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(54) **CHAIN ACTUATOR FOR A WINDOW UNIT AND WINDOW UNIT INCLUDING SAID CHAIN ACTUATOR**

KETTENANTRIEB FÜR EINE FENSTEREINHEIT UND FENSTEREINHEIT, DIE DEN KETTENANTRIEB ENTHÄLT

ACTIONNEUR A CHAÎNE POUR UNE UNITÉ DE FENÊTRE ET UNE UNITÉ DE FENÊTRE COMPRENANT LEDIT ACTIONNEUR A CHAÎNE

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## Description

### TECHNICAL FIELD

**[0001]** The invention relates to an actuator for window units of the chain type, for opening and closing the movable part of the window unit to which it is connected. In addition, the invention refers to a window unit comprising the above-mentioned chain actuator.

### BACKGROUND ART

**[0002]** Actuators are currently known for window units called "chain actuators". In the window unit manufacturing sector, chain actuators are used especially to actuate window units intended to be placed in positions that are difficult to access, such as for example in the case of skylights.

**[0003]** Traditional chain actuators comprise a frame and an articulated chain, having one end which can be fixed to the movable part of the window unit and connected to an actuation device.

**[0004]** The actuation device is configured to extend or retract the articulated chain with respect to the frame in such a way that, during operation, the at least partial extension of the articulated chain results in a moving away of the movable part of the window unit with respect to the fixed part of the window unit and the retraction of the articulated chain causes, on the other hand, the moving of the movable part of the window unit towards the fixed part of the latter. The actuation device is therefore configured to allow a bidirectional motion of the articulated chain, which results in the opening and closing of the window unit.

**[0005]** In particular, the articulated chain is equipped with a plurality of link elements, or more simply links, connected to each other and shaped to be able to abut, when the articulated chain is extended, one on the other so as to be able to mutually support each other to support the weight of the movable part of the window unit and therefore keep it open. In this way, when the articulated chain is extended with respect to the frame it has the rigidity necessary to transmit to the movable part of the window unit the thrust or traction necessary for movement of the latter. Generally, moreover, the articulated chain when extended between the fixed part and the movable part of the window unit tends to arrange itself according to an arc or curved trajectory, having an extrados side corresponding to the winding side of the chain. The "concave" side is therefore the winding side of the articulated chain. However, when the articulated chain is extended, it may happen that its links can orient themselves randomly, with the risk of losing or interrupting the equilibrium condition. An orientation of the links different from the one in which they are configured to reach the equilibrium condition can cause the collapse of the chain articulated on itself, and therefore the sudden and unwanted closing of the movable part of the window

unit. This situation can occur, for example, due to strong gusts of wind or accidental impacts. Also, this situation can occur when the articulated chain is subjected to a limited load, that is to say, a limited weight of the movable part of the window unit, and a considerable stroke. In these conditions, it is possible that a sufficient pressure and friction is not exerted on the surfaces of the links which abut each other to keep them engaged and therefore to ensure the condition of equilibrium.

**[0006]** At the same time, in order to preserve the stability and service life of the articulated chain itself, it is necessary that it is not induced to bend or is not left to bend excessively, in such a way as to prevent yielding or deformation of the link elements. In fact, as the load, that is to say, the weight of the movable part of the window unit and the stroke, increases, the articulated chain could develop a curvature which is so pronounced as to cause failure.

**[0007]** DE202012001762U discloses a chain actuator according to the preamble of claim 1.

### SUMMARY OF THE INVENTION

**[0008]** The problem underlying the invention is, therefore, that of overcoming the drawbacks of traditional solutions by allowing the articulated chain to be kept in a condition of stable equilibrium when extended between the fixed part and the movable part of the window unit. In other words, the problem raised and resolved by the invention is that of ensuring that the articulated chain is positioned between the fixed portion and the movable portion so as to have the stiffness necessary to support the load applied to it.

**[0009]** The task of a chain actuator for a window unit and a window unit which includes it is therefore to solve this problem.

**[0010]** Within the scope of this task, an aim of the invention is therefore to ensure that the mutually abutting links exert a suitable stress on each other to ensure a mutual engagement to reach and maintain a condition of stable equilibrium by the articulated chain.

**[0011]** Another aim of the invention is to allow the maintenance of a curved trajectory of the portion of articulated chain extending between the fixed portion and the movable portion of the frame in the equilibrium condition.

**[0012]** A further aim of the invention is to provide a chain actuator that is structurally simple, easy to use and easy to install without requiring specialized skills.

**[0013]** A further aim of the invention is to allow adjustment of the curvature, that is to say, of the arching, of the portion of the articulated chain extending between the fixed portion and the movable portion of the frame in the equilibrium condition. This task, as well as these and other aims which will emerge more fully below, are achieved by chain actuator for a window unit comprising it according to the attached independent claim 1.

**[0014]** Detailed features of a chain actuator for a win-

dow unit according to the invention, are indicated in the dependent claims.

**[0015]** Further features and advantages of the invention will emerge more fully from the description of a preferred but not exclusive embodiment of a chain actuator device for a window unit according to the invention, illustrated by way of non-limiting example in the accompanying drawings listed below.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0016]**

- Figure 1 shows a perspective view of a chain actuator according to the invention in which the articulated chain is retracted into the fixed portion;
- Figure 2 shows the actuator of Figure 1 with some components of the thrust device in detail;
- Figure 3 shows a perspective view of a portion of the chain actuator according to the invention, in which the articulated chain is extracted with respect to the fixed portion, and it shows some components of the thrust device in detail;
- Figure 4 shows a detail of a chain actuator according to the invention;
- Figure 5 shows a perspective view in partial cross-section of an actuator for a window unit or door according to the invention;
- Figure 6 shows the actuator of Figure 5 with some components of the thrust device and of the adjustment device in detail;
- Figure 7 shows a detail of the movable portion of the frame and a portion of the articulated chain of a chain actuator according to the invention;
- Figure 8 shows a side view of a chain actuator according to the invention coupled to a window unit in the closed position;
- Figure 9 shows the detail I of figure 8;
- Figure 10 shows a detail of a portion of an articulated chain and of a movable portion of the frame of a chain actuator according to the invention;
- Figure 11 shows a side view of a chain actuator according to the invention coupled to a window unit in the open position;
- Figure 12 shows detail II of Figure 11.

#### DETAILED DESCRIPTION

**[0017]** With particular reference to the accompanying drawings, the numeral 1 denotes in its entirety a chain actuator for a window unit.

**[0018]** The window unit 2 comprises a fixed part 21, which can be installed on an infrastructure, and a movable part 22, connected to the fixed part 21, in order to be movable with respect to each other. For example, the movable part 22 may comprise or consist of a door and the infrastructure may comprise or consist of a wall. In particular, the movable part 22 can be moved with respect

to the fixed part 21 between an open position, that is to say, spaced from the fixed part, and a closed position, that is to say, close to the fixed part 21.

**[0019]** In particular, the chain actuator 1 according to the invention can comprise a frame 30, that is to say, a structural body, having a fixed portion 31, apt to be coupled to the fixed part 21 of the window unit 2 or to the infrastructure, and a movable part 32 apt to be coupled to the movable part 22 of the frame 2.

**[0020]** The chain actuator 1 according to the invention comprises an articulated chain 40 connected to the movable portion 32 and to the fixed portion 31 of frame 30 to move the movable portion 32 with respect to the fixed portion 31 to operate the window unit 2 between an open position and a closed position. It follows that the articulated chain 40 is configured to move the movable part 22 of the window unit 2 with respect to the fixed part 21 of the latter so that the movable part 22 can adopt an open position or a closed position. The articulated chain 40 can therefore act as a movement member for the movable portion 32 of the frame 30, and therefore for the movable part 22 of the window unit 2.

**[0021]** The articulated chain 40 is composed of a plurality of segments 41, that is to say, a plurality of links or linked elements, arranged in series between a head segment 41a, connected to the movable portion 32, and a tail segment (not illustrated). The head segment 41a and the tail segment therefore represent the end segments of the articulated chain 40.

**[0022]** In particular, each segment of the plurality of segments 41 has a development direction S and is connected to at least one further segment, that is to say, to at least one adjacent segment, of the plurality of segments 41 in such a way as to rotate with respect to the latter reversibly around a hinge axis C in a winding direction  $\alpha$  to orient its direction S of extension between a jamming angle and a winding angle. In other words, each segment of the plurality of segments 41 is associated with a further segment in a rotatable manner in order to be able to rotate with respect to the latter around a hinge axis C, in a winding direction  $\alpha$  and in a direction opposite to this winding direction  $\alpha$ . In this way, each segment of the plurality of segments 41 can arrange itself, with respect to the further segment with which it is rotatably associated, so as to orient its development direction S between a jamming angle and a winding angle. Therefore, the direction of winding  $\alpha$  is the direction of rotation around the axis C, which leads a segment to orient its relative development direction S in the winding angle. Conversely, a direction opposite to that of winding  $\alpha$  is the direction of rotation around the axis C, which leads a segment to orient its development direction S in the jamming angle. This direction opposite to the winding direction  $\alpha$  is a jamming direction.

**[0023]** According to the invention, in the jamming angle each segment of the plurality of segments 41 has its own development direction S substantially parallel to the development direction S of the further segment so as to

exert a stress along an operating direction D, to mutually move the fixed portion 31 and the movable portion 32 of the frame 30. In other words, in the jamming angle, the development direction S of each segment is substantially aligned with the development direction of the further segment S so that the articulated chain 40 can exert a force along the operating direction D. That is to say, when the segments of the articulated chain 40 are in the jamming angle, the articulated chain 40 has sufficient stiffness to exert a stress on the movable portion 31 along this operating direction D. This operating direction D therefore represents a stress direction, such as a traction or a thrust, along which the articulated chain 40 acts on the movable portion 32. The plane in which the jamming angle and the winding angle are defined, or lie, is the operating plane of the articulated chain.

**[0024]** The chain actuator 1 also comprises an actuation device 50 coupled to the fixed portion 31 of the frame 30 and to the articulated chain 40. The actuation device 50 is actuated to extend, that is to say, extract, the articulated chain 40 from the fixed portion 31 along the operating direction D or to retract the articulated chain 40 with respect to the latter so as to, respectively, move away from or approach the movable portion 32 with respect to the fixed portion 31 and, therefore, open or close the window unit 2. The actuation device 50 is operated to move the articulated chain 40 bi-directionally with respect to the fixed portion 31, to exert a thrust or traction on the movable portion 32 to, respectively, move the latter away from or approach the fixed portion 31. The chain actuator 1 according to the invention comprises a thrust device 60 associated with the fixed portion 31 and configured to interfere, that is to say, interact, with the articulated chain 40 in a relative operating section, that is to say, a section positioned between the movable portion 32 and the actuation device 50, to force the segments of the articulated chain 40 forming this portion into their mutual jamming angle. In other words, the thrust device 60 is configured in such a way as to force the segments of the articulated chain 40 interposed between the movable portion 32 and the actuation device 50 to arrange themselves in such a way as to orient their development direction S in the jamming angle. In this way, the segments of the articulated chain 40 forming the operating section are forced to reach and maintain the jamming angle. That is to say, the thrust device 60 is configured to further facilitate the segments of the articulated chain 40 forming the operating section to reach and maintain the jamming angle. It follows that the thrust device 60 opposes a different orientation from the jamming angle of the segments of the articulated chain interposed between the movable portion 32 and the actuation device 50 and which, therefore, ensures that these transmit the stress to the movable portion 32.

**[0025]** According to the invention, the winding angle and/or the jamming angle can preferably be defined between the development direction S of the segment and the development direction of a further segment S

connected to the latter.

**[0026]** In the context of the invention, the expression "development direction S substantially parallel to the development direction S of the further segment" means that the development direction S of a segment does not diverge from parallelism with respect to the direction S of extension of a further segment. In other words it is understood that the jamming angle of a segment corresponds to an angle of substantially 180° between the development direction S of the segment itself and that of a further segment connected to it. In other words, the above-mentioned expression means that the operating section of the articulated chain 40 is arranged according to a rectilinear trajectory. This rectilinear trajectory therefore extends along the operating direction D.

**[0027]** Alternatively, the above-mentioned expression means that the development direction S of a segment does not diverge with respect to the development direction S of a further segment, that is to say, of a segment connected to it, by an angle greater than 2°, preferably not greater than at 1°, even more preferably not higher than 0.8° and most preferably not higher than 0.5°.

**[0028]** According to this preferred aspect of the invention, in the jamming angle, the development direction S of each segment of the operating section can differ from the parallelism with respect to D. More preferably, the segments of the operating section, that is to say, the segments of the articulated chain 40 interposed between the movable portion 32 and the actuation device 50, in the reciprocal jamming angle they can define an arc trajectory, that is to say, C-shaped in the operating plane. In other words, when each segment of the articulated chain 40 between the movable portion 32 and the actuation device 50 is in the relative jamming angle, they can be arranged according to an arc or C-shaped trajectory in the operating plane. The articulated chain 40 can therefore be configured to be able to arrange itself, between the movable portion 32 and the actuation device 50, according to an arc or C-shaped trajectory in the operating plane. The arc trajectory defines a concave side or extrados side and an opposite convex or intrados side of the articulated chain 40.

**[0029]** According to this preferred aspect, the operating direction D can correspond to or coincide with the chord of this arc-shaped trajectory.

**[0030]** Preferably, the winding angle is an angle supplementary to the jamming angle. According to a preferred aspect of the invention, in the jamming angle, the development direction S of each segment of the operating section is parallel to the operating direction D.

**[0031]** According to a preferred aspect of the invention, the operating direction D substantially corresponds or coincides with the direction of extraction of the articulated chain 40 with respect to the fixed portion 31. In other words, the articulated chain 40 in extraction with respect to the fixed portion substantially follows this operating direction D. In yet other words, the operating direction D is the direction along which the articulated chain 40 is

configured to unwind between the fixed portion 31 and the movable portion 32.

**[0032]** According to a preferred aspect of the invention, the operating direction D lies in the operating plane, that is to say, in the plane defined by the jamming angle and by the winding angle.

**[0033]** According to a preferred aspect of the invention, the only rotation which is allowed for each segment of the plurality of segments 41 is that with respect to the hinge axis C. In other words, each segment of the plurality of segments 41 is configured to be able to rotate or tilt with respect to the further segment, that is to say, with respect to an adjacent segment, only around the hinge axis C and between the jamming angle and the winding angle. That is to say, the articulated chain 40 is not configured to rotate about an axis parallel to or contained in the operating plane. In this way, the rigidity of the articulated chain 40 is ensured in the operating direction D which is necessary to transmit the stress to move the movable part 22, according to a predetermined trajectory, of the window unit 2 with respect to the fixed part of the latter.

**[0034]** According to a preferred aspect of the invention, the segments of the articulated chain 40 can be connected to each other in an articulated manner in sequence between the head segment 41a and the tail segment. In other words, the segments of the plurality of segments 41 can be operatively connected in series with each other.

**[0035]** According to a preferred aspect of the invention, each segment of the plurality of segments 41 is hinged to a further segment by means of a rotary connection element, such as a pin, which defines the above-mentioned hinge axis C.

**[0036]** According to a preferred aspect of the invention, the tail segment can be coupled to the fixed portion 31 and the latter can be configured to house at least part of the articulated chain 40 inside itself. Preferably, moreover, according to this aspect, the articulated chain 40 can be received completely, with the exception of the head segment 41a, inside the fixed portion 31 of the frame 10 when the window unit 2 is in the closed position.

**[0037]** According to a preferred aspect of the invention, the fixed portion 31 of the frame 30 is equipped with a guided slide channel for the articulated chain 40 which communicates with an environment outside the fixed portion 31 through an opening or outlet mouth. In other words, the fixed portion 31 can also comprise a sliding channel along the articulated chain 40 inside the same fixed portion 31. More specifically, this slide channel is configured to internally house the articulated chain 40, when retracted with respect to the frame 30, and to guide it and move it to gradually protrude from the above-mentioned opening or outlet mouth under the action of the actuation device 50.

**[0038]** According to a preferred aspect of the invention, the actuation device 50 can comprise a movement member 51 which interacts with the articulated chain 40 to extend and retract it in the fixed portion 31. In other words,

the actuation device 50 can comprise a movement member 51 which engages the articulated chain 40 to move it in extraction or retraction with respect to the fixed portion 31. Preferably, this movement member 51 can be a gearwheel.

**[0039]** Preferably, the actuation device 50 can be housed inside the fixed portion 31. According to a preferred aspect of the invention, the actuation device 50 may further comprise a motorised system for operating the actuation member.

**[0040]** According to a preferred aspect of the invention, each segment of the plurality of segments 41 with the exception of the head segment 41a can comprise or consist of a connecting rod element.

**[0041]** According to a preferred aspect of the invention, each segment of the plurality of segments 41 with the exception of the head segment 41a can have a first end region and a second end region each pivoted, that is to say, hinged to a respective second end region or first end region of at least one further segment.

**[0042]** According to a preferred aspect of the invention, each segment of the plurality of segments 41 with the exception of the head segment 41a can comprise a first plate element and a second plate element arranged parallel to each other and mutually connected by a pair of pins. Each pin defines a hinge axis C about which a segment can rotate relative to a further segment. The space between each pair of pins defines the pitch of the articulated chain 40 and it can be engaged by the movement member 51.

**[0043]** Preferably, the development direction S is a main development direction of each first plate element and second plate element.

**[0044]** Preferably, moreover, with reference to this development direction S, each first plate element and each second plate element is delimited by a pair of head surfaces and four lateral surfaces. The expression "head surfaces" means the surfaces, opposite each other defined on a tangential plane, preferably substantially orthogonal, to the development direction S.

**[0045]** According to a preferred aspect of the invention, when the segments interposed between the head segment 41a and the at least one engaged segment by the actuation member 51 are each in the jamming angle, the head surfaces of these segments they are facing each other, that is to say reciprocally abutting. In other words, in the jamming angle, each head surface is configured to mutually engage with a head surface of a preceding segment and/or a successive segment.

**[0046]** According to the invention, the thrust device 60 is configured to exert a first thrust force F1, along a thrust direction, on the section of the articulated chain 40 interposed between the movable portion 32 and the actuation device 50, that is to say, on the operating section of the articulated chain, and this thrust direction is intermediate between the movable portion 32 and the movement member 51. In other words, the first thrust force F1 generated by the thrust device 60 acts at an intermediate

point of the articulated chain between the movable portion 32 and the movement member 51. Since the articulated chain 40 is constrained to the two ends of the above-mentioned section, by the movable portion 32 and by the movement member 51, the first thrust force F1 acting in an intermediate point of the operating section generates a torque or bending moment which forces the segments of the operating segment to rotate with respect to the hinge axis C to reach the jamming angle.

**[0047]** According to a preferred aspect of the invention, the thrust device 60 can be configured to exert the first thrust force F1 along a thrust direction substantially orthogonal to the operating direction D.

**[0048]** According to a preferred aspect of the invention, the thrust device 60 can be fixed to the fixed portion 31. In this case, the thrust device 60 is therefore applicable to chain actuators or to already existing installations in order to increase their performance. In this case it could be required that the configuration of the movable part 21 and of the fixed part of 22 of the window unit 2 be suitably adapted so as to be able to contain it between them without preventing the closing of the window unit 2, that is to say, an approach of the movable part 21 with respect to the fixed part 21.

**[0049]** According to a preferred aspect of the invention, alternative to the last one explained above, the thrust device 60 can be integral with the fixed portion 31 or integrated with the fixed portion 31. In other words, the thrust device 60 can form a single body, that is to say, that can be manipulated individually, with the fixed portion 31.

**[0050]** Preferably, moreover, the thrust device 60 together with the fixed portion 31 can form a box-like body. In particular, the thrust device 60 can contribute to delimiting the fixed portion 31 along the perimeter. Even more preferably, for simplicity of construction and operation, the thrust device 60 can comprise a wall portion 67, which can form part of a wall of this box-like body. Even more preferably, the box-shaped body can be apt to house at least partially the articulated chain 40 and the movement member 51.

**[0051]** According to the invention, the pusher device 60 comprises a base 62, and a pusher 61 and elastic means 63 to spread apart the pusher 61 with respect to the base 62. Preferably, the base 62 can be integral with the fixed portion 31, that is to say, be part of the fixed portion 31, or can be fixed to the latter.

**[0052]** Preferably, according to this preferred aspect, the elastic means 63 can be preloaded so as to generate the above-mentioned first thrust force F1. Preferably, the elastic means 63 can comprise at least one torsion spring having a first end which abuts against the base 62 and a second end, opposite to the first end which abuts against the pusher 61. This first thrust force F1 is then transmitted to the pusher 61 and from this to the articulated chain 40.

**[0053]** According to a preferred embodiment, the pusher 61 is translatable along the thrust direction. Preferably, the pusher 61 is translatable with respect to the fixed part 31. Due to the effect of the elastic means 63, the

pusher 61 is movable along the thrust direction until it interacts with the articulated chain 40 so as to transmit to this the first thrust force F1. In other words, the thrust device 60 can be configured to translate with respect to the fixed portion 31 of the frame and exert the first thrust force F1 on at least one segment of the section of articulated chain 40 between the actuation device 50 and the movable portion 32.

**[0054]** According to a preferred aspect of the invention, the pusher 61, the wall portion 67 and the elastic means 63 are stably associated with each other. It follows that a lengthening in the thrust direction of the elastic means 63 or a contraction of the elastic means 63 in the direction opposite to that of thrust, is followed by a displacement of the pusher 61 and of the wall portion 67 respectively in the thrust direction or in a direction opposite to the thrust direction.

**[0055]** According to a preferred aspect of the invention, the pusher 61 and the base 62 are configured to define between them a recess which receives elastic means 63. According to a preferred aspect of the invention, the articulated chain 40 can be configured to be penetrated by the pusher 61. That is to say, the articulated chain 40 can be configured in such a way as to be engaged by the pusher 61.

**[0056]** Furthermore, according to this preferred aspect, the pusher 61 can be configured to guide the articulated chain 40 in the operating direction D and/or in the thrust direction. By penetrating the articulated chain 40, the pusher 61 prevents it from moving in the opposite direction to that set by the actuation device 50. In this way, the articulated chain 40 is thus facilitated to unwind in the operating direction D.

**[0057]** In addition, according to a further preferred aspect of the invention, the articulated chain 40 is configured to be penetrated by the movement member 51. According to a preferred aspect of the invention, the pusher 61 can comprise an insertion portion 611, apt to interact with the articulated chain 40. In particular, the insertion portion 611 can be the part of the pusher 61 apt to engage or penetrate the articulated chain 40. The insertion portion 611 facilitates the retaining of the pusher 61 in interaction or engagement with respect to the articulated chain 40.

**[0058]** More preferably, the insertion portion 611 is configured to insert into the space between the first plate element and the second plate element of the at least one segment.

**[0059]** According to a preferred aspect of the invention, the insertion portion 611 can have a curvilinear profile, preferably circular. In other words, the insertion portion 611 can have a peripheral edge that is at least partially curved or rounded. Even more preferably, the insertion portion 611 can be disc-shaped. In this way the friction between the pusher 61 and the articulated chain 40 is particularly reduced, especially when it is moved to be extracted or retracted with respect to the fixed portion 31.

**[0060]** According to a further preferred aspect of the

invention, the insertion portion 611 can be rotated so as to roll on the articulated chain 40 following a movement of the latter. In this way, the friction between the articulated chain 40 and the pusher 61 is further limited when the articulated chain 40 is moved to be extracted or retracted with respect to the fixed portion 31.

**[0061]** According to a preferred aspect of the invention, the pusher 61 can comprise a contact portion 612, which is apt to abut or come into contact with the articulated chain 40. The contact portion 612, therefore, transmits the first thrust force F1 to the articulated chain 40. Preferably, the contact portion 612 can be apt to abut, that is to say, come into contact with, a side surface of the first and/or second plate element of the at least one segment.

**[0062]** According to a preferred aspect of the invention, the contact portion 612 can have a curvilinear profile, preferably circular. In other words, the contact portion 612 can have a peripheral edge that is at least partially curved or rounded.

**[0063]** According to a further preferred aspect of the invention, the contact portion 612 can be rotated so as to roll on the articulated chain 40 following a movement of the latter. In this way, the friction between the articulated chain 40 and the pusher 61 is limited when the articulated chain 40 is moved to be extracted or retracted with respect to the fixed portion 31.

**[0064]** According to a further preferred aspect of the invention, the insertion portion 611 and/or the contact portion 612 can extend mainly around a rolling axis X, substantially orthogonal to the operating direction D and to the thrust direction S, and can be rotatable about this rolling axis X.

**[0065]** According to a further preferred aspect of the invention, the thrust device 60 comprises a limiting element 64, in spaced relation with respect to the pusher 61 along the thrust direction to define with the latter an opening or outlet mouth of the fixed part 31, which can be engaged by the articulated chain 40 to extend from the fixed part 31.

**[0066]** In particular, the at least one segment of the section of the articulated chain 40 on which the pusher 61 acts, in use, is interposed between the pusher 61 and the limiting element 64. That is to say that the at least one segment of the section on which the pusher 61 acts, in use, is the one which engages the outlet mouth.

**[0067]** Preferably, moreover, the limiting element 64 can be apt to limit the jamming angle and can comprise a friction reducing element such as a roller or rotatable disc apt to interfere with the articulated chain 40. The limiting element 64 can be apt to limit the rotation of the at least one segment in the jamming direction. In addition, the limiting element 64 may furthermore be apt to limit the movement of said at least one segment in the thrust direction.

**[0068]** According to a further preferred aspect of the invention, the distance between the limiting element 64 and the pusher 61 can be adjustable. In particular, this distance can be adjustable with respect to the tangent of

the pinion 51.

**[0069]** According to the invention, the chain actuator 1 comprise an adjustment device 70 configured to adjust or control the amount of the first thrust force F1, generated by the thrust device 60, and transferable to the articulated chain 40.

**[0070]** The adjustment device 70 is configured in such a way as to act as a stop element or limit switch element for the pusher device 60. In other words, the adjustment device 70 is apt to interact with the thrust device 60 in such a way as to regulate the translation with respect to the fixed portion 31 along the thrust direction. More preferably, the adjustment device 70 can act as a stop or limit stop element for the wall portion 67 of the pusher device 60. It follows that the adjustment device 70, as it is configured to be able to interact with the wall portion 67 of the thrust device 60, is configured to be able to interact also with the pusher 61 and/or with the elastic means 63 to adjust its translation with respect to the fixed portion 31 along the thrust direction. In other words, the adjustment device 70 is configured so as to limit or regulate a maximum stroke of the pusher 61 and/or to limit or regulate a maximum elongation of the elastic means 43 in the thrust direction.

**[0071]** In other words, the adjustment device 70 can be, that is to say, configured to adjust or control the maximum distance, or maximum stroke in particular of the pusher 61, with respect to the fixed portion 31 in the thrust direction. In fact, by interacting with the wall portion 67, as illustrated above, the adjustment device 70 is apt to counteract the elongation of the elastic means 63 beyond a certain or predefined maximum length. Preferably, the adjustment device 70 can be configured to be able to translate in a direction opposite to the thrust direction with respect to the fixed portion 31 of frame 10 and to be able to be fixed to the latter in a position desired by the user. Even more preferably, the adjustment device 70 can be fixed to the fixed portion 31 of the frame 30 in a position chosen by the user. As stated above, in this position, the adjustment device acts as a stop or end-of-stroke element.

**[0072]** In other words, the adjustment device 70 can be fixed or removably associated with the fixed portion 31 in a position selected by the user. For this reason, as mentioned above, the adjustment device 70 is configured to adjust the maximum stroke of the thrust device 60, in particular of the pusher 61 and/or adjust a maximum elongation of the elastic means 63.

**[0073]** According to a further preferred aspect, the adjustment device 70 can comprise an internal portion, housed inside the fixed portion 31, and an external portion which protrudes externally with respect to the fixed portion 31 so as to be able to be gripped or manipulated by a user. Through the external portion, a user, such as for example an installer, can adjust the position of the adjustment device 70 with respect to the fixed portion 31 and the pusher device 60. The outer portion and the inner portion can be integral with each other so that a displace-

ment of the outer portion is followed by a displacement of the inner portion to limit the maximum stroke of the pusher 61 in the thrust direction.

**[0074]** According to a further preferred aspect of the invention, the thrust device 60 comprises at least one slide guide 65 which extends along the thrust direction and in which the fixed portion 31 comprises at least one limit stop element 33 configured to interact with the slide guide 65. In other words, the limit stop element 33 opposes the translation of the pusher 61 in the thrust direction beyond a certain predetermined maximum distance, that is to say, the length of the slide guide 65 in the thrust direction. In other words, the length of the slide guide 65 in the sliding direction determines the maximum movement of the pusher 61 with respect to the fixed portion 31. Preferably, the slide guide 65 and the limit switch element 33 also contribute to guiding the movement of the pusher 61 with respect to the fixed portion 31 of the frame 30 in the thrust direction. Preferably, the sliding guide 65 is made in a wall portion of the thrust device 60.

**[0075]** According to a preferred aspect of the invention, the slide guide 65 can be configured as a through opening defining a slot, having a predefined length along the thrust direction. Furthermore, according to this preferred aspect, the limit stop element 33 can be configured as a protruding element protruding inside the through opening to partially engage it. In this way the pusher 61 can slide in the thrust direction with respect to the limit switch element 33 until a peripheral edge which delimits the through opening does not make contact with the limit switch element 33.

**[0076]** According to a preferred aspect of the invention, the slide guide 65 is a first slide guide and the pusher 61 further comprises at least one second slide guide 66 which, like the first slide guide 65, extends along the thrust direction. Similarly, the fixed portion 31 of the frame 30 comprises at least a second limit switch element 33 configured to interact with the second slide guide 66 and to define a maximum stroke of the pusher 61. Preferably, the first slide rail 65 and the second slide rail 66 have equal length in the thrust direction. The second slide guide 65 and the second limit switch element 33' further contribute to guiding the movement of the pusher 61 with respect to the fixed portion 31 of the frame 30 in the thrust direction. Preferably, the second sliding guide 66 is made in a wall portion of the thrust device 60.

**[0077]** Preferably, the first slide guide 65 and the second slide guide 65 are arranged so that the outlet mouth is interposed between them. Even more preferably, the first slide guide 65 and the second slide guide 65 are arranged symmetrically with respect to the outlet mouth.

**[0078]** According to a preferred aspect of the invention, the adjustment device 70, being configured to interact with the thrust device 60 to limit the stroke or translation in the thrust direction, consequently allows the translation of the first slide guide 65 and/or of the second slide guide 66 to be limited, with respect to the fixed portion 31 and in

particular with respect to the first limit stop element 33 and the second limit stop element 33', respectively. In this way, it is possible to adjust the stroke of the first guide 65, and of the second guide 66 if present, with respect to the first limit stop element 33, and to the second limit stop element 33' if present.

**[0079]** According to a further preferred aspect, the movable portion 32 can comprise a fixing element 35, apt to be fixed to the movable part 22 of the window unit 20, and an attachment element 34, associated with the fixing element 35 so as to be able to rotate with respect to the latter around a first axis of rotation A, transversal to the operating direction D, furthermore, according to this aspect, the head segment 41a of the articulated chain 40 can be connected to the attachment element 34. Since the articulated chain 40, through the attachment element 34, is associated with the fixing element 35, in this way, it acquires a greater degree of freedom of movement with respect to the movable part 22 of the window unit 2 to which it is associated. In particular, as the articulated chain 40 extends from the fixed portion 31, therefore along the operating direction D, the angle, that is to say, the inclination, between the operating plane of the articulated chain 40 and the movable part 22 of the window unit can vary freely. In this way, as the articulated chain 40 is gradually extracted with respect to the movable portion 31, the movement of the latter is made more free with respect to the trajectory followed by the movable part 22 so as to limit the stresses that the articulated chain 40 could undergo in a transversal direction to the operating plane and to which it would be subject if it were unable to rotate freely with respect to the movable part 22 of the window unit. In summary, it follows that the unwanted stresses on the articulated chain 40 are limited.

**[0080]** Preferably, in the context of the invention, the expression "transversal" means that the first axis of rotation A is substantially perpendicular to the operating direction D. Even more preferably, the expression "substantially perpendicular" means that the first axis of rotation A forms with the operating direction D an angle of not less than 75 degrees, even more preferably not less than 88 degrees.

**[0081]** According to a further preferred aspect, the head segment 41a is connected to the attachment element 34 in such a way as to rotate around a second rotation axis B parallel to the hinge axis C and transversal to the first rotation axis A. In other words, the rotation axis B is parallel to the hinge axis C of each segment of the plurality of segments 41 and is therefore orthogonal to the operating plane of the articulated chain 40.

**[0082]** According to a further preferred aspect, the movable portion 32 is also configured in such a way as to allow rotation of the head segment 41a with respect to the second rotation axis B up to a maximum angle  $A_{\max}$  in the jamming direction  $\alpha$  to determine a bending moment M suitable for determining an arching of the section of articulated chain 40 between the head segment 41 and the at least one segment engaged by the actuation device

50. In other words, the head segment 41a can rotate to a limited extent up to the maximum angle  $A_{\max}$ . The further segments of the articulated chain 40 are then forced to follow the rotation of the head segment 41a and to reach the relative jamming angle. That is to say, the movable portion 32 is configured to rotate so as to impose a rotation of the segments forming the section between the movable portion 32 and the actuation device 50 around the relative hinge axis C until it reaches the relative jamming angle thus determining the arching. Thanks to the above-mentioned bending moment M, the segments of the section of articulated chain 40 between the head segment 41 and the at least one segment engaged by the actuation device 50 can be forced to rotate around the respective hinge axis C in the jamming direction  $\alpha$  to reach the relative jamming angle. The arching of the operating portion of the articulated chain 40, that is to say, an arrangement according to an arc or C-shaped trajectory, occurs when the segments of the articulated chain 40 and the operating conditions of the latter, in particular the load applied to the chain articulated 40 by the movable part of the window unit, allow it. Since in the jamming angle the articulated chain 40 exerts the stress along the operating direction D, the movable portion 32 is therefore configured in such a way as to favour a stable spacing with the fixed part 31.

**[0083]** According to a preferred aspect of the invention, therefore, the movable portion 32 is configured so as to induce a rotation of each segment of the operating section of the articulated chain 40 until the respective jamming angle is reached. Since in the jamming angle the segments of the articulated chain 40 are able to exert the stress along the operating direction D, the movable portion 32 is therefore configured in such a way as to favour a stable spacing with the fixed part 31.

**[0084]** Preferably, by rotating up to the maximum angle  $A_{\max}$ , the head portion 41a also reaches the respective jamming angle.

**[0085]** Preferably, the maximum angle  $A_{\max}$  is between  $2^\circ$  and  $15^\circ$ , more preferably between  $2^\circ$  and  $10^\circ$ , more preferably between  $2^\circ$  and  $8^\circ$ .

**[0086]** According to a preferred aspect of the invention, the operating direction D lies on the operating plane.

**[0087]** According to a preferred aspect of the invention, the maximum angle  $A_{\max}$  reached by the head segment 41a can be such as to impart the bending moment M on the articulated chain 40 to maintain a stable spacing between the movable portion 32 and between the fixed part 31. In other words, the head segment 41a in the maximum angle  $A_{\max}$  determines the transfer of a second thrust force F2 on the articulated chain 40 which forces the segments of the operating section into the jamming angle. More preferably, the segments of the section of articulated chain 40 interposed between the movable portion 32 and the actuation device 50, that is to say, of the operating section, are forced to arrange themselves according to the above-mentioned curved trajectory in the operating plane of the articulated chain 40.

**[0088]** Preferably, the second thrust force F2 corresponds to the weight force of the movable part 22. The second thrust force F2 is therefore used to generate the above-mentioned bending moment M.

5 **[0089]** According to a preferred aspect of the invention, the movable portion 32 can further comprise connecting means 36 apt to mutually connect the attachment element 34 and the head segment 41a.

10 **[0090]** According to a preferred aspect of the invention, these connecting means 36 comprise a first hole 361 and a first pin 362, inserted in the first hole 361, which act in conjunction to define the second axis of rotation B.

15 **[0091]** In addition, the connecting means comprise a slotted hole or a guide 363 and a second pin 364, inserted in the second hole or guide 363 and wherein the slotted hole or guide 363 defines the maximum angle  $A_{\max}$ . In other words, the second hole or the guide 363 defines the amount of relative rotation between the attachment element 34 and the head segment 41a.

20 **[0092]** Preferably, the first hole 361 and the slotted hole or guide 363 are made in correspondence with the head segment 41a, while the first pin 362 and the second pin 364 are integral with the attachment element 34.

25 **[0093]** According to a preferred aspect of the invention, the first pin 362 is spaced apart from the second pin 364 to define an arm of a stress apt to subject the head segment 41a to the above-mentioned bending moment M which is suitable for causing an arching of the segments of the operating section of the articulated chain 40, to maintain a stable spacing between the movable part 22 and the fixed part 21. In other words, the distance between the first pin 362 and the second pin 364 defines the arm of the second thrust force F2 applied to the head segment 41a to impose a rotation on the latter in the jamming direction such as to orient the development direction of this in the jamming angle. The second thrust force F2 applied to the head segment 41a is preferably orthogonal to the first thrust force F1. Through the bending moment M the effect of the second force F2 on the articulated chain 40 is similar or comparable to the effect generated by the first force F1.

35 **[0094]** According to a preferred aspect of the invention, the first plate-like portion 411 extends mainly along the direction S of extension of the head segment 41a. Preferably, the second plate-like portion 412 extends along a direction substantially perpendicular to the development direction S. Preferably, the first plate-like portion 411 is rotatably coupled to a further segment so as to be able to rotate around a hinge axis C.

40 **[0095]** According to a preferred aspect of the invention, the attachment element 34 is configured to at least partially house the head segment 41a and the connecting means 36.

45 **[0096]** Even more preferably, the attachment element 34 is a cylindrical shell.

50 **[0097]** According to a preferred aspect of the invention, the fixing element 35 is C-shaped and defines a central region apt to receive the attachment element 34.

**[0098]** According to a preferred aspect of the invention, the fixed portion 31 is also connected in a rotatable manner to the fixed part 21 of the window unit 2. In particular, the fixed portion 31 is connected so as to be able to rotate with respect to the fixed part 21 around a third rotation axis E parallel to the first rotation axis A. In this way, the operating plane of the articulated chain 40 can rotate with respect to the movable part 32 and the fixed part 31. In this way, the stresses on the articulated chain 40 in a direction transversal to said operating plane are further limited. Lastly, the invention also relates to a window unit which comprises a chain actuator 1 as described above.

**[0099]** In particular, the fixed part 21 and the movable part 22 of this window unit 2 are interconnected by a chain actuator as described above.

**[0100]** According to a preferred aspect of the invention, the fixed part 21 and the movable part 22 are mutually hinged along an opening and closing axis which is parallel to the first axis of rotation A.

**[0101]** According to a preferred aspect of the invention, the window unit 2 can comprise a first end 23 and a second end 24, opposite each other, and wherein the fixed part 21 and the movable part 22 are mutually hinged at the first end 23. Preferably, the chain actuator 1 is associated with the second end 24, so as to allow rotation of the movable part 21 with respect to the fixed part 23 around the opening and closing axis. In this case the distance between the first end 23 and the second end 24 defines the radius of the trajectory in the arc of a circumference which the movable part 21 describes between the open position and the closed position, and vice versa.

**[0102]** The invention thus conceived is susceptible to numerous modifications and variations, all of which fall within the scope of protection of the attached claims.

**[0103]** Where the operating and technical features mentioned are followed by signs or reference numbers, the signs or reference numbers have been used only with the aim of increasing the intelligibility of the description and claims themselves and, consequently, they do not constitute in any way a limitation to the interpretation of each element identified, purely by way of example, by the signs or reference numerals.

## Claims

1. Chain actuator (1) for a window unit, wherein the window unit (2) comprises a fixed part (21), which can be installed on an infrastructure, and a movable part (22), connected to said fixed part (21), for being mutually movable and wherein said chain actuator (1) comprises:

- a frame (30) having a fixed portion (31) apt to be coupled to the fixed part (21) of the window unit (2) or to the infrastructure and a movable portion (32) apt to be coupled to the movable part (22) of

the window unit (2);

- an articulated chain (40) connected to said movable portion (32) and to said fixed portion (31) of frame (30) to move the movable portion (32) with respect to the fixed portion (31) to operate said window unit (2) between an open position and a closed position; and wherein said articulated chain (40) is composed of a plurality of segments (41) arranged in series between a head segment (41a), connected to said movable portion (32), and a tail segment, wherein each segment of said plurality of segments (41) has a development direction (S) and is connected to at least one further segment of said plurality of segments (41) in such a way as to rotate with respect to the latter reversibly around a hinge axis (C) in a winding direction ( $\alpha$ ) to orient its development direction (S) between a jamming angle and a winding angle, wherein in the jamming angle each segment of said plurality of segments (41) has its own development direction (S) substantially parallel to the development direction (S) of the further segment in such a way as to exert a stress along an operating direction (D), to mutually move the fixed portion (31) and the movable portion (32) of the frame (30);

- an actuation device (50) coupled to the fixed portion (31) and to the articulated chain (40) and operable to extend the articulated chain (40) from the fixed portion (31) along the operating direction (D) or to retract the articulated chain (40) in the fixed portion (31) so as to respectively move the movable portion (32) away from or towards the fixed portion (31) to open or close the window unit (2);

and wherein said actuator (1) also comprises a thrust device (60) associated with said fixed portion (31) and configured to interfere with said articulated chain (40) in a section thereof placed between the movable portion (32) and the actuation device (50) for forcing the segments of said articulated chain (40) forming said section into their mutual jamming angle;

wherein the actuation device (50) comprises a movement member (51) which interacts with the articulated chain (40) to extend and retract it in the fixed portion (31) and the thrust device (60) is configured to exert a first thrust force (F1), along a thrust direction, on said section of the articulated chain (40) and wherein said thrust direction is intermediate between the movable part (31) and the movement member (51);

wherein said thrust device (60) comprises a base (62), a pusher (61) and elastic means

- (63) for spreading the pusher (61) with respect to the base (62) and wherein the base (62) is fixable at or integral with the fixed portion (31);
- characterized in that** the thrust device comprises an adjustment device (70) configured to adjust or control the amount of the first thrust force (F1), generated by the thrust device (60) and transferable to the articulated chain (40);
- wherein said adjustment device (70) is configured to interact with said pusher (61) so as to regulate the translation with respect to said fixed portion (31) along said thrust direction and in such a way as to limit a maximum stroke of said pusher (61) in said thrust direction.
2. Chain actuator (1) according to claim 1, wherein said thrust device (60) is configured to exert the first thrust force (F1) along a thrust direction substantially orthogonal to said operating direction (D).
  3. Chain actuator (1) according any one of the preceding claims, wherein the pusher (61) is translatable along the thrust direction.
  4. Chain actuator (1) according any one of the preceding claims, wherein the chain is configured to be penetrated by the pusher (61) and the pusher (61) is configured to guide said articulated chain (40) in the operating direction (D) and/or in the thrust direction.
  5. Chain actuator (1) according to any one of the preceding claims, wherein the pusher (61) comprises an insertion portion (611), apt to interact with the articulated chain (40) and having a curvilinear profile, preferably circular.
  6. Chain actuator (1) according to claim 5, wherein the insertion portion (611) is rotatable so as to roll on the articulated chain (40) following a movement of the latter.
  7. Chain actuator (1) according to claim 3, wherein said insertion portion (611) extends mainly around a rolling axis (X), substantially orthogonal to said operating direction (D) and to said thrust direction (S) and is rotatable around said rolling axis (X).
  8. Chain actuator (1) according to any one of the preceding claims, wherein the pusher (60) comprises a limiting member (64), in spaced relationship with respect to said pusher (61) along the thrust direction to define with the latter an outlet mouth, which can be engaged by the articulated chain (40) to extend from the fixed part (31);

wherein said at least one segment of the section is interposed between said pusher (61) and said limiting element (64);

wherein said limiting element (64) is apt to limit said jamming angle.

## Patentansprüche

1. Kettenbetätigungselement (1) für eine Fenstereinheit, wobei die Fenstereinheit (2) ein festes Teil (21), das an einer Infrastruktur installiert werden kann, und ein bewegbares Teil (22) umfasst, das mit dem festen Teil (21) verbunden ist, um geräuschlos bewegbar zu sein, und wobei das Kettenbetätigungselement (1) umfasst:
  - einen Rahmen (30), der einen festen Abschnitt (31), der geeignet ist, um mit dem festen Teil (21) der Fenstereinheit (2) oder mit der Infrastruktur gekoppelt zu werden, und einen bewegbaren Abschnitt (32) aufweist, der geeignet ist, um mit dem bewegbaren Teil (22) der Fenstereinheit (2) gekoppelt zu werden;
  - eine Gelenkkette (40), die mit dem bewegbaren Abschnitt (32) und dem festen Abschnitt (31) des Rahmens (30) verbunden ist, um den bewegbaren Abschnitt (32) in Bezug auf den festen Abschnitt (31) zu bewegen, um die Fenstereinheit (2) zwischen einer geöffneten und einer geschlossenen Position zu betreiben; und wobei die Gelenkkette (40) aus einer Vielzahl von Segmenten (41) besteht, die zwischen einem Kopfsegment (41a), das mit dem bewegbaren Abschnitt (32) verbunden ist, und einem Endsegment in Reihe angeordnet ist, wobei jedes Segment der Vielzahl von Segmenten (41) eine Entwicklungsrichtung (S) aufweist und mit mindestens einem weiteren Segment der Vielzahl von Segmenten (41) in einer derartigen Weise verbunden ist, dass es sich in Bezug auf das Letztere reversibel um eine Scharnierachse (C) herum in einer Wicklungsrichtung ( $\alpha$ ) dreht, um seine Entwicklungsrichtung (S) zwischen einem Klemmwinkel und einem Wicklungswinkel auszurichten, wobei in dem Klemmwinkel jedes Segment der Vielzahl von Segmenten (41) seine eigene Entwicklungsrichtung (S) aufweist, die im Wesentlichen parallel zu der Entwicklungsrichtung (S) des weiteren Segments ist, in einer derartigen Weise, dass eine Spannung entlang einer Betriebsrichtung (D) ausgeübt wird, um den festen Abschnitt (31) und den bewegbaren Abschnitt (32) des Rahmens (30) gemeinsam zu bewegen;
  - eine Betätigungsvorrichtung (50), die mit dem festen Abschnitt (31) und mit der Gelenkkette (40) gekoppelt ist und betriebsfähig ist, um die

Gelenkkette (40) aus dem festen Abschnitt (31) entlang der Betriebsrichtung (D) ausziehen oder die Gelenkkette (40) in den festen Abschnitt (31) einzuziehen, um den bewegbaren Abschnitt (32) jeweils von dem festen Abschnitt (31) weg oder zu diesem hin zu bewegen, um die Fenstereinheit (2) zu öffnen oder zu schließen;

und wobei das Betätigungselement (1) ferner eine Schubvorrichtung (60) umfasst, die dem festen Abschnitt (31) zugeordnet und konfiguriert ist, um mit der Gelenkkette (40) in einer Sektion davon zu interferieren, die zwischen dem bewegbaren Abschnitt (32) und der Betätigungsvorrichtung (50) zum Zwingen der Segmente der Gelenkkette (40), die die Sektion ausbilden, in ihren gemeinsamen Klemmwinkel platziert ist;

wobei die Betätigungsvorrichtung (50) ein Bewegungsglied (51) umfasst, das mit der Gelenkkette (40) zusammenwirkt, um sie ausziehen und in dem festen Abschnitt (31) einzuziehen, und die Schubvorrichtung (60) konfiguriert ist, um eine erste Schubkraft (F1), entlang einer Schubrichtung, auf die Sektion der Gelenkkette (40) auszuüben, und wobei die Schubrichtung zwischen dem bewegbaren Teil (31) und dem Bewegungsglied (51) liegt;

wobei die Schubvorrichtung (60) eine Basis (62), einen Drücker (61) und elastische Mittel (63) zum Spreizen des Drückers (61) in Bezug auf die Basis (62) umfasst, und wobei die Basis (62) an dem festen Abschnitt (31) befestigbar oder in diesen eingebaut ist;

**dadurch gekennzeichnet, dass** die Schubvorrichtung eine Einstellvorrichtung (70) umfasst, die konfiguriert ist, um die Menge der ersten Schubkraft (F1) einzustellen oder zu steuern, die durch die Schubvorrichtung (60) erzeugt wird und auf die Gelenkkette (40) übertragbar ist; wobei die Einstellvorrichtung (70) konfiguriert ist, um mit dem Drücker (61) zusammenzuwirken, um die Verschiebung in Bezug auf den festen Abschnitt (31) entlang der Schubrichtung zu regeln und in einer derartigen Weise, dass ein maximaler Hub des Drückers (61) in der Schubrichtung begrenzt wird.

2. Kettenbetätigungselement (1) nach Anspruch 1, wobei die Schubvorrichtung (60) konfiguriert ist, um die erste Schubkraft (F1) entlang einer Schubrichtung auszuüben, die im Wesentlichen orthogonal zu der Betriebsrichtung (D) ist.

3. Kettenbetätigungselement (1) nach einem der vorstehenden Ansprüche, wobei der Drücker (61) entlang der Schubrichtung verschiebbar ist.

4. Kettenbetätigungselement (1) nach einem der vorstehenden Ansprüche, wobei die Kette konfiguriert ist, um durch den Drücker (61) durchdrungen zu werden, und der Drücker (61) konfiguriert ist, um die Gelenkkette (40) in der Betriebsrichtung (D) und/oder in der Schubrichtung zu führen.

5. Kettenbetätigungselement (1) nach einem der vorstehenden Ansprüche, wobei der Drücker (61) einen Einführabschnitt (611) umfasst, der geeignet ist, um mit der Gelenkkette (40) zusammenzuwirken und ein kurvenförmiges, vorzugsweise kreisförmiges, Profil aufweist.

6. Kettenbetätigungselement (1) nach Anspruch 5, wobei der Einführabschnitt (611) drehbar ist, um sich auf die Gelenkkette (40) im Anschluss an eine Bewegung der Letzteren aufzurollen.

7. Kettenbetätigungselement (1) nach Anspruch 3, wobei sich der Einführabschnitt (611) hauptsächlich um eine Rollachse (X) herum erstreckt, die im Wesentlichen orthogonal zu der Betriebsrichtung (D) und zu der Schubrichtung (S) ist, und um die Rollachse (X) herum drehbar ist.

8. Kettenbetätigungselement (1) nach einem der vorstehenden Ansprüche, wobei der Drücker (60) ein Begrenzungsglied (64) umfasst, das in Bezug auf den Drücker (61) entlang der Schubrichtung in beabstandeter Beziehung ist, um mit dem Letzteren eine Auslassöffnung zu definieren, die durch die Gelenkkette (40) in Eingriff genommen werden kann, um sich von dem festen Teil (31) zu erstrecken;

wobei das mindestens eine Segment der Sektion zwischen dem Drücker (61) und dem Begrenzungsglied (64) eingeschoben ist; wobei das Begrenzungsglied (64) geeignet ist, um den Klemmwinkel zu begrenzen.

## Revendications

1. Actionneur à chaîne (1) pour une unité de fenêtre, dans lequel l'unité de fenêtre (2) comprend une partie fixe (21), qui peut être installée sur une infrastructure, et une partie mobile (22), reliée à ladite partie fixe (21), pour être déplacée silencieusement et dans lequel ledit actionneur à chaîne (1) comprend :

- un cadre (30) ayant une portion fixe (31) apte à être accouplée à la partie fixe (21) de l'unité de

fenêtre (2) ou à l'infrastructure et une portion mobile (32) apte à être accouplée à la partie mobile (22) de l'unité de fenêtre (2) ;

- une chaîne articulée (40) reliée à ladite portion mobile (32) et à ladite portion fixe (31) de cadre (30) pour déplacer la portion mobile (32) par rapport à la portion fixe (31) afin de faire fonctionner ladite unité de fenêtre (2) entre une position ouverte et une position fermée ; et dans lequel ladite chaîne articulée (40) est composée d'une pluralité de segments (41) agencés en série entre un segment de tête (41a), relié à ladite portion mobile (32), et un segment de queue, dans lequel chaque segment de ladite pluralité de segments (41) a une direction de développement (S) et est relié à au moins un autre segment de ladite pluralité de segments (41) de manière à tourner par rapport à ce dernier de manière réversible autour d'un axe d'articulation (C) dans une direction d'enroulement ( $\alpha$ ) pour orienter sa direction de développement (S) entre un angle de coincement et un angle d'enroulement, dans lequel, dans l'angle de coincement, chaque segment de ladite pluralité de segments (41) a sa propre direction de développement (S) sensiblement parallèle à la direction de développement (S) de l'autre segment, de manière à exercer une contrainte le long d'une direction de fonctionnement (D), pour déplacer mutuellement la portion fixe (31) et la portion mobile (32) du cadre (30) ;

- un dispositif d'actionnement (50) accouplé à la portion fixe (31) et à la chaîne articulée (40) et pouvant fonctionner pour étendre la chaîne articulée (40) à partir de la portion fixe (31) le long de la direction de fonctionnement (D) ou pour rétracter la chaîne articulée (40) dans la portion fixe (31) afin d'éloigner ou de rapprocher respectivement la portion mobile (32) de la portion fixe (31) pour ouvrir ou fermer l'unité de fenêtre (2) ;

et dans lequel ledit actionneur (1) comprend également un dispositif de poussée (60) associé à ladite portion fixe (31) et conçu pour interférer avec ladite chaîne articulée (40) dans une section de celle-ci placée entre la portion mobile (32) et le dispositif d'actionnement (50) pour forcer les segments de ladite chaîne articulée (40) formant ladite section dans leur angle de coincement mutuel ;

dans lequel le dispositif d'actionnement (50) comprend un élément de mouvement (51) qui interagit avec la chaîne articulée (40) pour l'étendre et la rétracter dans la portion fixe (31) et le dispositif de poussée (60) est conçu pour exercer une première

force de poussée (F1), le long d'une direction de poussée, sur ladite section de la chaîne articulée (40) et dans lequel ladite direction de poussée est intermédiaire entre la partie mobile (31) et l'élément de mouvement (51) ;

dans lequel ledit dispositif de poussée (60) comprend une base (62), un poussoir (61) et des moyens élastiques (63) pour écarter le poussoir (61) par rapport à la base (62) et dans lequel la base (62) peut être fixée à la portion fixe (31) ou en faire partie intégrante ;

**caractérisé en ce que** le dispositif de poussée comprend un dispositif d'ajustement (70) conçu pour ajuster ou commander la quantité de la première force de poussée (F1), générée par le dispositif de poussée (60) et transférable à la chaîne articulée (40) ;

dans lequel ledit dispositif d'ajustement (70) est conçu pour interagir avec ledit poussoir (61) de manière à réguler la translation par rapport à ladite portion fixe (31) le long de ladite direction de poussée et de manière à limiter une course maximale dudit poussoir (61) dans ladite direction de poussée.

2. Actionneur à chaîne (1) selon la revendication 1, dans lequel ledit dispositif de poussée (60) est conçu pour exercer la première force de poussée (F1) le long d'une direction de poussée sensiblement orthogonale à ladite direction de fonctionnement (D).
3. Actionneur à chaîne (1) selon l'une quelconque des revendications précédentes, dans lequel le poussoir (61) est mobile en translation le long de la direction de poussée.
4. Actionneur à chaîne (1) selon l'une quelconque des revendications précédentes, dans lequel la chaîne est conçue pour être pénétrée par le poussoir (61) et le poussoir (61) est conçu pour guider ladite chaîne articulée (40) dans la direction de fonctionnement (D) et/ou dans la direction de poussée.
5. Actionneur à chaîne (1) selon l'une quelconque des revendications précédentes, dans lequel le poussoir (61) comprend une portion d'insertion (611), apte à interagir avec la chaîne articulée (40) et présentant un profil curviligne, de préférence circulaire.
6. Actionneur à chaîne (1) selon la revendication 5, dans lequel la partie d'insertion (611) est rotative de manière à rouler sur la chaîne articulée (40) à la suite d'un mouvement de cette dernière.
7. Actionneur à chaîne (1) selon la revendication 3,

dans lequel ladite portion d'insertion (611) s'étend principalement autour d'un axe de roulement (X), sensiblement orthogonal à ladite direction de fonctionnement (D) et à ladite direction de poussée (S) et est rotative autour dudit axe de roulement (X).

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8. Actionneur à chaîne (1) selon l'une quelconque des revendications précédentes, dans lequel le poussoir (60) comprend un élément de limitation (64), en relation espacée par rapport audit poussoir (61) le long de la direction de poussée pour définir avec ce dernier une bouche de sortie, qui peut être mise en prise par la chaîne articulée (40) pour s'étendre à partir de la partie fixe (31) ;

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dans lequel ledit au moins un segment de la section est interposé entre ledit poussoir (61) et ledit élément de limitation (64) ;

dans lequel ledit élément de limitation (64) est apte à limiter ledit angle de coincement.

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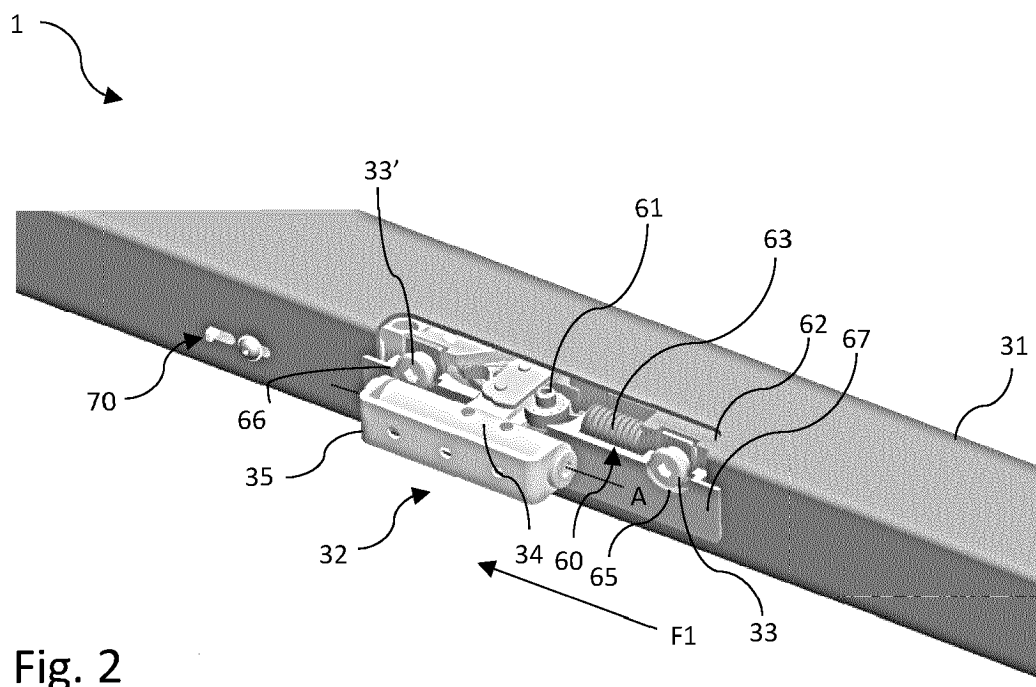
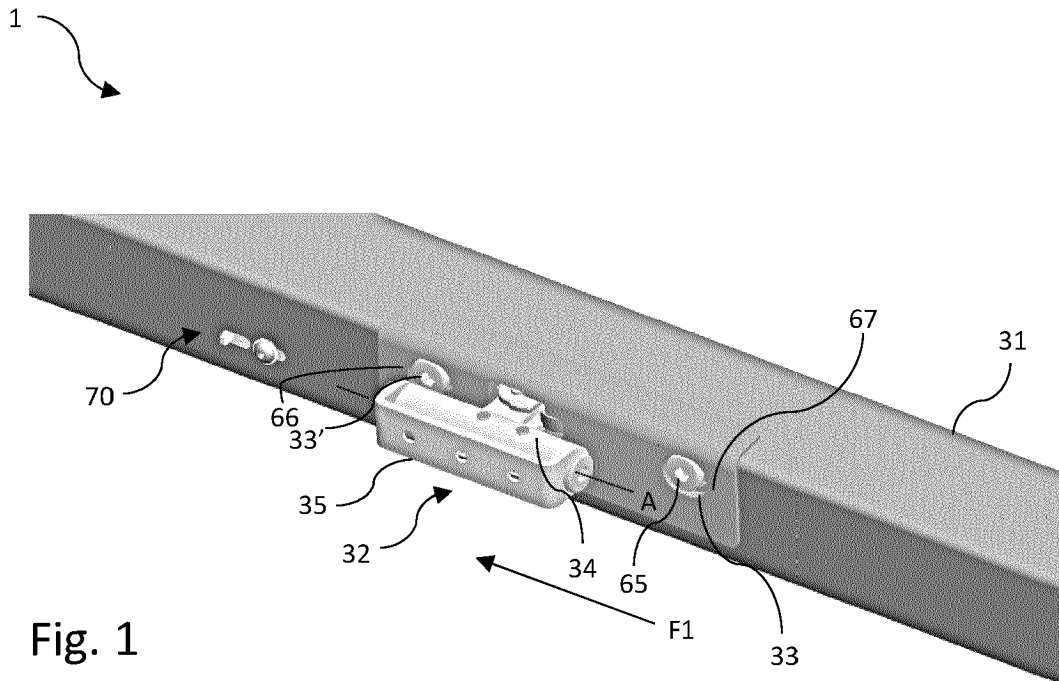
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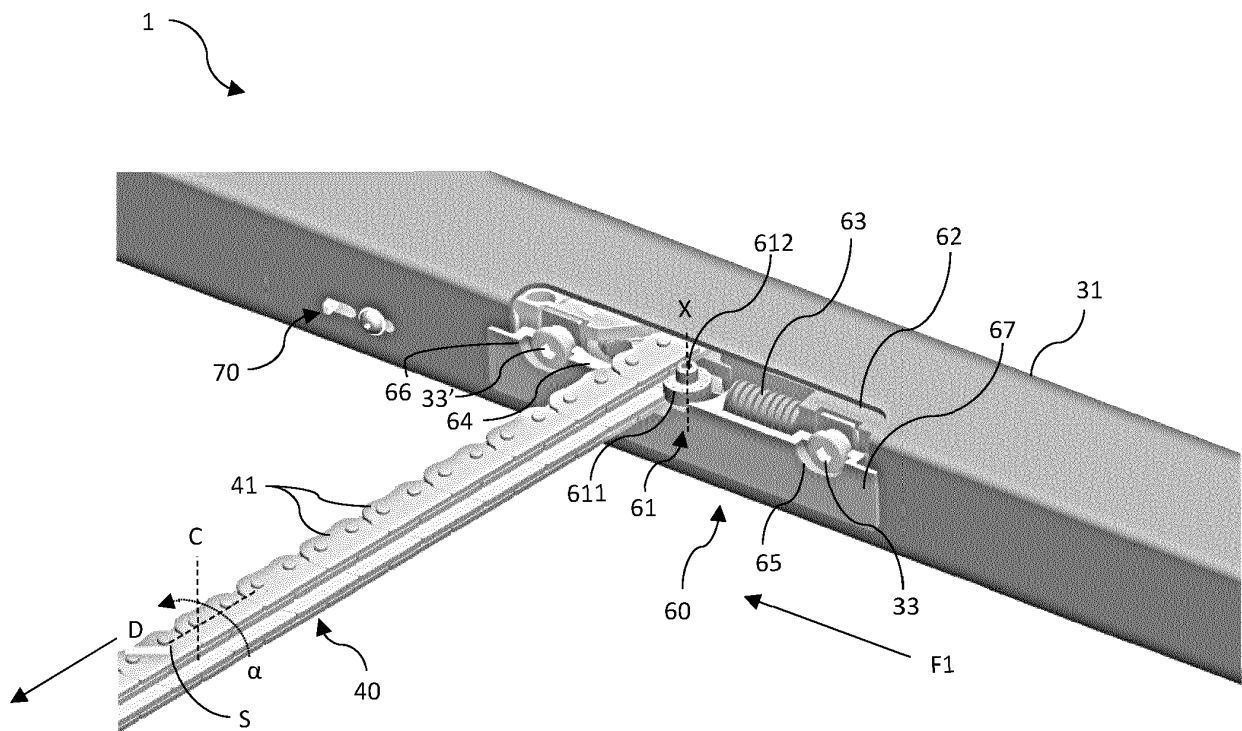


Fig. 3

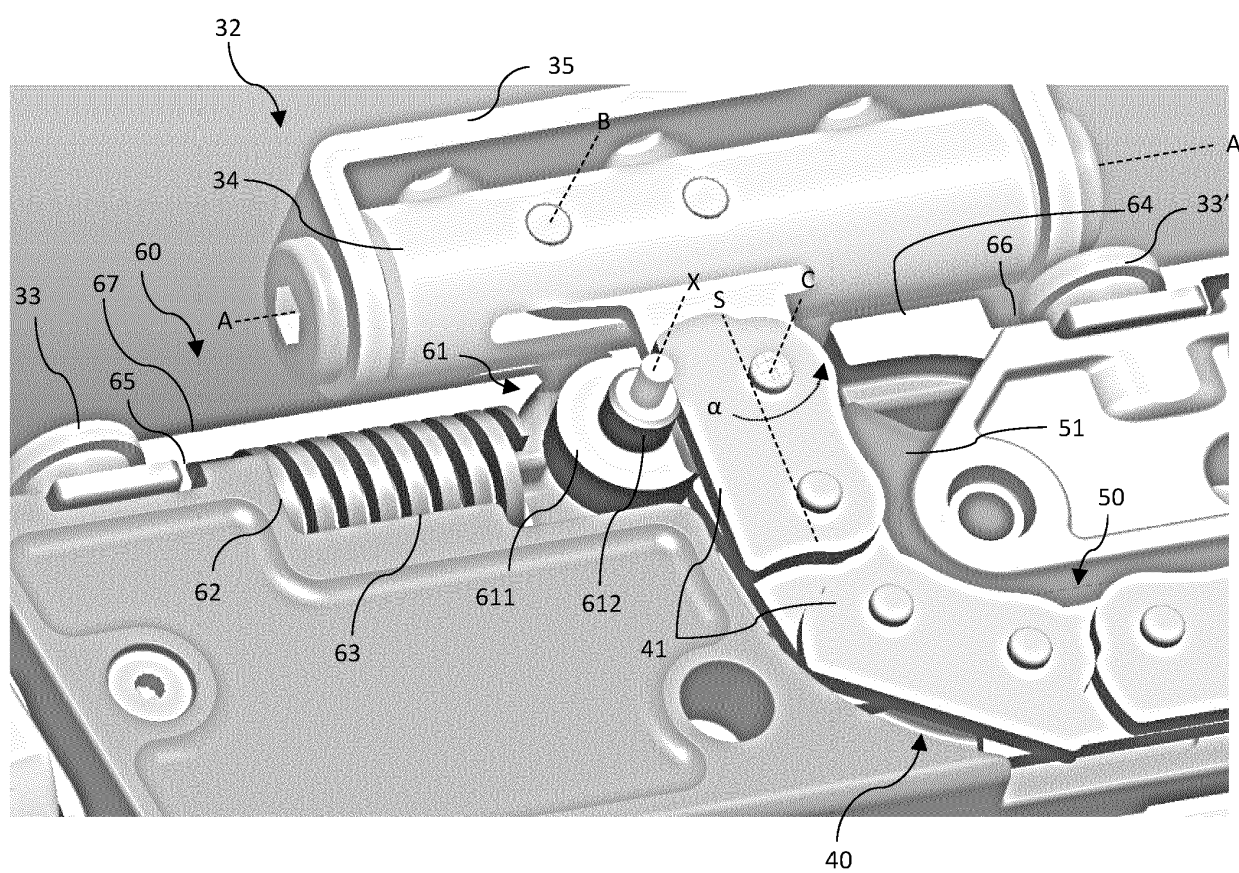


Fig. 4

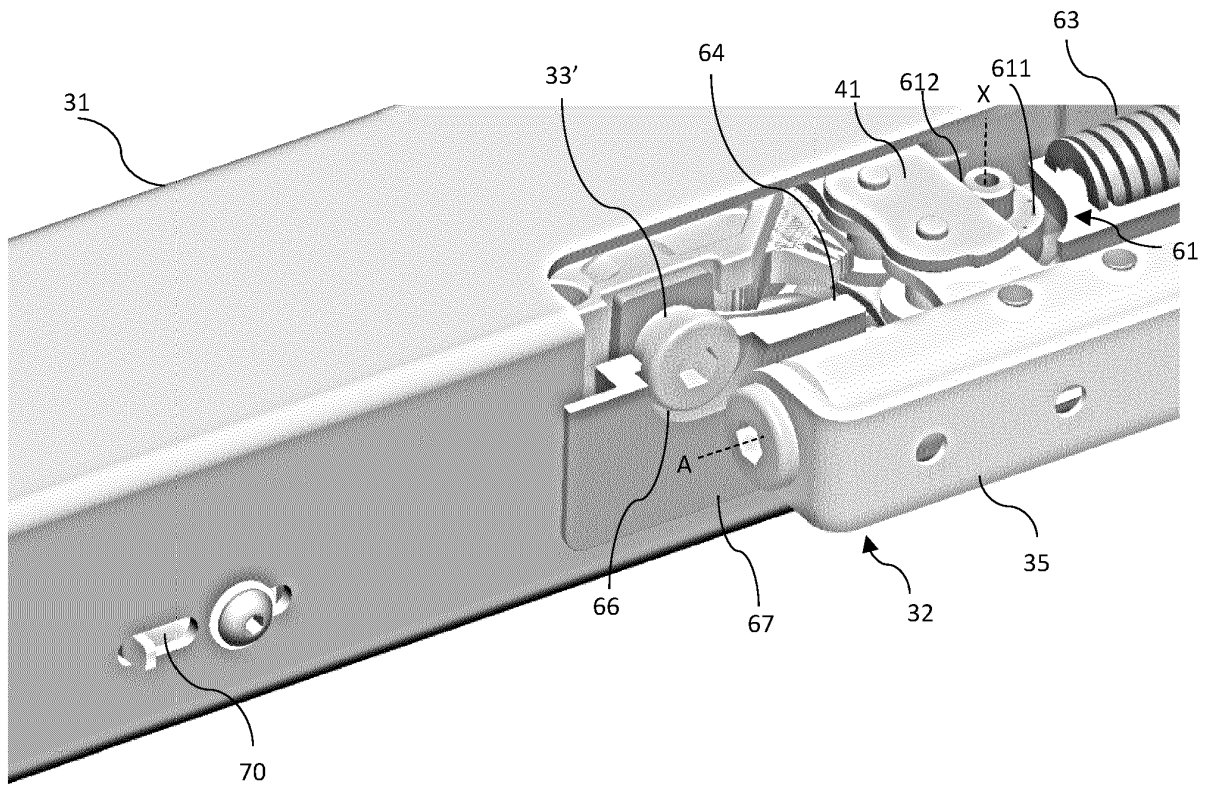


Fig. 5

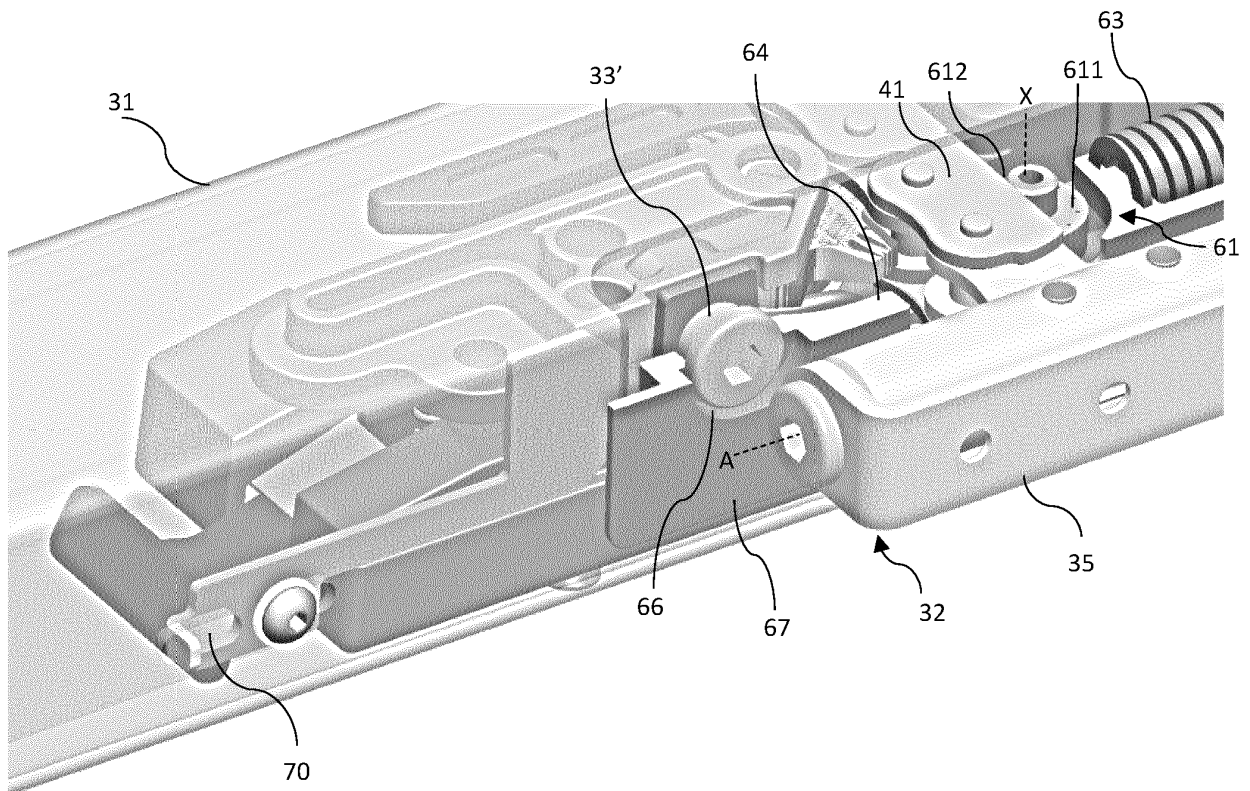


Fig. 6

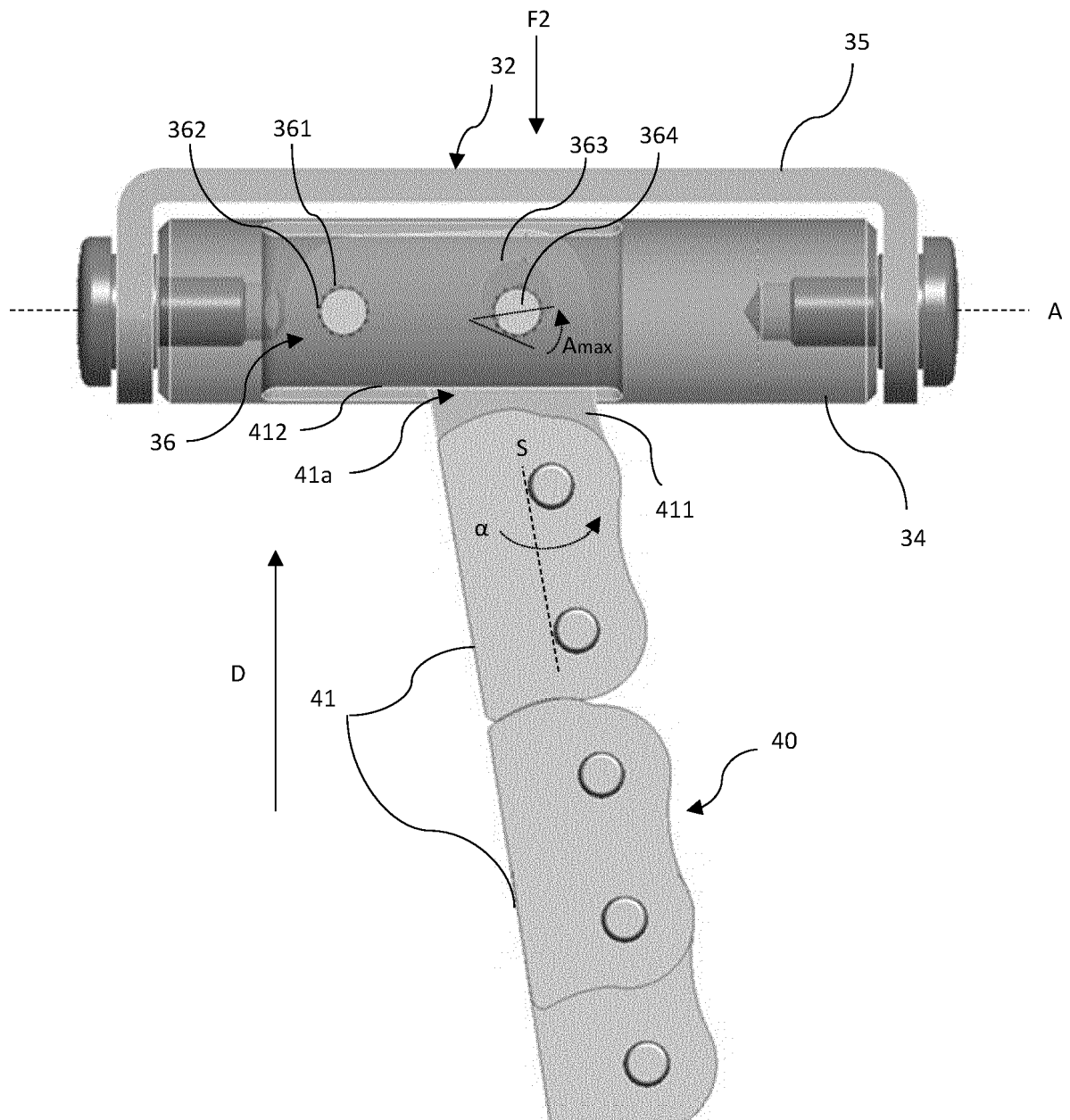


Fig. 7

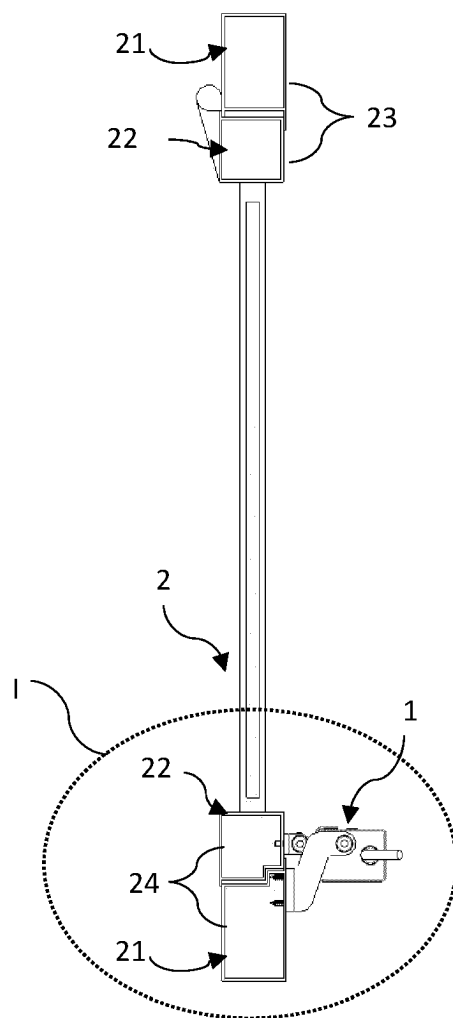


Fig. 8

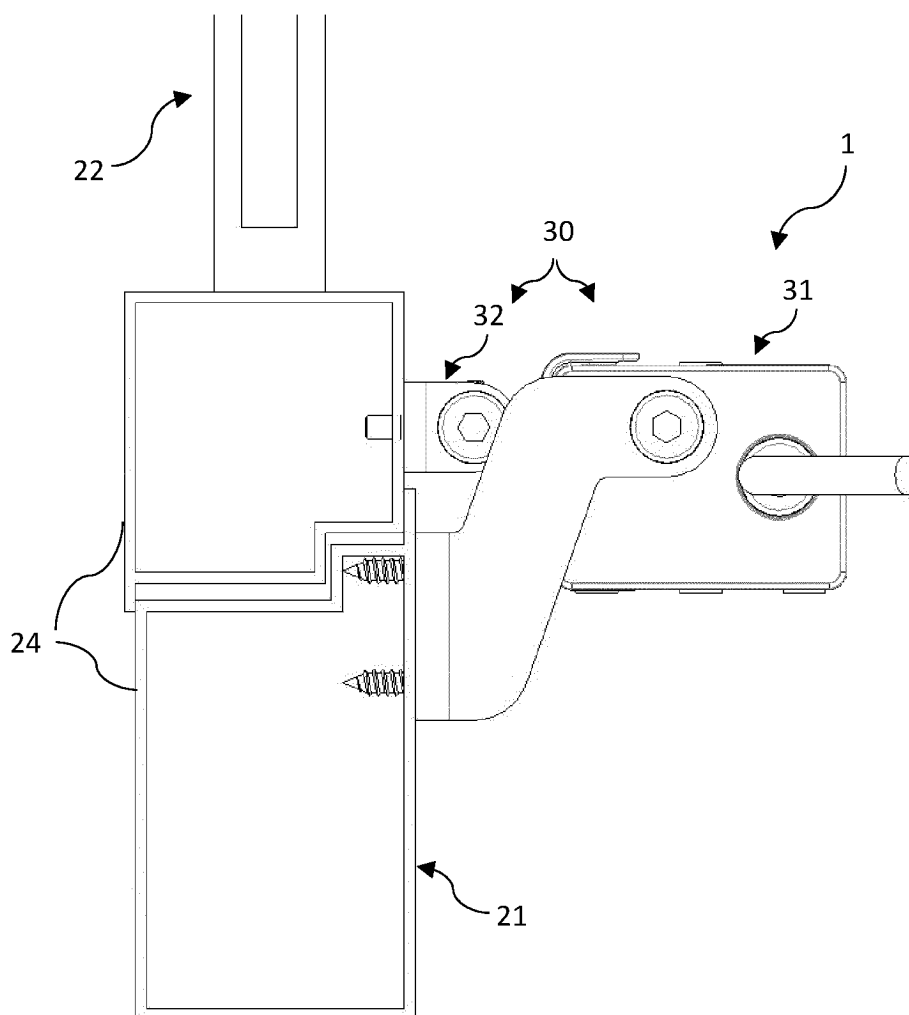


Fig. 9

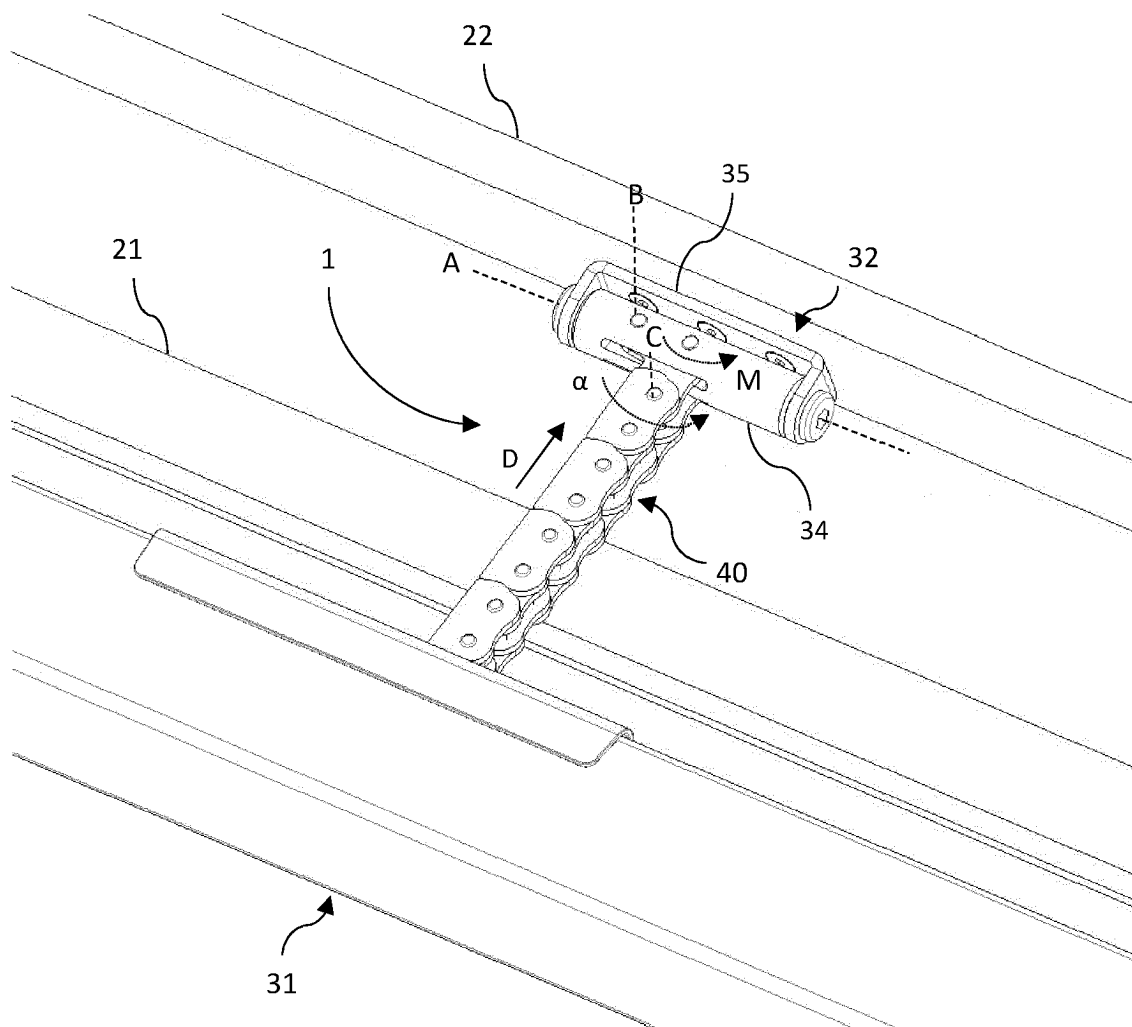


Fig. 10

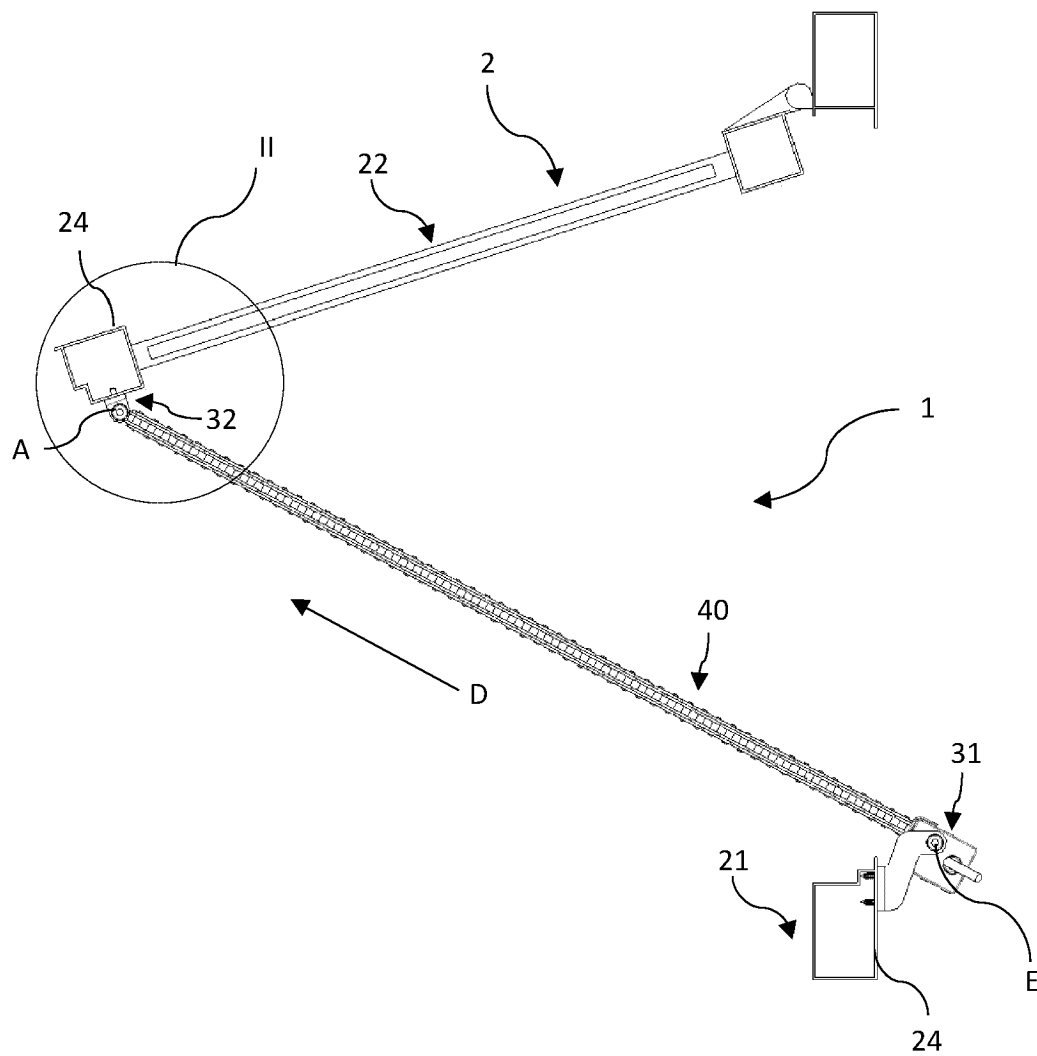


Fig. 11

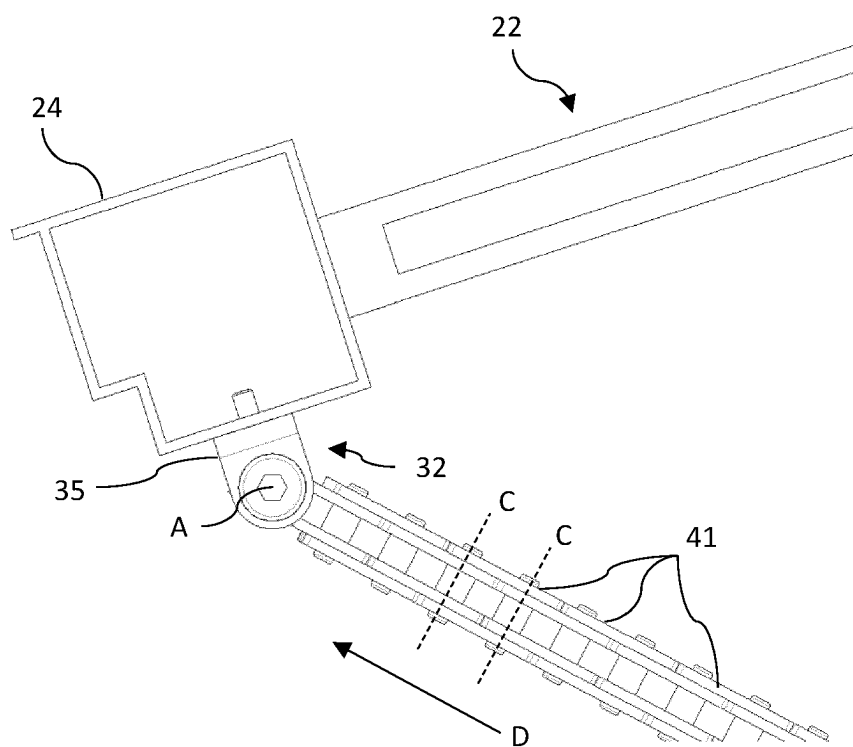


Fig. 12

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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