(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 662 518 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
13.11.2013 Bulletin 2013/46

(51) Int Cl.:
E05D 15/44 *(2006.01)*

(21) Application number: **13167397.2**

(22) Date of filing: **11.05.2013**

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

(30) Priority: **11.05.2012 DK 201270244**

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

(72) Inventor: **Valsgaard, Poul**
6950 Ringkøbing (DK)

(74) Representative: **Münzer, Marc Eric**
Guardian IP Consulting I/S
Diplomvej, Building 381
2800 Kgs. Lyngby (DK)

(54) Window assembly with a hinge assembly comprising a track, a slider and a pivoting link

(57) A window assembly (1) comprising a window frame (3), a window sash (4) and a hinge assembly (2), where the hinge assembly comprises: a track (25) having a first end (26) and a second end (27) and being fastened to the frame with the longitudinal axis of the track being arranged parallel with the plane of the window frame, a slider (28) fastened to the sash (4) near one corner of the sash and arranged such that the sash is pivotable with respect to the slider about a pivot axis (P6), said slider (28) being slideably arranged on the track, thereby allowing the sash to slide along the track and a first link (10) having a first end (10a) and a second end (10b), said first end being pivotably fastened to the frame (3) about a pivot axis (P1) arranged at a location on the frame between the first (26) and second (27) end of the track (25) and/or a second link (11) having a first end (11 a) and a second end (11 b), said second end (11 b) being pivotably fastened to the sash (2) about a pivot axis (P3). The hinge assembly further comprises a first displacement mechanism (14) arranged on a profile element (3b) of the window frame (3) and arranged to displace the first end (10a) of the first link (10) when the slider (28) slides along the track (25), the direction of said displacement having a vector component which is perpendicular to the longitudinal axis of the track, parallel to the plane of the window frame and away from the centre of the window frame and/or a second displacement mechanism (16) arranged on a profile element (4b) of the window sash (4) and arranged to displace the second end (11 b) of the second link (11) when the window sash (4) is pivoted with respect to the second link, the direction of said displacement having a vector component which is perpendicular to the longitudinal axis of the sash profile element (4b) to which the second displacement mechanism (16) is connected, parallel to the plane of the window sash (4) and away from the centre of the window sash (4).

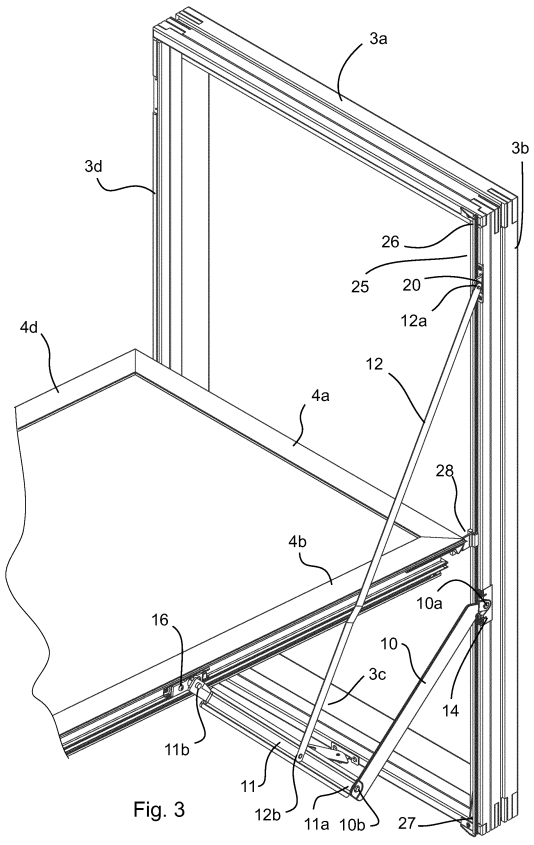

Fig. 3

EP 2 662 518 A2

Description

[0001] The current invention relates to a window assembly comprising a window frame, a window sash and a hinge assembly, where the hinge assembly comprises: a track having a first end and a second end and being fastened to the frame with the longitudinal axis of the track being arranged parallel with the plane of the window frame, a slider fastened to the sash near one corner of the sash and arranged such that the sash is pivotable with respect to the slider about a pivot axis, said slider being slideably arranged on the track, thereby allowing the sash to slide along the track and a first link having a first end and a second end, said first end being pivotably fastened to the frame about a pivot axis arranged at a location on the frame between the first and second end of the track and/or a second link having a first end and a second end, said second end being pivotably fastened to the sash about a pivot axis,

[0002] It should be noted that the current invention is mainly related to the hinge assembly itself, but the window assembly is included in the claims to define the invention in a clearer manner. The scope of protection should however extend to the hinge assembly itself.

[0003] It should also be noted that the term "hinge assembly" should in the context of the current invention be understood as a form of bracket or fitting or linkage which can be attached to the frame of the window assembly and which can be used to provide a defined form of motion to the window sash with respect to the window frame.

[0004] As an example of a hinge assembly according to the current invention could be mentioned a hinge assembly for a reversible window assembly, i.e. a window assembly which can be reversed about its horizontal axis or its vertical axis to bring the outer surface of the window in to face the inside of the window assembly in order to allow the outer surface to be cleaned. Another example is a side hung projecting window where a combined sliding and pivoting motion is used. In the current specification, a reversible fitting for a window which pivots about its horizontal axis is disclosed in the figures, however the scope of protection should include other forms of fittings/ hinge assemblies as well.

[0005] It should also be noted that the terms which refer to a numbered element, for example "first", "second" and "third", in the current specification are used to identify the elements to which the specification refers and that the presence of a "second element" does not imply the presence of a "first element", unless this is specifically mentioned. For example, within the scope of the current specification, it would be possible to have a situation where there was a "first" and a "third", but no "second".

Description of related art

[0006] Prior art hinge assemblies which provide a sash reversing function are disclosed in for example EP1419306 B1, DE29707709 U1 and WO2008040345 A1. Many more example fittings are available in the prior art.

[0007] However, the prior art types of fittings all suffer from drawbacks of more or less serious kind. For example in the prior art type fittings as disclosed in for example DE29707709 U1, a large cutout is made in the sash and frame in order for the fitting to fit into the window assembly. Other hinge assemblies, for example WO2008040345 A1, require that the frame and sash do not overlap and the fitting is arranged in the thin gap between the frame and sash. However this sets constraints on the design of the window frame and sash as well as the hinge assembly itself.

Summary of the invention

[0008] It is therefore a first aspect of the current invention to provide a window assembly and a hinge assembly which is better than the ones in the prior art.

[0009] A second aspect of the current invention is to provide a window assembly and a hinge assembly which can be hidden completely behind the sash in the closed position of the window assembly and/or which does not require any cutouts in the sash.

[0010] These aspects are solved in part by a window assembly as mentioned in the introductory paragraph further comprising a first displacement mechanism arranged on a profile element of the window frame and arranged to displace the first end of the first link when the slider slides along the track, the direction of said displacement having a vector component which is perpendicular to the longitudinal axis of the track, parallel to the plane of the window frame and away from the centre of the window frame and/or a second displacement mechanism arranged on a profile element of the window sash and arranged to displace the second end of the second link when the window sash is pivoted with respect to the second link, the direction of said displacement having a vector component which is perpendicular to the longitudinal axis of the sash profile element to which the second displacement mechanism is connected, parallel to the plane of the window sash and away from the centre of the window sash. This motion allows a more flexible design of the window assembly since the first link and/or the second link can be displaced during motion of the link, in addition to the rotation which is typical for such links.

[0011] In particular, this invention is suitable for window assemblies where a component or portion of the window assembly overlaps or partly overlaps with the first link and/or the second link in the closed position of the window assembly when looking at the window assembly perpendicular to the plane of the window assembly, but where the overlapping component or portion needs to pass the first link during the desired motion of the window sash. In this case, the provision of a displacement mechanism is suitable since the first link and/or the second link can be displaced to allow the overlapping component or por-

tion to pass the first link and/or the second link. For example, the component or portion of the window assembly which overlaps the first link and/or the second link could be the window sash, another link of the linkage, a sliding element, etc.

[0012] According to the current invention, a link should be understood as a physical member, typically an elongated member, which is pivotably connected to other elements via at least two pivot points. It should be noted that "the end" when used in the phrase "the end of the link", should be understood not necessarily as the physical "end" of the physical member, but rather as the point of the pivotable connection, the actual physical member could extend past the point of pivotable connection.

[0013] In one embodiment, the sash, the first link and the pivot axis between the frame and the first link could be arranged such that the first link is at least partially hidden behind the sash in the closed position of the window assembly when looking at the window assembly from the outside of the window assembly and in that the displacement of said first displacement mechanism is large enough so that the window sash is able to pass by the first link when the window sash is moved from a position where the slider is on one side of the pivot axis between the frame and the first link to a position where the slider is on the other side of the pivot axis between the frame and the first link. In this way, a window assembly with a nice and clean visual impression from the outside of the window assembly is made possible. In some cases, the hinge assembly could be arranged such that the displacement occurs when the slider is moved from a position where the slider is at one end of the track to a position where the slider is at the other end of the track.

[0014] In one embodiment, the first link could also be connected to the sash either directly or via one or more links. By directly is meant that the first link is in some way pivotably, displaceably and/or rigidly fastened to the sash. By via one or more links is meant that one or more links are arranged between the first link and the sash. In both cases, motion of the sash will cause motion of the first link and vice versa.

[0015] In one embodiment, the displacement of the displacement mechanism could be provided via a ramp element which causes a displacement upon rotation of the displacement mechanism. It should be noted that a screw mechanism is considered to be a form of spiral ramp mechanism for the sake of this specification. By choosing the slope of the ramp mechanism, the displacement to motion ratio is easily determined. Furthermore, by providing a non linear slope on the ramp, different functions can be easily integrated into the displacement mechanism. For example a rising portion followed by a straight portion could be provided to allow a displacement along the rising portion and then a zero displacement along the straight portion.

[0016] It should also be noted that in the above description of the invention, it is described that the displacement mechanism is "arranged to displace the first end of the first link when the slider slides along the track". This should however not necessarily be interpreted in that the motion of the slider causes the displacement. The displacement itself can be caused by rotation of the link with respect to the frame, by displacement of the link with respect to the frame, by displacement of the sash with respect to the frame and many more combinations. The above description should therefore be interpreted in that the displacement occurs when the slider slides along the track, but not necessarily due to the slider sliding along the track.

[0017] Furthermore, it should be noted that the displacement does not necessarily occur during the entire motion of the slider along the track. The motion could occur during only a portion of the sliders motion along the track. For example, it could be that between 0 and 25% of the travel of the slider, no displacement is caused, followed by displacement during 25%-75% of the travel of the slider, then no displacement during 75% to 100% of the travel of the slider. Also note that the displacement of the displacement mechanism will have the mentioned direction when the slider slides along the track in a first direction. When the slider slides along the track in the opposite direction, the direction of the displacement will be opposite.

[0018] In a preferred embodiment, the window assembly could comprise two hinge assemblies as described, one arranged on either side of the window assembly, said two hinge assemblies being arranged such that the first and/or second displacement mechanisms of the two hinge assemblies are arranged oppositely so that the two first ends of the links are displaced away from each other during motion of the sash.

[0019] It should be noted that in the examples shown and described in this specification, two hinge assemblies are mounted at the sides of the window assembly. However, it would also be possible to provide a window assembly according to the current invention by providing a hinge assembly at the top and bottom sides of the window assembly where the window opens about a vertical axis.

[0020] As mentioned previously, the current invention is mainly related to a new type of hinge assembly. As such the scope of protection should extend to the hinge assembly itself and not just to the completely assembled window assembly.

[0021] It should be emphasized that the term "comprises/comprising/comprised of" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof. For example in claim 1 it is stated that the window assembly comprises a hinge assembly. However this should be interpreted in that the window assembly comprises at least one hinge assembly.

Brief description of the drawings

[0022] In the following, the invention will be described in greater detail with reference to embodiments shown by the enclosed figures. It should be emphasized that the embodiments shown are used for example purposes only and should not be used to limit the scope of the invention.

Figure 1 shows a front perspective view of a window assembly according to the current invention in a closed position.

Figure 2 shows a front perspective view of the window assembly of figure 1 in a completely reversed position.

Figure 3 shows a front perspective view of the window assembly of figure 1 in a position halfway between the closed position shown in figure 1 and the reversed position shown in figure 2.

Figure 4 shows a side view of the window assembly of figure 1 in the same position as in figure 1.

Figure 5 shows a side view of the window assembly of figure 1 in the same position as in figure 2.

Figure 6 shows a partial side view of the window assembly of figure 1 in the same position as in figure 3.

Figure 7 shows an exploded front perspective view of the hinge assembly of figure 1.

Figure 8 shows a close up view of the pivot mechanism attached to the frame as shown by the numeral VIII in figure 7.

Figure 9 shows a close up view of the pivot mechanism attached to the sash as shown by the numeral IX in figure 7.

Figure 10 shows a close up view of the deflection element attached to the sash as shown by the numeral X in figure 7.

Figure 11 shows a perspective rear view of a second embodiment of a window assembly and hinge assembly according to the current invention. Note that the left frame profile element has been removed from the figure to show the details of the hinge assembly.

Figure 12 shows a detail view of the area marked with XII in figure 11.

Figure 13 shows a detail view of the area marked with XIII in figure 11.

Detailed description of the embodiments

[0023] Figures 1-6 show different views and configurations of a first embodiment of a window assembly 1 according to the current invention. Figures 1-6 all show a single hinge assembly 2 mounted on one side of the window assembly. It should however be noted that the hinge assembly shown in the figures is of the kind which is designed to be used as a pair, i.e. one mounted on each side of the window assembly. Only one hinge assembly has been included in the figures for the sake of clarity.

[0024] The window assembly comprises a window frame 3, a window sash 4 and a window pane 5. As is typical in these types of window assemblies, the window frame is made up of four frame profile elements 3a, 3b, 3c and 3d. Likewise the window sash 4 is made up for four sash profile elements 4a, 4b, 4c and 4d. The profile elements are joined at their ends into rectangular assemblies having four corners, where the corners refer to the location where the ends of the profile elements meet. The window pane 5 is joined to the window sash.

[0025] The hinge assembly 2 connects the window frame and the window sash. The currently depicted hinge assembly is of the kind which is typically called a hinge assembly for a "reversible window assembly", i.e. one which can be "reversed" to make cleaning easier.

[0026] The hinge assembly comprises a first link 10, a second link 11 and a third link 12. The first link 10 has a first end 10a pivotably connected to the frame about a first pivot axis P1 via a first pivot assembly 14. The second end 10b of the first link is pivotably connected to the first end 11a of the second link 11 about a second pivot axis P2. The second end 11b of the second link 11 is pivotably connected to the sash about a third pivot axis P3 via a second pivot assembly 16. The second end 12a of the third link 12 is pivotably connected to the second link 11 about a fourth pivot axis P4 located between the first and second ends 11a, 11b of the second link. The first end 12b of the third link 12 is pivotably connected to the frame about a fifth pivot axis P5 located at a fixed pivot mechanism 20.

[0027] The hinge assembly further comprises a track 25 which is fastened to the front surface of one of the side frame profile elements 3b. In the current example, the track has two ends 26,27 and extends along the entire length of the side profile element. A slider 28 is slideably mounted on the track. The slider is furthermore pivotably connected to one corner of the window sash about a sixth pivot axis P6. The sash is therefore able to displace up and down along the axis of the track. Furthermore, due to the arrangement of the links, as the sash is displaced up and down, the sash is also displaced outwardly and caused to pivot as shown by comparing figures 4-6. This type of fitting has been described many times in the past and is well known to the person skilled in the art, therefore, a detailed description of the basic function and setup of the hinge assembly will not be provided here. The read-

er is referred to for example WO2008040345 A1 for a more detailed explanation if this is desired.

[0028] Of particular interest to the current invention is the arrangement of the window sash and frame. As can be seen, from for example figure 1, the window sash completely overlaps the window frame. Therefore, there is no gap between the frame and sash in which the links of the hinge assembly can move during the sash reversing process. Furthermore, it can again be seen from for example figure 1, that the first link is completely hidden behind the sash in the closed position of the window. No cutouts or other forms of adjustments have been made to the front surface of the window sash. In the closed position of the current window assembly, a viewer looking at the window assembly from the outside would only see the window pane and the outer surface of the window sash. This provides for a very "clean" visual impression.

[0029] However, as can be seen for example from figure 2, at some point during the reversing operation, the corner of the window sash which is connected to the slider must pass the first and third links. Especially passing the first link would not be possible with prior art type hinge assemblies if the first link were at least partially hidden behind the sash in the closed position of the window as the sash would otherwise collide with the first link during the reversing procedure. However, due to the arrangement of the first and second pivot assemblies 14,16 (as described in more detail below) the first link and the third link can be displaced outwardly away from the sash, thereby allowing the sash to pass the first link.

[0030] The arrangement of the first and second pivot assemblies 14,16 are described in more detail with reference to figures 8 and 9 respectively. It should be noted that the pivot assemblies described in figures 8 and 9 have both a pivot and a displacement mechanism. In the claims, the term "displacement mechanism" is used to refer to the first and second pivot assemblies since the action which is most relevant with respect to the current invention is the displacement, however, it would be most correct to call the pivot assemblies of the current embodiment for "pivot and displacement mechanisms" or "pivot and displacement assemblies".

[0031] The first pivot assembly 14, shown in figure 8, comprises a housing 30 and an axle member 31. In this embodiment, the housing is made up of a core element 32 and a sheet metal outer "skin" 33. The sheet metal outer skin provides the strength for the housing. The core element could for example be injection moulded. In the current embodiment, the sheet metal outer skin comprises two parts 33a, 33b which are riveted 34 together. A metal cylinder 35 is arranged and supported inside the core element. In another embodiment, the housing could be cast as a single element, for example in aluminum or zinc.

[0032] The axle member 31 comprises a slot 36, having a straight part 36a and an angled part 36b. The axle member further comprises an engagement member 37 for engaging with the first end 13 of the first link 10. As can be seen from the figure, the engagement member 37 is formed with a cylindrical portion 38 and a key portion 39. The first end of the first link is formed correspondingly. During assembly, the first end of the first link is placed onto the cylindrical portion 38 and the key 39 aligned with a slot 40 in the first end of the first link. The cylindrical portion is then deformed like a rivet to firmly join the first link to the axle member of the first pivot assembly.

[0033] When the pivot assembly is assembled, the axle member is placed inside the metal cylinder 35 inside the core element and sheet metal skin portion. A pin 41 is then passed through the outer skin, the core, the metal cylinder and the slot in the axle member. The elements are now locked together. Due to the form of the slot 36, when the axle member is rotated due to the rotation of the first link 10, the axle member will either displace outwardly away from the frame member (if the pin is in the angled part 36b of the slot) or will purely rotate (if the pin is in the straight part 36a of the slot).

[0034] It should be noted that during the first half of the motion of the sash, i.e. from a position where the sash is closed to a position where the sash is at about 90 degrees to the window frame, the first link pivots outwardly. However, at the position where the sash is at about 90 degrees the first link stops pivoting outwards. Further motion of the sash to the fully reversed position pivots the first link inwardly again. This means that due to the shape of the slot in the axle member, during the first half of the motion of the sash, the first link displaces outwardly while during the second half of the motion of the sash the first end of the first link displaces inwardly again. This is suitable in the current embodiment, since the position where the sash needs to pass the first link close to the pivot assembly is right about where the sash is at its 90 degree position. After the sash has passed the pivot assembly, the first end of the first link starts to move in again. When the sash is in its fully reversed position, the first end of the first link is again fully retracted.

[0035] In other embodiments (see for example the embodiment of figure 11-13), a more complex displacement mechanism could be provided where the first end of the first link maintains its outwardly displaced position or keeps displacing outwardly while the sash progresses from its 90 degree position to its fully reversed position.

[0036] It can be noted that in the current embodiment of the frame, the frame comprises a forwardly protruding flange. This can be seen in figures 1-3. In the current embodiment, the first pivot assembly 14 has been placed in a recess provided in the forwardly protruding flange. This recess could be provided by machining a recess in the flange after manufacture of the frame element. In cases where the frame element does not comprises a forwardly protruding flange, or in cases where a thin forwardly protruding flange is provided, the first pivot assembly can be mounted directly to the frame element without the need for a recess, or be placed only partly in a recess in the thin protruding flange.

[0037] Referring to figure 9, the second pivot assembly

can be seen in more detail. Here again a housing 50 is provided and attached to the sash. The housing comprises a cylindrical opening 51 which can accept an axle member 52. The axle member is non-pivotably connected to the second end 16 of the second link 11. The axle member is furthermore formed with a spiral ridge 53 which fits with a spiral groove 54 on the inside of the cylindrical opening 51. As the housing pivots with respect to the second end of the second link, the axle member will displace outwardly.

[0038] It should be noted that in this embodiment of the hinge assembly, the first pivot assembly was arranged with a pin in a slot and the second pivot assembly was arranged with a spiral ridge in a spiral groove. However, it would also be possible to build both pivot assemblies with a spiral ridge/groove or both pivot assemblies with a pin/slot or the first pivot assembly with a spiral ridge/groove and the second pivot assembly with a pin/slot. As will be clear to the person skilled in the art, many options are possible.

[0039] In contrast to the first pivot assembly, the motion of the housing will keep rotating in the same direction for the entire motion of the window sash. Therefore, during the entire motion of the window sash, the second end of the second link will displace outwardly. In this way, when the sash is in its fully reversed position, the second end of the second link will be fully displaced outwardly.

[0040] Due to this, as the sash approaches its fully reversed position and the first end of the first link starts to be fully retracted, the second end of the first link will be pulled outwardly due to the motion of the second end of the second link. The first link will therefore bend slightly, thereby allowing the sash to continue towards its fully reversed position even though the first end of the first link is being retracted. This situation is shown in figures 2 and 5. If there were no displacement mechanism at the second end of the second link, the sash would press hard up against the first link in the position shown in figures 2 and 5.

[0041] In order to even further prevent unwanted contact between the sash and the first link, a sliding element 70 is provided at the corner of the sash. This sliding element is shown in more detail in figure 10. The sliding element is made from a material with a low coefficient of friction which allows the friction between the contact between the sliding element and the first link to be reduced. Furthermore, the sliding element ensures that the first link does not come into direct contact with the sash. Direct contact between the sash and the first link could cause damage to the sash, for example scraped paint.

[0042] It should be noted that in the figures the sliding element 70 is shown to extend only a short distance along the sash profile element. However, depending on the arrangement of the sash and frame, the sliding element could in certain embodiments also extend further along the sash profile element. In one example, the sliding element extends along at least 25% of the length of the sash profile element. In another example, the sliding element extends along at least 50% of the length of the sash profile element.

[0043] It should also be noted that in this first embodiment, three different forms of displacement are used. A first displacement is due to the displacement of the first end of the first link via the first displacement mechanism. A second displacement is due to the displacement of the second end of the second link via the second displacement mechanism. A third displacement is due to the displacement of the first link and the third link via the sliding element 70 which presses the links outwardly. Depending on the design of the window assembly and hinge assembly, it would be possible to make use of any one or more of these three forms of displacement. For example, in one embodiment as shown below the first displacement could be used alone. In another embodiment (not shown) the second displacement could be used alone. In another embodiment (not shown) the third displacement could be used alone. Or any combination could be used, for example first and third, or second and third, or first and second.

[0044] It should also be noted that in certain cases, it could be okay to remove a portion of the outer edge of the sash so that the sash did not completely overlap the frame. In this situation, it could be considered to provide a hinge assembly where the first pivot assembly did not have any displacement mechanism, and only the second pivot assembly connected to the sash comprises a displacement mechanism. In this situation, the first link could be provided in the non overlapping portion. Therefore, the sash could slide past the first link without the need for a displacement mechanism at the first pivot assembly. In this situation, one could also imagine the case where the first link had a thickness at its first end which was less than the thickness at its second end. In this way, as the second pivot assembly displaced the second link outwardly, the second end of the first link would also be displaced outwardly. Therefore only the first end of the first link would need to be thinner. In order to maintain the strength of the first link, the first end of the first link could be made wider. It should be noted that by thickness is meant the dimension of the link which is parallel to the plane of the window assembly and perpendicular to the longitudinal direction of the link and by width is meant the dimension of the link which is perpendicular to the plane of the window assembly and to the longitudinal direction of the link.

[0045] The embodiment of figures 1-10 also comprises an additional feature which is difficult to see from the figures, but which should be mentioned. The portion of the third link 12 which overlaps with the first and second links in the closed position of the window assembly is slightly twisted along its longitudinal axis. The portion is twisted approximately 10-15 degrees from the plane which is perpendicular to the window assembly and parallel to the longitudinal axis of the hinge assembly (or at least the longitudinal axis of the track). The twist is arranged such that the edge of the third link which faces

the first link is twisted away from the first link and the edge of the third link which faces the second link is twisted away from the second link in the open position of the window assembly. In general it could be said that the hinge assembly comprises a first link and a third link where the third link is pivotably fastened to the first link, arranged on one side of the first link and twisted along its longitudinal axis such that the edge of the third link which faces the first link during normal use is twisted away from the first link.

[0046] In normal linkage mechanisms, a link which needs to pass beside another link, like the third link in the current embodiment which needs to pass the first link, would have a certain thickness and its edge be rounded such that if the link was not perfectly aligned beside the other link during the closing motion, the link would align itself beside the other link due to the rounded edge. However, in fittings where a very thin link is used, like the third link in the current embodiment, it is not possible to provide this aligning effect since the link is not thick enough to provide a rounded edge. Therefore, the third link in the current embodiment is provided with a twist. The twist ensures that when the third link approaches the first link, even if the third link overlaps the first link slightly, the twist will push the third link to the correct side of the first link and prevent the third link from blocking on the first link. It should be noted that this feature could be used with other types of fittings and not just with the fitting described in the current embodiment or the current claim set.

[0047] Figure 11 shows a second embodiment (100) of a window assembly and hinge assembly. As with the previous embodiment, the window assembly comprises a window frame 101 comprising four window frame profile elements (101a,b,c,d). In the figure, the left window frame profile element (101a) has been removed in order to better see the details of the displacement mechanism. A window 102 sash is supported in the window frame via the hinge assembly 103. As with the previous embodiment, only the left hinge assembly is shown in order to avoid too many details in the figures. For the most part the hinge assembly has the same function as the hinge assembly 2 of the first embodiment and therefore the function will not be described more here.

[0048] The main difference between the two embodiments is in the function of the displacement mechanism 110 connected to the first link 111. The details of the displacement mechanism can be explained by reference to figures 12 and 13. Please note that the housing of the first displacement mechanism 110 as can be seen in figure 11 has been removed in figure 13 in order to show the details of the displacement mechanism.

[0049] The displacement mechanism 110 comprises a linear gear (112) and a rotary gear (113). The linear gear is arranged displaceably in a groove 114 which is arranged parallel to the longitudinal axis of the track 115 of the slider 116. The linear gear is sandwiched between two elements, where one of the elements has been removed in the figures to show the linear gear and the groove. A pivotable tab 117 is connected to one end of the linear gear. The pivotable tab is arranged such that when the slider 116 is slid down the track 115, the slider engages the pivotable tab at a certain position of the slider and then pulls the pivotable tab and the linear gear long with it.

[0050] The linear gear 112 is engaged with the rotary gear 113 and when the linear gear displaces, the rotary gear 113 rotates. An axle 118 is further engaged with the rotary gear. A screw mechanism (not shown) is arranged between the axle and the rotary gear, such that when the rotary gear rotates and the axle is held in a fixed angular position, the axle will displace with respect to the rotary gear. The end of the axle is non-rotatably fastened to the first link such that the first link holds the axle in a relatively fixed angular position. As the axle displaces, the end of the first link is therefore also displaced.

[0051] When the linear gear has displaced the desired amount, the pivotable tab pivots away from the slider, thereby allowing the slider to disengage from the pivotable tab and continue its motion without further displacement of the linear gear. As can be seen from figure 13, the groove in which the linear gear displaces has a bent portion 119 at each end which steers the motion of the pivotable tab 117. When the sash is moved from its fully reversed position to its closed position, the procedure is reversed. The slider at some point comes into contact with the pivotable tab which engages with the slider and pulls the linear gear along with the slider. As the linear gear displaces, the rotary gear rotates and the end of the first link is displaced inwardly. At some point, the pivotable tab retracts due to the bent portion in the groove and the slider continues until the window assembly is in its fully closed position.

[0052] In this embodiment, the displacement of the end of the first link can be precisely controlled. For example by choosing the slope on the screw mechanism, the displacement of the first link can be increased or decreased in a simple manner. Furthermore, the link stays fully displaced (or even continues its displacement) while the sash is going from its 90 degree position to its fully reversed position. Due to this, in this embodiment it is not necessary for the second link to be displaced and there is no need for a sliding element as in the first embodiment since the first link will stay displaced during the entire reversal procedure of the sash. However, a second displacement mechanism or a sliding element could be introduced if desired.

[0053] The above description has described two embodiments in detail. However, the person skilled in the art will realize that there are many other forms of embodiments which will fall within the scope of protection. For example the above described two embodiments have both used rotation and some form of spiral ramp or screw mechanism to provide the displacement, however other forms of displacement mechanism are also possible. For example, in one embodiment (not shown), the slider

could comprise a first ramp which pushes the pivot point of the first link outwardly when it is slid past the first pivot point. As will be clear to the person skilled in the art, many different embodiments are possible.

[0054] Furthermore, the above description has alone focussed on hinge assemblies for reversible window assemblies. However, other forms of hinge assemblies could also be considered relevant for the current invention. For example a side hung, side projecting window could also be relevant.

Claims

1. A window assembly (1) comprising a window frame (3), a window sash (4) and a hinge assembly (2), where the hinge assembly comprises:

a. a track (25) having a first end (26) and a second end (27) and being fastened to the frame with the longitudinal axis of the track being arranged parallel with the plane of the window frame,
b. a slider (28) fastened to the sash (4) near one corner of the sash and arranged such that the sash is pivotable with respect to the slider about a pivot axis (P6), said slider (28) being slideably arranged on the track, thereby allowing the sash to slide along the track and
c. a first link (10) having a first end (10a) and a second end (10b), said first end being pivotably fastened to the frame (3) about a pivot axis (P1) arranged at a location on the frame between the first (26) and second (27) end of the track (25) and/or
d. a second link (11) having a first end (11a) and a second end (11b), said second end (11b) being pivotably fastened to the sash (2) about a pivot axis (P3),
characterized in that the hinge assembly further comprises
e. a first displacement mechanism (14) arranged on a profile element (3b) of the window frame (3) and arranged to displace the first end (10a) of the first link (10) when the slider (28) slides along the track (25), the direction of said displacement having a vector component which is perpendicular to the longitudinal axis of the track, parallel to the plane of the window frame and away from the centre of the window frame and/or
f. a second displacement mechanism (16) arranged on a profile element (4b) of the window sash (4) and arranged to displace the second end (11b) of the second link (11) when the window sash (4) is pivoted with respect to the second link, the direction of said displacement having a vector component which is perpendicular to the longitudinal axis of the sash profile element (4b) to which the second displacement mechanism (16) is connected, parallel to the plane of the window sash (4) and away from the centre of the window sash (4).

2. A window assembly (1) according to claim 1, **characterized in that** the sash (3), the first link (10) and the pivot axis (P1) between the frame (3) and the first link (10) are arranged such that the first link is at least partially hidden behind the sash (4) in the closed position of the window assembly when looking at the window assembly from the outside of the window assembly and **in that** the displacement of said first displacement mechanism (14) is large enough so that the window sash is able to pass by the first link when the window sash is moved from a position where the slider (28) is on one side of the pivot axis (P1) between the frame and the first link to a position where the slider is on the other side of the pivot axis (P1) between the frame and the first link.

3. A window assembly according to claim 1, **characterized in that** the sash, the first link and the pivot axis between the frame and the first link are arranged such that at least the first end of the first link is not hidden behind the sash in the closed position of the window assembly when looking at the window assembly from the outside of the window assembly and **in that** the first end of the first link is connected to the frame via a pivot assembly which does not comprise any displacement mechanism.

4. A window assembly according to claim 3, **characterized in that** the thickness of the first link near the first end of the first link is less than the thickness of the first link near the second end of the first link.

5. A window assembly (1) according to any one of claims 1-4, **characterized in that** the first link (10) is also connected to the sash (4) either directly or via one or more links (11).

6. A window assembly (1) according to any one of claims 1 to 5, **characterized in that** the hinge assembly comprises both a first and second link as mentioned in claim 1 and **in that** the hinge assembly further comprises

a. a third link (12) having a first end (12a) and a second end (12b), and where
b. the first end (11a) of the second link (11) is pivotably fastened to the second end (10b) of the first link (10) about a pivot axis (P2),
c. the first end (12a) of the third link (12) is pivotably fastened to the frame (3) about a pivot axis (P5) and

d. the second end (12b) of the third link (12) is pivotably fastened to the second link (11) about a pivot axis (P4) located at a point between the first and second ends (11a, 11b) of the second link.

7. A window assembly (1) according to any one of claims 1-6, **characterized in that** the position of the pivot axis (P3) of the connection (16) between the second end (11b) of the second link (11) and the window sash (4) is adjustable along the longitudinal axis of the sash profile element (4b) to which the second end of the second link is pivotably fastened.

8. A window assembly (1) according to any one of claims 1-7, **characterized in that** the first (14) and/or second (16) displacement mechanisms comprise a first element (31 ;52) and a second element (30;50), the first element arranged to be rotatable with respect to the second element and there being a spiral ramp mechanism (36;53,54) arranged between the first and second element such that upon rotation of the first element with respect to the second element, the first element is displaced with respect to the second element along the displacement direction as mentioned in claim 1.

9. A window assembly (1) according to claim 8, **characterized in that** the first element (31 ;52) or the second element is non rotatably coupled to the first or second link (10;11) such that rotation of the first or second link causes rotation of the first or second element with respect to the second (30;50) or first element respectively.

10. A window assembly (1) according to any one of claims 1 to 9, **characterized in that** the window assembly comprises two hinge assemblies (2) as described in any one of claims 1 to 9 and mounted as described in any one of claims 1 to 9, one hinge assembly arranged on one side of the window assembly and the other hinge assembly arranged on the other side of the window assembly, said two hinge assemblies being arranged such that the first (14) and/or second (16) displacement mechanisms of the two hinge assemblies are arranged oppositely so that the two first ends (10a) of the first links (10) and/or the two second ends (11b) of the second links (11) are displaced away from each other during motion of the sash (4).

11. A window assembly (1) according to claim 10, **characterized in that** the two hinge mechanisms are mounted on the left (3b) and right (3d) sides of the window assembly and that the window sash pivots about a horizontal axis (P6).

12. A hinge assembly (2) of the kind disclosed in any one of the window assemblies (1) disclosed in any one of claims 1-11.

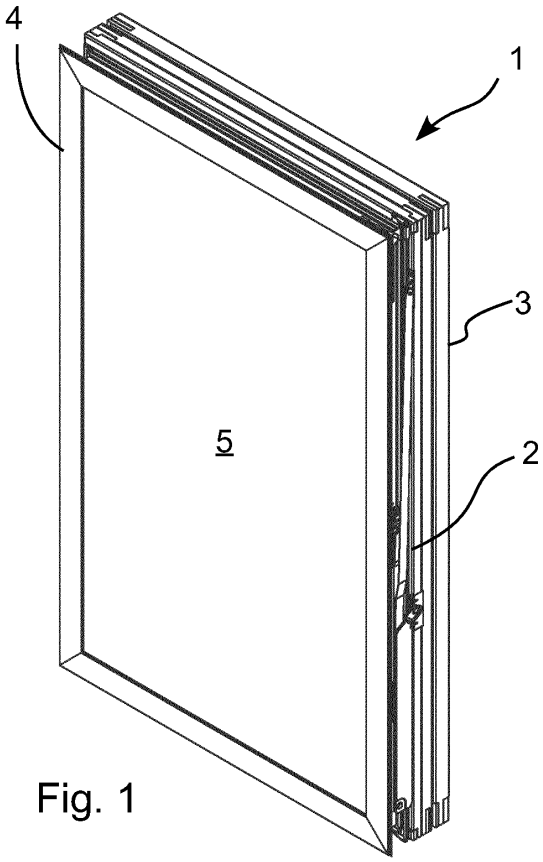

Fig. 1

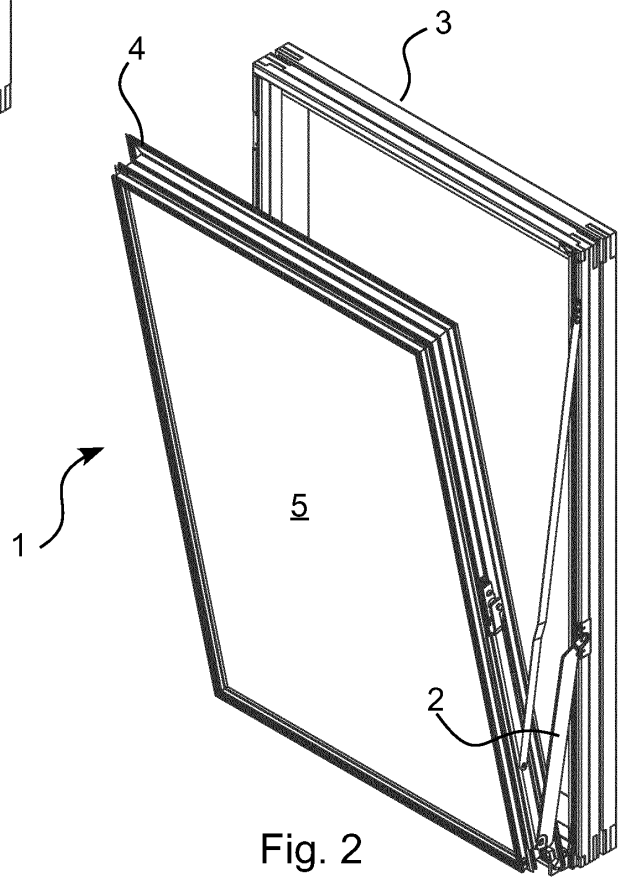

Fig. 2

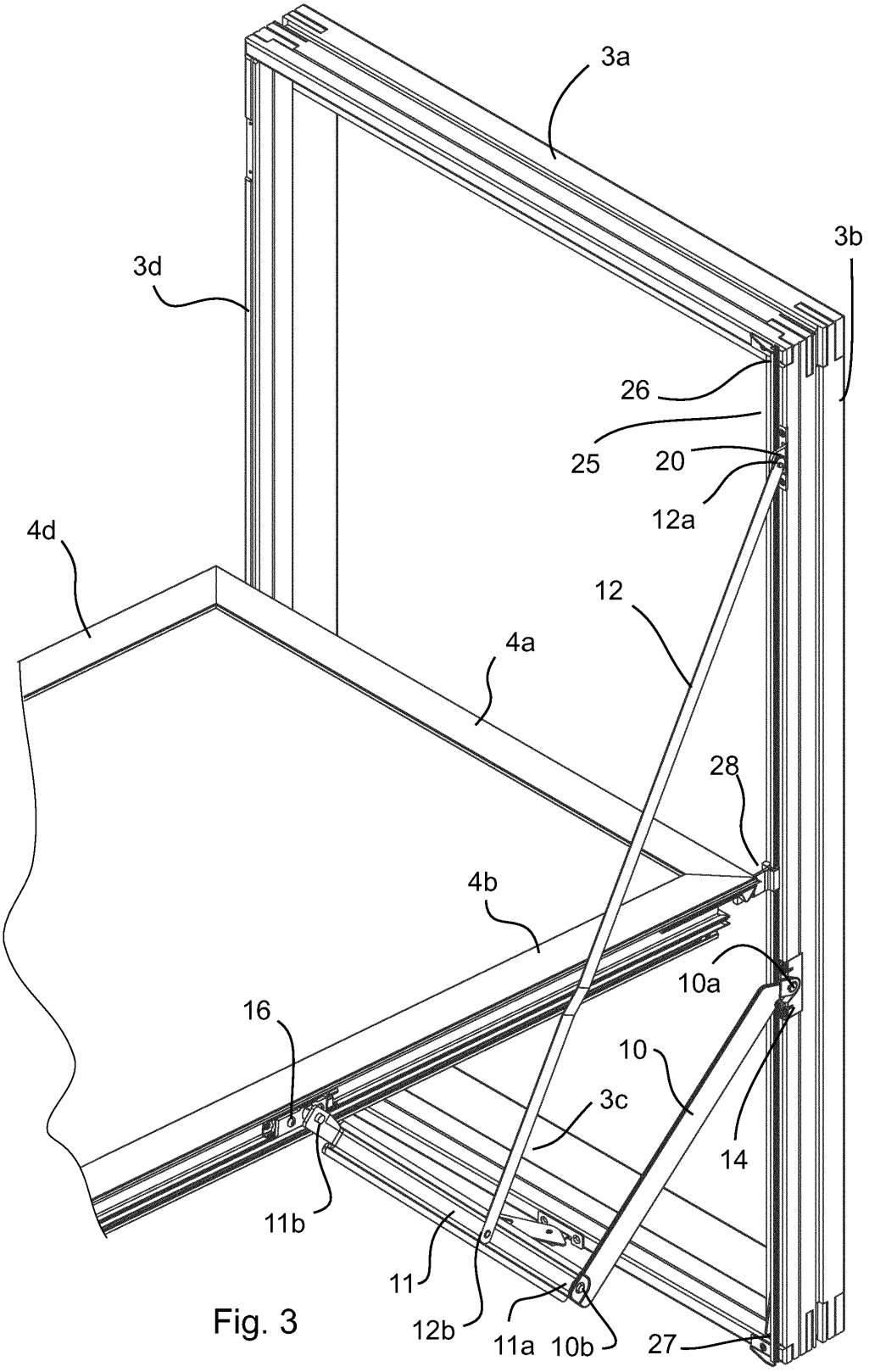
3a
3b
3d
26
25
20
12a
4d
12
4a
28
4b
10a
16
10
3c
14
11b
11
12b
11a
10b
27

Fig. 3

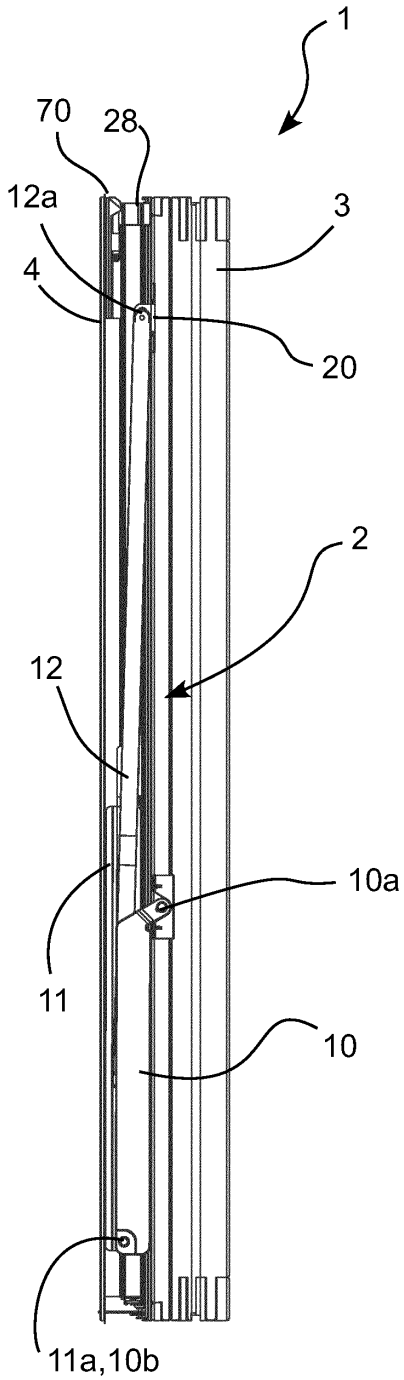
1
70
28
12a
3
4
20
2
12
10a
11
10
11a,10b

Fig. 4

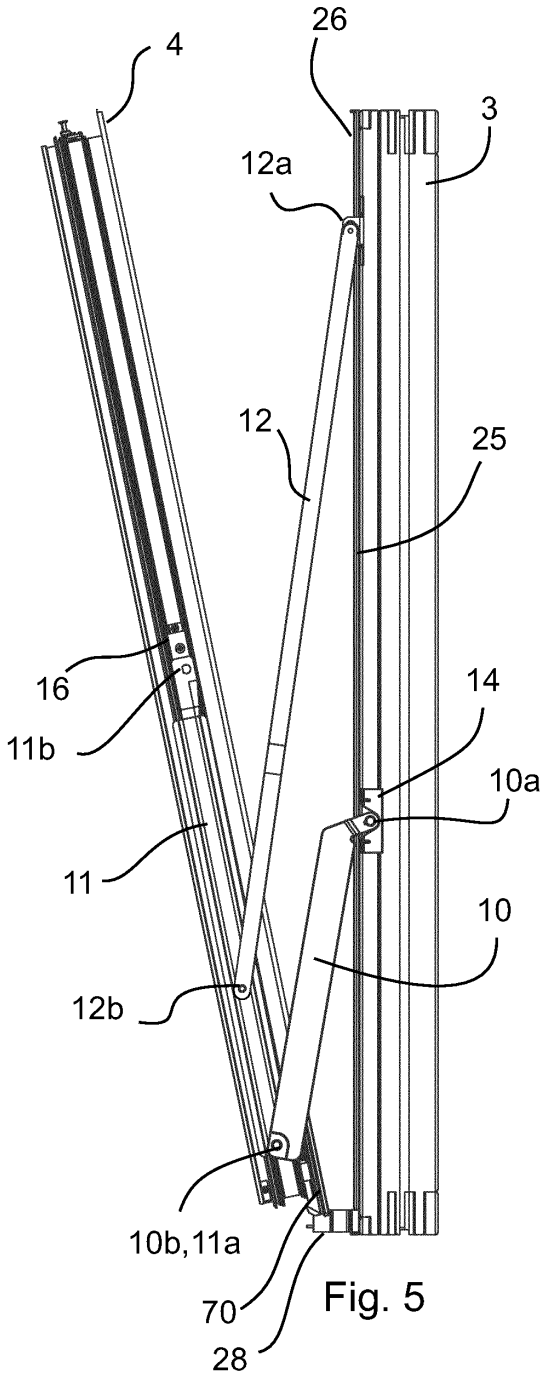
4
26
3
12a
12
25
16
11b
14
10a
11
10
12b
10b,11a
70
28

Fig. 5

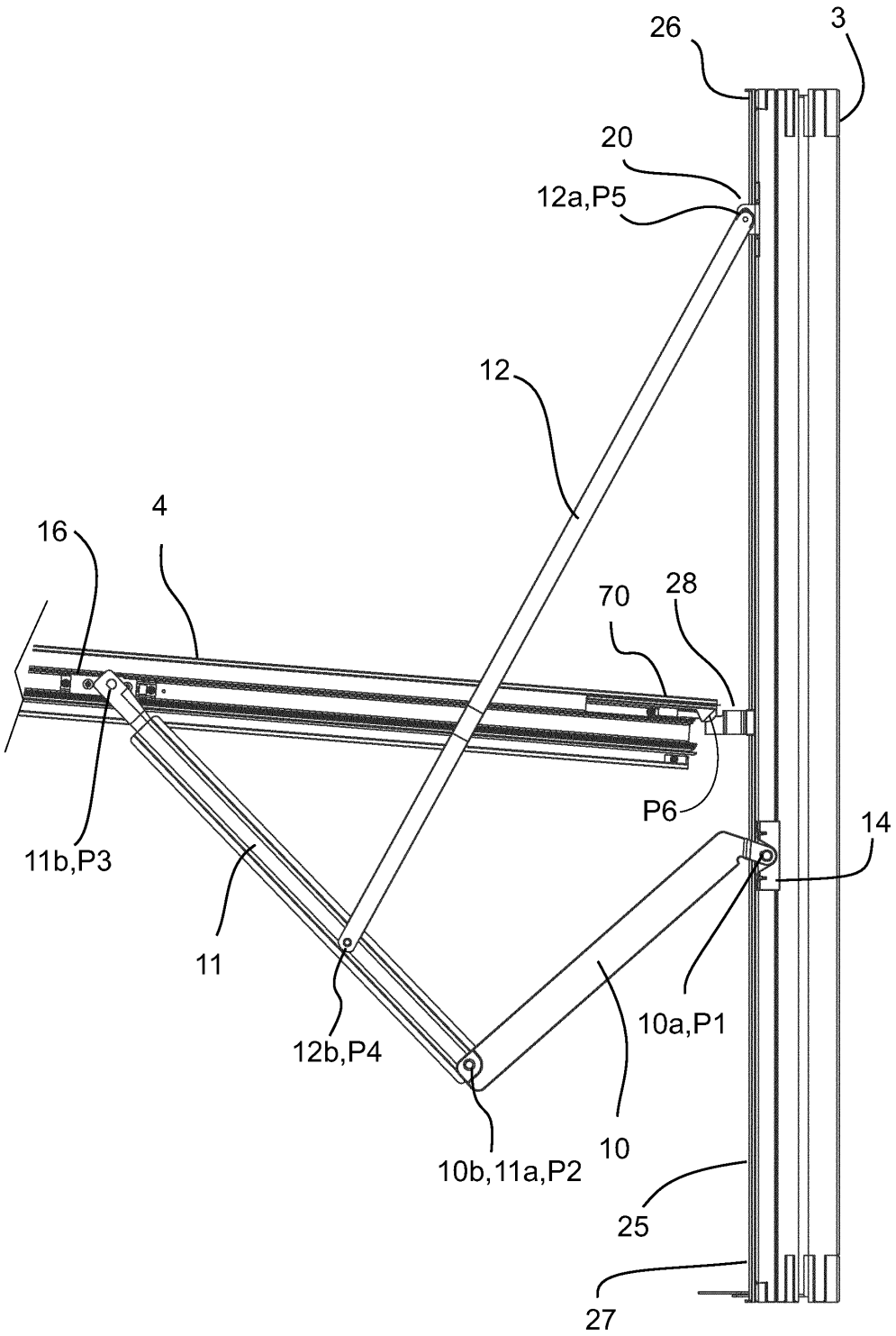
26
3
20
12a,P5
12
4
16
70
28
P6
14
11b,P3
11
12b,P4
10a,P1
10
10b,11a,P2
25
27

Fig. 6

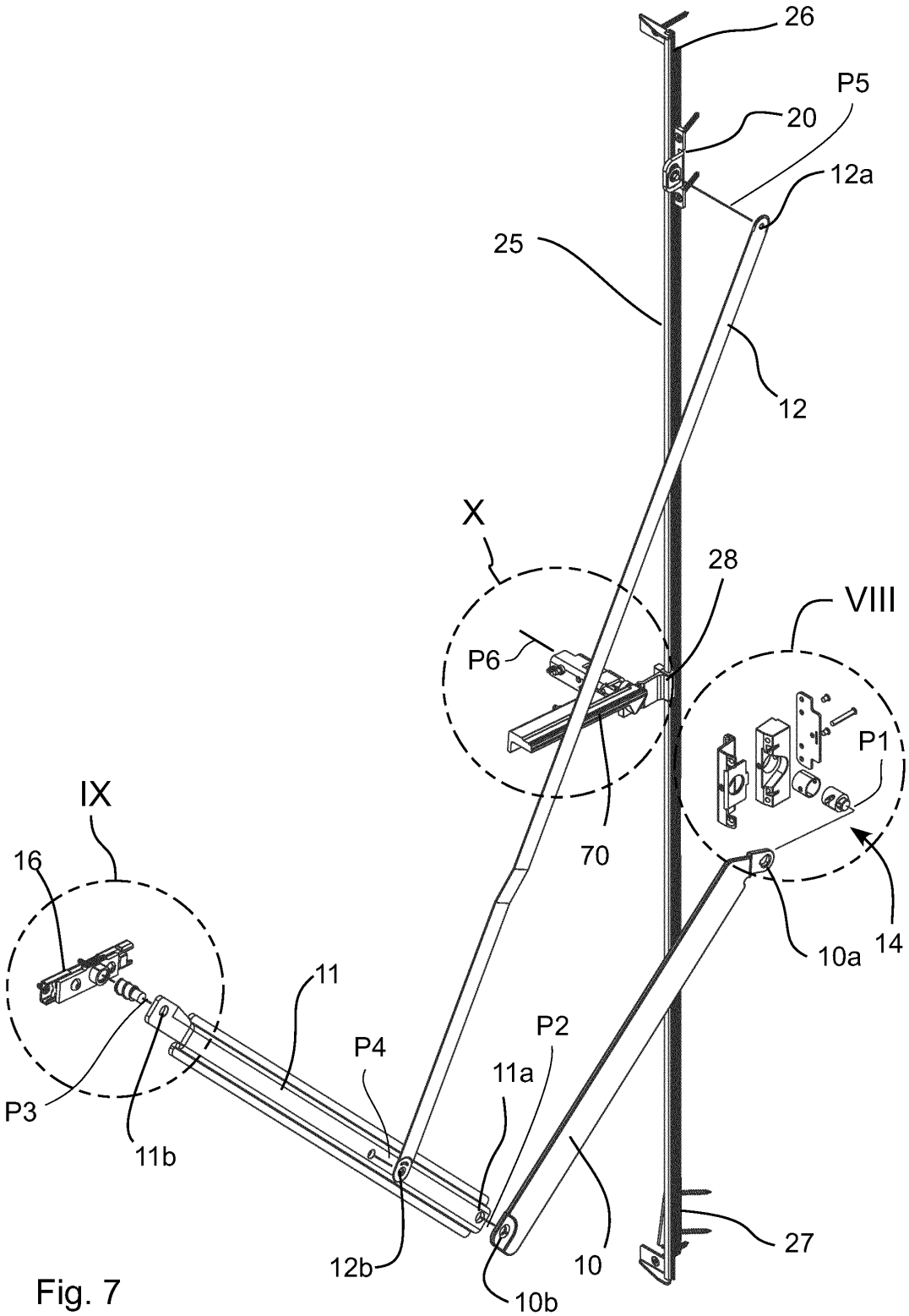
26
P5
20
12a
25
12
X
28
VIII
P6
P1
IX
16
70
10a
14
11
P2
P4
11a
P3
11b
12b
10
27
10b

Fig. 7

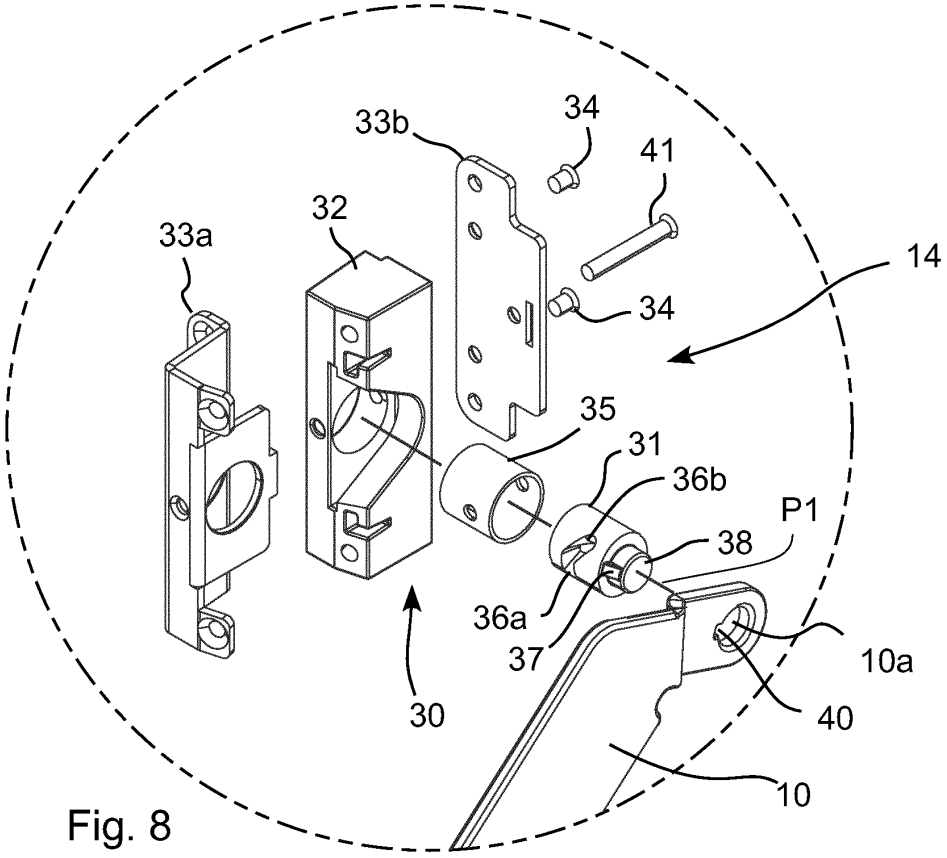
33b
34
41
32
33a
14
34
35
31
36b
P1
38
36a
37
10a
30
40
10

Fig. 8

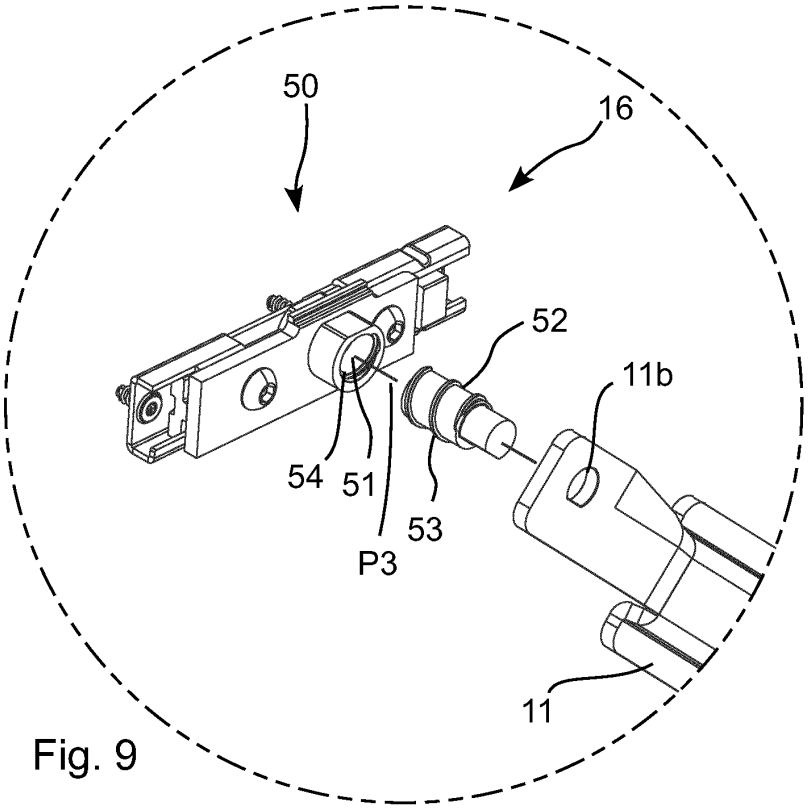
50
16
52
11b
54
51
53
P3
11

Fig. 9

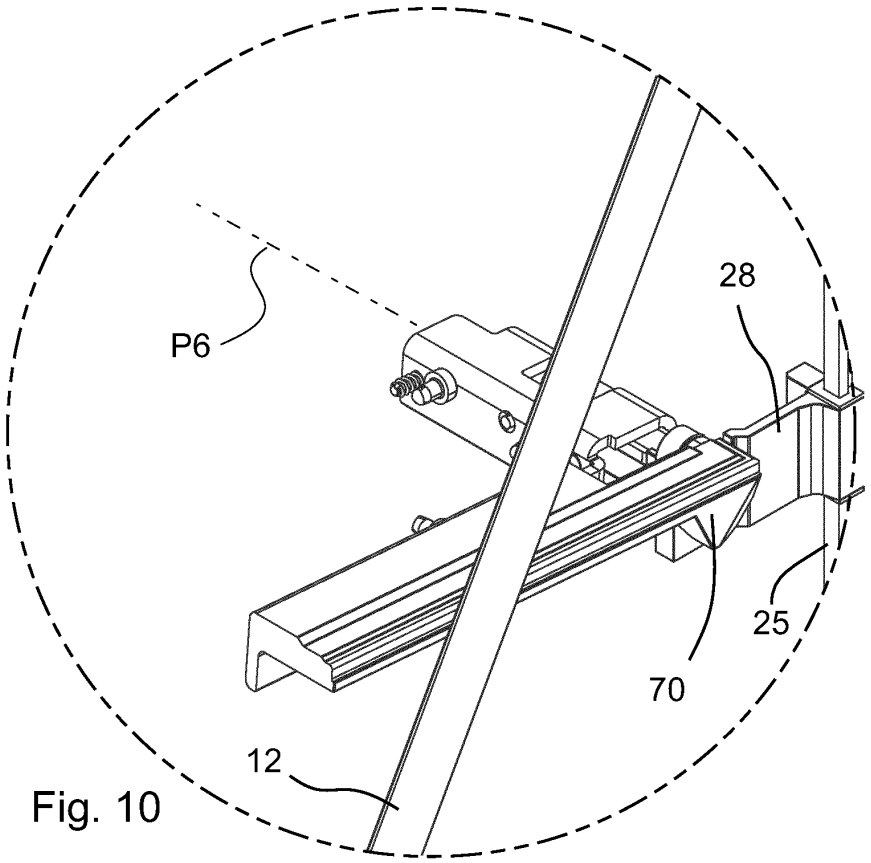

Fig. 10

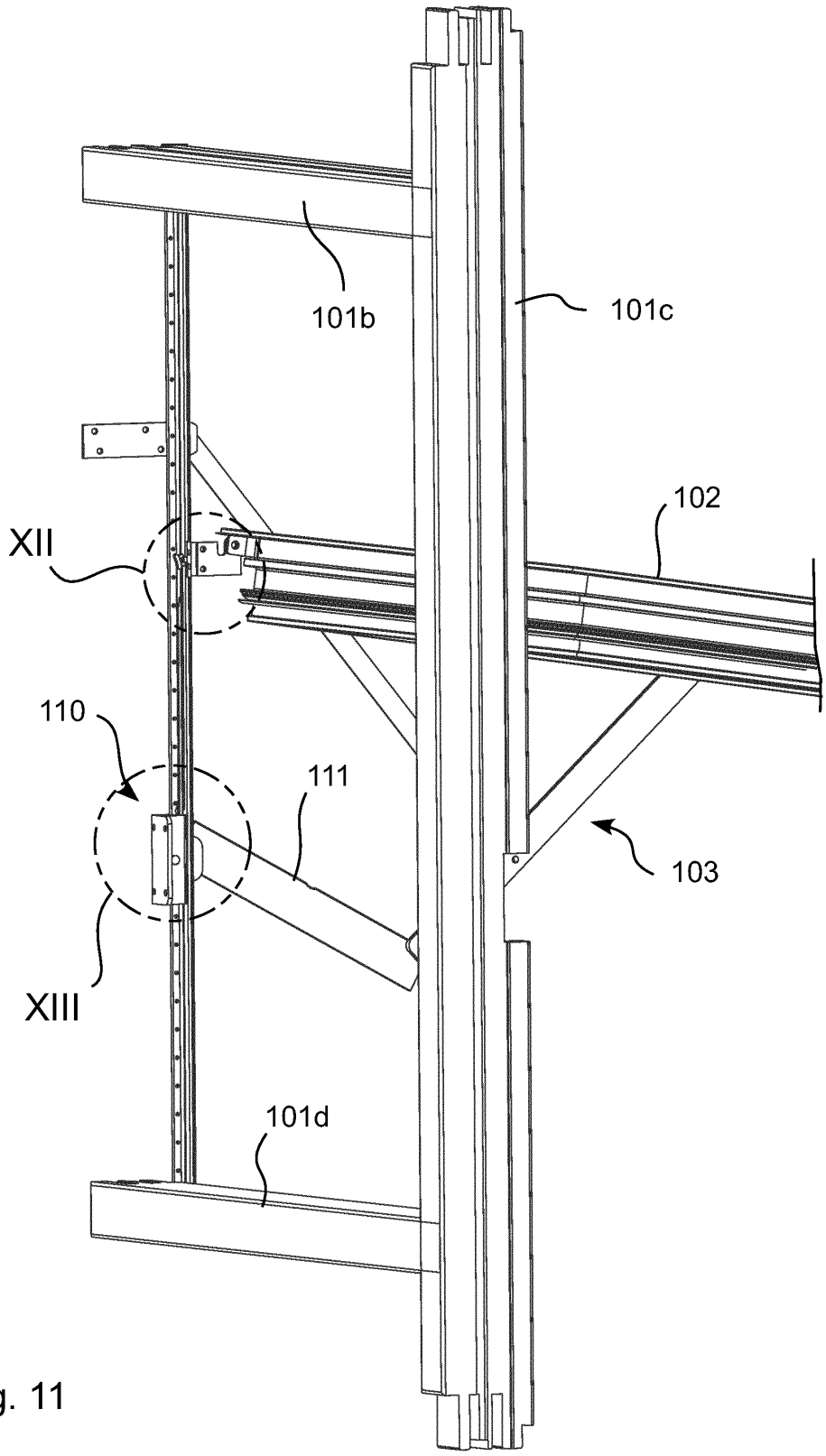

Fig. 11

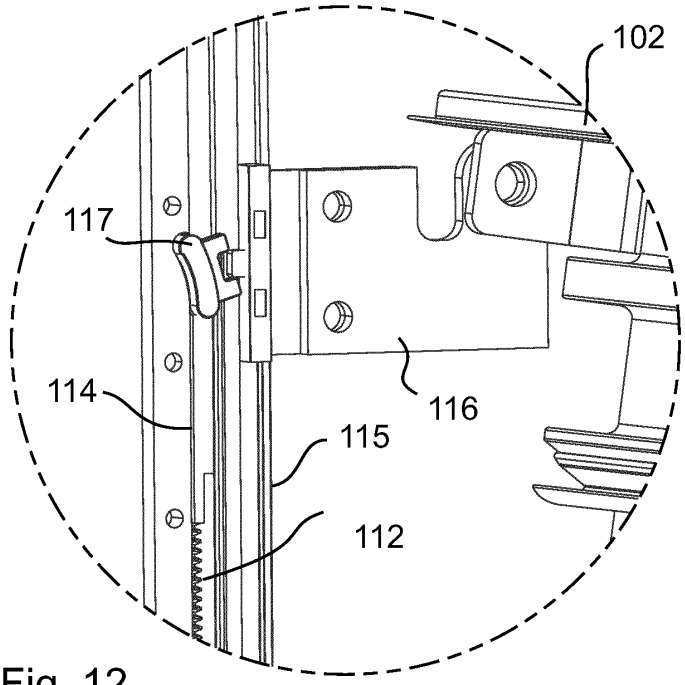

Fig. 12

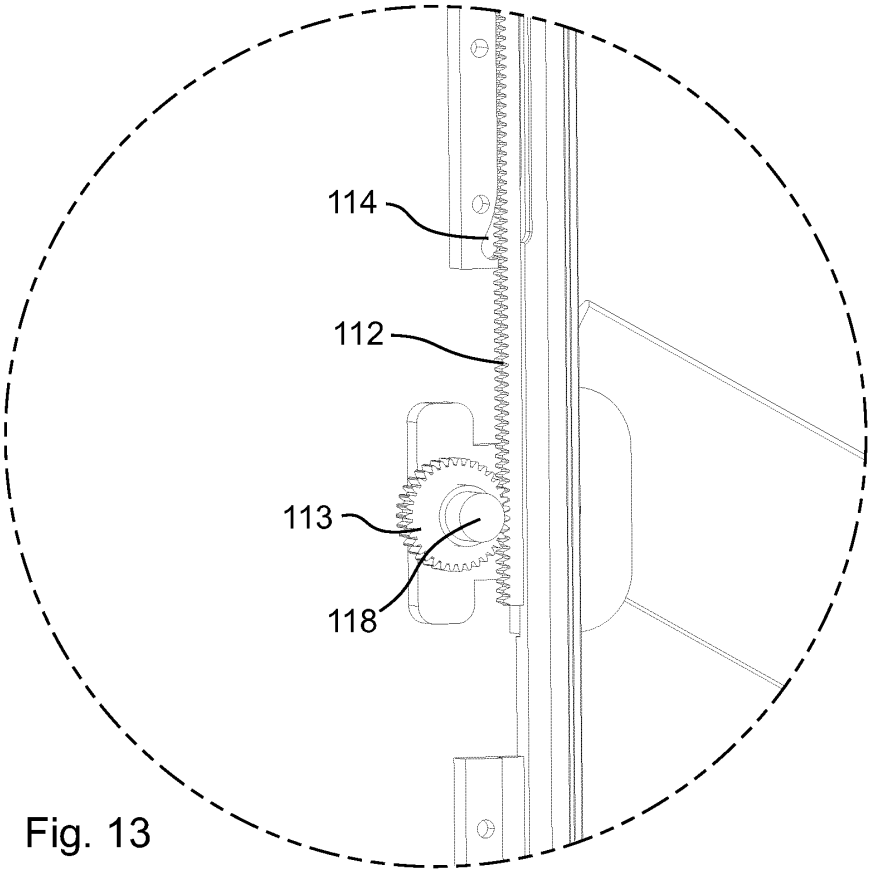

Fig. 13

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1419306 B1 **[0006]**
- DE 29707709 U1 **[0006] [0007]**
- WO 2008040345 A1 **[0006] [0007] [0027]**