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

(72) Inventor: **Grinvalds, Carsten**
2620 Albertslund (DK)

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

(54) **A HINGE ARRANGEMENT OF A ROOF WINDOW WITH IMPROVED OPERABILITY**

(57) In the hinge arrangement (4) mounted in a roof window having a frame and a sash carrying a pane (3), a hinge (5) of a set of hinges includes a frame hinge part (51) connected to one frame side member (11), and a sash hinge part (52) connected to one sash side member (21). The sash hinge part (52) is able to rotate relative to the frame hinge part (51) about a hinge axis (α). Guiding means providing guidance for the sash hinge part (52) relative to the frame hinge part (51), and motion modulating means configured to act on the hinge (5) to affect the movement of the sash hinge part (52) relative to the

frame hinge part (51) are provided. The frame hinge part (51) and the sash hinge part (52) of the hinge (5) are connected to each other by a hinge pin (53) such that the hinge axis (α) extends through the frame hinge part (51) and the sash hinge part (52). The guiding means are provided at a distance from the hinge pin (53) and in connection with the motion modulating means. The motion modulating means comprise a biasing device (7) including a spring (71; 471), and the guiding device comprise a transmission device (6).

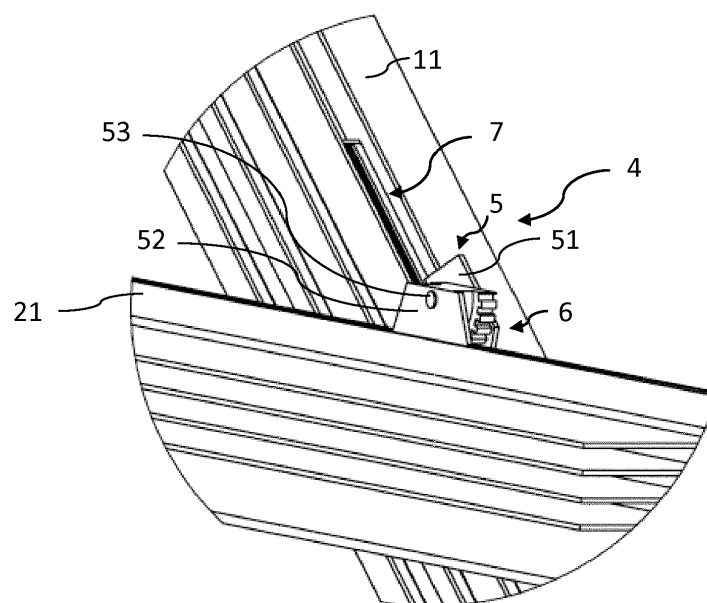


Fig. 5

DescriptionField of the invention

5 **[0001]** The present invention relates to a hinge arrangement for a roof window having a frame with a plurality of frame members and a sash with a plurality of sash members and carrying a pane, said hinge arrangement comprising: a set of hinges, each including a frame hinge part configured to be connected to one frame side member in a mounted condition, and a sash hinge part configured to be connected to one sash side member opposite said frame member in the mounted condition, said sash hinge part being adapted to be rotated relative to the frame hinge part about a hinge axis extending substantially perpendicularly to the longitudinal direction of the frame side member and the sash side member in the mounted condition, within a predefined angle interval, guiding means providing guidance for the sash hinge part relative to the frame hinge part, and motion modulating means configured to act on the hinge to affect the movement of the sash hinge part relative to the frame hinge part over at least a part of the predefined angle interval. The invention furthermore relates to a roof window including a set of hinges.

Background art

15 **[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.

20 **[0003]** In such roof windows, the most common hinge arrangement makes use of a so-called pivot hinge which has attained more or less industry standard status. The pivot hinge comprises an arc-shaped guidance in the frame hinge part to receive a sliding element. In order to be able to position the sash in an arbitrary open position, motion modulating means are provided to obtain a braking action on the sash hinge part relative to the frame hinge part, typically in the form of a leaf spring protruding into the arc-shaped guidance and interacting with the sliding element.

25 **[0004]** Although this pivot hinge has proven to function extremely well, it is not desirable in all fields of application. This is mainly due to the fact that the braking action provided by the friction of the leaf spring is difficult to control and may under some circumstances also need maintenance such as lubrication.

Summary of the invention

30 **[0005]** With this background it is an object of the present invention to improve a hinge arrangement with respect to the overall operability conditions.

35 **[0006]** In a first aspect, this and further objects are met by a hinge arrangement of the kind mentioned in the introduction which is furthermore characterised in that the frame hinge part and the sash hinge part of the hinge are connected to each other by a hinge pin such that the hinge axis extends through the frame hinge part and the sash hinge part, and that the guiding means are provided at a distance from the hinge pin and in connection with the motion modulating means.

40 **[0007]** In this manner, a simple hinge arrangement is provided, but which at the same time provides for the improved operability aimed at, since the motion modulating means cooperate with the guiding means to provide a kinetic pattern in the hinge arrangement when in use, i.e., during opening, closing and parking the window sash in arbitrary positions. The invention is furthermore based on the recognition that even though the simplified hinge connection provides a well-defined point of rotation in the hinge pin itself, it has proven surprisingly advantageous to be able to affect the movement of via the guiding means.

45 **[0008]** In a presently preferred embodiment, the motion modulating means comprise a biasing device. Thus, the movement of the sash hinge part is supported by the biasing device which provides a torque about the hinge pin of the hinge arrangement. In a further development of this preferred embodiment, the biasing device includes a spring. This is a mechanically simple manner of providing the bias.

50 **[0009]** In another presently preferred embodiment, which may also be combined with the above-mentioned preferred embodiment, the motion modulating means comprise a braking device.

55 **[0010]** In a further presently preferred embodiment, which may be combined with one or both of the above-mentioned embodiments, the guiding means comprise a transmission device. This makes it possible to combine the two functions of guiding the movement of the sash hinge part relative to the frame hinge part, and transmitting the force provided by the motion modulating means. In a development of this embodiment, the transmission device comprises a rack slidably connected to the frame hinge part, to cooperate with a pinion connected to, preferably integral with, the sash hinge part. The rack-and-pinion coupling is a simple and reliable mechanical structure.

[0011] In a second aspect, a roof window comprising a hinge arrangement is provided.

[0012] Other presently preferred embodiments and further advantages will be apparent from the following detailed description and the dependent claims.

Brief description of drawings

[0013] The invention will be described in more detail below by means of non-limiting examples of embodiments and with reference to the schematic drawing, in which

Fig. 1 is a perspective view of a roof window with a prior art hinge arrangement;

Fig. 2 is a partial perspective view of a hinge arrangement in a first embodiment of the invention, shown in the mounted condition in the frame and the sash of a roof window;

Fig. 3 is a partial perspective view of the hinge arrangement of Fig. 2, from another angle;

Fig. 4 is a partial perspective view of the hinge arrangement of Fig. 2, from another angle and with the sash in an open position;

Fig. 5 is a view of detail V of Fig. 4, on a larger scale;

Fig. 6 is a plan view of the hinge arrangement of Fig. 2;

Fig. 7 is a cross-sectional view along the line VII-VII of Fig. 6;

Fig. 8 is a partial perspective view of a hinge arrangement in a second embodiment of the invention, shown in the mounted condition in the frame and the sash of a roof window;

Fig. 9 is a partial perspective view of the hinge arrangement of Fig. 8, from another angle;

Fig. 10 is a partial perspective view of the hinge arrangement of Fig. 8, from another angle and with the sash in an open position;

Fig. 11 is a schematic side view of the hinge arrangement of Fig. 8, with parts of the roof window sash removed;

Fig. 12 is a plan view of the hinge arrangement of Fig. 8;

Fig. 13 is a cross-sectional view along the line XIII-XIII of Fig. 12;

Fig. 14 is a partial perspective view of a hinge arrangement in a third embodiment of the invention, shown in the mounted condition in the frame and the sash of a roof window;

Fig. 15 is a partial perspective view of the hinge arrangement of Fig. 14, from another angle;

Fig. 16 is a partial perspective view of the hinge arrangement of Fig. 14, from another angle and with the sash in an open position;

Fig. 17 is a schematic side view of the hinge arrangement of Fig. 14, with parts of the roof window sash removed;

Fig. 18 is a plan view of the hinge arrangement of Fig. 14;

Fig. 19 is a cross-sectional view along the line XIX-XIX of Fig. 18;

Fig. 20 is a partial perspective view of a hinge arrangement in a fourth embodiment of the invention, shown in the mounted condition in the frame and the sash of a roof window;

Fig. 21 is a partial perspective view of the hinge arrangement of Fig. 20, from another angle;

Fig. 22 is a partial perspective view of the hinge arrangement of Fig. 20, from another angle and with the sash in an open position;

Fig. 23 is a schematic side view of the hinge arrangement of Fig. 20, with parts of the roof window sash removed;

Fig. 24 is a plan view of the hinge arrangement of Fig. 20;

Fig. 25 is a cross-sectional view along the line XXV-XXV of Fig. 24;

Fig. 26 is a partial perspective view of a hinge arrangement in a fifth embodiment of the invention, shown in the mounted condition in the frame and the sash of a roof window;

Fig. 27 is a partial perspective view of the hinge arrangement of Fig. 26, from another angle;

Fig. 28 is a partial perspective view of the hinge arrangement of Fig. 26, from another angle and with the sash in an open position;

Fig. 29 is a schematic side view of the hinge arrangement of Fig. 26, with parts of the roof window sash removed;

Fig. 30 is a plan view of the hinge arrangement of Fig. 26;

Fig. 31 is a cross-sectional view along the line XXXI-XXXI of Fig. 30;

Fig. 32 is a partial perspective view of a hinge arrangement in a sixth embodiment of the invention, shown in the mounted condition in the frame and the sash of a roof window;

Fig. 33 is a partial perspective view of the hinge arrangement of Fig. 32, from another angle;

Fig. 34 is a partial perspective view of the hinge arrangement of Fig. 32, from another angle and with the sash in an open position;

Fig. 35 is a schematic side view of the hinge arrangement of Fig. 32, with parts of the roof window sash removed;

Fig. 36 is a plan view of the hinge arrangement of Fig. 32; and

Fig. 37 is a cross-sectional view along the line XXXVII-XXXVII of Fig. 36.

Detailed description of the invention

[0014] 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.

[0015] 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 α' 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 are of course conceivable, for instance at the centre of the roof window or offset slightly above or under the centre depending of the actual need for an optimal balancing of the weight of the sash, including various structural modifications thereof affecting the overall weight and different types of pane configuration with one, two or multiple layers of glass.

[0016] 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 at the sash top member with a lock mechanism to interact with a striking plate on the frame top member. This operating and locking assembly could include a ventilation and control flap as described in applicant's patent EP 2 607 578 B1. 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'.

[0017] 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.

[0018] Referring now to Figs 2 to 7, a first embodiment of a hinge arrangement 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 as in the above, without the 'mark.

[0019] The hinge arrangement generally designated 4 is shown in its mounted condition in a roof window having a frame 1 with a plurality of frame members, of which one frame side member 11 is depicted, and a sash 2 with a plurality of sash members, of which the sash side member 21 opposite the one frame side member 11 is shown.

[0020] The frame 1 with its plurality of frame members 11 defines a frame plane and is in turn adapted to be connected to a load-bearing structure of a roof of a building. The sash 2 with its plurality of sash members 21 defines a sash plane represented by an upper pane line t, cf. Fig. 7.

[0021] The sash carries a pane 3. In the embodiment of the inventive roof window shown in Figs 2 to 7, the pane 3 has four glazing sheets. As shown in other embodiments, panes 3 having two or three glazing sheets are indicated, but the invention is also applicable to roof windows with a single-glazing pane and more glazing sheets than four.

[0022] The inventive hinge arrangement 4 comprises a set of hinges, of which one hinge 5 is shown, and the other hinge of the set is positioned at the opposite frame and sash side members.

[0023] Each hinge 5 includes a frame hinge part 51 configured to be connected to one frame side member 11 in a mounted condition. The term configured implies that suitable forms of mounting means such as holes and screws are provided although not shown. Correspondingly, a sash hinge part 52 is configured to be connected to one sash side member 21 opposite said frame member 11 in the mounted condition.

[0024] The sash hinge part 52 is adapted to be rotated relative to the frame hinge part 51 about a hinge axis α , cf. Fig. 7, extending substantially perpendicularly to the longitudinal direction of the frame side member 11 and the sash side member 21 in the mounted condition, within a predefined angle interval. Typically, the predefined angle interval in normal use in a standard roof inclination is 0 to 90 degrees, but the sash may also be able to rotate such that the external

side of the pane 3 is accessible from the interior, i.e., about 180 degrees.

[0025] As will be described in further detail below, guiding means providing guidance for the sash hinge part 52 relative to the frame hinge part 51 are provided in conjunction with motion modulating means configured to act on the hinge 5 to affect the movement of the sash hinge part 52 relative to the frame hinge part 51 over at least a part of the predefined angle interval.

[0026] The frame hinge part 51 and the sash hinge part 52 of the hinge 5 are connected to each other by a hinge pin 53 such that the hinge axis α extends through the frame hinge part 51 and the sash hinge part 52. This entails that the hinge axis α is located within the circumference of both hinge parts 51, 52.

[0027] Furthermore, the guiding means are provided at a distance from the hinge pin 53 and in connection with the motion modulating means.

[0028] In this first embodiment, the motion modulating means comprise a biasing device 7. The term biasing encompasses the ability of one part to affect another part with a pre-load or force. The biasing may be tensional or compressional, but other kinetic configurations are conceivable.

[0029] In the first embodiment shown, the biasing device 7 includes a spring 71 in the form of a coil spring which is at one end fastened to an abutment 72 and at the other end to a connecting element 73 providing the connection to the guiding means of the hinge arrangement 4.

[0030] Here, the abutment 72 is stationary in the hinge arrangement 4 and the connecting element 73 is movable. It is also conceivable to make also the abutment movable with suitable check means.

[0031] In this first embodiment, the guiding means comprise a transmission device 6. The transmission device 6 comprises a rack 61 slidably connected to the frame hinge part 51, to cooperate with a pinion 62 connected to the sash hinge part 52.

[0032] The pinion 62 is here shown integral with the sash hinge part 52.

[0033] The rack 61 is received in fitting 60 which is in turn fastened to the frame side member 11.

[0034] A particularly simple embodiment of the hinge 5 is to form the frame hinge part 51 to comprise a base plate 51a and the sash hinge part 52 to comprise a base plate 52a. The hinge pin 53 is here shown connected to the base plate 51a of the frame hinge part 51 and journaled in the sash hinge part 52. Furthermore, the sash hinge part 52 to comprise a bridge portion 52b connected to the base plate 52a and an arc portion 52c connected to the bridge portion 52b. In the case the pinion 62 is integral with the sash hinge part 52, the pinion 62 may as shown be formed at the periphery of the arc portion 52c.

[0035] To provide the connection between the guiding means and the motion modulating means, the rack 61 is connected to the biasing device 7. In use, for instance by opening the sash relative to the frame, the spring 71 of the biasing device 7 exerts a force on the rack 61 which moves accordingly and induces a rotating movement on the sash hinge part 51 via the pinion 62.

[0036] Referring in particular to Fig. 7, the hinge axis α of the hinge arrangement 4 is located to the exterior of the upper pane line t. The position of the hinge arrangement 4 in the roof window is chosen such that the distance between the hinge axis α and the upper pane line t lies in the interval 0 to 50 mm, preferably 5 to 30 mm, most preferably 10 to 20 mm.

[0037] In the first embodiment, it is seen that the hinge arrangement 4 is located entirely on the exterior side of the upper pane line t. Thus, the frame hinge part 51 is fastened to a top surface of the frame side member 11 and the sash hinge part 52 to a top surface of the sash side member 21.

[0038] A gap 9 is provided between the frame side member 11 and the sash side member 21. A number of sealings 91 is provided in recesses in the frame side member 11.

[0039] In the second embodiment shown in Figs 8 to 13, elements having the same or analogous function are denoted by the same reference numerals as in the first embodiment, to which 100 has been added. Correspondingly, in the third embodiment elements carry the same reference numerals to which 200 has been added, and so on. The components of the roof window are denoted by the same reference numerals throughout. Only differences relative to the first embodiment will be described in detail.

[0040] The hinge arrangement 104 comprises as in the first embodiment a biasing device 107 and a transmission device 106 of substantially identical configuration.

[0041] The main difference from the first embodiment resides in that the hinge arrangement 4 is located at least partly on the interior side of the upper pane line t. To this end, the frame side member 11 comprises a set of recesses to accommodate parts of the hinge arrangement 104. Of these recesses, longitudinal recess 111 to receive the biasing device 107 is indicated in Fig. 10. The sash side member 21 is also provided with recesses to accommodate such parts of the hinge arrangement 104.

[0042] Also indicated in connection with the second embodiment, cf. Fig. 11, is the distance d between the hinge pin 153 and the point of action of the motion modulating means on the guiding means of the hinge arrangement 104, viz. at the mesh between the rack and pinion of the transmission device 106. The distance d is an indication of the torque attainable to affect the movement of the sash hinge part 52 and hence of the entire sash 2. It is noted that such a distance d is present in all of the embodiments of the present invention, although not indicated explicitly throughout.

[0043] In the third embodiment shown in Figs. 14 to 19, the guiding means comprise a transmission device 206 in the first and second embodiments.

[0044] The motion modulating means comprise a braking device 208.

[0045] The braking device 208 comprises a plurality of wheels 2081, here connected to the frame hinge part 251, to interact with an engagement element 2082 in connection with the guiding means 206 of the hinge arrangement 204.

[0046] The plurality of wheels 2081 is biased towards the engagement element 2082 to provide a progressive force pattern. Alternatively, or additionally, the plurality of wheels 2081 may form a converging path to provide a progressive force pattern.

[0047] In this third embodiment, the engagement element of the braking device 208 comprises a bar 2082 to cooperate with the plurality of wheels 2081. The bar 2082 is in the embodiment shown connected to the rack 61 of the transmission device 206 forming part of the guiding means of the third embodiment.

[0048] In the fourth embodiment shown in Figs 20 to 25, the guiding means 306 of the hinge arrangement 304 comprise an arc configuration and the engagement element of the braking device 308 constituting a part of the motion modulating means comprises a slide element 3082 to cooperate with the plurality of wheels 3081.

[0049] In the fifth embodiment shown in Figs 26 to 31, the guiding means comprise a track set 406 to accommodate the connecting element 473 of the biasing device 407 constituting part of the motion modulating means of the hinge arrangement 404.

[0050] In this fifth embodiment, a first track 461 is provided in the frame hinge part 451 and a second track 462 in the sash hinge part 452. The connecting element 473 of the biasing device 407 is received in both of these tracks 461, 462.

[0051] Referring in particular to Fig. 29, the movement of the sash hinge part 452 relative to the frame hinge part 451 assisted by the cooperation between the motion modulating means and the guiding means is indicated. The spring 471 of the biasing device 407 forming part of the motion modulating means exerts a force on the connecting element 473 which in turn is transferred into a torque due to the distance d from the point of action to the hinge pin 453.

[0052] The sixth embodiment, shown in Figs 32 to 37, corresponds in substance to the first embodiment to which braking device 508 corresponding to the braking device 208 of the third embodiment has been applied.

[0053] Thus, the guiding means of the sixth embodiment comprise transmission device 506 and the motion modulating means comprise both biasing device 507 and braking device 508. This offers a further improved possibility to control the motion during opening and closing of the roof window, i.e. rotating the sash 2 relative to the frame 1.

[0054] In further, not shown embodiments, other combinations between the shown and described embodiments may be carried out. Moreover, the motion modulating means may comprise an external drive device, for instance electrically driven.

[0055] 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

1				frame
	11	frame side member		
		111,411	recess	
2				sash
	21	side member		
3				pane
4, 104, 204, 304, 404, 504				hinge arrangement
	5, 105, 205, 305, 405, 505			hinge
	51	frame hinge part		
		51a	base plate	
	52	sash hinge part		
		52a	base plate	
		52b	bridge portion	
		52c	arc portion	

(continued)

		53	hinge pin	
5	6, 106, 206, 506			transmission device
		60	fitting	
		61	rack	
10		62	pinion	
	306			arc configuration track set
	406			
		461	track	
15		462	track	
	7, 107, 407; 507			biasing device
		71	spring	
20		72	abutment	
		73	connecting element	
	208, 308, 508			braking device
25		2081, 3081	wheels	
		2082	bar	
		3082	slide element	
30	9, 109			gap
		91	sealing	
35	α		hinge axis	
	t		upper pane line	
	d		distance	

Claims

1. A hinge arrangement (4) for a roof window having a frame with a plurality of frame members (11) and a sash with a plurality of sash members (21) and carrying a pane (3), said hinge arrangement (4) comprising:

a set of hinges (5), each including a frame hinge part (51) configured to be connected to one frame side member (11) in a mounted condition, and a sash hinge part (52) configured to be connected to one sash side member (21) opposite said frame member (11) in the mounted condition, said sash hinge part (52) being adapted to be rotated relative to the frame hinge part (51) about a hinge axis (α) extending substantially perpendicularly to the longitudinal direction of the frame side member (11) and the sash side member (21) in the mounted condition, within a predefined angle interval,

guiding means providing guidance for the sash hinge part (52) relative to the frame hinge part (51), and motion modulating means configured to act on the hinge (5) to affect the movement of the sash hinge part (52) relative to the frame hinge part (51) over at least a part of the predefined angle interval,

characterised in that

the frame hinge part (51) and the sash hinge part (52) of the hinge (5) are connected to each other by a hinge pin (53) such that the hinge axis (α) extends through the frame hinge part (51) and the sash hinge part (52), and that

the guiding means are provided at a distance from the hinge pin (53) and in connection with the motion modulating

means.

2. A hinge arrangement according to claim 1, wherein the motion modulating means comprise a biasing device (7; 107; 407).
3. A hinge arrangement according to claim 2, wherein the biasing device (7; 107; 407) includes a spring (71; 471).
4. A hinge arrangement according to claim 3, wherein the spring (71; 471) of the biasing device (7; 107; 407) is a coil spring which is at one end fastened to an abutment (72; 472) and at the other end to a connecting element (73; 473) providing the connection to the guiding means of the hinge arrangement (4).
5. A hinge arrangement according to claim 4, wherein the abutment (72; 472) is stationary in the hinge arrangement (4) and the connecting element (73; 473) is movable.
6. A hinge arrangement according to any one of the preceding claims, wherein the motion modulating means comprise a braking device (208; 308; 508).
7. A hinge arrangement according to claim 6, wherein the braking device (208; 308; 508) comprises a plurality of wheels (2081; 3081), preferably connected to the frame hinge part (251; 351; 551), to interact with an engagement element (2082; 3082) in connection with the guiding means (206; 306; 506) of the hinge arrangement.
8. A hinge arrangement according to claim 7, wherein said plurality of wheels (2081; 3081) is biased towards said engagement element (2082; 3082) and/or form a converging path.
9. A hinge arrangement according to claim 7 or 8, wherein the engagement element of the braking device (208; 508) comprises a bar (2082) to cooperate with the plurality of wheels (2081).
10. A hinge arrangement according to claim 7 or 8, wherein the guiding means (306) of the hinge arrangement (304) comprise an arc configuration and the engagement element of the braking device (308) comprises a slide element (3082) to cooperate with the plurality of wheels (3081).
11. A hinge arrangement according to any one of claims 1 to 9, wherein the guiding means comprise a transmission device (6; 106; 206; 506).
12. A hinge arrangement according to claim 11, wherein the transmission device (6; 106; 206; 506) comprises a rack (61) slidably connected to the frame hinge part (51), to cooperate with a pinion (62) connected to, preferably integral with, the sash hinge part (52).
13. A hinge arrangement according to claim 12 and any one of claims 2 to 5, wherein the rack (61) is connected to the biasing device (7; 107).
14. A hinge arrangement according to claim 12 or 13 and any one of claims 6 to 9, wherein the rack (61) is connected to the braking device (208; 508).
15. A hinge arrangement according to claim 5, wherein the guiding means comprise a track set (406) to accommodate the connecting element (473) of the biasing device (407), preferably including a first track (461) in the frame hinge part (451) and a second track (462) in the sash hinge part (452).
16. A hinge arrangement according to any one of the preceding claims, wherein frame hinge part (51) comprises a base plate (51 a) and the sash hinge part (52) comprises a base plate (52a), the hinge pin (53) being preferably connected to the base plate (51 a) of the frame hinge part (51) and journaled in the sash hinge part (52).
17. A hinge arrangement according to claim 16, wherein the sash hinge part (52) comprises a bridge portion (52b) connected to the base plate (52a) and an arc portion (52c) connected to the bridge portion (52b).
18. A hinge arrangement according to claim 1, wherein the motion modulating means comprise an external drive device.
19. 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 represented by an upper pane line (t); and
a hinge arrangement (4) according to any one of claims 1 to 18, **characterised in that**
the hinge axis (α) of the hinge arrangement (4) is located to the exterior of the upper pane line (t).

20. A roof window according to claim 19, wherein the distance between the hinge axis (α) and the upper pane line (t) lies in the interval 0 to 50 mm, preferably 5 to 30 mm, most preferably 10 to 20 mm.

21. A roof window according to claim 19 or 20, wherein the hinge arrangement (4) is located entirely on the exterior side of the upper pane line (t).

22. A roof window according to claim 19 or 20, wherein the hinge arrangement (4) is located at least partly on the interior side of the upper pane line (t).

23. A roof window according to any one of claim 22, wherein the frame side member (11) comprises a set of recesses (111) to accommodate parts of the hinge arrangement (104).

24. A roof window according to any one of claims 19 to 23, wherein a gap (9) is provided between the frame side member (11) and the sash side member (21), preferably accommodating a number of sealings (91).

25. A roof window according to any one of claims 19 to 24, wherein the number of glazing sheets in the pane (3) is two, three, or four.

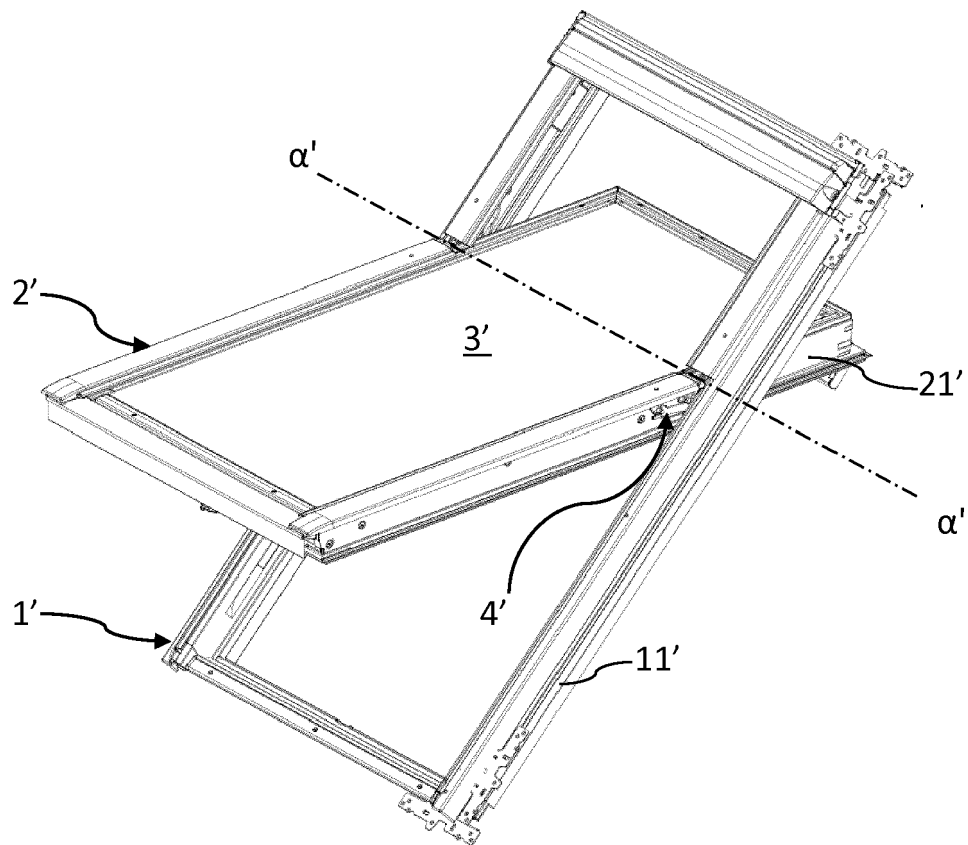


Fig. 1 (PRIOR ART)

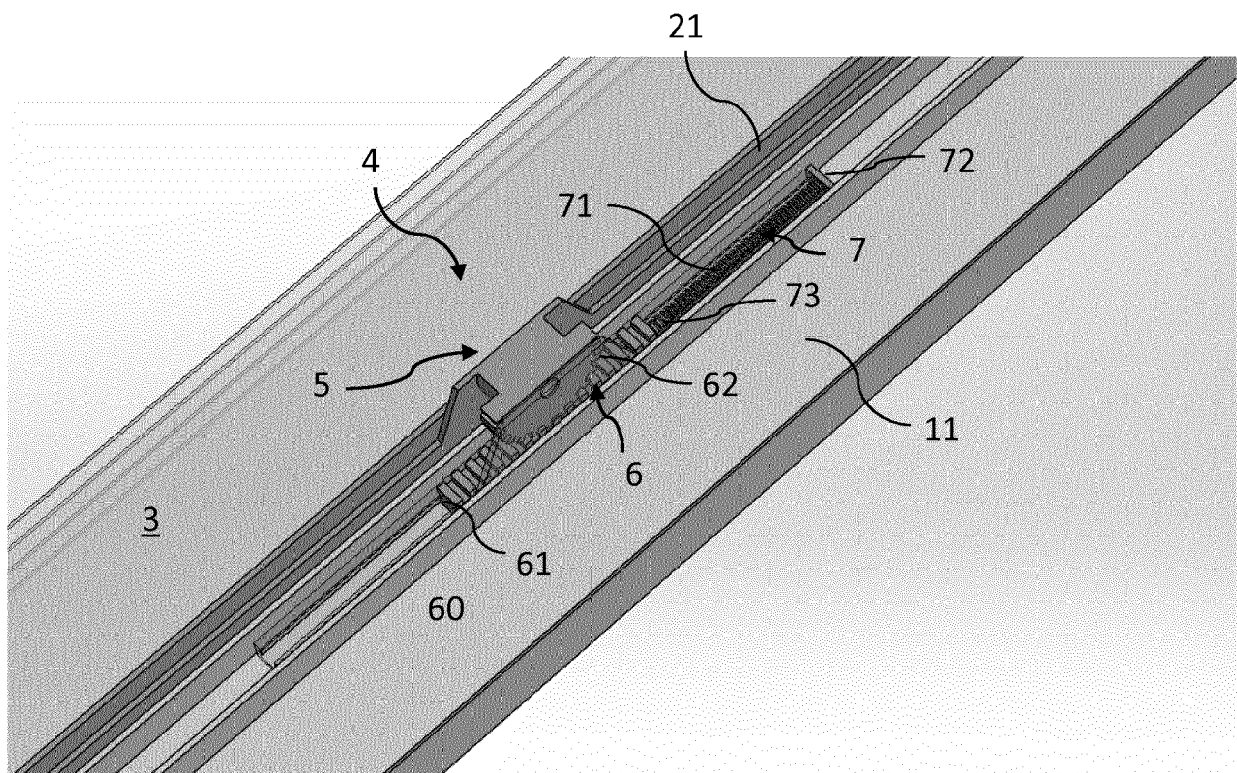
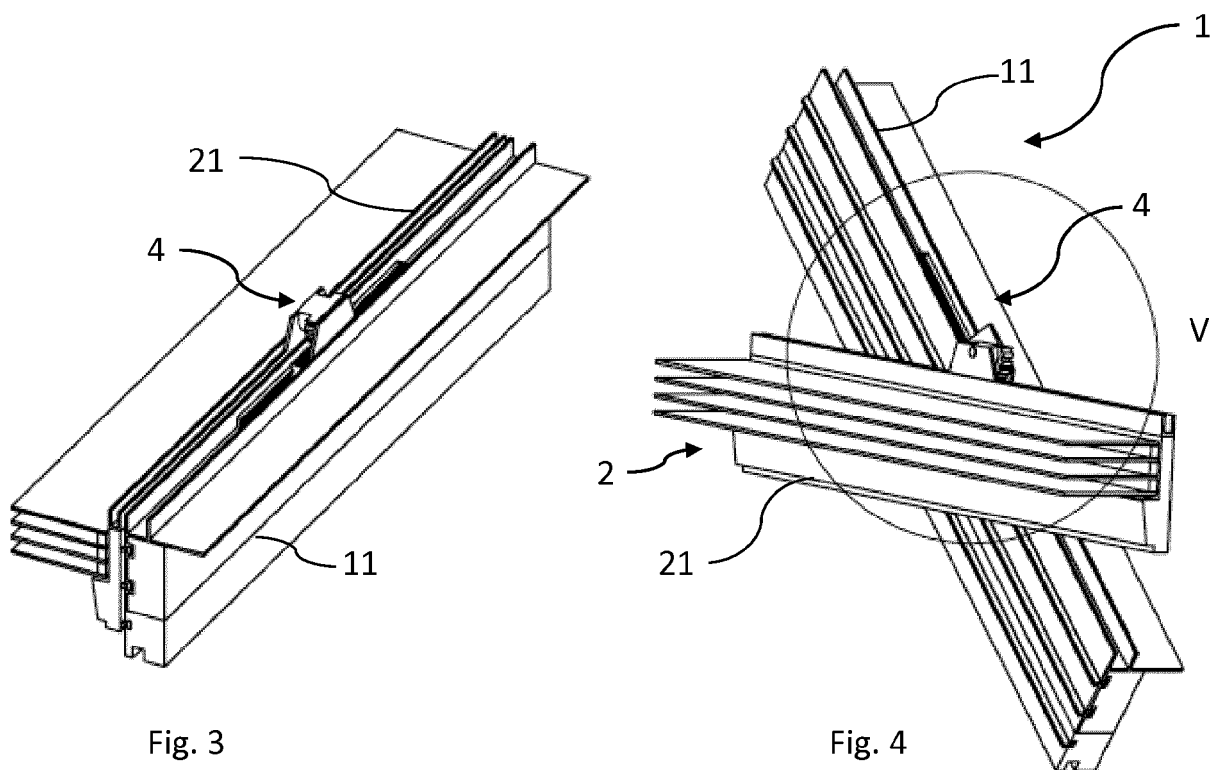


Fig. 2



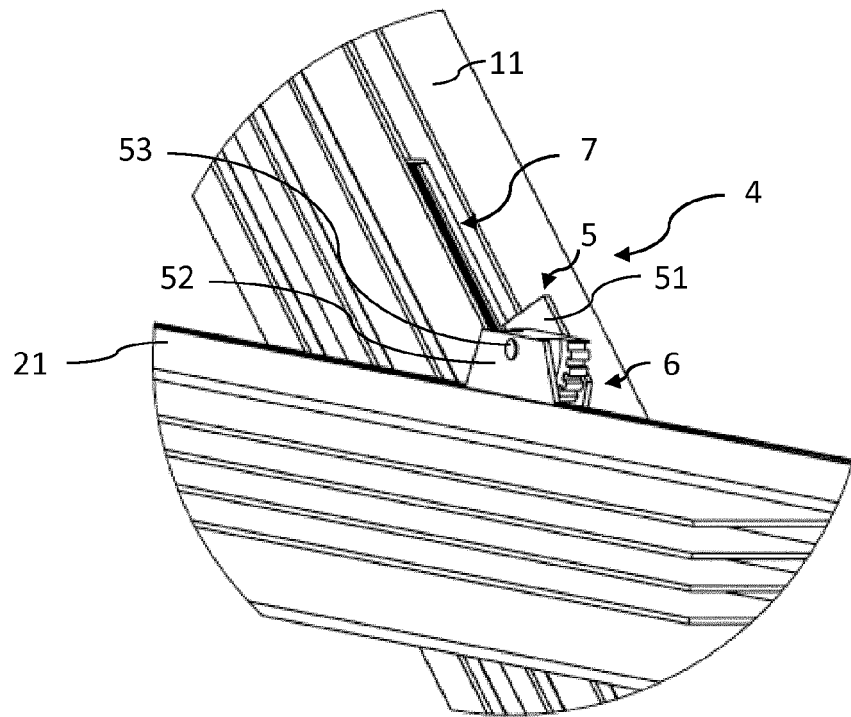


Fig. 5

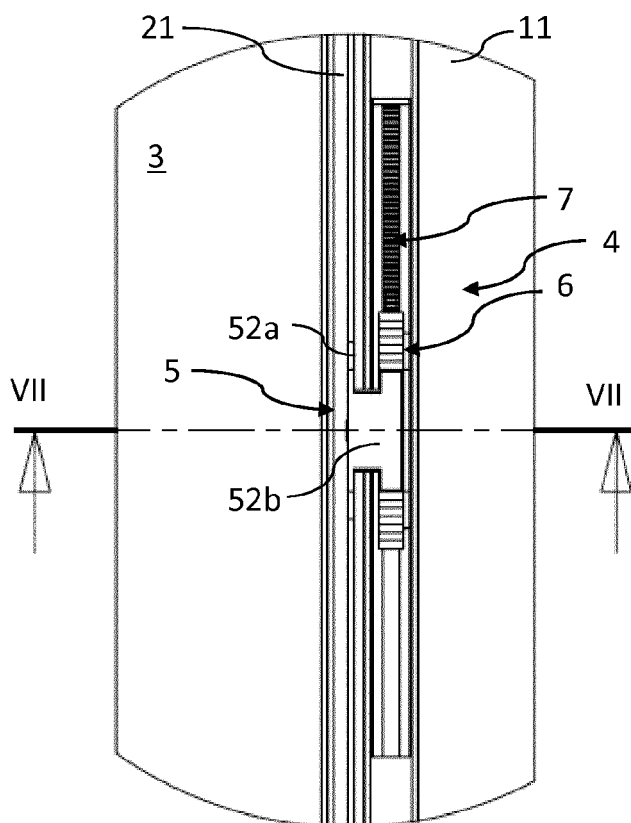


Fig. 6

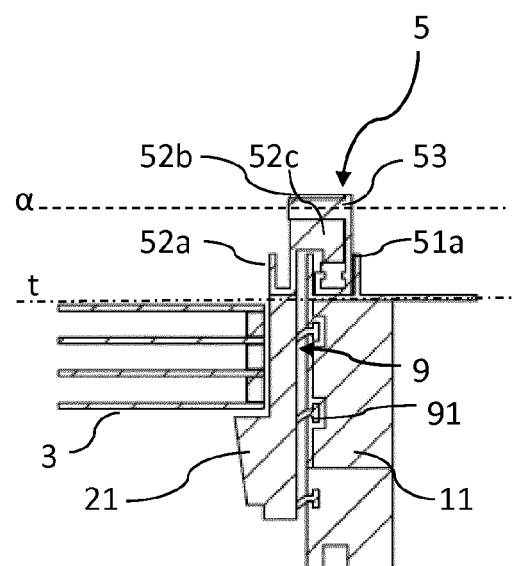


Fig. 7

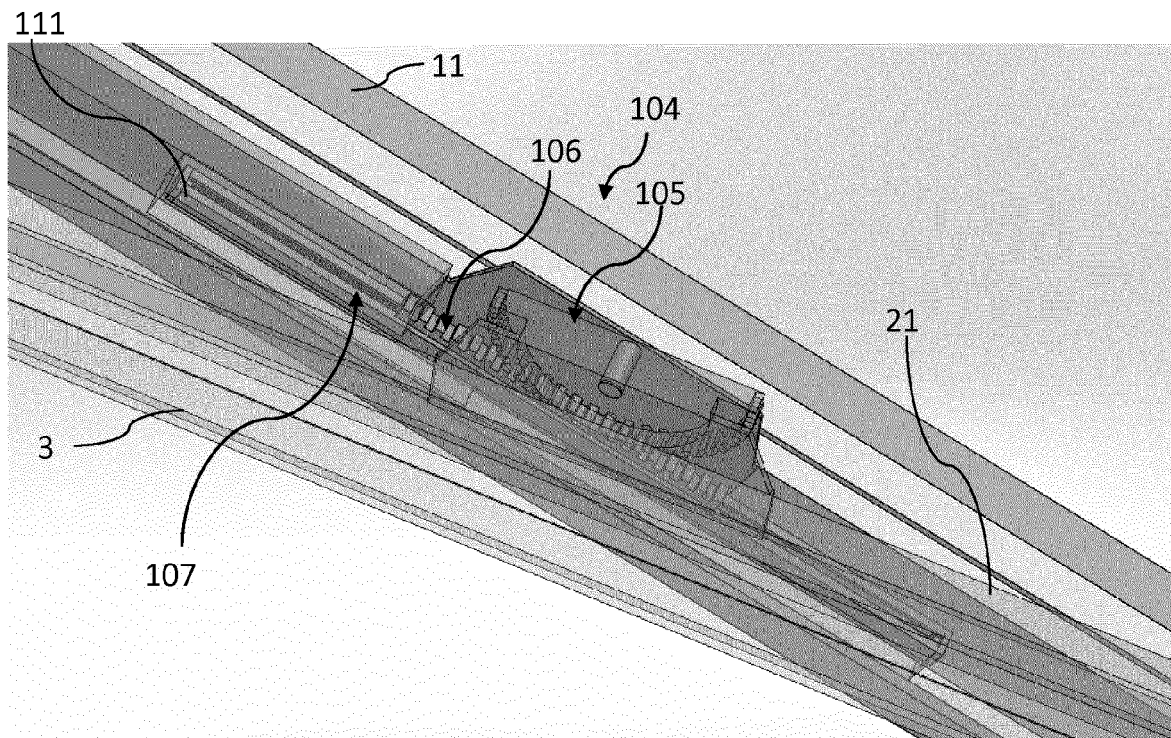


Fig. 8

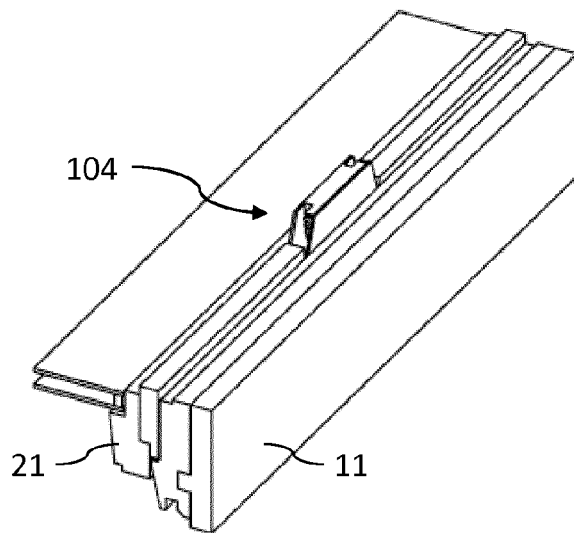


Fig. 9

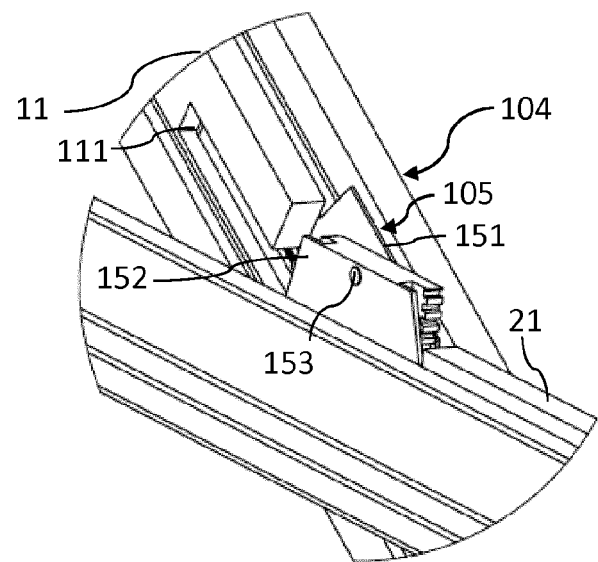


Fig. 10

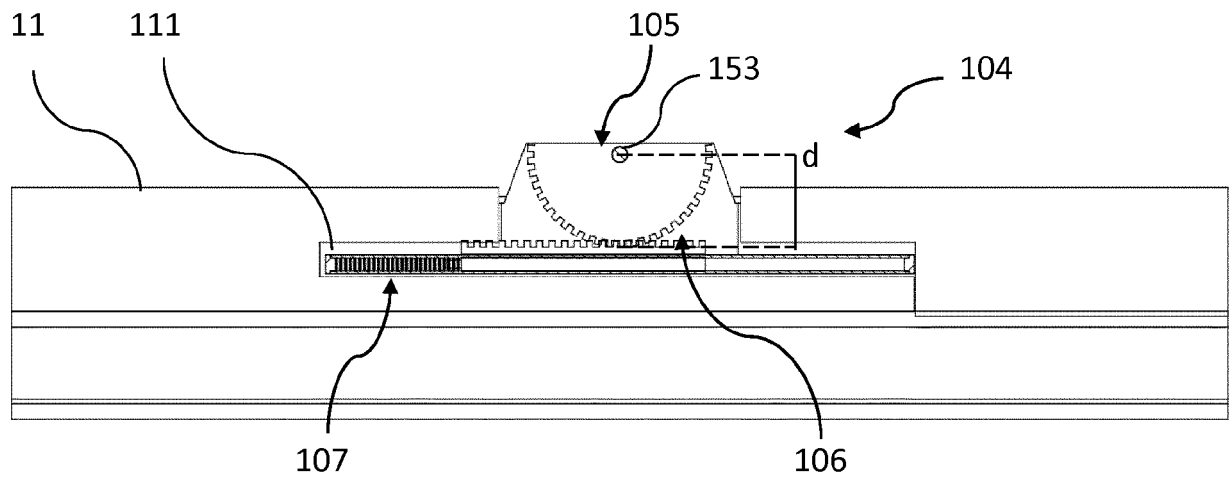


Fig. 11

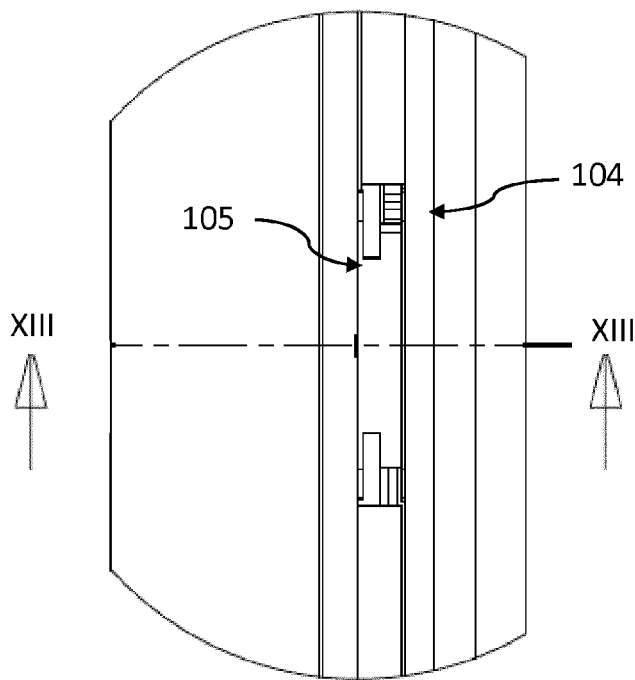


Fig. 12

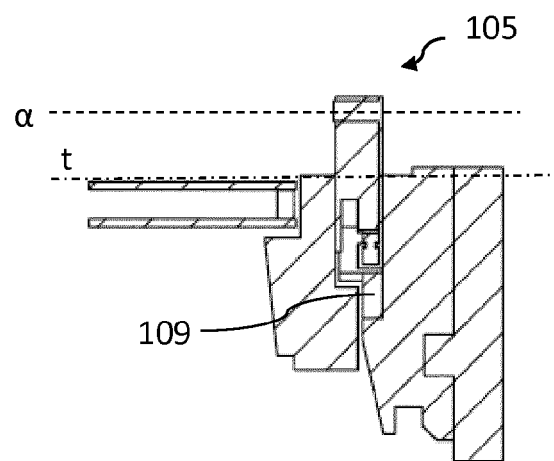


Fig. 13

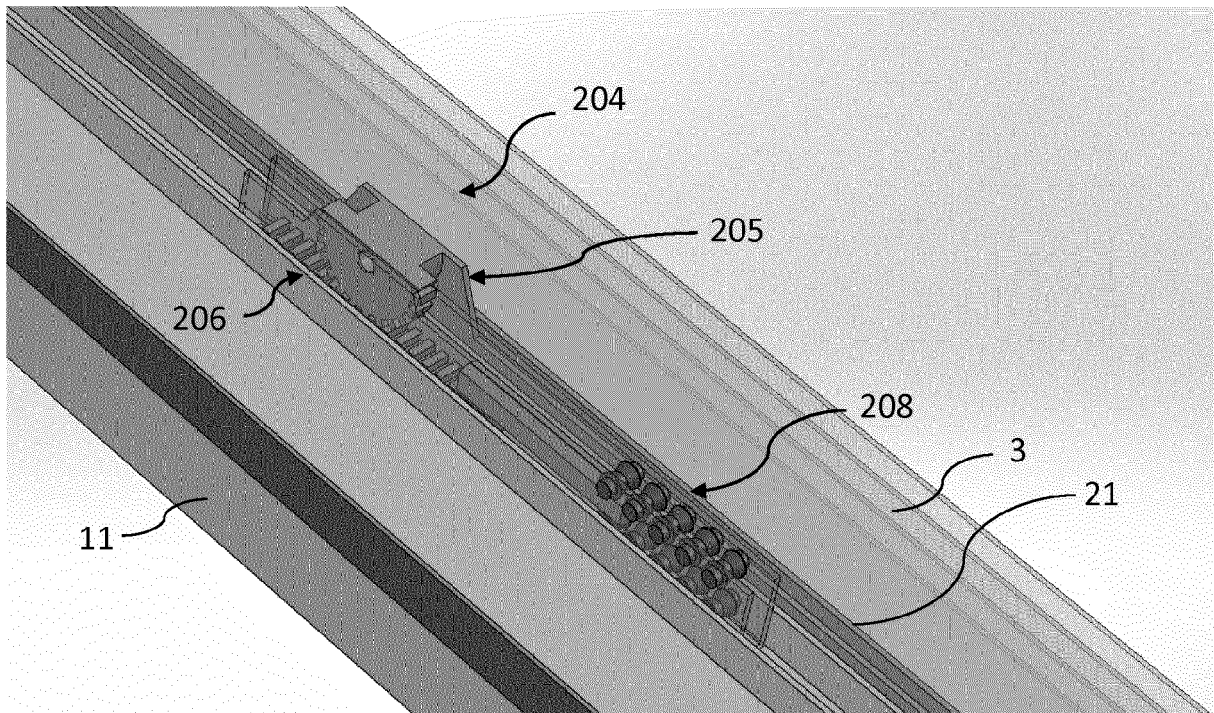


Fig. 14

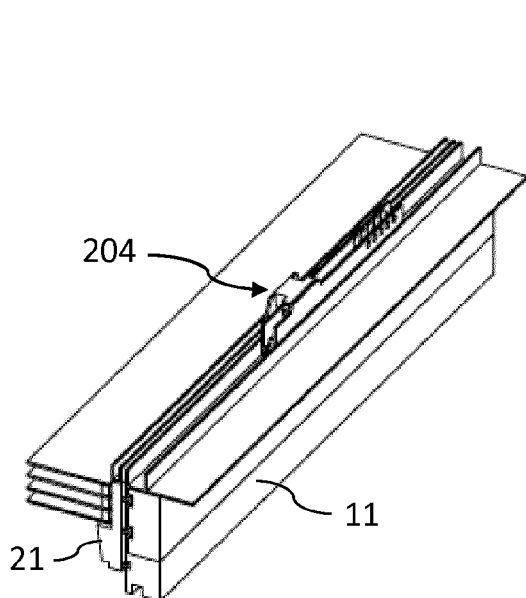


Fig. 15

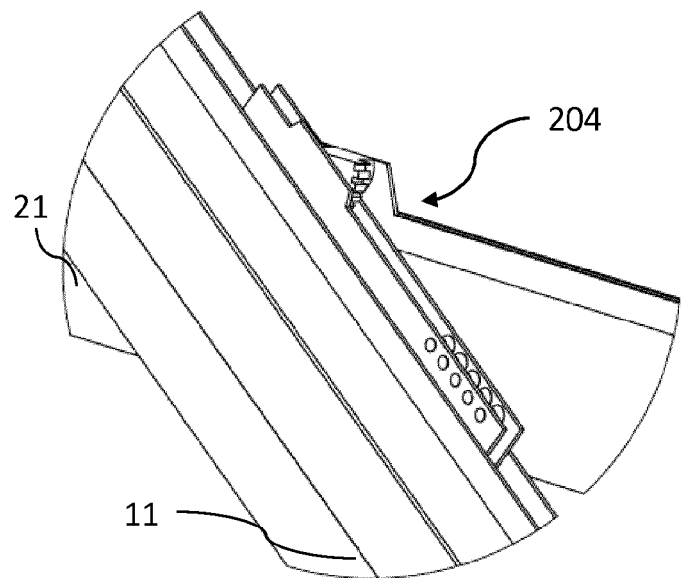


Fig. 16

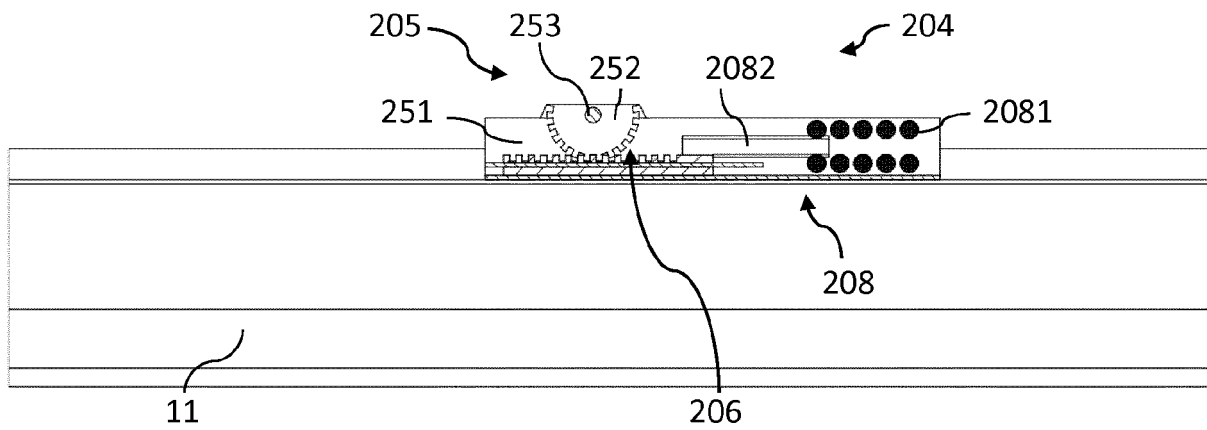


Fig. 17

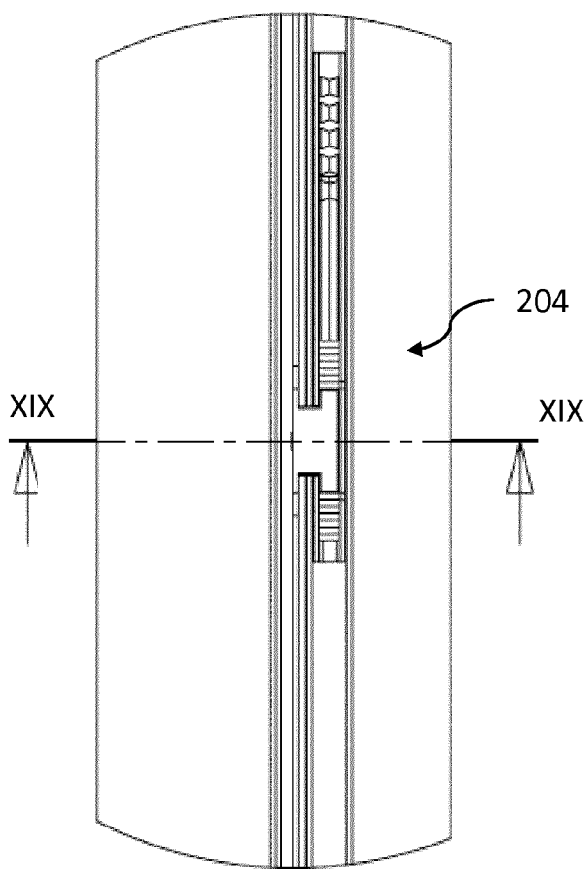


Fig. 18

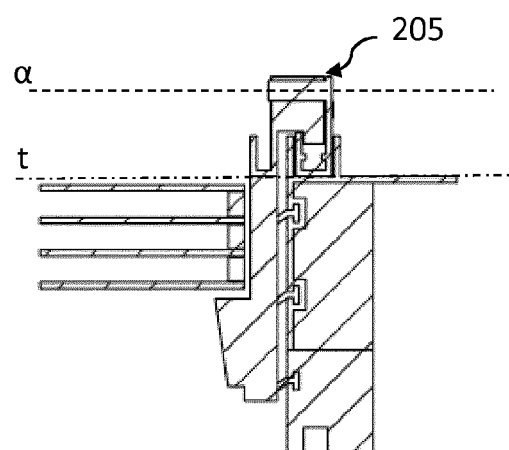


Fig. 19

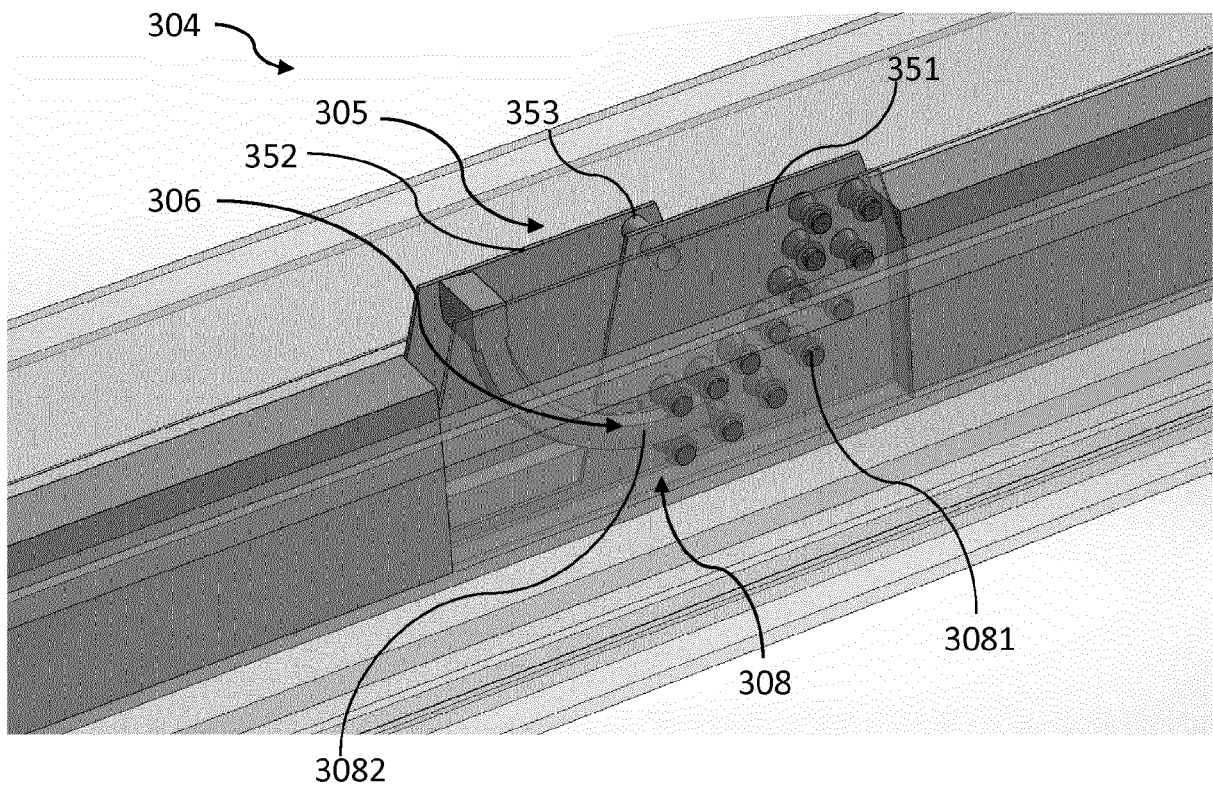


Fig. 20

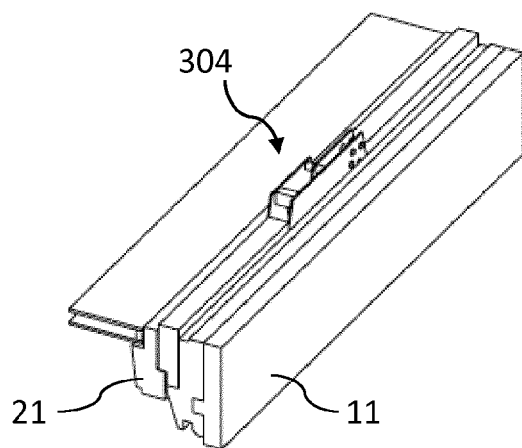


Fig. 21

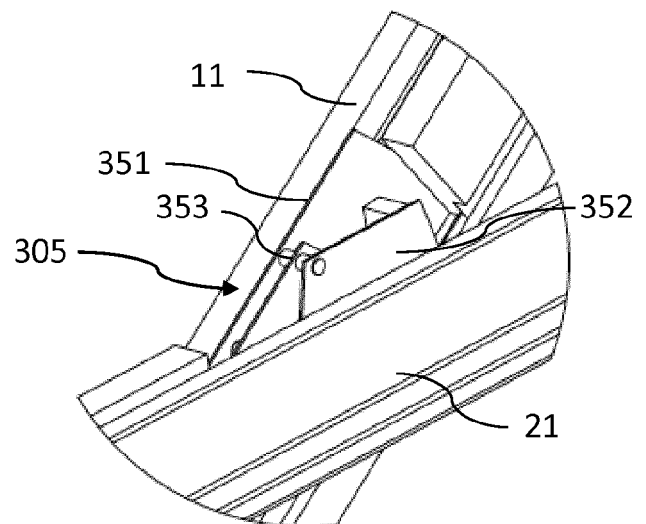


Fig. 22

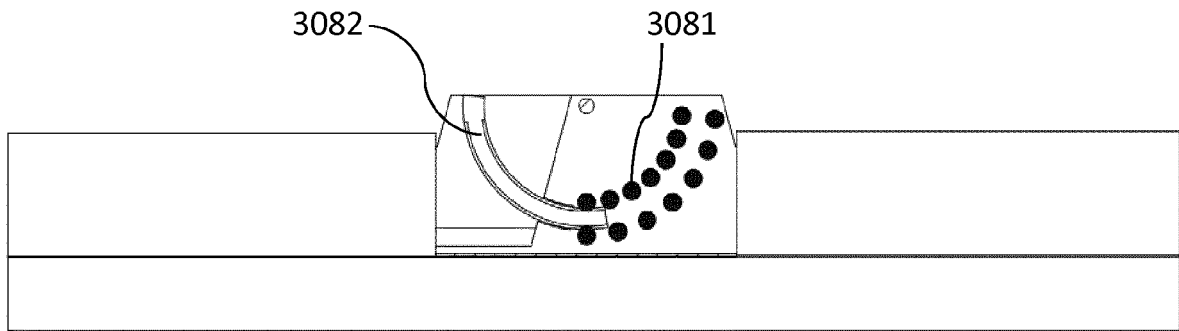


Fig. 23

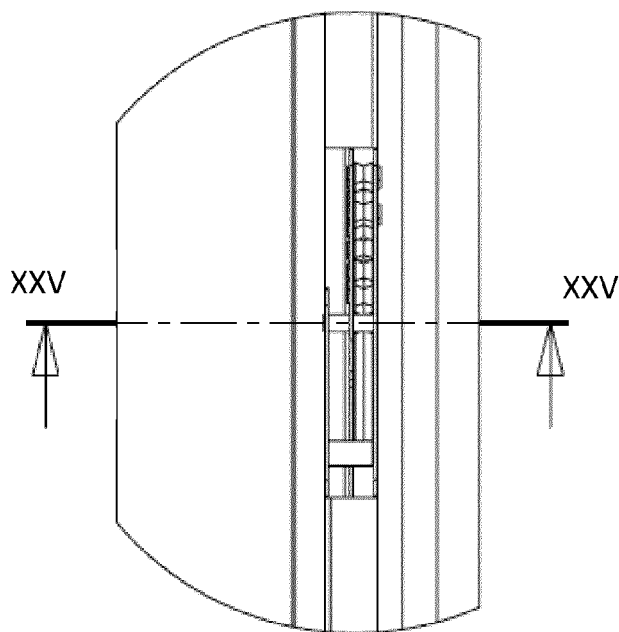


Fig. 24

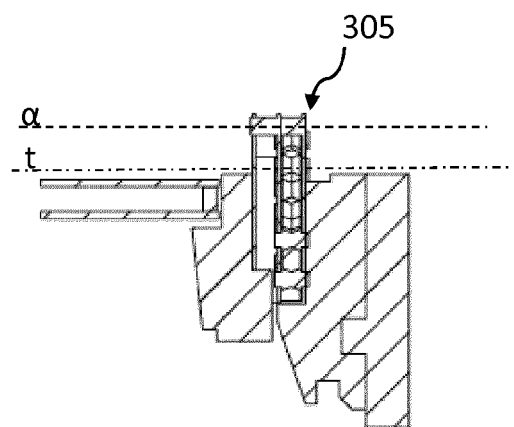


Fig. 25

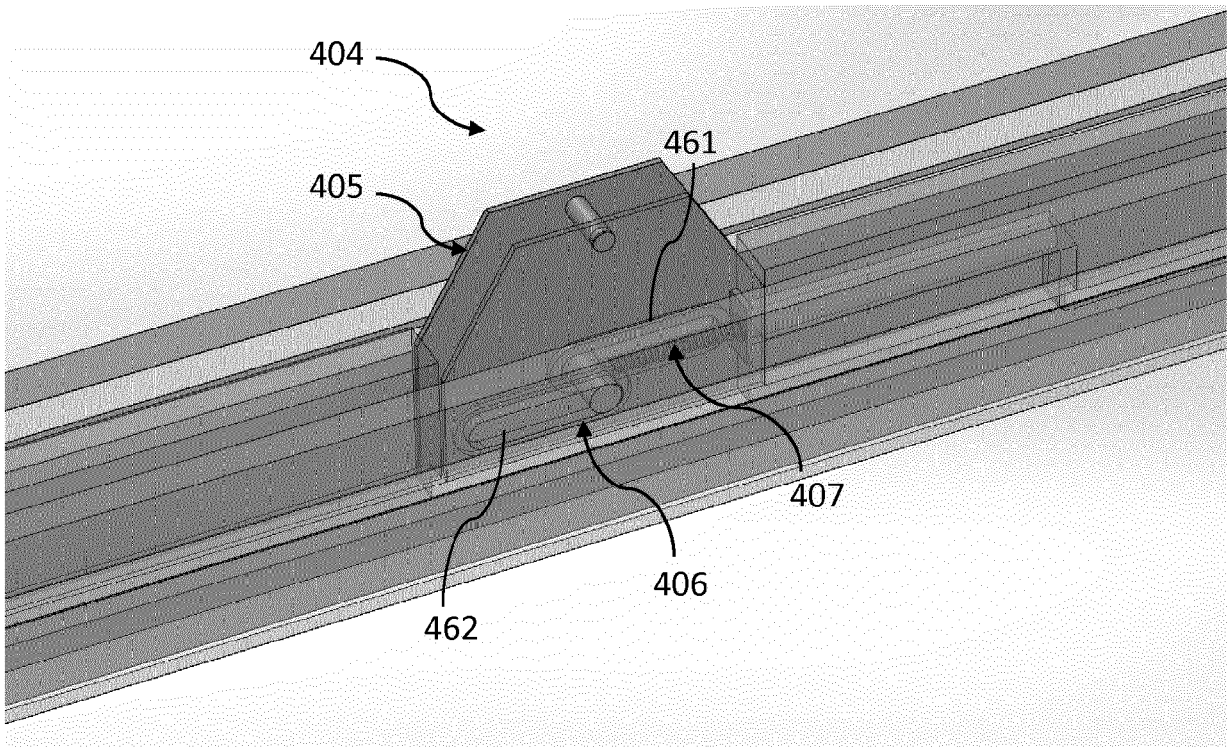


Fig. 26

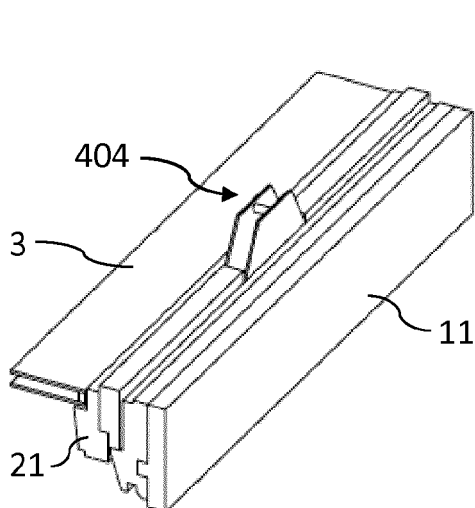


Fig. 27

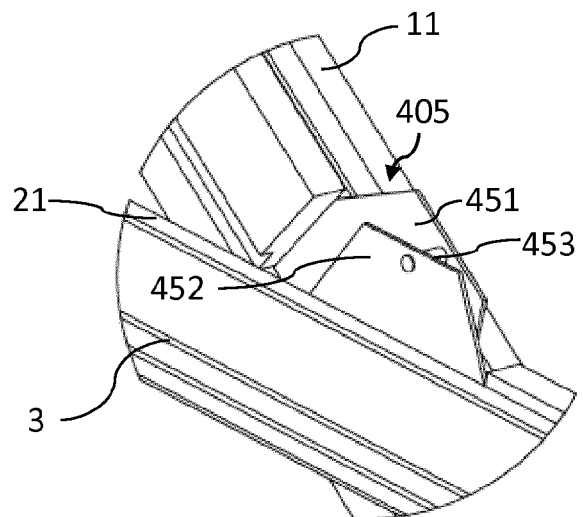


Fig. 28

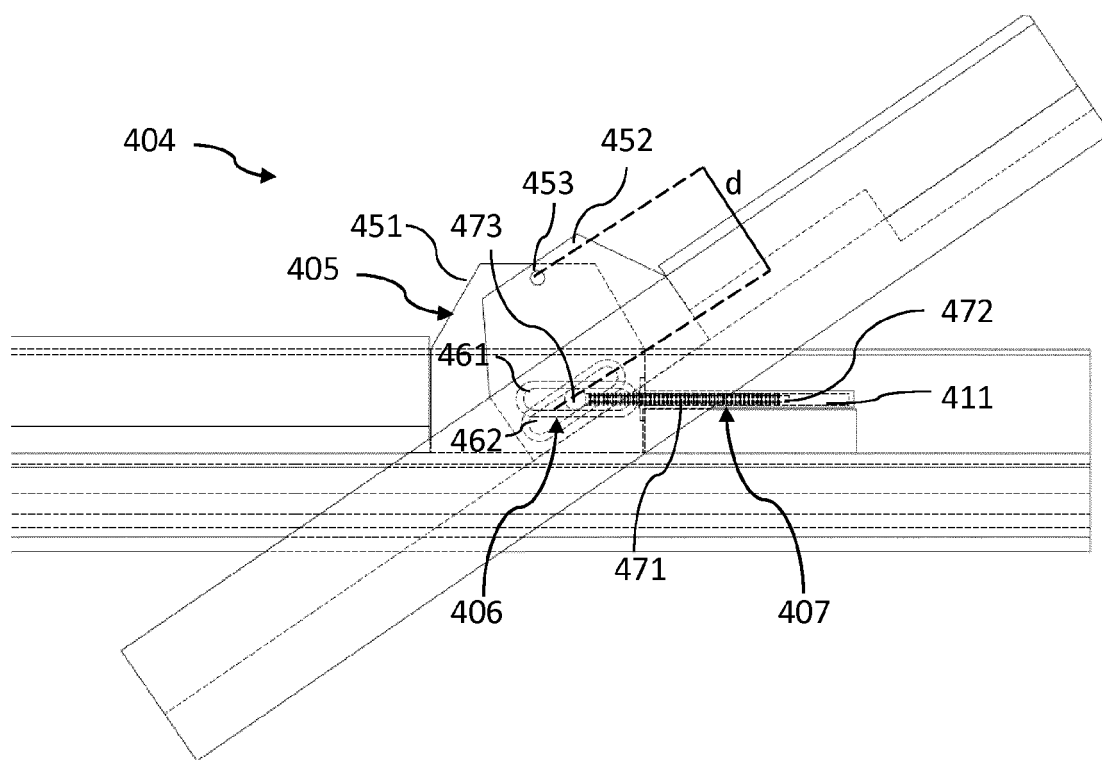


Fig. 29

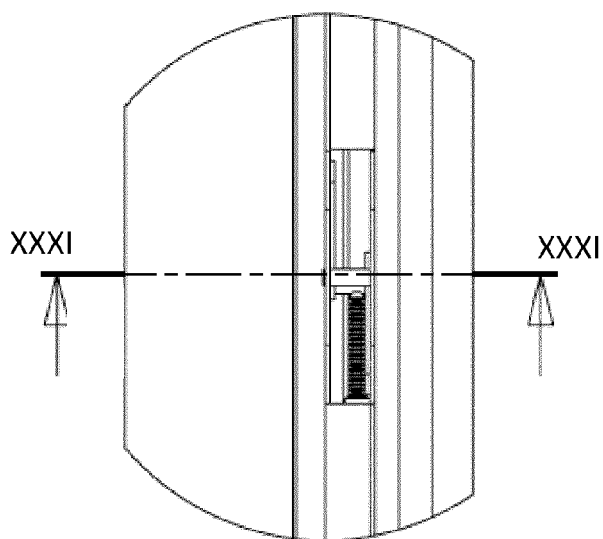


Fig. 30

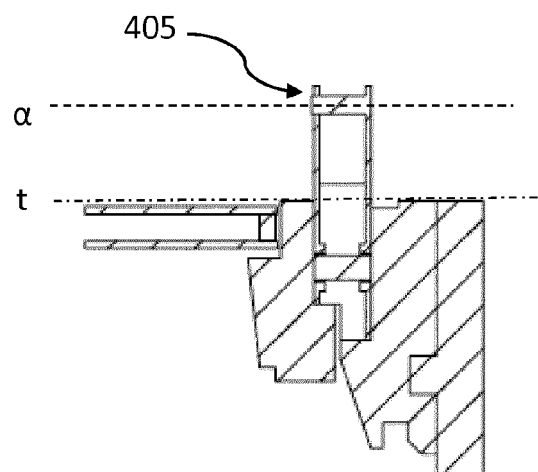


Fig. 31

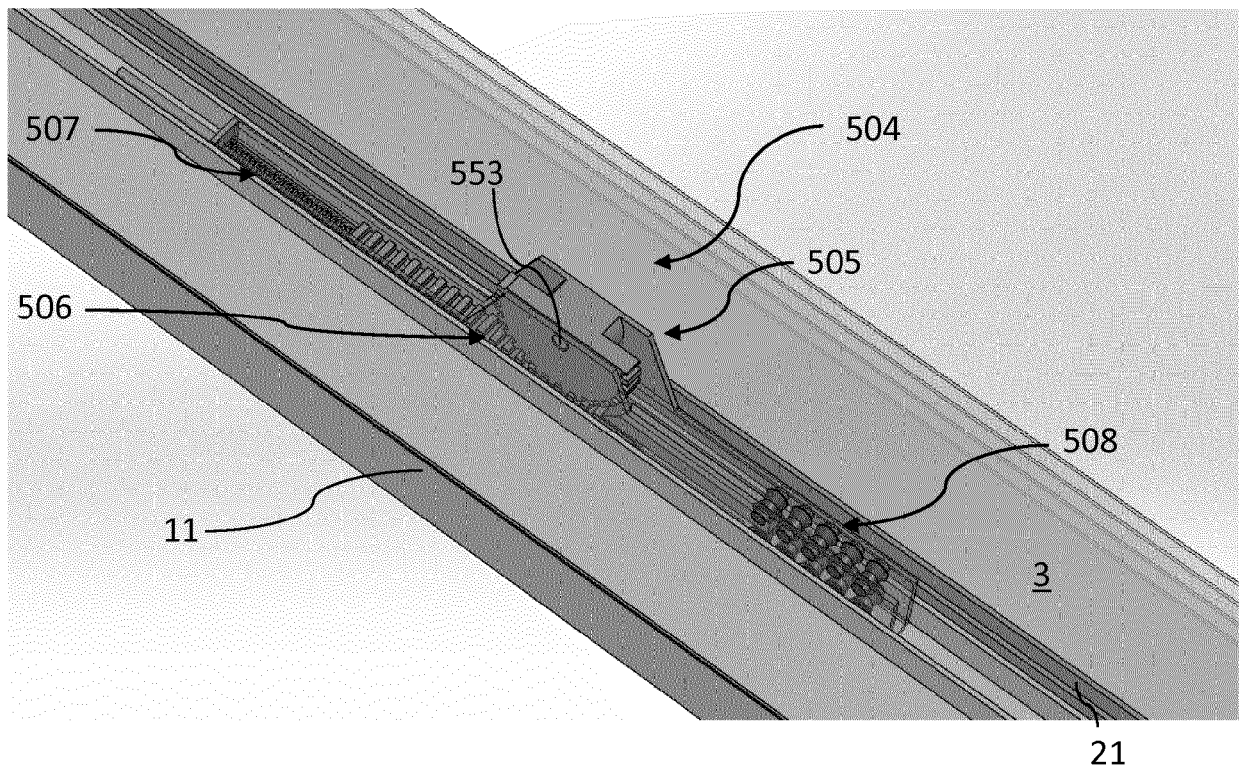


Fig. 32

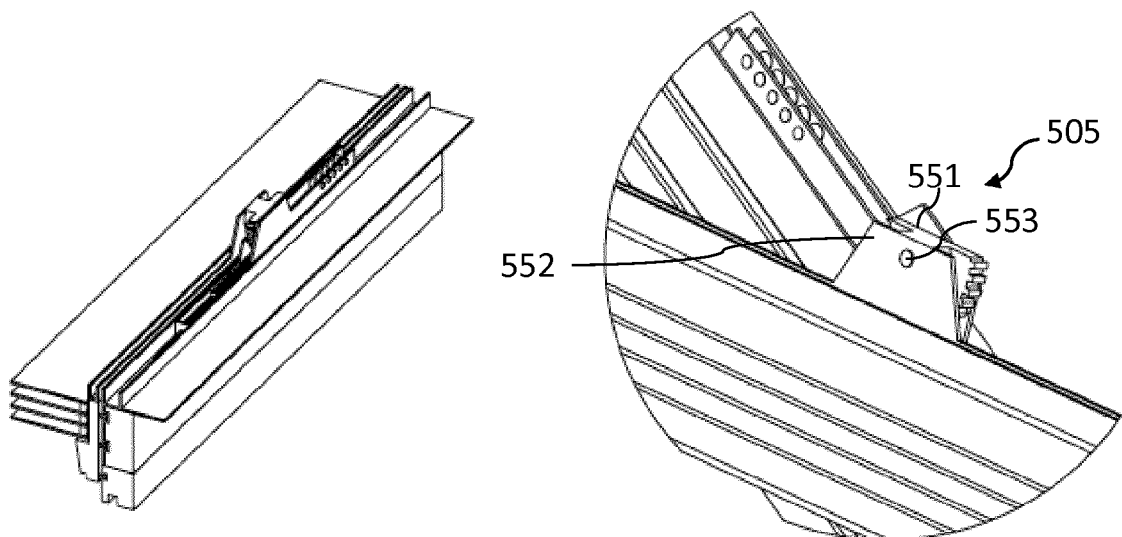


Fig. 33

Fig. 34

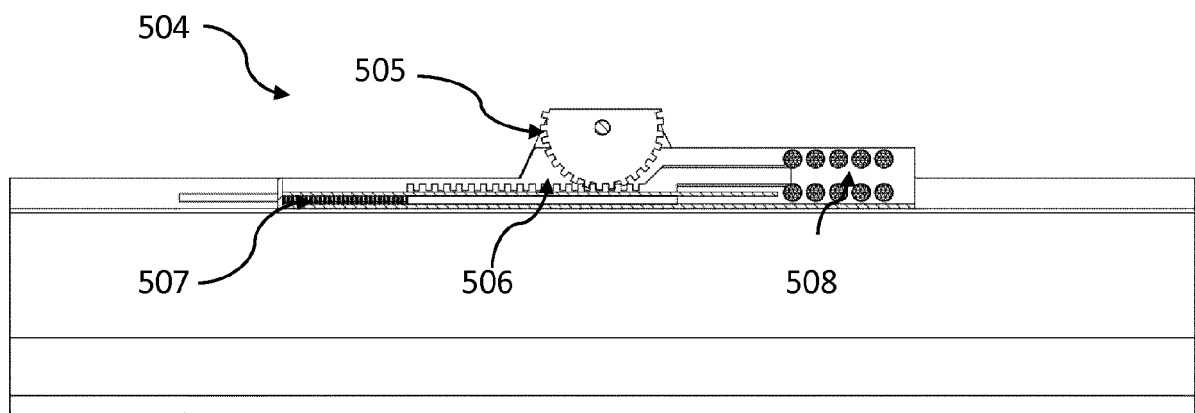


Fig. 35

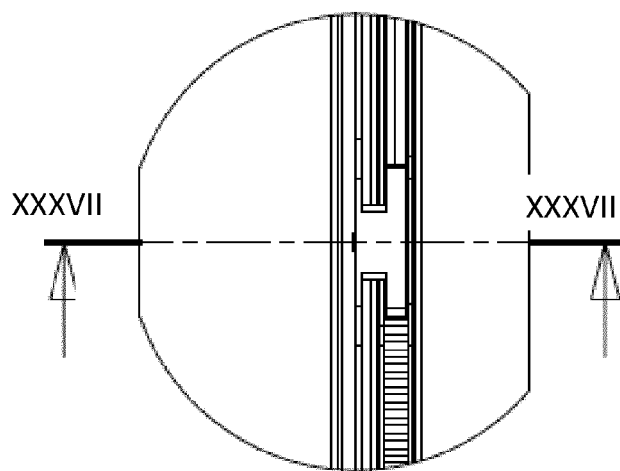


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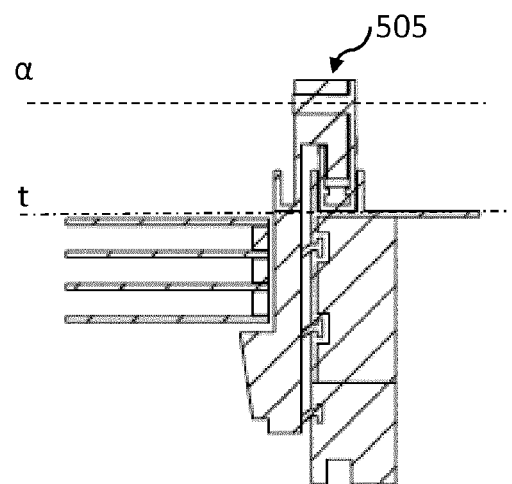


Fig. 37



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 19 9612

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X	WO 2008/044953 A1 (FAKRO PP SPOLKA ZOO [PL]; FLOREK RYSZARD [PL]) 17 April 2008 (2008-04-17) * page 2, paragraph 5 - page 7, paragraph 3; figures 1-9 *	1-6,11, 16,17, 19,20, 22-25	
X,D	EP 2 770 146 A1 (VKR HOLDING AS [DK]) 27 August 2014 (2014-08-27) * paragraph [0013] - paragraph [0030]; figures 1-8 *	1-6,11, 16,17, 19,20, 22-25	
X	FR 1 345 146 A (ETABLISSEMENTS JOLLY PERE ET F) 6 December 1963 (1963-12-06) * page 1, column 2; figures 1-3 *	1,6-8, 11,16,17 9,10	TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 April 2017	Examiner Guillaume, Geert
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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