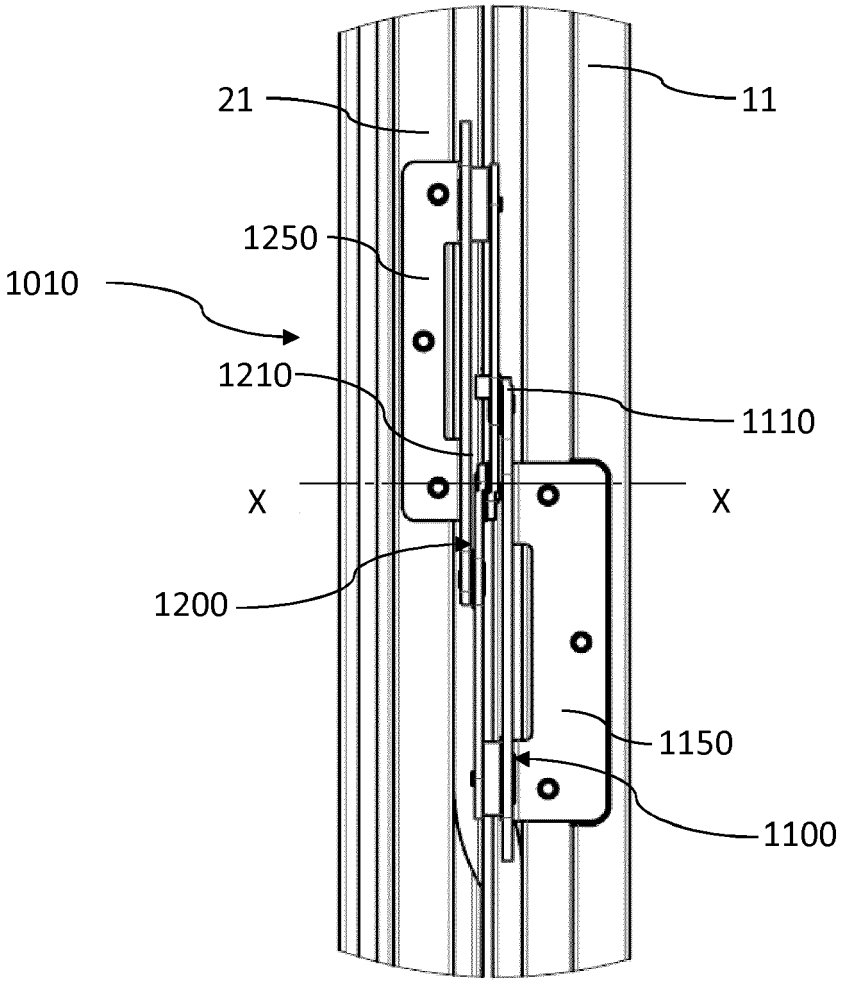
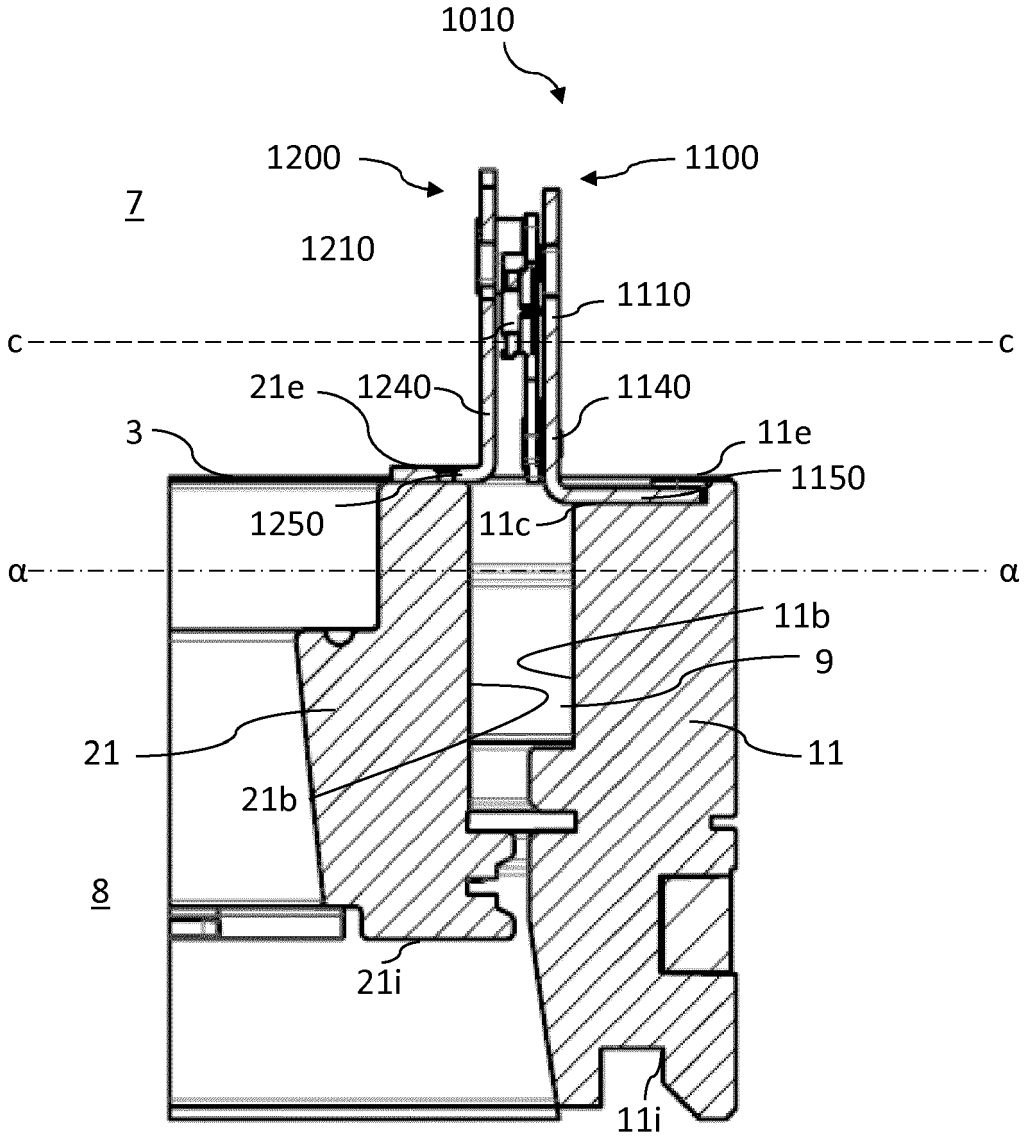


Fig. 9


1010
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1100
7
1210
1110
c
c
21e
1240
1140
3
11e
1150
1250
11c
α
α
11b
9
21
11
21b
8
21i
11i

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 2608

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Place of search	Date of completion of the search	Examiner
The Hague	28 November 2017	Tran, Kim Lien

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